The Wireless World AND RADIO REVIEW

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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.

METRES OR KILOCYCLES.

THE recommendation has been put forward by the B.B.C. that frequency in kilocycles instead of wavelength in metres shall be adopted as the numerical indication of station tuning. Thus it is hoped that we shall no longer refer to the wavelength of the Daventry station as being 1,600 metres, but instead that the frequency is 187 kilocycles. The product of wavelength and frequency is the velocity of the ether wave and is a constant (300,000,000 metres a second), so that frequency is obtained by dividing 300,000,000 by the wavelength. Until the proposal meets with more general support wavelength is to be given by the B.B.C. as well as frequency, though, so far as the listener is concerned, both wavelength and frequency are not required in determining dial settings in the process of tuning, and it is probably hoped that sooner or later wavelength will cease to survive.

Why is this change to kilocycles required, and what are the advantages to be gained? It must be borne in mind the station wavelengths are allotted not according to wavelength differences in metres, but on a basis of differences in frequencies. To prevent interference by heterodyning, the separation of 10 kilocycles between broadcasting stations has been agreed upon. Thus from a list of station frequencies rather than wavelengths it can be seen at a glance where spaces exist for the working of new stations. A tuned circuit of good design covers a wavelength range from just below 200 metres to nearly 550 metres, representing a frequency band of 900 k.c., and giving a separation of 2 degrees between stations on the tuning dial.

So far as the listener is concerned, the adoption of kilocycles would prove less tax on the memory than a scale of wavelengths in metres. For instance, the wavelengths of several of the British stations are represented as 491.8, 384.6, 361.4, 353, 326.1, 297, 294, 277.8, 275.2, 272.7, 252.1. Expressed in kilocycles these become 610, 780, 830, 850, 920, 1,010, 1,020, 1,080, 1,090, 1,100, 1,190, numbers which are easily visualised. The process of allocation avoids the use of decimals, and the 10 kilocycles separation assures a nought as the last digit.

It is by reference to station frequency that superheterodyne receivers are operated, while a better understanding of the principles of modulation would result by a more general acquaintance with radio frequencies in their relationship with audio frequencies.

On the other hand, assuming a development in short-wave broadcasting, the numerical representing frequency is less convenient than the expression of wavelength in metres. Three wavelengths in use to-day for short-wave broadcasting are 22.02, 30.2 and 32.79 metres, which, expressed in kilocycles, become 13,620, 9,920 and 9,150. In regard to short-wave transmission also there is the direct relationship between the length of an aerial and its fundamental wavelength, and the actual wavelength in metres, therefore, conveys a number which is of real value in the setting up of a station. For short-wave transmission and reception "wavelengths," therefore, will probably continue to be used in preference to "frequencies," and the adoption of the frequency scale for the broadcasting band will result in the use of two forms of tuning unit.

Standing in the way of the adoption of a scale of kilocycles is the natural prejudice which exists towards abandoning a system with which we are familiar for one embodying a range of figures which for a while will convey little as to relative magnitude. To think in terms of a new unit will present difficulty, and in so far as the experimenter is concerned frequent reference will need to be made to a kilocycle-metre conversion table.

Receiving sets and wavemeters which are calibrated in terms of wavelength will require new scales of frequency, though it must not be thought that the utility of tuning condensers following definite straight line laws will become obsolete. Correspondence is invited on this subject, and an expression of views may serve to guide those with whom the responsibility rests for recommending the change.

Two-Range Selective Buzzer Wavemeter

An Indispensable Instrument for the Experimenter's Laboratory.

By W. JAMES.

A BUZZER wavemeter is one of those instruments which the "advanced" experimenter affects to despise, although it is really his best friend. Many experimenters would have nothing less than a heterodyne wavemeter, but while they are collecting the batteries to set it up the humble buzzer wavemeter has usually done the work.

There appears to be a widespread idea that the buzzer wavemeter is not an instrument of precision. It is popularly supposed to tune broadly and to be rather a troublesome instrument. One has to admit that a buzzer can be a most annoying thing, but only a cheap, nasty buzzer. A good one will buzz every time it is switched on, and the pitch of the note emitted will not vary very much unless it is badly adjusted.

Reliability Essential.

Reliable buzzers are not very expensive and work from a single dry cell. A cell of medium size, such as a Siemens type "T," will last for a long while, and when the buzzer has been carefully set it will not need re-adjusting for some considerable time. Thus we can dispose of the buzzer question. We buy a good one and soon forget the old things we used to be obliged to use.

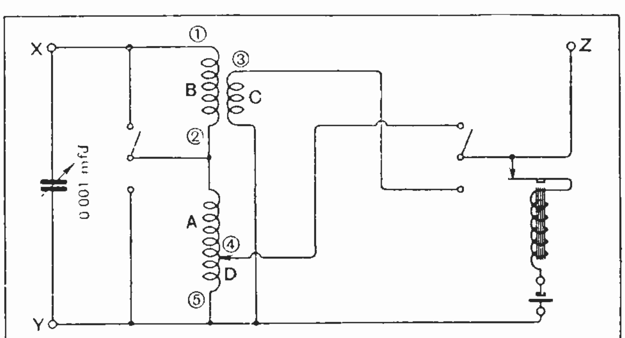


Fig. 1.—Theoretical diagram. The numbers and letters correspond with the wiring diagram in Fig. 4.

It is probably true that the main defect of the old type of buzzer wavemeter was its failure to give a clear, sharp signal—rather did it give a signal over many degrees of the tuning dial. But here we have to consider the difference between the receivers of to-day and those used years ago, when the buzzer wavemeter was introduced.

Modern Requirements.

In the early days of wireless, when crystal receivers were exclusively used, the buzzer wavemeter was called upon to give a fairly powerful buzz, so as to enable the operator to set his crystal detector and to tune his receiver to the appropriate wavelength. To-day there is no need for a buzzer wavemeter with a broadcast crystal set. Rather do we require a wavemeter with the most sensitive of sets—sets designed to have good selectivity and to receive the distant stations. We therefore need a wavemeter which radiates a faint signal, for the set will amplify this to loud-speaker strength. Our wavemeter must also tune sharply so that we can determine with a fair degree of accuracy the wavelength to which the receiver is tuned, or, conversely, so that we can set our receiver to a given wavelength with accuracy.

We therefore see that a buzzer wavemeter for use with a modern high-class receiver must be quite a different thing from that which was suitable for use year's ago, and here we have a clue as to why the buzzer wavemeter is

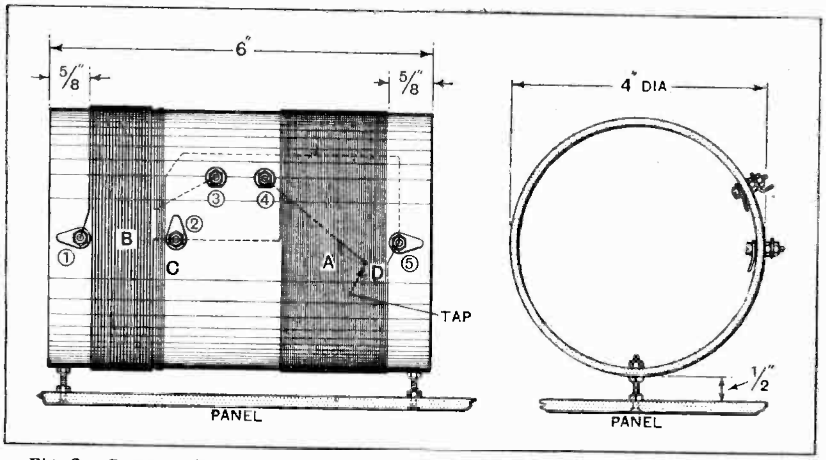


Fig. 2.—Construction of tuning coil. A has 125 turns of No. 32 D.S.C. tapped at the 25th turn. B has 29 turns of 27/42 Litzendraht, and C, 6 turns of No. 32 of D.S.C.

not always looked upon with favour. Its very simplicity has been its downfall.

People take a coil and tuning condenser, shunt the circuit with a cell and buzzer, and say they have a buzzer wavemeter. They have, of course, but it is an old-fashioned one, which tunes very broadly and gives too loud a buzz for modern receivers.

The first requirement of a modern wavemeter is sharp tuning. We therefore have to provide a resonant circuit with quite low losses. To do this it is necessary to provide a really good tuning coil and tuning condenser, and, having done this, the buzzer must be so coupled to the tuned circuit that the effective resistance of the latter is not unduly increased. If we connect the buzzer direct to the ends of the tuned circuit the tuning is bound to be very broad, because of the damping effect of the buzzer circuit, and, incidentally, the oscillations produced will be far too powerful for a modern receiver.

Exciting the Tuned Circuit.

We have therefore to find a method of causing the tuned circuit to oscillate, but without such great damping, and it was found after a few experiments that a simple transformer arrangement was ideal. Alternative methods were tried, of course, but were not found really satisfactory. It was thought at first that a single wire from the buzzer to the tuned circuit (a type of one point connection) would suffice, but the oscillations produced were hardly strong enough.

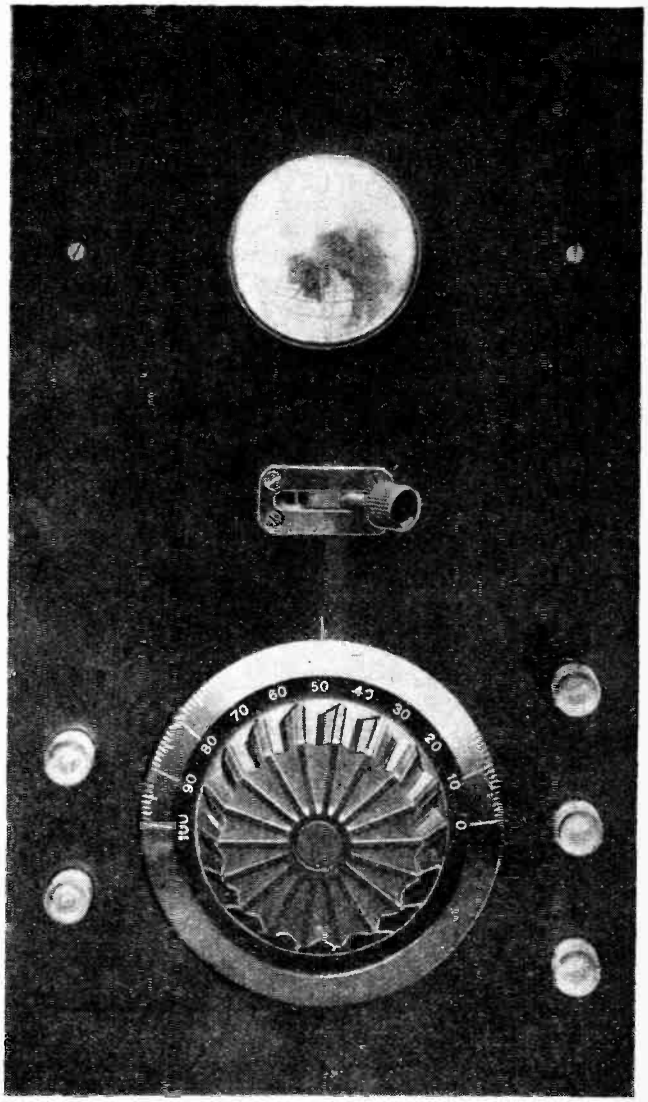
With the circuit arrangements of Fig. 1 we have a tuning condenser of 0.001 mfd. and two coils A and B. Coil A is for the longer broadcast waves, and coil B for the shorter waves. Both are wound on a tube 4in. in diameter, and are designed to have quite low losses.

One half of the switch shown is used to short-circuit one coil, while the other coil is connected to the tuning condenser. This simple switching arrangement is perfectly satisfactory. To excite the long-wave coil A the buzzer and battery are connected across a portion of the tuning coil A, a tap being made at point D. The number of turns between the end of coil A marked (5) and the tap D therefore determines the coupling, and the damping of the tuned circuit due to the buzzer.

The tapping position can be altered to suit the requirements of the reader, but the writer has found that the values given below are satisfactory when the receiver has two or more valves.

For the short waves a separate primary winding C is used. This is wound at one end of coil B, and its number of turns were adjusted so as to provide really sharp tuning, with oscillations of reasonable strength.

It will be noticed that when the knob of the switch is upright the buzzer is disconnected from the battery. When the switch knob is pushed to the right, the long-wave coil A is connected to the tuning condenser, coil B is short-circuited, and the buzzer is connected to the tap on the coil. When the



Plan view of panel

Two-range Selective Buzzer Wavemeter.—

switch knob is moved over to the left-hand side, the long wave coil is short-circuited and the short-wave coil is connected to the tuning condenser, while the buzzer is joined to the short wave exciting coil marked C.

A 0.001 mfd. tuning condenser is used, partly in order to obtain a reasonable wavelength range, and partly to keep the circuit resistance down. This condenser should be a reliable one, and have a capacity curve such that the tuning curve of the wavemeter is a reasonably good one.

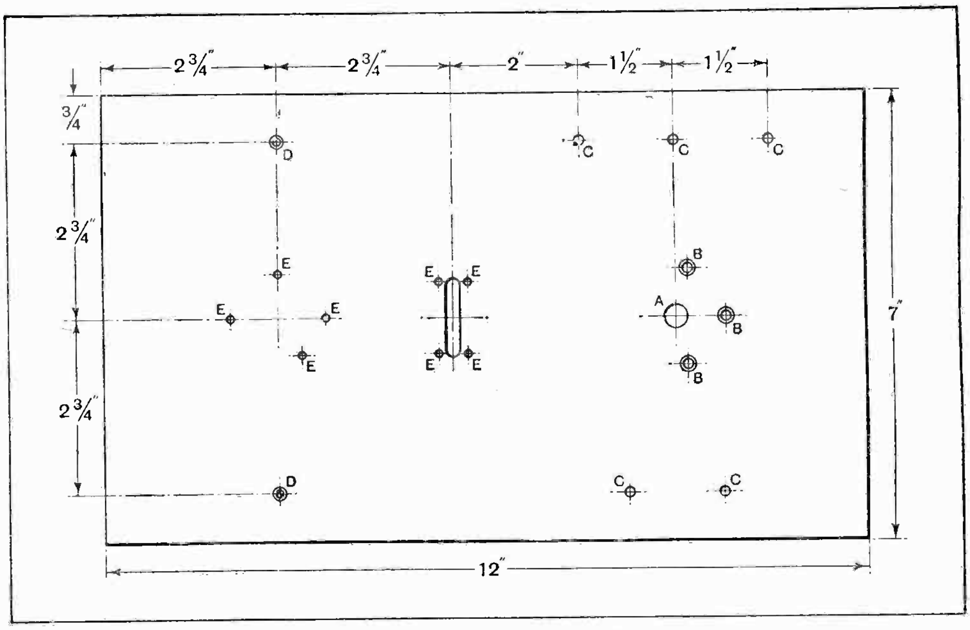


Fig. 3.—Arrangement of parts on the panel.

The construction of the coil will be understood by referring to Fig. 2. A piece of ebonite 4in. external diameter by 6in. long, has at one end a winding of 29 turns of 27/42 Litzendraht wire. This is coil B, and the winding is commenced ⅝in. from the end of the former. Its ends are connected to points 1 and 2, and the turns are wound touching, making the winding length 1.1in. long. If Litzendraht is not available, a fairly good coil can be made of the same number of turns of No. 20 D.S.C. wire. Coil C should be wound at the end of coil B, and comprises 6 turns of No. 32 D.S.C. copper wire wound in the same direction. Its beginning end is connected to soldering tag (3), while its finishing end goes to soldering tag (5), the connections being made inside the tube. Coil A may now be wound, and comprises 125 turns of No. 32 D.S.C. copper wire with a tap at the 25th turn, as shown in Fig. 2. The length of coil A is 1.75in., and it will be noticed that one end is connected to tag (2), while its other end is connected to tag (5). The tap is taken to tag (4). These tags are held by small 4 B.A. screws and nuts.

The remainder of the construction is quite easy. A Radion panel 12in. × 7in. is used. At one end, and in the position shown in Fig. 3, a Cyldon Log Mid-line 0.001 mfd. tuning condenser is fastened. In the centre of the panel a Burndept double-pole change-over switch is fitted, and further along a Burndept shunted high note buzzer. There are also 5 terminals. The coil is held in position by two 4 B.A. screws about an inch long.

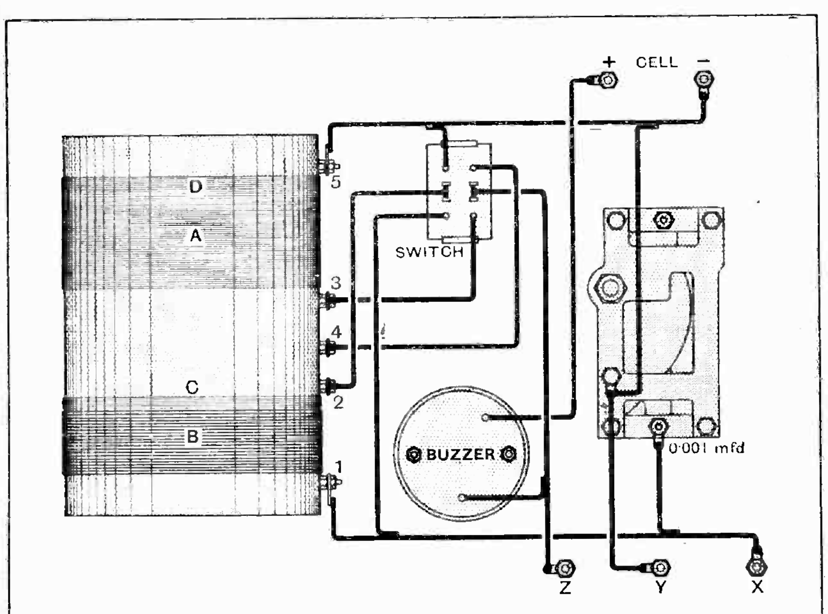


Fig. 4.—Wiring diagram corresponding to the circuit in Fig. 1.

The wiring diagram, Fig. 4, shows the connections, the particular position of the wires being quite clearly shown in the photographs. Covered connecting wire of a stout gauge is used, and the wires are so placed that they are not likely to shift.

In Fig. 5 are curves showing the wavelength range of the writer's instrument. It will be seen to be sufficient for all broadcast requirements.

The wavelength curve shows that the condenser setting is the same for wavelengths of 400 and 1,600 metres. This was obtained by adjusting the number of turns in the long wave coil A. At other points the curves differ, due to the fact that one of the coils is tapped, while the other one has a primary winding which has the effect of making the working capacity of the circuits rather

Two-range Selective Buzzer Wavemeter.—different. They could be made more nearly to coincide by adding a little capacity to the short-wave circuit, but this is hardly worth while, and was not attempted.

Finally, three terminals, X, Y and Z, are provided so that the wavemeter can be used as a tuner or wave trap if desired. Thus, between terminals X Y, we have a tuned circuit depending upon the position of the switch (the cell being removed, of course), while if a connection is made between terminals Z and Y and terminals X and Y, we have a transformer or an auto-transformer, depending on the position of the switch, ZY being the primary and XY the secondary. This may be used as an extra tuned circuit to a receiver, or perhaps simply as a wave trap.

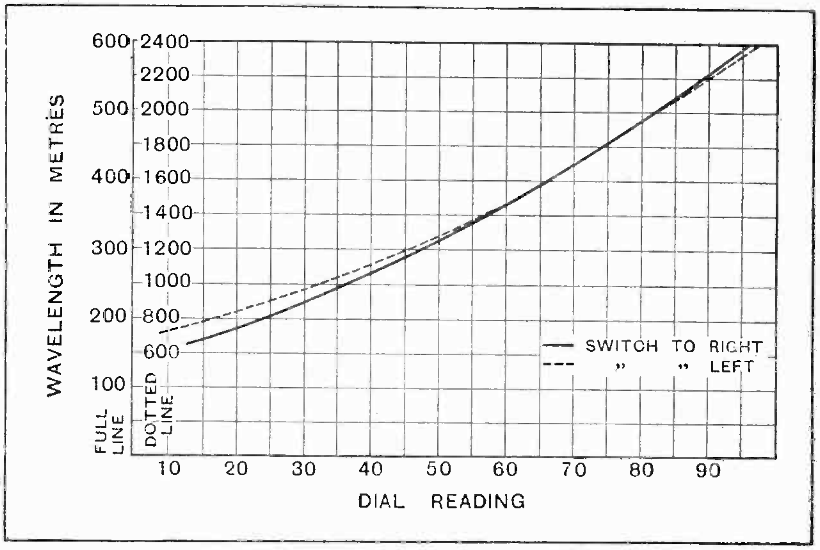
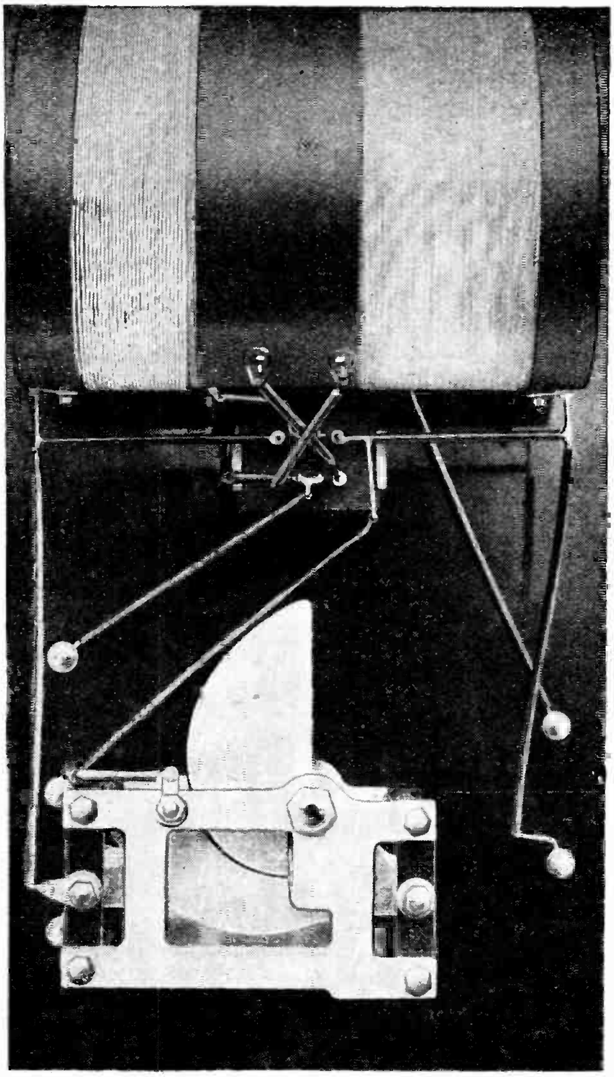


Fig. 5.—Calibration curves of original instrument showing wavelength range.



Underside of panel.

Anyone wishing to do so could, of course, fit a plug-in crystal detector when the wavemeter could be used as a crystal receiver.

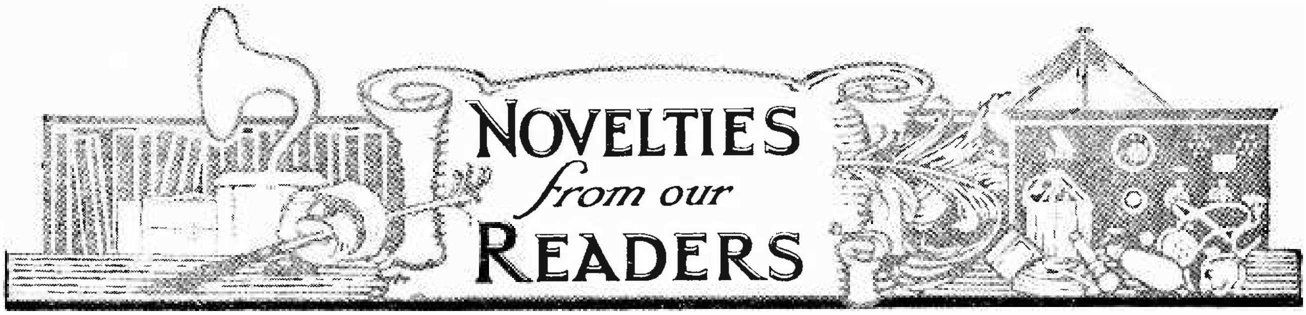
Calibration.

It is not very hard to calibrate a wavemeter such as this. The writer has tried calibrating his from an "Everyman Four." Distant stations of known wavelength were tuned in, and the buzzer wavemeter reading for the same wavelength was noted. If a number of stations are received and recorded in this way, quite a good curve for the wavemeter can be drawn. This curve can conveniently be fastened to the side of the box of the instrument, or those who do not care to bother with a wavelength chart can purchase a special condenser dial and mark wavelengths, kilocycles, or stations on it.

The wavemeter illustrated has been used by the writer for a considerable time, and has proved itself to be a reliable instrument. It is quite invaluable when trying new circuits, or when a definite station of known wavelength is desired.

ADDING H.F. AMPLIFICATION.

THE addition of an H.F. amplifier to a detector-L.F. combination not particularly designed with this object in view is, as a rule, by no means a simple matter, and the difficulties in the way of a satisfactory realisation of the scheme are greatly increased when the receiver already included a high-frequency valve. If this is properly balanced, these difficulties are not insuperable, but there is one type of set to which it is safe to say that the addition in question cannot be made: namely, that having an unneutralised H.F. coupling, the first valve of which is normally stabilised by the aerial load. When this load is removed by the interposition of another stage—however good this may be—uncontrollable oscillation will almost invariably be produced.

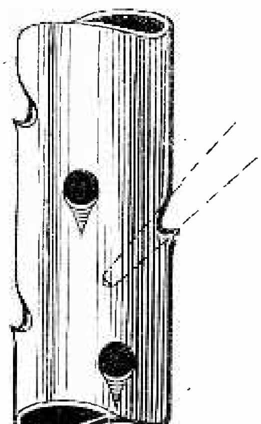


NOVELTIES *from our* READERS

A Section Devoted to New Ideas and Practical Devices.

EARTH TUBE.

Drilled copper tubing is frequently used for making the earth connection from a receiver, a solid point being fitted to the lower end in order that the tube may be easily driven into the ground. There is no object, however, in drilling lateral holes in the tube if these become choked up with earth or clay, and to prevent this it is a good plan to drive a centre punch into each



Preventing choking of holes in earth tube.

hole at an angle of 45° as shown in the diagram. This forms a lip at the lower edge of each hole, which forces the earth to one side as the tube descends, thus leaving the holes open and permitting water poured in at the top of the tube to diffuse freely into the surrounding earth.

R. N. B.

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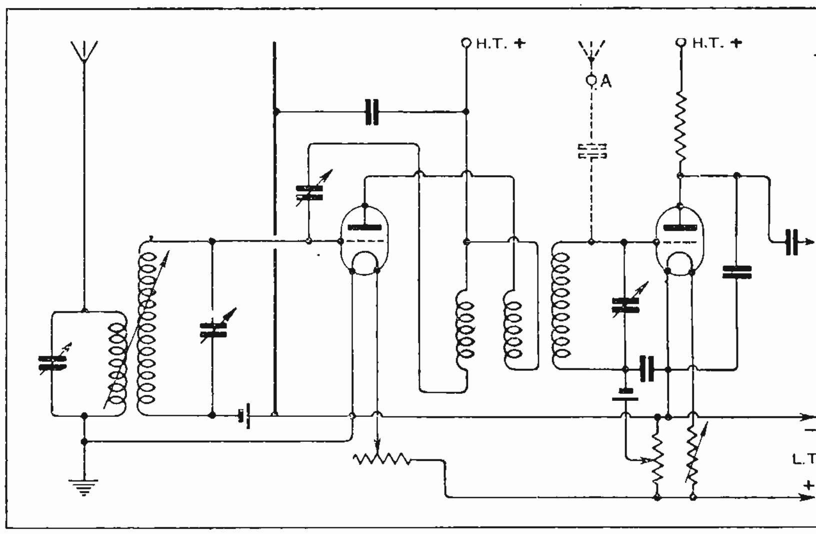
AN "ALL-WAVE FOUR" HINT.

A simple method of cutting out the H.F. valve when only detector and L.F. stages are required is to fit a terminal on the front panel between the neutralising condenser and the variable condenser tuning the H.F. transformer. This terminal is connected to the grid end of the H.F. transformer secondary winding or, alternatively, to the corresponding side of the variable condenser. With some



Modified "All Wave Four" circuit with alternative aerial terminal (A) for receiving on detector and L.F. valves.

aerials it may be necessary to insert a small fixed condenser of, say, 0.0002 mfd. capacity between the terminal and the grid connection. To operate turn out the filament of the H.F. valve and connect the aerial to the new terminal. The secondary of the H.F. transformer now becomes the aerial tuning coil, and it will be found that sufficient signal strength to operate the detector will be obtained from the local station and in certain circumstances from Daventry.

B. W. B.

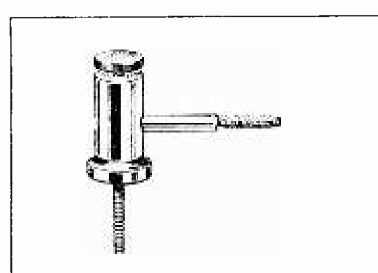
VALVES FOR IDEAS.

Readers are invited to submit brief details, with rough sketches where necessary, of devices of experimental interest for inclusion in this section. A dull-emitter 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," Dorset House, Tudor St., London, E.C.4, and marked "Ideas."

TAP WRENCH.

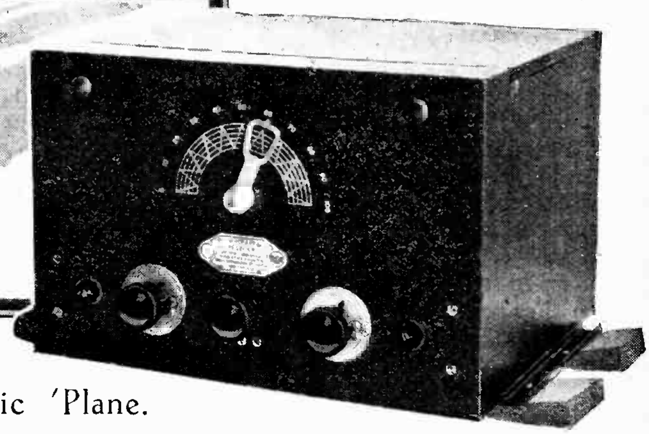
The ordinary tap wrench is a comparatively clumsy tool with which to hold small taps such as 8B.A.



Telephone terminal used as tap wrench.

A large size telephone terminal is an excellent substitute, and is quite suitable for sizes up to 6B.A., giving ample grip for the fingers.

J. K.



A Description of the Apparatus on the Ill-fated "American Legion" Transatlantic 'Plane.

By Our New York Correspondent.

IN the spring of this year several daring airmen assembled near New York and made preparations to fly across the Atlantic to Paris. One of these machines, the "American Legion," came to grief during a test flight, with the tragic result that both her pilots, Commander Davis and Lieut. Wooster, were pinned under the machine and drowned in a few inches of water.

The machine had been equipped with a specially built wireless installation, ready for the flight, and this was not seriously damaged in the crash. As it is likely that this same installation may be put aboard another pioneering 'plane in the near future it is thought that a detailed description of it may be of interest.

The transmitter is designed to operate on 45 metres and 600 metres. Fig. 1 gives a general view of it, while Fig. 2 shows the internal arrangements. The receiver, shown in the title of this article, has a double wave range: 45 metres, and 550 to 850 metres.

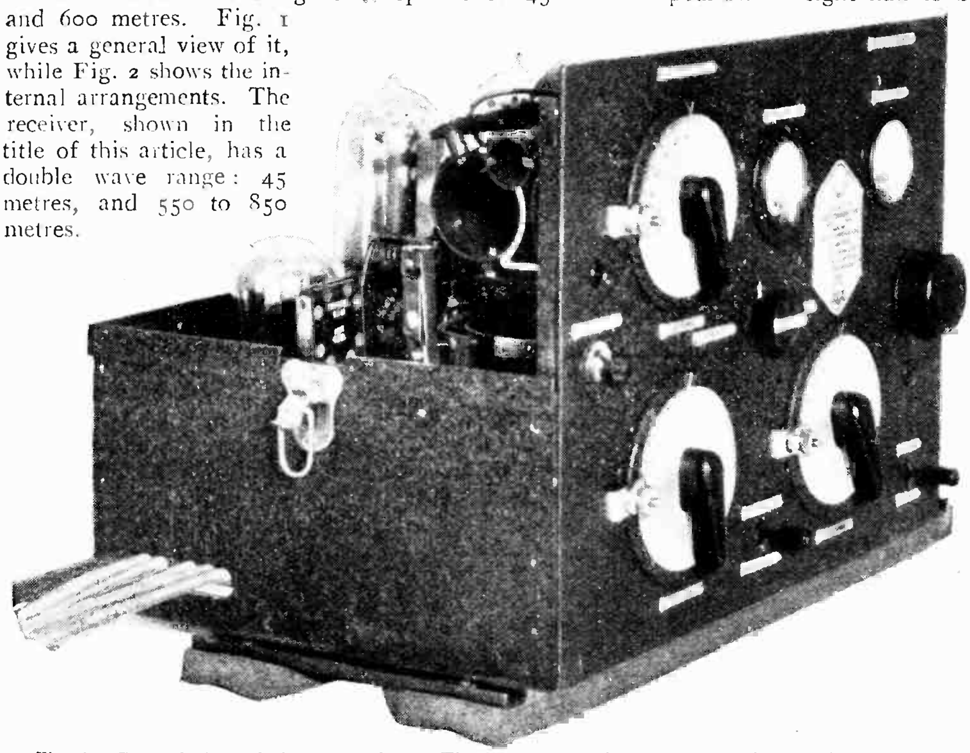


Fig. 1.—General view of the transmitter. The quartz crystal mounting can be seen just above the clasp on the side of the case. To the left is the master oscillator valve and to the right the 50-watt amplifying valve.

This equipment was designed and built by the Westinghouse Electric Company and the Radio Corporation of America in the record time of 21 days. In the "American Legion" it was mounted on two special shelves placed about two feet to the left of the main petrol tank. The receiver was secured to the top shelf, and the transmitter on the bottom shelf, both being mounted on sponge rubber, to eliminate vibration as far as possible.

The accumulator for lighting the valves was mounted on the floor of the fuselage, and a dynamotor was also attached to the fuselage. The weight of the transmitter and receiver, less batteries and accessories, is only 65 pounds. Weight had to be reduced in every possible direction so as not to hamper the cruising range or lifting power of the giant 'plane.

Details of the Transmitting Equipment.

The transmitter is composed of two units. One is a short-wave unit operating on a wavelength of 45 metres, and the other has a wavelength range of from 550 to 850 metres.

The short-wave part of the apparatus consists of a quartz-crystal-controlled $7\frac{1}{2}$-watt master-oscillator valve of the UX-210 type. The quartz crystal is ground to hold the master oscillator to 90 metres. The output of the oscillator then passes on to a UX-211 50-watt amplifier valve, the output of which is tuned to 45 metres, or twice the frequency of oscillation of the crystal. This output circuit is then coupled to the trailing aerial. The day and night range on

American Aircraft Wireless.—
this wavelength is expected to be well over 1,000 miles. The 600-metre component of the transmitter consists of one 50-watt oscillator valve, the output of which is conductively coupled to the aerial. The transmitter is equipped with a flame-proof send-receive switch to cut off the transmitter and switch the aerial from the transmitter to the receiver. The aerial consists of 350 feet of wire, which unwinds from a reel and passes down through the fairlead. This fairlead consists of an insulated tube with a metal flange, and connection with the set is made from the flange against which the aerial wire bears, thus making contact. Two ½ lb. weights, shaped like sausages, serve to weigh down the free end of the trailing wire.

When sending on the short wave it is necessary to reel out about 60 feet of wire, the exact amount being found by watching a small lamp until optimum radiation is indicated. This lamp is placed on the front panel, and is connected in a circuit tuned to 45 metres and inductively coupled to the transmitter. It is thus a simple form of absorption wavemeter.

The receiver employs three valves, an oscillating detector and two stages of L.F. amplification. The total weight of the receiver is 14 pounds.

The receiver is designed to receive between 550 and 850 metres, and also on the 45-metre band, but it is not expected that reception on this latter band will be possible on an aeroplane in flight, owing to ignition interference. The "American Legion" had three engines.

A number of bamboo poles were to be carried by the "American Legion," so that in the event of a forced landing a mast could be built up in sections to a height of over 45 feet, for the purpose of transmitting emergency signals.

Very elaborate radio arrangements had been made for the flight of the "American Legion." On the American side arrangements were made for the Radio Corporation of America's two powerful coast stations at Chatham, Mass., and Tuckerton, N.J., to broadcast a message to ships, advising the 'plane's departure. Thereafter these two stations, and the Canadian Marconi Co.'s station at Louisburg, N.S., were to keep a constant watch on 45 metres for signals from the machine. Lieut. Wooster was to act in the dual capacity of relief pilot and wireless operator.

Arrangements were also made for a British station to keep a look-out for the "American Legion" and relay any intercepted messages to France, and back over the transatlantic high-power station circuits to America. It had been tentatively arranged that the first few minutes of every alternate hour would be devoted to the transmission of bulletins about the progress of the 'plane, and for this purpose a special three-letter code had been drawn up to facilitate the handling of messages and preclude any possibility of error.

It is a great pity fate intervened to prevent a practical demonstration of the possibilities of this equipment, and, indeed, the possibilities of radio as a whole, over the period of such an extensive flight.

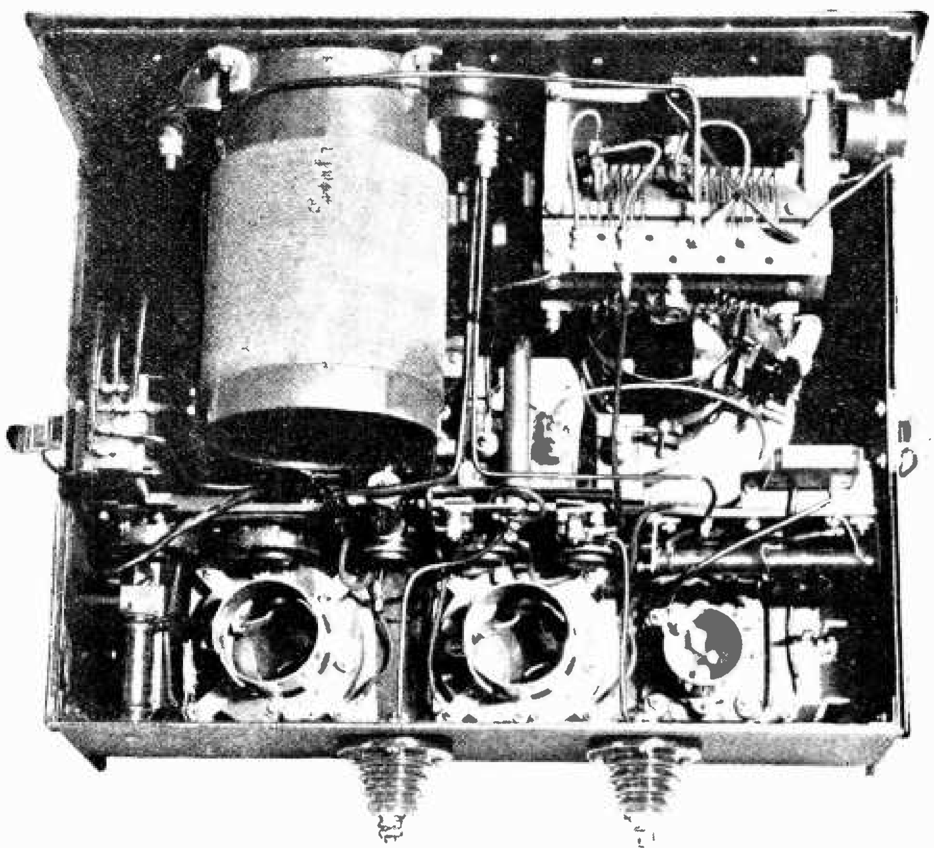


Fig. 2.—Interior of transmitter. The long-wave tuning coils are on the left and the short-wave on the right

The Radio Corporation of America announce that they are commencing to manufacture, commercially, aircraft sets similar to that described above, for use on aeroplanes flying over the long-distance air-mail and other air routes in the United States.

THE "DX-ER'S" PARADISE.

NEW ZEALAND is steadily gaining the reputation of being the long-distance listener's paradise.

In a letter to the General Electric Co., of Schenectady, N.Y., Mr. W. A. Waters, of Palmerston North, New Zealand, writes: "Yesterday (June 3rd) I rebroadcast Holland in the morning, listened to WGY of Schenectady for two hours in the afternoon, and finished with JOAK, Tokio, Japan, on the loud-speaker for an hour!"

CURRENT TOPICS

News of the Week—in Brief Review

BLIND LISTENERS IN IRELAND.

Free receiving licences are now issued to blind persons in the Irish Free State.

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IDEAL HOSPITAL WIRELESS.

Each patient in the new Allison Hospital at Miami Beach, Florida, has a complete wireless set to himself with a separate aerial, so that he may tune in any station he desires.

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EXHIBITION MONTH.

September has become the accepted month for wireless exhibitions. Towards the end of the month some half-dozen European exhibitions will be running concurrently.

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LUCKY MAN.

A *Morning Post* correspondent is rejoicing over the fact that, to all intents and purposes, the Post Office has granted him a perpetual receiving licence. The local post office sent him a notice stating that his licence would expire on the 31st June!

THE ENTHUSIAST.

Seen the other day, in a Paris street: a motor cycle pillion rider, equipped with frame aerial and portable set, listening to a concert on the phones.

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LICENCE NUMBERS IN I.F.S.

That 40,000 wireless licences will have been issued in the Irish Free State by the end of this year is the confident hope of the Department of Posts and Telegraphs. At the present time about 30,000 licences are extant.

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REDUCTION IN VALVE PRICES.

As we go to press we learn of important reductions in the prices of British valves, the principal changes being as follows: —

Old price.	New price.
8s. 0d.	5s. 0d.
30s. 0d.	22s. 6d.
22s. 6d.	20s. 0d.
18s. 6d.	12s. 6d.
14s. 0d.	10s. 6d.

These reductions take place as from to-day (Wednesday).

AMATEUR TRANSMISSION ON 8 METRES. Members of the QRP Transmitters' Society photographed in a rural setting on July 17th, when tests were conducted between two portable stations each working on a wavelength of 8 metres and employing the new Mullard short-wave valves.

HAVE YOU HEARD 3XL?

A new short-wave transmitter, operating on 60 metres, is being experimented with by the Radio Corporation of America at Bourn Brook, N.J. Its call sign is 3 XL.

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WHERE IGNORANCE IS . . . CULPABLE.

Recent complaints of oscillation in Isleworth led to a "capture" by the Post Office direction-finding van. The owner of the offending set was found to be ignorant of the trouble he was causing.

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WIRELESS AIDS FILM PRODUCERS.

Instead of endeavouring to put himself in two places at once, the up-to-date film producer is resorting to the portable wireless transmitter for the conveyance of his instructions over large areas of country.

A special licence has just been issued to the Paramount-Famous-Lasky Corporation to operate a 15-watt mobile radio telephony transmitter at Guadalupe, California, for the purpose of securing cohesion between separate parties of actors in outdoor scenes. The wavelength of the transmitter is 107 metres. Several portable receivers will be in use, and the director will thus be able to communicate with actors far beyond the range of a megaphone.

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WHAT'S IN A NAME?

"Suppose a man comes to you and asks you for an audion or an oscillion, an ultradynatron or a kinotron, a pliotron, a dynatron or a pliodynatron, an ultraaudion or an iontube, a vacuum tube or an electronic tube or a thermionic tube, a tungar, a thereicrion, an amplifier, a radion or an oscillator. Any or all of this bewildering array of practically meaningless words are used to indicate that he merely wants a valve!"—"Some Absurdities of Wireless Nomenclature," by Francis T. Fawcett, M.A., D.Sc., in *The Journal of the Institute of Wireless Technology*.

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EMERGENCY RADIO IN CEYLON.

The construction of a mobile transmitting station for use in emergencies is being considered by the Government of Ceylon. It is felt, says a correspondent, that such a set would be very useful on occasion when any important centre is cut off from telegraphic or telephonic communication. In such cases the transmitter would be rushed to the affected spot and enable communication to be resumed. The most likely causes of trouble in Ceylon are storms and floods, which quickly upset the telegraph system. The only obstacle to success might be caused by the fact that the same storms and floods would hamper the movements of the transmitter.

Tests are now being conducted with a mobile set having an approximate transmitting range of 300 miles.

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CANADIAN EXPEDITION'S WIRELESS LINK.

Six aeroplanes, with pilots and mechanics of the Royal Canadian Air Force, are sailing from Halifax, Nova Scotia, on board two Government ships for Hudson Straits to make a day-to-day survey for eighteen months of the ice and fog conditions in the 500-mile stretch of water which links the North Atlantic with Hudson Bay, writes a New York correspondent.

Three bases will be established at intervals of 250 miles, with fuel, food and equipment for the whole period of 18 months. Wireless, under the Royal Canadian Corps of Signallers, will keep the expedition in daily communication with headquarters in Ottawa.

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MONSOON UPSETS BEAM SERVICE.

Monsoons have interfered with the speedy opening of the Anglo-Indian beam service, some damage having been caused to landlines under the control of the Indian Telegraph Department. Signals have, however, been exchanged between Bombay and England (Grimsby and Skegness), the occasion being Lord Irwin's visit to Bombay on July 23rd to open the broadcasting station. The Viceroy took advantage of the opportunity to send a beam message to King George, a reply being received from His Majesty in 38 seconds. Owing to the uncertainty created by damaged landlines, the Post Office test of the service may be delayed for an indefinite period.

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C.N.R. ADOPTS "CARRIER CURRENT."

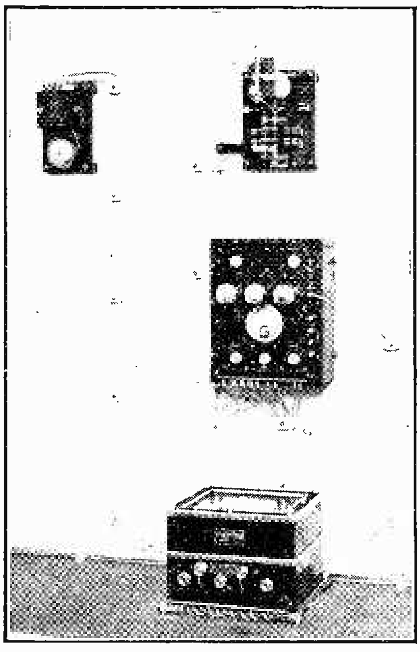
The Canadian National Railways have recently placed in operation in Canada the first unit of what promises to become the world's largest "carrier current" telegraph system.

By the adoption of the carrier current method it is possible to use one set of wires for the simultaneous transmission and reception of numerous signals, the wire being employed merely as a medium for high-frequency oscillations similar to those transmitted from a broadcasting station.

Before the end of the year the Canadian National Railways will employ the system for communication across the entire width of the Dominion. The first link in the chain has already been forged, the carrier system already being in use between Montreal and Toronto.

TRANSMITTING ON 8 METRES.

Exchange of communication between two transmitters each working on a wavelength of 8 metres was a feature of the Field Day held by the QRP Transmitters' Society on July 17th. The transmitters each incorporated one of the new Mullard short-wave valves, which are capable of dissipating 50 watts even at these very high frequencies. Owing to difficulties experienced in finding a suitable power supply only 7 watts were applied to each transmitter; nevertheless, successful two-way communication was obtained without aerial or earth at either end over distances not exceeding two miles. It was then found that by raising each transmitter about 8ft. from the ground the range could be increased to



AUTOMATIC S.O.S. DEVICE. A new instrument designed by the Marconi Company which gives audible warning by means of a bell when an S.O.S. message is received. The employment of this device, which is provided for in the Merchant Shipping (Wireless Telegraphy) Rules just issued by the Board of Trade, dispenses with the necessity for maintaining continuous wireless watch on board ship.

four miles, a signal strength of R3 to R4 being obtained. No effect was noticeable in signal strength when the instruments were turned so that the fields of their coils were either in or out of alignment with the apparatus at the other station.

Later in the day a small aerial working as a voltage-fed Hertz was added, and signals were received at a strength of R6 to R7 over a distance of five miles. No aerial was used with either receiver.

On August 14th the Society will conduct further tests on the 8-metre wavelength. Information regarding the experiments can be obtained by any reader on application to the Hon. Secretary, Mr. C. D. Abbott (G6TA), 120, Cavendish Road, S.W.12

TRANSMITTERS' NOTES AND QUERIES.

Short-wave Transmissions.

Information of interest regarding short-wave transmissions in various parts of the world is contained in a number of letters received during the past week. One correspondent complains, with reason, that the position on 20 to 35 metres is rapidly becoming very complicated, and, according to his experience, 2XAF on 32.77 metres is almost always jammed.

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2XG, the Western Electric Co.'s station near New York, works generally on 16 metres, and is usually to be heard testing at 2 p.m. G.M.T. and again between 10 and 11 B.S.T. Other wavelengths are occasionally tried and the frequency announced by the technical operator. This station comes in very strongly, one correspondent finding it almost overpowering with headphones on two valves, while another obtained good loud-speaker reception with three valves.

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A reader also states that he often picks up short-wave transmissions of the KDKA programmes relayed on about 19 and 15 metres, but is unable to identify the transmitting stations as he finds both suffer from rapid fading and distortion, especially that on 15 metres.

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Through the courtesy of the Marconi Co. we are now able to give a more complete list of the wavelengths of the beam stations than in our issue of May 18th:—

GBH	Grimsby (Australian circuit), 25.906 metres.
GBJ	Grimsby (South African circuit), 16.146 and 34.013.
GBK	Bodmin (Canadian circuit).26.080(temporary).
GLG	Dorchester, 15.740 and 15.707.
CG	Drummondsville, Canada, 26.269 (temporary).
CF	Drummondsville, Canada, 32 metres (temporary).
CRHA	Lourenço Marques, 18.360.
CRHB	Praia (Cape Verde Islands), 18.094.
CRHC	Loanda, Angola, 18.182.
VIZ	Ballan, Victoria, 25.728.

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Reception during the Eclipse.

Mr. Eric Megaw, the well-known amateur whose station 6MU, in Belfast, is one of the most active in Northern Ireland, carried out some long-distance tests during the Eclipse with the object of observing its effect on the reception of stations on the West Coast of America. Mr. Megaw was operating with very short wavelengths, using Osram valves in both transmitter and receiver. According to his observations, signals from California increased greatly in strength just after the period of totality. This effect seems to have been generally noticed.

6MU has experienced some difficulty in communicating on very short wavelengths with stations not far distant. On one occasion he was unable to get into direct touch with Armagh, though the station called was only about 35 miles away, but was able to relay the message *via* an American station, the distance of the double journey being about 6.000 miles.

SPEECH CHARACTERISTICS.

Transients and their Relation to Good Articulation in Telephony.

By G. G. F. DUTTON, Ph.D., D.I.C.

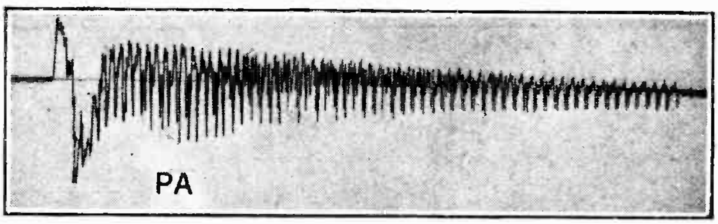
GOOD articulation is vital to wireless telephony. In direct communication one can, excepting sermons and speeches, always say "What?" but the radio telephone is not reversible; it rectifies the flow of language. To articulate well over imperfect wireless transmission and reception apparatus is an art, and consequently requires effort from the speaker. The effort is required in order to emphasise those characteristics in speech which are so difficult to transmit and reproduce.

An instrument which can sustain a note for, say, one-eighth of a second and over can be recognised with ease over quite ordinary radio receiving apparatus (we will assume that the transmission is by the B.B.C.—hence perfect). When we come to instruments which do not sustain notes, however, but are of the plucked string or percussion variety, the problem of recognition of tone is not so simple. For instance, a loud-speaker may reproduce a violin excellently, providing pizzicato notes are not played; but it may, on the other hand, cause pain to the listener when reproducing piano notes. One cannot compare the tones of two pianos or two banjos so easily as two violins or two singers. The drums are even more troublesome than the plucked or struck string instruments.

The human musical instrument, the voice apparatus, employs sustained notes, transient notes, and noises. In practice a transient note never exists without noise, and it is the addition or subtraction of noise due to imperfect telephone apparatus that causes the articulation difficulties. The tone of a voice as distinct from peculiar intonation can be recognised as easily as a violin over imperfect apparatus; it is not the transients one recognises, but the sustained notes such as vowels.

Confusing Consonants.

The sounds which are difficult to recognise are transients or consonants such as "t" and "d," "s" and "f," "p" and "b," etc. In normal speech one can supply the missing sounds mentally from the context of the speech, but individual letters or names present difficulty. The term "mumbled speech" means that the speech is produced by a person who is too lazy to make the transient sounds.



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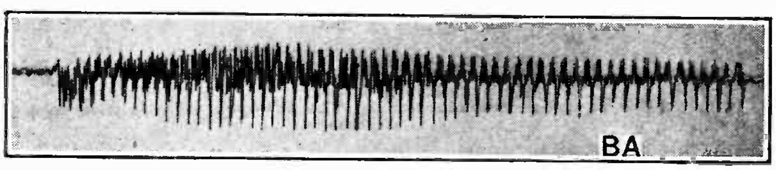

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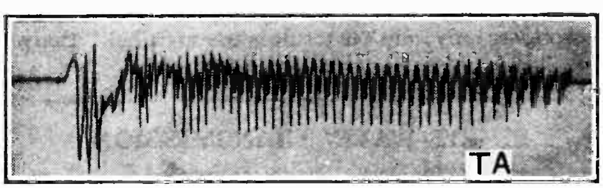

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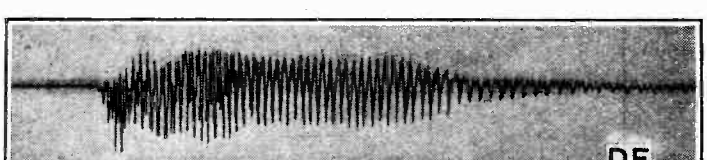

(4)

Audiograms of syllables showing wave forms of consonants and vowels.

Let us compare the transients "p" and "b." They are both produced by the rapid opening of the lips. When pronouncing the word "pa," for instance, we first make the transient "p" by opening the lips quickly, there is a sudden rush of air past the lips, then the vocal chords are set in vibration to produce the vowel "a." When pronouncing "ba" the lips are opened and the vocal chords are set in vibration simultaneously; there is very little, if any, rush of air past the lips when the mouth is opened. To test this, take a strip of thin waxed or waterproofed paper and hold one end of it about half an inch from the mouth; pronounce "pa" and "ba" consecutively. One will notice that the paper is given a violent flick for the word "pa," but that it shows little sign of motion when "ba" is pronounced. The same effect is produced when "pa" and "ba" are whispered, *i.e.*, when the vocal chords do not vibrate.

Example (1) is the audiogram of the syllable "pa" spoken with the normal voice. Notice the initial explosive wave before the vocal chords begin to vibrate. Example (2) is the audiogram of "ba"; in this case the initial explosion is very small. If the receiver diaphragm cannot respond faithfully to the explosive portion of "pa," then this sound will become more and more like "ba" as the explosion is reduced.

The transients "t" and "d" bear the same relationship to one another as "p" and "b." For the production of the transient "t" the air pressed in the mouth is suddenly released by

Speech Characteristics.—

withdrawing the tip of the tongue from the teeth of the upper jaw. The sudden rush of air through the teeth and lips produces the characteristic hitting sound of "t." The transient "d" is produced in a similar way to the "t," except that there is no initial sudden escape of breath and consequent explosion. Test this with the strip of paper as before; both the whispered and the spoken "t" will flick the paper violently. When producing "d," however, the paper will remain undisturbed. Example (3) is the audiogram of the transient "t" followed by the vowel "a" as in calm"; note the initial explosion. Example (4) is the audiogram of the transient "d" followed by the vowel "e" as in "see." There is no initial explosion; the vocal chords build up their vibration simultaneously with the opening of the mouth by the tongue.

In a somewhat similar manner the transients "k," "g," "m," "n," "s." etc., are produced by the sudden release or stoppage of the breath through the mouth and nasal cavity.

Word formation is very interesting, and can be studied best by reference to the audiograms. Take the word "from," for instance, the audiogram of which is shown in example (5). The initial transient, "f," is clearly shown, followed by another transient, "r," after which the sound wave becomes nearly periodic for the vowel, "o." Then follows the transient preceding the nasal portion of "m." The lower wave shown in the audiogram is that of a 250-cycle tuning fork, which serves as a time base. The transient "f" extends over approximately 1/20th sec., the "r" 1/10th sec., the "o" ¼ sec., and the transient portion of "m" 1/125th sec. Example (6) is the audiogram of the word "oscillogram." Note the sudden cessation of the sound "o" and the irregular wave form characteristic of the transient "s." The transient "l" occupies approximately 1/60th sec., the terminal transient "m" is not shown. Note the irregular wave form of the consonant "g." The word "limited" is shown in example (7). The transient portion of "l" is not clear, but the withdrawal of the tongue from the roof of the mouth can be seen by the sudden rise in amplitude of the sound wave representing the vowel "i." The transition from "i" to "m" can be seen clearly. After "m" the voice maintains the steady vowel "i" for a brief period, then is suddenly stopped, to be immediately followed by the vowel portion of the consonant "t." There is a slight pause after "t," followed by a few cycles of the vowel "e," then the abrupt change to the vowel portion of the consonant "d."

The wave forms of the sounds of plucked string or percussion instruments are not so complicated as the consonants in speech. The drums and lower notes of the piano do not reproduce well in radiotelephony because telephones and loud-speakers do not respond sufficiently to the lower notes, *i.e.*, below 250 cycles. We thus hear the overtones only, and the result is the so-called "tinny" effect.

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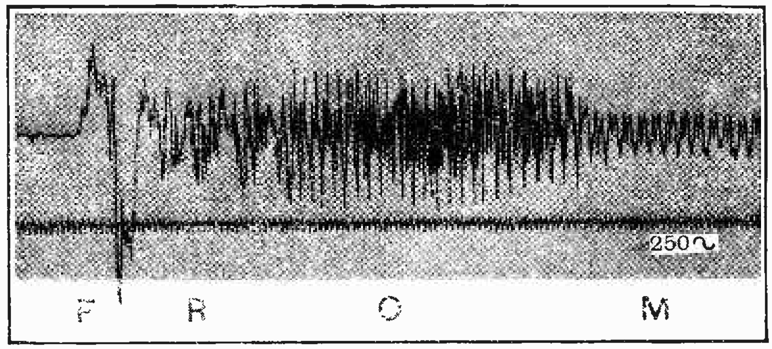

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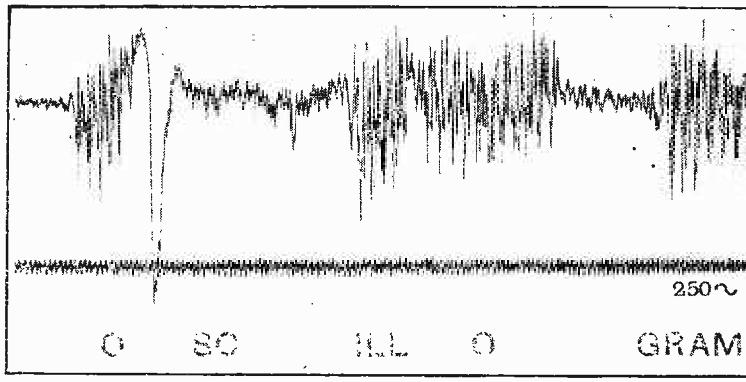

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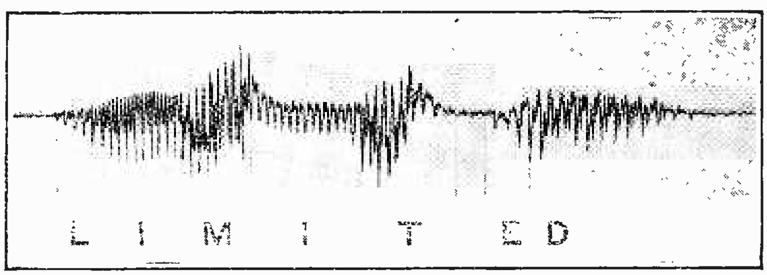

Audiograms of some complete words. The 250-cycle wave is used as a time base.

HINTS and TIPS for NEW READERS

A Section Devoted to the Practical Assistance of the Beginner.

ELIMINATORS AND GRID BIAS.

THE constructor of an eliminator, whether it is designed for operation on A.C. or D.C. mains, would be well advised to abandon the idea of including an arrangement for obtaining grid bias from the same source. An attempt to do so will increase the risk of failure to obtain a "quiet" supply, and will also increase the cost, as extra by-pass condensers will be required. It should be unnecessary to point out that no current is taken from a grid bias battery, which accordingly should last as long when connected to a set as when standing idle. The initial cost of such batteries is low, and there seems to be little point in taking special trouble to eliminate them, except perhaps in the case of instruments designed for the non-technical listener who may have no desire to acquire even sufficient knowledge to enable him to make the necessary replacements as they become due.

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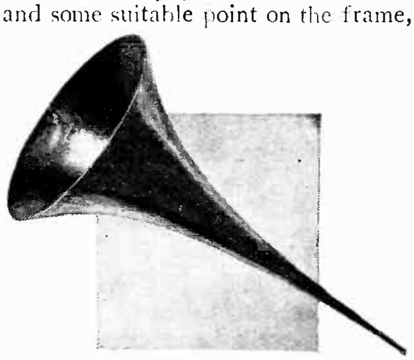
LOUD-SPEAKER HORNS.

THOSE who are attempting to obtain reproduction of good quality at low cost should not overlook the possibilities of the large and well designed logarithmic horn, in conjunction with a good unit. Such an arrangement gives quite fair volume with the output which is provided by an ordinary power valve, which consumes only some 5 or 6 milliamperes of current from the H.T. battery when correctly biassed. It is probable that the appearance of these horns will always militate against their general adoption, but those who are fortunate enough to have lofty rooms will often be able to mount the loud-speaker in a reasonably inconspicuous manner (above the level of the eye) by suspending it from the ceiling. The movement may be in the angle made by two walls and the ceiling, with the flare at a slightly lower level.

When a super-power valve is used, there is often superfluous volume, and in such cases it is possible to effect a considerable improvement in reed-driven diaphragm units by providing additional damping. It will be realised that instruments as supplied by manufacturers must be sensitive, or the volume obtainable will fail to satisfy the ordinary user. In this matter the amateur will find some helpful hints in an article dealing with gramophone pick-up devices in *The Wireless World* for June 20th, 1927, but it must be borne in mind that less drastic damping is necessary for a loud-speaker. Much may often be done by inserting a few layers of folded tissue paper between the reed and some suitable point on the frame, to which the paper should be secured by means of some adhesive. No definite instructions can be given on this point, as various units differ considerably in construction.



A commercially-made logarithmic horn. It measures over 5 feet in length, the diameter of the flare being about 2 feet.

This modification will naturally reduce volume, but it may improve quality very appreciably by suppressing such natural resonance as may exist in the reed and diaphragm.

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FAULTY GRID CONDENSERS.

CONSIDERATION of a circuit diagram will show that coupling condensers used either in tuned anode H.F. circuits or resistance amplifiers must be capable of withstanding the high-tension voltage applied to the preceding valve. It is mainly for this reason that the need for high insulation is so often stressed, as any leakage will result in the application of a positive bias to the grid to which it is connected. Now this positive voltage, providing it is not excessive, may not do much harm if the valve is acting as a grid circuit detector, although it will upset its adjustment to a certain extent, but it will be highly undesirable in the case of a low-frequency amplifier.

A milliammeter connected in the plate circuit of the valve will always give an indication of grid condenser insulation under these conditions; if anode current is excessively high with normal grid bias, it is probably defective. Similarly, in a low-frequency amplifier, if a greater negative bias than usual is necessary to prevent the form of overloading giving rise to grid rectification (as indicated by downward deflections of the milliammeter needle) it may be assumed with some confidence that a similar fault exists.

Still another (and an even more definite) test may be made by disconnecting the H.T. supply to the preceding valve, and noticing if this results in a reduction of the anode current. If it does not, the condenser insulation is probably quite adequate.

METRES AND KILOCYCLES.

It is usual to set the dials of variable condensers in such a way that a zero reading indicates minimum interleaving of fixed and moving vanes, so that any increase in the reading shown on the scale will indicate that the circuit of which the condenser forms a part is tuned to a higher wavelength, but to a lower frequency. This is rather confusing to those who are trying to ignore wavelengths and to think in frequencies only; the difficulty may, however, be easily overcome by resetting all tuning condenser dials to indicate zero when the vanes are fully interleaved, and the capacity is a maximum. With this arrangement, the higher frequencies will correspond to the higher dial readings.

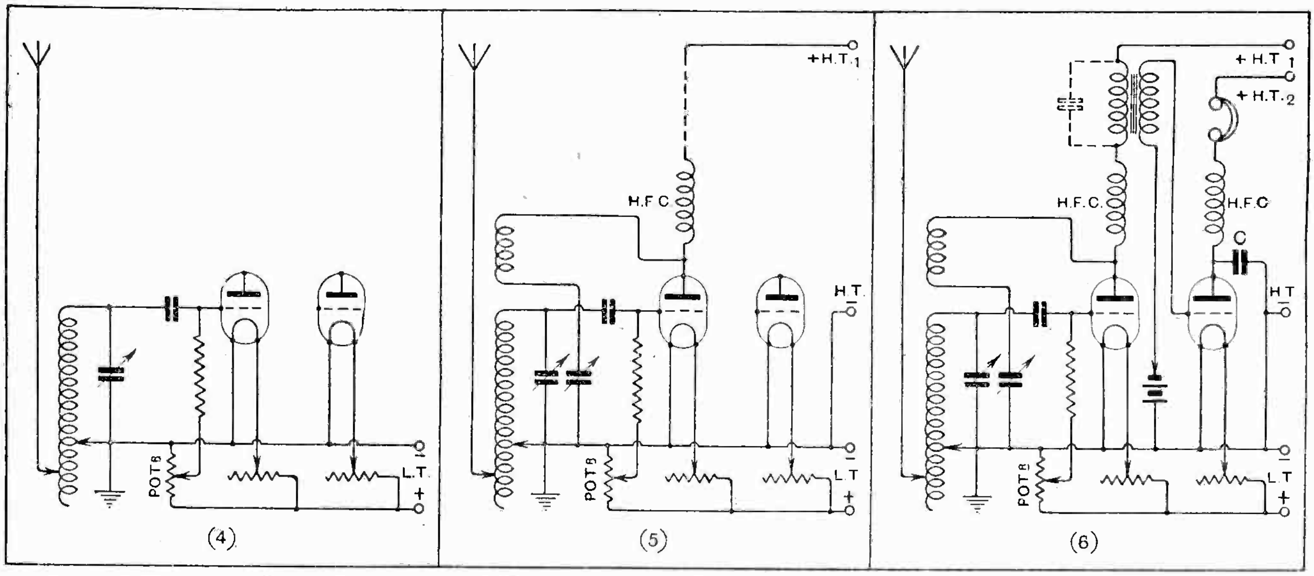
DISSECTED DIAGRAMS.

Practical Points in Design and Construction.

No. 76 (a).—A Typical Short-wave Receiver.

(Concluded from last week's issue.)

The present series of diagrams is intended to show progressively, and in an easily understandable manner, the various points to which special attention should be paid in the design of typical wireless instruments, and at the same time to assist the beginner in mastering the very necessary art of reading theoretical circuit diagrams. A simple detector L.F. combination is most generally favoured for the reception of the ultra-short waves; a conventional circuit of this type, with suitable modifications for its special function, is shown below.



A grid condenser is inserted, and the low potential end of its leak is joined to the slider of a potentiometer, the resistance element of which is connected across the low-tension battery.

The two parallel anode circuits are completed, the first through H.F. choke transformer primary (its position is shown by dotted line), and the second through the reaction coil and condenser.

The transformer secondary is connected between grid and filament of the L.F. valve, with bias interposed. The plate circuit is completed through choke and phones. A parallel by-pass condenser is added.

