The Wireless World AND RADIO REVIEW

VOLUME XVII

JULY 1st—DECEMBER 30th, 1925

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ILLUSTRATIONS

AUTHORS

BOOK REVIEWS

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

THE EUROPEAN ETHER PROBLEM.

THE International Broadcasting Bureau at Geneva, which operates under the title of Office International de Radiophonie, has already commenced operations, and a communication has recently been received from Mr. A. R. Burrows, whose appointment as Director of the Bureau was announced in these columns some time ago, stating that a Conference is to take place at Geneva on July 6th and 7th. Technical experts of every broadcasting organisation in Europe will meet to discuss questions of importance in connection with the organisation of broadcasting stations in Europe. It is stated that the prime object of the Conference is to secure mutual agreement upon a system whereby the existing European stations and several of the projected stations can operate at their highest possible efficiency without any risk of mutual interference.

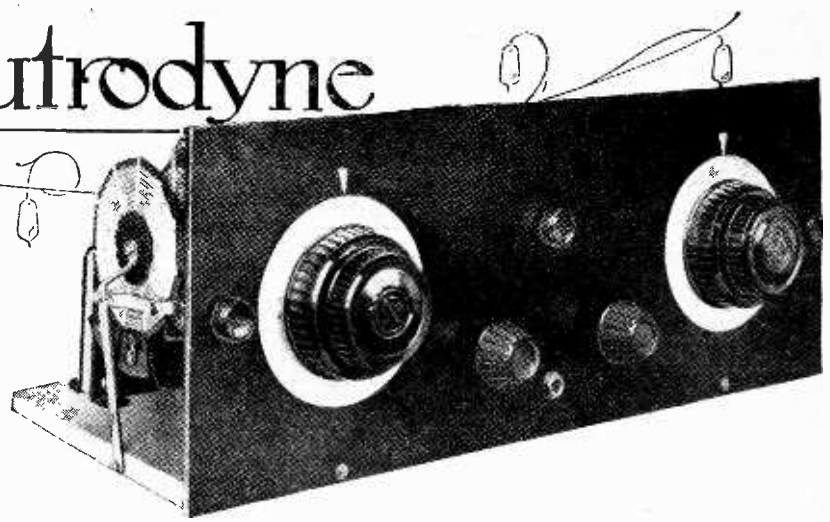
The communication points out that a satisfactory outlook for the future is impossible if the present policy is pursued any further. We assume that by the present policy is meant the haphazard way in which stations are put up and start working on wavelengths convenient to themselves without consideration of other parties, whilst there is a general scramble amongst the European nations to see which can claim the biggest share of the ether first.

It is interesting to note that this first Conference of the International Bureau is virtually a Conference of engineers to deal with the technical side and the technical problems involved, and that the Conference will not be controlled by political considerations. There is little doubt that a considerable amount of "give and take" spirit must be shown by the engineers representing the various broadcast organisations in Europe, because the difficulties in the way of a satisfactory settlement are considerable, and there seems to be no possibility of overcoming these unless some sacrifices are made both by the British Broadcasting Company and also the organisations in the rest of Europe.

It seems almost certain that sooner or later it will be recognised that the solution to the difficulties at present encountered lies in a reduction in the power of some of the bigger stations, even if this may necessitate the setting up of additional stations of lower power to serve the same area. Stations of very high power will cause considerably more interference than will be caused by several smaller stations which could be so arranged as to serve the same number of listeners. If and when at a later date it is found that these smaller powered stations, being more numerous, are causing interference because of the difficulty of selecting a sufficient number of wavelengths, then the next direction in which it will be possible to find a solution will be in reducing the wavelength of all stations so that there is a wider frequency band between each transmitting station. From the experiences which are being recorded continuously at the present time it is also apparent that if shorter wavelenghts were employed for broadcasting, then the same area would be covered with less initial power, and the number of broadcasting stations increased with less interference.

CONTENTS.

Reflex Neutrodyne



A Stable Two-Valve Receiver for Long Distance Telephone and Local Loud Speaker Reception.

By H. A. HARTLEY.

TO obtain reliable loud-speaker results from broadcasting stations at ranges up to 300 miles or more, it is generally necessary to employ at least four valves in a circuit involving several critical tuning adjustments. The tuning of such a circuit could not be entrusted to a person unpractised in the art of tuning, and the demands made on the filament battery would involve considerable maintenance costs if the receiver is to be used regularly. It was with the object of reducing the number of valves and tuning adjustments necessary to obtain the above-mentioned results that this two-valve reflex set was evolved.

The writer has constructed most of the so-called "super" circuits which have appeared during the last few years, with, it must be admitted, unsatisfactory results. One fact, however, was revealed during this period, which indicated that the most promising results were to be obtained from the neutrodyne circuit and other circuits similar in principle.

The comparative difficulty of building an efficient neutrodyne set, involving two or more H.F. valves, in the home workshop is undoubtedly the reason why this excellent receiver has not been more widely adopted in this country, but the two-valve receiver about to be described could be constructed easily, and retains all the best features of the original "neutrodyne."

The general arrangement of the circuit, which was published in *Radio Broadcast* early in 1924, is due to Mr. W. van B. Roberts. If the reader constructs this receiver and follows the instructions carefully, he will possess an instrument which, on an efficient aerial, will give

(1) Distortionless loud-speaker results from any main broadcasting station up to about 400 miles away, without interference from the local station, and using only two valves.

(2) Clear, reliable reception on headphones up to distances of 3,000 miles.

(3) Freedom from interferences by radiation.

(4) Excellent results in the hands of a novice, and

(5) Freedom from hand capacity effects.

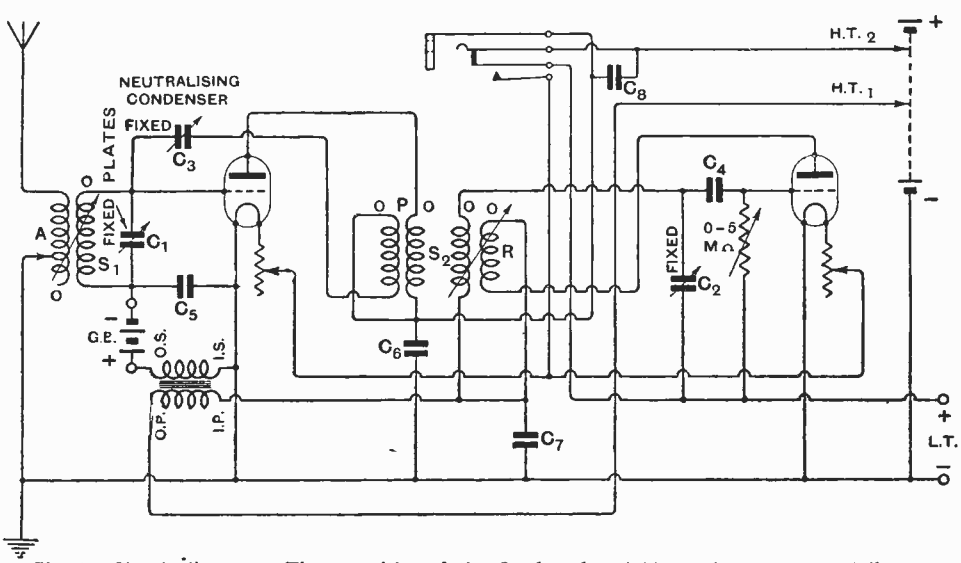


Fig. 1.—Circuit diagram. The capacities of the fixed and variable condensers are as follows: C_1 and C_2, 0·0005 mfd.; C_3, 0·00005 mfd. (approx.); C_4, 0·00025 mfd.; C_5, 0·0002 mfd.; C_6, 0·005 mfd.; C_7, 0·00025 mfd.; C_8, 0·001 mfd.

The receiver is a combination of the neutrodyne principle in a regenerative reflex receiver, but, unlike many home-constructed reflex sets, is very stable and easy to operate. There are two tuning controls, only one of which is critical, and stations can be logged, with approximately equal readings on each dial, so that an inexperienced person need only turn the condensers to the pre-determined readings to receive any broadcasting station within range. The

Reflex Neutrodyne.—construction of several receivers of this type has suggested to the writer various improvements over the original circuit, which have been incorporated in the following description.

Construction and Assembly.

Having procured the necessary components, the constructor should commence by drilling the panel and mounting the condensers, rheostats, and jack. "Ormond" low-loss condensers were chosen, as the aluminium end plates are very convenient for mounting the various brackets necessary to support the coils, and as they are fitted with ¼in. shafts. Other makes of square law condensers may, of course, be used, provided they are fitted with ¼in. shafts, which are necessary if slow-motion dials are to be used. It may be explained here that condensers with built-in verniers are unsuitable for this receiver, as the accurate logging of stations, if such be used, is impossible. To those who have never used a well-constructed slow-motion dial, the close tuning obtainable is a revelation, and the extra initial expense will never be regretted. It is not absolutely essential that the first condenser be fitted with such a device, but, as symmetry in the layout of the panel was desired, both condensers were so equipped.

The two small knobs near the side edge of the front panel are used to actuate the tuner and reaction coil couplings. The spindle on the left-hand side is 2½in. long, while that on the right, which acts also as a support for the H.F. transformer coils, is 5in. long. Both spindles are cut from 4B.A. screwed rod, and are fitted to the panel without bearing bushes. Washers are fitted on each side of the panel, and it is unlikely that the absence of metal bushes will cause any inconvenience

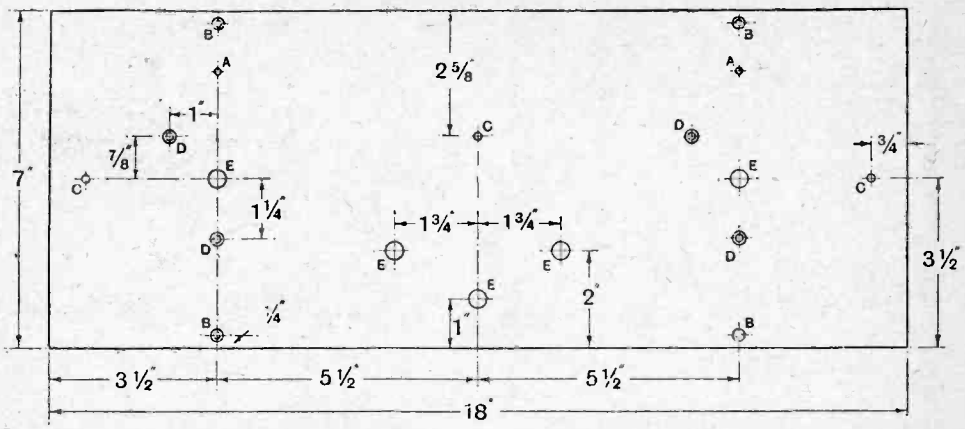


Fig. 2.—Drilling details for front panel. The sizes of holes are as follows: A, 1/8in. dia., position depending upon diameter of tuning dial; B, 1/8in. dia., countersunk for No. 4 wood screws; C, 5/32in. dia.; D, 5/32in. dia., countersunk for No. 4 B.A. screws; E, 3/8in. dia.

here. The tapping switch should be constructed from the usual parts, with the switch arm spindle prolonged through the front panel. If the constructor does not desire to go to the trouble of mounting this switch behind the panel, he may, of course, fix it on the panel itself, although the writer has always thought that a row of

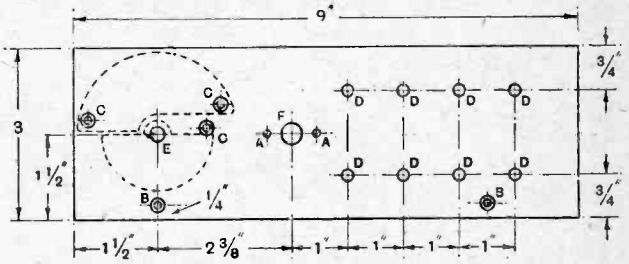


Fig. 3.—The terminal panel. The sizes of holes are as follows: A, 1/8in. dia.; B, 1/8in. dia., countersunk for No. 4 wood screws; C, 5/32in. dia., countersunk for No. 4 B.A. screws; D, 3/16in. dia.; E, 1/4in. dia.; F, 3/8in. dia.

switch studs detracts very much from the appearance of any well-built set. The switch has been mounted in the centre of the panel; but if a symmetrical layout is of secondary importance, the switch may be mounted nearer to the aerial coil with advantage. The assembly of the front panel may be left at this stage until the coils are ready for mounting. In the meantime the L.F. transformer, valve holders, and fixed condensers may be screwed to the baseboard in the position indicated in Fig. 4.

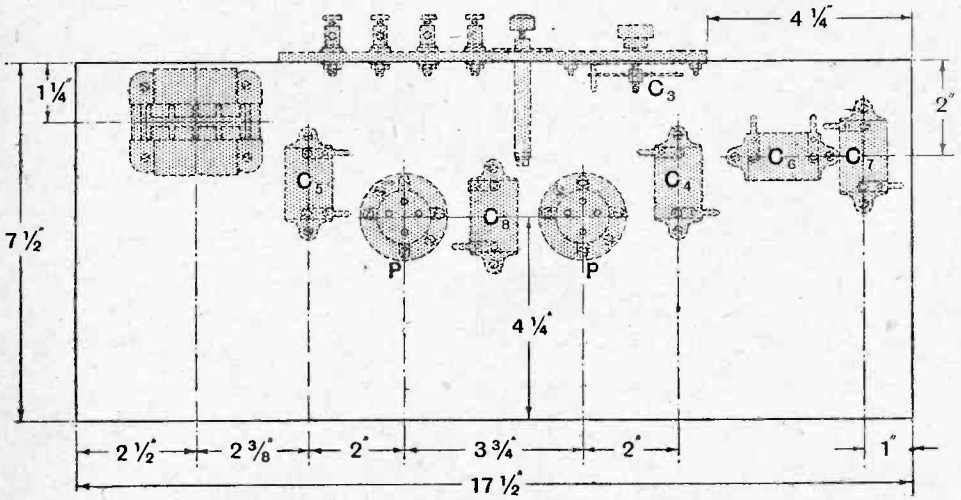


Fig. 4.—Arrangement of components on baseboard.

The coils are wound on thin ebonite or fibre disc formers, 5in. in diameter, with eleven equally spaced slots. In no case does the diameter of a finished coil approach 5in., but the sections between the slots are useful for mounting purposes. As will be seen in Fig. 5, the sections not

Reflex Neutrodyne.—

occupied by mounting screws may be cut down to the level of the windings if desired. Before winding the coils, each spider-web former should be marked with an arrow indicating the direction of winding, and *each coil should be wound in the same direction.* These arrows are useful in mounting the coils, as the front of each coil (as indicated by the arrow) must face the same direction. Each end of the windings should be neatly soldered to a tag fixed to the former by a brass screw. Coil A is made by winding on 40 turns of No. 26 D.S.C. wire, tapped at the 1st, 2nd, 5th, 10th, 20th, 30th, and 40th turns. Coils S_1 and S_2 are identical and are wound with 44 turns of No. 26 D.S.C. wire.

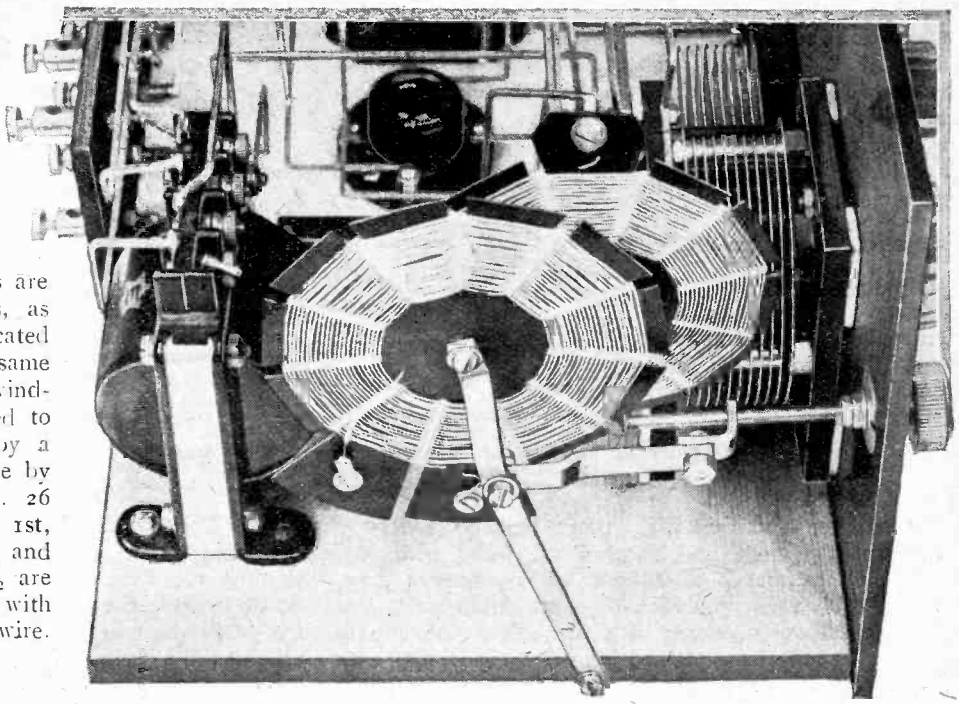


Fig. 5.—Details of the variable coupling between the aerial and closed circuit coils.

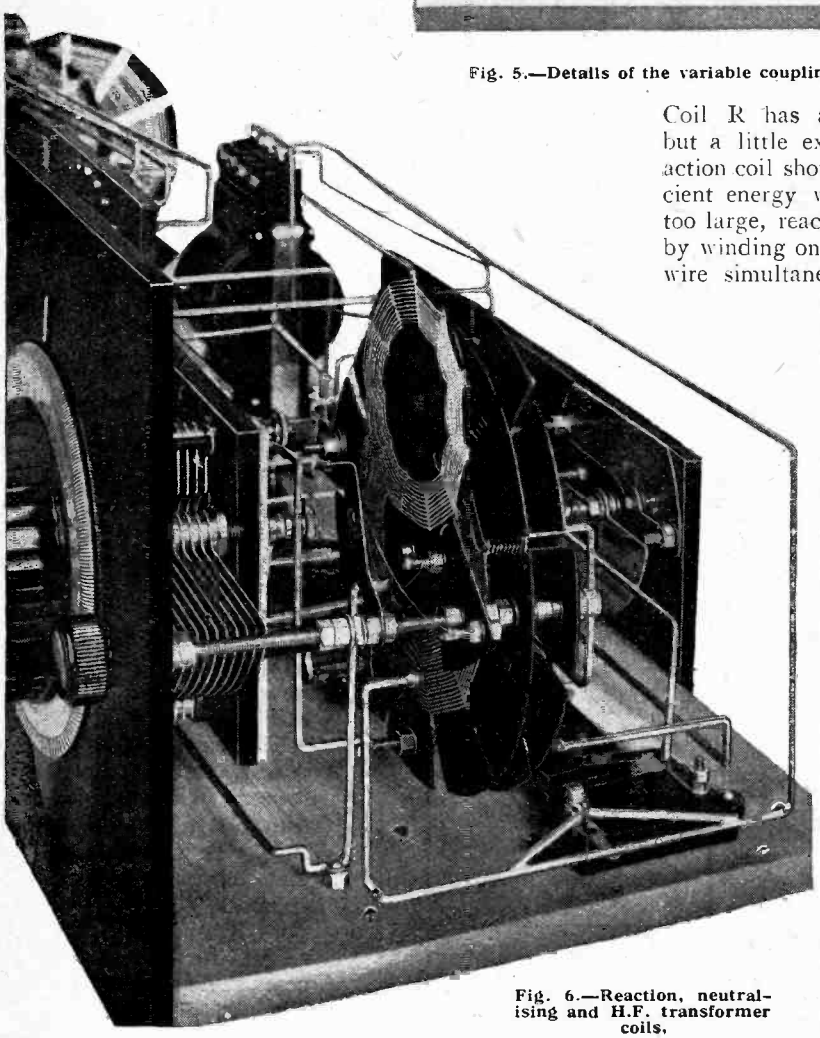


Fig. 6.—Reaction, neutralising and H.F. transformer coils.

Coil R has about 18 turns of No. 26 D.S.C. wire, but a little experimenting may be done here. The reaction coil should be just large enough to feed back sufficient energy without noticeable "back-lash." If it is too large, reaction is difficult to control. Coil P is made by winding on 20 turns of two colours of No. 26 D.S.C. wire simultaneously, and the inside of one winding is connected to the outside of the other, as shown in the circuit diagram, so that the winding proceeds from the outside of the coil to the centre, immediately back to the outside, and again to the centre in the same direction. The separation of these various coils on their common axes when mounted should be about $\frac{3}{8}$in.

The mounting of the tuning coils A and S_1 is clearly shown in Fig. 5. The aerial coil A is fixed and is carried at its centre by a small angle bracket screwed to the end plate of the adjacent tuning condenser. The secondary coil S_1 is carried by a brass arm pivoted at the edge of the baseboard. A connecting link joins this arm to the threaded angle piece on the adjusting screw. It may be explained that the rather tiresomely slow movement of the coupling between coils A and S_1 is intentional, as much variation here is undesirable, since it affects the readings of the condenser connected across S_1. When the receiver is completed, the two coils should be separated just sufficiently to eliminate interference from the local broadcasting station, and then left in that position. The set can then be calibrated for the other stations.

LISTS OF PARTS REQUIRED.

1 Radion panel, 18in. × 7in. × $\frac{3}{16}$in.
1 Ebonite panel, 9in. × 3in. × $\frac{3}{16}$in.
1 Wood baseboard, 17$\frac{1}{2}$in. × 7$\frac{1}{2}$in. × $\frac{1}{2}$in.
2 Ormond low loss square law condensers, 0·0005 mfd., without vernier.
2 Accuratune dials (4 inch).
1 Igranic intervalve transformer.
1 Switch arm and studs.
2 Ashley valve holders.
1 Watmel variable grid leak.
1 0·005 mfd. fixed condenser.
1 0·001 mfd. fixed condenser.
2 0·00025 mfd. fixed condenser.
1 0·0002 mfd. fixed condenser.
1 Single-circuit filament control jack.
1 Telephone plug.
Terminals, small knobs, 4 B.A. screwed rod, brass strip, square tinned copper wire, 2 oz. No. 26 D.S.C. wire, small quantity of green 26 D.S.C. wire, screws, washers, etc.

The photograph reproduced in Fig. 6 shows in detail the mounting of the group of coils P, S_2, and R. The coils S_2 and R are supported on one side by the reaction adjusting spindle, and on the other by a short length of 4B.A. rod screwed into the metal end plate of the condenser. Clearance holes are drilled where the rotating spindle passes through the formers, and the coils are kept in position by spacing washers and pairs of lock nuts. The spindle would be unable to carry the weight of the coil without some additional support. A brass strip 5in. × $\frac{1}{4}$in. × $\frac{3}{32}$in. screwed to the condenser end plate at an angle of about 30° to the base board provides this additional bearing. Lock nuts are fitted to the spindle on each side of the strip, and one pair of these is used to clamp a brass angle piece which engages with the bearing strip and acts as a stop for the position of maximum coupling of the reaction coil.

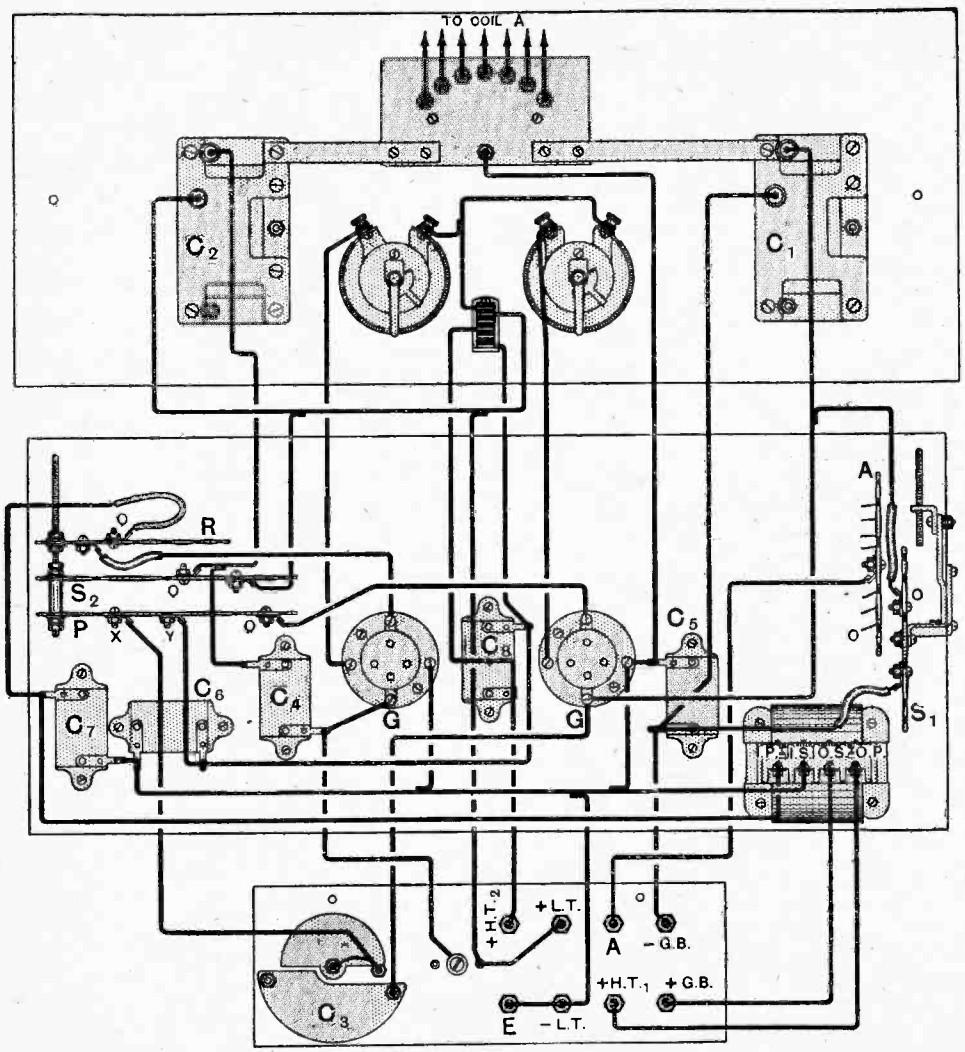


Fig. 7.—Wiring diagram. In the coil P, the junction between the outside of the neutralising coil and the inside of the transformer primary winding is at Y, the inside of the neutralising coil is at X, and the outside of the transformer primary at O. The minus side of the H.T. battery is connected to the terminal marked —L.T. Condenser capacities are given below Fig. 1.

Having mounted the valve holders, fixed condensers and intervalve transformer, the terminal panel should be drilled, and the terminals, grid leak, and neutralising condenser mounted thereon. This latter can be easily constructed from two condenser plates, or can be purchased ready made.

Eight terminals are provided for the aerial, earth, and battery connections. For the sake of appearance, a single terminal has been provided for the —L.T. and —H.T. leads, in order that the terminals may be arranged in pairs.

Wiring.

The wiring may now be carried out with No. 16 S.W.G. square tinned copper wire. It is essential that the connections to the coils be made in exactly the manner shown in the wiring diagram where the letter denotes the outer end of each coil. The stationary and moving plates of the variable condensers should also be connected as shown, otherwise difficulty in tuning due to hand capacity will be experienced.

The grid leak and neutralising condenser have been placed at the rear, since, with two given valves, only an initial adjustment is

Reflex Neutrodyne.—

required. If, however, the valves are changed, other settings of both the leak and the condenser will be required.

Adjustment and Tuning.

When the wiring is completed, the valves should be inserted in their holders, the aerial, earth, and batteries connected, and the receiver tuned to strong signals. The tuning operation involves the adjustment of the aerial coil tapping and of the two tuning condensers. Without turning off the amplifying valve rheostat, the valve should be removed from its holder, a piece of gummed paper fastened round one of the filament legs, and the valve re-inserted in the holder. If the paper has not become dislodged, the filament will not light, and the operation of neutralising the capacity of the valve may be proceeded with. Remove the headphones from the plug, insert the plug in the jack, and connect the headphones in series between the detector valve H.T. terminal and the detector valve tap of the H.T. battery. The amplifying valve will not now function as an audio-frequency amplifier. The signals originally tuned in will still be heard, and, without touching the tuning condensers, the neutralising condenser should be adjusted until no signals can be heard in the headphones. If the moving plate of the condenser is too far from the fixed plate, the capacity will probably be too small to achieve this result, in which case the distance between the moving plate and the fixed plate should be reduced and the process repeated. When this silent point has been determined, the receiver has all stray capacities neutralised, and it is then in perfect order for general reception. The process must be repeated if the valves are changed.

It will be noticed that the withdrawal of the telephone plug from the jack interrupts the filament circuit. This enables one to find the best position for each of the rheostats; and, leaving them set, the receiver can be left untouched by merely removing the telephone plug.

After very little experience the operator will be surprised at the ease with which distant stations can be brought in with satisfactory volume. The condenser across coil S_2 is very critical, and the careful adjustment of this dial in conjunction with the right amount of reaction is important. If it is found that a certain station comes in at, say, 65 on the second dial, the corresponding reading on the first dial will be between 63 and 67.

A carefully compiled table of condenser readings is of great use in finding any particular station when desired. The condensers are merely set to these figures when a slight adjustment of the reaction coil will bring in the station.

If the reader understands the use of the vernier principle, a small vernier scale fitted in place of the nickel-plated panel indicators shown would be of great service.

It is to be hoped that, in the future, broadcast listeners will adopt the neutrodyne principle in some form or other to lessen the nuisance caused by oscillating receivers, and the writer can unhesitatingly recommend this receiver as being one of the most easily constructed and most efficient sets of this type.

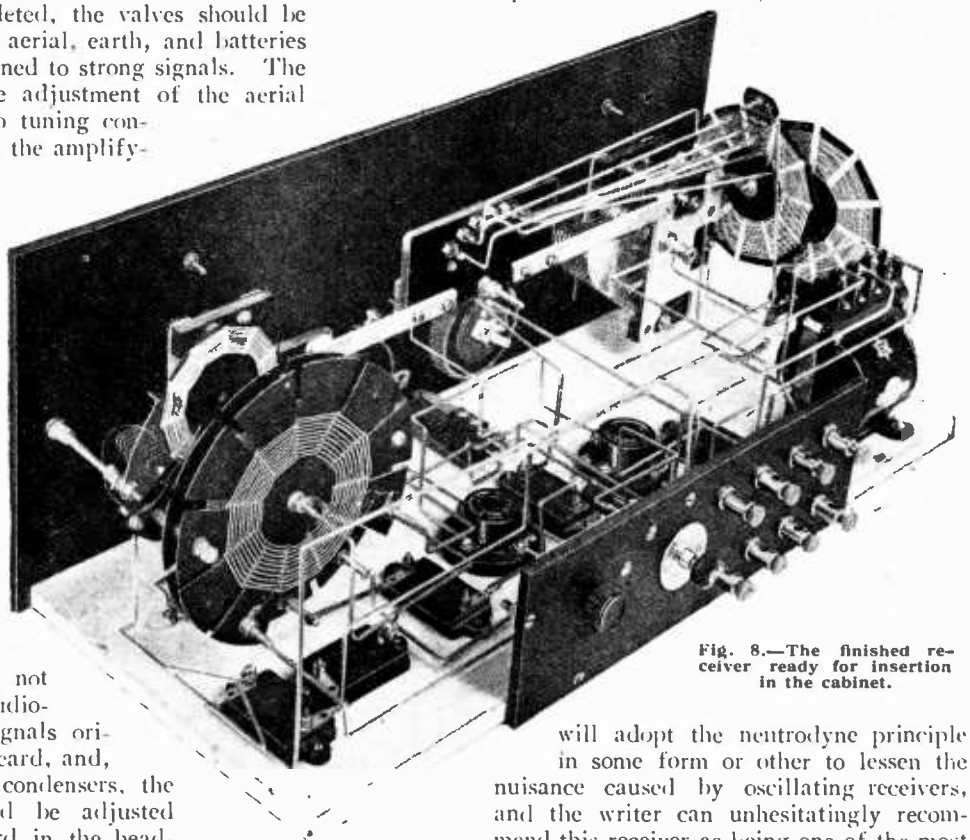


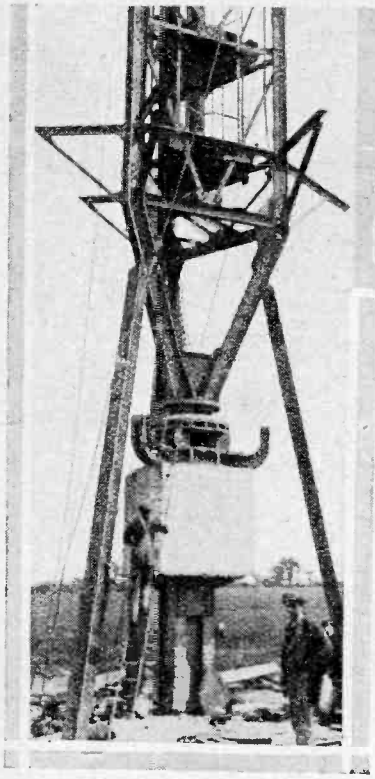
Fig. 8.—The finished receiver ready for insertion in the cabinet.

EUROPEAN ETHER PROBLEM.

LISTENERS to broadcast telephony programmes in all European countries will follow with interest a Conference convened by the Office Internationale de Radiophonie to take place at Geneva on July 6th and 7th. Invitations have been sent from Geneva to the technical staff of every broadcasting organisation in Europe, whether that organisation is actually engaged in broadcasting or making plans for commencing operations next autumn.

The prime object of this Conference is to secure mutual agreement upon a system whereby the existing European stations, and the several projected or actually in course of erection, can operate at their highest possible efficiency without any risk of mutual interference and consequent disappointment to listeners.

A memorandum on the subject, together with a proposal for future working, has recently been forwarded to the Office Internationale at Geneva by Capt. Eckersley, Chief Engineer of the British Broadcasting Company. This has been circulated throughout Europe, and will be a basis for discussion.



Rugby—The Giant Station of the G.P.O.

An Authoritative Description of the Plant and Work of Construction.

By E. H. SHAUGHNESSY, O.B.E., M.I.E.E.

At the Rugby station valves are to be employed on an unprecedented scale for the generation of H.F. currents, and the engineers responsible for the design have had to face many new and difficult problems.

THE new Rugby radio station, which is now rapidly approaching completion, will provide a means of communicating with the most outlying parts of the British Empire throughout all periods of the day and night. In power it will greatly exceed any other station in the British Isles and will be unsurpassed by any station in the world.

The selection of a suitable site for a large wireless station is always a difficult matter, and in the case of the Rugby station these difficulties were increased by the size and special requirements involved.

The site lies about four miles south-east of Rugby, near the village of Hillmorton, in the extreme south-east corner of Warwickshire, and comprises some 900 acres, or approximately 1½ square miles of land. It is situated on level ground and bounded on one side by the Watling Street and on the other side by the Oxford Canal. The station buildings are erected approximately in the centre of the site, and the twelve masts are disposed around it. A general view of the site showing seven masts is given in Fig. 1. The masts, which are 820ft. high, were constructed by Messrs. Head, Wrightson and Co., Thornaby-on-Tees, and are of lattice steelwork, having a triangular cross-section of 10ft. side. Owing to their large cross-section, the great height of the masts is not

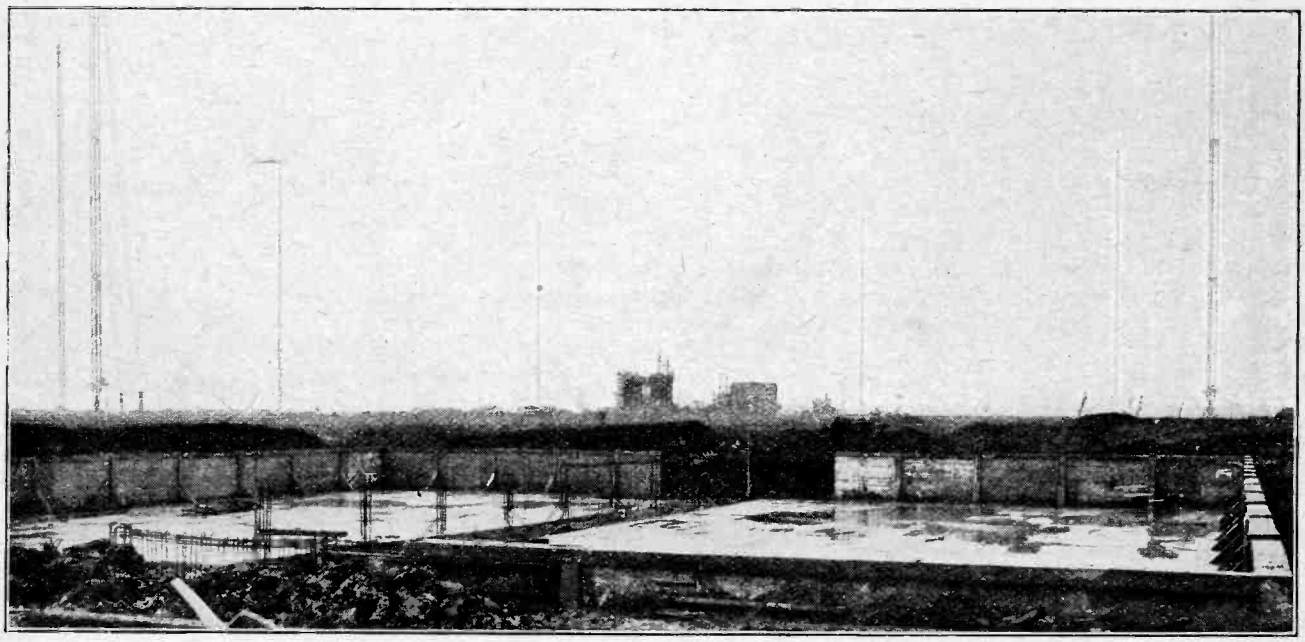


Fig. 1.—General view of the site. The reservoir in the foreground is for the valve cooling water.

immediately apparent, and can only be thoroughly realised by a trip to the top.

The masts are each supported by fifteen steel wire rope stays arranged in three groups of five stays, each stay being attached to a concrete anchor block through an insulating device at its lower extremity.

The lower end of the mast tapers to a point, below which is a ball and socket joint. The purpose of this joint is to allow the mast to move under the load of external forces—such as wind load and antenna pull—without throwing strain on the foundations. Although each stay is initially tensioned to several tons pull, yet under the stress of the heaviest winds and the application of the antenna load, which is of the order of 10 tons, the top of the mast moves several feet.

Beneath the above-mentioned ball and socket joint is an insulating layer of porcelain blocks, and beneath these

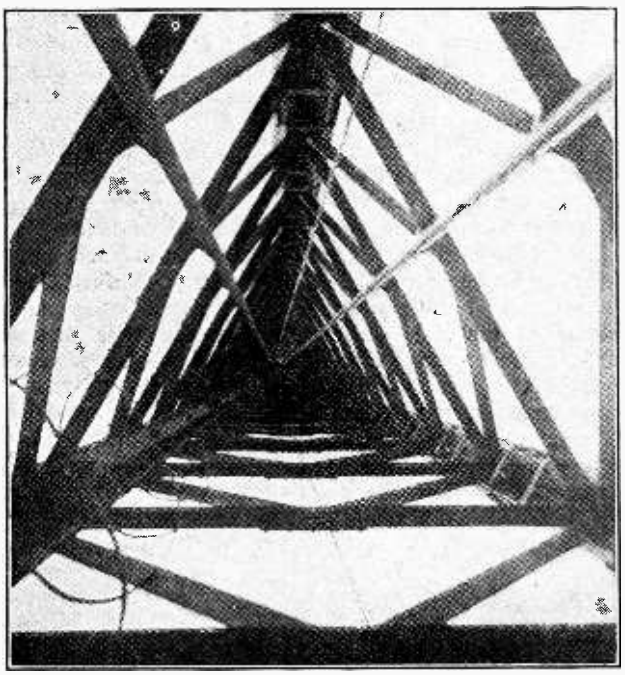


Fig. 2.—Interior of lattice mast, showing lift guides and safety ladder.

is another insulator consisting of granite blocks. Arrangements are made to enable the porcelain blocks to be changed in the event of breakage, and, in fact, during construction temporary wooden blocks were used, the mast afterwards being bodily lifted by hydraulic jacks to permit the insertion of the insulators. The granite blocks are in turn supported from the foundations by a short steel column. A platform is erected on the mast about 33ft. above the ground, on which is placed the electrically driven winch (Fig. 6).

A good view of the inside of the mast looking upwards is shown in Fig. 2. The space is occupied by a steel ladder and a small lift cage, both of which run from top to bottom of the mast. It will be noticed that the ladder is protected by steel hoops every few feet. These serve two purposes: they provide an additional sense of security

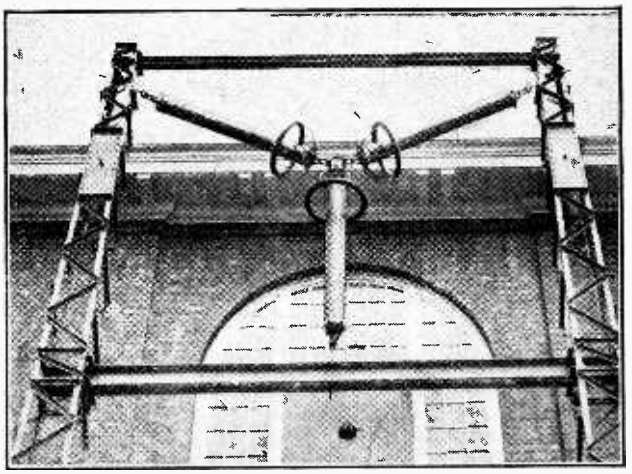


Fig. 3.—Aerial lead-out insulators.

and prevent a climber being knocked off in a wind by a swaying rope.

The electric lift, which holds three persons and takes twelve minutes to complete its journey, is provided with the usual safety devices to prevent accidents due to overwinding or failure of the lift rope. The provision of a lift on each mast might at first sight be thought an extravagance; actually, however, they effect an economy, as, in the event of aerial overhauls being necessary, the loss of time involved in men climbing the masts would be prohibitive, and in heavy winds it would lead to prolonged stoppage. The masts are placed exactly a quarter of a mile apart, and will support antennæ of cage or sausage type of about 12ft. diameter.

In view of the danger to aircraft, arrangements are being made to provide powerful navigation lights on the tops of some of the masts situated at the remote ends of the site.

The station buildings consist of two blocks—the wireless block shown in Fig. 4, and the substation, which is seen projecting beyond the main building at each end

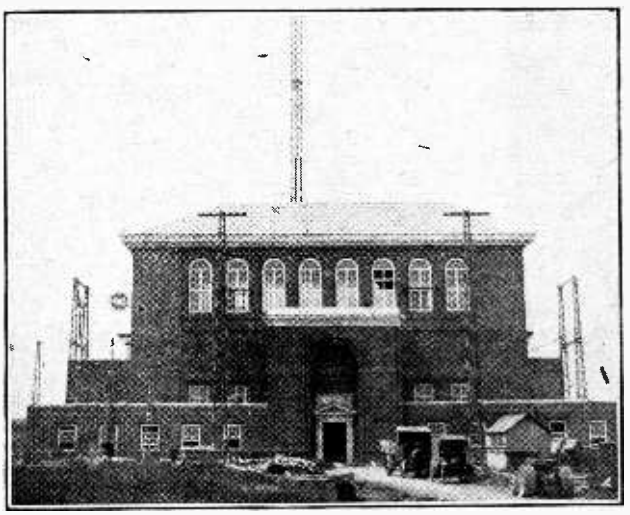


Fig. 4.—General view of station buildings. The subsidiary towers support the aerial lead-out and earth screen wires.

and is connected thereto by offices and retiring rooms. On each side of the main building can be seen the pairs of poles carrying the antenna lead-out, shown in greater detail in Fig. 3. The remaining poles support the earth wires, which radiate out from the building to the poles, and then descend to the ground. The earth system contains over 100 miles of wire, which, over the greater portion of the site, has been buried beneath the surface. This operation was rapidly carried out by means of a specially built plough on which was mounted the drum of wire. The plough was drawn by a motor tractor and laid the wire in one operation. The main transmitting building consists, in effect, of three floors. On the ground floor are situated the valve panels and control gear (Fig. 5); above this will be mounted the condensers. Above the condensers again will be placed the huge inductance coils, some of which will be 16ft. in diameter, wound with cables consisting of over six thousand separately insulated wires.

The valve equipment will consist of two separate transmitters, a telegraph transmitter capable of dealing with from 500 to 1,000 kilowatts, and an experimental telephone transmitter giving an antenna input of 200 kilowatts. Some idea of the power of these sets will be realised when the reader is reminded that the power of local broadcasting stations is about 1½ kilowatts, while the power of the Chelmsford broadcasting station is about 25 kilowatts.

The valve transmitter will be controlled by a steel tuning fork which will be maintained in continuous oscillation at about 2,000 vibrations per second by means of a small valve. By means of apparatus recently developed by the Post Office, the current oscillations produced by this fork are extremely rich in harmonics. By means of suitable filter circuits one of these harmonics is selected and amplified in several stages. This harmonic, after amplification, will be applied to the grids of the main transmitter valves. As the frequency of the tuning fork is remarkably constant, the frequency of the transmitter, which is a multiple thereof, will be equally constant.

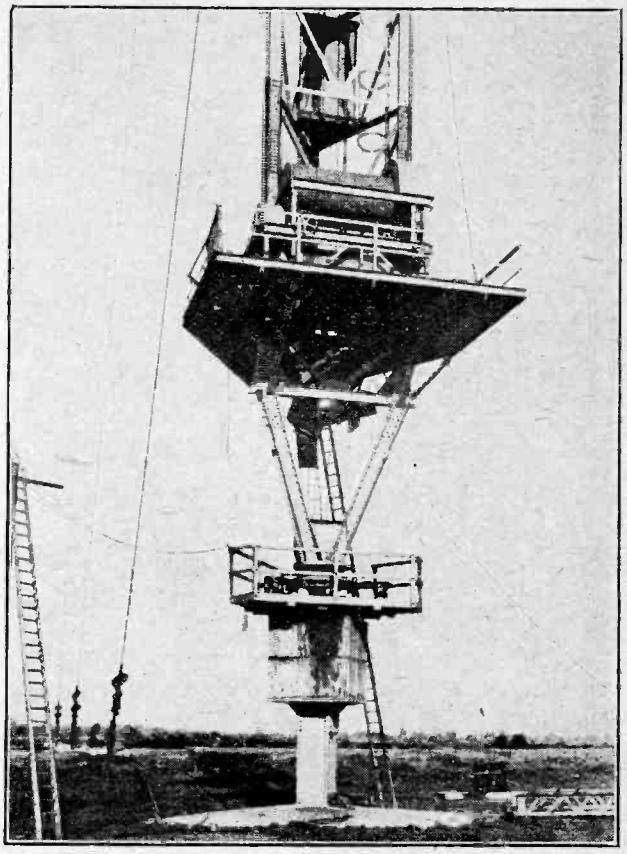


Fig. 6.—Base of one of the aerial masts, showing socket joint, base insulator and winch platform.

The experimental telephone transmitter will operate on a system developed by the Western Electric Company in which the carrier wave and a portion of the signal usually radiated is suppressed. As a result, the signal actually radiated, with a certain aerial current, is equivalent to one of much greater power radiated by the ordinary type of wireless telephone transmitter, and yet causes considerably less interference on adjoining wavelengths. The scheme also possesses another advantage, namely, that without special apparatus it is extremely difficult, in fact practically impossible, to obtain understandable signals on an ordinary receiver. This gives a certain element of secrecy to the transmission.

The telephone transmitter is being installed for experimental trials in Trans-Atlantic telephony, in co-operation with the American Telegraph and Telephone Company, and a special receiving station for the American traffic is being erected near Swindon, Wilts.

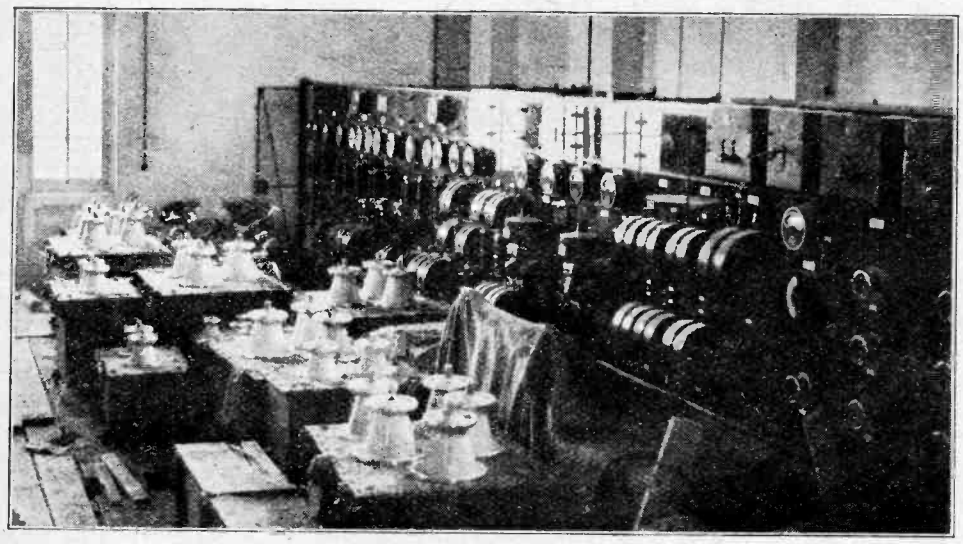


Fig. 5.—Valve control panels and power condensers in course of erection.

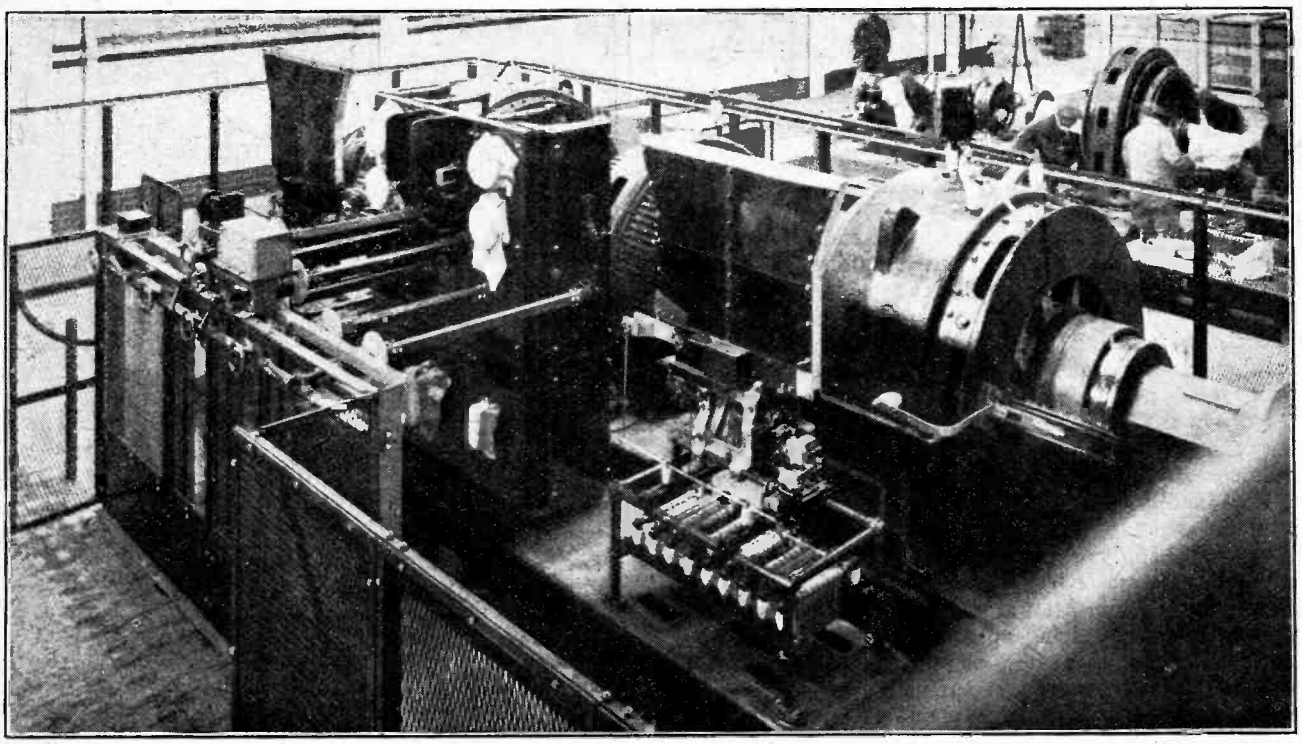


Fig. 7.—View of the D.C. generator sets in course of erection, showing one of the switchboards with remote control and interlocking devices.

The valves used on both telegraph and telephone transmitters will be of the water-cooled type, and will be cooled by a supply of distilled water which will in turn be cooled by means of water circulating from a pond constructed on the site, and shown in the foreground in Fig. 1.

The power supply to the station is being obtained from a public supply, and duplicate mains have been provided to minimise the risk of supply failure. As received it is an alternating three-phase supply at 12,000 volts pressure, and is led to a high tension switchboard for distribution to the various transformers, which reduce the pressure to 416 volts for all auxiliary machinery and to 2,200 volts for the main motor generators (Fig. 7).

The main generators consist of three motor generator sets of special design, manufactured by the British Thomson-Houston Co., of Rugby, each set having an output of 500 kw. at 6,000 volts D.C. As these sets can be connected in series, it is possible to obtain a supply of 1,500 kw. at 18,000 volts D.C. for the anodes of the transmitting valves. The motor generator sets are each located in a screened enclosure, and an ingenious system of electrical and mechanical interlocks ensures that these enclosures cannot be entered while the apparatus is alive. Each motor generator set and its control gear is mounted on insulators, and all controls are effected through the medium of insulated rods. As there is considerable likelihood of a short circuit occurring inside a valve when the filament burns out, special steps have been taken to provide for this event. High-speed circuit breakers are arranged to operate within 1-30th of a second after a short circuit, and to insert a blocking resistance in the circuit to prevent excessive current flowing.

As may be imagined, the filament supply to such a large valve transmitter will absorb a considerable amount of power. It is extremely important that such a supply should not be subject to fluctuations in voltage, and to ensure that this does not occur the filament supply is obtained from alternators driven by synchronous motors, each alternator having an output of 200 KVA at 416 volts 100 cycles. As an additional precaution, special voltage regulators are fitted to the alternator to prevent fluctuations in pressure which might occur, due to switching or to variation in the supply frequency.

To ensure continuity of supply for control circuits and to provide an independent source of lighting, a small secondary battery is being installed which will be charged by motor-generator and booster sets.

As may be imagined, the construction of a station of this magnitude entails a vast amount of work of specialised character in many branches of engineering. Structural, hydraulic, electrical power and radio engineering have each of them their special problems which call for solution, and in each subject it usually happens that these problems require an extension of our present knowledge of the subject.

In consultation with the Wireless Telegraphy Commission, consisting of Dr. W. H. Eccles, Mr. L. B. Turner and Mr. E. H. Shaughnessy, the designs have been fully prepared by the Post Office engineers, or detailed specifications have been prepared from which the manufacturers have designed some of the plant.

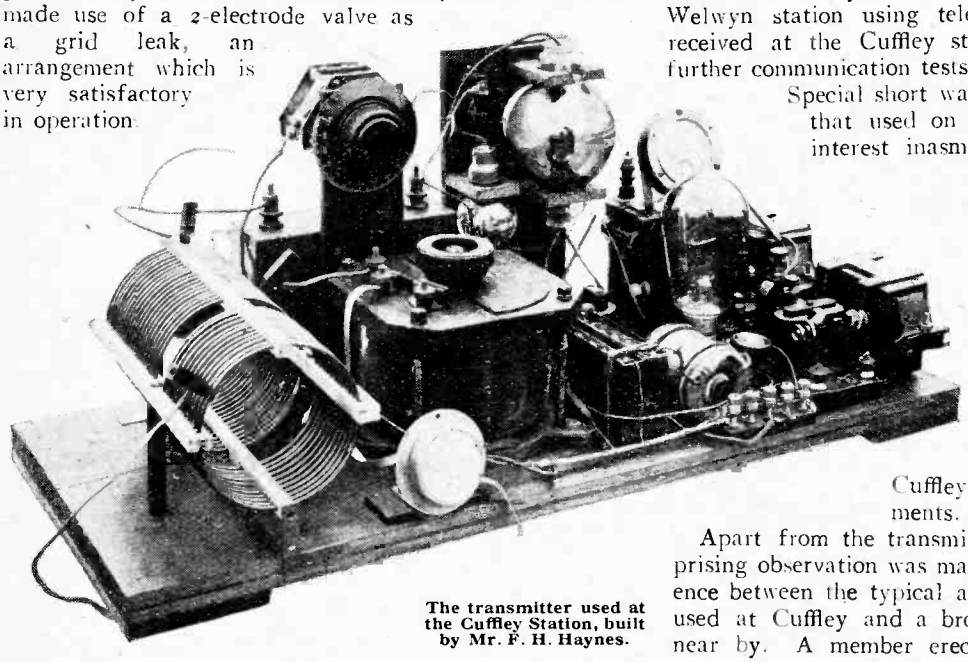
The completion of the station will bring this country in touch with all countries of the world, and will provide a means of communication with ships of the British Navy at all times of the day and night.

TRANSMISSION BETWEEN MOBILE STATIONS.

Radio Societies' Field Day.

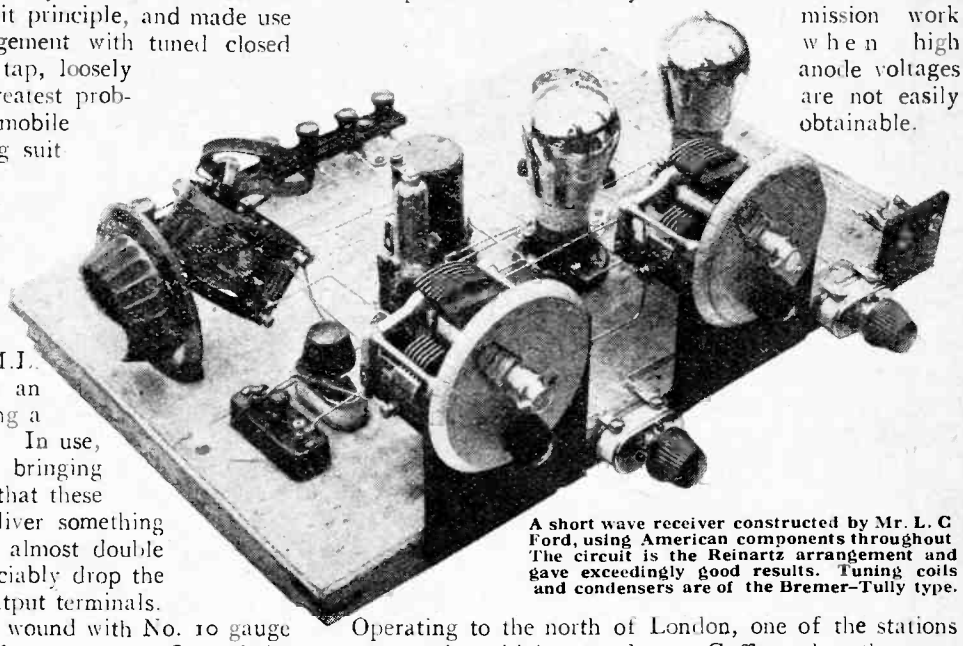
THE Eastern Metropolitan Group (R.S.G.B.) held its first outdoor meeting on Saturday, June 20th, when tests were carried out between two mobile transmitting equipments. The two transmitters, although differing as regards layout and method of assembly, were similar in circuit principle, and made use of the tuned grid coil arrangement with tuned closed circuit inductance and anode tap, loosely coupled to the aerial. The greatest problem in setting up a small mobile transmitter is that of obtaining suitable high voltage supply, and after reviewing many methods by which a high voltage could be obtained, it was decided to adopt a rotary converter driven from a low-voltage accumulator source. Machines of the M.I. type were used, running with an input of 12 volts and delivering a current of 25 ma. at 500 volts. In use, however, it was found when bringing a modulator valve into circuit that these machines were required to deliver something like 40 ma., and this load of almost double the rated output did not appreciably drop the voltage developed across the output terminals.

The tuning inductances were wound with No. 10 gauge copper and threaded into wooden supports. One of the sets used the orthodox grid condenser and leak with grid potential control of the oscillator valve, whilst the other made use of a 2-electrode valve as a grid leak, an arrangement which is very satisfactory in operation.



The transmitter used at the Cuffley Station, built by Mr. F. H. Haynes.

Transmitting and modulating valves were of the Marconi-Osram T.100 and D.E.T.1 types. This latter type has a dull emitter filament requiring a potential of 6 volts and passing 2 amperes, and being of comparatively low impedance is admirably suitable for amateur transmission work when high anode voltages are not easily obtainable.



A short wave receiver constructed by Mr. L. C Ford, using American components throughout The circuit is the Reinartz arrangement and gave exceedingly good results. Tuning coils and condensers are of the Bremer-Tully type.

Operating to the north of London, one of the stations was erected on high ground near Cuffley, the other proceeding northwards along the Great North Road was erected at Welwyn. The first signals transmitted by the Welwyn station using telephony on 130 metres were received at the Cuffley station and were followed by further communication tests.

Special short wave receivers were constructed, that used on the Cuffley station being of interest inasmuch as it was entirely built with American component parts of the special low loss types that have been recently developed.

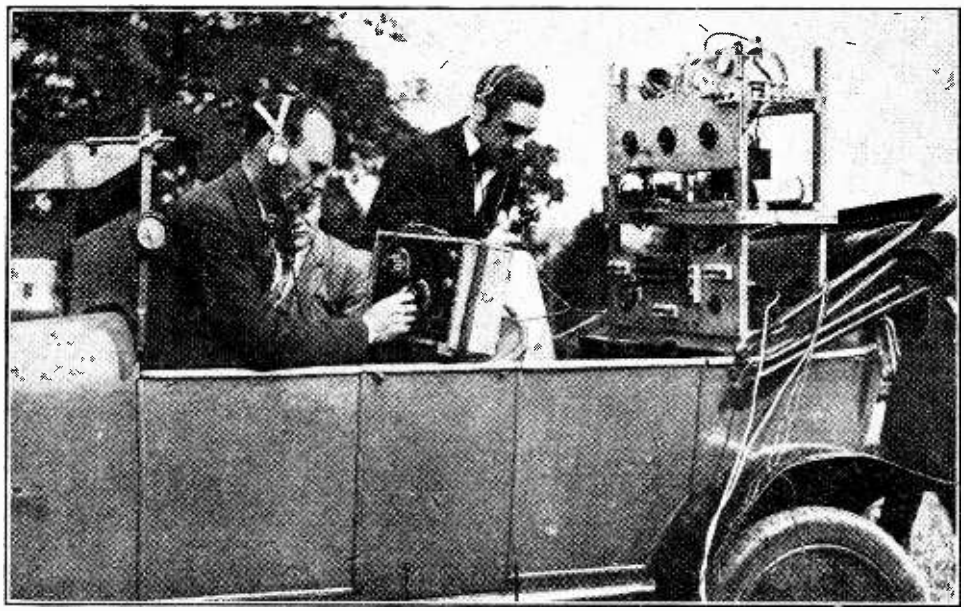
The experiments afforded a good opportunity of revealing the difficulties met with in mobile station working, and many members of the wireless societies situated in the Eastern Metropolitan Group attended at the Cuffley station to witness the experiments.

Apart from the transmission tests themselves, a surprising observation was made in connection with interference between the typical amateur transmitting station as used at Cuffley and a broadcast receiving set installed near by. A member erected a receiving aerial a few

Transmission between Mobile Stations—

yards away from the transmitting aerial and almost passing over the transmitting apparatus. Using a four-valve set, it was found that the signals from 2LO, some 15 miles away, could be received without interference either when keying or transmitting telephony on the short wave mobile set. This observation is of importance, and should have bearing upon the use of amateur transmitting apparatus during broadcasting hours.

(This meeting is the last of the session to be arranged by the Eastern Metropolitan Group Lecture Association. Meetings will be resumed in September. Hon. Secretary: Mr. R. M. Atkins, 7, Eton Villas, Haverstock Hill, London, N.W.)



Mobile Station (2AOB) used at Welwyn. The transmitter was built by Mr. Holdness and the receiver by Mr. Neale, members of the Tottenham Wireless Society.

Calls Heard.

Extracts from Readers' Logs.

East Orange, New Jersey.

British :—2CC, 5NN, 2LZ, 2FM, 2KZ (telephony), 6NF, 5PZ, 5MA, 2RB, 2JF, 2NB, 2WJ, 2LS, 5LF, 2DZ, 5MQ. *French* :—8FQ, 8CT, 8SSC, 8BF, 8AB, 8HSG, 8GO, 8UU. *Italian* :—1CO, 1RT, 1ER, 1MT. *Spanish* :—EAR2, EAR6.

(0-v-1) CHESTER W. SMITH (U 2CXW).

Trondhjem, Norway.

British :—2CC, 2DX, 2DW, 2KW, 2LZ, 2NB, 2WY, 2YX, 5BA, 5MZ, 5QX, 5SZ, 5TZ, 5UQ, 6AL, 6FG, 6RM, 6TD, 6US, 6UV.

J. R. K. SAURE AND S. SAXEGAARD.

Leicester.

British :—2LZ, 2VX, 2XY, 5DH, 5NW, 5LF, 5SI, 5SZ, 6TD.

(0-v-1.) R. POLLOCK.

Lower Bebington, Birkenhead.

British :—2PZ, 2YX, 2QY, 2QB, 2SSK, 2NC, 2WCS, 2BC, 2BR, 2PZ, 2LPS, 2BS, 2IN, 2AOX, 5SY, 5TZ, 5RB, 5TG, 5HA, 5BH, 5NW, 5MA, 5LU, 5ON, 5PW, 5PO. B. C. CHRISTIAN.

(0-v-1.)

Verviers, Belgium.

British :—2LZ, 2QM, 2XY, 5MA, 5SI, 5SZ, 6MX. *Belgian* :—4YZ. *French* :—8BV, 8FQ. R. PIROTTE.

Bath.

British :—2GY, 2II, 2JJ, 2AWM, 5HA, 5HX, 5RF, 5ST, 5SZ, 6DO. *Belgian* :—R2, R4, R7, X2. *German* :—A8. *Russian* :—SOK (Sokolinki station).

(0-v-0.) (No aerial or earth.) G. W. SALT.

Burnham-on-Crouch, Essex.

British :—2KJ, 2LZ, 2MC, 5OM, 5BP (all telephony). (Valve reflex.)

R. C. HORSNELL.

New Haven, Conn., U.S.A.

British :—2CC, 2KF, 2OD, 5NN, 6YM. *French* :—8FG, 8SM, 8UDI.

C. B. WEED (v 1BHM).

Merthyr Tydfil, Wales.

British :—2FM, 2JJ, 2TU, 2UV, 2VX, 5BX, 5HX, 5ID, 5JK, 5MS (telephony), 5NW, 5RB, 5ST, 5SZ, 6DO, 6FG, 6JV, 6RM, 6RS (telephony), 6TD.

(0-v-0.) W. T. REES.

Reading.

British :—2SW, 5OC, 6RM, 2KT, 2NJ, 6TD, 2NJ, 6MP, 6TW, 6ME, 6JF, 5HS, 5BV, 5TZ, 2LZ, 2XY, 5SI.

(0-v-0.) A.S.C.

Stuttgart, Germany.

British :—2OO, 2VX, 5JK, 6AL, 2QM. *French* :— 8JRK, 8GI. *Swedish* :—SMGB, SMGC, SMVH.

ROLF FORMIS.

Dulwich.

British :—2MI, 6OT, 2ZD, 2IH, 2NJ, 6QB, 5HS, 6IJ, 6US, 5IX, 2FM, 5RZ, 6YR, 6NS, 6TD, 2RU, 6RM, 5SL, 5HA, 2HQ. *French* :—8FQ, 8OW, 8AR, 8KZ, 8HM, 8QQ, 8QZ, 8HID, 8RD, 8MN, 8LL, 8GGA, 8JW, 8HSF, 8MJM, 8BN, 8RL, 8RLH, 8DD, 8PLM, 8OO, 8FI, 8RIC, 8TM, 8CT, 8ARV, 8TVI, 8JC, 8CMT.

(0-v-0.) G. C. EDWARDS.

Leicester.

French : 8HSK, 8YOR, 8GL, 8OW, 8KQ, 8SSU, 8JRK, 8LL, 8RK, 8KX, 8HGB, 8KZ, 8DD, 8CP, 8TK, 8PL, 8CS, 8SSB, 8PD, 8SA, 8MSM, 8HU, 8HBK, 8PLM, 8UT.

(0-v-1.) W. H. HARRIS.

Cambridge.

British :—2HB, 2NE, 2QB, 2QC, 2QM, 2ZB, 5AX, 5IS, 5OX, 5RH, 5ZA, 6AL, 6LB, 6MX, 6US.

E. W. THOMAS (5YK).

Gt. Shelford, Cambs.

British :—2CF, 2GY, 2HQ, 2BM, 2JV, 2SV, 2XD, 2QC, 2KT, 2UG, 2RO, 5JH, 5HX, 5OC, 5DT, 5UV. *Dutch* :—OKY, OPM. *French* :—8HZ.

(0-v-1.) G. A. JEAPES (2XV).

Copenhagen.

British :—2WJ, 2CC, 2MQ, 2JU, 2LZ, 2RB, 5TZ, 5IC, 6NF, 6NV, 6UV, 6XY, 6GM. *French* :—8MT, 8QG, 8WU, 8RLH, 8FO, 8RLS, 8WAL, 8SSC, 8PL, 8EE, 8AG, 8CPP, 8JBL, 8ALG, 8BF, 8SSU, 8TK, 8GK, 8HSD, 8NK, 8EO, 8UD, 8KL, 8MJM. *Swedish* :—SMZS, SMZT, SMPL, SMXV, SMPZ, SHER, SMVL, SMVH, SMRG. *Finnish* :—2NN, 1NA, 2NJ, 2NM, 2ND.

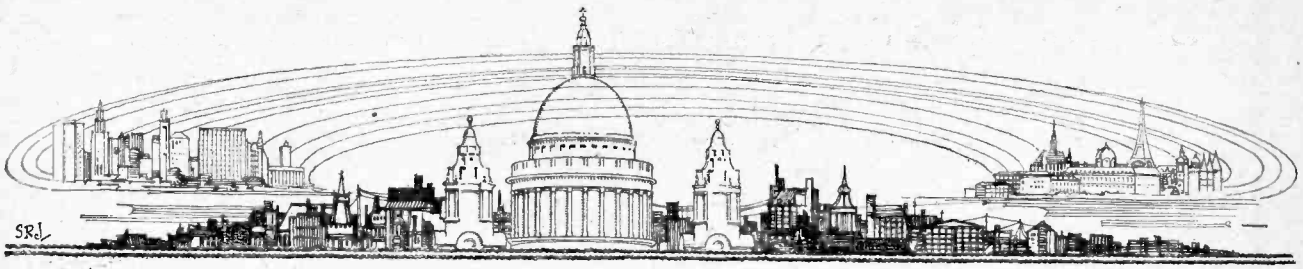
BORGE JORGENSEN.

Norwich.

British (80 *to* 110 *metres*) :—2XV, 2ZB, 2JU, 2IN, 2OY, 2VX, 2ND, 2GO, 2FU, 2FM, 2YQ, 2YX, 2IN, 2DX (telephony), 2DR, 5BV, 5PW, 5HA, 5NW, 5TZ, 5RB, 5MA (telephony), 5OC, 5CT, 5KC, 5XY, 5DN, 5GV, 5CW, 5DA, 5YK, 5MK, 5YI, 6TD, 6AL, 6RM, 6BT (telephony), 6YR, 6RL, 6GM, 6SM, 6QB.

(150-200 *metres*) :—2XV, 2KT, 2SM (telephony), 5CT, 5FT.

H. J. B. HAMPSON (6JV).



CURRENT TOPICS

Events of the Week in Brief Review.

NEW AUSTRALIAN BROADCASTING STATION.

A Sydney message states that the Post Office has approved an application by the Sydney Trades Hall to run a broadcasting station for the transmission of news, lectures, politics, and music.

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NEW VALVE MANUFACTURERS.

At the statutory meeting of Burndept Wireless, Ltd., on June 20th, it was announced that a portion of their new factory at Willesden would be used for the manufacture of valves on a large scale by mass production.

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NEW RELAY STATION FOR QUEENSLAND.

The Australian Federal Authorities have authorised the erection of a relay station at Rockhampton, Queensland, which will work on 323 metres, and relay portions of the programmes from the main station at Brisbane.

RAPID INCREASE IN SWISS LISTENERS.

Since the Swiss broadcasting stations began their regular service the number of registered receiving sets had grown from 980 in 1923 to nearly 17,000 at the end of 1924, exclusive of private sets which had not been registered.

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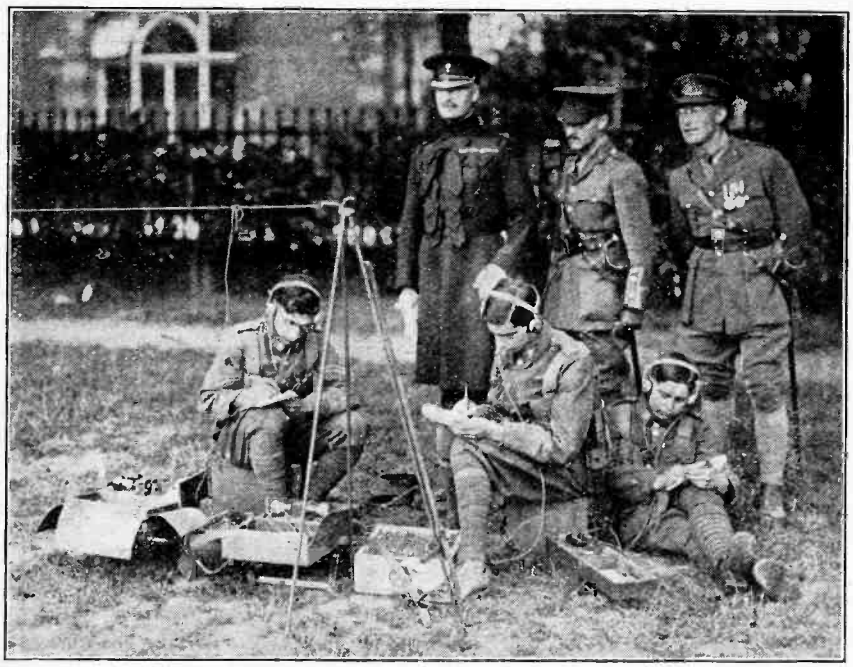
BROADCASTING IN JAVA.

Many applications to erect broadcasting stations in Java have been received by the Government, but it is understood that it prefers to reserve all rights to itself as a monopoly.

oooo

BROADCASTING IN THE RHINELAND.

It is understood that the Rhineland Commission may partly rescind the existing prohibition on broadcasting in the occupied area, and that permits may be granted by the responsible Generals of the respective districts for the use of broadcasting stations for business, scientific, and educational purposes.



WIRELESS IN CADET MANŒUVRES. Major Hughes is here seen inspecting the wireless equipment on the occasion of a recent Field Day of the St. Paul's O.T.C.

UNKNOWN STATIONS.

A correspondent wishes to identify a C.W. station with call sign NEA which he heard at about 10.25 p.m. on June 12th, calling PCUU on a short wave. Also 9EA, heard at 12.10 p.m. on June 13th.

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SWEDISH AMATEURS PLEASE NOTE.

A report has been received that a Swedish station, SMY - -, was heard by the Inland Revenue Radio Society at 11.15 G.M.T. on Sunday, June 7th, replying to a test call sent out by their portable station SAI. The Society is anxious to verify this fact and will be glad if the owner of SMY - - will communicate with the hon. secretary, Mr. W. J. Tarring, C2, York House, Kingsway, London, W.C.2.

oooo

SOUTH AMERICAN AMATEURS ACTIVE.

Several communications have lately reached us recording the hearing of amateur stations in South America. One correspondent writes that on the morning of June 17th he heard the Peruvian 4RL working on 40 metres with the United States. Another, at 10.15 p.m. on June 14th, heard the Brazilian stations 1AB and 1AP in communication on about 30 metres. We shall be glad to receive reports from other listeners who may have heard similar stations.

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BROADCASTING IN SPAIN.

A new broadcasting station for the Union Radio was opened in Madrid on June 17th. The call sign is EAJ7 and it will transmit a mixed programme on 430 metres daily from 3.30 to 4.30 p.m. A musical programme will be transmitted on the odd days of the month between 7 and 9 p.m. (G.M.T.), and on even days between 11 p.m. and 1 a.m.

oooo

GENEVA INTERNATIONAL EXHIBITION.

The International Exhibition to be held in Geneva from September 9th to 20th is expected to arouse considerable interest. Intending exhibitors of radio apparatus, etc., are informed that the Customs formalities will be reduced to a minimum, as the goods exhibited will be considered as being in bond as long as the exhibition lasts, and the Swiss Federal Railways will not charge freight for their return.

MISUSE OF AMATEUR CALL-SIGN.

The owner of the station 2AAR, Mr. F. G. Morgan, 53, Cecil Street, Wavertree, Liverpool, has reason to believe that some other transmitter is making use of his call-sign, and will be glad of any information which will enable him to discover the transgressor.

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WIRELESS SOCIETIES IN FRANCE.

The Fédération des Radio-Clubs de la Région Parisienne has recently been formed by members from various Radio Societies in the district. Messrs. Edouard Branly, Berthelot, and General Ferrié have been elected honorary presidents.

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AUTHORS' RIGHTS IN GERMANY.

The Prussian State Court has decided that broadcasting companies in Germany who wish to transmit extracts from books or plays by living authors must first obtain their permission and must be prepared to pay them for the privilege of broadcasting such extracts.

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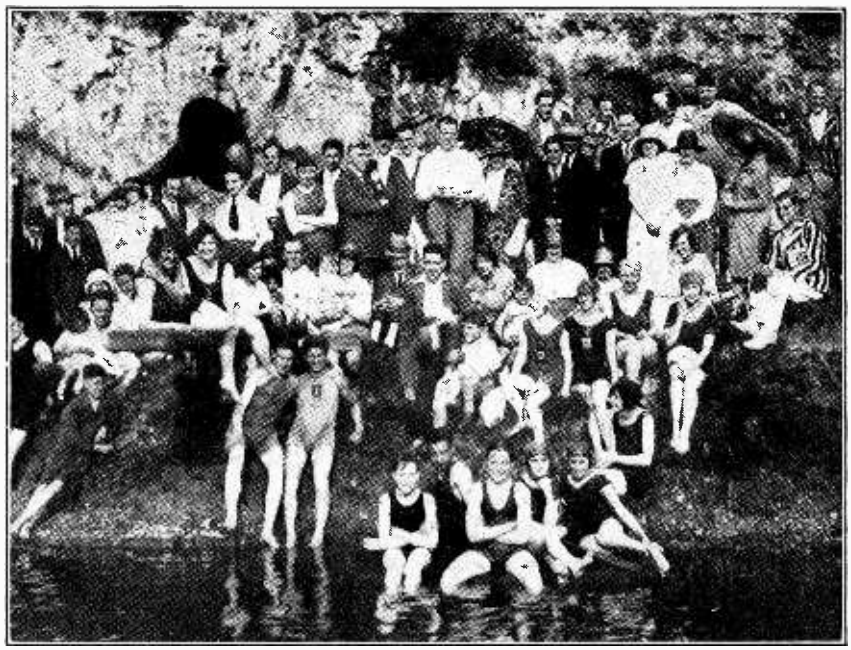
WIRELESS ON MISSION SHIP.

The s.s. "Strathcona II," belonging to the Royal National Mission to Deep Sea Fishermen, has been equipped with a Standard Marconi ½ kw. quenched spark transmitter and a special receiver tunable to all wavelengths up to 26,000 metres, thus covering all transmissions of meteorological bulletins, time signals, etc., of especial value to fishing fleets.

This little ship, which is only 85 ft. long, is one of the smallest ever to cross the Atlantic. She will be the only ship belonging to the Mission fitted with a wireless transmitter, though other vessels of their fleet carry receivers.

DR. LEE DE FOREST, the celebrated wireless engineer, who is at present in this country for the purpose of giving demonstrations of his invention, the "Phonofilm."



[By courtesy of the "Bristol Times and Mirror."]

LOUD SPEAKERS AT SWIMMING CLUB. Through the enterprise of Automobile Accessories (Bristol) Ltd., members of the Henleaze Swimming Club, Bristol, recently enjoyed the novelty of hearing the Cardiff programme while bathing.

NATIONAL RESEARCH.

The Bureau of Standards at Washington, U.S.A., has issued the report of the Visiting Committee, in which great emphasis is laid on the value of research work conducted by a national institution. Numerous examples of savings effected by such research at the Bureau of Standards are given, and it is stated that in the motor car industry the combined result is a saving of $155,000,000 per year to the American public. The value is also emphasised of basic research undertaken without reference to its direct value but often of the utmost use in connection with subsequent discoveries.

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QSL's WAITING.

The owners of the call signs G6AM and G6US are requested to communicate with Mr. H. J. B. Hampson (G6JV), who has QSL cards for them in his possession.

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A CORRECTION.

We wish to correct an error in the explanation of Fig. 10 in Mr. S. K. Lewer's "Notes on Short Wave Reception," which appeared on p. 619 of our issue of June 17th. The wires A and B are of copper, not resistance wire, and are connected to the L.T., so that the leads to the L.T. circuit may be easily changed without crowding several wires on one terminal.

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AIR MINISTRY APPOINTMENTS.

The Air Ministry announces that in pursuance of the policy already announced, by which the functions of scientific research and technical development, which were formerly combined in one directorate, have been divided, the Secretary of State for Air has appointed Mr. H. E. Wimperis, M.A., F.R.Ae.S., M.I.E.E., to be Director of Scientific Research, and Mr. D. R. Pye, M.A., to be Deputy Director under the Air Ministry.

YOUR CALL SIGN?

For the benefit of others as well as themselves, amateur transmitters, both in Britain and in other countries of the world, are earnestly requested to co-operate in the preparation of reliable information regarding call-signs, etc., by forwarding full particulars of their stations to the Editor of "The Wireless World," 139-140, Fleet Street, London, E.C.4.

CATALOGUES RECEIVED.

The catalogues and price lists mentioned in this section can in most cases be obtained on application to the firms concerned. As a matter of business courtesy, stamps for return postage should be enclosed.

The Electric Depot, Ltd. (Pritchett Street, Aston, Birmingham). Illustrated pamphlet dealing with accumulator charging boards for D.C. circuits.

Sexton-Barnes, Ltd. (61, Borough Road, London, S.E.1). Leaflet descriptive of Sexton-Barnes No. 10 "Red Seal" loud speaker.

Fuller's United Electric Works, Ltd. (Woodland Works, Chadwell Heath, Essex). List 91C, descriptive of Fuller inert and dry cells. List 320A, relating to Redline ebonite panels.

Audion Radio Co. (52, Dorset Street, W.1). Folder describing Loewe Audion valves.

Radio Components, Ltd. (19, Rathbone Place, London, W.1). Catalogue of Radcom wireless components.

Igranic Electric Co., Ltd. (149, Queen Victoria Street, London, E.C.). Publication No. 6144, combined filament rheostat and variable grid-leak. Publication No. 6149, combined filament rheostat and 300-ohm potentiometer. Publication No. 6150, combined filament rheostat and high-resistance potentiometer. Publication No. 6141, Ultrynic (regd.) autocoupler.

AN AMATEUR STATION.

"British 2NB."

By N. G. BAGULEY.

BRITISH 2NB appeared on the London ether towards the middle of November last. Essentially a temporary station only, no great efforts have been made to place it among the ranks of London's "DX hounds." This, primarily, because of the difficulties encountered in the operation of a transmitter in a house other than one's own. A few details of the station may interest those amateurs with whom communication has been established.

Aerial and Counterpoise.

The antenna system consists of a mast 35ft. high stayed by wire guys broken up at intervals with insulators from which is suspended a four-wire cage 14in. in diameter and 55ft. long. The cage tapers to 8in. diameter at the lead-in end, which is approximately the same height as the open end. The wire used throughout is No. 14 hard-drawn copper, and has proved most satisfactory. In addition to this having a lower H.F. resistance than the average stranded wire, it was found to withstand better the shearing motion which is bound to occur at the junction between the lead-in and the horizontal portion—particularly if the lead-in is inclined to swing.

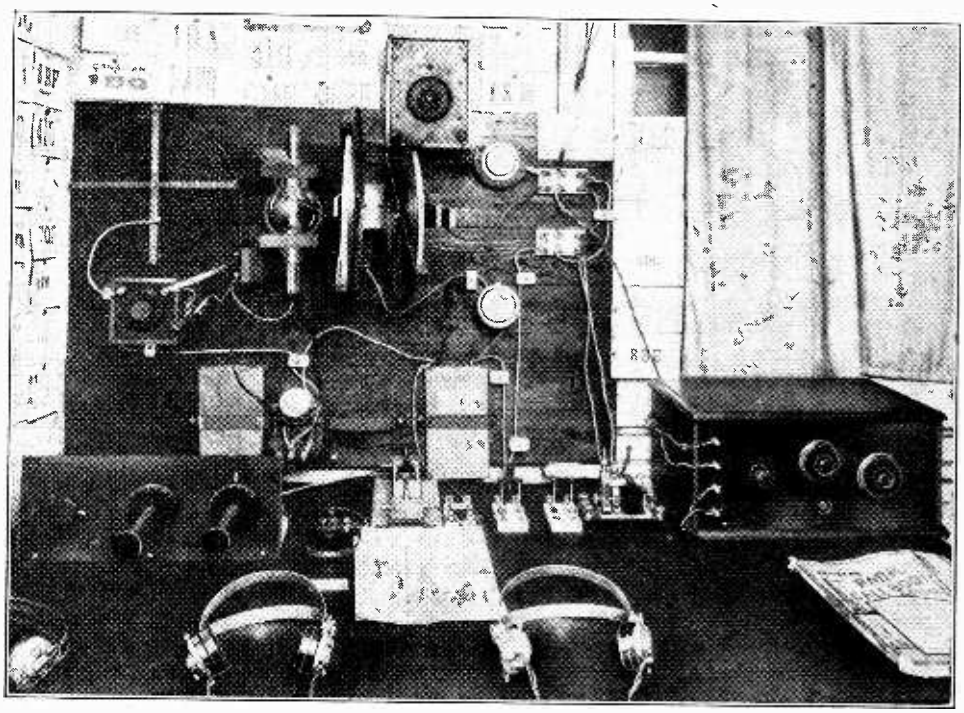
The earth screen is directly beneath the aerial, and is composed of four wires, 55ft. long, spread out fanwise 6ft. from the ground. Care has been taken with the insulation of the whole system, and Buller's "petticoat" insulators are installed throughout in order to minimise capacity losses. In the writer's opinion the use of a low capacity antenna insulator is most essential when working with waves of 100 metres and below; the average reel, egg, or shell type being most unsuitable.

The Colpitts oscillator circuit was first tried, but was given up for the well-known reasons. The circuit finally adopted for waves of 100 metres was a coupled Hartley with tuned grid coil employing series feed. As will be seen from the photograph, the wiring up of the transmitter corresponds almost exactly to the circuit diagram when drawn out in the orthodox way. In this manner much stray capacity between leads is avoided. Practically no magnetic coupling exists between grid and plate inductances, as the former is mounted on porcelain cleats some 24in. away in a manner calculated to prevent any field interaction.

The Tuning Coils.

The flat spiral inductances are made from 20 gauge copper strip. The formers are made from strips of teak 18in. by 1in. by 1in. These were baked thoroughly and boiled in paraffin wax. It was found that the insulating properties of this material compared favourably with the best ebonite, besides being much stronger and easier to work. The aerial and plate inductances are mounted together, one being hinged so as to facilitate coupling adjustments.

The aerial series condenser is variable, and has a maximum capacity of 0.0003 mfd., the plates being double spaced to prevent heating and consequent losses. The grid coil has a small variable capacity in shunt. This condenser is almost a necessity for tuning up the set, and is useful for making small wavelength changes, as the frequency is mainly dependent on the constants of the grid circuit. A variable condenser is not used across the plate coil, although it is a refinement and useful in reducing the plate current. Passing over the grid condenser and leak and H.T. condenser, etc., we come to the valve, a Mullard type o/150.



The station of British 2NB. The transmitting valve and inductances are mounted in the centre, while to the left can be seen the low loss tuner fitted with extension handles.

An Amateur Station.—

The filament is heated by alternating current supplied by a small step down transformer operated from the mains, a rheostat for controlling filament voltage being connected in the primary of the transformer. Large condensers have been tried connected from centre tap to the outside of the secondary winding, but no benefit has been derived either as regards increased output or quality of note. The same may be said of H.F. chokes in the filament leads.

Chemical Rectifiers.

The anode of the valve is normally supplied with chemically rectified A.C. at 1,200 volts, although 1,500 volts can be obtained when desired. The rectifiers have been a nightmare, but they certainly hold out under surprising overloads. When unduly pressed they squirt fire and make appalling noises. In all, forty cells are employed, 20 on each side of the centre tap of the H.T. transformer. Each cell consists of a laboratory boiling tube, 6in. × 1½in., containing aluminium strip 5½in × ½in., and a lead strip of the same dimensions. The tubes are filled within one inch of the top with ammonium phosphate solution.

The H.T. transformer operates on current from the main at 205 volts A.C. 50 cycles. A variable resistance is connected in the primary circuit. The input into the rectifiers can be varied from 400 to 1,900 volts. The key has been tried in various places in the circuit, and has finally come to rest in the primary of the H.T. transformer. Most certainly the centre tap of the filament transformer is the most suitable place, but when the rectifiers are overloaded, the only way to prevent them heating up is to key in the primary of the transformer. No filter circuit is used; but with full wave rectification and the internal capacities of the rectifiers no difficulty has been experienced in obtaining practically a D.C. note. The filament voltage is found most important in this connection, and by working the valve at 9.75 volts instead of at 10.6 (rated voltage) an increase of aerial current and a pure note is obtained. Each H.T. lead has a 300 turn H.F. choke included, and a 1 mfd. condenser is shunted across the H.T. input to the set, to act as a by-pass. On 94 metres—the normal operating wave—the aerial current indication is 1.8 amps at an input of 94 watts. On 55 metres 0.8 amps is obtained.

Arrangement of the Receiver.

The receiver is of the usual o-v-l type employing a DEV low-capacity detector and a low loss tuner. Lorentz basket weave coils, fixed tune antenna coil, and "ball reaction" coil is all that need be said of the receiver. A tuner of this type is preferred to a three-coil holder, which, although convenient, is often noisy and a source of losses when operating at high frequencies.

Since December 15th last the DX list includes 143 different American stations, Porto Rico, G HH1 at Mosul—all worked. Reports have been received from Christchurch (New Zealand) and Idaho (7th district), U.S.A. Every European country possessing amateur transmitters has been worked.

In conclusion, the writer would like to take the opportunity of thanking many of the London amateurs for their co-operation, which has helped to make a short visit extremely enjoyable. This station has recently been licensed to work on 55, 18.3, and 9.2 metres. If audible, reports will be welcomed on these latter two waves, and should be sent to N. G. Baguley, 33, Castle Gate, Newark, Notts.

ETHER AND REALITY.

THE very interesting and instructive series of lectures by Sir Oliver Lodge, which were recently broadcast from 2LO, are now published by Messrs. Hodder and Stoughton, Ltd., in book form with a suitable prologue and epilogue by the author.

We doubt if there is any listener who did not appreciate and enjoy Sir Oliver's clearly expressed, thoughtful, and practical discourses, excepting perhaps the small but insistent minority who wish the B.B.C. programmes to be devoted entirely to light music and frivolity; it is, therefore, unnecessary to enlarge upon the contents of this book.

In his preface Sir Oliver Lodge modestly writes:—"An attempt to set forth in intelligible fashion something of what is known about the ether and its functions is made in this book; and although, like everything human, it is far from infallible, it represents the outcome of a lifetime of study and meditation, and may be acceptable as a guide until something better is available." It is understood that he is preparing another and larger work dealing with the same subject in fuller detail.

Throughout the book, from the first chapter which outlines the presumed or known nature and functions of ether, to the end, where its possible relation to Life and Mind is discussed, the author carefully distinguishes between proved facts, probabilities, and surmises, but it is apparent that even the surmises are the outcome of earnest thought and study.

"We used to try to explain the properties of ether in terms of matter. . . . We have learnt that the problem lies in the opposite direction; and modern Physics, since Lord Kelvin's time, may be said to be devoting itself to the explanation of matter in terms of ether."

The more we read and re-read this book, the more channels of thought it opens out. There are no learned technicalities, only to be comprehended by the initiated, but every phase of the mighty subject is expressed in plain language which should appeal alike to the man of average intelligence and to the physicist, philosopher, poet or theologian; to the latter, perhaps, especially, as it is evident that the author does not consider that scientific research and religious convictions need in any way be antagonistic.

"Ether and Reality," by Sir Oliver Lodge, F.R.S., D.Sc. Hodder & Stoughton, Ltd. 179 pp.; 3s. 6d. net.

New Apparatus

A Review of the Latest Products of the Manufacturers.

COIL CHANGE-OVER SWITCH.

The Utility type of change-over switch is now so extensively used that it scarcely needs description. The manufacturers, Messrs. Wilkins & Wright, Ltd., are now, however, supplying a very useful component consisting of one of their double-pole change-over switches mounted on a base piece sufficiently large to give support to a pair of coil sockets. This component should be particularly useful in broadcast receiver construction for changing over from the 300-metre broadcast band to a 1,600-metre wavelength. A double pole change-over switch with plug and socket connectors has, of course, many applications.

Wilkins & Wright inductance change-over switch.

SIGMAX SAFETY BATTERY.

It is probable that almost as many valves are destroyed by accidental connection to the H.T. supply as by filament deterioration in normal use. In the Sigmax battery a resistance is connected between the negative end of the battery and the negative terminal. By this means the maximum current that can pass from the battery is limited, and an accidental contact, even to a 0.06 type valve, will not destroy its filament. The inclusion of this resistance in the circuit has no detrimental effect, as it is comparatively low compared with other resistances in the valve plate circuits, while it is invariably shunted by a large capacity condenser fitted in the receiving instrument. The provision of this resistance as part of the battery is a good arrangement, for any protecting device of this sort, to be effective, must be connected right at the point of current distribution.

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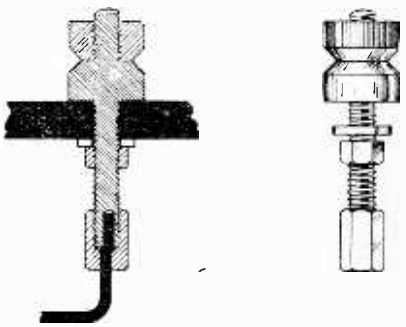
TIXIT TERMINALS.

Wireless component parts, when appearing on the front of the panel, are invariably given a nickel-plated finish. In the case of terminals, nickel-plating renders soldering difficult, as the plated surface must be removed before the solder will adhere.

This difficulty may be overcome by the use of tags, but a much better appearance is obtained by employing the Tixit type terminal with its nut fixing. As shown in the accompanying sectional illustration, it will be seen that a hole is provided in the stem of the terminal to take the connecting wire. The hole is, however, slightly out of centre so that when the nut is screwed up a small and somewhat acute bend is applied to the wire, making not only a good mechanical joint but a reliable electrical connection. The terminals are drilled for No. 16 wire. Instrument wiring has a very attractive appearance when this type of terminal is employed.



The Tixit terminal, showing the method by which a shearing force is applied to the wire to obtain good electrical and mechanical connection.

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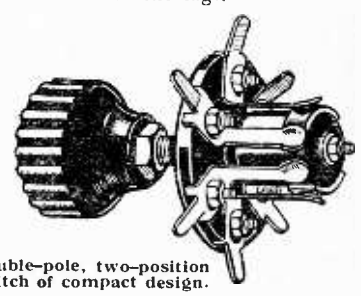
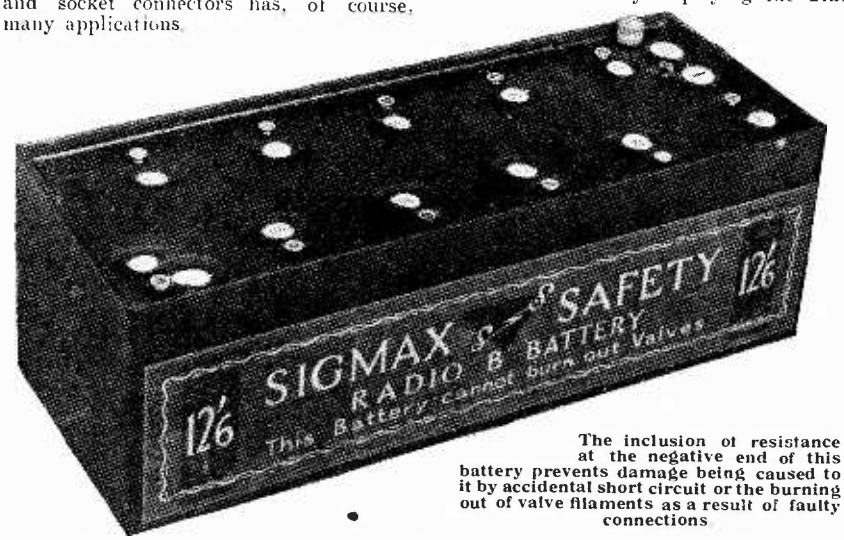
ROTARY CHANGE-OVER SWITCH.

A compact switch, occupying very little panel space and operated by a rotary movement, has been received from Messrs. G. M. Bowles, Shirley Road, Acocks Green, Birmingham. It is a double-pole, two-position switch, and consists of six spring tags with a small cylinder carrying two copper segments which, on being rotated, change the connections between the tags.



Double-pole, two-position switch of compact design.



The inclusion of resistance at the negative end of this battery prevents damage being caused to it by accidental short circuit or the burning out of valve filaments as a result of faulty connections.

NEWS FROM THE CLUBS.

Secretaries of Local Clubs are invited to send in for publication club news of general interest. All photographs published will be paid for.

Lewisham and Bellingham Radio Society.

A general meeting of the society was held at their headquarters, 136, Bromley Road, Catford, S.E.6, on June 16th, when the officers of the club came up for re-election and the affairs of the society were discussed at length. General satisfaction was expressed with the position of the club. The new four-valve receiving set which has been constructed for experimental purposes will be used during a series of field days, for which arrangements are now being made and of which particulars will shortly be announced. It was unanimously agreed that the society should apply for a transmitting licence at an early date in readiness for the winter session, and the offer of Mr. R. E. Stanley, the society's technical adviser, to further this undertaking was heartily applauded. Meetings are held at the society's headquarters on Tuesdays at 8.15 p.m., and particulars of membership may be obtained from the hon. secretary, Mr. C. E. Tynan, 62, Ringstead Road, Catford, S.E.6.

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The Croydon Wireless and Physical Society.

The final meeting of the present session was held at 128, George Street, Croydon, on Tuesday, June 23rd, at which general business was discussed. Hon. secretary, Mr. H. T. P. Gee, 51 and 52, Chancery Lane, W.C.2.

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The Swansea and District Radio Society.

The outdoor meeting on Tuesday, June 16th proved very popular with the members, there being a big attendance. The society, with the kind permission of Capt. Yarwood, went on board the Blue Funnel liner s.s. *Protesilaus*, 6,110 tons, trading with the Far East ports. The senior operator, Mr. G. S. Robinson, gave an interesting demonstration of the ship's transmitting apparatus and went to a great deal of trouble in answering any questions that the members put to him. It was necessary, owing to the big attendance, for the demonstration to be given in relays. The transmitting apparatus used was 1½ kw. Siemens quenched spark. There was also an emergency set, which is used when any of the main apparatus breaks down. The power for the main transmitter is obtained from a D.C. supply of 65 volts through the generator to 220 A.C., to be transformed to 8,000 volts, giving an average in the aerial of 9 amps. Leyden jar condensers were used, also helix coils with an inductance of 60 microhenries. The receiver was a one-valve D.E.R. using reaction, the valve was a Marconi Osram D.E.R. .3 amp. using 1.8 volt on the filament and 72 volts high tension, there also being a stand-by crystal set with a large combination of crystals which can be used in the case of emergency. In the case of a breakdown with the generator, the lights in the operators' room, two side lights, and the light on the mast automatically switch over on to the emergency accumulators. A hearty vote of thanks was passed to the operator for his demonstration.

Hon. secretary, E. H. White, 100, Bryn Road, Swansea.

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Woolwich Radio Society.

We have received a copy of *The Oscillograph*, the monthly publication which this enterprising society issues for the benefit of its members. In the current number Mr. F. S. Frazer discusses the question of series *v.* parallel condensers in reception and transmission, and members of the society are asked to forward comments on the points raised.