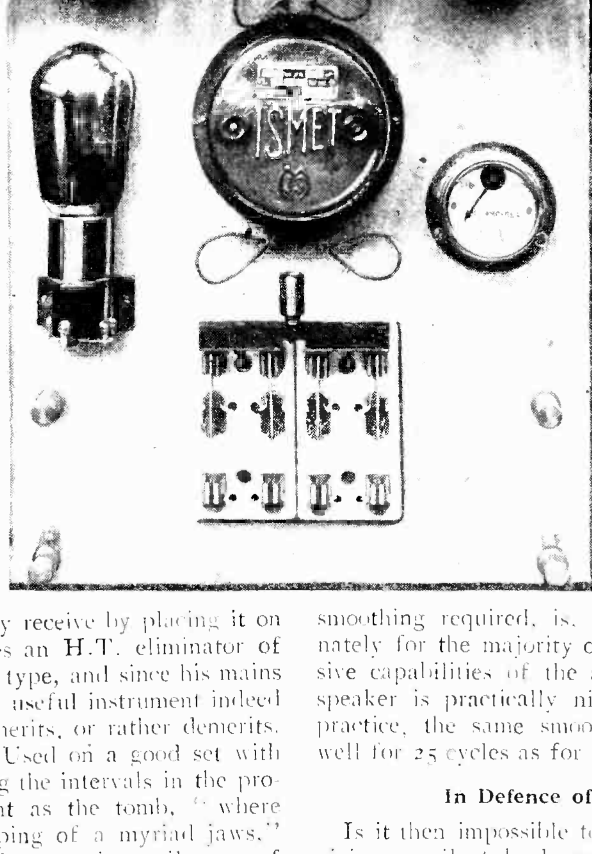
Generally speaking, a smaller grid condenser than usual, in conjunction with a leak of higher resistance, is recommended for short-wave work. A capacity of 0.0001 mfd. with a 5-megohm leak is a suitable combination. The use of a potentiometer as an aid to the obtaining of smooth reaction is advocated because the sensitivity of a receiver of this kind depends almost entirely on good control of regeneration, which can most easily be attained by these means, in conjunction with a suitably proportioned reaction coil. This may consist of about five or six turns of fine wire (about No. 30 D.S.C.), with adjacent turns touching, carried on an extension of the former on which the coil is wound, and spaced about ⅜in. from its high-potential end. This winding is suitable as a rule for the 20-70-metre waveband, but an experimental alteration should be tried if possible. More turns will be required for the longer waves. A reaction condenser of 0.00015 to 0.0002 mfd. will be found suitable, and, like the grid condenser, should be fitted with a slow-motion device.

The choke should have an extremely small self-capacity, and its coupling to the other inductances must be reduced as much as possible; these requirements are satisfied by the use of a single-layer winding of about 250 turns of No. 42 D.S.C. wire on a former of 1in. diameter.

Slightly better stability is often obtained by connecting the by-pass condenser (usually about 0.0003 mfd.) between the plate end of the transformer winding and negative L.T. rather than directly across the winding, as shown.

The choke in the anode circuit of the L.F. valve, in conjunction with the by-pass condenser C helps to reduce capacity effects by keeping H.F. currents out of the phone leads. The choke described above is suitable for this position, with a condenser of 0.001 mfd.

TRICKLE CHARGER FOR H.T. ACCUMULATORS



To Work from A.C. Mains.

By N. P. VINCER-MINTER.

In spite of all that has been written concerning H.T. battery eliminators, the fact remains that the best form of H.T. supply is a good H.T. accumulator, both from the point of view of giving a completely noiseless supply, and of giving freedom from trouble.

A suitable interval having now elapsed to permit of the howls of execration dying down, the writer would anticipate the inevitable flood of objurgatory and advisory letters which he will undoubtedly receive by placing it on record that he already possesses an H.T. eliminator of the most modern and up-to-date type, and since his mains are A.C. he finds it an extremely useful instrument indeed for determining the respective merits, or rather demerits, of the ordinary loud-speaker. Used on a good set with an expensive loud-speaker during the intervals in the programme, it is literally as silent as the tomb, "where naught is heard save the champing of a myriad jaws," as the poet tells us. Used with a moving coil type of loud-speaker, it can no longer be said with honesty that it is in any way reminiscent of the Sahara desert from the point of view of silence. The writer has, by bitter experience, found that this is true of a very large number of battery eliminators of the highest repute. The truth is, of course, that most loud-speakers treat the lower musical frequencies with lofty disdain, and, therefore, the 50-cycle hum from the mains is usually only a negligibly weak undertone, not because of the excellence of the smoothing arrangements, but because of the failings of the loud-speaker. Let us beware, therefore, lest we attribute as a virtue to our eliminator the shortcomings of our loud-speaker. This little failing of the ordinary loud-speaker accounts to a large extent for the fact that an eliminator designed for 90 cycles is still quite free from objectionable hum when used on a 25-cycle supply. The lower the frequency the greater the smoothing required, is, of course, the rule, but, fortunately for the majority of H.T. eliminators, the responsive capabilities of the average "distortionless" loud-speaker is practically nil at this low frequency, so, in practice, the same smoothing circuit will serve equally well for 25 cycles as for 50 or even 90 cycles.

In Defence of H.T. Accumulators.

Is it then impossible to build an eliminator capable of giving a silent background with a really good loud-speaker? By no means, and the writer hopes to prove it by describing such an instrument in the columns of this journal at a later date. In the meantime, what is the matter with using H.T. accumulators? Is there any disadvantage attending their use as compared with the use of an eliminator? Those who have had the bitter experience of dragging bulky H.T. accumulators to the local lead sulphate supply stores every two or three weeks, will be under no

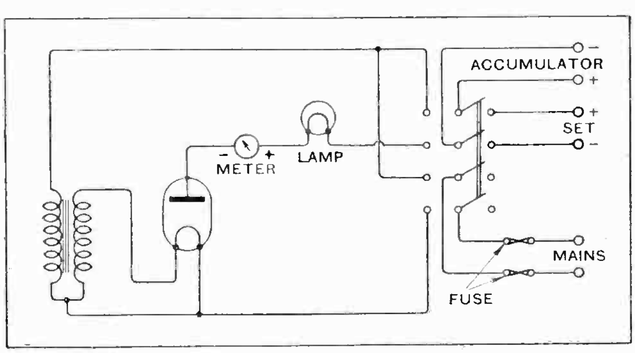


Fig. 1.—The electrical connections.

Trickle Charger for H.T. Accumulators.—delusion concerning the disadvantages; but since such people naturally have no electric light mains in their house (for nobody in his right senses would carry heavy H.T. accumulators to a charging station when he has mains in his house) they could not use an eliminator in any case. So why grumble? It is their own fault for using H.T. accumulators. The "super" type of dry cell H.T. battery is designed specially to fill their needs. Having exploded this imaginary disadvantage, is there any other which can be advanced? A glance at the advertisements of many H.T. battery eliminators will reveal the statement that H.T. batteries have to be renewed every two or three years, and are thus in the long run very expensive.

Probable Life of Cells.

Naturally, we can discount fifty per cent. of this statement as pure advertisers' hyperbole, but it must be fully admitted that, placed in the hands of the average garage, it is doubtful whether even the best of accumulators will last more than a year, since they simply will not stand a five-amp. charging rate, whilst being "topped up" with a hose is, strangely enough, equally detrimental to their welfare. On the other hand, if they are kept at home, and moderate care is taken with them, there is no reason why the modern slow-discharge type of battery in a glass container should not last five years.

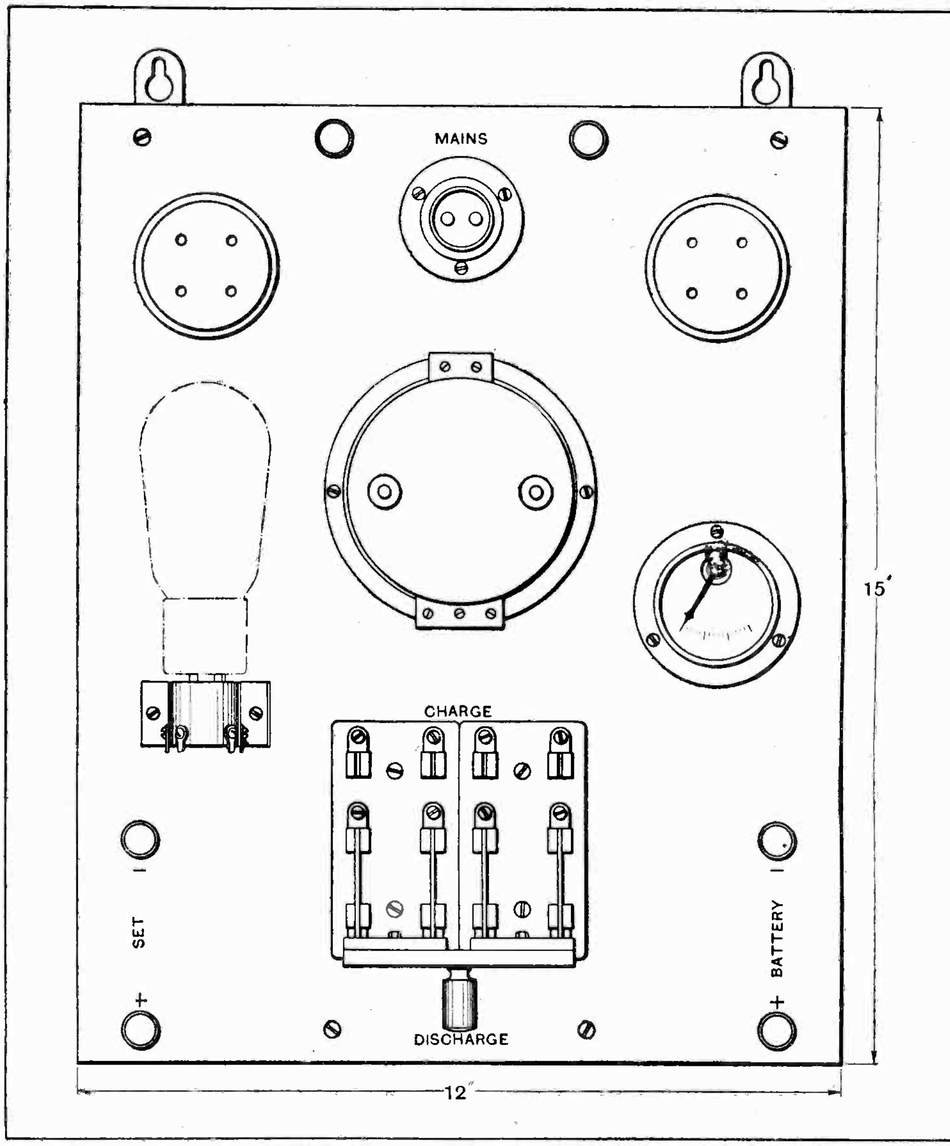


Fig. 2.—Layout of components on the charging board.

Against all this, however, it must be admitted that the taking of H.T. power from the mains has a certain appeal for us. It seems, does it not, that the most sensible thing to do is to take our power from the mains, but before we build our eliminator, let us make absolutely sure what it is we desire to "eliminate." It is surely the *trouble* of a battery, and not necessarily the battery itself that we wish to eliminate? In the case of dry cell H.T. batteries, it is the trouble and disadvantage associated with their progressively declining voltage and rising internal resistance which we wish to eliminate, whilst in the case of H.T. accumulators, it is the trouble of taking them to the charging station, and in order to do this we usually go to the trouble of building the ordinary battery eliminator, with all its attendant disadvantage of background hum and its lack of constancy of output voltage, irrespective of what type of valves we use in the set.

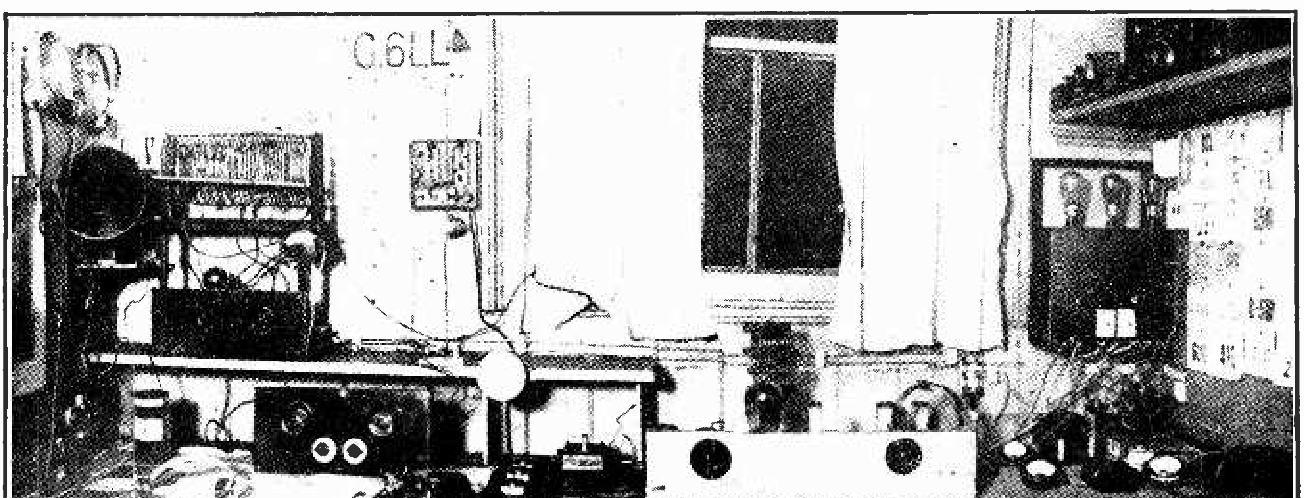
Surely our battery troubles can be eliminated in a more sensible way, if we have mains, by the simple expedient of obtaining a good H.T. accumulator with all its great advantages of freedom from noises and choice of definite voltages, and using it in conjunction with a trickle charger? In the case of D.C. mains, the apparatus required is so absolutely simple, consisting merely of a lampholder and a lamp, that it is scarcely worth mentioning, and it is, therefore, only the case of A.C. mains which we shall consider here, and the writer takes the opportunity of briefly describing a simple trickle charger which he has had in use for over a year with every satisfaction. It should be distinctly understood that this apparatus has not been built specially for this article, but

Trickle Charger for H.T. Accumulators.—
was built to suit the writer's own particular requirements. Actually, it is made to hang on the wall in the room in which the set is housed, and so all components are mounted on a vertical board. Naturally, this will not be suitable for use in a living room, and if intended for use there it would be better to mount the components in a manner suitable for placing in some form of cabinet. The layout is, of course, quite immaterial, and it is, therefore, only the electrical circuit which we need discuss here.

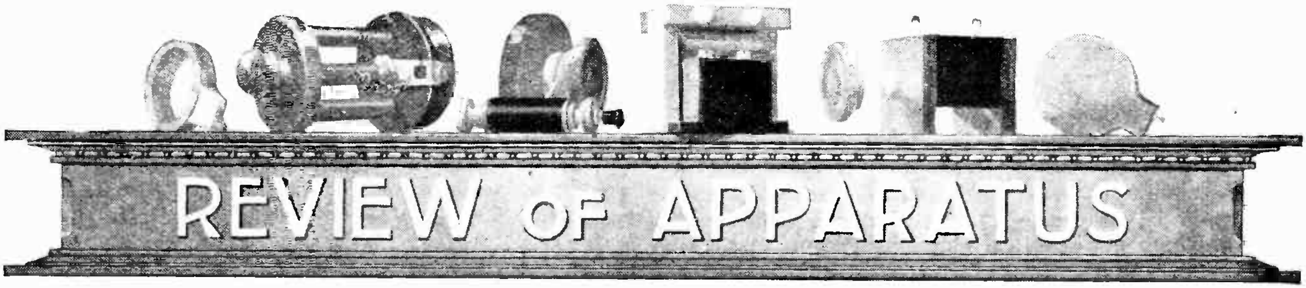
An examination of the circuit diagram will show that the device consists of a rectifying valve lit by a filament transformer from the mains, and arranged to supply a rectified current to the accumulator for charging purposes, a four-pole switch being used to change the accumulator over from the set (Discharge) to the mains (Charge). Two fuses are also included in the mains, whilst a milliammeter and a lamp (to act as a resistance) are included in the plate circuit of the valve. The actual valve used by the writer for the past year has been the Mullard D.U.10, whose filament consumes 1.1 amps. at 4 volts (nearly 4½ watts). The transformer consists merely of one of the small "bell ringing" type of instrument, giving an output of 3, 5, or 8 volts at 1 amp., which are obtainable from almost any high-class electricians for a few shillings. The actual instrument adopted by the writer has been in use for over a year without giving any trouble. Actually, the 3-volt tapping is used, and the valve filament is thus run at a somewhat lower temperature than normal, but no harm will result from this provided that the correct value of plate circuit resistance is used. In the carton in which the valve is sold full details will be given concerning the value of plate circuit resistance to use. This depends on the filament temperature, and also on the voltage of the accumulator to be charged. A tapped wire-wound resistance can be made up if desired, although the writer has found a lamp resistance perfectly satisfactory, and actually uses a 240-volt, 20-watt lamp when charging a 120-volt accumulator. This gives a charging current of roughly 20 milliamperes, which is ample, since this is somewhat more than the current taken out of the battery by even a large set, and it will thus only be necessary to put the switch over to the "charge" position every other night or so, in order to keep the battery fully charged. Further, this exceedingly low charging rate is all to the good for the health of the battery, and actually the writer has, by this low charging current, used for many days, succeeded in nursing back to comparative health several badly sulphated batteries brought to him by "friends." It should not be forgotten when purchasing a transformer that it is necessary to see that the primary is suitable for the particular mains with which the apparatus is to be used.

With regard to the milliammeter, this is only a 10s. instrument of the moving iron type, but is quite accurate enough to perform its function of indicating the approximate value of the charging current. The only other apparatus required are two fuse boxes and two porcelain D.P.D.T. switches. With regard to the latter, they are mounted side by side and made to function as one switch, by joining each set of two poles together by means of a small ebonite bar, as is clearly shown in Fig. 2. It might be mentioned that it is quite possible to use an ordinary small power valve as the rectifier by connecting the grid and plate together.

Once constructed and installed, this instrument will be found to act as a perfectly reliable and never failing source of "H.T. from the mains." It is, in fact a mains unit equally as much as the more conventional type, and the only point of difference is that it eliminates the trouble of a battery without actually eliminating the battery itself, instead of eliminating the battery and its trouble and bringing in its wake a whole host of troubles of its own.



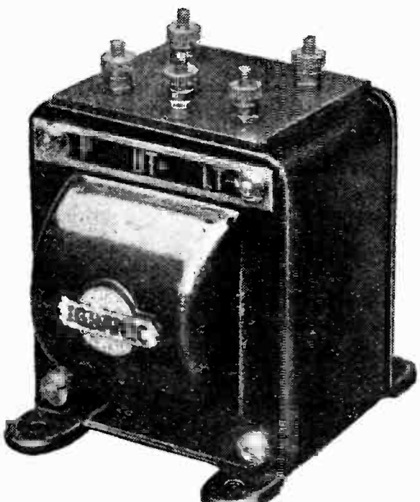
AMATEUR STATION G 6LL, owned by Mr. J. W. Mathews, at 178, Evering Road, Clapton, E.5. On the left is shown the 150–200-metre transmitter having a direct-coupled Hartley circuit. The receiver is of the 0-v-1 straight-circuit type with Weagant reaction control and is tunable from 13 to 200 metres. The short-wave transmitter employs the tuned-plate tuned-grid circuit with aerial tapped to the plate coil and acting as a voltage-fed Hertz. On the extreme left is the modulator panel, which may be used with either transmitter.



Latest Products of the Manufacturers.

CHOKE CONDENSER OUTPUT UNIT.

The convenience of building as a single unit a condenser and low-frequency choke coil has been appreciated by the Igranic Electric Co., Ltd., 147, Queen Victoria



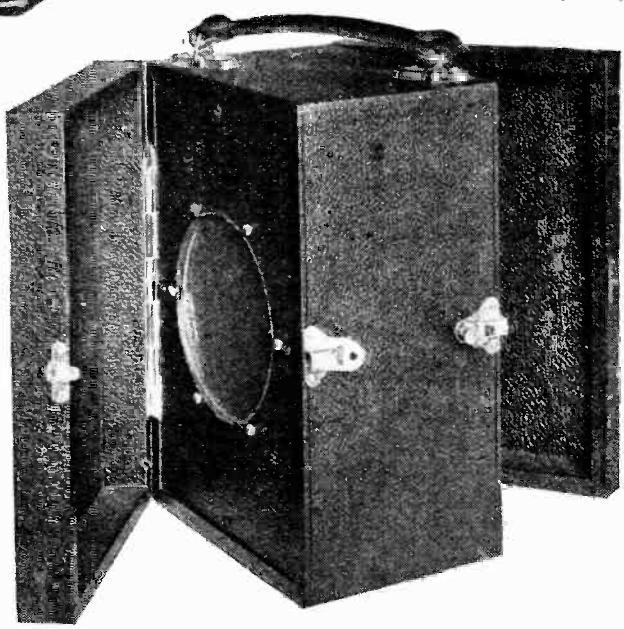
Igranic choke condenser and output unit containing feed choke and condenser.

Street, London, E.C., by the addition to their range of components of an output filter circuit built in the form of a single unit. The feed choke connected in the H.T. lead is assembled on a core of "D" stampings, and the feed condenser, which has a capacity of 1 mfd., is rated to withstand a D.C. test of 400 volts. The unit is suitable for use with small sets where the anode current of the output valve does not exceed a few milliamperes.

BECO PORTABLE LOUD-SPEAKER.

Although the majority of modern portable sets are fitted with self-contained loud-speakers, there are still many portables to which the telephones or loud-speaker are externally connected.

The demand for a portable loud-speaker has been met by the British Electrical Sales Organisation, 623, Australia House, Strand, London, W.C.2. The standard Beco loud-speaker is, of course, of quite small overall dimensions, and is therefore admirably suited for portable use. The loud-speaker movement is clamped to a board forming one side of a cabinet, and is covered by a hinged lid. The reverse side of the cabinet opens to give access to the adjusting screw and terminals. The cabinet is strongly constructed, and the leatherette finish renders it durable. On test the loud-speaker was found to be sensitive, the baffle board and closed back to the cabinet probably adding to the strength of signals.



The Beco loud-speaker. One door exposes the diaphragm and the other the terminals and adjusting screw.

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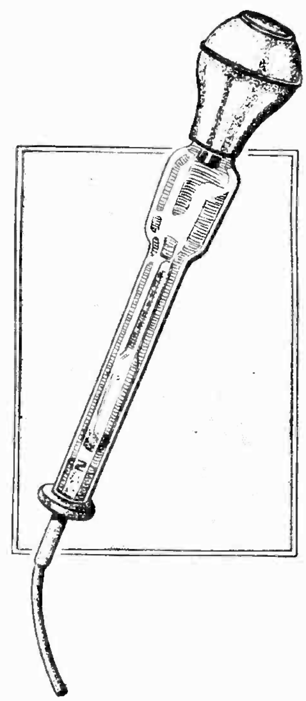
UTILITY HYDROMETER.

The best method of determining the condition of an accumulator battery is by the specific gravity of the acid, and the terminal voltage alone is not a safe guide.

To obviate the difficulty of pouring acid from the battery for the purpose of testing the gravity, the Utility Syringe Hydrometer Co., 16, Howard Road,



Acid is withdrawn from a cell by suction and the gravity readily revealed by the hydrometer.

Ilford, Essex, supply a form of hydrometer enclosed in a tube with suction bulb, so that the acid can readily be withdrawn from a cell, the floating hydrometer at once revealing the gravity. In use it was found that the floating hydrometer did not adhere to the walls of the acid container as was expected, and it was observed that small projections were provided around the bulb of the hydrometer to overcome this difficulty.

This form of hydrometer is also particularly useful for adding or removing acid or water to cells for the purpose of suitably adjusting the gravity.

The Experimenter's Notebook

By "EMPIRICIST."

Practical Notes on Capacity Neutralisation.

(Concluded from page 76 of the July 20th issue.)

SO far the neutralisation of capacity coupling has been considered with reference to one typical circuit only, and attempts have been made to deal generally with the subject, using this one neutralising method by way of illustration. It is now necessary to review briefly some of the remaining methods in order to consider the special problems which they present.

Foremost among these are the so-called "bridge" methods, one of which was shown by Rice in his original specification, and is generally held to be the first example of a neutralised circuit.

The essential arrangement is shown in Fig. 11 (a). Here the inductance L_1 is tapped at an intermediate point, usually the centre, and the filament is connected to this tap. The grid of the valve is connected to one end of the coil, and a neutralising condenser is connected between the plate and the other end.

In order to appreciate the operation of this circuit we may refer to Fig. 11 (b), which is a schematic diagram of the various capacities, etc., involved. Any E.M.F. across L_2 in the original figure will be introduced at the point X, and it is clear from the diagram that if L_1 be centre tapped and C_3 adjusted to equality with C_0, no current will be set up in the circuit L_1 C_1 taken as a whole. There will, however, be currents flowing in opposite senses through the two halves of L_1, and, as a result, voltages will be induced in these two halves which, though cancelling out in the complete circuit, are nevertheless finite in themselves.

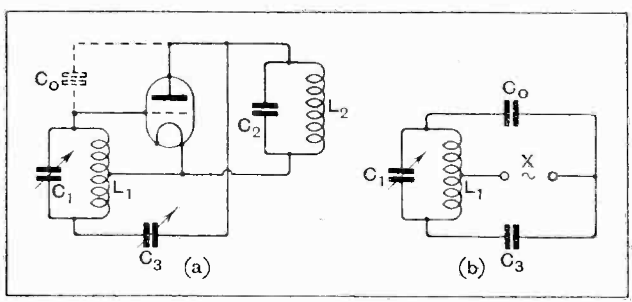


Fig. 11.—The "bridge" method of neutralisation due to Rice.

We are thus faced with yet another form of imperfect neutralisation which may give rise to considerable trouble in practical circuits, since no adjustment of C_3 will completely remove the voltage on the grid of the valve, though it will stop interaction between the circuit L_1 C_1 *taken as a whole*, and any similar circuit, such as L_2 C_2, on the anode side of the valve. The circuits will thus not oscillate at the wavelengths to which they are tuned, but they may do so at other wavelengths.

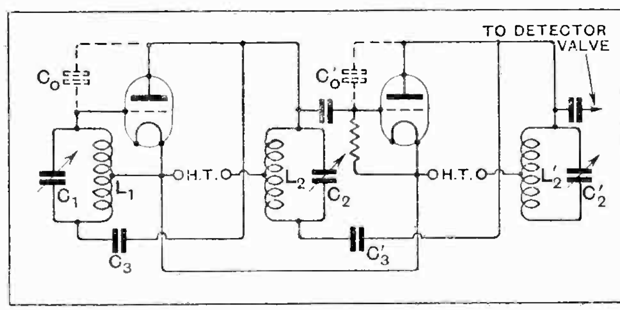


Fig. 12.—Two-stage amplifier with centre-tapped coils.

If we consider the circuit of Fig. 12 it will be seen that both L_1 and L_2 are centre-tapped coils, and in consequence their tuning condensers do not connect the grid and plate to an earthing point in the circuit. Redrawing this arrangement as in Fig. 13, let us imagine an E.M.F. V_2 of very high frequency applied as shown across one half of L_2. Then, since the circuit L_2 C_2 is resonant to quite a normal frequency, much lower than that under consideration, the volt drop in C_2 will be negligible and the same voltage will be applied practically simultaneously to the two halves of L_2. Now, as there is a certain amount of coupling between these halves, their inductance will be partially cancelled; ideal close coupling would cause a complete cancellation, but this is not considered to exist in the present arrangement. There will thus be a "residual inductance" in shunt with the E.M.F., and since the system has self-capacity

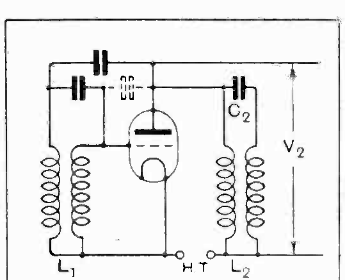


Fig. 13.—The circuit of Fig. 12 redrawn and simplified to show essential features.

The Experimenter's Notebook.—
there will be some high frequency to which the plate system is resonant as well as the normal frequency corresponding to the resonance of L_2 and C_2.

If the coil systems are substantially the same on the grid and plate sides, the natural frequencies will be identical in the two circuits, and high-frequency oscillations may take place on a totally different wavelength from that to which the circuits are tuned. These oscillations have been observed by a number of writers, and several means have been described for counteracting them. The most noteworthy and fundamental method of attack is due to Round, who makes the alternate inductances astatic, *i.e.*, wound in two opposing half sections. As a result the natural frequencies of the alternative coils are different from each other, and there is no tendency for the system to become unstable in this manner.

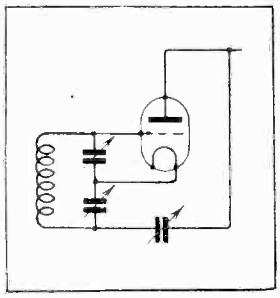


Fig. 14.—"Bridge" circuit with divided tuning condenser.

Another "bridge" circuit which avoids the difficulties just described is shown in Fig. 14. Here the tuning condenser is in two parts and is conveniently constructed as a double condenser of the type frequently used for tuning two separate circuits simultaneously. Since the inductance of the condenser branches is negligible, and since, also, there is no current flowing through the coil when a balance is attained, there is no second frequency of oscillation, and even though there will be a residual voltage on the grid at balance, as before, it will not be in the sense favouring regeneration, since the reactance is capacitative and not inductive.

Lastly, mention must be made of a most important cause of instability in any neutralised receiver, namely, coupling between remote stages. If we consider any standard two-stage neutralised amplifier such as that shown in Fig. 15 we may find a state of affairs where perfect neutralisation exists between consecutive circuits (*i.e.*, between 1 and 2 or between 2 and 3 in the figure), but where instability occurs when all the circuits are brought into tune. If this is definitely not due to battery reaction and all the usual precautions have been taken to test for this, it is very likely that coupling between 1 and 3 is the cause of the trouble. The cure for this is either adequate screening of the last circuit or else a neutralising arrangement to balance out the unwanted couplings. A typical means is shown in the figure; a tapping point is taken in the inductance of circuit 3 and a lead connected to this point and to a neutralising condenser X. In series with this condenser is a coil Y negatively coupled to the inductance

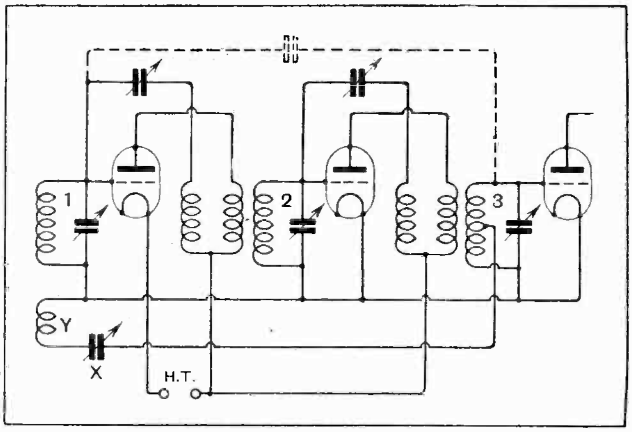


Fig. 15.—Compensating for capacity coupling between circuits 1 and 3 by means of a subsidiary circuit XY.

of 1. The tapping position and the turns on Y must be found by experiment, but it may be said that, for the average layout, about one-thirtieth of the total turns on the inductance of 3 is enough for the tapping point, and about a quarter of the turns of 1, closely coupled to and spaced from this coil, is suitable for coil Y, in conjunction with a neutralising condenser of normal value for X.

It is not possible to deal adequately with all the ramifications of this important subject, but it is hoped that the outline given in these articles may enable experimenters to add to their stock of knowledge by carrying out investigations on their own. It should always be borne in mind that a good layout is the foundation of a good set, and the suggestions made in a previous article in these series may be studied with advantage in connection with these notes on capacity neutralisation.

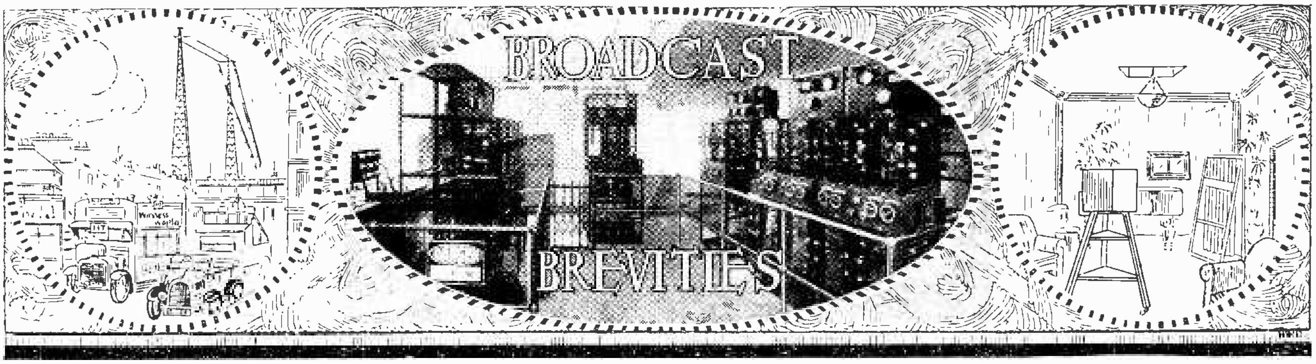
INTERCHANGEABLE FIXED RESISTORS.

NOW that plug-in coils are going out of fashion, many experimenters must have a stock of coil-plugs, belonging either to coil-holders or to the coils themselves, for which they are at loss to find a use. It may therefore be helpful to point out that such plugs make a very satisfactory basis for interchangeable fixed resistors. It is only necessary to insert one plug in the filament circuit of each valve, mounting it in any way that may be convenient (*e.g.*, by screwing it to the baseboard by a couple of grid-leak clips), and to connect, by a suitable length of resistance wire, the contacts of another plug, which is then pushed into the first.

If it is desired to have a number of different resistances on hand for rapid interchange, a number of the removable resistor units may be made up, while if the change is only to be made in the event of abandoning one type of valve in favour of another, it is easy to remove the plug from the set and fit a fresh length of resistance wire, the plug itself being the former on which the wire is wound.

It is not suggested that it would be an economical proposition to buy coil-plugs especially for this purpose, but this use of them may help to empty the overflowing "junk-box."

A. L. M. S.



News from All Quarters: By Our Special Correspondent.

Holidays at Savoy Hill.—The Menin Gate Triumph.—Overworked Artists.—B.B.C. and Esperanto.—Where Ship Interference is Worst.—The Impersonal Corporation.

Exodus.

Something of the cheerful bustle which so impresses the visitor to No. 2 Savoy Hill is departing. I noticed it last week. A still greater change will probably be noticeable as the month wears on. The reason is not far to seek.

Even the B.B.C. staff feels entitled to a holiday, and the number of absentees is increasing. I hope it keeps fine for them.

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Only a Rumour.

I hear a rumour that one of the control room engineers proposes to spend a quiet holiday listening to broadcasting.

oooo

Bravo, B.B.C.!

On the success of the Menin Gate broadcast the B.B.C. deserve every congratulation. The transmission was not faultless, but the difficulties which had to be contended with were many. I understand that the "fade out" during King Albert's speech was due to temporary failure on the Belgian overhead lines, though the British Post Office line from the coast may not have been beyond reproach.

Lord Plumer evinced special interest in the broadcast, asking the B.B.C. officials several questions as to the likelihood of the transmission being successful. The same interest was shown by King Albert, whose speech, it was noticed, was in his own handwriting.

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The Continental Lines.

Apart from one or two League of Nations transmissions from Geneva, the Menin Gate broadcast was the most ambitious yet attempted by the B.B.C. on the Continent. One obstacle to relays of this type is the parlous state of the land lines over there. It is rather remarkable, but nevertheless true, that the French and Belgian telegraphs are still suffering from the effects of the war.

Who knows but what in the next ten years the lines may improve to such an extent that listeners will hear racing at St. Cloud, or share the delights (and not the risks) of Monte Carlo?

A Fruitful Appeal.

As a proof of the value of the broadcast appeal, it is interesting to note that the Westminster Abbey Fund benefited to the extent of between £2,000 and £3,000 as a result of the recent appeal from 2LO and other stations. In addition, a generous donor has undertaken to provide a sacristy which will cost not less than £10,000. So that altogether the appeal may be said to have realised upwards of £12,000.

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British Talent in the U.S.A.

Some time ago the English Singers travelled over to the States with the idea of conducting a two or three weeks' tour of American broadcasting stations; the tour extended over two or three months. A little later they repeated the visit and are now thinking of making the trip once again, as there appear to be engagements for British artists in the States whenever they want them.

I hear that a new party of well-known British singers is being collected for an American tour led by a gentleman who has been one of the most popular B.B.C. officials since broadcasting in this country started.

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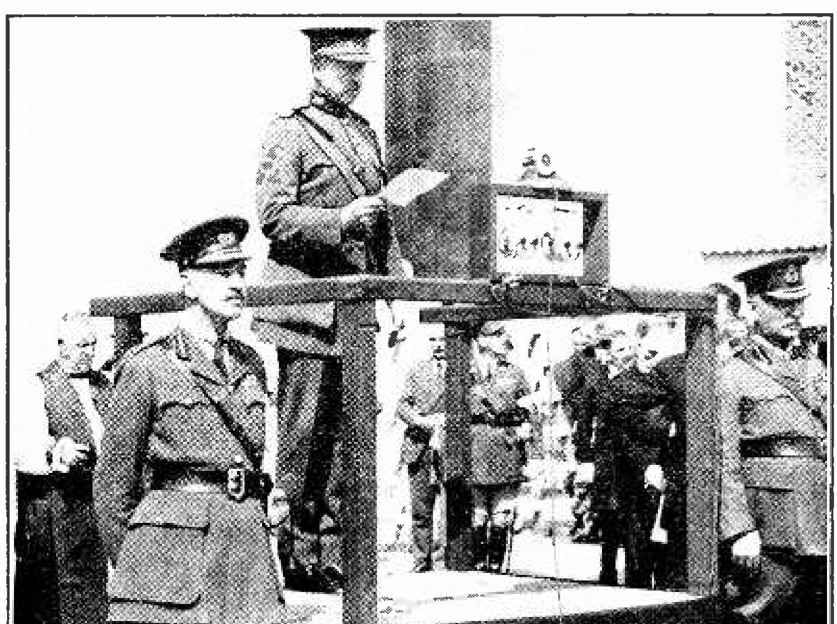
Value of Trips Abroad.

Expeditions of this kind should be heartily encouraged, if for no other reason than that they give a much-needed "rest" to artists who might be in danger of exhausting their repertoire. A trip abroad gives them an opportunity of rol-



AT THE MENIN GATE. King Albert delivering his speech at the opening of the Menin Gate Memorial, Ypres, on Sunday morning, July 24th. The lower microphones were used for broadcasting, while the upper microphone served the Amplion public address equipment.

lecting fresh impressions and material while making good use of the repertoire they already possess.

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Overworked "Stars."

It seems to me that the B.B.C. is rather prone to overwork its "stars," forgetting that the microphone artist's task of providing fresh material at frequent intervals is much more arduous than that of the actor or music-hall comedian, whose "gems" are not scattered to the four winds in a single night.

The microphone is a gluttonous taskmaster.

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Denmark "Tours" Europe.

For a period of three hours the other evening, listeners to the Copenhagen station heard concerts picked up and relayed from the principal cities of Europe. Among the stations heard, according to a Copenhagen correspondent, were London, Paris, Toulouse, Berne, Prague, Langenberg, Moscow, Brussels, Oslo, Frankfort and Lyons.

In most cases the reception was remarkably pure, and the feature aroused the greatest enthusiasm.

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Perlmutter at the Microphone.

Nick Adam, the original Perlmutter in "Potash and Perlmutter," will be heard by London listeners on August 12th.

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Ketelby Night.

A programme of music by Ketelby, composer of "In a Monastery Garden," will be broadcast from 2LO on August 6th.

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Advantages of Life in Sark.

Language difficulties present fewer obstacles to listeners in the Isle of Sark than in most places, for here they speak English and French with equal facility and can enjoy English, French, Belgian and Swiss programmes with equal zest.

Unfortunately there is the usual fly in the ointment; in Sark it is interference from ships, which literally surround the little island with its 600 inhabitants. A correspondent who recently visited Sark tells me that there are now about 30 receiving sets. In winter the news bulletins are especially welcome as there are then only two steamers per week from Guernsey, whence all supplies and newspapers emanate.

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B.B.C. and Esperanto.

The B.B.C. has issued the following statement concerning proposals for the inclusion of Esperanto in the regular broadcast programmes :—

"The B.B.C., while adhering in principle to the resolution of the General Assembly of the Union Internationale de Radiophonie, is unable to fall in with the particular proposals, which were to broadcast in Esperanto a weekly account of forthcoming programme features and to announce the names of the stations once nightly in Esperanto. The latter seems unnecessary, and the former is not done by British stations even in the English language.

"The B.B.C. considers that any time that it is able in the future to devote to Esperanto would be best devoted to a definitely instructional course. The possibility of allotting this time is now being seriously considered, but it is not expected that room can be found for the subject until the scheme of alternative programmes shall have, at any rate partially, been brought into effect."

FUTURE FEATURES.

London.

AUGUST 7TH.—Albert Sandler and the Grand Hotel, Eastbourne, Orchestra.

AUGUST 8TH.—Mr. James Agate: Dramatic Criticism.

AUGUST 9TH.—Musical Comedy.

AUGUST 10TH.—"A Fool and His Money," a wayside comedy by Laurence Housman.

AUGUST 11TH.—Ballad Concert.

AUGUST 12TH.—William Blake: A Programme of Verse and Song.

AUGUST 13TH.—Opening Night of the B.B.C. Promenade Concerts.

Birmingham.

AUGUST 10TH. — Second B.B.C. Composers' Light Programme.

Bournemouth.

AUGUST 9TH.—A Scottish Night.

AUGUST 10TH.—"Summer Holidays." A savoury for those who have had their holidays.

AUGUST 11TH.—Spanish Programme.

Cardiff.

AUGUST 10TH.—"The Make up Box" Concert Party.

AUGUST 12TH.—A Weatherly Recital.

Manchester.

AUGUST 9TH.—Eye-witness Account of the Last Day's Play in the Lancs. v. Kent County Championship Cricket Match, played at Old Trafford.

AUGUST 11TH.—Mr. Phillip Gallimore: "Gentlemen of the Road."

Newcastle.

AUGUST 8TH.—"Omar Khayyam." An Oriental Phantasy in a Persian Garden.

Glasgow.

AUGUST 8TH.—A North American Programme.

AUGUST 9TH.—Ladies' Night.

AUGUST 11TH.—"Catherine Parr" or "Alexander's Horse." A sketch by Maurice Baring.

Aberdeen.

AUGUST 11TH.—Mr. C. H. Webster: "The Ideal Cricketer."

AUGUST 12TH. — "A Valuable Rival." A Lowland Scots Comedy in one act.

Belfast.

AUGUST 8TH.—"St. Christopher's Medal," a play. "Over the Hills," a comedy in one act.

AUGUST 13TH.—Fred Duprez (Comedian).

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Middle-aged Programme.

"A Middle-aged Man" has arranged for broadcasting from 2LO on August 17th one of the series of "My Programmes."

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All Scotch.

The Scottish National Players pay a visit to the Aberdeen studio on August 12th, and will broadcast a programme of Scots folk songs, choruses and readings. Included in their programme are two plays, "A Valuable Rival," by Neil G. Grant, and "The Crystal Set," by John H. Bone. Miss Elliot C. Mason, Miss Nell Ballantyne, Mr. Charles R. M. Brookes and Mr. Tyrone Guthrie will assist in the production of this programme.

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"La Bohême" from 2LO.

On August 19th a performance of Puccini's opera, "La Bohême," will be broadcast from the London studio, with Heddle Nash as Rudolph, Frederick Collier (by permission of Russell Janney, the "Vagabond King" Company) as Schaunard, and Sylvia Nelis as Mimi.

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Talks on Wireless Careers.

Wireless as a career will form the subject of a series of talks to be given from the Birmingham station, beginning on August 16th, by Mr. W. E. Elliott, Principal of the Universal Radio College, Birmingham. He will deal with the possibilities of wireless as a career, and describe the openings available for young men.

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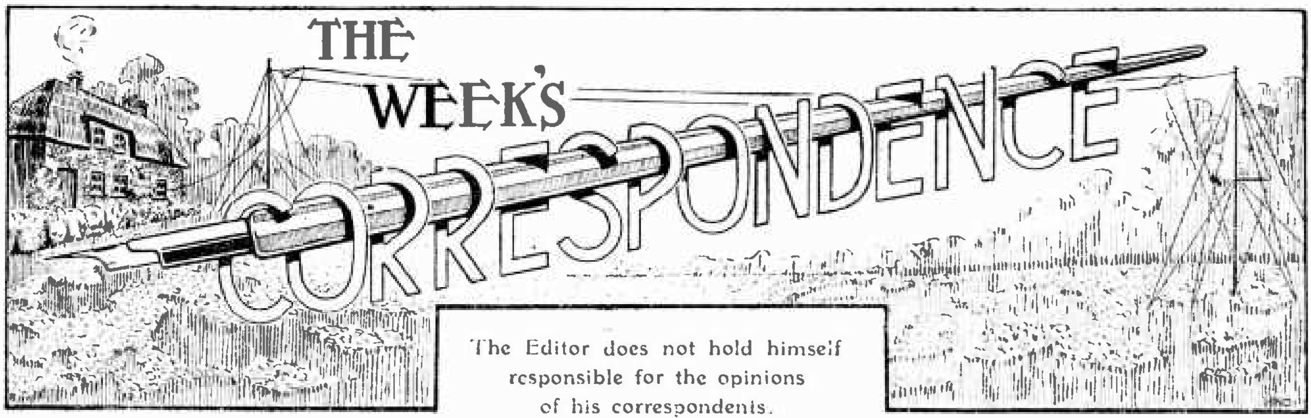
The Impersonal Corporation.

That reliable criterion of public interest in broadcasting—the correspondence bag at Savoy Hill—is still well filled each day, despite the so-called "off season." The letters deal largely with future programme suggestions, while some contain praise or blame in connection with broadcasts already carried out. Needless to say, the oscillation problem also comes under review.

But the most noticeable feature is the change which has come over the general style of the letters since the advent of the Corporation. The personal touch which entered into the correspondence in the days of the British Broadcasting Company has vanished, and with it has gone much of the humour that helped to make up the Savoy Hill letter bag.

Nowadays the ordinary person rather hesitates to intrude upon the official sanctity of the Corporation; he would as soon send a chatty letter to H.M. Postmaster-General.



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

Correspondence should be addressed to the Editor, "The Wireless World," Dorset House, Tudor Street, E.C.4, and must be accompanied by the writer's name and address.

METRES AND KILOCYCLES.

Sir,—With all due respect for Capt. Eckersley's superior knowledge of the subject, I feel sure that he is wrong in one or two points in his article, "Frequencies or Wavelengths," in *The Radio Times*.

His remark, "of course, the whole thing does not matter one button to the man in the street," shows his complete ignorance of the subject from the point of view of the "man in the street," for it does matter a very great deal to the "man who pays the piper" whether the onus of calculation between kilocycles and metres is thrust upon him, instead of, as at present, on the engineers.

If, as Capt. Eckersley points out, kilocycles are only given to facilitate matters for the engineers, why publish them at all to the general public, who do not want them? Surely it should only be necessary for the engineers to be supplied with a list of the kilocycles and their corresponding wavelengths in metres?

The whole truth is that the "man in the street" is more than a little nervous that the system that he is used to, and that his set is calibrated to, etc., will eventually be dropped by the B.B.C., and he will be forced, whether he likes it or not, to have something that he does not want.

If Capt. Eckersley were wise he would keep the frequencies for his technical engineers, who apparently have always worked in kilocycles, and allow us (the men in the street) this opportunity to regain our waning confidence in him, and to feel that his point of view was not entirely a personal one.

London, W.8. D. A. BENTLEY.
July 15th, 1927.

INTERNATIONAL ASPECTS OF BROADCASTING.

Sir,—In the replies by Messrs. G. Rolland Willans and H. D. Harris to my letter which appeared in your issue of June 29th, both of them admit—as they must do—that the erection and maintenance of a short-wave station by the B.B.C. would entail some expenditure; but both assume that such an expenditure would be of negligible dimensions. They have no knowledge of what this mere side-line would cost. Neither have I, but, even if the cost of erection and of the first year's maintenance were only £20,000, it would be that much definite reduction in the revenue set aside for the provision of programmes for the people who actually pay. Whether these people pay 10s. or £10 per annum per head is beside the point.

Already a ridiculously large proportion of our licence fees is filched by others. One would think it common justice that the Post Office should be paid solely for the work they do in collecting licence duty, tracking down oscillators and rounding up non-licensees. Instead of this, a goodly surplus is absorbed by an insatiate Exchequer as an item towards the expense of the general upkeep of the country. Uncomplainingly and patiently have we tolerated this obvious sharp practice. Now we are asked to tolerate still another theft.

I claim, without fear of contradiction by reasonable men, that my point of view represents that of the greater proportion of listeners. The clamour of those who want a special short-wave station for Empire Broadcasting is but the usual strident demand of a noisy minority. Analysed, this minority consists of: (1) Well-meaning people who feel that they *must* do something (with other people's money) for the poor, lonely Sons of Empire; (2) short-wave enthusiasts who nightly comb the overworked ether in search of distant transmissions and noise; (3) the "emigrant population" (as Mr. Willans calls them) who wish to be kept in touch with the Mother Country.

I have every sympathy with the ardent desire of the third class to hear the boom of Big Ben, the winner of the three-thirty, the merry rattle of the Savoy Orpheans, and the decorous, uplifting beauty of a B.B.C. Sunday programme. If I lived in Calcutta, Roorkee, Almora, Nigeria, Wessels Nek, Trinidad or Umlazi, I should most certainly clamour for a far-reaching British Broadcast. But I am sure that I should also admit that it was unreasonable to expect *special* and *free* provision for my needs. If I wanted to be kept in touch with the trend of the average Englishman's intelligence and desires and politics as depicted by such enlightened papers as the *Daily Mail*, the *News of the World* and *John Bull*, then I should order these papers *and pay for them*. Why not?

If the short-wave supplicants "who people our distant units of Empire" were poor, ragged, underfed, underpaid derelicts from the Mother Country, I would say, most cheerfully, let the poor beggars have a free listen-in. But they are not in this unhappy financial position. They are not in the position of hungry urchins seeking to peer for a moment through the rents in the canvas of a circus tent. If they can afford a wireless set efficient enough to give them enjoyment of a programme which has penetrated several thousand miles of atmospheric disturbances, heterodyning and jamming, then they can afford to pay for, or contribute towards, the cost of erecting and maintaining a short-wave station.

Consequently, I maintain that there are two simple solutions to this question:—

(1) If Empire Broadcasting is of purely national importance, then let the nation do the job and pay for it (instead of expecting a relatively small number of licensees to bear the expense).

(2) If Empire Broadcasting is of imperial importance, then let the Empire do the job—and also pay for it.

Why is there no Empire Radio Society to cater for the needs of all these eager people living in the distant units of Empire and for the gentlemen at Illingworth and Brighton who dabble in 20- to 30-metre stuff? Why will they not inaugurate such a Society, pay their subscriptions like patriots and men, and, out of such a joint income, erect and maintain their own short wave station in Britain? The B.B.C. would then, I am sure, be only too pleased to supply them with entertainment and uplift juice, free, gratis and for nothing. They could "tap" and broadcast just what they wanted, and I—and 2,249,999 other listeners—would register no protest at all.

To sum up once again, the *average* listener wants the best entertainment he can get for his money, and is not interested in short-wave transmissions. Why, then, should he see his beloved B.B.C. bullied into spending some of his money on such a side-line merely because a strident minority is chiefly concerned with distance and noise? To hear a 22.02-metre account of the national hysteria caused by Lindbergh's arrival in U.S.A. (compared with the quiet British welcome of Brown and Alcock some years ago) may excite the tinfoil and mica emotions of a short-wave intelligence, but, like all noisy novelties, it is apt to pall in time. A short-wave station would be valueless to the average home listener. Therefore, why, in Heaven's name, should he pay for its erection and maintenance?

Twickenham. BERTRAM MUNN.

July 13th, 1927.

Sir,—Mr. Bertram Munn, in his letter, apparently strongly objects to Britishers in the remoter districts of our colonies being given the opportunity of getting in touch with the Old Country. Surely this is a very selfish attitude, and I have no doubt that, of the 2,300,000 licensed listeners in Great Britain, the majority would not agree with him, but would be only too willing for the surplus revenue to be used towards the cost of erecting a short-wave station. It is very apparent that Mr. Munn does not know the very-often-present feeling that settlers in our colonies experience of being cut off from all home news, and I can assure him that to those settlers a short-wave British station would be a Godsend.

Mr. S. G. Fisher may be glad to know that there are at present two or three short-wave transmitting stations in Kenya Colony, and the writer hopes to have the pleasure of co-operating with him in experimental work on the lower waves from his station KY1AA in Nairobi, which will shortly be re-opened. L. DE FOLDU MORRISON.

Ballater, N.B.

July 13th, 1927.

THE PROPOSED REGIONAL SCHEME.

Sir,—In connection with the article in your issue of July 13th on the regional scheme, I beg to submit the following suggestion.

Two or more alternative programmes to be broadcast as circumstances allow. Each programme to have a wavelength allotted to it, and to be broadcast from one or more main stations as may be convenient. A large number of low-power relay stations to receive the programmes by land line and to broadcast them on their respective wavelengths. Thus the relay stations would have no wavelength of their own, but would use the wavelengths allotted to the programmes, each station simultaneously sending out as many programmes as are provided.

Alternatively, relay stations might receive the programmes by wireless, but in this case rebroadcasting would be on different wavelengths to those used by the main stations. All relay stations, however, would share the same wavelengths. Thus the maximum number of wavelengths required would not exceed twice the number of programmes provided.

Bristol. G. B. BENNETT.

July 20th, 1927.

EMPIRE BROADCASTING.

Sir,—May I suggest that there is plenty of money for the home service as well as an Empire short-wave service if the licence fees were used proportionately. To my mind there should be *no* surplus, the P.M.G. taking only enough to cover the *real* expenses connected with the licences, etc., the rest of the money would be ample to give us the *best* alternative programmes from the latest equipped regional stations, and a short-wave transmitter for the Empire.

Some of your correspondents seem rather selfish in their views, the short-wave station would be solely for the Colonies, etc., and it would be up to the latter to have the right sets on the market for reception; after all, it is the overseas listener who wants to hear England, not the other way round, so why worry about our present sets being no use for short waves?

Personally, I am going in for one if my situation is not too bad for reception on 20 to 70 metres.

London, W.8. (MISS) A. N. J. SHORTER.

July 14th, 1927.

Sir,—My letter in your issue of the 6th inst. appears to have created a considerable amount of misunderstanding. In the first instance I should like to enlighten Mr. Bevan Swift when he says I am not in possession of facts concerning the T. and R. Section.

When I wrote "this admirable organisation has never distinguished itself very greatly in any direction" I meant this essentially in so far as it applies to the public eye. It must be remembered, I think, that the broadcast listener regards the amateur transmitter as something of a rather pestilential nature, liable to interfere with his beloved broadcast. My reason, therefore, for making the above statement is that the T. and R. Section is practically unknown to the greater masses and that a little publicity through the medium of its suggested connection with Empire broadcasting would do it and the members of it, individually, no harm. Personally, I have always found the T. and R. Section a most excellent institution, enjoying its cake and tea after a hard day's work, and lectures equally so, although I must confess that I cannot remember having ever paid my subscription under its present constitution, but at the same time I have vague recollections when it was the Radio Transmitter's Society of giving ten shillings to Mr. Marcuse one evening for which he thanked me, of course, with his famous smile, a smile which if the rest of us possessed would make the world a better place.

I have the greatest admiration for the *genuine* amateur transmitter; I think he has done magnificent work in the past, has contributed very largely to the development of short-wave radio communication, that like most of us in this intolerable age he is persecuted by the ramifications of bureaucracy and Toryism and is compelled to fill the Treasury coffers to an absurd extent if he wishes to use a watt more than ten. On the other hand, I have absolutely no brief whatsoever for the "ham" or man who transmits simply to see his aerial ammeter read, and I maintain that these men are not even genuine "hams." As I understand the American "ham," his interest in amateur radio is far more from the point of view of fellowship with his fellow countrymen than a real technical interest; and he admits it. But not so your English "ham" (loathsome word); he wears a mask of hypocrisy by assuming he is an "experimenter" and transmits simply for the sake of shooting out his own call sign and the sheer bravado of the thing. A harmless amusement, to be admitted, but it would be rather more satisfactory to definitely define this class of transmitter as a "ham," pure and simple, and not embody him with men who really do know what they are talking about and are genuine amateur radio engineers, such as those who operate the stations mentioned in my last letter.

However, this is beside the issue of Empire broadcasting. I can only assure Mr. Bevan Swift that I meant no offence to the organisation of which he is past chairman, that I shall continue to eat the said organisation's cake and drink its tea with great relish, that I shall devour its lectures and discussions in like capacity, that I shall do both these things if I am not prevented from entering its premises by a hard-hearted treasurer.

In reply to Mr. A. O. Milne, I still maintain that the B.B.C. made an evasive reply when the whole question of Empire broadcasting arose. And it was the engineering staff that must have appeared to be the cause of that reply in the eyes of the public. I consider the technical capacity of some of the B.B.C. engineers to be unequalled, and I merely asked the question as to why the whole argument of technical unreliability should be brought up in order to cover the parochial minds of the B.B.C. and people like Mr. Milne, whose conception of Empire appears to be essentially confined to the British Isles.

No one is asking the B.B.C. to provide a service which does not benefit the home community in the least and for which it has to pay. I have suggested a scheme in which the B.B.C. could derive revenue from the Colonial Governments, if it were operating an Empire service, no doubt the bare suggestion of which has its faults, but I believe it to be the nucleus of a system which would operate satisfactorily. I notice Capt. Fraser found time to put a question to Mr. Amery on the subject, however.

Mr. Milne says that I have suggested that the T. and R. Section should pay for Empire broadcatsing. I have suggested nothing of the kind, but mentioned that if any amateur station did volunteer to help along the preliminary experiments of a service I thought the T. and R. might help him financially if he incurred any small expense. And I mentioned it because I knew that if this happened the T. and R. Section would get into the daily Press along with the amateur who volunteered, thereby resulting in splendid propaganda for the T. and R. and opening the eyes of a somewhat sceptical public.

But does it not seem strange that the B.B.C. cannot undertake the preliminary task of an Empire service at once? Is it not lowering their prestige in the eyes of our far-flung Empire community to let Mr. Gerald Marcuse, patriot and enthusiast, start the ball rolling from his amateur station? I have never been to Daventry, but I assume the power supply must be extensive and flexible; I assume also that the station has facilities, what with its four hundred feet masts and so forth, for putting up a short-wave aerial; I assume also that a suitable space is vacant or could be made vacant in the existing buildings for the erection of a short-wave transmitter, a set in any case which does not occupy a great deal of room, even with high input. We have our power supply, aerial, space for accommodating transmitter, already existing line amplifiers and other minor equipment. Where, then, is the gigantic, overpowering, devastating expense? Why should the B.B.C. spend, perhaps, a few hundred pounds of the British public's money on a venture which might eventually be one of the greatest bonds of the Empire? And why cannot the B.B.C., with their power supply, etc., etc., and vast army of engineers, put up an experimental circuit at Daventry immediately?

I leave the answer to the imagination.

Mr. F. A. Robinson asks if I have ever listened-in on short waves; I have, and I think the B.B.C. relays have been marvels of radio engineering skill on some occasions, and I rejoice in hearing the voice of Mr. Partridge, momentarily turned announcer, before the relay is put through. On the other hand, I am quite ready to admit that fading is objectionable and that short waves have their own peculiar symptoms like everything else connected with wireless. But I still maintain that a short-wave station would feed India or South Africa with more satisfaction to listeners in those countries than Daventry.

Brighton. DALLAS BOWER.
July 20th, 1927.

TRADE NOTES.

Bowyer-Lowe to Move.

The Bowyer-Lowe Co. is obviously not feeling trade depression. The company is on the move to a bigger factory. For some time past Bowyer-Lowe progress has taxed their present accommodation severely. A move to another site in Letchworth is planned to take place in September.

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A Presentation.

By a happy inspiration, and as an earnest of his faith in the educational and recreative possibilities of radio, the president of the Wireless Retailers' Association of Great Britain, Sir Charles Bright, F.R.S.E., has decided to present a complete wireless receiving station to the local institute at Hatfield Heath, near which he resides.

The installation consists of a three-valve set made up of detector and two L.F. amplifiers, specially constructed by Radi-Arc Electrical Company (1927), Ltd.

The low-tension current is to be supplied from a non-sulphating battery made by N.S. Accumulators, Ltd., who guarantee their products to be proof against sulphation.

The installation is completed by the very latest in loud-speakers, and the local ear for wireless music will be cultivated through the medium of a handsome A.R.19, the product of Graham Amplion, Ltd.

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Making Loud-speakers at Home.

That loud-speaker building will be one of the most popular hobbies in the coming winter is prophesied in the current issue of the "Brown" Budget, issued by S. G. Brown, Ltd., North Acton, in an article on the "Brown" C.T.S. Unit and C.T.S. Accessory Set, by the aid of which anyone can build a complete horn or disc type loud-speaker. Both the unit and set are being put on the market in response to an undoubted demand for components which will assist the tyro in the construction of his own loud-speaker.

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New Press Agent.

Mr. C. D. Clayton, of Messrs. Charles D. Clayton, Ltd., Gloucester House, 19, Charing Cross Road, W.C.2, has been appointed Press agent for the Radio Manufacturers' Association.

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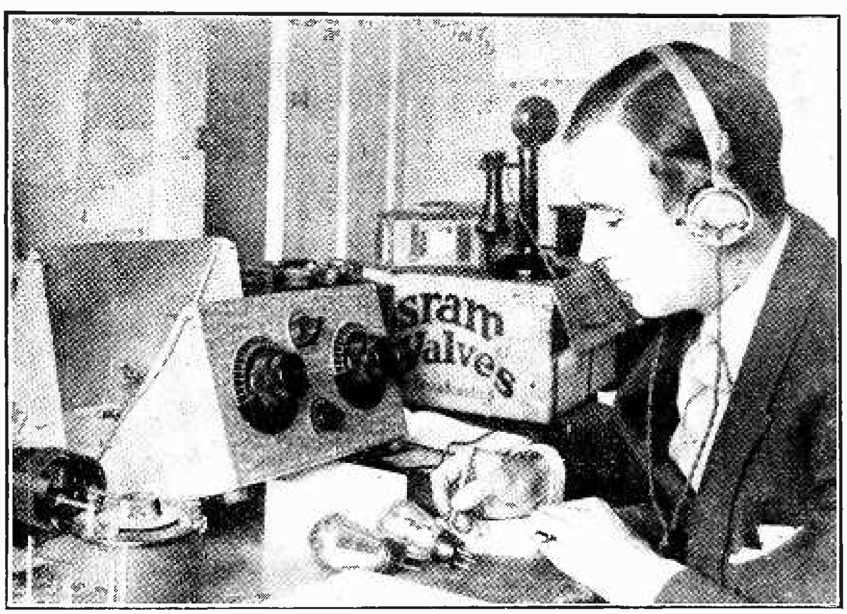
Catalogues Received.

The Marconiphone Co., Ltd., 210-212, Tottenham Court Road, London, W.1. Instruction books concerning the new Marconiphone Three Valve Receiver, Model 32, and new A.C. Unit, Model A.C.2.

Hart Accumulator Co., Ltd., Marshgate Lane, Stratford, London, E.12. Price lists of "Hart," "Radio," and "Compacto" high-tension accumulators.

Wright and Weaire, Ltd., 740, High Road, Tottenham, London, N.17. Price lists of "Wearite" components, including coils and the "Wearite" H.F. choke.

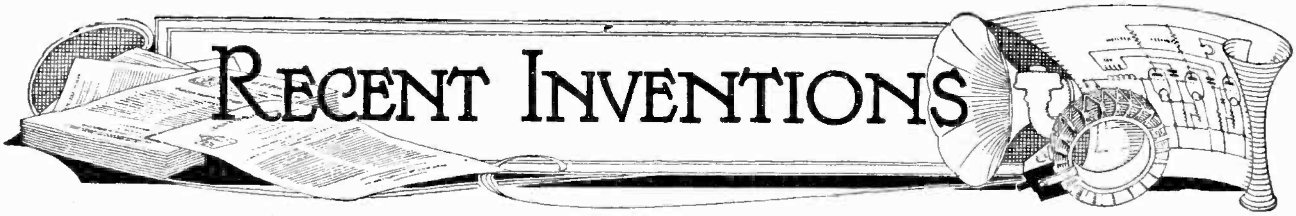


ON 32.79 METRES. Listening to the account of the Dempsey–Sharkey fight broadcast from 2XAF. It is interesting to note that the set, which incorporates G.E.C. valves, is similar to that described in "The Wireless World" of June 29th last.

BOOKS RECEIVED.

"Die Mehrfachröhre und ihre Verwendung in Selbstbau." Notes and diagrams of various valve receiver circuits, being Part IV. of Dr. Funk's "Wohlfeile Rundfunk-Technik." Pp. 80, with 26 illustrations and diagrams. Published by Rufu-Verlagsgesellschaft m.b.H. Hamburg. Price 60 pfenninge.

"Navigational Wireless," by S. H. Long, D.Sc., M.I.E.E. A text-book on the theory and practice of wireless telegraphy as applied to direction finding. Pp. 164, with 162 diagrams and illustrations. Published by Chapman and Hall, Ltd., London. Price 12s. 6d. net.

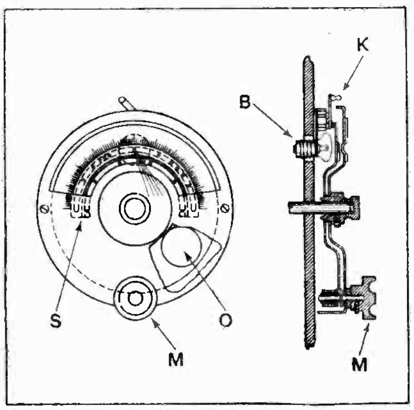


The following abstracts are prepared, with the permission of the Controller of H.M. Stationery Office, from Specifications obtainable at the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1s. each.

Rapid-tuning Adjustments.
(No. 271,004.)

Convention date (Germany), June 27th, 1926.

To reproduce rapidly the precise adjustments necessary to cover the wavelength of a particular station to which the set has previously been tuned is not always a simple matter, particularly when the tuning condenser is provided with a vernier control. Mr. Nehrke overcomes this difficulty by mounting a strip S of black paper or celluloid behind the graduated dial and in front of a small flash-lamp bulb B. A small depression



Illuminated dial to facilitate rapid tuning. (No. 271,004.)

is formed in the outer dial through which a needle can be passed to pierce the blackened strip when the station is first tuned in.

Subsequent retuning on the vernier knob M is facilitated by the appearance of the ray of light from the flash lamp. A switch K is provided for lighting the lamp as required, whilst an aperture O is formed in the scale disc to enable it to be renewed when necessary.

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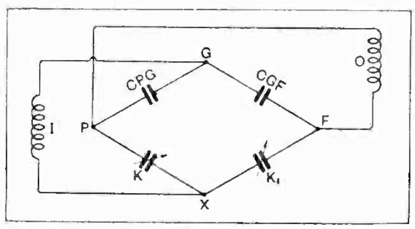
Stabilising H.F. Amplifiers.
(No. 270,531.)

Application date: August 14th, 1926.

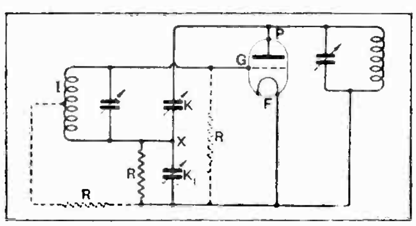
A scheme for neutralizing the interelectrode capacity of an amplifying valve is described by Mr. C. P. Allinson in this patent. It is based upon a Wheatstone bridge arrangement, in which one arm comprises the internal plate-grid capacity, CPG, whilst another arm contains the complementary grid-filament capacity CGF. In this way two of the internal electrode capacities are accounted for.