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

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Golders Green and Hendon Radio Society.

Members of the above society spent a very instructive evening on June 17th, when all the transmitting and receiving gear that was used on the long range experiments of Saturday-Sunday, June 6th-7th, were on view. The 45- and 175-meter wave equipments were very ably explained in detail by Mr. Maurice Child and Mr. Crewe, who were chiefly responsible for the design and assembly of the sets respectively.

Another field day has been fixed for July 19th, when a very special effort is being made to allow everyone, even to the merest novice, to handle and work a transmitting set. Short talks will also be given on transmitting sets, with demonstrations on the best way of adjusting them.

Hon. Secretary: Mr. W. J. T. Crewe, 111, Prince's Park Avenue, N.W.11.

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Leyton Radio Association.

The headquarters of this Association are now in the High Road Schools, Leyton, where meetings are held each Wednesday at 8.15 p.m.

Hon. Secretary: Capt. H. Thorley.

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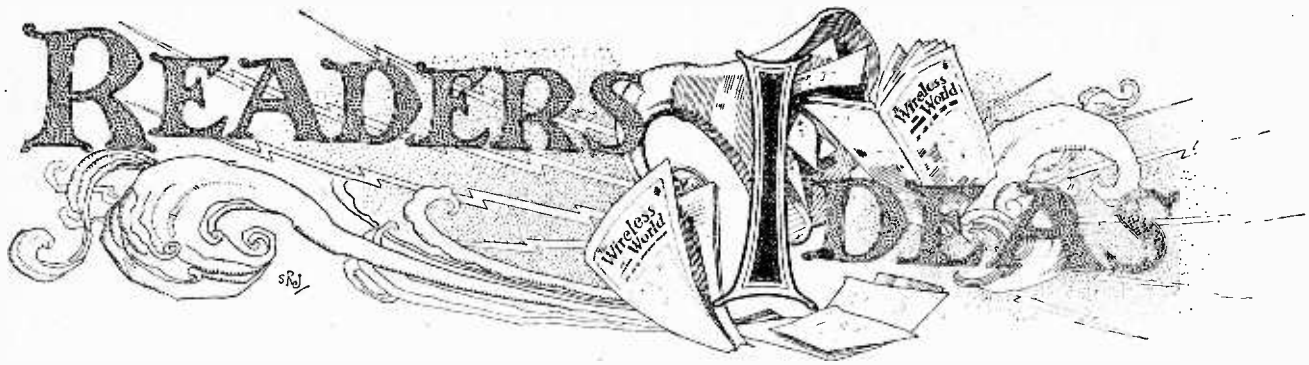
Crewe and District Radio Society.

A successful field day was held on June 16th in the beautiful grounds of Crewe Hall, when a demonstration was given by Mr. J. Noden (6TW) on the prevention of oscillation, the disadvantages of a slack aerial, etc.

Hon. Secretary: R. Peach, 84, West Street, Crewe.

Members of the Crewe and District Radio Society photographed on the occasion of the recent successful field day in the grounds of Crewe Hall.

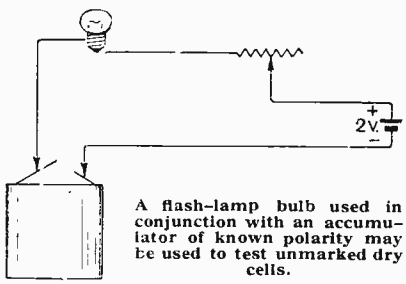


A Section Devoted to Novelties and Practical Ideas.

TESTING FOR POLARITY.

When a voltmeter is not available the following method may prove useful for testing batteries of low voltage.

An ordinary flash-lamp bulb is connected in series with a variable resistance and a 2-volt accumulator of known polarity. Flexible leads are provided so that the circuit may be completed through the battery of unknown polarity. With the flexible leads short circuited, the resistance is adjusted until the lamp is glowing visibly, after which the leads are applied to the unknown battery. If the



A flash-lamp bulb used in conjunction with an accumulator of known polarity may be used to test unmarked dry cells.

lamp burns less brightly, the E.M.F. of the battery is in opposition to the accumulator. Conversely, the E.M.F.s are acting in the same direction in the circuit if the lamp burns more brightly. The test should be only momentary, when there will be little likelihood of burning out the lamp if the resistance is adjusted to a suitable value.

In the absence of more elaborate methods of testing polarity, this arrangement will be found very useful for testing dry batteries for filament heating, grid batteries, etc., which have not been marked by the maker. —W. B.

ADJUSTMENT OF GUY WIRES.

The screw strainers generally employed to take up slackness in guy wires are able to deal only with a limited amount of expansion in wire. If the strainer is supplemented with a variable link of the type shown in the

Adjustable link for aerial guy wires.

accompanying diagram, the connecting screw may be moved into the next hole when the limit of the strainer is reached. The link is quite easy to construct from brass or iron strip, and is well worth the trouble involved if it is the means of saving a resplicing of the guy wire.—A. H.

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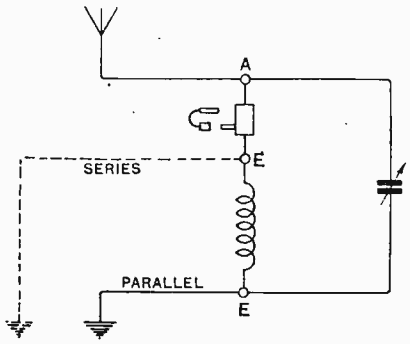
SERIES-PARALLEL SWITCHING IMPROVEMENT.

In the well-known "three terminal" method of connecting the aerial tuning condenser in series or



Series-parallel connections with provision for loading coils.

parallel with the A.T.I., it is an advantage to connect a plug-in coil holder between the terminals that would normally be connected by a link. A short-circuiting plug made to fit the coil holder will enable the circuit to be used in the ordinary way, while in the "parallel" position a load coil may be used instead of the shorting plug. For long wavelengths this arrangement will often prove convenient when a limited number of tuning coils is available.—W. J. N.

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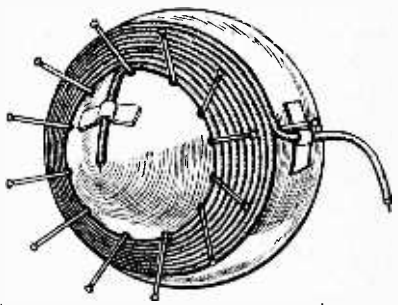
SPHERICAL VARIOMETER WINDINGS.

An indiarubber ball makes an excellent former for winding spherical coils for variometers and reaction rotors.



Former for variometer windings.

A circle of suitable diameter is described on the surface of the ball, and a row of pins fixed on the circumference. The first turn of the coil is wound between the pins and the ball, and the winding is continued over the surface. The coil should be wound with D.C.C. wire, and when the required number of turns have been completed a coating of shellac varnish should be applied to the surface. Upon the skill with which this coating is applied will depend the success of the coil; the shellac should hold together the top surface of the turns, but should not penetrate in any appreciable quantity to the lower surface, otherwise the coil may stick to the former. When the shellac has

dried, the pins are withdrawn and the coil removed by carefully pressing the ball away from the windings. A second coil wound in the same direction will complete the rotor winding when the pair are mounted together and connected in series.—S. C.

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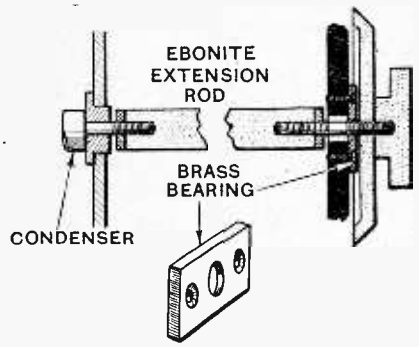
CONDENSER BEARINGS.

It is sometimes convenient to mount variable condensers a short distance behind the panel of a receiver and



Improved bearing for condenser extension rod.

to connect them by means of ebonite extension rods to dials on the front panel. While this method affords many advantages from an electrical point of view, there are constructional difficulties to be overcome if it is to be entirely successful. Chief among these is the difficulty of obtaining a correct alignment of the spindles and bushes in the condenser and on the front panel. In the first place, the condenser must be mounted in correct alignment with the bush in the front panel; and, secondly, the holes in the extension rod must be correctly centred, drilled and tapped. Even if a lathe is available the alignment of these holes will not be correct unless the ebonite rod is perfectly cylindrical, so that it is best to assume that some inaccuracy will be present and to make allowance for this.

The diagram shows a simple method of mounting the condensers which minimises the effects of bad alignment. A hole larger in diameter than the end of the extension spindle is drilled in the panel and covered with a brass plate which is drilled to take the spindle, and which acts as the front bearing. The condenser is rotated, and the movements of the bearing plate observed in order that it may be screwed to the panel in the position giving least friction. It will then be found that the condenser works quite smoothly, and the binding that might occur with an ordinary bush in the front panel is obviated.—R. B. T. C.

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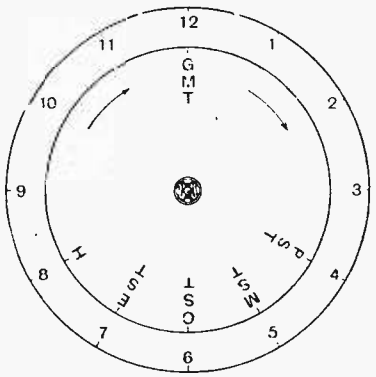
TIME CALCULATOR.

Amateurs interested in long-distance communication who frequently listen for stations on the American Continent will find this calculator of great value in arriving at the equivalent time at the transmitting station.

The calculator consists of two concentric discs of paper or thin cardboard held together at the centre with an ordinary snap fastener. On the larger disc, which may be fixed to the wall near the receiving apparatus, are marked the twelve hour divisions, while the smaller rotating disc is marked at appropriate points with letters indicating the regional times used in America and Canada.



An easily constructed device for calculating equivalent times on the American Continent.

The times indicated are as follows:—

G.M.T., Greenwich Mean Time.
H., Halifax, Nova Scotia.
E.S.T., Eastern Standard Time.
C.S.T., Central Standard Time.
M.S.T., Mountain Standard Time.
P.S.T., Pacific Standard Time.

—W. J. T.

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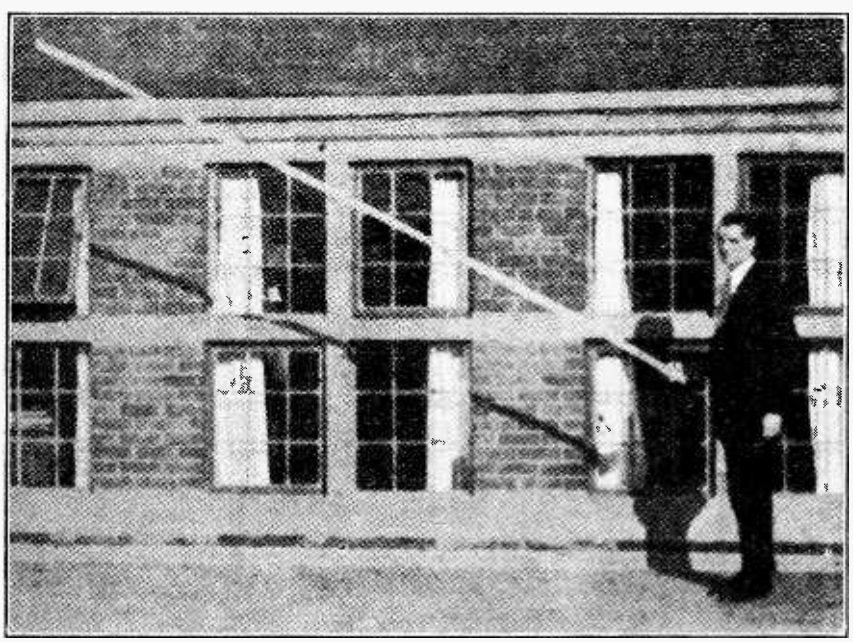
A LIGHT AERIAL SPREADER.

Lightness can be combined with rigidity if ordinary sawn laths are used in the construction of aerial spreaders. The spreader shown in the photograph is 12ft. in length, yet it can be raised from the ground with ease when held in the hand at one end.

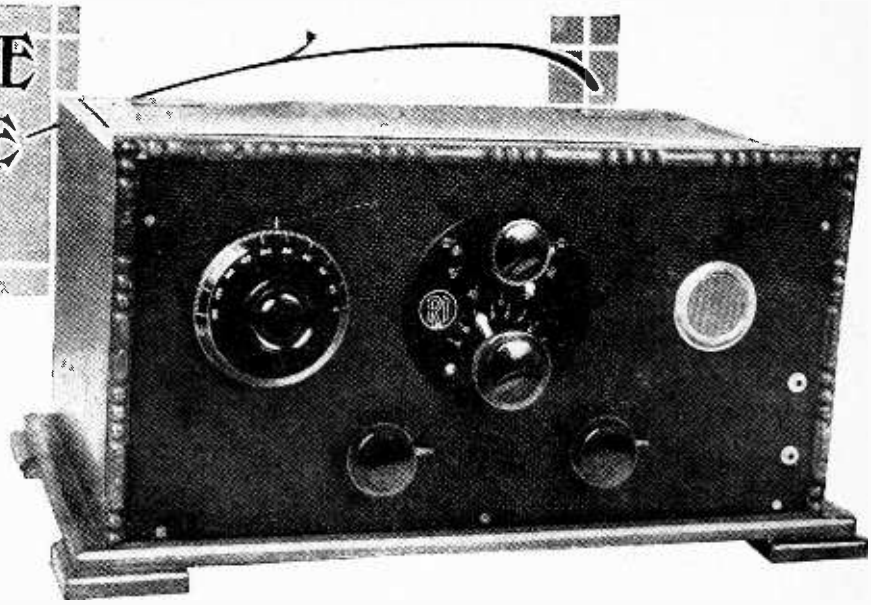
The laths used in the construction of this spreader measure 3ft. in length, 1in. in width, and $\frac{3}{16}$in. in thickness. The laths are nailed together with $\frac{3}{8}$in. panel pins at the edges, and the first set of laths are cut so that the sections overlap each other by 4in. at the first joint. The spreader may then be built up to any required length with laths of full length. The ends of the spreader are plugged with pieces of wood of square section into which eye bolts may be screwed for the attachment of aerial and halyards.—H. A. S.



A light and rigid aerial spreader of square section.

TWO-VALVE ALL RANGE RECEIVER

A Set for Loud-Speaker Local Reception and 5XX.



By J. WILSON.

IN the design of any wireless receiver one of the first considerations must be the method to be adopted for tuning. Until the advent of more complicated receivers it was customary to design the tuner almost independently of the amplifying and detecting apparatus. In the modern receiver it is more usual to embody the tuner with the complete apparatus in one instrument, especially where additional tuned circuits for amplification at high frequency, before detection, are employed.

Circuits for Broadcast Reception.

The choice of receiving circuits for broadcast reception is becoming more and more dependent upon the circumstances controlling the operation of the transmitting stations themselves. In this country the policy adopted by the B.B.C. compels the amateur to make a choice either of a comparatively simple set for reception of his local station and the long wave station, or else to be prepared to build a very much more elaborate receiver which will enable him to cut out his local station at will and listen for other more distant transmissions. With few exceptions it is usually unsatisfactory to employ a selective receiver which is capable of picking up distant broadcasting for reception both of these stations and of the local station. For reception of the local station it is almost general now to employ a loud-speaker if a valve set is used at all, and the simpler the receiver for local reception the easier it is to ensure good quality reception. Those who study quality in the reception of the local station usually find that it is best to employ a separate set for this and a more selective type of apparatus when long distance reception is required.

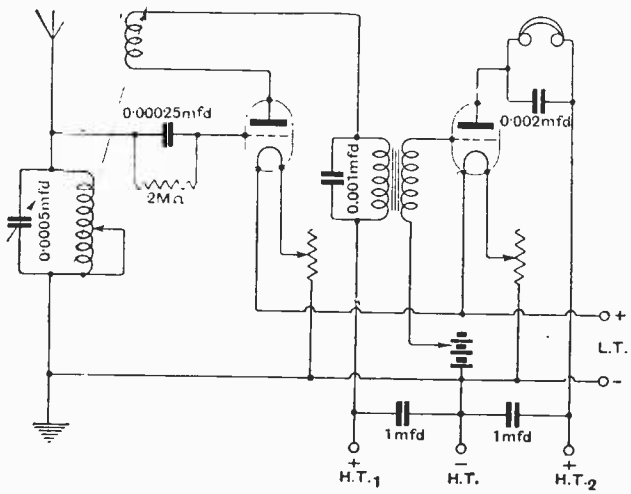


Fig. 1.—Circuit diagram of the receiver drawn theoretically.

Methods of Tuning.

There are several alternative methods of tuning which can be adopted for a simple receiver. One of the most popular is perhaps the plug-in type of coil which can be interchanged for different wavelength ranges. Another alternative is to use variometers, but unless these are of special type they are usually limited in wavelength range. The question of the employment of reaction with plug-in coils increases the difficulty of using them to satisfaction, as with each change in the tuning coils for a different wavelength range there is the necessity for choosing a suitable value of coil for reaction.

A unit has recently been put on the market by Radio Instruments, Ltd., which provides a very convenient method of tuning, and incorporates a reaction coil with adjustable coupling providing smooth reaction over a wide wavelength range. This unit is employed in the receiver here described, which makes use of two valves, one as detector and one as a L.F. amplifier. The tuning unit may be used with different values of variable condenser in parallel with the main inductance according to the wavelength range which it is desired to cover. With a 0.001 mfd. condenser in parallel, the unit will tune from approximately 175 to 4,000 metres, the exact range depending, of course, partly upon the capacity of the aerial system. A 0.0005 condenser has been used in this

Two-Valve All Range Receiver.

particular set, as this is large enough to cover the full range of broadcast stations, including the long wave stations.

It is well known that coils consisting of a single layer winding are more efficient than bank wound coils of the ordinary pattern. This unit consists of a single layer coil wound on a paxoline former with eight tappings, which are brought to studs and a switch. One objection to a single coil for a wide wavelength tuning band is that usually when different tappings are used losses occur through the fact that there is a " dead end " of the coil which is not in circuit with the receiver on the shorter wavelengths. This objection is largely overcome in the design of the unit because the " dead ends " are automatically short-circuited by the switch as different tapping points are selected in tuning.

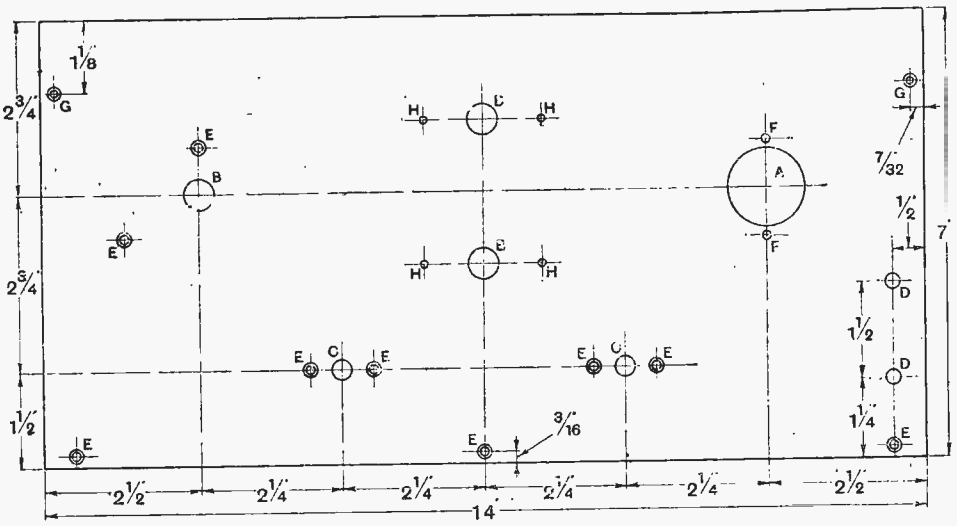


Fig. 2.—Details for drilling the front panel.

The Circuit.

The circuit chosen for the receiver is shown in Fig. 1. Provision is made for different potentials to be applied to the anodes of the two valves by means of two positive H.T. terminals, and negative bias to the grid of the L.F. valve is, of course, arranged for. A grid bias battery of nine volts is employed, provided with tappings so that sufficient latitude is provided here for any types of valve to be used which are suitable as detector and L.F. amplifier.

The size of the front panel of the set is 14in. × 7in., and the baseboard, which should be of seasoned wood so that it does not easily warp, should be 14in. × 8in. The positions and spacing of the drilling holes for the panel are all indicated in Fig. 2. To mount the tuning unit it will be found most convenient to utilise the engraved dial plate as a template and mark out the fixing holes from this. With the unit used for this receiver it was found that the screws supplied were not long enough to go through the panel and also hold the engraved dial and the unit itself in position, so that longer screws with the same thread, had to be substituted.

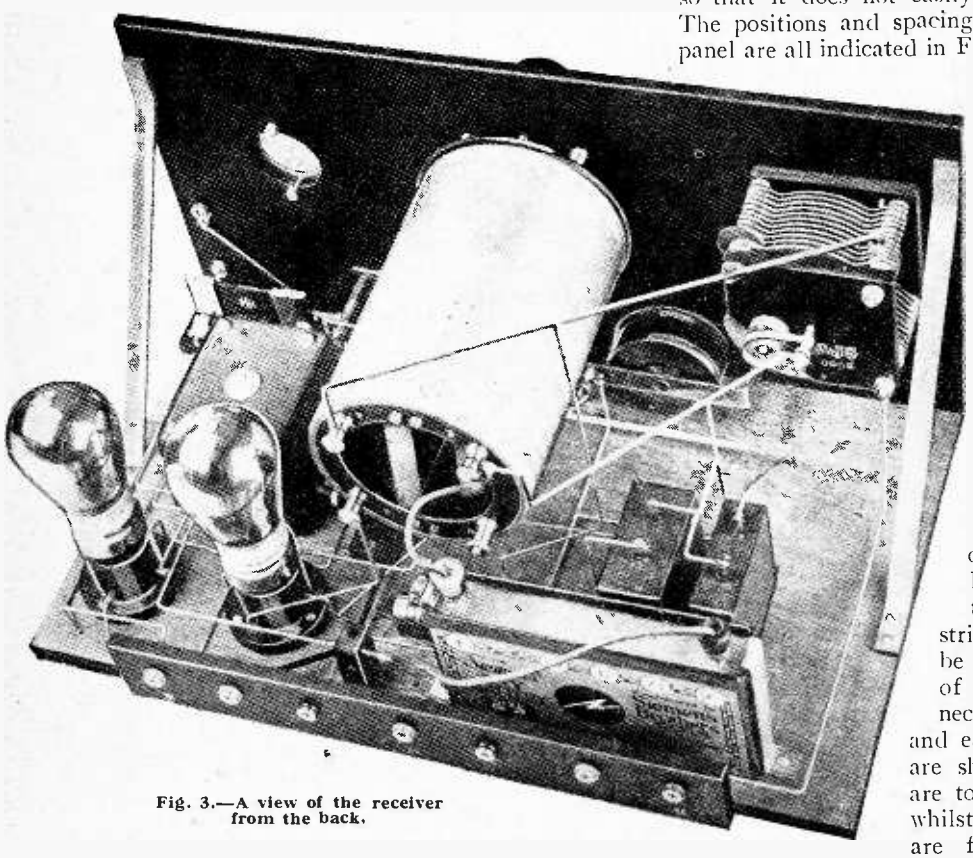


Fig. 3.—A view of the receiver from the back.

Details of Construction.

It is best to buy the panel cut to shape and prepared unless facilities exist for doing this at home. An additional strip of ebonite 10½in. × 1½in. will be required for fixing to the back of the baseboard to carry the connections for batteries, aerial, and earth, and the holes for drilling are shown in Fig. 6. These holes are to carry seven " Clix " sockets, whilst the three holes at the bottom are for wood screws to fix the

Two-Valve All Range Receiver.—

terminal strip to the wooden baseboard. Fig. 5 shows how this panel goes on the baseboard, and shows also the position of the valve holders, transformer, condensers, etc., located on the board, and the correct position and spacing is given for each component.

The front panel is secured to the baseboard by means of three wood screws, the holes for which are marked E on the panel layout (Fig. 2). In addition, two brass brackets are used to help support the panel. These are clearly shown in the photographs (Figs. 3 and 4), and the positions of the fixing holes are indicated in Figs. 2 and 5.

The terminals for the loud-speaker or telephones are on the front panel, as this is usually the most convenient position. All other external connections are made to the terminal strip at the back, and "Clix" are admirably suited to this purpose, different colours being selected to differentiate between the various connetcions, which are: Aerial, earth, L.T. negative, L.T. positive, H.T. negative, and H.T. positives 1 and 2. These are the positions marked A on the drawing of the terminal strip (Fig. 6), and shown with their designation in the wiring diagram (Fig. 7).

After the panel has been drilled and the components mounted on it, the panel should be fitted into place and screwed to the baseboard, and the supporting brackets put in position. The components should already have been mounted on the baseboard in accordance with the layout given in Fig. 5, and the terminal strip at the back of the baseboard should be screwed into position. Everything is now ready for wiring up the receiver, and if the diagram (Fig. 7) is turned round so as to show the back of the panel, the baseboard and the terminal strip in their relative positions, the process of wiring should be quite simple, as the wiring layout can be put up at the back of the bench and followed conveniently in this way. The flexible leads from the earth terminal E of the tuning unit and from the wire going to the L.S. terminal of the transformer, should be of convenient length, so that the grid battery can be tapped out as desired.

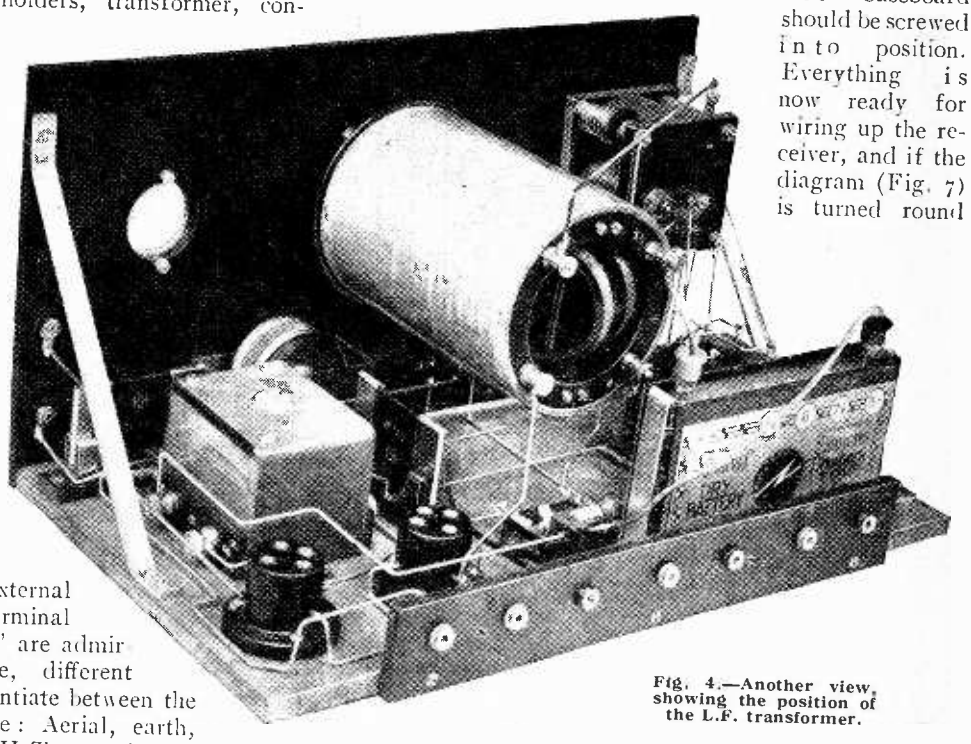


Fig. 4.—Another view, showing the position of the L.F. transformer.

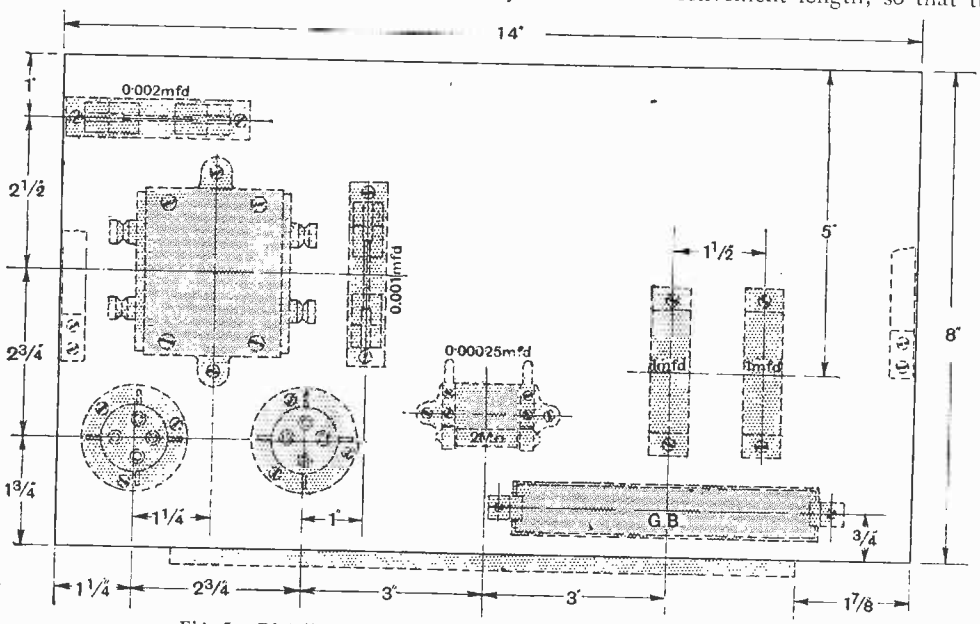


Fig. 5.—Distribution of the components on the wooden baseboard.

The choice of valves is a matter which is left to the reader, as there are so many types with almost equal merits now available. The Igranic filament resistances used in the present receiver are not, of course, suitable for employment with valves of the 60 milliampere class, and these in any case would not be so suitable as other types designed specially for detector and L.F. stages where it is desired to operate a loud-speaker.

Very little need be said with regard to the operation of the receiver, as the adjustments are so simple. Tuning should be made on the studs of the tuning unit, which are marked in letters

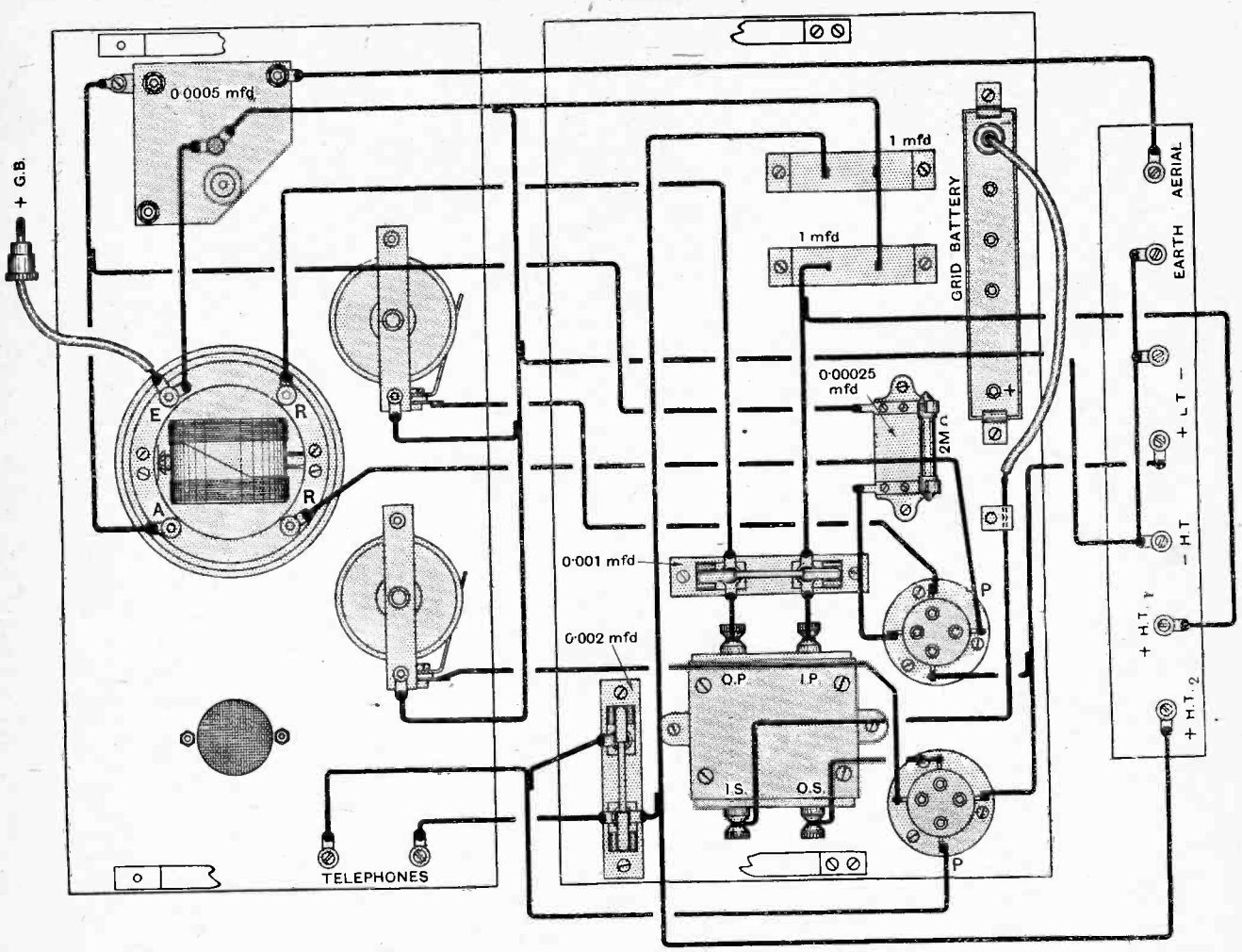


Fig. 7.—Complete wiring diagram for the receiver.

on the engraved dial. The fine adjustment should be made by means of the variable condenser. Reaction coupling can be varied with the knob located just above the inductance tapping switch, and when this is adjusted a slight readjustment of tuning on the condenser should be made.

The construction of a case to house the receiver is a matter which is left to the individual constructor, but cases can, of course, be obtained at reasonable prices from a number of cabinet makers if it is not desired to do the cabinet work one's self. A receiver for reception of the local broadcasting station or for 5XX will not require to be adjusted after once it has been tuned to the station, and, therefore, many readers using a receiver of this type may prefer to accommodate it in some existing cupboard or piece of furniture which may be large enough to house the batteries as well, and leave only the loud-speaker outside, thus avoiding the artificial appearance of the set which is sometimes objected to if it is not in keeping with the furnishing.

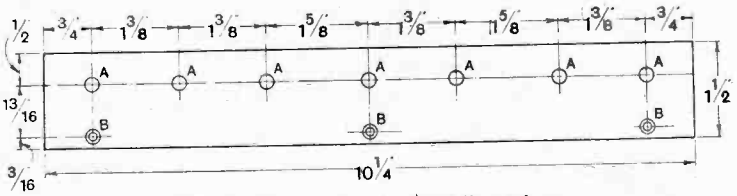


Fig. 6.—Terminal strip with dimensions.

LIST OF COMPONENTS.

Ebonite panel, 14in. × 7in. × ¼in.
Ebonite terminal strip, 10¼in. × 1½in. × ¼in.
Baseboard, 14in. × 8in. × 1in.
2 Filament Resistances (Igranic).
1 Variable condenser, 0·0005 mfd. (A.J.S.).
1 R.I. tuning unit with reaction.
1 Gambrell L.F. transformer.
2 Valve holders.
1 Siemens 9-volt H.T. unit for grid bias.
2 1 mfd. condensers.
1 Grid condenser, 0·00025 mfd. and grid leak, 2 megohms.
2 Fixed condensers, with clips for mounting, 0·001 mfd. and 0·002 mfd. respectively (McMichael).

Broadcast Brevities

SAVOY HILL

Opening of Daventry.

The Postmaster-General has been invited to open the Daventry station on July 27th, and has consented to do so if the state of public business permits. It is expected that an additional million crystal listeners will be brought in when the new 5XX gets going.

oooo

Bringing in Other Areas.

I am told that the B.B.C. engineers are fully alive to the requirements of other districts which are at present or are likely to become cut off from a broadcasting service through the removal of the high-power station from Chelmsford. Listeners who have paid for licences, as well as the potential millions who are without service, will not be overlooked in future schemes of development. Only about 78 per cent. of the total population is at present served by crystal. No additional stations are contemplated in the meantime, but schemes have been formulated whereby between three and four million more listeners might be brought in by other means. By the end of this year 90 per cent. of the population might very well be served with crystal facilities.

oooo

Alternative Programmes.

Plans for alternative programmes are a constant theme for discussion at B.B.C. headquarters, but some misapprehension appears to exist among listeners in this connection as to the extent of the work which Daventry will carry on. It has been decided that the programmes broadcast from the new 5XX will be arranged and given in the London studios. In other words, no studio facilities are being provided at Daventry, and artists will not, therefore, appear before the microphone there.

oooo

Coal Mine Broadcast.

Apropos the broadcast which took place on June 27th from a Sheffield coal mine, our leading humorous paper suggested that the sounds from a London Club Library between three and six p.m. should be broadcast as an antidote to the feverish activity of modern life which is exercising our doctors.

oooo

Unusual Broadcasts.

There is nothing extraordinary in that suggestion. Many suggestions are received by the B.B.C. from time to time for unusual broadcasts, and the idea has even been put in all seriousness for a broadcast of the sounds from a well-known restaurant during mealtime. Following the broadcast from the Zoo it was suggested by one listener that microphones should be set up in the jungle, and that the conversation of penguins should figure in a broadcast from the South Pole. The latest suggestion is for a menagerie to be kept at 2LO for use in connection with the Children's Corner.

oooo

U.S. Visitors.

A member of one of the largest wireless stockbroking firms in the United States, who has been visiting England, draws some anomalous distinctions between the system of broadcasting here and that in America. He points out that in America there are more than five hundred stations, each carrying its own style of programme, and in and around New York listeners have the choice of between thirty and fifty stations. Broadcasting in America is as competitive as any other business.

oooo

Confusion and Chaos.

But that, as Mr. Hoover pointed out long ago, has resulted in tremendous confusion and chaos. The leading broadcasters are divided between those actually interested in broadcasting for its direct or indirect advertising value, and those interested in either the selling of receiving or transmitting sets. Considerable antagonism exists between these two groups, and conferences are called to try and straighten out the tangle. Something like one hundred stations approach near to the power, status, and technical quality of our own. The American listener is, therefore, not nearly so well served, having regard to the relative areas. The country is divided into zones, and the Western zone repeats the wavelengths of the Eastern Zone, thus easing the situation. A ten kilo-cycle separation is the maximum: thus theoretically, if there is anything like proper modulation, stations must clash. Even then it is impossible to get all stations into the wave-band, and so stations have to divide time where they are close together in place and wavelength.

oooo

The Nightingale.

One word more about the nightingale and we have done—at any rate until next season. A correspondent informed the B.B.C. that the scene of operations was badly chosen, hence the difficulty of securing a satisfactory transmission; the nightingale was in excellent voice at Warrington, and the installation of a microphone in a Lancashire town would, the correspondent asseverated, solve the problem which had beset the engineers in

TOPICALITIES.

FUTURE FEATURES.

Sunday, July 5th.

BIRMINGHAM.—3.30 p.m., Band of H.M. Royal Air Force.

MANCHESTER.—3.30 p.m., Light Symphony Concert.

GLASGOW.—4 p.m., Open-air Service and Parade at the Cenotaph, George Square.

Monday, July 6th.

LONDON.—9.15 p.m., "Radio Radiance" Revue.

CARDIFF.—8 p.m., Band of H.M. Royal Air Force.

GLASGOW.—8 p.m., Norwegian Music, Humour and Poetry.

Tuesday, July 7th.

ALL STATIONS.—8 p.m., "Weekly Dispatch" Wireless Ballot Programme.

Wednesday, July 8th.

BIRMINGHAM.—8 p.m., An Evening with Mozart, including Act II. of the Opera "Figaro."

BELFAST.—8 p.m., Symphony Concert.

Thursday, July 9th.

5XX.—8 p.m., The J. H. Squire Celeste Octet.

LONDON.—8 p.m., Operatic Programme, conducted by Dr. Malcolm Sargent.

ABERDEEN.—8 p.m., Operatic Programme.

Friday, July 10th.

BOURNEMOUTH.—8 p.m., Liza Lehmann Programme.

MANCHESTER.—8 p.m., Chamber Music and a Play.

GLASGOW.—8 p.m., "The Three Musketeers." Episode IV.

Saturday, July 11th.

LONDON.—8.15 p.m., "Join in the Chorus."

BIRMINGHAM AND 5XX.—8 p.m., Radio Fantasy, "The Gift of the Garden."

Surrey. The engineers had, however, furbished up their ornithological knowledge. They were aware that the nightingale may be heard occasionally as far north as Lancashire and Yorkshire, but the possibilities of securing a transmission from Surrey were, technically, the most favourable. Moreover, if the nightingale will not sing in Surrey when a million-odd listeners are waiting expectant, this elusive bird is not likely to oblige listeners any the more readily from other parts of the country.

Super Receiving Station.

The super receiving station near Bromley, Kent, which was announced to be ready for service during the summer, will not, after all, come into operation for several months ahead. The original plan was to use the station for checking jamming and to calibrate wavelengths of British broadcasting stations, but a more ambitious plan is now under consideration, and the station will probably play an important part in Geneva's future administration of international broadcasting.

oooo

French Interference.

An interesting theory has been advanced as regards the statement in the newspaper press to the effect that the French station which has been interfering on the Bournemouth and Manchester wavelengths has been using the call-sign 8AJ. This, it is pointed out, is the call-sign of SFR, Paris, known to all listeners as Radio-Paris, but in view of the disclaimer issued by Radio-Paris, some unauthorised person has been using Radiola's call-sign. Anyhow, the French law on the subject needs clarifying.

oooo

Opera Broadcast.

The Frankfort Opera Company have recently claimed that they were not bound to sing if the opera was being broadcast. The local theatrical court confirmed this view, but the Court of Appeal in Berlin reversed it, and decided that the singers were entitled to 10 per cent. increase in salary in respect of broadcast performances. This is only confusing the issue, and it is to be hoped that if ever an agreement is concluded in this country between the opera companies and the B.B.C., a more common-sense view will be taken An operatic star is not paid according to the size of the audience which he or she actually draws. It would be a sorry day for the singer, however celebrated, if payment were by results. How much, we wonder, would Madame Tetrazzini have received in respect of her concert at the Albert Hall following her broadcast from 2LO last March?

oooo

Originality at Nottingham.

Nottingham at present holds the record for originality. A talk is given from the studio, and ten minutes of the period is set aside for discussion. Listeners are invited to ring up and put their questions to the announcer. These are broadcast so that the listener, when asking a question, is heard all over the country by other listeners, and the lecturer himself has a pair of headphones on in the studio, and listens to the questions by wireless. When he answers the questions he speaks into the microphone, and his answer is broadcast to the listening public, and is also sent to the questioner by telephone line, so that the latter, if he wishes, can hear the answer coming from the receiver of his telephone and from his loud speaker at one and the same time.

oooo

Insect Mortality.

Several recent outside broadcasts at night have been responsible for high mortality among insect life. The lights from the valves of the transmitter attract insects and moths, and it has been a common occurrence to have to sweep up hundreds of these insects which have been so attracted and then electrocuted in the set. It has been known for a big moth to wedge itself between the plates of the condenser and shut the transmitter down whilst committing suicide.

oooo

Fewer "Talks."

The discontinuance of the 10.10 p.m. Talk during the holiday months of August and September is contemplated. Consideration is being given by the various stations to the adoption of different methods of broadcasting Talks, and some original broadcasts are expected to take place during the autumn.

WIRELESS ON LIGHTSHIPS. Few occupations can be more lonely than that of the crew on a lightship. The photograph shows Light Vessel No. 67, the first to be fitted with broadcast receiving apparatus. Inset, Officers and men anticipating better times during their next period of isolation.

Manchester's Gong.

A great deal of criticism is being levelled against the directors of the Manchester Station for using a gong tuning note to indicate the conclusion of items in the programme. At 2LO and most other stations the oscillating valve has been used after the 7 and 10 o'clock time signals ever since the temporary experiment with the piano scale was dropped some two months ago. Listeners suggest that the gong note, which is an essentially German idea, should be dropped.

oooo

Fifteen Operas.

The Manchester Station, which has already fifteen operas to its credit since broadcasting first began, will give a performance of Leoncavallo's "I Pagliacci" on July 15th, to be followed by the "Church Scene" from Gounod's "Faust."

WORKING EBONITE.

Workshop Advice for the Amateur Constructor.

By W. FULDE.

HAVING so often seen good wireless sets, large and small, marred by the way in which the ebonite has been worked, and having heard of numerous panels scrapped because of stripped threads, chipped holes and corners, I hope that these notes will guide the amateur craftsman over his future difficulties.

Previous to the advent of wireless, ebonite was rarely used by the amateur; it was only used by experienced men in the making of more or less delicate instruments, and what wrinkles they had on its manipulation they were loath to impart.

These notes apply only to good quality ebonite. The many composition materials are well nigh unmanageable for the amateur, and cheap ebonite is a waste of time and money. When you get your ebonite get the best.

There are no special peculiarities about ebonite. Turning and filing should present no difficulties if the material is machined in the same way as brass. Use no lubricant, and always keep the tools sharp and clean. Finishing cuts must be light, using a broad round nose tool; a knife tool may be used for corners. Do not use hooked tools. Frequent grinding of the tools is necessary, and in filing liberal use of the file card is essential to ensure success. When drilling in the lathe, withdraw the drill after about every half inch drilled, and plunge in cold water. This prevents choking and burning, or where there is a thin outside wall it prevents bulging or splitting.

Drilling and Tapping Panels.

Panels should be marked off from carefully squared centre lines. Centres of holes to be drilled should be marked by a press from a drawpoint, and afterwards centred by an Archimedian drill. Do not use a centre punch, as this is likely to break the panel near the edge. Reminders, and sizes of holes, etc., may be written on the panel in white Indian ink, and washed off with methylated spirits when no longer required.

In drilling with a hand drill, it is imperative to keep the drill steady for good results. This is assisted by holding the drill and work in a comfortable position, by not trying to turn the driving wheel too fast, and by frequent clearing of the drill. For blind holes, the drill must be pushed as far into the chuck as it will go. Packing, such as a piece of wood of a thickness sufficient to allow the drill to project the depth of the hole, may then be pushed on the drill against the chuck face. The use of a stout collar with a binding screw permits of ready variations of depth.

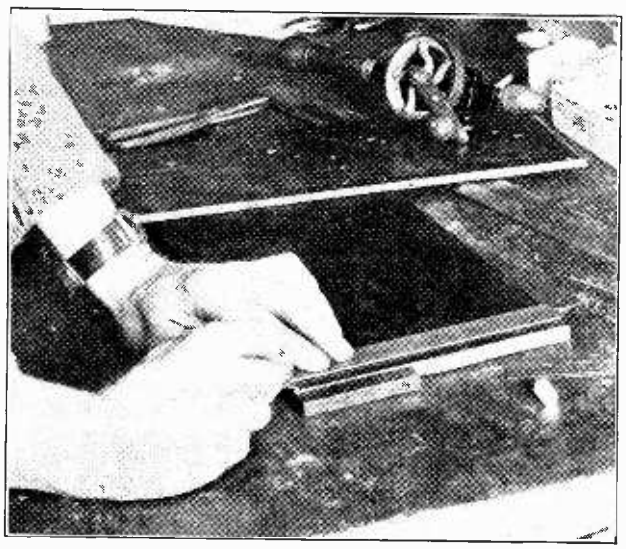
For tapping, a hand chuck makes the best tap holder; the holes should be slightly countersunk, and the taps damped with paraffin or naphtha, and frequently withdrawn for cleaning and damping. When tapping blind holes, do not use a taper tap; go straight in with the plug tap, or the intermediate tap, for threads larger than No. 4 B.A.

If you should strip a hole, it can be re-drilled for a size larger, or plugged with a piece of ebonite rod and drilled for a size smaller. Should a new position for the hole be used, the old hole can be filled with shoemaker's wax (heelball) run in with a warm iron. Where a blind hole has gone just a little too far and made a pip or bulge on the face of the panel, the pip can be pressed down with a warm iron covered with a piece of rag, the iron to be hot enough just not to singe the rag.

Finishing and Polishing.

The finishing and polishing of ebonite, whether turned parts or panels, requires more care and patience than any of the other processes. For turned parts which are finished in the lathe and the hand polishing of panels the process is the same.

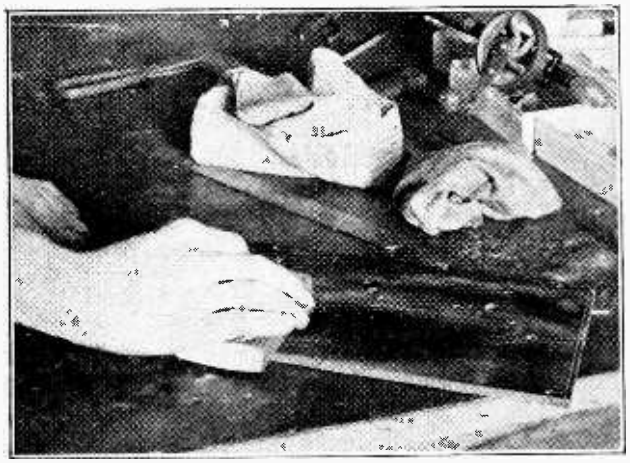
Emery cloth is first applied (when used for a job in the lathe it is taken in narrow strips, ½ to 1 inch wide, according to the job, and for panels, in strips 3 to 4 inches wide) drawn tightly over a flat piece of wood in a single thickness only. No. 0 emery cloth is the coarsest that should be used. The coarser grades make scratches which take a long time to grind out. In the lathe the strips are applied with a sliding motion backwards and forwards; on the panels, over the piece of wood with a circular motion. The grinding down with this



Marking off the panel with a square and scriber.

Working Ebonite.—

piece of No. o emery will wear the emery smooth, when it should be thrown away. Next repeat the process with No. F emery, then with No. FF. This time lubricate the emery liberally with "Brasso" liquid metal polish, which speeds the action of the emery and prevents burning. Always keep the emery very wet with "Brasso."



The first step of the finishing process—rubbing down with emery cloth.

The last emery used is No. o blueback paper, also lubricated and applied in straight strokes. Next grind the job with a pad of stout linen or cotton soaked with "Brasso," which will give the work a very smooth, dull surface. At this point a fine satin finish can be made on panels which contrasts pleasantly with brilliantly polished knobs and dials. This is done by sprinkling the panel with dry pumice powder, and brushing briskly in straight strokes with a semi-soft brush; a brush which has the bristles closely packed is best. Apply the pumice and brush until the desired satin gloss is obtained. If a brilliant polish is the desired result, omit the pumice process, and after the "Brasso" pad, burnish the job with another pad, this time soaked with a liquid plate polish such as "Silvo." This cleans up the job and produces a very brilliant polish; the job is finally washed with warm water and dried, then rubbed up with a clean chamois.

The use of the "Brasso" and "Silvo" is the ultimate result of much experimenting with various lubricants, and these have been found to produce the best results without leaving any grease behind or discolouring the vulcanite, and these processes in no way impair its dielectric properties.

Where the worker has a high speed buff, much of the hard work of rubbing will be saved by doing these processes on the buff, using linen or cotton buffs with tripoli paste in the first stages instead of the emery cloth mentioned above.

In conclusion, the writer might mention that when

Giving the panel a satin finish—dry pumice powder and a cloth are used.

knurling knobs, etc., fix the knurling tool in the slide rest tool holder and rotate the job slowly by pulling the belt round *by hand*. A clean, sharp, knurl, of whatever type, is the result.

"BEAM" STATION AT WINTHORPE.

THE wireless "beam" stations, which the Marconi Company proposes to erect for the Post Office on a site at Winthorpe, near Skegness, will communicate with India and Australia, says *The Times*. The Marconi stations transmitting to South Africa and Canada are at Bodmin, while the receiving stations for South Africa and Canada are at Bridgwater.

Assuming that the two stations to be erected on the new site at Winthorpe will be for transmission, some brief account of what it is proposed to set up may be given. The masts, of which there will probably be five in a row at each station, will be 300ft. high, but the number will depend on the wavelength that it is proposed to use. They will be arranged in lines oriented on India and Australia respectively, that is, broadside to the objective. From the top of each mast, and on the side facing towards the objective, the aerial wires will be hung; while a second series of wires also hung from the heads of the masts will form the reflector.

The area that will be required for such stations is not considerable in view of what they will be able to accomplish. The masts will be placed 650ft. apart, and in addition to the ground so occupied there will have to be space for a few buildings and a small clear area. The aerial system will be designed so as to direct the flow of waves within an angle of 30 deg.

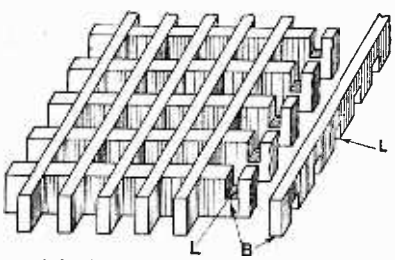
The site will shortly be handed over to the Marconi Company. By the terms of the contract, the work must be completed within nine months of the handing over of the site, and it is likely therefore that this section of the Imperial wireless scheme will be ready for service some time next spring.

RECENT INVENTIONS

Brain Waves of the Wireless Engineer.

A Built-up Panel. (No. 227,503.)

British Patent No. 227,503, granted to C. R. Heron and J. F. Jackson describes rather a novel departure from the familiar ebonite panel for wireless receivers. The experimenter who is constantly changing from one circuit to another will, no doubt, have discovered that one of the most expensive items in each new receiver is that of a really good ebonite panel. According to this invention, this difficulty is overcome by building up a panel of cellular structure such as that shown in the accompanying illustration. It will be seen that it consists of a number of slotted bars B, which interlock by means of a half-lap joint L. The fixing devices on the various components such as screws, nuts, and fixing bolts are simply passed through appropriate holes in the structure and fixed in the normal way. The idea of the invention reminds us somewhat of the familiar "Meccano" constructional



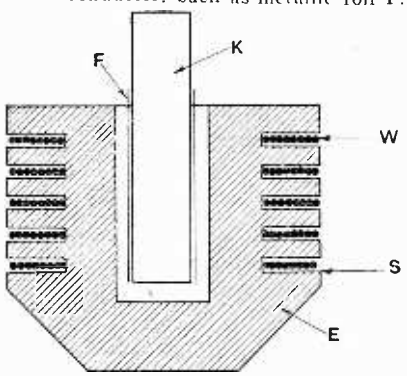
A built-up panel. (No. 227,503.)

sets. The invention also provides for various alternative modifications and constructions. For example, ebonite strips mounted on ebonite rods with ebonite spacing washers are also suggested.

oooo

Damped High Frequency Transformers. (No. 228,834.)

B. Hesketh describes in the above British Patent a form of construction for a high frequency transformer. Experimenters will probably have discovered how readily a series of tuned high frequency circuits associated with valves cause the system to oscillate. The object of the invention is to overcome this defect. The principle, of course, is not by any means new, and consists essentially in introducing a metallic area into the field of the coils or windings of the transformer. This damping plate, as it is called, acts by virtue of eddy currents which are produced. Thus, in the accompanying illustration, the windings W of a high frequency transformer are formed in slots S in an ebonite former E. The ebonite former is hollow, and contains within it a movable core K. This consists of an insulating rod which is coated with a conducter, such as metallic foil F.



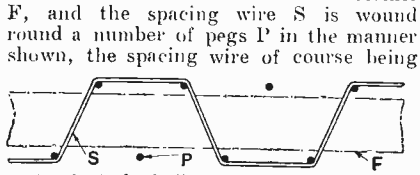
A damping plate stabiliser. (No. 228,834.)

Thus, by moving the coated rod in and out of the core the amount of metal which is in the field of the transformer can be varied. This results in a variation of the damping of the circuit and controls the amount of regeneration and therefore the self-oscillation of the circuit. Several other modifications of this idea are described in the specification and include a circular plate which can be moved parallel with the surface of a disc type of transformer. This particular embodiment is used, for example, in the Gecophone receiver.

oooo

A Multi-layer Coil. (No. 228,839.)

A multi-layer coil is described in British Patent No. 228,839, by H. R. Taunton, which should prove of interest to the experimenter. The idea of building an inductance consisting of a number of spaced layers is quite old, the Burndept coil, for example, being one of the first to become popular. Since then many modifications have been devised and have consisted chiefly in the method of winding the spacing wire. The accompanying illustration shows a method which, it is claimed, adds both to the efficiency and the appearance of the coil. The coil is wound on a circular former F, and the spacing wire S is wound round a number of pegs P in the manner shown, the spacing wire of course being



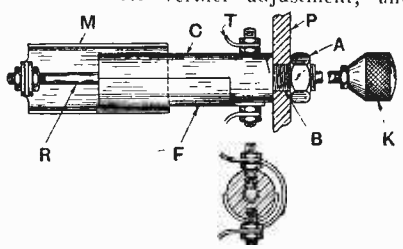
Method of winding a multi-layer coil. (No. 228,839).

continuous with the main portion of the coil. The spacing layers are so wound that they add to the total inductance of the coil. A further feature of the invention is that by winding the spacing layer L in the manner shown the turns at the side of the coil become chords of circles, and give the resulting coil a straight-sided appearance.

oooo

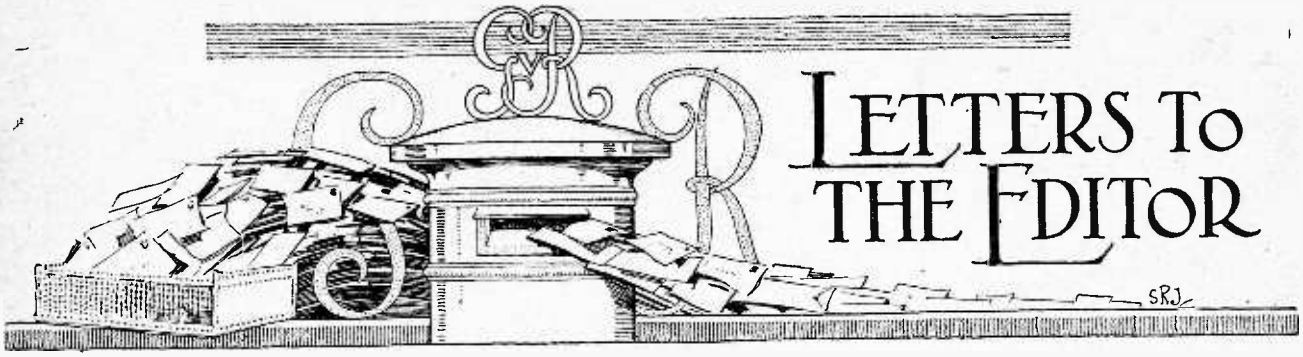
A Vernier Condenser. (No. 228,006.)

A rather interesting form of condenser is described by J. R. Spink and J. B. Langley, in British Patent No. 228,006, one form of which is shown in the accompanying illustration. The object of the invention is to provide a condenser which is suitable for vernier adjustment, and



The Polar vernier condenser. (No. 228,006.)

this is accomplished by giving the adjusting element two distinct movements. Referring to the illustration, it is seen that the condenser is mounted upon an insulating cylinder C, which carries a fixed plate in the form of a cylindrical segment F. Through the centre of the insulating cylinder there is a rod R provided with two nuts, which carry another cylindrical segment M. The rod passes through a bush B which also serves to fix the condenser to a panel P by means of a nut A. The rod is provided with an adjusting knob K by means of which it can be pushed in and out so that the area of overlap of the two cylindrical segments can be varied. The rod is also capable of rotation, so that the relative position of the two coaxial cylindrical segments can be varied with respect to each other in addition to the variation of overlap by the sliding motion. Contact with the movable segment is obtained by means of an internal brush fixed inside the cylindrical segment C and provided with a terminal T. Several modifications are described in the specification, one of which consists in providing two sets of coaxial cylindrical segments so that the total capacity of the condenser can be materially increased.



The Editor does not hold himself responsible for the opinions of his correspondents.

Correspondence should be addressed to the Editor, "The Wireless World," 139-140, Fleet Street, E.C.4, and must be accompanied by the writer's name and address.

INTERFERENCE WITH OSLO.

Sir,—With reference to Mr. A. R. Burton's letter in *The Wireless World* (No. 305) of June 17th, I would like to inform him that the interference he complains of is from Radio Ançel, an apparently new French station which has recently been transmitting gramophone records and speech on 380 metres at great strength and greater tonal impurity.

I have received this station almost nightly on 0-v-0 at good strength, but have been unable to ascertain its exact locality—all I could get being "91, Boulevard——(?) à Paris." I have communicated with Radio Ançel in the hope that the French postal authorities will know the address of the station. In the event of my receiving a reply, I shall be pleased to give any further particulars which might be of interest.

On one occasion this station thanked COI "pour vos bonnes nouvelles." Who is COI?

S. E. CRYER.

Halton, Bucks.

THE QSL QUESTION.

Sir,—On June 11th I opened two-way communication with Y7XX, an amateur transmitter in Jugo-Slavia.

I have had several complaints from foreign amateurs that the British stations they communicate with have asked for an acknowledgment card and received one, but have failed to return the compliment. This is, to say the least, very bad manners, and not likely to keep up the prestige of our amateur transmitters. The exchange of cards amounts to a fraternal greeting between the two stations involved, and is not a matter that should be overlooked. G2UV makes it a point to always reply to any communication referring to the station, authentic or otherwise, stating one or the other. If cards are not available an ordinary postcard would be just as much appreciated. It is the spirit of the exchange and the lasting acknowledgment that counts. 2UV has recommenced work, and will be found any evening after midnight on 90-115 metres, the general wave being 95 metres. The 10-watt transmitter is still in use, and has a 5,000-mile record yet to be beaten, 300 volts dry cells at 30 milliamps. being the input. 2UV was received in Jugo-Slavia, strength R6-7.

W. E. F. CORSHAM (G2UV).

Sir,—I was interested in a recent letter in *The Wireless World* with reference to non-transmitters and report cards. I have been using a report card of my own type, as amateur transmission in Northern Ireland is prohibited, and perhaps my experience of the use of these cards would be of interest to your readers.

I have received the greatest courtesy and kindness from Swedish, Belgian, French, and Dutch transmitters, and it is a peculiar point that the unlicensed Dutch and Belgian amateurs have been the most satisfactory to report to, as they send details of transmitter very fully and go to great trouble to put one in touch with other transmitting amateurs. This is a great help, as it is very difficult for a non-transmitting amateur to learn the identity of these transmitters.

The licensed French transmitters, on the whole, are not so good in giving replies, although several have been very kind in supplying QRAs of other stations.

About 75 per cent. of the Americans will reply, and their cards are always interesting, although probably a little practice will be necessary in deciphering them!

Incidentally, I have full reports for a number of transmitters who are unknown to me.

Best wishes for the success of *The Wireless World*.

Strandtown, Belfast. T. PALMER ALLEN.

Sir,—Amateur transmitters as a rule like to receive reports as to their transmissions, but I should like to know how they expect "Short Wave Fans" to report to them, as a good majority of them cannot key out even poor Morse, and, again, it is not necessary to send at a speed at which many of us cannot possibly read.

Some transmitters are evidently out to break records, not for distance, but for speed of sending, which ends up in a jumble of dots and dashes which is neither one thing nor the other.

When atmospherics are bad it is impossible to follow anything but good sending, and if transmitters would only tap out at 12 to 16 words per minute (preferably 12) with a firm, steady hand, I think reports would come in from greater distances than before. I hope some of them will note this.

TWELVE PER MINUTE.

JAMMING BRITISH BROADCASTING.

Sir,—I am interested to read that the interferer who jammed Bournemouth was using more than 3 kilowatts, as I picked him up here three times calling Coblenz on a wavelength of about 370 metres. I received him on a straight set, detector and 2 L.F., at deafening strength, so the interference in the south must have been abnormal. He spoke in broken English, calling Coblenz and Raymond. (MRS.) B. W. BOOKER.

Carnforth, Lancs.

NOTEWORTHY RECEPTION IN EGYPT.

Sir,—In the early hours of May 28th, while testing my short-wave receiver 0-v-1 on a 5-foot uninsulated indoor aerial and a 3-foot earth lead on the floor, I was greatly surprised to receive the Italian amateur station 1AF calling CQ, and, later, English 5NW calling for test, and later communicating with 6WE.

Early on the following day, with the same aerial and earth arrangement, the signals of English 2KZ, who was calling for U.S. test, and later 1YD, were readable ten feet away from the loud-speaker.

I have received many American and English amateur stations, but taking into consideration the aerial and earth arrangements on this occasion, this reception may be of interest to your readers, and especially to the owners of the above stations.

The distance between the above stations and Alexandria is more than 2,200 miles.

This is the first Egyptian report of long-distance reception of amateur stations.

L. P. SCLAVOUNOS.

General Manager,
Egyptian Radio Company,
Alexandria.

Readers' Problems

Readers Desiring to Consult "The Wireless World" Information Dept. should make use of the Coupon to be found in the Advertisement Pages.

Matching H.F. Transformers.

MANY readers experience difficulty in matching transformers or anode coils for use in multi-stage long-wave amplifiers, such as are made use of in the intermediate stages of a receiver employing the superheterodyne method of reception. They frequently possess some such instrument as a buzzer wavemeter with which they can excite the individual coils or transformers to be matched, but meet with difficulty when desiring to ascertain when the instrument under test is resonant with the excitations of the wavemeter. The best method to adopt is undoubtedly to make use of some such instrument as a Moullin voltmeter, but such a device is not always available, hence a simpler method must be sought. If a pair of high-resistance telephones in series with a carborundum crystal are shunted across the coil, a useful approximation can be made by adjusting the coil and estimating aurally when it is in resonance.

Several coils or transformers may be adjusted in this way. Of course, the presence of the telephones and carborundum crystal does make a difference to the tuning, but at the same time this effect is not sufficiently serious to abort all attempts at matching, and it must be remembered also that the intermediate transformers in a superheterodyne receiver are usually deliberately made rather broad in the tuning, only the first or input transformer being sharply tuned. It is, of course, essential to use a high-resistance crystal, preferably of the type we have mentioned.

°°°°

Causes of "Frothing" in Accumulators.

A READER who is troubled by "frothing" of his accumulator when on charge has written to us seeking the cause and cure of this annoyance. He explains that he has had this accumulator in use for several months, and that hitherto it has not evinced the slightest sign of "frothing" during charge, but has quite suddenly developed this trouble, which occurs even when the instrument is put on charge at a rate far less than the normal charging rate.

This trouble should never occur in any accumulator of reputable make where the manufacturers' instructions for its care and use are carried out correctly. It is caused by impurities present in the electrolyte acting chemically on the celluloid casing of the accumulator. It is highly probable that this accumulator has recently had ordinary tap water added to it to make up for evaporation losses in the electrolyte. It cannot be too strongly emphasised that distilled water only should be used, since the chemical impurities present in ordinary tap water not only affect the celluloid and produce the "frothing" previously mentioned, but are also seriously detrimental to the plates.

The remedy in cases where "frothing" has already occurred is to empty out the electrolyte and thoroughly wash out the accumulator with distilled water before adding fresh electrolyte. Even then the trouble may not be absolutely cured, and it may be necessary to repeat this process two or three times—an expensive process which would be avoided by the use of distilled water in the first place.

°°°°

Dual Receiver with Valve Rectification.

THE main reason which deters many readers from constructing receiving sets involving the principle of dual amplification seems to be the inconstancy of the crystal detector. Many readers who have already made up reflex receivers embodying a crystal rectifier have attempted to overcome this difficulty by removing the crystal detector and substituting a valve. They have usually found, however, that the receiver has become quite uncontrollable.

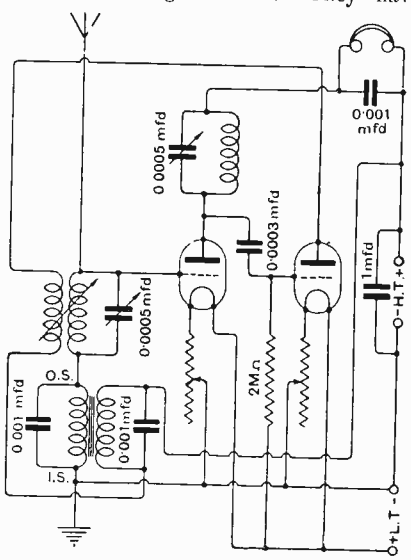


Fig. 1.—A dual receiver employing valve rectification.

When using the conventional one-valve reflex receiver, the presence of the low impedance crystal exercises a considerable damping effect, which prevents the set from oscillating, as may be proved by merely lifting the catwhisker of a correctly functioning valve-crystal reflex receiver. It is not surprising that the substituting of the valve for this crystal causes the set to be very much more prone to instability. It is necessary, therefore, when constructing a dual amplification receiver employing valve rectification, to exercise very great care in the lay-out and wiring of the instrument. A suitable circuit is given in Fig. 1. Great care should be exercised with the connections of the L.F. tranformer to achieve best results. The secondary connections may be made in accordance with the diagram, but no definite rule can be given with regard to the primary windings, and the reader will have to experiment with these. In one way it will be found that the set loses a very great proportion of its efficiency owing to the first valve being caused to rectify. The various fixed condensers included in the circuit, more especially those shunting the transformers, are important, and are with many types of transformer very critical for best results.

°°°°

Loss of Efficiency in Reflex Circuits

A READER has raised the question of the efficiency of H.F. amplification in a receiver of the dual amplification type, maintaining that H.F. amplification is practically non-existent; and in the case of a two-valve set which he possesses, which uses this principle and also reaction, the instrument is functioning as an ordinary regenerative detector valve with a stage of L.F. Of course, it cannot be denied that a valve which is called upon to amplify at two frequencies simultaneously is very much less efficient from the point of view of H.F. amplification than when it is functioning solely in this latter capacity, but at the same time it is a fallacy to suggest that practically no H.F. amplification exists at all. One has only to consider the case of a simple one-valve-crystal reflex receiver to discredit this suggestion. As is well known, it is not possible under ordinary circumstances consistently to receive signals from a station

50 miles distant when using a valve and crystal in the form of a simple crystal set followed by a valve amplifier, and if heard the signals are usually little more than a "still, small voice." If, however, we use our valve as a dual frequency amplifier without any reaction whatsoever, excellent telephone reception can consistently be had at the distance mentioned. The question of the actual amount of H.F. amplification efficiency lost by reflexing an H.F. valve is, however, a very interesting point. This depends to a great extent on the care which is taken in constructing the receiver, particularly with regard to the connections of the L.F. transformer. The O.S. terminal of the transformer can usually be permanently connected up to that portion of the circuit which is nearest, electrically speaking, to the grid of the valve. This having been done, the primary connections should be experimented with, since it will be found that there is one method of connection which gives vastly superior results, the opposite method tending to cause instability, thus seriously impairing the functioning of the valve, not only as an H.F., but also as an L.F. amplifier.

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Building a Superheterodyne.

A READER who has had no previous experience with a superheterodyne receiver proposes to construct an experimental instrument embodying four valves only, in which only one stage of intermediate frequency is used, since he hopes in this way to secure an insight into the workings of this instrument, and so be enabled to avoid the many pitfalls which beset the too ambitious home constructor, who imagines that the building of a superheterodyne consists in merely wiring a set up in accordance with some theoretical diagram.

Our reader's idea is excellent, since he will be able very easily to set up and operate the intermediate amplifier without the usual "matching" and stabilising troubles which occur when the intermediate amplifier consists of three stages. He will thus be able to gain very valuable experience which will considerably smooth the way for him when later he turns his attention to the construction of a more ambitious and permanent instrument, as is his intention.

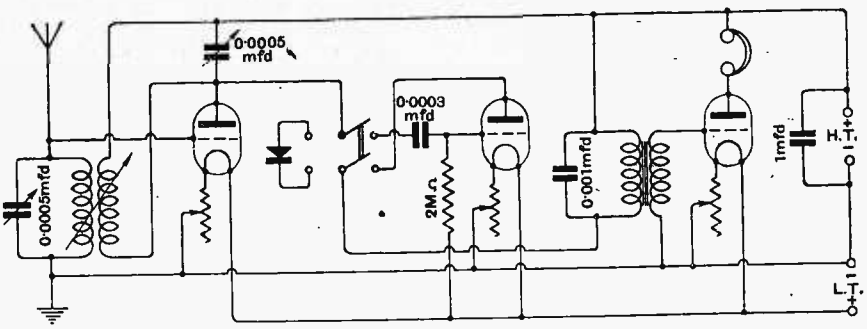

Fig. 2.—A three-valve receiver employing optional valve or crystal rectification.

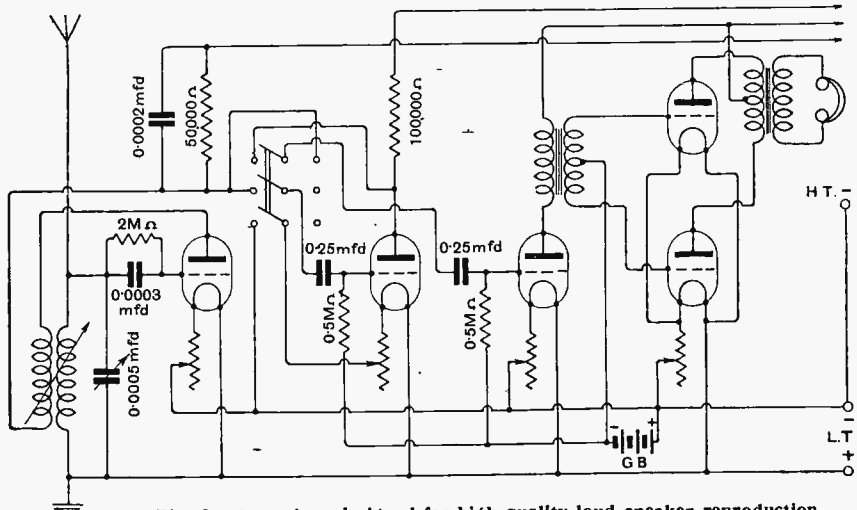

Fig. 3.—A receiver designed for high quality loud-speaker reproduction.

A Straight Valve and Crystal Receiver.

A READER wishes to construct a three-valve set consisting of H.F., detector, and L.F., in which optional valve or crystal rectification is obtainable by a simple switching arrangement. He desires, however, that full magnetic reaction be available, irrespective of whether valve or crystal is used as a detector.

We give in Fig. 2 a circuit in which all these points are given attention. It will be seen that the switching incorporated is simple and efficient, and provided reasonable care is taken to avoid serious "stray capacity" losses in the wiring, a very efficient receiver should result, capable of receiving many B.B.C. stations on the telephones, besides receiving the local station on the loud-speaker at excellent strength, irrespective of whether valve or crystal rectification is used.

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Membership of Foreign Radio Engineering Institutes.

A READER wishes to ascertain the procedure necessary to adopt in order to become a member of the Institute of Radio Engineers (M.I.R.E.), and he also seeks information concerning particulars of membership, etc.

We regret that we have no detailed information in our possession relative to this matter, since the institute is, of course, a purely American organisation; but foreign members of any nationality are in no wise debarred from membership, provided that they fulfil the necessary formalities. Intending members should communicate with the Institute of Radio Engineers, Incorporated, 104th Street and Convent Avenue, New York City, U.S.A.

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A Receiver Employing both Resistance-Capacity and Push-Pull Amplification.

A READER who is using an amplifier of the push-pull type preceded by a stage of ordinary transformer-coupled amplification desires to substitute this preliminary stage by two stages of resistance coupled amplification, provision being made for switching out one stage of amplification if desired.

This can be quite easily effected by following out the circuit given in Fig. 3, where all necessary values are given.

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AN INSTITUTE FOR THE RADIO ENGINEER.

IN the Correspondence columns of the present issue we publish a letter received from Mr. James Nelson, in which is set out the aims and objects of a proposed new Institute for Radio Engineers. We have delayed publication of this letter until now because we desired first of all to interview Mr. Nelson and to enquire a little more fully into the details of his plans. We found Mr. Nelson sincere of purpose and genuinely determined to start an institute which would be of value to the wireless worker in a professional capacity, whilst he indicated that he was anxious that in launching this association he should not interfere with the interests of any existing body.

Frankly, we are sorry to see that the necessity for the formation of a new and distinct institution should have arisen, and we had hoped that the Institute of Electrical Engineers, of which Mr. Nelson, we note, is a member, would have taken some steps before this to accommodate within its institution the radio engineer and to recognise him as having qualifications distinct from those which are required of the candidates for membership of the Institution of Electrical Engineers at present. Our contemporary, the "Electrician," commenting in their issue of June 26th on the proposals made by Mr. Nelson, suggests that the Institution of Electrical Engineers would receive for membership anyone who has the qualifications to make him eligible for membership of the proposed new Radio Institution.

Our own impression, however, is that the policy of the Institution of Electrical Engineers is not to recognise radio qualifications as distinct from general electrical engineering qualifications, whereas we understand that the proposals of Mr. Nelson are to form an institute which will primarily recognise radio qualifications and will only require the qualifications of general electrical engineering in so far as these are essential to a proper knowledge of the technicalities of radio communication.

It must surely be recognised that there are to-day very many radio engineers fully qualified in their own profession who yet have very little, if any, practical experience of heavy electrical engineering, but with experience and knowledge of the light side of electrical engineering and high-frequency work, perhaps very far above the knowledge of an electrical engineer who would have the qualifications necessary for admission to full membership of the Institution of Electrical Engineers.

We welcome the proposed formation of an Institute of Radio Engineers, because we believe that this will be a means of bringing together professional radio engineers in this country who at present have no professional institution to which they can attach themselves. The Radio Society of Great Britain is acknowledged to be the organisation of the wireless amateur, and many professionals may be found amongst its membership, but nevertheless the Radio Society adopts the policy that it will remain an amateur society, and that it does not cater primarily for the interests of the professional.

We believe that, provided the qualifications for mem-

CONTENTS.

bership of the new Institute are maintained at a high level, the Institute will have a future before it, but only so long as the attitude adopted is that at any time it is ready to be affiliated to or absorbed by the older Institution of Electrical Engineers, if and when that body decides to acknowledge the distinction between the qualifications of a radio engineer and the electrical engineer who at present forms the bulk of the membership of the Institution.

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THE WIRELESS TELEGRAPHY (EXPLANATION) BILL.

THE purpose of the Wireless Telegraphy (Explanation) Bill presented to the House of Commons on June 22nd by the Postmaster-General is to explain the meaning of the expressions "transmission" and "rent or royalty" where used in certain provisions of the Wireless Telegraphy Act, 1904.

This Bill, it will be remembered, has been presented as a result of the shelving of the Wireless Telegraphy and Signalling Bill, which produced such an outcry when first presented to the House in February of this year.

It seems certain that that Bill will be substantially redrafted before it is again brought forward, and in the meantime the "Explanation" Bill is intended merely to legalise the present action of the Postmaster-General in requiring a licence for a receiving station, whereas the Act of 1904 refers only to licences for transmission, and also to authorise the P.M.G. to impose a charge (as is at present the practice) in respect of receiving licenses and experimental transmitting licences, although the old Act states that these shall not be liable to any "rent or royalty." The P.M.G. gets over this difficulty by describing the charges now made as "fees" charged in respect of the grant or removal of licences.

The actual wording of the two clauses in the (Explanation) Bill is as follows:—

> "The expression 'transmission' where used in subsection (7) of section one and section two of that Act in relation to messages includes, and shall be deemed always to have included, the reception as well as the sending of messages:
>
> The expression "rent or royalty" where used in section two of that Act in relation to licences does not include, and shall be deemed never to have included, fees (whether periodical or of any other kind) charged in respect of the grant or renewal of licences:
>
> "Provided that nothing in this Act shall render any person liable in respect of any act or omission prior to the twenty-second day of June, nineteen hundred and twenty-five, to any penalty to which he would not but for this Act have been liable."

It is unlikely that any objection will be raised to the first section of this Bill, for all it does is to legalise the position of the Postmaster-General and involves no fresh issues. With regard to the second clause there have frequently been objections raised to the excessive charges in the way of fees made by the Postmaster-General in respect of licences issued for experimental transmission, and if the principle of payment of fees is once accepted with no limit or specified graduated scale then a position is at once created where the Postmaster-General may continue his exorbitant charges for experimental transmission, and may even make further increases so that transmission becomes a luxury which only the wealthy amateur can afford.

H.M. The King speaking into the microphone by which a squadron of aircraft was directed by wireless.

We feel certain that the wording of the original Wireless Telegraphy Act of 1904 was intended to guarantee that persons should be given facilities to carry out experimental work if they desire to do so, and any interference with this principle conveyed in the wording of the present (Explanation) Bill should be firmly opposed.

oooo

THE B.B.C. AND THE RAILWAY CENTENARY.

THE enterprise of engineers of the British Broadcasting Co. in carrying out what are generally described as "stunts" is already fully recognised, and one might have thought that they had exhausted the possibility of introducing new ideas which would make an appeal to the public.

Last week, however, we had a further example of what can be done in the way of novel entertainment, and the success of the transmission of sounds from the footplate of a Scotch express was undeniable. Elsewhere in this issue there appears a short account of the experiments explaining how these were undertaken.

Selective Single Valve Reflex Receiver.

The receiver here described is primarily designed to give the highest degree of selectivity possible in a simply constructed and operated single valve instrument, and, at the same time, to bring in distant stations with greater volume than is obtainable from a plain detector. It represents, in fact, an effort to obtain maximum results from one valve.

Maximum Results from One Valve.

By H. F. SMITH.

A FEW words regarding considerations influencing the design of the set may be of interest. It is generally realised that a detector valve, with reaction brought up to the critical point, is, in skilled hands, capable of long range reception, but, unfortunately, if the grid is made sufficiently positive for good detection by the usual leaky grid condenser method, really smooth reaction is seldom attainable. A crystal detector is, therefore, used, and it is possible to work the valve at its best both for amplification and regeneration.

Referring to the circuit diagram, it will be seen that the circuit adopted is of the reflex type, somewhat similar to that popularised by Voigt, using untuned aerial, tuned valve-to-crystal transformer, and crystal detector. The rectified pulses from the detector are fed back to the valve without the intermediary of an L.F. transformer.

The rectified crystal output is reflexed back to the valve, as very appreciable low-frequency amplification is thus obtainable. For the sake of stability and freedom from buzzing, no L.F. transformer is used. As there is no step-up of voltage to the grid, the valve may well be of the high impedance, high amplification type, and the D.E.5B, D.E.3B, and D.E.Q. types (the latter with special holder and about 60 volts H.T.), are suitable if very loud signals are required.

Type of Valve.

For ordinary requirements, a general purpose valve, such as the D.E.R., works admirably. It will generally be found that there is less interference from the local station if a semi-power valve such as the B.T.H. B4 is used, with suitable grid-bias and ample H.T. Presumably this is due to the fact that the long, straight part of the characteristic curve of this type of valve does not allow any "bottom bend" rectification of a strong signal, and the full filtering effect of the sharply tuned valve-to-crystal high-frequency transformer is obtained. The untuned aerial, coupled circuit tuner, gives in itself good selectivity without multiplication of controls. It should be noted that, as the grid circuit of the valve is lightly damped, oscillation will normally occur when this and the plate circuit are brought nearly into tune. This self-oscillation is prevented by the damping effect of the crystal, which is, however, connected across only a portion of the valve-to-crystal transformer (about half of it, or sometimes even less). If the usual artificial or treated galena is used, the output will be much greater than if connected across the whole inductance, and tuning will be sharper. It is suggested that the constructor tries various tapping points before permanently wiring up, always bearing in mind the need of including enough turns to stabilise the set. If a detector of high resistance, and consequently lower damping, such as the perikon or new semi-permanent type, is used, there must be more

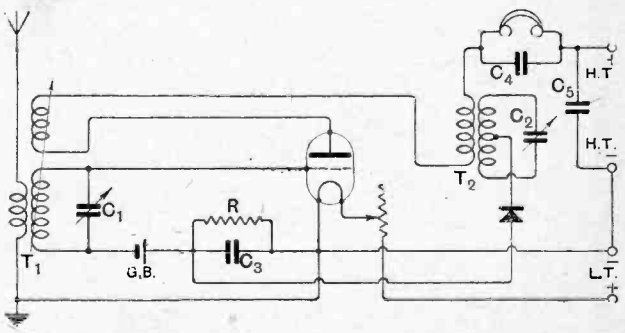


Fig. 1.—Coupling between the windings in T_1 and T_2 is fixed and selectivity is maintained in the crystal circuit by tapping off only a portion of the secondary turns. Reflexing is carried out by an original method in which a potential is developed across a high resistance (R) connected in the grid circuit.

Selective Single Valve Re-ex Receiver.—

inductance in the crystal circuit, and the tapping may be taken from the 60th turn from the bottom. Incidentally, it may be remarked that troubles with dual valve and crystal circuits are often due to too heavy damping by the detector.

To reduce to a minimum the magnetic coupling between the coils, they are tilted up in the usual "Neutrodyne" fashion, and are, in fact, very similar to the transformers used in that circuit. The panel of the set illustrated measures 14in. × 8in.; this length cannot be appreciably reduced if adequate spacing between the transformers is to be provided.

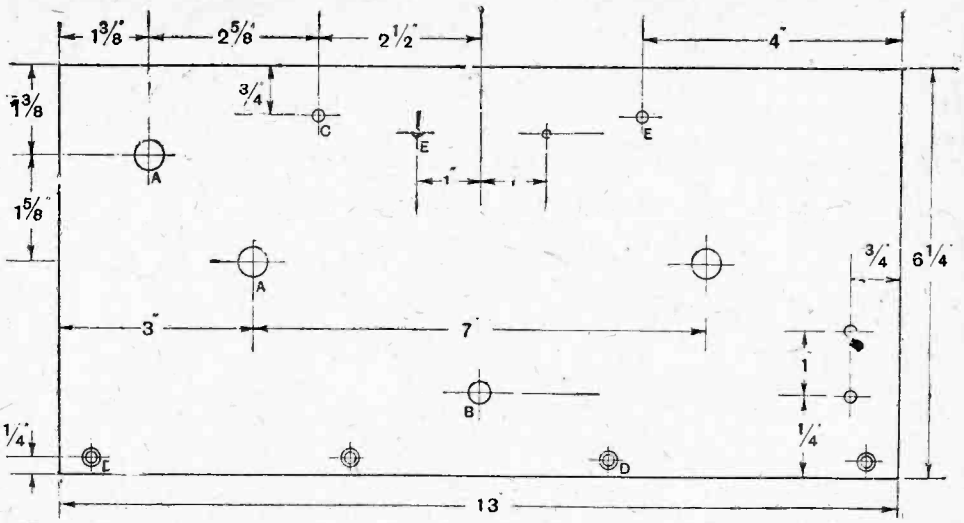


Fig. 2.—Details for drilling the front panel. Sizes of holes: A = 7/16in.; B = 5/16in.; C = 5/32in.; D = 5/32in. and countersunk; E = 1/8in.

A dimensioned drilling plan for the panel is given, though positions will vary slightly according to the makes of components used. The layout shown is, however, a good one to follow. On the panel are mounted the variable condensers, reaction coil, filament resistance, crystal detector, telephone and H.T. bye-pass condensers, terminals, and feed-back condenser C_3, with its shunting resistance. The value of this latter is not critical, as it merely permits of a biasing voltage being impressed on the grid, without appreciably reducing the L.F. pulses applied to it.

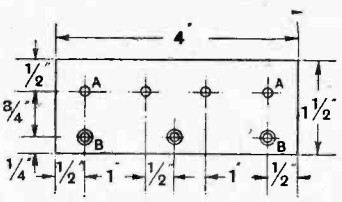


Fig. 3.—The terminal strip. A = 3/16in.; B = 1/8in. and countersunk.

The two transformers, which cover the broadcast waveband when tuned by 0.0003 mfd. condensers (C_1 and C_2) of fairly low minimum capacity, are similar in construction, except that T_2 has a greater number of primary turns, and a tapping point is provided about the middle of the secondary for connection to the crystal. All windings are put on in the same direction. T_1 has 15 turns of No. 20 wire on the primary and 80 turns of No. 22 on the secondary former. T_2 has respectively 25 and 80 turns of the same sizes of wire. Both the secondary formers are of 3in. diameter, and the primary windings are slipped into the bottom ends of the secondaries. If it is not possible to obtain ebonite tube of the correct diameter (2⅝in.) for these primary formers, a length of 3in. tube, 1½in. long, may be reduced by cutting out a small piece, binding with wire, and immersing in hot water. The connections are as follow:—T_1.—Bottom end of primary to aerial, top to earth; bottom end of secondary to feed-back condenser C_3, top to grid. T_2.—Bottom end of primary to reaction coil, top to phones; bottom end of secondary to —L.T., top to variable condenser. Note that in each case the moving plates of the variable condensers connected across the secondary windings go to the bottom ends. The transformers are fitted to the baseboard by means of a light brass angle piece, which can be bent to give the desired angle. A small grid bias cell, if necessary, may be secured to the base by a fibre strap.

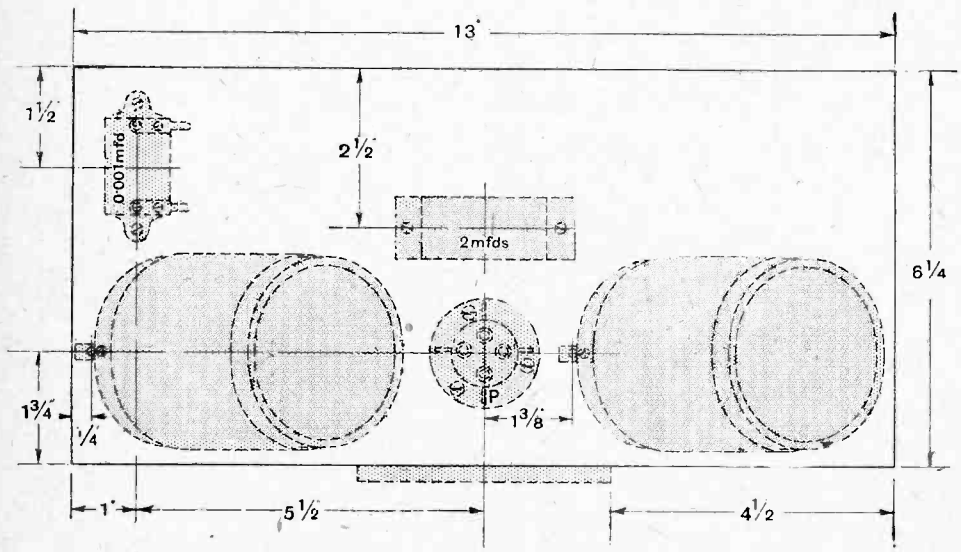


Fig. 4.—Positions for securing the components to the baseboard.

The reaction coil consists of about 20 turns of No. 24 double silk covered wire on a small basket former, which may be cut from ⅛in. ebonite sheet with a fretsaw, or one of the commercial patterns, stamped in fibre or presspahn, may be used. It should be

Selective Single Valve Reflex Receiver.—

fitted immediately above the top of transformer T_1. A small ebonite block is bolted to the centre, and is drilled to receive the end of the 2 B.A. threaded brass

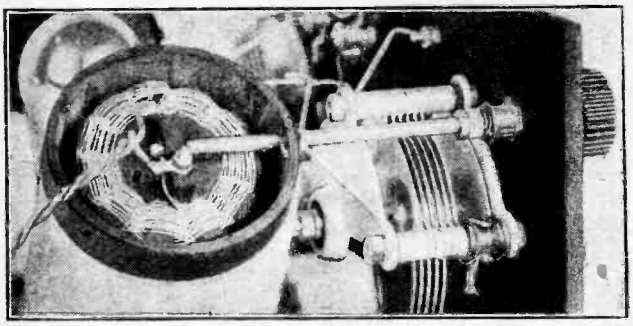


Fig. 5.—Reaction coupling is provided by means of a basket coil rotatable in the end of the aerial transformer.

control rod. This rod passes through the panel bush, and is secured in position by a couple of nuts and a spring washer at the back.

The style of wiring shown will be found convenient and effective; all L.T. and earth potential leads are carried in insulating sleeving, and kept down on the panel or baseboard, while heavier bare wire is used for most of the high-frequency leads, and rubbered flex for the connections to the reaction coil.

The crystal detector should be rigid and well made; the small plug-in pattern shown is convenient and stable. Reversal of connections to the crystal

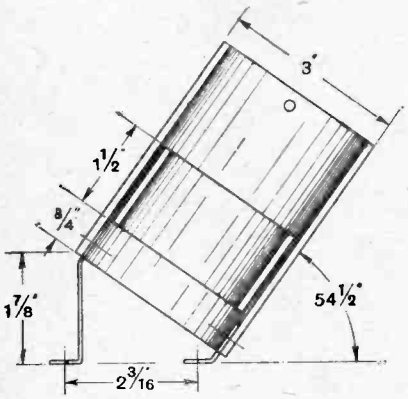


Fig. 6.—Constructional details for setting up the H.F. transformers.

should be tried if reaction is not sufficiently smooth.

The operation of the set, once the correct values of H.T. voltage, filament current, crystal tapping point, and grid bias (if any) have been found, is fairly simple and straightforward. Both condensers are varied together, and the readings will be nearly the same on each. As stated above, the valve will

LIST OF PARTS REQUIRED.

Ebonite panel, 14in. × 8in.
Wooden baseboard, 13¼in. × 6½in.
2 Ebonite tubes, 4¼in. long × 3in. dia., ⅛in. wall.
2 Ebonite tubes, 1½in long × 3in dia., ⅛in. wall.
½ lb. No. 22 D.C.C. copper wire.
Small quantity No. 20 D.C.C. and No. 24 D.S.C. wire.
2 Variable condensers, 0·0003 mfd., with verniers (Wilkins & Wright).
For reaction coil: basket former, 1 ⅜in. inside dia., 2 ⅜in. outside dia., length 2 B.A. threaded rod, "one-hole" panel bush, knob and pointer.
Valve socket.
Filament resistance (Atlas).
Crystal Detector (Radio Instruments, Ltd.).
2 0·001 fixed condensers.
Fixed resistance, 100,000 ohms to 1 megohm (Dubilier).
Reservoir condenser, 0·5 to 2 mfds. (Dubilier).
Connecting wire, sleeving, screws, etc.
Cabinet (Peto Scott).

oscillate when the grid and plate circuits are brought into tune, unless the damping effect of the crystal is present. It is therefore desirable to set the detector when the grid circuit is distuned, while listening to a signal which would be very strong if both circuits were correctly tuned. The reaction coil should be at zero coupling. Never try

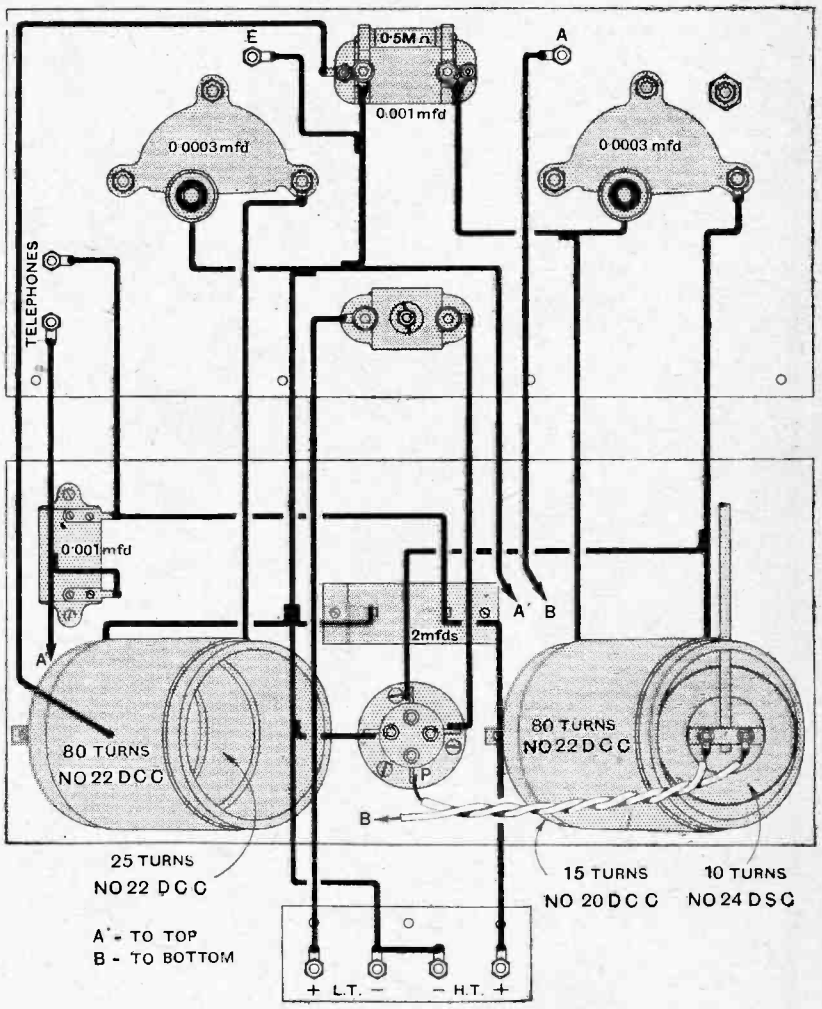


Fig. 7.—Practical wiring diagram. The leads A' and B are connected to the primary windings of the H.F. transformers.

Selective Single Valve Reflex Receiver.—

to adjust on a weak signal, or with both circuits in tune.

If a valve of low impedance, such as the semi-power type, is used, it may be found that oscillation is produced too easily, and reversed reaction is necessary to prevent it. The remedy for this is to move the crystal connection a little higher up the secondary winding of T_2, and possibly to remove a few turns from the reaction coil. It may also improve matters if about five turns are taken off the primary winding of this transformer. Again, if a valve with high impedance and high amplification factor is used, reversed conditions will obtain, and it will probably be necessary to add a few turns to both the primary and reaction coil.

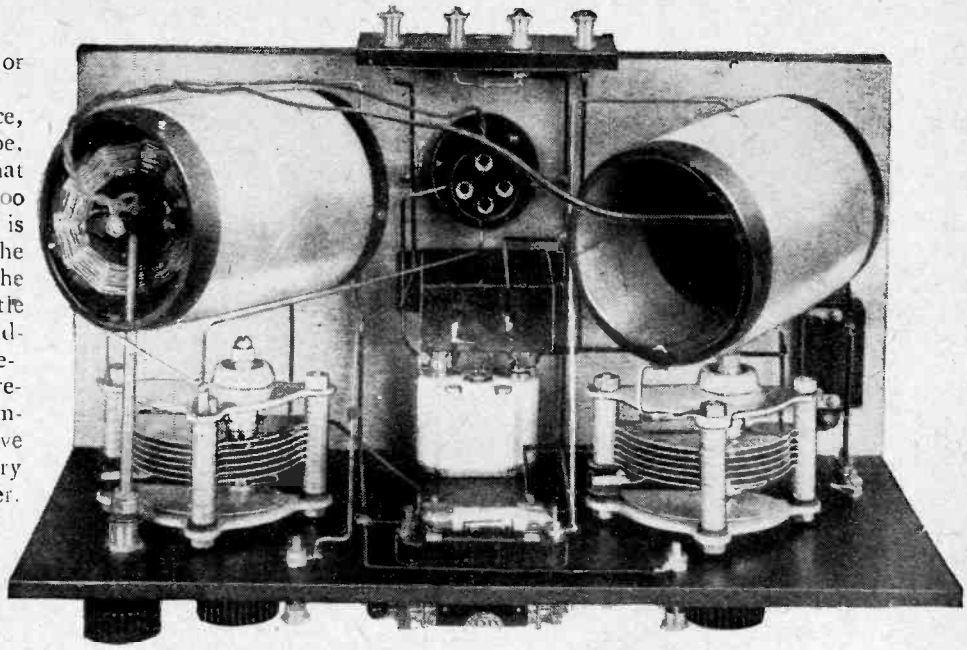


Fig. 8.—View of the interior showing the arrangements of the components and wiring. It will be seen that the small brass bolts used for attaching the crystal detector to the front of the panel also secure the condenser and resistance.

The receiver may be fitted into a cabinet of the usual American pattern, with lift-up lid. A valve observation window is of advantage if a bright-emitter valve is used.

At a point 50 miles north of London, that station, as well as Cardiff, Manchester, Bournemouth, Newcastle, Birmingham, Nottingham, Stoke-on-Trent, Brussels, Bremen, and one or two other stations, are received at from very good to fair telephone strength in daylight, on an average aerial. The addition of an efficient single-valve note magnifier brings up several more stations to audibility, and gives some of the above on a loud-speaker. After dark, and under moderately good atmospheric conditions, a large number of more distant stations are, of course, heard.