The remaining arms of the bridge contain condensers K, K_1, which may be of much larger value than CPG or CGF, provided the correct balancing-ratio is maintained. The input or grid coil I is connected from the grid G to a point X, which it will be noted, is not necessarily at earth or filament potential, but is separated therefrom by the condenser K. The output coil O is connected as usual across the plate P and filament F.

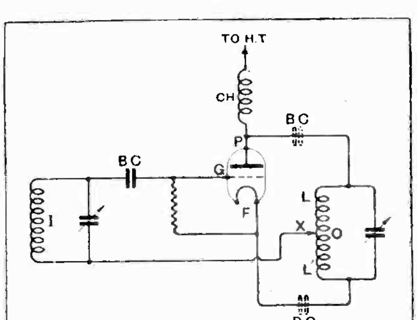
Diagrams (b) and (c) represent two alternative circuit arrangements based upon this principle. In (b) a stabilising resistance R is shunted across the balancing condenser K_1, or it may be connected as shown in dotted lines. In (c) the balancing capacities K, K_1, are replaced by equivalent inductances, these in fact being constituted by the two sides L, L_1 of



(a)



(b)



(c)

Circuits of stabilised H.F. amplifier. (No. 270,531.)

the tapped output coil O. A blocking condenser BC may be inserted in the grid lead, or in either of the dotted-line positions shown. The plate voltage is supplied through a choke coil CH.

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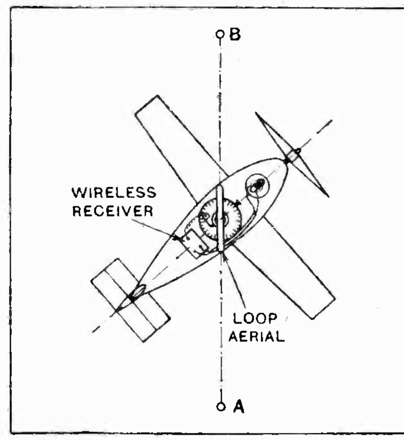
Aircraft Wireless.
(No. 265,940.)

Convention date (Germany), February 12th, 1926.

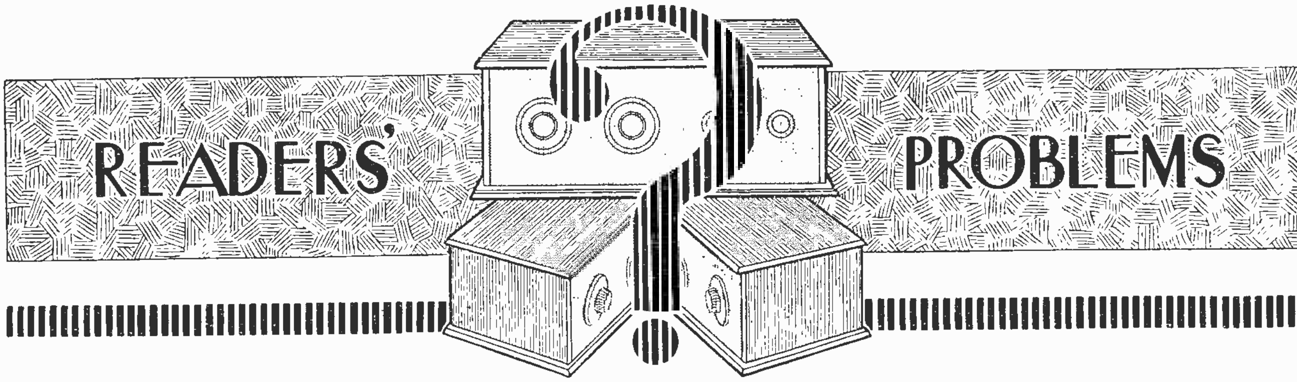
Herr Junkers instals in an aeroplane a loop aerial which is continuously rotated at a low speed by means of a



Rotating frame receiver for use in aerial navigation. (No. 265,940.)

slip-stream windmill, or by reduction gearing from the engine. Adjustable contacts on the aerial spindle make an intermittent connection between the loop and a receiving set once every half-revolution, so that a corresponding short response is heard in the phones. The intensity of the received signal gives an indication of the angle between the direction of flight and the known bearings of a beacon station located along the line AB. As the machine yaws away from the direction of AB the signal note diminishes in strength, and *vice versâ*.

As an additional aid to navigation the spindle contacts are arranged to emit an independent note from a local source at the particular moment when the loop, in its rotation, passes a definite position relative to the longitudinal axis of the aeroplane. When this auxiliary note coincides with maximum strength of reception from the beacon station, the aviator knows that he is flying in the desired direction.



"The Wireless World" Information Department Conducts a Free Service of Replies to Readers' Queries.

Questions should be concisely worded, and headed "Information Department." Each question must be accompanied by a stamped addressed envelope for postal reply.

Output Transformer or Choke Filter Circuit ?

I am building the "All Wave Four" receiver, using the modified circuit which you publish in your June 8th issue. I intend to use the receiver in conjunction with an ordinary 2,000-ohm loud-speaker, but as later on it is possible that I shall build a moving coil loud-speaker with a low-resistance coil winding, I am rather in a dilemma concerning the output circuit which I should adopt. If I use a choke filter output circuit or a 1 to 1 ratio output transformer, this will be in order, for my present loud-speaker, but will presumably be unsuitable for the moving coil type, whilst if I put in a step-down transformer having a ratio of 1 to 25 or thereabouts, I should be able to use a moving coil loud-speaker but not the ordinary type. It appears that the only thing for me to do is to insert in the set two output transformers, or one step-down transformer, and a choke filter circuit with a change-over switch. As this would be rather expensive and cumbersome, I was wondering if you could inform me of any simpler way out of the difficulty? O. F. A.

Your problem is far more simply solved than you suppose. We should advise you to purchase neither a 1 to 1 transformer nor a choke, but should advise that you obtain a step-down transformer having a ratio in the order of 1 to 25 and connect it up in accordance with Fig. 1. You will notice by studying this diagram that when using an ordinary loud-speaker we are making use of the primary of this transformer as a choke, and using a choke filter output circuit, the ordinary loud-speaker connecting to terminals T_3 and T_4. The secondary winding will only be used when you eventually obtain your moving coil instrument which will connect to T_1 and T_2. Since naturally the primary of the transformer is intended to be connected in the output circuit of a power valve, it will make an excellent choke. You will find no difference in results, whether you use a choke filter circuit such as this or a 1 to 1 transformer for your ordinary type of loud-speaker.

In our diagram you can make use of the single wire loud-speaker extension system in the usual manner in the case of an ordinary loud-speaker by connecting the extension wire to T_3, the other terminal of the distant loud-speaker being earthed. In the case of the moving coil loud-speaker, T_2 should be connected to the earth terminal of the set, whilst the extension wire connects to T_1, the other terminal of the distant loud-speaker being earthed, as before.

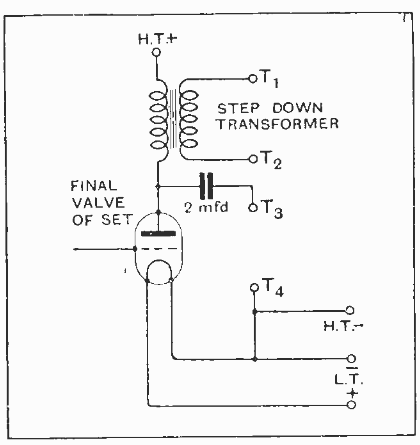


Fig. 1.—A comprehensive output circuit.

It might be pointed out that terminals T_1 and T_2 will be found very useful for tuning in different stations on the telephones, and may thus be put to some use, even before you obtain your moving coil loud-speaker. Thus it will be found that if a station is received on the loud-speaker connected to T_3 and T_4 at good volume, you will be enabled to obtain pleasing volume in an ordinary pair of 2,000 or 4,000 headphones by connecting them up to T_1 and T_2, the volume being very loud in the loud-speaker, but only moderate in the telephones, due to the big step-down ratio. This is a useful tip to remember, as the telephones can be temporarily connected up to T_1 and T_2 for the purpose of tuning in different stations without disturbing the loud-speaker connections. In practice it will be found that the connection of telephones across the secondary winding will not upset the quality or volume given by the loud-speaker.

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Single Dial Control of the "Everyman Four."

I am intending to construct the "Everyman Four" receiver, but in order to simplify tuning I propose to alter the design in order to use one dial control. To effect this I intend to use two condensers mounted on the the same shaft for tuning the aerial-grid and the H.F. transformers. I shall be glad if you will give me a suitable layout and a practical wiring diagram. G. F. D.

We should be doing you a definite disservice by giving you a wiring diagram and the particulars you desire, because by attempting to use one dial control you would be sacrificing a large part of the efficiency of this receiver. This instrument has two control dials, and, since we have two hands, not the slightest difficulty is experienced in searching for distant stations, as both dials can be rotated simultaneously. The two dials keep more or less in step with each other, but not absolutely so, with the result that the efficiency gained by employing two-dial control (which, after all, is just as simple as single-dial control) is very considerable indeed.

Apart from the fact that the efficiency of the receiver would be sacrificed by making your suggested alterations, you will realise that your project requires a complete rearrangement of the components in the receiver, and the receiver would no longer be the "Everyman Four," nor could it even lay just claim to the title of a modified "Everyman Four," as it would depart so greatly from the principles laid down in the articles concerning that receiver. A two-control receiver is always much more efficient than a single-control receiver, the only exceptions being a crystal set and a set designed for the local station only.

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External or "Home Grown" Oscillation.

I am a comparatively new entrant into the fold of broadcast listeners and I no doubt occasionally cause unintentional interference through permitting my receiver to oscillate. When receiving certain distant stations I have noticed a continuous whistle which cannot be eliminated by adjustments to my set. I should be obliged, therefore, if you could recommend a simple method of ascertaining whether the oscillations responsible for this whistle are generated in my own receiver or emanate from some external source. J. D. H.

If the heterodyne note can be made to vary in pitch by rotation of the tuning condenser then the receiver is oscillating. If, on the other hand, the note varies only in intensity when the tuning condenser is rotated, then the oscillation responsible for the heterodyne is generated externally. There is, however, another test which will indicate whether or no the receiver is oscillating. Tap the aerial terminal with a damp finger, and if a loud "plop" is heard in the telephones or loud-speaker the receiver will generally be found to be in a state of oscillation. Under these conditions the receiver becomes a low power transmitter and very considerable interference will be experienced by neighbouring listeners.

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Tropical Reception.

I propose to construct a receiver for use in the West Indies, but I am undecided as to which type of receiver would prove most suitable under the prevailing conditions. The main difficulty to be encountered will be accumulator charging, and the primary consideration, therefore, is economy in high and low tension consumption. I should be obliged for any advice you can give me in this matter. H. M.

The conditions with which you will have to contend would put out of court any of the multi-valve receivers designed for reception of the medium or long-wave broadcasting stations, and we think you would be well advised to concentrate on the reception of those stations transmitting on the very short waves. A number of the American broadcasting stations regularly transmit their programmes on wavelengths in the order of 20 and 30 metres, as well as on the longer wavelengths, and these short waves are more easily received over considerable distances than the latter. In addition to this the "atmospherics" are less troublesome on 30 metres than on 300 metres, with the result that signal strength over interference is greater. Full constructional details of a short-wave receiver, suitable for use under the conditions you desire to receive, appeared in *The Wireless World* of June 29th last, and we suggest you refer to this for further information.

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Increasing the Range of a "Superhet."

I have constructed a seven-valve superheterodyne receiver consisting of first detector, oscillator, three long-wave amplifiers, second detector and one L.F. valve. Ample volume is obtained from the local station, and a limited number of distant stations are heard at telephone strength. When the receiver is connected to a short aerial and the usual earth quite a number of stations are received at loud-speaker strength. I desire to use the receiver with a frame aerial, and should be obliged if you can suggest any alterations or additions which will enable the more distant stations to be heard on loud-speaker. W. S. R.

The sensitivity of your superheterodyne receiver could be considerably improved by the addition of a stage of radio-frequency amplification before the first detector valve. This will amplify the weak oscillations generated in the frame and enable better detectors to be obtained. The suggested arrangement is shown in Fig. 2, from which it will be seen that the high-frequency valve is neutrodyned in the usual manner, and the secondary winding of the transformer tuned by a 0.0003 mfds. variable condenser. The high-frequency transformer can be mounted on a base carrying a suitable number of pins, so that it can be easily changed for others covering different wavelengths. Constructional details of "plug-in" H.F. transformers were given in the issue of *The Wireless World* for April 27th last, and we suggest you refer to this for the necessary particulars. The valve V_1 should have an A.C. resistance of between 20,000 and 30,000 ohms, with an amplification factor of the order of 20, and will require a negative bias of about 1½ volts. The valve V_2 is the separate oscillator, and V_3 the first detector valve, in the anode circuit of which is connected the first intermediate frequency transformer.

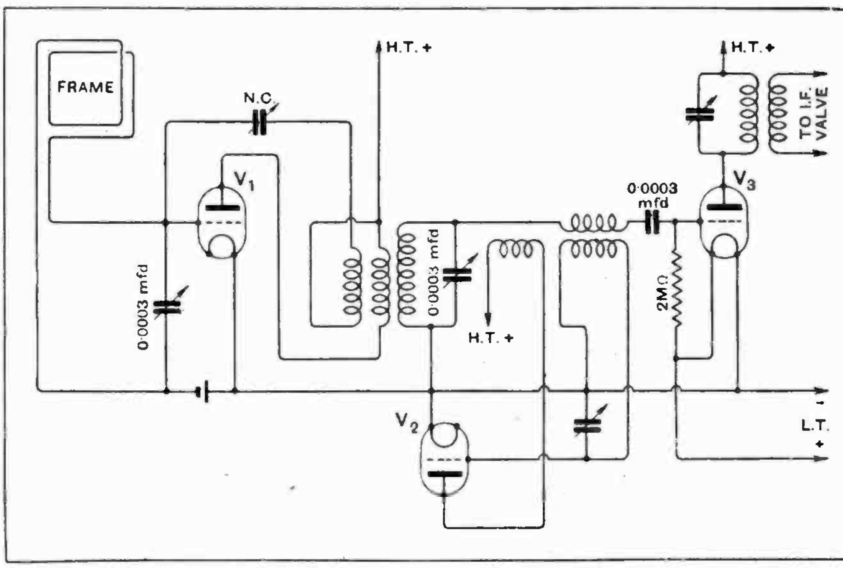

Fig. 2.—Adding a stage of H.F. amplification to a superheterodyne receiver.

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Raising the Voltage of D.C. Mains.

I propose installing a loud-speaker receiver. I have a private electric lighting plant giving 50 volts, which will not be sufficient for the L.F. valves. Is there any manner in which I could utilise my existing plant for H.T. purposes? V. E. N.

The first thing which occurs to us as being suitable for your case is that you should build the four-electrode valve L.F. amplifier which was described in full in an article appearing in our issue for May 4th last, which required an H.T. voltage of only 40 volts. A second method would be to purchase an additional H.T. accumulator and run it in series with your lighting plant. In this case do not forget, however, that the small H.T. accumulator will require to be charged at a much lower rate than your big lighting accumulators.

A third method is to obtain one of the small special motor generators that are on the market. Usually these are designed to run from a six-volt accumulator and to give on their output side various voltages, and are sold in several types. These instruments are usually completely contained in a metal casing and include special smoothing circuits built into them. Provided that they are obtained from a good maker, they are thoroughly reliable. You are advised to write for particulars to the M-L Magneto Syndicate, Ltd., Victoria Works, Coventry.

The Wireless World

AND RADIO REVIEW
(15th Year of Publication)

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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.

CONTROVERSIAL BROADCASTS.

THE B.B.C. is frequently getting into trouble through broadcasting matter of a controversial character—matter which sometimes is regarded as detrimental to certain commercial interests. The latest outcry comes from the Licensed Victuallers' Central Protection Society of London, which has expressed strong disapproval of a sermon recently broadcast from 2LO which advocated prohibition. The view was taken that it was unfair for the Broadcasting Corporation to permit one side of a case to be presented without giving equal facilities for the other side of the argument to be put before the public at the same time. Of course, these objections to the policy of the B.B.C. arise from the fact that broadcasting is a monopoly here, and there seems to be no redress against the organisation when matter is broadcast of a nature calculated to affect adversely the interests of certain individuals or sections of the community.

Whilst we realise that it would be almost impossible for the B.B.C. to avoid a certain amount of controversial broadcast matter, yet we feel that the weapon of publicity which the Corporation wields is so powerful that a very grave responsibility rests with those who permit the broadcasting of any matter which may be detrimental to the interests, either moral or commercial, of any part of the community. All the assurances of the members of the Mustard Club could not compete against the publicity of broadcasting if the B.B.C. chose to invite some anti-mustard crank to give a series of talks before the microphone. The question which, of course, must arise is where is the line to be drawn and who is to decide what controversial matter is harmless and what is not.

As things stand at present, the broadcasting of matter is conducted much on the same lines as is a high-class journal, where almost anything can be included by the editor at his discretion unless it is libellous or offensive; but the running of a journal is not a monopoly, and the circulation of the journal is largely dependent upon the editorial matter keeping within bounds. Broadcasting, for the reason that it is a monopoly supported by the Government, is placed in a very different position. The number of listeners far exceeds the number of readers of any printed publication, and there is no alternative broadcasting to which the listener can subscribe if he finds himself in disagreement with the policy of our present organisation. It would seem that there is room for some definite ruling which would prevent unfair use of the enormous publicity potentialities of the microphone.

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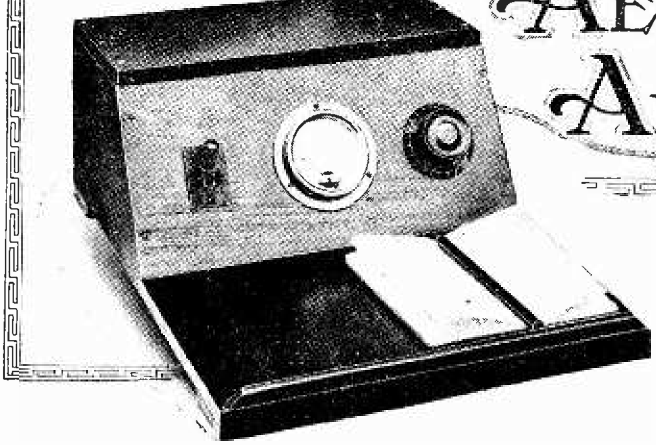
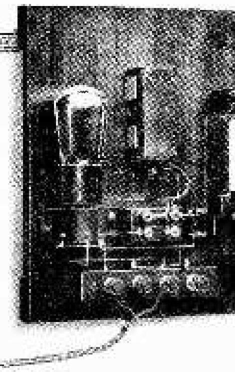
VALVE PRICES.

WE take some credit to ourselves for the fact that a reduction in the price of many existing types of valves has now been announced by the principal valve manufacturers of this country, for it was through the columns of *The Wireless World* that expression was first given to the need for such a price reduction, and we cannot but think that our campaign has at least contributed to bringing about this price reduction earlier than would have been the case in the ordinary course of events. Now that the reduction has taken place, the cheap valve set seems to be more nearly within reach, but manufacturers who would be able to produce the cheap valve set have still the handicap of the royalty to contend with. In our issue of July 27th we stated the case for a reduction of this royalty charge in order to bring the valve set into keener competition with the crystal receiver. Broadcasting will gain in popularity in this country in proportion as the valve replaces the crystal, but at present the contrast in price between the valve and the crystal set is too great for the change to be made by a large proportion of the listening public. A reduction of the Marconi royalty, so as to bring the charge on to a scale reasonably proportional to the selling price of the set, is a matter to which we urge that the Marconi company should give their close consideration. What might be lost to the company in royalty fees would, we believe, be amply offset in the results from increased sales of valves and other apparatus in which the company is interested.





Remote Indicating Aerial Ammeter

An Instrument which does not Increase Aerial Circuit Resistance.

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

THE use of aerial ammeters of the usual hot-wire pattern in low-powered transmitting sets introduces a considerable source of loss which perhaps is not so generally realised as it should be. Introducing such an ammeter in the aerial circuit increases the total resistance of the latter without increasing the radiation or "useful" resistance—in fact, the resistance of the ammeter alone may be as much as the whole aerial resistance before its insertion, especially when using one of the sensitive low-reading (and therefore high resistance) type which are suitable for low powers.

Disadvantages of Hot-wire Meters.

It certainly is essential to have some sort of indication of current in the aerial for adjustment purposes, and perhaps the obvious suggestion that would be made in view of the foregoing remarks is that the hot-wire meter should be used for adjustment purposes and then, when all adjustments for maximum current have been made, the meter should be short-circuited so as not to absorb a large amount of power when the set is used for signalling. Unfortunately, alteration of aerial resistance *after* adjustments have been made is quite likely to upset these adjustments, so that, although everything was correct for maximum current with the meter in circuit, when the latter is removed, some things—the coupling to the aerial, for example—are not in their correct position. Other disadvantages of the hot-wire ammeter—especially in its cheaper forms—are its sluggishness and the ease with which it can be burnt out.

It is sometimes very convenient to operate the receiver at some distance from the transmitter—in another room, for example—and to control the transmitter by means of a system of relays for switching supplies and for keying, but there is always the doubt as to whether the transmitter is continuing to function at its best efficiency. In order to get over this difficulty, the writer tried two types of remote indicating ammeters, one, which has already been described in this journal, using the aerial current to heat a valve filament and the emission current from the latter used to operate a D.C. milliammeter, and the other type using an anode bend valve voltmeter across some suitable part of the aerial circuit and passing the plate current of the valve also through a D.C. milliammeter.

The disadvantages of the first type are: (1) the insertion of resistance due to the valve filament into the aerial circuit, so that in this respect no advantage over the hot-wire type is gained; (2) the necessity of inserting the valve exactly at a point of earth potential, as otherwise considerable loss would ensue due to the leads from the valve and the indicating milliammeter, which would certainly be practically at earth potential.

Against these disadvantages is the advantage that the instrument can be made to indicate at a considerable distance from the actual point of insertion in the aerial circuit.

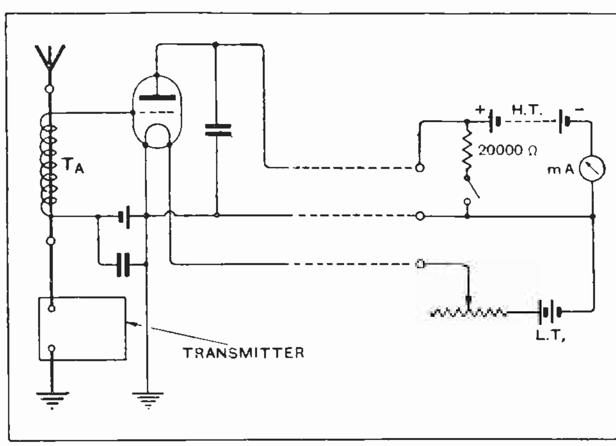


Fig. 1.—Circuit arrangement of the remote indicating aerial ammeter. The receiving set H.T. and L.T. batteries may be used for the ammeter as well if desired.

Remote Indicating Aerial Ammeter.—

Turning now to the second type, the anode bend valve voltmeter need introduce no appreciable loss in the aerial circuit; the indications given are as instantaneous as with ordinary D.C. instruments. It is practically impossible to "burn out" the instrument when currents which are far in excess of the normal full-scale current are met with accidentally, and, lastly, it is a very simple matter to instal, even as a remote indicating meter, since it does not very much matter in what part of the aerial circuit it is put, within reason.

The ammeter described in this article is of this second type. The circuit is given in Fig. 1, and shows the two parts of the instrument—the valve and one or two small components which are put near the aerial, and the valve batteries and the indicating milliammeter, which are put near the receiving set, or anywhere else as desired.

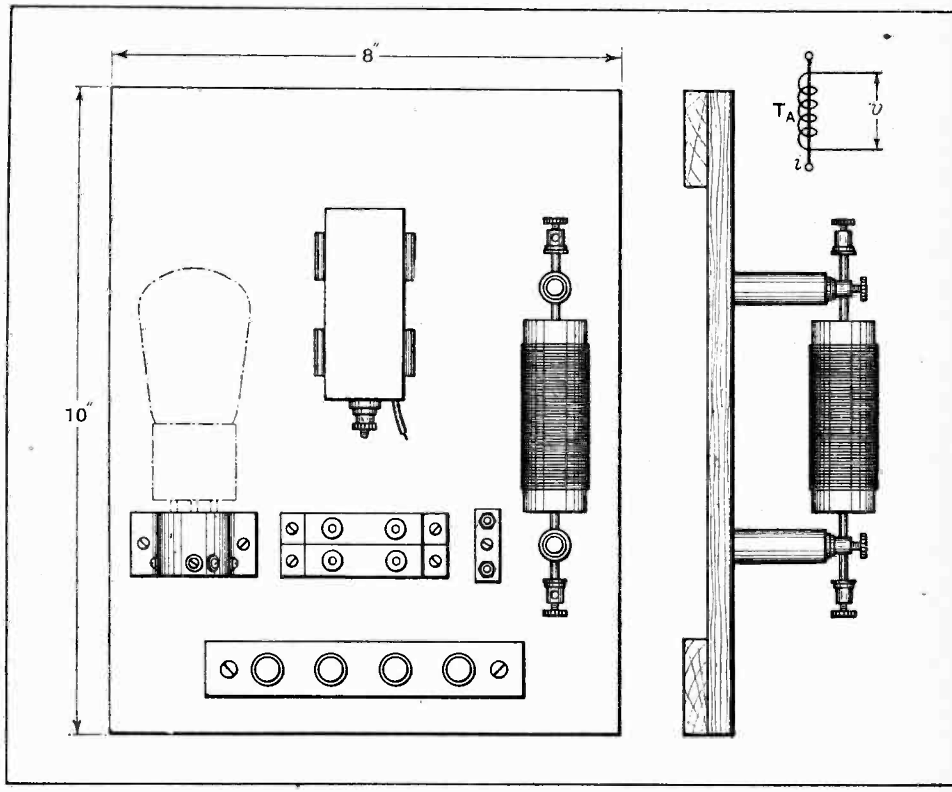


Fig. 2.—Layout of the valve and transformer portion of the ammeter. The aerial current i flowing through the primary rod of the transformer T_A produces a voltage v across the secondary which is measured by the valve.

It will be noticed that the grid bias battery is mounted with the valve in order to shorten the wiring, and that a condenser is used across this to look after any changes of resistance of this cell that may occur. This condenser is not strictly necessary if the instrument is to be used for indicating only, but is desirable if it is to be used for actual measurement work, so that the effective impedance of the battery does not vary with frequency.

The other condenser, connected between the plate and filament of the valve, is necessary so as to minimise any H.F. currents flowing to the rest of the meter which might cause loss and which would certainly make the reading of the D.C. milliammeter for a given voltage input to the valve depend on the frequency.

The Indicator Section of the Ammeter.

The second part of the instrument consists essentially of H.T. and L.T. batteries (which may be the receiver batteries if desired), a milliammeter reading about 0-2 or 0-3 mA., and a filament resistance for setting the working zero. If the meter is to be used for measurement work a resistance of the order of 20,000 ohms should be included, with a switch, so that the voltage of the H.T. battery used may be tested from time to time on the D.C. milliammeter. This scheme is shown in the diagram of connections (Fig. 1).

The method of obtaining a voltage for the meter to record is of interest. It really consists of a transformer with a half-turn primary and a multi-turn secondary—the number of turns in the secondary for a given diameter depending on the voltage required and the current in the primary. With one cell grid bias, the valve voltmeter will take up to 1 volt (R.M.S.) A.C. without loading up the circuit (*i.e.*, without running into grid current).

The writer advises that the secondary turns should be found by trial—it does not matter if too many are used

LIST OF PARTS.

1 Valve holder, "Apex" (Apex Elec. Supply Co.).
2 Fixed condensers, 0·005 (T.C.C.).
1 0-3 mA. milliammeter (F. C. Heayberd & Co.).
1 30 ohms filament resistance (L. McMichael).
1 Keyswitch (Ericsson).
Baseboard wood, 10in. × 8in. × ⅜in.
Resistance and holder, 20,000 ohms (R.I. & Varley).
1 60 v. H.T. battery, type No. 1,200 (Siemens).
1-1½ v. "T" type Siemens grid bias battery.
8 Terminals.
Sistoflex (Spicers, Ltd.).
No. 28 D.S.C. wire flex.

Approximate cost, less batteries and valve - £2 5 0

In the "List of Parts" included in the descriptions of THE WIRELESS WORLD receivers are detailed the components actually used by the designer and illustrated in the photographs of the instrument. Where the designer considers it necessary that particular components should be used in preference to others, these components are mentioned in the article itself. In all other cases the constructor can use his discretion as to the choice of components, provided they are of equal quality to those listed, and that he takes into consideration in the dimensions and layout of the set any variations in the size of alternative components he may use.

Remote Indicating Aerial Ammeter.—
at first, since the valve will not be burnt out by too many volts on the grid!

In using the ammeter—or valve voltmeter, as it is when the transformer is removed—the filament resistance should be adjusted until the milliammeter reads, say, 0.5 mA., or some other suitable value when there is no aerial current, this reading being called the working zero, and all measurements made afterwards with the same value of working zero.

For indicating purposes only the actual setting of the working zero may be dispensed with and the filament resistance used merely to control the *sensitivity* of the ammeter as a whole. Almost any valve may be used, but a low filament consumption type is usually preferable, and it is as well to use one of not too high an amplification factor, in order to obtain good deflections with H.T. supplies of the order of 40-60 volts.

The general form of an instrument made on these lines is shown in the photographs—but of course the actual form can be left entirely to the reader's particular needs. In conclusion, the instrument described will be found easy to construct and use, besides increasing the radiating efficiency of a low-power transmitting station.

RECTIFIERS FOR H.T. SUPPLY.

Circuits Obviating the Necessity for Centre-tapped Filament Winding.

By D. KINGSBURY.

THE usual scheme for obtaining a direct current supply from an alternating current source by full-wave rectification involves the use of a transformer with a tapped secondary winding. It occasionally happens, however, that one comes across a perfectly good transformer suitable in every way except that its secondary has not a tapping at the mid-point. Under these circumstances certain alternative rectifier connections become valuable.

Fig. 1 shows the voltage doubling circuit, which, although quite an old arrangement, does not seem to be very well known. Two separate half-wave rectifying valves are used, which are in a sense in series with one another. The theoretical no-load D.C. voltage of this circuit is $2 \times \sqrt{2} \times$ the A.C. R.M.S. volts. Assuming 220 for the latter the D.C. volts are just over 600. This means that good condensers must be used, and that the rectifier *must* be switched off before the filaments of the valves in the receiver prior to touching the latter if shocks are to be avoided.

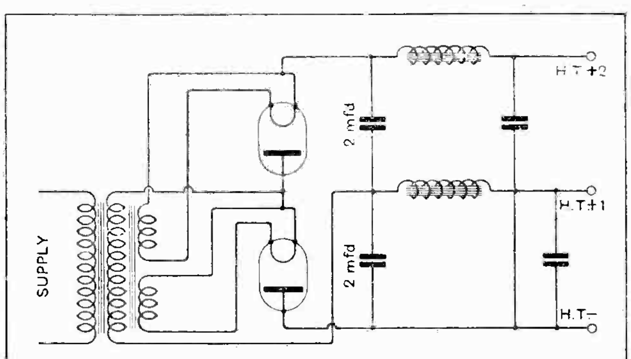


Fig. 1.—Full-wave rectifier with separate windings for heating filaments. The rectifying valves are virtually in series and a half-voltage tapping is available with half-wave rectification.

The voltage of the rectifier drops considerably as current is drawn from it, but 15 mA. at 250 volts or 20 mA. at 150 volts are easily obtainable from a 220-volt A.C. winding with normal rectifier valves. The former valve is very suitable for working an L.S.5 type valve, and the latter a D.E.5A or LL.525 (super-power) pattern.

It will be observed from the diagram that the filaments of the rectifying valves cannot be supplied from a common source.

One of the advantages of this circuit is that a half-voltage tapping is available on the D.C. side, although the current drawn from this is the result of half-wave rectification only. In general but a small current would be required at the reduced voltage, so that smoothing

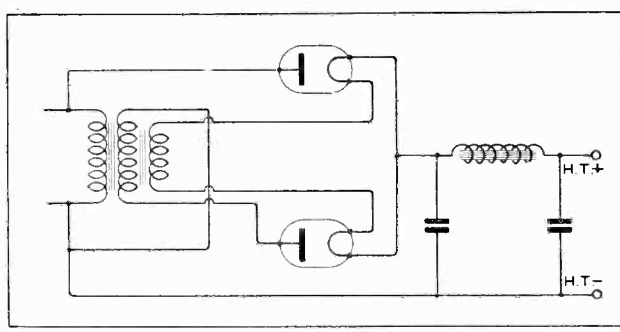
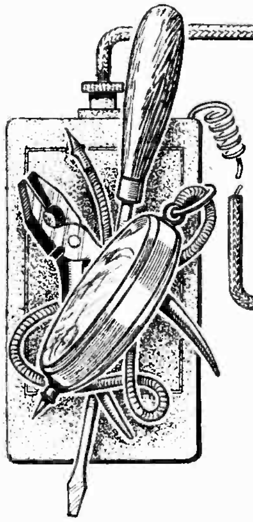


Fig. 2.—Rectifier in which the upper valve receives A.C. direct from the mains and the lower valve the opposite phase through a winding on the transformer.

apparatus need not be unduly expensive, the secondary of a discarded L.F. transformer in most cases being an adequate choke.

The short-circuit current of this arrangement is somewhat less than the saturation current of one valve, 44 mA. from valves capable of 50 mA. being a possible figure.

The circuit shown in Fig. 2 differs from the usual rectifier connections, in that one valve is receiving supply direct from the mains, while the other is provided with the opposite phase by means of the transformer. The behaviour of this arrangement is more or less identical with that of the standard circuit. It should be noted that the negative lead goes right back to the mains, and so care must be taken that the earthing arrangements in the set do not put this lead in direct contact with earth.



PRACTICAL HINTS AND TIPS

A Section Mainly for the New Reader.

PORTABILITY.

IT is a platitude to say that one of the first requirements of a portable set is that it shall be as light as possible. The trouble is that so very few are!

The modern resistance-coupled valve with grid-leak type of resistances in both anode and grid circuits represents one of the lightest possible arrangements, such a stage weighing as many ounces as a transformer-coupled stage capable of equally good results from the "quality" point of view would weigh pounds.

As far as portability is concerned, the loud-speaker remains a problem, and those who require extreme lightness would probably do best by arranging for phones only.

A satisfactory loud-speaker can be made from a reed mechanism, such as a Brown "A" type phone or gramophone attachment arranged to operate a diaphragm let into one side of the case, with possibly a protecting grill. Such an arrangement is extremely light, but the H.T. battery supply required for the power valve is much greater than would be necessary if phones only were used.

Possibly four-electrode valves will help us out here—power valves of this type are already available.

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THE CHOICE OF AN ACCUMULATOR.

ACCUMULATORS, or secondary batteries, are a comparatively expensive part of wireless receiving equipment in first cost, and possibly in upkeep. As a source of L.T. or filament current for the experimenter, however, they remain unsurpassed.

Purely utilitarian receivers are now sometimes made to work entirely from the house service mains, whether A.C. or D.C. (and quite rightly), but in probably every case it will be found that the choice of valves suitable for such arrangements is extremely limited, and so the experimenter prefers to retain, at least, his L.T. battery.

The choice of an accumulator depends essentially on two factors, the service for which it is required and the length of one's pocket. From the standpoint of sheer value in terms of ampere-hours per shilling expended, the glass box type of cell with a single pair of heavy plates is probably the cheapest. Such cells, however, suffer from three disadvantages: first, they must be discharged very slowly if their rated ampere-hour capacity is to be obtained; secondly, a very low charging current must be employed, which means that a very long time is required fully to recharge them; and thirdly, owing to the fact that only one side of each plate is facing a surface of opposite polarity and also to the wide separation between these surfaces, the internal resistance of this class of cell is somewhat high. This means that the voltage applied to any apparatus, such as valve filaments already connected, would be reduced appreciably if further apparatus taking a comparatively heavy current, such as a modern loud-speaker field coil, were connected to the same battery.

One maker, at least, has overcome the second objection—namely, the long time taken for a recharge—by laminating the plates, but it remains to be seen whether this type of construction will have as long a life as the true "mass" plate.

The foregoing remarks are not intended to deprecate the use of the "mass" plate cell, but to point out its limitations. The up-to-date experimenter probably has ambitious ideas on the subject of loud-speakers and sets capable of adequate volume without noticeable distortion, and it is an unfortunate fact that the demands on the batteries become heavier with almost each new published design.

It is desirable, therefore, to err on the large size when buying a new battery, and the following queries have been thought worthy of special mention for guidance in the purchase of an accumulator. Certain tips, based on practical experience, are added:—

(*i*) The case. Is it transparent? If celluloid, is it likely to hold together during the life of the battery? An opaque case is not suitable for an *experimenter*, who is presumed to take an intelligent interest in his apparatus. A flimsy case may eventually cost the price of a new carpet. The very best cells have a separate stout case for each cell, several cases being cemented together or held in a crate to make a battery.

(*ii*) General design. Is there adequate space beneath the plates for falling sediment? This is probably the most important point of all, as the ultimate end of an accumulator is frequently reached when the sediment is touching the plates, and so shorting across. Such a cell will not hold its charge for long. To turn a cell upside down and shake the sediment out, or to cut around the top of the case and lift the plates out to get at the sediment is to disturb the plates at a time in their life when they will not stand it. A first-class cell will have about ¾in. clear space beneath the plates, and by the time this is full the accumulator may be considered as worn out.

Can the top of the cells be kept clean easily, and are separate terminals fitted to each cell of the battery instead of burnt-on lead strips? Separate terminals allow tappings to be conveniently taken for valves of lower voltage, and the cells may be paralleled if for any reason a heavy current is required at not more than two volts. Are some type of non-corrosive terminals fitted? A fair proportion of accumulators have to be scrapped eventually because one or more terminals become so corroded as eventually to drop off. There is nothing like cotton wool, bought in quarter-pound packets at a chemist's, for keeping the top of an accumulator in a clean condition. Small tufts, used and discarded as if surgically unclean, will prevent casualties in the way of suits, tablecloths, carpets, etc. Should corrosion actually start on any terminals, the detachable portion should be boiled in strong soda water for a few moments, dried and well vaselined, and the fixed portions should be cleaned of all grease, dabbed over with ammonia solution on cotton wool, and then coated with vaseline. It is useless to vaseline an acid-wet surface, as the action will continue underneath the surface of the grease.

(*iii*) Life. To obtain a good long useful life from a battery, a discharge rate of 1-12th of its actual ampere hour rating is quite heavy enough. The most economical rate of charge and discharge is probably somewhat less, say, 1-20th of the actual rating. This means that the total current likely to be required at any one time for all valves, loud-speaker coils, relays, etc., should be multiplied by 20, and this figure taken as the best guide to the size of cell to purchase. It is well to get into the habit of thinking in terms of actual capacity. The ignition rating has absolutely no justification to-day.

Three years may be taken as a good life for an average cell, but this figure may be exceeded fairly easily if the charging is always done at home under carefully controlled conditions. The manufacturers' directions should be adhered to faithfully in all particulars.

The prolongation of life of a cell by repairs may be taken as doubtful, and in nearly every case is financially unsound. When a cell will not hold its charge, or will not take a charge, by far the best thing to do is to replace it with a new one.

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THE "EVERYMAN FOUR" ON THE GRAMOPHONE.

THOSE who are considering the use of an electromagnetic pick-up device, either ready-made or of the type described in a recent article in this journal,[1] may be interested to know that it is a fairly easy and simple matter to adapt the L.F. amplifying portion of an existing receiver for the reproduction of gramophone records. It will often be found, however, that the sensitivity of the pick-up, which is reduced by the necessary mechanical damping, will be insufficient to give full volume with two stages of low-frequency amplification. Fortunately, however, it is by no means difficult, in the case of a receiver of the "Everyman Four" type, or any other using anode-bend rectification, to convert the detector into an extra low-frequency amplifier. This valve is normally based so as to operate on the curvature of its grid volts-anode current characteristic, but by reducing the bias voltage by about 50 per cent. it will function on the straight part of its curve. When a potentiometer, in conjunction with grid cells, is included, any negative voltage may readily be obtained. An arrangement of this kind is shown in Fig. 1, which makes clear the necessary modifications. It will be seen that the pick-up transformer may be permanently connected, and that a single-pole, change-over switch is wired in such a way that it may be thrown into circuit as desired. For gramophone reproduction the filament of the preceding high-frequency valve (not shown in the diagram) will, of course, be extinguished.

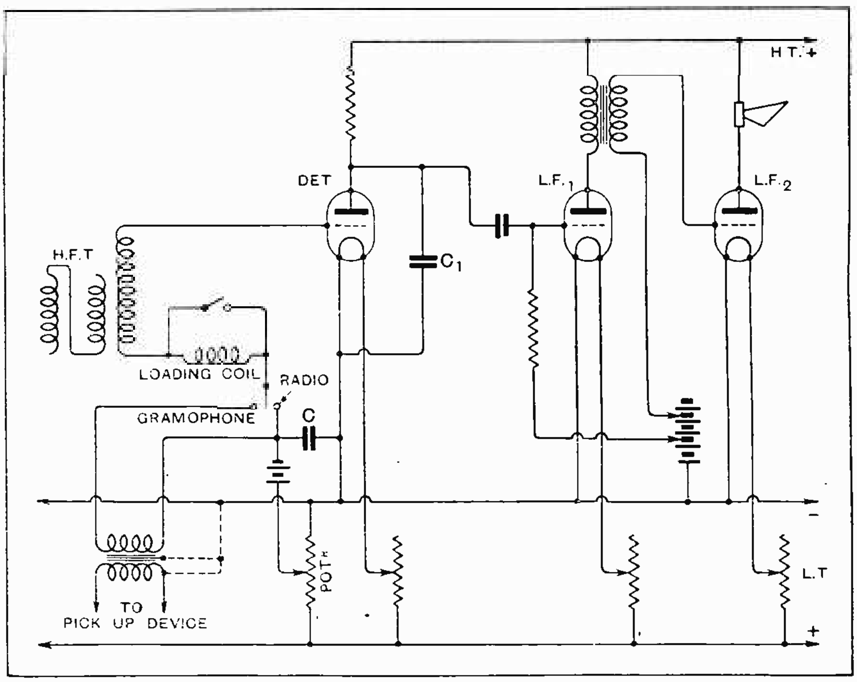

Fig. 1.—Showing method of connecting a gramophone pick-up device to a conventional receiver. C is the usual by-pass condenser across the potentiometer and grid bias battery, while C_1, the anode by-pass condenser, may be removed when the detector valve is converted into an L.F. amplifier.

To improve the stability of the amplifier it is recommended that both the iron core and one side of the primary winding of the pick-up transformer should be connected to the L.T. negative 'bus-bar (and consequently to earth), as shown in dotted lines.

If a potentiometer is not included it will probably be necessary to return the low-potential end of the transformer secondary to filament through its own bias battery.

[1] *The Wireless World*, July 20th, 1927.

THE CHOICE OF VALVES FOR REFLEX SETS.

THERE seems to be an air of mystery surrounding the choice of a valve which has to perform the dual functions of a radio- and an audio-frequency amplifier. Really the matter is quite simple if one looks at it from the quality, and therefore the audio-frequency, point of view.

In nearly every case the audio-frequency load following a reflex valve will be an intervalve transformer or a loud-speaker, so that we are at once limited in our choice to a valve with an A.C. resistance of 30,000 ohms in the former case, and 3,000 to, say, 6,000 ohms in the latter.

It *is* possible to make a valve of the 6,000-ohm class (L.525, D.E.5, etc.) work a loud-speaker on the local station at a range of, say, ten miles by working the valve reflex and using a very good crystal detector. Valves of the 3,000-ohm class will, as a general rule, have too low a voltage amplification factor to allow this to be done, and in order to obtain the comparatively small extra amplification required, recourse may be made to a valve detector in place of a crystal.

We may say, then, that for a single valve reflex intended to be as efficient as possible on the local station, we are limited to valves of the 6,000-ohm or 3,000-ohm class, the final choice depending upon the type of detector chosen. If the maximum possible amplification of weak signals for use on telephones be required, one of the new valves designed for resistance coupling, and having a voltage amplification of 40 for an A.C. resistance of 70,000 ohms should be used. Quality of reproduction on any but very weak signals will not be good.

A 3,000-ohm class of valve should be used as the final audio-frequency valve of a multi-valve reflex, whether actually working dual or not, if the means can be found to provide all the H.T. current it requires for successful operation. The next best is, of course, the 6,000 ohms type.

There remains the valve which is doing first-stage audio-frequency duty. As already stated, this will be followed by an L.F. transformer, and so can be of the class with a voltage amplification of, say, 20, and an A.C. resistance of about 20,000 to 30,000 ohms. The transformer should have an impedance of at least 50 henries, which means that it is of first-class make, with a step-up ratio varying from 2.7 : 1 to 3.75 : 1, according to the maker.

If radio-frequency transformers of the Litz-wire wound Paxolin tube pattern so frequently advocated in the pages of this journal are being used, they can be suited to any of the types of valves mentioned by the use of more or less primary turns. If the "tuned anode" type of coupling is being used, the 30,000-ohm valve recommended for the first L.F. stage will also make a suitable H.F. valve, but will probably require stabilising by one of the balancing methods to obtain best results.

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L.T. CONNECTIONS.

THERE is a point which arises when valves of two different voltages are operated from the same accumulator by means of tappings which is well worthy of attention.

Fig. 2 indicates the normal connections of such an arrangement. It has been assumed that a six-volt accumulator is being used, and that one of the two valves shown is worked off a single cell (two volts) and the other off the full six volts.

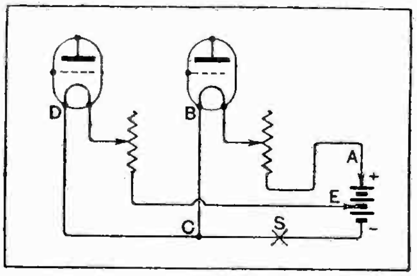

Fig. 2.—Illustrating a possible source of danger when connecting two-volt and six-volt valves to a common L.T. battery.

Now suppose a break was to occur in the negative lead at the point marked S. Offhand one would expect the valve filaments to "go out"; in fact, it has been known for a switch to be fitted at this point in order to put them out; but if the circuit A B C D E is followed out, it will be seen that the two valves are in series across two cells, *i.e.*, four volts of the accumulator. Should the total normal current of the six-volt valve (or valves) be more than three times that of the two-volt valve (or valves), the latter will be overloaded and probably ruined.

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L.F. TRANSFORMERS.

ONE of the accidents that may befall an L.F. transformer is that it may, through a short circuit at the valve-holder, receive the full voltage of the H.T. battery across its primary terminals. If the battery happens to be composed of an extra large type of dry cell in new condition, or a bank of accumulators, the current which will flow in consequence will be such as to saturate completely the iron core magnetically.

After such treatment the iron will have changed and the inductance of the winding will be appreciably less, to the detriment of reproduction of the low tones.

The theoretical way to restore the transformer to its original condition would be to force through the primary low-periodicity alternating current, the peak value of which was at least as high at the direct current which flowed during the "short." By means of a rheostat, the alternating current is gradually reduced to zero, after which the transformer is ready for normal use.

Unfortunately, this procedure would be accompanied by such high voltages across the secondary as to be unsafe unless a phenomenally low frequency of alternating current (some one or two cycles per second) could be obtained. In the circumstances the best that can be done is to apply a gradually diminishing direct current to the transformer, and by means of a reversing switch which is thrown backwards and forwards while the current is being decreased to simulate the very low frequency alternating current already mentioned.

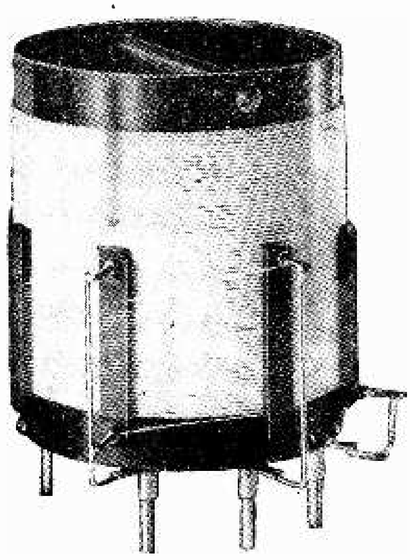
Careful experimenters frequently refuse to lend their L.F. transformers to less careful friends partly because of the possibility of this type of accident occurring, and the same people will generally treat a second-hand transformer with suspicion until proved to be O.K.

Only a comparatively short time ago the results of such accidents were not necessarily obvious, but with the modern coil-driven loud-speaker it is necessary that each individual piece of apparatus in a receiver should be as perfect as possible.

A Review of the Latest Products of the Manufacturers.

"ALL-WAVE FOUR" TRANSFORMERS.

The interchangeable transformers for the "All-Wave Four"[1] constructed by Simmonds Brothers, Shirelands Road, Smethwick, as compared with the originals, differ in that the spacing of the pins has been slightly altered in such a way that the risk of introducing a short-circuit of the H.T. battery is completely obviated. The rearrangement has been effected so that the disposition of the components and wiring may be carried out in any logical manner, including that adopted in the original receiver referred to above.



Plug-in H.F. transformer for use with "The Wireless World" "All-Wave Four" with suitable windings for the 180,550-metre band.

The windings of the transformer are exactly in accordance with specification, and it is gratifying to note that they are disposed in such a way that there is adequate spacing between the windings and the terminal screws to which primary and neutralising coils are attached.

The base is of solid construction, and is supplied with a circular ebonite distance-piece, in order that it may be raised slightly above the surface of the baseboard to enable the high-frequency high-potential leads to be well spaced from earth and other H.F. conductors. As shown in the accompanying illustrations, each transformer is fitted with an ebonite crossbar which serves as a grip for inserting or removing the coil from the holder.

Beginners will appreciate the inclusion of a sketch with each set of transformers, showing the actual connections to the soldering tags of the base.

[1] *The Wireless World*, April 27th, 1927.

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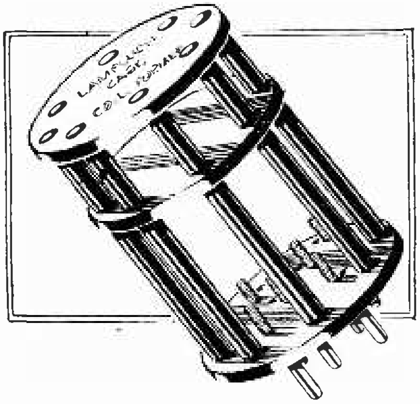
LAMPLUGH CAGE COIL FORMER.

For the construction of interchangeable H.F. transformers for aerial and intervalve coupling, a coil former has been introduced by S. A. Lamplugh, Ltd., King's Road, Tyseley, Birmingham. The end plates are held apart by eight ebonite rods, and to prevent bowing under the stress of the tight winding an ebonite plate is provided sliding on the rods between the end plates. The position of the sliding plate is, of course, adjusted so as to form a barrier between primary and secondary windings when arranged as separate spools side by side. This plate also serves as a guide for the leading-out wires, and is suitably drilled for this purpose, keeping the leads well away from the windings.



Lamplugh former for H.F. transformer construction.

Six split pins arranged in the usual "cross" formation are fitted to the base plate with convenient holes for bringing through the leads. The rods and end plates are finished smooth and polished. A good feature is the entire avoidance of metal screws in the construction.

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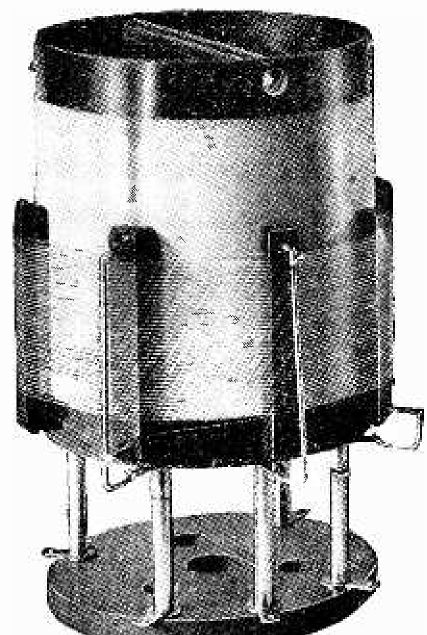
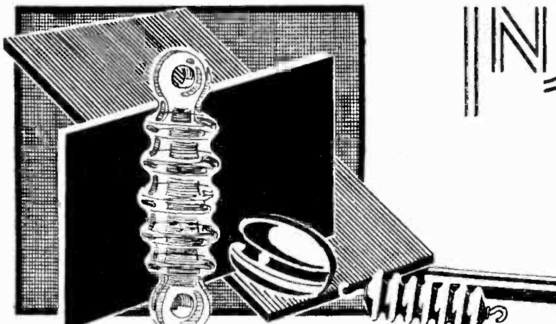
NEW MARCONI AND OSRAM VALVES.

Three new valves have made their appearance during the past week. Several valves of the coated filament variety have recently been introduced in the Osram and Marconi series, and the latest additions comprise three 6-volt valves with coated filaments passing 0.1 ampere. Styled the D.E.H.610, the high-frequency valve has an impedance of 65,000 ohms, with an amplification factor of 40; the low-frequency valve, the D.E.L.610, has an impedance of 13,000, with an amplification factor of 15; and the D.E.P.610, a power valve, possesses the low impedance of 4,500 ohms, with an amplification factor of 7.



The long-wave coil for the "All-Wave Four" with base piece.



INSULATORS AND INSULATION

Materials Suitable for Use in Wireless Receivers.

By JAMES STRACHAN, F.Inst.P.

EBONITE, or hard rubber, is *par excellence* the best and most convenient insulator for wireless apparatus, and holds its own in modern practice with or against various substitutes.

The better qualities of ebonite are composed of pure rubber, hardened or vulcanised with 20 to 30 per cent. of sulphur, but the lower grades are adulterated by the use of scrap rubber and the introduction of large quantities of mineral matter. Good ebonite is not cheap, and cheap, hard ebonite should be regarded with suspicion. Good ebonite becomes soft and pliable in boiling water, and pares softly to the edge of a sharp knife. A small piece held on a loop of wire in a bunsen flame should burn away almost completely, leaving only the merest trace of mineral residue.

Ebonite Substitutes.

Among the substitutes that have appeared on the market for panel work we have seen three types, viz., (1) celluloid compositions, (2) casein compositions, and (3) synthetic resinous compounds. Celluloid and casein lend themselves to the production of highly coloured and ornamental panels, but their insulating value is not of high order, and their use should be confined to the construction of sets designed for working with fairly strong signals where the amplification is largely L.F. Synthetic resins of the bakelite type, although not quite so good as ebonite in their insulating qualities, are mechanically stronger and more durable, and may be used in the construction of the average broadcast receiver, but for serious work the experimenter should stick to ebonite of the best quality for panel work.

The actual ohmic resistance of insulators to direct currents is not necessarily an adequate basis for comparison in their application to high-frequency work. For example, the writer discovered, in his experiments with crystals, that silver sulphide containing traces of copper conducts direct currents but is a very good insulator to high-frequency currents. The resistance of average ebonite to a direct current is more than a million times that of dry wood, but this difference does not appear so pronounced in wireless work where thin panels of well-seasoned dry wood may be used frequently for temporary rigs provided the components are properly wired and well spaced.

The accompanying table gives a rough idea of the resistance of various common insulating materials to direct currents, and is useful in many ways, but should not be taken as an index to the absolute fitness or unfitness of such materials for wireless work.

The uses and limitations of paraffin wax and mica are fairly well known to the experimenter. A useful substitute for paraffined paper (dielectric constant about 2.5) and mica (dielectric constant about 3) is thin sheet gutta-percha (dielectric constant about 4). This may be obtained commercially in rolls a few inches wide, and 2 to 3 thousandths of an inch (mils) thick. Its insulating properties are of the same order as that of good rubber, and it has the valuable property of becoming plastic at a comparatively low temperature when heated. Fixed condensers with gutta-percha dielectric may thus be sealed up air-proof by pressure and moderate heat (about 90° to 100° C.).

Insulating Material.	Resistance per Cubic Centimetre in Billions of Ohms.
Sulphur	40,000 to infinity
Paraffin wax	300,000 to 3 millions
Ebonite	20,000 to 300,000
Porcelain of good quality	20,000
Paraffined paper	2,000
Mica	1,000
Glass	800 to 1,000
Well varnished dry wood	20
Dry paper or cotton	10
Celluloid	1

Numerous attempts have been made to utilise the excellent insulating qualities of sulphur in wireless work, but its mechanical brittleness is its weakness. For this reason it is practically useless for panels, but for many purposes useful mouldings may be made by fusing sulphur with 25 to 30 per cent. of mica flakes or asbestos in short fibres. Useful insulating washers and formers for coils may be readily made by soaking the desired shapes made from good quality blotting-paper in melted sulphur. The sulphur should be melted in a porcelain dish or enamelled vessel just above its melting-point, when at

Insulators and Insulation.—
its point of greatest fluidity it rapidly penetrates the porous paper. Cotton tape may also be treated in this fashion. The dielectric constant of sulphur is rather high (4.2), but it is cheap, and for many purposes preferable to paraffin wax.

A comparative practical study of various insulators in wireless work soon demonstrates that to obtain the best results we must avoid porous and hygroscopic substances as much as possible. Such substances as paper and celluloid, which are fairly good insulators when perfectly dry, become poor insulators under ordinary atmospheric conditions. All insulators, even ebonite, condense or absorb thin films of atmospheric moisture on their surface to some extent, and while the high-frequency currents take the path of least resistance in the wiring of the circuit, the highest efficiency must be sought in eliminating moisture films, and dust which engenders such films, on the smoothest surfaces. In damp weather the sensitivity of a receiver is frequently improved by thoroughly warming it up. It should be remembered that a substance like rock salt is a very good insulator when absolutely bone-dry, but when exposed to the average atmosphere becomes a fairly good conductor by absorption of atmospheric moisture.

Dry air, with its low dielectric constant, is the ideal insulator for inductances as in air-spaced coils, and the same principle may be utilised in H.F. circuits by a simple means which I have used successfully. The components, valves, H.F. transformers, and condensers are supported on ebonite rods, about 6in. long and ½in. diameter, plugged into a wooden baseboard. This is a cheap and very efficient method of obtaining good spacing and long leakage paths for experimental work. I know of no more flexible method of mounting when trying out various circuits.

Surface Deterioration.

As the efficiency of ebonite or any other insulator in wireless work depends upon the condition of its surface, it should be noted that surface deterioration of ebonite is caused by the combined action of light and air. The deteriorated surface should be removed by polishing with a very fine abrasive, such as powdered alumina. This action of the air may be retarded by occasionally rubbing the surface of the ebonite with the merest trace of vaseline applied with a soft, clean cloth.

Occasionally the experimenter desires to unite two ebonite surfaces together and finds it difficult to get a cement for this purpose. This may be done by making the surfaces flat (but not polished) and uniting them with a thin film of the best isinglass glue. For plugging up holes in old panels, a very useful cement is made by melting equal quantities of Canada balsam resin with the best orange shellac. This cement may also be used for holding metal fittings securely in ebonite.

Ebonite insulators make the most efficient arrangement for aerials, but, being exposed continuously to light and air, should be cleaned regularly with fine emery paper.

Glazed Porcelain.

Few aerial insulators of glazed earthenware are proof against exposure to frost in winter weather. The surface becomes cracked and the interior of porous clay becomes waterlogged. Porcelain for this purpose must be of very good quality. Attention to aerial insulation is of much greater importance than cleaning the aerial wire. The same remarks apply to the leading-in tube.

Glass varies very much in its insulating properties with its composition. Common glass, composed largely of soda and lime silicates, is rather a poor insulator and inferior to porcelain. The best glass for insulating purposes is lead-potash glass.

Vulcanised fibre, which is really a form of compressed paper, in which the fibres are united by the action of chemical reagents, has similar properties to paper. If it is desired to use this material for panels the grey variety should be obtained, and not the red, which is coloured with oxide of iron. After the fibre panel is drilled it should be thoroughly dried in an oven and soaked for several hours in melted paraffin wax. The finished panel is about equal to paraffined paper in insulating qualities. Paraffined fibre prepared in this way is superior to celluloid and casein compositions, and is not subject to surface oxidation like ebonite. In conclusion, it should be remembered that the superiority of ebonite to other insulators for wireless work depends upon the preservation of its surface, and unfortunately the very finest and purest grades of this material are more liable to such changes.

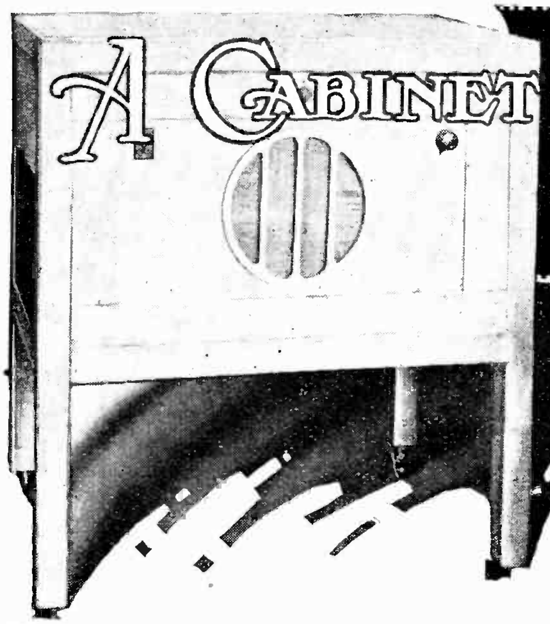
LOUD-SPEAKER ECHO.

JUST in the same way as the control of echo has been found desirable and even necessary at the transmitting end of our wireless entertainments, so appreciable improvements may sometimes be effected by suitable modifications to the room in which loud-speaker reception is carried out.

A room with a linoleum floor covering, unpadded or leather-covered furniture, and thin window curtains, will sometimes be found to contain so much echo that the voices of certain speakers emanating from the usual horn type loud-speaker are well-nigh unintelligible. A surprising improvement will usually be made if heavier window curtains and a door curtain, such as is used in winter times as a draught dispenser, be set up by trial. A room with a carpeted floor will probably be sufficiently damped if containing a reasonable amount of furniture, but an improvement is still sometimes possible by the introduction of a door curtain, or a further set of window curtains.

In carrying out these tests, the point to listen for is not whether the loud-speaker sounds "echoey"—no amount of juggling with the room will alter that—but whether, with one's eyes closed, the confines of the room assert themselves, or, in other words, whether it is possible not to feel that one is in a room with a loud-speaker.

D. K.



A Cabinet Moving-Coil Loud Speaker

Detailed Instructions for Building a High-quality Reproducer of Simplified Design.

By A. R. TURPIN.

NO one will dispute that a coil-driven cone loud-speaker gives far better reproduction than any other type, but the average enthusiast usually is deterred from constructing such an instrument by the following reasons:—

First, the field current would require another accumulator, and a large one at that, and the charging station does seem such a long way off!

Secondly, he is under the impression that countless rows of L.S.5 valves with umpteen volts high tension are required to obtain anything above a whisper.

Thirdly and lastly, although it is extremely easy to tell anyone to wind 250 turns of No. 40 gauge wire in half an inch of space, it is quite another matter to do so evenly and efficiently.

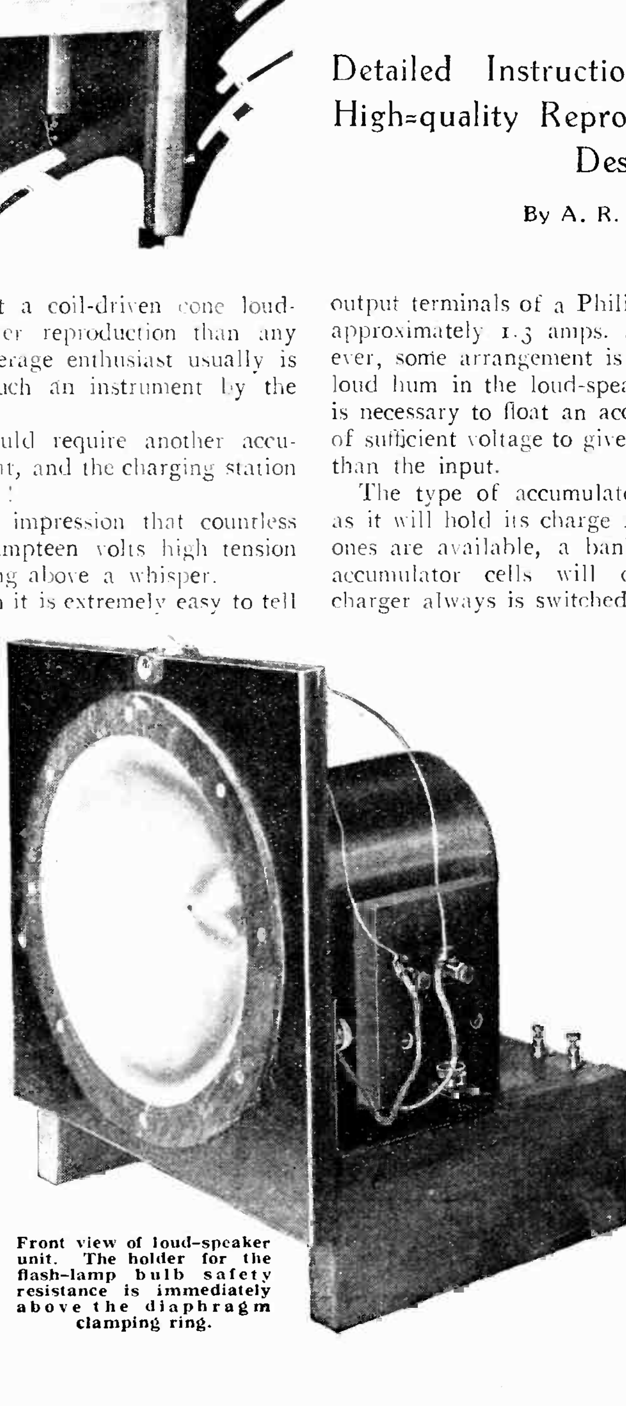
In the following article the writer has endeavoured to dispel all these deterrents and describe the construction of a loud-speaker which is not only pleasing to the ear but also pleasing to the eye.

Field Current.

To those blessed with direct current mains, no difficulty is experienced because it is an easy matter to connect the field coil direct to the mains; but for the large majority of readers this is impossible owing to the fact that their supply is A.C.

To overcome the difficulty of continually charging a large accumulator, the field winding is connected to the output terminals of a Philips rectifier, which will supply approximately 1.3 amps. at 12-15 volts. Unless, however, some arrangement is made to smooth the output, a loud hum in the loud-speaker will result. Therefore it is necessary to float an accumulator across the terminals, of sufficient voltage to give an output current slightly less than the input.

The type of accumulator used is immaterial as long as it will hold its charge for a short period. If no old ones are available, a bank of the larger size of H.T. accumulator cells will do admirably, providing the charger always is switched on before the field, otherwise the large output current for such small cells soon would cause the plates to buckle and flake.



Front view of loud-speaker unit. The holder for the flash-lamp bulb safety resistance is immediately above the diaphragm clamping ring.

Pot Magnet.

The pot magnet is perhaps the most important part of the loud-speaker, because upon the design of this depends the volume obtained for a given input. All other things being equal, the power obtained is practically proportional to the flux density across the air space, and the flux density is approximately proportional to the length of air space and number of ampere-turns on the core.

Thus it will be seen that if we double the flux density, we shall double the output, which would be more than equal to adding another valve in parallel.

For this reason, and

A Cabinet Moving-coil Loud-speaker.—

because the cost of increasing the size of the pot magnet is nowhere near the cost of adding an extra valve, the magnet has been made as large as practicable, so that the flux density may be as great as possible without saturation of the core being approached.

An extremely high voltage is built up when the field circuit is broken, which in time will damage the windings. In order to prevent this, it is necessary to connect a quenching resistance across the winding. A successful method of doing this is to place a 50-ohm resistance in series with a 6-volt flash-lamp bulb, adjusting the resistance so that the bulb just glows. This will also act as an indication that the field current is on, otherwise it is extremely easy to forget to switch it off.

The Cone and Coil.

The next item to consider is the cone and coil. All things considered, a small size cone, about 7in. diameter, has been found best, and this is suspended with oiled silk, which is preferable to rubber, as it is not likely to perish so quickly, and will not cause unwanted resonance, also it is easier to handle.

The coil used is of low resistance, as this is far easier to wind efficiently than one of high resistance, and although this necessitates the use of an output transformer the increased volume is well worth the trouble.

Some arrangement must be made for centralising the coil in the air space, and the writer has tried two methods and found both successful.

The first method is by threads at an angle of about 35°, and the second by means of a brass spider. The first is, on the whole, to be preferred, as no difficulty is experienced if the coil is not exactly parallel to the pole pieces; but, on the other hand, if the spider is used and once set correctly it will remain so.

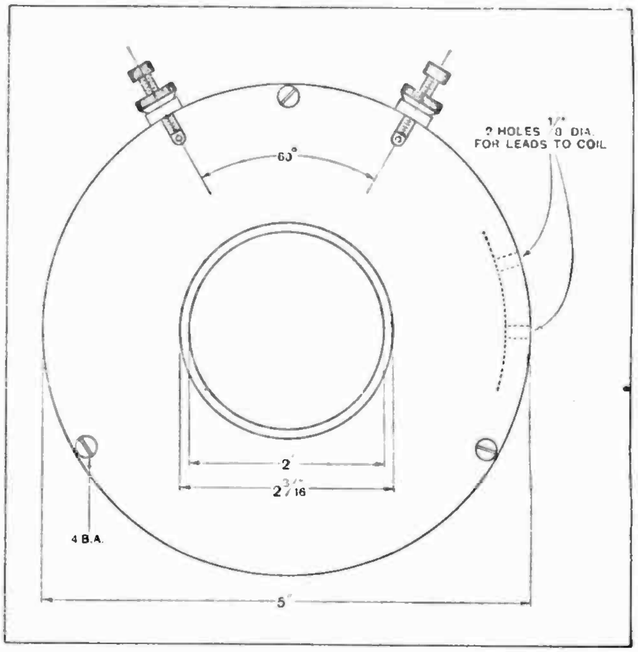


Fig. 1(b).—End elevation of field magnet.

The transformer is constructed from standard stampings, and built up on a cardboard former, but if desired an existing transformer may be rewound, or one of the new Ferranti output transformers with 25 : 1 ratio purchased.

Construction—Pot Magnet.

This is shown in Figs. 1(a) and (b), and may be purchased complete from the Star Engineering Co., Didsbury, Manchester. The shell is of soft grey iron, and the centre pole of wrought iron; the cover is a push fit, and is secured to the shell by three equally spaced screws. The air gap has been reduced to a minimum of $\frac{3}{16}$in.

Two further holes are drilled in the side of the pot to bring out the leads to the field winding.

Referring now to the field winding, we have available a current of 1.3 amps. at about 6-14 volts, therefore it is desirable to wind as many turns of wire as possible into the space

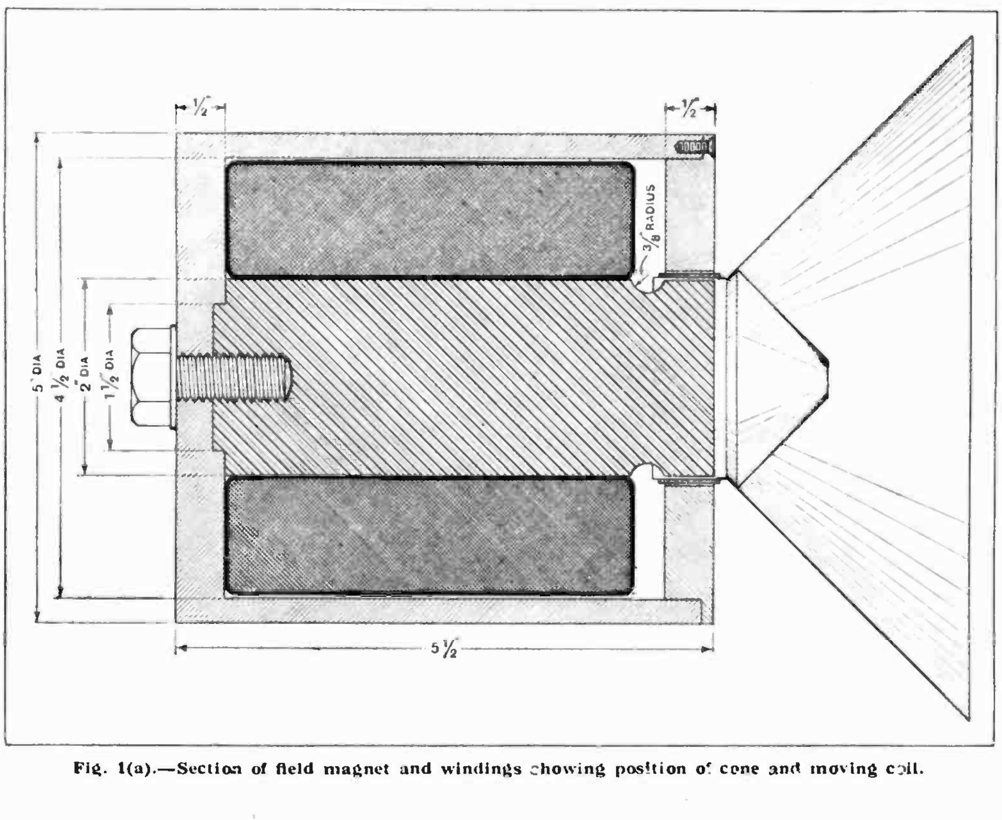


Fig. 1(a).—Section of field magnet and windings showing position of cone and moving coil.

A Cabinet Moving-coil Loud-speaker.—

available, always providing the gauge of wire used will carry the current without overheating unduly.

In the present case No. 18 S.W.G. enamelled wire will be suitable. Thus the winding space being 5.3 square inches, and No. 18 enamelled wire, winding 490 turns per square inch, and allowing 10 per cent. for insulation, we shall be able to wind on about 1,800 turns. To do this, however, each layer must be wound on carefully, and a successful way of obtaining this result is as follows :—

Obtain a length of curtain pole, 2in. diameter and 4¼in. long, and wind over it five or six layers of stout cartridge paper. Cut out two discs of three-ply wood 5in. diameter and screw to the ends, the whole being mounted on two iron brackets (the same brackets as are used later to support the cone will do) by means of large wood screws (see Fig. 2). The spool of wire should now be mounted on a rod in two blocks of wood, and placed in a convenient position on the floor, the coil former brackets being screwed firmly to the work-table. Before beginning the winding, four strips of strong tape should be placed along the former and tied in position with cotton, with the ends brought out over the three-ply flanges and pinned temporarily in position with drawing-pins.

The wire may now be wound on, and it is advisable to wear a glove while doing this, otherwise the fingers are likely to become blistered. If after a number of layers have been wound on the turns become uneven, it is best to even the surface by putting on two layers of cartridge paper, so that a new even surface is presented.

Taping the Field Winding.

Having wound on sufficient wire to completely fill the pot magnet, leaving enough space for insulation, the ends of the tape should be unpinned from the flanges and tied tightly round the coil. The flanges are now removed and the coil forced off the former. If the beginning layers have been wound on tightly, some difficulty may be experienced in removing the coil, in which case one of the plywood flanges should have a hole cut in it slightly larger than the wooden core, and be placed over the end; using this as a support for the coil, the core may be driven out by tapping it gently with a hammer.

The coil should now be given a liberal coating of shellac and baked for about three hours, the heat of the oven being such that it is just possible to bear the hand on the bars.

When baked, the coil should be wound round tightly with Empire tape. It was to give sufficient clearance for winding with tape that the inside diameter of the coil was increased by winding the layers of cartridge paper over the former.

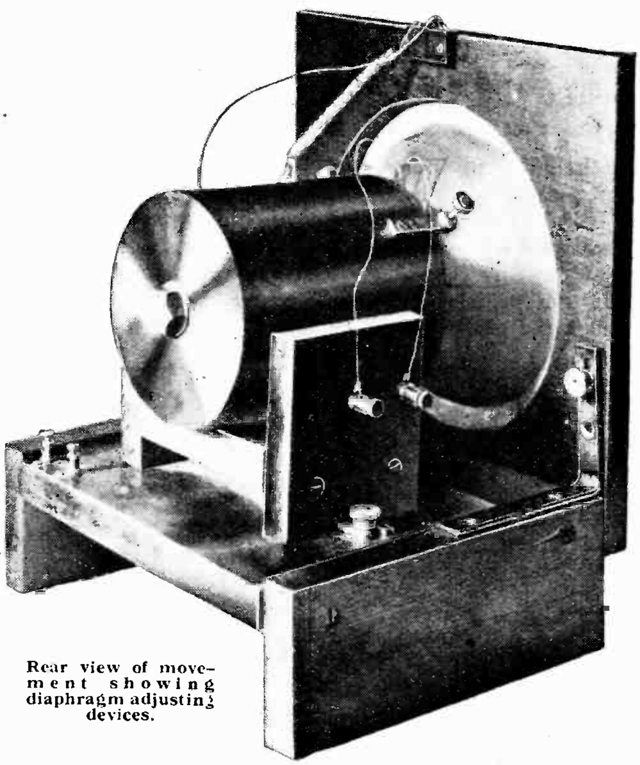
The ends of the windings should be soldered to short lengths of rubber flex before binding, the whole being given a further coat of shellac and again baked.

The field coil being completed, it should be slipped over the centre pole piece and wedged firmly in position with pieces of card, the interior of the pot having previously been shellacked to prevent rust.

The field magnet is now complete. The coil will take about 10 lb. of wire, and the resistance will be approximately 6 ohms, so that using 6 volts a current of one amp. will flow.

Constructing the Cone Diaphragm.

The thread method of supporting the coil consists of two lengths of ⅛in. × ⅜in. brass strip, secured to the periphery of the pot as shown in Fig. 1(b), and projecting about half an inch over the edge. In the projecting portion a 4 B.A. hole is drilled and tapped, and a screw inserted, in the end of which a small hole has been drilled.


Rear view of movement showing diaphragm adjusting devices.

Through this hole is passed a thread, which is secured to the cone immediately below it by gummed paper. It will be seen from the drawing that by adjusting these threads by means of the screws, the coil may be moved in any direction until centrally over the cone.

The cone is the next part to be constructed. This is made from cartridge paper about 0.08in. thick. Monckton or Hollingsworth paper is recommended for the purpose.

The cone is cut out as shown in Figs. 3 and 4 and stuck with Seccotine.

The shape of the diaphragm is a circular cone of 90 degrees, and the best diameter found is that of about 7in. The material used is a light but stiff drawing-paper, a smaller cone of the same material being used to reinforce the apex.

The method of construction is as follows: On a sheet of paper mark out a circle 9½in. diameter, and two smaller concentric circles 2$\frac{11}{16}$in. and 2½in. (see Fig. 3). Next rule two lines, making a segment of 90 degrees, and a further line ¼in. from one of these on the inside for overlap. The portion between the two small circles should now be serrated and the shaded portion cut out.

The cone should now be joined with Seccotine along the overlapping portion.

The reinforcing cone is made in the same way. A

A Cabinet Moving-coil Loud-speaker.—

circle is drawn 3in. in diameter and smaller ones 2¾in. and ½in. concentrically, the space between the two outer circles being serrated and a similar segment cut out as in the larger cone and the ends joined.

When both cones have been given sufficient time to stick securely, the serrated edge of the smaller one is bent inwards, as shown, and coated with adhesive, and fixed concentrically on the inside of the larger cone.

The serrated edge of the latter being bent outwards, so that it may be slipped inside the end of the moving coil and secured with a liberal coat of Seccotine.

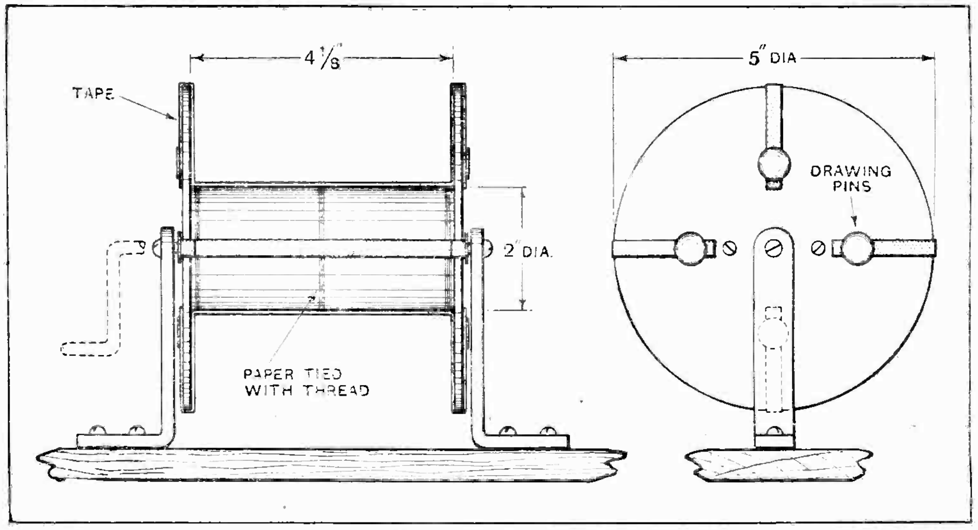


Fig. 2.—Winder for field magnet coil.

Winding the Moving Coil.

The moving coil should be both light and strong, and this part calls for the greatest amount of patience. The coil consists of four layers of No. 40 gauge enamelled wire, each layer ⅝in. long. The method of construction is as follows:—

A 2½in. length of 2in. dia. curtain pole is used as a former. A hole is drilled through the centre to take a length of rod, and the whole mounted in the iron brackets previously used for the field coil former (see Fig. 5). Over this is wound exactly three layers of Hollingsworth paper, the outside end only being stuck to facilitate removal and the bulge formed by the beginning and finish should be hammered flat. Over this is wound one layer of thin greaseproof paper, similar to that in which cigarette packets are wrapped, and the ends joined by Seccotine, care being taken that it does not stick to the cartridge paper underneath. The width should be 1½in.

Now mount the bobbin of No. 40 gauge wire on a spindle and thread between the leaves of a book so that a slight tension is kept on the wire, and secure the beginning end to the greaseproof paper by a strip of gummed paper.

It is absolutely imperative to wind on each layer evenly, and to do this with the naked eye is practically impossible, so that a watch-maker's glass or some such arrangement will be found necessary.

Now give the paper a liberal coating of celluloid varnish, and commence winding while it is still wet. When the first layer has been wound on, give a further coat of varnish and wind on the next, repeating the procedure until the four layers have been completed, then give two liberal coats and allow to dry thoroughly.

Some trouble may be

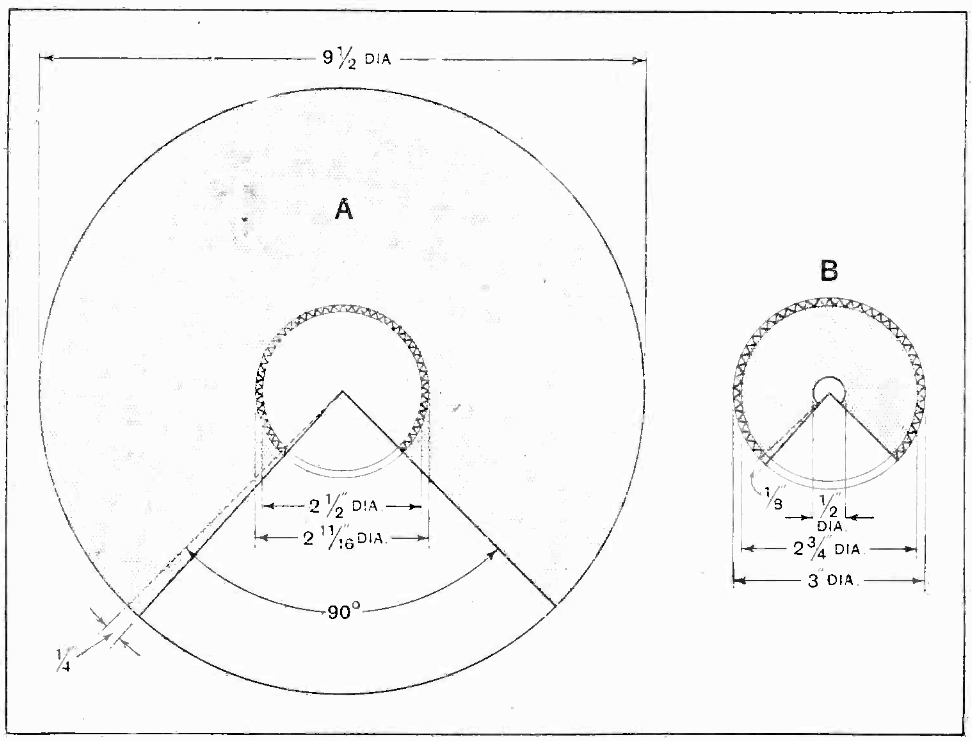


Fig. 3.—Method of marking out paper for diaphragm, A, and reinforcing cone, B.

A Cabinet Moving-coil Loud-speaker.—

experienced when winding the second and remaining layers, owing to the difficulty of seeing the wire on top of the preceding layer. This may be overcome by using a light-coloured celluloid enamel instead of plain varnish. But too much pigment should not be used as this will weaken the coil, so it is advisable not to stir the pigment up too much from the bottom.

When the coil is perfectly set it may be withdrawn from the former, and the completed coil will be found to be extremely strong and yet light.

The method of removing the coil from the former without damaging it is as follows:—

Trim the greaseproof paper within $\frac{1}{16}$in. of the coil, just removing the beginning and finishing ends from the gummed paper. Now place the wooden former in a vice so that it does not quite grip it, and so that the jaws butt up against the edge of the cartridge paper packing, then push on the top of the wooden former or even tap it slightly with a hammer, when the coil and cartridge paper will be forced off, the latter then being removed easily.

Mounting the Moving Coil.

The coil is then stuck to the truncated end of the cone, which is serrated slightly, with a liberal coating of Seccotine, taking care that the axis of the coil is at right angles to the face of the cone.

When this is set a small cone $2\frac{1}{4}$in. in diameter is fixed in a like manner to the centre of the cone to strengthen it. It is advisable to remove the pip of this to prevent damping, but the hole should not be more than $\frac{1}{4}$in., otherwise the low notes may be reduced slightly. In passing, the reader is advised to have this cone off until he has experimented with the centralising device, otherwise it is difficult to tell whether the coil is central or not. After a few trials it will be found quite easy to feel when it is free.

The next item to construct is the cone support. This consists of $\frac{1}{2}$in. plywood in which a circular hole has been cut of diameter, as shown in the drawing, and a clamping ring of 3-ply wood secured by wood screws, the flexible support of oiled silk being clamped between them. The

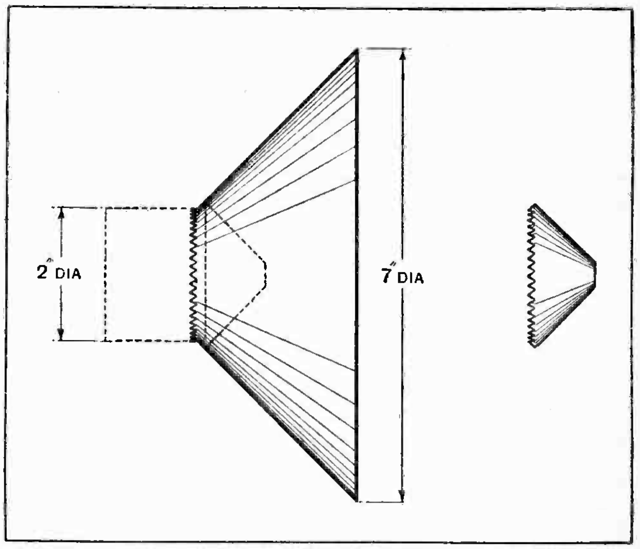


Fig. 4.—Leading dimensions of finished diaphragm.

best method of securing the cone to the oiled silk is as follows:—

Obtain a piece of silk ten inches square, and after smearing the plywood ring with Seccotine, clamp it in position, the silk being held across the hole while this is being done by means of drawing pins. Although it should be free from wrinkles it must not be under tension.

Next lay this face downwards, and after coating the edge of the cone with Seccotine, lay it on to the silk and place a light weight across it, allowing 24 hours to set.

When properly dry carefully cut out the centre portion of the silk within $\frac{1}{4}$in. of the edge of the cone, with a sharp razor blade, then stick down the overlap with more Seccotine and leave to dry. It is absolutely impossible to get anything like a neat or efficient join by cutting out a ring of oiled silk or attempting to stick on a strip. The cone may now be given a coat of celluloid varnish.

There is left to make now only the pot magnet base. This is clearly shown in the photographs. The cone can be centred approximately by either loosening the clamping screws on the magnet base, which allows a lateral movement, or those on the cone supporting brackets, in which a slot has been cut, which gives a vertical movement. The final adjustment is obtained by means of the centre thread screws.

The Transformer.

It is of course necessary with a speaker of this type to use a transformer. In that used by the writer the core consists of approximately five dozen pairs of No. 4 Stalloy stampings. These are a stock pattern, and may be obtained from J. Sankey and Sons, Ltd., 164, Regent Street, W.1.

The former is built up from cardboard. First cut out one strip and make an oblong tube so that it fits tightly over the centre core. Next cut out ten circles, $2\frac{3}{4}$in. diameter, with a square hole in the centre so that each disc fits tightly over the square tube, over which they are slipped, each being spaced from the next by a strip of card about $\frac{3}{16}$in. wide. When the discs have been pro-

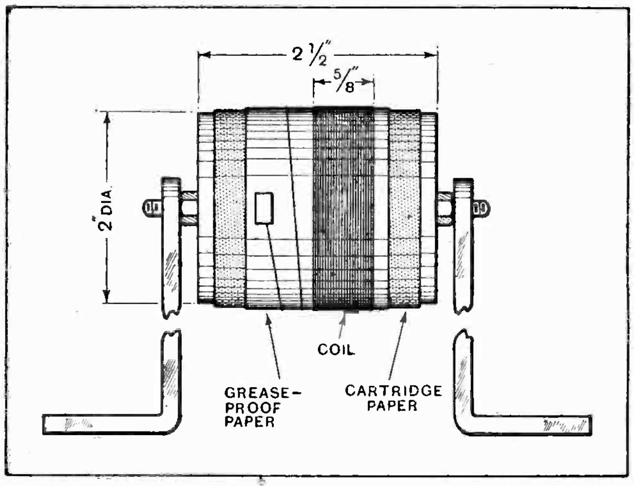


Fig. 5.—Method of winding the moving coil.

A Cabinet Moving-coil Loud-speaker.—
perly assembled the whole should be given a liberal coat of shellac and baked.

It will now be seen that we have nine slots; three of these are wound full of No. 40 enamelled wire for the primary, and two with 150 turns of No. 28 D.S.C. wire for the secondary. The best method of winding this transformer is to cut a small block of wood the same size as

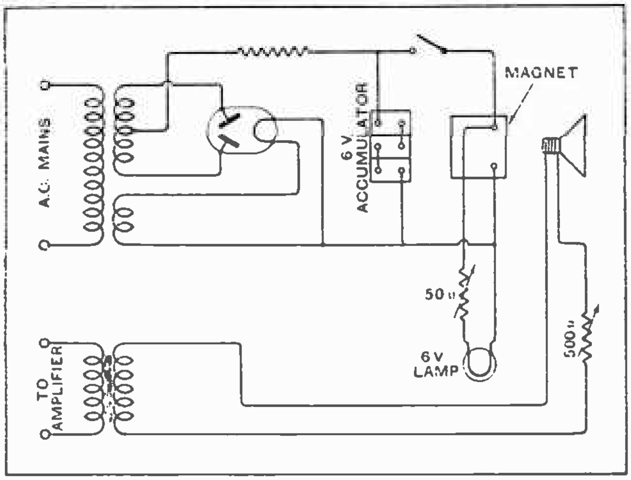


Fig. 6.—Complete circuit diagram including rectifier for supplying current to field winding.

the core and drill a 2 B.A. hole through the centre, over which is slipped the cardboard former.

Two lengths of plywood are next cut, 3in. diameter, and the whole clamped tight by a length of 2 B.A. rod and nuts. The end of the rod should protrude about 1in., so that it may be gripped in the chuck of a hand drill held in a vice. The beginning and ends of each of the primary sections should be soldered to wire of a stouter gauge. When the required number of turns has been wound on, the three primary sections are joined in series and likewise the two secondary.

Variations of the number of turns and disposition of windings in the slots may be tried, but when connected to a single D.E.5A valve the writer has found the following to give the best results:

P, space, S, space, P, space, S, space, P.

When complete the whole may be mounted as shown in drawing.

Remarks.

The writer has found that about the minimum power for input which can be used so that speech is audible in a room 16ft. by 12ft. without strain upon the listener is one D.E.5A valve with 18 volts grid bias and 120 volts on the plate, and working the valve at its full grid swing. This is with 0.5 amp. passing through the field winding.

It should be remembered, however, with a loud-speaker of this type connected to a well-designed receiver, broadcasting may be listened to with far less strain than a horn loud-speaker working at a much greater volume.

Using the same valve and the needle of a milliammeter in the anode circuit, showing a slight kick and with 1 amp. in the field winding, dance music is of sufficient volume for dancing in a room of the size mentioned above.

If desired, a greater volume may be obtained by using the larger size Philips rectifier and passing 2 amps. through the field winding, the floating battery being increased to 12 volts.

NEWS FROM THE CLUBS.

"Hare and Hounds."

Direction finding, a subject which has loomed large in the activities of many societies this summer, provided some interesting experiments at the North Middlesex Wireless Club's recent Field Day at Cuffley. A transmitter was erected at Goff's Oak, and signals were received and reported on by several portable frame aerial sets at various distances, while two-way working was carried on with a distant amateur station. In the afternoon a hunt was carried out for a concealed transmitter, the "hounds" being equipped with attaché case receivers with built-in frame aerials.

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Effect of Telephone Wires.

It was found that the presence of telephone wires affected bearings by as much as 20 degrees and even in some cases completely screened the sets. The correct bearings were obtained by several groups, but dusk put a stop to operations before the "hare" had been unearthed.

The North Middlesex Wireless Club intends to hold a D.F. Field Day on a larger scale on October 1st next, when a whole afternoon will be devoted to the search and considerably more power will be used.

Hon. secretary, Mr. H. A. Green, 100, Pellatt Grove, Wood Green, N.22.

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Tests in a Motor Boat.

A series of transmission and reception tests on a motor boat in Dublin Bay provided the members of the Wireless Society of Ireland with an enjoyable and profitable afternoon on Saturday, July 23rd. The president, Mr. G. Marshall Harriss, M.A., M.I.E.E., kindly placed his large motor boat at the service of the society, a party being taken out from the port of Dublin across the bay to Dalkey.

During the outward trip and while off the coast at Dalkey transmission and reception tests were carried out on 45 metres with a view to observing any effects on signals caused by the coast line, directional effects, etc. Communication was maintained throughout the afternoon between the society's portable station 13B (in charge of the hon. secretary) on the motor boat, and station 14B operated by Mr. Jos. P. Campbell, of Sutton. Members on the island operated a receiver controlled by Mr. H. Duncan, 16B, and Mr. W. Warren, 17B, and were thus in touch with the tests throughout. Observations of signals from 13B were also taken at the society's station 12B at Trinity Street, Dublin, and by Mr. D. G. Kennedy, 14C. Valves used in the tests were supplied by the Mullard Wireless Service Co., and gave a very fine performance.

The society hopes to hold another outing during the present month.

Hon. secretary, Mr. H. Hodgens, 12, Trinity Street, Dublin.

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New Transmitting Station.

A transmitting licence has been issued to the Stoke-on-Trent Wireless and Experimental Society, which will shortly be transmitting on a wavelength of 440 metres with the call sign 6NC.

Reports of these transmissions will be gladly received by the Hon. Asst. Secretary at Elm Tree House, Penkhull, Stoke-on-Trent.

NOTES & QUERIES

Short-wave Transmissions.

AGA (Nauen) has lately been carrying out telephony tests on approximately 13.5 metres. A correspondent heard this station on 20th and 21st July between 8.0 and 8.20 p.m. B.S.T. at very good phone strength, and again on 27th and 28th July at about the same time he heard faint telephony on the same wavelength, which he believed came from AGA, but the signals were not sufficiently clear to enable him definitely to identify the station.

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WLW, the short-wave station of the Crossley Corporation of Cincinnati, is transmitting on 52.02 metres, and works on most evenings, except Friday, during the week.

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The *Radio News* of America has also installed a short-wave transmitter working in conjunction with WRNY, the wavelength being 30.91 metres, and the Atlantic Broadcasting Corporation is stated to have installed a 64-metre transmitter in their station WABC.

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The programme transmissions on about 17 metres from Malabar, Java, are easy to pick up between 1400 and 1800 B.S.T. The station usually calls up PCG in Holland, and is understood to be operated by Mr. A. C. de Groot, Bandoeng, Java.

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Several of our correspondents have reported reception of ANH on 17 metres. One states that he received this station on June 28th between 1400 and 1600 B.S.T. on a three-valve receiver with a vertical indoor aerial and counterpoise, the strength being about R7.

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Another tells us that on July 31st he heard PKX, which is believed to be the parent station of ANH, on about 27 and 32 metres, both transmissions, which were in Morse, being identical.

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General Notes.

Mr. L. Rees, "Milnthorpe," Whitefield, Manchester, who is experimenting with the "Short Wave Transmitter" described in our issue of 29th July, would like to get into touch with another amateur who is also constructing this transmitter with a view to comparing notes.

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Mr. C. C. Mortimer (BRS 88), 86, Magpie Lane, Bromley, Kent, who is using an underground aerial 30ft. long 2ft. deep, is anxious to arrange tests with any station on 30 to 50 metres.

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Mr. M. F. J. Samuel (G 5HS), 16, Blenheim Road, London, N.W.8. tells us that between April 17th and June 17th he successfully worked on 23 metres with a number of stations on the Pacific Coast of U.S.A., Canada and Texas.

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New Call-signs and Stations Identified.

2AX (Ex-2AUX) C. S. Bradley, 10, Montenotte Rd., London, N.8. (Transmits on 23 and 45 metres and welcomes reports.)
2FM F. C. McMurray and R. E. L. Beere, 92, Algernon Road, S.E.13. (Change of address.)
5BR (Ex-2BOW) G. L. Brownson, "Bryning," Hermitage Rd., Hale, Cheshire.
5ML F. W. Miles, "Rydal," Beechwood Ave., Coventry. (Change of address.)
6AH A. Hine, 81, Chaworth Rd., West Bridgford, Notts.
6AS C. R. Chadfield, 13, Albert St., Melton Mowbray. (Transmits on 45 metres generally at about midnight.)
6FY R. A. Fereday, 37, Wallwood Rd., Leytonstone, E.11.
6NC L. J. R. Taylor, Elm Tree House, Penkhull, Stoke-on-Trent. (Transmits on 440 metres.)
6TR P. H. B. Trasler, 37, York Rd., Northampton. Transmits on 8, 23, 90 and 150 metres.
6UO (Ex-2AVR) E. R. Cook, Morton, Gainsborough, Lincs. (Transmits on 23 and 45 metres and welcomes reports.)
2AAQ Tollington School, Tetherdown, N.10.
2AXT V. Leach, White House, Hucclecote, Nr. Gloucester.
2BIP R. M. Kay, 82, Daisy Bank Road, Victoria Park, Manchester.
2BRJ D. W. Heightman, "Belowda," Park Quay, Clacton-on-Sea.
SB 1ID Luiz Novaes, 125, Rua Piabanha, Petropolis, State of Rio de Janeiro, Brazil.
NR 2FG F. Gonzalez, Box 384, San José, Costa Rica.

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QRAs Wanted.

G 5CN, G 5NZ, G 5YX, EB V9, EB Z4, EB 4GR, EB 4PJ, EF 8BW, FF 8AKL, ED 7OS, EN 0CX, EK 4RT, EK 4XY, EU R1KPI, RL 2RD, R 5UL.

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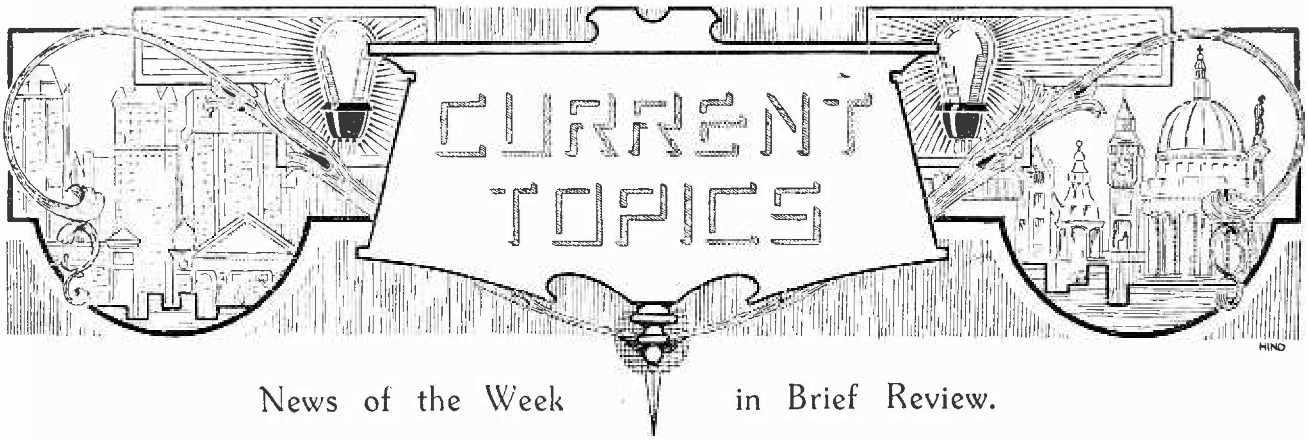
Italian Amateur Transmitters.

Through the courtesy of our Italian contemporary *Il Radio Giornale*, we are able to supplement and correct the list of Italian amateur transmitters contained in the R.S.G.B. Diary and Log Book for 1927 :—

1AD F. Capecchi, Via Arnolfo 4, Firenze. (Correction.)
AE F. Piscia, Borgomanero (Novara). (Correction.)
1AJ E. Pasoli, Via S. Paolo, 21, Verona.
1APT Laboratorio Aeronautica, R. Politecnico, Turin.
1AS Dr. S. Pozzi, Via Michelangelo 2, Novara. (Change of address.)
1BJ A. Cigna, Salita Cappuccini, Biella.
1CB A. Spinelli, Via Kramer 32, Milan.
1CC I. Zampini, Via Savoia 44, Rome (34).
1CD A. Barbiani, Via in Lucina 17, Rome.
1CE E. Candiani, Badia Polesine (Rovigo).
1CG D. Stringher, Via Mazzarino 12, Rome (3).
1CI G. Ferroni, Via Podesti 26, Ancona.
1C E. Pasoli, S. Paolo, Verona.
1CL E. Volterra, Via Loggia, Ancona.
1CM M. Colognesi, Via Maffei 60, Stienta (Rovigo).
1CP E. Zampini, Esanatoglia (Macerata).
1CQ G. Caponi, Via Alfieri 14, p.p. Florence (22).
1CR V. Quasimodo, Via Alvarez 20, Gorizia.
1CS Rag. cav. G. Pluda, Piazza Sempione 6, Milan.
1CZ G. Galli, Piazza Pestalozzi 117, Chiavenna.
1CX G. Giannini, Lungotevere Mellini 24, Rome.
1DA E. Momo, Corso Galileo Ferraris 82, Turin (10)
1DB B. Trevisan, Barriera della Rocchetta Vicenza.
1DC A. Gaudenzi, Via Plinio 11, Milan.
1DD C. Ricchiardi, Corso Vitt. Eman. 4, Turin.
1DE G. Selenati, Via Sergia 9, Pola.
1DG W. Savignoni, Via Alessandria 112, Rome.
1DH V. Guadagni, Via Gino Capponi 17, Florence.
1DI G. Nardini, Via U. Polonio 4, Trieste.
1DJ G. Gabba, Via Beverora 33, Piacenza.
1DK C. Bernatzky, Piazza Cernaia 13–6, Genoa (9).
1DM Rag. Antonio Caselli, Via Mario Ruini 2, Modena.
1DN A. Cantalini, Piazza del Duomo, Aquila.
1DO G. P. Ilardi, Via Savoia 84, Rome.
1DP G. Grimaldi, Via Goffredo Mameli 7, piano 1°, Cagliari.
1DQ A. Hugony, Via Notarbartolo 5, Palermo (37).
1DR G. Dionisi, Via Taranto 26, Rome (40).
1DS Ferdinando Morillo di Trabonella, Via Notarbartolo n.6, Palermo.
1DT A. Ruffo, Villa Ruffo Scaletta, Piazzale Flaminio, Rome (10).
1DU G. Piazza, Corso Dogali 7, Genoa (104).
1DV T. Sampieri, Linguaglossa (Catania).
1DZ C. Tagliabue, Via Gustavo Modena 26, Milan.
1DY Co. A. Ancillotto, Borgo Cavour 39, Treviso.
1DW F. Dodero, Via Principe Amedeo 17, Turin.
1EA P. Camillo, Via Assarotti 14–10, Genoa.
1EB G. Fabricatore, Via Frattina 81, Rome.
1EC A. Alessandrini, Via Palestro 87, Rome.
1EV E. Varoli, Verzuolo (Cuneo).
1FB F. Bassi, Via Luccherini, 12, Sienna.
1FC R. Scupla F. Cesi, Rome.
1FL E. Fioro, Viale Magenta 24, Milan. (Correction.)
1FO F. S. Orefice, Muro Palamaio 40, Vicenza.
1FP F. Pugliese, Via Borgonuovo 21, Milan. (Not 1EP.)
1GA A. Gaudenzi, Corso Buenos Ayres 17, Milan.
1GB G. Baglioni, Piazza Gualdi 3, Vicenza.
1GC G. G. Caccia, Villaggio Giornalisti, Milan.
1GE E. Gervasoni, presso Carraresi, Via S. Jacopo 13, Florence.
1IN Istituto Nautico C. Colombo, Fiume.
1KX A. Niutta, Via Ciro Menotti 20, Rome.
1LP L. Ponzio, Via XX Settembre 50, Turin. (Correction.)
1LS L. Stefanelli, Milan.
1MV Marcello Via, Villini Serbucci, Tivoli (Rome)
1MZ A. Magrini, Via Marengo 4, Turin.
1NA G. Salom, Palazzo Spinelli, Venice.
1NC N. Cillo, Asolo (Veneto).
1NM A. Muzio, Via Babbuino 186, Rome.
1NO F. Marietti, Corso Vinzaglio 83, Turin. (Correction.)
1PL D. L. C. Picchioni, Via Ripetta 80, Rome.
1PM Officina Radio Montatori, Viale Angelico 19, Rome.
1PN N. Palina, Direttore Scuola Radio, Gorizia.
1PP G. Pianzola, Corso Peschiera 18, Turin.
1SF Ten. Spadaro, Piazza Pollarola 30, Rome.
1TA Cap. Filippini, Governo Tripoli (Libia).
1TR L. Manca di Villahermosa, Laconi (Sardegna).
1TU D. Bolaffi, Via Roma 36, Turin.
1UB On. Dott. Umberto Bianchi, Via Scipioni 145, Rome.
1UU A. Criscuoli, Via Leyni 52, Turin.
1VR R. Visconti, Via S. Secondo, 46, Turin.
1WD W. Brancadori, Viale del Re, 56, Rome.
1WW Mario d'Amelio, Villa Cilento a Capodimonte 4, Naples.



News of the Week in Brief Review.

A LITTLE BRIEF AUTHORITY.

The Horsham (Sussex) Urban District Council has decided that, when tenants of the Council's houses desire to erect wireless aerials, application must be made to the Council's surveyor.

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UP-TO-DATE POLAND.

Experiments in wireless reception on a moving train are being repeated on the Warsaw-Zyrardow railway, tests now being in progress with apparatus installed on a long-distance train. If the tests are successful, further trains will probably be equipped.

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MORE TELEVISION.

M. Denes von Mihaly, the Hungarian experimenter, has stated that he intends to form a company in London for the development of his system of television. He hopes to produce television receivers at a cost of about £20 each.

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WANTED: INDIAN WIRELESS.

An object lesson concerning the necessity for the development of internal wireless in India has been provided by the recent floods which isolated Baroda from the outside world. The *Times of India* points out that although Bombay is in touch with England by beam wireless, it cannot communicate with Baroda, 200 miles away!

It is recommended that, pending the establishment of a wireless service between the two places, the Government should arrange for some form of aeroplane reconnaissance.

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INDEXES AND BINDING CASES.

The index for Volume XX of *The Wireless World* is now ready, and a copy will be sent to any reader on application to the publishers, Dorset House, Tudor Street, London, E.C.4.

Binding cases for the same volume can also be supplied, price 2s. 10d. post free.

THE NEIGHBOUR'S LOUD-SPEAKER.

An American inventor is stated to have patented a "sound absorber" which, when placed in a room, deadens the noise produced by neighbours' loud-speakers and gramophones.

Trivial obstacles of this kind will not baulk the genuine wireless enthusiast!

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LICENCES IN DEMAND.

During the first wireless prosecution at West Bromwich a Post Office witness was asked by the magistrate's clerk whether there had been a rush for licences since the defendant had been summoned.

Witness: We hope to do good business to-morrow.

The defendant, who pleaded guilty to operating a set without a licence, was fined 20s. and 3s. costs.

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BROADCASTING IN BRITISH EAST AFRICA.

The relaying of programmes on short waves from world stations is to be undertaken by the British East African Broadcasting Company, which has been formed at Nairobi after nine months' negotiation with the Government, culminating in the issue of a licence. The chairman is Lord Delamere.

The company is also starting an "Empiradio" telegraphic direct service from Nairobi to London, says *The Times*, at 30 per cent. below the cable company's rates.

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SWEDISH WIRELESS IN TURKEY.

As a sequel to the raising of the ban on wireless in Turkey, a Swedish firm has concluded a contract for the monopoly of deliveries of wireless receiving apparatus in Turkey during a period of five years.

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AN OLD QUESTION.

Among the minor controversies which occupy the attention of newspaper readers during the hot season is a little discussion on the words "radio" and "wireless." The latter term is practically universal so far as colloquial English is concerned, and seems likely to remain so for many years to come. In America the position is reversed.

No doubt the question will provide further food for reflection next summer; until then most of us will continue to talk "wireless."

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LISTENERS IN THE FATHERLAND.

The German broadcasting industry hopes that by the end of the year two million broadcast receiving licences will have been issued. On June 30th last there were 1,713,899 licensees, an increase of 78,171 over the previous quarter.

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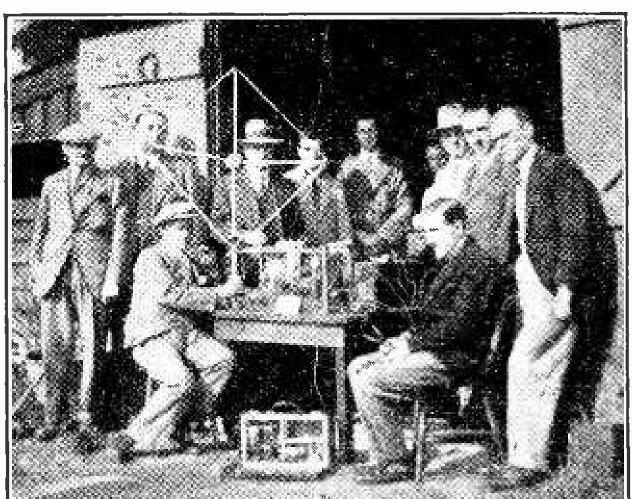
RUSSIA'S BROADCASTING SYSTEM.

There are now fifty-six broadcasting stations in Soviet Russia, according to the latest report from Leningrad. Five stations are situated in Leningrad, while Moscow has no fewer than nine.



THE FIELD DAY SEASON. Members of the North Middlesex Wireless Club photographed on a recent field day at Cuffley, where D.F. tests were carried out with self-contained portable sets.

COLD WIRELESS TASK.

A powerful wireless station is to be erected in Greenland in connection with the American meteorological station now being constructed at Holstenborg, in the south-west. According to our Copenhagen correspondent, the wireless station will keep in touch with Denmark and Sweden throughout the winter, and this will necessitate a wireless expert "wintering" in Greenland throughout the Arctic night.

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DEATH OF FRENCH WIRELESS CELEBRITY.

The sudden death of M. Paul Dupuy, manager of the *Petit Parisien* newspaper, has removed a prominent figure from French wireless circles. M. Dupuy was one of the pioneer spirits in the development of broadcasting in France, and at the time of his death was Honorary President of the Confederation of Radio Clubs in the south-west.

oooo

FISHERY WIRELESS.

The use of wireless for communication between fishing vessels is likely to be extended in view of the success obtained with wireless telephony apparatus recently installed on a number of Hull trawlers. The vessels, which have just returned to Hull, report very favourably on the results obtained over distances of nearly 400 miles.

Six other trawlers are being equipped with wireless telephony apparatus, and several firms which were awaiting the results of the tests are contemplating adopting the system. The installations can be used by unskilled seamen.

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CHEAPER VALVES.

Last week *The Wireless World* was able to announce the notable reductions on August 3rd in the price of valves manufactured and sold by the British Radio Valve Manufacturers' Association.

The companies concerned are as follow:—

British Thomson-Houston Co., Ltd.
Burndept Wireless, Ltd.
A.C. Cossor, Ltd.
Edison Swan Electric Co., Ltd.
Electron Co., Ltd.
General Electric Co., Ltd.
Marconi's Wireless Telegraph Co., Ltd.
Marconiphone Co., Ltd.
Metropolitan-Vickers Electrical Co., Ltd.
Mullard Wireless Service Co., Ltd.
Standard Telephones and Cables.

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COMPULSORY S.O.S. DEVICES.

In less than a year, automatic S.O.S. call devices will become compulsory on certain vessels.

It is announced by the Board of Trade that two types of auto-alarms for use at sea, designed by the Marconi Co. and the Radio Communication Co., have been approved by the Postmaster-General and the Board of Trade. These instruments are for registering automatically on board ship any distress calls received from other ships at sea. Within the next twelve months foreign-going ships carrying between 50 and 200 persons and coasting ships carrying 50 persons or more will have to be fitted with one of these approved instruments if the duration of the voyage from one port to another exceeds eight hours.

oooo

PHOTO TRANSMISSION ADVANCE.

An advance in connection with wireless photo transmission is announced by the Radio Corporation of America. The improvement secures a photographic reproduction nine times the size of the original. Instead of applying a light beam on the surface of the sensitised paper, a special photographic paper is used which is affected by heat in the same way that ordinary sensitised paper is influenced by light. A jet of hot air is blown on to the prepared paper, producing a black mark. When a radio signal is received, a jet of cold air intercepts the hot air wave, and the paper is left unmarked.

The new method, it is stated, produces an enlarged print considerably clearer than that obtained by the earlier system.

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BROADCAST CO-OPERATION IN SOUND TESTS.

The vagaries of air waves and the factors which determine their speed were the subject of an interesting experiment recently carried out by the Air Ministry, assisted by the British Broadcasting Corporation. A gun was fired at Shoeburyness, the exact time of discharge being broadcast from Daventry. The public were asked to listen for the sound and to report the time and place of hearing.

At the end of the trials Mr. F. J. W. Whipple, superintendent of Kew Observatory, who organised the experiment, announced that he had received a message from Professor S. W. J. Smith, of Birmingham University, where there is an air-wave recording instrument. Prof. Smith reported that his microphone showed that the air waves from Shoeburyness reached Birmingham University in about 12 minutes. The time of passage on July 9th averaged 11 min. 51 sec., and on July 15th it averaged 12 min. 16 sec.

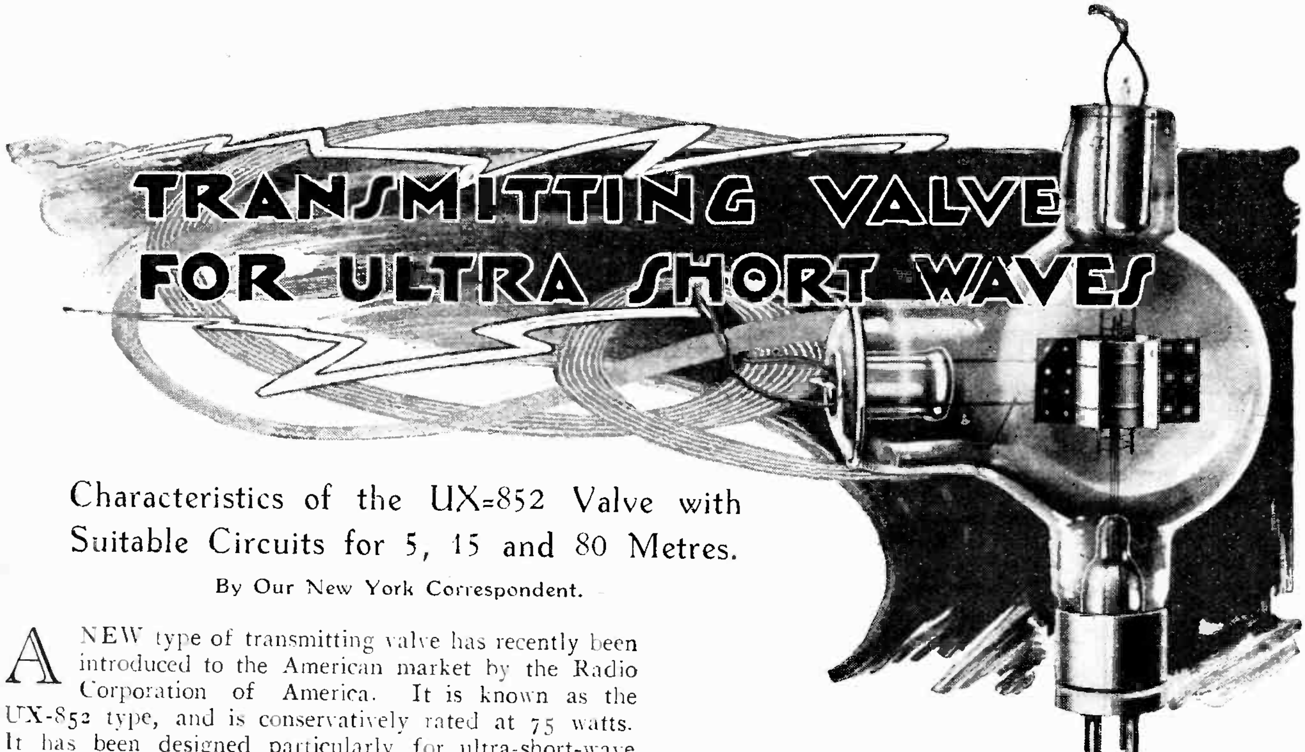
Research is in progress to ascertain the several factors responsible for the variation in speed.

INDIA'S FIRST BROADCASTING STATION. Constructional work in progress on the Bombay Broadcasting Station, which was opened by the Viceroy on July 23rd. Bombay's call sign is 2BY; its power is 3 kW.

AMATEUR TRANSMITTERS IN SOUTH AFRICA.

We are indebted to our South African contemporary *Radio* for the following QRAs, which are additional to those appearing in the R.S.G.B. Diary and Log Book and the supplementary lists published in our issues of December 1st, 1926, and July 13th, 1927.

A 6H H. Haycock, "Monaco," Hospital St., Cleveland, Johannesburg.
A 9D E. C. du Plooy, 109A, Sixth Ave., Mayfair, Johannesburg.
A 9E J. Spence, 4, Princess St., Mowbray, Cape.
A 9F J. T. McCash, 15, Spanker St., Bezuidenhout Valley, Johannesburg.
A 9G J. F. Crawford, 60, Durban Rd., Pietermaritzburg.
A 9H E. R. Ansell, 11, Roberts Rd., Pietermaritzburg.
A 9J C. P. Causton, 77, Kloof St., Capetown.
A 9K R. C. H. Taylor, 91, St. Frusquin St., Malvern, Johannesburg.
A 9L W. Beament, Grosvenor Hotel, Kingwilliamstown.
A 9M K. Frost, Van Coller's Boarding House, Senekal, O.F.S.
A 9N A. M. McIver, 127, Teignmouth Rd., Umbilo, Durban.
A 9O C. L. Knight, 8, Norden St., East London.
A 9P J. F. Lukat, 25, St. Frusquin St., Malvern, Johannesburg.
A 9Q S. S. Lazarus, 18, Craft Ave., Durban.



Characteristics of the UX-852 Valve with Suitable Circuits for 5, 15 and 80 Metres.

By Our New York Correspondent.

A NEW type of transmitting valve has recently been introduced to the American market by the Radio Corporation of America. It is known as the UX-852 type, and is conservatively rated at 75 watts. It has been designed particularly for ultra-short-wave work, and it is free from excessive strains, can be wired very easily, and is relatively cool in operation. It is capable of oscillating at frequencies even below one metre.

As will be seen from the illustration in the title, the bulb of the UX-852 is round in shape, from which three connection arms branch off. One of these arms carries the filament leads, and is fitted with a standard UX base, only two of the pins being in actual use. The socket in which the valve is mounted must be so arranged that the filament will be in a vertical position.

The other two arms carry the grid and plate leads, and are not fitted with a base. Instead, two heavy stranded leads, arranged in parallel, are brought from each stem, one pair connecting to the grid, and the other pair connecting to the plate. These double leads serve to improve considerably the current-carrying capacity at exceptionally high frequencies, and the makers recommend that both leads for each element should be employed at all times so as to carry safely the large circulating currents which flow at very high frequencies.

Details of Construction.

Owing to the fact that the filament, grid, and plate leads are brought out of the valve through individual and widely separated seals arranged about the main spherical portion of the glass bulb, the glass is subjected to minimum strain. Furthermore, leakage and internal breakdown are reduced to negligible proportions, as compared with valves in which all leads are closely grouped, particularly those using a four-pin base for all connections, as is the usual American practice.

Another favourable point about this new design is that the nature of the arrangement permits support to be given to the internal elements without the use of internal insulation or "spacers." This accounts for the exceptionally low inter-electrode capacity, which, in turn, explains why the valve is able to oscillate at such exceptionally high frequencies.

The internal construction of the UX-852 is as simple as it is ingenious. A cylindrical plate, or anode, having six radial cooling fins, is supported in place by two stiff wires which are anchored in the pinch through which the plate leads are brought out.

Grid Supports.

A cylindrical grid, composed of a very open spiral of wire, is placed inside the plate, and is concentric with it. The grid is supported in the same manner as the plate, by the pinch through which the grid leads pass.

The filament consists of a double spiral of thoriated tungsten wire supported at its mid-point and ends by stiff wires embedded in the filament lead pinch.

This simple construction, with inter-electrode capacity reduced to a minimum, permits the valve to be operated on wavelengths below 100 metres. The valve gives excellent results on the popular 40- and 20-metre channels, and it has been successfully operated on wavelengths below 5 metres and even down to 77 centimetres, or a frequency of 390,000 k.c., which is by no means the limit for the amateur who desires to explore the lowest wavelengths of short-wave wireless.

Characteristics.

As compared with the usual type of American transmitting valve, the UX-852 is easy to wire up in a circuit, because, with the leads coming out of the bulb at different points, all connections do not have to be concentrated

Transmitting Valve for Ultra Short Waves.—

at the base; the wiring can be proportionately shorter and can be more widely spaced, thus still further reducing unwanted capacity effects.

Mounted in an upright position the valve has ample air circulation, and is much cooler in operation than the general run of American transmitting valves. This is due, in part, to the use of the large spherical bulb, instead of the usual narrow, cylindrical bulb.

The valve is capable of handling high-plate voltages

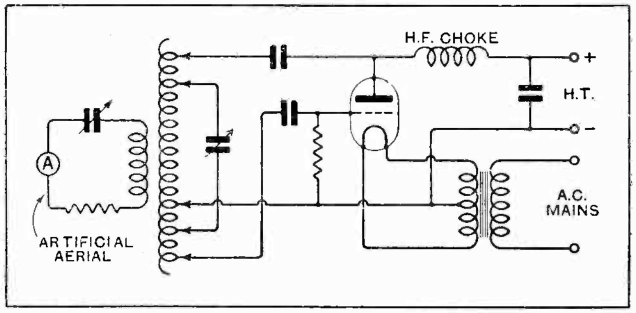


Fig. 1.—Circuit used by the Radio Corporation of America for testing the UX-852 valve on 80 metres.

without danger of internal breakdown. It is specially intended for high-frequency operation, and will handle plate voltages of 2,000 normally, and up to 3,000 with proper precautions, without internal breakdown.

The following are the characteristics of the UX-852 :—

Filament voltage	10 volts.
Filament current	3.25 amps.
Filament power	32.5 watts.
Plate voltage	2,000-3,000 volts.
Plate current (oscillating) ...	0.075 amp.
Input power	150 watts.
Maximum safe power dissipation	100 watts.
Amplification constant	16.
Nominal output	75 watts.
Plate impedance (zero grid) ...	8,000 ohms.

The accompanying diagrams indicate the circuits employed by the Radio Corporation of America when making their laboratory tests of this new valve.

Details of Test Circuits.

Fig. 1 indicates the general arrangement of the circuit used for 80-metre transmission tests, the constants being as follows :—

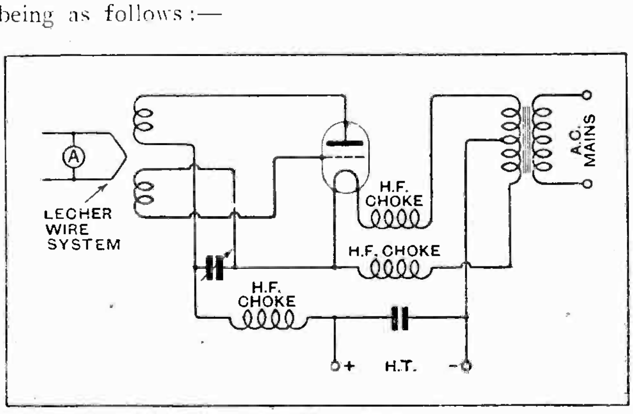


Fig. 2.—Transmitting circuit for wavelengths between 5 and 15 metres.

The oscillating circuit inductance has ten turns of edgewise-wound copper strip, ⅜in. wide, and spaced ⅛in. on an 8in. former. The maximum capacity of the tuning condenser is 250 micro-microfarads, and the plate blocking condenser and the grid condenser both have a capacity of 0.05 mfd. The grid leak is 20,000 ohms. The H.F. choke consists of 200 turns of No. 30 D.C.C. wire wound on a 1in. former. The lighting transformer is 110-10 volts, with centre tap. For the dummy aerial use was made of an inductance similar to the oscillating circuit inductance, with taps, a tuning condenser of 250 micro-microfarads maximum capacity, and a resistance of 15 to 30 ohms.

In the 5-15-metre tests, the circuit for which is given in Fig. 2, the oscillating circuit inductances consisted of two turns each, 3in. in diameter. The tuning condenser is 250 micro-microfarads (max.). The H.F. chokes for the filament leads consist of ten turns each, wound on a 1½in. former. The choke in the plate lead is 100 turns on a 1in. former.

For the tests below 5 metres (see Fig. 3) the inductance consists of the grid and plate leads. The plate-blocking condenser is 0.05 mfd., and the H.F. chokes are ten turns on a 1in. former.

It is pointed out that the above values of components do not necessarily represent the best possible arrangement;

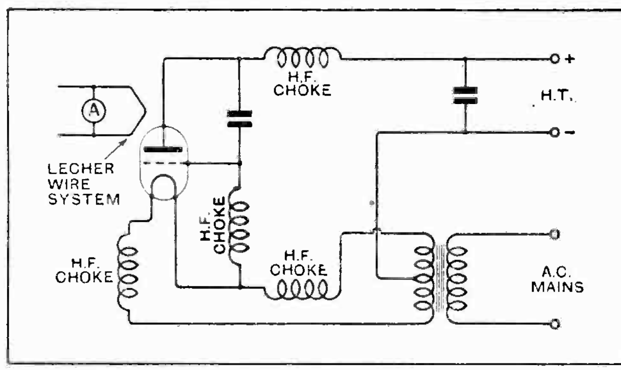


Fig. 3.—Circuit for wavelengths below 5 metres.

they were chosen because the apparatus happened to be available at the time of conducting the tests, and other combinations of values would probably give even better results.

Figs. 1, 2, and 3 will be recognised as the well-known Hartley, Meissner, and Colpitts circuits respectively. By means of the thermo-couple ammeter (A) in the dummy aerial circuit the output power of the valve can be measured.

The UX-852 is suitable for use as an oscillator, either with or without crystal control, or as a power amplifier. Even without crystal control it is reported that the valve gives a very steady pure note at distances as great as 5,000 miles.

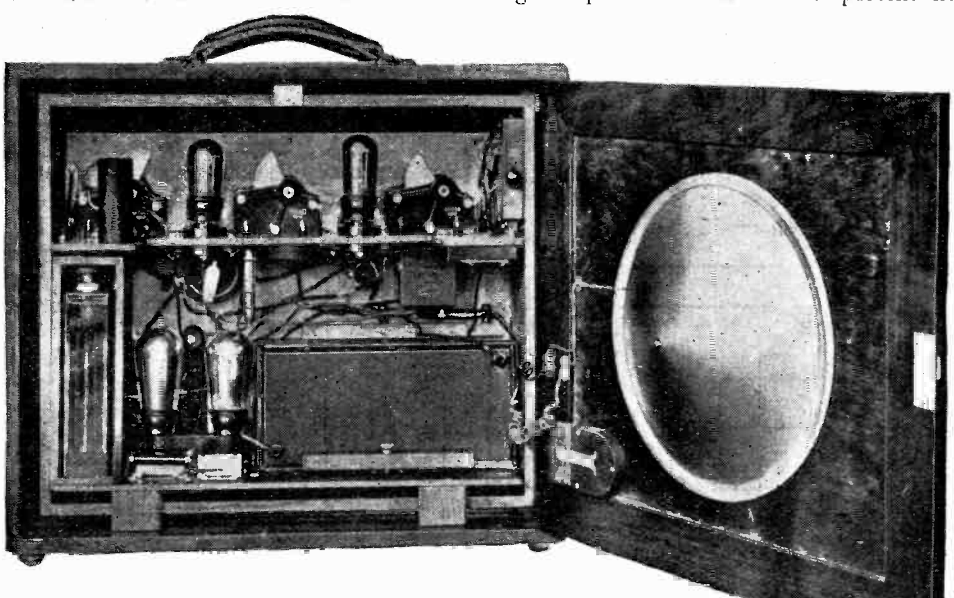
An enterprising New York newspaper, the *Evening Telegram*, has announced its intention of making exhaustive tests on 75 centimetres with this new valve. Nothing definite is known yet as to the effects of skip distance on such short wavelengths, and the radio department of the newspaper in question intends to investigate the problem.

A Robust and Well-finished Four-valve Receiver.

On first examining the Marconiphone Portable one is struck by its workmanlike appearance and sound construction. Realising that a portable set is likely to receive a good deal of comparatively rough usage the designers have assembled the components in a strong wood cabinet which has been given a durable matt finish. Inside this outer case is fitted a wooden frame round which are wound the pick-up coils in two layers for long and short wavelengths. Most of the components are mounted inside this framework and a very strong form of construction is thus obtained. The loud-speaker is of the cone type and is mounted on the hinged door at the back, which is perforated with a series of holes to allow free egress for the sound. The controls are situated in a recess on the opposite side of the set and are protected by a hinged flap.

There are three main and two subsidiary controls. Of the three tuning controls the first tunes the frame aerial, the second tunes the anode circuit of the H.F. valve, and the third controls reaction, which has been introduced to increase signal strength on distant stations. The left-hand of the subsidiary controls is an on-and-off switch which breaks both the H.T. and L.T. circuits, and the right-hand knob is a volume control.

Tuning is simplified by a calibration chart inside the lid of the tuning compartment and should present no



Interior view of the Marconiphone Portable. The spare tuning unit is mounted on the open door just below the loud-speaker leads.

Marconiphone Portable Type 43.

difficulty after a little practice. It is necessary slightly to retune the other condensers after moving the reaction control.

On test we found the set sensitive and highly selective. Continental stations could be tuned in 3½ miles from 2LO while that station was working.

On the long waves, too, the performance is good. Daventry comes in well in London, and there is no difficulty in separating it from Radio Paris. It is here that the volume control comes in useful, for when reaction is made use of to improve selectivity the volume may be too much for the L.F. valves; the volume control then enables distortion to be reduced without in any way affecting selectivity.

On the score of quality, however, we were frankly disappointed. One or more valves were obviously running into grid current even with small volume for indoor use, and the nature of distortion seemed to indicate that the first L.F. valve was at fault. Reasonably good quality could be obtained, however, by further reducing volume.

The circuit comprises an H.F. valve with neutralised tuned anode coupling to the detector and capacity controlled reaction. The two L.F. valves are transformer and resistance-capacity coupled, the normal order being reversed, *i.e.*, transformer coupling is used between the detector and first L.F. and resistance coupling before the power output valve. Grid bias is derived from a battery concealed in a recess behind the H.T. supply.

To change over from short to long waves it is necessary to open the back of the set, change over a plug-in unit and slide a multiple contact switch in the top right-hand corner into the appropriate position.

The mounting of valves is especially good, all valve holders being rubber-sprung. Separate holders are used for the H.F. and detector valves and a double mounting for the L.F. amplifiers.

The weight of the set is normal for its class, as is also the price, which is £31 10s. complete, including valves, batteries and accessories. The manufacturers are The Marconiphone Co., Ltd., 210-212, Tottenham Court Road, London. W.

RECENT INVENTIONS.

The following abstracts are prepared, with the permission of the Controller of H.M. Stationery Office, from Specifications obtainable at the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1s. each.

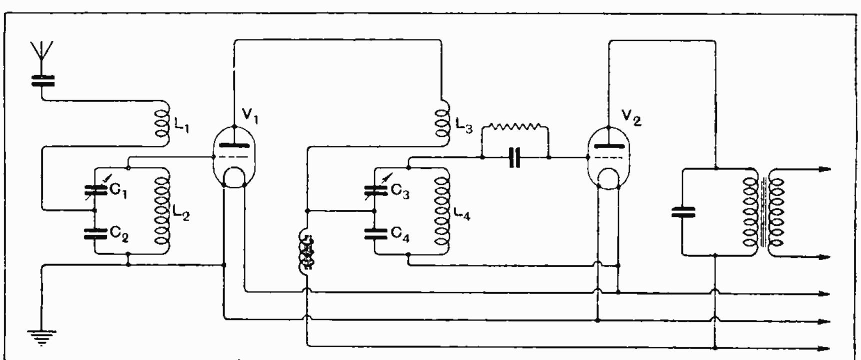
A Constant-Coupling Circuit.
(No. 256,967.)

Convention date (U.S.A.), August 11th, 1925.

In this patent Mr. S. Y. White, already well known to English amateurs in connection with the so-called Loftin-White circuits, covers an intervalve coupling between two amplifying valves so designed as to maintain a constant rate of energy transfer between the valves over a wide tuning range. The arrangement is also stated to limit and control reaction between the input and output circuits of the first amplifier due to inter-electrode capacity, and to prevent the risk of self-oscillation arising from this cause.

It will be seen from the figure that the coupling between the valves V_1 and V_2 is partly electromagnetic across the coils L_3 and L_4, and partly electrostatic through the condenser C_4, which is common to the output circuit of valve V_1 and the input circuit of valve V_2. The variable condenser C_3 serves to tune the input circuit of the valve V_2 as a whole.

A similar arrangement is used to couple the aerial and the first valve. The energy transfer between the aerial and the valve V_1 across the coupling condenser C_2 will decrease as the received signals increase in frequency, whilst that taking place across the coupling coils L_1, L_2 will increase under the same conditions. If the windings of the coils L_1, L_2 are so arranged that both the electromagnetic and electrostatic components of the transferred energy are in phase, the respective variations with frequency will then mutually counteract each other. In other words, the effective coupling will remain constant for all settings of the tuning condenser C_1. In order to minimise inter-electrode capacity coupling across the valve V_1, the value of the inductance L_3 and capacity C_4 are so chosen that the plate circuit of that valve can never approach resonance with its input circuit.



Receiver with constant coupling in aerial and intervalve circuits. (No. 256,967.)

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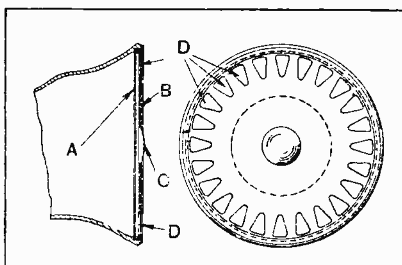
Loud-speaker Attachment.
(No. 270,073.)

Application date: April 12th, 1926.