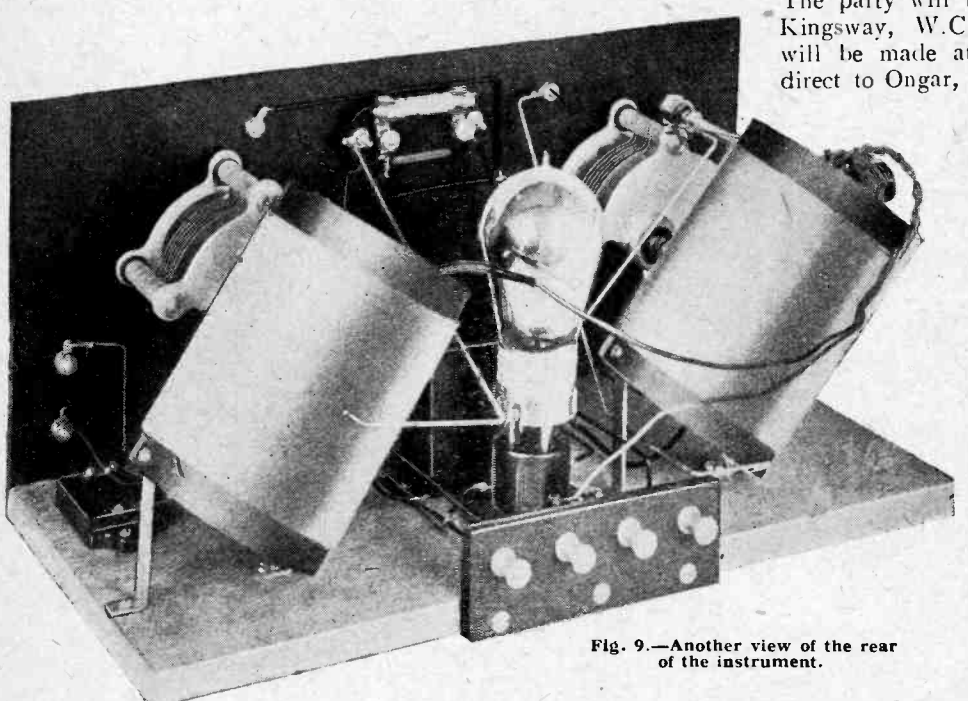


Fig. 9.—Another view of the rear of the instrument.

R.S.G.B. TO VISIT ONGAR.

A VISIT is to be paid to the Ongar Transmitting Centre of the Marconi Company by members of the Radio Society of Great Britain on Friday, July 17th. The party will travel by chars-à-banc from Kingsway, W.C., from which a departure will be made at 2 p.m., and will proceed direct to Ongar, where representatives of the company will conduct the members on a tour of inspection. After the visit has been completed, the party will proceed to Epping, where tea will be taken at the "Cock Hotel." The party is due to return to Kingsway by about 7.30 p.m.

The inclusive cost, per head, will be 8s. 6d., and members desirous of attending are particularly requested to forward their applications, together with remittance, at the earliest possible moment, but in any case not later than Friday, July 10th, as after that date it will not be possible to make arrangements for additional travelling facilities.

DIRECTIONAL RECEPTION.

Principles Underlying the Action of the Frame Aerial.

By R. D. BANGAY.

IN order to understand the principles made use of in all classes of directional reception, it is necessary first of all to have a clear idea of the components of an electric wave. All wireless telegraph and telephone signals consist of a series of electric waves travelling outward from the transmitting aerial at the speed of light. These waves may be modulated or continuous or split up into groups according to the method adopted for generating and controlling them. For the purpose of this explanation, however, we are not concerned with that aspect of the phenomenon, and it will therefore immensely simplify the explanation if we take the hypothetical case of a single individual wave and trace out its career from its birth in the transmitting aerial.

If we analyse the changing conditions occurring in a swinging pendulum, it will be found that the energy imparted to the bob weight of the pendulum is continually changing its form, from a kinetic condition at one moment when the pendulum is moving rapidly across the middle point of the swing and the bob weight is at its normal level, to a potential condition at the next moment when the weight has reached its maximum height above normal level and is for the moment stationary.

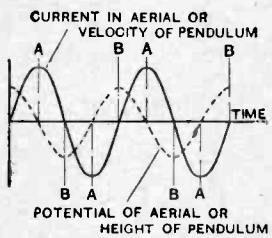


Fig. 1.—Analogy between variations in current and voltage in an aerial, and changes in the form of energy in a swinging pendulum.

Form of Energy in a Transmitting Aerial.

Similarly, when a current is oscillating in the aerial circuit, the energy is continually changing its form from a "kinetic" condition at one moment when the current is actually flowing but has not yet charged up the aerial, to a "potential" condition at the next moment when the aerial is fully charged and the current has for a moment ceased flowing, *i.e.*, just before it reverses its direction. Twice during each cycle, the whole of the energy is in one form or the other; at intermediate moments the energy is partly in the kinetic and partly in the potential form. This point will be more readily appreciated by referring to Fig. 1, which illustrates the simultaneous values of the current flowing in the aerial and the charge on the aerial during two oscillations. This diagram shows that when the current is at its maximum value, as at the moments A, the charge as represented by the E.M.F. of the aerial is zero, while when the charge on the aerial is at its maximum, as at the moments B, there is no current flowing in the aerial. The same curves, it will be noticed, might equally well represent the height of the swing pendulum and the speed at which it is moving.

Electromagnetic Radiation.

If we examine the two conditions of the electrical circuit separately, we find that each produces a different kind of field. Thus, when the current is flowing, a *magnetic field* is produced, and when the aerial is charged an *electrostatic field* is produced. Both fields consist of, or can be represented by, a number of lines of force. The electrostatic field acts along lines of force running at right angles to the earth's surface, as illustrated diagrammatically in Fig. 2. The magnetic field, on the other hand, acts along lines of force surrounding the aerial and parallel with the earth's surface, as illustrated diagrammatically in Fig. 3. In both of these diagrams, for the sake of simplicity, only a few lines of force radiating from a single point on the aerial are shown. Actually, of course, the lines of force emanate from all points along the aerial and extend indefinitely into space. When the aerial is "oscillating," it is clear that a succession of these electrostatic and magnetic fields are being radiated as the current in the aerial rises and falls.

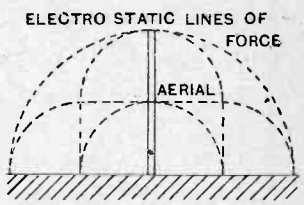


Fig. 2.—Distribution of electrostatic lines of force round a transmitting aerial.

An electric wave consists of a combination of both of these fields, and each wave, therefore, possesses an electrostatic and a magnetic component.

The lines of force comprising the two fields are, as we have seen, acting at right angles to one another. Thus, if we erected a cross facing the transmitting aerial and at some distance from it, the arms of the cross would lie along the magnetic lines of force of the advancing wave, and the stem of the cross would be along the electrostatic lines of force.

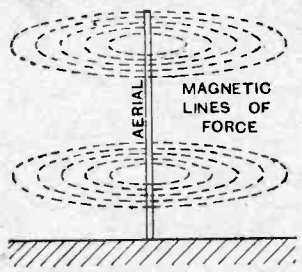


Fig. 3.—Magnetic lines of force parallel to the earth's surface, generated by the aerial current.

Now when considering the E.M.F. induced by an incoming wave in a receiving aerial, it is simpler entirely to disregard the electrostatic component and consider the wave purely as a system of magnetic lines of force.

Lines of Force in the Magnetic Waves.

But before turning our attention to the receiving aerial there are three points to consider in connection with the magnetic component of the wave, namely, (1) the direction in which the lines of force move, (2) the "sense"

Directional Reception.—

in which the lines of force act, and (3) the density of the lines.

As regards the first point, the lines move continuously outward in the direction of the propagation of the wave. If these lines of force were visible, they would appear to an observer looking down at them from above as a group of ever-expanding circles resembling the circle of ripples set up on the surface of a pond by dropping a stone into it. We may say therefore that the magnetic lines of an electric wave move along a direction at right angles to themselves, or, in other words, they travel broadside along the direction of propagation. Thus, Fig. 4 represents diagrammatically a small section of a wave front near the transmitting aerial, in which the arrow indicates one of the directions along which they are moving. Each complete line of force is, of course, a complete circle, as illustrated in Fig. 3, but as we are only interested in that part of the wave front which reaches a particular receiving aerial, there is no need to show more than a small section of each circle. As this section gets further away from its starting point, the circles of which the lines form a part get larger and larger in diameter with proportionately less curvature in them, and therefore the lines representing a small section of the advancing magnetic field of a wave at some distance from the transmitter can be represented by a number of parallel straight instead of curved lines, as illustrated in Fig. 5.

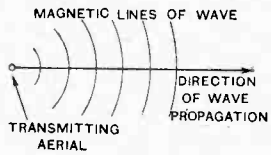


Fig. 4.—Distribution of magnetic field near the aerial.

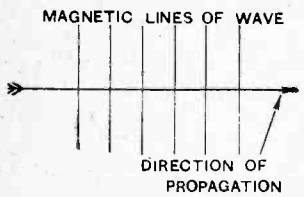


Fig. 5.—Magnetic wave front at a considerable distance from the transmitter.

As regards the second point, namely, the "sense" in which the lines of force act, this depends upon the direction in which the current is flowing in the aerial. If the current is flowing from the earth to the top of the aerial, the "sense" in which the lines of force are acting will be anti-clockwise, looking down on the aerial as shown by the arrow heads in Fig. 6A, and *vice versa* if the current is flowing down the aerial, the "sense" of the lines will be reversed as shown in Fig. 6B. Since the current in the aerial producing the wave is oscillatory and reverses its direction during each wave, it is easy to see that a complete wave will consist of a group of these lines of force, half of them acting in one sense and half in the opposite sense, as illustrated in Fig. 7.

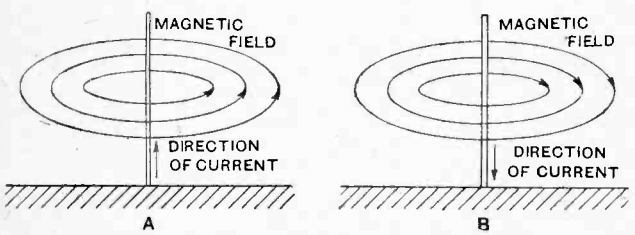


Fig. 6.—Magnetic "sense" of field produced with the aerial current flowing (A) from the earth upwards, (B) towards the earth.

As regards the third point, namely, the density of the magnetic component of the wave, this depends upon the strength of the current in the aerial. Now the current in an oscillatory circuit varies throughout each complete cycle (*i.e.*, during the generation of a complete wave) from zero to a positive maximum back to zero, then to a negative maximum and back to zero again. Thus during the production of each wave, the lines of force will reach a maximum density twice (once when the field is acting in each sense), and will also fall to zero density twice during each wave. We may therefore represent our birdseye view of the section of the wave front more accurately than in Fig. 7 by graduating the closeness of the lines to represent the relative densities of the magnet field in the wave, as shown diagrammatically in Fig. 8.

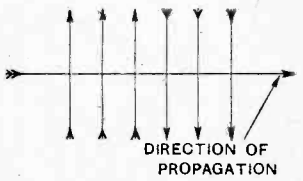


Fig. 7.—"Sense" of magnetic lines of force produced by a complete cycle of current in the aerial.

We may summarise these conclusions, then, by considering an incoming wave as a system of lines of magnetic force travelling broadside along the direction of propagation and in a horizontal plane parallel with the surface of the earth. Moreover, if an observer were to stand in the path of an oncoming wave and were equipped with some means of measuring the density and sense of the lines of force as the wave passed him, he would notice that they grow gradually from zero density just before the wave reaches him to a maximum density in one sense during the first quarter of the wave, falling to zero during the second quarter, growing once more to a maximum density in the opposite sense during the third quarter, and finally falling to zero again as the wave passes him on its never-ending journey.

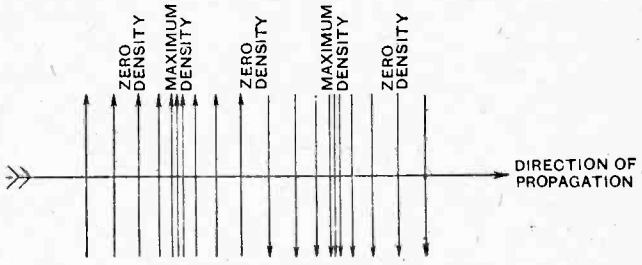


Fig. 8.—Density of magnetic lines in a complete wave.

Effect of Magnetic Field on Receiving Aerial.

We may now turn our attention to the receiving aerial and observe the logical effect which the advancing wave must have when it reaches the aerial. An ordinary aerial may be considered as a simple conductor erected perpendicularly to the earth's surface. If this conductor is

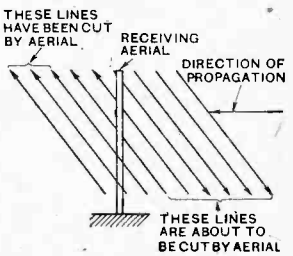


Fig. 9.—Magnetic lines of force in wave front impinging on the receiving aerial.

Directional Reception.—

erected in the path of the oncoming wave, the lines of force constituting that wave parallel to the earth's surface will be " cut " by the conductor, as shown in Fig. 9, no matter from what direction the wave may have emanated, in much the same way as the circle of ripples created on the surface of a pond may be said to be cut by a stick projecting at right angles to the surface of the water in the path of the ripples.

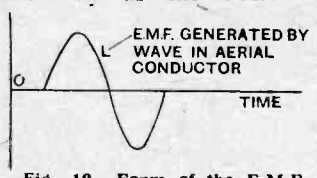


Fig. 10.—Form of the E.M.F. and current induced in an aerial by a single complete wave.

When magnetic lines of force are "cut " by a conductor an E.M.F. is generated across the conductor. The magnitude of the E.M.F. is proportional to the rate of cutting, *i.e.*, to the number of lines of force cut per unit of time. Moreover, the direction of the E.M.F. will depend upon the " sense " of the magnetic lines which it is cutting.

In the case we are considering, although the whole system of magnetic lines is advancing at a uniform speed and in a uniform direction, the density of these lines, as we have seen, varies from zero to a maximum density twice in each wave. When the densest portion of the magnetic field is cutting across the aerial, the latter is cutting the lines of force at the greatest rate. It follows, therefore, that the E.M.F. generated in the receiving aerial will start at zero, rise to a maximum, and fall to zero once during each half wave or twice during the passage of a complete wave. Again, the sense of the magnetic lines of force during the first half of the wave is opposite to that during the second half, and consequently the direction of the E.M.F. generated in the receiving aerial will first be acting in one direction and then in the other during the passage of the wave. In other words, the E.M.F. generated in the receiving aerial by a single wave will start at zero, rise to, say, a *positive* maximum, fall to zero again, then rise to a *negative* maximum, and finally fall to zero. We may therefore indicate the E.M.F. generated across any single conductor lying at right angles to the earth's surface in the path of a wave by a sine curve as illustrated in Fig. 10, and if the aerial is connected to earth, a corresponding current will flow up and down the aerial. A succession of waves will, of course, create a succession of these effects resulting in an oscillatory current.

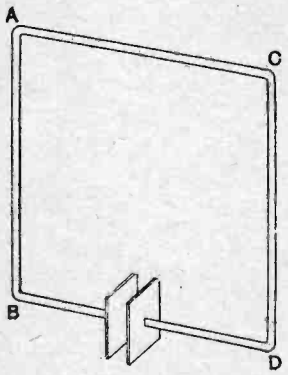


Fig. 11.—Oscillatory receiving loop erected with the sides AB and CD perpendicular to the earth's surface.

Directional Reception.

The amplitude of this E.M.F. is proportional to the maximum intensity of the magnetic field cutting the conductor, and is obviously independent of the direction from which the signals are emanating.

Suppose, now, we erect two such aerial conductors, AB and CD, a short distance apart and perpendicularly to the surface of the earth. And suppose, instead of connecting them to earth in the ordinary way, we connect the two top ends and the two bottom ends together in such a way as to form a loop which includes a condenser in one of the horizontal connecting leads as shown in Fig. 11. This loop, it will be seen, now forms a closed oscillatory circuit.

In examining the receiving properties of this loop to signals coming from any given direction, we need only consider the effect in the two vertical conductors AB and CD, and we may disregard the horizontal conductors, because they always lie along the plane in which the magnetic lines of force are travelling, and, therefore, the magnetic lines of force comprising the incoming wave are never cut by these horizontal conductors. The incoming wave will therefore generate no E.M.F. in them, no matter from what direction it may arrive.

The two vertical conductors, on the other hand, always lie at right angles to the magnetic lines of force, and, therefore, E.M.F.s are generated in these conductors exactly as if they were two ordinary aerials. In this case, however, there is no connection between the vertical conductors and earth, and, therefore, although the incoming wave generates an E.M.F. across these conductors, it does not necessarily follow that a current will flow in them.

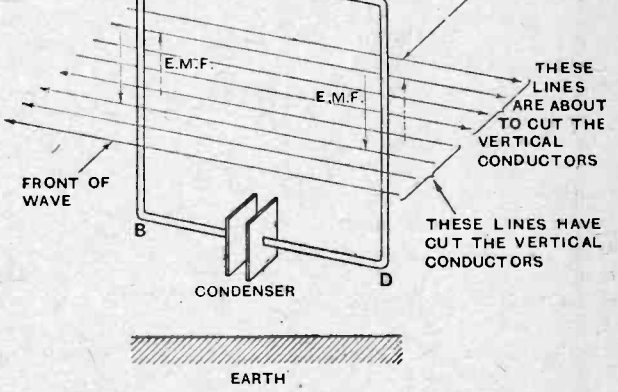


Fig. 12.—When the plane of a frame aerial is parallel to the magnetic lines of force, the E.M.F.s induced in the vertical sides are in opposition.

Conditions for Minimum Signal Strength.

Let us suppose now that the loop of wire is so arranged that the plane of the loop lies parallel to the magnetic lines of force in the incoming wave; that is to say, the plane of the loop will be at right angles to the direction of propagation of the wave and facing the direction of the transmitting station as shown in Fig. 12. Obviously, in this case, the wave will reach both vertical conductors of the loop at exactly the same instant, and consequently the density and sense of the magnetic field cutting each conductor at all moments during the passage of the wave must be exactly the same. It follows, therefore, that the E.M.F.s generated in the two vertical conductors will always be equal in magnitude and acting in the same direction with relation to the surface of the

Directional Reception.—

earth, *i.e.*, either both in an upward, or both in a downward, direction as shown by the full line and dotted line arrows in Fig. 12.

If we examine the direction of these E.M.F.s with relation to the oscillatory circuit formed by the loop, it will be seen that they are both acting in opposite directions round the loop. For example, the upward E.M.F. in the left-hand conductor is acting in a clockwise direction round the loop, while the upward E.M.F. generated at the same time in the right-hand conductor is acting in an anti-clockwise direction. Since, as we have just explained, these E.M.F.s are always equal in magnitude, and since, as we have now seen, they are always acting in opposite directions with relation to the loop circuit, the result is that the effective E.M.F. in the loop circuit must in these circumstances always be zero, and, therefore, no current will be generated in the loop circuit by a wave coming from that direction. If, therefore, a detector is connected across a loop aerial of this character, no signals can be detected if the plane of the loop is facing the transmitting station. In other words, we may say the receiving property of a loop aerial is zero in a direction at right angles to the plane of the loop.

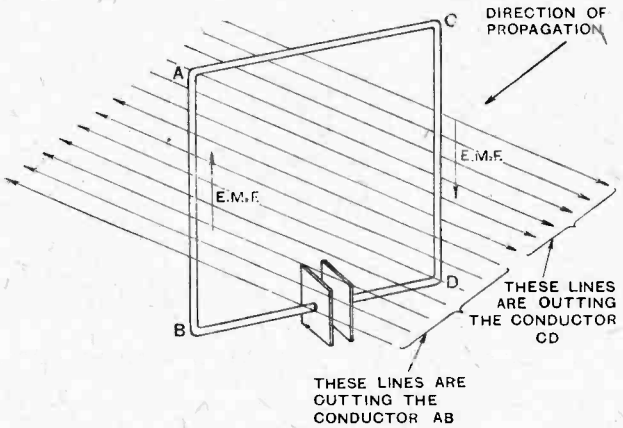


Fig. 13.—E.M.F. induced in a frame aerial placed at right angles to the direction of propagation. The E.M.F.s in the vertical arms will operate in the same direction if AC is comparable to the wavelength of the transmitter.

Conditions for Maximum Signal Strength.

Suppose, now, the loop of wire is moved to occupy a position edgewise to the incoming signals, *i.e.*, so that its plane faces at right angles to the transmitting station as shown in Fig. 13. It will be seen now that any wave coming from this direction will reach the near vertical conductor slightly in advance of the time when it reaches the far conductor. Consequently, although each conductor in turn cuts the same sequence of magnetic lines forming the incoming wave, the cycle of E.M.F. generated in the near conductor will always be more or less in advance of the same cycle of E.M.F. generated in the far conductor, according to their distance apart. If the two conductors are far enough apart, one conductor will be cutting the front of the wave while the other is cutting the back of the wave, in which case the direction of the E.M.F. generated in the two conductors will be as shown in Fig. 13, *i.e.*, both in the same direction round the loop. If, on the other hand, the conductors are comparatively close together, then when the maximum E.M.F. is reached in the near conductor, the E.M.F. generated in the far conductor will not quite have reached its maximum value. Consequently, although the E.M.F.s may in this case be acting in opposite directions around the loop, they will not always be exactly equal, and, therefore, there will, in any case, be a resulting E.M.F. acting round the loop.

It will be found that this resulting E.M.F., whether the loop be large or small, varies throughout the period of the wave from a positive maximum to a negative maximum, and is therefore exactly similar in character to, though not necessarily so large as, the E.M.F. generated in the vertical conductors taken individually. It will therefore produce a corresponding cycle of current in the loop circuit which can be detected in the ordinary way. We may say, therefore, that a loop aerial is to a certain extent receptive to signals coming from a direction along the plane of the loop.

(To be continued.)

BROADCASTING AS AN ADVERTISEMENT.

The American Point of View.

IT has been stated recently in the British Press that American broadcasting is inferior to British owing to the element of advertising. This is certainly true in some respects, but the advertisers put on real entertainments in order to win favour with the public (writes an American correspondent of *The Times*). The bad advertisers are those who are causing the criticism. They force themselves upon the listener and even go to the extent of telling him where he can take old jewellery and buy a fur coat. The announcers also have great freedom, and sometimes their suggestions are distasteful. On the other hand, the American Telephone and Telegraph Company are very strict as to the type of programme which an advertiser may present. For example, one of the largest moving picture houses rents a station on Sundays from 7.20 to 9.20 p.m., the manager acting as announcer. The overture for the opening is given from the stage; then concert numbers by high-class artists, belonging to the theatre staff, are also given from the stage. On other evenings a large grocery chain store company hire a station and give an hour's programme of string music. The only advertising that is done in connection with this item is the announcement that the music is given by the company. No other mention is made of the company's name, neither is any effort made to sell.

The point to be emphasised is that broadcasting in America is just as competitive as any other business. In order to make a broadcasting station popular, attractive programmes must be presented, or people will turn to a station offering better entertainment.

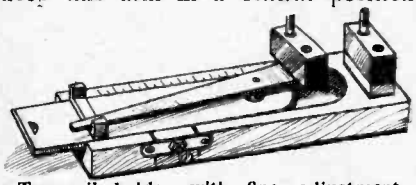
READERS' NOVELTIES

A Section Devoted to New Ideas and Practical Devices.

A VARIABLE COIL HOLDER.

The sliding lid of a pencil box can be converted at small expense into an efficient two-coil holder. The fixed coil plug is screwed to the body of the box, while the moving coil holder is mounted on a pivoted lever on the sliding lid.

The coupling is adjusted first with the slide by means of which the approximate setting may be quickly obtained. If a scale is marked on the edge of the box, a record may be kept of the settings of the slide for different stations. The final adjustment of the coupling is obtained by the small angular movement of the pivoted arm to which the moving coil is attached. It is advisable to keep this arm in a central position



Two-coil holder with fine adjustment and clamping device constructed from a pencil box.

during the course of adjustment, so that it may be moved to the left or right to give either an increase or decrease of coupling.

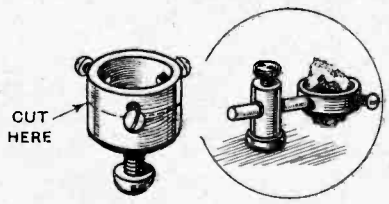
If the slide is at all loose, some kind of clamping device is an advantage. A convenient method of providing this is to make two parallel saw-cuts in the side of the box and to fit an adjusting screw, which will force this section of the groove against the slide.—C. S. A.

o o o o

AN IMPROVED CRYSTAL MOUNTING.

It is convenient to be able to explore both sides of a crystal for a suitable spot for rectification, and a convenient mounting which enables this to be done is shown in the diagram.

A crystal cup provided with three radial set screws is obtained, and a ring, including the three screw holes, is cut off with a hack-saw. One of the screws is replaced by a length of brass rod screwed for a short distance at one end to fit the tapped hole in the ring. The rod is held in an ordinary telephone terminal, so that the ring may be clamped in any desired position.—J. H. B.

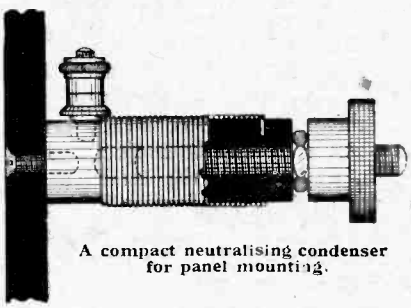


Reversible crystal mounting.

o o o o

NEUTRODYNE CONDENSER.

A compact and efficient neutrodyne condenser for panel mounting can be built up on a short length of ebonite. Having squared up the ends of the rod, central holes are drilled and tapped at each end, one to take a piece of 2 B.A. rod, and the other for the securing screw. A lock nut and terminal head are fitted to the 2 B.A. rod, which acts as one electrode of the condenser. The other electrode



A compact neutralising condenser for panel mounting.

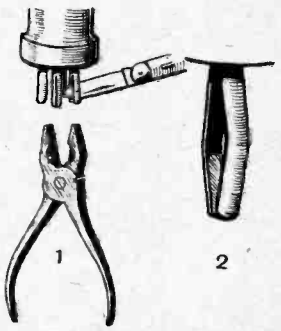
is a layer of foil or bare wire wound on the outside of the ebonite rod and fitted with a terminal. The condenser is very rigid, and the capacity once set, is not likely to change.—R. E. A.

o o o o

VALVE LEG CONTACTS.

Much annoyance and delay is caused in experimental work by bad contacts between valve legs and their sockets. This is in large measure due to neglect of the valve legs, which tend to close up in use, and do not, therefore, touch the walls of the socket.

It is customary, when a bad contact is traced to their cause, to open out the two halves of the valve leg with a penknife. The ends of the valve leg then press outwards and make



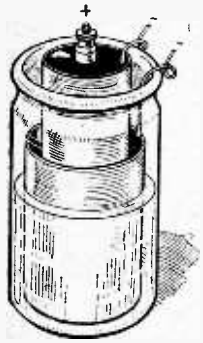
Correct method of opening valve pins. The appearance of the pin after treatment is shown at (2).

good contact, but the cure is not permanent, as the metal from which the pins are made is not very hard, and after removal from the valve holder it is generally necessary to open out the pins before again replacing the valve. A better method of treating the pins, which effects a more lasting cure, is shown in the diagram. The point of the penknife blade is inserted near the bottom of the slot and the sides of the valve pin are then bent together with a pair of pliers. The point of contact is thereby transferred to the middle of the pin and will remain effective for a far longer period.—A. E. S.

RESTORING THE ACTIVITY OF DRY CELLS.

Dry cells of large capacity are being widely used in country places for the supply of filament control to the 0.06 type of valve. The following method of resuscitating exhausted cells may, therefore, be of interest to readers who obtain their filament current in this way.

In most dry cells the zinc container is eaten away and the sal-ammoniac exhausted before the depolarising agent surrounding the carbon rod. The cell will, therefore, be restored to activity if supplied with a new zinc electrode and fresh electrolyte. In practice the best way of doing this is to remove the paper from the outside of the cell, which may then be placed in an ordinary jam jar containing a solution of sal-ammoniac in water. If the zinc container is intact, and the cell has failed through the exhaustion of the electrolyte, holes should be pierced so that the solution may penetrate into the interior of the cell. If, on the other hand, the container is badly corroded, an auxiliary zinc electrode may be placed round the cell and connected to the negative terminal of the cell.—J. L. R.



Supplying a new zinc electrode and electrolyte to an exhausted dry cell.

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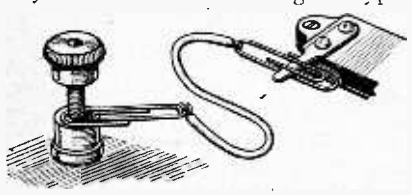
A USEFUL CLIP CONNECTOR.

An ordinary bent wire paper clip makes a very effective connector for experimental work. It is very convenient to keep a series of lengths of flex to which clip connectors have been soldered at each end. These may be used for connecting all types of components, as the clip is easily adapted either to soldering tags or to terminals.



Paper-clip connectors can be attached both to terminals and soldering tags.

VALVES FOR IDEAS.

Readers are invited to submit brief details, with rough sketches, where necessary, of devices of experimental interest for inclusion in this section. A receiving valve will be despatched to every reader whose idea is accepted for publication.

Letters should be addressed to the Editor, "Wireless World and Radio Review," 139, Fleet Street, London, E.C.4, and marked "Ideas."

The larger sizes of clip used without a flex connection are very useful for joining up flash-lamp batteries to form an H.T. battery.—G. H. G.

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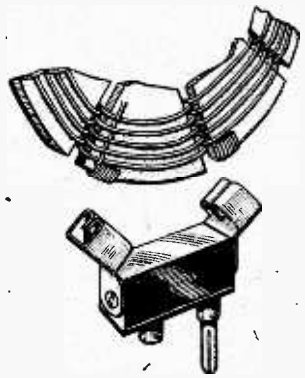
A PLUG ADAPTOR FOR BASKET COILS.

Basket coils intended for use in a three-coil tuner can be mounted in a single set of coil plugs of the type illustrated in the diagram, thus eliminating the expense of a separate plug adaptor for each coil.

A shallow plug of the type usually sold for panel mounting is preferable to the standard plug used on duolateral coils. At each end of the plug is fixed a clip contact of the type used in the construction of knife switches.



A basket coil mounting of low capacity.

Contacts of this kind are stocked by most dealers in wireless components, but cheap qualities constructed with soft copper should be avoided, as the strain imposed by the insertion and removal of coils is generally greater than the contact would be called upon to carry in a switch. The spring contacts should be connected one to each of the coil sockets.

The method of making contact with the coil, although simple, is very effective. The coils are wound on slotted discs of some suitable insulating material, and short lateral slots are cut near the outer edge of the coil in the side of two adjacent winding slots. The ends of the winding are bared, and wound in the lateral slots to form contacts which will fit into the clips on the coil holder. The turns may be tinned and soldered together to give additional strength.—C. M. K.

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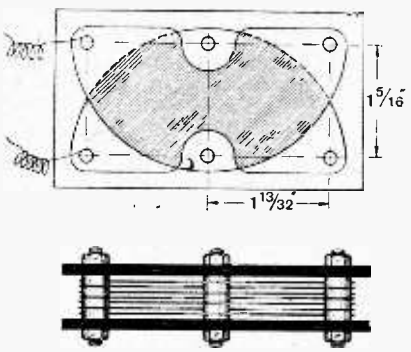
FIXED AIR CONDENSERS.

The semi-circular vanes used in the construction of variable condensers may be used to build fixed air condensers for short-wave work. The plates are separated with ordinary spacing washers, and, owing to the peculiar shape of the vanes, can be clamped together with six securing bolts. The dimensions given in the drawing are for standard 3in. vanes, and the area of overlap is approximately 20.5 sq. cm.—E. W. O. S.



Fixed air condenser built with standard condenser vanes.

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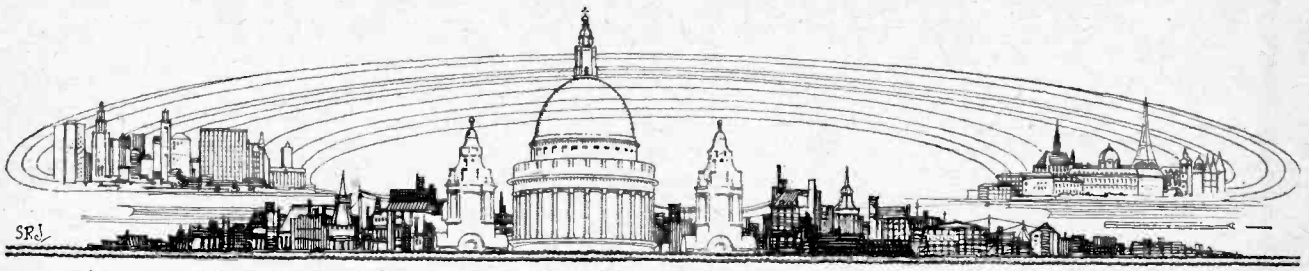
CORRODED ACCUMULATOR TERMINALS.

It is extremely difficult to free terminals that have become corroded by sulphuric acid. The salts formed by the action of the acid seem to fill up the interstices between the threads, and the force required to free the terminal is often sufficient to loosen the terminal screw in the lead lug.

It was accidentally discovered by the writer that the application of heat from a soldering iron enabled the terminal to be moved quite easily, and this method has been applied with complete success in all subsequent cases of corroded terminals. After the terminals are removed, they are washed free from verdigris and liberally covered with vaseline to stop further action of the acid.—C. B.



CURRENT TOPICS

Events of the Week in Brief Review.

SOUTH DEVON ASKS FOR SECOND RELAY STATION.

The Sidmouth Radio Society are asking the B.B.C. to erect a Relay Station at Exeter, which, they think, would serve a large agricultural area and be a great boon to farmers.

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NEW ARCTIC STATION.

The Canadian Government has decided to erect a wireless station this summer at Aklavik in the Arctic Ocean. The Mounted Police force at Herschel Island will also be provided with supplementary equipment for summer work. This little-known settlement is at the mouth of the Mackenzie River, well within the Arctic Circle, and Herschel Island lies some sixty miles to the north-west of Aklavik, on the coast of Yukon.

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BROADCASTING IN INDIA.

The Government of India is prepared to receive applications for the establishment of a Broadcasting Company in India, and a similar company in Burmah. The final date upon which such applications will be received is August 31st, 1925.

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WIRELESS IN HOSPITALS.

The excellent movement to provide wireless receivers in hospitals is receiving encouraging support. It is often one of the hardest tasks for doctors and nurses to revive in a patient the will to live, and anything which tends to divert his thoughts and to interest him must be of direct therapeutic value. Messrs. Gent and Co., Ltd., have recently installed at the Cottage Hospital, Crewe, a complete receiving equipment provided with 54 pairs of headphones and 4 loud speakers, the receiver being their standard "Tangent" Radiometric type "B" 4-valve type.

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GIFT FOR THE ESKIMOS.

The Moravian Mission boat "Harmony," which left London Docks on June 23rd for her annual visit to Labrador, will take out a four-valve set for use in the Mission School for Eskimos and the children of settlers at Mokkovik by means of which it is hoped that the inhabitants of these isolated settlements will be able not only to get the principal Canadian and American broadcasting stations, but also the news bulletins from 5XX.

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WIRELESS TELEGRAPHY (EXPLANATION) BILL.

The text of this Bill, which was issued on June 24th, declares that the expression "transmission" when used in certain sections of the Wireless Telegraphy Act of 1904, shall be deemed to include reception as well as sending, and that "rent or royalty," as used in Section 2 of the Act, does not include fees charged for the granting or renewing of licences. These definitions are included in the new Wireless Telegraphy Bill, which will be debated at a later date, and the present Bill may therefore be regarded as an interim measure to settle these two questions.

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AURORA SPECTRUM AND UPPER ATMOSPHERE.

Professor McLennan, in the course of investigations to determine the origin of the peculiar green line found in the spectrum of the Aurora Borealis, has considerably extended our knowledge of the nature of the upper atmosphere, and the data obtained may prove of great importance in long-distance transmission and reception.

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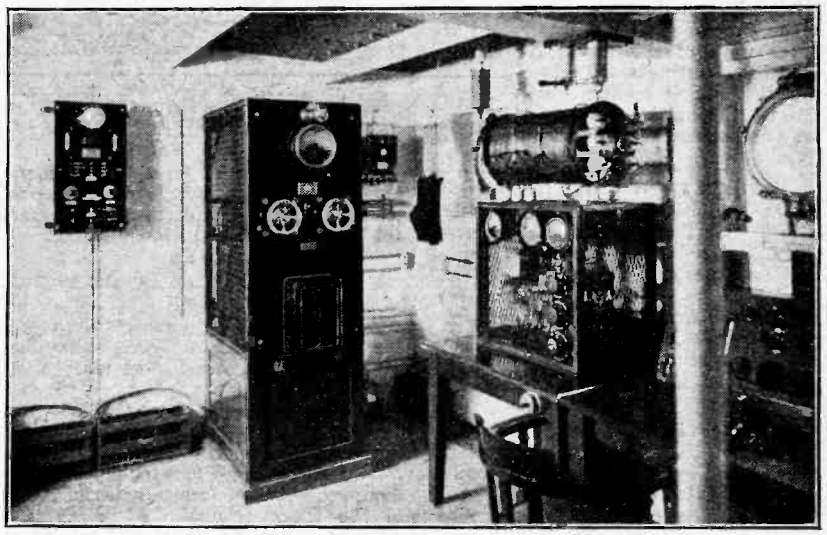
WIRELESS TELEPHONY IN BUSINESS.

One of the chief obstacles to commercial organisation in isolated parts of the world is the absence of developed telegraph and telephone systems, giving facilities for rapid communication, upon which frequently depends the success of a business venture. To overcome this difficulty, an increasing number of firms in various parts of the world are installing wireless apparatus to keep their branches in remote places in touch with headquarters.

One of the latest commercial concerns to employ wireless communication in this way is the Royal Dutch Shell Group, who have installed Marconi equipment to enable their outlying properties in South America to maintain telephonic communication with the local headquarters. The transmitters in use have a power of ½ kw.; the receivers, which are of the type RP.7, have five valves, and are self-contained in a teak box, which forms a



MODERN MARINE WIRELESS EQUIPMENT. A view of the 1½ kilowatt spark transmitter recently installed upon the ss. "Chitral" by the Radio Communication Co., Ltd. The apparatus incorporates an automatic starter of the solenoid type.

travelling case should the receivers be required for portable purposes.

The Sarawak Government are installing Marconi telegraph and telephone equipments in two of their wireless service stations, and are also opening up new lines of communication by the use of further equipments of a similar construction.

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MISUSE OF CALL SIGN.

Mr. A. E. J. Symonds (2PZ) states that during the last three months he has received a number of QSL cards from America, the Continent, and Great Britain, although he has not transmitted during all this time. He will welcome any information enabling him to discover who is using his call-sign.

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FOR NORTHERN AMATEURS.

Mr. Alan Smith, 48, High St., Yiewsley, who has recently been allotted the call-sign 6VP, wishes to get into touch with an amateur transmitting station in Scotland or the north of England for a regular 6 months' test on a wavelength of 90 metres.

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PARLIAMENT NOT MUSICAL OR DRAMATIC.

In the course of the debate on the Dramatic and Musical Performer's Protection Bill, the Parliamentary Secretary to the Board of Trade referred to the possibility of broadcasting the proceedings of the House. The Deputy Speaker was, however, doubtful whether these could be considered either musical or dramatic.

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BROADCASTING IN POLAND.

Reference was made in a recent issue to the commercial wireless station at Cracow, Poland, which, it was stated, would shortly be employed to relay programmes from the Warsaw broadcasting station.

We now learn from an authentic source that this information was incorrect and that the Cracow station is totally unsuitable for work of this kind. An experimental broadcasting station has been installed at Varsovie by the Société Radio-technique Polonaise, and transmits tentative programmes on Saturday evenings.

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BOOKLET ON CRYSTALS.

Messrs. Leslie G. Russell, Mineralogists, of 1 to 5, Hill Street, Birmingham, have recently prepared for free issue on application a useful eight-page booklet entitled "Radio Crystals." It contains much helpful information on the composition, properties, and relative merits of the various substances used in crystal detectors.

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COMPETENT REPAIRERS WANTED.

In the *Evening News* of June 27th attention was drawn to the damage often done to receiving sets by incompetent traders who undertake to do maintenance and repair work. A scheme by which really competent repairers would be authorised and recognised is warmly advocated.

YOUR CALL SIGN?

For the benefit of others as well as themselves, amateur transmitters, both in Britain and in other countries of the world, are earnestly requested to co-operate in the preparation of reliable information regarding call-signs, etc., by forwarding full particulars of their stations to the Editor of "The Wireless World," 139-140, Fleet Street, London, E.C.4.

SCRAMBLED BROADCASTING.

The *Nation and Athenæum* in its issue of June 27th emphasises the vast difference between broadcasting conditions in this country and the United States. Here, the majority of listeners are, more or less, content to receive "on the crystal" the programme from the nearest B.B.C. station, but over there the six hundred competing stations make high selectivity almost essential, and it is stated that the new station in Chicago will transmit on ever-varying wavelengths that can only be picked up by those possessing a costly "unscrambling" apparatus.

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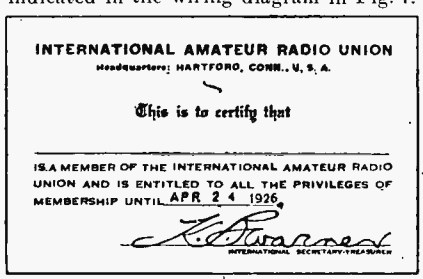
A CORRECTION.

In the circuit diagram in Fig. 1 of the article on a "Reflex Neutrodyne" in last week's issue, it is regretted that the inside end of the coil S_3 was shown joined to the lead from the I.P. connection to the L.F. transformer. The inside end of S_3 should be connected, of course, to the moving vanes of the condenser C_2 as indicated in the wiring diagram in Fig. 7.


INTERNATIONAL AMATEUR RADIO UNION

Headquarters: HARTFORD, CONN., U. S. A.

This is to certify that

IS A MEMBER OF THE INTERNATIONAL AMATEUR RADIO UNION AND IS ENTITLED TO ALL THE PRIVILEGES OF MEMBERSHIP UNTIL APR 2 4 1926

INTERNATIONAL SECRETARY-TREASURER

A reproduction of the membership card issued by the newly-formed International Amateur Radio Union.

ADDRESS WANTED.

We have received from 2BW America a letter for 5DH, but having no record of his name and address will be grateful if he will communicate with us.

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INTERNATIONAL AMATEUR RADIO UNION.

A reproduction appears on this page of the card which is now issued to members of the International Amateur Radio Union.

Formed this year in Paris on April 17th, the Union already shows signs of rapid development. According to the Constitution, any country having twenty-five members may form a national section of the Union, the aim of which is to possess a section in every country of the globe and so give everyone greater opportunities for the enjoyment of amateur radio.

BELGIAN BROADCASTING PROGRAMMES REDUCED.

The disappointing response to the appeal made a few months ago by *Radio Belgique* for public support has necessitated the cutting down of their weekly programme. Afternoon transmission will take place on Tuesdays, Thursdays, and Saturdays only. The evening transmissions will not be modified for the present.

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WIRELESS PIRATES.

According to reports, there are now $1\frac{1}{4}$ million listeners who have not yet taken out a licence, notwithstanding the warning held out by the Postmaster-General in connection with the new Wireless Bill.

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PRESENT ADDRESSES WANTED.

We are asked by the Hon. Secretary of the R.S.G.B. to state that he has certain literature and copies of the Society's Journal, which he wishes to forward to the undermentioned members whose present addresses are unknown to him. He will be very gratified for any information of their present whereabouts.

The last known address is in each case given below:—F. G. Aylott, 8, Sumatra Road, Kilburn, N.W.6; L. Birch, 30, Limesford Road, Waverley Park, S.E.; F. H. Dupre, 2, Edinburgh Mansions, Howick Place, S.W.; P. V. Dupre, 101, Dartmouth Road, Brondesbury, N.W.2; J. G. Evans, "Highbury," Harrop Road, Hale, Cheshire; H. A. S. Gothard, 8, Longford Terrace, Folkestone; E. Hare, "Penelve," Leiston, Suffolk; Captain Sir J. W. Mackenzie, Bart., F.R.C.S., 15, Upper Richmond Road, S.W.15; G. Mahon, 11, Haymarket, S.W.1; F. Marshall, Junr., 2, Park Lane, W.1; J. C. Mason, 16, Cressingham Road, New Brighton, Ches.; Captain Simon Orde, 16, Pelham Crescent, S.W.7.; J. B. Purefoy, c/o Royal Automobile Club, S.W.1; Rev. Phillip S. Sidney, 4, River Terrace, Sunbury-on-Thames; W. M. Smith, 3, South Tay Street, Dundee; H. J. Talbot, 1, South Hill Mansions, South Hill Park, N.W.3.

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CATALOGUES RECEIVED.

D.P. Battery Co., Ltd. (Bakewell, Derbyshire). Illustrated leaflets dealing with D.P. storage batteries, types LSH and LY.

Paris-Radio (2, Rue Manuel, Paris). Illustrated price list of valve and crystal receivers and loud-speakers.

A. H. Hunt, Ltd. (H.A.H. Works, Tunstall Road, Croydon). Leaflet No. 152, describing the "Easitune" anti-capacity handle.

Burndept Wireless, Ltd. (Aldine House, Bedford Street, Strand, London, W.C.2.). Publication No. 262, May, 1925, catalogue of Burndept apparatus. Price 1s.

Houghton, Ltd. (88-89, High Holborn, London, W.C.1). Houghton's "Radio News," Vol. 2, No. 2, containing illustrated descriptions of newly introduced radio apparatus and accessories.

S. G. Brown, Ltd. (Victoria Road, North Acton, London, W.3). Art catalogue describing and illustrating Brown wireless instruments and telephones.

F. E. Wootten, Ltd. (56, High Street, Oxford). Catalogue of Wootophone wireless sets and components.

Ripault's, Ltd. (King's Road, St. Pancras, London, N.W.1). Radio lists D 1, D 2, D 3, D 3B, etc., relating to Ripault's wires and cables and wireless components.

Goswell Engineering Co., Ltd. (12A, Pentonville Road, London, N.1). Illustrated catalogue of Quality wireless components.

Detailed Description of the New High-Power Broadcasting Station Now Nearing Completion.

RECENT work at Daventry has been very rapid, and the station is well on its way towards completion. With practically all the apparatus installed, one mast completed and the other nearly finished, the station should be in good order for the opening by the Postmaster-General on July 27th.

Details of the station have now been given, and it has been possible to secure some excellent photographs, taken a few days ago, of the layout of the station and apparatus. It is hard to believe that the work of building the station has been carried out in less than six months.

The site of the station, one of the highest points in the Northampton uplands, covers altogether about 60 acres, of which only a part is in use for the present station. It is interesting to note that it is built on the high ground called Borough Hill, the situation of an old Roman Camp, overlooking the ancient Watling Street—the road that the Romans built from Dover to Chester.

The buildings consist of a power-house, a small transformer building (these two are seen in the heading photograph, which is taken from one-quarter way up one of the masts), and quarters for housing the staff of six resident engineers.

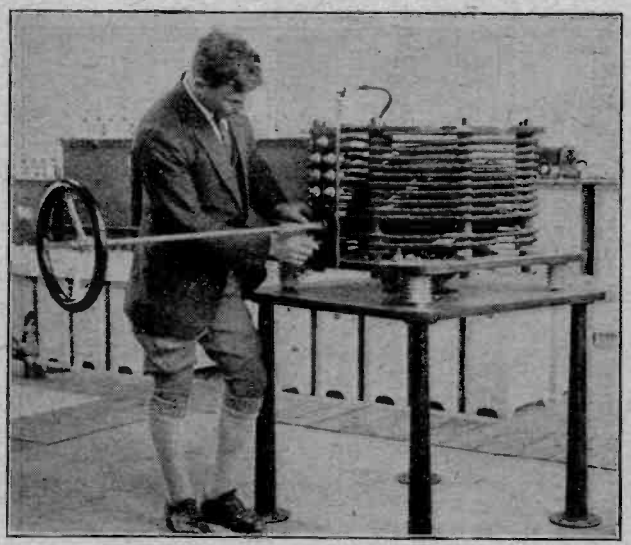


Fig. 1.—The vario coupler to the aerial circuit.

The power house is over 120ft. long and 65ft. wide, and contains one large room for the transmitting set, a generator room, amplifier room, workshop, two offices, and also a small test studio, which will be draped and furnished in a manner similar to the studios at 2, Savoy Hill.

The masts are of the lattice type with triangular section, and are 500ft. high. They are each sup-

Daventry.—

ported by three sets of guy ropes, spaced at 120°, and are mounted on steel bases with very solid concrete foundations.

As the ground is 650ft. above sea level, the tops of the masts will actually be 1,150ft. above the sea. On the top of each mast is fitted a warning light for aircraft. One of these lights is shown in Fig. 6, the glass dome covering four electric lamps, and these are flashed according to a prearranged code by means of the motor contact-maker shown in the picture.

The aerial is of the T-type, the horizontal part consisting of six wires spaced by hoops 6ft. in diameter, with a similar lead-in. The span is about 600ft.

The earth system consists of a ring of zinc plates 200ft. in diameter round about the power house. The ring of plates is clearly shown in the heading photograph, and radial connecting wires from these plates are brought to the insulator seen on top of the roof of the power house. The lead-in from the aerial is also brought close to the same point.

In addition to the main earth, there is a buried earth underneath the power house, and to this is earthed the frames of the machines and transmitting apparatus.

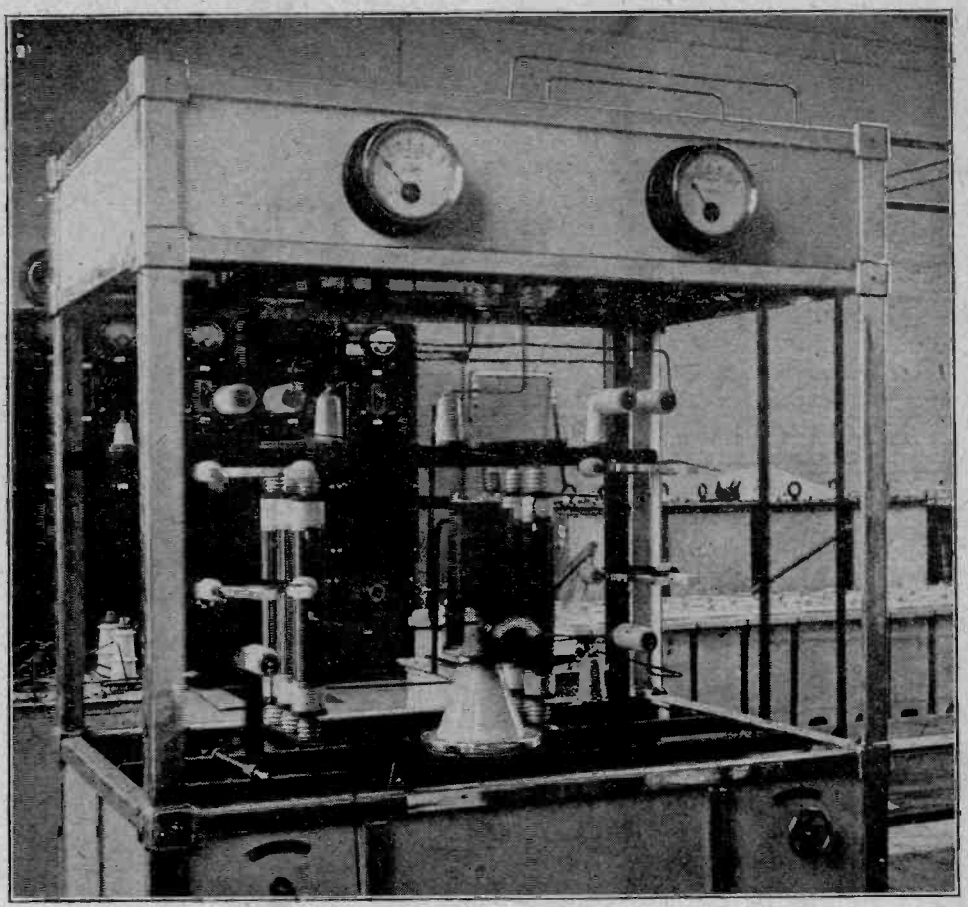


Fig. 2.—The drive oscillator panel.

An Efficient Radiation System.

With this type of aerial and earth, especially as it is situated on such high ground, a very efficient radiation system has been obtained, and with the set working at the same power as now in use at Chelmsford, signal strength at corresponding ranges should be greater from Daventry than from Chelmsford.

The power supply for the station is taken from the mains of the Northampton Electric Light and Power Co., at a voltage of 11,000, the supply being 3-phase A.C., and this is transformed down to 375 volts in the small separate building. The lighting of the station is taken from one phase at 210 volts.

For the transmitter itself, there are eight machines, each containing 3-phase induction motors, three of them being motor generators, and five motor alternators.

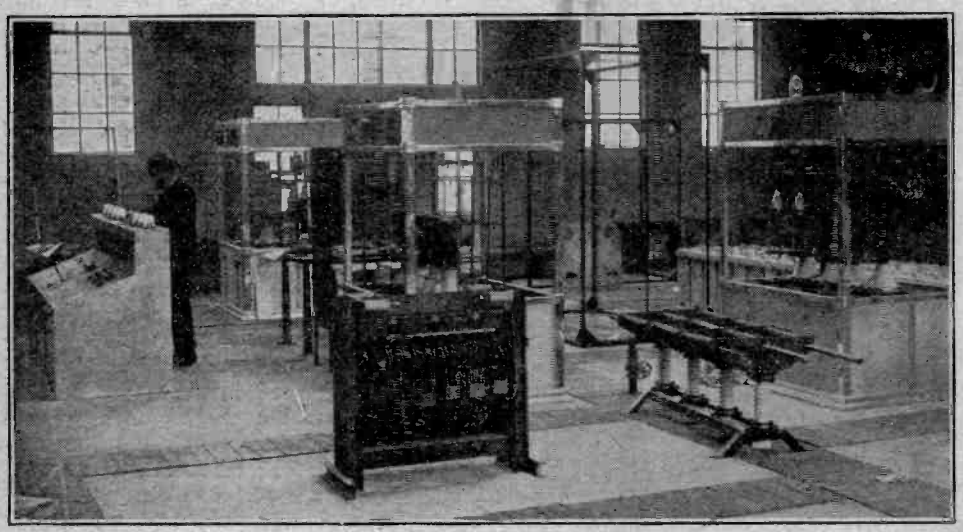


Fig. 3.—General view of the transmitter room.

Daventry.—

Seven of these machines are shown in Fig. 4, the two left-hand ones being two of the 20-kw. motor generators for supplying the filaments of the oscillator and modulator valves. Next to these are two 20-kw. motor alternators for the filaments of the drive and rectifier systems, and the last three are 70-kw. motor alternators for the high-tension supply of the set.

The motor alternators give a voltage of 1,000 at 300 cycles, and for the high-tension this is transformed up, giving a rectified voltage of 10,000. The machines are all conveniently controlled by one switchboard.

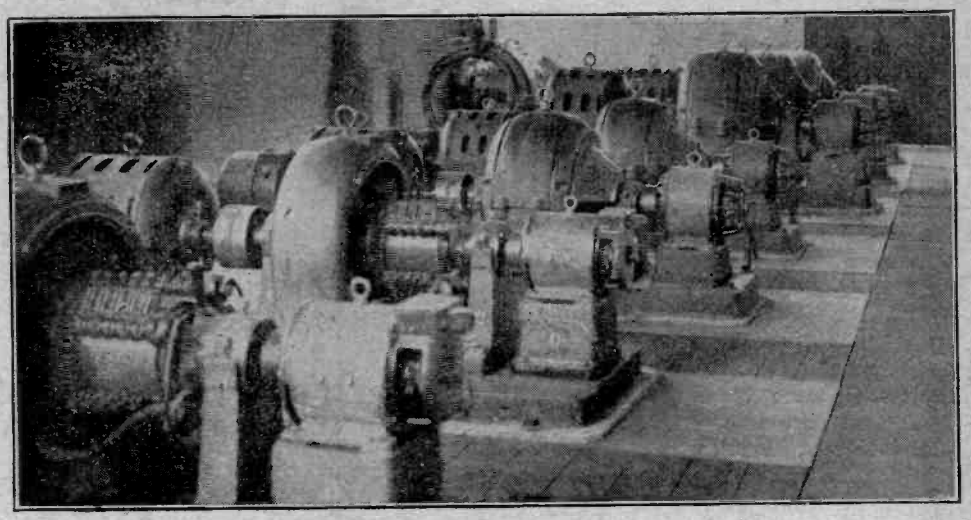


Fig. 4.—A glimpse in the machine room.

The Transmitter.

Coming now to the transmitter itself, the design is practically identical with that of the Chelmsford station, with many minor improvements suggested during the running experience of that station, and various safety and stand-by devices are incorporated as are necessary for a permanent station.

The set is divided into five parts—the rectifiers, the drive oscillator, the main oscillator, the sub-control, and the control system.

All of these, except the sub-control, contain water-cooled valves, and special arrangements have been made to ensure that the water supply for this purpose is more than adequate, as the consumption of water to keep all these valves cool is quite large.

It is interesting to note that the method of spraying the water into small tanks where it is led to and away from the anodes of the valves, keeps the anodes and their water jackets perfectly insulated.

The general lay-out of the transmitting room is shown in Figs. 3 and 5. In the foreground in Fig. 3 is the speech transformer, each winding having an inductance of the order of 50 henries. To the right of this are the air core chokes. Behind, from left to right, the drive panel, the oscillator panel, the rectifier panel. At the back the frames for the large air condensers (one plate of these is shown on end), and, to the right, the

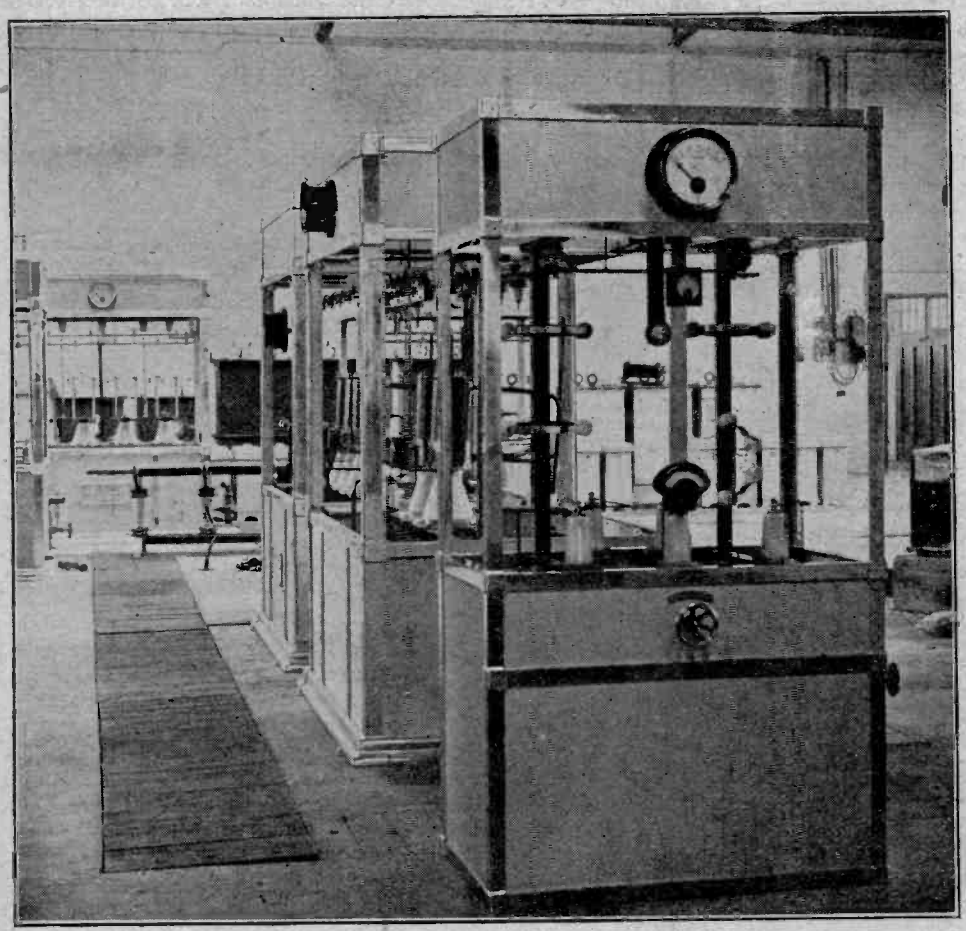


Fig. 5.—The sub-control panel is seen in the foreground, with the main control panels in the rear.

Daventry.—main switchboard of the set. In Fig. 5 are seen the sub-control panel, and behind it the main control panels, while right behind can be seen the rectifier panel and, on the ground, some of the smoothing condensers.

The power of the set will be 25-kw. to the main oscillators, but the motor alternators and generators are capable of dealing with more than twice this power, so that an increase of power could be obtained by the addition of extra valve panels. The wavelength of 1,600 metres will be retained. The wavelength will be absolutely constant as a result of the special rigid inductances in the drive circuit. Moreover, the large air condensers in the main high-frequency circuits are shielded and thus protected from interaction with other parts of the circuit.

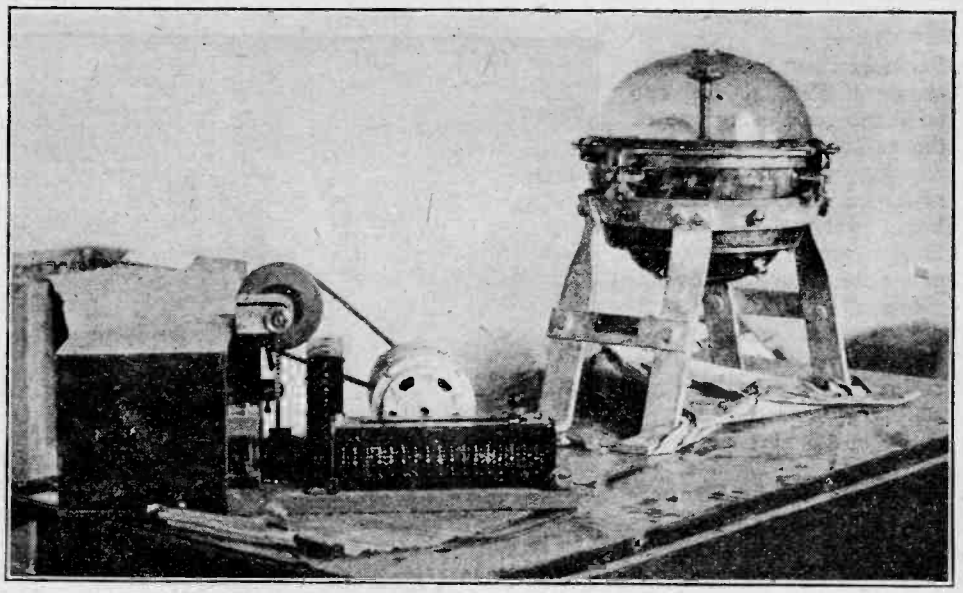
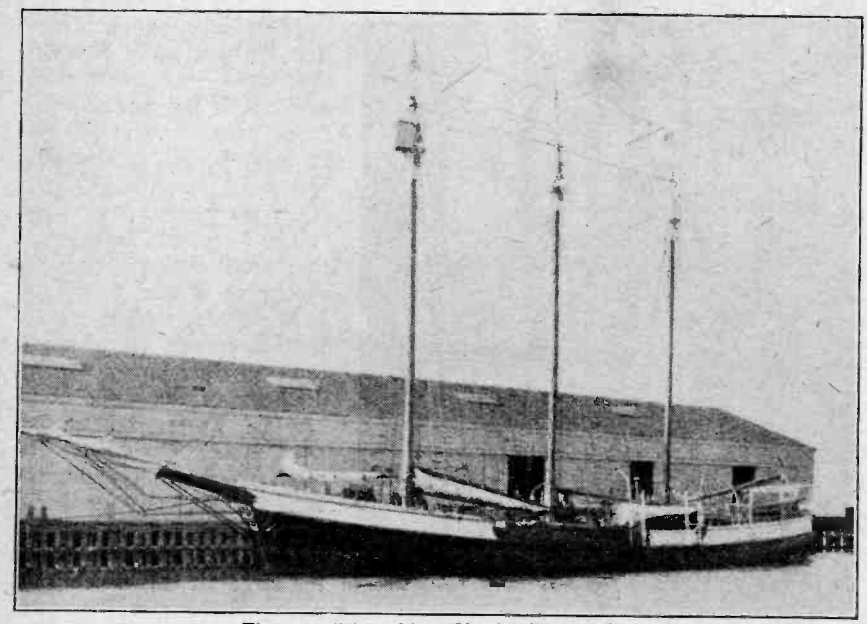


Fig. 6.—The aircraft warning light and automatic contact maker.

Land Lines and Amplifiers.

The transmissions from the Daventry station will emanate (like the Chelmsford transmissions) from London, the music being sent to Daventry over Post Office land lines, several spare lines being provided to avoid any possibility of a breakdown. There will be amplifiers at Daventry to amplify the music up to the strength required to operate the sub-control valves of the transmitter. Special amplifiers have been designed for the London and Daventry ends of the line to ensure that the least possible distortion is experienced, so that the quality of transmission from Daventry should be equal to that of London. The present Chelmsford site is considered advantageous by way of providing an alternative transmission for listeners on the south coast when experiencing interference by ship and coast station jamming, and no doubts need be entertained as to the ability of the new station at Daventry to fulfil this requirement.

It appears that the transmitter has a very excellent layout, and when completed will be of very smart appearance, and there is no doubt that the Daventry station will be the finest and largest broadcasting station in the world. If it maintains the quality of the transmission now sent out from Chelmsford, British listeners will have no reason for being anything but proud of the latest addition to the B.B.C.'s system of stations.



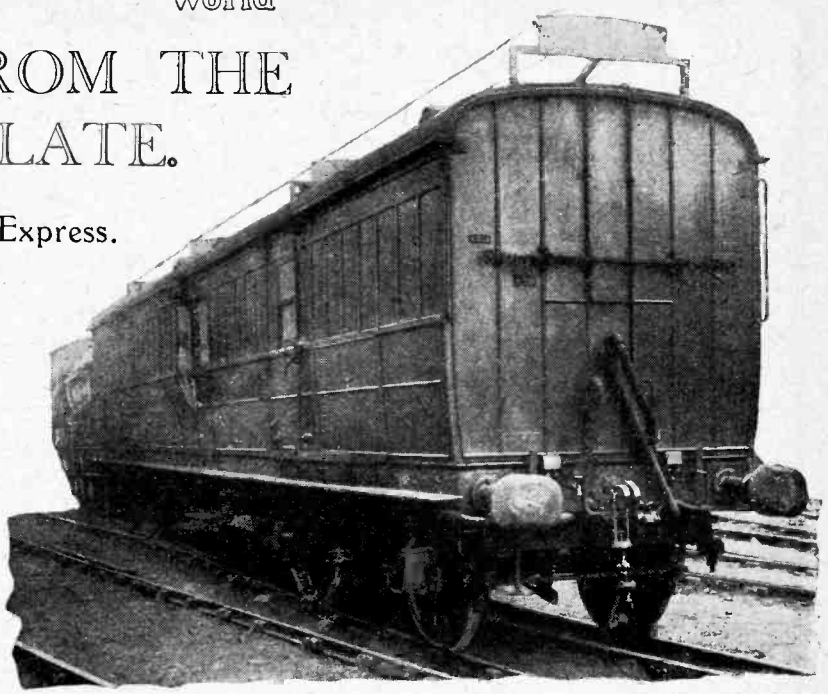
The expedition ship "Charles Brower."

ANOTHER AMERICAN EXPEDITION.

NOTABLE among the numerous expeditions now being conducted from America is that of the s.s. "Charles Brower," commanded by Captain Carl Hansen. This vessel, which carries a powerful wireless equipment manufactured by the Zenith Company, is proceeding on a commercial expedition to North Alaska in the interests of the fur trade. An attempt will be made to keep in wireless touch with the outside world during the entire voyage, and while the vessel is at Point Barrow, Alaska's most northerly point, it is hoped to communicate with the McMillan expedition. The photograph shows the s.s. "Charles Brower" prior to sailing.

SOUNDS FROM THE FOOTPLATE.

Broadcasting the Scotch Express.



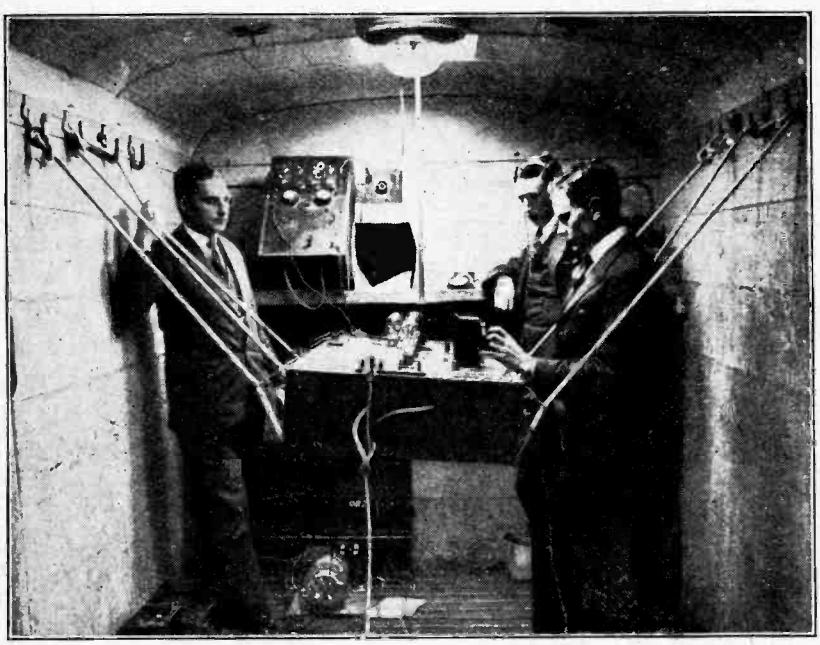
The brake van, which housed the low-power telephony transmitter.

AN interesting experiment was carried out by the B.B.C. on June 30th in broadcasting conversation and train noises from the footplate of a Scotch express leaving King's Cross at 8.25 that evening.

The technical arrangements were under the charge of Capt. West. The railway company provided a brake van in which to house the train transmitter, which consisted of a choke control telephony set of low power working entirely off batteries. The aerial (three wires) was run 18in. above the roof of the van, and the earth was made to the two bogies of the van and also to the tender and engine, the van itself being placed directly behind the engine. The microphone, which was of an improved carbon type, was suspended by means of rubber bands to avoid vibration on the side of the cab, thus enabling the announcer and official of the railway, who were on the footplate, to make remarks about the journey, with the engine and other noises as a background. The engine-driver and fireman also joined in the conversation.

The difficulties experienced were those of mounting the apparatus to avoid vibration and consequent ponging and variation of wavelength, and the obtaining of an efficient earth, the reason being that no rigid earth could be obtained, the running contacts of the wheels and bogies continuously varying the earthing efficiency.

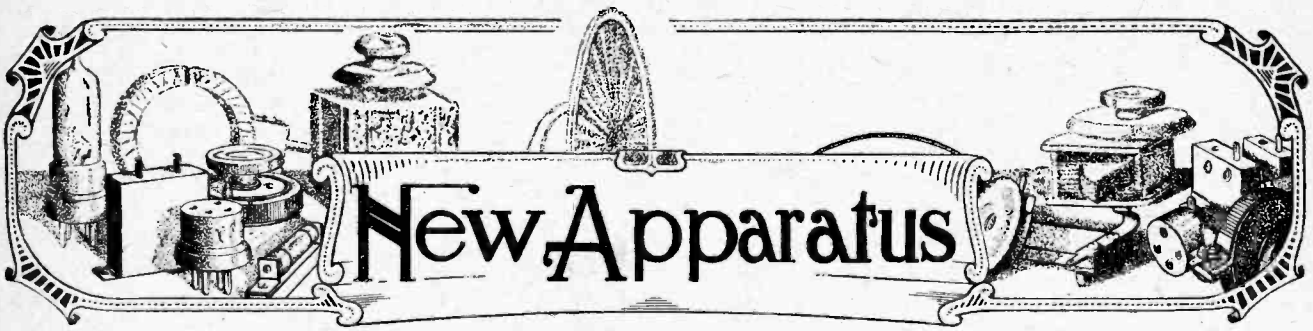
With regard to receiving, the railway company provided a single wire chosen from the group of line side telegraph wires from Potter's Bar to Hitchin. This wire was cut at each end, and was tapped at Hatfield Station and connected to a loose coupled wireless receiving set, which comprised several stages of high-frequency, a detector, and two low-frequency valve amplifiers. The transmission, therefore, consisted mainly of wired wireless along this wire, the connection on to this wire being made by a kind of inductive effect from the aerial on the train, and the sounds as picked up on the wire were transferred over Post Office land lines to 2, Savoy Hill, and then radiated from all stations.



Captain West (left), who was in charge of the technical arrangements, photographed with other engineers in the brake van. Note the suspension of the transmitter to avoid shocks.

The mobile equipment was in the hands of Mr. Honri and Mr. Murray, of the B.B.C. research staff.

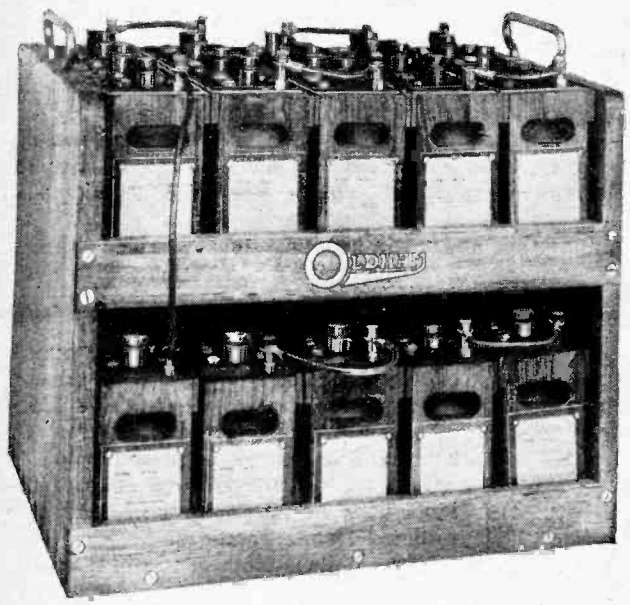
It must be realised that wired wireless has never been attempted before on such a short wavelength as 100 metres, and the success of this experiment points to the possibility of a similar method being used on a wavelength more suitable for wired wireless, such as 20,000 metres. No doubt the time will come when every long-distance express train will have its telephone installed by means of which any passenger may communicate with any Post Office telephone subscriber throughout the British Isles.



A Review of the Latest Products of the Manufacturers.

THE OLDHAM HIGH-TENSION ACCUMULATOR BATTERY.

The extensive use of power amplifying valves necessitates a source of plate voltage which is capable of delivering heavy currents for prolonged periods, while the recent popularity of the superheterodyne receiver compels the amateur to turn his attention to a means for deriving liberal plate current supply. It is not only the number of valves employed in a superheterodyne receiver that gives rise to a heavy plate current consumption, but the fact also that positive grid bias is frequently employed to stabilise the intermediate high-frequency amplifying stages. It would appear that one of the most satisfactory methods of deriving liberal plate current supply is from the accumulator type high-tension battery, and Messrs. Oldham &



Oldham 120 volt accumulator high tension battery.

Son, Ltd., Denton, Manchester, now market a particularly useful model. The cells consist of glass box containers sealed to prevent the spilling of acid, and fitted with vents and lead lugs. The battery is made up in sections each of six cells, and the accompanying illustration shows a number of these sections assembled to form a 120-volt battery.

By this method of assembly easy access is obtained to any individual cell.

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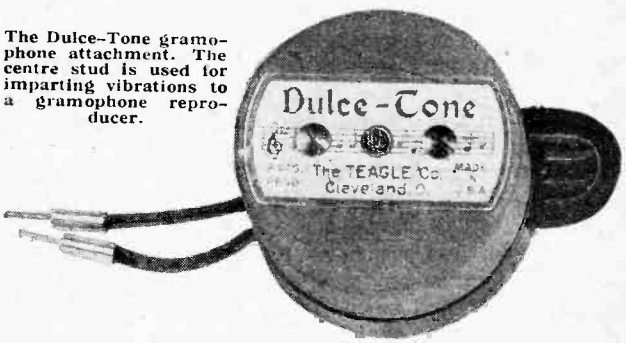
GRAMOPHONE LOUD-SPEAKER ATTACHMENT.

An interesting device is offered by Messrs. C. G. Vokes, 38. Conduit Street, Regent Street, W.1, for making use of the reproducer and horn of a gramophone to serve as a loud-speaker.

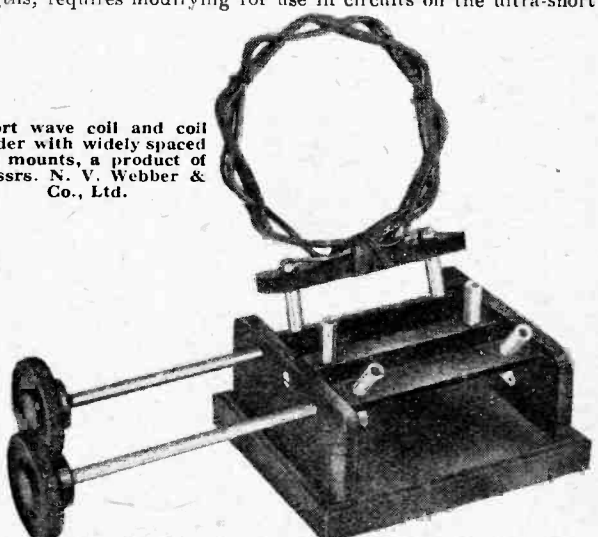
This instrument is arranged to stand on the revolving table of the gramophone, and at its centre is a small V-ended peg, to which is imparted the vibrations normally delivered to a loud-speaker diaphragm. The needle of the reproducer rests on this V, throwing into vibration its mica diaphragm, and thus giving loud-speaker reproduction.



The Dulce-Tone gramophone attachment. The centre stud is used for imparting vibrations to a gramophone reproducer.

WEBBER COILS AND COIL-HOLDER.

A welcome departure is made in the spacing between the pin connectors in the new three-coil holder made by Messrs. N. V. Webber and Co., Ltd., of Vale Road, Oatlands Park, Weybridge. Without exaggerating the losses present in the plug-in type of coil, it must be admitted that the usual pin and socket design, although quite satisfactory on broadcasting wavelengths, requires modifying for use in circuits on the ultra-short



Short wave coil and coil holder with widely spaced pin mounts, a product of Messrs. N. V. Webber & Co., Ltd.

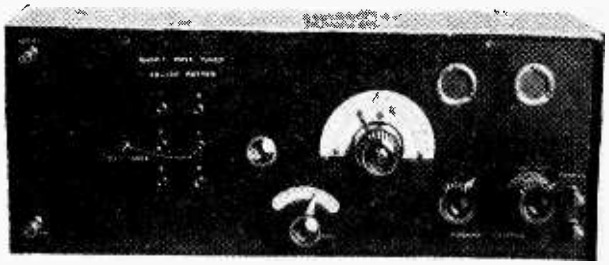
wave band. The plug-in coils used are carefully designed, bearing in mind the usual causes of inefficiency in coil construction. A mounting piece having widely spaced connectors is made use of, necessitating the introduction of this specially designed holder.

SHORT WAVE WORK

Two-Valve Set for 40 to 120 Metre Reception

In the design of receivers for short wavelengths it is of little use to apply methods which have been developed primarily for the broadcast band of wavelengths.

A new technique has to be developed for waves below 100 metres, and the following article contains a description of many devices that have become standard practice in short wave work.



By J. G. MACVIE.

THE number of interesting wireless transmissions, both telephonic and telegraphic, now taking place on waves below one hundred metres is evidenced by the lists of "Calls Heard" appearing in this journal, and those experimenters who are working on these lines will doubtless find interest in the following brief description of a special receiver to cover wavelengths of from 40 to approximately 120 metres.

The Circuit.

After much experimenting, the circuit shown in Fig. 2, which has been recommended in a previous issue,[1] was chosen as the most efficient and most easily controlled. It consists of a detector valve, followed by a single stage of transformer-coupled low-frequency amplification, reaction being obtained by a combination of magnetic and capacity coupling. The great advantage of this method is the remarkably smooth oscillation control obtainable with the reaction condenser, without appreciably affecting the tuning of the secondary (or grid) inductance.

The aerial inductance is "aperiodic," the coupling remaining fixed in relation to the secondary coil, whilst oscillation is facilitated by means of the air-dielectric condenser in series with the aerial coil.

A high-frequency choke is included in the plate circuit of the detector valve, but none is employed in the telephone leads.

[1] *The Wireless World*, October 15th, 1924, p. 63.

The Tuner.

Although some few short wave transmissions *can* be received with the usual type of tuning coils and condensers, the construction of a low-loss tuner is in most cases essential. In this set the tuner is wound with No. 18 S.W.G. enamelled wire, the turns being air-spaced and supported with the least possible amount of dielectric material.

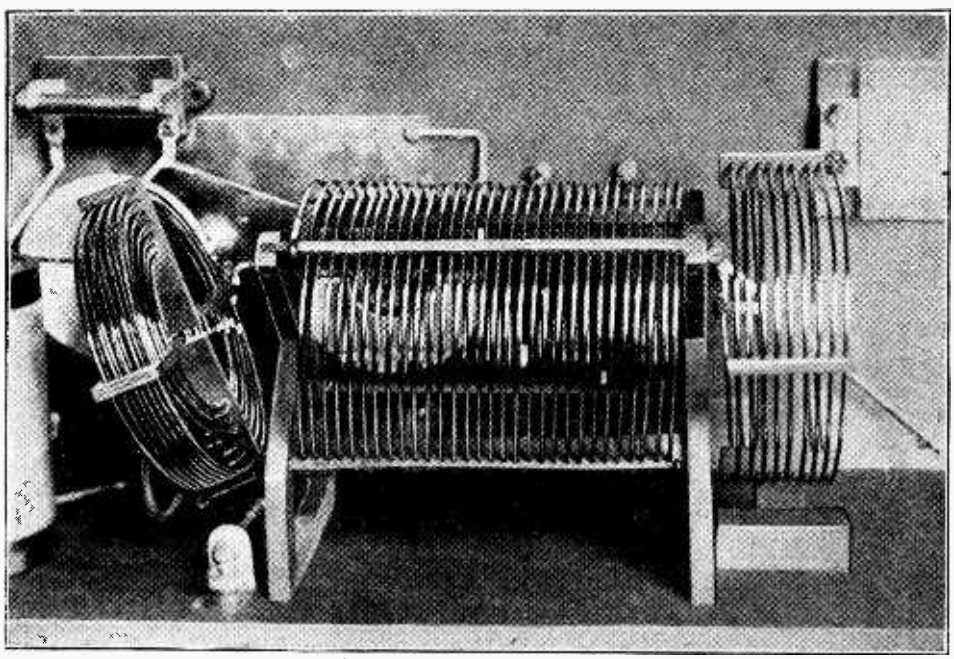


Fig. 1.—The tuner unit, viewed from the back of the instrument. The secondary, or grid, coil is mounted horizontal in the centre, with the reaction coil on the left and the aerial coil on the right-hand side.

Details of the coil supports are given in Fig. 8. The end supports for the secondary coil (*a*) are cut from ¼in. ebonite, while the spacing strips (*b*) for the secondary coil, the aerial coil support (*c*) and the reaction support (*d*) are cut from ⅛in. sheet. For the aerial and reaction coils additional spacing strips, one for each coil, will be required. These will differ in shape from the designs shown at (*c*) and (*d*) in Fig. 8 only in the omission of the projections used for fixing the coils to the baseboard and reaction

Short Wave Work.—

spindle respectively. As will be seen in Fig. 1, the supporting strips are fitted together at right angles.

For the wavelength range of 40 to 120 metres, the aerial coil should contain nine turns, the secondary coil thirty, and the reaction coil twenty-five to thirty turns.

The aerial and secondary inductances are wound as single-layer coils on a former 3in. in diameter, the wire having been previously stretched to harden and straighten it. The coils are then threaded through the holes in the ebonite supporting strips

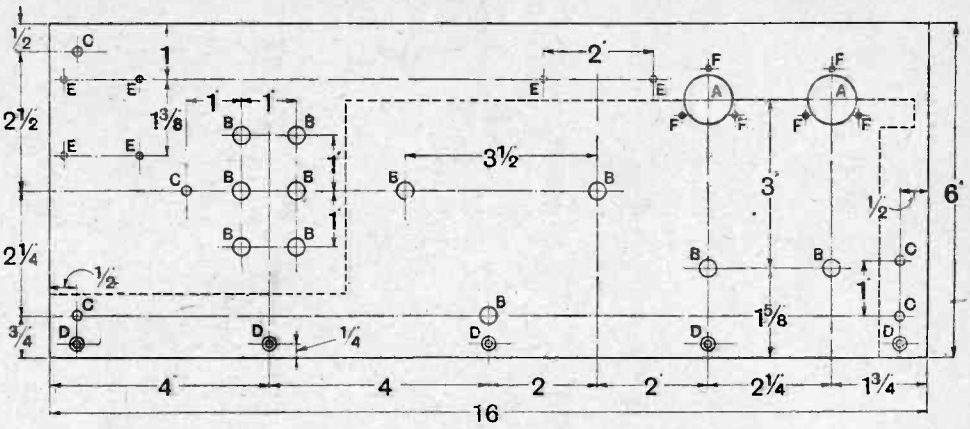


Fig. 4.—Drilling dimensions for the front panel. The sizes of holes are as follows: A, 7/8in. dia.; B, 5/16in. dia.; C, 5/32in. dia.; D, 1/8in. dia. and countersunk for No. 4 wood screws; E, 4B.A. tapping (0·116in. dia.); F, 3/32in. dia.

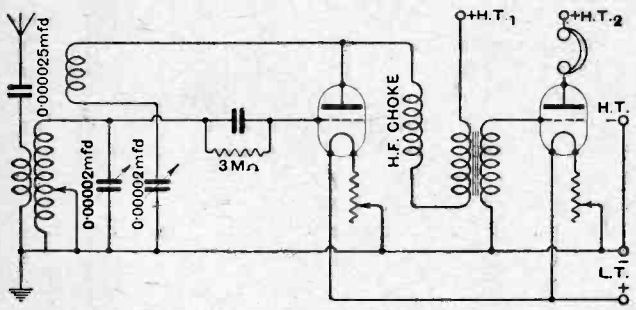


Fig. 2.—Circuit diagram. A coupled tuner is employed with an untuned aerial circuit. The combination of magnetic and capacity reaction gives smooth control over the reaction coupling on short wavelengths.

The secondary coil has six tappings at its low potential end, at the first, fourth, seventh, tenth, twelfth, and fourteenth turns, the tapping points being "staggered." The leads are then carried straight to six small well-spaced sockets on the panel.

The reaction coil has five layers, each of five turns, the vertical supporting strip being extended and carried on a length of 2 B.A. brass rod, by means of which its position can be varied by rotating the small knob on the face of the panel. Once a suitable position of the coil has been found, it is left fixed, and fine reaction control obtained by altering the capacity of the reaction condenser.

Fixed and Variable Condensers.

The air-dielectric condenser in series with the aerial reduces the effective capacity across the A.T.I., stimulates oscillation, and sharpens tuning. It is similar to one described in the issue of this journal for October 8th, 1924, and has five plates 1¾in. × 1in., with a spacing of $\frac{1}{32}$in.

The variable condenser tuning the secondary coil, and also the reaction condenser, are of the two-plate vernier type. They have an extremely low minimum capacity, whilst the maximum capacity variation is just sufficient to tune between the tappings of the secondary inductance. This secondary condenser is fitted with a vernier knob giving a gear reduction of 3.5 to 1, and even then tuning is remarkably sharp.

The grid condenser is of 0.0002 mfd. capacity, and the leak has a value of 3 megohms. The value of the grid leak has a marked influence on the smoothness of the reaction coupling, and a suitable value should be found by trial for the particular detector valve in use.

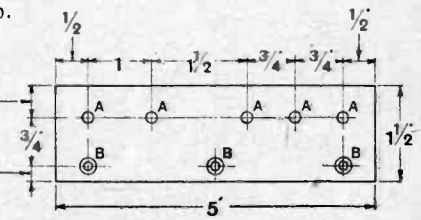


Fig. 5.—Terminal panel. The sizes of holes are as follows: A, 5/32in. dia.; B, 1/8in. dia. and countersunk for No. 4 wood screws.

The high-frequency choke consists of 220 turns of 36 S.W.G., D.S.C. copper wire on an ebonite tube 1½in. in diameter and 3¼in. long. The choke is mounted vertically on the base board near the intervalve transformer, and is clearly shown in the photographs in Figs. 6 and 7.

The back of the panel, with the exception of the

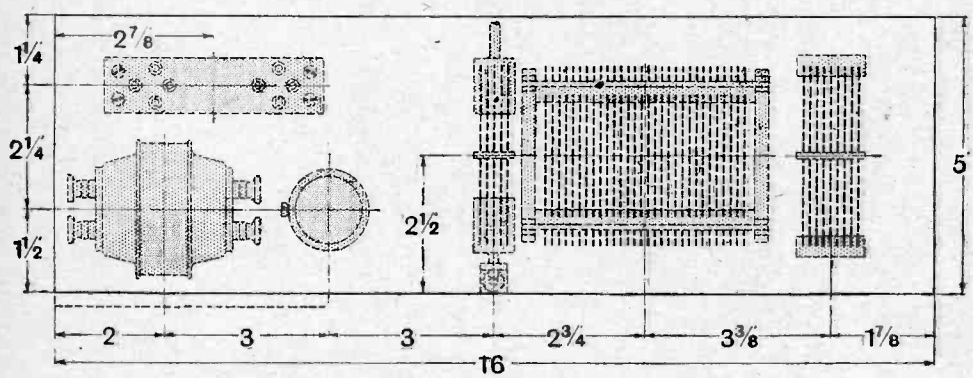


Fig. 3.—Relative position of components mounted on the base board. The valve panel is raised from the base board on wooden supports screwed to each end of the ebonite strip.

Short Wave Work.—

end in close proximity to the secondary inductance, is covered with an earthed copper foil screen in order to eliminate the "hand-capacity" effects which are so marked on these short waves.

The valves are carried on a raised ebonite platform behind the panel, the sockets being of the low-capacity type now procurable, and on the panel immediately before them are the inspection windows and two 30-ohm. rheostats.

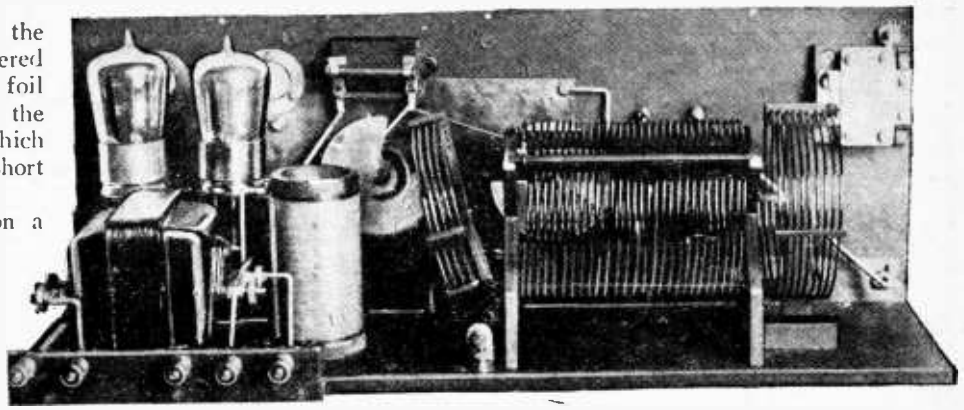


Fig. 6.—Rear view of the finished receiver.

The low-frequency transformer is well screened and is mounted close to the battery terminal strip on the baseboard. In a receiver of this type, quality of telephony is generally of secondary importance, and a high-ratio transformer may be employed with the object of obtaining an increase in amplification. A 4 : 1 ratio will be satisfactory for general reception, though a 6 : 1 or 8 : 1 ratio may be used for C.W. work, provided that the primary winding is not too small. Separate high-tension terminals are provided for the detector and low-frequency valves. An accumulator H.T. is recommended as a complete absence of set noises is essential if long-distance amateur transmissions are to be logged successfully. If an H.T. battery consisting of dry cells is to be employed, condensers of about 1 mfd. capacity should be connected between each positive tapping and minus H.T.

All wiring is short and well spaced, and is carried out with No. 16 S.W.G. tinned copper wire. The whole set is contained in a wooden cabinet, the internal dimensions of which are 16in. × 6in. × 5in.

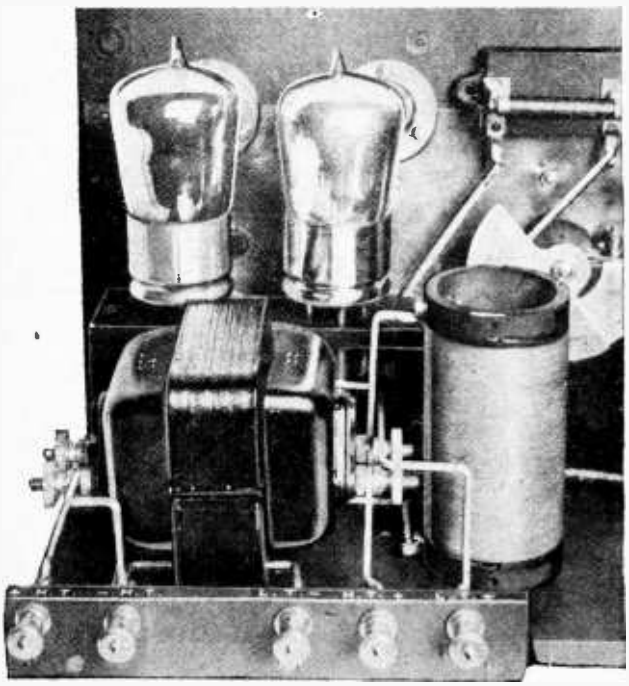


Fig. 7.—View showing the valve platform, L.F. transformer and high-frequency choke coil.

Performance.

Results obtained are very satisfactory, using two 0.06 type valves with standard four-pin sockets. NKF is frequently received with the aerial and earth disconnected.

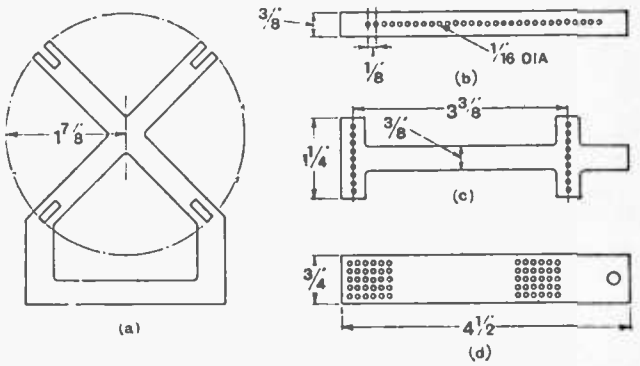


Fig. 8.—Details of the coil supports. The secondary coil supports (a) and (b) are cut from 1/4in. and/ 18in. ebonite respectively. The aerial and reaction supports are constructed with 1/8in. ebonite.

The adjustments under these conditions are, of course, rather critical, but the results thus obtained are instructive inasmuch as they indicate that a valve with grid rectification, supplemented by reaction, is capable of responding to infinitely small input voltages. For long-distance amateur reception, therefore, the additional complication of H.F. amplifying valves does not appear to be justified. KDKA has been received under similar conditions. With an average aerial and earth NKF, WRP, KDKA, and many American, Cuban, French, Dutch, and Swedish amateurs are received at good strength.

LIST OF COMPONENTS.

Front ebonite panel, 16in. × 6in. × ¼in.
Terminal panel, 5in. × 1½in. × ¼in.
Base board 16in. × 5in. × ½in.
2 Vernier condensers, approx. 0·00002 mfd.
1 Fixed mica condenser, 0.0002 mfd.
1 Grid leak, 3 megohms.
2 Filament rheostats, 30 ohms.
1 Intervalve transformer, 4 : 1 ratio.
Materials for series aerial condenser, tuning coils, etc.

Broadcast Brevities

SAVOY HILL

Plymouth.

The Plymouth station is maintaining its reputation for outside broadcasts, and has recently transmitted the songs of blackbirds, skylarks and a blue jay from a thicket about ten miles from Plymouth. Although only a relay station, Plymouth is very active in its outside broadcast work. It was the first station to bring the sea to the listener's home. A microphone was placed on the beach in Bovisand Bay, about four miles from Plymouth on the eastern extremity of the breakwater in Plymouth Sound, and the noise of the waves was broadcast from all stations.

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Waves "On Tap."

An interesting technical feature of this transmission was that Plymouth, in common with other stations, has two lines to London. On one the station was taking the London programme, and on the other, which is normally used as a control line, the sea was brought to London. It is a singular fact, therefore, that the sea from Plymouth went to London and back again to Plymouth before it was actually broadcast from the Plymouth aerial. The sound of the waves was "on tap" for the use of London, as it was needed at varying times throughout the two hours' programme during the evening.

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Training Announcers.

The training of announcers alluded to in these columns a week or two ago, is not the only problem with which the B.B.C. is faced in this connection. It is a case of "first catching your hare," and there is considerable difficulty in obtaining announcers of the right type. Perfect articulation is not the sole qualification. Tact and personality count for a good deal, and the possession of a degree of wit of the right sort—not of the variety stage kind, however—is also an asset. General knowledge is essential.

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American Announcers.

American broadcasting companies pay a good deal of attention to their choice of announcers, and the position is important enough to warrant particular care in their selection in this country as well.

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200 Feet Aerials?

It has been suggested that great assistance would be afforded to listeners if the length of aerial wire could be increased, and one listener suggests that aerials should be fifty feet high and 200 feet long. The present maximum is 100 feet and it is likely to remain at that figure.

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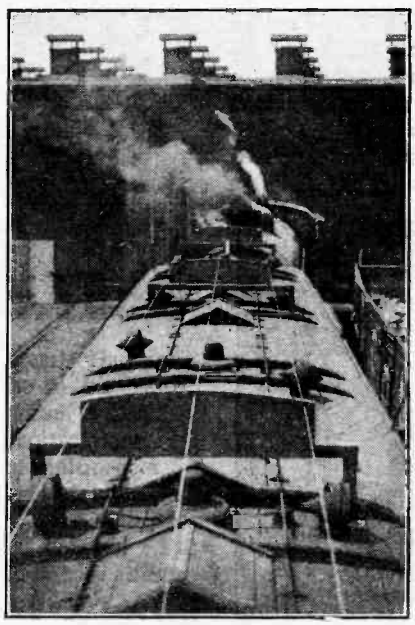
French Aerials.

They order these things differently in France. There are no restrictions on the length of aerial, and consequently they usually consist of four wires about 300 feet long. When broadcasting in that country reaches the British standard of development, it is fairly certain that some restrictions will be imposed.



THE TRAIN EXPERIMENT. An interesting photograph taken on top of the wireless coach, showing the aerial on its supports. Broadcasting from a train was carried out with gratifying success on Tuesday, June 30th.

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Public Hall Broadcasts.

Some alarm is being expressed over the B.B.C. experiments of broadcasting from public halls, and it is stated that if the broadcasting policy is to create studios equipped with an auditorium capable of seating thousands of persons at each broadcasting performance, wireless is undoubtedly entering into direct and serious competition with the theatrical entertainment providers of the country.

TOPICALITIES.

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Competition Not Intended.

Nothing is further from the company's mind, I am told, than to compete with other forms of entertainment by providing seating accommodation for "thousands of persons" in public halls or theatres in direct competition with other forms of entertainment. The Y.M.C.A. Hall was well filled on the occasion of the recent experiments, but the small admission fee which was charged, *i.e.*, sixpence per head, was for the useful purpose of augmenting the funds of the Children's Hospital Wireless Scheme, and was a uniform and purely nominal charge, the philanthropic object being clearly stated, as it would be on the occasion of any future broadcasts of a similar nature.

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Copyright.

Needless alarm has also been expressed as regards the question of copyright in any theatrical plays which may be broadcast. The arrangements which have been made with associations of theatre managers are specifically for the purpose of regularising the broadcasting of excerpts of stage performances, and in this connection it is pointed out that the B.B.C. has organised over 100,000 hours of programmes without the necessity of establishing a legal criterion for the assessment of copyright interests in broadcasting.

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Contract Restrictions.

A well-known and popular author recently informed the Press that there are very many contracts in existence in which the broadcasting of excerpts of a play would be *ultra vires*, and managers cannot broadcast plays unless they are allowed by their contracts. "If it is proposed to broadcast in defiance of agreements to the contrary, the powers that be may find that they have not yet surmounted all their difficulties."