In order to reduce distortion and any tendency to "blast," Mr. Harrison, of Dewsbury, provides a diaphragm attachment to be fitted in the open end of a loud-speaker horn. As shown in the figure, the fitting comprises an inner diaphragm A with a wide central aperture, and a second or outer diaphragm B provided with a series of peripheral slots D and a central convex portion C. Sound waves passing through the central opening of the first diaphragm first impinge against the boss C, and then escape through the peripheral openings D. Both diaphragms may be made of paper or parchment, and are separated by a spacing ring of rubber. They are secured to the end of the loud-speaker horn by suitable clamping rings.



Loud-speaker attachment to reduce distortion and blasting. (No. 270,073.)

THE EXPERIMENTER'S NOTEBOOK.

Switching in L.F. Amplifiers.

By "EMPIRICIST."

IN a previous article, dealing with the layout of the low-frequency circuits in a wireless receiver, reference was made to jacks and switches for the purpose of cutting out a valve, and a rather pessimistic tone was adopted regarding the possibility of doing this in a satisfactory manner. The writer has had it on his conscience for some time that this was a somewhat cowardly manner of dismissing a difficulty, and the present article is written with the intention of reviewing both current practice and possibilities of future development in this respect.

The most common form of low-frequency amplifier consists of two transformer stages, and in order to fix ideas we shall confine our attention, in the first place, at any rate, to amplifiers of this type; furthermore, we shall assume the first valve to be a detector operated on the "grid condenser and leak" principle. Referring to Figs. 1(a), 1(b), and 1(c), we have theoretical circuit diagrams illustrating three possible ways of cutting out a valve in an amplifier of the above type; all are possible and not infrequently encountered in practice, but there are certain advantages and disadvantages attaching to each which it will be as well to consider. In none of these cases has any switch been shown to turn off the filament of the valve not in use, but this must be imagined to be done for each circuit.

First, in the case of Fig. 1(a), we note that the loudspeaker is inserted in circuit with either one of two valves. This has been an extremely popular method of cutting out a stage, more particularly in America, where the plug and jack system was first developed for wireless purposes; but since the advent of special power valves particularly designed for feeding a loud-speaker it has largely lost its usefulness. It must be borne in mind that the object of cutting out a stage of amplification of any kind is not to diminish the volume of sound produced by the loud-speaker, but to reduce the amplification of the set so that a strong station can be reproduced at full volume with greater economy and less tendency to overloading of the valves and consequent distortion. If, therefore, we change the valve to which the loud-speaker is connected, we are either obliged to use two "super-power" valves or to be content with a smaller volume of undistorted loud speech when one stage is cut out.

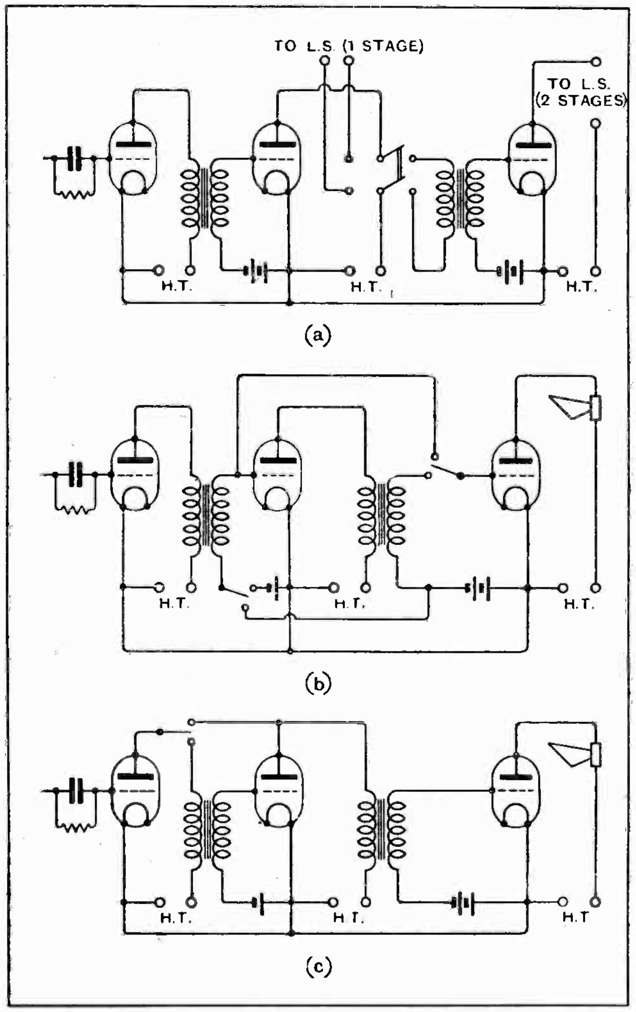


Fig. 1.—Alternative methods of switching a two-stage transformer-coupled amplifier:—(a) Loud-speaker connected in the plate circuit either of the first or second L.F. valve; last valve filament switched off when not in use. (b) Grid of last connected to secondary of either the first or second transformer; first L.F. valve filament switched off when not in use. (c) Primary of second intervalve transformer connected in plate circuit of either first or second L.F. valve; first L.F. valve filament switched off as in (b).

In some cases it occurs as a matter of course that the last two valves are of the same type. Thus with certain valves designed to be lit from A.C. mains there is only one type of valve provided for all purposes, and as it is of no particular consequence to economise in H.T. and L.T. power, it is a perfectly satisfactory arrangement. In other cases it may be desired for some reason or other to employ valves of the same type in the last two positions, and in this event the circuit of Fig. 1(a) is a highly convenient one for the purpose. But in general, when a valve of particular type is employed to feed the loud-speaker of the set, and it is desired to keep the feed current of the other valves down to a reasonably low limit, there is a fundamental objection to this circuit, inasmuch as the power delivered to the loud-speaker is curtailed when one stage is cut out.

Next, considering Fig. 1(b), we have an arrangement in which the grid of the "power valve" is connected to the secondary winding of either the second or the first intervalve transformer. The advantage of this is that in all cases the intervalve transformers and the loud-speaker are worked in circuit with their appropriate valves, the

The Experimenter's Notebook.—

cutting out of a stage being effected by removing from circuit both the second valve and its associated transformer. The disadvantages are, first, the necessity for a double switching operation, as both the grid bias and the grid connection must be changed by the switching operation (inasmuch as the power valve requires much more grid bias than the second valve), and, secondly, that switching is effected on a grid lead which is in general more sensitive to electrostatic induction than a plate lead, and in consequence more likely to lead to instability and frequency distortion. Otherwise this is the most satisfactory of all methods from a theoretical point of view.

Switching Transformer Primaries.

Lastly, we have Fig. 1(c), which represents the commonest and most generally useful method of cutting out a stage. Assuming that the detector and the first L.F. valve are of the same type and connected to the same H.T. tapping through identical transformers, it is then possible to switch over the detector plate from the primary of the first transformer to that of the second, the latter never needing to be disconnected from the plate of the first L.F. valve if the filament of the latter is extinguished when one stage is cut out. This circuit is indubitably very convenient under the conditions above specified, and even when the two valves are operated on different values of H.T. it is not less convenient than the circuit of Fig. 1(b), but in the event of different transformers and valves being used in the first and second positions, there is an objection owing to the fact that the first transformer and first L.F. valve are removed, leaving the detector valve and second transformer to operate in conjunction with each other. There are many arguments in favour of transformers of different ratio for the first and second positions, and therefore we must account this as a limitation on the utility of the circuit of Fig. 1(c).

A remaining possibility exists, namely the connection of the detector grid circuit to the grid of the "first L.F." valve, but this appears to offer no advantages and many disadvantages as compared with the circuits previously given.

Having outlined the various schemes which may be employed for cutting out a stage, we may now proceed to the consideration of the practical details involved in carrying any of them into effect. Here it is more than ever necessary to take whatever precautions are possible as regards the layout of the amplifier, seeing that we are definitely committed to some lengthening of the leads, as the wiring has in all cases to be brought up to some accessible point in order that the plugging or switching operation may be performed.

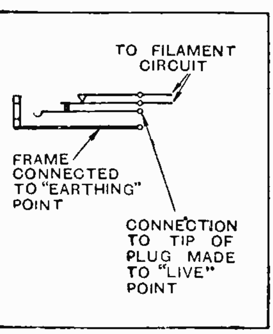


Fig. 2.—Typical jack for stage switching. The frame should be connected to a point of "earth" potential which may be + H.T.

The use of plugs and jacks as opposed to switches has many advantages and need by no means be considered only in relation to the first of the above circuits, in which it is most commonly used. As, however, both plugs and jacks introduce a great deal of metal into the circuit, which may thus give rise to electrostatic fields, care must be taken in connecting them up. In the first place, whatever the manufacturer's recommendations, the metal frame of the jack must be connected to a "dead" point of the circuit, and in consequence the shank of the plug will be similarly connected (see Fig. 2). The tip of the plug and its corresponding contact on the jack will be "live," and by a judicious arrangement of the components of the amplifier we may make the length of lead connected to it small. As a matter of course, the use of square tinned wire will be avoided in "live" connections, and the leads will be taken by the most direct route possible to their destinations.

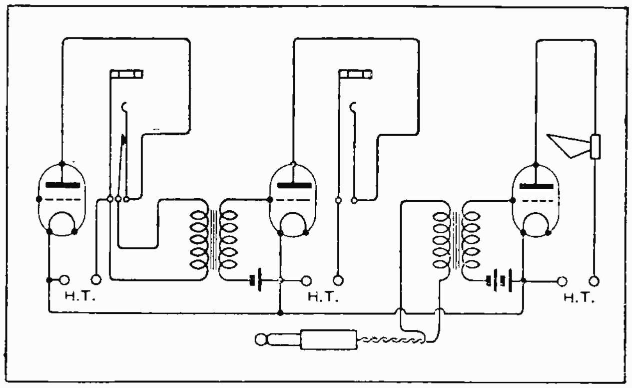


Fig. 3.—The circuit of Fig. 1 (c) adapted for use with plugs and jacks; a filament switch (not shown) is incorporated in the right-hand jack.

Certain manufacturers of wire market a form of flexible cable which consists of an inner conductor surrounded by vulcanised rubber insulation, round the outside of which is located an outer conductor in the form of a metal braid. It is a pity that this type of wire is not more generally employed for loud-speaker connections, since the outer conductor can be connected to the "earthing" point and the inner to the "live" point, and the lead constitutes a non-inductive and electrostatically shielded arrangement.

Induction from Loud-speaker Leads.

The presence of long leads connected to the earlier stages (*e.g.*, the plate lead of the detector valve in Fig. 1(c)) is not likely to have such a bad effect if there is not a serious source of induction at the output end of the amplifier. Furthermore, we may make use of this wire with great advantage when using plugs and jacks for general switching operations, as, for example, in Fig. 3, which shows a practical means for carrying the scheme of Fig. 1(c) into effect. It will be noted that in essence Fig. 1(c) and Fig. 1(a) come to the same thing, only in the former case the switching is carried out one complete stage further back in the amplifier. It is thus just as readily adaptable to plug and jack methods as the latter, provided the presence of a plug with a short length of "flex" on the front panel of the set is not considered a disadvantage.

The Experimenter's Notebook.—

A similar arrangement may be employed for the operation of the circuit shown in Fig. 1(b), but it is probable that, in spite of the precautions just described, a tendency to instability will be experienced. It is probable that, for general switching operations, in which "live" leads are involved, such as those already described and others, even more difficult, in which many stages of radio frequency circuits have to be dealt with, a type of switch will have to be developed in which the switch proper is situated "near its job" and operated by an extension handle of some kind from the front panel. If, then, the total switching operation consists of the opening and closing of a number of contacts in different parts of the receiver circuit we shall be enabled to carry out all operations simultaneously from the front panel by working a single knob, and in spite of this the leads of the circuit will remain substantially as short as if there were no switch involved.

The Ideal Arrangement.

Fig. 4 shows what may be described as an ideal stage-switching arrangement for operating according to the scheme shown in Fig. 1(b). In all normal switching layouts it is necessary to have a lead which extends across the stage to be cut out, and it is this lead which not infrequently gives rise to trouble. According to the present scheme, the lead X, which is the "bridge" across the stage to be removed, is doubly disconnected when not in use, and is thus completely isolated from the amplifier; means may also be provided for connecting it to an "earthing" point when it is not in use, and thereby avoiding electrostatic coupling due to the capacity between it and the parts of the amplifier to which it is adjacent. Referring to this figure, the switches S_1 and S_2 are situated as near as possible to their "jobs," whereas S_3 and S_4 may be operated anywhere that is convenient. The switch S_5, if required, should be operated in the proximity of the lead X, otherwise a considerable extension of the latter may do more harm than good; the best arrangement is, perhaps, the incorporation of S_5 into either S_1 or S_2, a blade switch being employed similar to those embodied in jacks.

It may, perhaps, be felt by many readers of this article that the difficulties of switching out a stage have been overstressed. The writer can only say in anticipation of this criticism that he has encountered only too many amplifiers which were unstable when "all out" in two stages, and in which the instability was entirely due to the extra wiring involved in the switch connections. Admittedly, the trouble arises mainly when a serious attempt is made to get high amplification, but these are exactly the conditions under which it is worth while to take precautions in order to achieve the best results, and it is hoped that some readers of a mechanical turn of mind, who have experienced these difficulties, may think it worth their while to work out a practical embodiment of the arrangement shown in Fig. 4, with links of insulating material connecting switches in various parts of the circuit.

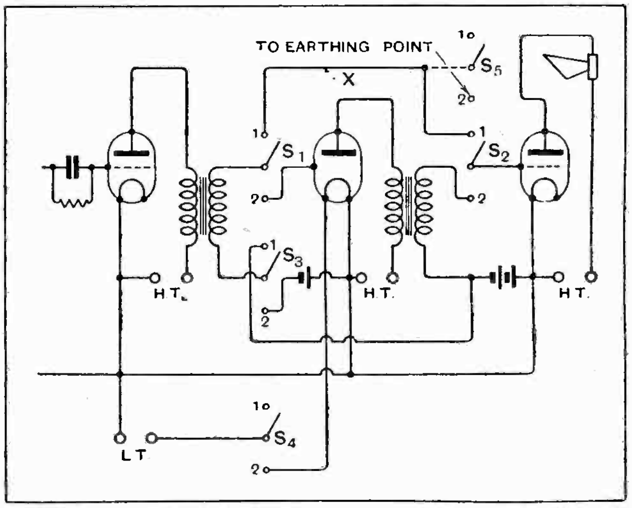


Fig. 4.—Ideal stage switching arrangement operating according to the scheme of Fig. 1(b). The lead X, which connects across the optional stage, is completely isolated when not in use, or may be "earthed" by a switch S_5.

NEWS FROM THE TRADE.

Novel Public Address System.

Much skill in balancing amplifier loads was called for at Newcastle on August 7th when the Marconiphone Co. operated an interesting public address installation. This was on the occasion of the meeting of the Non-Political Union. Speeches were amplified in the Palace Theatre, which seats 4,000 people, and were also relayed over special land lines to the Empire Theatre, seating 2,500, the Gaiety Theatre, seating 1,500, and the Pavilion, seating 3,000, so that a total audience of 11,000 was enabled to listen.

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Mullard Co.'s Change of Address.

As and from August 2nd the head office of the Mullard Wireless Service Co., Ltd., was removed to Nightingale Works, Nightingale Lane, Balham, S.W.12. The London office, Mullard House, Denmark Street, W.C.2, continues operations, and all orders from the London area are executed from this address as hitherto.

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"Kaynite" Reorganisation.

We learn that negotiations have now been concluded for the reorganisation of Messrs. A. W. Knight, Ltd., of "Kaynite" Radio Works, 180, Tower Bridge Road, S.E.1. Prompt delivery can be given of all "Kaynite" proprietary lines, which include coil winding machines, battery eliminating components, and transformers.

Valves in Fog Signalling Apparatus.

It is interesting to learn that Cossor valves are being used in the fog signalling apparatus at Dublin Port. These valves are in continuous operation, except for a few minutes every two months to change the batteries. The apparatus employs five 2-volt Cossor valves with the filaments connected in series, using an 8-volt L.T. supply and a plate voltage of 50. After a period of over 4,000 hours' continuous use the valves were found to be operating efficiently with no change in output current.

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For Time Signals.

Receivers specially designed for the reception of time signals and Press bulletins from the world's wireless stations are described in Pamphlet No. 240 issued by Marconi's Wireless Telegraph Co., Ltd., Marconi House, Strand, W.C.2.

News from All Quarters: By Our Special Correspondent.

First Programmes from 5GB.—What of the Regional Scheme?—Studios Everywhere?—B.B.C. at Olympia.—Empire Broadcasting.—Preparations for Washington.

Those Alternative Programmes.

In a few days' time 5GB will launch its first programme. The station is ready to start any day, and the B.B.C. is merely awaiting the Post Office licence, which, I gather, is not likely to be withheld much longer.

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Short Transmissions.

No attempt will be made at first to present a full-blown programme from 5GB, the intention being to give us a transmission of two or three hours each night consisting of an alternative to the fare provided by the present high power station. The programmes will probably be typical of the material sent out from London or Birmingham or Bournemouth.

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Range of 5GB.

The wavelength will be near 500 metres, but this, and the question of power, will be unsettled until the licence is forthcoming. It is expected, however, that the power will be such as to guarantee an alternative programme to all listeners within range of 5XX.

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Completing the Scheme.

With regard to the development of the regional scheme as a whole, there is still a mysterious silence. The erection of the new Daventry station has been looked upon as the glorious dawn of a new era in which a choice of programme will be available all over Britain. Beautiful though the dawn may be, there are people who are beginning to think it a little hazy, not to say foggy. It would surprise me if the B.B.C. were able, when 5GB starts, to state even vaguely where the remaining regional stations will be located.

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Doubts and Delay.

Whether this indicates a certain tendency towards procrastination on the part of the B.B.C. or the Post Office (perish the thought!) cannot be determined at the moment, but the B.B.C. can rest assured that immediately 5GB has justified its existence there will be an insistent demand for an alternative service from those parts of the country out of range of the new station.

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A Studio in Every Town?

The only opposition to the regional scheme is likely to come from those districts which would be deprived of the main station they already possess. The districts mentioned include Bournemouth, Cardiff and Manchester; here civic pride might claim with perfect reason that as centres of broadcast talent for four or five years they do not deserve the loss of local privilege entailed by the pooling process of a regional scheme.

As an offset to the loss, however, each of these towns would retain its studio; nor does it seem unlikely that in course of time a broadcast studio linked up with a central control point will be the prerogative of every considerable town in Britain.

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B.B.C. at Olympia.

The B.B.C. show at the National Radio Exhibition, Olympia, which opens on September 24th, will be of the "still life" variety, but hardly less interesting on that account than the "aquarium" studio displays of previous years.

Exact replicas will be shown of the transmitting and control rooms at Savoy Hill, and I understand that the display will include an important collection of transmitting valves.

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Morning Transmissions.

General satisfaction seems to have resulted from the recent changes in programme timing, particularly in regard to the noon transmission from 2LO.

Prior to the changes a number of objections were raised, but no protests have been received since. However, Savoy Hill is rather used to this sort of thing!

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More A. J. Alan Tales.

A. J. Alan, whose reputation for queer stories is well known to listeners, will be heard on August 27th in "The Photograph" and "Charles."

FUTURE FEATURES.

London.

AUGUST 14TH.—Religious Service relayed from St. Martin-in-the Fields.

AUGUST 15TH.—Sir Walter Scott Programme.

AUGUST 16TH.—Promenade Concert.

AUGUST 17TH.—"My Programme," by a Middle-aged Man.

AUGUST 18TH.—"All at Sea," a Musical Comedy by Philip Luaraine, and R. St. Jerome.

AUGUST 19TH.—"La Bohème." Music by Giacomo Puccini.

Birmingham.

AUGUST 14TH.—Oratorio Gems.

AUGUST 16TH.—Mr. W. P. Elliott: "Wireless as a Career."

Bournemouth.

AUGUST 15TH.—An Irish Concert.

AUGUST 18TH.—"The Rest House," a Radio Satire by Andrew Harding.

Cardiff.

AUGUST 15TH.—A Welsh Programme.

AUGUST 18TH.—5WA's Sunshine Carnival, relayed from Clarence Park, Weston-super-Mare.

Manchester.

AUGUST 16TH.—Concert by Lakeland Artists.

AUGUST 17TH.—Promenade Concert.

Newcastle.

AUGUST 15TH.—Echoes of Napoleon.

AUGUST 18TH.—Concert by the Municipal Orchestra.

Glasgow.

AUGUST 16TH.—Scottish Humour Series—No. 12, Ed. Lowry (Keep Smiling).

Aberdeen.

AUGUST 17TH.—Scottish Programme.

Belfast.

AUGUST 15TH.—A Quiz at the Theatre.

AUGUST 19TH.—Promenade Concert.

B.B.C. and Empire Broadcasting.

A statement on the question of Empire broadcasting was issued last week by the B.B.C. While no new policy is indicated, the Corporation makes it known that it has always regarded Empire broadcasting as an important objective, and is accordingly continuing elaborate research, particularly in regard to reception. The eventual service, says the B.B.C., will be in terms of rebroadcasting through existing Colonial stations.

Meanwhile, the B.B.C. wishes amateur transmitters every success in their efforts.

This timely statement on a topic upon which the B.B.C. has remained mute for so long may revive many drooping spirits, but on examining it closely the reader may well ask whether it is a definite declaration of policy or merely an attempt to placate the public at a moment when amateurs are likely to score a triumph.

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Technique of the Running Commentary.

Listening to the running commentary on the Southern Command Searchlight Tattoo on Bank Holiday, I noticed several of the old tags which were such a feature of the early football commentaries.

Such expressions as "I say, isn't that splendid!" and "Oh, well done, well done!" don't help the listener to visualise the scene; in fact, they merely tantalise and exasperate. Everyone knows, of course, that a successful running commentary is tremendously difficult to achieve, but it is time that some kind of technique became recognised. At present there is no scheme of training in the subject, and the poor commentator has to rely solely on his own judgment. The preparation of a few "Do's" and "Don'ts" in, say, pamphlet form might rob the task of many of its terrors to the inexperienced.

BROADCASTING STATION

Located in New York City. Now on Air Daily and Nightly.

FOR SALE or LEASE

300 applications before U. S Radio Commission have *not* been granted.
Here is an opportunity for a responsible individual or firm interested in broadcasting.
$75,000 invested, but will sacrifice valuable rights, license, lease and privileges.
Fully equipped studio with modern Western Electric apparatus.
Power 500 watts. Extremely low operating cost.
Extremely low operating cost.
Call letters may be changed. Write for appointment, giving complete details of use. Principals only.

P. O. BOX 15, STATION H, N. Y. C.

ANY OFFERS? An unusual advertisement which appeared recently in the "New York Times."

Captain Eckersley at Washington.

Captain P. P. Eckersley, chief engineer of the B.B.C., has been nominated as Delegate of the Union Internationale de Radiophonie at the forthcoming Washington Conference.

The principal purpose of the Conference is to secure a revision of the International Radiotelegraphic Convention signed in London in 1912, and to prepare new articles which will be applicable to all the newer developments of wireless, including broadcasting.

The Union Internationale de Radiophonie intends to let no opportunities slip; I hear that certain proposals concerning wavelengths and other matters have already been submitted to the International Radiotelegraphic Bureau at Berne for examination at Washington. The Conference opens on October 4th, and its deliberations will probably occupy several weeks. All the principal countries will be represented.

Making Our Flesh Creep.

A "blood brother" of the Peigan (Blackfeet) Indians, Mr. Escott North, is to broadcast from 2LO on August 18th. He is a native of Nottingham who has worked in America for many years as a cowboy. As a member of the Trail Riders of the Canadian Rockies, he has a budget of blood-stirring stories to tell, and listeners should make a point of hearing them.

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This Evening's Play.

Lord Dunsany's play, "The Lost Silk Hat," will be broadcast from 2LO this evening (Wednesday).

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Willie Rouse Again.

Willie Rouse ("Wireless Willie") has not been heard by listeners for a long time. He makes his reappearance before the microphone in the London studio on August 24th.

LATEST IN STUDIOS. This "broadcasting hall," recently opened at 3LO, Melbourne, indicates the modern trend in the direction of larger studios capable of giving effects similar to those of outside broadcasts.

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

Correspondence should be addressed to the Editor, "The Wireless World," Dorset House, Tudor Street, E.C.4, and must be accompanied by the writer's name and address.

EMPIRE BROADCASTING.

Sir,—I read with much interest both your Editorial and the letter of Mr. Mountain of Nigeria in your issue of June 29th.

While agreeing that a B.B.C. short-wave broadcasting station would be a very great boon to the whole British Empire, I cannot but commend the B.B.C. on delaying the erection of such a station until the research work of wealthy companies, like the General Electric (of America) and Westinghouse, has shown entirely conclusive results.

I am not suggesting that it is forgotten that broadcasting in England and in the United States is maintained on entirely different principles, but would point out that the B.B.C. has no publicity or sales department to benefit from world-wide advertisement, and world-wide thanks would be its sole recompense for the large outlay which a suitable short-wave installation would cost.

I would like to emphasise "suitable," as Mr. Mountain would appear to think that the power the Americans use for their short wave transmissions is negligible compared with that used by the B.B.C. at their broadcast frequencies. I happen to be exceedingly familiar with the design and construction of both 2XAF and 2XAD, and would state that the antenna power (I refer to kilowatts in the aerial rather than metre-amperes) which 2XAF utilises on 32.79 metres, and which is about the minimum to give consistent signal strength, at that frequency, for rebroadcast purposes in Europe and the Antipodes, approaches very closely that used by the B.B.C. at their Daventry station 5XX.

Assuming that the B.B.C. propose expending sufficient money to build a station similar to 2XAF, will they not do well to wait just a little longer and ascertain definitely that a wavelength around 32 metres is more desirable for their purpose than, say, 12, 22 or 42?

P. H. DORTE (G6DO).

Schenectady, New York, U.S.A.

Sir,—I apologise for further burdening your Correspondence pages with the subject of Empire broadcasting, but so many views have now been expressed which are either irrelevant or lacking in technical practicability that at any rate I am not likely to make myself unpleasantly conspicuous by any ignorance which I may show. Besides being a keen broadcast listener I have had the experience of designing and building a 3 kW. short-wave broadcasting station, as well as having experimented with transmission and reception on wavelengths from 440 metres down to 5 metres.

I do not dispute the great desirability of a reliable Empire broadcasting link—if we could have it. I am concerned here only with the technical and not the political side of the question. It does not help to criticise the B.B.C., the Government, or anybody else for failing to accomplish something which has never yet been accomplished, and which, for all we know at present, may never be technically possible. I refer, of course, to the suggested establishment of short-wave link transmitters operating on wavelengths somewhere between 20 and 45 metres. An argument popular with enthusiastic wireless novices seems to be that if they can occasionally receive American short-wave broadcasting on a simple set at awkward hours of the night it will be therefore feasible to link up this country with Australia, Africa or India through similar short-wave stations at reasonably convenient hours. Further comment upon this is unnecessary. We must face the facts.

Owing to rapid fading as well as the irregularity and awkwardness of the times at which good reception is to be expected at a great distance it is quite impossible to apply the term "service" to short-wave broadcasting links as they exist at present. The chief function of an Empire link would presumably be the rebroadcasting of important ceremonies, sporting events or special concerts. Such events cannot wait for special hours of the night or favourable atmospheric conditions.

The B.B.C.'s own efforts at rebroadcasting Schenectady are commendable and extremely interesting from an experimental point of view, but from the standpoint of the recipient of broadcasting as a service which must be run to schedule they only demonstrate that short-wave intercontinental links are at present fatuous.

I think a few years of experiment upon short-wave transmission and reception is necessary before the matter is subjected to the serious discussion which it is receiving at present. In particular I believe a great deal might be done to reduce high-speed fading by the use of multi-phase short-wave transmitters radiating circularly polarised fields. Also something might possibly be accomplished by the use of a number of widely separated receivers pooling their low-frequency outputs at some central point by means of suitable land-lines.

I think that we ought to admit that the B.B.C. is quite justified in expressing diffidence about erecting an expensive short-wave transmitter on the scale of the present Daventry stations. At the same time I do not see why it should incur much expense to rig up a temporary experimental set of, say, 4 kW. There must be a few spare valves, inductances and even odd connecting wires at Daventry, and could not the H.T. supply of Daventry Junior be tapped while the latter is not in use? Also a short-wave transmitting aerial need not be much of an affair. But perhaps I have no business to make suggestions of this nature.

Finally I have a constructive suggestion which, though it may be proved absurd, is well worth airing. It is that we have in the Rugby radiotelephone unit something which more nearly approaches a reliable intercontinental telephone link than any short-wave station. The fact that a London subscriber can be put through to a New York subscriber in the afternoon on most days of the week is highly suggestive of the possibilities of this service as an occasional broadcasting link. Now that the first novelty is wearing off it appears that the daily queue of subscribers waiting to dispose of three pounds a minute is not a long one, and probably many of the conversations which take place are not highly important; in any case, urgent private messages can be sent by telegraphic services. Could not the B.B.C. offer an adequate fee for the occasional use of this service for, say, half an hour once a week? The speech quality of the Rugby link must essentially be rather poor, owing to the limited frequency band allowable on 6,000 metres. It seems to me, however, that an occasional exchange of programmes between London and New York, *via* Rocky Point and Rugby, would help to create a new interest and give the stimulus which is so badly needed by the broadcasting industry at present. This would at any rate constitute a first serious step in the development of intercontinental relaying.

London, N.W.3. E. HOWARD ROBINSON.
July 22nd, 1927.

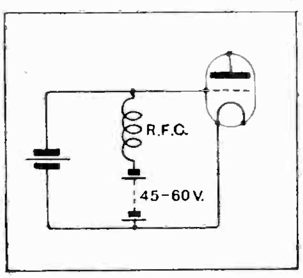
CRYSTAL-CONTROLLED 45-METRE TRANSMITTER.

Sir,—My recent article in *The Wireless World* on a crystal-controlled 4-metre transmitter has aroused some comments from an old friend of mine, Mr. Stanley P. McMinn, of New York, whose letter (copy) I enclose.

Dear Mr. Bloxham,—I find that I must take issue with you over some of the statements contained in that excellent article of yours in the April 13th issue of *The Wireless World*. The criticism is offered not in any captious manner, but solely with the thought of advancing the art of radio communication by such little as I may be able.

The conventional arrangement as shown by you in Fig. 1 is perfectly O.K. with slight modifications and will give full output provided (1) that the top crystal plate is made exceptionally light—featherweight, about the physical dimensions of an American ten-cent piece; (2) that there is the minimum of capacity in shunt with the crystal. It is important to use as much "lumped" capacity in the plate circuit as possible and to avoid distributed capacity in the inductance. In other words you must shunt the *entire* inductance with a variable condenser and then reduce the number of turns until the resonant point is reached with the condenser plates *practically all the way in*. This results in maximum R.F. current in the tank circuit as measured by an R.F. meter in series between the inductance and the condenser.

It is entirely practical and safe to use voltages up to 550 or 600 on the crystal, provided sufficient negative bias is used to hold the plate current to a maximum of 50 mA. Such high voltages require, however, that the top crystal plate be extremely light, for if it is heavy it imposes a physical load on the crystal which must raise and lower the weight with each individual vibration. In consequence of the power expended, both the crystal and the mounting plates heat up excessively.



Grid circuit connections advocated by Mr. McMinn.

It is not entirely safe to put the key in the grid circuit of the amplifier, due to the possibility of surges. It is much safer either to key the negative high-voltage line or to put the key in the old familiar centre-tap position. Some success has been obtained by keying the R.F. feeder direct, but this is difficult because of the ease with which adjustments are upset.

There seems a misconception that one "picks an harmonic of the crystal" for operation at double frequency. As a matter of fact, the crystal generates but one frequency. Harmonics are generated in the oscillator *tube*, and it is these harmonics that are amplified. A high negative bias puts a hump in the sine wave.

In my own case, I am using a UX210 crystal-controlled tube which is fed by a full-wave rectifier with 550 volts at 50 mA. actually on the tube. The output from the oscillator is fed directly to a UX203-A (which is normally rated at 50 watts output), and on the plate of this tube there is full-wave rectified A.C. of 1,200 volts with the plate current varying from 160 to 220 mA. according to the wavelength in use.

At present, I have two crystals with fundamental wavelengths of 75.6 and 84.15 metres. These are in plug-in mounting, and, in conjunction with plug-in inductances in the power amplifier, allow me to QSY any one of four frequencies in about 30 seconds. The same antenna is used for all frequencies and is a single wire 100 feet long with a counterpoise, also single wire, 75 feet long. The fundamental is in the neighbourhood of 120 metres. The same antenna is also used for 20-metre transmission, though a separate transmitter utilising the tuned-grid tuned-plate circuit is used.

It is obvious, of course, that when the amplifier of the crystal-controlled set is tuned to the same frequency as the crystal it is necessary to neutralise the circuit to prevent self-oscillation and minimise radio-frequency feed back, which would otherwise put an undue load on the crystal, cause it to vibrate excessively and result in cracks and chips which ruin it. S. P. McMINN.

New York,
June 1st, 1927.

My reply to the points raised is as follows:—First it must be borne in mind that some discrepancy may be found in the most suitable arrangements for securing maximum efficiency, due to the somewhat different characteristics of English and American valves.

I see no cause for comment on Mr. McMinn's point (1) since I think that I made it clear in my article that the grid of the oscillator valve must have either a leak or bias in order to prevent its becoming too negatively charged and reducing the output, which condition would occur if no leakage path is provided, the crystal itself being quite a good insulator.

With regard to (2), in so far as it relates to the capacity-inductance ratio in the plate circuit, I cannot agree with Mr. McMinn's suggestion that the best condition is obtained with a minimum inductance and a maximum capacity in shunt with it. In the case of the plate circuit of the oscillator valve, we are tapping off at one end what is in effect a radio-frequency feeder energising the grid of the succeeding valve. The valve is essentially a voltage-operated device and the object should therefore be to create the maximum possible P.D. across the coil, to one end of which the feeder is attached, and under these conditions the input taken by the amplifier valve will be greatest.

It is to be admitted that the current in the LC current will be much greater when the number of turns is reduced and the capacity increased, but the *voltage* across the coil is thereby reduced accordingly and therefore the "grid swing" (or voltage variation) transmitted to the amplifier valve is also reduced.

In the case of self-excited transmitters, or any transmitters not crystal-controlled, it is usually desirable to increase the ratio of C to L somewhat, at the expense of efficiency, in order to get stable oscillation. This question, however, does not arise in the case of a crystal-controlled circuit, since, provided the crystal is controlling properly and there is not sufficient feed-back to upset it, the crystal will prevent any frequency variations taking place by virtue of its peculiar properties in this respect. R. BLOXHAM.

Blackheath, S.E.3,
June, 1927.

THE PROPOSED REGIONAL SCHEME.

Sir,—If I were a wealthy man I would give every listener a copy of your July 27th issue, as the selection of letters is a very fair sample of the temper of the listener-in to the present B.B.C. programmes. I have read and re-read every letter referring to the above scheme, and they all boil down to "give us an alternative programme," never mind about how you do it.

If the B.B.C., in the face of these letters, can still sit by in placid indifference then nothing short of dynamite will shift them.

Will Captain Eckersley inform us how it is that Germany can be heard practically all over Europe with their stations Berlin, Frankfurt, Langenberg and Stuttgart, whereas other than Daventry (as London) and London (as Daventry) the rest of the B.B.C. stations may as well not exist for what one can hear of them.

In conclusion I wish to heartily associate myself with your correspondents "Quid Rides," L. Longden Thurgood, and "An Edinburgh Listener-in." PRE-B.B.C.
July 27th, 1927.

Sir,—May I make a few remarks in answer to your correspondent Mr. Longden Thurgood, who contributed to your correspondence page this week?

He wishes to know where are the B.B.C. stations. May I advise him that they are situated in splendid positions for the purpose for which they were intended. Surely your correspondent does not think the northern stations and relay stations were intended for listeners down south.

Does he know the power of the Continental stations which he mentions? And does he realise that those stations are received across a great deal of water?

While not exactly agreeing with the power of the B.B.C. stations, I can't agree with Mr. Thurgood's remarks about getting German engineers to fit six stations with German apparatus. I consider those remarks an insult to British wireless manufacturers and B.B.C. engineers.

I wonder if your correspondent has listened to the B.B.C. stations from Germany or any other part of the country from where he does his "knob twiddling."

It is not at all fair to say the B.B.C. could not muster up the efficiency of those German stations. They can do so. The efficiency is equal to any German station. The power is not, perhaps, equal. Why should it be? Those German stations supply most of Germany with their wireless programmes, whereas Britain employs relay stations.

May I add that British engineers are quite capable of constructing apparatus equal to the Germans, and are doing so.
July 28th, 1927. "MARINE OPERATOR."

Sir,—In the hope that the above proposed scheme will bring about an improvement in the very bad conditions existing for the Birmingham listener, great interest is manifest in this city.

Since 5IT changed wavelengths with Bournemouth thousands of sets have been rendered useless for the purpose of listening to Daventry. I speak for both crystal and valve users.

The tuning from 5IT is so flat that even on a modern four-valve set the station covers 12 degrees, with two peaks.

Before these new two-valve sets are put on the market I beg to recommend that they be carefully tried within four miles of 5IT, in which radius there are over forty thousand licence holders. If the user can hear Daventry either on the old or the new wavelength without 5IT cutting across, then the set will be good value for money. L. KITCHING.
Birmingham,
July 28th, 1927.

TELEVISION.

Sir,—Of recent date the public has had constantly put before its notice through the medium of the daily Press the subject of television. We have been told that television has been achieved; that the time is not far distant when every household will have its televisor; that television will be as commonplace as broadcasting itself. While allowing for the discrepancies of that pernicious individual the stunt journalist, it seems that we are approaching an era when television will be possible as a commercial proposition, but by no means in the way some people would have us believe. Apart from the very fact that television technically has not reached a condition anything approaching domesticity, it seems that Jenkyn and Baird are well ahead in their researches, but when these researches (or those of anyone else) are complete and the gigantic technical problem is solved, the subject will have yet another problem to be solved in the form of what we might term the political situation.

Let us assume that we have reached a stage when television is so perfect as to render it suitable for domestic use. The view put forward to-day by those concerned with the development of this science is that when this condition obtains television broadcasting stations will be set up and the public invited to purchase suitable apparatus to receive the matter put out by these stations.

But it must be obvious to those who maintain this idea that the problem is beset with difficulties. In the first instance, a television system without an accompanying system to reproduce the voice or sound of the object is useless. No one would care to see a big national event by television in absolute silence; the television-transmitted play or musical performance would be impossible without an accompanying synchronised system of wire or wireless telephony, as the case may be. And since the proposed "televisors" to be offered to the public are not in any way to work in co-operation with the broadcasting service, this means that to render his televisor a complete success the owner would eventually have to purchase an additional wireless set to his existing broadcast receiver, or line amplifier if the system were conducted by line. If, when television is complete, the present broadcasting service controls it, then the matter is simplified to a great extent, but it seems that from a technical viewpoint the question of synchronisation would be somewhat difficult with so many varying types of broadcast receivers in use to-day. But we have no assurance at present that the B.B.C. will control television, so it is perhaps premature to discuss a purely technical consideration; but, as has been said, the television service to come is to be operated by an entirely different body as far as one can gather.

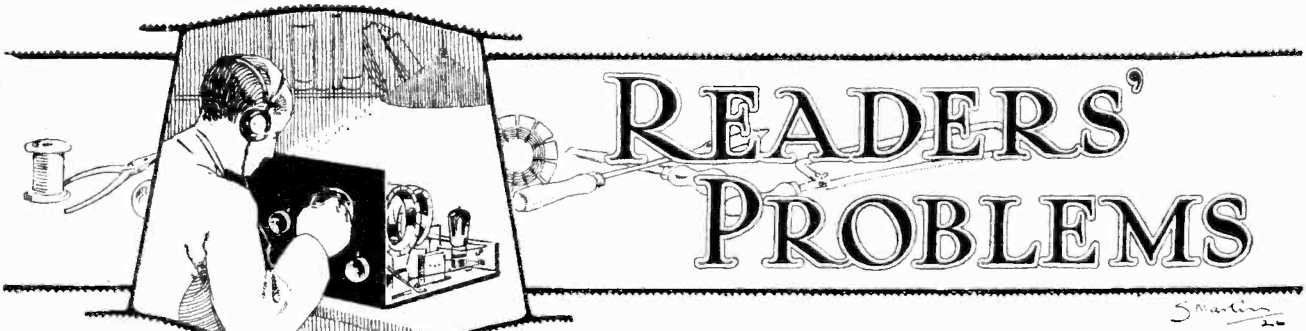
Does it not seem, however, that from the political channel we are approaching the whole subject entirely in the wrong way? Suppose the B.B.C. is operating a broadcast and television service. The result of such a service even coming into being would be the immediate opposition of the whole of the theatrical industry *en masse*, and in addition a far more powerful force financially, speaking internationally, in the form of the film industry. While no mechanical or electrical contrivance on earth could ever substitute legitimate drama, a television service (not only in Great Britain but anywhere) would very soon show signs of its existence at the box offices of the cinema theatres in the same way as broadcasting has affected the music-hall and vaudeville theatre—perhaps not directly but certainly indirectly. Again, one imagines that the financial ramifications of the film and vaudeville entertainment industries are sufficiently powerful, combined, to cause considerable impedance to a television service for entertainment ever being established. It seems, therefore, that with such obstacles ahead as these the home "televisor" is a very long way off. But, on the other hand, the film industry might utilise television in the near future very much to its advantage.

If the technical development of the subject proceeds along the lines of Jenkyn in America, *i.e.*, the transmission and reception of cinematograph films by wire and wireless, it seems within the bounds of possibility that a system might be devised wherein the distributing film companies would transmit their films to the cinemas by wire or wireless or, going farther ahead, one might visualise each of the great film producing countries with its own vast film centre transmitting perhaps a dozen different films at once to cinemas direct: a hundred cinemas, say, receiving and projecting one film, a second hundred another film, and so on. This would surely have a marked effect on the economic aspect of the film industry, and would render possible a "super-production" being on view at every cinema in the country at the same time for perhaps a week.

Personally, I think that television is essentially connected very directly with films, for I see no point in being able to see the face of a singer or movement of an orchestra at a broadcasting studio while listening to broadcast, any idea of a musical production or revue on the lines of a stage performance being out of the question, of course, due to cost, since the performance could only be "put over" once, and the television play with speech accompaniment would probably fail as hopelessly as that other prostitution of true drama—the broadcast play.

To sum up, it appears highly probable that television will develop along the lines suggested above, and that the home televisor and television broadcasting station are more a premature announcement of what certain organisations would like television to be than a careful survey of what it is likely to become and where its benefits would be best utilised.

Brighton, DALLAS BOWER.
July, 1927.



Readers' Problems

"The Wireless World" Information Department Conducts a Free Service of Replies to Readers' Queries.

Questions should be concisely worded, and headed "Information Department." Each question must be accompanied by a stamped addressed envelope for postal reply.

Do Volume Controls Distort?

I am desirous of including some form of volume control in my receiver, and should be glad if you could indicate what method I should use.

A. S. R.

If your receiver has an H.F. stage, an excellent control of volume can be had by dimming the filament of the H.F. valve. On no account, however, must you attempt to control volume by dimming the filaments of the L.F. valves. Another excellent method if you are using resistance coupling in the first L.F. stage is to use a tapped wire-wound resistance; such resistances, of course, are now obtainable from various manufacturers. A third method is to use a variable resistance having a value from about 0 to 40,000 ohms in parallel with your loud-speaker. As you are doubtless aware, special telephone plugs having such volume control resistances incorporated are available for those who use plugs and jacks, whilst quite a number of such resistances are available for those who use ordinary terminals for their loud-speakers.

We have given in Fig. 1 a diagram indicating the position of these three volume controls. They are shown in the circles which we have marked A, B, and C.

There is one rather serious danger for the novice in using method C, and this is as follows. Assuming that the receiver be tuned to the local station so that volume is far too great from the loud-speaker, and so that also there is distortion due to overloading of the last valve, the natural tendency of the operator would be to adjust the volume control. This will at once reduce volume to reasonable limits, and it will do it by reducing the input to the loud-speaker. The input to the last valve will still remain the same as before, and the last valve will still be overloaded, and distortion will still take place.

Method A is apt to involve the novice in a somewhat similar difficulty, as follows. Supposing, again, the local station is tuned in and volume is far too loud, resort will at once be had to the volume control. Now method A controls the input to the anode bend detector valve, and signals may be so strong that in order to reduce them to reasonable strength in the loud-speaker, and also possibly in order to prevent overload of the last valve, it may be necessary to use the volume control so drastically that the input to the anode bend detector valve is reduced to an exceedingly low value, and distortion may set in from this cause.

Method B has none of these disadvantages, since it enables a full input to be delivered to the detector valve, whilst enabling the input to the L.F. amplifier to be controlled. Thus, supposing the local station is tuned in as before, the last valve is overloaded, and volume much too loud, the application of the volume control in method B will reduce volume, and also overload distortion by lessening the input to the L.F. amplifier without interfering with the input to the anode bend rectifier. It would seem, then, that method B is the best method to use, although methods A and C, if used intelligently, are quite sound.

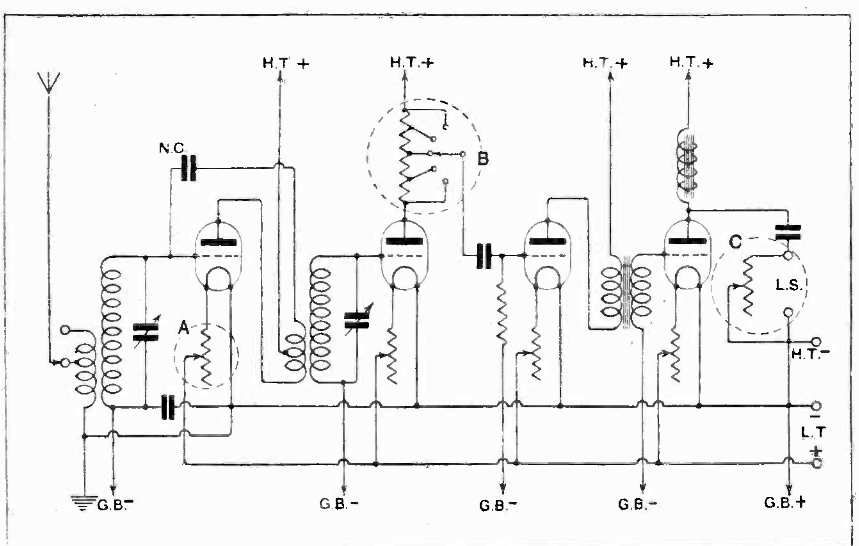


Fig. 1.—Typical receiving circuit showing alternative volume controls.

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A Question of Flux.

I propose adding a choke filter output circuit to my existing receiver. I have a transformer, the primary of which is burnt out. Will the secondary be suitable for a choke?

R. M.

The iron core of a transformer is designed to accommodate only a limited magnetic flux, since most L.F. transformers are intended to be used after medium impedance valves, where the plate current is small. If used as an output choke it is probable that the core will saturate and cause distortion, due to the comparatively heavy plate current. This is more especially the case if the secondary winding is used, owing to the large number of turns, and, therefore, the greater magnetic flux produced for a given current.

Eliminating A.C. Mains Hum.

Some time ago I built an H.T. battery eliminator for use with my four-valve receiver, my mains being 240-volt 50-cycles A.C. The results obtained were very good, and even when no programme was actually being transmitted only a negligibly faint hum could be heard in the loud-speaker. Lately I have built a loud-speaker of the moving coil type, and on connecting it up to my set through a suitable output transformer I get a loud and unpleasant hum which practically ruins the programme. Restoring my old loud-speaker, which is of a very expensive type, the hum at once disappears. Can you tell me the cause of this? J. T. S.

The phenomena which you mention seem to indicate that the smoothing arrangements in your eliminator are inadequate when using a moving coil loud-speaker. Your ordinary loud-speaker is apparently very inefficient from the point of view of reproducing the lower musical frequencies. A 50-cycle hum from the eliminator is probably present all the time, but your ordinary loud-speaker takes very little notice of it. On substituting a moving coil loud-speaker, however, it does give due weight to the lower musical frequencies, and so, naturally, the 50-cycle hum is reproduced loudly.

You must therefore use a more generous smoothing equipment, by which we do not necessarily mean that you must increase the inductance of your chokes, because in certain circumstances which we have already discussed in these columns an increase in the inductance of the chokes might, by causing magnetic saturation, increase rather than decrease the hum. You should see that your chokes are all of generous proportions and suitable for carrying the maximum plate current with a wide margin of safety from the point of view of magnetic saturation. You may also have to increase the capacity of your smoothing condensers. In cases which are brought to our notice, however, of inadequate smoothing arrangements, we most often find that the trouble is due to saturation of the iron cores of the chokes, rather than to too small a value of inductance in capacity in the smoothing unit.

A problem of this kind is one which quickly reveals to us the deficiencies of many of our instruments which have been hitherto unimpeachably good as in the case of your eliminator. Often readers have found that in an L.F. amplifier the cheapest and worst transformer is as good as the best on the market, the sole reason being that the loud-speaker reproduction is so bad that not even the world's worst transformer could make it sound any worse. The use of a good loud-speaker of the type you have now got at once reveals the weak spots in a receiver from the point of view of quality, and the wide margin of difference separating good and bad transformers is at once made plain.

An Efficient Single-valve Circuit.

I wish to build a single-valve circuit for the reception of broadcasting, incorporating the following features: Leaky grid rectification, auto-tapped aerial, and capacity controlled reaction, and use the method of reaction adopted in your "Sensitive Two" receiver. D. R. G.

We give in Fig. 1 a diagram such as you require. The tuning coil may be wound on a 3in. former and consist of 70 turns of No. 24 D.C.C. The reaction coil may consist of 15 turns of a much finer gauge of wire wound as a continuation of the tuning coil at its low potential end. We refer, of course, to a continuation from the mechanical point of view, and not from the electrical point of view, as the reaction coil in this circuit is in an entirely separate circuit, and is not electrically connected to the low potential end of the grid coil as in the Reinartz circuit. The H.F. choke can consist of any of the commercial chokes which are at present on the market. Needless to say, an L.F. amplifier can be added to this instrument in the ordinary manner, the primary of the transformer taking the place of the telephones, and the filament connections of the amplifying valve or valves being coupled up to the filament connections of the detector. The fixed condenser shunting the telephones may be of 0.0003 mfd. capacity.

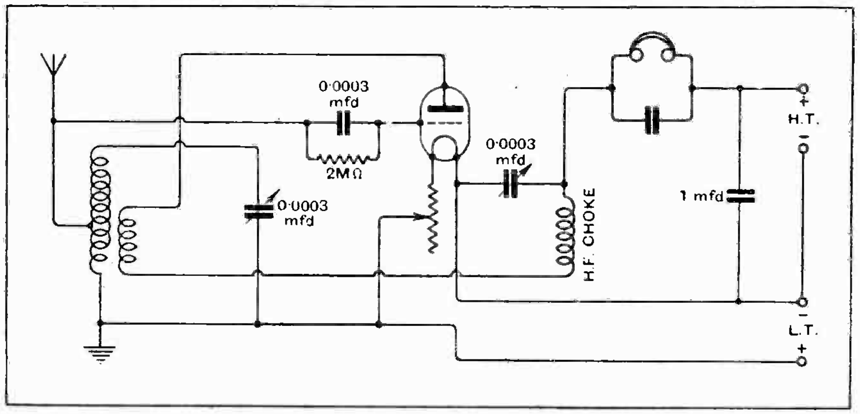

Fig. 1.—A sensitive and selective single valve circuit.

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Reflexing on Short Waves.

I have a reflex receiver which has given very good results on both the normal broadcasting and on the Daventry wavelength, the various wavelengths being covered by interchangeable coils. Recently I purchased some of the new "skeleton" plug-in coils for reception of stations working on the short wavelengths, but can obtain no success. Can you tell me where I have gone wrong? P. R. R.

It is asking too much of any reflex receiver, no matter how well designed, to expect it to give satisfaction on short wavelengths. It must be remembered that it is necessary first to get a valve to give complete satisfaction as a plain H.F. amplifier on short wavelengths before we attempt to reflex it. In other words, reflexing consists in the use of a valve performing the functions of H.F. and L.F. amplification simultaneously. It is obvious, therefore, that before a valve can be said to be performing the functions of a reflex valve it must be giving some account of itself as an H.F. amplifier. First let us make the valve perform the functions of an H.F. amplifier efficiently before we proceed to reflex it. In our opinion, it would be far better for you to build a separate receiver consisting of a plain detector and L.F. set for short wavelengths, and would refer you to our special short-wave issue of June 2nd last for full constructional details of such an instrument.

Process of Elimination.

I have constructed the "Everyman Four" receiver, and although excellent results are obtained from the local station, the more distant B.B.C. and Continental stations are not received at very good strength. I should be obliged if you could assist me to locate the cause of this poor performance. J. M. S.

Insensitivity of a receiver is more difficult to trace than complete failure to receive signals, and the tracing of the cause is a tedious and lengthy process unless a definite system of elimination is followed. It would therefore be advisable to commence with the H.F. circuit and work through the receiver, testing each circuit in turn.

In the issue of July 15th last on page 752 appeared a suggested method to adopt for tracing faults in the high frequency circuit of the "Everyman Four," and we think this would prove a very satisfactory commencement. Continuing, the telephones can then be connected in the anode circuit of the first L.F. valve and if the receiver is functioning correct to this point, good telephone reception should be possible. It is only by adopting eliminating tests of this nature that faults can be really satisfactorily traced.

New Wine in Old Bottles.

I have a two-stage transformer coupled amplifier which has given me sterling service for the past four years. I intend building the "All Wave Four" receiver, and, not wishing to waste this amplifier, I propose building the first two valves of this receiver and adding this amplifier. Will this be in order? F. H. T.

It is not a practicable proposition for you to do as you suggest. It must be remembered that the "All Wave Four" depends to a large extent for its well-known properties of sensitivity and selectivity upon the use of a high-efficiency coupling between H.F. and detector valves. The secondary of this transformer is in fact wound with Litz wire in order that the H.F. resistance of the detector valve grid circuit be reduced to a minimum. Having thus reduced the damping in the circuit by the use of this special wire, it would be foolish to employ leaky grid rectification and so deliberately introduce damping losses due to grid current in the circuit, and thus set at nought the high-efficiency design of the H.F. transformer. We therefore have to use anode rectification in this circuit.

In order that anode bend rectification be reasonably sensitive to weak signals, so that distant stations can be received well, we naturally make use of one of the new high resistance high magnification factor valves which are now upon the market specially for this purpose. Such valves, it will be found, have a fairly sharply defined bottom bend, and provided the grid voltage of the detector valve is adjusted very carefully, so that the working point occurs on the bottom bend, we shall have a very sensitive detector indeed. It might be mentioned here that the better the valve (that is, the more sharply defined the bottom bend) the more critical will be the adjustment of the detector valve, and this was the reason for using a potentiometer in the "All Wave Four" detector grid circuit.

Now these valves already have a fairly high A.C. resistance, and as is known, when the valve is adjusted and used as an anode bend rectifier, the A.C. resistance is still further enhanced. It is obvious, therefore, that if good quality is a primary consideration with us, the external impedance of the detector valve plate circuit must be exceedingly high, and even the best of transformers have not a sufficiently high inductance primary to give us the necessary impedance, and if a transformer is used, we shall notice a serious weakening of the lower notes. We must, therefore, make use of an anode resistance of a quarter or half a megohm.

From this explanation you will readily see the inadvisability of using your amplifier after the detector of the "All Wave Four." It would be inadvisable even if your amplifier contained really up-to-date L.F. transformers, which can scarcely be the case in view of its age.

We might point out that the reasons we have given for the non-use of a transformer following the detector valve of this receiver apply equally in the case of headphones, and no attempt to use telephones after the detector valve should be made. Many readers have tried to use telephones after the detector by putting them in series with the anode resistance; we thus have, in the case of the "All Wave Four," a 500,000 ohm resistance in series with the 30,000 ohms A.C. resistance of the telephones. It will be readily seen that very little voltage will be set up across the telephones, nearly all the voltage being set up across the anode resistance, and, therefore, only a small fraction of the total signal strength value will be heard in the telephones. We might state that our remarks here apply with equal force in the case of the "Everyman Four" receiver. If either of these receivers are to be made up for telephones only, three valves must be used; that is, a resistance coupling must follow the detector valve, and, of course, a suitable output valve after the resistance coupling.

Improving a Two-valve Set.

I am situated 15 miles from my local station. I am using a detector and 1 L.F. type of receiver with reaction, the L.F. coupling being by means of a transformer. This arrangement gives me very satisfactory results with several pairs of headphones without approaching too near the oscillation point. Would it be worth my while buying a loud-speaker, or should I first have to put in an additional valve? G. D.

In order to test whether your present arrangement would work a loud-speaker or not, you should tune in your local station, and if you find that signals on your single pair of headphones are deafening, then you can take it for granted that adequate volume would be obtained from a loud-speaker without any additional apparatus.

It is necessary for signals to be really and truly unbearably loud on a pair of telephones before one can say that a loud-speaker connected to the receiver would give reasonably good volume. We would inform you, however, that if you find that signals are not strong enough for the loud-speaker, there is not the slightest need to add additional apparatus, as a simple two-valve set of this description used at the distance you name, in conjunction with a reasonably efficient aerial, should give you adequate loud-speaker volume with good quality. You are naturally advised to make sure that your aerial and earth system are as efficient as possible, but you are also advised to make sure that the valves you are using are the best obtainable and that your L.F. transformer is a good one.

If you have a poor transformer, therefore, put in a new one and see that your new one is a good one. High ratio is not necessarily an indication of a good transformer, and you will probably find that best results will be given by using a transformer having a ratio considerably less than 5 to 1. The detector valve should be of a good type having an A.C. resistance of about 30,000 ohms, and as high an amplification as possible for this A.C. resistance, and we would suggest some such valve as the D.E.5B, which gives an amplification factor of 20 for the A.C. resistance we have mentioned. Do not, of course, attempt to use a 70,000 ohm valve.

By the judicious use of reaction other stations should be received, apart from your local station, the selectivity and sensitivity of such a set as yours being ample for this purpose at 15 miles' range from the local station.

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Long Wavelengths and the "Everyman Four."

I was very interested in the reply to "D. L. W." in your issue of July 13th, in which a method was shown of vastly increasing the range of the "Everyman Three" on the long wavelengths, and was wondering whether this method was equally applicable to the "Everyman Four." P. C. D. R.

This system, while giving excellent results with the "Everyman Three," is not applicable to the "Everyman Four," because the "Everyman Four" has in the anode circuit of its detector valve a very high resistance, and therefore if we attempt to put a reaction coil in series with this we shall not obtain the same results as we do by putting a reaction coil in the plate circuit of the "Everyman Three," where we have a transformer primary taking the place of the high anode resistance.

The only method by which you could approximate to the method used in the "Everyman Three" is to use a choke, or, of course, a low value of anode resistance (not greater than 150,000 ohms wire wound) in the plate circuit of the "Everyman Four." You could experiment in this manner. Do not forget to shunt the anode resistance or choke, as the case may be, by a fixed condenser of not less than 0.0001 mfd. capacity. Of course, you could substitute a transformer in the first L.F. stage, and use leaky grid rectification, but then the receiver would cease to be the "Everyman Four," and would simply become the "Everyman Three" with an extra L.F. stage added.

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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.

OUR INFORMATION SERVICE.

We regard our Information Department as an essential feature of the service which we consider a wireless journal should provide for the benefit of its readers, but in order that this section of our service may operate so as to provide the maximum of benefit to all our readers there are certain directions in which we would ask our readers to co-operate with us when making use of our Information Department.

In our issue of October 14th, 1925, we announced that in future we should make no charge for replying to questions forwarded to our Information Department, but we requested that in order to assist us in carrying out this work to the satisfaction of readers, we hoped that readers, in turn, would co-operate with us by wording their questions as concisely as possible, and that they would refrain from sending in more than one question at a time, each question to be accompanied by a stamped addressed envelope. We, on our part, have continued to maintain this free service of replies, and have from time to time augmented our technical staff in order to enable us to cope with the ever-growing number of letters which we receive, but in many cases we have not enjoyed the co-operation from our readers which we had looked for. Instead of confining their enquiries to one question at a time we constantly receive letters of several pages closely written which, if dealt with adequately, would call for a small booklet in reply. Only recently we received a letter containing thirteen questions, numbered consecutively with a page of further questions unclassified which had been added as an afterthought.

It must be quite apparent that the whole object of the Information Department as a service to assist readers in their difficulties will fail if we continue to handle enquiries of this nature, which occupy time which it is our intention should be more equally divided between our correspondents.

In order to facilitate the smooth running of our service and to ensure prompt replies it will be well, perhaps, to indicate in some detail the scope of the department. The service is primarily run for the assistance of readers who may require additional information on points dealt with in the articles in the journal, and where necessary to provide additional information regarding constructional sets described. We are prepared to extend our replies to theoretical and practical problems encountered by the reader, provided these are not of such a character that the information can readily be obtained from some standard text book. We assume that our enquirers are regular readers of the journal, and that we can, therefore, refer them to various back numbers of the paper if we consider that their questions have recently been covered. We frequently receive requests for a circuit for, say, "a good five-valve receiver," but here we would point out that the time has long passed when one can give the necessary information merely by supplying a theoretical circuit diagram. One cannot to-day give the requisite information for building a satisfactory receiver without supplying a complete design in addition to the circuit diagram, because the choice of components and the design of each individual component play such an important part in the performance of the whole, and a complete specification for the design of a receiver we should regard as outside the scope of our Information Department, although suggestions from readers will be always welcomed as to any particular type of set which they would like to see described in the pages of the journal. Finally, we must make a special appeal to our correspondents to confine their enquiry to one question at a time, the question to be written on one side of the page only, and any diagram which may accompany the enquiry should also be drawn on one side of the page on a separate sheet.

Those who fail to observe these regulations must blame themselves if their enquiries are not dealt with in routine order, but have to wait until prompt attention has been given first to others who have followed the rules laid down.

Wireless World Regional Receiver

Medium-distance Loud-speaker and Long-range Phone Reception.

By H. F. SMITH.

WHATEVER the means by which we are to be given a choice of alternative programmes, it is fairly certain that a large number of listeners will have to improve the selectivity of their receivers if they are to be able to receive even one transmission clear of interference. Now there can be little doubt that the best method of ensuring this quality lies in the use of tuned H.F. amplification, and those who have up to the present been satisfied with a detector-L.F. combination will have to think seriously of adopting this most valuable aid to selectivity. It is admitted that an efficient wavetrap or absorption circuit may do much towards eliminating unwanted signals, but it is generally agreed that the best way of applying a tuned filter circuit is to make it act as a coupling between two valves.

A high-frequency amplifying valve is nowadays something more than a passenger, and the amateur who is already getting surplus volume on his o-v-2 receiver may well assume that the addition of more magnification will result in overloading. The best way out of the difficulty is to abandon the second L.F. amplifier, and with it (the writer believes) many such troubles as L.F. oscillation, howling, and a good deal of distortion from various causes. A detector followed by one resistance-coupled stage, and preceded by an H.F. valve if made necessary by distance and the requirements of selectivity, *is* enough for a very considerable proportion of the population of this country, even at the present time, and is still more likely to be so when our stations have greater power.

The fact that each additional L.F. valve amplifies dis-

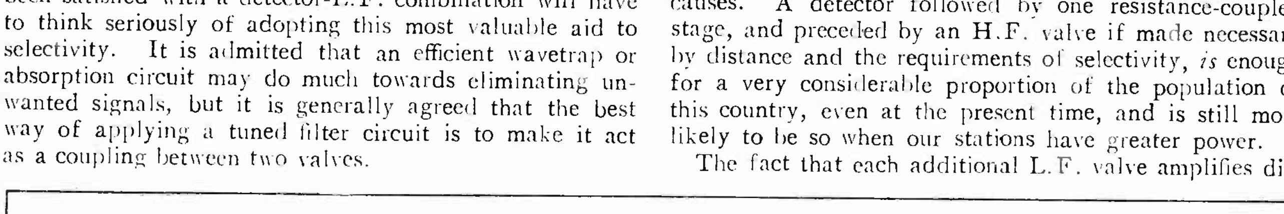


Fig. 1.—The circuit diagram. C_1, C_2, C_3, 0.0005 mfd.; C_4, 0.25 mfd.; C_5, 0.0001 mfd.; C_6, 0.005 mfd.; C_7, C_8, 2 mfds.; R_1, R_2, 30 ohms; R_3, 6 ohms; R_4, 250,000 ohms; R_5, 0.25 megohm; R_6, 2 megohms; L_3 is the output choke.

Wireless World Regional Receiver.—

tortion due to the preceding one is not sufficiently often stressed; we see the curve of a single stage, and are inclined to think that the same proportional amplification will be obtained from our two-stage amplifier. This is not so, but the point is of small importance, when an average loud-speaker is used, as compared with other pitfalls, the principal of which is incidental L.F. reaction, the tendency towards which probably increases with improvements in the efficiency of valves and transformers. Things are bad enough when actual oscillation, manifesting itself in the form of howling, is produced, but a more insidious evil is incipient oscillation, which may introduce into the overall amplification curve of our amplifier, though it be made up with good and suitably-chosen components, such peaks as are rivalled only in the curve of the World's Worst Transformer. This reaction is generally caused by inter-stage coupling through a resistance in the H.T. battery, or even more often in the potential divider of an eliminator. Clearly the risk of such troubles

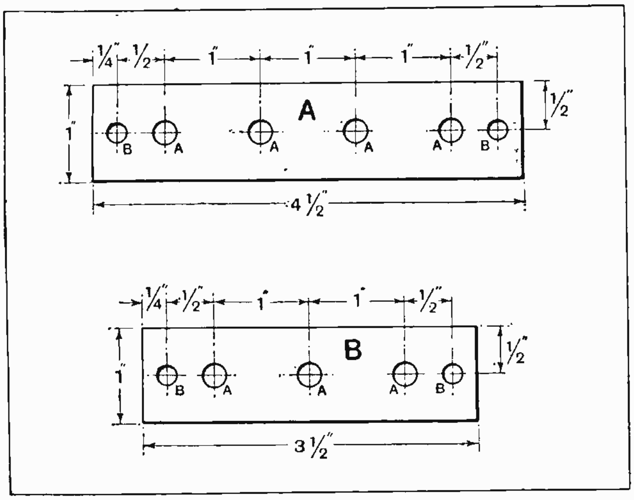


Fig. 2.—A, The battery terminal panel. B, The aerial terminal panel. Holes marked A are drilled and tapped for sockets; those marked B are 7/32in. clearance holes for No. 8 wood screws.

is minimised when a single stage only is included in the receiver; moreover, the tendency towards instability due to an imperfect separation of H.F. and L.F. components in the anode circuit of a detector (always a difficult matter when resistance coupling is used) is demonstrably less marked when the second low-frequency amplifier is omitted.

Lest the foregoing should give the impression that it is an almost hopeless task to get two L.F. stages into a state of really satisfactory operation, it should be added at once that such an amplifier can be, and often is, made to perform as it should. In any case, it is an absolute necessity for long-range loud-speaker reception. For work at comparatively short distances, however, it is submitted that a single stage is safer, and, thanks to recent improvements in valves, sufficient magnification may be obtained, even with resistance coupling.

Before describing in detail the instrument illustrated at the head of this article, a few words may be said concerning its purpose, limitations, and performance. In the first place, it is most emphatically not intended for

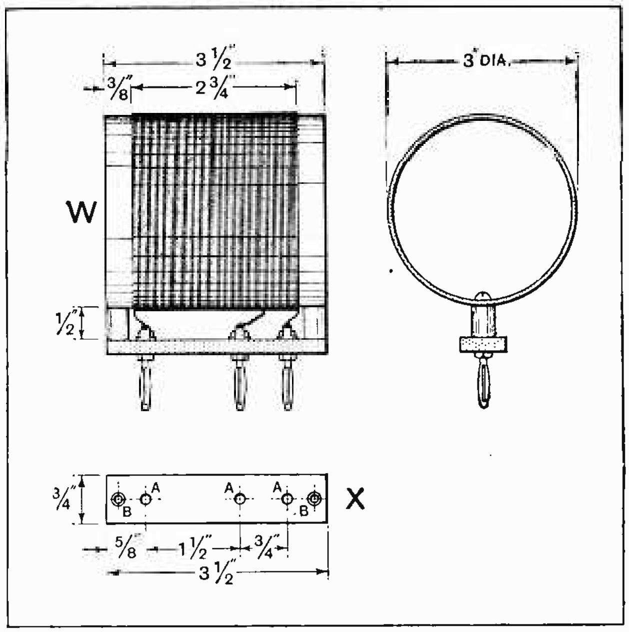


Fig. 3.—W, Constructional details of short-wave aerial-grid coil, and below, X, the ebonite block forming its base. Holes marked A are drilled for sockets, and those marked B are 1/8in. dia., countersunk for No. 4 wood screws.

receiving distant stations on the loud-speaker; those to whom this kind of reception is essential must add another L.F. amplifier. Range should always be estimated conservatively, and it is safe to say that, under average

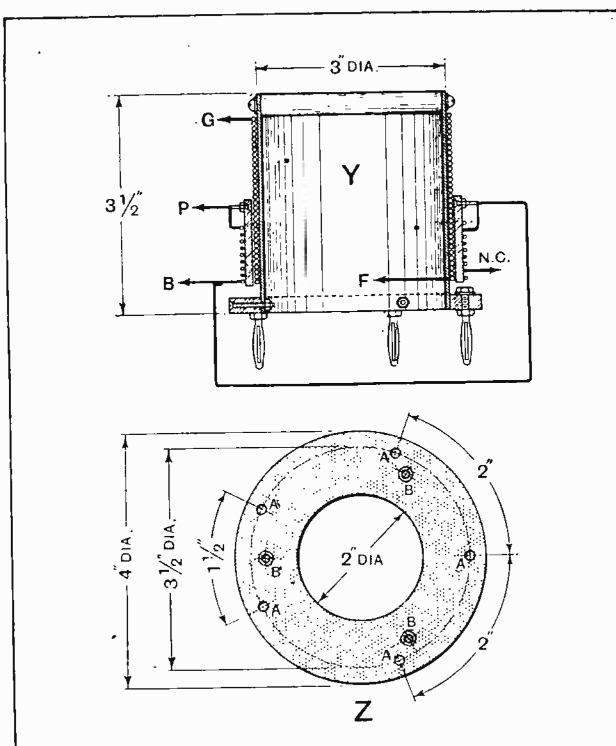


Fig. 4.—Y, Details of the short-wave H.F. transformer. Z, Transformer base. Position of holes for sockets are shown at A, and those for the holding-down screws at B

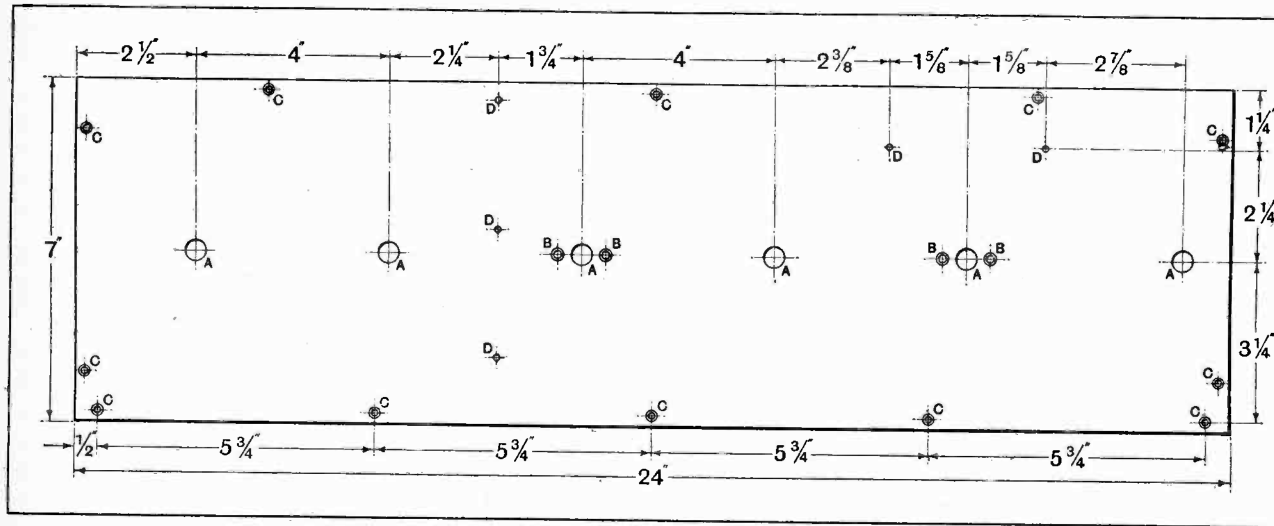


Fig. 5.—Drilling details of the front panel. A, 7/16in. dia.; B, 5/32in dia. C, 1/8in. dia., countersunk for No. 4 wood screws; D, 1/8in. dia.

conditions, an ordinary B.B.C. main station should give signals up to the power-handling capacity of a 4,000-ohm output valve (the so-called super-power valve) at 40 miles, and the more powerful London station at at least 50 miles. One hesitates to assign a definite figure for the proposed new stations, but 60 miles will allow a large margin of safety. Daventry should be receivable up to 150 miles. Under moderately favourable conditions all these ranges are exceeded very considerably. On head telephones the sensitivity is that to be expected from a modern receiver, and a number of Continental stations, including all the high-power, long-wave transmitters, should be heard in daylight under fair conditions.

The above results are only obtainable with valves having suitable characteristics; this is a point which should be emphasised, as the performance of the set will otherwise be disappointing. The H.F. transformers are designed for valves of from 20,000 to 30,000 ohms, a voltage factor of about 20 being assumed for this impedance. The detector is important, and for best sensitivity it should have an amplification factor of 35 or 40, which will mean that its impedance is of the order of 70,000 ohms. Any ordinary power or "super-power" valve is suitable as an L.F. amplifier, the latter being the better if the user is willing to provide the heavier anode current which is consumed.

A possible danger which arises when the power valve is fed direct from the detector, as in this case, should be mentioned. This is that the detector may be overloaded before the output valve is loaded up to its full capacity. As to whether this undesirable state of affairs will arise depends both on the amount of amplification provided and the percentage of modulation at the transmitting end. The matter has been the subject of careful observation, and it is considered that the risk of trouble from this source is practically negligible, as grid cur-

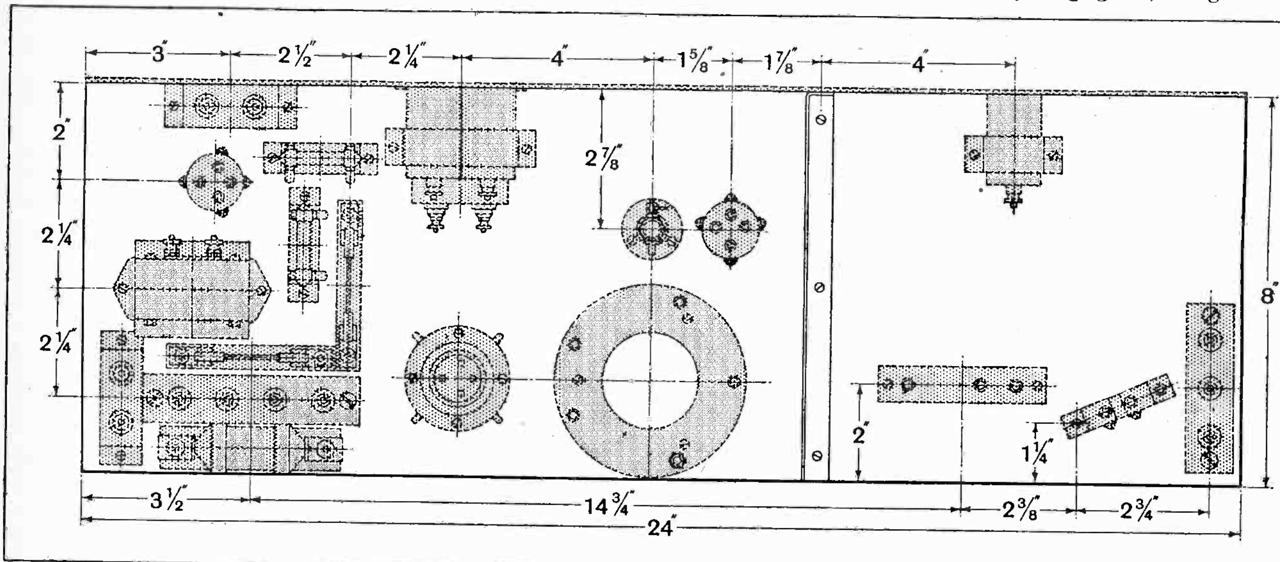


Fig. 6.—Disposition of components on the baseboard. The bias battery GB_2 and the by-pass condenser C_1 are secured in position by the same metal strap.

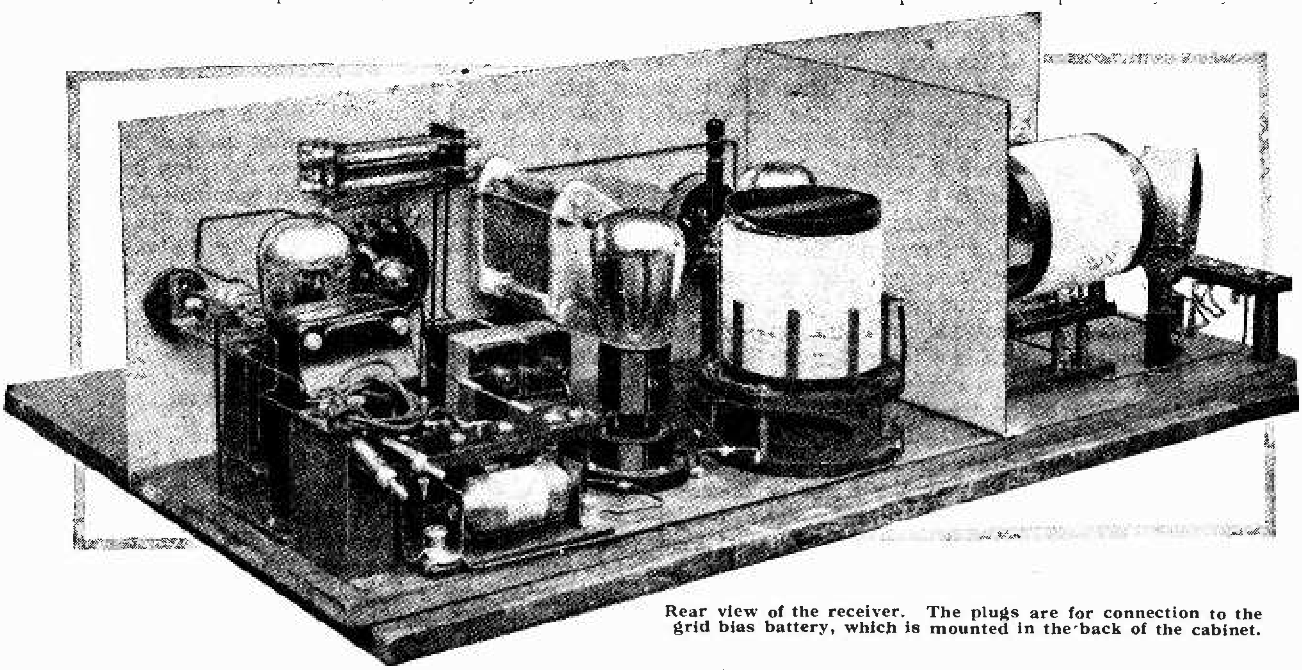
Wireless World Regional Receiver.—
rents start in the detector *after* overloading of the 4,000-ohm valve used in the output position has begun. This is under normal working conditions, with 120 volts of high tension. The problem would admittedly become difficult if an attempt were made to feed, say, a 2,500-ohm valve direct from the rectifier, but the set we are discussing is intended for use with an ordinary power or super-power valve.

Circuit Details.

The circuit diagram of the receiver, given in Fig. 1, may now be considered in detail. It includes a tuned, loosely-coupled aerial circuit with an alternative "untuned" auto-coupled arrangement, a stage of neutralised transformer-coupled H.F. amplification with interchangeable coils, an anode bend detector with potentiometer control, and a single stage of resistance-coupled amplification. A choke-condenser filter is included in the anode circuit of the output valve, in conjunction with a will be introduced into the normal aerial-earth circuit, although the mains themselves often make a very fair "earth."

It will be seen that the aerial inductance (L_1) is an ordinary plug-in coil, mounted in a holder screwed to the baseboard at one point, so that the coupling of this coil with respect to the secondary (L_2) may be varied. The capacity of a "standard" aerial is such that No. 30 or 50 coils will usually cover the broadcast waveband, while a No. 150 is generally suitable for reception of the long-wave stations. Coils vary somewhat in physical size, and it is as well to arrange the position of the holder so that L_1 is roughly co-axial with L_2, and in such a way that the former may be rotated sufficiently to put the axes of the two coils at right angles for loosest coupling.

Those who wish to avoid the extra complication of a separately tuned aerial circuit may omit it entirely, using the terminal A_2, and still obtain good results, particularly on the shorter wavelengths. In any case, the aerial condenser C_1 forms part of a comparatively flatly tuned



Rear view of the receiver. The plugs are for connection to the grid bias battery, which is mounted in the back of the cabinet.

jack which is so arranged that the insertion of a telephone or loud-speaker plug completes the L.F. circuit through the closing of the upper contacts. This is a particularly convenient device in a receiver which is intended for occasional long-distance reception on phones, and by taking the return lead to negative L.T., the wiring is simplified, particularly when a metal panel is used, as the circuit may be completed through the frame of the jack.

The separately tuned aerial circuit is of advantage when receiving on the 900-2,000 metres waveband, and on all wavelengths when a D.C. battery eliminator is used, though in this case it will be as well to omit the lead between L.T. negative and the earth terminal, thus ensuring that the filaments are in direct metallic connection with earth at one point only, namely, through the mains. The adoption of this plan will, however, preclude the use of the "untuned" aerial arrangement, as a break

circuit, and there is little reason, apart from appearance, for using one of as high efficiency as those which tune the secondary and H.F. circuits (C_2 and C_3).

Aerial Coil as Wave-trap.

Although the separately tuned aerial circuit may be omitted, its retention is advised in cases where maximum selectivity is necessary, as the coil and condenser may be made to act as an absorption circuit for the elimination of signals from a powerful transmitter at a very short distance. To put this device into operation, the aerial is inserted in socket A_2, a suitable coil is plugged into L_1, and the condenser C_1 is rotated until the undesired signals are reduced to minimum strength. Efficiency may be improved by using a comparatively high tuning capacity; to obtain this it is recommended that a fixed air condenser of 0.0003 mfd. should be connected in parallel with C_1. For fuller information on this subject the reader is re-

LIST OF PARTS.

3 Variable condensers, 0.0005 mfd. (Pye).
1 Panel, 24in. × 7in.
1 Single coil holder (Wearite).
2 Reversible valve holders (Athol).
1 " Antipong " valve holder (Sterling).
1 Neutralising condenser (Gambrell).
2 Paxolin tubes, 3in. dia., 3½in. long.
2 Ribbed formers, 3½in. long (Becol).
1 Condenser, Mansbridge, 0.25 mfd. (Sterling).
2 Condensers, Mansbridge, 2 mfds. (Sterling).
1 Potentiometer, Bakelite (Igranic Pacent).
1 Rheostat, Bakelite, 30 ohms (Igranic Pacent).
1 2-way Rheostat, 6 and 30 ohms (Loriostat).
3 Dry cells, " 0 " size (Ever-Ready).
1 Fixed condenser, 0.0001 mfd. with base (McMichael).
1 Fixed condenser, 0.005 mfd. with base (McMichael).
1 Grid leak, 2 megohms (Dumetohm).
1 Grid leak, 0.25 megohm (Dumetohm).
2 Grid leak bases (Dubilier).
1 Anode resistance 250,000 ohms (Varley-R.I.).
1 L.F. choke, 30 henries (Sterling).
1 Single open filament control jack (Edison Bell).
150 yards 9/40 Litz wire, S.S.C. and D.S.C. overall (Lewcos).
40 yards 27/42 Litz wire, S.S.C. and D.S.C. overall (Lewcos).
1 Cabinet, 24in. × 7in. high × 8in. deep (inside measurements) (F. Digby).
Ebonite scrap, screws, wire, plugs, sockets, metal for screen, etc.
Approximate cost, including cabinet, £10 15s.

In the "List of Parts" included in the descriptions of *THE WIRELESS WORLD* receivers are detailed the components actually used by the designer, and illustrated in the photographs of the instrument. Where the designer considers it necessary that particular components should be used in preference to others, these components are mentioned in the article itself. In all other cases the constructor can use his discretion as to the choice of components, provided they are of equal quality to those listed, and that he takes into consideration in the dimensions and layout of the set any variations in the size of alternative components he may use.

ferred to articles by A. P. Castellain in *The Wireless World* for January 19th and 26th, 1927.

The receiver lends itself particularly well to the use of a metal panel, as none of the components mounted on it are at high radio-frequency potential. That illustrated is made of aluminium, 3-32in. thick. As an experiment, its front surface was treated by the sandblast process, afterwards being given a coat of clear cellulose varnish. The resultant finish is unusual, but distinctly pleasing. In this matter, of course, the constructor may follow his own inclinations, and may use ebonite or wood if he prefers, remembering, however, that the rotors of the tuning condensers are at the potential of the grid bias battery, and thus require some slight insulation. At this point, a small matter which is often rather puzzling may be cleared up. In the Pye condensers which are used, both stator and rotor vanes are separately insulated, both from each other and from the metal end-plate and frame. Thus there are three separate terminals. As far as the set under discussion is concerned, the frame is connected to L.T. – through the metal panel, and the high-potential and low-potential ends of each tuned circuit are joined respectively to fixed and moving vanes. These connections are marked F and M in the practical wiring plan. The soldering tags on the frames serve as convenient negative low-tension connection points.

Plug and Socket Connections.

To provide a quick change-over for the alternative methods of aerial coupling, plugs and sockets are used, and for the sake of uniformity the batteries are connected by the same method, the leads for the plugs being passed through a hole in the back of the cabinet. Separate holes are drilled for the aerial and earth leads. The terminal strips, on which the sockets are mounted, consist of rectangular pieces of ebonite sheet, ¼in. thick, cut and drilled as shown in Fig. 2. They are raised above the baseboard by 1½in. distance pieces cut from ebonite tube, ½in. in external and ¼in. in internal diameter, through which 2in. wood screws are passed into the baseboard.

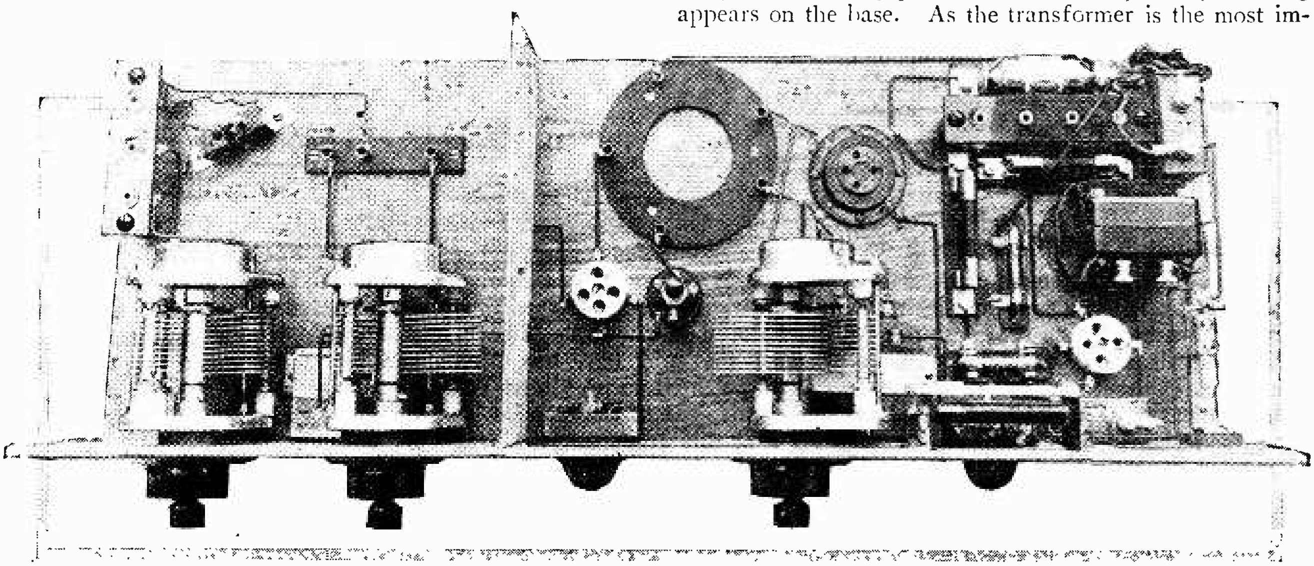
The construction of the short-wave grid coil will be clear from a consideration of Fig. 3. It is wound on a Paxolin tube, 3½in. long and 3in. in diameter, mounted by means of two ½in. distance pieces and screws on an ebonite strip carrying three plugs. These latter, as used by the writer, are of the so-called " banana " type, with spring sides, and a solid end. Unfortunately, they do not seem to be generally available commercially, which is a pity, as they are distinctly better than the usual split pins. The coil is wound with a total of 70 turns of 27/42 Litz wire, a tapping being made at the 12th turn from the end for connection to the plug engaging with the socket joined to the aerial terminal A_2. The base consists of a rectangular strip of ebonite, ¼in. thick, drilled as shown at X in Fig. 3 for the sockets and for the screws by which it is secured to the baseboard. The screws and nuts by which these sockets are fitted should be sunk into the ebonite in such a way that they do not make contact with the woodwork.

The H.F. Transformers.

The windings of the short-wave H.F. transformer are the same as those first described in this journal in connection with the " Everyman-Four " receiver, although in this case provision is made for interchangeability, to allow of reception on the long waves. For the benefit of new readers it may be recalled that these transformers, in conjunction with a suitable valve, give a measured H.F. amplification of nearly 40 over the whole of the broadcast waveband. The windings are carried on a Paxolin former, of the same dimensions as that on which the grid coil is wound. This cylinder is fitted to an ebonite ring 3in. in internal and 4in. in external diameter by means of three equally spaced 6 B.A. screws, which are passed through both former and disc, and secured with nuts. Four pins and one socket (the latter to prevent accidental incorrect insertion of the transformer into its base) are arranged around the disc on a diameter of 3½in. An ebonite cross-bar, which acts as a grip, is fitted across the top of the tube.

The windings of the transformer, as well as the construction of the former, is shown in Fig. 4. The secondary has a total of 70 turns of No. 27/42 Litz. Over this is the primary winding, with 15 turns of No. 40 D.S.C. wire, separated from the secondary by eight ebonite spacers, 1½in. long, ¼in. wide, and ⅛in. thick. Their upper surfaces are grooved with 32 depressions to the inch, and the primary section is wound in alternate

Wireless World Regional Receiver.—
grooves, allowing a spacing of $\frac{1}{16}$in. between turns; this space is for the parallel neutralising winding. Two of these spacing strips carry a single half-inch No. 8 or 10 B.A. screw at their upper extremities, for anchoring the ends of primary and neutralising windings. The heads of these screws are deeply countersunk to avoid any risk of short-circuiting to the secondary winding. The strips carrying the screws are actually placed near the pins to which they will be connected, and not diametrically opposite each other, as shown in Fig. 4, which is drawn in this manner so that the connections may be made clear. The connections of the various ends are indicated in Fig. 4 by the lettering P, N.C., B, G, and F, which represent ultimate connections to plate (or preceding valve) neutralising condenser, H.T. battery, grid, and filament (of detector valve). The actual pins to which the ends of the windings are joined are shown in the practical wiring plan, in which corresponding lettering appears on the base. As the transformer is the most important component in an H.F. amplifier, the greatest care must be taken in its construction, and the best materials only should be used. Litz wire must be handled very carefully, and the ends should be bared by very gentle scraping, to avoid the possibility of breaking any of the strands.



Plan view, with coils removed.

(To be concluded.)

CLUB NEWS.

An Enterprising Post Office Society.

In conjunction with the Art and Horticultural Societies of the Western District Post Offices, the Western Postal Radio Society held an exhibition and competition on Friday and Saturday, July 29th and 30th. This, the first exhibition held by the Society, proved exceedingly popular and successful. Prizes were given in six of the seven sections, namely, for crystal sets, one-valve sets, best set with the essential parts home made, most original set, multi-valve set, and gadgets. In the seventh, a non-competitive section, members exhibited apparatus of their own construction, including ancient apparatus, graphs for various purposes, amplifiers, etc. Mr. Orr, one of the members, demonstrated his "Everyman Three," this feature being one of the biggest attractions. Two types of loud-speaker, the Celestion and a coil-driven cone type with large baffle as described by Dr. McLachlan in *The Wireless World*, were also demonstrated. Interest never flagged during these demonstrations, and owing to the exceptional quality large crowds were attracted and held. The apparatus exhibited showed that the crystal set still seems to have a strong hold on amateurs. Some distinguished visitors from other societies supported the exhibition and lent a hand when necessary.

Hon. secretary, Mr. E. G. Nurse (2AJR), Western District Post Office, London, W.1.

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Cheap and Efficient Battery Charger.

Every wireless user with an electric light supply considers, sooner or later, the question of charging his accumulators from the mains.

At the last meeting of the North Middlesex Wireless Club, Mr. T. Tagent described how he had solved the problem in his own case by the use of a valve rectifier fed from a suitable transformer.

After dealing briefly with the theory of the valve, the lecturer proceeded to elaborate the simple rectifier circuit, step by step, until he had built up the final circuit of the complete installation, explaining the advantages of each as he went along.

In order to keep the current constant a stabilising resistance or "barretter," consisting of a wire of high temperature coefficient was used.

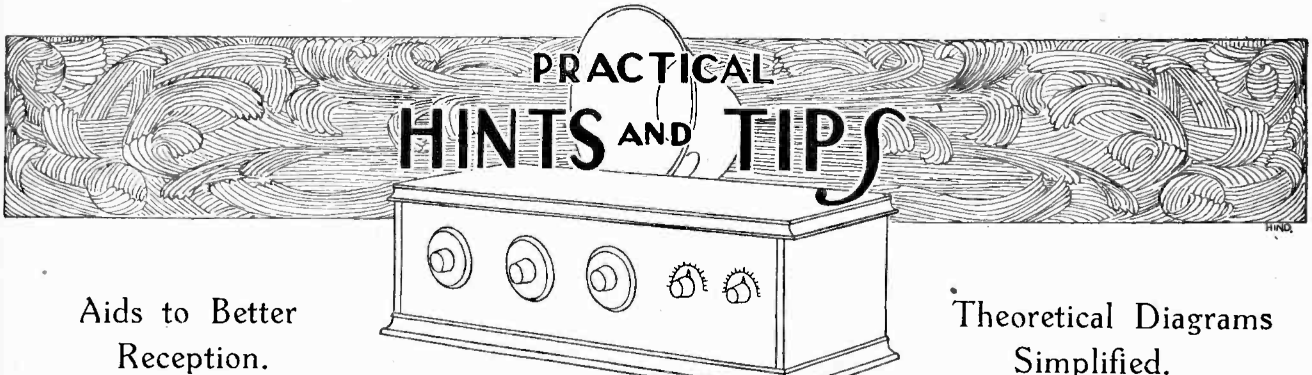
The number of cells on charge did not then affect the charging rate, though this could be controlled externally by means of a tapped resistance. The filament of the rectifier being fed with A.C. from the same transformer as the anode, the unit was entirely self-contained, automatic in action, reliable and economical in use, and low in first cost, Mr. Tagent's own apparatus having cost just over £2.

These latter remarks were endorsed by one or two members with experience of similar apparatus, and during the discussion which followed it was mentioned that it was sometimes found cheaper to charge six cells than only one!

The meeting then closed with a vote of thanks to the lecturer, and the chairman reminded members that the next meeting, on August 17th, would be devoted to a lecture on "Short-wave Reception" by Mr. W. Gartland.

In view of the number of short-wave broadcast stations now on the ether, this should prove of great interest.

Hon. secretary, Mr. H. A. Green, 100, Pellatt Grove, Wood Green, N.22.



Aids to Better Reception.

Theoretical Diagrams Simplified.

CAPACITY-CONTROLLED REACTION.

IN almost any arrangement of capacity controlled reaction, in which energy is fed back from the plate to the grid circuit, we have the choice of using a large reaction coil with a small condenser, or a small coil with a large condenser. There seems to be no general agreement as to which is the better method of the two, but the theoretical advantage would appear to be with the latter. In practice, however, this is not a matter of vital importance, unless our receiver depends for its sensitivity almost solely on critical control of regeneration. The use of a condenser of small physical dimensions, and having a maximum capacity of some 0.00004 mfd., is often convenient. The additional size of the reaction coil need present no difficulty, as it may be wound with very fine silk-covered wire, such as No. 42 S.W.G.

oooo

GRID BIAS.

A POINT which is not always realised when considering the setting of grid bias for the various valves within a receiver is that one dry cell will provide ample bias for all but the last stage.

Assuming that sufficient demands are being made on the set to warrant biasing the grid of the last valve to 9 volts, it will be obvious that the peak value of the A.C. signal voltage swing will be 18 volts.

Since we have a right to expect at least 25 times voltage amplification from any modern stage of audio-frequency amplification, be it resistance coupled or transformer coupled, this 18 volts swing on the grid of the power valve would be produced by 18/25, or, say, 0.7 volt on the grid of the preceding valve.

To accommodate this 0.7 volt swing a bias of only 0.35 volt is necessary, always providing that the particular valve employed does not pass grid current until the grid bias has been raised to a potential positive in respect to the negative end of the filament.

Reversing this argument, the grid bias produced by a single cell, *i.e.*, 1.5 volts, is only fully employed when a voltage swing of 90 is deemed desirable on the grid (S) of the output stage.

The small bias normally required could quite well be obtained in many cases by inserting resistance (fixed or variable) in the negative lead of the valve filament circuit, and connecting the grid to −L.T. as in Fig. 1.

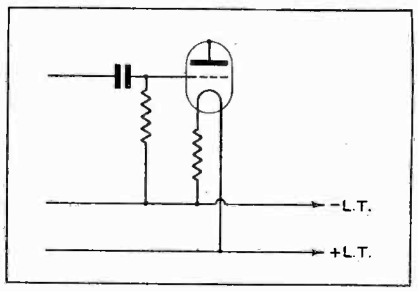


Fig. 1.—Obtaining grid bias by connecting the filament resistor in the negative L.T. lead.

Whether this method will work depends upon the characteristics of the valve filament. For instance, many filaments rated at 2 volts will function well at 1.6 volts, leaving 0.4 volt available for biasing, resistance drop in battery leads, etc. With four- or six-volt a large surplus voltage is available.

When only just sufficient bias is used the maximum performance of the valve will be obtained at an appreciably lower H.T. voltage than would otherwise be necessary, thus economising in batteries.

A FEW FACTS ABOUT VALVES.

A HIGH amplification factor is always desirable, but not always practicable, because an increase is invariably accompanied by a rise in impedance and a reduced ability of the valve to handle large voltage inputs.

oooo

If two valves have the same impedance, the one with the higher amplification factor may be considered as the better, all other things being equal. A valve with an impedance of 30,000 ohms, and a voltage factor of 10, used in conjunction with a suitably designed H.F. transformer, will give only half the magnification obtainable (with the same transformer) from one of similar impedance, but with a factor of 20.

oooo

A reduction in impedance is accompanied by an increase in anode current under fixed operating conditions (grid bias and H.T. voltage).

oooo

The straight part of the grid volts-anode current characteristic curve of a low-frequency output valve is always slightly longer under operating conditions that would appear from a consideration of the static curve as usually published. This "flattening" effect is due to the presence of an inductive load in the anode circuit, and its extent is dependent on the frequency of the currents being dealt with: the lower the periodicity the less "flattening" takes place. Thus, if our amplifier passes on voltages corresponding to the lower audible frequencies, the permissible increase in bias, over and above that indicated by the static curve, is very slight.

oooo

In choosing a valve for an H.F. amplifier, remember that almost invariably an increase in impedance will be accompanied by an increase in the selectivity obtainable from the receiver. This principle cannot be carried too far, however, as the inter-valve coupling device will be unable to "extract" a reasonable proportion of the H.F. energy in its anode circuit for transference to the detector or the next stage if impedance is excessive.

oooo

High-impedance amplifying valves, whether H.F. or L.F., require small negative bias voltages. The converse holds good.

oooo

The risk of causing damage by the application of a considerable H.T. voltage without negative bias is most pronounced when dealing with power and super-power valves.

oooo

It is always worth while fitting a variable or semi-variable filament resistance for a valve which has a high ohmic resistance in its anode circuit. Full emission will not be required, and actually better results may be obtained with a dull filament, apart from the fact that consumption of current from the L.T. battery will be reduced.

oooo

"Softness" is indicated by the presence of a blue glow between the electrodes. If the bulb is completely obscured by the "gettering" process it may not be possible to see this glow, but the trouble will be shown by an excessive anode current, or by a peculiar hissing sound in telephones connected in the same circuit. A soft valve should be discarded at once, as it may pass sufficient current to exhaust the H.T. battery in a very short time.

oooo

A high-impedance valve, with a high voltage factor, is almost invariably the best for a tuned anode circuit, particularly from the point of view of selectivity.

oooo

It should be remembered that it is excessive anode current—not voltage—which reduces the life of a valve. Thus, if the H.T. voltage is increased beyond that specified by the makers, negative bias should be greater than that usually specified. If this is of such a value that anode current is reduced to that which would pass under normal operating conditions, the life of the valve will not be appreciably decreased.

oooo

A grid rectifying valve must have a positive grid bias for correct operation.

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SWITCHING ALTERNATIVE LOUD-SPEAKERS INTO SERVICE.

IN these days, when several distinct types (as apart from makes) of loud-speakers are available, rapid switching is desirable if the differences between any two are to be appreciated to the full. The two obvious ways to wire up the instruments in order to make the change from one to another are as shown in Fig. 2 (a).

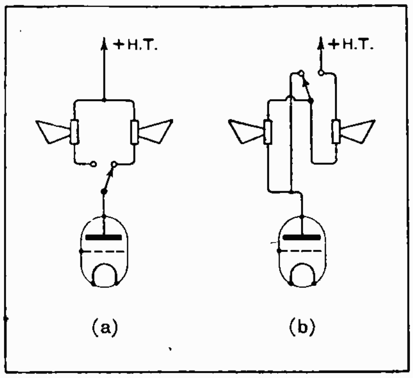

Fig. 2.—Alternative method of switching loud-speakers.

If the instruments are wired up in accordance with Fig. 2 (b), however, two important advantages are gained. In the first place, the anode circuit of the valve is never interrupted, and, moreover, by leaving the switch "open"—*i.e.*, in a midway position—the combined effect of both loud-speakers in series is available.

The continuity of the anode circuit of the valve is probably the most important of these gains, since it is highly undesirable to interrupt suddenly the current in an inductive circuit such as a loud-speaker winding. Again, if the source of H.T. supply happens to be a valve rectifier of none too liberal design, a break in the circuit of the anode of the last valve, which will probably be taking the major portion of the rectifier output, may cause a very considerable rise in the H.T. volts to the remainder of the valves, with possible ill effects.

The arrangement depicted in Fig. 2 (b) may be expanded to accommodate any number of loud-speakers.

CONNECT TELEPHONES TO MARKED POLARITY.

WHENEVER a pair of high-resistance telephones is used in the anode circuit of a valve so that the anode current to the valve passes through them, care should be taken to see that the telephones are connected so that their polarity is correct with respect to the H.T. battery. This point is often overlooked through ignorance, or neglected because considered of no consequence. In actual practice it may greatly affect the sensitivity of a pair of telephones after a time, since a current flowing through the windings in the wrong direction tends to demagnetise the permanent magnets, while a current in the correct direction keeps them magnetised. Just because a new pair of telephones give equally loud signals either way round do not think that this shows that the polarity will not matter ultimately. The sensitivity of telephones depends very largely upon the permanent magnets being powerful. Cases are known where high-resistance telephones which had lost their magnetism have been restored and given a new lease of useful life simply by using them connected the right way round in the anode circuit of an amplifier valve taking a fairly large plate current.

All high-resistance telephones should have their polarity marked either on the leads or at the terminals of the earpieces. The telephone lead marked positive should go to the positive terminal of the H.T. source, while the negative lead should go to the anode of the valve.

These remarks, of course, do not apply to low-resistance telephones used in conjunction with a telephone transformer.

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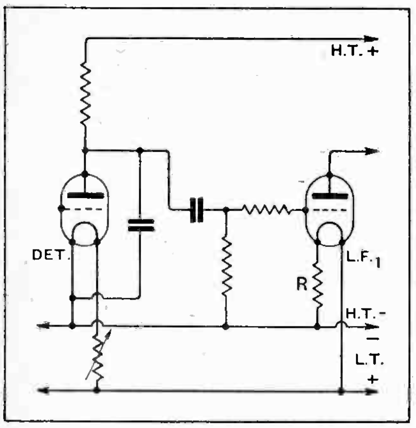
A CORRECTION.

IN the circuit diagram accompanying a paragraph headed "Cascade H.F. Amplifiers," which was published in this section of *The Wireless World* for July 27th, 1927, the L.T. *positive* 'bus-bar was incorrectly shown as being in connection with the metallic screen. This lead should actually terminate at the junction with the rheostat of the first H.F. valve. Moreover, in a screened set it is particularly desirable that the standard practice of connecting H.T. negative to L.T. negative should be followed, instead of the opposite arrangement.

THE "ALL-WAVE FOUR."

THE problem of biasing the first low-frequency valve of the "All-Wave Four" (described in *The Wireless World* for April 27th, 1927) is not altogether a simple matter if maximum amplification of the highest quality is to be obtained. The same applies to any receiver using two stages of transformer-coupled L.F. magnification, and in which a modern valve with a high voltage factor is used after the detector. The difficulty is due to the fact that these valves require less than 1½ volts negative bias (that supplied by a single dry cell) when used as amplifiers, unless the H.T. voltage applied is considerably in excess of the usual 120 volts or so. Generally speaking, about 0.75 volt is sufficient,



Obtaining grid bias by using voltage drop across the filament resistor (R).

and fortunately this pressure is easily obtainable by making use of the drop in voltage across a suitably-chosen filament resistor inserted in the *negative* low-tension lead, and joining the low-potential end of the grid leak directly to L.T. negative, as shown in Fig. 2. This is one of the few instances where it is permissible to depart from the standard *Wireless World* practice of connecting filament resistances in the positive lead.

If the first-stage L.F. amplifier is an "R.C." valve consuming 0.1 amp. at 4 or 6 volts, the "drop" across a 10-ohm resistor will, as a rule, give sufficient bias for our purpose. The insertion of this amount of resistance will reduce filament current below the rated value, but this is an advantage, rather than otherwise, as the full emission of a valve is never required when a high resistance is inserted in its anode circuit.

There are several other solutions of the problem. For instance, it will be realised that we apply a negative bias to resistance-coupled amplifying valves only to prevent the flow of currents in the grid circuit; certain valves, constructed on what is known as the "short-path" principle, operate in such a way that these currents do not begin until the grid becomes at least one volt positive. Accordingly, if one of these is used, no bias will be required, and the grid leak may be connected direct to L.T. negative, the filament resistance being in the positive lead as usual. Again, when long-distance reception is not the primary object, the utmost amplification obtainable will be neither necessary nor desirable, and, instead of a high-magnification valve, one of about 20,000 ohms impedance may be used, with a grid bias voltage of 1½ or more.

oooo

LOUD-SPEAKER VOLUME.

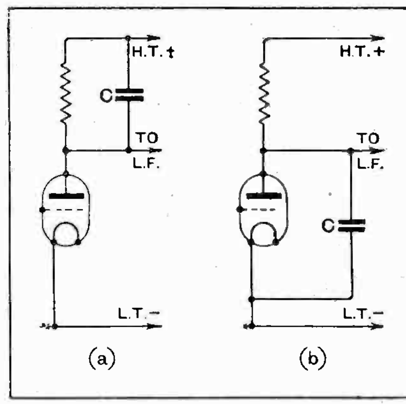
THE exact interpretation of the above phrase is a matter which often puzzles the wireless amateur. Unquestionably, signals which can just be heard when the listener's ear is placed near the instrument *may* be, and are, frequently so described by over-enthusiastic amateurs. Rather than worry over the exact degree of intensity which really merits the description, it would seem better for those who have a milliammeter to classify loud-speaker signals as those which are *just* strong enough to overload the output valve when the receiver is adjusted for maximum sensitivity. Thus such a statement as "full volume with a 3,500-ohm output valve" would convey a fairly accurate idea as to the performance of the receiver.

oooo

ANODE BY-PASS CONDENSERS.

IT will be noticed that the high ohmic resistance included in the anode circuit of a detector valve for the purpose of coupling it to a succeeding L.F. stage is almost always shunted by a fixed condenser. The function of this capacity is mainly to improve the efficiency of the rectifier, and also in certain cases to facilitate the obtaining of reaction effects. In general, it will be found that an increase of the size of this condenser will result in stronger signals, but it should be pointed out that excessive capacity will introduce a form of distortion due to reduction in amplification of the higher audible frequencies, and reproduction will appear to be "dead." It will often be convenient, however, to increase the overall sensitivity of the receiver, when searching for distant stations (on whose signals the highest quality is hardly expected) by substituting a larger condenser than that ordinarily used for local reception.

Two alternative methods of connecting the by-pass condensers are shown in Fig. 3. In the first (*a*) it



Alternative methods of connecting an anode by-pass condenser (C).

is simply in parallel with the coupling resistance, while in the second (*b*) it is joined between the anode and the common negative lead. While there is not, as a rule, much to choose between the two, there can be little doubt that the connection (*b*) is most generally favoured by the designers of modern receivers. It has the advantage of restricting the flow of high-frequency currents in the H.T. battery, and more particularly in the leads connected to it.

As stated above, a large condenser tends to reduce the amplification of signal voltages corresponding to the higher audible frequencies. It should be realised that a given capacity will give rise to a greater proportional reduction when the coupling resistance is comparatively large. Thus the rule is that a high resistance calls for a small condenser, and *vice versâ.*

House Wiring Systems

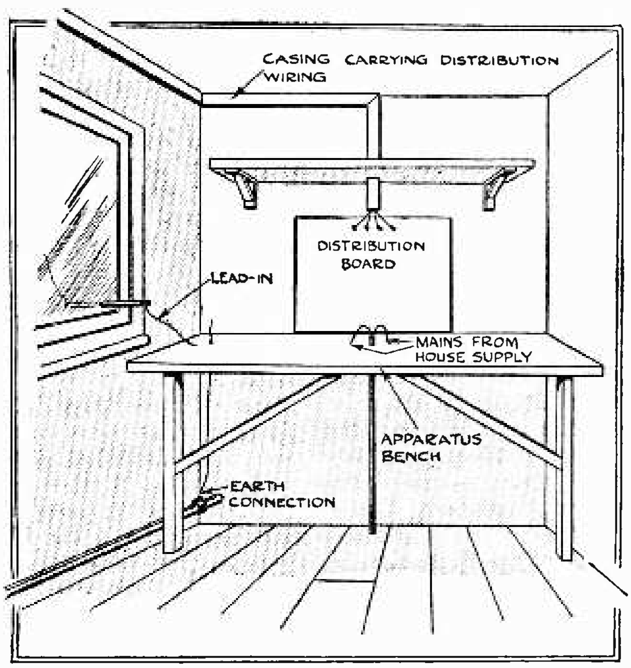
Tested Methods and General Hints.

By N. P. VINCER-MINTER.

ANY intelligent student of the history of broadcasting will have realised that after five years the wireless receiver is gradually taking its place in the average household as a provider of entertainment. Hitherto it has been regarded more in the light of a scientific novelty than anything else, and as such it was necessary that the receiver be boldly displayed in a conspicuous position in the house. The more complicated-looking the receiver and its concomitant wiring the better the impression made upon the non-technical visitor.

Now that it is possible to get really good reproduction, from the local station at any rate, wireless is no longer regarded as a scientific novelty but as a source of instruction and entertainment. Consequently, it must be made as simple as possible to operate, and wireless entertainment, like electric light, must literally be obtained at the touch of a switch, the receiver and other apparatus being installed somewhere out of sight just as is the electric light meter. It is obvious, therefore, that in houses of the future, wiring will have to be carried out throughout the house, and loud-speaker plug-in points placed in every room when the house is built, in the same manner as electric light and bell wire systems are installed. In the case of a house already built, wiring will have to be carried out in casing as in the case of installing electric bells in an old house. Unfortunately, those who have to undertake the work are often woefully ignorant in the matter of what type of wire to use, how many wires to put in, and where and how to place them, since there is no authoritative information on this point as in the case of the installation of electric light wiring. It is with a view to partially remedying this state of affairs that the present article is written, it being distinctly understood that the systems described are not the result of mere theorising, but of practical experience.

The simplest method for wiring a loud-speaker to a distant set is to merely connect a length of electric light "flex" between set and loud-speaker. This method works fairly well in practice if the lead is not too long. If it is of too great a length, the upper musical notes will be weakened owing to their being shunted away by the capacity formed across the loud-speaker terminals by the two long twisted wires which act as a shunting condenser. Still, a considerable length can be used without a noticeable loss of the upper frequencies as the capacity present in a length of ordinary "flex" is small. If cheap twin bell wire (which is usually well waxed) is used, however, the higher musical tones are so reduced that very disagreeable distortion is produced, and a muffled sound is given to speech. The writer discussed this in an article published last year, entitled "Music Without Muffling."[1] The reason is that the capacity of this type of wire is high. Apart from this, it is not wise to lead wires having a high D.C. potential with respect to earth all over the house, and there is risk of fire (especially if a



A suggested arrangement of the receiver room. The wooden casing for the distribution wires should be specially noted.

[1] *The Wireless World*, Feb. 10th, 1926, page 217.

House Wiring Systems.—
battery eliminator or H.T. accumulators are used) if a short circuit occurs due to some mechanical scraping away of the insulation. This can easily be guarded against by the use of a choke filter output circuit, or a transformer, and since for various other electrical reasons, such as the question of magnetic saturation of the iron cores of loud-speakers, such a device should always be employed wherever a modern power valve is used (as it always should be) in the output stage of a modern loud-speaker receiver, this disadvantage is overcome.

Volume Control.

We will therefore tentatively decide upon the use of twin electric lighting "flex" unless we find something later on to decide us to do otherwise. We can easily put a pair of terminals or a wall plug in various rooms, which we can wire up to the distant set, thus being able to connect up our loud-speaker quickly in any room we desire. But what about volume; must we always run to the distant receiver to reduce volume? Must we also proceed to the distant part of the house every time we wish to switch on or off? Not necessarily so. Volume control is easy enough. A variable resistance (value about 0 to 40,000 ohms) can be shunted across the loud-speaker, and this will give a very smooth and effective control of volume. Such volume control resistances can now be obtained, wire-wound or otherwise, and can be connected permanently across the loud-speaker terminals or across the wall plug or terminals, and will give a smooth control of volume which can only be equalled but not excelled by other methods. Alternatively, one can use a jack in conjunction with what is known as a volume-control plug, which consists of a plug into which is built a variable resistance such as we have just been discussing. It can be clearly seen attached to the telephones in the photograph. Unfortunately, such instruments are at present expensive, and until some enterprising manufacturer can provide us with one at a reasonable price, their use will flag, which is a great pity, as they are extraordinarily convenient as the writer has found to his own satisfaction, and are, moreover, quite reliable, the one illustrated having been in constant use for nearly two years without giving any trouble.

Switching the Filaments.

Now for the method of switching the set on and off. The first idea which occurs to us is merely to extend two wires, connected directly in the filament circuit, and to place a switch across the two wires at every place where there is a loud-speaker point. There are quite a large number of reasons against this project, one of the principal ones being that there is a certain voltage drop along the wires, which, in the case of two-volt valves and a wo-volt accumulator, might reduce the actual voltage across the valve filament below the operating point, even though most two-volt valves will work well on a volt and three-quarters. We can get over this difficulty quite simply, however, by the use of an ordinary "constant current" relay which consists of an electro-magnet, which, when excited, closes and holds closed against a spring a local switch for switching on the L.T. The relay itself is operated by a local battery, which is switched on by closing one of the switches already mentioned, this being installed by the side of the loud-speaker point. The relay has to be kept with current passing through its windings all the time, but since relays of remarkably small wattage (about 2 watts) can be obtained this doesn't greatly matter. If the ordinary type of open telephone jack with filament control is used for the loud-speaker points, quite a neat and attractive scheme can be worked out, and this is illustrated in Fig. 1. This system has much to commend it, although in the case of the writer's own house it has given place to what may be termed a "circular system," which is much better adapted to his particular needs, although not necessarily to the needs of others. This is illustrated in Fig. 2, but before discussing this we will further discuss Fig. 1.

Series and Parallel Systems.

It will need no great effort of the imagination to see that the insertion of the loud-speaker plug into any one of the jacks will switch on the set via the relay, the effect being the same as though a small switch situated close to the loud-speaker jacks had been closed. Removal of the loud-speaker switches off the set. What could be simpler? If a second loud-speaker is inserted, we merely close another switch in parallel with the existing closed filament switch. Now this is an excellent scheme for a block of flats or prison, fed from a master receiver, since the set will remain switched on until the last flat-dweller or convict pulls out his loud-speaker or telephone plug, as the case may be, and the last person to withdraw his plug switches off the receiver. This system has, however, one or two serious drawbacks for the ordinary household. In the first place, it absolutely vetoes the use of a volume control in conjunction with each individual loud-speaker as already described; a controlling resistance placed across any loud-speaker is in parallel with each one, and diminishing the volume in one loud-speaker diminishes it in all. There are various minor disadvantages also, which will not be discussed fully here, one being the impossibility of using a pair of telephones at the same time as the loud-speaker is working without risk of damage to the eardrums or alternatively absurdly feeble volume from the loud-speaker.

The "circular system" illustrated in Fig. 2 operates in a somewhat different manner. To explain it we will at first ignore the filament switching device and concentrate on the method of switching in the loud-speakers. Now, referring to Fig. 2, J_1 represents a group of three jacks, all three being side by side with each other in one room. J_1 is shown in detail, but J_2, J_3, etc., are all the same, consisting of three jacks all mounted together, each group of three being in separate rooms. There are six rooms, and therefore eighteen separate jacks in all. Now, each individual jack is of the same type as those fully drawn in J_1; in other words, a four-point jack with the two centre points joined together, so that when a plug is *not* inserted in a jack it is short-circuited. It is then obvious that if we insert no plugs in any jack we shall have a simple circuit of wire around the house, a completely closed circuit in fact.

Supposing, now, we have a receiver in the same room as, say, J_3, the receiver having a telephone plug attached to the secondary terminals of an output transformer (the

House Wiring Systems.—
secondary terminals of a choke filter output circuit would serve equally well). In the room occupied by, say, J_1 is a loud-speaker fitted with telephone plug and shunted across it is a volume control, or perhaps the volume control is shunted across the first jack in J_1 as shown in dotted lines. Into this jack we thrust the loud-speaker plug, the receiver output plug being thrust into any of the three jacks comprising J_3; at once we have a completed circuit, and, the set having being switched on (by a

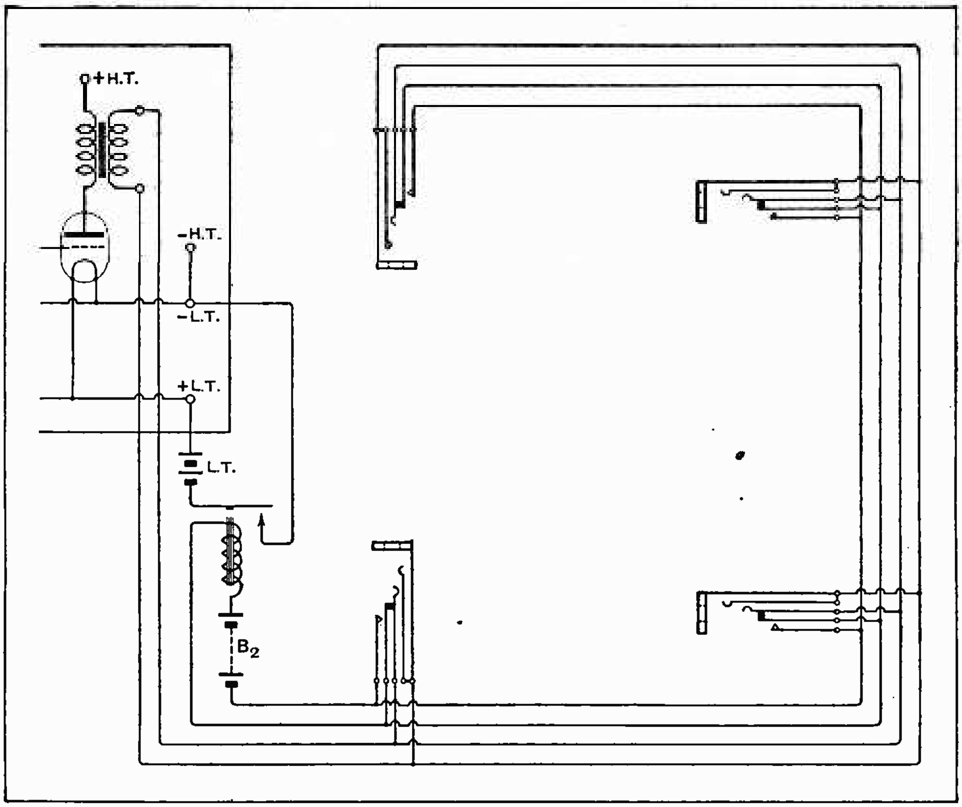


Fig. 1.—This system is specially suitable for a block of flats with receivers fed from a central receiver.

method to be described later), music is heard and volume governed by the "shunt control" shown in dotted lines across one of the jacks in J_1, and adjusted according to requirements. All is now going well, but perhaps there is some member of the family slightly hard of hearing who prefers headphones. These can be thrust into any of the other two jacks in J_1, and so now we see why we have more than one jack in each room, but why *three* jacks? For no reason except that these specially mounted jacks do not appear to be made in groups of two.

Jack Units.

They are made in groups of three in an ebonite moulding and are small and neat, as can be seen by the photograph. Moreover, they are quite inexpensive, although there is nothing whatever to prevent the home constructor obtaining two ordinary four-point jacks and mounting them up in a little box himself, except that the cost of two ordinary jacks works out no cheaper than the cost of one of these ready-made blocks.

Now the volume for the telephones, which will be in series with the loud-speaker, will be far too great, but fortunately our telephones are fitted with a volume control plug as is clearly shown in the photograph, and so all is well on this score. Perhaps J_4 is situated in a sick-room, and one loud-speaker is required there, but with greatly diminished volume. All will be well if the loud-speaker is fitted with a volume control plug, or if one of the individual jacks in J_4 has a volume control shunting it like the first jack in J_1. Thus we can connect or withdraw loud-speakers or telephones *ad lib* without the withdrawal or insertion of one interfering in any way with the other. Actually, the writer has experimented with four loud-speakers and two pairs of telephones simultaneously on this system, and proved its complete efficacy in this respect. It will be realised that a choke-filter circuit or output transformer is imperative, as otherwise in the case of the experiments mentioned above, there would have been twelve thousand ohms in the plate circuit of the output valve, and practically all the D.C. volts from the H.T. battery would have been dropped across the loud-speakers and there would have only been a very low voltage on the anode circuit of the last valve with consequent distortion. As it is, of course, we have only the low (D.C.) resistance choke or output transformer primary in the plate circuit of the last valve, and scarcely any volts are dropped.

Further consideration of this scheme will show us that we can have the wireless receiver in any room of the house we like, and thus we can "feed-in" from a receiver via any jack on the "circle" and we can "feed-out" to a loud-speaker or to telephones at any point on the "circle." Someone may ask, "Well, what is the advantage of this, do you want us to instal a separate receiver in every room?" By no means, but what is intended is this. Suppose we have our local station receiver fitted up in a remote part of the house and operated, perhaps, on an indoor aerial with the secondary of its output transformer plugged into the jack there, then in some other room of the house is located the "den" of the wireless experimenter member of the family (there is usually one), and in this "den" is a long-distance experimental receiver or perhaps a short-wave receiver. In the experimenter's room is also an ordinary output transformer for attachment to any of the numerous experimental sets he designs, whilst, needless to say, there is

House Wiring Systems.—

also a jack situated on the "circular system." Perhaps on a particularly good night an especially good item is picked up from some other station on an experimental set. The family is meanwhile situated in some other room enjoying the programme from the local station. The enthusiast in his "den" can, by touching the remote control button (yet to be explained), instantly switch off the local station set and plug in on the "circle" with his special programme. It must be specially noted that there is no need to go to the distant set and remove the input plug as the fact of the secondary of its output transformer being left in circuit will do no harm.

The Filament Circuit Relay.

Now for the remote control system. This consists of an "intermittent" type of relay which, by a simple but ingenious arrangement, turns a small commutator through an angle of ninety degrees every time its circuit is closed. Space forbids a detailed description of the instrument; suffice to say that it operates by the momentary depression of a button and not by the closing of a switch. One pressure of the button (which may be of the ordinary electric bell block or pendant type) switches on the set, the next pressure switches it off, and so on, alternately. Current only flows in the relay momentarily, at the time the button is pressed. It operates from a four-volt source of supply, and, actually, the one used by the writer is operated by two Exide D.T.G. type 2-volt cells in series, which he charges twice yearly, although, if desired, the L.T. battery of the set may be used to operate it. The actual relay used first appeared in the 1925 Wireless Exhibition and has been in constant use for nearly two years without giving the slightest trouble. Actually as many pushes are used as there are jacks, and P_1, P_2, etc., shown in Fig. 2, correspond to J_1, J_2, etc. In this system the set can be switched on in one room and off in another, there being no need to return to the original room in which the set was switched on in order to switch it off. The writer has used this system for some time, and is enabled to receive with telephones or loud-speaker in one room simultaneously, in two rooms simultaneously, or can switch on in one room and switch off in another as already explained.

With regard to the actual wiring used, it is obvious that the relay wire can consist of any sort of cheap twin bell wire laid anywhere, such as under the carpet, if desired. The "circular" wire must not be run under carpets, nor bunched together with the relay wires as the resultant capacity affects quality. When the system was first installed excellent results were obtained by running the circular wire on top of the picture rail, the actual wire consisting of one wire of the ordinary twisted double electric lighting flex, the relay wires were run anywhere convenient, such as under carpets, round the skirting board, etc., as already mentioned. This system can be confidently recommended to anybody who wants a rough "try out." Later, wooden casing, used so much for electric bell wiring, may be installed. This is shown clearly in one of the sketches illustrating this article. It has two grooves, and perfectly good results will be obtained by running the "circular" wire in one groove, and the two relay wires in the next groove, but care must be taken to avoid bunching the wires together where

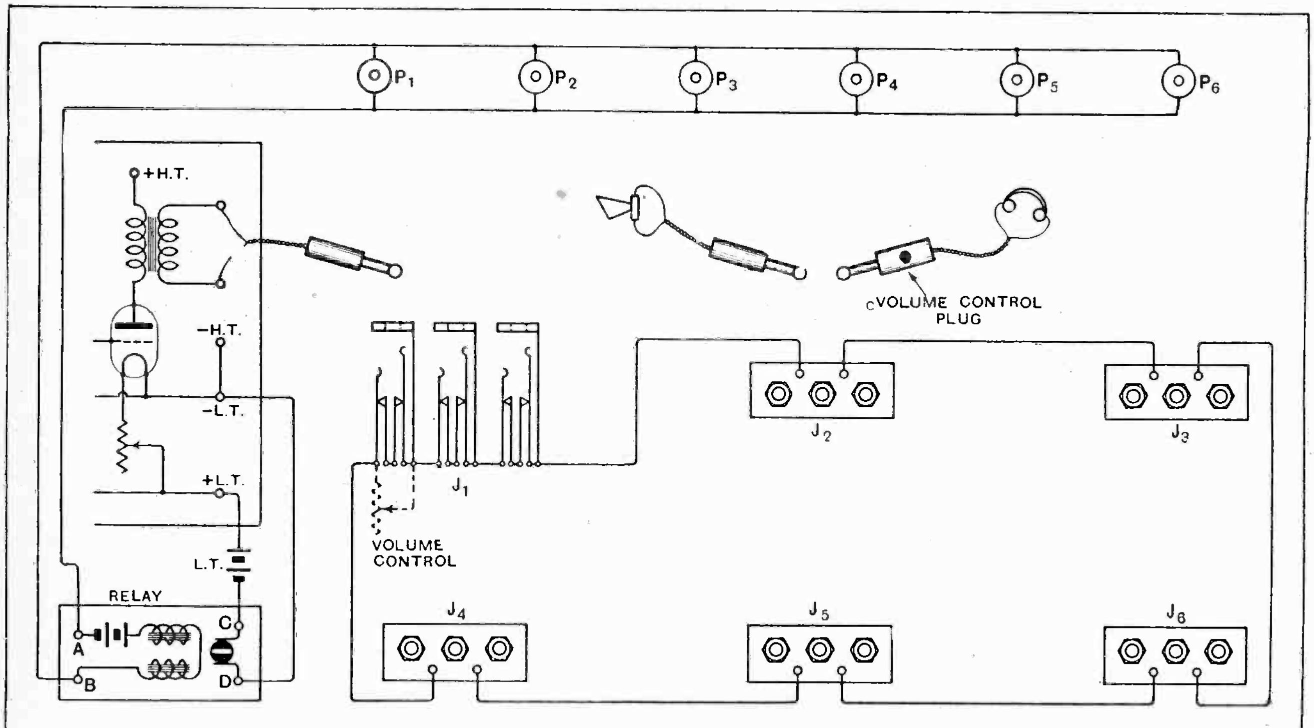


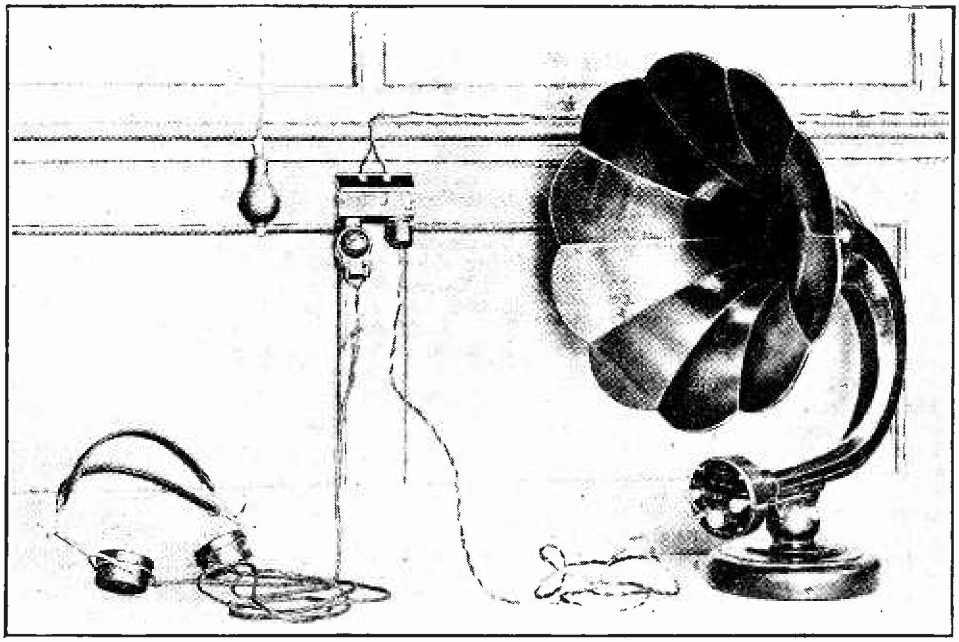
Fig. 2.—This system is probably more suitable for the average household. It should be noted that the connection boxes J_2 to J_6 are precisely similar to J_1.

House Wiring Systems.—
they emerge from the casing to connect to pushes or jacks as the case may be.

In the case of a house in the course of erection, it is quite possible (and, indeed, highly desirable) that lead-covered wire be used, and run under floor boards and in the plaster of walls, the lead coverings being bonded together and earthed as in the case of electric light wires. Obviously, the relay wires can be of ordinary lead-covered wire, but ordinary lead-covered wire must *not* be used for the "circle" wire. Many builders and wiring contractors have carried out elaborate systems of wiring, only to receive nothing but low groanings from the loud-speakers when the installation was put into use, due to the extremely high capacity between the wire and its lead covering. There is, however, a special brand of lead-covered wire made for this purpose, which is so constructed with an arrangement of paper that it is almost air-spaced inside its lead covering, and, consequently, there is very little capacity between wire and lead covering, and the wire may therefore be embedded in a plaster wall without ill effect, and may for the same reason be laid side by side with the ordinary lead-covered relay wires.

Now if lead-covered wire is used, only one wire need be used for the relay circuit, as an earth return may be made via the lead sheathing. It would appear, then, that a successful two-wire system has been evolved. The wiring contractor merely starts off from the spot in which he intends the set to be placed and takes a tour through every room of the house, one wire being the *special* lead-covered type, the other the ordinary lead-covered type. A liberal portion of wire must be left protruding in each room in a spot most convenient for the affixing of the jack block, and the button push. Fig. 2 should make the matter quite clear, it being remembered that one wire of the relay circuit will be the lead sheathing. For the man who is going to add the system to an existing house, the wooden casing system is the one to use. Remember that the two relay wires (which may be of the cheapest type of twin bell wire) should be laid in one groove of the casing, and the single "circle" wire may be laid in the other groove. Those who intend to fix the arrangement up in the cheapest possible manner without casing must remember to keep the relay and "circle" wires at least an inch or two apart from each other; as mentioned before, the writer found that the "circle" wire, consisting of one wire of ordinary twisted lighting "flex" laid on top of the picture rail with cheap twin bell wire for the relay laid under carpets or around the skirting board with staples, gave results which were all that could be desired. It should be emphasised that both the systems described in this article have been extensively tested. The scheme shown in Fig. 1 was first put into use over three years ago, the scheme illustrated in Fig. 2 being of more recent date.

There is, perhaps, only one other point to be discussed in connection with this system, and that is the question of lightning safety devices, and the use of an H.T. battery eliminator. Is it necessary, for instance, after one has gone to all the trouble of fixing this arrangement up so that the distant receiver can be switched off in bed, to be compelled to rise to close the lightning switch and to open the eliminator switch? By no means. In the first place, if desired, the filament relay may be duplicated or triplicated in order to perform these two operations without the slightest addition or complication of wiring, the relays being merely placed side by side and connected in parallel. To those who are of a mechanical turn of mind, however, no difficulty will be experienced in making the necessary alterations to their existing relay to make it perform a dual function, or, indeed, of making the whole relay themselves. Speaking more specifically of lightning safety devices, it will be found that a good and well designed spark gap is hard to excel.



A typical reception point. Note specially the volume control on the plug attached to the telephone.

Doubtless a very great number of *Wireless World* readers have experimented in house wiring systems themselves, and many have worked out some highly ingenious methods of overcoming the faults inherent in many schemes, and a symposium of the systems used would undoubtedly be highly illuminating and instructive.

It is hoped to publish in an early issue a continuation of this article, in which our contributor will discuss the principal commercial systems of house wiring and remote control of receivers, giving details of each and discussing the advantages and disadvantages when applied to different circumstances.

CURRENT TOPICS

Events of the Week in Brief Review.

A BLANK WEEK.

"What! No Patents?" Under this caption the *New York Times* to-day remarks on the fact that for the first time in years a week has passed without the issue of a radio patent. This fact, perhaps more than any other, is significant of the approaching stability of the radio trade. On the other hand there is now a great and ever-growing incentive to inventors to evolve a set which will not need the protection of the R.C.A. patent umbrella; our New York correspondent recently heard a very successful demonstration of a set for which this was claimed.

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BERLIN TO BUENOS AIRES.

The first official attempt to speak by wireless telephony from Berlin to Buenos Aires, a distance of about 7,000 miles, was satisfactorily accomplished on August 3rd. If the results of the tests continue satisfactory, it is intended to establish a public service as soon as the necessary equipment has been installed at Buenos Aires.

It may be of interest to recall to our readers the full and picturesque title of the Federal capital of Argentina: Ciudad de Santissima Trinidad y puerto de Nuestra Señora de Buenos Aires, meaning "the city of the most sacred Trinity and port of Our Lady of favourable breezes."

oooo

A SWING AND ROUNDABOUT EXPERIMENT.

The B.B.C. engineers at Keston some time ago tried an interesting experiment for overcoming the fading trouble often experienced with short-wave broadcasts from America. Two of these stations happening to be transmitting the same programme on different wavelengths, which were both received by Keston, united and retransmitted, with the result that the fading effect was almost entirely eliminated.

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ULTRA-MODERN MUSIC.