No one can accuse the British Broadcasting Co. of participating in any act or enterprise of copyright piracy, and it is an improbable, if not impossible, suggestion that the copyright position will not be clearly ascertained before any question arises of resort to legal opinion.

Helping the Theatres.

The impression of all connected with broadcasting is that the theatres will be helped to a greater extent than many connected with the profession are at present inclined to admit. Nothing can replace the pull of the actor's personality as expressed in a combination of his voice movements and facial expression, and the sympathetic response of all these things between the various characters. Broadcasting may satisfy the human demand for entertainment to a certain extent; but it is also expected to create, especially in the case of a theatrical performance, a desire for sight of the persons heard.

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Opera Broadcast.

In broadcasting the second act of Puccini's opera, "Madame Butterfly," from Covent Garden Opera House this evening (Wednesday), the B.B.C. fulfills its original intention of transmitting one night of the Italian Season in addition to the opening night of the German Season, when an excerpt was broadcast from "Der Rosenkavalier."

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Keen Demand for Opera.

It was hoped that the Italian Season broadcast would take place on the first night of that season, and I understand that the Covent Garden Opera authorities were in no sense to blame for the omission. Indeed had the matter rested entirely between the opera authorities and the B.B.C., it is probable that a larger number of operas would have been drawn upon this season. There is, at any rate, believed to be a keen demand among listeners for this kind of entertainment, which is a hopeful sign as regards the future musical education of the country.

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Outside Broadcasting.

Attention is being given by the B.B.C. engineers and the officials on the programme and music sides to the question of broadcasts from buildings other than the studio. The scientific aspect of acoustics is one which requires a good deal of study, and it is felt that at present we have only touched the fringe of the problems involved. Should an audience be present at a broadcast or not? Is a complete change necessary in the arrangement of the orchestra so that the positions occupied by the instrumentalists shall be entirely different from those recognised as normal by musical authorities?

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New Microphone Necessary?

Should the hall in which a broadcast performance takes place be square, oblong, or of horse-shoe shape on the lines of a theatre? Should a new kind of microphone be devised so that the sounds which are received by it shall be diffused instead of converged, as it were, into a narrow compass? Where and how should the microphone be placed? These are a few of the problems which have to be solved.

The recent broadcasts from the Y.M.C.A. Hall in London were satisfactory up to a point, and the experiments will be continued elsewhere, in halls and probably in theatres, with and without a visible audience, until some approach is made to conditions which may be considered ideal.

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Edinburgh Station.

The present premises of the Edinburgh station have been found inadequate, and during July a move is being made to more commodious premises. To inaugurate the opening of the new station a special programme is being arranged for the evening of July 31, in which a number of eminent artists from London and elsewhere will take part. Distinguished citizens of Edinburgh are also expected to broadcast on that occasion. The programme will be relayed to Glasgow, Aberdeen, and Dundee.

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Non-Stop Programmes.

From the artistic point of view, it is undesirable to introduce non-stop broadcast programmes, but listeners are sometimes impatient at the delay between items which occur particularly at some of the provincial stations. These delays are usually more noticeable in the case of simultaneous broadcast programmes, and are caused by the considerable amount of work necessary in the Control Room, the nerve centre of broadcasting, to secure the requisite amplification and to adjust intensity to varying local conditions. Plans are now under consideration which, if they are found practicable, will enable distant stations to control amplification in London and so enable the stations to help themselves to the London programmes at any moment desired. Saving in time, trouble and expense will thus be effected, while the quality of S.B. will be improved.

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Talks under Water.

The attempt to broadcast from under water at the Zoo, to find out whether fishes speak or not, proved abortive; but more successful was the broadcast of submarine noises at the "President" broadcast in the Thames recently. Continuing the idea, a diver will take a microphone down to the bed of Belfast Lough and will talk to listeners. The Belfast station is trying to arrange with the Belfast Harbour officials an early date for this broadcast.

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"High Speed."

Listeners must not feel alarmed by the title of Manchester's programme for July 22nd. The speed will be manifest in the studio and not in their headphones or loud speakers. The idea is simply to give eighteen artists, none of whom has yet had the opportunity of broadcasting, a few minutes each in which to display their qualities as singers, entertainers, or instrumentalists.

FUTURE FEATURES.

Sunday, July 12th.

LONDON.—3.30 p.m., Casano's Octet. 9 p.m., Wagner Concert, conducted by Percy Pitt.
BIRMINGHAM.—3.30 p.m., A Programme for a Summer Afternoon.
CARDIFF.—9 p.m., Instrumental evening.
NEWCASTLE.—9 p.m., Chamber Music.

Monday, July 13th.

LONDON.—8 p.m., "The Services." Programme by the Band of H.M. Royal Air Force.
CARDIFF.—8 p.m., Light Symphony Programme.
ABERDEEN.—8 p.m., Chamber Music.

Tuesday, July 14th.

ALL STATIONS (except 5XX).—8 p.m., "Winners": A Revusical Extravaganza.
5XX.—8 p.m., Music for Strings.

Wednesday, July 15th.

BIRMINGHAM.—8 p.m., Songs from English Opera.
BOURNEMOUTH.—8 p.m., "Old London."
CARDIFF.—8 p.m., The Celtic Spirit.
MANCHESTER.—8 p.m., The Opera, "Il Pagliacci" (Leoncavallo).
NEWCASTLE.—8 p.m., An Hour of Opera.
GLASGOW.—8 p.m., Orchestral Programme with W. H. Squire ('Cello).
BELFAST.—7.30 p.m., Symphony Concert.

Thursday, July 16th.

5XX.—8 p.m., "An Hour at a Party."
LONDON.—8 p.m., "Way Down South." 9 p.m., Chamber Music.
MANCHESTER.—9.15 p.m., Chamber Music.
ABERDEEN.—8 p.m., Violinist—Vocalist—Orchestra.
GLASGOW.—8 p.m., Fair Holiday Programme.

Friday, July 17th.

LONDON.—9 p.m., Revue, "Radio Radiance."
BIRMINGHAM.—8 p.m., "Melody and Mimicry." W. H. Squire ('Cello).
BOURNEMOUTH.—8 p.m., Instrumental Programme by Gordon Bryan, William Primrose and the Orchestra.
CARDIFF.—8 p.m., An Hour with the Composer, Herbert Bedford.
ABERDEEN.—8 p.m., A Summer's Evening Programme.

Saturday, July 18th.

CARDIFF.—8 p.m., Instrumental Music of Yesterday and To-day.
MANCHESTER AND 5XX.—8 p.m., Ballad Concert.

AIRCRAFT CONTROL by WIRELESS

Squadron Drill at the R.A.F. Display.

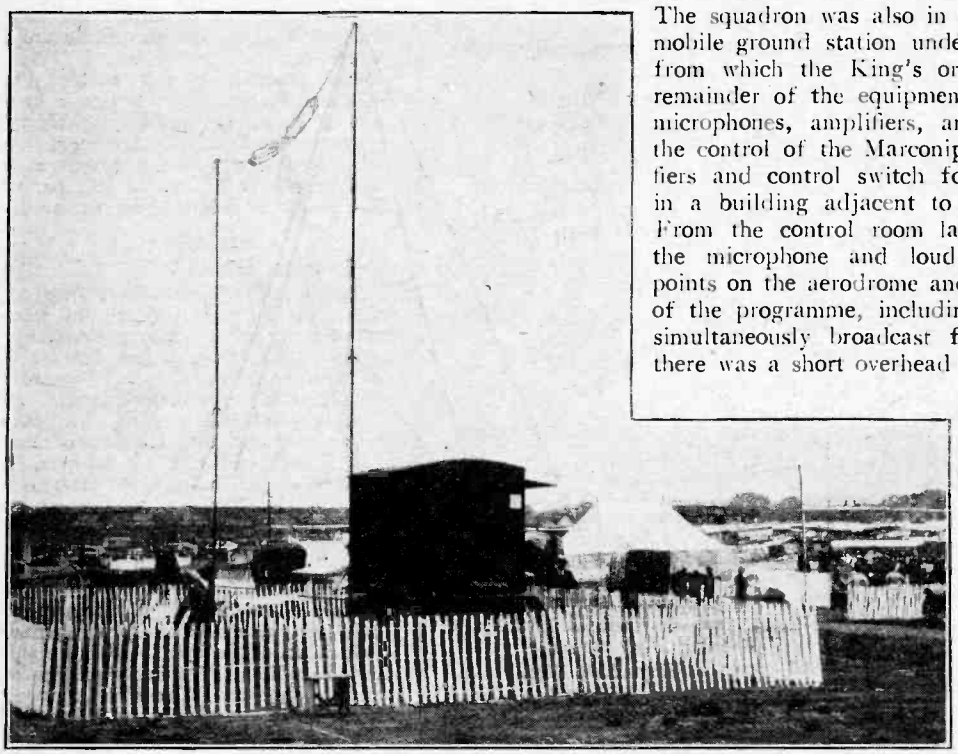
AS a medium for communication with aircraft in flight, wireless telephony is unrivalled. Information can be imparted much more rapidly by word of mouth than by the use of telegraphy and the Morse code, and both the pilot's hands are left free for manipulation of the controls.

It was through the stimulus given by the requirements of the airman to the development of apparatus for wireless telephony that a standard of quality and reliability was reached which made possible the inauguration of broadcasting in this country. Further, the public interest in wireless which called forth the B.B.C. organisation was awakened by the telephony transmissions from the Croydon, Lympne, and Pulham aerodromes with which every wireless enthusiast used to astound his friends and relations.

At the R.A.F. display at Hendon on June 27th a large audience was able to compare the progress that has been made in the development of wireless telephony for aviation and broadcasting. The demonstration was made possible by close co-operation between the signals section of the R.A.F. and the Marconiphone Co., Ltd. The R.A.F. was responsible for the communications between aircraft in flight and the ground station, while the Marconiphone Company arranged a system of microphones and loud-speakers by means of which the King was able to give an order to the aeroplanes in flight. A photograph of the King in the act of giving the order is reproduced on another page.

The R.A.F. and B.B.C. Organisations.

A squadron of nine fighting machines, each equipped with wireless receiving apparatus, gave a demonstration of squadron drill under the direction of the squadron leader whose machine was fitted also with a transmitter. The squadron was also in communication with a special mobile ground station under the control of the R.A.F. from which the King's orders were transmitted. The remainder of the equipment, comprising the land lines, microphones, amplifiers, and loud-speakers, was under the control of the Marconiphone engineers. The amplifiers and control switch for this system were installed in a building adjacent to the R.A.F. ground station. From the control room land lines communicated with the microphone and loud-speakers erected at distant points on the aerodrome and to the B.B.C., whence part of the programme, including the King's command, was simultaneously broadcast from all stations. Finally, there was a short overhead line between the control room and the R.A.F. ground station—the only link between the two organisations.



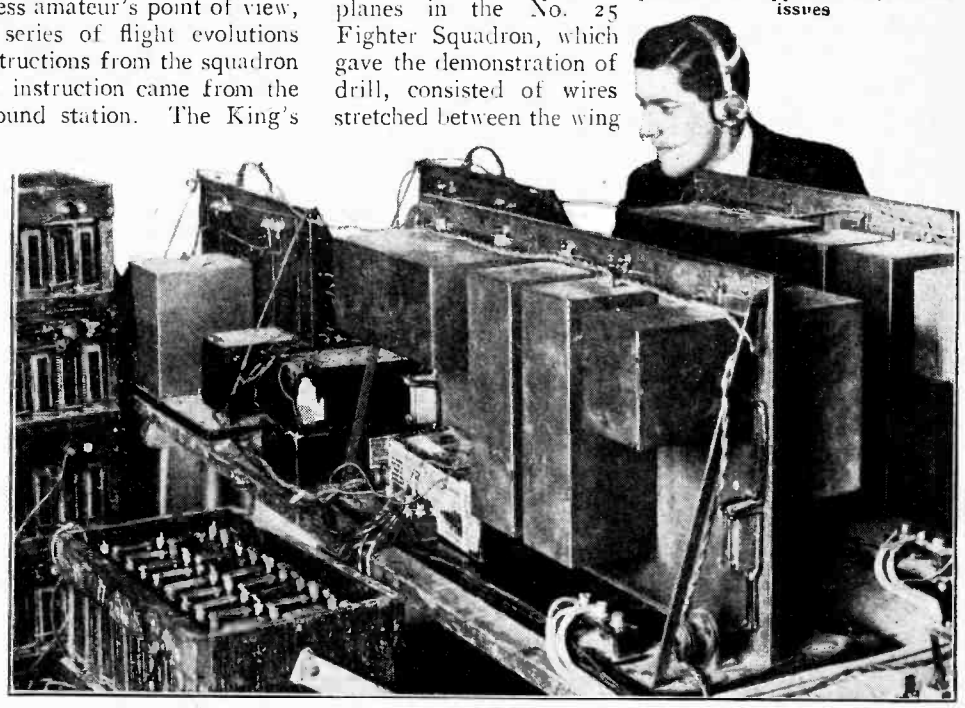
The R.A.F. ground station at Hendon, through which the King's orders to the No. 25 Fighter Squadron were transmitted.

The voice of the announcer and music from the Central Band of the R.A.F. were reproduced in the groups of loud-speakers erected in each enclosure, and the excellent quality of both speech and music was at once appreciated by the audience, many of whom had previously heard the B.B.C. transmissions only in a very distorted form

Aircraft Control by Wireless.—

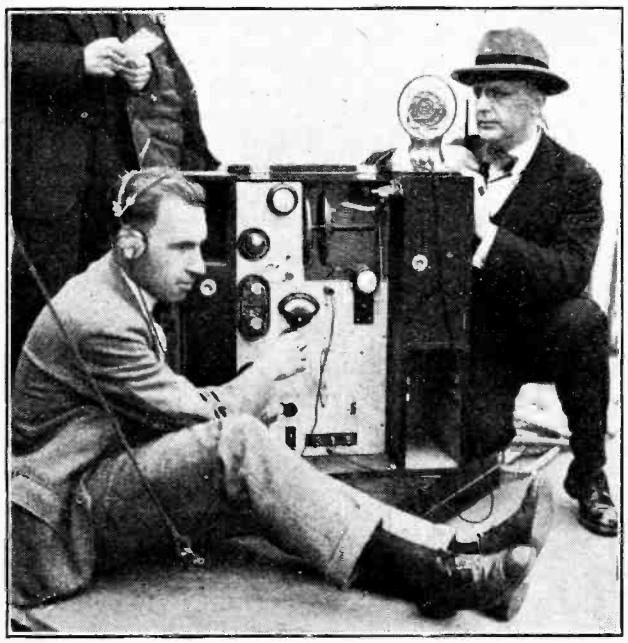
through inferior apparatus. It is to be regretted that time did not permit the installation of more than three groups of loud-speakers, as the wind and noise from aeroplane engines prevented many people on the windward side from hearing adequately. The most interesting event, however, from the wireless amateur's point of view, was the squadron drill. A series of flight evolutions were first carried out under instructions from the squadron leader's aeroplane. The final instruction came from the King through the R.A.F. ground station. The King's order to alter course was also heard, through the loud-speakers, by the audience, who were able to see the manœuvre immediately executed by the aeroplanes overhead.

Owing to external interference, however, the results obtained were in no way indicative of the full capabilities of the apparatus. On the previous day, when tests were being carried out with the squadron in the air, the transmissions were excellent, and the success with which the designers have been able to eliminate interference from engine noises was at once apparent. During rehearsal the background of noise in no way interfered with the intelligibility of the orders given; indeed, one had to listen very carefully to be quite sure that the background of noise emanated from an aeroplane engine. The significance of this achievement will be at once appreciated when it is realised that the commands were spoken within a few feet of the open exhaust of a 400 h.p. engine. It was noticed that the aerials on the "Grebe" aeroplanes in the No. 25 Fighter Squadron, which gave the demonstration of drill, consisted of wires stretched between the wing tips and the tail. A lead-in to the cockpit was taken from the centre of each wire. With an aerial system of this type the troublesome capacity changes associated with trailing aerials are eliminated.



Control room for the loud-speakers, microphones and amplifiers connected to the R.A.F. ground station. Detailed descriptions of this apparatus have appeared in previous issues

In a report issued by the B.B.C. in conjunction with the R.A.F., it is stated that no breakdown occurred in any part of the apparatus, but that interference was caused externally by powerful heterodyning. The wavelength upon which the tests were to be made was previously announced by the R.A.F., and the authorities are in possession of evidence which suggests that the interference was deliberate, although at present the offender has not been traced.



WJZ's portable transmitter.

AMERICAN PORTABLE TRANSMITTER.

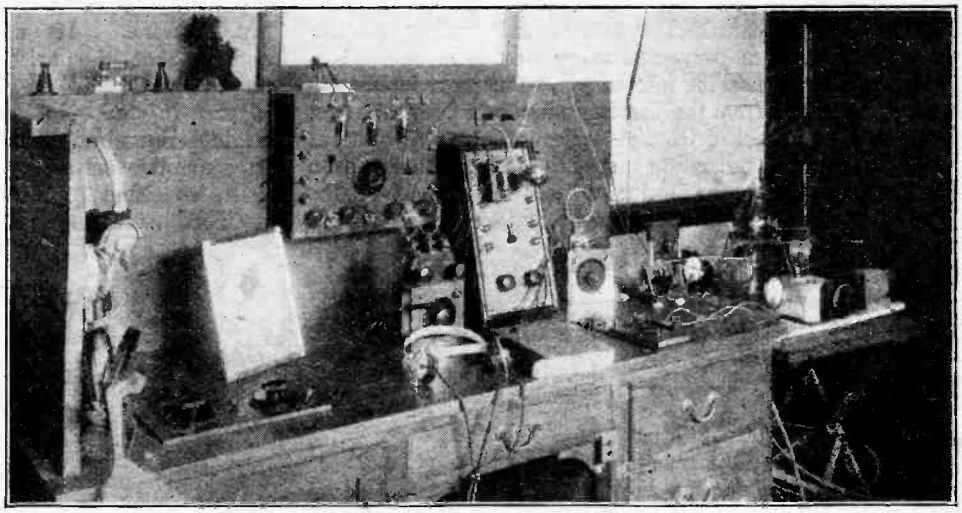
LISTENERS to WJZ, the well-known broadcasting station of the Radio Corporation of America, recently enjoyed the thrill of hearing a graphic description of the boat races between the Universities of Columbia, Princeton, and Pennsylvania.

For the purpose of this transmission a special set was built and installed on a boat which closely followed the rival crews, and during the race the relative positions of the crews, together with other details, were vividly described by Major Andrew White, who is seen in the photograph speaking into the microphone. This set, using a power of 5 watts and a wavelength of 60 metres, communicated with the Radio Corporation laboratories at Van Cortland Park.

TRANSMISSION AND RECEPTION ON 18 METRES.

A Description of the Equipment at G5NN.

By J. H. D. RIDLEY.



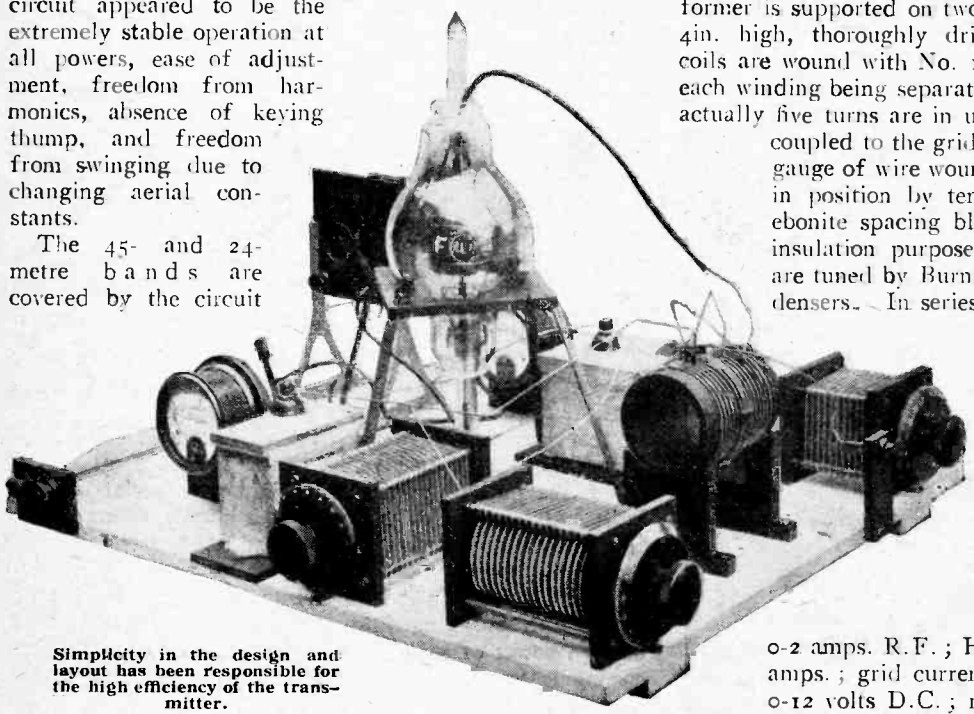
General view of the transmitting and receiving equipment at G5NN.

IN the past two years the activities of G5NN have been confined solely to short-wave long-distance C.W. transmission, varied on occasion by telephony transmissions to the United States and Europe. Conspicuous success has been met with on every occasion when watch has been kept at suitable times for international amateur communication.

Although circuits have been many and varied at this station both in transmission and reception, nothing freakish has been employed on any occasion, and it is no doubt mainly due to this fact that G5NN has been logged in practically every country in the world except China. For the 95-metre band the most satisfactory circuit for transmission has proved to be the "four-coil Meissner"; this circuit was chosen after exhaustive trials of the "three-coil Meissner," Hartley, Colpitts, and master oscillator circuits. The main advantages of this circuit appeared to be the extremely stable operation at all powers, ease of adjustment, freedom from harmonics, absence of keying thump, and freedom from swinging due to changing aerial constants.

The 45- and 24-metre bands are covered by the circuit shown; this appears to be the most satisfactory circuit for these short waves, and its operation is extremely simple, being as easy to tune as a 90-metre transmitter. The valve employed was a Mullard O.250 C, standard in every respect, which gave excellent results. The valve has now been replaced by an O.250 F of similar make, with a slight increase in efficiency. The filament is supplied from a 12-volt accumulator through two 7/16 cables 3ft. long; this accumulator is supported on porcelain feet to reduce leakage by capacity to earth.

The grid and plate coils are wound on a 4in. ebonite tube threaded $\frac{1}{32}$in. deep, five threads to the inch; this former is supported on two wooden blocks approximately 4in. high, thoroughly dried and well shellaced. The coils are wound with No. 16 S.W.G. tinned copper wire, each winding being separated by one pitch of the thread; actually five turns are in use in each coil. The aerial is coupled to the grid coil by four turns of the same gauge of wire wound in low-loss fashion and held in position by tension maintained by the four ebonite spacing blocks, which are necessary for insulation purposes. The grid and plate coils are tuned by Burndept low-loss transmitting condensers. In series with the aerial is another of these condensers, which is used for making final adjustments for the aerial tuning. The aerial is worked on the third harmonic at 18 metres, and is tuned by the condenser to 45 when working on that wave. In order that it may be possible to see what is happening in the circuit the following meters are utilised: Aerial, 0-2 amps. R.F.; H.T. positive feed, 0-75 milliamps.; grid current, 0-50 milliamps.; filament, 0-12 volts D.C.; rectifiers, 0-15 volts A.C.



Simplicity in the design and layout has been responsible for the high efficiency of the transmitter.

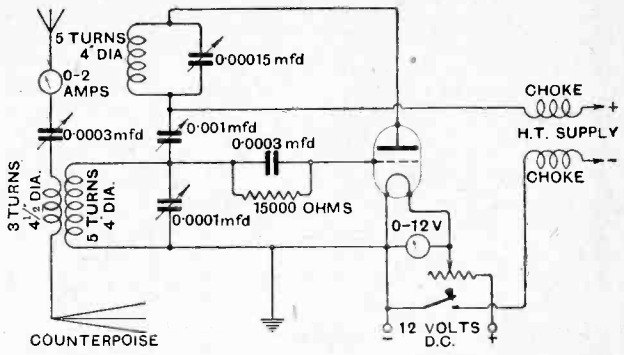
Transmission and Reception on 18 Metres.—

The high-tension supply is obtained from A.C. mains stepped up to 2,000 volts, rectified by Marconi U.100 valves, smoothed by a condenser of approximately 8 mfd. with suitable chokes, and passed through two high-tension power leads to the transmitter at the opposite side of the room. The note obtained is absolutely pure, and has an advantage over other types of emission, being more easily read through jamming and atmospherics.

The receiver at G5NN is in two units; the valve detector and amplifier, and the tuner unit. The detector valve and note magnifier is a standard Burndept II receiver. No alteration whatever has been made to this set, except the use of a DEQ valve as detector and a DE5 valve as magnifier; the former type of low-capacity valve has been in use at G5NN since the first American broadcast was received in 1922, when its bright emitter counterpart was used with conspicuous success. The inter-electrode capacities of these valves may be of interest to experimenters. Two valves (type QX) were taken for measurement purposes. In the first valve the capacity from filament to grid was 1.92 mmfds.; filament to plate, 2.04 mmfds.; grid to plate, 2.88 mmfds. In the second valve, filament to grid, 1.74 mmfds.; filament to plate, 2.16 mmfds.; grid to plate, 2.58 mmfds.

Accumulator high tension of 72 volts is utilised on the receiver, and consists of three Exide 24-volt units. The filament supply is derived from a 6-volt accumulator.

Turning to the tuning unit, this is somewhat out of the ordinary, and consists essentially of a secondary circuit tuned by a Burndept anode condenser, with double-spaced vanes giving a maximum capacity of 70 mmfds., a minimum of 6.8, and a dielectric loss of 23 ohms. Upon the box of this condenser, which is mounted on the usual type of ebonite panel, is carried a three-coil holder with drilled out plugs to reduce losses, and also with fibre gear wheels to do away with any tendency towards noise when moving the reaction coil. The aerial circuit is untuned, and consists of a two-turn coil of No. 16 S.W.G. tinned copper wire. The plug mounting is made of very thin ebonite, which carries the usual plug and socket fittings, which are cut down to reduce circuit capacity. With a three-turn coil $3\frac{1}{4}$in. in diameter in the secondary and a four-turn coil as reaction, the set tunes from approximately 17 to 32 metres, and with a five-turn coil in the secondary from 25 to 58 metres. As a point of interest it may be mentioned that this set will oscillate freely with only three-quarters of a turn in the secondary with the condenser at zero capacity. The tuning range of this coil is at present unknown.



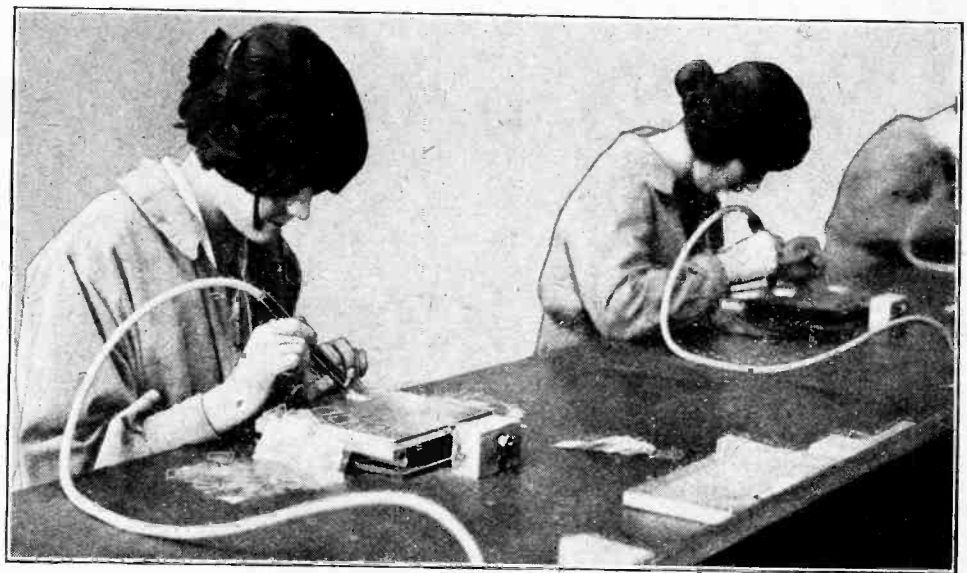
Connections of the transmitter, which employs a modified form of the Meissner circuit.

An accurately calibrated wavemeter is used for checking purposes, and measurements can be made on either transmission or reception with ease to within one-tenth of a metre on the lower bands.

It was with the aid of the transmitter described above that signals on 18 metres were transmitted to Australia in full daylight, being received there at 4.45 p.m. in the afternoon of April 26th. Reception was carried out in Melbourne by Mr. Pringle, senior engineer of Amalgamated Wireless, Ltd. Signals were reported at strength 6, and the whole of the transmission was copied, in spite of the absence of a prearranged schedule.

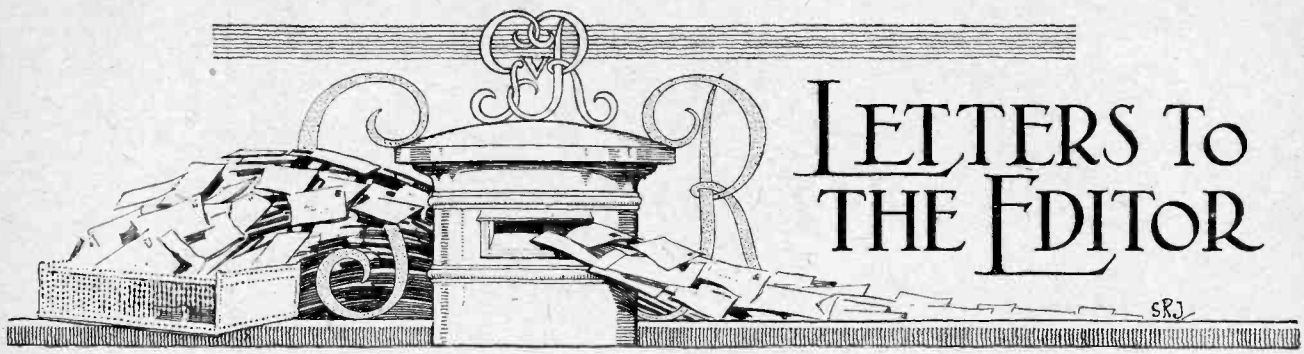
TESTING MICA.

THE extreme care necessary in the construction of mica dielectric condensers is evidenced by the test which is applied to the mica plates as shown in this illustration. With the pieces of mica which are on test resting on the surface of the metal plate, a high voltage is applied by means of a pencil-shaped electrode. The discharge in the form of a stream of sparks spreads out over the face of the mica, reaching the plate at the edges in the case of a good specimen, though a faulty piece possessing impurities or fractures permits of the discharge taking a path through the mica.



[By courtesy of the Dubilier Condenser Co., Ltd.]

Operators at work testing mica by high voltage discharge.



The Editor does not hold himself responsible for the opinions of his correspondents.

Correspondence should be addressed to the Editor, "The Wireless World," 139-140, Fleet Street, E.C.4, and must be accompanied by the writer's name and address.

PROPOSED TECHNICAL WIRELESS SOCIETY.

Sir,—If one reviews the wireless societies which exist at the moment, and at the same time peruses the wireless and technical Press, one is forced to the conclusion that a really technical society is wanted in Britain, a society which would correspond to the Institute of Radio Engineers of America.

This subject has been talked over between a number of professional men and advanced amateurs, and it has been decided to go right ahead with the formation and registration of such a body. A sufficient number of keen wireless men have agreed to find the necessary capital for registering, and to see the matter through; but, to ensure lasting success, there must be a large membership, so that offices can be secured and good Proceedings issued at not infrequent intervals.

It is intended that the society shall be called the British Institute of Radio Engineers. The rules and regulations would, as far as possible, be taken from the constitution of The Institution of Electrical Engineers or a similar body.

The classes of membership proposed would be fellows, members, associate members, graduates, and students. Entrance would be by examination after proposal and seconding by not less than four corporate members or associate members. The body would be a non-political one, and would deal only with the technical side of wireless. It would not attempt to deal with the non-technical side of broadcasting. An effort would be made to issue Proceedings of value at monthly intervals.

It should be clearly understood that a professional standing would be adopted in all matters, and that the headquarters would eventually be situated in London.

The society is actually in the process of being registered, so will all those interested or willing to co-operate please send in their names either to the writer or to Mr. Y. W. P. Evans, M.I.R.E., 66, Oxford Road, Manchester, at an early date, and at the same time indicate the class of membership for which they would apply? JAMES NELSON, M.I.E.E.

Prescot, Lancs.

[A copy of the above letter was forwarded to the Radio Society of Great Britain with a request for the Society's views upon this interesting subject. The reply is printed below.]

Sir,—I have to thank you for your letter of the 17th inst., relative to the proposed formation of a professional Radio Society to be called the British Institute of Radio Engineers, and to say that the same, together with a copy of the letter from Mr. James Nelson, M.I.E.E., was placed before my Council at their meeting held yesterday.

The Council feel that, while the formation of such a body might not interfere with the promotion of the objects for which the Radio Society of Great Britain is established, in view of the fact that the latter is an amateur scientific organisation, there might, however, be occasions on which the fact that an additional organisation is in existence would render it increasingly difficult to provide for each body a sufficient number of those papers and lectures which are so necessary to the successful conduct of an amateur or professional society's activities. This aspect of the matter becomes more acute when it is borne in mind that there is already in existence one professional wireless organisation, namely, the Wireless Section of the Institution of Electrical Engineers.

In this latter connection, my Council are of opinion that the promotion of an additional body whose interests will be centred in the professional wireless engineer is a matter which concerns not so much the Radio Society of Great Britain as the Wireless Section of the Institution of Electrical Engineers, and they feel that the question is one which merits the closest consideration by that body.

(*Signed*) H. A. ROCK,
for the Hon. Secretary, Radio Society of Great Britain.

THE B.B.C. AND DISTANT RECEPTION.

Sir,—I was glad to see in your Editorial comment of June 24th that you advocate the policy of the B.B.C. closing down occasionally in order to give the amateur a chance to test his set on other and more distant stations.

It is a fact that the "itch for distance" does possess the users of even the most humble apparatus, and from a progressive point of view it is a very desirable thing that experimenters, and especially the younger and more enthusiastic of their class, should be given a respite occasionally from the emissions of their local station.

As you point out, the best way for the distance enthusiast to learn that distant transmissions are not of the same quality as those from a nearby source is by practical trial. But it is quite possible he has sufficient acumen to know this, and quite other reasons actuate him in desiring to receive new stations.

The B.B.C. have certainly toyed with the idea, but the actual shortening of the time occupied by them is very small; at present, I believe that they have quietly dropped the idea altogether.

I trust that your voicing of this matter will have the effect of obtaining this concession for the Radio enthusiast who represents an important source from which we derive new ideas for receiver and component part design, manufacturers being more or less tied to existing forms of apparatus by reason of their neglect of research and experimental work.

An instance where a defect in standard construction is available is the coil holder. The prong and socket in these components are much too close together, and the same may be said of the pins which project from valves. In the latter case there are fortunately noteworthy exceptions, but the coil plugs are standardised. The amateur has shown that a change in both these cases would be desirable from the efficiency point of view, and I venture to say that they could point to other desirable improvements sufficient in value and number to justify the concession of which you speak.

Croydon. E. S. TARDREW.

SHORT WAVE TESTS.

Sir,—It may interest some of your readers to know that I am now conducting fairly regular tests on 23 and 45 metres with the call sign 6GH.

My present schedule is as follows:—Midnight to 8 a.m. daily: 6.30 to 7.30 p.m. on Wednesdays and Saturdays; 2 to 3 p.m. and 7 to 7.30 p.m. on Sundays.

Beckenham, Kent. G. E. HITCHCOCK.

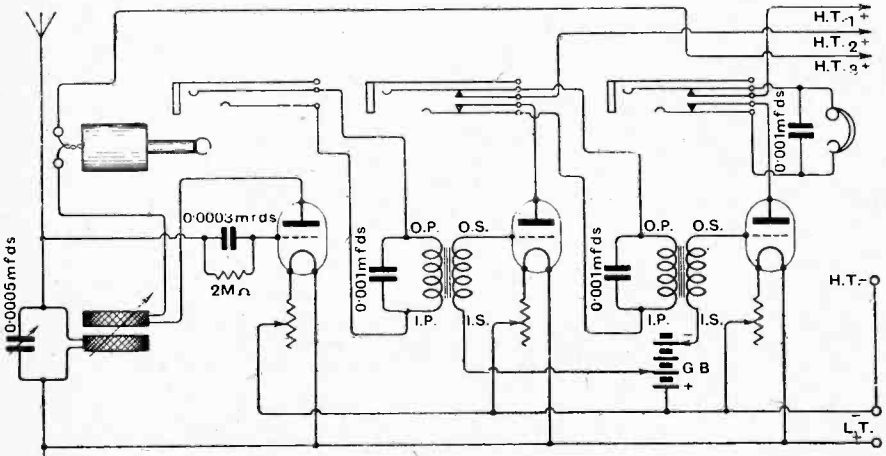
Readers' Problems

Readers Desiring to Consult "The Wireless World" Information Dept. should make use of the Coupon to be found in the Advertisement Pages.

Methods of Switching in L.F. Circuits.

IT is usually the practice, when employing plugs and jacks or other methods of switching in order to regulate the number of valves in use on the L.F. side of the receiver, so to arrange matters that if the volume from the loud-speaker is too strong for the ordinary room, the final stage of L.F. can be eliminated, and the output of the penultimate valve passed direct to the loud-speaker. Now a moment's consideration will reveal the fact that it is quite the wrong method of procedure, for the following reasons. If the volume from the loud-speaker is unbearably great, it is highly probable that considerable distortion will be present also, due either to the overloading of the loud-speaker or of the valve. It is becoming more and more the practice nowadays for valve-set owners to use a special power valve in the final stage, with an ability to handle large power without distortion. If, therefore, distortion due to valve overloading is present when all the valves of a receiver are in use, it is more than probable that it is not the final power valve that is being overloaded, but the preceding valve, which is in most cases a valve of the ordinary general purpose type, not having an ability to handle large power without distortion. If, therefore, we eliminate the fourth valve in the ordinary manner we shall certainly reduce our volume, but the distortion due to overloading will still be present. Obviously then, this method of procedure is incorrect, and we must seek some other method. Fortunately this is by no means difficult, since the obvious thing to do when the volume from all four valves of a standard four-valve set is too great is to step over the third valve and pass the output of the detector valve direct to the fourth valve, which is a power valve. In this manner, of course, valve distortion will be completely eliminated in contrast to the more usual method of switching where the fourth valve is eliminated and the output of the third valve passed direct to the loud-speaker. The same argument holds true in a power amplifier designed to handle exceptionally large power, where often the final valve is of the L.S.5.A. type having an exceptionally long "straight line" characteristic, the preceding valve being of the D.E.5 type, which, although greatly superior to an "R" type valve in this respect, cannot be said to approach the power handling capacity of the L.S.5.A. type.

In the circuit which we illustrate an attempt is made to carry out these principles in practice. It will readily be seen that the output of the detector valve can be passed either directly to the telephones or loud-speaker or be passed to any of the L.F. valves. The plug and jack system is used in preference to switching, since it is more readily adaptable to this circuit. An additional advantage of the plug and jack system in this instance is that the output of any experimental receiver, such as a short wave receiver, can be instantly passed to this amplifier by withdrawing the plug of the detector valve and plugging in the output of the experimental receiver to the input of either L.F. valve, whilst the *status quo ante* can instantly be resumed by withdrawing the plug of the experimental receiver and re-inserting that of the detector valve of the combined instrument.



The amplifier of this receiver can be coupled to other receivers.

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Methods of Eliminating Morse Interference.

A READER recently constructed a receiver which had very marked selective properties—so much so, in fact, that when tested in London it was found that no difficulty was experienced in eliminating the local station and receiving a more distant station differing in wavelength by only a few metres, without any local interference. Our reader informs us that tuning is very sharp, stations coming in at full strength or being completely eliminated by a movement of only one degree on the H.F. tuning dial. The receiver was actually made for use in a coastal town where Morse interference is very prevalent. The results obtained from it, however, from the point of view of eliminating morse, are no better than those given by other receivers of very inferior selective properties.

This apparent anomaly puzzles our reader, but the explanation is, unfortunately for coastal dwellers, very simple. Assuming for the moment that it were possible for us to construct a receiver capable of differentiating between stations only one metre apart in wavelength, so that a transmission sharply tuned to 300 metres could be received without any interference from a transmission of equal strength which was equally sharply tuned to 301 metres, it is obvious that this receiver would indeed be the last word in selectivity; yet in spite of these properties it would be no more successful in eliminating interference than any other receiver if the 301 metre station commenced transmitting on the 300 metre wavelength. Now in the case of receiving stations situated on the coast, it is obvious that there would be no cause for complaint if the offending Morse stations confined themselves to the emission of signals sharply tuned to the 300 or 450 metres wavelength, as in the case of a C.W. station. Unfortunately, however, much of the apparatus used on ship and

shore stations is of such antiquated design that the wave emitted, instead of confining itself sharply to a definite wavelength, spreads itself over a wide band embracing many tens of metres, so that actually a reputed 300 metre signal from one of these stations can be received with very little loss of intensity, if we tune our receiver sharply to 365 metres. It is obvious, therefore, that under these circumstances the super-selective receiver previously mentioned would be of no greater use than an ordinary receiver from the point of view of Morse elimination. It is well that dwellers in coastal towns should be aware of this fact, and that they should remember that the real remedy lies at the transmitting end, and that it is impossible to build a receiver capable of differentiating between several incoming signals of the same wavelength.

It must not be thought that the question of the elimination of Morse interference is in the same class as the problem of atmospheric elimination, which in the present state of knowledge of radio science is admittedly insoluble. At the same time it must be remembered that spark transmitters vary in the "breadth" of their tuning, some offending less than others in this respect, and it is well to make the receiver as selective as possible, in order to eliminate the less glaring offenders at least Dwellers in Morse-infested districts will always obtain relief by tuning in to the 1,600 metre transmissions from 5XX, since the discrepancy between this wavelength and the ordinary ship and shore wavelengths is sufficiently large to escape even the broadest wave emitted by a spark transmitter.

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Increasing the Wavelength Range of a Receiver.

A READER who has a variometer-tuned two-valve set designed for a wavelength range covering the B.B.C. stations wishes to make alterations to this receiver, so that he will be able to tune in to 5XX and other long-wave stations, but he is in some doubt whether to effect this by means of adding loading coils in series with both the aerial and anode variometers, or to arrange clips on his panel so that he may insert the "clip-in" type of fixed condensers in parallel with each variometer when desiring to receive on the long wavelengths.

It is recommended that the loading coil method of increasing the wavelength range of the receiver be adopted in this case, or indeed in any case where it is desired to increase the normal maximum wavelength range of a receiver by any great amount. In cases, however, where it is only desired to increase the maximum limit of the wavelength range by a comparatively small amount, then the method of adding parallel capacity may be usefully employed. It is not easy to lay down any definite rule concerning the maximum amount of increase in range it is desirable to bring about by this method, but a good working rule to adopt is never to add a parallel capacity greater than 0.0005 mfd. in value. In other words, if it is found by calculation that the addition of a parallel capacity of 0.0005 mfd. is insufficient to increase the maximum limit of tuning to the desired wavelength, then it will usually be found more efficient to use a loading coil.

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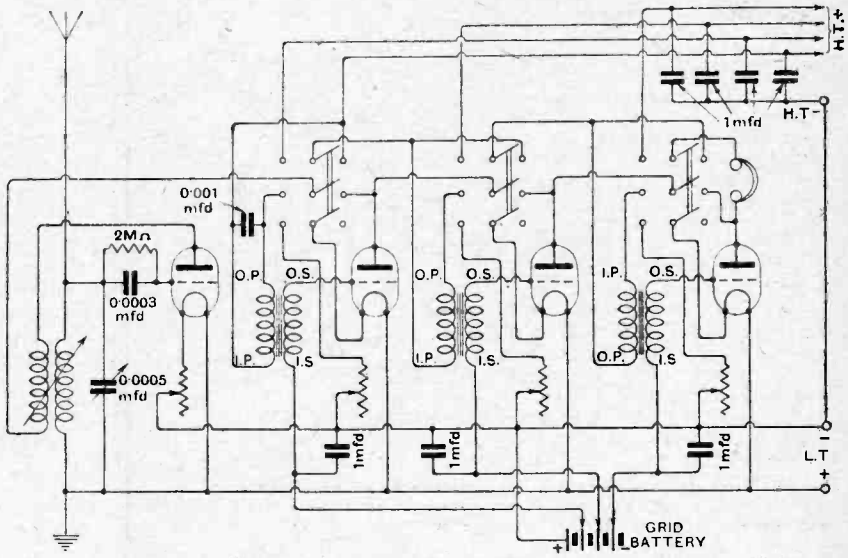
Design of Four-valve Set for Outdoor Demonstration.

A READER desires to construct a four-valve set using three stages of transformer coupled amplification for the purpose of giving outdoor demonstrations with a loud-speaker of a very large type. He desires that special attention be paid to the question of the best combination of valve and transformer in each stage to give the best results from the point of view of good quality, whilst universal switching arrangements are required so that any possible combination of valves may be used as desired.

In the circuit which we illustrate below attention has been paid to all the points mentioned by our reader. The first valve, which is an ordinary "R" type general purpose valve, is the usual conventional type of regenerative detector valve. This should be followed by a transformer having a low ratio, such as 2.7 to 1, the succeeding valve being a medium low impedance power valve of the D.E.5 type. The second transformer should be of medium ratio, such as 4 to 1, and since the signals delivered to the grid of the subsequent valve will be of considerable amplitude, it should be of a low impedance type, such as the L.S.5. Since this valve has a very low impedance and not a very high amplification factor, the final transformer can have a high ratio, 6 to 1 being quite suitable. It is now obvious that signals will be of very great magnitude, and it becomes imperative to use a valve designed to handle large power in the final stage such as the L.S.5A, otherwise distortion will occur. It must not be forgotten that for efficient working all four valves of the receiver will require different anode voltages, whilst different values of grid bias will be necessary on each L.F. valve. It is advisable that all components be well spaced out in order to avoid interaction. Far greater satisfaction will be had from the instrument if a 1 mfd. condenser is shunted from the L.T.– terminal to each H.T.+ and G.B.– tapping as indicated in the diagram. With regard to the switching arrangements, it will be seen from the tabulated switching indications given below that all possible combinations of valves can be used if desired, according to individual requirements.



A receiver in which any possible combination of valves can be used.

Valves in Use.	Switch No. 1.	Switch No. 2.	Switch No. 3.
Nos. 1, 2, 3, 4	Left	Left	Left
1, 2, 3	Left	Left	Right
1, 2	Left	Right	Right
1	Right	Right	Right
1, 4	Right	Right	Left
1, 3, 4	Right	Left	Left
1, 2, 4	Left	Right	Left
1, 3	Right	Left	Right

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EUROPEAN BROADCASTING.

Progress of the Geneva Conference.

AT the time of writing, the International Broadcasting Conference of Engineers is taking place at Geneva. Information just received by *The Wireless World* informs us that agreement has been reached by the technical representatives of the various broadcasting interests in Europe to carry out a series of experimental transmissions from different stations in order to ascertain the best methods to be adopted to avoid interference between stations. Particular attention will be paid to stations of neighbouring countries causing interference, and also to interference of a still more local character which is frequently experienced where heterodyning takes place between two or more stations which are received at approximately the same strength in any particular locality.

Purpose of Experiments.

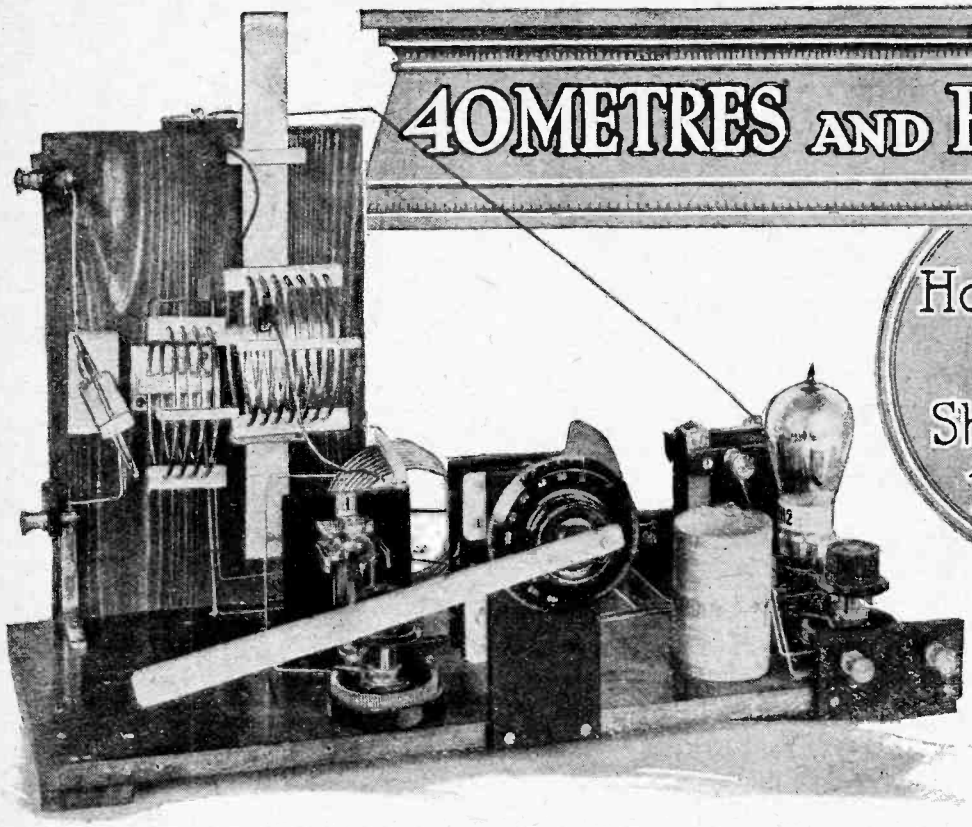
It is hoped that these experiments will show how closely stations can work to the same wavelength or restricted wavelength band when the stations themselves are located at considerable distances apart. So far it does not appear that the question of adopting uniform power for the broadcasting stations in Europe has come up for consideration, but we feel ourselves that in this direction lies one of the most promising methods of arriving at a solution. Already there are 90 broadcasting stations on wavelengths between 200 and 600 in Europe, and 40 others projected. If even a small number should decide to resort to high power the position would become impossible. We have repeatedly stated in these columns that we do not favour the policy of increasing the power of broadcasting stations as a means of serving a larger area and overcoming interference from other stations. Such methods can only intensify the interference, not perhaps within the area served by the high power station, but in all localities which fringe upon the average limit of range of the station of high power.

Interchange of Programmes.

Other experiments, we are informed, are to be carried out in order to see whether satisfactory transmission over lines between one national broadcasting station and another can be achieved so as to link up broadcasting in different countries, and so make an exchange of programmes possible. These proposals, we understand, were originated by the British Broadcasting Company, and it is a step towards the development of broadcasting which will undoubtedly be welcomed, but, at the same time, we do not consider that it will satisfy those who like to listen-in direct for distant foreign stations, because to have the programme of the foreign station transmitted from your local station is not by any means the same thing as direct reception after careful tuning and elimination of interference.

Whatever attitude the B.B.C. adopts in this connection, we feel sure that the desire for direct reception of distant stations will never be quelled, but rather that it will increase as time goes on and the public become more and more familiar with the operation of selective and more elaborate receivers suitable for the purpose.

CONTENTS.



40 METRES AND BELOW

How to Build an Ultra Short Wave Receiver

By

F. H. HAYNES.

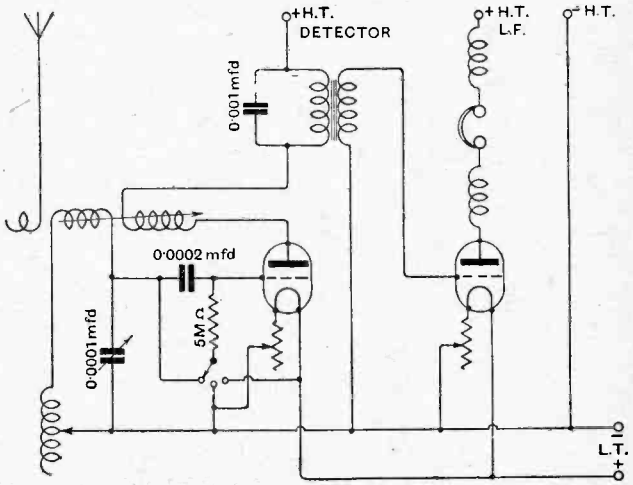
FIVE years ago when in possession of the 1,000 metre wavelength for experimental work the amateur probably considered himself a little ill used by the change to the, then, comparatively short wavelength of 440 metres. He rapidly realised, however, that the new wavelength was a useful one, as it bore a relationship to the natural wavelength of the small aerial systems invariably used and gave rise to marked improvement in the range of amateur communication. With the advent of broadcasting with a waveband of approximately 300 and 500 metres it at first seemed that the amateur was to be driven off the ether.

It is safe to say that the new wavelength of 200 metres then allotted to him was taken up with reluctance, so much so that in a strong endeavour to maintain a claim to a "practical" wavelength the right was obtained from the Postmaster-General to use a fixed wavelength of 440 metres during certain hours. Although this privilege still exists, the use of shorter wavelengths has presented such interesting experimental work that the fixed wavelength of 440 metres is now practically abandoned. It was with a wavelength of about 200 metres that general working with the North American continent was established, and constant investigation is being made into the difficulties of adopting still shorter wavelengths. Prior to the authorisation by the Postmaster-General of still shorter wavelengths for amateur use transmissions on 100 metres had proved successful in accomplishing two way working with New Zealand, and later Australia.

Transmitting and receiving on still lower wavelengths has been taken up, yielding the astounding fact that with small power communication during daylight can be carried out between the remotest points on the earth's surface.

A New Technique.

The customary principles of receiver design require modification as the wavelength is reduced. The writer



The circuit comprises a detector valve with reaction followed by a note magnifier. The tuned closed circuit is divided to facilitate aerial and reaction coupling.

in previous articles introduced such modifications as capacity coupling for oscillation control, the use of choke coils in the telephone leads, and a special design of

40 Metres and Below.—

self-supporting inductance coil using a minimum of dielectric material and with turns suitably arranged to give good efficiency at the high oscillation frequencies of the short waves.

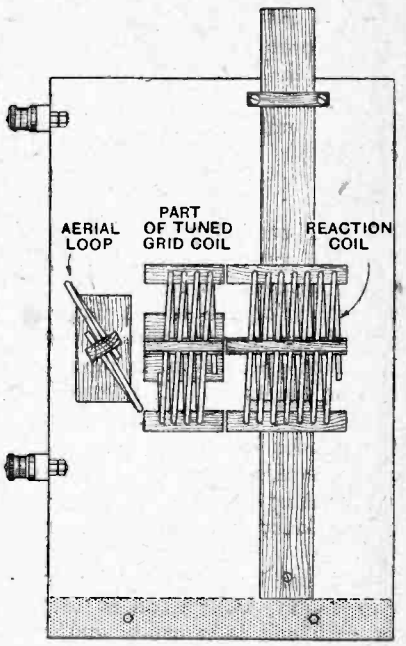
There is no difficulty in setting up oscillations on wavelengths between 15 and 40 metres with an ordinary four-pin general purpose valve having a tuned grid circuit with a tuned plate circuit or reaction coil. The capacity coupling presented in the valve itself between the grid and plate is sufficient to set up oscillation, but for better control it is advisable to make use of the "V24" type valve in which a much lower capacity is presented between grid and filament.

Circuit for 20-Metre Reception.

Such an oscillating valve circuit with leaky grid condenser rectification is invariably employed by the amateur for continuous wave reception, and the only problem requiring solution for adapting it for "ultra" short wave work is the method of linking the tuned grid circuit with the aerial. An aerial system can be made to beat at multiples of the frequency to which it is tuned, rendering it responsive to subdivisions of its fundamental wavelength. Its response to particular harmonic frequencies can be improved by suitably arranging the current and potential distribution along its length by the imposition of capacity and inductance. For practical purposes, however, unless the entire aerial system is built for operation on one particular wavelength, definite harmonic tuning is best neglected.

Some Surprising Observations.

It is on a wavelength of about 20 metres that one appreciates for the first time what is truly meant by an aperiodic aerial. On broadcasting wavelengths the so-called aperiodic aerial is in reality sharply tuned by virtue of its tight coupling with a tuned closed circuit. With a circuit resonating to 20 metres, however, it will be observed that, unless a small aerial having a natural period of this wavelength is employed, the aerial dimensions are immaterial. Another observation will be the apparent extreme sharpness of tuning of the grid circuit, which, if the aerial inductance, best referred to as the "aerial loop," is loosely enough coupled, is entirely uninfluenced by changes in the inductance or capacity of the aerial. It is for this reason that the term "aerial loop" has been coined, for it may consist merely of a piece of wire brought within the region of the grid coil, and it does not matter whether the counterpoise is connected up or not, while signal strength may even be unimpaired by disconnecting the aerial wire from its terminal so long as it terminates somewhere near the receiving apparatus.

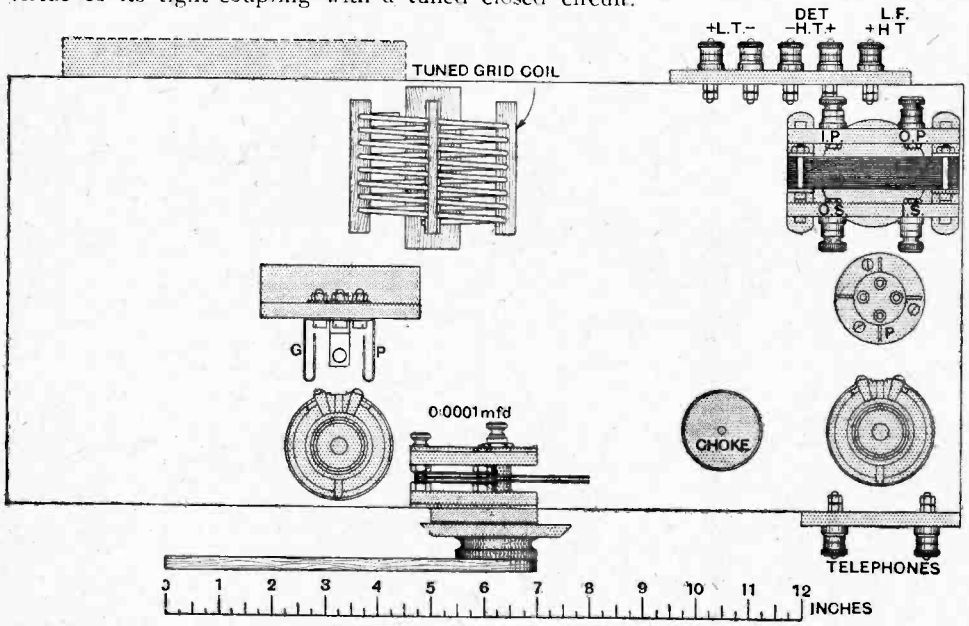


The arrangement of the coupling coils, drawn to the scale of inches accompanying the drawing of the baseboard.

The Circuit.

The aerial loop is a single turn of wire connected to a pair of terminals and placed within the region of a few turns of the tuned closed circuit. The closed circuit is provided with a clip for tapping out a suitable number of turns, and in order that the reaction coil may suitably couple with the closed circuit it is necessary to divide this latter coil into two portions. Leaky grid condenser rectification is made use of, and maximum signal strength with smooth reaction control is best obtained with the leak connected on the positive side of the filament battery. A single stage note magnifier increases the range of reception.

The output terminals to the telephone receivers are fed through suitable choke



Layout of the components on the baseboard. A simple form of construction is adopted, and the components are arranged to provide short wiring paths.

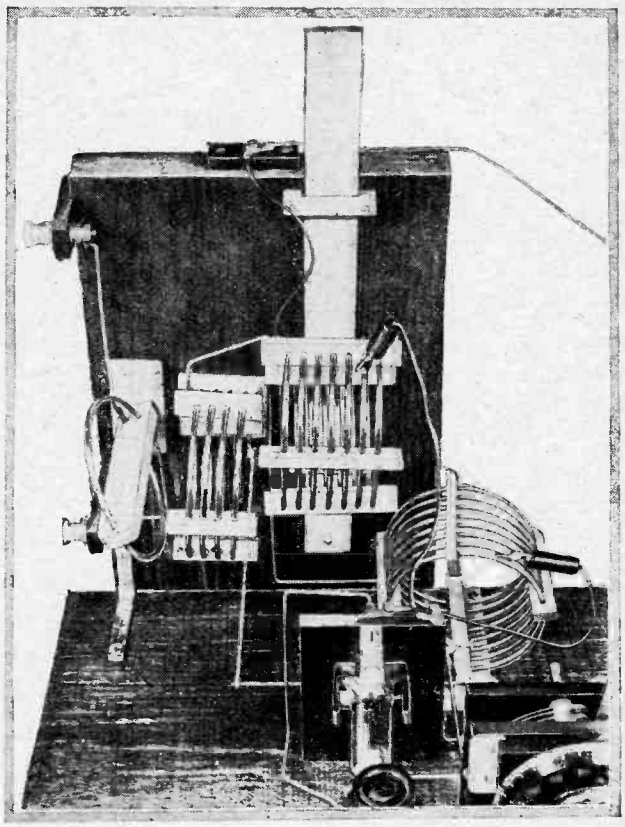
40 Metres and Below.—

coils to avoid the capacity changes that would normally occur when handling the telephone receivers, for in operation the entire receiving set is well insulated from earth as well as the filament heating and high tension batteries.

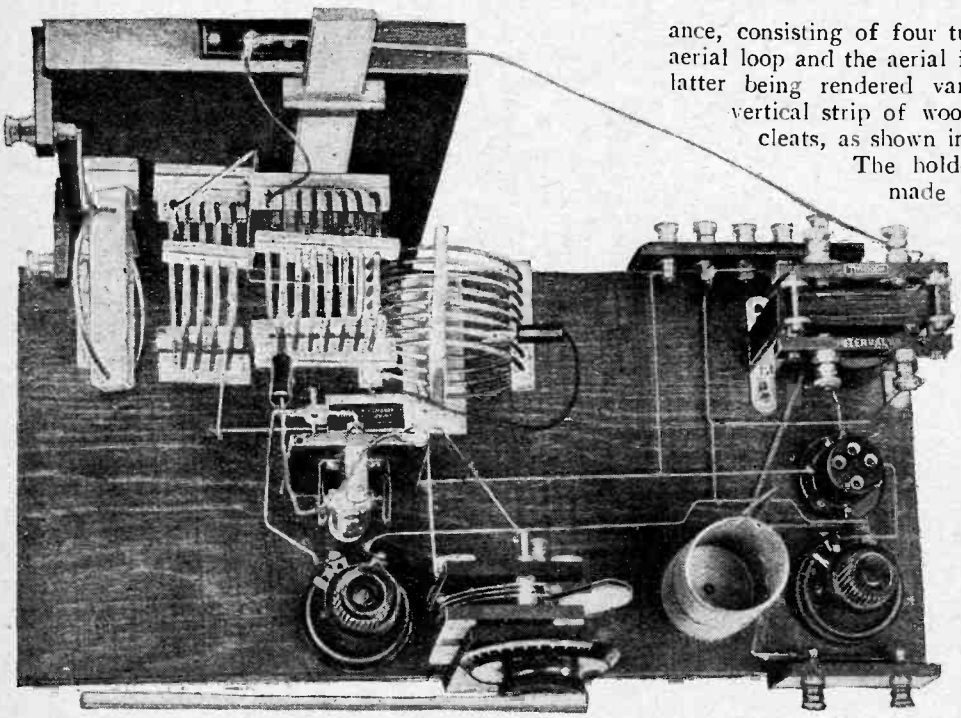
Construction.

A baseboard layout is adopted, with vertical back piece for supporting the tuning inductances, the two boards being held together squarely with a cast brass bracket. For the tuning inductances No. 12 S.W.G. hard drawn copper wire is used, and a hard wooden former of about 2½in. in diameter must be procured for shaping the turns. The length of wire required for the coils should be pulled tight in an endeavour to stretch it to render it perfectly straight before winding. It is advisable also to polish it. In winding on to the former care must be taken not to permit the wire at any moment to run slack, and there must be no spacing between the turns.

Each coil is supported by four strips of wood, and planed $\frac{3}{16}$in. white wood is suitable. One strip of wood for each coil is carefully marked up with the positions for the holes, and the spacing of the holes ($\frac{3}{16}$in.) is transferred to the remaining strips by the use of a square with the pieces lying side by side. When drilling, the pieces should be clamped in the vice to prevent splitting, and small guide holes (drill No. 40) put through accurately to locate the holes which are subsequently drilled out to size with a No. 32 drill. The strips of wood are easily threaded on to the spirals, and the method of mounting the coils is easily seen from the illustrations. A portion of the closed circuit inductance, consisting of four turns, is mounted between the aerial loop and the aerial inductance, the coupling of the latter being rendered variable by attaching it to a vertical strip of wood sliding beneath two wooden cleats, as shown in the photograph above.



The coils, although specially designed for short-wave reception, are robust, and permit of the use of a clip connector for critical adjustment. The clips are made by bending up the tags of spade connectors and soldering them to short plugs.



The complete receiver. Tags are mounted on the valve bracket and on one of the insulating strips of the secondary coil for terminating the flexible connections.

The holder for the "V24" valve is made up from a piece of ¼in. ebonite, and stray capacity between the grid and plate connections is reduced by cutting away the ebonite around the clips. A convenient method of mounting the tuning condenser is shown.

The only other component requiring reference is the pair of choke coils. A dry strawboard tube about 1½in. in diameter makes a good former, and is wound with two sections each 1in. in length with No. 38 D.S.C. Terminal strips are provided as shown, and wiring up is carried out with No. 16 tinned copper, using tags under the terminals. With

40 Metres and Below.—

all inductances wound in the same direction the adjacent ends of the secondary and reaction coils are connected to the L.T. circuit and the I.P. transformer terminal respectively.

Operation.

The grid potential as applied by the grid leak and the H.T. battery potential of the detector valve must be regulated until smooth self-oscillation is obtained with the aerial disconnected and at all settings of the tuning condenser. When connected to the aerial it may be found that oscillation ceases with certain positions of the condenser, in which case the position of the aerial loop should be varied so as more loosely to couple with the four turns of the closed circuit. Tuning will be found to be exceedingly sharp though quite manageable, as it will soon be noticed that the condenser dial must be rotated very slowly. Passing through the tuning position of a distant station a click only will be heard until the condenser setting is critically adjusted.

When the receiver shown in the accompanying illustrations was completed a few weeks ago the first signals heard were those of the Argentine Station CB8 on a wavelength of about 20 metres. The station was heard at good strength immediately the valve filaments were switched on. Later, during the same test the American Station NKF was heard. Subsequent tests revealed that the tuning range is approximately from 15 to 40 metres.

LIST OF PARTS REQUIRED.

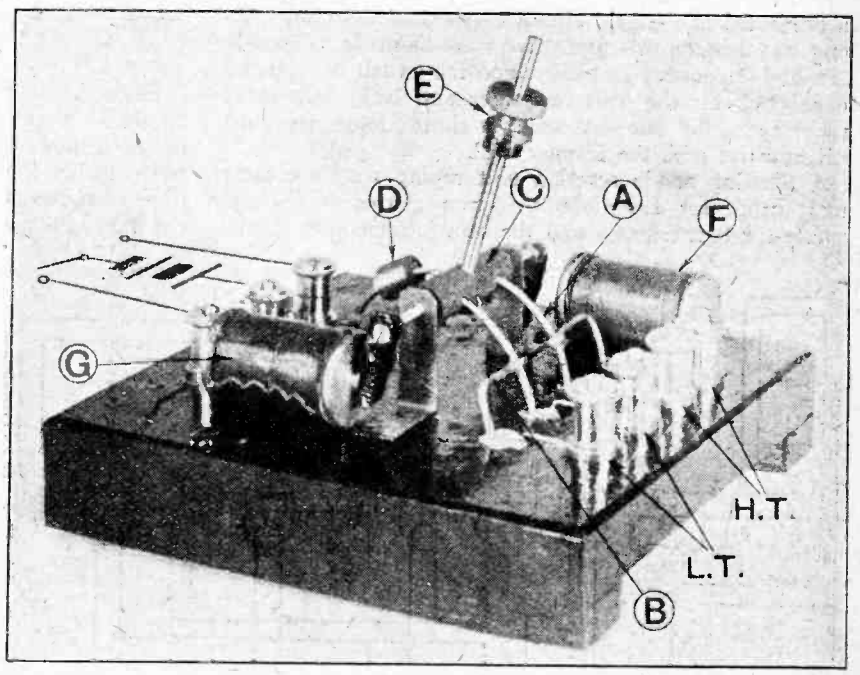
Ebonite for terminals, etc. Wooden baseboard, 18in.×8in.×¾in. Wooden back, 6½in.×10½in.×¾in. 2 Rheostats. 2 Variable condensers, 0·0001 mfd. 1 Intervalve transformer. 1 5-megohm grid leak. 1 Fixed condenser, 0·00025. 1 Fixed condenser, 0·001. 1 V24 valve holder. 1 Base-mounting valve holder. 3 Plugs. 9 4B.A. terminals. 1 lb. No. 12 H.D. copper wire. ½ lb. No. 16 tinned copper wire. ½ oz. No. 40 D.S.C. wire.

REMOTE CONTROL COMPONENT.

A Simple Trip Relay Providing Good Contact.

UNLESS the contacts of relays used in receiving circuits are beyond reproach, parasitic noise will develop which will entirely spoil the results obtained. One of the best contacts is given by an amalgamated electrode dipping into a cup of mercury. This method is invariably employed in electrical standardisation work involving the measurement of low resistances, and its use in this relay has been fully justified.

Two pairs of mercury cups connected to terminals on the base are used to make and break the H.T. and L.T. circuits of the receiver. The short-circuiting electrodes A and B are fixed to a rotating ebonite drum, C, which also carries adjustable balance weights, D and E. The relay is actuated by two electro-magnets, which attract soft iron armatures mounted at the ends of the drum spindle. The magnet coils are connected to three terminals, a common terminal being employed for the beginning of each coil. When a current from the local battery passes through F, the circuit is made, while a current through G lifts the electrodes out of the mercury and breaks the receiver circuits.



Photograph showing details of the switch.

The magnet coils can be taken from a buzzer or good quality electric bell mechanism, which will be found quite satisfactory for the purpose, as when the balance weights have been adjusted, there is very little inertia to overcome in the operation of the switch. The rotating ebonite drum C, which carries the contact arms, is, of course, very lightly pivoted in holes in the two supporting brackets; in fact, the brackets merely act as a support and guide for the switch arm. The switch should be fitted up in some place where it is not likely to be moved, as, if it is upset, there is the risk of spilling the mercury from the cups.

The balance weights are adjusted so that the arm remains in either the "on" or "off" position without any aid from the magnets.

F. W.

A SUPERHETERODYNE MODIFICATION.

The Use of Intermediate Frequency Amplifying Valves for Direct H.F. Amplification on Long Wavelengths.

THE advantages of the superheterodyne method of reception are more apparent on short than on long wavelengths, and for this reason the range of many receivers of this type is restricted to wavelengths below 600 metres. It is desirable, however, to make provision for the reception of stations such as the Eiffel Tower, Radio Paris, and Chelmsford, which transmit on wavelengths between 1,000 and 3,000 metres, and this can best be done by passing the incoming signals directly to the intermediate frequency amplifier. This method is hardly practicable if each stage of the amplifier is separately tuned, but in the accompanying circuit it will be seen that there is only one tuning control, and that the remaining stages are resistance-coupled.

Switching Arrangements.

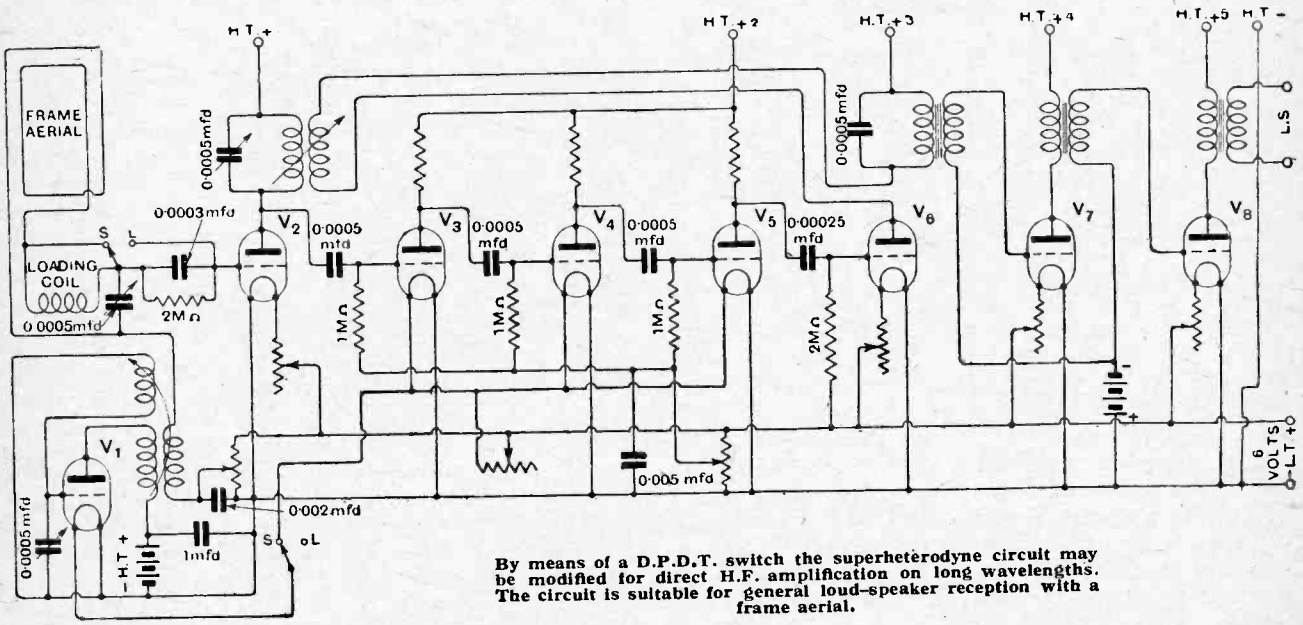
This circuit, which has been adopted with success in a receiver designed by Mr. T. Hindle, M.J.I.E., of Haslingden, includes a particularly neat method of changing from long to short waves involving the use of an ordinary double-pole change-over switch. One pole is used to switch off the local oscillator, while the other is connected to the grid circuit of the first detector. On long wavelengths this first valve must be made to operate as a high-frequency amplifier, and the switch is arranged to short-circuit the grid condenser and leak. On short wavelengths the same switch arm short-circuits the load coil in series with the frame aerial.

A Sterling anode reaction unit tuning with a 0.0005 mfd. condenser from 900 to 3,000 metres is used to couple the first detector and the first intermediate amplifying valve. The tuning of this unit determines the beat frequency when the superheterodyne circuit is being used on short wavelengths. The beat frequency should be adjusted to approximately 3,000 metres, as the total amplification obtainable from the resistance-coupled amplifier increases with the wavelength. The exact wavelength used in the intermediate amplifier, however, is not important, and may be varied, as occasion demands, to avoid interference from long-wave C.W. stations. When the circuit is changed for the reception of long waves, the wavelength of the reaction unit is reduced to coincide with that of the incoming signal. At the same time, the first potentiometer is adjusted to give a negative instead of a positive grid potential, as the first valve is now operating as a high-frequency amplifier.

Valves of the D.E.3 type are used for the local oscillator, V_1, and the first detector, V_2, while D.E.3B. valves with an amplification factor of 16 have been adopted for the intermediate amplifiers V_3, V_4, and V_5. A separate potentiometer is provided to control the grid potential of these valves. The second detector, V_6, is of the D.E.3 type, and the low-frequency amplifiers, V_7 and V_8, are low-impedance valves of the D.E.5 type.

Performance.

Since the amplification in the intermediate amplifier is aperiodic, the selectivity of the receiver will depend upon the performance of the anode reaction unit. If the selectivity is not the maximum obtainable with superheterodyne reception, the sacrifice is amply compensated for by the increased general utility of the receiver.



By means of a D.P.D.T. switch the superheterodyne circuit may be modified for direct H.F. amplification on long wavelengths. The circuit is suitable for general loud-speaker reception with a frame aerial.

THE HIGH-TENSION PROBLEM

With Particular Reference to the Maintenance of Dry Batteries.

By C. H. STEPHENSON.

IT is no exaggeration to say that one of the most unsatisfactory components used in wireless reception is the high-tension battery. The inadequacy of ordinary H.T. batteries has been emphasised in recent months, owing to the more extensive use of loud-speakers and to the development of semi-power valves such as the D.E.5, B.4, etc. The advances made in low filament consumption valves are remarkable, and with prices falling it should not be long before the high-temperature valve is obsolete.

This has a marked bearing on the H.T. question, because, as the filament consumption of valves becomes less, so is the cost of L.T. energy reduced, and the proportion of the total operating costs represented by the H.T. battery becomes higher. The lower cost of semi-power valves will materially increase their popularity, with a resulting greater demand on the H.T. supply.

It is interesting, therefore, to examine the H.T. question and try to find the least expensive solution. The majority of amateurs use dry batteries, and it is this source of current with which the following notes deal. There are various makes of H.T. accumulators on the market, and, provided charging facilities are available, they offer a satisfactory solution, except on the score of initial cost. The writer does not consider the open-type accumulator suitable on account of messiness, and the sealed pattern is very expensive. As another alternative, there is the H.T. motor generator (anode converter), but here again expense is a serious item, and the L.T. consumption is large compared with that of dull emitter valves. Some amateurs are fortunate enough to have D.C. mains available, but it is quite fair to assume that the great majority rely on dry batteries.

Dry Cells as a Source of H.T.

The writer has had many years' experience in the manufacture of dry cells in very large quantities, and is of the opinion that a fundamental error has been made in the form in which H.T. batteries are offered to the public. During his connection with battery manufacture he conducted numerous experiments to determine the factors responsible for the premature failure of small cells, but no satisfactory conclusions were arrived at, and, judging by opinions expressed in the Press to-day, the question still remains unsettled. For the present, therefore, one must accept the unreliability of these small cells as inevitable.

It is a mistake to connect a large number of cells permanently in series. The number varies from twenty-four in the case of a 36-volt battery, to sixty-seven in a 100-volt unit, and it is evident that the age-old aphorism regarding a chain has been ignored. If a single cell should fail, the whole battery is ruined. It should be remembered that if there are x cells in a battery, the "risk of loss" is proportional to x squared. Thus a 72-volt battery has twice as many cells as one of thirty-six volts, and is approximately double the price of the latter. If it is assumed, as may fairly be done, that the failure of a single cell virtually ruins the whole battery, then the "risk of loss" is four times greater with the 72-volt unit than with the smaller battery.

Effect of Short-circuiting Cells.

It is not unusual to see the advice given that, in the event of a cell failing, it should be short-circuited. This practice is fatal. It would be bad enough, were it possible, to short the one defective cell only, but, as tappings are generally made in steps of three volts, such a course will actually short-circuit one good cell through a defective one. The danger in short-circuiting cells is that it almost invariably results in the zinc container being eaten through, with the consequent discharge of semi-liquid electrolyte into the main body of the battery. The electrolyte then creeps along between the cells and provides a leakage path which leads to the rapid discharge of the greater part of the whole battery. The only safe thing to do is to disconnect the faulty cell or cells, an operation which the most enthusiastic amateur is likely to attempt once only, particularly if the battery should be sealed with pitch.

It would seem that the only logical way to market an H.T. battery is in units containing as few cells as possible. Commercially, this resolves itself into the use of three cell pocket lamp batteries, and, all things considered, this solution is one which the writer very strongly advocates. The risk of loss is then reduced to the cost of replacing a $4\frac{1}{2}$-volt battery, which is a very small item. The higher the voltage used, the more favourably does the assembly of pocket lamp batteries show up.

There are now cases available on the market for these batteries, and whilst a multiplicity of spring contacts is not good, the writer has not had much trouble from this source. Furthermore, there is no reason why a sounder contact scheme should not be worked out.

The High-Tension Problem.—

Tapping Points.

One small difficulty in making up an H.T. battery in a home-made case is the provision of tapping points. It is entirely unnecessary to tap a 54-volt battery, for example, at 3-volt intervals. It suffices to make three taps at 3-volt intervals, and then one at each 9 volts thereafter. This reduces the tappings from nineteen to nine. The number could be still further reduced were it not necessary to use a common negative lead when different voltages are tapped off a single battery. The above arrangement allows the detector anode voltage to be adjusted in steps of 3 volts, whilst the voltage on any other valve need never be more than 4½ volts higher or lower than any desired value. This margin is not usually serious in the case of an H.F. or L.F. valve.

There seems to be an idea that these pocket lamp batteries are not as good as the regular type of H.T. battery. The fact is that precisely the same cells are almost universally used for both. Some slight modifications have been made in some cases, the intention being to improve the stocking qualities of the regular pattern. It must be admitted, however, that these modifications have not been attended with marked success. It may be taken as a fact that the results obtained from an H.T. battery made up of pocket lamp units will be quite equal to those from a regular type H.T. battery. Another important point is the question of freshness. Owing to the rapid deterioration of all these small cells in stock, it is very desirable that the user receive them as fresh as possible. The fact that pocket lamp batteries are in regular demand for purposes other than wireless means that the dealer is less likely to have old batteries on his shelves.

Rate of Discharge.

No regard has as yet been paid to the question of the current taken from an H.T. battery. It may safely be stated that the H.T. battery is frequently overloaded in the case of multi-valve sets. The evil is, however, in the writer's opinion, not quite so bad as is sometimes made out. It is good practice to discharge an H.T. battery at a greater rate than that at which it would give the maximum watt-hour output, on account of the deterioration factor when the battery is idle. The object to aim at is to get the maximum watt-hours per shilling.

As a rough approximation, one can say that an H.T. battery of the usual size will suffice to supply the current for a 3-valve set using valves of the R or similar type. If the last valve is a semi-power type, it will be better, though not essential, to use a separate battery to feed it. It is, of course, always good practice to use a separate H.T. battery for the L.F. valve or valves, though this is hardly necessary if only one L.F. valve of the R type is used.

Importance of Grid Bias.

A very important matter is to see that the L.F. grids are given the correct potential. It is well known that lack of suitable grid bias is a frequent cause of distortion and weak signals, but the enormous effect this bias has on the H.T. consumption is probably not realised. The following figures were obtained with a B.4 valve, using an anode battery of 84 volts.

Grid Bias—Volts.	Anode Current—Milliamps.
+0.5	8.0
−2.5	6.5
−3.8	4.2
−4.8	3.2

The performance was quite satisfactory with the grid at −4.8 volts, the valve giving good loud-speaker output, whilst the anode current was only half that with the grid at −2.5 volts. The same point is of importance in the case of H.F. valves where the grids are frequently given a positive potential in order to produce damping. Incidentally, this is very bad practice.

The conclusion arrived at so far is that for the ordinary set a single battery, or at most two, built up of pocket lamp refills is the best solution. What about the super loud-speaker equipment?

There are certain large H.T. batteries on the market made up in 50-volt and larger units, which are similar to the ordinary H.T. units except that the individual cells are larger. The writer has used this type and does not like it on the grounds of expense. The batteries cost 24s. for about 54 volts, and whilst, on account of the cells being larger, the likelihood of individual failure is reduced, the risk is ever present, and the scrapping of a 24s. article is a serious item. There do not appear to be any reasonably cheap pocket lamp batteries of large size, so that one is really driven to use the above type when large anode currents are required.

It might be suggested that one could connect two sets of ordinary pocket lamp batteries in parallel, but this course cannot be successfully adopted, as there is serious risk of voltage differences which would lead to one of the sets discharging through the other.

40-METRE TRANSMISSIONS FROM WNP.

DESPITE all rumours to the contrary, the expedition to the North Pole, undertaken by Commander McMillan and the U.S. Navy, appears to be proceeding "according to plan."

Mr. E. F. McDonald, his second in command, sailed from Boston on June 17 in the *Peary* to join the flagship *Bowdoin* at Wiscasset, Maine, taking with him three Navy aeroplanes for the proposed flight from Etah, Greenland, which is about eleven degrees from the North Pole, together with twenty receivers, which are to be given to the missionaries at the various points where the vessel touches. Mr. J. L. Reinartz is in charge of the wireless station WNP on board the *Bowdoin*, and has arranged with the American Radio Relay League to record and check his transmissions.

As soon as the observation work of the expedition gets under way, the despatches of Commr. McMillan to the National Geographic Society will be sent regularly to certain stations owned by members of the A.R.R.L.

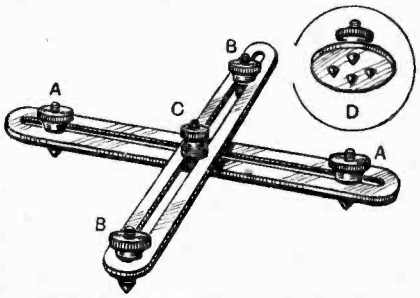
Transmission from the *Bowdoin* (WNP) is now being made on about 40 metres, but it is understood that Mr. Reinartz intends to reduce this gradually until he finds the wavelength that gives the greatest satisfaction in the continual daylight which the expedition will soon encounter.

READERS' NOVELTIES

A Section Devoted to New Ideas and Practical Devices.

ADJUSTABLE COMPONENTS TEMPLATE.

It is rarely possible to mark out the whole of an instrument panel geometrically with the rule and square, as the spacing of the securing holes on many components, such as square law condensers, are not symmetrically arranged, and in the absence of a template, a series of pre-



Adjustable template for transferring component dimensions to the instrument panel.

cise measurements must be made if the holes are to register accurately. Even when the securing holes are symmetrical, it is not unusual to find that through errors in assembling, the spacing is not what the designer originally intended it to be; the angle brackets on intervalve transformers may be taken as a typical example. Similarly, it is not advisable to place too much reliance on printed paper templates, which are frequently found to be inaccurate through shrinkage of the paper after printing.

The solution which first presents itself is to place the components in position on the panel, and to mark the positions of the holes with a scriber. This cannot always be done conveniently, as the scriber must be held vertically if the markings are to coincide with the holes. The writer has found the adjustable template illustrated of great value in transferring the relative positions of securing holes to the panel.

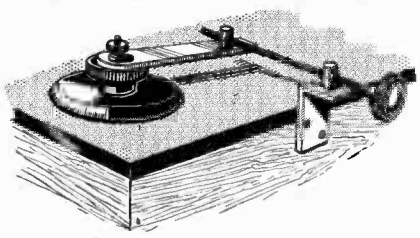
Two slotted arms are clamped together with a screw at C in such a way that the point of intersection of the arms, and also the angle between them, may be varied. Each arm carries one or more hardened steel centres which are attached to clamping screws, and may be moved to any required position. The centres B on the upper arm are made longer than those A on the lower arm to bring the points into one and the same plane. If desired, a special template, D, for valve sockets, may be constructed for use in conjunction with the adjustable arms.

In using the template all screws are slackened and the centres adjusted until they fit into the holes in the components. The conical form of the centre will ensure that punch marks occupy the centres of the securing holes.—R. E. W.

oooo

VERNIER CONDENSER ADJUSTMENT.

The diagram shows a vernier adjustment which is capable of giving a very minute control over the movement of a variable condenser. A short length of 4BA screwed rod is fitted into the top of the condenser dial for the purpose of clamping the adjusting arm. To the end of this arm is fitted a small terminal, which



Critical control attachment.

has been tapped out to take a 4BA screw. The terminal is fitted to the arm with a spring washer, and is capable of rotation. A length of 4BA screwed rod passes through this terminal and is mounted in a bearing bracket secured to the side of the cabinet. For normal adjustments of the condenser the clamping screw on the top of the dial is released.—W. R. D. F.

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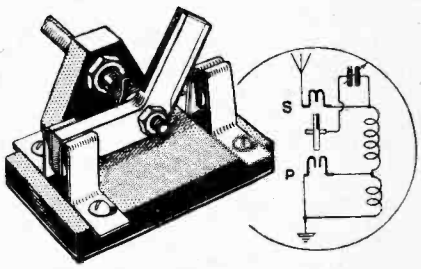
SERIES-PARALLEL SWITCH.

When a single tuning condenser is used, both for series and parallel tuning of an aerial circuit, a gap occurs in the wavelength band when



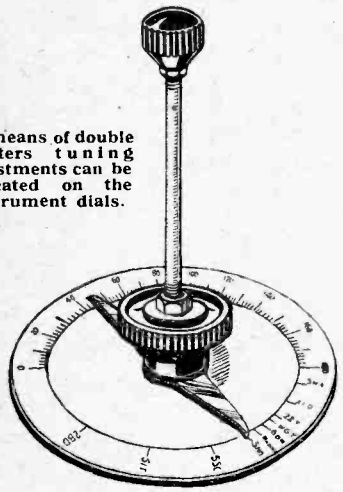
Single lever series-parallel switch.

the condenser is changed from the series to the parallel position. It was with the object of making the two wavelength ranges overlap that this series-parallel switch was constructed. When the switch is moved into the parallel position, a small section of the aerial coil is short-circuited. The number of turns in this short-circuited section must be found by experiment. If the tuning condenser has a capacity of 0.00075 mfd. and if there are 60 turns in the aerial coil, approximately 20 turns must be short-circuited. It will be noticed that the action of the switch depends upon the one pair of clip contacts touching when the switch tongue is withdrawn. These contacts should, therefore, be constructed from good spring material, in order that they will not be forced apart in use. The other pair of contacts are arranged to remain apart when the switch is opened on that side.—R. T. B.

CONDENSER SCALE.

A circular xylonite condenser scale is very useful for logging the position of broadcasting and amateur transmitting stations which it may be required to receive at some future date.

On the upper half of the dial, a



By means of double pointers tuning adjustments can be indicated on the instrument dials.

scale of 180° is permanently engraved, or alternatively a prepared scale may be stuck on to the xylonite disc with amyl acetate. The condenser knob is fitted with two pointers, arranged on a diameter passing through the centre of the knob. Having tuned in the station, a pencil mark is made opposite the lower pointer, and identified with the call sign of the station. By these means, the necessity is obviated of keeping a written list of condenser settings, which may be inadvertently lost.—L. T.

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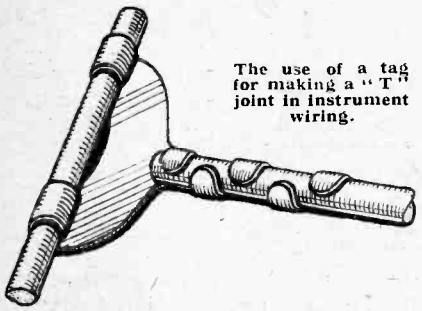
RIGHT-ANGLE WIRING JOINT.

In wiring a receiver it often happens that right-angle joints have to



The use of a tag for making a "T" joint in instrument wiring.

be made in inaccessible places where it is extremely difficult to hold the wires together.

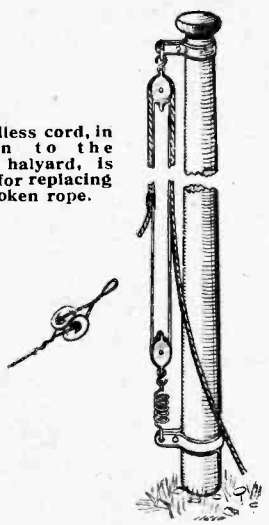
A spade connector of the type cut from sheet metal is pressed over and soldered to the vertical wire in the usual way. The two sides of the blade are then turned over at the ends with a pair of round-nosed pliers and hooked over the horizontal wire. Both hands are thereby left free to manipulate the final soldering of the joint.—H. H.

oooo

REPLACING A BROKEN HALYARD.

If the aerial mast is fitted with an endless cord or wire running over pulleys at the top and bottom of the mast, the replacement of a broken halyard will be quite a simple matter. The new halyard is attached to the endless cord and carried over the top pulley, after which the halyard may be detached from the endless cord and secured to the aerial.

The top pulley should be chosen with a V-shaped groove so that the endless wire may rest in the bottom



An endless cord, in addition to the aerial halyard, is useful for replacing a broken rope.

of the groove in the space below the comparatively thick halyard. The bottom pulley should be attached to a coil spring of suitable strength The pull of the spring should be sufficient to keep the endless wire from twisting, but should not be so great as to cause undue friction in the top pulley.—J. F.

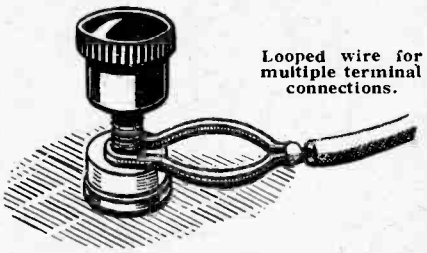
VALVES FOR IDEAS.

Readers are invited to submit brief details, with rough sketches, where necessary, of devices of experimental interest for inclusion in this section. A receiving valve will be despatched to every reader whose idea is accepted for publication.

Letters should be addressed to the Editor, "Wireless World and Radio Review," 139, Fleet Street, London, E.C.4, and marked "Ideas."

TELEPHONE CONNECTIONS.

When several pairs of telephone leads are to be secured in a single pair of terminals, much annoyance is caused by connections falling off while fresh phones are being connected. Specially shaped wire tags were found very useful for connecting telephones to the type of W.D. terminals in which the top screw



Looped wire for multiple terminal connections.

cannot be entirely removed. The wire is shaped so that the diameter of the large loop is slightly larger than the diameter of the terminal. The small loop just slips over the terminal thread. It will be found that with this method of connection several pairs of phones may be fitted successively to the terminal without confusion.—R. E. S.

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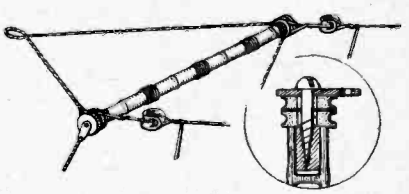
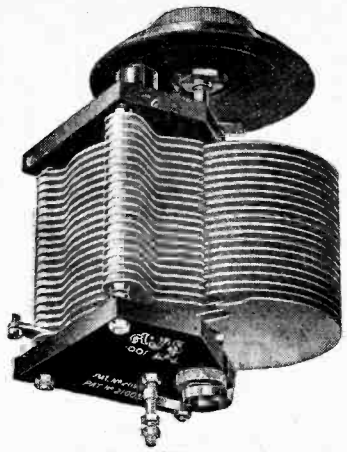
TWIN WIRE SPREADER.

A light and effective aerial spreader may be constructed from bamboo rod, which is obtainable from any hardware stores. The rod, having been cut to the required length, is plugged with wood at each end and fitted with pairs of porcelain reel insulators. The outer insulators may be used for the supporting ropes, and the inner pair for the aerial wires themselves. If the aerial is to be used for trans-



A plugged bamboo rod makes a light aerial spreader.

mission, it may be advisable to fit additional "egg" or "shell" insulators for the aerial wires, as a part of the surface of the inside insulators is occupied by the ends of the bamboo rod. Cords may be attached to the screws in the end of the rod for the purpose of steadying the aerial during a gale.—V. I. N. W.



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·0003 " " **11/6** ·001 " " **17/6**

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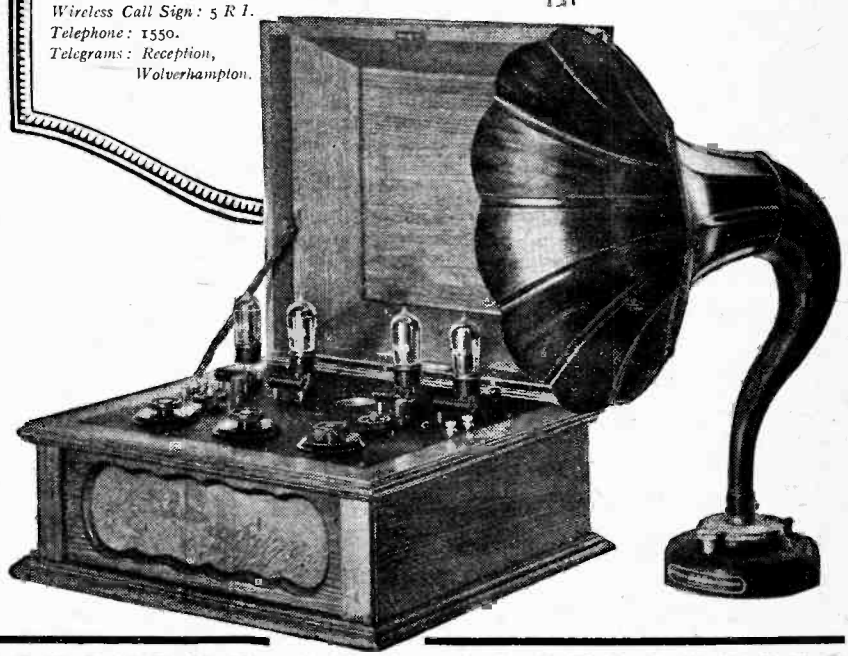


MAKERS OF RECEIVERS AND ACCESSORIES

MAKING GRID LEAKS.

Special Processes in Grid Leak Manufacture.

THERE is always a feeling of uncertainty about grid leaks for radio circuits because there is no easy way for the user to tell whether the resistances are accurate or not, since the grid leak does not cause any effect that can be readily recognised, as is the case with a switch or rheostat or amplifying transformer. Nevertheless, the grid leak is an important device and, for work with circuits that are inclined to be unstable, absolute accuracy is necessary.

The Daven Radio Company, the largest of the American grid leak manufacturers, have developed a number of interesting devices which they employ to control the accuracy of their product, by which they claim to maintain an accuracy of plus or minus 5 per cent. With their permission, the accompanying photographs and information are published.

Construction of the Grid Leaks.

The grid leaks described are of a conventional type, consisting of an element of ink-coated paper, centred within a glass tube. At each end is a ferrule which, with a small cork inside, seals the tube and serves as a terminal. This gives a compact unit which is air-tight, so that no atmospheric changes affect the paper element after the tube is sealed with the end caps. The high quality of the finished product, which to all outward appearances is very simple, is only obtained by carefully planning each assembly operation so that the work follows right through the line, careful attention being paid to all the little kinks and tricks peculiar to the work.

To insure uniformity, paper of one stock is bought in large enough quantities to make millions of elements. When received at the factory it goes through a special ageing process and is then coated with a resistance material held in a binder. Experience with various forms of power and hand-operated paper cutters has shown that the ordinary photographer's paper trimmer is the most satisfactory device for cutting up the paper into the little $\frac{5}{32} \times \frac{15}{16}$in. strips required.

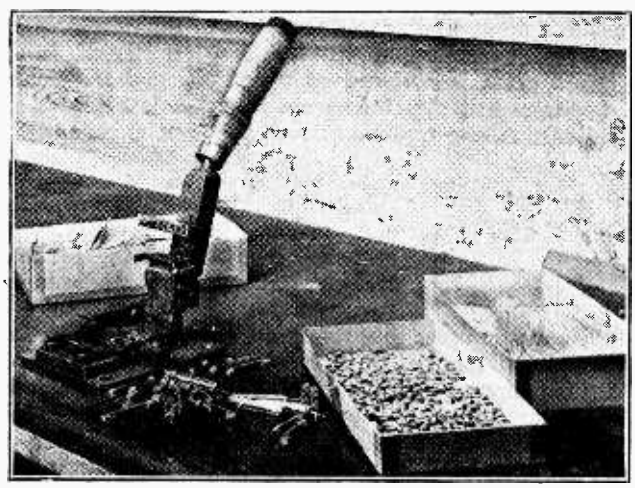


Fig. 1.—Fixing metal clips to the ends of the prepared paper.

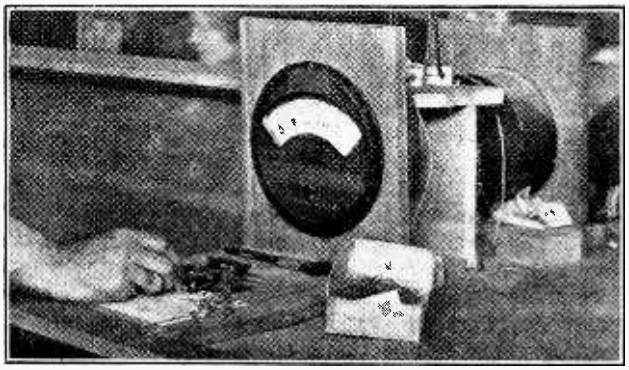


Fig. 2.—Testing the elements. If the resistance value is not correct, the amount of ink on the paper is adjusted.

The glass tubes, corks, and nickeled brass end caps are bought from outside manufacturers. It is interesting to note here that a tolerance of only 0.004 to 0.005in. is allowed on the outside diameter of the glass, and a tolerance of 0.030in. on the length. Also the glass is of special chemical composition, since it is essential that it should have practically infinite resistance. The stock of tubes, corks, caps, and elements is at all times kept in an electrically-heated oven at a temperature of 115 deg. Fahrenheit. This prevents any absorption of moisture. The subsequent assembling operations are so timed that not more than five minutes elapses between the time the stock is taken from the oven and the time the tubes are sealed air-tight.

In the first operation the connecting leads or clips are attached to the paper elements in hand presses. These elements with the clips are then placed in the heated stock oven. In the next operation the resistance of the elements is measured and brought to the correct value. This is done in an ingenious way. Two supports are arranged on the table in the form of blocks, which receive the clips of the elements. The two terminals of the measuring instrument are arranged on a bar so that by means a foot-operated lever they may be brought down tight on the clips and the meter read. If the resistance value is not correct, ink is either added or removed from the strip by means of a brush.

Mounting and Capping the Units.

As the work progresses along the table one operator threads a small cork over each clip, the next puts this unit in a glass tube, and the ends of the clips are crimped slightly. A special machine was devised for this work to prevent the element from buckling up inside the tube when the corks are pushed in tight. When the lever is first pushed down, two jaws come down and pinch the clips, holding them fast. A further movement of the lever pushes two plungers horizontally against the corks, driving them home into the

Making Grid Leaks.—

tube. This machine is shown in Fig. 3. The elements are then centred in the tube, and proceed to the soldering table. An automatic capping machine, shown in Fig. 4, is employed. This requires four operators, two for inserting caps and two for inserting glass, cork, and resistance units. This machine caps many thousand units per day.

The capper has thirty-two tube-holding arms arranged radially on a turntable driven by an electric motor. One operator puts a cap in the lower holder of each arm as the table turns. The cap runs over a gas flame for a distance of about 12in. as the arm travels around. When it reaches a certain predetermined point a drop of molten solder is dropped into it from a spout leading from a solder pot. By means of a valve gear operated by the turntable a slide valve in the bottom of the pot is opened and closed at the proper time to deliver the drops of solder. The cap continues on its way, still over the gas flame, until it gets to a place where it is carried over a flat supporting ring. At this point the next operator inserts the glass tube and presses it on firmly, the pressure being taken up by the ring underneath. This unit continues over to an automatic counting device, and is then released from the arm by a tripper and falls into a box, the solder having hardened by this time. It then goes over to the other side of the machine, where the process is repeated and the other cap put on. The glass tubes and caps are of such size that a clearance space exists

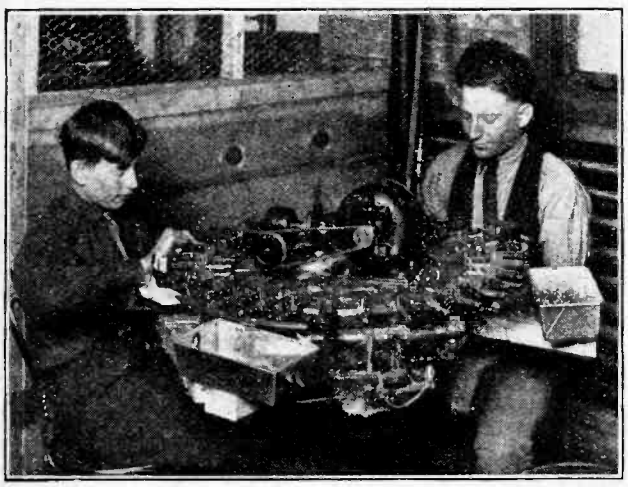


Fig. 4.—Capping the tubes in an automatic machine.

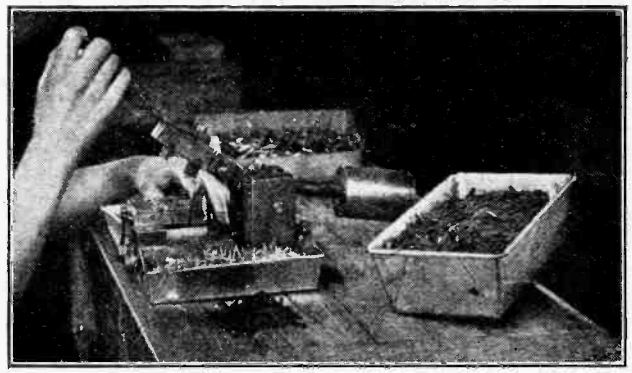


Fig. 3.—The ends of the elements pass through corks which are pressed into the ends of a glass tube

between them to allow the excess solder to run out during the capping operation. This thin wall of solder between the glass tube and metal cap also serves as a cement, so that it is impossible to pull the metal caps off from the tubes. The difference in the coefficient of expansion of the glass tube and brass cap also serves to aid this action.

The Final Inspection.

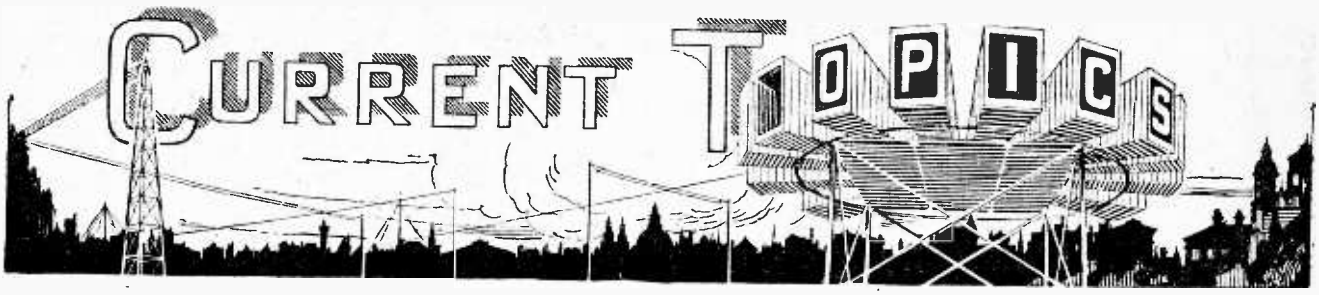
The resistors are then inspected and any excess solder is trimmed off around the glass. An inspection is also made to insure that the paper element is properly centred in the glass tube and that the caps are on straight. A final resistance measurement is made and the resistors sorted according to their values.

When the final test has been completed, paper labels having the resistance values marked on them are pasted on the glass tubes and the finished products packed for shipment.

In measuring the resistances a definite and constant voltage is applied to the resistor and the current flowing through it is measured by a sensitive microammeter calibrated to read directly in megohms. These meters are calibrated daily by comparison with a standard. The meter used for the first measurement when the brushing operation is performed is checked every ten minutes by making up twenty complete resistors of different sizes and measuring their values with the final test meter. In this way a check is obtained on the meter, and the factory superintendent also knows exactly what is being turned out so that any troubles become apparent at once.

WIRELESS IN EAST RUSSIA.

RADIO is esteemed the best link between the towns and the villages in Russia's Far East, where it is espoused by the Proletradio Association, which urges that the radio telephone station to be equipped in Vladivostok for the eighth anniversary of the October Revolution will have failed in its purpose of elevating the level of refinement in the community, amongst the peasants, if receivers are not provided in the villages. On the occasion of the anniversary named, the Proletradio proposes to install telephones in twenty country centres, and loudspeakers in thirteen chief towns and club houses. The peculiar topographical conditions of the Primorsk area constrains the Proletradio to pay particular attention to the choice of apparatus in order to ensure good audibility for speeches, music and songs. It is seeking permission to import British apparatus as the most reliable, and more suitable than any other to local conditions. Various official authorities, says a Moscow journal, are encouraging the Proletradio with financial assistance to carry out its interesting project.



Events of the Week in Brief Review.

FROM CZECHO-SLOVAKIA TO MASSACHUSETTS.

Mr. J. Borden (1CMX), of Fall River, Mass., last month got into communication with OK1 in Prague. The Czecho-Slovakian station, working on 42 metres, sent the greetings of the Radio Club to the American Radio Relay League and its president, Mr. Hiram Percy Maxim.

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NEW TRANSATLANTIC STATION IN SWEDEN.

The transatlantic station at Grimeton, near Varberg, in Sweden, was opened on July 2nd by H.M. the King of Sweden, who addressed a radiogram to President Coolidge, which met with a cordial reply.

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R.S.G.B. TO VISIT ONGAR STATION.

As mentioned in our last issue, members of the Radio Society of Great Britain will, through the courtesy of the Marconi Company, have an opportunity of inspecting the wireless station at Ongar on July 17th, when an expedition by motor coaches starting from Kingsway has been arranged.

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SWEDEN'S NEW BROADCASTING STATION

A new station has been opened in Karlsborg, which will broadcast on a wavelength of 1,350 metres. It is intended that this shall be a high-power station with an aerial output of 25 kw.

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WIRELESS TELEGRAPHY ACT.

The Select Committee on the Expiring Laws Continuance Act recommends that the Wireless Telegraphy Act, 1904, should be continued unless superseded by other legislation during this session.

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PROPOSED ARCTIC EXPEDITION BY GERMAN AIRSHIP.

Subject to permission from the Ambassador's Conference, a new German airship will attempt to reach the North Pole in 1927. It is expected that scientists from Norway, England, and America will also take part in the expedition. A powerful wireless installation will enable the airship to keep in constant touch with the rest of the world during its flight.

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THE "SUPER-HET" EXPLAINED.

In the course of the weekly talk of the R.S.G.B. broadcast from 2LO on the 6th inst., Capt. L. F. Plugge described the supersonic heterodyne receiver as "a baby broadcasting station of your own" on which "you listen to your own broadcasting station, as it were, causing the distant station to modulate your own transmission."

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RADIO JARGON.

A French contemporary makes a laudable attempt to explain some of the abbreviations with which aspiring amateurs in this country and the United States often disfigure their QSL cards. This takes the form of three columns, headed respectively "*Abréviation*," "*Traduction Anglaise*," and "*Traduction Française*," from which we select the following examples:—O.M., Old Man, Monsieur (*mon vieux*); O.W., Old Woman, Madame; H.I., Radio laugh, Rire.

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WIRELESS IN BELGIUM.

The Secretary of the Réseau Belge points out an error in the short article on "Broadcasting in Belgium" appearing in our issue of June 17th, and states that "Radio Club Belge" should read "Réseau Belge," an association of Belgian amateurs working on short waves, with Mr. Deloor as general manager and Mr. Haumont as traffic manager. He also kindly undertakes to forward QSL cards for Belgian amateurs addressed to him at 11, Rue du Congrès, Brussels.

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BELGIAN AMATEURS WORK WITH BRAZIL.

The first two-way communication between amateurs in Belgium and Brazil was accomplished on June 17th, when 1HB (Belgium), working on 35 metres, got into touch with K2 (Brazil), working on 32 metres. Communication was maintained for an hour, and cordial greetings exchanged. Later in the month 1AF (Belgium) also succeeded in working with the same Brazilian station.

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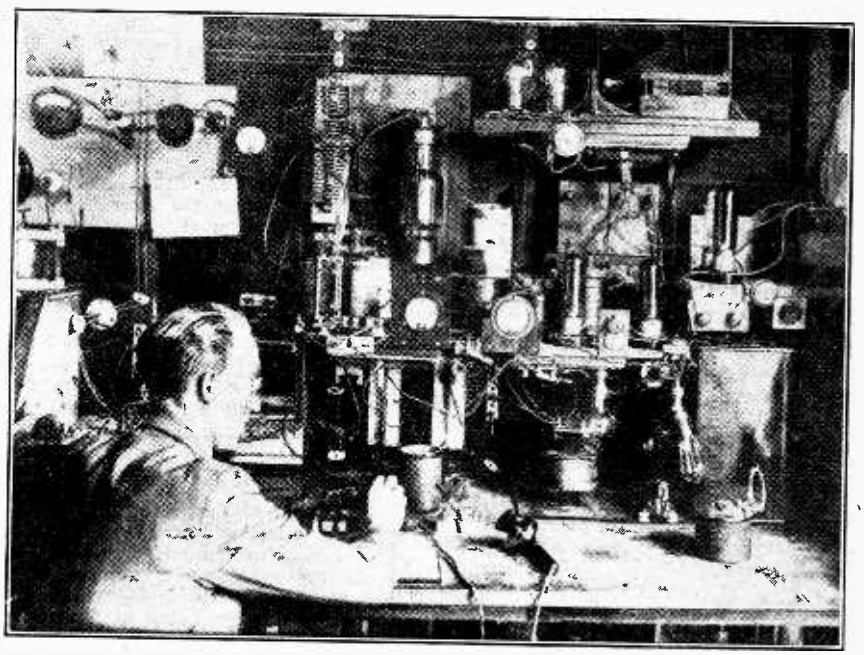
S.B. ON FOUR DIFFERENT WAVE-LENGTHS.

The General Electric Co. of Schenectady, New York, is now transmitting



AUSTRALIAN 2CM. An interesting photograph, which has just reached this country, showing Mr. C. D. Maclurcan, of short-wave fame, operating his transmitter. Mr. Maclurcan established two-way communication in daylight with Mr. E. J. Simmonds (G2OD) on a wavelength of 20 metres.

the evening programme on four different wavelengths, viz., WGY on 380 metres, 2XAF on 38 metres, 2XK on 109 metres, and 2XAH on 1,660 metres. Listeners are asked to report on the comparative quality, fading and strength of signals on the different wavelengths.

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ADDRESSES OF AMATEURS WANTED.

We have received communications for forwarding to the owners of 5DH and 6RM, whose present addresses we have been unable to trace, and will be greatly obliged if the owners will write to us.

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SURREY STATION HEARD IN INDIA.

2DX, owned by Mr. W. K. Alford, of Camberley, Surrey, was heard at Sialkot in the Punjab on June 7th, while transmitting with an inside aerial consisting of 10ft. of copper tape stretched across the ceiling of the room and using a counterpoise of insulated wire running across the floor. The wavelength was 42 metres, and the indicated aerial current 1.7 amperes.

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AN INSPIRATIONAL STUDIO.

The divergence in broadcasting practice in the United States as compared with that of this country is strongly exemplified in the design of the new Zenith Broadcasting Studio in Chicago. In place of concentrating on the acoustic properties, the surroundings and fittings are designed to excite the artistic emotions of the performers. Grilled openings and gateways look out into a scenic garden. A fountain plays in the centre surrounded by ornamental stone seats. To encourage still further the artistic temperament, an electrician, carefully concealed, controls the lighting, producing the effects of sunrise, sunset and moonlight to accord with the nature of the music or recitations transmitted. We presume that bizarre and pantomime effects are also employed to infuse the necessary gusto into comic turns.

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LIFEBOATS AND WIRELESS.

The new Board of Trade regulations under the Life Saving Appliance Rules of 1924, make it compulsory for foreign-going vessels carrying more than ten lifeboats to have one equipped for wireless telegraphy. If the number of lifeboats exceeds fifteen, the one so equipped must be a motor boat, and if the number exceeds twenty there must be two such motor boats.

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½-kw LIFEBOAT SET.

To comply with the above regulation, the Marconi Co. has designed a compact set with a quenched spark transmitter driven by a small petrol plant which can also, if required, supply power for a small searchlight.

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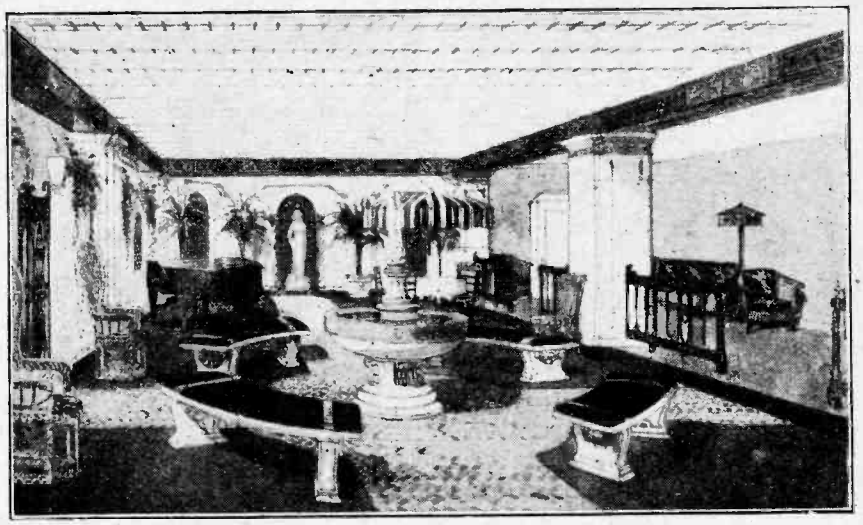
YACHT RACE REPORTED BY AMATEURS.

The progress of the yacht race from San Francisco to Tahiti was followed by amateur stations in California. Mr. F. J. Quement (6NX), of San José, maintained nightly communication with the yacht "Idalia," which was transmitting on 40 metres and using 200 watts, and another station received messages from the "Eloise," using only 50 watts.



A TEMPERAMENTAL STUDIO. The latest practice in the art of broadcasting, as carried out in America, aims at creating a studio "atmosphere" to coincide with the emotions of the artist. The above drawing depicts the new Zenith studio in Chicago.

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INTERNATIONAL PREFIXES.

The vexed question of regularising the International Prefixes, which was discussed at the International Congress of Wireless Amateurs last April, still remains unsettled. The sub-committee recommended the following allotment of letters :—

A—Australia.
B—Belgium.
C and D—Canada and Newfoundland
E—Spain.
F—France.
G—Great Britain.
H—Switzerland.
I—Italy.
J—Japan.
K—Germany.
L—Luxembourg.
N—Holland.
O—South Africa.
P—Portugal.
Q—Cuba.
R—Russia.
S—Scandinavia.
T—Poland.
U—U.S.A.
W—Hungary.
X—Mobile and Ship stations.
Y—India.
Z—New Zealand.

For Central and South America the committee proposed the letter A, followed by the initial letter of the country, thus : Argentine, AA : Panama, AP.

It is hoped that this or some similar method will soon be universally adopted.

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BROADCAST WAVELENGTHS.

The Technical Committee of the International Union of Radiotelephony states that nearly ninety European broadcasting stations are now working on wavelengths between 200 and 600 metres, and that forty more are projected. A new plan of wavelengths has been prepared, and a considerable change may be expected in September, when experiments will be made to determine the practicability of this scheme.

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PROGRESS AT DORCHESTER.

Mr. E. W. Mathias, the Marconi engineer in charge of the construction of the new beam wireless station at Dorchester for communication "Via Marconi" with North and South America, in the course of an address before the Dorchester Rotary Club on July 7th, said that there were at present five masts at Dorchester in a straight line at right angles to the direction in which communication was to be established, namely, New York. The masts were 277ft. high, each having a cross arm at the top measuring 90ft. from end to end. The weight of the masts was approximately 45 tons each, including the cross arm, the stays being half a ton each, and 180 cubic yards of concrete were used for each of the masts. A further line of masts would probably be erected in the near future at the Dorchester Station on the south of the Bridport Road in order to establish a further service with South America.

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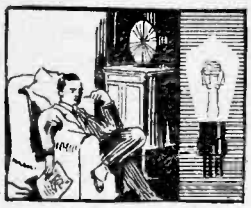
WGY SHORT WAVE HEARD AT CHELMSFORD.

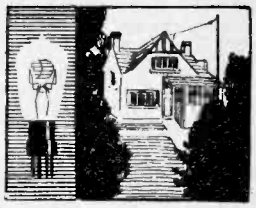
A correspondent from Chelmsford reports having plainly heard WGY, the General Electric Company's station at Schenectady, New York, early on the morning of Sunday, July 5th, transmitting on 40 metres. Speeches by the Secretary for State, General Pershing, and others were being relayed from 28 stations throughout America, and our correspondent could hear the various speakers called up and their conversation before being announced.

YOUR CALL SIGN?

For the benefit of others as well as themselves, amateur transmitters, both in Britain and in other countries of the world, are earnestly requested to co-operate in the preparation of reliable information regarding call-signs, etc., by forwarding full particulars of their stations to the Editor of "The Wireless World," 139-140, Fleet Street, London, E.C 4.



NEWS FROM THE CLUBS:



Secretaries of Local Clubs are invited to send in for publication club news of general interest. All photographs published will be paid for.

Lewisham and Bellingham Radio Society.

At the meeting held on June 23rd an attractive programme was arranged for the remainder of the summer session. Exhibitions and short non-technical lectures will be given on the first and third meetings of the month; other meetings will be informal and for instruction in Morse. Forthcoming events :—August 4th, demonstration of coils, coil-winding, and variometer construction. On August 18th an interesting competition will be held for "crystal sets working loud-speakers."

Meetings are held on Tuesdays at 8.15 pm., at headquarters, 136, Bromley Road, S.E.6. Hon. Sec., Mr. C. E. Tynam, 62, Ringstead Road, Catford, S.E.6.

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Stockport Wireless Society.

The annual picnic of the Society on Sunday, June 21st, proved most enjoyable. After lunch at Bakewell the party drove to Rowsley and Chatsworth Park, where a portable set was put into operation and the inaugural ceremony of the presentation of the Manchester and Salford lifeboat heard on the loud-speaker.

Hon. Sec., Mr. L. A. Gill.

Worthing Wireless Society.

The first meeting of this Society was held at Grice's Restaurant on Tuesday, June 16th, when the officers and committee were elected. Mr. H. Heatly was elected Chairman, Mr. H. P. Trounce Hon. Treasurer, Mr. H. N. R. Moore Hon. Secretary, and Mr. E. H. Paulton Asst. Secretary, with Messrs. J. H. Pratt, R. N. Oates, A. E. Coleman, R. Paine, E. Snell, R. Woods, and H. F. Cocking as members of the committee.

The headquarters of the Society will be at Grice's Restaurant.

A technical committee was formed to advise and help members in the management of their sets, and the rules of the Society were discussed and adopted.

Hon. Sec., Mr. H. N. R. Moore, 18, Cortis Avenue, Broadwater, Worthing.

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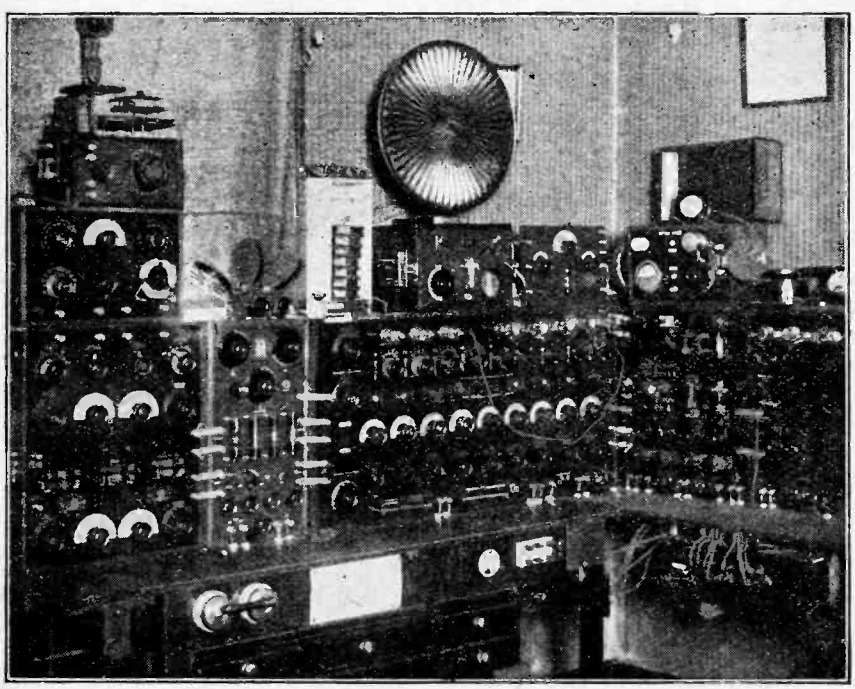
Golder's Green and Hendon Radio Society.

The summer programme of the Society as at present arranged is :—Field day, July 19th; informal meetings, July 15th, August 5th and 19th, Sept. 2nd and 16th.

Hon. Sec., W. J. T. Crewe, 111, Princes Park Avenue, N.W.11.



A NORTHERN AMATEUR'S EQUIPMENT. An imposing array of receiving apparatus owned by Mr. D. G. Bird, of South Shields.

North Middlesex Wireless Club.

The club's meeting at Shaftesbury Hall on June 24th was devoted to the solution of difficulties met with by the members in their experimenting.

No final decision was arrived at as to whether it was preferable to join the ends of a twin wire aerial usually left open, although some state a distinct increase in signal strength is gained thereby.

It was suggested that in order to obtain smooth control of reaction so necessary for long-distance and weak stations the reaction coil should be tuned and the voltage on the filament and plate of the detector valve very carefully adjusted.

When working a reflex set, so popular nowadays, it was clearly shown that to get best results a plate voltage of at least 100 volts was necessary to prevent the valve from rectifying.

Hon. Sec., Mr. H. A. Green.

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Ipswich and District Radio Society.

The spring session of the Ipswich and District Radio Society was brought to a close on Monday, June 22nd, when a good muster of members assembled at headquarters, 55, Fonnereau Road, Ipswich, for the final lecture.

Mr. A. E. Mould was the speaker, and entertained his audience with an interesting address on two-valve reflex circuits, at the same time substantiating his opinions with very plausible loud-speaker results. Mr. R. Stanley Lewis followed with a further demonstration with a receiver, embodying dual magnification principles, and here again results were good.

Following the discussion, it was decided that the club should be closed down for the summer months, opening again in September, when the monthly meetings will be continued.

The Hon. Secretary (Mr. H. E. Barbrook) announced that provided the necessary permission from the Air Ministry was forthcoming, it was hoped to arrange visits to Pulham Air Station and Chelmsford at an early date.

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Bristol and District Radio Society.

The general meeting of the Society was held at the Club Room on Friday, July 10th, when the reports on short wave reception sent in by members were read and discussed.

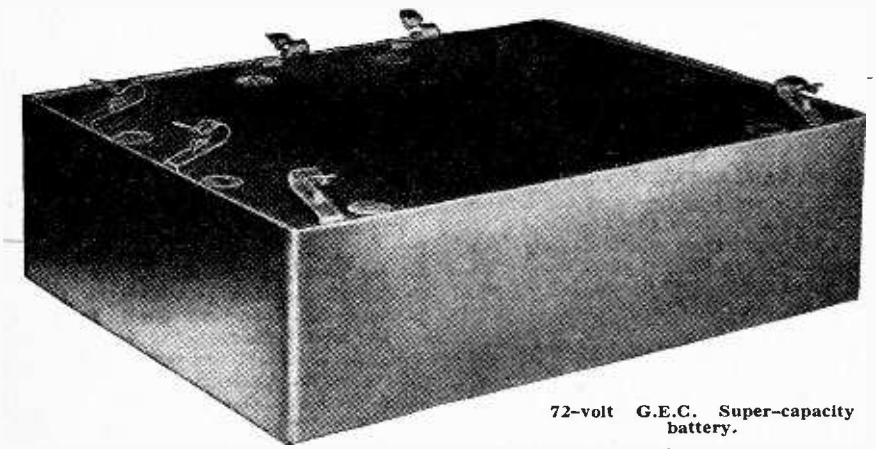
The subject for research during July and August is "Oscillating Crystals for Transmission and Reception."

Hon. Sec. (Transmitters' Section), Mr. A. N. Porter, 17, St. John's Road, Clifton.

A Review of the Latest Products of the Manufacturers.

G.E.C. SUPER CAPACITY BATTERIES.

The satisfactory operation of multi-valve receivers depends to a considerable extent upon the efficiency and capacity of the high-tension batteries, particularly when power valves are used for loud-speaker reproduction. The small type of H.T. battery has its limitations, and is quite unsuitable for operating under the above conditions.



72-volt G.E.C. Super-capacity battery.

The General Electric Co., Ltd., have recently introduced a new range of Gecophone Super Capacity H.T. batteries composed of large cell units suitable for giving discharge currents up to 50 ma. and capable of delivering 5 ma. for a period of 800 hours.

The new batteries are standardised in three sizes, viz., 18, 36, and 72 volts, with suitable tappings. The price is moderate in view of the large capacity. The battery is recommended for the operation of multi-valve receiving sets where it is not convenient to use accumulator high tension batteries.

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MODIFICATIONS TO GAMBRELL TUNING COILS.

Modifications have been made in the inductance values of several of the tuning coils manufactured by Messrs. Gambrell Bros. The series formerly bore identification letters from A to J, with two special coils a and $a/2$ for short-wave work. Two additional coils have now been introduced in the series marked B, and E, while the inductance values of the remaining coils have been slightly modified. The new coils bear the mark "N" in order that they may not be confused with the coils formerly manufactured. Gambrell coils, owing to their particular construction, give a wide range when tuned with a given condenser, and with the addition of two coils to the series ample overlap is obtained between one coil and the next when the tuning condenser has a maximum value as low as 0.00025 mfds. and provided it has a low minimum capacity.

GEARED THREE COIL HOLDER.

A new coil holder of unusual interest is now being manufactured by Messrs. A. G. Parker & Co., Ltd., Bisley Works, Whittall Street, Birmingham, and is marketed under the name of the Hale-Parker Three Coil Holder.

Details of construction can be seen in the accompanying illustration, though it might be explained that while the rack and pinion action is propelling a holder away from the fixed centre coil holder, a rotating action is obtained by means of a cam so that when the end of the framework is reached the moving coil has turned through 90° and is at a position of zero coupling.

From a mechanical standpoint this coil holder is a thoroughly good job, and although taking up considerable space its use is warranted for critical adjustment.

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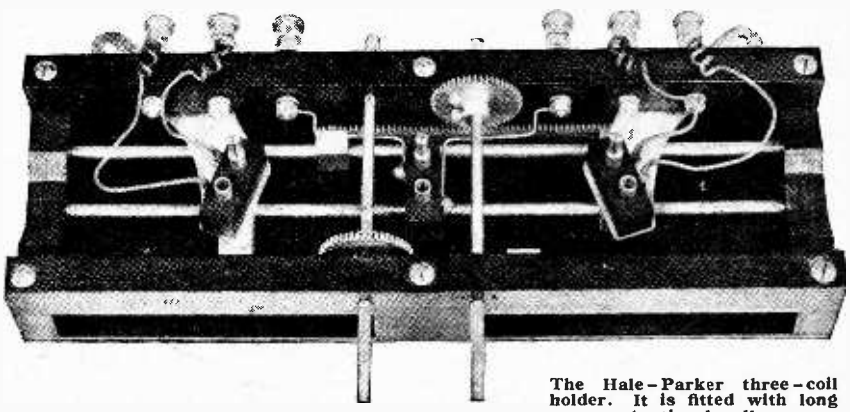
ACCUMULATOR SERVICE.

Judging from our own correspondence, amateurs will warmly welcome any scheme which will provide an efficient service for the maintenance and recharging of their accumulators, and a reliable staff of experts who will undertake minor repairs to their sets.

We understand from the Radio Service Co., Kentish Town, N.W.5, that they will undertake an accumulator service of their own or their customers' batteries and keep a staff of qualified engineers to remedy minor defects at a moderate inclusive fee or estimate for complete overhauls and reconstruction.



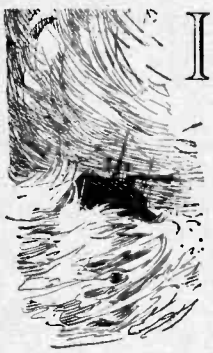
The Hale-Parker three-coil holder. It is fitted with long extension handles.

ADVENTURES IN A HURRICANE.

A Wireless Operator's Story of a Lucky Escape.

By VICTOR A. K. SMITH.

An ungarnished account of one of those rare instances in which wireless is powerless to save.



IT was at six o'clock in the evening that the steamer *Maid of Corfu* weighed anchor and left Bahia Blanca, Argentine. We were homeward bound with a cargo of over 5,000 tons of grain, and most of the crew were looking forward to a thirty days' fine trip to Manchester.

The pilot was "dropped" at 8 p.m., the weather then being very fine but a little cold.

All hands soon settled down to their monotonous routine, myself assuming watch in the wireless cabin. At midnight the wind increased in velocity, and at daybreak a strong southerly gale was blowing.

All hatches were examined and everything loose was made secure to the decks. Seas were then being "shipped" fore and aft when, an hour before noon (April 1st), a tremendous sea broke over the forecastle head carrying with it wire drums, ventilators, railings, steam pipes, etc., all of which with the heavy sea fell on No. 1 hatch and "stoved" it in. The ship, which was then doing three knots, was immediately stopped and all hands called to repair the damage before the hold became flooded, which would have been very serious. It was a difficult task, but eventually the hatches were again secured and covers renewed. By noon a hurricane was blowing from the south with tremendous force, as if bent on breaking the ship to pieces, and gradually we were being driven shorewards.

A Crash in the Darkness.

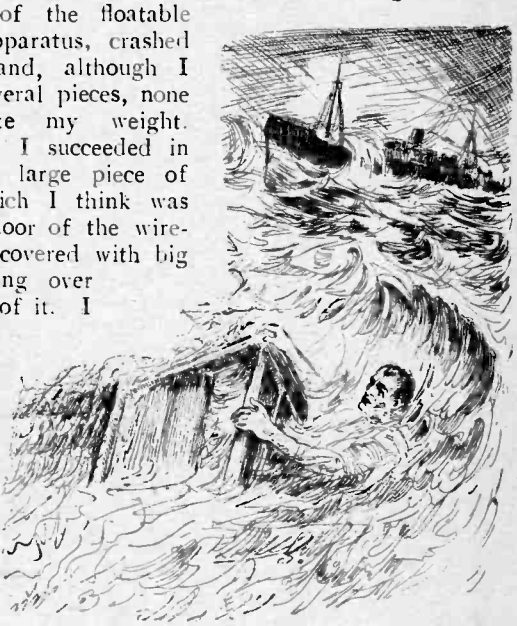
The wireless cabin and my sleeping room were made of thick wood with an iron girder foundation, but they overlapped the after-well deck and occupied one of the most exposed positions on board.

After a period of two hours' wireless watch I came "off duty" at 2.15 p.m., and entered my sleeping cabin. Having another hour and threequarters to spend before my next watch commenced, I started to read a book, wedging myself between the chest of drawers and my bunk to prevent the heavy rolling of the ship from throwing me over. Suddenly, with a terrific crash of timber, the room was plunged into darkness. Instinctively throwing up my arms to protect my eyes, I felt myself being jammed between the bunk and chest of drawers and violently thrown about.

Imagining I was now in the well deck inside the wrecked cabin, I lowered my arms and felt about for some firm hold, but to my horror I began to sink. My sleeping room, together with the wireless cabin, had been completely washed overboard, and I was sinking through the bottom.

On opening my eyes I found I was well under the water entangled in the wreckage. I struggled desperately to free myself, and endeavoured to rise, but was struck a violent blow on the head by loose wreckage or wireless gear. Fortunately I retained consciousness, but my plight was increased when my left foot became jammed in some heavy object which began to pull me under. I now became frantically alarmed, and made an unsuccessful attempt to unlace my boot; fortunately, I was able by an extreme effort to break away the toe cap and thus wrench it completely off. This lucky wrench probably saved my life, and I came to the surface. By this time I was choking badly, having swallowed a good deal of sea-water.

Although I can swim a little, it was, nevertheless, impossible to do so in such mountainous seas, but I managed to scramble on to some of the wreckage of the wireless cabin, and, while floating on the crest of a wave, I sighted the ship, only to perceive that she, too, was at the mercy of the elements. Would she survive? I began to give up hope, for I could see no sign of life; in fact, I could only see the upper deck works of the ship above water. Had my plight been observed by my shipmates? A welcome lifebuoy which came floating towards me, however, dispelled my fears, and I knew that an attempt to rescue me was being made. I realised it would be impossible to lower a lifeboat, as the stormy seas would smash it up before it could enter the water. I waved to the ship, which was several hundred yards away, but in so doing I loosened my hold, and was swept off the wreckage by the mountainous seas. The wreckage, including most of the floatable wireless apparatus, crashed into me, and, although I grasped several pieces, none would take my weight. Eventually, I succeeded in reaching a large piece of timber, which I think was the thick door of the wireless room, covered with big nails sticking over most parts of it. I then found that the lifebuoy was quite close, and by a superhuman effort I succeeded in grabbing it, only to find



Adventures in a Hurricane.—

that the life-line was missing. Meanwhile the steamer was coming astern, and I could see some of the crew waving to me.

I then caught sight of the chief, second, and third officers fighting their way to get to the after part of the ship. At one minute they would be completely under the waves that swept the well deck, hanging for their lives on to any firm support; the next minute they would renew their endeavours to reach the "poop." At length they succeeded.

By the skilful seamanship of Capt. G. L. Clive, the vessel was manœuvred so as to enable Third Officer P. Clissold to throw another lifebuoy—this time quite close to me—which I succeeded in grabbing. The ship was then getting closer, and I could plainly see Chief Officer F. C. Brooks, who made signs for me to get into the lifebuoy. I was loath to leave go of the wreckage, but, knowing the officers were doing their utmost to save me, I got into the buoy.

As I was being pulled towards the ship I turned three complete somersaults in the water, but grimly held on. The engines were still going astern, and I thought I would be caught by the propeller. The suction was gradually drawing me through the buoy. I shouted to the officers to stop the engines, but the ship was in capable hands, and the propeller stopped immediately after I shouted.

The ship was still rolling and plunging heavily, and I was frightened of the poop crashing into me; in fact, it did come within a foot of my head, when I was suddenly heaved out of the sea, and willing hands of the officers and sailors pulled me aboard.

The first words that greeted me were from Second Officer A. Flack, who said, "Lucky fellow, no more work for you to do this trip!"

I was bleeding from numerous cuts, and as it was impossible to take me across the sea-swept decks, I was taken to the carpenter's quarters in the poop, and after a good rub down put to bed.

When my room was washed overboard, it struck the port rigging of the main mast, causing the starboard rigging to break, and it looked as if the mast would break each time the ship gave a heavy roll, but, fortunately, it held out.

At 6 p.m. the same day the heavy seas smashed some of the steering rods. All hands were again called to do necessary repairs. The hand steering gear was then put into operation, but the heavy seas smashed it completely. Steering was then tried by steam winches, using very thick wire rope, but it was hopeless. The enormous seas smashed the deck fittings away, and the only way out of the trouble was to renew some of the steering rod, a very difficult task in the circumstances. The steamer was then beam on to the seas, and the captain steered the ship only by skilful and exemplary seamanship.

Just after 8 p.m. an enormous wave carried away the port lifeboat and bent the thick iron davits, and also smashed the starboard lifeboat.

Dawn found the battered and weather-stained ship still fighting against the hurricane with no steering gear. At noon the wind decreased slightly, and the same evening the steam steering gear was put into action after being out of operation for twenty-four hours.

The following day we had fine weather, and on Friday, April 4th, we managed to reach Montevideo, Uruguay, where necessary renewals and repairs took place.

Two steamers, a British and an Italian, were driven ashore during the hurricane, and both became totally lost, although they were not loaded with cargo, but, fortunately, all lives were saved, according to reports received at Montevideo. We also saw three other steamers put into Montevideo for repairs as a result of the hurricane.

I must record my deep appreciation of the British officers and sailors who bravely risked their lives to save mine. Their heroic conduct will never be effaced from my memory. I am proud to have sailed with such splendid men.

BROADCASTING AND LIBEL.

SOME time ago the B.B.C. made an announcement that Mr. Cyril Tolley, the British amateur golfer, had been divorced in America. This was later found to be a misstatement, for, as Mr. Cyril Tolley informed the B.B.C., he was not married and was in Birmingham at the time the announcement was broadcast. Whereupon the B.B.C. corrected their announcement, and explained the mistake: apparently the Mr. Tolley in question was a Canadian golfer, Mr. Cyril William Tolley. In this case the B.B.C.'s explanation was accepted, but what would happen if someone demanded his legal rights in a case like this?

Apparently the B.B.C. would be liable to an action for slander only, and not libel, as would have been the case if the report were issued in a newspaper. There are several differences between slander and libel, which make it less unpleasant to be sued for the former than the latter. Although the British public use the words indiscriminately, slander is mere spoken words, while libel has to be published in some permanent form, such as printing or portraiture. In addition, the man who has been slandered has to prove that damage has been done if he is going to succeed in his action, but in the case of libel no special damage need be proved, libel being actionable in itself.

Thus the B.B.C. have a great advantage over the daily newspapers, in that they cannot be sued for libel, but only for slander, although, of course, there are no decided cases on the subject.

The B.B.C. have also occasion to pat their backs on another point. Libel is a criminal offence, while slander is only civil, so we shall never see the directors of the B.B.C. sitting in a criminal court, although nothing would please some people more than this spectacle when the usual Saturday night's weather report is being broadcasted.

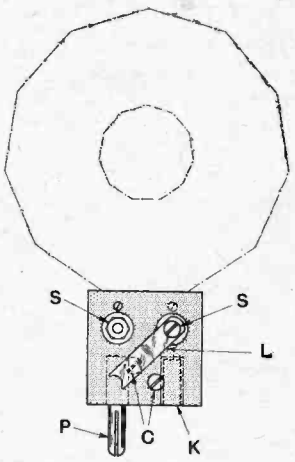
H. A. S.

RECENT INVENTIONS

Brain Waves of the Wireless Engineer.

Reversing the Reaction Coil. (No. 227,624).

A scheme is described in British Patent No. 227,624 by A. P. Portway for reversing the direction of the current through a plug-in coil. The device may be applied either to the coil holder or to



Reaction reversing switch incorporated in coil plug. (No. 227,624.)

the base of the coil. Referring to the illustration, which shows the invention as applied to the coil itself, it will be seen that the ends of the winding are taken to two screws S provided with nuts, which pass right through the insulated part of the plug. This is provided with the usual pin and socket P and K. Both the pin and the socket are electrically connected to two studs C, which also pass right through the insulated part of the plug. The two screws each carry a lever L, mounted respectively on each side of the coil plug. It will be seen that the lever L acts as an ordinary contact arm for a two-way switch, and connects the end of the winding to the pin or to the socket by virtue of its position in relation to the two contacts C. Thus it will be seen that having inserted the coil in the holder the direction of the current through the coil can be varied merely by movement of the two levers. In another modification the coil can be short-circuited.

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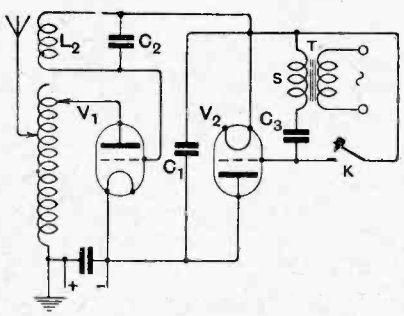
Keying Transmitters. (No. 224,574).

As soon as the experimenter uses more than a few watts for his transmitter he is almost invariably troubled by the problem of keying the output. A rather interesting method is described in British Patent No. 224,574 by R. I. Wells, H. L. Crowther and N. F. S. Hecht. The system makes use of an "inverted valve" in the grid circuit of the oscillator. Referring to the accompanying illustration, it will be seen that an ordinary valve generator is shown with series feed and a tuned grid circuit. Thus, the grid circuit L_2 C_2 is connected to earth through the usual grid condenser C_1, which instead of being shunted by a grid leak, is shunted by an "inverted valve" V_2. By an inverted valve, of course, is meant one in which the anode is connected to earth, and the filament is at high potential. Across the grid and filament of the grid leak valve is the secondary S of a transformer T, the secondary being connected through a small condenser C_3. Let us now examine the manner in which the scheme functions. Let us assume that the filament of the grid leak valve V_2 is cold. Owing to the condenser C_1 the grid of



Keying a C.W. transmitter through a three-electrode valve. (No. 224,574.)

the main valve would become isolated, and would assume a large negative charge, and the valve would cease to function. On heating the filament of the valve V_2 the electronic stream which would be produced between the filament and the anode would act as a path of fairly low resistance across the grid condenser C_1, and accordingly render the valve V_1 operative. Across the grid and filament circuit of this valve we have the secondary S of the transformer connected through a small condenser. This transformer is now supplied with alternating current and an alternating voltage will therefore be impressed between the grid and the filament of the valve V_2. A rectifying effect will obviously occur, and again, as there is no grid leak to this valve, its grid will accumulate a negative charge and cut off the electronic stream between the filament and the anode. This in turn will then cause the main grid condenser C_1 to charge up and cut off the supply to the oscillator. Across the grid and filament of the valve V_2, however, is the manipulating key K, which on closing short-circuits the secondary of the transformer through the condenser C_3. The grid of the valve V_2 then becomes discharged, the electronic stream between the grid and the filament is maintained once more, which in turn provides a leak for the condenser C and again renders the oscillator operative. In this way it will be seen that it is possible to control the output of a comparatively high power valve by means of a small key through the medium of a small valve.

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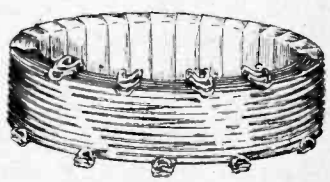
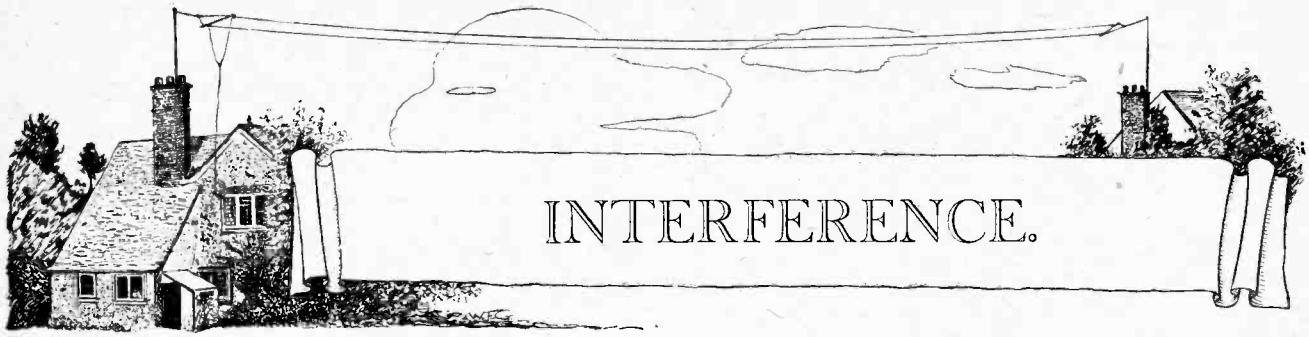
A Multi-layer Coil. (No. 227,967).

A rather peculiar form of coil winding is described in British Patent No. 227,967 by S. J. Williams. The patent refers to the type of plug-in coil which consists of a number of layers separated by cross-wise windings, in which loops are formed at each side and bent back over the edge of the coil, such as is shown in the accompanying illustration. A feature of the invention is that the cross windings are wound in such a manner that the current flowing through them passes in the opposite direction to that flowing in the main part of the coil. The specification states that decided improvement is obtained by winding the coil in this manner, but it is rather difficult to see why this should be so. Of course, the



Appearance of finished coil wound on the system described in British Patent No. 227,967.

electrical constants of the coil would be entirely altered by adopting this method of winding, and it would be interesting to compare two coils, one wound in this manner, and one wound in the normal way.



INTERFERENCE.

Artifices and their Functions in Reducing Disturbances.

By N. W. McLACHLAN, D.Sc., M.I.E.E., F.Inst.P.

A NUMBER of artifices have been catalogued in Part I.[1] which may assist in breaking down the onslaught of interfering noises. It is well to know the theoretical grounds for employing any specific means, and these will be discussed in this section. Broadly speaking, there are two main methods of attack, namely :—

(1) Directional reception.
(2) Selective circuital reception.

Directional Reception.

This method is so well known that it hardly needs any comment. Advantage is taken of the fact that interference is often directional, and so long as it is not too intense, and there is a sufficiently large angular distance between the incoming signals it is desired to receive and those which are to be excluded, a frame aerial or a combination of frame and vertical aerial giving a heart-shaped curve is likely to be beneficial. The latter combination of aerials is used because it reduces the polar receiving diagram of the aerial. There are other methods of reducing the polar diagram of a receiving system, *e.g.*, spaced frames, in which two frame aerials are spaced a certain distance apart. This is roughly comparable—not analogous—to two cascaded circuits, because the resultant diagram gives enhanced selectivity. If one could cascade several frames, say four, in the same manner as tuned circuits, the two circles representing the horizontal median section of the polar diagram of reception would resolve themselves into very sharp ovals, as shown in Fig. 1. The gain in directional selectivity would be comparable with the use of a reflector. There is also the long horizontal wire or wave aerial used in the American Transoceanic Station at Long Island. The latter class of aerial is from one to two wavelengths in extent, and points to the transmitting station. It is the most directive of the three, *i.e.*, its polar [2] diagram has the smallest surface and is the most suitable, due to its sharpness. Whichever type of aerial is employed, it is of importance that the diagram should be approximately equi-directional for a narrow band of frequencies on each side of the central one.

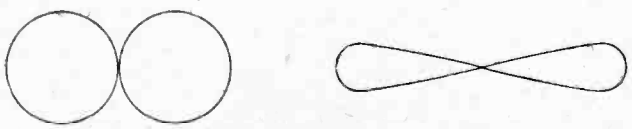


Fig. 1.—Polar receiving diagram of aerials.

It has already been shown that an impulse, or, in fact, any interfering signal, can be resolved into a frequency spectrum. Now consider an atmospheric and its accompanying spectrum, and let it impulse some form of directional antenna. If the polar diagram is identical for a wide band of frequencies on either side of the central, the attenuation of these, due to the atmospherics, will be greater than if the diagram were less peaked and had an increased area on each side of the central frequency. Moreover, with a fixed diagram the interference will be less than with one which increased in the manner indicated, and it would be still less if the diagram decreased; but this would not have to be sufficient to exclude the side frequencies of modulation.

To take a case in point—when a tuned frame is combined with a tuned open aerial, it is possible, by adjusting the relative signal strengths on the two aerials and by correctly phasing the oscillations in each, to obtain a heart-shape diagram. This diagram, however, only holds for the central frequency, since the phases of the oscillations are incorrect on other frequencies unless the selectivity curves of the two circuits are identical. Such a condition is not usually found in practice. In any case, correct phasing is difficult to maintain with tuned aerials. Moreover, non-tuned [3] frame and open aerials, when combined as in the Bellini-Tosi system, yield a fairly constant directional diagram over a wide

[1] *The Wireless World*, February 25th, 1925, page 79.

[2] In general one is apt to forget that the polar diagram of an aerial is in reality a *surface* and not merely a plane curve. Signals come in from all directions in space, *i.e.*, vertically, horizontally, and intermediately. Thus for non-horizontally propagated interference an aerial blind in all but a small portion of the horizontal plane would be a boon. As an example of reception of an inclined wave front, take any horizontal aerial. An e.m.f. is induced in it because the front of the wave is inclined to the vertical, *i.e.*, the wave can be considered to have a horizontal and a vertical component.

[3] Sometimes erroneously termed "aperiodic." In general both open and frame components can oscillate, but the frequencies exceed that of the signals to be received.

Interference.—
range of frequencies on each side of the central. When directional reception is viewed in its proper perspective, it is really a form of selectivity. With a single tuned frame aerial the selective directional effect is due to the relative phases of the oscillations in the opposite sides (for reception in a horizontal plane). When the frame is abeam of the incoming waves, the phases in the two legs are identical, but opposed so far as resultant e.m.f. is concerned. As the frame is rotated, the phases differ, due to one side being further from the transmitter than the other. Moreover, when any directional system is analysed, it will be found to function on a "phasing" basis.

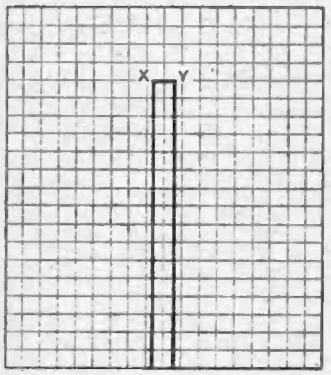


Fig. 2A.—Hypothetical or ideal band pass filter or selectivity curve with vertical sides. The attenuation of frequencies outside the band XY is complete, *i.e.*, the filter is then "blind."

Selective or Filter Circuits.

The second anti-interference artifice, which is usually termed "Selectivity," is more accurately described as "Tuned Circuit Selectivity," because it invokes the aid of one or more tuned circuits. The fundamental action may be regarded as one of phasing or timing, for with any tuned circuit the oscillations build up according to their relation to the resonance frequency. The physical viewpoint, however, is different from that which pertains in directional reception.

In order to avoid repetition, the reader is referred to a former article on selectivity.[1] The selectivity curve of any tuned circuit has the well-known shape exhibited in Fig. 2B. The steepness of the sides depends upon the ratio L/R, where L is the inductance of the coil, and R the effective resistance of the whole circuit, including the condenser The greater this factor for any given circuit, the steeper are the sides. Moreover, a low resistance circuit has a greater degree of selectivity than one of high resistance, and, furthermore, the current and, therefore, the voltage across the condenser (this usually being applied to the input valve) is also greater, thereby entailing enhanced signal strength. This is shown clearly by curve 2 of Fig. 2B.

Now it is important to notice that these curves are obtained experimentally by using a series of steady or progressive continuous waves of different frequencies, which induce equal voltages. Moreover, the experimental conditions to ensure the response at any given frequency are absolutely fixed or constant. At the instant when the circuit is suddenly confronted by an oscillatory magnetic field, the current is zero, but gradually grows until it attains a steady value. It is this *latter* simple condition under which the curve of Fig. 2A is secured.

When we penetrate the paths of practice, this sublime state of affairs seldom obtains, and it is imperative to have auxiliary information and a modified view of the matter to cope with the problem. This is treated in a subsequent section of this article.

When one or more tuned circuits are loosely coupled in cascade, and precautions taken to prevent interaction, capacity coupling and energy supply from extraneous sources,[2] there is a pronounced gain in selectivity. Using arbitrary units for the current or voltage, thus avoiding a knowledge of the coupling, the method of arriving at the selectivity curve for two circuits is to find the curve for each and take the product of corresponding ordinates. Thus, for two identical circuits the ordinates of the curve are squared; for three circuits they are cubed, and so on. This is approximately correct for high-frequency circuits of 20,000 cycles upwards, but for note filters it requires some modification to cope with frequency effect and the possibility of tighter coupling.

The curves of Fig. 3B have been inserted to illustrate the gain in selectivity of two and of three identical tuned circuits over one alone.

The other mode of securing selectivity is to use reaction, but it ought to be stable. It often happens that where reaction is involved, the theory of high selectivity and practical results clash. This is due probably to the reactive valve not being worked on the straight part of its characteristic, or to the grid voltage making too large an excursion. It is well to remember that for optimum operation a reactive valve must not be unduly excited, and grid current must be avoided. Also, artifices which are introduced to produce stability sometimes detract from selectivity. The effect of reaction, as is well known, is to cause an equivalent decrease in the high-frequency

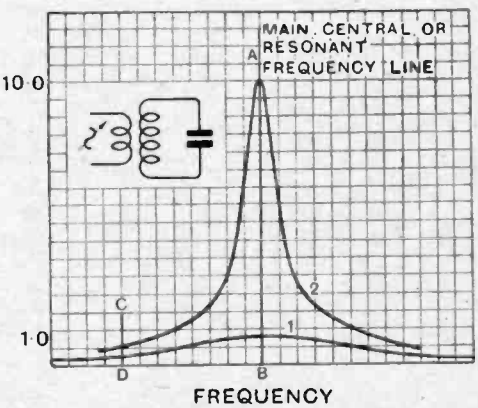


Fig. 2B.—Diagram showing resonance curves of a single tuned circuit. Condensers and inductance valves equal for curves 1 and 2, and the resistance of circuit 1 is ten times that of circuit 2. This can be accomplished by using reaction, or by specially designed coils using standard wire for medium and high frequencies and large solid wire at very high frequencies. For equal induced voltages the selectivity at A compared with that at C is AB/CD.

resistance of the circuit to which it is applied.[3] In other words, with a coil of given inductance, the value L/R may be made relatively large, and the selectivity curve metamorphosed from (1) to (2) of Fig. 2B.

[1] *Experimental Wireless*, p. 394, April, 1924.

[2] See *The Wireless World*, November 12th, 1924.

[3] See *Experimental Wireless*, p. 623, August, 1924, for an article on low resistance aerials.

Interference.—

The question now arises, What is the advantage of filter circuits when selectivity of the same order can be secured by the aid of reaction using a valve? In the first place, reaction *alone*, although allowing us to dispense with several circuits and yielding a greater signal strength, is not always stable, owing to the customary fluctuations in batteries, valves, etc., and, in the second place, the selectivity curve has a sharper peak, and the sides are not quite so nearly vertical as those of a good filter circuit. Moreover, reaction cuts out a greater proportion of the side frequencies of telegraphic and telephonic modulation than a filter circuit. This may be regarded as the commercial aspect of the matter, where reliability counts for so much.

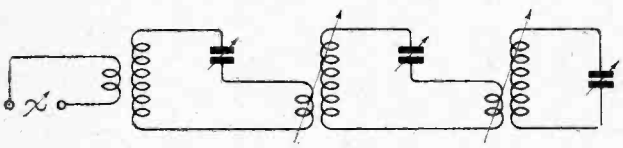


Fig. 3A.—Three circuits in cascade.

From the amateur's viewpoint there is no necessity for extreme precautions, and thus reaction is useful, provided it is handled carefully. Bearing this in mind, a combination reaction-filter circuit has been given in Fig. 5.[1] This was fully discussed in the appropriate place, but there is one point which must be emphasised. For optimum action against interference with a filter circuit, or more particularly one using reaction, the receiver must be absolutely in tune with the carrier wave of the station it is intended to receive.

Relation Between Intensity and Interference.

The action of any form of filter circuit on steady continuous waves is suggested by curve 3 of Fig. 3B. For equal induced voltages in the first unit the currents in the last unit, and, therefore, the voltages applied to the amplifier, are shown by this curve. The further the interfering frequency from the central, the greater is the attenuation. The interference can, therefore, be more intense when its frequency is well removed from the central. For any given frequency in the neighbourhood of the central, say, 5 per cent. away, the intensity of the interference has a limit beyond which it upsets reception at the central frequency. To take a concrete example, suppose the central frequency is 150,000 cycles ($\lambda =$ 2,000 M.) and the interfering frequency 148,000 cycles (taken to be of steady strength), and that the selectivity curve of the receiver shows the ratio of the signal strength (for equal induced voltages in the aerial) at 150,000 to that at 148,000 is 1/100. Assume, for comfortable reception, that the voltage on the amplifier due to the interference must not exceed one-fifth that of the signal (this gives a ratio of 1/25 for the energy in the phones). The maximum permissible voltage on the aerial due to the interference is $100 \times \frac{1}{5} = 20$ times that of the desired signal. An increase beyond this ratio will produce unpleasant audition. In this respect it is well to be clear regarding the mode of reception. With phones an interfering signal may be made inaudible by reducing the amplification, although this is often impossible if a reasonable loudness is to be obtained. With loud-speakers the same argument is applicable, but the interference may be more pronounced for strong signals than with phones, because the magnification has to be adequate to overrule extraneous noises.

The use of screens, astatic coils, and the like has been discussed already.[2] In this connection it should be stated that coils will only function astatically provided the external field in which they are placed is uniform, non-rotating, and is directionally in a plane parallel to both axes and at 90° to that containing the coils.

The latter stipulation avoids spaced frame effect, in which the oncoming waves meet one coil before the other, thus giving misphasing and a resultant e.m.f. in the circuit. Where the behaviour of the field is ubiquitous, it is sometimes possible to get a better balance by moving one coil with reference to the other (in some plane). Care must, of course, be taken that the coil leads do not upset the astaticism of the combination, also coupling to adjacent or surrounding metal screens. It must not be forgotten that any piece of metal acts as an untuned receiver; currents are induced in it which react on unprotected or misplaced coils.

Elimination of Electrostatic Coupling.

Trouble is sometimes experienced by electrostatic coupling between the circuits and the aerial. This is avoided by screening boxes, but it can be reduced perceptibly by an earthed copper gauze or metal gratings placed in appropriate places. One of the best examples is found in the Marconi direction-finding coupling transformer placed between the aerial and the tuned circuit. This is a tightly coupled unit with a piece of earthed copper foil inserted between the windings, the foil being

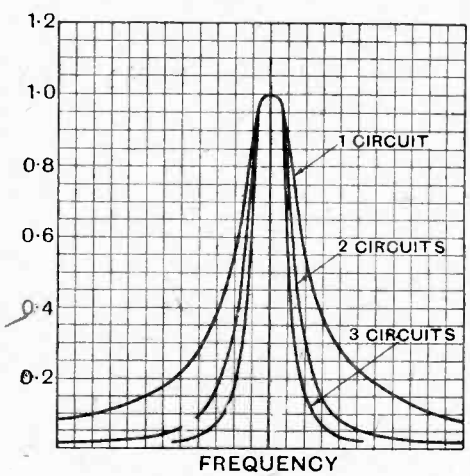


Fig. 3B.—Selectivity curve of one, two and three tuned circuits in cascade with loose coupling. The coupling is entirely electromagnetic, and the energy is supplied solely by this means. The current amplitude at the central or main frequency has been held constant at 1·0 unit. No allowance is made numerically for loose coupling and circuital losses. This only affects the absolute magnitude of the current.

[1] *The Wireless World*, April 29th, 1925, page 393.

[2] *The Wireless World*, November 12th, 1924.

Interference.—
insulated *at the joint to avoid short-circuiting*. In this way the capacity coupling is almost nil, whilst the electromagnetic coupling is not seriously impaired.[1]

Rejector Circuits.

Another form of filter arrangement is found in the rejector circuit. For effective operation a rejector circuit must be *of very low resistance*. Hence few turns of large solid or stranded wire, according as the waves are short or long, and a large condenser with negligible loss will yield the best results. A valve with reaction coupling may be used to reduce the resistance of the rejector, but this does not usually conduce to a stable circuit. The selectivity curve of a rejector circuit *alone* is akin to that of a tuned circuit inverted. Here, again, the steepness of the sides which governs the "cut off" frequencies is controlled by the ratio L/R. The rejector when used alone attenuates the central frequency and those on either side in a degree controlled by the steepness of the sides and the width of the curve. The overall selectivity curve of the system depends upon the rejector and the way in which the remainder of the circuit is constituted.

Superheterodyne.

This device is really a combination high-frequency filter at two different frequencies, and its action will be best understood by a concrete instance. Let the initial frequency be 700,000, the beat frequency 100,000, and the width of the side frequencies on telephony from 690,000 to 710,000 cycles. Then at beat frequency, if the telephony is to be undistorted, the width of the side frequencies will still be 20,000 cycles, *i.e.*, from 90,000 to 110,000 cycles. Consider now the frequency band on each wavelength. At 700,000 cycles the band is 3 per cent., whereas at 100,000 cycles it is 20 per cent. At the latter frequency, if a tuned anode or other like circuit were used, the tuning would have to be extremely flat, which would result in little or no amplification. Furthermore, the selectivity gain of the beat frequency circuit would be zero. In practice, when selectivity is desired, the beat circuit would have a frequency band of, say, 5 per eent. This would mean that all note frequencies from 0 to 2,500 cycles would not be appreciably attenuated, whereas those in excess of 2,500 would suffer attenuation which increased with the frequency. Moreover, the quality of the telephony would be impaired. In telegraphy, however, a wide frequency band is unnecessary, so that the selectivity of both aerial and beat circuits could be high, thereby giving a considerable overall selectivity.

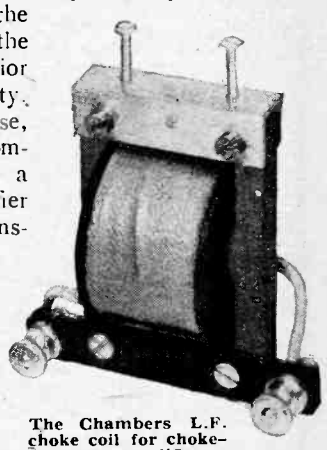
Owing to amplification at three different frequencies, and the introduction of tuned circuits at each stage for telegraphy, a superheterodyne enables enormous amplification and high selectivity to be secured. For telephony there are only two tuned stages (two high frequencies), and a balance must be struck between selectivity and quality. Since the selectivity can be secured —although not quite so readily—by reaction and filter circuits at the aerial frequency, the main feature of a superheterodyne for telephony is the increase of amplification without seriously impairing the stability. A good example is to be found, say, in using a frame aerial at a distance of thirty miles from a broadcasting station. At Chelmsford, for instance, it is quite easy to get fairly good quality loud-speaker strength from 2LO on a frame 12in. square, using a superheterodyne set with five valves, namely, 1 H.F. amplifier with tuned anode, 1 detector with anode tuned to beat frequency, 1 detector and a double-note magnifier. If a throw-back or reflex is made of the beat note or the audio frequency on the first valve, four valves will serve. For simplicity, a local oscillator is used, although the oscillation can be generated by the first valve by including the necessary tuned circuits. By using reaction between the anodes of the second and third valves the amplification can be increased considerably, loud-speaker strength being secured with four valves; but the quality is appalling. Since the term loud-speaker strength is an ambiguous one, it may be stated that a grid bias of twenty volts was required on the power valve to avoid grid current.

(*To be continued.*)

[1] In sereening boxes the electromagnetic coupling is reduced, largely due to the continuity of the screen.

CHOKE COUPLING FOR L.F. AMPLIFIERS.

THE choke-capacity method of coupling low-frequency amplifiers has apparently not received the attention it deserves, for a direct comparison between a choke-capacity and a transformer coupled amplifier will in many instances prove that the results obtainable from the former amplifier are superior from the point of quality. This superiority is, of course, most marked when the comparison is made between a well-designed choke amplifier and one employing transformers of a type not specially designed for the valves employed—unfortunately, a far too common occurrence.

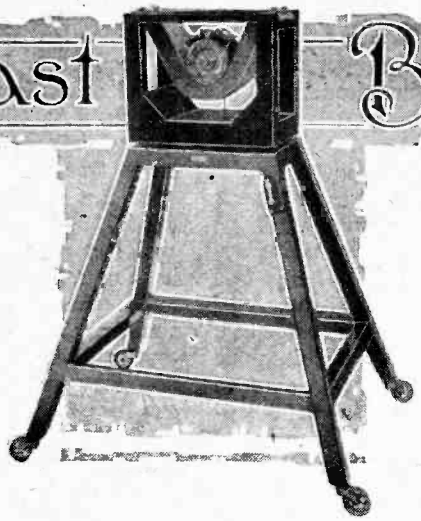


The Chambers L.F. choke coil for choke-capacity amplifiers.

When employing one of the newer types of transformer, the advantage of the choke method is not so marked, and it is then that the possible amount of amplification becomes important. Under the best conditions—that is, with a valve of high amplification factor such as the DE5*b* (20) and a good choke—it is possible to get an amplification of about 17 per stage. With a DE5 valve and a good transformer, a reasonable degree of amplification is about 30. When a poor transformer is used, however, the amplification per stage will be less than this, and it is then that the choke-capacity coupling offers the advantage of purity with strength.

A number of chokes are available on the market: one is illustrated here, and is supplied by F. J. Chambers. This instrument is reasonable in price and suitable for use in choke-capacity amplifiers of all descriptions.

Broadcast Brevities



SAVOY HILL TOPICALITIES.

Power of Main Stations.

Further interest has been aroused in the development policy of the B.B.C. by a report that some of the relay stations are to be raised to main station status. The report can be dismissed as outside the realms of practicability at the moment. The position may be summed up as follows :—

Eighty per cent. of the population of the United Kingdom is now within crystal range of one or other of the services of the B.B.C. The aim is to increase that figure to 100 per cent. The most feasible way in which this may be accomplished is by increasing the power of certain main stations. That step, however, cannot be taken without the authority of the Post Office, but before the time is considered opportune for approaching that department it is necessary to ascertain whether the manufacturers would be in a position to cater for any sudden and largely-increased demand for apparatus. Preliminary action has been taken, but the scheme does not contemplate alterations in any of the existing relay stations, nor are additional relay stations likely to be erected.

oooo

Continental Stations.

A new aspect of the question is, of course, created by the possible raising of the power of Continental stations to 10 kilowatts. Immediately there is any indication of foreign background being introduced into British programmes the British authorities will, it is expected, take whatever steps necessary to protect the interests of British listeners. There are several ways in which this may legitimately be done, but it is thought that the Geneva Bureau, working through the International Congress, will find a platform for the settlement of the difficulties which are threatened by the sudden burst of activity on the part of several of the Continental broadcasting authorities.

oooo

The Cat Broadcaster.

The cat tribe has made its *début* before the microphone. During the reading of the second news bulletin the other evening the studio window was left open as the weather was rather sultry, and the announcer was sailing along placidly with his news announcements when a terrific din was set up by prolonged caterwauling from an adjacent yard. Thus the cat who sang to the British Isles is more famous than he knows, but his fame would have been short-lived if the announcer could have interrupted the animal's "harmonics."

FORTHCOMING EVENTS.

Sunday, July 19th.

LONDON.—3.30 p.m., First performance by the 2LO String Orchestra.

BIRMINGHAM.—3.30 p.m., Chamber Concert.

Monday, July 20th.

BIRMINGHAM.—10.30 p.m., Interlude Protein : "The Valley of Enchantment."

NEWCASTLE.—8 p.m., Concert relayed from the Royal Infirmary.

Tuesday, July 21st.

5XX.—8 p.m., Symphony Concert : The Royal Albert Hall Orchestra, conducted by Sir Landon Ronald.

ALL STATIONS (except 5XX).—8 p.m., Shakespeare.

Wednesday, July 22nd.

CARDIFF.—8 p.m., The Spirit of Adventure—in Bristol and Bath.

MANCHESTER.—8 p.m., A "High Speed" Programme.

Thursday, July 23rd.

ABERDEEN.—8 p.m., Gems from Opera and Violin Solos.

BELFAST.—9 p.m., "Among the Heather"—Scottish Songs and Airs.

Friday, July 24th.

LONDON.—3.30 p.m., Opening of the Mary Sumner House by H.R.H. Princess Mary Viscountess Lascelles.

BOURNEMOUTH.—8 p.m., The Comic Opera, "Falka" (Chassaigne).

Saturday, July 25th.

BIRMINGHAM.—9 p.m., Scenes from Great Comedies.

ABERDEEN.—8 p.m., The Opera, "Carmen" (Bizet), Acts I. and II.

Wireless Maintenance Men.

Complaints have frequently been heard from listeners in certain localities that defects have a nasty habit of developing in their receiving sets at the most inopportune moments, and the owners are forced to scour the district to find an expert who will come along at short notice to execute repairs. The resultant workmanship is said sometimes to be far from satisfactory, and the money expended has been wasted. The time for the creation of a body of expert maintenance men, acting under the *ægis* of a responsible authority, seems therefore to be vital. Such organisations as the Post Office and the Automobile Association provide expert maintenance men upon whom a telephone user or a motorist can rely, and similar facilities should be made available for the wireless listener. It is a promising field for some body of radio manufacturers.

oooo

Outside *v.* Inside Broadcasts.

Many listeners appear to prefer outside broadcasts to studio transmissions, but, on the other hand, a strong body of opinion is believed to exist opposed to increasing the number of outside transmissions. Broadcasts of a certain character, where the question of acoustics plays an important part, undoubtedly result in improved reception when relayed from outside halls, while special broadcasts necessarily take place at the actual scene of the event.

oooo

A Permanent Public Hall.

Conditions are frequently more favourable for broadcasting from the properly appointed studio, and the results are more definite. Nevertheless, it is probable that the B.B.C. may later have permanently at its disposal an outside hall from which two or three concents could be given weekly instead of from the studio, and in that case an audience might be admitted, not as a regular custom but at intervals; in any case there would be no intention of exploiting this method of broadcasting to the detriment of other forms of entertainment, the providers of which might feel that their box-office receipts were being prejudiced.

oooo

Announcers.

That there is a field for broadcast announcers is admitted, but the fact must not be overlooked that it is at present a very limited field, and that the qualifications required are such as to preclude all those who regard the work of announcing as simplicity itself and requiring nothing

in addition to clear articulation. An idea has got abroad that there is a dearth of announcers, with somewhat alarming results. Applications have poured in to Savoy Hill from all sorts and conditions of people.

oooo

A Question of Courtesy.

One applicant telephoned and was answered by a woman secretary. On hearing a feminine voice the caller said "I don't want to speak to a woman. Put me on to some man or other." He was, of course, disqualified, but as a matter of courtesy he was transferred to a male member of the staff, to whom he remarked, "I believe you want announcers." It was explained to him that although no vacancy actually existed, no doubt if the perfect man came along it might be possible to utilise his services. "Well," said the caller, "I am the perfect man." Of course, all the applicants had a similar opinion.

oooo

Daventry Testing.

The power tests at Daventry started on July 1st, and everything worked according to plan. Transmission tests are not, however, likely to be made at the earliest until July 20th. The engineers consider that a week before the actual opening day will be sufficient to try out the new apparatus.

oooo

Bromley Super Receiver.

An idea exists among a section of wireless experts that the new super receiver station near Bromley (Kent), to which reference has already been made in these columns, is to be used for tracking down interference from foreign stations; that the station is, in fact, intended to police European broadcasting. This point is obviously for the Office International de Radiophonie at Geneva, and it cannot be decided by the broadcasting authority of any one country. One can, however, foresee objections being raised to such a scheme in certain countries, and it is well to state that the present purpose of the station at Bromley will be purely experimental for trying out new ideas of all sorts as affecting transmission, or the invention of new apparatus.

oooo

A Listening Post.

The station will also be used as a listening post for listening to B.B.C. transmissions, not from the point of view of judging quality, as the station is much too far away, but of seeing whether the strength varies, and to ascertain if there is any interference on any particular station in Great Britain.

Still another object is to pick up programmes from America, Paris and Brussels, and to put them on the line to 2LO when it is considered that any particular programme is suitable for rebroadcasting to British listeners.

oooo

Talks by Capt. Frost.

Listeners will remember a series of technical talks given by Captain Frost ("Uncle Jack Frost") at various times. He is preparing two further series—one for adults and the other for children. In the former he will deal with the making of wireless components, covering the field pretty extensively in seven Talks at weekly intervals, commencing early in August. He will treat in the first two of the making of the receiving valve and subsequently with the condenser, battery, accumulator, etc. He aims, by simple explanations and analogies, to assist the listener in a proper understanding of his apparatus.

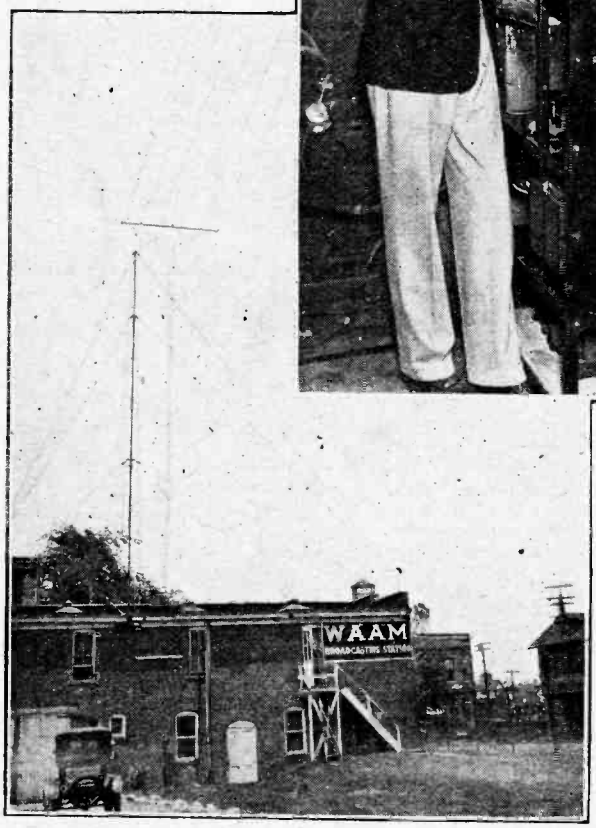
oooo

Making History.

The Easter to July series of broadcast Talks is now coming to an end, and the record of speakers and speeches will, the B.B.C. expects, fill a worthy place in the history of British broadcasting.

LOW POWER BROADCASTING IN AMERICA.

In spite of the large number of broadcasting stations in America it is not, perhaps, generally realised that in most cases the power used is considerably inferior to that employed in this country. The elated announcement has just been made that WAAM, Newark, N.J.

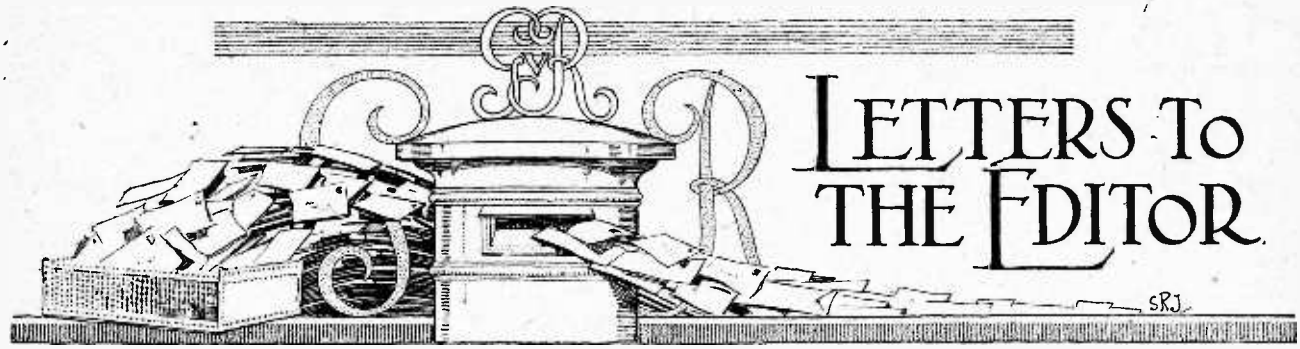


is increasing its power to 500 watts. The new transmitter is seen in the upper photograph, while the lower photograph gives a good impression of the exterior of a typical American low-power broadcasting station. WAAM makes use of a counterpoise, an arrangement which has been found more satisfactory than the original earth system.

oooo

Popular Speakers.

The series was based on the principle of including representative speakers from as many different stations as possible. The directors of all the B.B.C. stations were asked to recommend the best and most popular local speakers for inclusion in a national simultaneous broadcast programme, and seven stations have been represented in the series. Dr. J. J. Simpson, Keeper of Zoology in the National Museum of Wales, gave a series on "Life in the Water." Prof. J. Arthur Thomson, the eminent biologist, broadcast to all stations from Aberdeen a series dealing with wonders of animal life, while other noted authorities contributed talks on a diversity of subjects of general and educational interest.



The Editor does not hold himself responsible for the opinions of his correspondents.

Correspondence should be addressed to the Editor, "The Wireless World," 139-140, Fleet Street, E.C.4, and must be accompanied by the writer's name and address.

THE B.B.C. AND DISTANT RECEPTION.

Sir,—May I crave space in your correspondence columns to put on record an opinion which differs from your own as expressed in your leading article on June 24th? —

There are two classes of broadcast listener whose interests appear to be mutually opposed. There is the normal listener who is content with the local programme and has little or no desire to hear distant stations; and there is the pseudo-experimenter, who has outgrown his wireless parents and wants any station other than the local one. The former class outnumbers the latter by about a thousand to one.

Between these two extremes there are many who really belong to the former but have been deceived by untruthful statements about the capabilities of commercial sets. These have a real grievance, but it is not against the B.B.C.

In addition to these there is the genuine experimenter who welcomes difficult conditions because they alone furnish the need for research and progress. To them there is no merit in doing that which is simple. The more difficult the problem the greater the ultimate victory. These experimenters, amateur and professional, have been responsible for the phenomenal progress of the art.

The noisy minority who affect to despise the local station and who complain that the normal operation of broadcasting in 1925 prevents them from doing what they were able to do in 1924, cannot expect progress to be retarded because they themselves are stationary. They must accommodate themselves to the changed conditions.

It is possible to cut out your local station and work a distant station on a different wavelength if the right apparatus is used, and the right apparatus in Bath is not necessarily right in Peckham, nor does it follow that it will be right in December because it was right in May.

To cut out in this manner is actually a wonderful achievement which is without parallel in any other form of entertainment, and it is not to be expected that it can be done without effort.

I hold no brief for the B.B.C.; in fact, I join issue against them on many points, but in this respect the company is acting wisely in considering the nine hundred and ninety-nine while sympathising with the odd one per thousand. Just as the unscrupulous manufacturer must be called upon to substantiate the claims made on behalf of his sets, so must misguided enthusiasts be called upon to substantiate their claim to be considered "experimenters."

London, S.W. WILLIAM D. OWEN, A.M.I.E.E.

WIRELESS AND VEGETATION.

Sir,—In your issue of June 10th, under the heading of "Unfruitful Wireless," "A Listener" attributes the unfruitfulness of his pear tree to the aerial above it. Now while I do not belong to the fraternity who blame wireless for all our misfortunes, it seems quite logical to me that the unfruitfulness may be due to the presence of the earthed conductor in shielding the tree from the influence of atmospheric potentials which are well known to be beneficial to plant growth.

As it is well known to horticulturists that plants grown under a network of wires raised to a high electrical potential become more fruitful, it is only logic to expect the reverse if the wires are earthed, thereby screening the plants from the natural atmospheric potentials.

Personally, being an experimenter, I should give preference to the aerial, but if "Listener" values his tree I should advise him either to alter his aerial so that it does not come within, say, 50 ft. of the tree, or to arrange it so that it can be lowered to the ground during thundery weather, so that the tree may enjoy the full effects of the elements at such times. The Royal Horticultural Society might well be asked their opinion on this point, as it is very interesting and well worth investigating.

Shepherd's Bush, W.12. T. WHITE.

WIRELESS WISDOM FROM AMERICA.

Sir,—I am afraid no English wireless publication will interest me again, as I have had sent me a lot of American books from which I have acquired such exclusive information that I almost feel competent to start out as a popular circuit expert myself.

How about this? "If you experiment long enough and study long enough you will appreciate the truth of these statements:

"(1) Selectivity is attained at the expense of signal strength.

"(2) Conversely, signal strength is attained at the expense of selectivity.

"(3) Selectivity is roughly proportional to the number of tubes used because of the greater losses introduced by the greater number of tubes.

"(4) Tone quality diminishes with amplification and the number of tubes in a given type of circuit.

"(5) Tone quality decreases as signal strength increases.

"(6) For every circuit there is a simple optimum wavelength at which the best volume is obtained.

"(7) For every circuit there is a single optimum wavelength at which best distance is obtained, not necessarily coinciding with (6).

"(8) Selectivity is only obtained by introducing losses into the circuit to render the undesired station inaudible and the desired one audible.

"(9) Dielectric losses are not of great importance at high radio frequencies (short waves). They are of more importance on long waves or on audio frequency.

"(10) The size of wire is not of great importance so far as the conductivity of H.F. currents is concerned; a large wire is more likely to cause H.F. losses than a small one.

"(11) Squealing and howling circuits are more generally indicative of range or distance getting qualities.

"(12) Radio frequency amplifiers are not at their greatest efficiency when completely neutralised. There must be a tendency to free oscillation" (!!!)

I think these priceless paragraphs are like the cheese which spoke for itself; and I hope you will publish them in order to spread the light upon our English ignorance. Although the "super-het" is an American invention, I am afraid the contributor cannot have tried a really respectable one.

London, N.W.3. G.R.

Readers Desiring to Consult "The Wireless World" Information Dept. should make use of the Coupon to be found in the Advertisement Pages.

Correct Position of Transformer in Reflex Circuits.

WHEN constructing receivers of the reflex type, one of the most important technical points which must be observed is the position of the L.F. transformer in the circuit, since this point often decides whether the receiver will be a success or otherwise, and the electrical disposition of this component, if wrongly made, will so greatly reduce the L.F. efficiency of the receiver that reflexing is no longer worth while. One of the commonest methods of connection is that illustrated on the left-hand side of Fig. 1, but a moment's thought will reveal to us the great inefficiency of connecting the transformer secondary in this particular portion of the grid return lead.

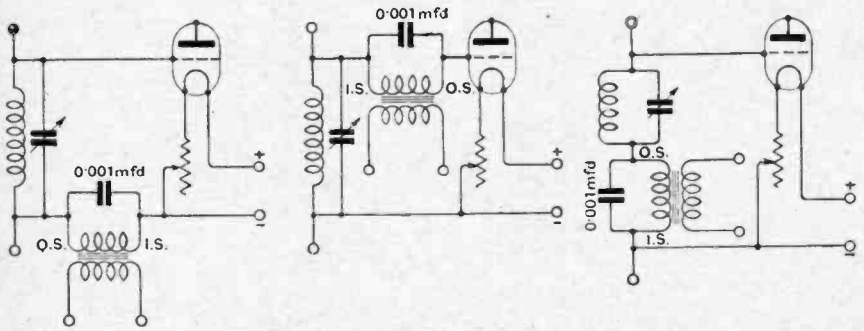


Fig. 1.—Three methods of connecting the intervalve transformer in reflex sets.

It must be remembered that in the case of the ordinary accumulator, or large dry cell used for filament lighting, standing on the table or floor, a considerable capacity exists between this bulky component and the earth, and since one end of the secondary winding is directly connected to the L.T. battery and the other end directly to earth, it is obvious that the effect is the same as if we placed a fixed condenser of large capacity across the transformer secondary terminals. The result of this is, as every experimenter knows, that not only is signal strength very considerably reduced, but the quality of loud-speaker reproduction is marred, the general tone becoming "muffled." In the central diagram of Fig. 1 this difficulty is eliminated in the manner shown, but a fresh disadvantage of equal magnitude is introduced, since it is obvious that a capacity is formed between earth and the windings of the transformer; the result being that not only is the H.F. efficiency of the valve reduced, but distortion arises from the fact that the higher musical frequencies are shunted away to earth through the medium of this capacity.

Undoubtedly the best method of obviating these difficulties in ordinary circumstances is to connect our transformer in accordance with the right-hand diagram of Fig. 1. It will be seen that this method of connection steers a middle course between the disadvantages of the two systems previously considered. The disadvantage of having the high impedance of the secondary winding in the aerial tuning circuit is overcome by shunting the secondary with a condenser of 0.001 mfd. capacity, which acts as a by-pass for the H.F. current, but is not sufficiently large to by-pass impulses at audible frequency. With ordinary types of transformers this condenser should be of the capacity stated, since if it is made smaller it will be found that a loss in the efficiency of the valve as an H.F. amplifier will result, whilst if it is made larger, the signal strength from the point of view of L.F. amplification will suffer, and distortion may be introduced. It is therefore advisable to use a condenser of reputable manufacture in this part of the circuit, whose actual capacity is within a reasonable percentage of its rated capacity.

oooo

Preserving Aerial Efficiency.

A READER whose aerial is 75 feet long, this being the maximum span which space permits him, is contemplating substituting this aerial by an eight-wire "sausage" type of aerial, but he wishes to know first whether the extra efficiency gained will justify the expense and work involved. It is certainly not recommended that our reader make the alteration he suggests. A multi-wire aerial is only to be recommended in those cases where it is not possible to erect a single-wire aerial of greater length than forty or fifty feet, and even then it is recommended that only two wires be used, these being spaced at least four feet apart.

In our reader's particular case, it is probable that a decrease rather than an increase in efficiency would occur, because, owing to the greatly increased value of aerial capacity, it would be necessary to reduce the number of turns in the A.T.I. in order to keep the L.C. value constant. This would result in a reduction of the potential difference set up across the aerial tuning coil by the incoming signals. Since at a distance of twenty miles from a broadcasting station it is necessary that the crystal receiver and aerial system be of maximum efficiency in order to receive signals of reasonable strength, it is recommended that our reader pay special attention to reducing aerial and earth losses. In this respect there are several points to be observed. In the first place it may be said that the average amateur is apt to pay too much attention to insulation and not enough to isolation, and this point is therefore especially commended to our reader's notice, although at the same time the former point must not be neglected. Another important point to remember is that it is always advisable to use some form of copper wire rather than insulated steel wire, a point which observation indicates is not always realised.

If possible use an inverted L type aerial, and make aerial and downlead all one piece. Particular attention should be paid to the use of a good earth, the earth lead being *soldered in several places* to the buried earthing device. Remember also that the advice given above concerning aerial wire applies equally to the earth lead. Finally, avoid all joints, but if unavoidable, they should be *well* soldered.

With regard to the receiver, it is to be recommended that if maximum signal strength is desired, a loose-coupled or auto-coupled circuit be used. It is unfortunate that many amateurs fail to realise that connecting crystal and telephones in shunt across the whole of the A.T.I. is not necessarily productive of the greatest signal strength.

Receiving KDKA on a Conventional "B.B.C." Set.

READERS who are in possession of valve receivers of the ordinary type employing plug-in coils frequently wish to listen for the transmissions of KDKA and other short wave stations, but are debarred by the expense and trouble of constructing a special short wave receiver. At the same time they may have made many unsuccessful attempts to receive these special transmissions by using special basket coils containing only a few turns, but the great difficulty which they encounter is the coupling of the aerial to the grid circuit of the detector valve, since, as is well known, it is advisable that the aerial be *not* directly coupled in the manner usually adopted on the broadcasting wavelength. It is inconvenient to disturb the interior of the set by adding a three-way coilholder, and in many cases readers give up the attempt altogether. This is, however, not at all necessary, and provided that the receiver is already efficient on the broadcasting wavelengths, it is not at all difficult to receive sixty-metre transmissions with very little trouble. First it will be necessary to eliminate the H.F. stage, since the less

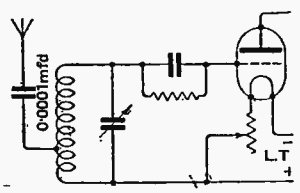


Fig. 2.—Connections of aerial for receiving KDKA.

said about the efficiency of H.F. amplification on sixty metres the better. In the case of a receiver embodying transformer coupled H.F. amplification, this may be done quite simply by following the instructions given in column 2, page 643, of the June 24th issue of this journal.

In the case of a "tuned anode" receiver the procedure is still more simple, since it is only necessary to remove the anode coil and connect together the grid and plate sockets of the H.F. valve by the bridging piece therein described. It will be necessary to construct a basket coil for aerial tuning having the requisite number of turns for the wavelength to be received, and to connect it to the aerial through a 0.0001 mfd. fixed condenser in accordance with Fig. 2. The actual tapping point on the coil is best found by experiment. The reaction coil, which for KDKA may consist of about ten turns, is coupled to the grid coil in the usual manner.

oooo

Correct Transformer Ratio with D.E.Q. Valves.

A READER is constructing a two-valve receiver for the reception of KDKA and the American amateurs working on wavelengths of from 40 to 80 metres, and proposes to use a D.E.Q. type of valve, and seeks our advice concerning the correct ratio of transformer to employ in this set when a valve of the type indicated is used.

Without knowing more definitely the main purposes for which it is proposed to use this receiver, it is not altogether easy to advise on this point. At first sight it would appear that a low ratio transformer should be used, since the detector valve has a very high impedance of the order of 100,000 ohms, and as is known, a low ratio usually indicates a transformer having a fairly high impedance primary. This combination will undoubtedly be productive of the best results from the point of view of high quality of reproduction, and if the main object of the set is to receive the musical programmes from KDKA, it would be better to employ a low ratio transformer. If louder signals are desired, however, or if the receiver is to be used extensively for the reception of amateur morse transmissions, a high ratio transformer having a ratio of say 4 to 1 is preferable.

A Demonstration Set for the Local Station.

A READER wishes to construct a five-valve receiver designed to give maximum volume and purity from a main station thirty miles distant, using an outdoor aerial but incorporating no reaction. It is desired to use resistance coupling for the L.F. stages.

At this distance it is desirable, if reaction is to be eschewed, to incorporate a stage of high-frequency amplification preceding the detector valve. This will make the energy input to the amplifier considerably greater, which is a great advantage, since it will be found that the efficiency of a resistance-coupled amplifier will be greatly enhanced when the input is comparatively large. Sufficient selectivity will be given by the tuned H.F. stage, but in order to still further increase this and at the same time preserve the simplicity of tuning, it is as well to incorporate the so-called aperiodic aerial tuning, and for this purpose one of the plug-in coils which are sold for this purpose may be used in the aerial tuning circuit. The circuit which we illustrate in Fig. 3 will be found extremely suitable. Since we are not making use of reaction, we can increase our L.F. amplification by giving the resistance in the anode circuit of the detector valve a higher value than usual, a value of 100,000 ohms being suitable. We may also use a valve having a high amplification factor for the rectifier, the QX being very suitable for this purpose.

It will be found that with this type of valve anode rectification is obtained by connecting the grid return lead to the negative side of the L.T. battery. Actually it will be found that best results are obtained when the grid is biased negatively by a small battery, but it is advisable to incorporate a potentiometer as shown for critical adjustment. The first L.F. valve may be of the D.E.5B. type, the second L.F. valve being preferably a D.E.5, whilst the final valve may be of the D.E.5.A. type.

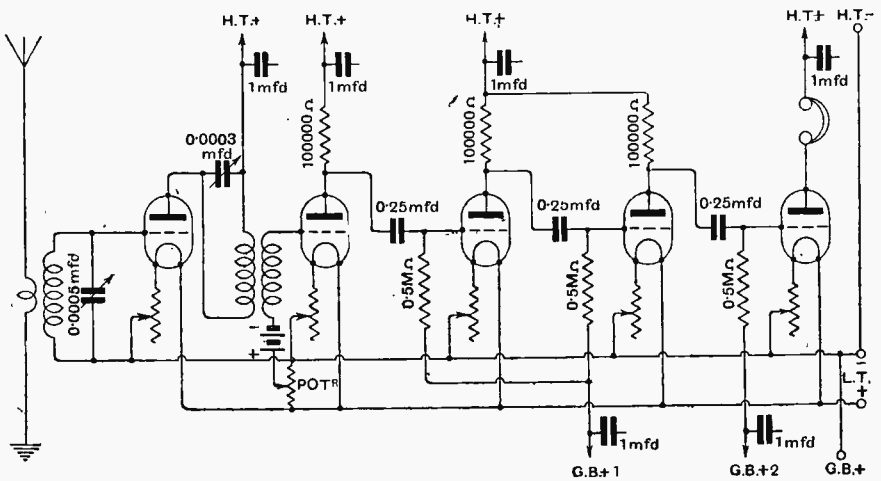


Fig. 3.—A selective loud-speaker circuit for moderate distances.

The Wireless World AND RADIO REVIEW

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MORE MODIFICATIONS IN CONDENSER CONSTRUCTION.

IT would seem that the variable condenser has been singled out by designers of wireless instruments for the purpose of demonstrating their skill, while manufacturers probably feel that they are judged on the merits of this component. As is to be expected with much attention turned to condenser design, modifications have rapidly followed one another, and the condenser is apparently doomed to remain for a while in a transition state of development.

Good Points.

Losses in condensers have been discussed to the full, and no doubt a better understanding of the electrical requirements has been gained, giving rise to modifications, which during the past twelve months have been steadily incorporated. The prospective purchaser of a condenser when scrutinising the instrument looks for such points as plain top bearing, lateral rigidity of the moving plates, low zero capacity, an attractive method of suspension of the fixed plates to give good distribution of the electro-static field with low dielectric loss, a spindle that is at earth potential, good electrical bonding together of the plates, and for general tuning purposes the plates to be true square law shaped.

Capacity and Dial Movement.

The changes in capacity produced by a variable condenser may be: (1) where the dial movement is simply proportional to the capacity: that is, where the capacity variation is linear; (2) where the wavelength ratio to the dial setting is linear; and (3) where the relation of the dial setting to the frequency of the circuit is linear.

Shape of the Plates.

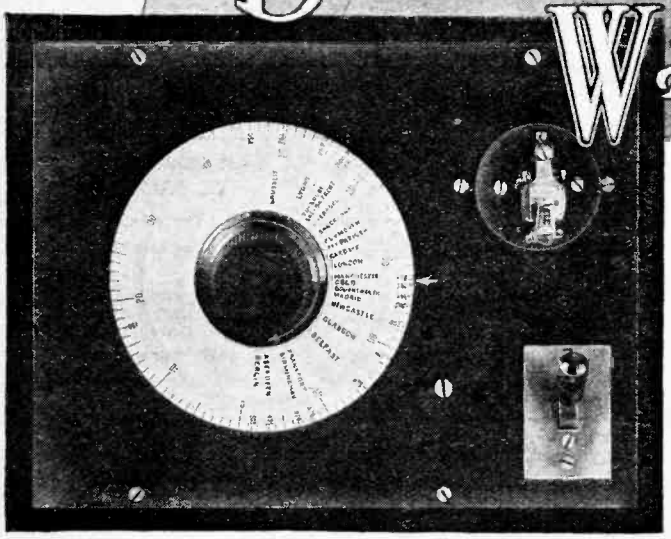
The first type of condenser, having semi-circular plates, when used in a tuned circuit suffers from the disadvantage of a crowding of wavelengths near the zero end of the scale. The second type, with cut-away plates, gives even distribution of wavelengths round the dial, and, although for tuning purposes an improvement on the first type, is not so convenient as a condenser in which a simple ratio exists between frequency and dial setting.

Straight Line Frequency Condensers.

The number of stations which can be operated in a given band of wavelengths is determined by a frequency difference, and the assignment of wavelengths is not made by equal wavelength intervals, but by a specified difference in frequency. It consequently follows, in view of the relationship of wavelength to frequency, that there is still, even with the square law or straight line wavelength condenser a crowding together of stations towards the zero end of the scale. If, therefore, tuning is to be accomplished with equal ease at all settings of the dial, the plates must be shaped to produce a uniform frequency change for dial movement. The actual design, however, may not prove simple.

CONTENTS.

BROADCAST WAVEMETER.



There is little purpose in knowing the wavelengths used by broadcasting stations unless a wavemeter is employed by the listener as a guide to tuning. An accurate wavemeter, capable of sharp tuning, is an essential part of the receiving set. It will not only eliminate a great deal of unnecessary condenser swinging, the principal cause of interference, but will assist in increasing the number of stations heard.

By F. H. HAYNES.

SEARCHING for distant stations without an indication of the wavelength to which the receiving set is being tuned is somewhat futile, and it is surprising to observe how few broadcast listeners equip themselves with an instrument for definitely indicating wavelengths. Even among keen enthusiasts wavemeters seem to be very little used, probably owing to the absence, until recently, of a suitable instrument on the market.

A broadcast listener does, after a while, get some idea of the tuning range of the circuits of his receiver, but owing to the considerable change in wavelength produced by variations of coupling between the tuning inductances only very rough estimates can be made. When various plug-in coils are used for tuning it is impossible to form an accurate estimate of wavelength, and when an endeavour is being made to receive a particular station it is not unusual to see coils being interchanged and condensers swung through the full range of their capacities, truly a surprising state of affairs!

Wavemeter Circuits.

The simplest form of wavemeter consists of a tuning coil bridged with a condenser forming a tuned circuit in which oscillations are set up by means of a buzzer and battery. Such a wavemeter serves its purpose admirably, and is useful for testing that all is in order with a receiving set and for indicating wavelengths with sufficient sharpness of tuning. It has the advantage that it produces a signal whether or not the receiver is in an oscillating condition, and, consequently, changes of reaction coupling which may materially alter the wavelength can be made when tuning to the wavemeter.

Another type of circuit, the heterodyne wavemeter, consists of an oscillating valve with tuned grid coil which possesses the special merit of sharpness of tuning. If the receiver is to oscillate in order to bring in the required transmission, then an accurately calibrated heterodyne wavemeter will indicate the exact setting required and save much condenser swinging.

The heterodyne type of wavemeter does not produce an audible signal on a receiver not capable of oscillating, and for this reason a leaky condenser is often fitted in the grid lead of the wavemeter so that it becomes periodically charged by the electron stream to the grid of the valve and discharged by the leak resistance. This periodic fluctuation of the potential of the grid, which stops the oscillations at intervals depending upon the grid condenser and leak values, produces groups of damped

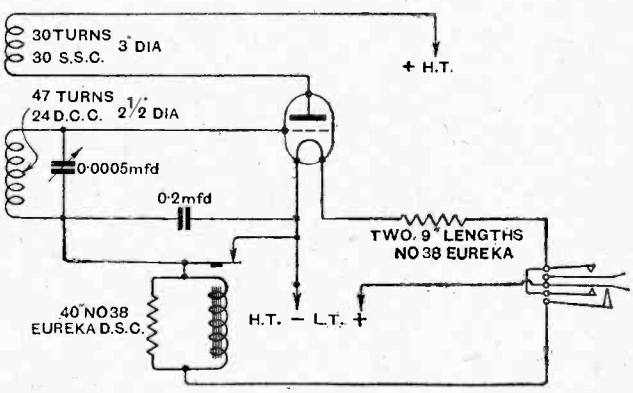


Fig. 1.—By means of a two-way key switch the wavemeter can be operated as a simple heterodyne or a buzzer can be brought into operation to interrupt the circuit and fluctuate the grid potential so that the signals from the wavemeter are audible in the receiver without adjustment to the reaction coupling.

wave trains audible faintly on a non-oscillating detector and at good strength when brought to an oscillating condition. It is not always easy, however, so to regulate the value of the leak resistance that a note of suitable

Broadcast Wavemeter.—

frequency is obtained, though the principal drawback to the method is that complete obliteration of oscillation is produced by the charges acquired by the condenser in the grid circuit. The damping down of the oscillations by this method gives rise to a degree of flatness of tuning which is likely to defeat the object of using a valve at all as an oscillation producer, and a means must be devised which will suitably vary the amplitude of the oscillations without undue damping, and yet sufficiently modulating them to produce an audible note.