A story from Cincinnati relates how in the days when broadcast stations were liable to jam one another, the song of a star tenor broadcast from New York was intermingled with a piano solo from a local station. Musical "highbrows," however, accepted the combination gladly, imagining that the Cincinnati pianist was playing the correct accompaniment to the tenor's song, and were ravished with this masterly example of polytonality.

TOO MUCH OF A GOOD THING.

Residents of Easton, Connecticut, are protesting before the Federal Radio Commission against the erection of a broadcasting station in their midst. They object to the proposed removal of WICC from Bridgeport, Conn., to a residential part of Easton known as Sport Hill. Incidentally, one of the objections is stated to be the quality of the programmes, which compare unfavourably with those they can already receive from New York.

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ELECTROTECHNICS AMID LOVELY SURROUNDINGS.

The International Electrotechnical Commission is holding a series of meetings beginning on September 4th at Bellagio, on Lake Como, Italy, when matters of many kinds ranging from nomenclature to the rating of rivers will be discussed by representatives from some twenty-five countries.

The Italian Committee has arranged an interesting tour, combining an inspection of important power plants with visits to some of the historical cities of Northern Italy. Dr. W. H. Eccles is one of the British delegates.

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JAZZ DE LUXE.

It is stated that the musical instruments used by one of the bands whose dance music is broadcast by WJZ, New York, are valued at $11,550, including nearly $4,000 for saxophones and allied instruments, and nearly $2,000 for the percussion instruments. We wonder whether the resultant noise is really worth this extra expense.

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BREMEN'S EXPERIMENTAL WAVE-LENGTH.

The broadcasting station at Bremen has been transmitting for some weeks on a wavelength of 252.1 metres (1,190 kc.). This, however, is only an experimental wavelength, and according to reports has not been found very favourable for reception by the majority of listeners to this station. It is probable, therefore, that this wavelength will not be permanently adopted. It will be remembered that the previous wavelength used by Bremen was 400 metres.

A RUDE AWAKENING.

A Northampton grocer, while listening in comfort to the evening programme after a hard day's work, dozed and fell off his chair. Unfortunately the band of his headphones was driven into his head with such force that he had to be taken to hospital.

oooo

A BUSY TIME OF PREPARATION.

The American delegates to the International Radiotelegraphic Conference which is to be held in Washington next October and their technical advisers are meeting daily to arrange and unravel the mass of technical detail involved in the suggestions made by some forty nations regarding amendments to the existing Radio Convention; six American committees are also working on the specific problems affecting American interests and planning a systematic programme.

The International Bureau of the Telegraphic Union at Berne has compiled and translated the foreign suggestions into French; these have now been re-translated into English and will shortly be published by the Government Printing Offices in Washington.

M. Etienne, the Director of the International Bureau of the Telegraphic Union, is expected to arrive shortly in America and will work with the U.S. delegates in the preparation of the agenda.

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A LENGTHY CONFERENCE EXPECTED.

The probable length of the International Radio Conference is occasioning some discussion. The London Conference of 1912 was convened on June 1st and adjourned on July 5th. The Paris Conference two years ago began in August and ended in the latter part of September. The forthcoming Washington Conference, however, will have representatives from fifty nations, and there are between 1,600 and 1,700 proposals to be discussed. It is therefore believed that it may last as long as two months.

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INTERNATIONAL RADIOTELEGRAPHISTS TO BE REPRESENTED.

The International Federation of Radiotelegraphists at a meeting recently held in Rotterdam decided to send a delegate to represent them at the International Radiotelegraphic Conference. Mr. J. Masden, Denmark, and Mr. T. J. O'Donnell, Great Britain, were elected President and Secretary for the ensuing year.

EMPIRE BROADCASTING.

Mr. Gerald Marcuse (G2NM) has now received official sanction from the G.P.O. for his experimental venture in broadcasting to the British Empire. He is, we understand, now authorised to transmit speech and music for a period not exceeding six months from September 1st, the power not to exceed 1 kW. and on wavelengths of 23 and 33 metres. Continuous transmission is not allowed on more than three days a week, and must not exceed two hours on each occasion.

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CLEARING THE ETHER.

Radio engineers are, no doubt, greatly interested in the announcement from Chicago that commercially practicable means have been evolved whereby electrical power can be transmitted at a pressure as great as 132,000 volts through underground cables. There can be no doubt that the extensive use of such a system of distribution would materially help to clean up the ether.

oooo

THE LAW'S DELAY.

The fact that in the United States as many as ten years may elapse between the application and issue of a patent is liable to be very disconcerting to manufacturers. As an instance, the Lederer patent (1,180,264) relating to the thoriated tungsten filament, in connection with which litigation is now pending, was applied for in December, 1905, and issued in April, 1916. In somewhat similar case is the Latour patent relating to a common "B" battery. This was first applied for in France in October, 1916, and in America in July, 1918. It issued in May, 1926, and was the subject of a reissue in November of the same year. Other examples—and there are many—are the De Forest "Feed-back" patents (1,507,016-7), each of which was issued in September, 1924, after being in the patent office about ten years. This condition necessarily begets a jumpiness among manufacturers that can be little appreciated in England.

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ANOTHER GIFT TO A HOSPITAL.

The Stockton and Thornaby Hospital is now the happy possessor of a wireless installation with eleven loud-speakers and headphones for 100 beds, which has been provided jointly by Miss Mary Scott, of Paignton, in memory of her nephew, Lieut. Scott, and Miss F. G. Kirk, of Norton.

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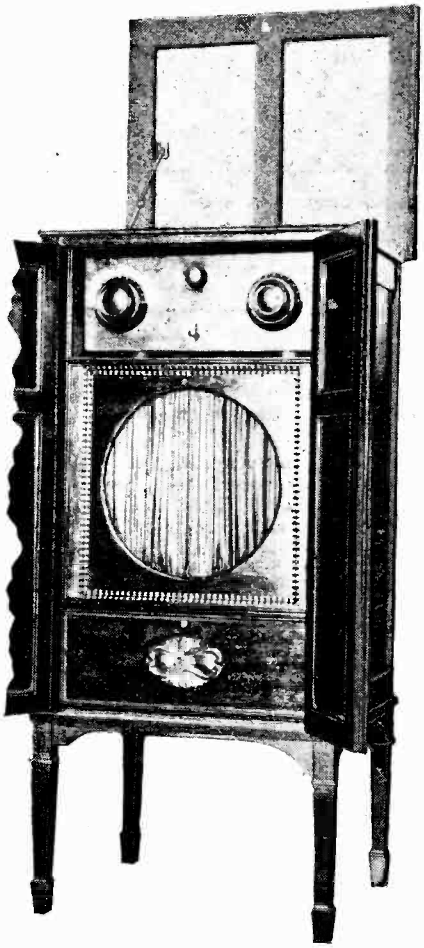
A POLYGLOT JARGON.

The use of recognised abbreviations is undoubtedly convenient if not absolutely necessary in Morse transmission, and is not out of place on "QSL" cards, where much information has to be condensed into a small space and may also be destined for a foreign amateur who is possibly more familiar with these abbreviations than with plain English; but, if we may judge by some of our French and American contemporaries, "Radiese" is in danger of ousting their own native languages as a medium for *written* correspondence. We extract from a French journal the following communication from one Frenchman to another as a typical example:—"Vy tnx dr OM pr selfs vy FB. Sri pr retard à répondre à lettre mais vy QRW," which, translated into English, might read: "Many thanks, dear old fellow, for the coils, which were excellent. I am sorry for the delay in replying to your letter but have been busy." This message would probably have been even better expressed in courtly French (e.g., "mon vieux" is infinitely preferable to "old fellow" or "old man"), and it seems almost criminal for a Frenchman to discard his own musical language in favour of such a hideous jargon.



An attractive cabinet built by a reader, Mr. E. H. Whittaker, to contain an "Everyman Four" receiver and coil-drive loud-speaker.

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OBITUARY.

We regret to record the death of Dr. De Groot, one of the most enterprising of Dutch pioneers of wireless, who died suddenly in the Red Sea on his way to attend the Radiotelegraphic Conference in Washington. Dr. De Groot was the leading spirit among wireless engineers in the Dutch East Indies, and was largely responsible for the short-wave broadcast transmission from Bandoeng, Java, which has recently attracted so much attention from listeners.

TRADE NOTES.

Gift to Club for the Blind.

The Manchester and District Social Club for the Blind is now the possessor of a fine "Cosmos" 5-valve receiving set, the gift of Messrs. Metro-Vick Supplies, Ltd. The Lord Mayor of Manchester presided at a social gathering of members of the Club and formally presented the set, which, it is understood, the donors have undertaken to maintain. The Lady Mayoress, who was also present, received a handsome basket of flowers from the little daughter of Mr. Norman White, the local manager of Metro-Vick Supplies.

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A Severe Rough-usage Test.

The strength of the modern valve filament was strikingly demonstrated by a "transit test" recently carried out by the General Electric Co., Ltd. A large number of "Osram" valves were packed in small cartons without any of the usual protection afforded by wood-wool packing, air-spacing, and other customary measures, and despatched from London to Glasgow and back. Several of the cartons were badly crushed and the valves damaged. In some cases the pins were broken off and in others they were driven through the fibre-board container, yet in every case the filament was unbroken.

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New Output Transformers.

Messrs. Ferranti, Ltd., have added another to the number of their well-known transformers. Their latest type, known as the Output Transformer, is specially designed with a view to obtaining the best loud-speaker results with large power valves having very low impedance and consuming considerable plate current. They are made in two ratios: OP1-1 : 1 for use with ordinary loud-speakers of the diaphragm and cone types, and OP2-25 : 2 for operating loud-speakers of the coil-driven cone type.

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Correction.

With reference to our note on "Kaynite" Reorganisation on page 186 of our issue of August 10th, we are asked to state that the correct title of the company acquiring the organisation is A. W. Knight and Co.

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Catalogues Received.

The Wet H.T. Battery Co., 12, Brownlow Street, High Holborn, W.C.1. Instructions for use, maintenance, and working hints and prices of the "Standard" Sac Leclanche Wet H.T. and L.T. Batteries.

Radi-Arc Elec. Co. (1927), Ltd., Bennett Street, London, W.4. Prices and particulars of "Liberty" High-Tension Battery Eliminators for D.C. and for A.C. supply from mains.

Athol Engineering Co., Seymour Road, Crumpsall, Manchester. Leaflet with prices of Aerial Earthing Plugs, Porcelain Coil Mounts, Terminal Blocks, etc.

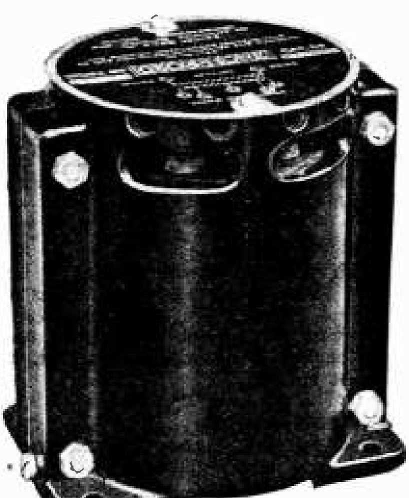
NEW APPARATUS

The Manufacturers' Latest Products.

TRANSFORMER FOR K.L.1 VALVES.

For supplying the heater current of the new Osram and Marconi K.L.1 valves the General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2, now supply a suitable transformer.

It is important for maximum efficiency that the potential applied to the heated cathode shall not drop below 3.5 volts, whilst it is necessary to guard against the heater being overrun. The common practice is to connect a variable resistance between the transformer secondary and the heater connections of the K.L.1 valve in order to provide critical regulation, and particularly is this necessary when a transformer designed for working with 200 volts is connected to a 240-volt supply. A novel feature of the G.E.C. transformer is its suitability for working on various supply voltages, the output being regulated according to the number of valves connected to the secondary. Contrary to usual practice, the primary is not a tapped winding, the tapping points being made only on the secondary



For A.C. filament supply—the new Gecophone mains transformer.

leads and brought out to five terminals. Instructions are supplied with the transformer showing the method of connecting up, depending upon the supply voltage and number of valves connected to the output. The design of the transformer permits of its use on supply voltages between 200 and 260 at frequencies of 40 to 100 cycles and an output up to 8 amperes is obtainable at 3.5 volts.

The design, as regards arrangement of windings and method of clamping the core stampings as well as the method of assembly and insulating the windings, follows small power transformer practice. The general dimensions are liberal, and the cast-iron outside container is of heavy construction. The metal cover over the terminals prevents the fingers coming into accidental contact with the supply voltage, and short-circuiting of the mains cannot easily occur. In operation there is practically no stray field, which, of course, might link with the audio-frequency amplifying equipment. The transformer when on full load is quite silent.

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"NEGROLAC" AERIAL WIRE.

A new form of aerial wire bearing the name "Goltone Negrolac Aerial" is a recent product of Ward and Goldstone, Ltd., Frederick Road (Pendleton), Manchester. As it is only necessary for an aerial wire to serve as a conductor of moderately low resistance it would seem that there is little scope for producing specially constructed wires for aerial use. When erecting and using aerials, however, other requirements become apparent. First of all a wire that will not kink is a distinct advantage, and one that can be unwound without spiralling into loops is less likely to become broken when subsequently subjected to tension owing to the pulling out of bends.

The new Negrolac wire is not springy. It can be easily paid out without kinking, and its smooth surface prevents it becoming entangled with foliage or other surrounding objects with which an aerial usually engages in the process of erection. The wire consists of 49 strands of No. 34 S.W.G. enamelled wire assembled in sevens. It has a woven covering resembling insulating sleeving treated with a flexible black enamel, rendering it entirely waterproof. The wire is not unduly heavy, offers little wind resistance, being about ⅛in. in diameter, and will withstand considerable pull without stretching. As well as these mechanical advantages the aerial wire can be recommended from the electrical standpoint as possessing a particularly low resistance, the dimensions of the conductor being far in excess of normal reception requirements.

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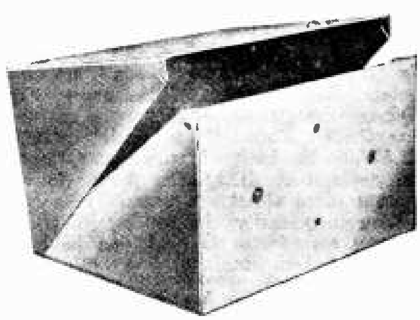
UTILITY ALUMINIUM CONTAINERS.

A constructional article in a recent issue described the building of a short-wave receiver in which a new feature had been incorporated. Instead of the usual form of polished wooden cabinet the use of an aluminium containing box was shown which would not only serve as a screen, and prove far more durable than wood, but would withstand extreme climatic conditions, as well as possessing a particularly attractive appearance.

The use of metal containers is likely to become popular, and to meet the demand for containing boxes of this type



Is the metal container likely to replace the wooden cabinet for set building? A specimen aluminium container recently introduced by Messrs. Wilkins & Wright, Ltd.

Wilkins and Wright, Ltd., Utility Works, Kenyon Street, Birmingham, are now placing on the market a range of metal boxes at prices comparable with the usual wooden cabinets.

The box examined was found to be exceedingly well made. All edges were found to be cleanly cut and the two halves held together by brass hinges formed a good, smooth fit when the box was closed. All corners were made by bending the aluminum to form a seam and the faces held together by rows of neat aluminium rivets. The sheet aluminium employed was about No. 16 S.W.G., so that the sides of the box were entirely rigid without any tendency to bulge and could not be depressed. A good white finish was given to the aluminium, probably by some process of chemical immersion.

SELECTIVE MORSE RECORDING.

Some Further Notes on the Hot-wire Microphone and Audio-Resonant Selection.

By G. G. BLAKE, M.I.E.E., F.Inst.P.

IN a lecture entitled "The Hot-wire Microphone and Audio-Resonant Selection," which he delivered before the Radio Society of Great Britain on May 25th, 1927 (see *Experimental Wireless*, August, 1927), the author described a method of selective reception, and showed that it was possible to select messages from one or more of a number of radio transmitting stations which were being simultaneously received. The method embodied the use of hot-wire microphones and acoustic resonators.

The intention of this article is to augment the lecture and give constructional details which should save time and trouble for anyone wishing to repeat the experiments.

Fig. 1 is a photograph of the apparatus employed in the "zero shunt" circuit, by means of which the signals after selection by a hot-wire microphone were amplified and recorded. For convenience in referring to this photograph a diagram of connections is reproduced in Fig. 1(a).

The parts of the apparatus seen in the photograph which correspond to the latter are as follow:—

Mounted on the vertical ebonite panel (shown on the extreme left) are:—

(1) A variable resistance R; this may conveniently be made by painting a ½in. band of blacklead across about 2½in. of the ebonite, connections being made by means of a switch and studs embedded thereon (ordinary household blacklead answers quite well made into a thick paste with methylated spirits and applied with a brush). When finished the range of resistances available should be between the values of 100 and 660 ohms.

(2) A potentiometer S is connected across the 6-volt battery which is employed to heat the filament of the valve V. This potentiometer, as will be seen, supplies the opposing E.M.F. for the "zero shunt" and balances out the plate current.

(3) The rheostat shown at R_1 controls the filament.

(4) Behind the valve V, and nearly hidden thereby in the photograph, is a 440-ohm variable resistance R_3. This is not shown in the diagram; it is employed in series with the hot-wire microphone in order to control its heat.

Mounted on the baseboard (from the left) are the following: A valve holder and a B.T.H. B4 or other similar valve. Behind the latter and hidden in the shadow is an iron-cored transformer, the primary of which is wound to a resistance of 220 ohms, and its secondary to a resistance of 9,600 ohms. The primary winding as shown at T in the diagram is connected in series with a milliammeter, mA, a hot-wire microphone (to be described in detail later), and the full 12 volts of the battery employed to supply current for all the different circuits. (Neither the batteries nor the hot-wire microphone are shown in the photograph, Fig. 1, as they are not mounted on the baseboard.)

To the right of the milliammeter on the baseboard a delicate galvanometer can be seen. This is connected in the plate circuit of the valve in series with the wind-

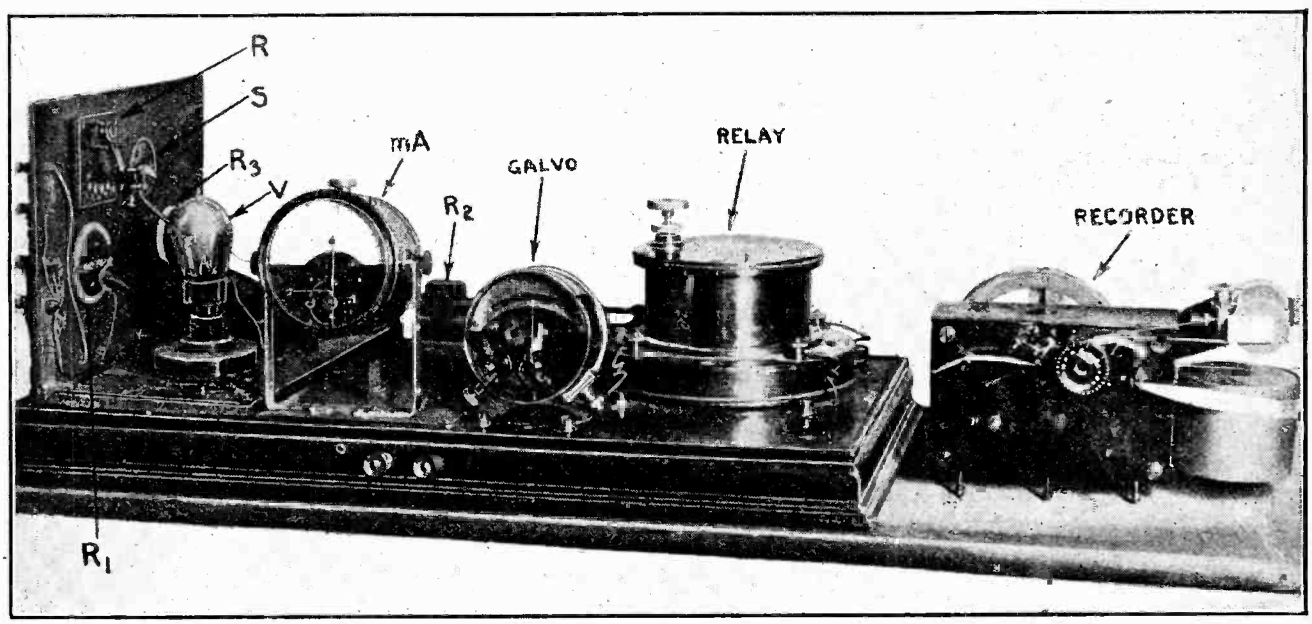


Fig. 1.—General view of audio-resonant recording apparatus.

Selective Morse Recording.—ings of a Siemens or other sensitive form of relay, which is seen by the side of the galvanometer.

The recorder is seen on the extreme right of the photograph. This is an old Post Office Morse inker which has been converted into a "siphon" recorder in a similar manner to that described by W. Winkler in *The Wireless World*, June 25th, 1924. The current operating this recorder is obtained from a 4-volt tapping as shown in the diagram, and is regulated by means of a 440-ohm series resistance R_2, which can be seen at the back of the baseboard in the photograph.

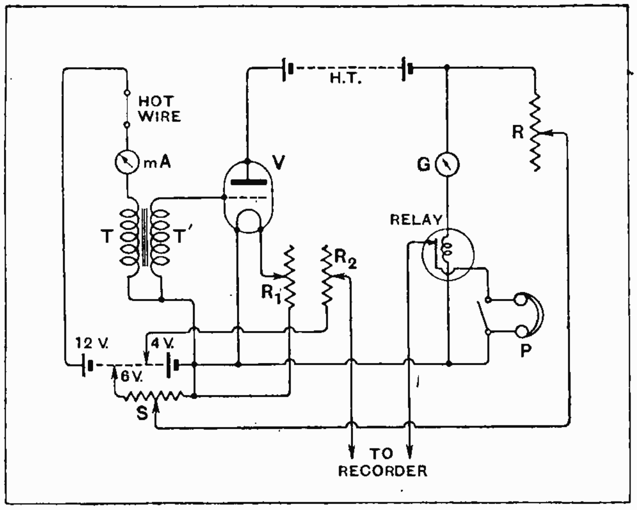


Fig. 1(a).—Circuit diagram of apparatus shown in Fig. 1.

The two terminals marked + and − on the front of the baseboard are for connection to a pair of 60-ohm telephones which are included in series with the secondary circuit of the relay and the "siphon" recorder. When adjusting and setting the latter it is most helpful to follow the signals in the phones, to ensure that the recorder is responding accurately.

Terminals for connection to the various tappings of the 12-volt accumulator and the 75-volt H.T. battery are provided on the ebonite panel.

Fig. 2 is a photograph of three resonators each of which is fitted at its orifice with a hot-wire microphone. All of them answer quite well, which shows that there is considerable latitude in their shape and design.

The largest one, marked A in the photograph, is seen as viewed from its end; its microphone is arranged at the orifice (a round hole in the end of the cylinder ⅜in. in diameter) and just within the cylinder. In front of the hot-wire and on the outside of the cylinder an adjustable slit diaphragm is fixed.

The slit, which can be made as narrow or as broad as desired, runs parallel with the hot-wire. This resonator was made from a large tin (originally used to contain photographic chemicals) 6in. in diameter and 15in. long; its acoustic frequency is about 224, in pitch a little lower than the middle C of a piano.

Adjustable Resonators.

B in Fig. 2 is another resonator made of glass tube 1½in. in diameter. This is mounted on a wooden base which supports it in alignment with and opposite to an "Amplion" loud-speaker. The distance of the latter from the resonator can be adjusted by means of a micrometer screw S. The microphone is mounted at the orifice of the resonator behind a slit diaphragm.

In practice it was found better to collect the sound of the received signals by means of a mouthpiece M (the mouthpiece from an old carbon-grain P.O. microphone was used). This resonator is 9in. long when its plunger is fully extended, and responds to a frequency of 376, a few notes above the middle C of a piano.

The third resonator, shown in the foreground of Fig. 2, is made of glass tube 1in. in diameter and 21in. long. This has a frequency of 160 (five notes below middle C).

The plungers by means of which the effective lengths of these resonators are adjusted consist in each case of two cardboard discs, the space between which is packed with cotton wool. When the discs are screwed together by means of a nut on the end of a threaded plunger rod R, the cotton wool is squeezed outwards sufficiently to form a tight packing against the walls of the resonator.

The Hot-wire Microphone.

A word or two as to the construction of the hot-wire microphone may be useful. The Wollaston wire which is employed for this purpose is obtainable from Messrs. Johnson, Matthey and Co., of Hatton Garden, London, and is 0.0001in. in diameter.

Fig. 3 shows a simple method of mounting. X is a fibre washer, the Wollaston wire is laid across the hole in the centre of the washer and clamped at each end by means of two small brass washers, Y and Z. In order to allow for variations in the length of the wire when it is afterwards heated it is allowed to sag slightly. Wires L and L′, which are connected to the bolts, are connection wires. Having mounted the Wollaston wire, the next thing to do is to remove the silver sheath from that portion of it which is to act as the microphone. For

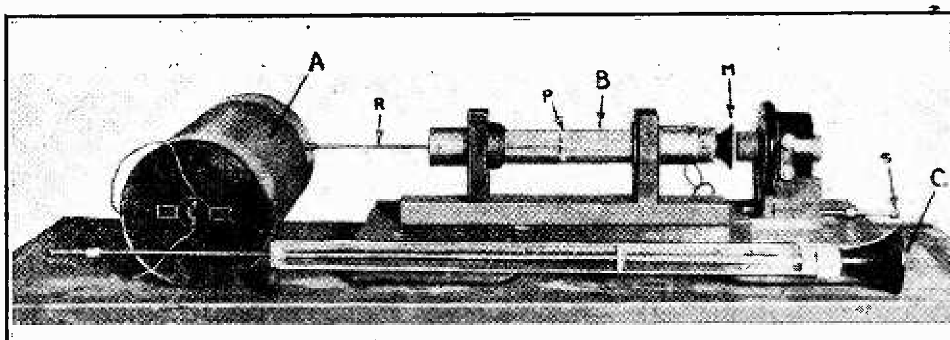


Fig. 2.—Three experimental hot-wire microphones and resonators.

Selective Morse Recording.—
this purpose a small brush is made by inserting a very small tuft of cotton wool into the end of a fine glass tube. This is dipped into strong nitric acid and is very gently brushed over the centre portion of the Wollaston wire until all the silver has been removed from a length of about $\frac{3}{16}$in. at its centre and its almost invisible platinum core laid bare. It is helpful to wear a watchmaker's lens while performing this delicate operation.

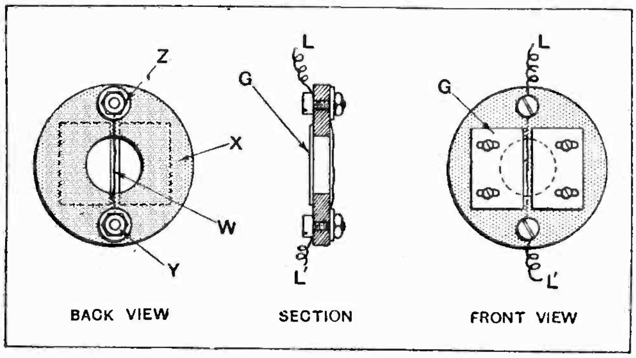


Fig. 3.—Constructional details of the hot-wire microphone.

It now remains only to close up the central hole in the washer and form a slit diaphragm having an opening about $\frac{1}{16}$in. wide running parallel with the Wollaston wire as shown at G. The celluloid backing from an old photographic film answers very well for this purpose, and it can be attached to the front side of the washer by screws or by means of adhesive plaster.

By reference to Fig. 3 it will be seen that the slit diaphragm and the Wollaston wire are mounted on opposite sides of the washer.

The microphone is now complete and ready for mounting (with the Wollaston wire inwards) on the end of a suitable resonator. For experimental purposes a binding of adhesive plaster answers admirably for holding it in position.

When this has been accomplished the mouthpiece from an old P.O. microphone can be fixed in front of it (also with adhesive plaster) and the instrument is complete.

Great care must be taken when the Wollaston wire is first heated. As much resistance as possible should be put in series with the hot wire when the current from the 12-volt accumulator is switched on, the filament being watched carefully as the resistance is reduced and as it is gradually heated up to just *dull red heat.* (Its reddish glow should be only just discernible in a darkened room, and that only from quite close by.) It will be found that this form of microphone has a long life, and, so long as the milliamperage passing through it is noted and never exceeded, it will last much longer than the filament of a thermionic valve.

It is a good plan to arrange a stop on the dial of the rheostat so that it is impossible to turn it too far and burn out the hot-wire. If such an accident should occur it is not at all a difficult matter to mount up a new filament.

In practice the following method will be found the simplest when setting the relay :—

First balance out the plate current by adjustment of the slider of the potentiometer until the needle of the galvanometer is at zero.

Next carefully adjust the setting of the relay contacts. When this has been done the relay itself should not require any further adjustment. Any necessary subsequent adjustments can now be made by means of the slider of the potentiometer.

(*To be concluded.*)

TRANSMITTERS' NOTES AND QUERIES.

General Notes.

Capt. R. Tingey asks us to state that he is still receiving cards and letters for 2LV and 2LW. He gave up his transmitting licence a year ago, and these call signs have been re-allotted: 2LW to Mr. F. H. Lawrence, "Lyncroft," Albion Road, Sutton, Surrey. We shall be glad if the present holder of the call sign 2LV will let us have his name and address for inclusion in our lists.

XEK 4AP is the call sign of an aeroplane which often flies between Berlin and Cologne and transmits on a wavelength of 42.5 metres with an input of 20 watts off a 200-volt generator. The operator will welcome reports, which may be sent *via* Deutscher Funktechnischer Verband, 19, Blumenthalstrasse, Berlin, W.57.

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Short-wave Transmissions.

NU 2XG, the Western Electric Co.'s station at New York, is still attracting considerable interest among listeners. We understand that this station is used as a short-wave relief for transatlantic telephony when, on account of atmospherics or other causes, the ordinary long-wave telephony between New York and Rugby is unsatisfactory.

The short-wave stations at Nauen are also very active; AGA transmits telephony and Morse on 14.9 metres and AGC on 17.2 metres. A correspondent in Bristol finds that they suffer badly from fading. On a few occasions he has received both transmissions at almost full loud-speaker strength on two valves, but this has lasted for only a short time, the signals having gradually died away until it has been impossible to hear even the carrier wave on the headphones.

Spanish Amateurs.

Through the courtesy of Señor Miguel Moya (EAR 1), Madrid, we are able to supplement and correct the list of amateur transmitters in Spain which appeared on page 268 of our issue of March 2nd, 1927.

Corrections.

EAR 23 J. N. D. Custodio, Calzada 40, Ecija.
EAR 32 B. Ferraz, Villa Primitiva, Ciudad Lineal Madrid.

Additions.

EAR 56 J. Calvo, Cardenal Cisneros 15, Madrid.
EAR 57 C. Igartna, Montera 39, Madrid.
EAR 58 E. Gabana, Camaño 9, Figueras.
EAR 59 J. Mas, Fabrica 16, Palma de Mallorca.
EAR 60 R. Sagrera, Salmerón 187, Barcelona.
EAR 61 J. Romero, Provenza 276, Barcelona.
EAR 62 L. Picallo, Establiments, Palma de Mallorca.
EAR 63 F. Balsells, Pza Constitucion 16, Reus.
EAR 64 D. Liria, Emilio Ferrera 4, Almeria.
EAR 65 A. Creixell, Sebastian Souviron 8, Malaga.
EAR 66 L. Derqui, Duque Sto. Mauro, Hotel B. del Rio, Sardinero.
EAR 67 C. Pereda, Lope de Vega 2, Santander.
EAR 68 A. Botella, Elche.
EAR 69 M. Lora, Sta. Lucia 4, Puerto de Santa Maria.
EAR 70 M. Telleria, C. Santa Clara, Tolosa.
EAR 71 F. Brotad, Capuchinas 1, Palma de Mallorca

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QRAs Wanted.

EI OC7, SA HG1, EL LA6Z, XEF Omega, XEF 8TA, EX 1AS, LP 1, RKV, ZHJ, RRP, SB FP.

RECENT INVENTIONS

The following abstracts are prepared, with the permission of the Controller of H.M. Stationery Office, from Specifications obtainable at the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1s. each.

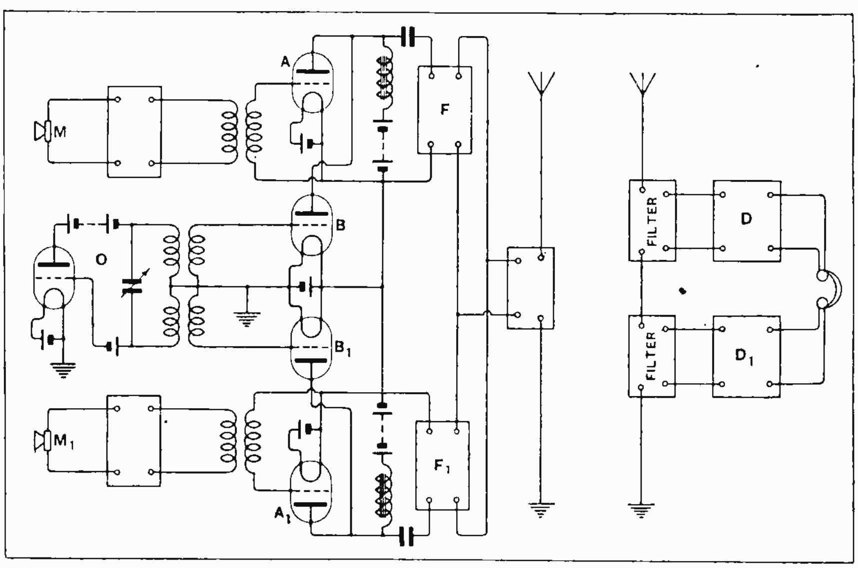
"Plastic" Broadcasting.
(No. 270,001.)

Application date: February 2nd, 1926.

In order to secure a plastic or stereophonic effect, the Standard Telephones & Cables, Ltd., propose to separate the upper and lower side-band frequencies of a single carrier-wave which has been modulated with low-frequency oscillations having a definite phase-difference. As shown, the carrier frequency is supplied from an oscillator O to two modulators B, B_1 arranged in push-pull. Two separate pick-up microphones M, M_1 are located near the orchestra but at a sufficient distance from each other to secure a definite phase-displacement. The input is passed through amplifiers A, A_1 to the modulators. The resulting output will in both cases contain sum and difference components of the carrier-wave and musical frequencies.

A filter circuit F is arranged to pass the higher side-band components, whilst a second filter F_1 passes the lower side-band frequencies. Sufficient overlap is provided to allow a certain proportion of the original carrier-wave also to appear in the combined output circuit leading to the transmitting aerial.

The radiated energy, therefore, contains two separate "versions" of the original sound. At the receiving station the incoming signals are passed first through two filters similar to F, F_1, and then through two separate detectors, D, D_1. The rectified currents are finally fed to the separate earpieces of a pair of headphones, or to two separate loudspeakers, so that the spatial distribution of the original sounds is accurately reproduced.



Transmitting and receiving circuits for stereophonic broadcasting. (No. 270,001.)

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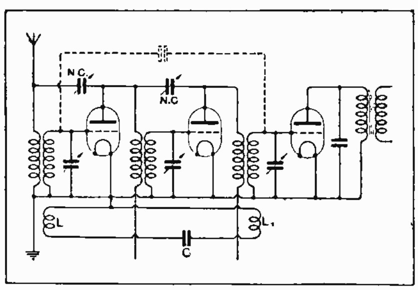
Neutralising Inherent Reaction.
(No. 271,253.)

Application date: June 8th, 1926.

In addition to the usual neutralising condensers N.C. for stabilising the operation of high-frequency amplifiers, an auxiliary closed circuit comprising inductances L, L_1, and capacity C is utilised to compensate for residual coupling effects. The coil L, which has very few turns, preferably only two of stiff wire, is coupled to the grid circuit of the first valve, a similar coil L_1 being coupled to the grid circuit of the third or any subsequent valve. It is essential that at least two valve stages should separate the coils L, L_1. The condenser C has a capacity of 0.006 mfds. Patent issued to the Igranic Co. and P. W. Willans.



Auxiliary circuit for neutralising residual coupling effects. (No. 271,253.)

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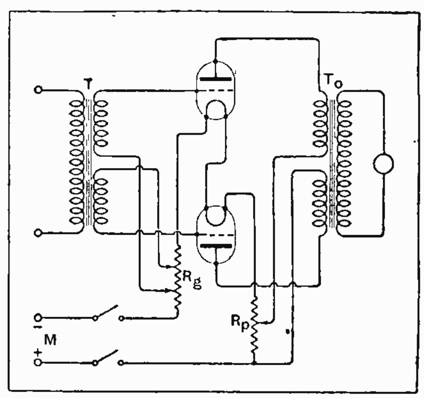
Push-pull Amplifiers.
(No. 271,222.)

Application dates: April 14th and 30th, 1926.

It is usual to supply the filament current in parallel to amplifiers arranged in push-pull relation. Whilst this has the advantage of preserving symmetry between the respective grid potentials, it is sometimes advantageous to supply the filaments in series.

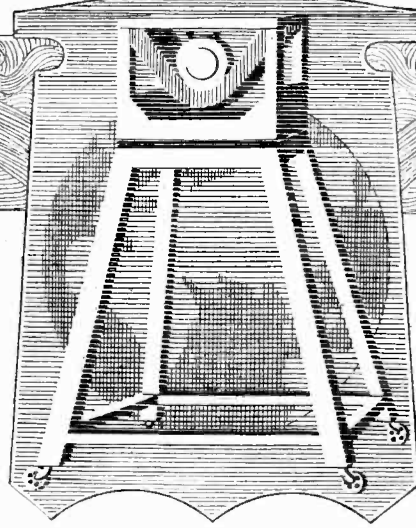
In order to utilise a series filament feed, and at the same time to preserve the necessary symmetry of grid voltage, the secondary winding of the input transformer T is divided, and the two ends are taken to two different tappings on the resistance R_g, which is in series with the filament supply from the mains M.



Push-pull amplifier with filaments in series. (No. 271,222.)

A similar method is adopted for equalising the plate voltages applied to the two valves, relatively to their respective cathodes. For this purpose the primary of the output transformer T_o is split, and the two ends are taken to separate tappings on the resistance R_p from which the plate voltage is derived. It will be seen that both resistances R_p and R_g, together with the two valve filaments, are all in series across the mains M. Patent issued to the British Thomson Houston Co., R. C. Clinker, and G. S. C. Lucas.

BROADCAST BREVITIES



NEWS FROM ALL QUARTERS.

By Our Special Correspondent.

The Regional Scheme.

5GB will start transmitting on Sunday, August 21st, using a frequency of 610 kilocycles, which gives a wavelength of 491.8 metres. This station, which, according to Savoy Hill, must *not* on any account be termed "Daventry Junior," will have an input of 30 kW. It will in general transmit programmes contrasting with those radiated by 5XX, which will continue to relay London. A considerable proportion of the programme of 5GB will be transmitted from the Birmingham Studio, which will thus have a larger audience than hitherto.

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Preparing the Way.

The entry of 5GB into the ether signalises the first steps in the desired Regional Scheme. If favourably received by listeners, the road will be opened for the gradual extension of the scheme, under which the whole country will be served by pairs of stations with widely separated frequencies and probably equivalent power.

In its experimental stage 5GB, situated only a few yards from 5XX, will have masts approximately 100 ft. high, but if and when the station becomes permanently established 300-ft. masts will be substituted.

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Further Adjustment of Wavelengths.

Under the equitable international distribution of wavelengths, Great Britain has secured nine medium waves and one long wave for its broadcasting service. In order to undertake the transmissions from 5GB and at the same time observe the international agreement, certain wavelength adjustments have been necessary. 5GB will rank as a high-power medium-wave station with a frequency of 610 kilocycles (491.8 metres). Bournemouth will revert to 921 kilocycles (326.1 metres). Transmission from Birmingham will be suspended. This does not mean the closing down of the Birmingham station. On the contrary, the new arrangements will have the effect of vastly increasing the audience of the Birmingham station, which will provide a large proportion of the programmes to be radiated by 5GB. Birmingham listeners will be able to adjust themselves to the new conditions with very little trouble. Many who, living close to the old transmitter, have relied upon indoor aerials will probably have to substitute outdoor aerials. It is felt, however, that whatever temporary inconvenience or adjustment may be entailed is a trifling premium for the enhanced service they and others will enjoy permanently thereafter.

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Be Patient.

In common with previous experiments leading ultimately to improved service, the Daventry experimental station, while it will give a satisfactory measure of reliability, cannot be expected to be as free from breakdowns as the established stations equipped on a basis of permanent service.

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The Opening Programme.

The first item, to be transmitted on August 21st, will be an organ recital by the Rev. Cyril Jackson, relayed from Southwark Cathedral. This will be followed by a ballad concert, in which Miss Kate Winter (soprano), Mr. Tom Kinniburgh (bass), and Miss Lena Konterovitch (violin) will participate. It is considered only fitting that one of the early broadcasting artists—in the person of Miss Winter, who was first heard by listeners in 1923—should also be one of the first to be heard by 5GB listeners.

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The Proms.

Although Promenade Concerts will be given every weekday during the season, listeners should not imagine that every concert will be simultaneously broadcast from every station, leaving them no choice but to listen or switch off. London and Daventry, for instance, will not be transmitting another "Prom." until next Monday (August 22nd); on an average these stations will transmit two of the concerts each week, but provincial stations will not necessarily take them on the same nights. Bournemouth and Plymouth, for example, will have Thursday's (to-morrow's) concert while the remainder of the stations are giving their individual programmes. The microphone, however, will be in circuit for every concert, and it will be open to any station to take the whole or any part of a concert from the Queen's Hall for which it has programme space.

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Talks on Astronomy.

Sir Oliver Lodge will talk about "Pioneers in Astronomy" in a series of broadcasts starting on September 29th.

FUTURE FEATURES.

London.

AUGUST 22ND.—B.B.C. Promenade Concert.

AUGUST 23RD.—Musical Comedy Programme. "Mary Stuart," a Play by John Drinkwater.

AUGUST 24TH.—The Kneller Hall Band.

Birmingham.

AUGUST 23RD AND 25TH.—B.B.C. Promenade Concert relayed from the Queen's Hall, London.

Bournemouth.

AUGUST 25TH.—A Musical Burlesque on the Trial Scene from "The Merchant of Venice."

AUGUST 26TH.—Promenade Concert from the Queen's Hall, London.

Cardiff.

AUGUST 24TH.—B.B.C. Promenade Concert relayed from the Queen's Hall, London.

AUGUST 27TH.—A Running Commentary on the Glamorgan v. Somerset Cricket Match.

Manchester.

AUGUST 23RD.—B.B.C. Promenade Concert relayed from the Queen's Hall, London.

AUGUST 25TH.—An Evening at Blackpool. The Wylie-Tate Concert Party relayed from the Central Pier.

Glasgow.

AUGUST 27TH.—"The Happy Hangman," a Grotesque in One Act.

Aberdeen.

AUGUST 25TH.—"Heart's Desire," a Comic Opera in Two Acts by Mabel Constanduros.

Belfast.

AUGUST 24TH.—"Umbrellas," a Comedy in One Act by Elizabeth Baker.

London and Daventry's Share of the "Proms."

Promenade Concerts at the Queen's Hall will run to September 24th. Those which will be broadcast from 2LO and 5XX as at present arranged are the following: August 22nd, 23rd, 25th, 29th and 30th, and September 2nd.

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National and Symphony Concerts.

As regards the National and Symphony Concerts, it is expected that these will be simultaneously transmitted to all stations in the same manner as were broadcast the National Concerts from the Albert Hall last season.

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Announcers' Pronunciation.

The publication of some of the recommendations of the committee appointed by the B.B.C. to advise upon words of doubtful pronunciation has occasioned considerable comment and not a little adverse criticism. It is admitted, however, that though there are many words in our language which may correctly be pronounced in various ways, it is certainly desirable that every B.B.C. announcer should, as far as possible, use the same pronunciation.

Without entirely agreeing in every detail with the recommendations of the committee, their names and reputations are in themselves a sufficient guarantee that each doubtful word has been carefully considered and that the verdict has the concurrence of those in the highest authority.

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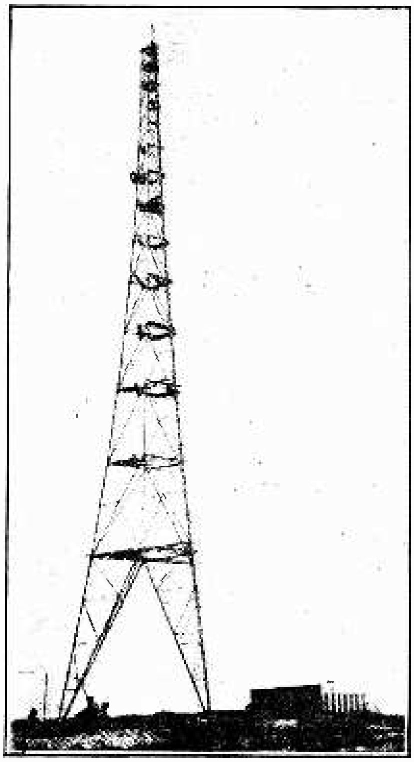
Empire Broadcasting.

The B.B.C. announces that it is definitely committed to playing its rightful part in the development of Empire broadcasting. This has always been envisaged as an important objective. The B.B.C. states that so seriously does it regard the matter that it has declined to accept premature and unsound proposals, the adoption of which, while yielding great publicity, would certainly retard and prejudice the full attainment of the objective. To undertake now the relaying of B.B.C. programmes on short waves would arouse temporary interest, but would inevitably be followed by keen disappointment and disillusion when the measure of the unsatisfactory character of the service was fully comprehended. The B.B.C., relying on the best available scientific opinion and research, with the full agreement and support of the authorities concerned and of enlightened public opinion both at home and abroad, is pressing forward with its plans for the regular provision of effective Empire transmissions. The problem is one rather of reception than of transmission, and it is in this direction that the B.B.C. is continuing elaborate research. The eventual service, if it is to reach the majority, will be in terms of rebroadcast through existing Colonial broadcasting stations. Meanwhile the B.B.C. wishes amateur transmitters every success in their efforts, which it is hoped may contribute to the solution of a problem still baffling in many essential respects. Moreover, while continuing its work on Empire broadcasting, the B.B.C. is not disposed to give it priority over service to listeners in this country, for whom a new and greatly improved system of distribution is now in the final stages of preparation.



One of the masts of the new Danish station at Kallundborg, which it is expected will be ready this month.

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The B.B.C. Arms.

The emblazonment of heraldic devices symbolising the advancement of modern science must occasionally prove somewhat of a problem to the College of Heralds, who doubtless experience some difficulty in reducing wavelengths or kilocycles to terms consistent with their stately and archaic phraseology. The new arms of the B.B.C., however, are symbolical without being complicated, and, I imagine, do not unduly strain the recognised laws of heraldry. My own recollection of these laws and language being extremely rusty, a plain and unheraldic description must suffice:—

The shield has a blue (azure) ground on which is a terrestrial globe in white (argent) surrounded by a golden ring to represent broadcast transmission, and ranged about this are the seven remaining planets.

The crest is a lion rampant holding in his right (dexter) paw a heraldic thunderbolt representing respectively Great Britain and electric transmission.

The supporters are two eagles with bugles to signify proclamation, the eagle being the swiftest bird recognised in heraldry, though, incidentally, heralds may now have to revise their symbols to keep pace with aviation and wireless.

The motto is, "Nation shall speak peace unto nation"

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A Popular Oratorio.

Birmingham listeners will hear Handel's oratorio "Judas Maccabæus" on August 28th. The soloists are Florence Holding (soprano), Gladys Palmer (contralto), Tom Pickering (tenor), and Joseph Farrington (bass). "Judas Maccabæus" owed its inception to the victory of William, Duke of Cumberland, over Charles Edward, the Pretender, at the Battle of Culloden, on April 16th, 1746.

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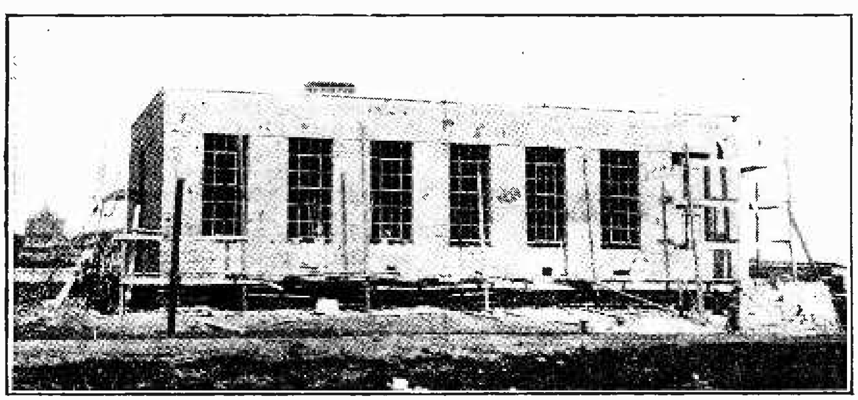
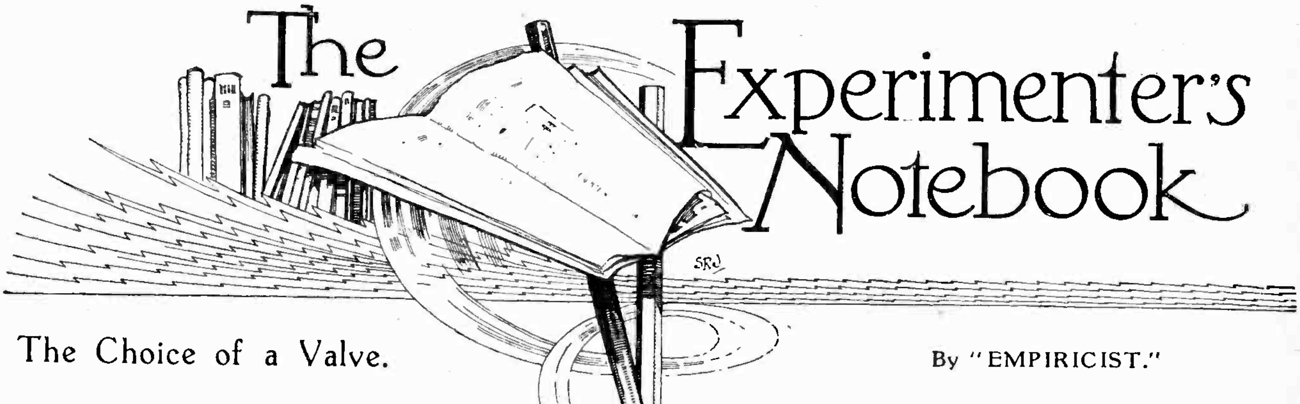
Russian Music in Bournemouth.

The Russian programme which had to be postponed from July 12th will be broadcast from Bournemouth on August 24th. Miss Kathleen Mitchell will sing, to M. Gregori Tcherniak's balalaika accompaniment, Russian and Tartar folk songs, arranged by Herbert Bedford, Julia Chatterton and Lady Brittain. M. Tcherniak began teaching himself the balalaika when he was still only a child.



The station building at Kallundborg under construction.



The Experimenter's Notebook

The Choice of a Valve.

By "EMPIRICIST."

NOWADAYS, when such a very large diversity of types of receiving valve are found on the market, the experimenter may be pardoned for finding himself thoroughly bewildered when faced with the choice of a valve for a particular function in a wireless circuit. This article is written with the intention of reviewing some of the principal considerations which govern the selection of a valve, the standpoint being not that of discriminating between the valves of different makers but between different types of valve each of which is in general manufacture.

Valve Constants.

Valves, as is well known, are commonly classified in terms of their two characteristic constants, namely, internal resistance and magnification factor. The former has been denoted more accurately "slope" resistance; it has no relation to direct current resistance and only represents the effect which the anode circuit has upon a piece of apparatus to which it is connected and in which alternating currents are flowing. We may consider this matter roughly in relation to Fig. 1 (a). Here the grid of the valve is connected to any desired voltage and the plate circuit is completed through an oscillatory circuit LC as shown in the figure, any desired value of high-tension voltage being employed. With the arrangement of Fig. 1 (a) it will be found that the circuit LC is

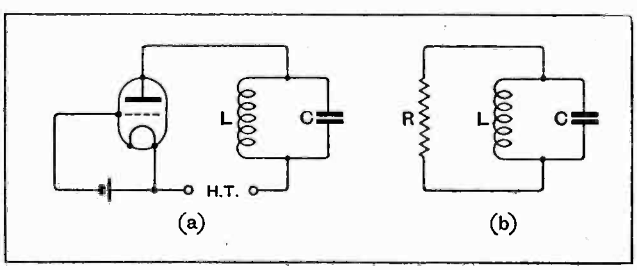


Fig. 1.—The internal resistance of a valve exercises a damping effect on tuned circuits connected in the anode circuit.

considerably damped, and by any method of measuring damping we could establish the fact that there was some shunt resistance R (see Fig. 1 (b)) which had precisely the same damping effect on the circuit as the valve. This resistance is then equal to the internal resistance of the valve, measured at the specified value of high-tension, grid and filament voltages.

It is a characteristic property of valves that when they are passing a plate current which lies within certain reasonable limits their internal resistance is more or less constant. The value of plate current is capable of being regulated by both the grid and plate voltages, and the limits of plate current above referred to are those which correspond to the range of "straight line characteristic." As for most reception purposes—it is the range of straight line characteristic with which we have to deal—this constant of the valve which represents its A.C. damping effect is of the greatest importance.

The Magnification Factor.

The magnification factor of the valve may be considered perhaps more easily from the direct current standpoint. If we apply certain values of high-tension and grid voltage to a valve we will find a definite current flowing in the plate circuit. Suppose we increase the high-tension voltage, the current will increase; if we then reduce the grid voltage we may bring the current back to its former value. It will be found that the variation necessary with grid voltage will be considerably less than that originally effected to the plate voltage, and the ratio between the two will be tolerably constant over a very wide range of grid and plate voltages, this constancy even extending to the curved parts of the valve characteristic.

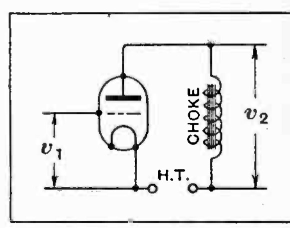


Fig. 2.—If the impedance of the choke is high compared with the internal resistance of the valve the ratio of v_2 to v_1 will equal the valve amplification factor.

The significance of this constant in an A.C. circuit may be considered in relation to Fig. 2. Here we have a valve in the plate circuit of which is inserted a choke of very high impedance for some frequency which we may consider as audible, in order to fix ideas. It is readily possible in practice to make a choke with an impedance of about 10 megohms, and if we consider the valve to have an internal resistance of 10,000 ohms the choke thus has an impedance of 1,000 times the resistance of the valve. If we consider the ideal case where the choke has an infinite impedance, matters will not be far removed from what can be achieved in practice and we shall therefore make this assumption in the present case.

Suppose, then, to the circuit of Fig. 1 we apply an

The Experimenter's Notebook.—

alternating voltage v_1 between the grid and the filament. Since no current can flow in the circuit, a voltage will spring up across the choke in which the conditions of the experiment which has just been described will be automatically reproduced, *i.e.*, when the grid voltage increases by a certain amount the plate voltage will decrease by an amount which is exactly that necessary in order to keep the plate current steady. The voltage across v_2 will thus be greater than that across v_1 in a constant ratio.

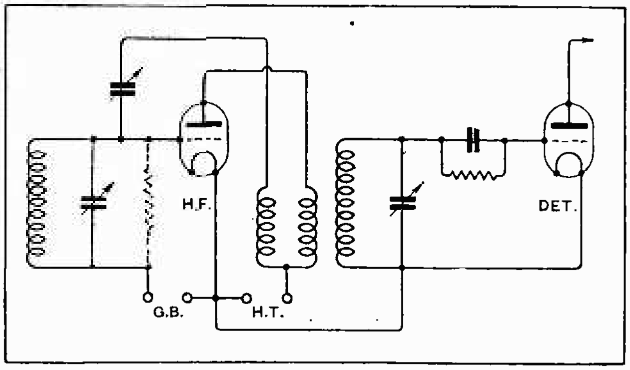


Fig. 3.—Grid current, if present in a circuit of this type, exercises a serious damping effect on the input circuit.

which is the magnification factor of the valve as previously defined.

In practice, as we cannot consider any impedance to be infinite, a certain amount of this magnification will be lost, but in audio-frequency circuits, at any rate, the fraction is often so small that for the purposes of rough calculation we estimate that the total valve magnification is produced in the plate circuit.

In considering the purposes to which different valves may be applied we have therefore two main characteristic constants which exercise a predominant effect. There are also, however, other very important properties in a valve which must be taken into account. First we must know that we can apply to the valve such voltages that the internal resistance and magnification factor will have their stated value. Secondly, we must give due attention to the question of grid current, nearly always one of the banes of the radio experimenter.

Both of these points can be cleared up by reference to the manufacturers' published characteristics, and in order to appreciate these it is necessary to know precisely at what grid voltage the flow of grid current begins. Usually this point is somewhere in the neighbourhood of the negative terminal of the filament, *i.e.*, at zero voltage if, as is customary, we reckon from this point. For certain valves, however, notably bright emitters and, occasionally, certain types of dull emitter, there is considerable grid current flowing at this point, and we have to apply a further negative bias in order to reduce it to zero. On the other hand, again, there are dull-emitter valves in which a considerable positive voltage may be applied to the grid before current starts to flow. This may be reckoned an advantage inasmuch as all the valve characteristics are better than they seem at first sight on account of it being possible to work satisfactorily at a point further up the characteristic.

Effect of Grid Current.

In order to illustrate the effect of grid current, an instance may be quoted that came within the writer's experience. A simple high-frequency circuit, arranged as in Fig. 3, was being tested, and two valves, of types which may be denoted as A and B, were being tried out in the H.F. position. These valves, according to the maker's characteristics, were substantially identical, and measurements by well-known methods confirmed this fact. Valve A, however, gave on test very much superior results to valve B.

On careful investigation it was found that, under parallel conditions, there was practically no grid current flowing in the case of valve A, whereas in the case of valve B a considerable amount was found. Adjustment of grid bias so as to cut off this grid current resulted in an improvement of signal strength in the case of valve B and a weakening of signal strength in the case of valve A, the result being that the valves ultimately worked practically as well as each other. The results showed, however, that it was possible to work further up the straight part of the characteristic with valve A, as the damping effect in the grid circuit was insignificant in comparison with that found in valve B under the same conditions; the effect in the case of the latter valve was as if a resistance (shown dotted in the figure) were placed in shunt across the grid circuit.

There are other important reasons, of course, why it is necessary to avoid the flow of the grid current, notably in the case of audio-frequency amplifiers, where it is one of the most fruitful causes of distorted speech. The present example was given as it appeared to be one which was not widely appreciated.

(To be continued.)

BOOKS RECEIVED.

Drake's Radio Cyclopedia, a complete and non-technical reference work, covering over 1,500 subjects, arranged alphabetically, with 985 illustrations, and including instructions for building, operating and testing receivers, power units and radiophone equipment, by Harold P. Manly. Published by F. J. Drake, Ltd., Chicago.

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"Easy Lessons in Wireless," by Robert W. Hutchinson, M.Sc., A.M.I.E.E. An elementary book intended for the absolute beginner, describing in non-technical language the general principles of wireless telegraphy and telephony, and the various components used in receivers. With diagrams and notes on crystal and valve circuits and a chapter on transmitting. Pp. 168, with 141 illustrations and diagrams. Published by the Universal Tutorial Press, Ltd., London. Price, 1s. 6d.

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"The Small Car Handbook," 4th edition, entirely revised and brought up to date. Deals fully in a non-technical manner with the modern types of small family cars, and is intended to assist the inexperienced owner-driver to look after his own car in his own garage. Pp. 217, with over 200 illustrations. Published by Iliffe & Sons Ltd., London. Price, 2s. 6d. net.

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

Correspondence should be addressed to the Editor, "The Wireless World," Dorset House, Tudor Street, E.C.4, and must be accompanied by the writer's name and address.

EMPIRE BROADCASTING.

Sir,—Permit me to thank you for your Editorial of May 4th on Empire broadcasting.

Before proceeding to discuss the merits of such a scheme I would like to give you some idea of the success which has attended the relaying of transmissions from overseas high-frequency stations. I have not included the full programmes, as the matter would occupy too much space.

EXTRACT FROM LOG, DURBAN STATION.—INTERNATIONAL RELAYS.

January 9th-16th, February 16th, March 6th, and subsequent dates we re-broadcast transmissions from 2XAF, KDKA, AGC, and PCJJ without a failure, reception being exceptionally good on all occasions. During one of these relays the steamship *Asturias*, with 400 American tourists on board, was lying in Durban Harbour, and greetings from the U.S.A. were received by the visitors *via* the Durban station. It has fallen to a foreign station to be the first to cater for the wishes of the citizens of the outposts of the British Empire—a direct link with home—and be it said to the everlasting credit of the Philips Radio Station, PCJJ, that their relay of London and Daventry was a great success.

It appears as if the responsible authorities at home were deplorably lacking in their conception of the unbounded possibilities of Empire relay work and the priceless value of such a scheme in the event of a national crisis; to mention one example—in the event of war—a direct call by England's statesmen to the Dominions.

The bonds of fellowship between the Mother Country and her Dominions would be forged in an unbreakable link by our participation in the social, economic, and educational life of the Homeland.

It is hard, if not impossible, for those fortunate enough to be domiciled in the British Isles to realise what such a link would mean to the men and women of these far-off lands, bringing as it would the joy and pleasure of hearing speeches from their Majesties the King and Queen and the leading men of this great commonwealth of nations.

Picture for yourselves the men and women who live out on farms situated in the vast reaches and undulating plains of South Africa, Australia, Canada, New Zealand, and India, miles from the big centres with their bioscopes, theatres, and playgrounds, and try to realise what contact with home would mean to them. I appeal to the listeners and Press in the British Isles to exert every effort to assist in establishing a short-wave station for this work. By doing so you will promote British trade and earn the everlasting gratitude of your brothers and sisters in our far-flung lands. Finally, I would mention that the South African stations will be working S.B. on high and low frequencies soon, enabling you to hear what is going on out here. Who will be first in the race?

I would like to take this opportunity of extending greetings to our colleagues in all branches of the radio profession at home.

NOEL DOUGLAS CUMMING,
Asst. Engineer, Durban Broadcasting Station.

Durban, South Africa.
July 14th, 1927.

Sir,—With reference to previous correspondence on the above subject, and particularly to Mr. Munn's letter in your August 3rd issue, although some divergence of opinion exists on ways and means, there is, I think, a general feeling in favour of an Empire station, and there does not seem to be any need for further discussion on the desirability or suitability of the venture.

If we are to wait, as suggested by some, until the State takes up the matter, there is likely to be a considerable delay, since this question does not readily fall within the province of any Government Department, so one turns to the B.B.C. as the only competent body to accomplish something.

With regard to the suggestion that it would be improper for the B.B.C. to divert programme revenue to other purposes, the position is somewhat equivocal; whilst, on the one hand, this organisation derives its income from licence fees paid by a section of the population (a rather large proportion of the tax-paying community, one might add). on the other hand, the B.B.C. is national in character, and has been granted a charter, together with the privilege of a monopoly, by the State in the interests of the general public. If Mr. Munns' point of view were followed to its natural conclusion, the beer tax would be spent on the embellishment of public-houses, and the tobacco tax on providing bigger and better tobacconists; the disposal of the revenue from dog licences might present some difficulty, but no doubt some means could be found of disposing of all this superfluous wealth in brightening the life of dogs in some way. A purist might complain that if the B.B.C. have no right to spend revenue in the general public interest, reciprocally the State has no right to grant the B.B.C. the monopoly of propagating sounds in a medium which is the property of all.

Returning, however, to a more practical view of the situation, Mr. Munn gives us his views on a diversity of subjects, palpable red herrings to divert the attention of the reader from the main theme. In one particular he is quite right, however; no authoritative person has so far come forward to give an estimate of what a short-wave station would cost. Mr. Munns' mention of £20,000 a year as a basis for discussion is a figure we can no doubt reject, having regard to the fact that Mr. Marcuse, without, one gathers, any financial support from the general public, intends to run a station for a few months. The B.B.C. have, as stated by Mr. Dallas Bower, enormous resources at their disposal and no doubt equipment lying idle which can be utilised until matters are put on a proper footing, when no doubt the original outlay could be recuperated; and the expense is likely to be so small, relatively, that adherence to the thesis that programme revenue must remain inviolate would be on principle only—a principle whose validity is open to discussion.

I trust that Mr. Munn does not, as he states, represent the views of the average listener, but if he does, and the B.B.C. do not feel justified in making a move, they should announce the fact publicly, so that the proper authorities might be invited to take action.

H. D. HARRIS.

Garches, France.
August 8th, 1927.

METRES OR KILOCYCLES.

Sir,—Though your admirable Editorial on the subject of "Metres or Kilocycles" states the case for and against the proposed changes in calibration nomenclature very fully, there are some aspects of the question which require illumination.

(1) Commercial stations all work to the wavelength scale. Considerable confusion may arise unless the change, if change there is to be, is applied to all stations. No difficulty will

be found by the professional in working with two scales, nor, probably, by the majority of your readers; but it is the B.B.C. which is proposing the change, and the B.B.C. caters for a vast body which contains a large number of semi-educated persons—from the radio point of view—who have some glimmering of the idea of a wavelength but who never will understand a kilocycle.

(2) If it is not already so the case will soon be that the majority of listeners are not in the least concerned with technicalities of broadcasting. They are not interested in either wavelengths or kilocycles. They do not understand them and do not want to do so. They work on the dial. "It comes in at 55." From their point of view it doesn't matter what you use as a scale for your spectrum.

My own feeling is that, as regards the general listening public, no case has been made out for a change by the B.B.C., unless commercial stations are to change, when the B.B.C. must fall into line. ERNEST H. ROBINSON. (5YM.)

Pirbright,
August 3rd, 1927.

THE PROPOSED REGIONAL SCHEME.

Sir,—Capt. Eckersley's interesting article on the proposed distribution of broadcasting stations seems to me to disclose a very serious position which calls for united efforts on the part of listeners to prevent a great injustice being perpetrated.

It seems to me that as a non-profit-making public service it is the primary duty of the B.B.C. to provide the best service in their power and to distribute it as equally as possible to the whole country, and not to concentrate their service on certain favoured areas so as to earn a larger number of licence fees and to save expense in building transmitters. If any distinction is to be made, it should be rather in favour of the remote country districts whose inhabitants have not the alternative distractions which seem to prevent townspeople from listening very often to the wireless programmes. Yet it is apparently proposed to transmit from five centres only, at such a power as will give a "B" service over a distance of 50-70 miles. The B.B.C. will hardly venture to leave Northern Ireland without a station at all, so that they will have only four transmitters left to cover Great Britain. A simple calculation will show that four circles of 70 miles' radius (Capt. Eckersley's highest figure) will, after allowing for area lost over the sea and/or by overlapping, cover only two-thirds of the 90.000 square miles of Great Britain. In other words, one-third of the country is to be permanently condemned to a "C" service or worse.

If the whole ten frequencies allotted to this country were used without duplication it would be possible to give a "B" service to every district except the outlying parts of Scotland, Wales, and Cornwall, which certainly present a problem unless we can afford to waste considerable energy over the sea; but most of these should get a "C" service, and "man-made static" should be rare in these districts. This is postulating stations which would give a "B" service area of only 50 miles, so that economy of power would be effected.

Roughly outlined, such a scheme would need the retention of the present high-power station at Daventry, which I assume to have a "B" service area of at least 80 miles on account of its high wavelength and consequent less rapid attenuation. Eight new stations would be needed, somewhere in the neighbourhood of the following points :—

(1) Sevenoaks, (2) Amesbury, (3) Builth Wells, (4) Nantwich, (5) Goole, (6) Middleton-in-Teesdale, (7) Carstairs, (8) Central Highlands.

This would use up nine of our frequencies, and the tenth would be occupied by three low-power stations giving a "B" service area of 35-40 miles and situated near Okehampton, Thetford, and Central Ulster. These would S.B. programmes from the other stations, but not from the adjacent ones. All other stations would normally have their own programmes.

It will be seen that none of the places mentioned is on the coast, as I consider this is a wasteful position, and, furthermore, I consider that too much account should not be taken of existing telephone facilities, as surely the B.B.C. ought, if necessary, to erect its own land lines. Any scheme should be worked out on geographical considerations first and all the time.