A Sharply Tuned Wavemeter.

With this object in view the circuit shown in the accompanying diagram was developed. A buzzer is used to fluctuate the potential of the grid, though at no time is the grid filament connection broken, and the potential changes are not so severe as to produce an excessive degree of flatness of tuning. It will be seen that when the blade of the buzzer is making contact with the screw, that a negative potential is applied to the grid, whilst when the contact breaks, connection is made to the positive of the filament battery through the buzzer winding and its non-inductive shunt. Careful test, however, revealed that by employing a large capacity condenser of the order of 0.2 mfd. across the buzzer contacts and a buzzer working at a high note frequency, that the grid never actually becomes positive in potential with regard to the filament. This is probably due to the voltage drop across the resistance when the condenser is receiving a partial charge in the reverse direction, and to the current flow produced in both the resistance and the condenser by the induced current set up in the buzzer magnet windings.

From the circuit it will be seen that a two-position key is connected in the battery leads.

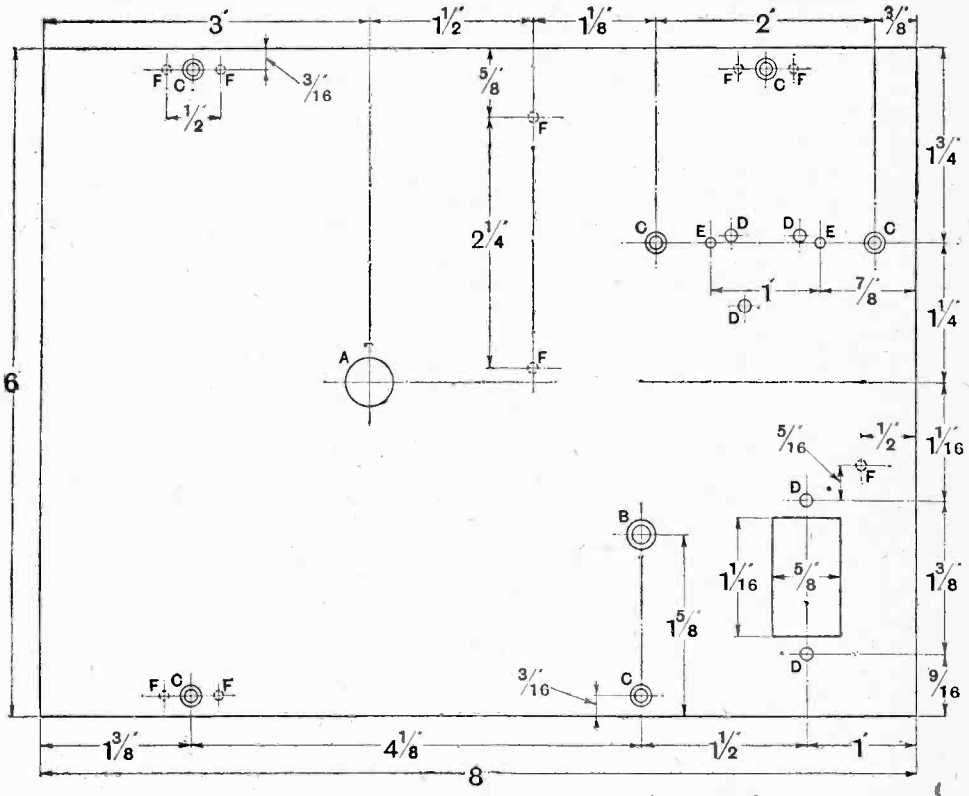


Fig. 2.—The dimensional panel layout. The sizes of holes: A, 7/16in.; B, 5/32in., and countersunk for 4B.A. screws; C, 9/64in., and countersunk for 5B.A screws; D, 9/64in.; E, 3/32 in., and tapped for 6B.A. screws; F, 3/32in. on underside of panel, and tapped for 6B.A. screws.

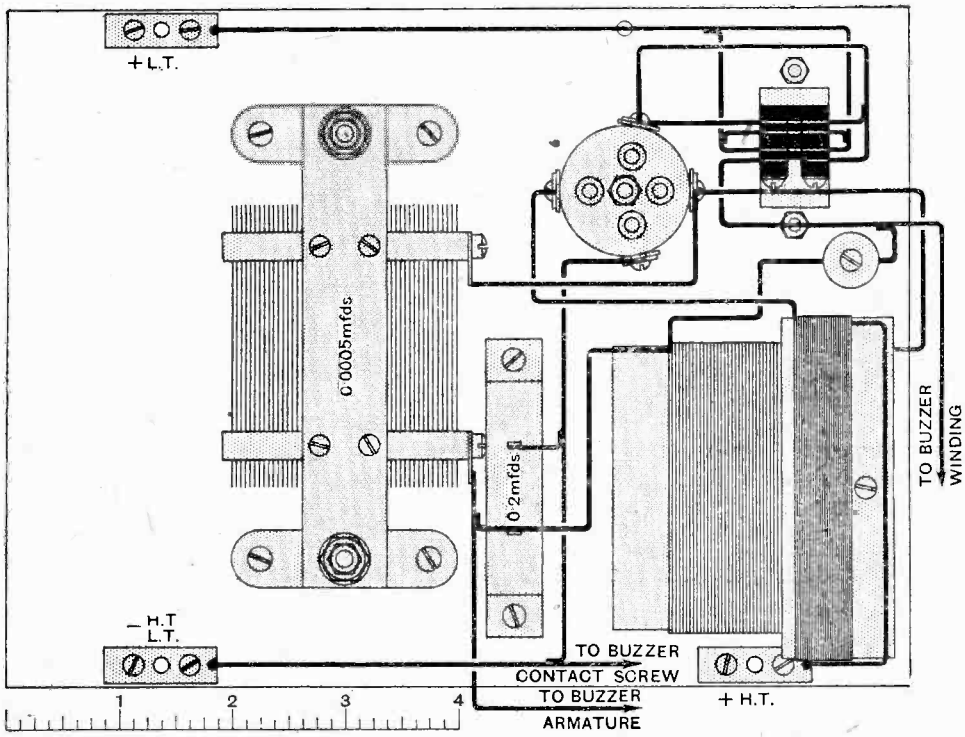


Fig. 3.—Practical wiring diagram, showing to scale relative positions of the component parts.

Broadcast Wavemeter.—

In one position the circuit is a simple heterodyne wavemeter producing very sharp tuning for use with an oscillating receiver and when using the wavemeter for capacity and inductance measurements. The other position gives modulated waves whereby signals are set up in a receiver irrespective of the reaction coupling.

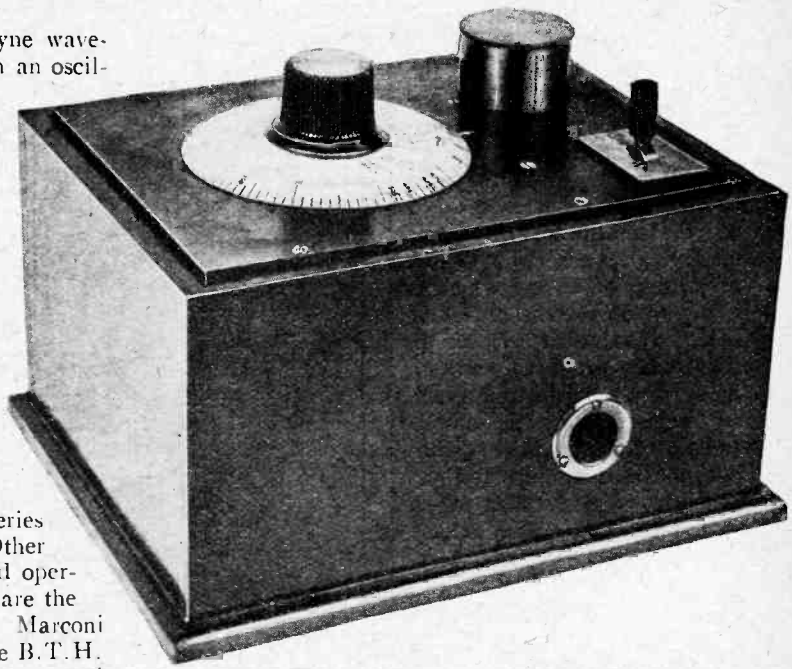


Fig. 5.—The finished instrument. In addition to the valve window a hole in the bottom of the box is useful for viewing the filament of vertical filament type dull emitter valves.

Construction.

The size of the panel and cabinet is determined by the type of valve to be used and the batteries required to operate it. The depth of the box may be kept to a minimum by selecting a valve with a short bulb. The dimensions shown accommodate the Metro Vick D.E.11 and its batteries, consisting of two Siemens type "S" cells connected in parallel for filament heating and operating the buzzer and two Hellesens 9-volt grid batteries connected in series for the plate potential. Other suitable valves, though larger in dimensions and operated from a single cell "Exide" accumulator, are the Mullard D.3 L.F. (double green ring), the Marconi Osram DER, the Ediswan ARDE L.F., and the B.T.H. B.3. These valves have a long life, though to guard against accidents it is advisable if possible, when calibrating the instrument, to obtain a pair of valves so that when replacing one by the other changes are not produced in the wavelength scale.

Great care must be taken in the selection of the tuning condenser, and for better uniformity in the relationship between wavelength and degrees on the dial the square law type is to be recommended. When accurately calibrating a tuned circuit the author, on one occasion, observed a small bend in the wavelength curve which was traceable to the rotation of the "square law" plates moving into the field of the coil, causing a slight drop off its inductance value. A condenser of the type shown in the photograph was therefore adopted to guard against this difficulty, though revolving plate condensers in metal boxes equally well serve the purpose, while the unprotected type must not be set up so that the moving plates move closely into the field of the coils. The condenser shown gives a complete revolution of the dial in moving from minimum to maximum, a desirable feature when actual station settings are to be recorded upon it. The centre knob operates through reduction gear, giving the necessary critical adjustment of tuning of which the instrument is capable. There is inappreciable backlash in the mechanism connecting the dial and moving plates, while neither side of condenser is earth or spindle electrically connected.

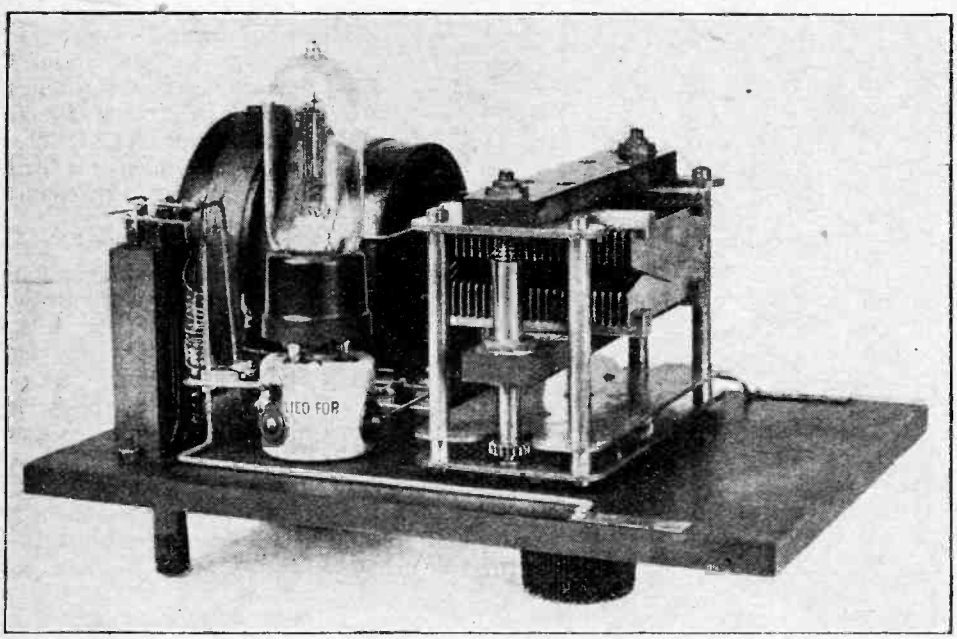


Fig. 4.—Underside view of the finished wavemeter. The space at the end of the panel is occupied by the dry cell batteries attached to the interior of the box, though if a deeper containing box is used a condenser with semi-circular plates can occupy this part of the panel.

The working drawings are self-explanatory as the instrument consists of so few components, and winding data is given in the circuit diagram. For convenience

Broadcast Wavemeter.—

the same gauge wire is used for the buzzer shunt as the fixed filament resistance, which is suitable for the D.E.11 type valve. For the other valves mentioned five 9in. strands of wire will be required. The tuning coils are attached by means of long 6BA screws, and spaced from the panel by means of short pieces of ebonite. A 6BA screw and nut with ebonite spacer holds the two ebonite formers together in addition to making use of one of the screws used for attaching the formers to the panel. A third screw prevents the reaction winding former from rotating, for it is most important that the relative positions of the two coils shall not change or the instrument will lose its calibration. Both coils are wound in the same direction, their connections being as shown in the practical wiring diagram, for oscillations to be set up.

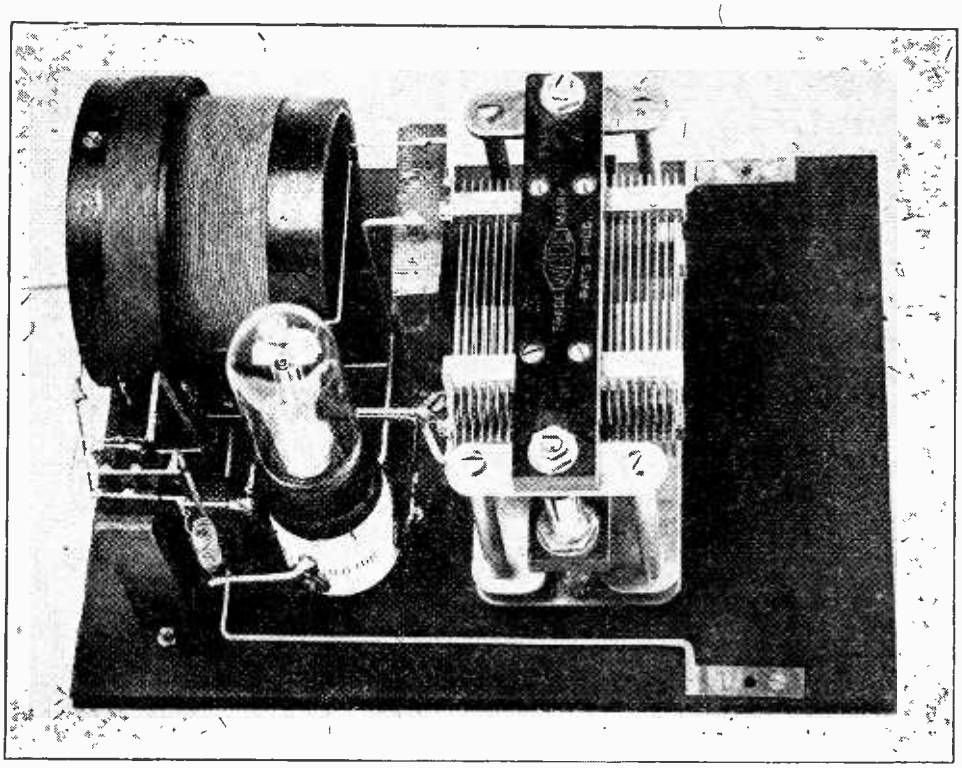


Fig. 6.—Another view of the apparatus on the panel.

In order that the filament may be viewed a $\frac{1}{2}$in. hole should be drilled in the bottom of the box immediately under the pip of the valve in addition, or as an alternative, to the valve window. The buzzer shunt is carried upon a small ebonite former, the wire being doubled before winding to render the coil non-inductive. The filament resistance is connected as a spiral in the lead from the filament to the key. Duplicate leads are shown in the practical wiring diagram to indicate the key contacts which are bridged across.

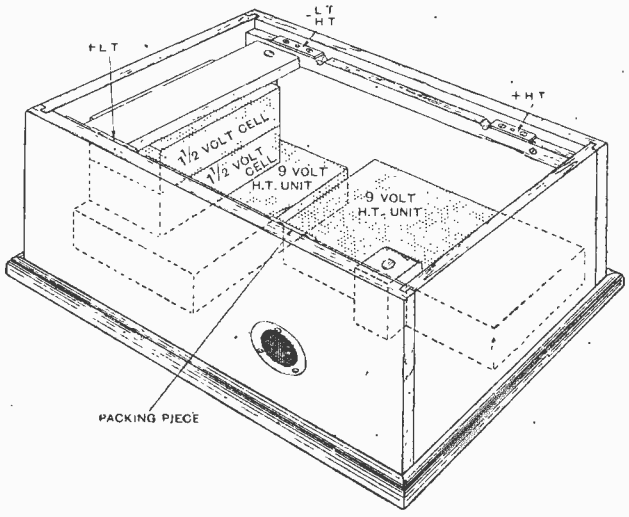


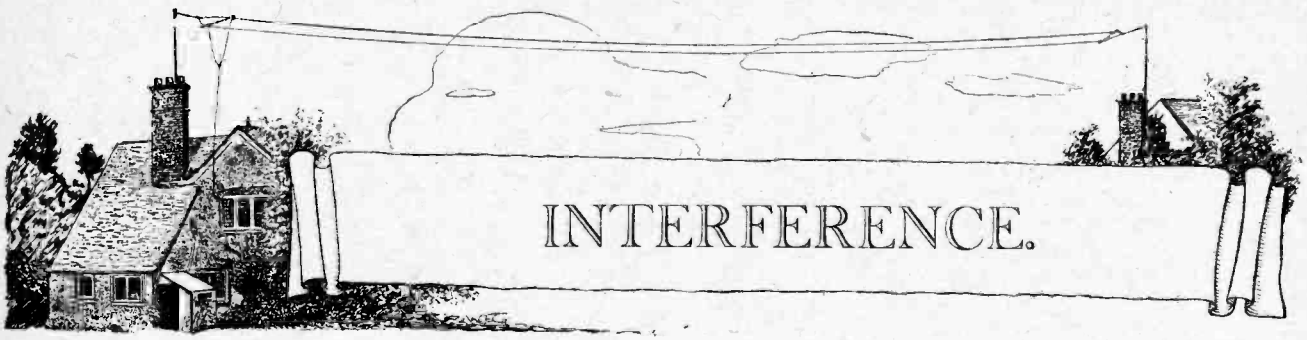
Fig. 7.—The method of assembling filament heating and high-tension batteries in the containing box. Contact is picked up by means of three copper tags and the packing piece is necessary to hold the panel level.

Operation.

When completed it is advisable to test for self-oscillation before assembling in the box, and as a preliminary external H.T. volts may be applied. The wavemeter valve circuit will not oscillate, of course, unless the buzzer contacts are closed. An oscillating receiver is necessary to receive the signal emitted by the wavemeter. Providing the wiring is correct and the buzzer is not troublesome, the wavemeter will function as a damped wave transmitter on throwing over the key.

Calibration.

No attempt must be made to calibrate until the instrument is completely finished and fitted to the box. To calibrate by comparison with a standard from which a curve can be plotted showing the relationship between wavelength and scale reading is recommended, though a very good calibration can be obtained if some half dozen or more broadcasting stations can be tuned in upon the broadcast receiver. It is then only necessary to adjust the wavemeter so that it interferes with the transmission of known wavelength. A number of points can thus be fixed and a curve prepared. From these fixed points one proceeds to estimate other wavelengths and tune the receiver to transmissions of wavelengths occurring in the gaps on the scale. By this process the whole scale will become so accurately calibrated that even errors in certain of the stated wavelengths of some of the European stations will at once be detected. Significant, also, is the ease with which transmissions can be tuned in and at once identified, and the number of stations which the broadcast receiver is capable of bringing in extends rapidly.



INTERFERENCE.

The Analysis of Impulsive Interference.

By N. W. McLACHLAN, D.Sc., M.I.E.E., F.Inst.P.

(*Concluded from page 87 of previous issue.*)

It has already been indicated that telegraphic and telephonic radio communication is concomitant with a series of side frequencies. In telephony the width of the band on either side of the central or carrier frequency is much wider than that with telegraphy at speeds of, say, 200 w.p.m. If, however, the speed of telegraphic signalling is sufficiently high, say 2,000 words per minute, the band is fairly broad. The effect of reaction in curtailing the higher acoustic frequencies in telephony is well known, and, moreover, it is inadmissible for good quality and adequate interpretational characteristics in speech, and especially in music, that the higher tones should be reduced perceptibly. Thus from this viewpoint of sterling quality a high degree of selectivity must be ruled out. On the other hand, in telegraphy there is, in general, a great deal more latitude, and the circuits can be made much more selective than those in telephony without deleterious effects. Hence we may epitomise the matter by saying that good quality and high selectivity are mutually exclusive.

Impulsive Interference.

The effect of a filter or a reactive circuit in attenuating *steady* frequencies on either side of the resonance point has already been mentioned. The most troublesome form of interference, however, is usually of an impulsive nature. In a previous section it was shown that any impulse can be resolved into a frequency spectrum. The relative effect of an impulse on, say, an aerial system depends upon :—

(*a*) The selectivity of the system.

(*b*) The relative intensity of the component frequencies of the impulse in the neighbourhood of the frequency to which the aerial is tuned.

Suppose an aerial system is tuned to 100 metres, and a series of impulses occur whose main spectral frequencies are in the region of 20,000 metres. The effect of the impulses on the aerial will be negligible unless their intensity is very great. In a case of this kind the relative effect of $\frac{\text{signal on 100 metres}}{\text{impulse on 20,000 metres}}$ is almost inversely proportional to the damping of the circuit, *provided the signal has attained its maximum value in the circuit.* When the signal is growing in the circuit the foregoing ratio may be much reduced. A lowly damped circuit is beneficial, despite this disadvantage. So far as selectivity is concerned, the steeper the sides of the selectivity curve, and the narrower the top, the smaller is the influence of a wave of any frequency outside the receptive range of the circuit.[1] On the other hand, the *relative* effect of the spectral frequencies which fall within the receptive range is *unaltered*. Thus, if the main spectral frequencies of an impulse fall within the frequency band of the receiver, there is little reduction in the current produced by the impulse. Or, again, if the spectral frequencies of an impulse—whatever its main frequencies may be—are sufficiently strong, those which fall within the frequency band of the receiver will cause trouble. Moreover, the efficacy of a filter circuit depends on the wave form and duration of the impulse, since this governs the spectral frequencies (relative magnitudes). If, therefore, a circuit is operated on a wavelength which is open to the main frequencies of interfering e.m.f.'s—atmospheric or otherwise—the only hope of reducing such interference is directional reception, unless, of course, the interference is not of a particularly directional nature.

The immunity from severe atmospherics on short waves of 100 metres or so is well known. The greater interference on long waves is due possibly to the main atmospheric spectral frequencies being in the long wave region. It appears that atmospherics have many and varied wave forms. Until more is known about these, our knowledge on atmospherics in relation to radio-receivers must remain in abeyance, although the spectrum mode of viewing the matter is independent of the wave form.

In viewing the problem of interference by the aid of an infinite series of frequencies there is one salient feature which must not be forgotten. The initial action of *any* component frequency is to cause a free oscillation of the circuit in question.

Experiments with Local Buzzer.

The influence of selectivity on a known form of impulse, such as a "Spark" or "Buzzer" transmission, can be examined by any experimenter, and the results will confirm the preceding statements. If the decrement of

[1] See *Experimental Wireless*, page 398, April, 1924.

Interference.—

the spark is high, the important spectral frequencies into which the damped oscillation can be resolved will cover a much wider band than when the decrement is low. Thus, if a receiving station is tuned to 550 metres and a spark station is operating on 600 metres, a low decrement spark will be more readily reduced in intensity than one of high decrement. If a spark station is not available for tests with filter circuits and reaction, the best plan is to fix up a local buzzer circuit whose decrement can be varied by inserting resistance. Filter and reactive circuits can then be compared on one's own premises. Whichever circuit is better with the buzzer will be better on actual signals, provided, of course, the wavelengths are in fairly close agreement.

In telephony a note filter circuit is out of the question, but in telegraphy it can be used to great advantage to follow a high-frequency filter. In general, it is uneeconomical and impracticable to do all the filtering at H.F., so that what may be regarded as the "overall" frequency band of a receiver can be narrowed down by the aid of note filters. In receiving spark stations it is to be observed that when using a note filter—say, one stage—a spark station[2] has a multitude of notes, *i.e.*, the notes cover a wide frequency band. The main or loudest note is that of spark frequency.

Summary.

1. If the interference is sufficiently intense it cannot be adequately reduced by known means at the receiver.

2. Before taking any elaborate steps the interference ought to be thoroughly diagnosed.

3. Every source of interference can be represented by a band, or spectrum, of frequencies. The wider the band the more widespread the interference. The interference is most troublesome when the frequencies of major importance are in the neighbourhood of the frequency of the signal it is desired to receive.

4. At any given wavelength the higher the speed of telegraphic transmission the wider the wave band and the greater the number of stations which are liable to be jammed.

5. The wave band of a telephone transmitter is much greater than that of a telegraph transmitter. In either case the width expressed as a percentage of the carrier frequency decreases as the wavelength decreases. Moreover, on any given wavelength a telephone station can cause more jamming than a telegraph station, provided the signal strengths are equal.

6. Jamming can be reduced by aid of directional reception provided there is an adequate angular distance between the desired and undesired signals and the latter are not too intense.

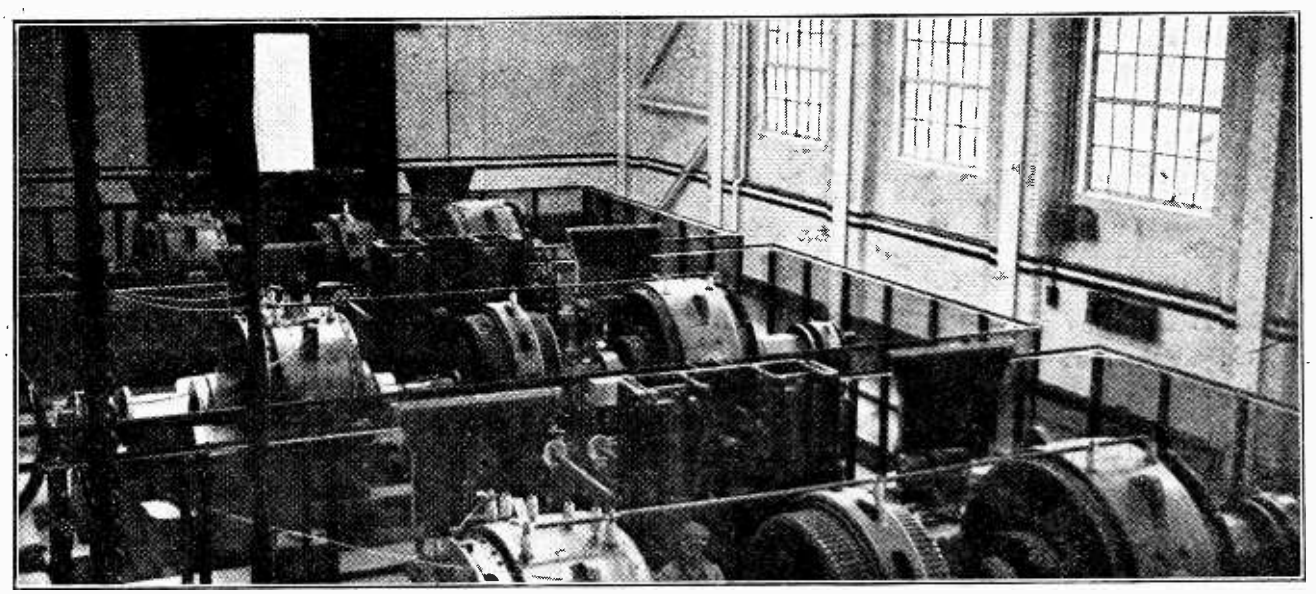
7. Selective circuits will attenuate appreciably all steady frequencies outside a certain band. If, however, the interfering frequencies fall within the band, or if the frequencies outside the band are of sufficient intensity, there is no cure at the receiver if directional reception fails.

8. To secure good filtering, selective or rejector circuits must have low resistances.

9. In using reaction to secure selectivity, stability is essential. The circuit must be absolutely in tune with the incoming signals or the selectivity will be obtained on the wrong wavelength. The valve should be operated on the straight part of its characteristic curve to preserve a constant negative resistance effect, and therefore unvarying selectivity, especially if jamming is prevalent. To accomplish this, the signals should be weak to limit the excursion of grid potential, and there must be no grid current.

10. High selectivity and high speed telegraphic transmission are mutually exclusive, as also are high selectivity and sterling quality in telephony.

[2] Without heterodyne.



THE EMPIRE STATION, RUGBY. A view in the machine room, showing the high tension generators in course of assembly

Wireless Afloat

The Equipment of Modern Shipping

By RICHARD TWELVETREES, A.M.I.Mech.E.

IMMEDIATELY prior to the start on her maiden voyage to Australia, the writer had the opportunity of examining and testing the wireless equipment on the R.M.S. *Chitral*, which sailed on July 3rd. The vessel, which is of 15,000 tons gross, was built for the Peninsular and Oriental Steam Navigation Company by Messrs. Alex. Stephen and Sons, Ltd., of Glasgow, for carrying mails and passengers between London and Australia, and represents the latest development in ship-building design and construction, the wireless apparatus in particular including a number of very interesting features.

Before giving details of the different apparatus comprising the equipment, it may be well to remind readers of some of the peculiar problems, which caused a great deal of trouble to radio engineers and wireless operators alike, prior to the introduction of the perfected appliances of to-day, for while the familiar apparatus used for broadcasting and the entertainment side of wireless may sometimes be forgiven if it causes annoyance by erratic behaviour, yet anything short of perfect reception and transmission in connection with a ship's equipment many endanger thousands of lives at a time. In addition to reliability there are other considerations of importance which may be enumerated briefly as follows:—(1) Adequate range of receiving and transmitting instruments. (2) Facilities for the rapid change of wavelength and control of power. (3) The elimination, as far as possible, of the prevalence of interference by other stations. These problems, to say nothing of others of a more technical character, have received very close attention from the research engineers of the Radio Communication Company, with the result that the latest apparatus meets the requirements enumerated above.

The installation on the *Chitral* comprises a standard 1½ kilowatt spark transmitter, used for normal operations in conjunction with other ships and coast stations; a continuous wave transmitter, by the aid of which the ship can remain in constant touch with land during the whole of the voyage from England to Australia; a direction-finding apparatus whereby the position of the ship can be determined in foggy weather, without interfering with the rest of the wireless gear, and, lastly, a combined receiving and transmitting gear fitted to the ship's motor lifeboat.

In the following notes, each of the units comprising the above equipment will be described briefly, and it will be seen that the apparatus includes many improvements upon earlier equipment.

The 1½ kilowatt Continuous Wave Transmitter.

This part of the equipment, Fig. 1, is installed in the wireless operator's cabin and is designed to operate from the main motor alternator and H.T. transformer, which forms part of the standard 1½ kilowatt "Polar" spark installation. The continuous wave transmission permits of long-distance communication (normally on a wavelength of 2,100 to 2,400 metres), to be maintained with the continuous wave stations, such as that of the Post Office Station at Devizes, and other stations in different parts of the world. This provides an alternative direct route for the disposal of traffic over far greater distances and with less interference than is the case with the usual coastal station service on a wavelength of 600 metres.

The current for the C.W. transmitter is supplied by an alternator with an output of 1½ kilowatts at 200 volts, 500 cycles per second, this frequency being adopted as being particularly suitable for the purpose. As may be

Wireless Afloat.—

seen from Fig. 1, the transmitter consists of an enclosed unit in an angle iron framework, the members of which form the support for the various components of the apparatus. A feature of the design is the provision of automatic protection switches, which are so arranged that immediately any of the doors of the cage are opened, the current to the transformer is cut off, thus ensuring safety when any changes or adjustments have to be made.

Included in the circuit is a smoothing condenser which eliminates ripple produced by the rectified alternating current supply.

Mullard valves are employed as rectifiers and oscillator, two U/250 valves being used for the former and one O/500 for the latter, all three valves being arrange in very accessible positions and mounted in such a way as to be free from risk of damage from either shock or vibration.

Mounted at the top of the transmitter unit are three indicating instruments, which are respectively the aerial ammeter, showing the amperes in the aerial, the high-tension feed milliammeter, and the valve filament voltmeter. The latter can be used to register the voltage either for the oscillator or the rectifier filaments, by means of a switch. Adjustable chokes are used for controlling the filaments, whilst a third, or compensator choke, is embodied with the circuit to maintain a constant load on the valves during Morse transmission. The photograph, Fig. 2, shows part of the aerial tuning inductance fixed above the transmitter unit. Tapping points for wavelength adjustment are made by metal clips, and any of the four standard wavelengths can be selected instantly by means of the switches situated at the right-hand side of the inductance.

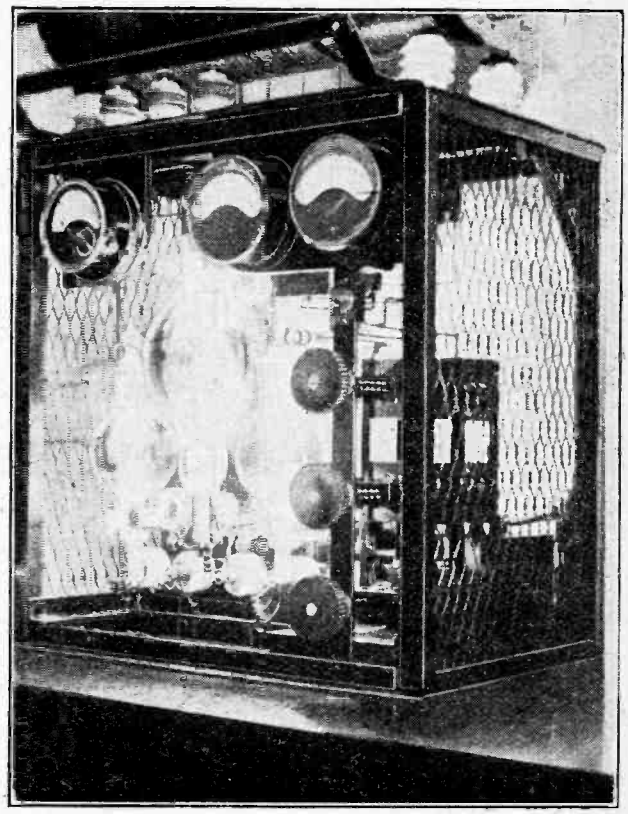


Fig. 1.—The 1½ kilowatt C.W. transmitter, designed to operate from the main motor alternator and H.T. transformer.

The Spark Transmitter Unit.

All the recording instruments, wavelength and power controls of the spark transmitter are conveniently located in front of the switchboard panel, the various elements of the high frequency and low frequency circuits, together with those of the emergency gear, being located at the rear. The motor alternator and the synchronous discharger are contained in a sound-proof compartment beneath the unit in a conveniently accessible position.

Other features of this apparatus include an automatic push button starter located on the operator's table, so that the motor alternator can be started quickly and smoothly; a "listening through" keying system dispensing with the usual "send-receive" switch and giving complete control of the spark frequencies by means of a regulator.

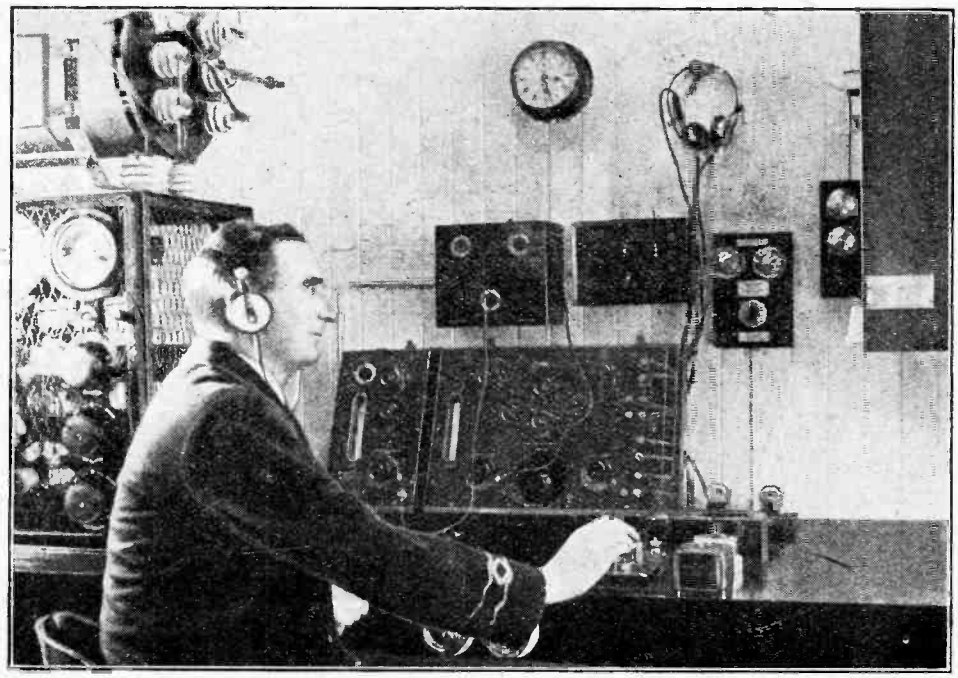


Fig. 2.—In the operator's cabin. The transmitter unit is seen on the left, with the aerial tuning inductance above it. The receiver stands in front of the operator, and on its left is the negatron oscillator.

Wireless Afloat.—

The Valve Receiver and Negatron Oscillator.

A valve detector is employed with the receiver. The receiver itself operates over a wavelength range of 250 to 20,000 metres, and incorporates a direct reading wavelength indicator in the closed circuit. This indicator, situated on the left-hand side of the instrument, Fig. 2, is calibrated, and enables the operator to adjust to the wavelength of the incoming signals easily.

For use in case of emergency, a stand-by crystal detector is embodied in the receiver, and the reception of continuous wave signals is effected by the aid of a Negatron oscillator located on the left-hand side of the receiving instrument.

The Direction Finder.

The direction finding equipment is a unit in itself. The receiving instrument, or tuner, Fig. 3, is situated in the ship's chart room and has a normal wavelength of 600 to 1,000 metres. The tuning is effected by the aid of a single variable condenser, the signals, of course, being received on the headphones. Projecting from the right-hand side of the receiver cabinet is a large control wheel, which rotates the vertical shaft, the base of which can be seen in the photograph. This shaft extends through the roof of the chart room to the deck above, where it terminates in the receiving framework, or loop aerial. The direction finder operates on the Robinson system. At the base of the vertical shaft is a revolving dial, which is calibrated from zero to 360 degrees, the zero setting being adjustable and made to coincide with the fore and aft line of the ship at the time of installation. The point of maximum signal strength indicates the bearing.

Fig. 3.—The direction-finding instrument, which has a normal wavelength of between 600 and 1,000 metres.

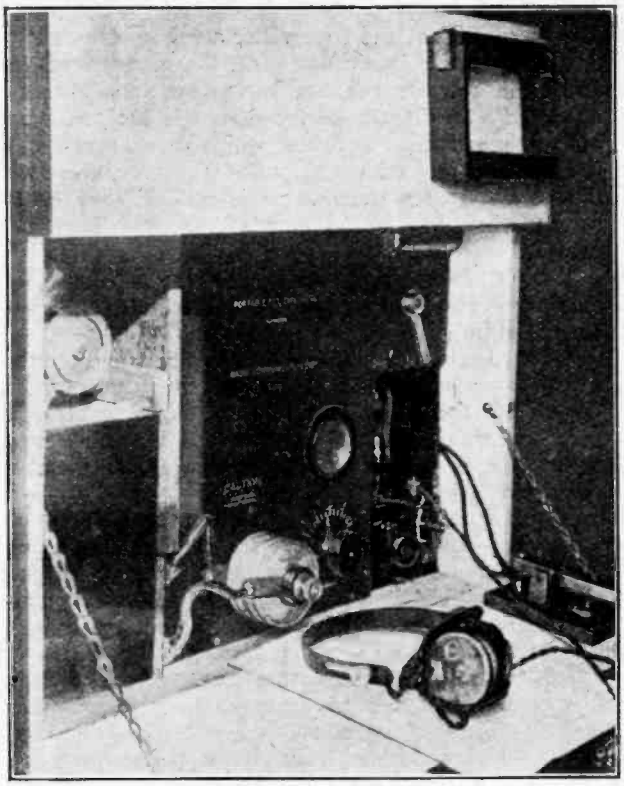


Fig. 4.—The lifeboat receiver-transmitter which is designed for operation by persons having no technical knowledge of wireless.

The Lifeboat Receiver-transmitter.

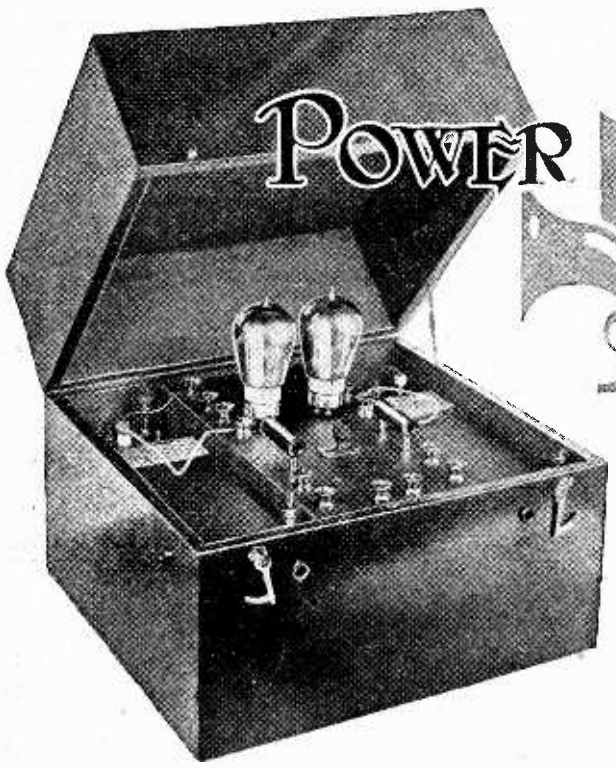
Not the least interesting part of the wireless equipment of the *Chitral* is the receiver-transmitter apparatus installed in the ship's motor lifeboat, which is so designed that signals can be sent or received by persons who have no technical knowledge of wireless. This, of course, is very important, for there is never any guarantee that a wireless operator would find a place in the motor lifeboat, if the latter had to be launched hurriedly.

The set is a ¼ kw. quenched spark transmitter working on a fixed wavelength of 600 metres supplied by a motor alternator with an easily erected aerial and a three-valve receiving set. The installation has a normal daylight range of from 50 to 60 nautical miles.

The apparatus shown in Fig. 4 is located in a small cabin at the forward part of the boat, and full instructions are provided in case messages have to be transmitted by inexperienced persons.

BROADCAST SYSTEM FOR GREECE?

THE Government of Greece has at last given permission for the use of wireless receivers, but stipulates that they must not be tunable to a wavelength of more than 2,000 metres, and that inside aerials alone are to be used. It is hoped that this may be regarded as an intimation that Greece which, as a country, has hitherto been somewhat backward in wireless matters, apart from the establishment of commercial and naval stations, is seriously contemplating some scheme of broadcasting.



POWER AMPLIFICATION

An Instrument Embodying a Novel Switching Arrangement

Special precautions have been taken in this instrument to secure natural reproduction, and a special switching arrangement has been introduced whereby volume is controlled in a manner which does not interfere with the quality of reproduction.

By N. P. VINCER-MINTER.

IN a recent article in which the writer described a three-valve general purpose receiver embodying one stage of low-frequency amplification, mention was made of the fact that a second stage of low-frequency amplification was not included, since in the writer's opinion one stage of transformer-coupled L.F. amplification gave as much loud-speaker volume as is obtainable without distortion under ordinary conditions, unless the use of special power valves with rather high H.T values is resorted to. It was further advised that in all cases where exceptional volume was desired, a specially designed power amplifier be constructed with an entirely separate H.T. supply and using valves capable of dealing with large power without distortion, and in the ensuing article the writer intends to describe a suitable instrument as a logical and practical outcome of the advice contained in his previous article.[1]

Principal Causes of Distortion.

It is well that we first consider briefly the reasons which make the construction of a separate power amplifier advisable, if not imperative. Probably the receiver which usually goes under the name of "standard four-valve set" is responsible for greater prejudice against the much-maligned loud-speaker than anything else. Let it be said at once that although some loud-speakers may be slightly better than others, there is not a great deal to choose between them, and that actually the standard of reproduction *attainable* by the average household instrument is really very good indeed, and we must look further for the cause of the nerve-wracking cacophony which many wireless enthusiasts delight to honour with the name of music.

In the course of the writer's experience a large number of cases of sets have come within his venue, which are quite nice on headphones without L.F. amplification, or with at most one stage of L.F. amplification, but are an abomination when the extra valve or valves are switched on for loud-speaker work, and as a result of this he would say that by far the greater number of these sets were quite well designed even on the L.F. side, and that ninety per cent. of the distortion complained of was due to *overloading* of valves. Sufficient time and space are not now available for a lengthy discursus into the reason why a valve distorts when too great a voltage swing is applied between its grid and filament, but this matter has been fully explained by the writer in a previous article, to which readers are referred for further information.[1] Let it be said definitely that the ordinary type of general purpose valve with limited emission is not suitable for use after two stages of L.F. amplification, and it will *not* be rendered suitable for this purpose by the application of 100 volts H.T. to its anode, nor will a power valve do much to help matters if it is merely inserted in place of an ordinary valve with an anode voltage of sixty and no grid bias.

Factors Determining Transformer Ratios.

Having then decided that a separate instrument is necessary, we may now proceed to the question of design. In the first place, transformers are used, since the writer has yet to be convinced that natural reproduction is impossible of attainment with transformers, provided that

[1] *Wireless World*, June 24th, 1925, page 639.

[1] *Wireless World*, April 1st, 1925, page 247.

Power Amplification.—

care is taken to see that the impedance of the primary of any transformer is two or three times greater than that of the valve in whose anode circuit it is connected. Since the amplifier is to be capable of addition to any existing type of receiver, including crystal sets, two stages of amplification are necessary in order to produce full loud-speaker volume from any receiver. The next question to be decided is the ratios of the first and second stage transformers. As we have just seen, it is necessary that the impedance of the primary of any transformer be two or three times the impedance of the valve *preceding* it. Now the ordinary detector valve has a very high impedance, and since it is obvious that more often than not the first transformer will be used immediately after a detector valve, it is important that the primary impedance of this component be high, and this, of course, involves a large number of turns on the primary of the transformer, this in its turn postulating the use of a low ratio transformer in the first stage for reasons detailed by the writer in a previous article.[1]

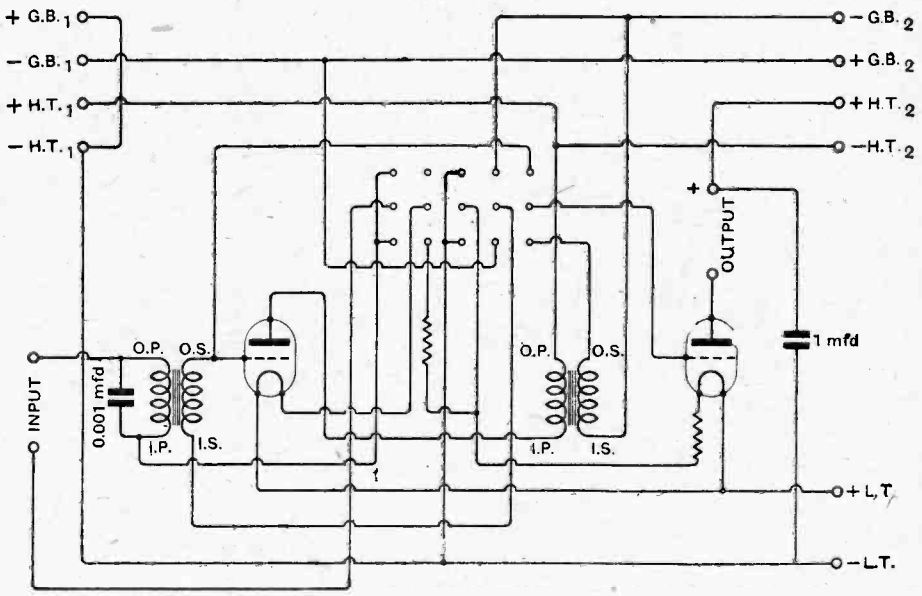


Fig. 1.—Theoretical connections of the amplifier.

The first L.F. valve is usually a medium-sized power valve, such as the D.E.5, and since this has a fairly low impedance our second transformer does not require so many turns on its primary, and a higher ratio may be used. The actual instruments used in this amplifier have ratios of 3 to 1 and 5 to 1 respectively, and are eminently suitable, not only on account of their ratio and excellent reproduction, but also on account of their ability to withstand high H.T. voltages with equanimity.

These points having been dealt with, we come to another point of equal importance. In a well-designed amplifier it is obvious that the final valve should be of a type capable of handling larger power than the preceding valve. This is a point realised and attended to by the more enlightened wireless enthusiast, but even this type of amateur frequently falls into the error of arranging his switching so that in the event of the volume being unbearably great, as in the case of a nearby station, the final valve is eliminated, and the loud-speaker transferred to the anode circuit of the preceding valve. This is obviously wrong for the following reason. If the incoming signals are so great that distortion due to valve overloading is present, it is more likely than not that the distortion due to overloading is due to the first L.F. valve, which is probably of the D.E.5 type, rather than to the final valve, which should be of the D.E.5A type, and therefore capable of handling large power without distortion. Therefore, although the elimination of the final valve, and the transference of the loud-speaker to the anode circuit of the first L.F. valve will certainly reduce volume considerably, the distortion will still remain the same, since the "overload" input to the grid of this valve is in no

[1] *Wireless World*, April 1st, 1925, page 247.

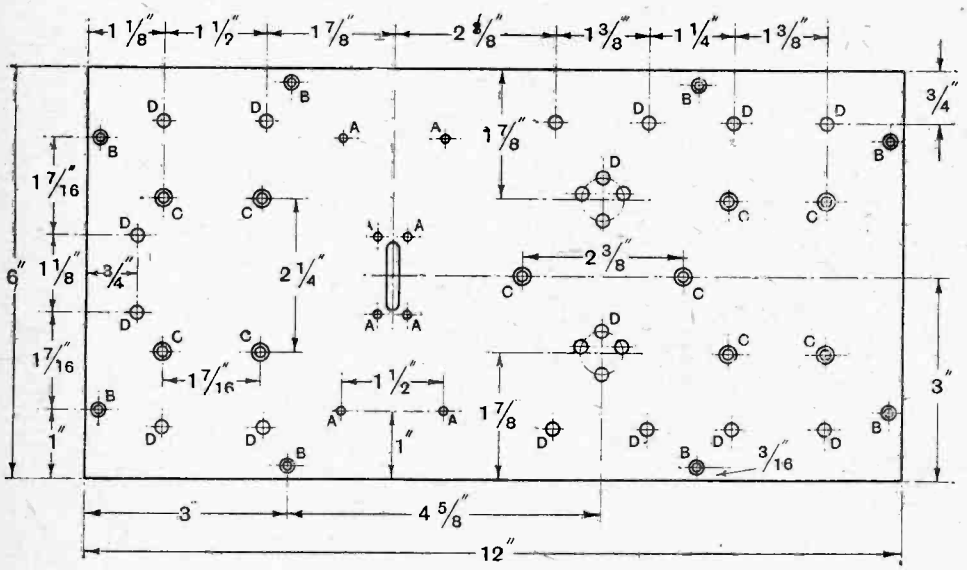


Fig. 2.—Dimensional drawing of the panel. Drilling sizes: A, 1/8in., B, 1/8in., countersunk for No. 4 wood screws. C, 5/32in., countersunk for No. 4 B.A screws. D, 3/16in.

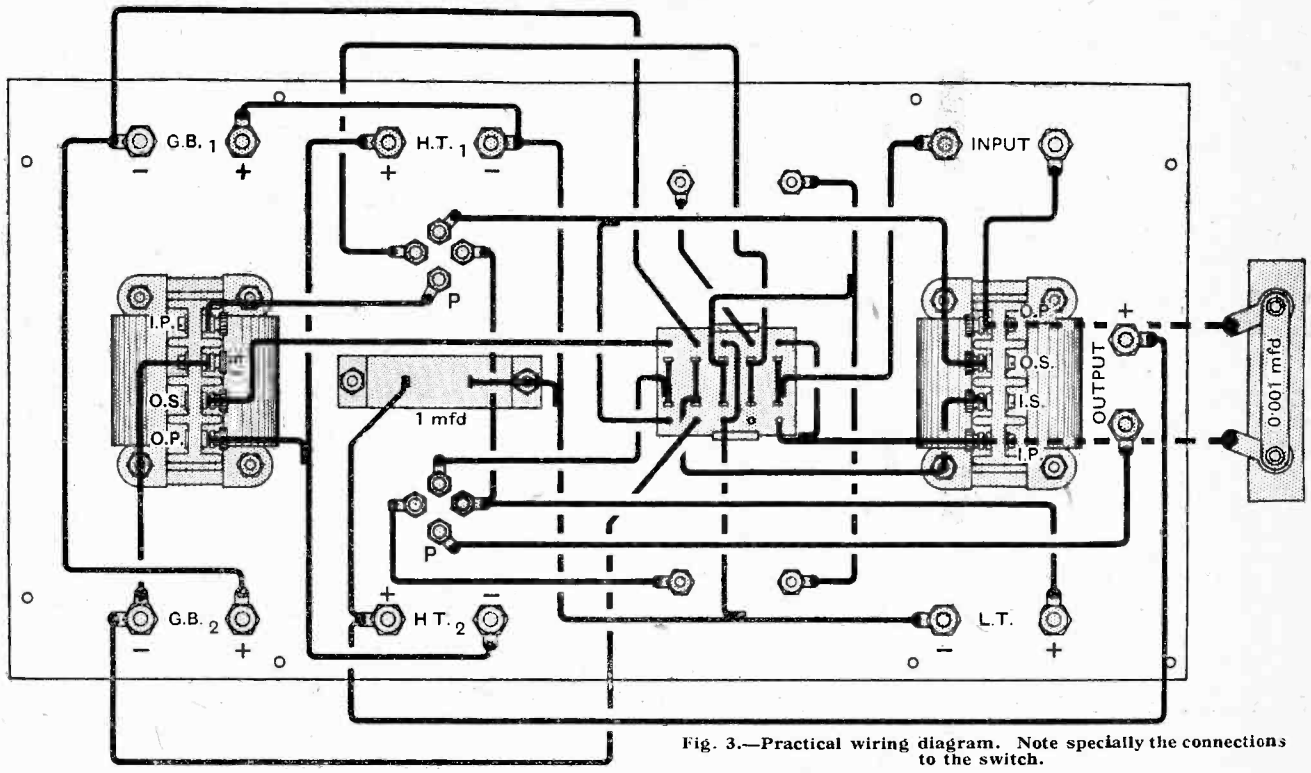


Fig. 3.—Practical wiring diagram. Note specially the connections to the switch.

way reduced. The obvious thing to do then is to so arrange our switching that in the event of signals being too strong the output of the detector valve can be passed straight to the final valve through the intermediary of the transformer, and the first valve eliminated. This is actually frequently done by many writers, but few of them seem to realise that by thus eliminating one form of distortion they are introducing another equally pernicious. The reason is that the switching is usually arranged so that the primary of the first transformer is disconnected from the anode circuit of the detector valve, and the output of the detector valve passed to the primary of the second transformer. Thus we have now the comparatively low impedance of the primary of the second (high ratio) transformer following the high impedance of the detector valve, and our care in choosing transformers of correct ratio has been nullified, or, perhaps, it would be more technically correct to say that our care in arranging that the impedance of the primary of the transformer following any given valve is suitable for the impedance of that valve has been set at naught. The writer has therefore so arranged the switching of this amplifier that *both* these defects are eliminated, and when it is desired to eliminate one stage of amplification, it is the *first valve* but the *second transformer* that is eliminated, the O.S.

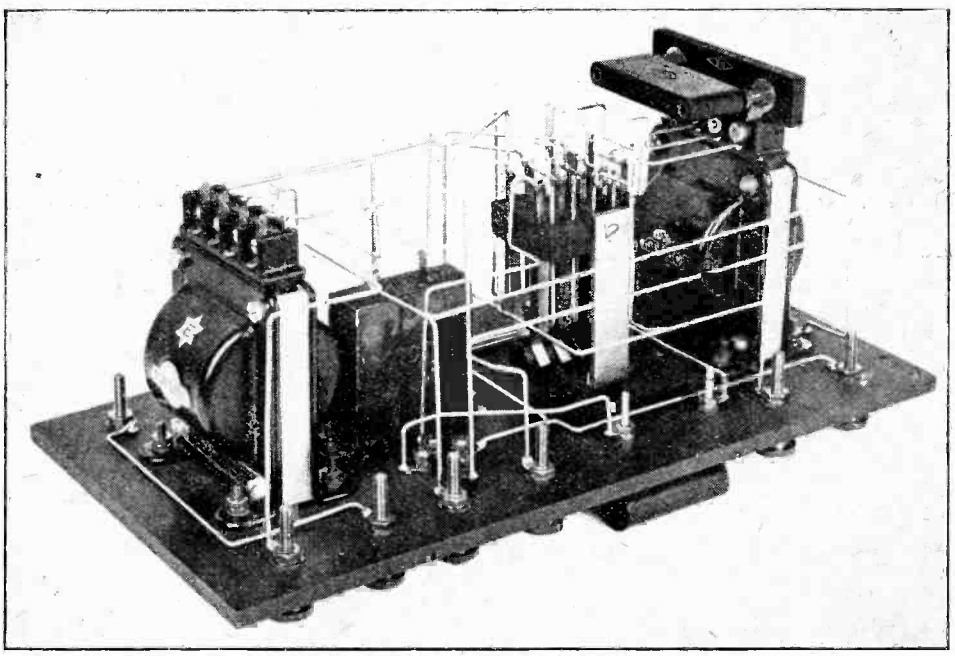


Fig. 4.—An underside view of the amplifier.

Power Amplification.—

of the first transformer being connected to the grid of the second valve, whilst an additional point of the switch is used, so that the grid bias suitable to the final valve is not upset when switching out one stage. This may sound complicated, but actually it is quite simple, as a glance at the theoretical diagram in Fig. 1 will show.

In order to explain matters fully, let us ignore the cabinet and its two H.T. batteries for the moment, and consider the case of a D.E.5 valve in the first stage and an L.S.5 in the second stage. We shall then require a 120-volt H.T. battery connected to the H.T.1 terminals, and a 4½-volt grid battery to the G.B.1 terminals, this being suitable for the D.E.5 valve. Now the L.S.5 is preferably operated with 180 volts H.T. and 12 volts G.B., and therefore we shall require to connect an extra 60-volt H.T. battery to terminals H.T.2 and extra grid bias to G.B.2 to bring the total G.B. on the final valve to 12 volts. If volume is too great, a movement of the switch will eliminate the D.E.5 and connect the O.S. of the first transformer to the grid of the L.S.5. Now it will at once be seen that if the extra switch point were not provided, the grid bias to the L.S.5 valve would be upset, as normally only 4½ volts negative would be applied to the I.S. of the first transformer. The extra switch takes care of this, however, and a further switch point is arranged for the breaking of the filament circuit of the first L.F. valve.

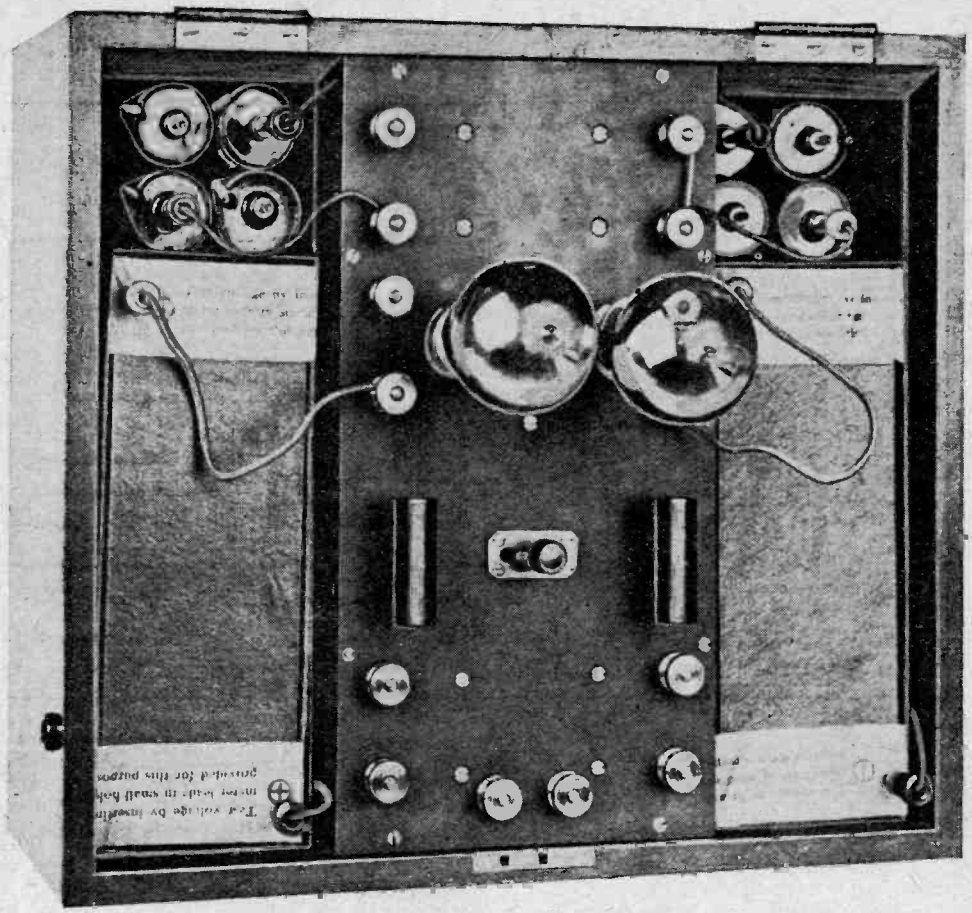


Fig. 5.—A general view of the completed instrument.

Choosing Correct Types of Valves.

Actually the instrument was designed for the employment of a D.E.5 valve in the first stage and a D.E.5A. in the second. Both these valves require an anode voltage of 120, so that terminals H.T.2 may be short-circuited and both H.T. batteries incorporated inside the cabinet, an extra H.T. battery exterior to the cabinet being added if at any time it was desired to use an L.S.5 or L.S.5A. type of valve in the second stage. With 120 volts H.T. the D.E.5 will require 4½ volts G.B. and the D.E.5A. about 9 volts or more, and so if a 4½-volt battery is connected to G.B.1 it is necessary to connect an extra 4½ volts or more to G.B.2. A 60-volt H.T. battery should be placed in each side pocket and the negative terminal of the battery in the left-hand side pocket (see photograph Fig. 5) connected to H.T.1, whilst a connection from the positive terminal of this battery to the negative terminal of the H.T. battery in the right-hand pocket should be made by means of wander plugs and a flexible wire passing along the bottom of the cabinet underneath the panel. Since the H.T.2 – terminal is the same as the H.T.1 + terminal, it is plain that a connection can be taken from this terminal to the positive terminal of the H.T. battery in the right-hand pocket. With regard to grid batteries, six volts are connected to each set of G.B. terminals in order to allow ample margin. The actual H.T. batteries used in this set are the "Eveready" 66-volt type, and there is ample room in the side pockets for both these and also the grid cells. It is recommended that a switch having a central "zero" position be used, such as the "Burndept," since in this way it is possible to arrange for the switching off of batteries when the instrument is not in use, unless a separate battery switch is resorted to. A further advantage obtained from a switch of this type is that arrangements can be made for the breaking of the primary circuit of the first transformer when the instrument is not in use.

Convenience of Switching Arrangements Used.

The writer has found this point of the greatest possible convenience, since it is possible to leave the amplifier with its input terminals permanently connected to one pair of telephone terminals of any receiver, the loud-speaker being permanently connected to the output

Power Amplification.—

terminals of the amplifier. Assuming that non-technical members of the family are listening-in with their telephones connected to the other pair of telephone terminals of the receiver they can instantly throw the loud-speaker into action, using one or two stages of amplification, as desired, and can just as simply throw it out of action. Were the primary not broken in this manner, it would be impossible to leave the amplifier permanently connected, since the primary would be in shunt with the telephones of the receiver, and so cause a considerable reduction in the strength of the signals being received on the telephones.

Desirability of Fixed Resistances.

The fixed resistances used in conjunction with this amplifier are worthy of note, being particularly neat and unobtrusive, and they also possess the advantage of being instantly interchangeable, according to the type of valve used. Of course variable rheostats on an L.F. amplifier are quite unnecessary. Since it is intended to use D.E.5 and D.E.5A. valves in conjunction with a six-volt accumulator, the components used are of 2.8 ohms resistance, but other values suitable for any type of valve can be obtained from the makers. They fit into special sockets on the panel, and are thus instantaneously interchangeable. They possess the great merit of not being an eyesore on the panel, an impeachment which cannot be withheld from many types of fixed resistance. Although the necessity of using an entirely separate H.T. supply is advised, there is no reason to prevent the filament battery supplying the receiver from also supplying the amplifier. Do not forget to connect an H.T. battery to H.T.2 if an L.S.5 valve is used in the last stage, and to increase the grid voltage applied to G.B.2, although the voltage values connected to H.T.1 and G.B.1 will be unaffected.

The main intention of the writer in this article was not so much to give a design to which the amateur should rigidly adhere as to lay down definite principles which ought to govern the design of any power amplifier, and therefore constructional details of the cabinet are not given, since it is thought that the amateur would prefer to design his own cabinet; but it is advised that whatever is done on this point, it is better to arrange for the H.T. and grid batteries to be totally enclosed. Full constructional details of the actual instrument as distinct from the cabinet are readily obtainable from the details given in Figs. 2 and 3 as well as from the photographs. The ebonite bushes seen in the sides and front of the cabinet are for the purpose of allowing connections to receiver, loud-speaker and accumulator to be made neatly and unobtrusively, so that the lid of the cabinet can be closed without removal of these wires.

LIST OF COMPONENTS.

Ebonite panel 12in. × 6in. × ¼in.
1 First stage transformer, 3 to 1 ratio (Igranic).
1 Second stage transformer, 5 to 1 ratio (Igranic).
1 5-point double-throw switch with central zero (Burndept).
1 Interchangeable type fixed condenser 0·001 mfd. (Peto Scott).
1 One microfarad fixed condenser (T.C.C.).
2 Fixed resistors with mountings, 2·8 ohms (A. J. Stevens and Co., Ltd.).
8 Flush mounting valve sockets.
14 Large terminals.
2 66-volt H.T. batteries (Eveready).
8 1½-volt grid cells (Eveready Type U.W.1).
1 D.E.5 type power valve.
1 D.E.5A type power valve.

Calls Heard.

Extracts from Readers' Logs.

Chiswick.

Australia:—3BQ, 3BD, 2CM, 2Y1. *New Zealand*:—4AG, 4AK. *Iceland*:—BG1. *Brazil*:—2SP, 1AB. *Argentina*:—AF2. *Unknown*:—FABC, AXD, V3I.
(All on 40 metres.)
H. and L. WILKINS (2BAO).

Cork, Ireland.

British:—2BDQ, 2FM, 2MC, 2PP, 2UV, 2XV, 5GV, 5GU, 5NW, 5XY, 6RY, 6RM, 6SZ, 6JV, 6UW. *French*:—8CC, 8CQ, 8EO, 8FMU, 8GM, 8JO, 8KR, 8KX, 8NA, 8NS, 8SSC, 4SR, 8UT, 8VL, 8VB. *Swedish*:—SMEB, SMUU, SMUV, SMXR. *German*:—KY4, DCN. *Dutch*:—OGN, OKV, OPM, 2PZ, PC7. *Swiss*:—9CH. *Danish*:—7ZM. *Belgian*:—Q2.
(0-v-1.) (50 to 100 metres.)
CHAS. MCCARTHY.

Coventry.

American (70 to 80 metres):—1AAC, 1ALW, 1AFL, 1DQ, 1CCX, 1CMX, 1CPV, 1CR1, 2BEE, 2CPD, 2AGO, 2AMF, 2CH, 2CXW, 2AKB, 3EV, 3UE, 3ZM, 3ZO, 3GK, 4TA, 4JY, 4XE, 4SA, 8DFO. *Canadian*:—1AR, 1DM. *French* (40 metres):—8RRR, 8RD1, 8SM. *British* (40 metres):—2LZ, 6RM, 5S1, 2NM, 6UV. *German* (30 metres):—POX.
(0-v-0.) BRIAN W. WARREN (2APG).

New Southgate, London, N.11.

British:—2AYP, 2AN, 2BM, 2FK, 2JB, 2KG, 2KT, 2QC, 2SN, 2UN, 2XO, 2XN, 2ZA, 5AR, 5A1, 5CP, 5CT, 5HJ, 5HT, 5MA, 5OV, 5PZ, 5QV, 5RY, 5TR, 5UV, 5ZA, 5ZS, 6BF, 6BJ, 6DV, 6DX, 6KJ, 6LB, 6OB, 6OX, 6PD, 6RY, 6TA, 6TX, 6UT, 6YG, 6YK, 6ZM, 6ZY. *Spanish*:—EAR1.
(0-v-0—0-v-1.) W. W. FONE.

Cambridge.

New Zealand:—2XA. *American*:—1ARE, 1KA, 1SW, 2APR, 2AWF, 2BW, 2CNK, 3CDK, 4SA, 5UK, 5W1, 8AWL, 8BAV, 8BF, 8BSW, W1R. *British*:—2AC, 2GY, 2JJ, 5GV, 5JH, 5OC, 6QB. *Belgian*:—4AS, Q2. *Italian*:—1RA, 1NO, 1AE. *Spanish*:—EAR6. *Swedish*:—SMYZ. *French*:—8ALG, 8CAX, 8EÉÉ, 8GSC, 8HZ, 8JAA, 8JAB, 8RRR, 8TBY, 8VT1, 8WOZ, 8YOR, OCDJ, UB.
(0-v-1.) W. K. ISLIP.

Pinner.

British:—2AMM, 2AN, 2AQX, 2AYP, 2BC, 2BDQ, 2BGM, 2BGO, 2BM, 2CA, 2CV, 2HQ, 2IX, 2JB, 2JJ, 2JU, 2KG, 2KT, 2LZ, 2MI, 2MK, 2PP, 2PY, 2QC, 2QM, 2SX, 2UC, 2UN, 2VX, 2WJ, 2XB, 2XM, 2XO, 2XV, 2XY, 2YQ, 2ZA, 2ZB, 5AQ, 5CW, 5DH, 5EL, 5FT, 5GV, 5HA, 5HL, 5HX, 5IO, 5IS, 5LF, 5LP, 5LX, 5MB, 5NJ, 5NW, 5OC, 5OX, 5QV, 5RB, 5RF, 5RY, 5SI, 5SZ, 5UV, 5VQ, 5ZA, 6AL, 6BD, 6BF, 6BO, 6DF, 6DO, 6JV, 6KJ, 6LB, 6PR, 6QB, 6RM, 6RY, 6TX, 6UT, 6YG. *Belgian*:—4SR, 4UC. *Dutch*:—OGN, OMS, OPM, ORW, OZN. *Swedish*:—SMEB, SMHI, SMRG, SMVR, SMXG, SMXR, SMYV, SMYY, SMZZ. *American*:—1CH, 1CMX, 1KZ, 2ANI, 2API, 4SA, 8AUL, 8UP, 8XAS. *Italian*:—1AF, 1AS, 1CM, 1ER, 1MT, 1RG. *Spanish*:—EAC9, EAR6, EAR9.
NORMAN GUY.

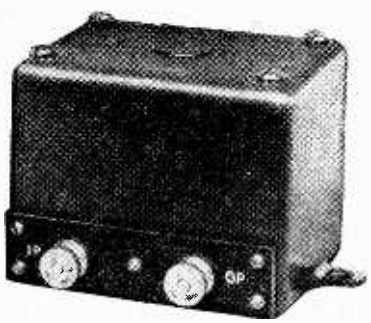
A Review of the Latest Products of the Manufacturers.

THE GAMBRELL INTERVALVE TRANSFORMER.

It would appear that a manufacturer desiring to enter the radio field first turns his attention to the production of a low-frequency transformer. Too often the result is a product which is cheap and nasty, with the result that a person who buys one on price and appearance fails to secure satisfactory reproduction of the broadcast programmes.

Made by the manufacturers of the well-known "efficiency" series of plug-in tuning coils, the Gambrell transformer on examination showed evidence of skilled design and careful workmanship. The instrument is completely enclosed in a metal case, and the terminals and securing feet are conveniently placed.

On test it was found to be an efficient and effective unit, perfectly suitable for inclusion in a high quality receiver. Two types are supplied, one being for the first stage and the other for the second stage of a magnifier.



The Gambrell Intervalve Transformer.

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THE NEW RADIO INSTRUMENTS' P.M. DETECTOR.

The permanent type of crystal detector introduced by Messrs. Radio Instruments, Ltd., 12, Hyde Street, New Oxford Street, London, W.C.1, some few months ago, has found its way not only into the construction of simple crystal receiving sets but is also employed generally by amateurs whenever an easily adjustable detector is needed. It consists of an ebonite tube fitted with terminals, and the detecting crystals are held into contact with a suitable pressure by means of a spring plunger which is capable of providing adjustment when required. The detector was formerly mounted between spring clips on the face of the receiving instrument, and modification has now been introduced by which the crystal detector takes up much less panel space. It is now fitted with a locking ring so that it can be mounted in the manner of the usual one-hole fixing. A well-finished ebonite cap fits over the plunger. The contact between the crystals will remain perfectly sensitive in one position for several weeks without attention, and the fitting of the cap prevents the adjustment being tampered with except when it is absolutely necessary to reset it.

The new Radio Instruments' P.M. detector.

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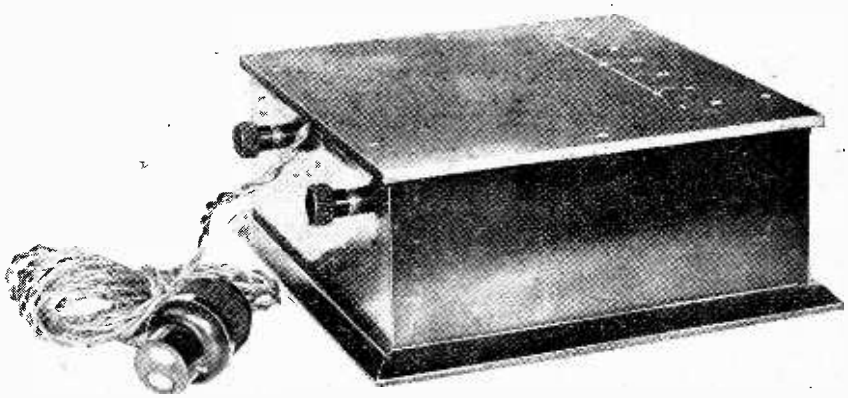
DYNIC D.C. REGULATOR.

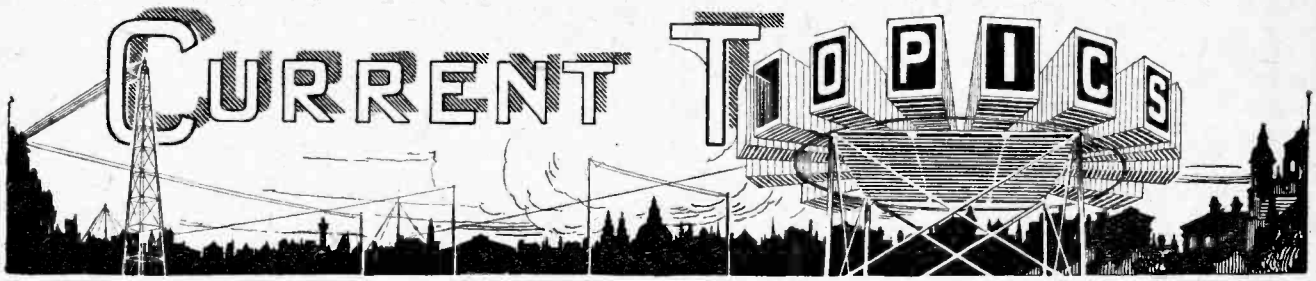
As one would gather from its name, this unit is a device with which one is able to regulate the voltage supplied to the plate circuits of a receiver. The instrument is used in conjunction with direct current mains and comprises a resistance and smoothing device. To bring the instrument into use, it is simply necessary to put the adaptor into any convenient lamp socket and to switch the current on.

Tappings are taken from the resistance to sockets on the face of the instrument, illustrated below, and various voltages may be tapped off by inserting wander plugs from the H.T. terminals of the receiver in these sockets. A compact and well-constructed instrument such as this will be found a boon to those who find the ordinary type of dry cell H.T. battery a rather short-lived and troublesome component, for not only is a plentiful supply of plate current made available at a steady and easily adjustable voltage, but there is an absence of noise. The usual bridging condensers should, of course, be included between the positive H.T. terminals and the H.T. negative in the set itself.

Dynic D.C. Regulators are supplied to suit all D.C. mains voltages by G.W.I., Ltd.



The Dynic D.C. Regulator.



Events of the Week in Brief Review.

ENGLISH AMATEUR COMMUNICATES WITH MACMILLAN EXPEDITION.

Mr. J. A. Partridge (2KF) reports that early on Monday, July 13th, he worked with the ss. "Bowdoin" (WNP) for about two hours while she was lying off Labrador with a broken propeller. Messages were passed across to the National Geographical Society, Washington, with the aid of U2BKR. Mr. Reinartz, who was operating WNP, reported the signals from 2KF as strength R.8, whilst his own came in very strongly.

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WORLD-WIDE INCREASE OF BROADCASTING.

The American Department of Commerce, which has recently endeavoured to take a census of wireless receiving sets in all parts of the world, estimates that there are between 15 and 20 million sets in the United States and about 1½ million in Great Britain. In Belgium, France, Italy and Spain wireless telephony is rapidly gaining ground, with consequent increased manufacture and importation of receivers, but as yet comparatively little progress has been made in Greece, Roumania and Yugo-Slavia.

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WIRELESS TELEPHONY BETWEEN SHIPS AT SEA.

It is stated that a regular service of wireless telephony has now been established on several German liners, which enables passengers to communicate with other similarly equipped ships while at sea. Duplex transmitting and receiving apparatus is used, one ship transmitting on 800 metres and another on 450 metres, or on other fixed wavelengths. The sets are said to have a satisfactory range up to 100 miles.

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INTERNATIONAL CONFERENCE AT WASHINGTON.

It is announced that a wireless conference will be held in September at Washington, U.S.A., at which the representatives of 50 nations will discuss national problems of broadcasting and wireless communication.

The necessity for such a conference arises from the enormous growth of radio since the London Conference of 1912, when it was only possible to consider matters relating to wireless telegraphy in ship and shore stations.

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REGULAR TWO-WAY COMMUNICATION WITH NEW ZEALAND.

Two-way communication with New Zealand is now a regular week-end programme for Mr. J. A. Partridge (2KF), who for the last three Sundays has worked Z2AE and Z4AL while receiving Z4AG and several Australian stations, including A2YI, 2CM, 3BD and 3BQ on good steady strength.

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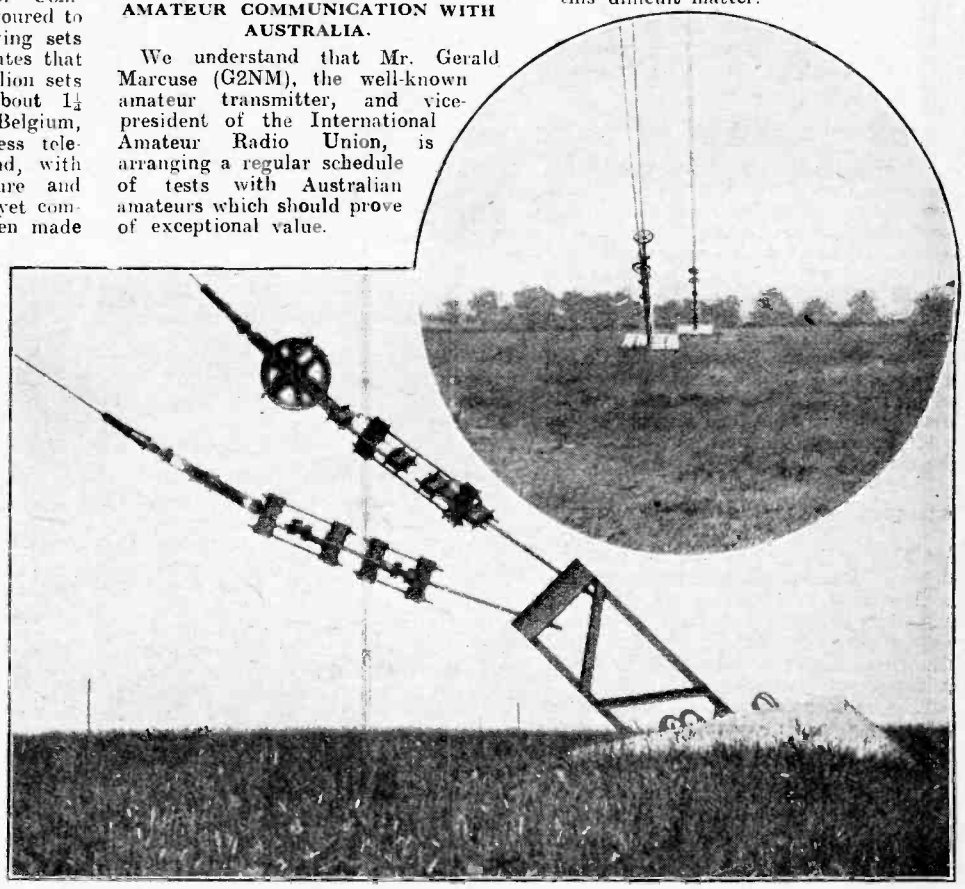
AMATEUR COMMUNICATION WITH AUSTRALIA.

We understand that Mr. Gerald Marcuse (G2NM), the well-known amateur transmitter, and vice-president of the International Amateur Radio Union, is arranging a regular schedule of tests with Australian amateurs which should prove of exceptional value.

B.B.C. SURPLUS.

Considerable discussion has appeared in the daily papers over the probable or possible ways of employing the surplus shown to the trading account of the B.B.C. for the year ending last March. The *Westminster Gazette*, whilst advocating improved programmes, justly remarks: "Of course it will never be possible to satisfy everybody . . . the real problem for the B.B.C. is to discover what class of items on its programmes will please the greatest number . . . Is there not room for more of the better class music?" We are glad to note that a committee of representative musicians has been formed to advise the B.B.C. in this difficult matter.



RUGBY'S AERIAL SYSTEM. Some idea of the immensity of the work now nearing completion at the Empire Station, Rugby, can be gained from the above photograph, which depicts the anchorage for one of the stay wires. (Inset) A view of two of the stays taken from one of the masts.

MEDICAL AID AT SEA.

An application of wireless, little known except to "those that go down to the sea in ships," is the Marine Medical Wireless Service, so invaluable for giving medical advice free of charge to coasting vessels and cargo boats which do not, as a rule, carry regular doctors. Started in 1920 by the Seamen's Church Institute, New York, this service has grown quietly and unostentatiously. Coast stations from which medical advice can be obtained by ships within range are rapidly increasing in number.

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EUROPEAN WAVELENGTHS.

The Technical Committee on Broadcasting has prepared a new international scheme of wavelengths which, it is hoped, will mitigate the present interference experienced by European stations. The older and more important stations will, as far as possible, retain their present wavelengths, and experiments will be conducted, after broadcasting hours, beginning on September 1st, to test the efficiency of the new scheme. The results of these experiments will then be considered at a further conference to be held in Geneva on September 21st and 22nd.

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BROADCASTING IN SOUTH AMERICA.

A station of similar design to 2LO has been erected in Lima, Peru, and will transmit on a wavelength of 360 metres.

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WELL-KNOWN MANAGING DIRECTOR RETIRES.

Mr. Guy Burney, the founder and managing director of the Sterling Telephone and Electric Company, and first chairman of the N.A.R.M., has decided to retire, and, to quote his own words, "to enjoy the fruit of happiness while there is still left some life in the old dog." The business was established in quite a small way in 1900 as a branch of the Berliner Telephone Manufacturing Co., of Hanover, and the present name was adopted in 1903. The works at Dagenham were opened in 1909, and during the war extensive contracts were carried out by the company.

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RUSSIAN AMATEURS RECEIVE MORE ENCOURAGEMENT.

A Moscow journal states that, with the object of increasing radio communication in Russia, it has been decided to grant licences to several private stations and to remove some vexatious formalities. Russian citizens will now be able to install receivers, subject to due registration, and private transmitting stations will also be licensed subject to certain restrictions as regards wavelengths, power, and times for working.

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WIRELESS COMMUNICATION IN MINES.

The Leicestershire Mines Radio Investigation Committee, which was formed in 1923 from members of the Leicestershire Wireless Society, has conducted a number of interesting experiments in the transmission and reception of signals between the underground workings and the surface.

A detailed description of these experiments is published by the Institution of Mining Engineers in the form of a paper by Mr. E. E. Bramall, read at a general meeting in February last.

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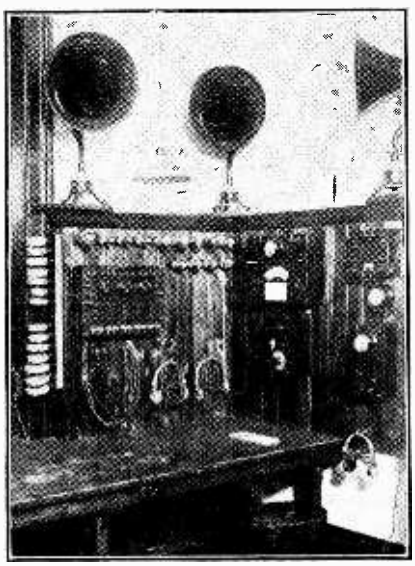
LITHUANIAN EXHIBITION.

Wireless will be a feature of the Agricultural and Industrial Exhibition at Kaunas, Lithuania, arrangements for which are now complete. The American-Lithuanian Trading Company will give wireless demonstrations. Radio concerts, in which special prominence will be given to Lithuanian music, will form an attractive feature in the entertainment programme, as will also the practical illustrations of the application of wireless to everyday life.



A NEW SERVICE DEPARTMENT. A corner of the Service Department recently opened by Burndept Wireless Limited at Aldine House, Bedford Street, London.

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WIRELESS TO CURE VANDALISM.

The Austrian Broadcasting authorities intend to employ radiotelephony as a means of protecting public parks and woods in and about Vienna from possible defacement by Sunday crowds and excursionists.

Talks will be broadcast not only urging people to keep their recreation grounds clean and tidy, but also giving instructive information about the birds, butterflies, etc., which may be seen, and places of interest in the surrounding country.

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BROADCASTING IN POLAND.

La Société Polonaise, Radiotechnique (Polskie Towarzystwo Radiotechniczne P.T.R. Sp. Akc) has recently applied to the Polish Government for permission to install two broadcasting stations in that country, one at Warsaw, to have an output of 15 kw. transmitted from an aerial supported by two 100-metre masts, and another 2 kw. station, either at Posen or Cracow. The company is associated with La Cie Générale de T.S.F., La Soc. Francaise Radioélectrique, Marconi's Wireless Telegraph Co., Ltd., and the Radio Corporation of America. It is understood that the capital will be mainly subscribed in Poland, and that the Government will take part in the administration and have a certain share of the profits.

In the event of the Polish Government agreeing to the proposed scheme, the station at Warsaw will be completed in about eight months.

BOOKS RECEIVED.

Catalogue of British Scientific and Technical Books. Compiled by the British Science Guild. New edition, revised and enlarged. Pp. 490+xxii. Agents: A. and F. Denny, Ltd., London. Price 12s. 6d.

Admiralty Handbook of Wireless Telegraphy, 1925. Pp. 547. H.M. Stationery Office. Price 5s. net.

Wörterbuch der Elektrischen Nachrichtentechnik. Part I. English-German. Pp. 292. Published by Julius Springer, Berlin.

Relativity. A very elementary exposition. By Sir Oliver Lodge, F.R.S. pp. 41. Price 1s. net. Published by Methuen and Co., Ltd., London.

The Broadcasting Time-Table and Reception Log. Fourth edition, corrected for Summer Time. 32 pp. Price 2s. 6d. net. Chapman and Hall, Ltd., London.

CATALOGUES RECEIVED.

[The catalogues and price lists mentioned below can, in most cases, be obtained on application to the firms concerned. As a matter of business courtesy, stamps for return postage should be enclosed.]

H. E. Ashdown (Birmingham), Ltd. (Perry Barr, Birmingham). Complete receiving sets in ornamental cabinets. Loud-speakers and accessories.

Autoveyors, Ltd. (84, Victoria Street, S.W.1). Wireless accessories and components. Variable bridge condensers, etc.

British L.M. Ericsson Mfg. Co., Ltd. (63-73, Kingsway, W.C.2). Booklet W.A.17. Receiving sets and component parts.

Cable Accessories Co., Ltd. (Britannia Works, Tipton, Staffs.). Progress Sheets Nos. 89, 94, 95 and 96. "Revo" lightweight headphones, loud-speakers, receiving sets, amplifiers, etc.

Leslie Dixon and Co. (9, Colonial Avenue, Minories, E.1). "Electradix" receivers, component parts. Instruments and electrical apparatus of all kinds.

D.P. Battery Co., Ltd. (11, Victoria Street, S.W.1). Storage batteries:—LSH type for public supply and tramway undertakings, LY type for country houses, etc., Kathanode type for electric locomotives.

Electrical Equipment and Carbon Co., Ltd. (109-111, New Oxford Street, W.C.1). List No. R3. "Telwave" low-loss condensers. Plugs, jacks, switches, etc.

Fleet Radio Stores (143-144, Fleet Street, E.C.4). Component parts and wireless accessories of all kinds.

H.T.C. Electrical Co., Ltd. (2, Boundaries Road, Balham, S.W.12). Low capacity valve-holders. Fixed crystal detector. L.F. transformers.

A. H. Hunt, Ltd. (Tunstall Road, Croydon). Genuine Helleser Dry Batteries, H.T. and L.T. types.

L. McMichael, Ltd. (Norfolk Street, Strand, W.C.2). H.F. transformers, reactors, dampers and tuning condensers.

A. J. Stevens and Co. (1914), Ltd. (Walsall Street, Wolverhampton). Variable and fixed condensers.

TRANSMITTING EQUIPMENT OF ONGAR.

Visit of the Radio Society of Great Britain to the High-Power Station.

THE excursion arranged by the Radio Society of Great Britain for their members to visit the transmitting stations at Ongar, Essex, took place on Friday last. The accompanying illustrations show the apparatus inspected. There is little need to dwell here on the general principles of the transmitting apparatus, and it is the unusual features to which reference will be made in this brief description of the equipment.

The stations are situated to the right of the main road from Epping to Chelmsford and about eighteen miles from London. Their network of masts and aerials is rather bewildering to the observer, for, although he at once appreciates that the site accommodates more than one transmitter, he finds difficulty in tracing the aerial systems.

Aerials.

By an examination of the aerial down leads it is to be seen that there are three independent aerial systems with their associated earth screens, though the largest aerial is earthed connected through an inductance at its remote end. The value of the earthing inductance corresponds with that used for aerial excitation and is regulated to create a nodal point at the centre of the aerial so that ammeters connected in the earth leads at both ends give equal readings.

Two other sets of aerials can be identified, the one consisting of a two-section cage and the other a cage aerial with wires widely spaced. The earth screens spread out symmetrically over the ground shadowed by the aerials, and the wires are bonded together at frequent intervals. The leading-in insulators are of the customary design, consisting of large porcelain tubes passing through holes in glass panels.

Power House.

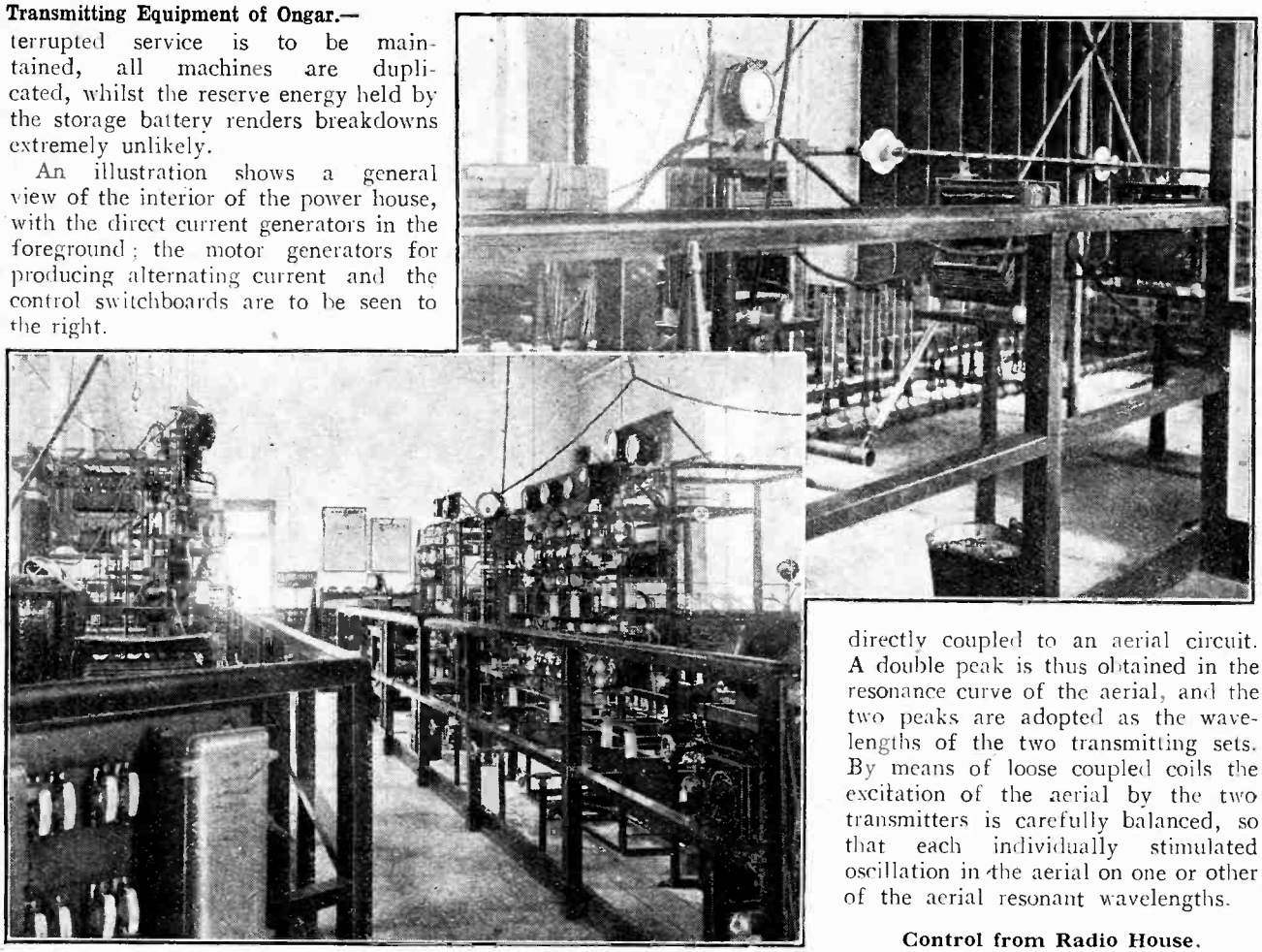
As a source of power oil engines of the semi-Diesel type are employed, directly coupled to the continuous current generators. The output of these machines is fed to a secondary battery, the accumulator room being built as an extension to the power house. By means of direct coupled motor generator sets, alternating current of high periodicity is produced and is fed by buried cables to the three buildings in which the transmitting equipments are housed. As is the practice where an unin-

Views of the power house, and the largest of the transmitting sets. The master oscillator, amplifier, keying load and rectifier valve equipments can be seen.

Transmitting Equipment of Ongar.—

terrupted service is to be maintained, all machines are duplicated, whilst the reserve energy held by the storage battery renders breakdowns extremely unlikely.

An illustration shows a general view of the interior of the power house, with the direct current generators in the foreground; the motor generators for producing alternating current and the control switchboards are to be seen to the right.



The split wave transmitter, showing the two independent sets and the aerial coupling inductances.

Transmitting Equipments.

Conveniently placed with regard to the three aerial systems are the station buildings which house four complete transmitting equipments. The layout of the sets is very similar though differing in power. Alternating current supply is used for filament heating through suitable stepdown transformers, whilst the plate potentials are obtained from step-up transformers and valve rectifying apparatus, additional valves being used as a back load when keying.

The style of the components adopted to handle the large energy employed can be seen in the illustrations and require no description, being of standard Marconi design. A feature of unusual interest is the split wave transmitter operating on one of the aerial systems so that two separate and independent messages can be transmitted simultaneously on different wavelengths. For this purpose two independent transmitters are employed up to a point when the auxiliary circuit links in with the aerial. The aerial is tuned by virtue of its coupling with a tuned closed circuit to be responsive to two wave bands very much in the same manner as two distinct wave bands are usually occupied by a transmitter when directly coupled to an aerial circuit. A double peak is thus obtained in the resonance curve of the aerial, and the two peaks are adopted as the wavelengths of the two transmitting sets. By means of loose coupled coils the excitation of the aerial by the two transmitters is carefully balanced, so that each individually stimulated oscillation in the aerial on one or other of the aerial resonant wavelengths.

Control from Radio House.

The transmitters are brought into operation as required direct from Radio House, London, and the traffic handled can be diverted from one set to another to provide a latitude varying with the number of messages in hand for a particular destination and the reliability of communication depending upon atmospheric conditions.

The relay keys are, of course, operated direct from Radio House, and much of the traffic is handled at a speed exceeding one hundred words per minute.

The transmitting sets at Ongar work in conjunction with receiving equipments at Brentwood, and regular communication is maintained with several of the European capitals as well as the North American Continent.

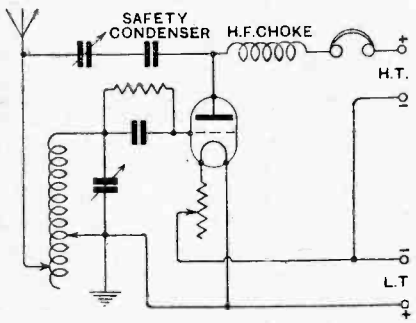
BROADCAST SERVICE IN CHURCH.

THE experiment of conducting a church service entirely by wireless was successfully carried through in Norwich on Sunday, July 12th. St. Bartholomew's, Heigham, was filled with people who took part in the evening service broadcast from St. Martin-in-the-Fields, Trafalgar Square. The congregation remained seated during the singing of the hymns, but knelt during the prayers. Twice during the sermon the St. Martin's congregation were heard laughing at the preacher's sallies.

A Section Devoted to Novelties and Practical Ideas.

SAFETY CONDENSERS IN REINARTZ CIRCUITS.

Reaction effects are obtained in certain receivers by connecting a small variable condenser between the plate of the detector valve and the aerial tuning circuit. In the event of a short circuit in this condenser, the H.T.



Connection of a safety condenser to a circuit with capacity reaction

battery would also be short-circuited through the tuning coils and H.F. choke coil.

The possibility of this untoward event happening is eliminated by connecting a fixed mica dielectric condenser in series with the variable condenser; then, if for any reason the variable condenser short-circuits, the H.T. battery will not be damaged. The insertion of the fixed condenser reduces the effective value of the reaction capacity, but there is no necessity to change the variable condenser if the fixed condenser is given a capacity above 0.001 mfd. The fixed condenser should be mounted carefully, so that its capacity to other parts of the circuit is as small as possible.

The principle is applicable also to many so-called "neutrodyne" circuits in which the neutrodyne condenser is connected through a small coupling coil to +H.T.—T. B.

A SILVERING BATH.

Wireless experimenters who are interested also in photography will find that spent hypo solution makes an excellent bath for silvering small brass parts such as terminals. The article to be plated should be treated with caustic potash in the usual way to remove grease after polishing with emery or cleaning with nitric acid. It is then only necessary to suspend the article by means of a piece of wire in the hypo bath to give a hard and permanent silver coating. An immersion of twenty-four hours will give a fair thickness of silver plate, but in this case a black deposit will probably form on the surface. This is quite loose, however, and may be removed with a damp cloth.—T. A. V.

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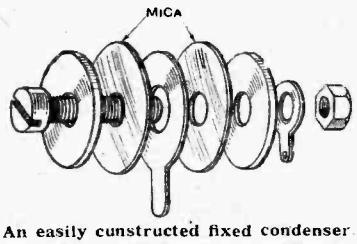
A COMPACT FIXED CONDENSER.

In a portable receiver where space is limited, the fixed condenser shown in the diagram will prove very useful as a series capacity for connection in the aerial circuit. The condenser fits immediately behind the aerial terminal, and is held together by the terminal shank. For the outside plates of the condenser ordinary

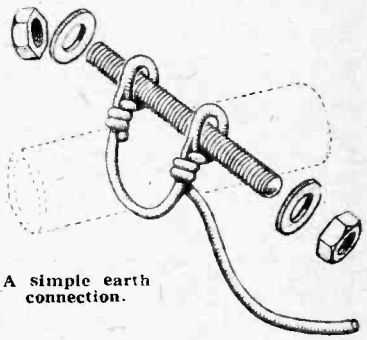


An easily cunstructed fixed condenser

washers may be used, while the centre plate may be cut from copper foil with a centre hole of suitable diameter. The condenser connection is taken from the copper foil to the tuning coil.—A. R. T.

EARTH CONNECTION.

The expense of a special earthing clip for a water pipe can be avoided by making a direct connection with the earth wire itself. Two small loops are spliced in the 7/22 cable, and soldered, if possible, to give addi-



A simple earth connection.

tional strength. The distance between the loops should be slightly less than the circumference of the pipe, which must be scraped perfectly clean. The loops are then pulled together with nuts and washers threaded on a short piece of 2B.A. rod. A joint of this type is equal to, if not better than, an earth clip joint from an electrical point of view.—F. W.

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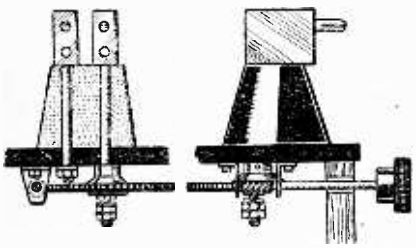
TESTING CRYSTALS.

When testing a series of crystals, much time is lost if each specimen has to be clamped separately in a crystal cup. A much quicker method is to float each crystal on the surface of mercury contained in a small metal cup. The fact that the crystal is not fixed will not cause any inconvenience, and after a little practice large quantities of crystals may be dealt with in a very short space of time. This method can be used, of course, only in the case of crystals which do not amalgamate with mercury.—A. H. P.

A NEAT VARIABLE COIL HOLDER.

This coil holder is intended primarily for use on a platform, on the top of a receiver, at right angles to the main vertical panel. A long securing bolt is employed to hold the fixed coil holder in position, while a



Coil holder for panel mounting.

spindle slightly greater in length is arranged to actuate the moving coil through a worm gear. A spring washer on the vertical spindle ensures smooth rotation of the moving coil. The spindle carrying the worm gear passes through the front panel and is fitted with a small knob. All the moving parts are thus concealed in the set, and the general appearance is a great improvement on the type of coil holder operated with long extension rods.—A. C. D.

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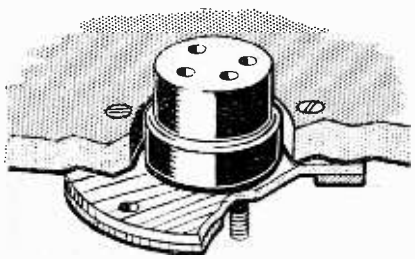
NON-MICROPHONIC VALVE HOLDER.

Ebonite valve holders of the type in which the socket screws project vertically from the base of the moulding can be isolated from mechanical vibration by the system indicated in the diagram. A circular hole slightly larger in diameter than the valve holder is cut in the receiver panel, and a rubber diaphragm cut from an old inner tube is stretched over the hole on the underside. Holes are cut



A valve holder mounted on a rubber diaphragm.

in the diaphragm for the valve socket screws, which are held in position with lock nuts.

In removing a valve, the holder should be held so that the strain does not fall on the diaphragm itself, which would otherwise be torn.—L. G. B.

TUNGSTEN CAT-WHISKER.

Not many amateurs realise that the tungsten filament, which may be obtained from burnt-out electric light bulbs, often gives results superior to the ordinary brass cat-whisker. If the lamp has been in use for some time it will be found that the filament is very brittle, and care should accordingly be taken in mounting. The new tungsten filament is quite soft and is to be preferred if obtainable.—E. J. B. C.

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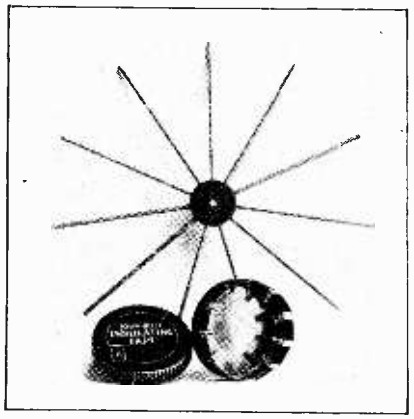
BASKET COIL FORMER.

In winding fixed coils it is not advisable to use too small a centre for the coil former. If the inside turns in the coil are of small diameter, their effect on the total inductance of the coil will not be very great, and they may add appreciably to the high-



A method of increasing the diameter of the hub of a basket coil former.

frequency resistance. The photograph shows a neat method of increasing the diameter of the centre of a basket coil former. A small tin box of suitable diameter is cut at the edges to fit the spokes of the former. It will be found that the new centre will fit quite rigidly on the spokes when the lid is replaced.—E. W.

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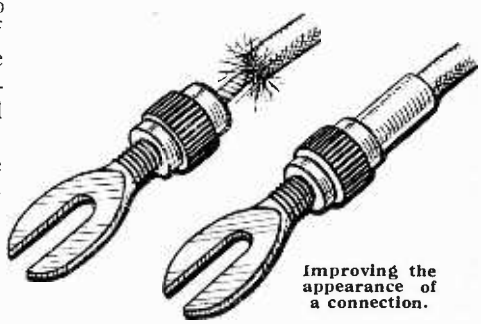
A SOLDERING HINT.

When using untinned copper wire for the connections of a receiver, difficulty is often experienced in tinning the ends before making a joint. The process of tinning will be carried out much more effectively if a groove is filed in one of the faces of the soldering iron and carefully tinned. Then, by sliding the wire into the groove, it will be tinned on all sides simultaneously.—J. D. B.

SPADE TERMINAL IMPROVEMENT.

Spade terminals of the type provided with a miniature chuck for gripping the connecting wire are



Improving the appearance of a connection.

greatly improved by the addition of a short metal sleeve.

The hole in the screw cap should be enlarged to the external diameter of the brass tube forming the sleeve This is then soldered to the cap, and effectively protects the ends of the wire from fraying and presenting an untidy appearance.—W. C. S.

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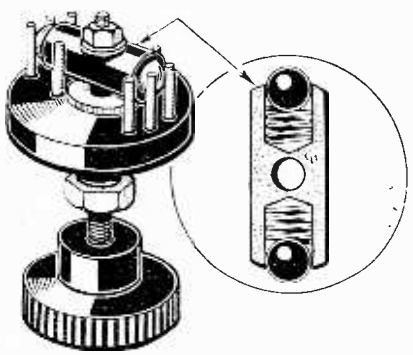
A COMPACT CHANGE-OVER SWITCH

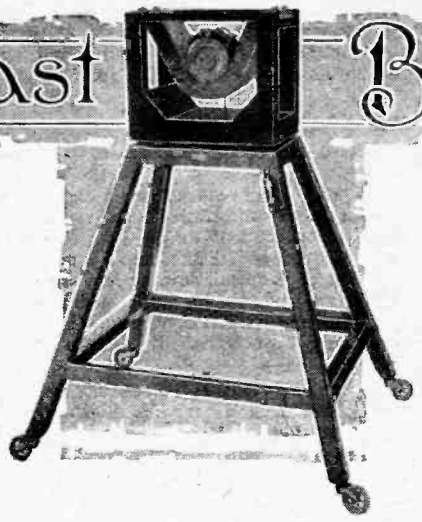
The change-over switch shown in the diagram is only $1\frac{1}{4}$in. in diameter, and is therefore a component suitable for panel mounting. The switch contacts consist of vertical pegs screwed into a circular ebonite base. Through the centre of the base is fitted a "one hole fixing" bush and spindle. The switch arm, which is constructed from a short length of ebonite rod, is fixed on the spindle at right angles with a lock nut. Holes $\frac{3}{16}$in. in diameter are drilled in each end of the spindle to take a short coil spring and a ball bearing. The springs force the ball bearings against



A neat change-over switch suited for panel mounting.

the contact pegs and short-circuit adjacent pairs. Stop pegs are fitted to limit the movement of the switch arm.—H. C.

Broadcast Brevities



SAVOY HILL

B.B.C.'s Annual General Meeting.

In his speech at the general meeting of the Board of the B.B.C., Lord Gainford paid a high tribute to the assistance rendered by the Press in connection with the broadcasting service. Especially he made acknowledgment of the help of the technical Press. This was no mere fulsome adulation, as the Press is watched and considered very carefully by the officials at Savoy Hill, where it is felt that when the history of broadcasting comes to be written the Press will figure prominently in the record as the strongest supporter of this new marvel of science which the B.B.C. has turned to the service of millions of people.

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The Wireless Bill.

The licensing position has been cleared up by the short Bill which has recently been before the House of Commons, and already some listeners have expressed anxiety as to the way in which the non-payers will be discovered.

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At Geneva.

Useful work was done by the European Conference of Broadcast Engineers which met recently at Geneva, and the British representatives are satisfied that a solution is likely to be found by next Autumn as regards interference between various European broadcasting stations. Complaints have from time to time been made that interference by foreign stations has been experienced by B.B.C. stations, notably Aberdeen, Bournemouth, Plymouth and Sheffield. At the Conference, the difficulty was to formulate some plan to prevent interference, and if there were two aspirants for a particular wavelength, the aim was to assess their claims in terms of principals.

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Consideration for Chief Stations.

One of the vital resolutions was that stations which had been longest in existence should suffer the least change in wavelength; but that, notwithstanding that resolution, stations of lesser importance should give way to other stations of greater importance. For instance, an impossible position would be created if a relay station in any continental state were to block out the capital station of another State. It was also recognised that every country represented should have, at any rate, one station (generally this would be the capital station) within the 300-500 metres waveband.

FORTHCOMING EVENTS.

Sunday, July 26th.

ALL STATIONS.—5.30 p.m., Poetry and Dramatic Recital by Edith Wynne Matthison and Charles Rann Kennedy.

EDINBURGH.—8 p.m., Community Hymn Singing Concert, conducted by Sir Walford Davies.

Monday, July 27th.

5XX AND ALL STATIONS.—7.30 p.m., Speeches at the Official Opening of the new High Power Station at Daventry.

Tuesday, July 28th.

ALL STATIONS (except 5XX).—8 p.m., Ballad Concert. 9 p.m., "Radio Radiance" Revue. (Third Edition.)

5XX.—8 p.m., Bach Programme.

Wednesday, July 29th.

LONDON.—8 p.m., Comic Opera, "The Dogs of Devon."

MANCHESTER.—8 p.m., Classical Programme.

GLASGOW.—8 p.m., Scottish Memories.

Thursday, July 30th.

LONDON.—9 p.m., Chamber Music.

Friday, July 31st.

CARDIFF.—8 p.m., "Adventure Afloat."

BELFAST.—7.30 p.m., "Liszt, and Excerpts from Grand Opera.

Saturday, August 1st.

LONDON.—8 p.m., Melody, an informal instrumental Recital followed by "The Roosters."

CARDIFF.—8 p.m., Music of Russia.

MANCHESTER AND 5XX.—8 p.m., The Opera, "Cavalleria Rusticana" (Mascagni), followed by "The Mastersingers" (Wagner).

ABERDEEN.—8 p.m., Scottish Programme.

TOPICALITIES.

All Night Sitting.

The Conference held all-night sittings, and had all Europe, as it were, on a pin; that is to say, the delegates were provided with vari-coloured papers, pieces of which they pinned on to charts, so that all present should ascertain at a glance exactly where overlapping occurred. It was finally decided to appoint a committee of seven members of the Conference to fix a scale of wavelengths for all stations. As a result of their decision, fifteen European stations will be removed from the 300-500 metres waveband, which will still be fully occupied, and sixty stations will go to 200-300 metres and 500-600 metres. Schemes for thirty-eight new stations were rejected.

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New Wavelengths.

Arrangements will be made on a date at about the beginning of September for all stations to change to the wavelengths allocated by the Committee of seven, and to carry out an experiment, after broadcasting hours, to ascertain if the new plans work. Listeners will be asked to co-operate and each country will take count of what is jamming its own stations. At the first rehearsal there will probably be considerable confusion, and a second rehearsal will be necessary after an exchange of experiences as between country and country through Geneva. The engineers will then be able to go back to Geneva at the conclusion of rehearsals equipped with information which will enable them to readjust their plan on the basis of the experience thus gained.

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Sanction for Wavelengths.

The immediate step before the broadcasting authorities is to approach their National Government to obtain sanction for the wavelengths which have been fixed, and this is being done immediately. Each country will approach the most competent national authority to measure the wavelengths with extreme accuracy during the rehearsals.

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Grand Opera.

Operatic productions continue to be among the most popular features of the Manchester programmes. On Saturday, August 1st, a performance of "Cavalleria Rusticana" will be given, the principals being Miss Stiles Allen, Miss Rachel Hunt, Mr. Edward Leer, and Mr. Lee Thistlewaite. Listeners all over the country will be enabled to listen to this opera, as it will be relayed to 5XX.

Power of Main Stations.

Apropos last week's reference to the power of main stations, the rumour persists that the erection of a high-power station additional to Daventry, somewhere in the North, is under way. This may be emphatically denied. No high-power station other than 5XX is contemplated by the B.B.C., and that section of the press which has been speculating on a probable site for such a station has been entirely misled.

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Daventry.

Arrangements for the opening of Daventry on July 27th are now practically completed. The chairman and directors of the B.B.C. will receive the Postmaster-General (Sir William Mitchell-Thomson) and guests at Euston Station, whence a special train will leave at 4.50 p.m., arriving at Daventry at 6.20. Motor coaches will meet the train at Daventry to convey the party to the B.B.C. station, where they will arrive about 6.40 p.m. There will thus be time to inspect the station and return to the studio before 7.30 p.m., at which hour the Postmaster-General will officially open the station.

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The Programme.

The 7.30 to 8 p.m. portion of the high-power station programme, including the opening speeches, will be given from the Daventry studio, and the remainder from the London studio, as usual. The local studio is normally for emergency purposes only. The accommodation is very limited, and arrangements will, therefore, be made for most of the guests to hear the speeches, etc., by means of a loud-speaker in a second room. The guests will return to London by the train leaving Daventry at 8.45 p.m., and will arrive at Euston at 10.15 p.m.

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The Lighter Side of Talks.

There are lighter aspects of what are regarded by some people as the heaviest part of the broadcasting programmes. Letters are sometimes received by a speaker subsequent to his Talk complaining, not of the Talk itself, but of the quality of transmission. A well-known personage, whose life work is devoted to interests far divorced from electric transmission got a note recently from a listener as follows :—

> "The station did not have enough power behind you last night. However, I got 90% of it, and it was very good; but next time will you ask them to put in another amplifying valve?"

Another speaker received a letter from an old friend in Norway whom he had not seen for many years, but who declared that he recognised the speaker's tones immediately he began to broadcast.

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"The Roosters."

An exceptionally good programme of fun and humour is being prepared by "The Roosters" Concert Party for August 1st, and, although we do not usually give programme items in these columns, we feel that no apology is needed for doing so on this occasion. The programme is a burlesque of all kinds of summer sports, and the famous concert party will deal in the manner indicated with the following sports :—

TENNIS.—The Lenglen Trail or The Shaven Lawn. (The Little Mower and How Much it is.)

CROQUET.—"Putting You Through the Hoop." (Air de Mallet.)

UP-RIVER.—The Punter's Paradise.

CRICKET.—Hobbs' Choice—Hundreds and Thousands. (Song) "O Willow Waly." (Sketch) "The Wicket World," or a "A Blob on the Escutcheon."

POLO—AND FRANCESCA.—The Chukker-in and the Chukker-out.

THE TURF.—See UP-RIVER.

SWIMMING AND BOWLS.—Ducks and Drakes.

THE TRACK.—Sprinter's Pie, a Running Commentary.

GOLF.—"The Swearing o' the Green" in Fore Reels. "Tee for Two"—a Round. "Plus Fours"—Comic Sketch.

SUMMER BEVERAGES. — Egg-Flip—A Rooster Lay. Peach Sundaes—"The Better the Day the Better the Feed." Banana Phosphates—"We Don't Care Two Straws." Vanilla or Strawberry—"Bring Your Own Wafers." Claret Cup Cordial—"All the Best!"

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Acoustics and the Loud-speaker.

In the broadcast talk on Saturday, July 18th, on behalf of the R.S.G.B., Mr. J. F. Stanley took for his subject the various acoustic factors involved, especially at the receiving end, in obtaining the best results from loud-speakers.

He advocated the use of large instruments not on account of their power but because their tone is usually more mellow and they will stand a greater amount of amplification without distortion. Mere loudness often defeats its own object, and it is more important to study the conditions governing distinctness.

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Echo Effect.

The greater the absorbing power of the room, the less the echo effect and, consequently, the more distinct the syllables become. It is often found better to split up a large audience into two or more rooms with a loud-speaker in each, than to put them all in one large hall with a much larger loud-speaker.

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Absorption Effects.

The advantage of a small room from the point of view of distinctness is that it has a larger surface in proportion to volume than a large room, and therefore a relatively larger amount of absorption of sound by the walls and ceiling takes place. This absorption depends on the characteristics of the room, and is a very important point in connection with distinctness.

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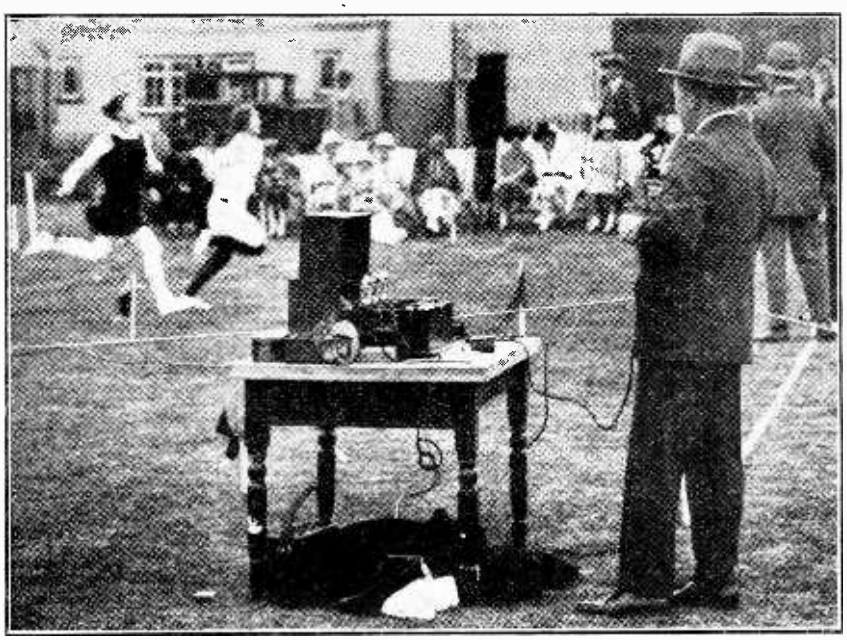
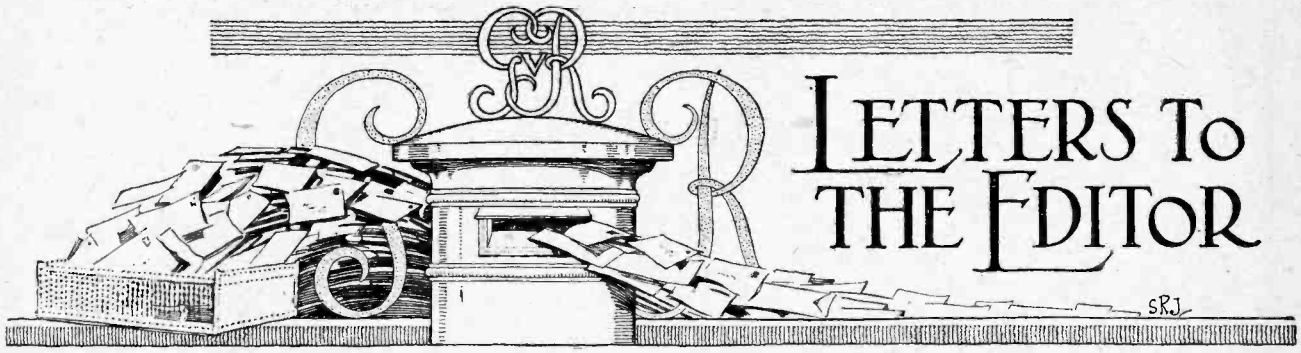
Fewer Talks.

Owing to the desire of the B.B.C. to reduce the number of talks during the summer holiday period, the R.S.G.B. has decided to forgo its next three talks, but they will be resumed on the 19th September.



AMPLIFIER AT SPORTS MEETING. An interesting novelty at the recent Summer Sports of Messrs. Catesby's, Ltd., was the use of home-made amplifying equipment for announcing the results.



The Editor does not hold himself responsible for the opinions of his correspondents.

Correspondence should be addressed to the Editor, "The Wireless World," 139-140, Fleet Street. E.C.4, and must be accompanied by the writer's name and address.

PROPOSED BRITISH I.R.E.

Sir,—I have read with interest your Editorial in the current issue of *The Wireless World* on the proposed formation of a British I.R.E., and am very pleased to note that you made full enquiries before dealing openly with the matter, the result of your enquiries having been such as to leave no doubt as to the sincerity of the proposed Institute. I have for some time felt, like yourselves, that the I.E.E. have not recognised radio engineering as distinct from general electrical engineering. This is a mistaken policy, and I have in mind one particular friend of mine who has had no electrical engineering experience whatever, and yet he can tackle almost any radio problem that is placed before him, both theoretical and practical, and it is for this class of individual that the proposed Institute is determined to cater. It is a pleasure to read the words, "We welcome the proposed formation of an Institute of Radio Engineers," for such encouragement is indeed necessary considering the amount of opposition we are experiencing from the purely electrical engineering profession. This opposition is only natural from persons who have not been trained as radio engineers, but have gained their knowledge in an atmosphere of general electrical engineering. We sincerely hope, should our scheme be successful, that we may be allowed to associate ourselves with the Institute of Electrical Engineers, and with this end in view we desire only to accept members whose profession leaves no doubt as to their radio qualifications.

Up to date I have received over 60 applications, and of these ten have been chosen as founder members at the initial fee of £5 5s. It is, perhaps, wise to explain that these founder members are necessary in order to draw up the articles of association and place them before the Board of Trade for their perusal, with a view to obtaining the registration of the Association, and the rather large fee mentioned is a guarantee of their qualifications and of good faith.

The subsequent fees will no doubt be smaller according to the grade of membership, and it will be necessary to pass examinations before election. I hope the fact that we have approximately 400 members of the American Institute of Radio Engineers in this country, paying about £700 or £800 yearly in fees, will help to emphasise the necessity of a British Institute. Of this number, about 5 per cent. are members of the I.E.E.

Should the Institute of Electrical Engineers consider the new Association worthy of the honour, I have no doubt that the latter would be pleased to become affiliated to, or entirely absorbed by that Institute which decision would, of course, rest with the Council in power at the time.

Y. W. P. EVANS.

Sir,—I am very pleased with your Editorial article *re* the formation of a new society for radio engineers.

Letters are coming in very freely, and quite 90 per cent. speak in glowing terms of the idea of this new society. They say that it is a move which has been waited for for a very long time.

I also appreciate very much the attitude of the Radio Society, and would like to assure them that I have not any intention of making this new institution a water-tight compartment. If we can get good papers together, by all means let the Radio Society members and any other persons interested share them, and, as you know, I am doing all I can to secure the co-operation of the Council of the I.E.E.

At the moment it is meaning a good deal of work for Mr. Evans and myself, so I should appreciate contributors forgiving any slight delay they may experience in receiving replies to their correspondence.

Any suggestions you yourself may care to make will be very much appreciated.

Thanking you very much for the attitude you have taken in this matter.

JAMES NELSON.

Prescot.

JAMMING FROM FRENCH BROADCASTING.

Sir,—With reference to Mr. S. E. Cryer's letter in your issue of July 1st regarding Radio Ancel, I have twice received this station at great strength on two valves, and on one occasion heard him on a crystal alone. I understand his address to be 84, Boulevard Perraire, Paris, and wrote to him. My letter was returned "Not known" by the Post Office, and since Paris on a crystal set in Edinburgh was scarcely credible I at once concluded it must be a local amateur's joke! Further information would certainly be welcome, and it will be interesting to hear if Mr. Cryer's letter has better luck than mine.

Edinburgh. HAROLD BARGER.

INTERFERENCE WITH BRITISH BROADCASTING.

Sir,—Referring to the letters published in *The Wireless World* of July 1st, written by S. E. Cryer and Mrs. W. B. Booker respectively, the writers will have seen on page 26 in the issue in question your further remarks on this subject, and the fact that a European agreement on wavelengths and power has become an absolute necessity is, of course, obvious.

It may be of interest to the two experimenters named to say that the reception in the south, on the sea coast, as regards noise, makes 5XX, 2LO, and Radio-Paris fade into insignificance. The transmission is altered at times, as on June 27th at 18.00 B.S.T., the wavelength was 360 metres, but the noise, the shouting, and the gramophone was the same.

It is, of course, only natural that new stations must experiment, and this, if done in a reasonable manner, is certainly very interesting.

To receive in the quietness of early morning a strange station obviously far away, transmitting very good music, is an experience worth waiting for, and, after a few weeks, to run it to earth, as in the case of Barcelona, makes the whole experience worth while.

The question of the "big noise," however, is one which makes all experimenters think, and wonder why such methods are adopted; the large power, non-improvement of transmission, and the times used for experiments are, to the average mind,

unreasonable, and some of the effects noted might be applicable to beam transmission.

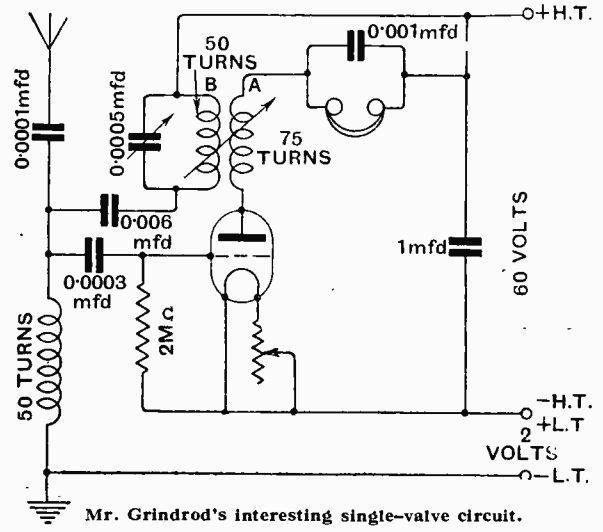
Deliberate interference is another phase to be dealt with. Somebody perhaps does not care for a certain orchestra playing in London sometimes on Sunday evening. He therefore does his best to prevent anybody else from hearing it. A personal demonstration of applied atmospherics and the disqualification of holding a licence is the only cure.

May I take this opportunity of saying how much I appreciate the very improved *Wireless World*.

Hove. TRANSFORMER.

AN INTERESTING SINGLE-VALVE SET.

Sir,—The circuit described below is the result of a fair amount of experimenting to find a really simple circuit giving good results from the local and any main station at, say, 50 miles distance. After trying out practically all single-valve circuits, both straight and reflex, and comparing them with the results I have got from this, I am satisfied that it gives equal performance, has no intricate tuning and is more selective than most. I made it up into a portable set, which fits comfortably into a 20 in. suit case with all batteries and 'phones. It is,



Mr. Grindrod's interesting single-valve circuit.

of course, necessary to get the correct direction of winding in the A coil. If there is any tendency to oscillate, the filament current may be reduced or coupling loosened. It will be found that there is one coupling which will give the best results from the near stations, and no further alteration will be needed, unless one wants to go further afield, when closer coupling is necessary.

The value of the fixed capacity reaction condenser is not critical, but 0.006 mfd. seems to be the most efficient. I have tried values from 0.0001 up to 0.25 mfd. For all round purposes a fixed aerial condenser of 0.0001 mfd. works well.

When once the correct coupling for the coils A and B has been formed, there is only the adjustment of the variable condenser. The aerial coil may be put right away from the other coils, or a three-coil holder can be used. In my set I use a two-coil holder, and have the aerial coil mounted at some distance away. Quite good results may be had from Chelmsford, using a No. 200 coil for the aerial, a No. 250 for coil A, and a No. 200 for coil B.

In my set I have embodied a series-parallel aerial switch and a reversing switch for coil A, so that the wiring need not be interfered with in any way when receiving stations needing different coils. For the sake of simplicity, however, the connecting of the switches have been omitted from the diagram.

Liverpool. E. B. GRINDROD.

B 28

THE REACTION CLICK.

Sir,—Although the limit of signal strength of a receiver is always fixed by the click of starting oscillation we have never seen any attempt to explain precisely to what this click is due.

We know well enough that it denotes excess of reaction, but this is no help to us in increasing signal strength.

The usual statement that our aerial is oscillating on one side of the click and not on the other is misleading and inaccurate, as the aerial is oscillating and transmitting to a certain degree long before signals come up to strength.

If it is due to the valve—accumulation of a charge on the glass or grid—then the valve makers should try to avoid it. If it is due to an introduction of negative resistance in the valve, concomitant with oscillation, then there ought to be some means of neutralising it automatically.

Perhaps it is due to the start of rectification or of harmonic oscillation.

More probably it is one of the usual phenomena which so frequently accompany high speeds, as shown, for instance, by a water jet which breaks into a spray at a certain critical speed, or the sudden increase in back pressure when air or water is passed through pipes at increasing speeds.

These are well known to be due to eddies, and there is every reason to believe that eddies will not form round the wires of the grid.

The usual cure for such eddies is to decrease the flow or decrease the resistance. Decreasing the flow of current through the valve—by using a higher impedance valve—certainly does delay the click, and, of course, decreasing the resistance by putting a positive potential on the grid does the same, but with loss of efficiency.

The use of a very small grid condenser helps matters, and the use of a leak makes the click more marked, and more difficult to control.

High-frequency amplification is limited only by the click, but in this case it is frequently due to a low-frequency component. The click is always associated with a flow of current, and the less current we have in H.F. work the better.

But once again, what happens at the click?

Luton. ERNEST J. BATY.

WIRELESS RECEPTION IN INDIA.

Sir,—I shall be very much obliged if any of your readers can help me in regard to getting information concerning the best kind of wireless set to take out to India. I am thinking of taking out a three or four valve set, as I shall have to be able to get both Calcutta and Bombay, which are 1,200 and 800 miles respectively from where I shall be living. I should also like to be able to pick up London if that is at all possible without too much expense.

I am anxious to get information from anyone who has had experience, and particularly from any who may be in this country and who knows something about wireless in India. I may say that I shall be stationed south-west of Madras, in the south of India.

I am also informed that it is necessary to get a special licence from Simla in order to import the set. I should like to have some information upon that from anyone who can give it to me. H. A. POPLEY.

Croydon.

CALLS HEARD IN INDIA.

Sir,—Readers of *The Wireless World* may be interested in the following calls, heard in India from June 8th to 25th, 1925: British: 2KF, 2XY, 2DX, 2LZ, 5DH, 6LF, 8AL (?), 5GH. French: 8SM, 8GB, 3ZZ. Finland: 1NA. Palestine: BIR, BSM, BSR. Germany: POX, POY. American: WIZ, U2BG, 2BW. Mexican: 1GH, 1GD. Argentina: CB8. Australian: 2CM, 2YG. Indian: 8UG (R.A.F., Kohat, N.W.F.). Unknown: S2Y, 73S. All below 50 metres. 0-v-2.

Kohat, N.W.F., India. M. H. FIGG.

Readers Desiring to Consult "The Wireless World" Information Dept. should make use of the Coupon to be found in the Advertisement Pages.

Using Transformer Secondaries as Chokes.

A READER wishes to construct a four-valve receiver which is to embody two stages of choke coupling. He desires no switching arrangements, but wishes to know if it is possible to use the secondary of an L.F. transformer for a choke in each stage in such a manner that the output of the detector valve or the first L.F. amplifier can be obtained by the simple process of attaching the telephones to the primary terminals of the transformers whose secondaries are being used as chokes.

This is certainly possible, but our reader should obtain low ratio transformers of a good make. A 2.5 to 1 ratio would be quite suitable. We give below in Fig. 1 a diagram of the necessary connections. Of course, it must be realised that the effect of the transformer will be to give a slight step down in voltage, and therefore there will be some loss in signal strength as compared to that obtainable when the telephones are connected directly in the anode circuits of the valves concerned. The step down, however, will not be so great that low resistance telephones are called for, and the ordinary high resistance type may be used. A low ratio transformer is frequently used by amateurs with great success as an output transformer in order to prevent the steady anoode current flowing through the windings, since it must be remembered that the last stage of a low frequency amplifier in which a large power valve is used, as it frequently is nowadays, is productive of a fairly heavy anode current.

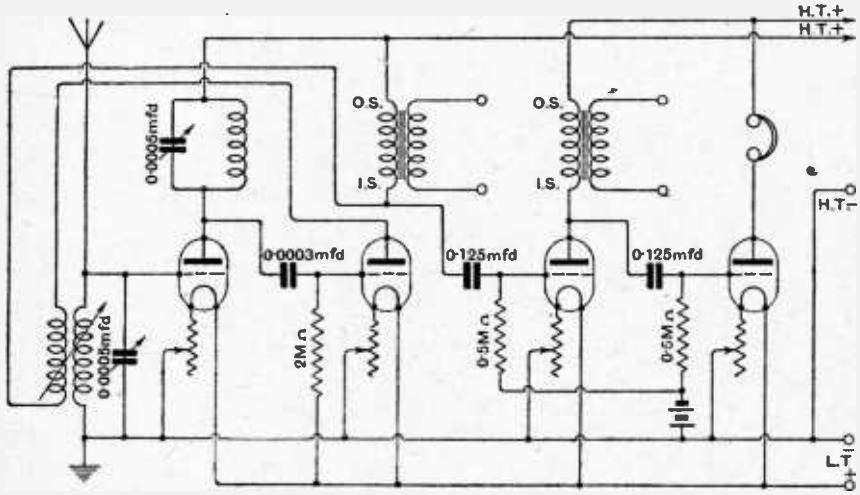


Fig. 1.—A four-valve receiver, with one stage of tuned anode H.F. amplification, valve detection, and two stages of choke-coupled low-frequency magnification.

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Designing an Intermediate Amplifier.

AN interesting point in receiver design which troubles many readers is the best wavelength to decide upon for the intermediate amplifier of a superheterodyne type of receiver. It is, of course, quite impossible to lay down any hard and fast value for this. Many readers have the idea that the longer the wavelength the better are the results, and some have carried this idea so far that they have attempted to construct their intermediate amplifiers to respond to a wavelength of thirty thousand metres. This idea is, of course, quite fallacious, and readers who design intermediate amplifiers to respond to such high wavelengths as this will find that, apart from all other disadvantages, their heterodyne beat will practically cease to be supersonic, since the frequency corresponding to this wavelength will come within the indeterminate borderland separating the lower radio from the upper audio frequencies. Apart from this, however, it is generally found that a receiver working on such a long wavelength is very noisy, the principal reason for this being that it is customary to employ iron-cored transformers for these very high wavelengths, and these pick up stray magnetic fields due to the presence of electric lighting mains, etc., in the same manner as ordinary low frequency transformers, in addition to the rather noisy "background" inherent in these components. It will be found also that unless the intermediate amplifier is very carefully screened, it will be prone to pick up atmospheric noises direct, a source of trouble which is very marked on these high wavelengths. There is actually no need to make the intermediate wavelength any longer than that upon which efficient and stable amplification can be secured. Experience shows that this result can be secured by making the amplifier have its optimum point somewhere between 3,000 and 7,000 metres. If great care is taken, successful intermediate amplification can be obtained on a wavelength a little lower than 3,000 metres, and a few readers have reported to us that they have had great success by arranging their intermediate amplifiers to respond to a wavelength of 1,600 metres, thus enabling 5XX to be received by direct H.F. amplification through the intermediary of a simple switch designed to cut out the first detector and oscillator.

Since also it is the desire of many of our readers to "reflex" their intermediate stages, it is very unwise to make the intermediate amplifier too high, since successful "reflexing" becomes increasingly difficult as the wavelength advances, it being extremely difficult on long wavelengths to separate the two frequencies. In order to overcome this latter difficulty many amateurs have gone to the other extreme, and have reduced the wavelength of their intermediate amplifier to as low as 1,000 metres. This is, however, not to be recommended, as the difficulty of securing effective and stable amplification on this wavelength is extremely great.

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Method of Using a Push-pull Amplifier.

WITH reference to the push-pull amplifier circuit which appeared in this section of the journal of recent date, many readers do not seem to quite understand the purpose of employing valves in this way. It may be said briefly that it is a very useful and efficient method of constructing an amplifier capable of handling large powers, and its sole purpose is not, as many people suppose, to enable ordinary valves to be used in a manner which will give the same results from the point of view of good quality as would an expensive power valve, important though this reason is. It is not generally realised that if two power valves are used in this

manner, double the permissible grid voltage fluctuation of any one power valve can be employed without causing amplitude distortion.

As is well known, it is necessary in the case of an ordinary valve amplifier to confine the operations of the valve to the straight portion of its grid volts-anode current curve which lies to the left of the point where grid current commences, and if these limits are overstepped by applying too great an input power to the valve, distortion appears. This portion of the curve is often spoken of as the "straight line" portion of the curve. Obviously this is more likely to occur in the final stage of L.F. rather than in the preliminary stages, and it is usual, therefore, to employ a power valve in this stage, since this type of valve has a considerably longer "straight line" portion of curve than an ordinary valve. However, if we care to use two ordinary valves in a push-pull amplifier, the effect is to add together the "straight line" portions of the curves of the two valves so that the result is similar to the use of a power valve in an ordinary amplifier.

It will be seen that a further advantage can be obtained in the case of signals of exceptional strength by employing two power valves in a push-pull amplifier, since it must not be forgotten that frequently the input to the grid is too great for even a medium-sized power valve of the D.E.5 type to handle without distortion, and by using two of these valves in a push-pull amplifier the effect is, roughly, to add together the "straight line" portions of these two power valves, which are already fairly long. Thus a very large amount of power indeed can be handled without distortion.

Readers who desire fuller information concerning this matter are referred to page 271 of the issue of *The Wireless World* for June 4th, 1924, where a complete constructional article of an instrument of this description was given, together with much useful technical data.

Many readers also are under the impression that it is necessary to use a low resistance loud-speaker with this instrument, but this is, of course, not the case, since it is possible to obtain the output transformer with windings suitable for either high or low resistance loud-speakers. A further advantage of this circuit lies in the fact that the loud-speaker windings are removed from the harmful influence of the H.T. battery.

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Efficiency in Valve-Crystal Circuits.

WE frequently receive requests from amateurs concerning the best method to adopt to increase the range of their crystal sets. In most of these cases this is necessary owing to the fact that readers live just on the outside borders of the limit of crystal range. In these cases it has become customary to recommend the provision of an L.F. amplifier, although it is doubtful whether this is the best advice that could be given, since when the input to an L.F. amplifier is rather small, the resultant quality is not good, and it is not improbable that the stray noises may be sufficiently great to mar reception. In these cases, therefore, we are definitely of the opinion that the use of the valve as an H.F. amplifier would be productive of greater satisfaction. In other cases crystal set users are desirous of adding a valve to their sets in such a manner that two or three stations may be received. In these latter cases, of course, H.F. amplification becomes indispensable. It has, however, become an obsession with many people that the correct thing to do in these cases is to convert the set to a one-valve-crystal reflex, since, they argue, in this manner maximum efficiency is obtained from the valve. This is not so, however, although it cannot be denied that this is the best method to adopt in cases where maximum signal strength from the local station is required. When a valve is used for dual amplification purposes, it will usually be found difficult to obtain a smooth control of reaction, since the set is prone to burst into low frequency "buzzing" long before the reaction coil coupling is sufficiently close to be of any benefit in providing H.F. reaction. Readers who remedy this defect by connecting a variable high resistance from the grid to the L.T.+ of the valve are, of course, merely working in a vicious circle. If, however, we abandon "reflexing" and adopt the circuit given in Fig. 2, we shall find that we are able to make full use of reaction without any risk of instability. Crystal users who adopt this circuit will find that not only are they able to hear the local station (which was hitherto only just audible) at excellent telephone strength, but at the same time other broadcasting stations are well within their range.

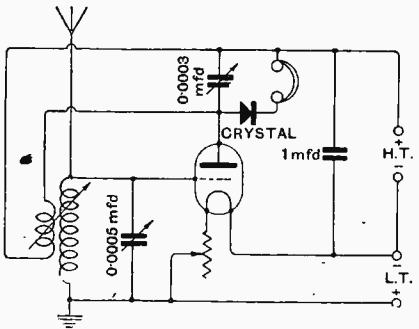

Fig 2 —Single valve and crystal set.

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Operating Dull-emitters Economically.

A READER who proposes to build a two-valve reflex receiver using valves of the type which require from 0.8 to 1.1 volts for filament lighting, such as the "Wecovalve," enquires whether it is feasible to run two of the valves in series from a two-volt accumulator without any filament resistance.

This is quite feasible, and these types of valves can be used in this manner very successfully and economically. When two such valves are used in parallel from a two-volt accumulator in the ordinary manner, it is obvious that it will be necessary to drop half the available voltage across a filament resistance, and this represents so much wastage. In addition the total current drawn from the accumulator will be half an ampere, since these valves are usually rated at 0.25 amp. When used in series in the manner previously described, however, no power is dissipated in a filament rheostat, and at the same time a further great economy can be effected by the fact that the current consumption for the two valves will be no greater than if only one valve were used. These "one volt" valves are extremely useful for series lighting, since it is obviously possible to run four of them in series from a four-volt accumulator, or six in series from a six-volt accumulator without any rheostat. In the case of a six-valve receiver, therefore, the total current consumption of 0.25 amp. is less than if six 0.06 amp. valves were used in the ordinary manner, in which case the total consumption would be 0.36 amp. An additional advantage is that the one-volt type of valve is more robust and less microphonic than the 0.06 amp. type. In cases where it is desired to use four or six of these valves with a two-volt accumulator they may be coupled in pairs, each member of the pair being in series with the other member. In this way it is obvious that the drain on the accumulator is reduced. Although these valves are not primarily designed for use with dry cells, it is certainly possible to draw 0.25 amp. from a large dry cell for a limited period, and thus one valve may conceivably be used from a dry cell, but it is not possible by the ordinary method of connection to run two of these valves from a dry cell. Further, the method of connecting dry cells in parallel is not always satisfactory, as one cell is liable to discharge into the other. By using two cells in series, however, it is possible to light three of these valves at the same current consumption as for one valve, and if five dry cells are used in series, no less than six valves may be lighted from dry cells.

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DAVENTRY—THE B.B.C. HIGH POWER STATION.

AFTER many months of arduous labour the Daventry Station of the B.B.C. is completed and has been formally opened by the Postmaster-General at a ceremony which took place on Monday last. It will be recalled that the Daventry Station, or at least a station on a site in that neighbourhood, was projected as soon as authority was obtained for a high-power station to operate on a wavelength of the order of 1,600 metres. The installation at Chelmsford has been in the nature of a temporary expedient to provide long-wave broadcasting, whilst this new station, in a more central position, was being prepared for service.

There has been a considerable speeding up in the work of installing the station during the past few months in order that it might be completed by the time specified, and, although it has now been formally opened, this is not, we understand, a guarantee that it will commence regular transmissions immediately, because, so far practically no time has been devoted to preliminary experimental transmissions which must be regarded as essential before guaranteed regular programmes can be put out. It would not be possible to anticipate every difficulty which might arise after completion of such a station as this, which is the newest and probably the biggest station yet constructed solely for broadcasting purposes.

It will be remembered that the transfer of the London Station, 2LO, to its present site was accompanied by considerable technical difficulties, and, in fact, the station was not operating satisfactorily until recent weeks, and if the same behaviour is adopted by the Daventry Station this must not come as a surprise to listeners. Criticism may be made from time to time of the policy of the British Broadcasting Company in the matter of the wavelengths and power of the stations and other matters of detail, but the progressive spirit which has been shown throughout the period since the B.B.C. was inaugurated is a matter which calls for admiration. When we consider that from the very outset it has been entirely pioneer work with innumerable difficulties to surmount and fresh problems arising from day to day, one must recognise that a very large amount of credit is due to those who have been responsible for the building up of such an organisation.

The whole question of broadcasting is, as we have recently learned, to come up for consideration by the Government before the end of the present year. The question of whether there should be competitive broadcasting in this country is a matter which need not be discussed here now, the object of the present note being to record the opening of the Daventry Station and to offer congratulations to the B.B.C. on their enterprise and the progress achieved.

It would be out of place to express appreciation of the work of the B.B.C. without coupling with it the name of the managing director, Mr. J. C. W. Reith, who must feel justly proud of the organisation which has grown up under his direction.

CONTENTS.

Long Distance Summer Reception.

By W. JAMES.

How to Make a Six-Valve Super-heterodyne Receiver.

IT will be agreed by the majority of amateurs that to receive at all regularly and consistently the programmes of distant B.B.C. and Continental broadcast stations with such purity and strength as to make their reception worth while, calls for a receiver of exceptionally good design. Of course, there is no difficulty in receiving a few distant stations occasionally with, say, a two-valve set installed at a place sufficiently distant from a B.B.C. station to make the problem of cutting out that station of minor importance. By far the greater number of amateurs, however, are not so favourably situated, and it is indeed a difficult, though an interesting, problem as to how a circuit can be arranged in order to have the desired selectivity and amplification without introducing more or less serious distortion.

Selective Circuits.

Selectivity can be obtained by employing a number of suitably arranged tuned circuits and by the use of a small frame aerial. These circuits can be used as a form of filter or multiple tuner, but, as a fair amount of high-frequency amplification is required, it is preferable to put the tuned circuits between valves and to use them as intervalve couplings. But it is no easy matter to build a straight H.F. amplifier with two or three stages for the broadcast wavelengths because of the well-known tendency of such an amplifier to oscillate and to be generally unmanageable.

Two things can be done, however; we can build the receiver on the neutrodyne or the super-heterodyne principle. In the neutrodyne receiver the H.F. couplings are so arranged that stray magnetic coupling is negligible, and the capacity of the condenser formed by the grid and plate of the valve and its circuit is balanced out. This type of receiver is used with an outdoor aerial, and the selectivity can be adjusted to the right degree by properly proportioning the intervalve couplings.

The usual neutrodyne receiver has two stages of tuned high-frequency amplification employing three similar H.F. transformers and tuning condensers. Such a receiver was described as long ago as December, 1923, by the writer, and the many reports from readers who built this set testify to its selectivity and faithful amplification. It is not a difficult receiver to operate,

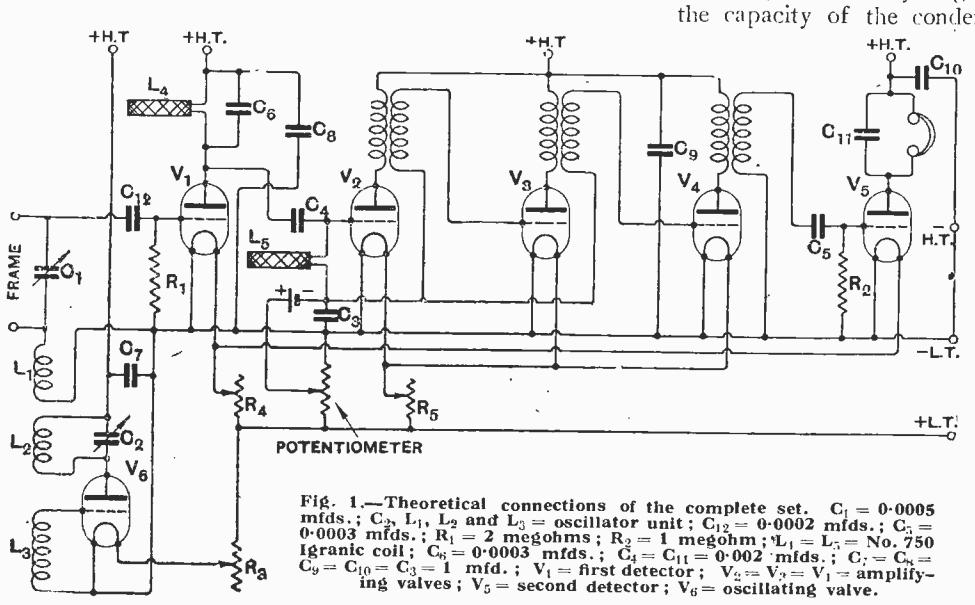


Fig. 1.—Theoretical connections of the complete set. C_1 = 0·0005 mfds.; C_2, L_1, L_2 and L_3 = oscillator unit; C_{12} = 0·0002 mfds.; C_5 = 0·0003 mfds.; R_1 = 2 megohms; R_2 = 1 megohm; L_4 = L_5 = No. 750 Igranic coil; C_8 = 0·0003 mfds.; C_4 = C_{11} = 0·002 mfds.; C_7 = C_8 = C_9 = C_{10} = C_3 = 1 mfd.; V_1 = first detector; V_2 = V_3 = V_4 = amplifying valves; V_5 = second detector; V_6 = oscillating valve.

Long Distance Summer Reception.—

as it has only three controls—the three tuning condensers. The adjustment of these is not critical; in fact, the individual stages are rather broadly tuned, but the overall selectivity is very good.

The Supersonic Principle.

The difficulty of obtaining high amplification on broadcast wavelengths is overcome in the super-heterodyne receiver by changing the wavelength of the incoming signal. An amplifier designed for a long wavelength such as 5,000 metres is employed, and between this and the aerial a wavelength changer is connected. The wavelength changer comprises a rectifier and a source of oscillations of such a frequency as to produce with the incoming signal a beat frequency which corresponds with the mean peak frequency of the amplifier. A frame aerial is used as the collector, partly because of the local oscillator and partly because such an aerial tuned with a condenser has fairly well-marked directional properties, and is more selective than an ordinary open aerial.

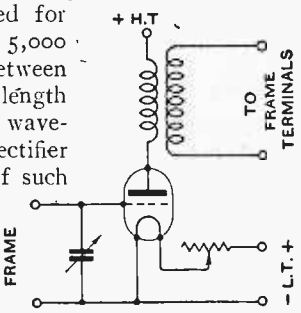


Fig. 2.—Connections of an H.F. unit. The condenser should have a capacity of 0·0005 mfds.; the H.F. Transformer is described in the text.

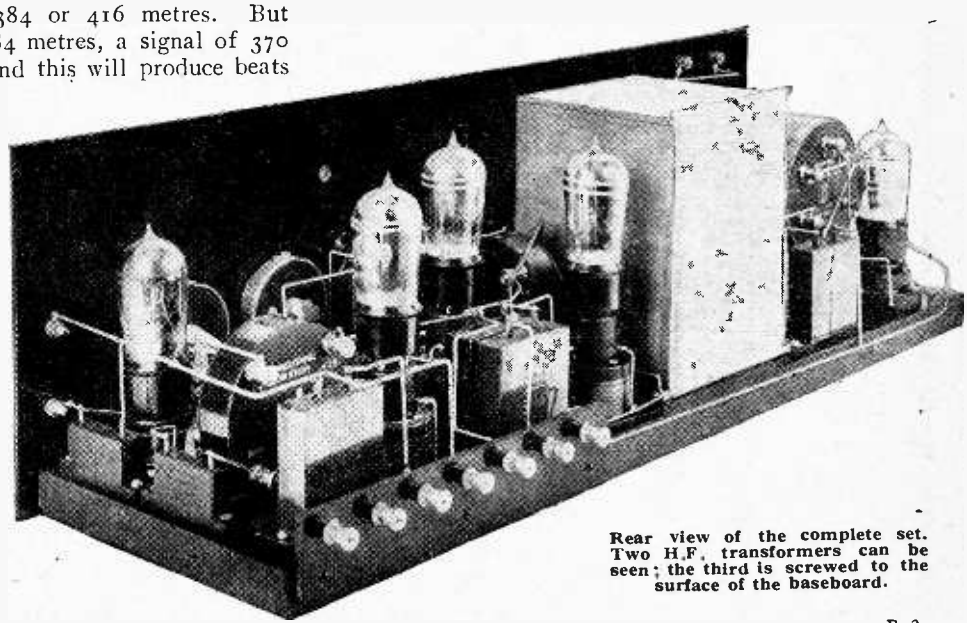
None will dispute the fact that it is possible to obtain far more overall amplification with a super-heterodyne receiver than with other receivers, but how does it compare for selectivity? The selectivity depends on the wavelength and characteristics of the long wave amplifier and on the tuning properties of the frame aerial (when no H.F. amplification is used before the first detector).

The effect of the wavelength of the amplifier on the selectivity may be explained as follows: Suppose the wavelength is 10,000 metres, and that we wish to hear a signal on 400 metres. Then the frame is tuned to 400 metres and the oscillator to 384 or 416 metres. But when the oscillator is set at 384 metres, a signal of 370 metres may combine with it, and this will produce beats of 10,000 metres. Also, if the oscillator is set at 416 metres, a signal of 435 metres will set up beats of 10,000 metres. We have, therefore, to rely upon the tuning of the frame aerial to be sufficiently sharp when tuned to 400 metres to keep out signals of 370 and 435 metres.

Now, suppose the wavelength of the amplifier to be adjusted for 3,000 metres. To receive a 400 metre signal the oscillator will be set at either 353 or 462 metres, which will beat with 315 or 545 metres. The frame aerial has to distinguish between 400 and 315 or 545 metres in this example, however, whereas when a 10,000 metres wavelength is used the frame is called upon to separate 400 and 370 or 435 metres. Clearly then, the selectivity will be best when the 3,000 metres amplifier is used.

When the receiver is used for the reception of modulated (telephone) signals, the possibility of stations heterodyning to produce an audible note is far less remote. Broadcast stations transmit, besides the carrier frequency, a band of frequencies which may lie between 50 and 6,000 or 7,000 cycles on either side of the main frequency. Thus a band or channel of frequencies approximately 14,000 cycles wide is occupied by the transmissions, and it is this fact which makes the problem of interference such a difficult one. Our high frequency circuits ought really to be so designed that they transmit without attenuation the whole range of the oscillating currents radiated from the sending aerial they are tuned to and exclude everything else. But this cannot be done. We can, however, make our receiver quite a selective one from a practical point of view, and one of the easiest ways is by using the super-heterodyne principle.

In the particular super-heterodyne receiver illustrated here, we have a frame aerial tuned by condenser C_1 (Fig. 1), the input circuit to the long wave amplifier L_4, L_5, C_4, and C_6, and three air core coupling transformers. The three transformers are wound with a fairly fine gauge of copper wire, and have a ratio of one to one. No tuning condensers are used with them, and when they are connected to the valves (Mullard D.06H.F.) have a natural wavelength of about 5,000 metres. These transformers tune fairly broadly; the arrangement of coils L_4 and L_5, and condensers C_4 and C_6, have the same natural wavelength as the amplifier, but they form a more selective circuit. Hence the overall selectivity of the long wave amplifier is such that a telephone signal of 60,000 cycles with its side bands is transmitted without noticeable distortion, while frequencies outside this range are not passed to any great extent.



Rear view of the complete set. Two H.F. transformers can be seen; the third is screwed to the surface of the baseboard.

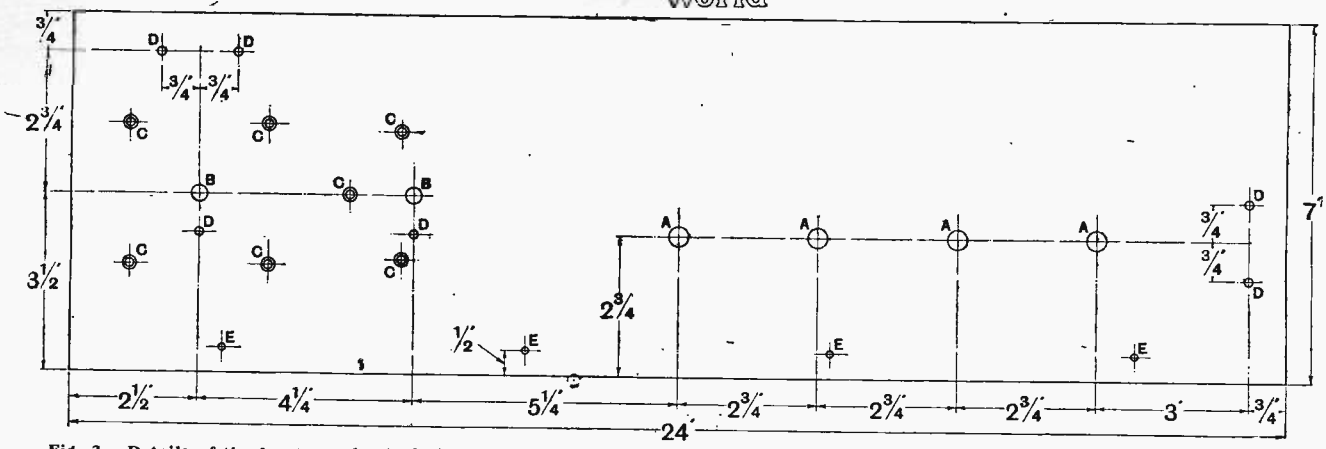


Fig. 3.—Details of the front panel. A, 3/8in. dia.; B, 5/16in. dia.; C, 5/32in. and countersunk for No. 4 B.A. screws; D, 5/32in. dia.; E, 1/8in. dia.

Five thousand metres is a wavelength which will give good results from the point of view of the examples given above, and, further, it is fairly easily possible to arrange an amplifier for this wavelength which will give high amplification without instability. The disadvantage of a 3,000 metres amplifier is its lower amplification and its liability to break into oscillation. A 10,000 metres amplifier would, of course, be expected to be even more stable than a 5,000 metres one, and to give an even greater amplification, but such an amplifier is not used because of the selectivity characteristics explained in the examples.

Five thousand metres represents a compromise; it is a wavelength on which it is possible to obtain good all-round results with valves of the D.06H.F. variety. If valves of another class, such as the DE 5*b* (which have a high amplification factor combined with a relatively low impedance and a high effective capacity) were to be used, the writer would use a wavelength of about 7,000 metres, as in his seven-valve super-heterodyne receiver[1] described a few months ago in this journal.

The arrangement of the input circuit of the amplifier is a rather unusual one, as the coils L_4 and L_5 are not magnetically coupled; they are mounted at right angles. Condenser C_4 is the coupling between the anode of the rectifier V_1 and the grid of the first H.F. amplifier V_2, and condenser C_6 is employed to bring the coils into tune. This circuit to some extent determines what frequencies shall pass to the amplifier. Its adjustment is, therefore, an important one. It must not tune too broadly, neither must it be too sharp—a nice problem.

Referring now to the input circuit of the rectifier, it will be noticed that a frame aërial with a tuning condenser has one end connected to a grid condenser and its other end joined through a coupling coil L_1 to negative L.T. The coupling coil is wound on one end of a former which also carries the coils L_2, L_3, of the oscillator. Hence when the oscillator is working, currents are induced *via* the coupling coil to the grid circuit of the first detector. The tuning of the oscillator affects slightly that of the frame, but not to a sufficiently great extent to make a calibration useless.

It would be better, from the point of view of selectivity, amplification, and permanence of calibration, of course, if a stage of tuned H.F. were added between the frame and the detector (as was suggested for the seven-valve receiver mentioned above)[2], but then we have another adjustment and another valve. Such a stage of H.F. was not incorporated in this set because it was thought that the majority of readers would prefer the

[1] *Wireless World*, March 4th, 1925.

[2] An aperiodic H.F. coupling was actually used in this receiver in order to dispense with the tuning adjustment involved when a tuned stage is used.

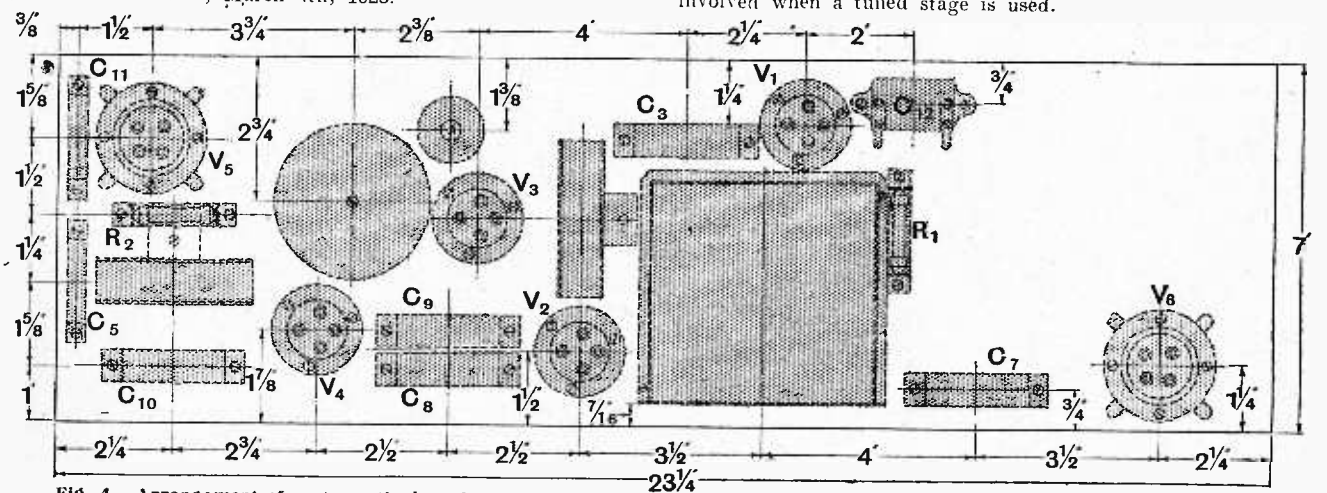


Fig. 4.—Arrangement of parts on the base board. The components are labelled and are described in the text and below Fig. 1.

Long Distance Summer Reception.—

arrangement of six valves actually used and to connect, if desired, an H.F. unit. Thus a unit would contain a .0005 mfd. tuning condenser and a transformer connected as in Fig. 2, and would stand either by the end

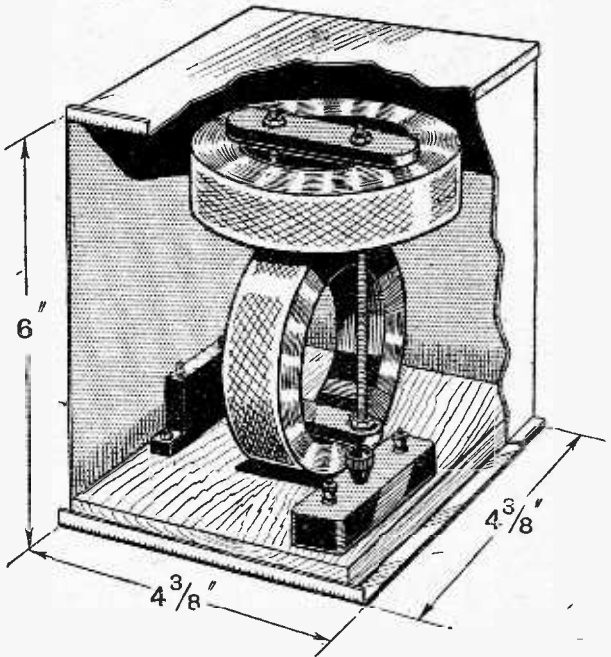


Fig. 5.—Method of mounting the two No. 750 coils, the coupling condenser and the anode tuning condenser. The case is of copper, all joints being soldered. Connecting wires are taken through insulating sleeving and through small holes in the sides of the box.

of the set or on the top of the case of the set just above the existing frame aerial terminals. The frame aerial would then be connected to the two terminals of the unit joined to the tuning condenser, and the secondary winding of the transformer to the frame terminals of the set. A transformer for the broadcast range for use with a Mullard D.06 H.F. valve would have a primary winding of 20 turns and a secondary of 50 turns, both of No. 26 D.S.C. wound on a tube 2½in. diameter by 3in. long.

How to Build the Set.

In its construction the receiver follows the writer's usual plan: a front panel carrying the controls, a baseboard for the valves and couplings, and a connection strip at the back. The components are arranged in a symmetrical fashion on the front panel, with the tuning controls and input terminals on the left, and the telephone terminals on the right. On the baseboard we have, on the left-hand side, just behind the oscillator coils and condenser (these coils are wound on a tube fitted over the oscillator tuning condenser) the oscillator valve. By the side of the second tuning condenser is the first rectifier, and between the valve and the back edge of the baseboard is a copper box which contains the two input coils of the amplifier L_4, L_5, with the condensers C_4 and C_6.

Next are the amplifying valves and transformers, and, finally, at the extreme right-hand side, and near the panel, is the second detector. The parts are so arranged that very short connecting wires are used, the valve holders themselves being mounted on pieces of wood to

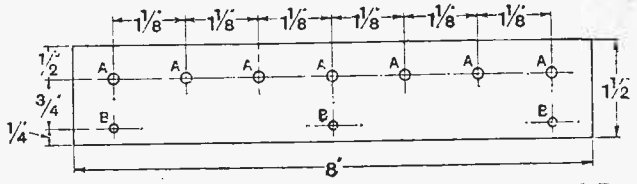
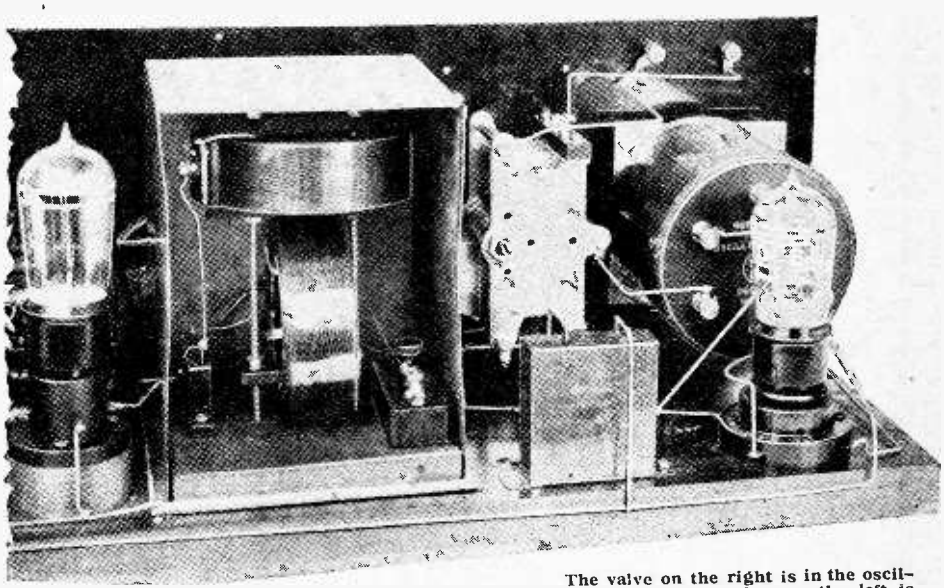


Fig. 6.—Details of the terminal strips. A, 5/32in dia. and B, 1/8in. dia.

raise their connecting terminals to the level of those of the coupling units. Such an arrangement is calculated to give the highest electrical efficiency; high amplification with stability can only be obtained when great care is taken to avoid all manner of stray couplings. Magnetic coupling can be minimised by putting the coupling transformers in different planes, as shown; the best way of minimising capacity coupling between the grid and plate circuits is to use short, well-spaced connecting wires. The grid and plate wires in the set illustrated are all very short, less than an inch long in many cases, and all are well spaced. Large capacity condensers are also connected across the H.T. tappings to avoid couplings through the battery.

Details of the layout of the panel are given in Fig. 3 and of the base in Fig. 4. In Fig. 3 we have, on the



The valve on the right is in the oscillator circuit and that on the left is the first amplifying valve. The first detector is between the back of the copper box and the panel.

Long Distance Summer Reception.—

left, the oscillator unit, then the frame tuning condenser, followed by the filament rheostat for the oscillator, the potentiometer for the amplifying valves, the rheostat for the two detectors, and, finally, the rheostat for the three amplifying valves. The telephone terminals are on the right-hand side.

The parts fixed to the baseboard are clearly indicated in Fig. 4. Pieces of wood of the diameter of the base of a valve holder and ¾in. high are fitted below the holders for the first detector, and the three amplifying valves and wooden brackets are used to secure the two H.F. transformers which are mounted vertically.

Inside the copper box (Fig. 5) is a wooden base ¾in. thick, and brackets made from No. 2 BA threaded rod, and pieces of ebonite to hold the two No. 750 Igranic coils. These coils are of the ordinary plug-in type, but the plugs have been removed. They are fixed at right angles. On one side of the base is screwed the fixed coupling condenser C_4 of 0.002 mfd., and on the opposite side is fixed, in this particular set, a small variable 0.0003 mfd. mica condenser of American manufacture. This particular condenser was used because it was on hand; it would be better, perhaps, to employ a wire-wound condenser of this capacity. Such a condenser is marketed by the Marconiphone Co., and its capacity may be adjusted by altering the amount of wire wound on the outside of the tube.

Wiring and Testing.

When the receiver has been assembled, remove the panel and put on as many wires as possible (Fig. 7), using a tinned copper wire of about No. 18 gauge. Then screw the panel to the baseboard, and finish off the wiring. There is no difficult wiring in the set; the filament wires are run on the baseboard, the +H.T. wires are run high, and the grid and plate in as direct and clear a path as possible. The actual wiring is clearly shown in the illustrations. Do not forget to connect the copper box to negative L.T.

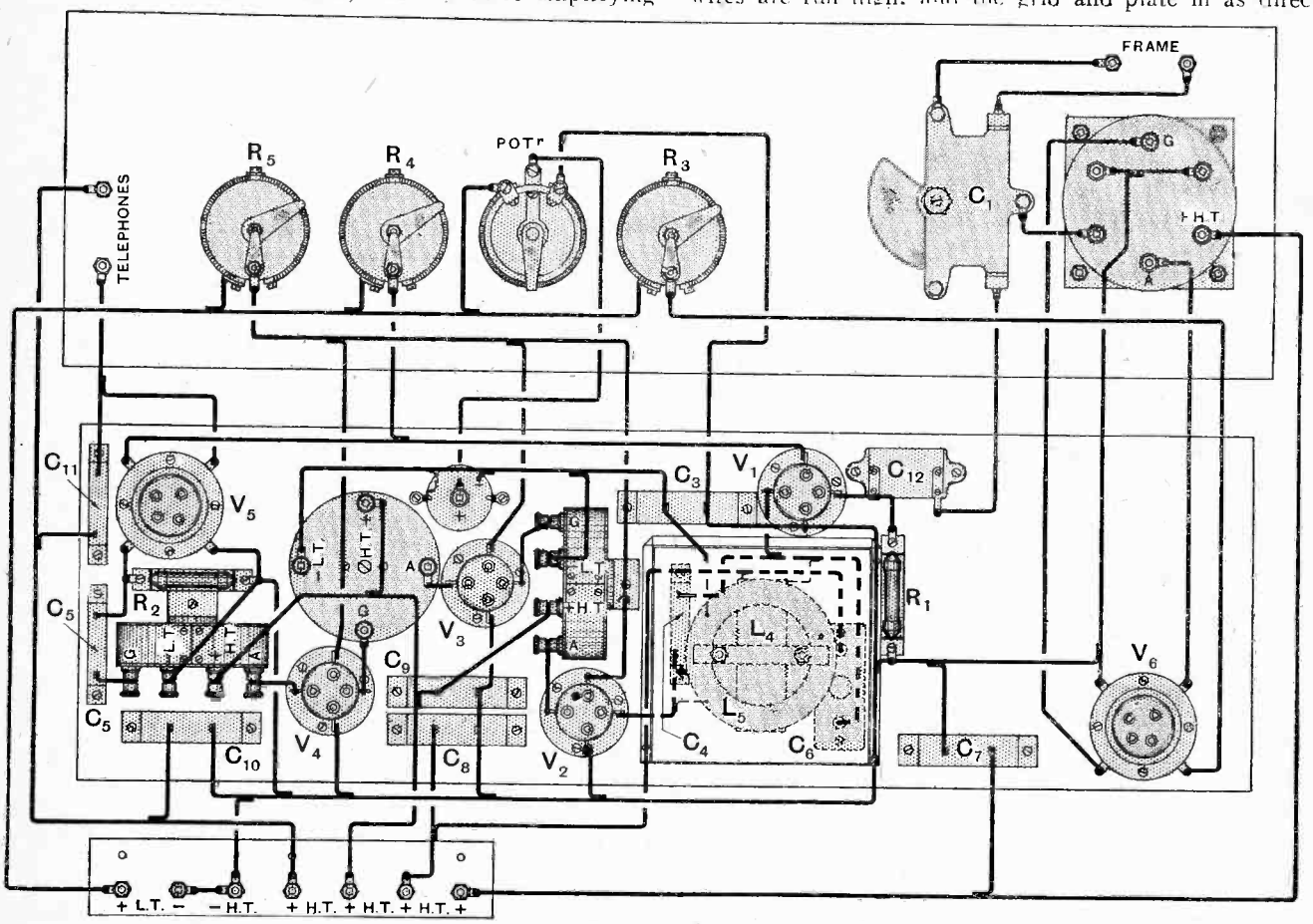


Fig. 7.—Wiring diagram. Grid and plate wires are short and clear of other wires. Run the filament wires low and the H.T. wires high.

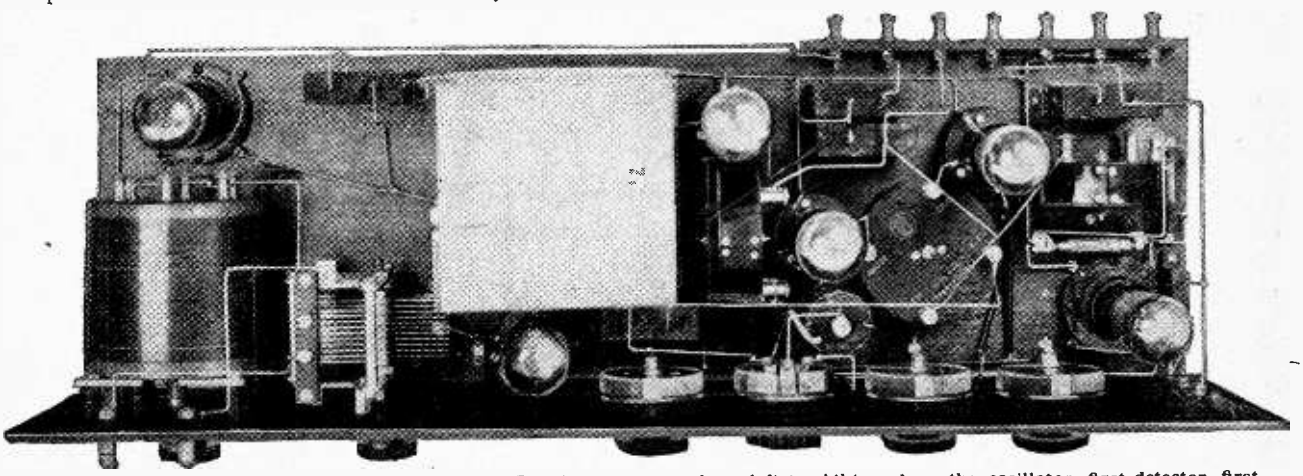
The set is designed for Mullard D.06 H.F. valves or valves of this class. With the frame aerial and phones connected, put about 50 volts on the plate of the oscillator, 66 on the three H.F. valves, and 45 on the two detectors. Then tune in the local station by turning the two condenser dials, keeping the potentiometer a little below the point where a slight hissing is heard. It will be noticed that the local station is heard at two settings of the oscillator, and, if the potentiometer is turned to the left, the amplifier eventually howls, while if it is turned to the right, the signals are weakened.

Having heard the local station, turn both condenser

DETAILS OF COMPONENTS USED.

1 Oscillator unit, combining the tuning condenser and coils (Radio Instruments, Ltd.).
3 H.F. transformers for 5,000 metres (Radio Instruments, Ltd.).
1 0·0005 mfd. tuning condenser (Cardwell or other good make).
2 Apex vernier dials.
2 No. 750 Igranic coils.
3 Filament resistances, dual pattern (McMichael).
1 Potentiometer (King or other type).
1 0·0002 mfd. grid condenser (C_{12}) (Dubilier).
1 0·0003 mfd. grid condenser (C_5) (Dubilier).
1 Wire wound 0·0003 mfd. condenser (Marconiphone Co.).
2 0·002 mfd. fixed condensers (Dubilier).
5 1 mfd. Mansbridge condensers (T.C.C.).
1 Grid leak, 2 megohms (R_1) (Dubilier).
1 Grid leak, 1 megohm (R_2) (Dubilier).
2 Grid leak mountings.
6 D 0·06 H.F. valves (Mullard).
6 Valve holders (Burndept).
1 Radion panel, 24in. × 7in. × $\frac{3}{16}$in. (American Hard Rubber Co.).
1 Radion strip, 8in. × 1½in. × $\frac{3}{16}$in.
11 Terminals (No. 4 B.A.).
1 Baseboard 23¼in. × 7in. × 1in.
1 Cabinet to suit.

dials a little at a time, and endeavour to tune in a weak signal. With this weak signal adjustments can be made to the values of plate voltage, to the filament rheostats, and potentiometer for best results. Now try the effect made apparent by maximum signal strength and best selectivity. Particular care should be taken with the valves. Change them about, as some work better in one position than another.



All the components are visible in this illustration. Reading the valves from left to right we have the oscillator, first detector, first, second and third amplifying valves and finally the second detector.

of varying the value of the condenser across the No. 750 coil connected in the plate circuit of the first detector. If the value of this condenser is about 0.0003 mfd., it should not require much alteration to bring the coils exactly in tune with the amplifier. The point of tune is

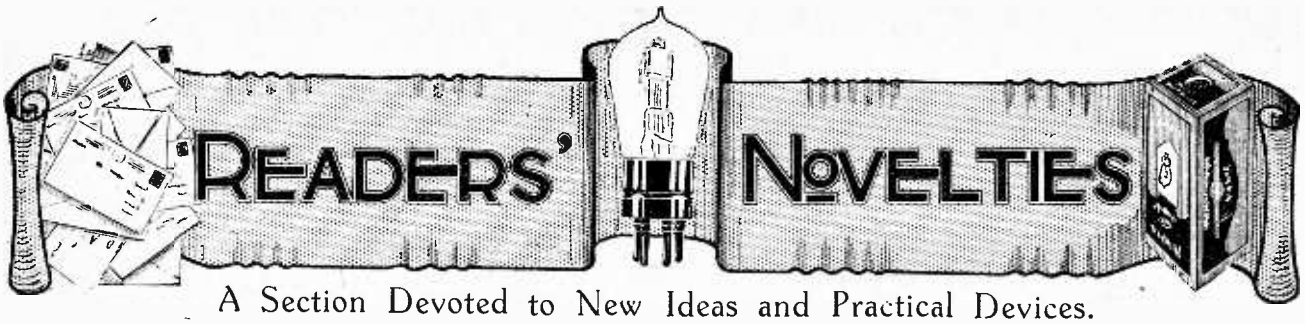
The first evening the set was tested 22 broadcast stations were heard at good strength; a stage of note magnification, added in the usual way to the telephone terminals, made many of them pleasantly audible on a loud-speaker.

PHASES OF MODERN SCIENCE.

THE revised edition of the Handbook to the Royal Society's exhibit at the British Empire Exhibition contains a number of short articles by eminent men of science on subjects ranging from astronomy to atoms. The names of the writers alone guarantee that each subject receives the best and most authoritative treatment compatible with the space available. Thus Sir Oliver Lodge contributes an article on "Radiation"; Sir Ernest Rutherford on "Electricity and Matter"; Sir R. Glazebrook on "The Origins of Wireless"; Dr. J. A. Fleming on "Thermionic Valves"; and other well-known authorities on biology, physics, chemistry, and kindred subjects, have written interesting and instructive accounts of the recent progress and discoveries in their respective branches of science expressed in non-technical language and of undoubted interest to the ordinary reader of intelligence. Among others we can mention "The Interior of a Star," by Prof. A. S. Eddington; "Verification of the Theory of Relativity," by Sir F. Dyson; articles relating to the atmosphere by Sir Napier Shaw, Dr. G. C. Simpson, F. J. W. Whipple, and Dr. C. Chree; and to biology by C. Tate Regan, Prof. E. B. Poulton, Dr. E. J. Allen, Sir A. S. Woodward, and other eminent writers.

The latter part of the book includes a descriptive guide to the exhibits in the Science Galleries.

"Phases of Modern Science," published in connection with the Science Exhibit at the British Empire Exhibition, 1925, pp. 232, price 3s. 6d., sold by A. & F. Denny, Ltd., London.



A Section Devoted to New Ideas and Practical Devices.

A NOVEL WEATHERCOCK.

Many amateurs fit weathercocks to the tops of their aerial masts, as much for the purpose of improving the general appearance of the aerial system as for obtaining an indication of the direction of the wind.

A suggestion for the transmitting amateur. Call sign carried on the weathercock at the top of the mast.

It would be of considerable interest to other transmitting amateurs, who might see the aerial mast in passing, if the weather vane were cut in the form of the call letters of the station. The letters could be cut from thin sheet metal and painted black on one side and white on the other. They would then be visible against the sky under all weather conditions.—L. W. C. M.

oooo

WINDOW PANE AS LEAD-IN INSULATOR.

An extremely efficient method of leading in the aerial, particularly for short wave work, is to pass the aerial wire through a small hole drilled in the centre of the window pane.

The drilling of this hole is best accomplished with an old dental burr, which can be obtained from one's dentist or from a dental supply stores. The burr is held for preference in an Archimedian drill, but an ordinary hand brace may be used if care is taken not to apply too much pressure. Turpentine should be used as a lubricant, and great care should be taken when the drill is about to break through the other side of the pane. When this stage is reached, it is generally advisable to complete the operation from the opposite side of the pane.—W. A. G.

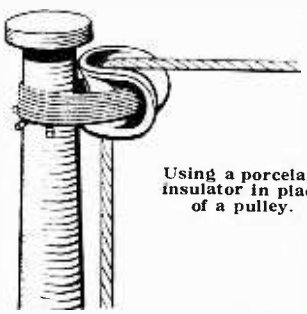
oooo

SUBSTITUTE FOR AERIAL PULLEY.

A large shell type insulator lashed to the top of the aerial mast makes a cheap and efficient substitute for a pulley.

An advantage additional to cheapness is to be found in the fact that the possibility of jamming, which is present with all but the best pulleys, is entirely eliminated.

The glazed surface of the porcelain allows the rope to slip through quite freely and does not tend to cause fraying.—L. H. T.



Using a porcelain insulator in place of a pulley.

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INDOOR COUNTERPOISE.

Difficulty in erecting an outdoor aerial is generally accompanied by a difficulty in finding a suitable earth connection inside the building. In such circumstances it is often better to employ a counterpoise earth in conjunction with the indoor aerial. Copper strip, which is now being placed on the market for transmitting aerials, is an excellent metal with which to construct the counterpoise. A network of strips laid under the floor covering is arranged to converge to a terminal near the receiving set. The copper strip will lie perfectly flat and will in no way damage the floor covering.—C. B. C.

GUNMETAL FINISH.

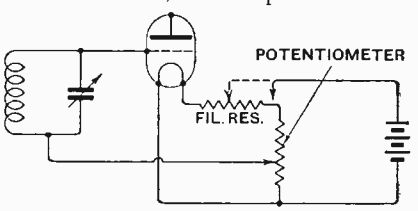
A black oxidised finish for brass is often preferred to a bright, plated finish. The oxidised coating can be formed by the following method. The articles to be oxidised are cleaned in the usual way and immersed in a bath consisting of one part of white arsenic, one part of iron oxide, and twelve parts of hydrochloric acid. The solution should be kept in a stoppered bottle and be used only in glass or porcelain vessels.—J. T. D.

oooo

POTENTIOMETER CONNECTIONS.

When a potentiometer is included in the circuit of a receiver it is essential to provide some means of switching off the current which would otherwise flow through the resistance coil from the L.T. battery when the set is not in use. If a separate switch is provided to disconnect the potentiometer winding, there is always the possibility that the valve filaments will be turned off at the end of the programme, and that the potentiometer switch will be overlooked.

By connecting the potentiometer resistance to the free end of the filament rheostat, the potentiometer



Switching off the current to the potentiometer when the filament rheostat is turned to zero.

current will be switched off at the same time that the valve filaments are turned off; and if the resistance of the potentiometer is large compared with that of the filament rheostat, adjustment of the filament current will not appreciably affect the grid potential.—F. A.

THE NEW SODION VALVE.

Development of a Sensitive Detector for Weak Signals.

By PAUL D. TYERS.

IN November, 1922, H. P. Donle presented a paper before the Institute of Radio Engineers on a new type of valve detector, which he termed the "sodion." The sodion operated on entirely different principles from the ordinary thermionic valve, and resembled perhaps more closely than anything the gas or soft valve. The original sodion was peculiar in that it had an anode consisting of liquid sodium.

The valve consisted of the sodium anode, which was heated by means of a coil connected in series with the filament, and traversed by the filament current. No grid in the true sense of the word was employed, but a U-shaped "collector" took its place. In use, telephones were included in the anode circuit, and the input was connected between the collector and the filament, or, rather, a filament potentiometer. The collector was normally given a potential which was derived from a battery and potentiometer, the potential being known as the neutralising voltage. Normally, the collector receives a large electronic current from the heated filament, which is partly due to its large area and also its proximity to the filament. The object of the neutralising voltage, of course, is to reduce this otherwise large current.

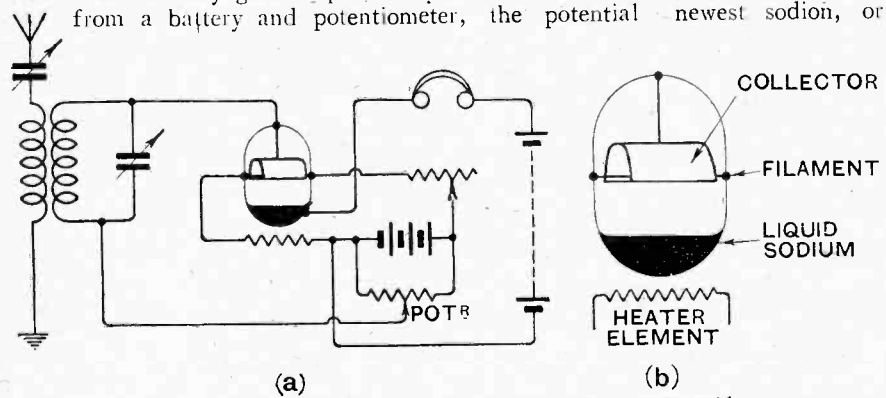
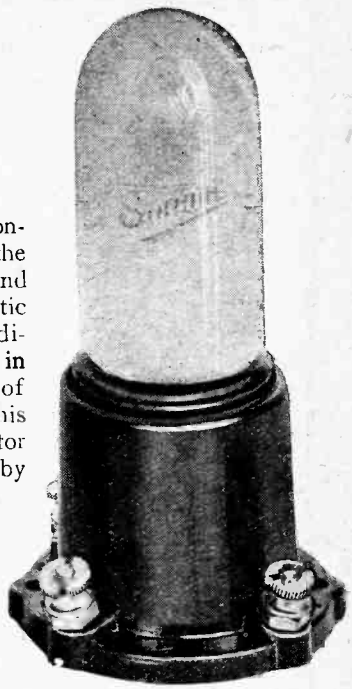


Fig. 1.—Connections of an early type of sodion valve to a receiver.

A diagrammatic representation of the early type of sodion as applied to an ordinary receiver is shown in Fig. 1. One great practical disadvantage of the early sodion was the liquid anode, which necessitated the tube being kept in one position. In addition it was found necessary to alter the neutralising potential from time to time, which was also somewhat undesirable.

About a year later the sodion detector was considerably modified. No alteration was made in the principle of operation, and the modifications were merely constructional details. The sodion of 1923 was a great advance on that of 1922, in that the liquid was replaced by an ordinary anode or plate, and the sodium atmosphere was obtained by introducing a small quantity of sodium into the tube before it was evacuated. As before, the same form of filament and U-shaped collector electrodes were employed, a heater coil connected in series with the filament being wound round the tube. A diagrammatic representation of the modified sodion is shown in fig. 2. The same type of circuit was used with this sodion, *i.e.*, the collector potential was regulated by means of a potentiometer.



In 1924 the newest type of sodion made its appearance, and a general idea of the valve can be obtained from the accompanying photograph. The newest sodion, or D 21 model, as it is termed, resembled even more closely the standard three-electrode valve. Fig. 3 represents a plan view of the electrodes. A central vertical filament is employed, around which are the collector and plate. Both these are of squirrel cage formation, *i.e.*, two concentric cylinders of parallel wires. The valve is pumped very hard, a slight quantity of sodium is introduced as before, and a heater coil is cemented on to the outside of the envelope of the valve. In order to maintain constant temperature of operation, the valve is provided with a frosted-glass shield, which renders it immune from the effects of draughts or other atmospheric disturbances. This glass shield, of course, is not air-tight, it merely being cemented to the base of the valve. The heater coil and the filament both consume approximately ¼ amp., and since they are in series the total consumption is only ¼ amp. at approximately 5 volts. It is interesting to

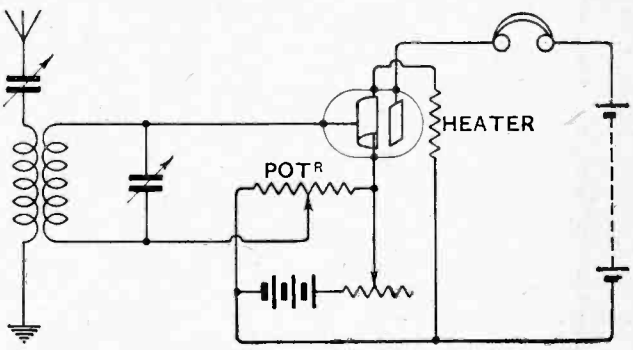


Fig. 2.—The arrangement of the 1923 sodion valve.

The New Sodion Valve.—

note that tantalum is used instead of the more usual tungsten for the construction of the filament. The earlier model sodions have been essentially ordinary detectors, but with the latest type it is possible to produce continuous oscillations at radio frequency with normal circuits. The valve, however, will not function either as a radio frequency or low-frequency amplifier.

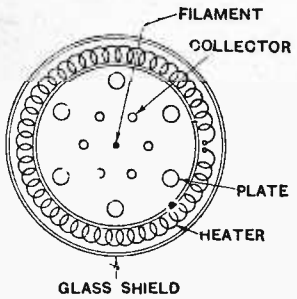


Fig. 3.—Plan view of the electrodes of the latest type of sodion.

Both the early-model sodions required a potentiometer for obtaining a suitable neutralising potential on the collector. This is obviated in the new model by making connection direct to the filament pin which is connected to the heater coil, so that the fall of potential across this can be utilised. Thus it will be seen that the new sodion can be used without any additional complications, and is therefore comparable with an ordinary valve.

Some Characteristics of the D 21 Sodion.

It is stated that the valve will operate without a grid leak, but on test it was found that satisfactory results could not be obtained without a leak, a 3-megohm leak between the grid and the negative side of the filament giving the best results.

The sodion is not particularly critical in operation, variation of plate voltage and filament voltage through a small amount having practically no influence on the operation of the valve at all. The sodion is essentially a detector for weak signals. On loud signals it was found to be no better than an ordinary valve detector. On weak signals it was decidedly more sensitive than an ordinary valve employing cumulative grid rectification. It is somewhat difficult to appreciate the efficiency of the sodion as a detector merely by listening to weak signals, but by employing it as a first rectifier with a superheterodyne a very decided increase in signal strength was noticeable. The sensitivity was slightly greater than that of a soft detector, and in addition the sodion has the advantage of being infinitely more stable and less critical. When used as a rectifier in a broadcast receiver employing resistance coupled speech amplification stages a decided change in the quality as compared with a bottom bend rectifier was noticeable. The sodion, in fact, gave a somewhat deeper or slightly woolly tone more resembling that obtained with a soft valve. On these particular signals, however, considerably louder results were obtained than with a bottom bend rectifier normally employed.

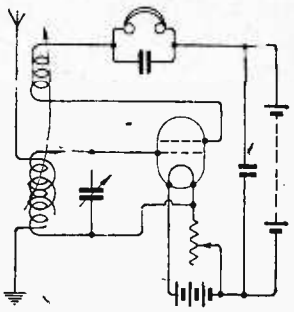


Fig. 5.—Another form of loosely coupled tuner connected to a sodion valve.

In testing the sodion, due allowance must be made for the type of input circuit. It will be remembered that the input impedance of the sodion is extremely low, and if connected across an ordinary aerial circuit the tuning will be exceedingly flat. It is practically essential to use a very loosely coupled input circuit. If a direct-coupled circuit is used, the selectivity will be exceedingly poor, and the benefits of the sensitivity of the detector will be entirely lost. Two suitable arrangements are shown in Figs. 4 and 5. The first arrangement is an ordinary coupled receiver, and calls for no particular comment, except that the coupling may be exceedingly loose, while the second employs a weak but fixed coupling. It consists of a tuned aerial circuit and a tuned closed circuit, a portion of the aerial circuit being wound over the closed circuit. A very efficient receiver can be built by employing an initial stage of radio frequency amplification followed by a sodion detector with a regenerative circuit. Owing to the low input impedance of the sodion, little selectivity can we obtained in the tuned anode circuit, or whatever form of coupling is used, owing to the high damping which exists, and accordingly all the selectivity has to be obtained from the aerial input circuit or previous stages of radio frequency amplification employing ordinary valves.

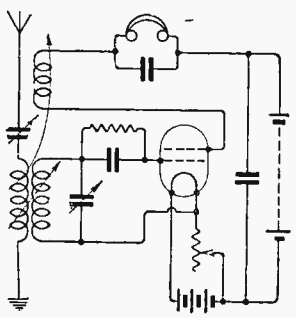


Fig. 4.—A loosely coupled tuner connected to a sodion valve used as detector.

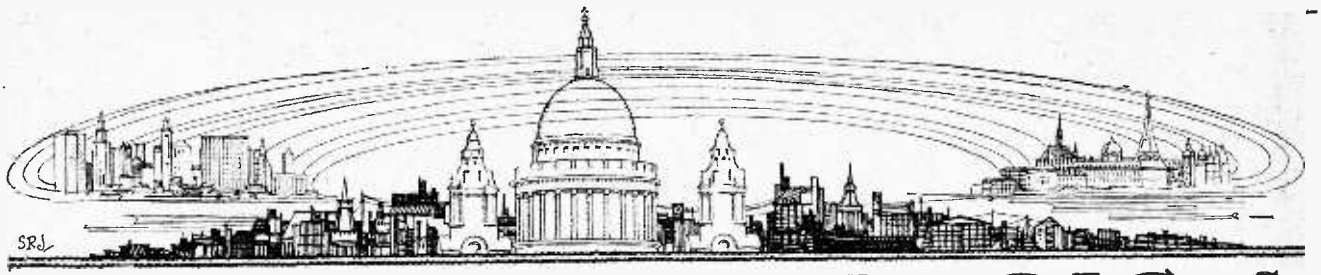
WIRELESS POSSIBILITIES.

A Gaze into the Future.

POPULAR interest in the future of wireless is again awakened by Professor A. M. Low's recently published book,[1] "Wireless Possibilities." This does not claim to be technical, but merely to indicate the probable paths along which the development of science will lead us. The author foresees a time when "we shall be able to chat to our friends in an aeroplane and in the streets with the help of a pocket wireless set and be able to do practically everything by the aid of radio that we now do with the voice." He visualises the time when directional wireless and beam transmission will enable people to converse freely without fear of their conversation being overheard by others, and even to see each other by the aid of television. The final chapter on Wireless and War is horrifying in its possibilities.

A vein of cynical humour runs through the book, as in the following passage: "Parliament must have its special wavelength, the divorce courts of the future will be broadcast to prevent people from catching cold by waiting outside. It will be quite easy for the judge, at a doubtful passage, to press a switch and to say, 'I think we will cut that out.'"

[1] "Wireless Possibilities," by Professor A. M. Low, pp. 77, price 2s. 6d. nett, published by Kegan, Paul, London.



CURRENT TOPICS

Events of the Week in Brief Review.

TWO-HOURS' CHAT WITH THE WORLD.

Mr. F. A. Mayer (2LZ), of Wickford, Essex, states that when working on 40 metres between 6 and 8 a.m. on Sunday, June 14th, he carried on a two-way communication with Australia (3BQ, Melbourne); New Zealand, (2XA, Gisborne); Argentine, (CB8, Beunos Aires); Brazil, (1AB, Nictheroy), several American stations and one Canadian, 3BQ sent the following message: "Greetings to Europe the first two-way communication on 40 metres." 2LZ was using about 300 watts at the time.

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SAN FRANCISCO EXHIBITION.

Wireless experts from all parts of the world are expected to be present at the Pacific Radio Exposition, to be held at San Francisco from August 22nd to 28th.

Among the attractions will be a reception held by prominent radio entertainers who will meet the listening public "face to face."

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BROADCASTING IN THE IRISH FREE STATE.

The long promised broadcasting station in Dublin is still a thing of the indefinite future, according to the "Irish Times," no progress having been made in its erection since the Secretary of the Irish Post Office announced on June 1st that the financial difficulties had been settled, the site chosen, and, if everything went well, broadcasting would be in full swing before Christmas. The Irish Free Staters continue to live in hope.

PROPOSED BROADCASTING STATION FOR NAIROBI.

The erection of a broadcasting station at Nairobi with a range of 400 miles to serve the whole of East Africa, is warmly advocated by Col. Norman Harrison, a director of the Western Electric Co., who has been investigating the possibilities of wireless in Kenya Colony and Uganda.

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TRANSMISSIONS IN "IDO."

In connection with the announcement that a new Russian broadcasting station is to be opened at Kiev, it is interesting to note that transmissions are to be made in the international language "Ido."

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GOVERNMENT WIRELESS TO AUSTRALIA.

A site for the erection of a high-power station to communicate from Britain to Australia has been secured by the Government on the Humber foreshore near the present Admiralty station.

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CANADIAN MARCONI COMPANY.

The name of the Marconi Wireless Telegraph Co. of Canada, Ltd., has now been changed under the terms of a special Act to "The Canadian Marconi Company."

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WIRELESS AS A CAREER.

Prospective wireless operators will be interested to learn that Radio Maritime, Ltd., have opened wireless training centres at Broadway, Hammersmith, and 26-27, St. Mary's Street, Cardiff.

MEETING OF THE A.R.R.L.

The third National Convention of the American Radio Relay League will be held in Chicago, on August 18th to 21st, when a large gathering is expected. The experience gained by the Traffic Department of the league in daylight working on short waves in connection with the Macmillan Expedition, should furnish much food for discussion.

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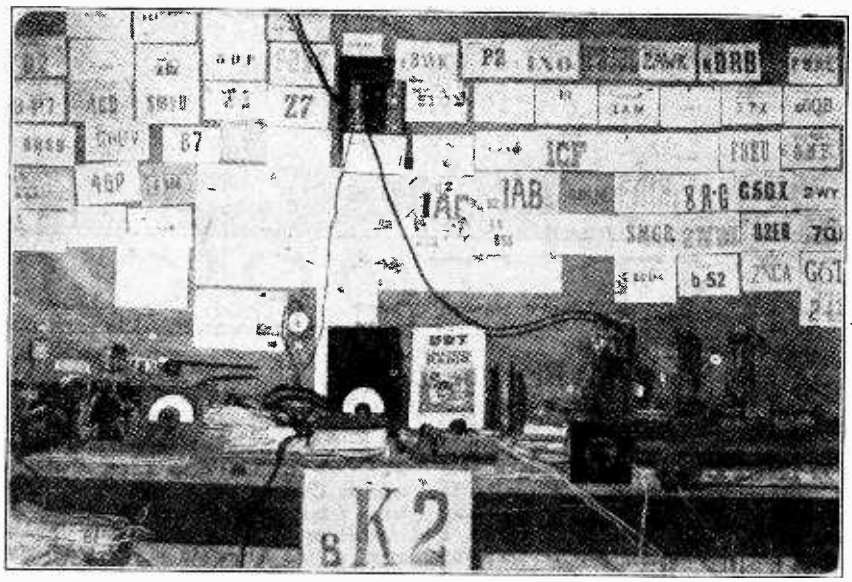
ROUND THE WORLD IN RELAYS.

The American Radio Relay League announces the receipt in Columbus, Ohio, of two amateur messages which had started in that town and been relayed round the world. The first originated from Mr. L. G. Windom's station 8GZ, transmitted on 20 metres. It was received by Mr. H. S. Nichols (2CC) in Stockfield-on-Tyne, who passed it on to Mr. E. J. Simmonds (2OD) at Gerrards Cross, who, in turn, passed it on to Mr. C. D. Maclurean (2CM) in New South Wales. It was then transmitted to Mr. R. L. Amsbury in California, who dispatched it on its last stage to the League Headquarters in Columbus.

The second message was sent also from 8GZ, but in the opposite direction, via Mr. I. H. O'Meara (2AC), of Gisborne, New Zealand, 8QQ in France, Mr. G. Marcuse (2NM) at Caterham, and Mr. A. W. Everest (1ARE), of Pittsfield, Massachusetts, who passed it on to Columbus.

R.S.G.B. AT ONGAR. Members and friends of the Radio Society of Great Britain photographed during the visit to the Ongar High Power station on Friday, July 17th.



A BELGIAN TRANSMITTER. A glimpse in the transmitting "den" of BK2, a member of the Reseau Belge. He describes himself as "one of the never-sleeping 'hams.'"

DYNIC D C. REGULATOR.

This useful accessory, which was reviewed in our issue of last week, is a product of the firm of Messrs. Jones and Stewart, Ltd., 59, Robertson Street, Glasgow. We regret our error in acknowledging this instrument to another firm.

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RECEIVERS TO BE LICENSED IN BARBADOS.

It is understood that the Government of Barbados intend to provide a system of licences for the use of receiving sets. The control of all wireless apparatus and the issue of licences is to rest with the Pacific Cable Board, and it is presumed that the regulations will be similar to those in force in England.

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BOARD OF TRADE WIRELESS COMMITTEE.

The Committee appointed by the Board of Trade to inquire into the use of wireless in navigation will be composed as follows:—Sir R. Burton Chadwick, M.P. (chairman), Wing-Commander G. P. Grenfell, R.A.F., Mr. S. J. Lister, Commander F. Loring, R.N., Vice-Admiral G. R. Mansell, the Hon. Alexander Shaw, Captain J. R. Somerville, R.N., and Mr. J. R. Willis (secretary).

The Committee will advise the Board of Trade regarding the development in the United Kingdom of the services of wireless direction-finding stations, wireless beacons, and similar aids to navigation.

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ABERDEEN WORKS WITH PALESTINE.

Successful two-way communication has been carried out on two recent nights between an Aberdeen amateur, Mr. W. R. Clark (G2VX) and a station operated by Mr. W. Lacey (BSM) at Bir Salem, Palestine. Notwithstanding the distance, chiefly over land of over 2,500 miles, BSM reported signals as R5 with a 0-v-1 receiver.

The Scottish station operated on a wavelength of 45 metres with a measured input of 9 watts, and transmission was effected on the 3rd aerial harmonic. In view of the remarkably low power employed, it is interesting to note that G2VX is situated in the heart of the city and surrounded by tall buildings.

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MORE SIGNALS FROM WNP.

Following upon the news published in these columns last week, of Mr. Partridge's (2KF) two-way communication with the MacMillan expedition ship "Bowdoin" comes a report from a Falmouth reader Mr. J. Rodgers (G6JO), who picked up signals addressed by WNP to Canadian 1AM on July 18th.

On the following morning signals were picked up between NRRL the amateur station with the U.S. Pacific Fleet, and Australian 2YI. In spite of heavy atmospheric disturbance, the Australian station could still be heard at 9.35 p.m. (B.S.T.).

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ENGLISH LESSONS FOR SWEDISH LISTENERS.

To add to the enjoyment which Swedish listeners obtain from English and American broadcasting stations, the official Swedish wireless service is inaugurating a special English course during the autumn, says a Stockholm message. The course will include lectures by professors and travellers and readings by authors of their own works in English.

oooo

WIRELESS TELEPHONY BETWEEN SHIPS AT SEA.

Apropos the note in our issue of July 22nd, it is stated the the German liners already fitted with wireless telephony are the "Columbus" and "Deutschland," and that the "Munchen," "Stuttgart," and "Albert Ballin" are to be similarly equipped. It is understood, however, that the G.P.O. is unwilling to grant similar facilities to the Cunard Company.

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WIRELESS IN THE BUSH.

The value of wireless in the Australian Bush is to be tested by the Rev. John Flynn of the Australian Inland Mission, and a wireless operator, who will accompany him on a 2,000 mile journey by motor car from Adelaide. Should the experiments prove successful, a scheme may be inaugurated to send doctors by aeroplane to settlers in remote districts on receipt of wireless summonses.

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TRADE NOTES.

We have received the first number of a monthly publication issued by Messrs. A. C. Cossor, Ltd., for the benefit of wireless dealers. This booklet, entitled the "Radio Mail," gives a quantity of useful information not only about valves but relating to wireless sets and accessories generally.

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30,000 natives from the Johannesburg mines listened to the speech of the Prince of Wales in that city by means of a special system for public announcements manufactured by Messrs. L. McMichael, Ltd., at their Slough works.

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Members of the Derby Railway Institute Radio Society spent a pleasant Saturday afternoon on July 4th, visiting the works of the D.P. Battery Co., Ltd., at Bakewell. Among other items of interest seen were the large cells for Post Office batteries which have a capacity of 5,000 ampere hours.

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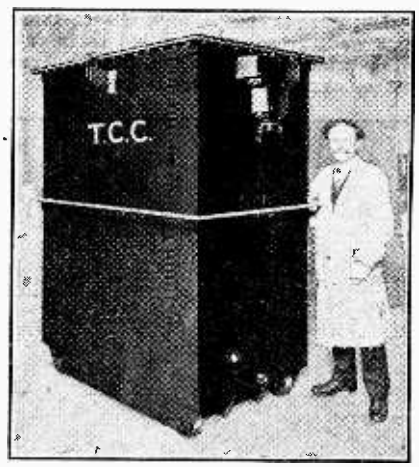
During his visit to Durban, H.R.H. The Prince of Wales listened to the broadcast stations on an Ethophone Grand Receiver supplied by Messrs. Collingwood and Beckwith, Ltd., the local agents for Messrs. Burndept Wireless, Ltd.



A GIANT CONDENSER, recently produced by the Telégraph Condenser Company.

A POPULAR FIELD DAY.

Novel Competitions Form Part of a Successful Field Day with a North London Society.

THE Golders Green and Hendon Radio Society carried out a highly successful field day on Sunday, July 19th, to a programme embodying several novelties.

Soon after 10 a.m. "The Old Cricket Field," at the corner of Lawrence Street and Highwood Hill, Mill Hill, was the scene of great activity. Four complete portable sending and receiving stations were quickly erected in the four corners of the field, with aerials which were limited to 25ft. from the free end to the terminal of the set. The constructors gave short talks on their particular circuit in turn for the benefit of the members, and proceeded to establish two-way working with each other. Each of the stations was equipped with Marconi Osram L.S.5 valves for transmission, whilst the high-tension supply was provided by C. A. Vandervell, and consisted of 120 volts at each station.

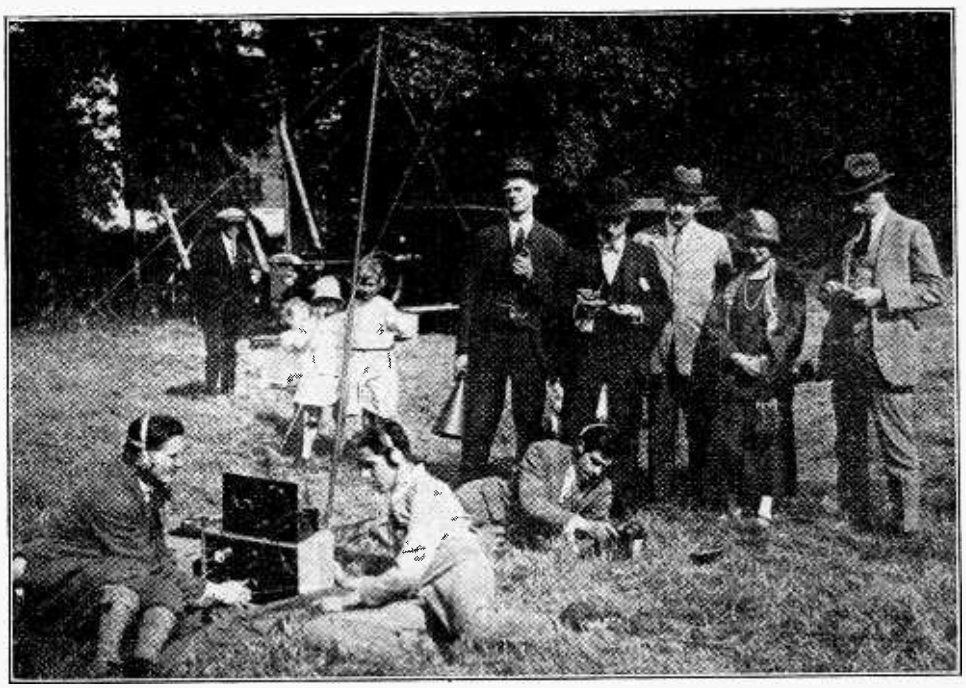
After an interval for lunch, the control station G5CT got going with a Colpitt transmitter deriving plate supply from an Evershed hand generator, which, despite an accident which placed the smoothing condenser *hors de combat*, yielded yeoman service. By the courtesy of Messrs. Douton and Edwards, Mill Hill, a 35ft. turret mast was erected in the centre of the field to support the the aerial.

The first competition consisted of dismantling the four stations in turn and getting them going upon a new site upon a predetermined wavelength in the shortest possible time. The stations were called by the control station and given the instruction to dismantle by radio, thus ensuring that no premature disconnections had been attempted. The operator at each station was assisted by a squad drawn by lots. This competition proved of great interest, and the winning squad took only 9½ minutes to effect the change in location. Mr. L. F. Fogarty kindly acted as judge. A test of Morse working, consisting of twelve groups of cipher and one of figures, was the next item, and the winner was required to send and receive *exactly* at ten words per minute.

A receiver tuning competition for beginners then followed. A coupled crystal set employing plug-in coils tuned by a square law condenser, had to be adjusted to resonance with a buzzer wavemeter at 300, 450, and 600 metres in turn, each competitor having to select his coils from a pile and set the crystal. This competition proved most instructive, since only the winner, Mr. E. A. Lynn, B.Sc., succeeded in tuning correctly to the three waves. His time was 5½ minutes! A snag to which many competitors fell easy victims was the fact that the coils were deceptive in external appearance—the smallest diameter tuning to the longest wave.

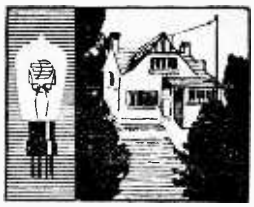
Prizes were awarded for each of the competitions, and the judge, assisted by Mr. Leslie McMichael, Mr. Maurice Child, and Mr. W. J. Turberville-Crewe, then examined the four sets to discover which was the most efficient and portable complete station. Considerable difficulty was experienced in deciding between two of the stations—one a feed-back transmitter by Mr. S. R. Donaldson, the other an ingenious master oscillator by Mr. C. L. Thompson. Finally, the prize fell to Mr. Donaldson, but the judge himself presented a consolation prize to Mr. Thompson for his very excellent set.

The prizes, kindly supplied by Radio Communication Co., L. McMichael, Ltd., Peranne and Co., Ltd., Dubilier Condenser Co., H. Clarke and Co. (Manchester), Ltd., Portable Utilities, Ltd., and Mr. L. F. Fogarty, will be presented to the winners at the opening meeting of the autumn session, September 23rd, 1925.



One of the portable transmitting sets opening up communication. Mr. Fogarty, who acted as judge, is seen with watch in hand, with Mr. McMichael on his left and Mr. Turberville-Crewe on his right. Mr. Child is on the extreme right.

NEWS FROM THE CLUBS:



Secretaries of Local Clubs are invited to send in for publication club news of general interest. All photographs published will be paid for.

Golders Green and Hendon Radio Society.

The first of a series of informal meetings arranged for the months of July, August and September was held by the above Society on July 1st with great success. Several members related difficulties they had experienced in the course of their work; these were discussed and suggestions for overcoming them put forward.

Sunday, July 19th, was the occasion of an interesting field day at Highfield Hill, Mill Hill, when a number of small transmitting sets of different design were erected. Short talks on the design and operation of each set were given by the constructors, and every member had the opportunity of actually operating.

The afternoon programme comprised competitions for various prizes presented by well-known manufacturers for the most rapid dismantling and re-erection of stations, Morse tests, sending and receiving in cypher and figures, and a receiver tuning competition for beginners.

Hon. Secretary, W. J. T. Crewe, 111, Princes Park Avenue, N.W.11.

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Lewisham and Bellingham Radio Society.

An informal meeting was held on June 30th, when an interesting demonstration was given by Mr. H. Diehl of DX loud-speaker work with a two-valve set of his own design, embodying many unusual features. A short discussion followed on "Ebonite and its peculiarities," in which Mr. W. H. Kelland and Mr. C. Tynam took part. It is hoped that this and similar meetings will assist members to a conclusive and successful method of constructing valve receiving sets.

On Sunday, July 5th, the Society held a field day, and carried out a series of tests with several types of aerials of various heights and dimensions, using a Reinartz receiving circuit (0-v-1) constructed and operated by Mr. J. Endacott. Despite considerable screening by neighbouring trees the results obtained from amateur transmission and B.B.C. stations were remarkable, and much valuable data was collected which will form the basis for future discussion.

An exhibition of one-valve sets was given on July 7th at the Club's headquarters, 136, Bromley Road, Catford, S.E.6, and a representative number of circuits were on view. The award of comparative points was a difficult matter, as each exhibit proved highly efficient on aerial test though each had been constructed for a different purpose. The honours of the evening were carried by Mr. Lawrence, whose really fine exhibit, mounted and housed entirely in ebonite, incorporated low-capacity switches and a very ingenious method of obtaining exceedingly fine adjustment.

Hon. Sec., C. E. Tynan, 62, Ringstead Road, Catford, S.E.6.

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North Middlesex Wireless Club.

The club's last meeting on July 8th took the form of a practical demonstration by Mr. Nash of marking out, drilling and wiring up a single valve panel, together with hints on the correct use of all the tools employed.

It was noticed that the marking out and drilling were done from the underside of the panel, and that one tap of a centre punch was used before drilling each hole in order to obtain dead accuracy. Soldering received the attention it deserved, all the chief fluxes in use being demonstrated. When using "killed spirits" as a flux it was necessary to wipe off all surplus spirit and to smear a trace of vaseline on the work in order to prevent corrosion. The actual wiring was carried out with 16-gauge square tinned copper wire, all wires being kept as short as possible and well spaced.

New members are cordially invited. Full particulars can be obtained from the Hon. Sec., Mr. H. A. Green, 100, Pellatt Grove, Wood Green, N.22.

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The Hounslow and District Wireless Society.

On Sunday, July 19th, the Society had a very interesting and successful "River Day."

Three punts were obtained, aerial systems being erected on two of them, two being used for the transmitter (call-sign 50X) and receiver and the third being used to check transmissions. Communication was successfully established with 2AH. A number of tests were carried out using both C.W. and Telephony, and some very interesting data were collected. During the broadcasting hours the experiments were discontinued, but a loud speaker was installed on the towing path for the benefit of a large number of people who came to see the station after hearing the transmissions on their own receivers.

It is proposed to hold another "River Day" on August 16th, and all those wireless enthusiasts wishing to take part in this event should apply for membership of the Society to the Secretary; Mr. J. C. Read, "Brixton House," Hanworth Road, Hounslow.

Some of the members and officials of the Sheffield and District Wireless Society photographed on a recent Field Day. The superheterodyne receiver was used to pick up transmissions from another party several miles away.

CONTINENTAL BROADCASTING.

A Review of Recent Developments in Holland.

By E. V. APPLETON, M.A., D.Sc.

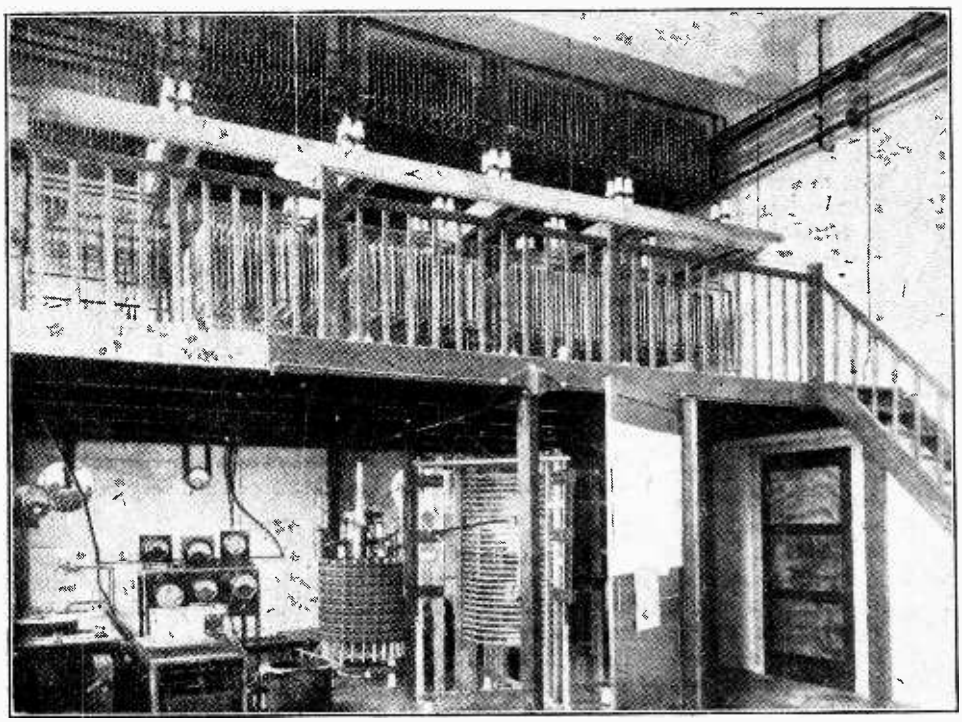
DURING a recent visit on the Continent I had an opportunity of discussing radio developments with many representative wireless engineers, and, in particular, was enabled to ascertain many details concerning the present status of Dutch broadcasting and the lines on which future development is to be expected. As it happened, the day of my arrival, May 2nd, was a red-letter day in the wireless history of Holland, for on that day was published the recommendations of a committee commissioned to report on the problem of Dutch broadcasting, and the report was naturally the chief topic of conversation in all wireless circles. At first I was somewhat surprised to find that the report had been presented to the Dutch Minister of Transport and Waterways, for there seemed to me no obvious connection between canals and wireless, but I was informed that in Holland the Postmaster-Generalship is not a political office, and the head of the postal service is a permanent official who works in the Department of the Minister of Transport and Waterways.

Wireless Licences.

Although the broadcasting report is rather lengthy, its main recommendations can be put very briefly to English readers, for the proposed organisation seems to be almost exactly like our own B.B.C. There is to be an exclusive licence given to a broadcasting company, which alone will have the authority to transmit. Wireless licences will be bought by listeners *via* the Post Office. The annual fee for a listening station will be 10 guilders (which is equivalent to about 16s. 8d.), of which $7\frac{1}{2}$ guilders will be repaid to the broadcasting company. From everybody I heard nothing but praise regarding the arrangements for broadcasting in Great Britain, and the excellence of the quality of the British transmissions, and I naturally felt very gratified that our own excellent service was to receive the flattery of imitation.

Various religious bodies in Holland have, at times, suggested that they each should have a station, but such schemes have not found favour in official circles, and it is now most likely that there will be one or more double stations transmitting simultaneously a programme of music and a programme of political or religious items. The Dutch Broadcasting Company, like the British one, is to be neutral in religious and political matters.

But although the inauguration of a Dutch Broadcasting Company will undoubtedly tend to popularise wireless in Holland, it will not mean the beginning of broadcasting in that country, for there has been in existence for some time now an excellent broadcast service from the Hilversum station on 1,050 metres, which is enjoyed by many amateurs and listeners. During a train journey, however, one is being constantly reminded that wireless in Holland is by no means the popular source of entertainment that it is here, for one sees aerials but rarely. I could not help but compare the scarcity of aerials seen in a train journey through Rotterdam with the large number seen in England in a comparable journey, say, from Tottenham to Liverpool Street Station. In other words, general listeners, as distinct from the wireless amateur, are by no means numerous.



View of the Philips transmitter at Hilversum, showing the large tuning inductances. The oscillatory circuit capacity is an air-condenser, the plates of which are seen in the gallery.

The Hilversum broadcast service is at present carried on by the Nederlandsche Seintoestellen Fabriek, of which Dr. A. Dubois, the treasurer of the Dutch Wireless Society, is the

Continental Broadcasting.—

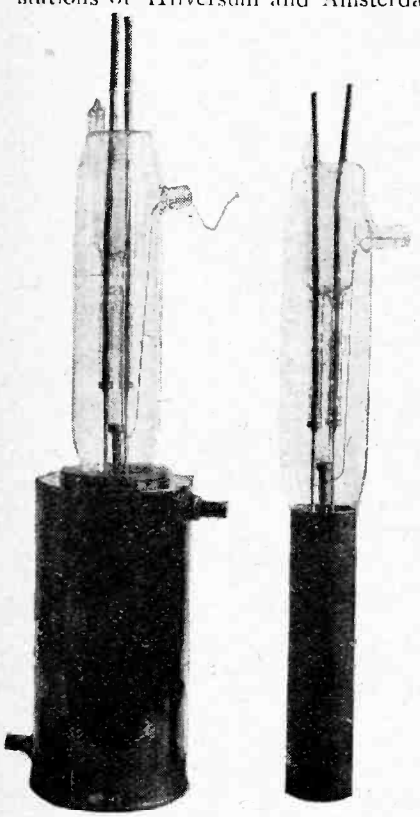
director. The only receipts toward the upkeep of this service accrue from voluntary subscriptions. Messrs. Philips, the lamp and valve manufacturers, have presented the stations with two large towers for the aerial. Excellent reception from this station is obtained in all parts of Holland.

Quite recently Princess Juliana, the daughter of the Queen of Holland, was presented with a wireless receiver on the occasion of her sixteenth birthday. The set was a multi-valve type and was made by the Nederlandsche Seintoestellen Fabriek and was fitted with Philips valves. On the occasion of the presentation of the set by Drs. Dubois and van der Pol, representing the two companies concerned, a special transmission took place from Hilversum for the demonstration of the set to the Queen and Princess.

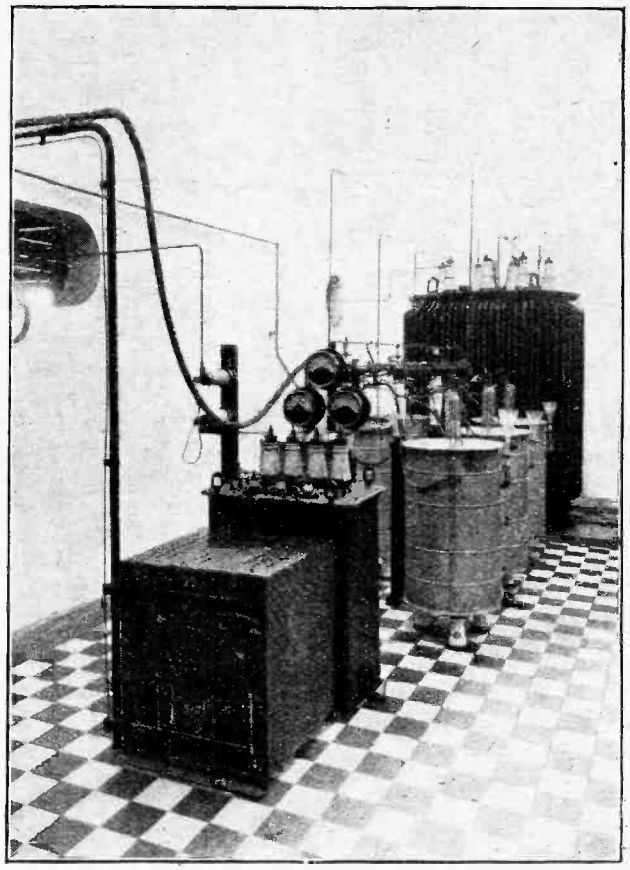
Interest in Foreign Reception.

The average Dutch listener is not at present content with receiving Hilversum, and all the British main stations, as well as Berlin, Brussels, Frankfurt, Hamburg, Paris, Rome, and Zurich, provide entertainment for the ambitious. The English stations are very popular, the reception from Chelmsford being excellent. The London signals, however, fade a good deal.

A Dutch equivalent of our *Radio Times*, called *Radioluistergids*, is already in existence, and this weekly publication includes the daily programmes of the Dutch stations of Hilversum and Amsterdam, as well as of all the stations which are normally audible in Holland. All the British main stations are included, as well as those of neighbouring countries. During my visit I got the impression that the modern Dutch listener is not likely to settle down as a "wireless stay-at-home" and become contented with his own local station. I think he will still be very much interested in foreign stations even when the full Dutch broadcasting scheme is established and in operation. This enterprising attitude is without a doubt largely due to the fact that the average Dutchman is a far better linguist than the average Englishman, and so can take an intelligent interest in foreign programmes and speeches.



Philips high-power valves in use at Hilversum. The anodes are made of chromium-iron and are water-cooled.



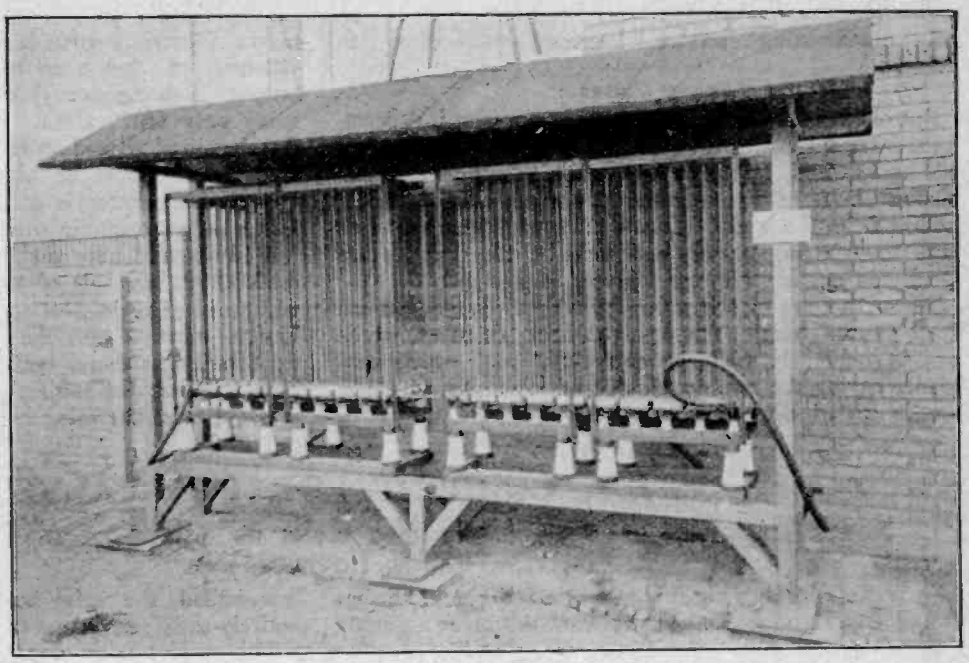
A corner of the building containing the power plant equipment.

It was to me a point of special interest to ascertain the types of wireless receivers and valves that are in common use for the reception of broadcasting in Holland. Since Holland has been somewhat slow in developing a definite broadcasting service, one might have expected that the development of the wireless component and valve industries would have been correspondingly slow. Thus it would not have been surprising if the wireless components and valves used were mainly of English or German manufacture. But I found that this was not so, for, although the circuits commonly used are similar to those used in England, the components and valves could nearly all be designated as made in Holland. The one exception to this seems to be that in the case of loud-speakers the Sterlin, Amplion, and Lumière types are very popular.

Types of Valves.

In the case of thermionic valves, Dutch wireless engineers are justly proud of the excellent types produced in the country, for Messrs. Philips, the well-known lamp and valve manufacturers, have their big factory at Eindthoven, in the South of Holland. It is very common in England to hear experimenters speak of a Dutch valve as being a soft valve with an appreciable pressure of gas and suitable for detection, but Messrs. Philips make a whole series of triodes and tetrodes, which are

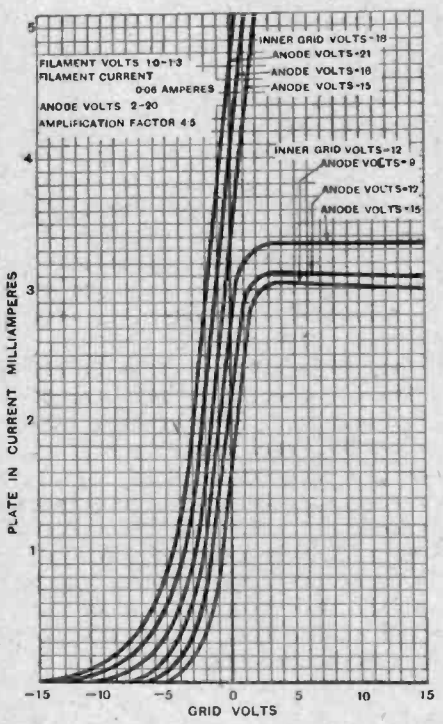
Continental Broadcasting.—

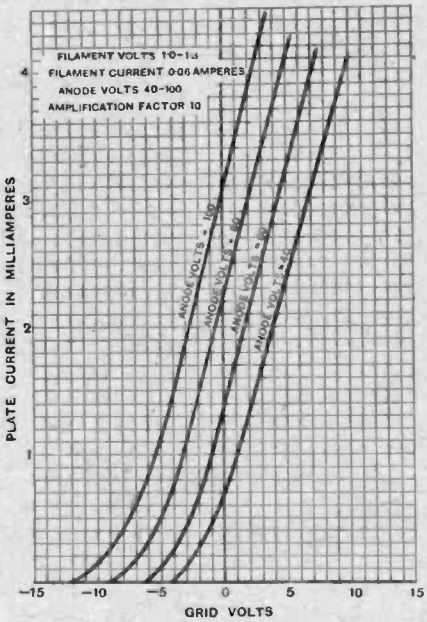


The oscillatory circuit carbon resistances in which 190 kilowatts of high-frequency energy are dissipated.

quite comparable with the hard valves of English manufacture. The four-pin socket of English design is used, and, in the case of tetrodes, the extra grid connection is made to the metal band which surrounds the cap.

But in one point Messrs. Philips have profited largely from the experience of this country. I refer to the vexed subject of valve type nomenclature. In England there seems to be nothing but chaos, and, as types of valves are increasing almost daily, the confusion is becoming rapidly worse. With us the type letter and serial number tell us practically nothing about the various operating characteristics of the tube. For example, how is one to know the marked difference between filament volts, filament current, and electron emission of B4 and B5 valves from the type names alone? This kind of difficulty has led Dr. van der Pol, who is in charge of the valve design department at Messrs. Philips, to adopt a scheme of naming valves which gives one some indication of the filament voltage, filament current, and amplification factor of the particular valve. The type letter (*e.g.*, A, B, etc.) refers to filament current consumption, the alphabetic sequence indicating increasing order of magnitude. An A type valve has a 60-milliampere filament and can be run from dry cells; a B type valve has a 0.1-ampere filament, which is best worked from accumulators, and so on. The first figure after the letter gives the normal filament voltage, and the two succeeding figures the amplification factor. Thus the A110 type requires a filament current consumption of 0.060 amperes and a filament voltage of one volt, while the amplification factor is 10, while a B406 valve requires 0.1 ampere at 4 volts for the filament, and the amplification factor is 6.





On the left are the curves of a typical four-electrode valve—the Philips A141. Above are the characteristic curves of a Philips A110 receiving valve. It will be noticed that the filament rating is 1·0—1·3 volts, 0·06 ampere.

Four-electrode Valves.

In England we find that, although there are many types of triodes on the market, tetrodes or four-electrode valves have never been much advertised by the makers. This has always struck me as curious, for there are great possibilities in the way of reduction of anode voltages in the use of tetrodes. In Holland, on the other hand, tetrodes are very popular, and to meet the demand Messrs. Philips have designed a dull-emitter tetrode which, working with an anode potential of 12 volts, gives steeper characteristics than, and the same amplification factor as, a normal three-electrode tube of the same filament characteristics working at an anode potential of 60 volts. It is almost certain that these tetrodes will be in great demand when the

Continental Broadcasting.—

full broadcasting service becomes established in Holland.

Power Valves.

But one must remember that for a complete broadcasting service, transmitting valves as well as receiving valves will be required, and it is interesting to note that transmitting valves of the required power are already being produced in Holland. Messrs. Philips have developed large transmitting valves, and some of these valves are already in operation in the Hilversum station.

The valves are of the water-cooled metal type and are about 57 cms. long. The metal case of the valve, which acts as anode, is made of chromium iron, which substance, having the same coefficient of expansion as glass, can be sealed directly to the glass part of the valve through which the filament and grid leads come. The normal filament current is 89 amperes, and with an anode potential of 15,000 an input of 255 kilowatts and an output (high frequency) of 190 kilowatts are obtained, using only four valves. Each valve has an amplification factor of 40 and an internal resistance of 3,000 ohm. The large amount of high-frequency energy developed by this transmitter is dissipated in large carbon resistances in an open-air rheostat.

From what I have said above it will be gathered that I realised, as a result of my visit, that wireless research was truly alive in Holland, and in conclusion I should like to mention also the intense enthusiasm of all the workers I met there, both amateur and professional. I have to thank the subject of wireless for an introduction to some most charming people.

L.T. CURRENT FOR 0·06 VALVES.

Some Experiences with Leclanche Cells as a Source of Filament Current.

By N. DOWNES, B.Sc.

ALTHOUGH with the advent of the low current consumption class of dull emitter valves a greatly increased demand for large capacity dry cells was foretold, the extensive use of accumulators, despite their many acknowledged disadvantages, appears to be scarcely affected. The dry cell referred to is, of course, a type of Leclanché cell in which the electrolyte is in the form of a stiff paste so that on being sealed the cell is, in effect, "dry." After a time it is found that due to the drying up of the electrolyte, or to other causes, the cell becomes useless, although the active elements themselves may not be exhausted.

The ordinary wet Leclanché cell, however, possesses several excellent features which have long been recognised in other branches of the electrical industry; but to the writer's knowledge, little mention of their use for filament heating has yet been made. These cells possess, among others, the following advantages:—

(1) The first cost is low.

(2) The maintenance cost is trifling.

(3) The electrolyte is non-acidic.

(4) Little attention is required beyond the replacement of water to make good the loss by evaporation, and very occasionally the addition of a few crystals of ammonium chloride (sal-ammoniac). To a certain extent they are electrically self-protecting, due to the rapid rate of polarisation under the influence of a short circuit. Little harm will be done, therefore, as the cell has the power of rapid recuperation. Provided the current output is suitable, the E.M.F. is steady, and its value compares favourably with other primary cells, being 1.45 volts on open circuit.

The disadvantages are:—

(1) The low value of the maximum permissible steady current.

(2) Bulkiness; not portable.

The first objection is overcome by the use of .06 valves. Since November last, the writer has been working one of these valves from a test battery consisting of three Leclanché cells in series. Recently an L.F. amplifier was added, the valve being a D.E.3. The result is entirely satisfactory, the same battery supplying the additional current without any signs of polarisation. The zincs show very little wear and should be good for much more service. The only attention required has been the addition to the cells of cold tap water, as required. The disadvantage is that when switching on or off the optional second valve, a readjustment of the detector filament resistance is very necessary. One quickly becomes accustomed to this, however, and eventually the action is performed quite automatically.

The second objection disappears by storing the battery in some convenient place, preferably cool and dry, and leading feeders, which may well consist of a length of twin bell wire, from battery to instrument. It is not necessary to use heavy gauge wire, as the resistance due to the use of thinner lines is small compared with the resistance of the valves.

In my own case, the same battery which supplies the electric bells in the house is used also for my instrument, and by pressing into service a portion of the existing concealed bell wiring system, a neat and inconspicuous result has been obtained, all that is in evidence being ordinary twin sockets connected across the wires in each of those rooms where it may be desired to use the instrument. To tap the supply, a plug connected by leads to the L.T. terminals on the set is inserted in the socket, the correct polarity being readily found by trial.

If new cells are necessary, obtain those with fairly large dimensions. The No. 2 size is suitable, and costs to-day about 2s. 6d. complete. Sal-ammoniac is very cheap, and a pound will be found ample for four cells. New zincs cost from 3d to 4d. each.

It is desirable in making up the solution to add sal-ammoniac to cold water until no more will dissolve, then add a little more water so that the solution is just weaker than saturation. With too much sal-ammoniac, crystals deposit on the zinc, while when the solution is too weak, chloride of zinc forms on the zinc. Both these conditions, by increasing the internal resistance of the cell, materially impair its efficiency.

BROADCAST BREVITIES.

NEWS FROM THE STATIONS.

Ten Million Additional Listeners.

The main function of the Daventry high power station is to provide a programme for those who are outside the range of medium power stations, and an alternative programme for other listeners. The population within the 100-mile radius of Daventry is, approximately, 23 millions. The new 5XX will provide some ten million additional crystal users with high power programmes, which will continue to be relayed from London by means of a Post Office land line. The small studio which was used for the opening ceremony is equipped with speech input apparatus similar to that used in the other studios of the B.B.C., but it will normally only be used on special occasions for special announcements.

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The Masts.

Owing to the high elevation of the ground, the tops of the masts are actually higher above sea level than the masts used at the new Post Office Station at Hillmorton, near Rugby, which can be seen quite clearly from the Daventry site, but it is worthy of note that the masts at the B.B.C. station are only 500 feet high, as compared with the 820 feet masts at Hillmorton.

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Rapid Development.

Development is so rapid in the construction of broadcasting stations throughout the world, that it would be unwise to make any extravagant claims on behalf of the new 5XX, but it may be said, without exaggeration, that the Daventry super broadcasting station is by far the most powerful in the world.

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Post Office Co-operation.

The B.B.C. engineers cannot adequately thank the Post Office for the assistance that has been given in providing the best available land lines in order to secure high quality transmission. One sometimes hears hard things said about the casual methods of Government Departments, but in connection with the completion of the Daventry broadcasting station the Post Office engineers rendered extremely valuable service for the benefit of listeners.

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Exchanging Programmes with America.

Through the International Union of Broadcasters at Geneva, the B.B.C. has been developing comprehensive proposals for the exchange of programmes. It should be kept in mind, however, that there is a good deal of experimenting still to be done before the necessary factor of safety can be guaranteed for the regular transmission and relay of these programmes. The B.B.C. proposes to arrange its American exchange with all the leading American organisations; but in the first instance the arrangement will be with the Radio Corporation of America.

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B.B.C.'s Central Receiving Station.

The B.B.C. has communicated with America through Mr. David Sarnoff, Vice-President and General Manager of the Radio Corporation, stating that it welcomes the suggestion of a still more ambitious scheme for an exchange of programmes between Britain and America, and pointing out that the Company has made plans to establish a central receiving station, equipped with all the latest devices for receiving the world's most powerful broadcasting stations, and, by this means, it hopes during the next winter season to be able to re-transmit to the ten millions of its listeners, with even greater success than heretofore, Transatlantic programmes.

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Broadcasting as an Ambassador.

In the course of the message the B.B.C. states that it is glad to feel that broadcasting, through the anticipated regular exchange of programmes, should be the means of increasing the good feeling that already exists between the United States and Great Britain. The message concludes:—"In reflecting the aspirations and thoughts of the best elements of all sections of the community, and in bringing these aspirations and thoughts within the ken of other communities widely separated by barriers of geography, language and race, the broadcasting medium should be able to do a very great deal to bring the nations together, and to establish a basis for a conscious world citizenship."

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Last Session's Talks.

In spite of a little criticism in certain quarters of broadcast talks during the last two sessions, the concensus of opinion showed that the series of talks by Sir Oliver Lodge on "Ether and Reality," broadcast during the spring, were among the most popular of B.B.C. programme items. Of course added to the subject matter, the style of presentation and the enormous prestige of this veteran, must be taken into consideration, together with his eloquent language and the peculiarly persuasive character of his delivery, but in their kind, the talks by Prof. J. Arthur Thompson and of Sir William Bragg, were equally well received.

FUTURE FEATURES.

Monday, August 3rd.

LONDON.—8 p.m., Bank Holiday Moments.
BIRMINGHAM.—9 p.m., Chamber Music.
CARDIFF.—8 p.m., First Concert from the Welsh National Eisteddfod.

Tuesday, August 4th.

5XX.—8 p.m., Wireless Favourites.
LONDON.—8 p.m., All Stations Programme (except 5XX): Symphony Concert.

Wednesday, August 5th.

LONDON.—9.25 p.m., "The Impressario"—Music by Mozart.
CARDIFF.—7.30 p.m., Third Concert of the Welsh National Eisteddfod.

Thursday, August 6th.

5XX.—9.35 p.m., Sociable Songs.
LONDON.—8 p.m., The London Chamber Orchestra (First Broadcast).
ABERDEEN.—8 p.m., Modern French Composers.

Friday, August 7th.

CARDIFF.—7.30 p.m., "The Messiah," conducted by Sir Walford Davies.
NEWCASTLE.—8.30 p.m., An Irish Hour.

Saturday, August 8th.

LONDON.—8 p.m., "What is This?"
NEWCASTLE.—8 p.m., "The Tales of Hoffmann."

New Series.

The difficulty in preparing a new series of talks for the coming autumn has been not merely to live up to the standard set in previous sessions, but, if possible, to surpass it, and the responsible officials think that they are in a fair way to do this. One series to which they are attaching considerable importance, will be by Prof. Julian Huxley, in which he will deal under the general title of "The Stream of Life," with the origin of life, the theory of evolution, and race and race-breeding.

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Success Overseas.

Another series, entitled "Opportunity Overseas," will result from negotiations now in progress with prominent people in the Dominions, with a view of giving talks by men who have emigrated and who have made successes in the particular vocations which they have chosen. The idea will be to tell people of the opportunities for success and how it may be achieved. The B.B.C. is glad to acknowledge the co-operation of High Commissioners and Agents-General in London in the preparation of this series.

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Triumphs of Engineering.

Then there will be a fascinating series dealing with the romance and triumph of great engineering adventures. These will be broadcast by Edward Cressey, a *nom de plume* which veils the identity of a well-known North of England educational authority. Each talk will describe obstacles encountered and overcome in feats of engineering skill.

Broadcasting of Noises.

Some recent criticism of the B.B.C.'s endeavours to capture novel sounds for broadcasting is regarded rather with a keen attitude at Savoy Hill. The B.B.C. is said to have become much too pre-occupied with noises, such as an express train in motion, and the noises produced in the working of a coal mine. "Next, no doubt," is the critic's comment, "we shall be promised noises of a cotton mill." The latter suggestion, though made in the spirit of levity, contains a germ of truth. It is possible that listeners may hear not only the noises from a cotton factory, but also from a steel foundry, a ship-building yard and other noises, with accompanying descriptions, of industrial activity.

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Too Much Noise?

But the suggestion that the B.B.C. is too much pre-occupied with noises must be strongly combated. Broadcasting is dependent upon aural effects, in view of the absence of the visual element. It is only by the transmission of actual sounds that realism can be obtained. Both of the broadcasts mentioned by the critic, i.e., that of the express train and the coal mine, were sufficient to show that realistic noises convey the best impression to the listener.

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Prophecies.

An extraordinarily large number of prophecies of the B.B.C.'s aims and intentions is being published. Probably this is due to the fact that we are in the midst of the "silly season," or it may merely be an attempt on the part of the writers of regular broadcast notes to show that they are able to obtain information which sounds authoritative enough to be impressive. Whatever the cause, definite statements are common that the B.B.C. proposes to erect new stations, or does not propose to increase the power of existing stations.

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Schemes for the Future.

A paragraph in several newspapers, couched in similar terms, was recently circulated in which the writer declared: "It has been said that the B.B.C. is considering an increase in the power of the main provincial stations, but I am able to state that this is incorrect." Any misconception that exists is on the part of the writer of that note. The B.B.C. has many ideas concerning increase of the power of some of the main stations, but for very good reasons those ideas cannot be communicated at present. Readers of these notes will know all about the schemes in good time.

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Interchange of Programmes.

It has been noted that the B.B.C. is making arrangements for the interchange of programmes with the Radio Corporation of America. This is part of an ambitious scheme for instituting "American Nights," "Italian Nights," "German Nights," etc., when listeners will be given an opportunity of comparing British and foreign programmes and of finding out for themselves whether the former are in any degree behind the latter in quality and interest.

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Selecting the Best.

This does not mean that good British programmes will be sacrificed for indifferent foreign material, and the work of the B.B.C. will be concentrated on selecting only the best from foreign sources.

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A Receiving Station.

Reference has already been made in these columns to the new super receiving station which the B.B.C. contemplate erecting in the autumn near Bromley, Kent. The station will be used for picking up the foreign programmes which will then be distributed to listeners from various stations in the country.

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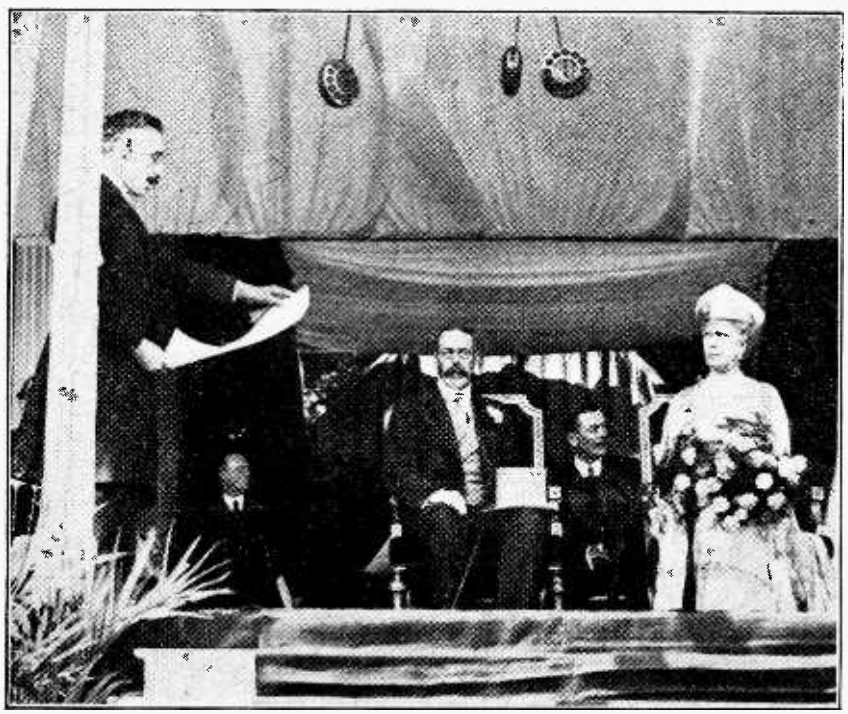
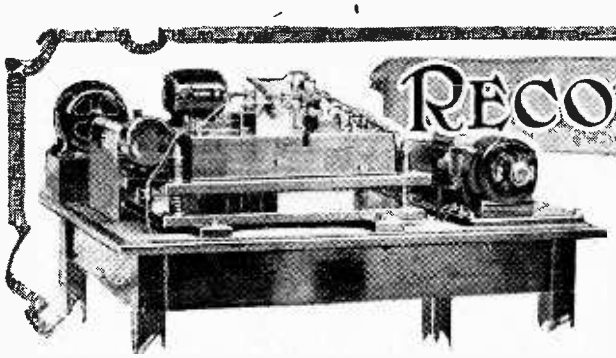
Music and John Henry.

The J. H. Squire Celeste Octet are providing an excellent programme for their visit to Manchester on Wednesday, August 12th. As usual, Mr. Squire makes a speciality of light classical pieces, such as Chaminade's "Scarf Dance," and a "Nigger Dance" by Ascher. Violin solos will be played by Mr. Mayer Gordon, and 'cello solos by Mr. Alec Fellows. Miss Wynne Ajello (soprano) will sing two groups of songs, including Rimsky Korsakov's "Chanson Hindoue." The task of providing humour to add to the variety of the programme will be in the capable hands of John Henry.



BROADCASTING AN INTERESTING CEREMONY. Their Majesties the King and Queen photographed on the occasion of the opening to the public of Ken Wood, Hampstead, on Saturday, July 18th. Note the suspended microphones.



RECORDING WIRELESS SIGNALS

PART I.

Principles of Automatic Reception.

By N. W. McLACHLAN, D.Sc., M.I.E.E., F.Inst.P.

THE recording of radio signals is a subject which has received little attention from the amateur. To secure high-class slip at speeds of 100 words per minute and upwards usually demands the use of special and costly apparatus. Some of this has already been described elsewhere[1], and if the reader desires, the necessary apparatus can be purchased from the manufacturers. The object of the present article, however, is to outline the general principles of recording and to indicate what can be done with comparatively crude apparatus of low cost. There are several salient practical points which must be observed, more particularly at speeds in excess of 35 words per minute. For instance, the incoming signals must be amplified to a tolerably high degree with the minimum of distortion: also jamming must be excluded, and the signal strength must be constant. The values of signal strength and the conditions quoted are to be regarded as average working values, so that continuous operation can be secured, thus dispensing with the annoying little adjustments necessary to cope with a variation in speed or signal strength, etc. On the other hand, it will be realised in theory and in practice that results can be obtained with less rigorous conditions and smaller signal strengths than those advocated herein. The experimenter, however, will do well to determine his own optimum conditions, using as a guide the information and data presented below. Radio is in a transitional state at the moment, and, given suitable apparatus of comparatively low prime cost and maintenance in service, the art of recording would be lifted from its present position of siphon and ink-marking to one free from the impedimenta of moving magnetic masses of by no means negligible inertia.

Principles of Recording.

The apparatus required is some form of receiving circuit with the usual detector and local oscillator or heterodyne when recording C.W. Following this, there must be a note amplifier whose design depends upon the strength of signal required to actuate the recording apparatus. For instance, with any ordinary relay, the minimum signal strength for recording at 30 words per minute is much less than that for 100 w.p.m., because the working force on the relay must be greater in the latter case than in the former. Whatever the speed of reception, there ought to be an adequate voltage margin on the power valve which operates the relay. This is a point which the average experimenter is apt to overlook, with the result that his set is constantly in need of adjustment. The object to be attained is commercial reliability, with amateur apparatus of as inexpensive a nature as possible.

So far as high-frequency amplification is concerned, there is really no need to speak, because everyone is familiar with the usual classes of amplifier. We have already[2] given two circuits which may be employed to combat interference and purify the signals. To these should be added the high-frequency amplifier and a note filter circuit if required. There are, of course, other ways of achieving selectivity by incorporating tuned circuits on the grids of the amplifying valves, but unless special precautions are taken in the way of screening and stabilising the set, the operation of tuning is usually beset with difficulty owing to spurious oscillation.

On the other hand, when the H.F. filter circuit is

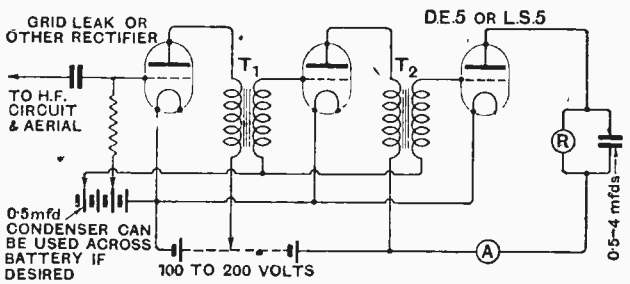


Fig. 1.—Simple recording circuit with transformer coupling using common anode, filament and grid bias batteries. Beat note 800 to 2,000 cycles.

valve-coupled, the direct effect of incoming radiation[3] on the coils is much attenuated, since the signal strength therein has undergone appreciable amplification and the ratio of signal to interference is increased as we progress along the amplifier. In general, however, it will be found necessary—especially if the coils are not wound astatically—to screen each intervalve filter, so that the above advantage is practically offset. Nevertheless, it is well to satisfy one's curiosity and gain experience by trying both modes of reception, namely (1) filter circuits with or without reaction followed by H.F. magnification, (2) combined filter circuits and H.F. magnification. With reference to the reaction circuits of Figs. 3

[1] *Journal I.E.E.*, August, 1923.

[2] *Wireless World*, April 29th, 1925, pages 392-393.

[3] See *Wireless World*, November 12th, 1924.

Recording Wireless Signals.—

and 4 of my recent article in this journal[4], the object of using reaction is not to increase the signal strength, but to enhance selectivity. Also, where valve-coupled filter units are employed, the magnification per stage must be kept down in order to realise the desired degree of selectivity.

In the section on the local oscillator given below, it is shown that the signals at the rectifying valve should be relatively weak to avoid distortion, with consequent mutilation of the signals. The mutilation will often be evident on the record when it is difficult to discover it in the phones, especially if the reception speed is of the order of 100 words per minute. Moreover, it is good practice to obtain the major part of the magnification at note frequency. We have, therefore, to discuss the problem of amplification at note frequency. Since there is only one note with relatively narrow side frequencies to be amplified, and its value is arbitrary, the question of *amplitude* distortion arising from unequal magnification over a wide band of frequencies does not arise. Thus

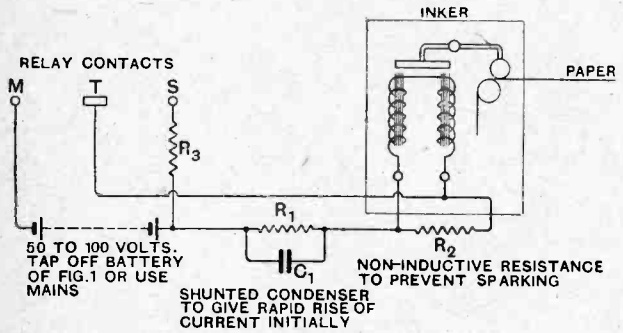


Fig. 2.—Showing connections from relay contacts to inker. If the inker has a low resistance, say 500 ohms, the current to operate it will be large, so that care must be taken not to overload the battery.

we are not tied down as regards a choice of iron-cored transformers.

Taking a simple case first, suppose the jamming is negligible, and it is desired to amplify signals from the detector to actuate a relay of the Post Office type at 30 words per minute. A simple and effective arrangement is sketched in Fig. 1. In the anode circuit of the rectifier is inserted the primary of an iron-cored transformer of relatively large inductance, say, 20 henries. The secondary of this is connected to the grid and filament of any amplifying valve with suitable grid bias. This again is coupled by means of a 3 : 1 or a 4 : 1 transformer to the power or recorder valve. The latter is given a grid bias sufficient to set it at the lower rectifying point. The H.T. on these two valves should not be less than 100 volts for reliable operation. The recorder valve should be of low impedance, so that during signalling a reasonable proportion of the H.T. is allotted to the relay, thereby ensuring a fairly large working current. Valves of the D.E.5 or L.S.5 type are best for this purpose. When a low impedance valve is not to hand, several high impedance valves, preferably of the same type, can be grouped in parallel, but the grid bias required ought to be approximately the same for all the valves. The relay in the anode circuit of the valve should have a d.c. resistance of the order of 2,500 ohms, and it should be shunted by a telephone type condenser of from 0.5 to 4 mfd. The effect of the condenser is to reduce the a.c. impedance of the last valve circuit, and in this way the direct current component is appreciably augmented. If a milliammeter is available, it should be inserted in the circuit. When the condenser is tapped on and off the relay terminals, the effect will be seen on the milliammeter; also the effect of various values of condenser. Alternatively, where a milliammeter is not used, the influence of the condenser will be evinced by an increased impact at the relay contacts, this being easily audible.

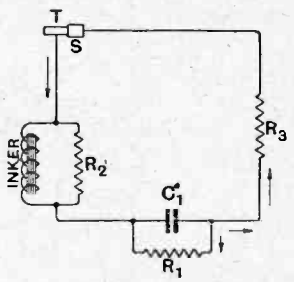


Fig. 3.—Showing circuit of Fig. 2 when T and S are in contact.

Having got the relay to function, the next step is to secure a permanent record on a moving paper tape. For this purpose some form of recording instrument is requisite. To the average amateur magnetic drum recorders or Wheatstone recorders are usually out of the question on a cost basis. Moreover, it will be assumed that some form of inker—probably antediluvian—is the only available instrument. In general the moving parts are heavy and need large forces to operate them at anything above hand-sending speeds. But large forces necessitate large currents, because the magnetic systems are rather feeble (compared with those of modern recorders). For instance, a Wheatstone type instrument of 2,500 ohms gives a pull of 0.06 lb. with a current of 4 milliamperes, whereas a magnetic drum instrument of equal resistance gives a pull of 1.2 lb., *i.e.*, twenty times the former. Now the equivalent mass of the moving parts of the Wheatstone is about 2.5 times that

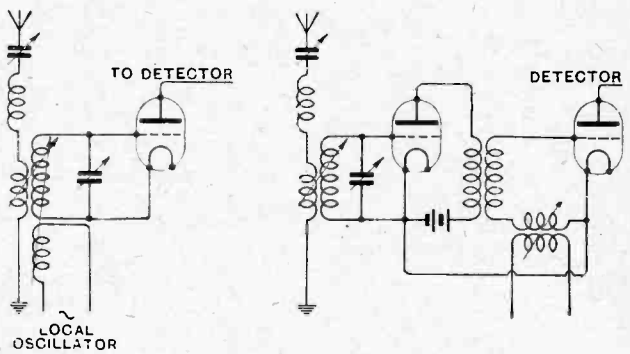


Fig. 4.—Showing two methods of applying a local oscillator for receiving C.W. and obtaining a beat note for recording. It is to be understood that these are only diagrammatic, and that no attempt has been made to show an elaborate screened circuit with astatic coils, etc.

of the magnetic drum, so that the force per unit mass ratio is $\frac{2.5 \times 20}{1} = 50$. With an ordinary inker the comparison would be even less favourable. The inker is connected to the relay contacts with a suitable battery, as illustrated in Fig. 2. When the relay tongue makes

[4] April 29th, page 392.

Recording Wireless Signals.—

contact with the marking stop the circuit consists of a battery, the inker, and a non-inductive resistance shunted by a telegraph condenser. The resistance-condenser combination is an old telegraphic artifice, and its action is as follows. At the instant of closing the circuit the battery begins to supply energy to the circuit; the condenser is uncharged and the majority of the current passes to the condenser for charging purposes, the resistance meanwhile having an easy time. In fact, the condenser acts as a temporary short circuit. Moreover, the voltage drop across it is very small at first, so that the greater portion of the battery voltage is across the inker. As the condenser gradually gets charged, the voltage across it increases, whilst that on the inker decreases until ultimately, when the current in the circuit is steady, the condenser voltage is given by RI where I is the steady current through R. This automatic voltage regulation across the inker yields a rapid initial rise of current, thereby ensuring a prompt response.

A glance at Fig. 2 will reveal other accessories. For example, the inker is shunted by a non-inductive resistance and there is a resistance connected between the stops M and S. The object of the former is to obviate sparking at the contact S when T breaks away from M, whilst the latter eliminates the possibility of short circuiting the battery if an arc should occur between M and T whilst T arrives at S, or if during adjustment of the contacts the three should inadvertently get jammed together. The elimination of sparking is an important matter. Continual sparking results in pitted contacts accompanied by a high resistance which reduces the current below a working value. The resistive shunt on the inker serves as a buffer for the electro-magnetic energy stored in the windings, which must be dissipated when T leaves M. When T comes in contact with S, the circuit is shown in Fig. 3. It will be seen that the condenser discharges through R, and also through the inker. Since the current through the inker is now reversed, demagnetisation occurs, which assists in the rapid annulment of eddy currents in the iron masses and promotes a more speedy return of the armature to the spacing stop. The effect of this artifice is not appreciated until it comes to high speeeds of reception, for which purpose an inker is usually unsuited. Concerning sparking and shunted condensers, the experimenter would be wise to consult some literature on line telegraphy—for instance, "Telegraphy." by T. E. Herbert. There are other methods of reducing sparking, *e.g.*, condensers and resistances across the relay contacts, which are discussed in this book. Double or reverse current methods of working the inker, in which the armature is driven both ways (no spring being used), are also given.

Local Oscillator or Heterodyne.

The use of a local oscillator to secure the customary beat note requires some comment. It is a wise policy to screen the oscillator and its batteries, but this is not absolutely necessary. There are two modes of introducing the oscillator which may be cited: (1) it is loosely coupled to one of the receiver coils; (2) it is injected in the grid circuit of one of the H.F. amplifying valves or the detector. The latter method is preferable, since it interferes less with the tuning and selectivity of the set. These methods are illustrated diagrammatically in Fig. 4. A variable coupling is indicated between the oscillator and the receiver, and the importance of this becomes very evident when the incoming signals are strong. The practical issues associated with the local oscillator can best be studied with the actual apparatus, using a circuit like that of Fig. 5, where the oscillator is coupled to one of the receiver coils. The voltage induced from the oscillator thus undergoes amplification before reaching the detector valve. Assume that there are two indicating instruments, one in the grid circuit of the rectifier (the valve working on the curvature of the anode-grid characteristic) to read grid current, the other in the anode circuit of the rectifier to read the mean change in anode current. In the absence of both local oscillator and signals there will be no grid current

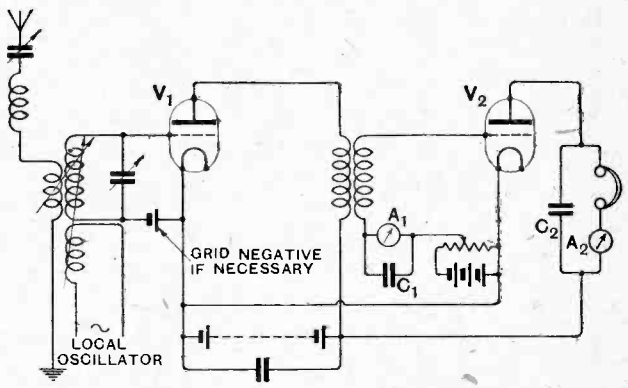
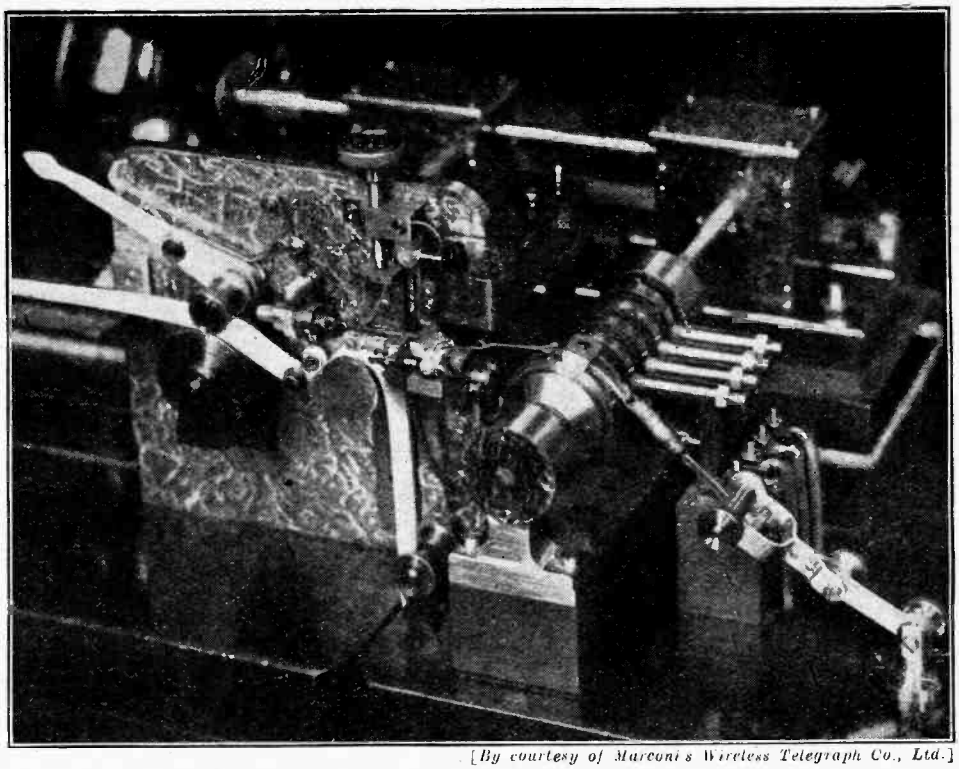


Fig. 5.—Showing positions of ammeters A_1 and A_2 (A_1 is a micro-ammeter) for experiments on the strength of the local oscillator. C_1 and C_2 are condensers to shunt the H.F., but not the L.F. currents. V_2 is a D.E.Q., Q.X., D.E.3.B., or other valve suitable for anode rectification.

and the anode current will be very small, since the valve is at its lower rectifying point. When the L.O. is switched on the anode current will rise to a certain value. By varying the L.O. coupling the anode current will vary. If the valve has no negative bias on its grid, there will in general be grid current, but this depends on the type of valve. In fact, some valves yield grid current when the negative end of the filament is at the same potential as the grid. The grid current can be varied by altering the L.O. coupling. Should grid current flow, a dry cell or potentiometer arrangement must be applied to prevent it, whilst the anode battery ought to be augmented by a voltage approximately equal to the negative bias multiplied by the valve magnification factor. Having eliminated grid current, suppose we again turn our attention to the L.O. It is decidedly advantageous to know the wavelength of both receiver and local oscillator, and for the sake of illustration these will be taken as being known. Now set the *receiver* to any wavelength where there are no signals—disconnect the aerial or remove the coupling coil and mistune the aerial if necessary—and again vary the L.O. The anode current will gradually increase as the L.O. comes into tune with the receiver, and after the tune point is reached it will gradually decrease; there might be a variation in this effect if the coupling between the receiver and

Recording Wireless Signals.—



[By courtesy of Marconi's Wireless Telegraph Co., Ltd.]

The drum and recording mechanism of the magnetic drum recorder.

L.O. were tight enough for the circuits to react upon each other, and the coupling should therefore be quite loose. The anode current change (increase from zero position without L.O.) is a measure of the strength of the L.O. in the circuit. The nearer the L.O. is to the tune point of the circuit, the greater the anode current. Thus when signals are being received we may say that for a given strength of beat note the intrinsic strength of the L.O. must increase as the pitch of the note increases. The veracity of this statement is appreciated most readily when receiving wavelengths of 10,000 metres and upwards.

Now let us find some signals and adjust the L.O. to give a suitable beat note. For aural reception 800 cycles is usually preferred, but for recording a higher pitch is better, and we shall therefore take a value of 2,000 cycles. This will necessitate a slightly stronger L.O., *i.e.*, the H.T. battery will have to be augmented. There are two cases which can be investigated (*a*) weak signals, (*b*) strong signals. With weak signals the L.O. can be strong and the signals will be insufficient to cause grid current in the rectifier. Let the L.O. coupling be gradually increased, and the signal strength in the 'phones will also increase. If we go far enough, grid current will appear and the beat note become impure, although strictly speaking it is not absolutely pure when there is no grid current. Furthermore, if the coupling is made tight, the damping of the receiver will increase, due to energy losses arising from the close proximity of the L.O. circuit, since this drains energy from the receiver and also alters the tuning. Moreover, with weak signals the desideratum is a stiff L.O. loosely coupled to the receiver and adjusted to avoid grid current at the rectifier

Amplifying without Distortion.

Where strong incoming signals are involved, the matter must be treated carefully. If the L.O. is also strong, there will be the inevitable flow of grid current. Let the coupling from the aerial be decreased or the aerial mistuned until no grid current flows. Then increase the signals and observe the effect in the telephones. The note is clear at first, and then, as grid current appears, it becomes mixed, until finally, with very strong signals, the note is almost masked completely by a series of deafening key clicks. Increasing the L.O. is of no avail, so cut it off altogether. The residue is a series of key clicks which punctuate the Morse characters. For further information on this topic the reader should consult a former article in this journal.[5] When dealing with the actual operation of recording signals, the question of key clicks will again be discussed. In order to appreciate the preceding remarks, the reader ought to perform the experiments himself. If a suitable transmitting station is not available, an auxiliary L.O. can be used as a transmitter, and the signal strength varied at will. For those with no transmitting licence, a closed circuit oscillator will serve very well if the anode battery is adequate and a suitable valve is employed, say, an L.S.5 with 120 to 200 volts on the anode.

As an example of a suitable station, take Ongar. Sufficiently strong signals can be obtained readily with little amplification at distances up to 40 miles. To obtain the above effects with strong signals, care must be exercised when using reaction[6] to avoid excessive selectivity, or the key clicks may be toned down a good deal.[5]

It may appear peculiar, but in the reception of Morse signals the amplification should be accomplished as far as possible without distortion of the signal. In this way it is easier to select the desired signal from a group of jamming stations when note tuning is employed, since there is then no mutilation. If the desired signal is mutilated during amplification, it is rather futile to use additional selective devices to effect purification when the reverse action has occurred. The only permissible distortion is that due to the filtering or selective action of the circuits—which is obviously indispensable—which causes a rounding of the signals to occur, so that the

[5] *Wireless World*, March 18th, 1925, page 201.
[6] *Wireless World*, April 29th, 1925.

Recording Wireless Signals.—

beginning and the end of a Morse character are less sharply defined at the receiver ('phones) than at the transmitting aerial. Where the local oscillator and rectifier are concerned, this condition of minimum distortion can be secured by using a strong L.O. to carry the rectifier beyond the bend of the curve to the straight portion. The signal must then be relatively weak to secure approximately linear amplification. For an amateur this is not always a practical proposition, since a negative bias of about 2 volts is required, and this entails a rather large H.T. battery. When, however, a common H.T. battery is used throughout the recording circuit, or the D.C. lighting mains are available, there is no difficulty experienced in this direction.

Finally, it will be well to indicate the conditions which exist in the anode circuit of the rectifier. With a L.O. alone, the lower or negative halves of the radio frequency currents are cut off, leaving a series of impulses every half cycle. The shape of the impulses is governed by the curvature of the anode-grid characteristic of the valve and by the strength of the L.O. These impulses can be resolved into a family of radio-frequency currents which are inaudible, and a steady current which can be registered on a d.c. meter. On the arrival of signals, additional radio frequencies appear, the mean anode current increases, there is a fundamental beat note accompanied by its side frequencies, and also the side frequencies of modulation. If the L.O. is so weak that the rectifier operates chiefly on the curved part of the characteristic, auxiliary or alien beat tones are created with their accompanying side frequencies. In fact, the action is actually extremely complex, there being many frequencies involved in the issue. Alien tones arising from curvature of a valve characteristic can be detected readily by setting one of the note amplifying valves which follow the H.F. rectifier to its rectifying point.

(*To be continued.*)

Calls Heard.

Extracts from Readers' Logs.

Norwich.

Great Britain (75 to 110 metres):—2DX ('phone), 2DR, 2XV, 2MR, 2IN, 2ZB, 2MK, 2XQ, 2JB, 2HT, 2NJ, 2WY, 2CM, 2BD, 2II, 2WY, 2FM, 2DF, 2MK, 2YO, 5CW, 5XY, 5OC, 5NW, 5YI, 5DH, 5BV, 5GV, 5SU, 5UW, 6QB, 6RM, 6RY, 6YR, 6VP. (150-200 metres) 5FT, 5YK, 2KT. *France* (75 to 110 metres):—8ZA, 8TU, 8TK, 8EU, 8U, 8KK, 8SSA. 8UT, 8WIN, 8LD, 8JAA, 8JA. 8NS, 8KR, 8VO, 8JR, 8SST, 8FZT. 8VL, 8MA, 8PK, 8RN, 8LM, 8WOX, 8VTI, 8EO, 8GV, 8QB, 8MJM, 8KT. 8CQ, 8CAX, 8RLM, 8NY, 8NS, 8NY, 8VT, 8BN, 8JL, 8JD, 8VU, 8VAA. *Belgium*:—4WS, W3, V2, 2C, X2, 6G, S6, Y4, W4. *Holland*:—OMS, OPV, PCUU, OCN, OMR, ORE, OKV, OMIA. ORO, OZA. *Scandinavia*:—SMRT, SMUU, SMUV, SMYZ. *Spain*:—EAR10, EAR6. *Italy*:—1BR. *Germany*:—4EA *Switzerland*:—9BR. *Finland*:—4MS.

(0-v-1) H. J. B. HAMPSON (6JV).

Glasgow.

(All telephony):—2DR, 2FN, 2IL, 2KF, 2KS, 2KZ, 2MG, 2TI, 5ST, 5NW, 2TN, 6NF, 4AU, 8MRA (heard on 30 to 190 metres). R. W. LODGE.

(0-v-1)

Bristol.

(June 30th to July 7th.)

French:— 8AAA, 8AG, 8ALG, 8BN, 8BP, 8CAX, 8CC, 8CQ, 8DE, 8DK, 8FOX, 8FO, 8GM, 8GN, 8GOF, 8GVR, 8IPK, 8JAB, 8JD, 8JK, 8JWS, 8KG, 8KM, 8KK, 8MO, 8NA, 8NOO, 8NS, 8PB, 8QBC, 8RF, 8RV, 8ROM, 8RDI, 8RVE, 8TK, 8VU, 8VUA, 8WOZ, 8WK, 8WO. *Dutch*:—OCTV, NOGG, NOGN, NOKV, NOME, NOPM, NOQW, NORO, NORW, NOZA, NOZN. *Belgian*:—4AS, 4AR, 4SR, 4UC, 4UM, B7, G6, R2. *American*:—1AXA, 1AV, 1CAA, 1NC, 1PM, 1XVX, 1XA, 2GK, 2SN, 2SU, 3BA, 3JW, 3MS, 3TO, 4BT, 4ER, 4JJ, 4PZ, 4QJ, 4SA, 5KKA, 5NQ, 5UK, 5WNW, 7GP, 9ABR, 9BA, 9EU, 9FF. *Others*:—SMRA, SMXG, 1AS, 1BR, 1AA, YCB, RER, ARB, CHR, KXP, CJNI, KAF, ANE, CIA, 7XC, 9AR, 9WW.

All heard on 0-v-1 without aerial or earth.

J. AND K. MONCKTON (G2BAZ).

Stations Unknown.

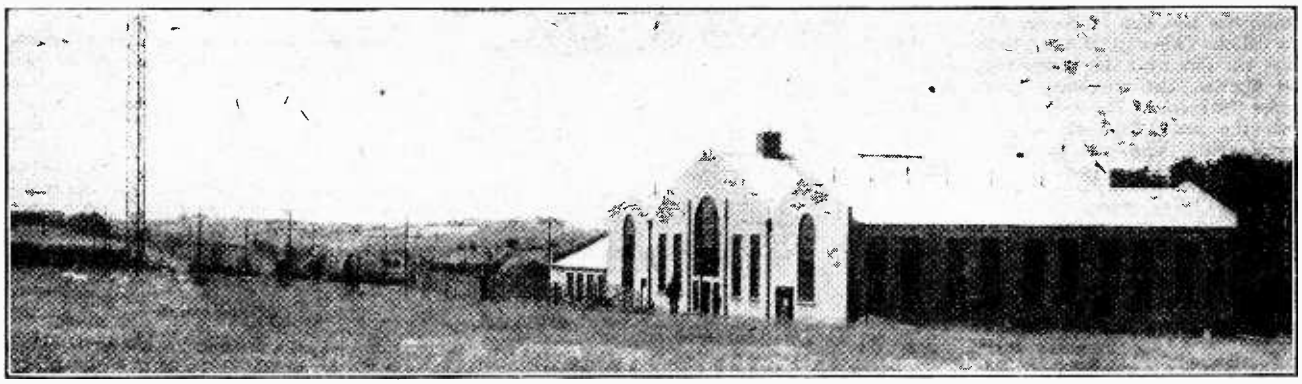
We print below a list of stations which some of our correspondents wish to identify, and shall be glad if any of our readers can furnish us with the desired particulars:—KY5 (110 metres), 4SR, OKG (100 metres), heard on July 5th. HDG working with MI2 on July 9th. D41 working with DYC.

Stations Located.

In reply to correspondents wishing to identify certain stations:—RB and M7 are stated to be Belgian amateurs. NEA is presumed to be ANE, the Government Radio Laboratory at Bandoeng, Java.

Co-operation in Tests Wanted.

Mr. F. R. Neill, Chesterfield, Whitehead, Co. Antrim, has been allotted the call letters 5NJ—the first to be issued in Northern Ireland—and expects to begin transmission on 23.45 and 90 metres about the middle of August. He will welcome reports from British listeners.



OPENING OF THE HIGH POWER BROADCASTING STATION AT DAVENTRY. On Monday, July 27th, the Postmaster-General, Sir William Mitchell-Thomson, K.B.E., M.P., opened the new B.B.C. Station in the Midlands. The photograph depicts a general view of the station buildings.

A Review of the Latest Products of the Manufacturers.

THE COLLET KNOB AND DIAL.

Many methods have been devised for securing an instrument dial to its spindle, and although at one time a threaded spindle with locknut was invariably adopted, several improvements have recently been introduced. The use of a locknut on a threaded spindle would be entirely satisfactory were the nut accessible.

The Collet knob and dial, manufactured by Messrs. Ebenestos Insulators, Ltd.,

Collet dial dismantled, showing the action by which a small brass collet is dragged into a tapering hole causing it to close and securely engage on the instrument shaft.

Excelsior Works, Canterbury Road, London, S.E.15, makes use of a brass inset having tapering sides and resembling very much in appearance a small drill chuck. The taper and sides engage in a tapering hole from the underside of the dial, and the thread in fitting into the detachable nut drags the collet into the hole and in so doing closes the slots and diminishes the size of the centre hole in the collet. Thus it is only necessary to place the dial over the instrument spindle and tighten the operating knob, which causes the sides of the collet to bind down upon the instrument shaft, producing a secure grip. The dial measures 3in. in diameter, and has a good finish.

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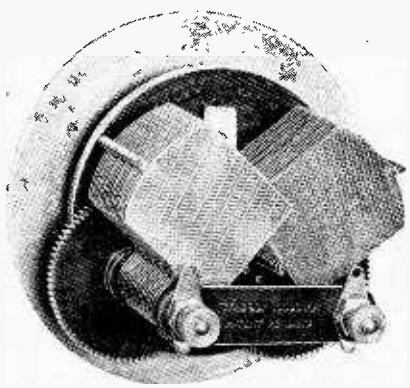
REMBLER VARIABLE CONDENSER.

Among the wide range of components supplied by Messrs. R. A. Rothermel, 24-26, Maddox Street, Regent Street, London, W.1, the Rembler variable condenser is of unusual interest.

As will be seen in the accompanying illustration the plates are almost rectangular in shape and are operated by means of pinions, so that they engage from corners, producing a square law capacity change. The disc on which the pinions and spindles are assembled is a good clean moulding, while the pinions themselves are also mouldings having teeth made with a cleanness that could not be exceeded even by milling. The plates are of thin brass, stiffened by pressing and given a good bright finish. They are bonded together on the spindles by soldering, and also at one of the edges by linking up small projections with solder. Positive connection is made between the plates and the terminals with soldered flexible connections, whilst the spindles of the terminals are also the spindles on which the plates revolve.

The obvious feature of this form of construction is that an exceedingly low minimum of capacity is obtainable, as the plates engage by their corners first, and thus only a very small surface is presented between the sets of plates at the position of zero setting. The two toothed wheels are driven by means of a small pinion attached to the spindle carrying the knob and dial, and a complete revolution of the dial changes the capacity from minimum to maximum, thus producing a good open scale. The dial is of metal, though several interchangeable paper dials are held in position by means of the



Rembler condenser, capacity 0·0005 mfds, obtainable from R. A. Rothermel.

operating knob, which is detachable. The backlash which might be expected by the use of gearing can scarcely be detected. The condenser is a thoroughly good job, both mechanically and electrically, and of unusually attractive appearance.

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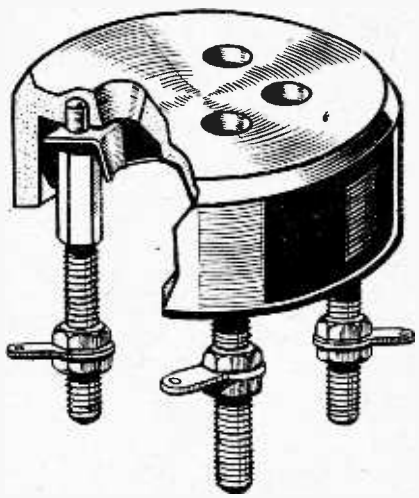
LOW CAPACITY VALVE HOLDER.

In the design of the H.T.C. series of valve holders, made by Messrs. H.T.C. Electrical Co., Ltd., an attempt has been made to reduce the capacity between the valve sockets to a minimum. The sketch illustrates a holder for panel mounting, from which it will be seen that a shell



H.T.C. Low capacity valve holder.

of moulded insulating material provided with four tapering holes is used as the support for the contacts. These are merely short lengths of a springy material and are held in position by four pieces of screwed rod. The result is a neat and novel construction, and, in addition to the advantage of possessing a low self-capacity, it is not possible to burn out the filament of a valve by accidentally inserting it in the wrong position.

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HERTZITE.

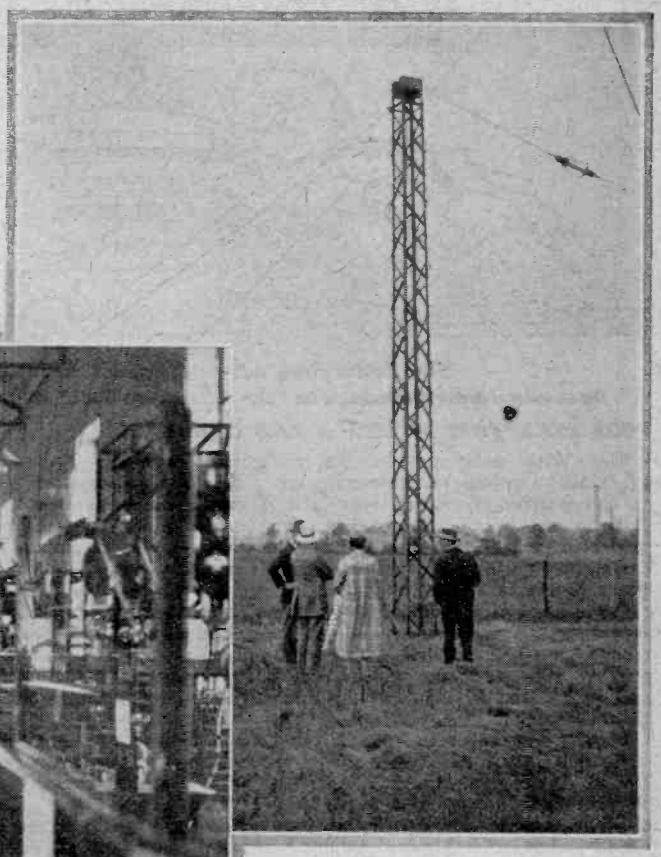
Supplies of this well-known crystal are now to be obtained from Messrs. L. G. Russell, 1-5, Hill Street, Birmingham. The makers supply a blue print circuit diagram of a good crystal receiver to all crystal users.

THE R.S.G.B. ANNUAL OUTING.

MEMBERS of the Radio Society of Great Britain paid a visit to the high-power valve transmitting station at Ongar on July 17th, by the kindness of Marconi's Wireless Telegraph Co., Ltd. The party, consisting of about fifty members, made the journey by char-à-banc.

An interesting afternoon was spent examining the equipment, of which a description with photographs

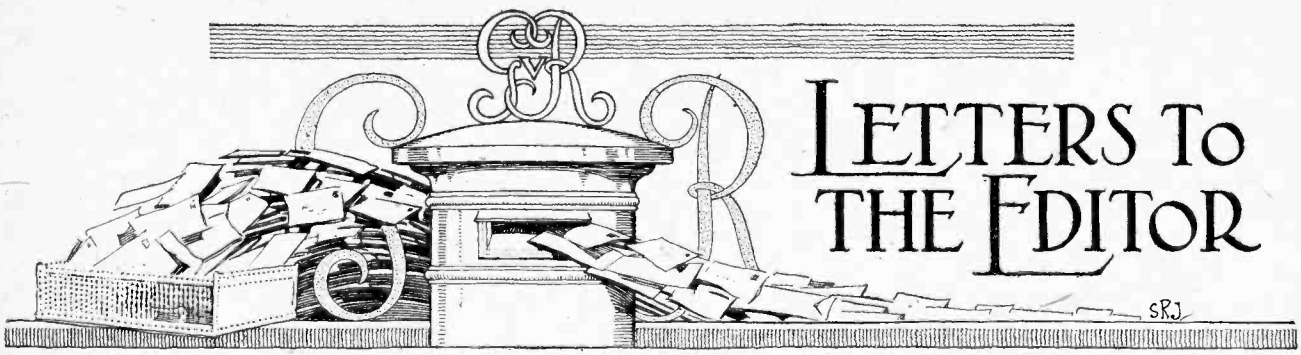
The equipment of the split wave transmitter in which two sets operating on different wavelengths make use of a common aerial. Regular communication with Paris and Burne is maintained.



One of the many steel lattice towers which support the earth screen. The ends of the wires are linked across while other bridging wires are arranged at intervals.

was given in our issue of last week. In the present number we are able to reproduce the accompanying photographs showing members of the party inspecting the station. The visit, in addition to being of the utmost interest from a technical point of view, was a happy social event, as it provided a means of bringing members together in conversation in a way which is not possible at the ordinary meetings of the Society. The admirable weather contributed largely to the general success of the excursion.

Members of the party inspecting the aerial layout.



The Editor does not hold himself responsible for the opinions of his correspondents.

Correspondence should be addressed to the Editor, "The Wireless World," 139-140, Fleet Street, E.C.4, and must be accompanied by the writer's name and address.

POOR RECEPTION IN DEVON AND CORNWALL.

Sir,—With reference to the paragraph headed "Power of Main Stations" appearing in "Broadcast Brevities" in the *Wireless World* of July 15th, I would like to point out that in my opinion Devonshire and Cornwall are the most neglected part of the country from the point of view of broadcasting. Crystal reception from 5XX is very faint, and at times fading is very pronounced.

Our nearest station is Cardiff, but, owing to the hilly country, reception can never be relied on. Bournemouth is the best received, on 3 valves, but, owing to the distance from the transmitting station, Morse takes away the pleasure of listening, and as for the Plymouth relay one might as well attempt to pick up WGY.

I write this letter bearing in mind Capt. Eckersley's recent article in the *Radio Times* under the heading "The Lure of Distant Listening," in which he writes "Which would you really listen to, the nearby or the far away? You may say that if the far-away programme is better than the near you would rather hear it. But, and this is the point I endeavoured to make, you would, however wonderful the programme, be continually embarrassed by interruptions."

Here in Devon and Cornwall we have no nearby stations, so our only line is to listen to the more distant, and no matter how wonderful the programme we are embarrassed by interruptions; the majority of inhabitants living in these villages cannot afford multi-valve sets; the continuous recharging of accumulators is bad enough when using only 1 or 2 valves when the charging station in some cases is eight and even more miles away, with no means of transportation.

Nr. Chudleigh, W. H. SYMES.
S. Devon.

WET CELL H.T. BATTERIES.

Sir,—The article "Solving the H.T. Problem," in the *Wireless World* of July 15th, has made me wonder why more use is not made of small wet Leclanché cells. I have had an 80-volt battery of this type (Siemens) in continuous use for 3½ years, and the voltage is still 80. Currents up to 30 ma. have been drawn from it in testing and experimenting. The only attention has been to keep the water level correct.

This type of cell is nearly as good as accumulator H.T. The cost, I believe, was £3. E. A. ANSON
(20A).

INDEPENDENCE OF THE HOME CONSTRUCTOR.

Sir,—I notice in your issue of July 8th a comment on the damage done to sets by incompetent traders. I question whether listeners in general have any use for skilled repairers in view of the following experiences.

I left the Army before broadcasting had started, well equipped with knowledge of practical repairs and fault tracing; I got together gear and testing instruments and advertised that I would give skilled assistance to wireless amateurs. The replies were very few, even during boom times, and also last year, when I tried again after reading articles by "Wireless Doctors."

Those I did assist were able to get stations they had long failed to bring in; but my real point is that amateurs with insufficient knowledge to put a set right will ask for months "What do you think is the fault?" before bringing in skilled assistance. The fault is generally simple, and frequently due to wrong connections. In one case a man had a set over a year, giving very poor results, before he would have it seen to by someone qualified.

I have had numerous people asking what they should do when they had no ability to carry out the simplest tests, but avoided advertisements because they would perhaps be charged for advice. W.W.

London, N.W.6.

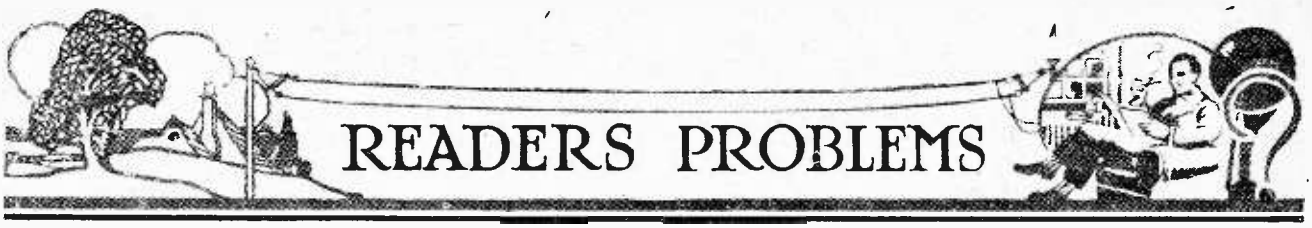
THE B.B.C. AND DISTANT RECEPTION.

Sir,—In your editorial of the issue of July 15th you make further reference to the policy of the B.B.C. of discouraging reception of any stations except the local one. I feel sure that the majority of your readers are entirely in agreement with the views which you have expressed from time to time when you have laid stress upon the interest which the listener derives from reception of foreign stations. It would be interesting if those readers who are in agreement with the policy of the B.B.C. would put forward some sound arguments in support.

Incidentally, the policy advocated so frequently in his technical talks by Capt. Eckersley seems to be rather contradicted by the recent publication by the B.B.C. of a supplementary *Radio Times* containing the programmes of foreign stations.

L.W.H.

AMPLIFIER AT TENNIS CHAMPIONSHIP. At the recent Midland Counties Tennis Championship at Edgbaston, the work of marshalling competitors and announcing results was effectively carried out by means of the Burndept speech amplifying system.

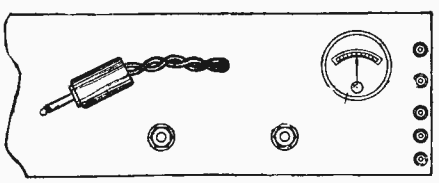


Readers Desiring to Consult "The Wireless World" Information Dept. should make use of the Coupon to be found in the Advertisement Pages.

Methods of Using a Milliammeter.

A READER who possesses a receiver employing three stages of transformer coupled low-frequency amplification desires to arrange for a milliammeter to be connected into the anode circuit of each L.F., or, alternatively, to embody switching arrangements in his receiver which will permit him to connect the milliammeter into the anode circuit of any of the L.F. valves as desired, and he seeks our advice on this matter.

To use a number of milliammeters for this purpose is a very uneconomical procedure, whilst the switching arrangement which our reader desires would be rather complicated, and further, the wiring necessary would in all probability bring sufficient self-capacity into the circuit to be troublesome. A far better method would be for our reader to adopt the system which we give in Fig. 1. A glance at the theoretical diagram will indicate that it is necessary for a four-point jack to be included in the anode circuit of each valve, the two centre points of these jacks being respectively short-circuited. It is now only necessary to attach a plug to the milliammeter, and it will then be possible to rapidly insert this instrument into the anode circuit of any valve as desired, whilst no complication of wiring is introduced. The section of panel illustrated above the theoretical diagram is quite self-explanatory, and merely shows a neat and convenient method of mounting the milliammeter on the panel.



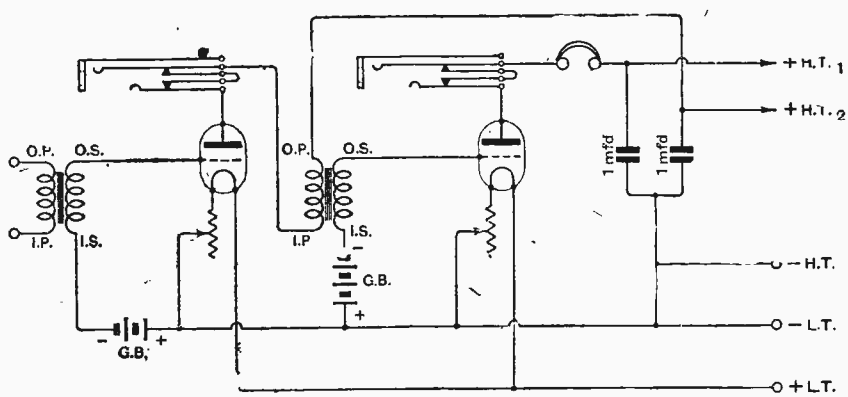


Fig. 1.—A method of connecting jacks to a receiver to form connecting points for a milliammeter to read the anode current.

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Elimination of Atmospherics.

A CORRESPONDENT has written asking for a selective circuit in which all other requirements such as selectivity and ease of tuning are subservient to the aforementioned requirement; his object being, so he informs us, to "tune out" atmospherics which are specially troublesome at this time of the year.

Although many devices have been suggested and tested from time to time in order to eliminate this bugbear of summer-time wireless reception, nothing of commercial utility has yet appeared. It is, of course, quite impossible to eliminate atmospheric noises by the ordinary selective methods of tuning, since they themselves are untuned and come in with more or less equal intensity over the whole gamut of broadcasting wavelengths. The case is parallel to the elimination of the flatly tuned Morse signals emitted by spark transmitters of antiquated design, which was fully discussed in this section of the journal for July 8th last, which readers are advised to read for a fuller explanation of this problem. The only phase in which these two problems are not similar is, of course, that in the case of atmospherics it is *not* possible to exercise any control at the "transmitter."

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Using Output Transformer and Choke Filter Simultaneously

A READER wishes to know if it is possible to operate two loud-speakers simultaneously from his receiving set, one making use of an output transformer and the other being fed by means of the choke filter method.

This can, of course, be accomplished quite simply by making the primary of the output transformer act also as a choke. A suitable circuit is illustrated in

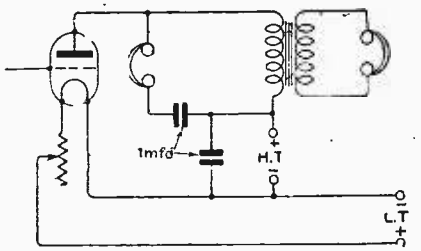

Fig. 2.—The output transformer is employed as a choke and as a coupling transformer, as described.

Fig. 2, showing how this arrangement is adapted to the final valve of any receiver. It is, of course, equally suitable for use with telephones. With regard to the telephones or loud-speaker attached to the output terminals of the transformer, they may be of either high or low resistance according to the type of transformer used, since it is possible to obtain output transformers having either a step down or a 1 to 1 ratio.

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Good Quality Headphone Reception at Moderate Distances.

A READER who resides at such a distance from his local station that crystal reception is impracticable desires to build a valve receiver which is economical in current consumption and at the same time is productive of headphone reception of the highest possible quality from the local station.

Since it is a necessity that special attention be paid to good quality, there are three important points which should be taken into consideration. The first is the avoidance of reaction, the second being the avoidance of the grid condenser and leak method of rectification with its attendant distortion, whilst the third point which

requires consideration is the provision of a stage of high frequency before the detector valve in order to compensate for the comparative inefficiency of anode rectification on weak signals. It is necessary also that we employ a special valve as detector valve which has such characteristics that it gives good anode rectification when the grid return lead is connected to the negative side of the filament. A suitable valve is the D.E.Q., which also fulfils the condition of current economy, since it consumes .2 amp. at 3 volts. In order to maintain the benefit of the economical filament consumption of this valve, we can use a D.E.V. type valve as our H.F. amplifier, since this valve also consumes .2 amp. at 3 volts, and so we can very easily run these two valves with their filaments connected in series across a small 6-volt accumulator, thus keeping the current consumption at .2 amp. and deriving the additional advantage that it is impossible to destroy the dull-emitting properties of the valves by excess of filament current. No filament rheostat is used, of course, and as will be seen from the circuit in Fig. 3, operation will be absolutely simple, thus rendering the set eminently suitable for placing in the hands of non-technical members of the family. The tone will, of course, be fully equal to a crystal set, with the advantage that signals on several

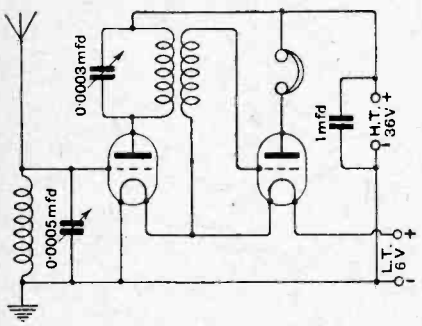

Fig. 3.—A high quality receiver for telephone reception.

pairs of telephones will be very much louder. A simple switch may be used between accumulator and receiver, or may be fitted to the panel itself. The receiver is not, of course, a long distance set, but signal strength at fifty miles or so will be excellent. In order to operate a loud-speaker the addition of a resistance-coupled amplifier is suggested. In order to receive the transmissions from 5XX it is only necessary to plug in the appropriate aerial coil and H.F. transformer. The receiver is undoubtedly economical, since the conventional type of 6-volt 30-ampere-hour accumulator would operate this receiver three or four hours nightly for about six weeks on one charge.

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Indications of a Faulty Valve.

A CORRESPONDENT has submitted a diagram of the circuit embodied in his two-valve receiver, which is given in Fig. 4, and asks us to assist him in tracing a fault.

He has ascertained himself that the fault lies in one of his valves, since the set functions perfectly when another valve is substituted. Since the valve is of the type where the filament and grid are almost completely enveloped by the anode, it is difficult for him to examine the valve. Our correspondent is puzzled by the fact that when put into the detector valve holder the valve lights normally but does not function, whereas if put into the H.F. valve holder it still refuses to function, but lights up very brilliantly. If, however, the set is tuned to receive a long wavelength station, the brilliancy of the filament is very little more than normal.

This is quite a simple fault which may occur in any receiver, and is due to the filament having sagged and come into permanent contact with the grid. This will, of course, render the valve inoperative, but will not prevent the filament from lighting. An examination of Fig. 4 reveals the reason of the brilliant illumination of the filament when the valve is placed in the first holder, and indicates, also, the reason for the variation of this brilliancy in accordance with the

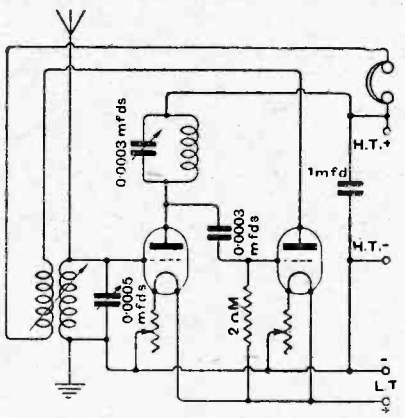

Fig. 4.—Normal connections of a two-valve set.

wavelength to which the receiver is adjusted. It will be seen that since the filament is in contact with the grid, the current from the filament battery will traverse a portion of the filament until the point of contact with the grid is reached, when a return path to the accumulator will be provided by the low D.C. resistance offered by the aerial tuning coil and grid return lead. Thus, a portion of the filament is virtually short-circuited by the low resistance aerial tuning coil, and owing to the fall in the total resistance of the circuit, the current will be considerably increased, resulting in a great increase in brilliance in the portion of the filament that still remains operative. Upon changing over to a long wavelength a larger number of turns are brought into the aerial tuning circuit, resulting in an increase in its D.C. resistance, which is reflected in a diminution of the brilliancy of the filament.

If the valve is inserted into the second valve holder it will light normally, the only alternative path for the current to take back to the accumulator being the grid leak, whose resistance is, of course, very high. For similar reasons the brilliance of the valve will not be increased if it is inserted into the valve holder of a conventional one-valve set employing the grid leak method of rectification, or into an L.F. amplifier, since in either case the resistance shunting a portion of the filament will be very high.

A valve which lights but fails to function may quickly be tested for the fault by connecting a battery and a pair of telephones or a galvanometer into circuit with the grid leg and either of the filament legs of the valve. If the valve is in order, there should, of course, be no D.C. circuit indicated by the telephones or galvanometer. There may, of course, be another reason for the valve refusing to function, such as a loss of vacuum. In many cases the filament may be detached from the grid by gently tapping the valve when it is lighted, but there exists, of course, a strong probability of rupturing the filament. Since the valve will be useless in either case, the remedy should, of course, be tried.

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Addresses Wanted.

A READER who has omitted to forward us his address has submitted the four-valve circuit appearing in this section of the issue of the journal for July 23rd, 1924, with a request to know the correct numbers of commercial coils to use for the reception of 5XX.

The anode coil should be No. 250, the reaction coil No. 100, and, assuming that the aerial condenser is to be left in series, the aerial coil should be No. 200; but if the condenser is connected in parallel, this coil should be No. 150.

Another reader has submitted a diagram of a panel lay-out for a three-valve set, containing among other components two Dewar switches, but has omitted to enclose his name and address.