If any of your readers who are interested in this matter care to try placing discs of tracing paper of appropriate sizes on a map of Great Britain they will find that, in addition to covering practically the whole land area with a "B" service, this scheme would give large areas two and often three alternative "B" services, while most of the centrally situated districts would have anything up to half a dozen programmes at good strength to choose from. It is true that I assume a reasonably selective receiver, but I think I am entitled to do so, as it is manifestly unfair to penalise vast districts because owners of old-fashioned sets may be too conservative to modernise them, or, as Capt. Eckersley suggests, too lazy to use them when they are modernised. I would suggest to Capt. Eckersley that listeners who want their wireless to be as simple as the cigar lighter will be content with the programme which is on tap from their local station, while those who are prepared to take some interest in their receiver, even if only to the extent of tuning in transmissions at different strengths, deserve better treatment than he proposes to give them.

The application of the same tracing-paper test to Capt. Eckersley's five-station scheme will show strikingly the large districts which would be outside the pale of the "B" service, and I trust that listeners will note this and protest energetically against such inequitable distribution.

Puddington, Devon. ROGER KINGDON.
August 1st, 1927.

HANDICAP OF THE CHEAP VALVE SET.

Sir,—After reading your leading article on the handicap of the cheap valve set we cannot help thinking that it is about time something was really done about Marconi royalties.

Take our own particular case. We are now preparing for the coming season, and, despite the opinions of many, we know that there is still a big market for a moderate-priced set.

To meet this we have designed a good two-valve set, capable of receiving several stations on the loud-speaker, to sell at the very low price of £5, and this complete with valves, accumulator, high-tension battery, all accessories, and a good loud-speaker.

But here is the snag. To this price we must add 25s. royalty, and we fail to see why for a set of this price such a proportionately high royalty should be charged.

We are in entire agreement with your remarks that a change in the basis on which the royalties are calculated is long overdue, and suggest that a levy of ten per cent. on the retail price of all complete sets would be far more satisfactory all round.

We must not lose sight of the fact that there are still a few million potential listeners, and as every set sold means 10s. per year in licence fees these potential listeners could contribute another million pounds per year to the B.B.C. for programme building and a little bit over for that Empire short-wave station.

There is no doubt as to the unfairness of the royalties on the low-priced sets, and we think everybody interested in radio should do all in their power to bring about this change.

Liverpool. HAROLD KNOX,
July 27th, 1927. p.p. M. Stanley and Co.

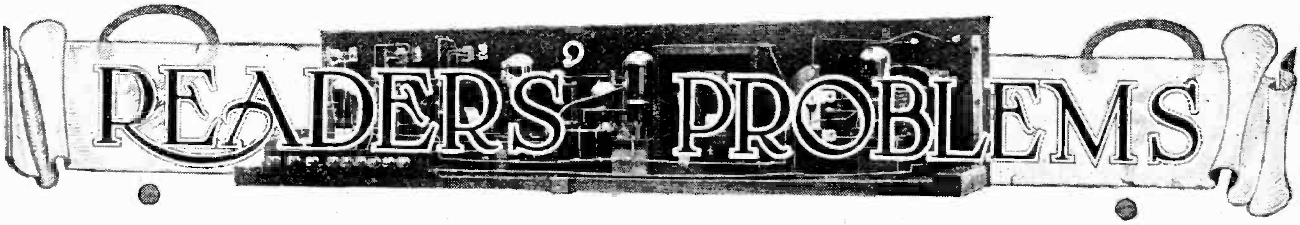
RECEPTION OF PEACE BRIDGE CEREMONIES.

Sir,—I listened to the broadcasting of the Peace Bridge ceremonies from station 2XAD last evening.

The reception on my 0-v-1 Hartley Circuit receiver was as clear on phones as the local station, 2LO, is on a one-valve receiver with reaction. Every word was heard, fading was practically non-existent, and atmospherics were not at all troublesome.

I consider the B.B.C. could have re-broadcast the whole or any part of this transmission with great success, and if they did not do so have missed another great opportunity. I do not know whether they re-broadcast the Prince of Wales's and Mr. Baldwin's speeches or not, as I was too interested in listening to the direct transmission to switch on my higher wavelength receiver. ALEC A. KEEN.

Chesham Bois,
August 8th, 1927.



"The Wireless World" Information Department Conducts a Free Service of Replies to Readers' Queries.

Questions should be concisely worded, written on one side of the paper, and headed "Information Department." One question only should be sent at a time, and must be accompanied by a stamped, addressed envelope for postal reply. Any diagram accompanying the question should be drawn on a separate sheet. No responsibility will be accepted for questions sent in which do not comply with these rules.

Broadcasting in the Tropics.

I shall shortly be proceeding to West Africa, and wish to build and take with me a receiver which would be capable of bringing in the British and Continental broadcasting stations, and should be glad if you could recommend to me a suitable design. S. L.

There is no receiver, however great the number of valves you use, which could be guaranteed to receive the stations you require in the locality you mention. The great trouble in tropical and sub-tropical countries is the question of atmospherics, which are extremely fierce and very persistent during the greater part of the year. The greater the number of H.F. valves used in order to get sensitivity the more troublesome are the atmospherics, and it might well be said that a plain straightforward receiver like the "All Wave Four," for instance, would stand as great a chance of giving satisfactory results on those comparatively rare occasions when atmospherics were not too conspicuous as would a much more elaborate and costly set.

As you may yourself know from experience, in this country atmospherics are usually worse on the long Daventry wavelength than on the normal broadcasting wavelength, and it will often be found that when atmospherics are bad on the normal broadcasting wavelengths of 200 to 600 metres, and far worse on the longer wavelength of Daventry, that on short wavelengths of 30 metres or so they are conspicuous by their absence. It might be said, therefore, that the short wavelengths are the salvation of people living in remote parts of the world, such as you are intending to do. Apart from this, short-wave transmissions have, generally speaking, a very great range, considering the small inputs which are used in the transmitters and the quite simple apparatus that is necessary to receive them, and, moreover, these long ranges can often be obtained in daylight. As you may know, the Dutch station at Eindhoven, Holland, constructed for the purpose of broadcasting to the distant Dutch East Indies, etc., has proved remarkably successful, whilst the transmissions from the American short-wave broadcasting stations are received with great success, not only in this country, but also in South Africa.

You could not do better, in our opinion, therefore, than to build or purchase a good short-wave receiver, and we would refer you to our special short-wave number dated June 29th, where full constructional details will be found of the "Empire" broadcast receiver. Moreover, this instrument was described with the special requirements of tropical countries kept in view, and an all-metal container was used, for, as you doubtless know, the ordinary wireless receiver often has a short life in a tropical country, owing to the ravages of climate and certain members of the insect world. An instrument such as we have described will probably afford you far better enjoyment than a broadcasting receiver designed for use on the ordinary wavelengths. Unfortunately, there is no short-wave broadcasting station in this country at the moment, although, as every reader of *The Wireless World* will be aware, a fervent hope is entertained of remedying this state of affairs in the not too distant future.

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A Simple Crystal Set.

I wish to construct an efficient crystal set using a centre-tapped plug-in coil, the receiver covering both long and short broadcasting wavelengths, and I shall be glad if you will give me a suitable circuit. L. S. R.

We give in Fig. 1 a circuit suitable for your purpose. The centre tapping on the coil provides an excellent means of

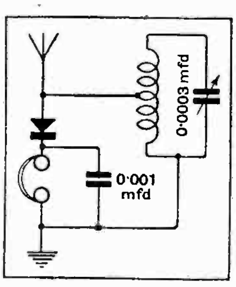

Fig. 1.—Simple crystal set using centre-tapped coil.

reducing both aerial and crystal damping, and so increasing the actual voltage developed across the tuned circuit, thereby increasing signal strength and at the same time sharpening tuning.

0·0003 or 0·0005 Mfd.?

I am building the "Everyman Four" receiver, but wish, if possible, to use 0.0005 mfd. condensers instead of 0.0003 mfd. specified. Will this result in any disadvantage? D. G.

Assuming that your condensers have as low a minimum value as a good 0.0003 mfd. condenser, then the only disadvantage which will result will be that you have a very crowded tuning scale, for the following reason:—

In the ordinary 0.0003 mfd. condenser the whole of the tuning range from minimum capacity up to 0.0003 mfd. capacity is spread over 180 degrees of the dial. Now, in the 0.0005 mfd. condenser, naturally the same wavelength band will be covered between minimum and the point on the dial which is equivalent to a capacity of 0.0003 mfd., and, naturally, the dial spacing between these two points will be less than 180 degrees, since you have the capacity from minimum to 0.0005 mfd. squeezed into the whole 180 degrees of the scale. Therefore you will have the same amount of stations squeezed into a much smaller space on the dial, which will be rather disadvantageous. You might argue that an advantage would be gained in so much that the tuning range of the set would be greatly extended in an upward direction. This advantage, however, is only an apparent one, since you will find that the set will become comparatively insensitive when working on that part of the condenser capacity above 0.0003 mfd. or so, and, although the wavelength range will be extended, the set will not be of much use for long-distance work at the top end of the scale.

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A "No-battery" Two-valve Receiver.

I have recently constructed an H.T. battery eliminator for use with the "B.B.C. Two-valve Receiver," and the results obtained are so good that I am contemplating modifying the apparatus so that the filament current as well as the plate current can be drawn from the 240-volt D.C. mains. I should be obliged if you could provide me with a suitable circuit arrangement to enable this to be done. V. M. H.

In Fig. 2 we give the complete circuit of the "B.B.C. Two-valve Receiver" and battery eliminator to enable both the H.T. and the L.T. to be drawn from the D.C. mains. We suggest that valves taking 0.1 amp. of filament current be employed and the filaments connected in series. This will limit the total current necessary to 0.1 amp., and, in addition to reducing the running costs, will enable easily procurable components to be used. The filaments of the valves should be connected in series, and it is recommended that an output transformer be incorporated. This should be purchased to suit the loud-speaker employed; that is to say a high-resistance loud-speaker will require a 1 to 1 ratio transformer, and one of the low-resistance type would necessitate the use of a step-down ratio.

Having decided that 0.1 amp. will be required, the next consideration will be the value of the resistance to limit the current to the valves. This can easily be ascertained by dividing the current into the mains voltage, and in the case under consideration 240 volts divided by 0.1 amp. gives 2,400, which will be in ohms. It must be remembered that a portion of this resistance is represented by the resistance of the filaments, so that to obtain the required resistance between last valve and positive main we must deduct this from the total. We assume that 6-volt valves taking 0.1 amp. are used, so that the resistance of such filament will be 6 divided by 0.1, which equals 60 ohms, or 120 ohms for both valves. We must now deduct this from the total resistance, which leaves 2,280 ohms. A resistance of this value could be made up using Eureka or other suitable wire, but a more simple method would be to employ lamps and a commercially made variable resistance to obtain the correct value required.

The two lamps shown in Fig. 2 should each be 60-watt metal filament lamps, and their combined resistances will amount to 1,920 ohms approximately, so that if R_1 has a total resistance of 400 ohms we shall have a little in hand to compensate for any slight discrepancy between the actual resistance of the lamps and their calculated resistance. R_1 could be an Igranic-Pacent potentiometer (porcelain type), one end of the winding and the slider being used, thus converting it into a variable resistance.

The filament of the L.F. valve is at a positive potential with reference to the detector valve, so that if the same H.T. tapping is used for both valves the detector will have a relatively higher plate voltage than the amplifier, the difference being of the order of 12 volts. For this reason two separate H.T. tappings are shown, and these will result in about 100 volts being applied to the detector and 120 volts to the L.F. valves. The smoothing chokes in each H.T. lead should have an inductance of about 110 henries, and a suitable component is marketed by Messrs. W. G. Pye, of Cambridge, the condensers C_1, C_2 and C_3 each being 4 mfds. The condenser C_4 is a blocking condenser and need not exceed 0.01 mfds. The remaining components in the circuit should be in accordance with those recommended in the construction article, and accordingly reference should be made to our issue of April 20th last for full particulars.

The valves recommended in the above issue will not be applicable in your case, and we suggest the detector be either a Mullard P.M.5X or Cossor 610 H.F. and the L.F. valve a Mullard P.M.6 or Cossor 610 P. (Stentor Six), these valves taking only 0.1 amp. filament current. Valves of other makes but having similar characteristics could be used, of course, if desired.

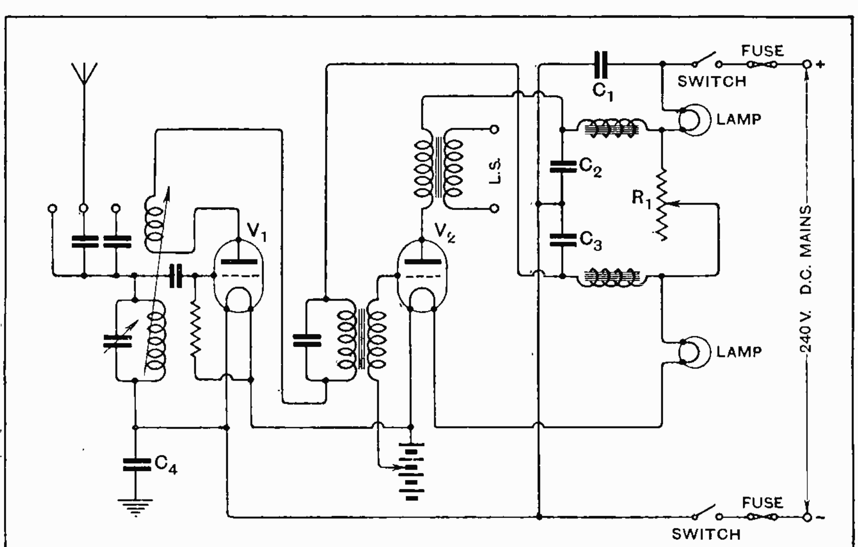

Fig. 2.—Complete circuit diagram of two-valve receiver working from D.C. mains.

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Paralleled Valves or "Push-pull"

I shall be glad if you can tell me the difference between connecting two similar type valves in parallel in the output stage of the receiver and connecting them in the push-pull system.

R. E. C.

When connecting two valves in parallel the filament connections are common, and the grids of the two valves and the plates also are respectively joined together. The result is that the A.C. resistance is halved, the amplification factor, however, remaining as before. Needless to say, the effect of paralleling is also to double the plate current consumption. When connecting two valves together in this manner the available grid swing is not doubled, as in the case of the push-pull system.

As is well known, in the push-pull system on the input side of the valves a special output transformer is used having a centre-tapped secondary, the grids of the two valves being joined respectively to each end of the secondary and the centre tapping going to H.T.+. The primary of this transformer connects to the output of a crystal set, or in the plate circuit of another valve. The plates of the two "push-pull" valves are joined to each end of the primary of a special transformer which has its primary centre tapped, this centre tapping going to negative grid bias. The secondary of this transformer connects to the loud-speaker.

The effect of connecting valves in this manner is to double the grid swing which would be obtainable with the use of one valve alone in the ordinary manner. The system first came into vogue in America before the days of power valves and enjoyed a great popularity, as it enabled results approaching those given by a power valve to be obtained with ordinary general-purpose valves. It is a mistake to think, however, that the system can only be used with general purpose valves, and it will be found that if two power valves are connected up in the push-pull system the straight line portion of the grid volts anode current curve of either power valve will be added together, thus enabling the two valves to handle an input of twice the power of that which could be handled without distortion by one valve alone.

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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.

EMPIRE BROADCASTING.

IN a recent issue of *The Times*, Capt. Eckersley has stated the case for the B.B.C. on the subject of Empire Broadcasting, and even at the risk of appearing to overburden our readers with our views on this important topic we feel that it would be unfair to those who have so strongly supported our campaign for the establishment of an Empire broadcasting station to allow Capt. Eckersley's discouraging letter to pass without comment. The burden of Capt. Eckersley's argument is that because what he terms an adequate and satisfactory service throughout the Empire cannot at present be granted we should wait until success is assured before establishing a station. In this view we heartily disagree with him. In our opinion there is much to be done experimentally on the receiving side in distant parts of the Empire if the short-wave station here is to be picked up satisfactorily enough for re-broadcasting through local transmitters, and how can it be hoped that success will attend these efforts unless considerable time is allowed for reception tests with transmissions from this country available as the subject-matter for the experiments? Capt. Eckersley adopts a policy of "waiting for perfection" and intimates that the B.B.C., jointly with the Marconi Company and the Radio Corporation of America, hope to achieve something in the future which will give us an Empire service. But why wait until a state approaching perfection is reached? We may never reach that stage, and as far as we can see, for years to come, there will be continual change necessary in improving what to-day we may consider the last word.

If Capt. Eckersley feels so strongly that Empire broadcasting must not be developed by stages, but, instead that he can launch the finished product all at once, we believe that he is making a serious mistake, and, further, it appears that to be consistent he ought never to have been satisfied for our own broadcasting to start with small beginnings, but rather he would have had us wait, perhaps, for the regional scheme and alternative programmes, with the present standard of quality in transmission, to be developed silently before any broadcasts took place in this country. We must remember that broadcasting here started with the experimental transmissions from Writtle, and even after the British Broadcasting Company was formed the transmissions, when viewed from the standard which has been reached to-day, were long in an experimental stage undergoing a process of evolution both on the transmitting and receiving side.

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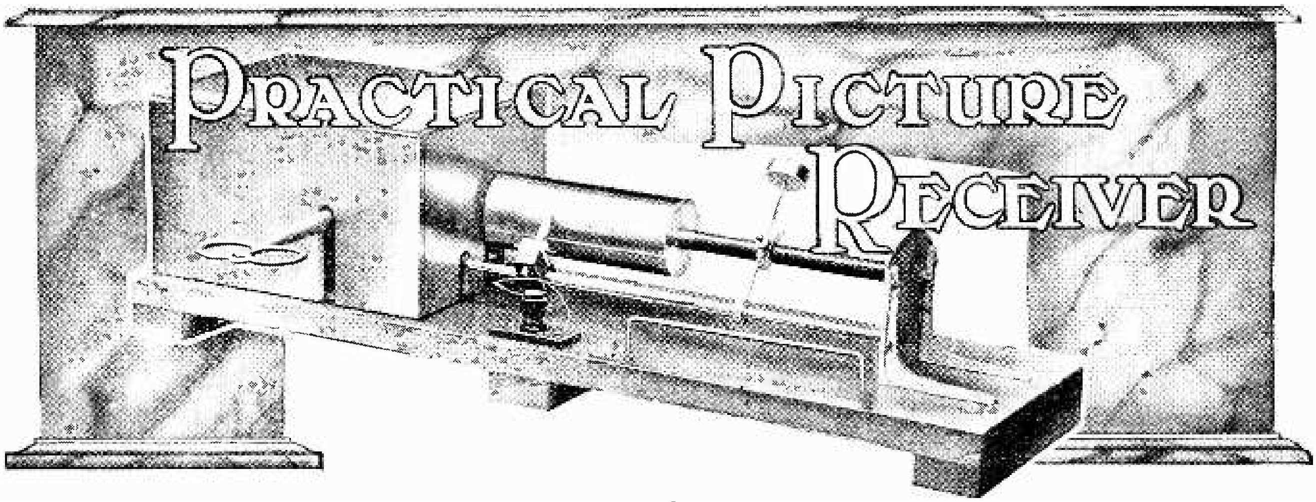
MORNING TRANSMISSIONS.

THE suggestion has been put to us, and we strongly recommend it for consideration by the B.B.C., that the 11 o'clock morning transmissions should be reinstated in place of the change to a later hour which took place recently. Further, we would be glad to see this transmission extended also to Saturdays, and it seems strange to us that a Saturday morning transmission has not hitherto been introduced. It will be remembered that one of the principal reasons for the establishment of the morning transmission was to enable sets to be demonstrated to prospective customers by the trade, and it seems probable that the need for such demonstrations is just as great, if not greater, on Saturday mornings than on other days of the week. That arrangement was made at a time when the policy of the Broadcasting Company could be more directly influenced by the trade, since the directors were mostly themselves members of the trade, but it was soon appreciated that these morning programmes were equally welcome to the private listener, and especially to hospitals. It is largely from the hospitals that the plea now comes for a re-instatement of the 11 a.m. transmission.

In broadcasting circles the topic of conversation at the time these lines appear will no doubt be the alternative programme from the new Daventry station. We cannot expect too much at first, yet we may look forward in the hope that the alternative programme will be available in the morning hours as well as the regular broadcasting periods.



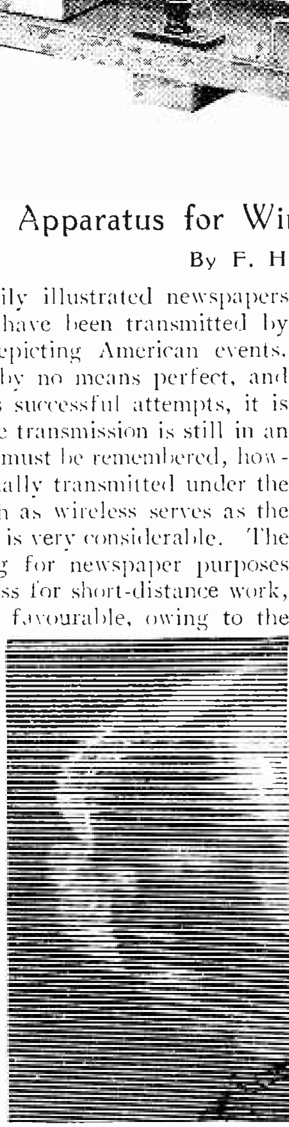
How to Build Simple Apparatus for Wireless Picture Transmission and Reception.

By F. H. HAYNES.

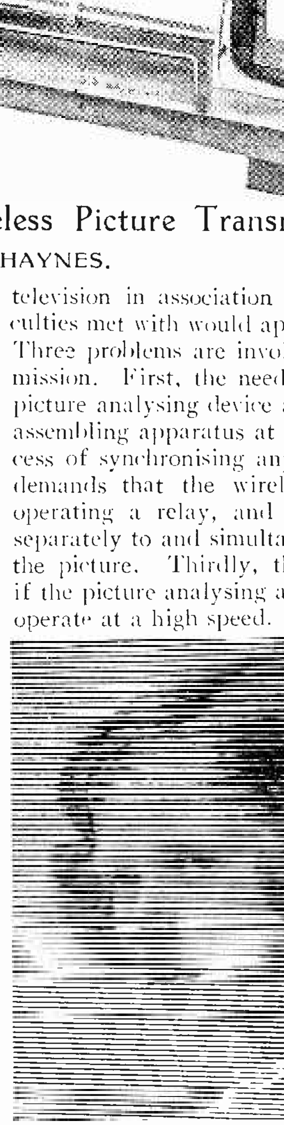
OCCASIONALLY our daily illustrated newspapers publish pictures which have been transmitted by transatlantic wireless depicting American events. These pictures are, as a rule, by no means perfect, and having in mind earlier and less successful attempts, it is generally considered that picture transmission is still in an early stage of development. It must be remembered, however, that these pictures are usually transmitted under the severest of conditions, inasmuch as wireless serves as the connecting link and the distance is very considerable. The development of picture sending for newspaper purposes will probably make little progress for short-distance work, where the conditions are more favourable, owing to the rapid means of communication provided by aeroplane. Except, perhaps, for distances exceeding 1,000 miles little is being contemplated in this connection, in view of the complication of the processes and imperfection of the results.

Picture Broadcasting.

Some time ago a descriptive article[1] appeared in this journal suggesting the possibilities of what was there referred to as "picture broadcasting," and in this new field of application attention is being turned to the possibilities of developing home receiving apparatus for reproducing pictures as an adjunct to broadcasting. Reference is made periodically to the possibility of moving picture reception or television in association with broadcasting, yet the difficulties met with would appear to be almost insurmountable. Three problems are involved in any system of picture transmission. First, the need for synchronisation between the picture analysing device at the transmitter and the picture assembling apparatus at the receiver. Secondly, the process of synchronising any form of mechanical equipment demands that the wireless signal must be capable of operating a relay, and this signal must be transmitted separately to and simultaneously with the signals forming the picture. Thirdly, the mechanical problems involved if the picture analysing and assembling gear is required to operate at a high speed. For the transmission of a single image, as apart from television, which ordinarily requires the handling of possibly sixteen complete pictures each second, these difficulties do not seriously stand in the way. The size of the picture is restricted, its analysis into dots of various degrees of light and shade is not taken finer than $\frac{1}{40}$in., synchronisation is effected by local chronometers or pendulums, the process being rendered all the simpler and the mechanical difficulties overcome by slowing up the transmission to occupy several minutes. Thus, to transmit a relatively small picture, measuring, say, 5in. × 4in., with an analysis only as fine as $\frac{1}{40}$in., the number of individual signals sent during the transmission of the picture becomes 5 × 4 × 40 × 40, or 32,000, which is approximately equivalent to



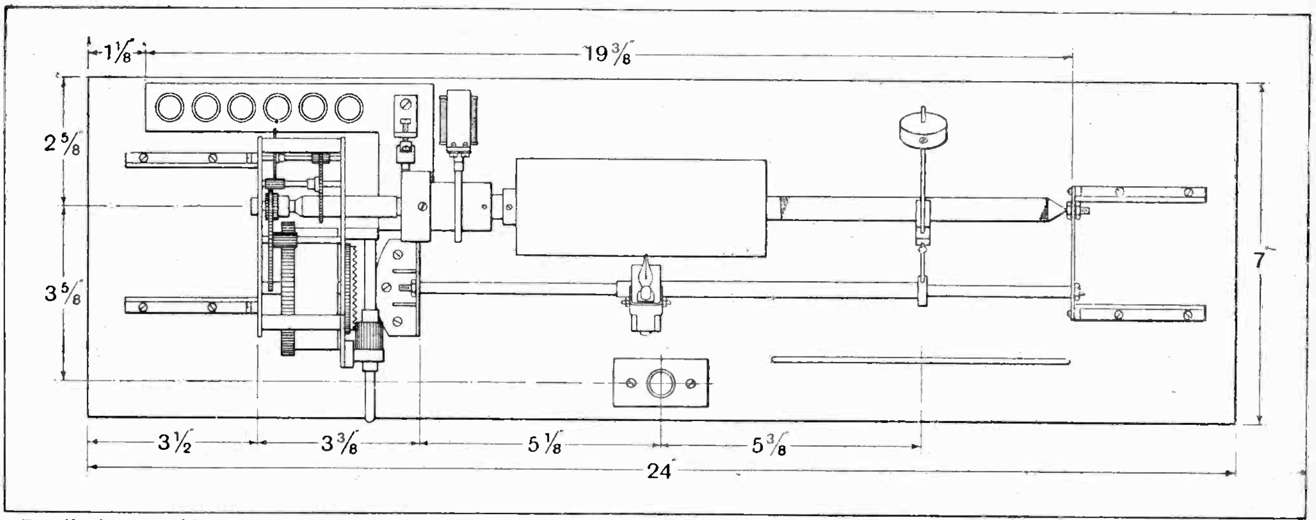
Half-tone image prepared with a 40 line screen, the varying widths of lines and spaces producing light and shade. The image is recorded by the gum-bichromate process on a thin copper foil, so that when bent round the cylinder of a picture transmitter and traversed by a metal point a circuit is interrupted by the gum deposit, which in turn "keys" the wireless transmitter.



(Courtesy T. Thorne-Baker.)

At the receiver the wave trains after being heterodyned are rectified to produce pulses of direct current. In circuit with this varying current is the paper on which the image is to be recorded. It is carried on the cylinder which runs in synchrony with the cylinder at the transmitter and moistened with a solution which under the action of the current produces a coloration of the paper.

[1] *The Wireless World*, March 24th, 1926.



Details for attaching the components to the baseboard, which is made from 3/4in. mahogany or oak and stiffened by three battens.

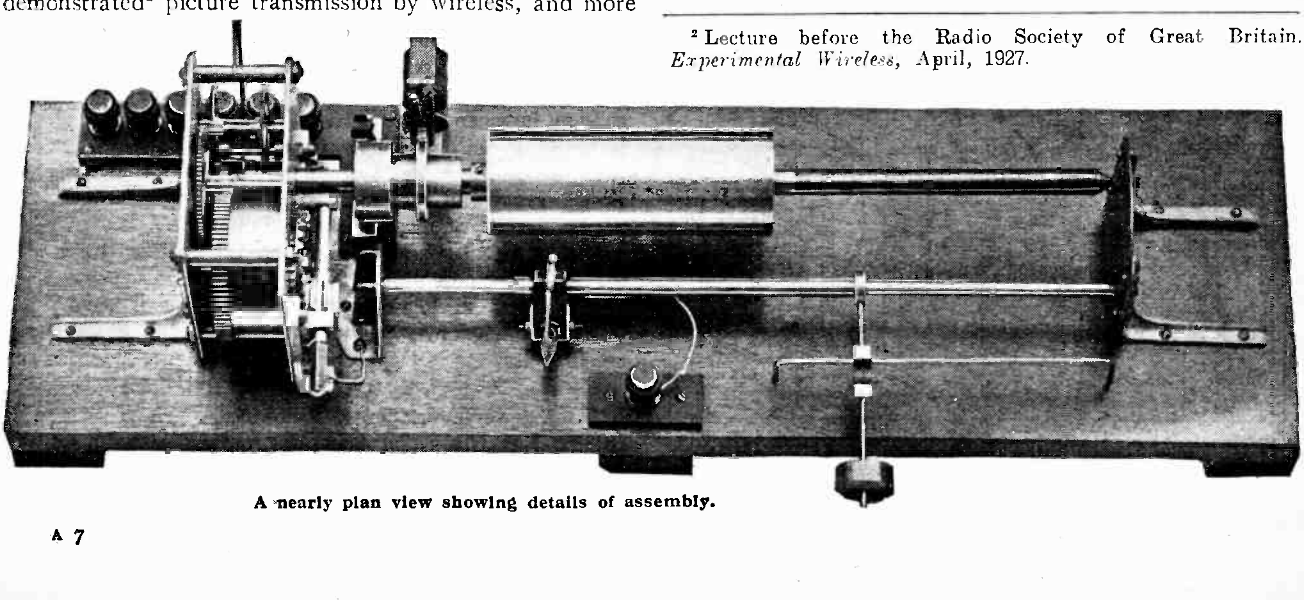
a keying speed of 300 words a minute, assuming that the complete picture is transmitted within a period of five minutes. The difficulties encountered in speeding up the mechanical devices to produce this small picture many times a second, giving the moving effects required by television, can be imagined, and unless the picture is kept very small and analysed in areas of about $\frac{1}{10}$in. square, keying speeds will be required which have never yet been obtained for commercial telegraphy, while the synchronising signal must be intermixed with the picture signals hundreds of times a second, the usual suggested method being the use of an alternating current of high periodicity.

Simple Picture Receiving Sets.

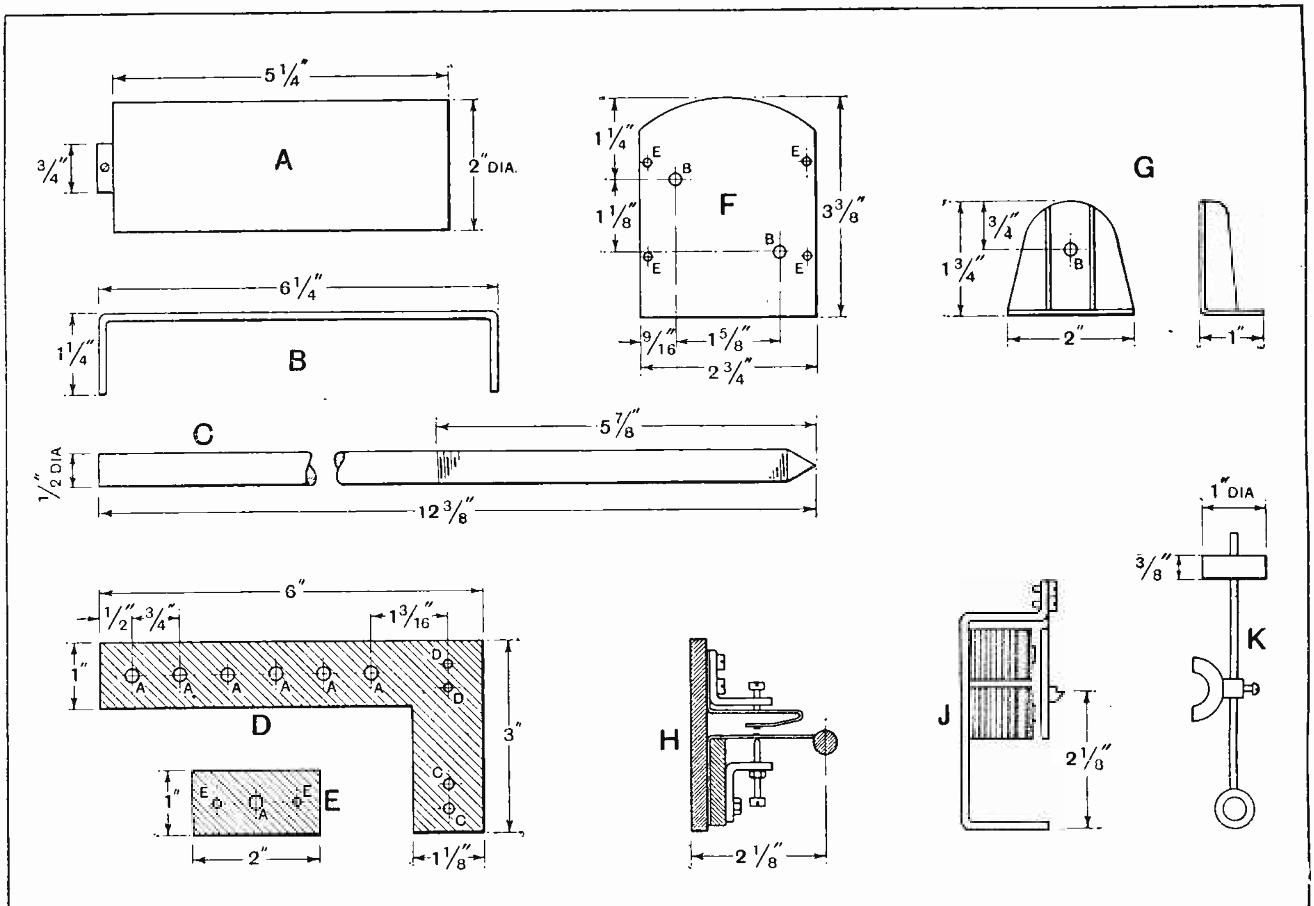
Omitting the history of picture transmission development and the names of the early experimenters, to whom great credit is due, and the commercial picture transmission services of the Western Electric, Marconi, and American Telegraph and Telephone Companies, several experimenters are to-day interesting themselves in the possibilities of successful picture broadcasting. In this country Mr. T. Thorne-Baker has many times successfully demonstrated[2] picture transmission by wireless, and more recently his work has been followed up by Capt. Otto Fulton. In Germany a home picture receiving equipment has been developed by Dr. Max Dieckmann, who is the author of a useful practical book showing how to build all the necessary apparatus. M. Belin is actively engaged on the problem in France, while in America the Jenkins Laboratories already market more than one type of picture receiving equipment for amateur use fitted with tuning fork as well as alternating current synchronising systems.

All of the various systems involve the traversing of the picture at the transmitter carried on the face of a cylinder. The image may be recorded photographically in slight relief and caused to operate contacts controlling a local current, or it may be recorded by the gum bichromate process on a metal foil, so that when traversed with a metal point the circuit is broken as it passes over the image; or a photographic film may be used, wrapped on a glass cylinder so that the image interrupts a narrow pencil of light passing through a small aperture and falling upon a light-sensitive coil. In transmission all that occurs is that the circuit making and breaking effect of

[2] Lecture before the Radio Society of Great Britain. *Experimental Wireless*, April, 1927.



A nearly plan view showing details of assembly.

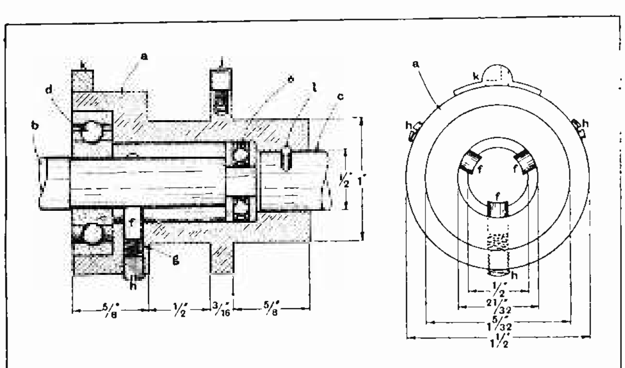


Dimensional drawing of the component parts. Where metal working facilities are not available the components can be procured constructed in accordance with the drawing. The reference letters serve to identify the parts in conjunction with the sketch on the next page. Sizes of holes: A, 7/32in.; B, 3/16in.; C, 5/32in.; D, 4B.A.; E, 1/8in.

the image "keys" the transmitter, thus sending out continuous wave trains of varying duration.

For reception an ordinary broadcast receiver is used, brought just to the oscillating point so as to heterodyne the continuous waves and give an audio-frequency note capable of amplification by L.F. stages. The output valve is arranged to rectify preferably as an anode bend rectifier by the use of excessive grid bias. A valve such as is normally used in a high-frequency amplifier replaces the usual output power valve. Each wave train, therefore, gives rise to a flow of continuous current in the output valve, which may be caused to operate a string galvanometer interposed in a beam of light falling upon a piece of photographic paper wrapped on the recording cylinder, or a relay may be used to control a suitably inked stylus, which is pulled down by the signal into contact with the paper; but probably the simplest method is to employ a semi-absorbent paper moistened with a chemical solution, which on the passage of a very small current between stylus and cylinder produces an electrolytic action and a discoloration of the paper. There is little fundamentally new in any of these processes of transmission and reception, originality only being shown in the details of mechanical design.

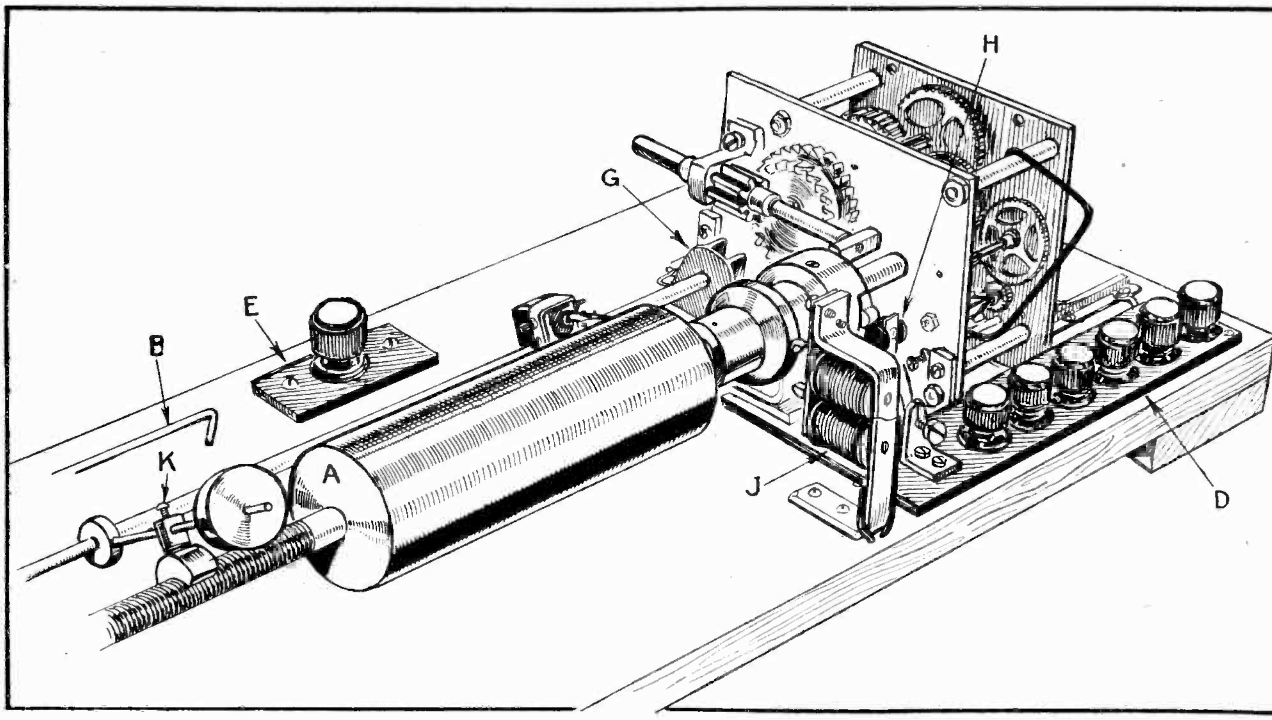
The apparatus to be described is based entirely upon the system adopted by Mr. Thorne-Baker, there being many points in his system which render it superior to other arrangements, particularly as regards simplicity of construction.



Sectional view of the clutch. (a) Turned brass housing. (b) End of shaft of clockwork motor. (c) Cylinder shaft. (d) Ball race. (e) Thrust race. (f) Fibre plungers. (g) Tension springs. (h) Adjusting screws. (j) Stop to arrest rotation. (k) Cam for two-way switch. (l) Securing pin.

Constructional Details.

To the model maker the making up of a picture receiving set will prove a simple matter, but the wireless set builder without a lathe and metal working tools will be rather at a loss, and his only course is to procure the



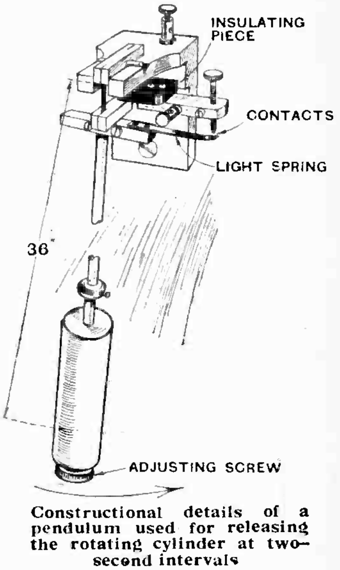
View showing assembly. The stylus is carried on an ebonite mounting piece to insulate it from the frame. It is pivoted and held lightly against the paper by means of a small tension spring. There should be no side play in the mounting of the stylus.

necessary clockwork motor and machined parts.[3] It is best to consider the machine in five units: (1) a clockwork motor, (2) the driving spindle with drum and clutch, (3) the travelling carrier and slide, (4) the electromagnet and auxiliary contacts, and (5) the baseboard, metal end brackets, terminals, and dust cover.

The clockwork has been specially selected to run at a suitable speed, possess ample power, and well governed so as to run through the complete picture, in a time of about six minutes without fluctuation of speed. It is obtainable with suitable brackets for mounting on the baseboard, and its position relative to the other apparatus is shown in the working drawing.

An adjustable friction clutch is interposed between the main spindle carrying the drum and the clockwork motor, so that the synchronising device will not throw an unnecessary strain on the clockwork pinions, and will permit of the motor running at constant speed. A trigger operated by an electric magnet engages on a stop on the clutch housing so as to arrest the rotation of the spindle until the magnet is energised. This magnet is operated from a swinging pendulum fitted with contacts to close at two-second intervals, and by tripping the rotation of the cylinder even for the briefest possible interval on each revolution the speed of rotation is precisely maintained. It is essential that this tripping action should not retard the clockwork, and the friction clutch has been designed so that with simple adjustment the speed of the clockwork remains uniform, and the cylinder rotates immediately the trigger releases. Two ball-races are fitted to the clutch, one for the purpose of correctly centring the two spindles, and the other as a thrust race to prevent side play of the cylinder. Friction is produced by three fibre pegs driven against the shaft of the motor by coiled springs and adjusting screws. The clutch housing, which is of brass, is secured to the main spindle by a $\frac{1}{16}$in. pin passing right through.

If all the components are not procured ready for assembling on the baseboard, it is probably advisable to purchase the main spindle, which carries an accurately milled out thread of 40 to the inch. A brass half nut is also required for building the carrier. To those who consider making the drum, it is built up from a $\frac{1}{16}$in. wall brass tube, the ends plugged with well-fitting $\frac{1}{8}$in. brass blanks and fitted with a collar and grub screw. Rustless steel rod supports the carrier so that it will remain clean and not create unnecessary friction. The brass tube of the carrier slides freely along it, and is fitted with a collar at one end to support the half nut and weight. The stylus is, of course, insulated from the carrier and is supported by an ebonite block, fitted with a pivoted pen holder and light tension spring so that a pen nib can be brought down lightly in contact with the surface of the paper.



Constructional details of a pendulum used for releasing the rotating cylinder at two-second intervals

[3] Collinson's Precision Screw Company, Limited, Provost Works, MacDonald Road, Walthamstow, London, E.17.

Practical Picture Receiver.—

Details for constructing the electromagnet and trigger are given in the drawings. The bobbins are wound full with No. 30 D.S.C. wire, both in the same direction, the inside ends being arranged remote from the pole ends and connected together. What may be found a little difficult to construct and set up is the two-way contact operated by the cam attached to the extreme edge of the clutch housing. The peak of this cam exactly coincides with the knife edge of the stop, and its purpose is to operate the spring contacts which form a two-way switch, so as to take the received signal from the picture and pass it to a sensitive relay at the time the synchronising signal is transmitted. Through the local contacts of the relay the electromagnet is energised from a 6-volt battery. This two-way contact is constructed from a light bronze spring, and is faced from a small cylinder cut from a piece of ebonite rod. It is essential that this cam-operated switch should not retard the action of the spindle. For at least the preliminary tests one is recommended to use the pendulum contact only for synchronising, adding the two-way contacts later.

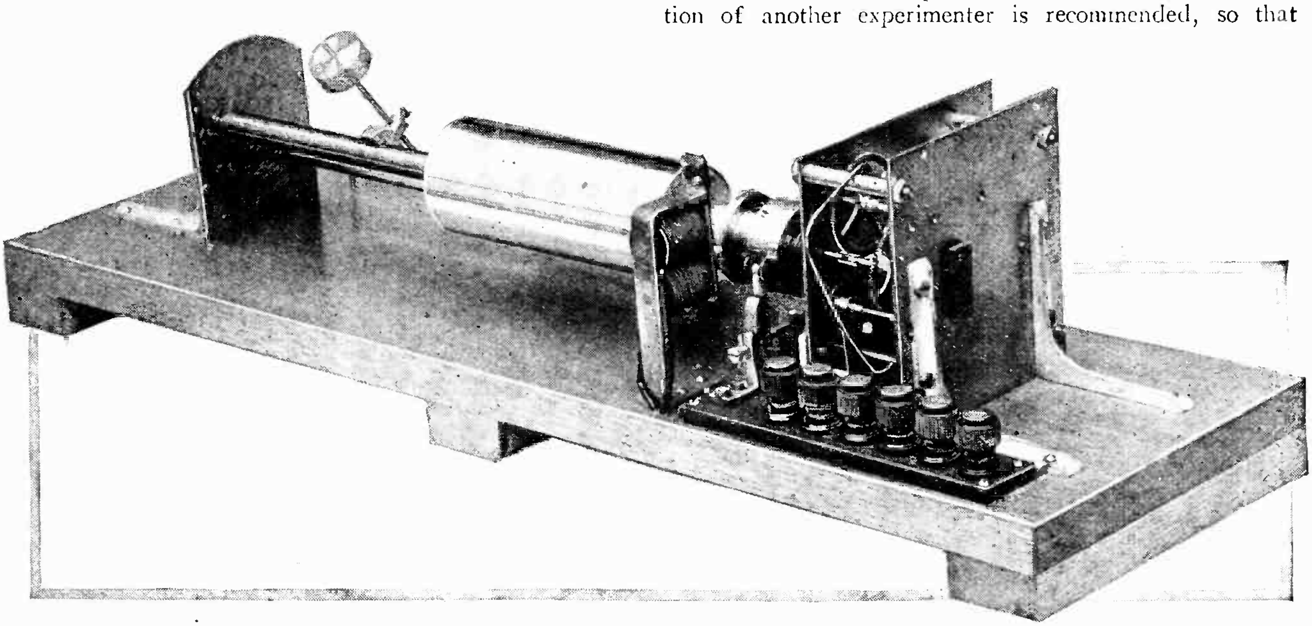
Constructional details of the pendulum are shown in the form of a sketch, as the actual dimensions are not important. It is about 36in. in length to the centre of the bob, and is adjusted to beat seconds. Contact is made between the screw and spring blade, when the pendulum is hanging vertically. This contact is, of course, connected in series with a 6-volt battery and the electromagnet, the regulator on the clockwork being so arranged that the trigger arrests the cylinder for the briefest interval.

Care is required in selecting suitable paper for carrying the electrolytic solution. Duplicating paper, of the variety that quickly absorbs the ink, is most suitable and resembles a thin white blotting-paper, yet is much tougher. It is soaked in the solution and then blotted off between blotting-paper, and thus still quite moist wrapped round the cylinder with an overlap of about ¼in., the starting edge being held in position by a thin line of Seccotine.

A good sensitising solution consists of potassium iodide and starch, which, with a current of less than 2 mA, produces a purple coloration. It is prepared by dissolving about 1 oz. of white dextrine in a small quantity of water and adding boiling distilled water to make up to about a half gallon. To this is added ½ lb. of potassium iodide and 2 lb. of potassium bromide. Another solution for which the writer is indebted to the Jenkins Laboratories and which is less expensive, consists of ammonium nitrate 3 oz., ammonium chloride 1½ oz., potassium ferrocyanide ¼ oz., and distilled water 16 fluid oz. All of these chemicals are obtainable from photographic dealers.[4]

To make a start in picture transmission the co-operation of another experimenter is recommended, so that two machines can be simultaneously assembled and the working mastered when connected to a common pendulum. For the first attempts the actual cylinder of one of the machines may be marked with an image recorded with some non-conducting deposit, such as celluloid cement. As very few readers will be in a position to carry out wireless transmission tests, details for making copper plates of half-tone pictures are omitted here.[5]

This new field of experiment will make a strong appeal to the wireless enthusiast who combines this hobby with photography. Broadcasting was hastened into being by the activities of the amateur, and the possibilities of setting up a picture broadcasting service may, too, pass into his hands for preliminary development.



The complete picture receiver. This instrument is equally suited for controlling a small transmitter for the transmission of pictures, and in preliminary experiments an image can be marked on the brass cylinder with an insulating material such as celluloid solution.

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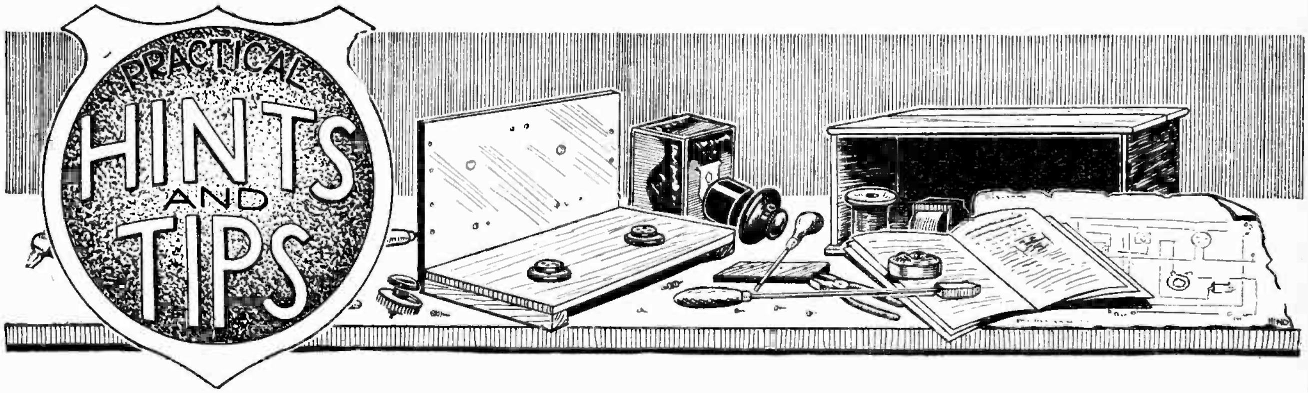
[4] Townson & Mercer, Ltd., 34, Camomile St., London, E.C.3.

[5] Details will be given on application to *The Wireless World* Information Department.



A Section Mainly for the New Reader.

SINGLE VOLTAGE ELIMINATORS.

IT is now generally understood that one dry cell (1.5 volts) will provide ample negative bias for any but the last valve of a receiver. With the modern resistance-coupled type valve with an extra high amplification factor this value of bias voltage should not be exceeded, but with any other type of valve it may be desirable to use more bias for the sake of economy in the H.T. current taken by the valve.

For instance, among the range of manufactured H.T. battery eliminators it will be found that the cheaper models only provide a fixed voltage, so that if two small power valves are being used, one as a first L.F. amplifier biased to $-1\frac{1}{2}$ volts, and the other as a second L.F. amplifier or output valve biased to -6 volts, the former will be taking more anode current than the latter, to the detriment of the quality of the output.

In such circumstances it would be better to bias the first L.F. valve to a much greater extent, possibly to -12 volts, while leaving the second valve grid at -6.

This treatment does not, of course, apply to detector valves working on the leaky grid condenser system, which must be biased positively to obtain the grid current necessary to produce results.

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REACTION AND THE NEUTRALISED TUNED ANODE

REGENERATION is a most valuable aid towards increasing the sensitivity of a receiver having an H.F. amplifying valve coupled by the neutralised tuned anode method, particularly as arrangements of this type generally make use of grid rectification, which inevitably imposes a certain amount of damping on the circuit. Unfortunately, however, an attempt to add reaction in the conventional manner will often destroy the stability of the amplifier; sometimes it will be found that the setting of the balancing condenser fails to hold good over the whole tuning scale, and at the best tuning is apt to be affected very considerably by variations of reaction coupling.

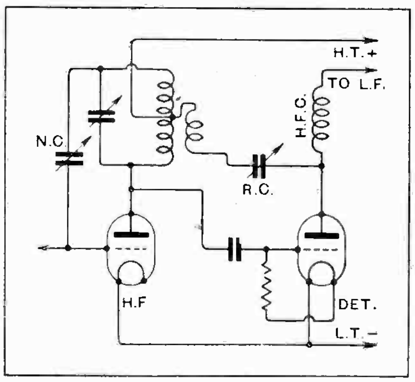

Fig. 1.—Method of adding reaction to neutralised tuned anode H.F. amplifier.

One of the best methods of making the addition in question is that shown in Fig. 1, in which high-frequency oscillations in the anode circuit of the detector are fed back through a reaction condenser R.C. (which may be of some 30 or 40 micro-microfarads) and a small coil coupled to the low-potential part of the coupling inductance. This extra winding should be in the position shown in the diagram; that is, it should start immediately over the centre tapping, and be continued towards the end of the coil, which is connected to the plate of the H.F. valve; it may be separated from it by spacing strips.

A total of about fifteen to twenty turns of fine wire (about No. 40 D.S.C.) will generally be sufficient for a set designed to cover the normal broadcast waveband, while as many as fifty may be required for the longer wavelengths. If the coupling units are to be interchangeable, a four-pin mounting will be required instead of the usual three-contact arrangement of a centre-tapped coil.

Apart from the added reaction section, no alteration is called for in the anode coil, which may have windings as usually specified.

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REJUVENATING CRYSTAL DETECTORS.

CRYSTAL detectors, especially those employing some form of galena mineral, are apt to become insensitive and difficult to adjust after a time owing to the surface of the crystal becoming slightly tarnished by exposure to the air. By breaking one or two small fragments off the crystal a fresh and active surface is exposed which with most crystals will be found to be as good as the original surface of a new crystal. The same is true of the catwhisker when this is made of some base metal such as brass or a poor quality of gold which is likely to tarnish. If the tip of the catswhisker is cut off with a clean pair of scissors a clean cross-sectional surface is exposed; this often improves the sensitivity and stability of the detector noticeably. Of course this does not apply when the catwhisker is made of some non-tarnishing metal.

A DISTORTIONLESS DETECTOR.

It is not much use having a high quality resistance amplifier in a broadcast receiver if distortion is taking place in the detector. Anode bend rectification, properly operated, gives sufficiently good results for most ordinary purposes, but there are some circumstances under which the most perfect possible detection is required even, if necessary, at the expense of sensitivity. One of the purest and most reliable methods of detection is to be had by using the anode and filament of a three-electrode valve as a diode rectifier and employing the grid simply to neutralise the space charge by means of a certain amount of positive bias. This arrangement is used in the demonstration receiver at South Kensington Museum.

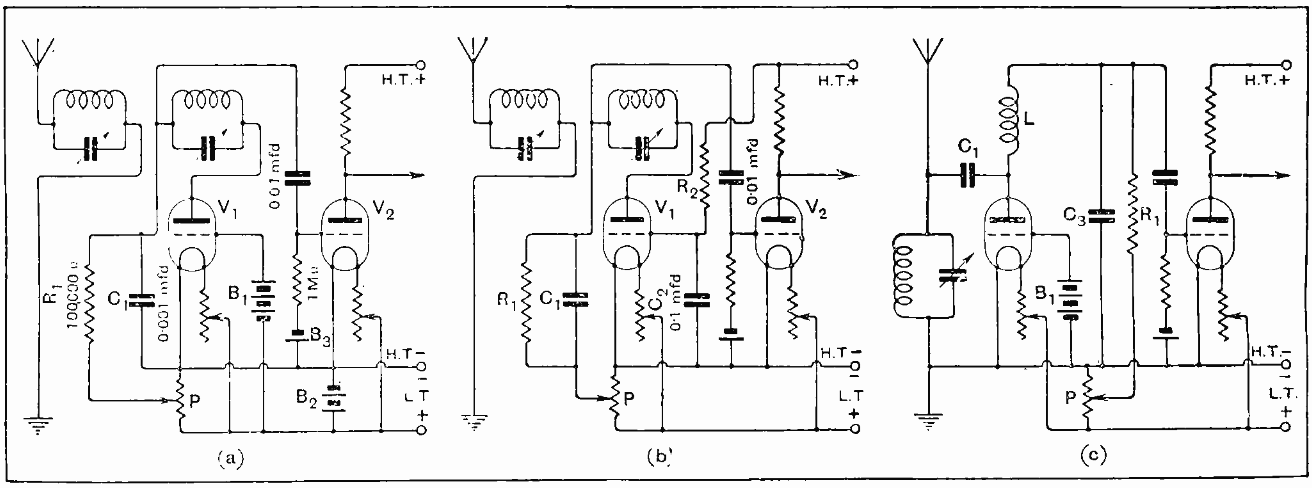

Fig. 2.—Using a three-electrode valve as a two-electrode rectifier

Circuits (a), (b) and (c) in Fig. 2 show ways of doing this simply. In each figure V_1 represents an ordinary valve used as rectifier. Most standard types of three-electrode valve seem to work equally well. There is no H.T. on the anode of this valve apart from a slight positive potential of about half a volt derived either from a potentiometer P, as shown, or from two dry cells. The grid of V_1 must have a positive potential of at least 6 volts, this being derived either from a separate biasing battery B_1, as in (a) and (c), or by connecting the grid to positive H.T. through a 100,000-ohm anode resistance R_2 as in (b). If the latter arrangement is used it is advisable to insert the 0.1 mfd. blocking condenser C_2 as shown. The circuits (a) and (b) are best adapted to loose coupling; they will work if the aerial is connected directly to the anode of V_1, but with this arrangement static charges on the aerial are apt to give rise to clicking noises. For direct coupling to an aerial the arrangement in (c) is best. Here the H.F. and L.F. currents are separated by the well-known "shunt-feed" method. In all three figures the detector is shown resistance-coupled to the succeeding low-frequency valve, but if transformer coupling is required the primary of the intervalve transformer is connected in place of R_1, the secondary being connected to the grid of the succeeding valve in the usual manner.

A valve used as a detector in the manner described is almost as sensitive as a galena detector, but is absolutely reliable and forms an almost perfect rectifier for small H.F. potentials and showing practically no "threshold" effect. It is particularly adapted to the reception of strong local broadcasting, but there is no reason why it should not be used after one or two stages of conventional tuned H.F. amplification. When a transformer is employed to couple this type of detector to an L.F. amplifier a high step-up ratio may be used, such as 6 : 1 or even 8 : 1.

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HAND-CAPACITY AND TUNING.

The effect of hand-capacity in many sets is very annoying, particularly when an attempt is being made to tune in a faint C.W. or telephony transmission on short wavelengths. One removes one's hand from the condenser knob and the station is lost. There is no need for this state of affairs at all. The first thing is to see that wherever possible the moving vanes, and not the stationary ones, of any variable condenser are on the earth side—that is to say, the moving vanes of a condenser in the grid circuit should go straight to the filament and the moving vanes of a condenser in the anode circuit should go to the positive H.T. lead. In certain circuits, however, one has a condenser in which both sets of vanes must be "alive" at H.F. potentials, no earthing being possible. In such cases the condenser should be set back well behind the panel and the spindle extended to the panel by means of an extension of ebonite rod. But better than all other precautions is the screening of the whole of the front panel of the set. Any thin sheet metal serves equally well; it is cut to the same size as the panel and fixed behind it, holes being made, of course, to accommodate any tuning controls and fixtures. This screen is connected to whichever side of the filament circuit forms the common earth point (usually the negative side). It is hardly necessary to point out that care should be exercised in fixing components to the panel to see that parts at H.T., grid battery, and H.F. potentials do not come in contact with the screen.

FAULTY COUPLING CONDENSERS IN RESISTANCE AMPLIFIERS.

IT is most important that the coupling condenser used in a resistance-capacity low-frequency amplifier should have a very high degree of insulation between its foils. Any leakage across the condenser tends to charge the grid of the next valve positively, and should this grid become actually positive distortion will occur, and the amplification will be reduced. For safety the leakage resistance of a coupling condenser should be over 100 megohms. This, and even a much higher degree of insulation, is not unusual in 1 mfd. Mansbridge condensers of reliable make, the smaller capacity condenser having a correspondingly higher resistance. Paper condensers, however carefully they are tested before they are sent out from the works, are apt to deteriorate subsequently for various reasons, and it is therefore advisable to give all condensers some sort of insulation test immediately before incorporating them into an amplifier. In the absence of delicate measuring instruments a very fair idea of the insulation of a condenser may be obtained by charging up the condenser from a D.C. source and finding how long the condenser holds its charge. For instance, a Mansbridge condenser of capacity between 0.1 mfd. and 1.0 mfd. may be tested by charging it by connecting it for a moment across a source of D.C. of 100 to 200 volts (H.T. batteries will do) and short-circuiting the condenser terminals after the condenser has been allowed to stand by itself for a time. If the condenser has held its charge a small but snappy spark is obtained. A good condenser should hold its charge well enough to give a distinct spark after at least two or three minutes. A really good condenser will hold its charge for hours. A condenser which does not give a spark after one minute must be considered as too bad for use in any resistance-capacity coupled amplifier.

This method of testing condensers is only suitable for condensers larger than 0.01 mfd., as with smaller capacities the charge held at 200 volts is so small that the spark produced on discharge is hardly noticeable.

In passing it might be noted that it is always preferable to use mica condensers for coupling where possible, as they are more reliable as regards insulation and permanence. Their cost, especially in high capacities, often precludes their use, but at the same time there is never any need to use a coupling condenser larger than 0.1 mfd., even for the lowest base frequencies, and in most cases a capacity of 0.01 mfd. is more than sufficient.

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LOOSE COUPLING FOR SELECTIVITY.

THE advantages of a straightforward loose-coupled aerial circuit for selectivity seems to be overlooked too much these days. In order to avoid the extra tuning knob involved a great deal of prominence has been given to the type of circuit in which the aerial is tapped directly on to, or is "aperiodically coupled" to the tuned input circuit of the set. Various rejector or trap circuits are frequently provided for cutting out an unwanted station. These trap circuits can be extremely effective in cutting out one particular station which is not too close in wavelength to the required station, but they are apt to upset one's tuning and, above all, one trap will only cut out one unwanted station at a time. The old loose-coupled circuit is, after all, the best of all the simpler methods of eliminating interference. Nobody has a right to complain of interference from local amateur transmitters or his inability to separate Paris from Daventry if he has not tried the very simple expedient of a properly adjusted loose-coupled aerial circuit.

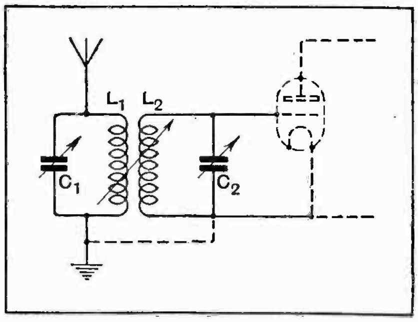

Fig. 3.—The simple loose-coupler is still one of the best methods of obtaining selectivity.

For the benefit of those who are new to the wireless art we show a loose-coupled circuit in Fig. 3. The aerial circuit is tuned with an inductance L_1 and variable condenser C_1, and is quite separate and distinct from the secondary circuit L_2 C_2 to which the receiver (either valve or crystal) is connected. There is no objection to the low-potential side of the set being connected to earth as shown by the dotted line; in fact this sometimes cuts out hum from the electric lighting mains. L_1 and L_2 may be plug-in coils in a two-coil holder of conventional type, allowing the coupling between the two coils to be varied. In the case of an ordinary valve receiver C_2 need not be greater than 0.0005 mfd., while the aerial condenser C_1 may well have a larger maximum capacity of, say, 0.001 mfd., although 0.0005 will do. The components L_2 C_2 in the secondary circuit should be of the low-loss variety; slight losses in C_1 and L_1 do not matter quite so much. The method of adjusting the circuits properly is as follows. Start with the coils L_1 and L_2 closed together and manipulate C_2 until the required station is tuned in. The adjustment of C_1 is not critical at this stage. Move L_1 and L_2 a little further apart now. Readjust C_1 and C_2 in turn to bring the signal to maximum again. Increase the distance between L_1 and L_2 still further with further readjustments of the condensers if necessary. Continue separating the coils, giving any slight touches necessary to the tuning, until the required signal is beginning to weaken even when both circuits are accurately tuned. When this state is reached the adjustments of both C_1 and C_2 are critical, and practically nothing is received unless both aerial and secondary circuits are in tune with each other and the required signal. Remember that the advantages of loose coupling are only obtained when the coupling is really very loose and both circuits are carefully tuned. True, there may be a slight loss of strength on the required signal, but the elimination of unwanted signals off tune is so much greater in proportion that useful reception is greatly improved.

It is to be noted that the effect of loose coupling is to make a set receptive on one wavelength only—which is what we want—while the wave-trap only eliminates interference on one particular wavelength. The operation of a loose-coupled tuner is very soon mastered and takes less time to manipulate than to describe.

D.C. MAINS FILTER CIRCUITS.

A Simple Explanation of the Action of a Single-stage Filter.

By N. W. McLACHLAN, D.Sc., M.I.E.E., F.Inst.P.

MUCH space has been devoted by writers in *The Wireless World* to the problem of designing filter circuits, battery eliminators, and the like. In particular Mr. Haynes has specialised in this subject, and his designs are well known to readers of this journal. The object of the present contribution is to give a simple explanation of a one-stage filter in reducing mains hum. This will enable the reader to make a simple calculation on his own apparatus, provided he knows the inductance resistance and capacity of the components used.

Perhaps the simplest smoothing arrangement is a carbon or metal filament lamp, followed by a condenser, as shown in Fig. 1. In treating this or any other case it is essential to bear in mind that the input and the output to the circuit may be important. These are shown in Fig. 2, where D is a D.C. generator represented by an inductance and resistance. In series with this is the mains resistance R_1, R_2, and the capacity between the go and return leads is shown by the condensers C_1. These latter are lumped capacities equivalent (for the sake of diagrammatic simplicity) to the distributive capacity of the cable. Their smoothing propensities depend upon the inductance of D and the resistances R_1, R_2. The larger these values, and also the capacity of the line, the greater is the smoothing. Thus a long line will give greater smoothing than a short one, provided always that it does not pick up additional disturbances due to trams, etc., by virtue of its length. The input to the consumer is at WZ. Sometimes a condenser is used to bridge the mains in order to facilitate smoothing. Its efficacy depends upon the inductance of the generator D and the resistances R_1, R_2. The greater these values the more marked is the influence of a condenser at XY. In some cases it has little effect, and is better paralleled at a later stage. From a safety point of view it is inadvisable to put a paper condenser straight across the mains, in case of failure and accompanying short circuit.

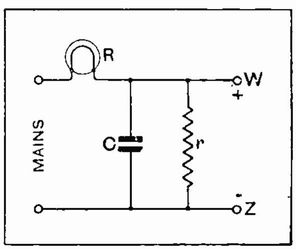

Fig. 1.—Resistance-condenser filter circuit. The resistance *r* represents the output load.

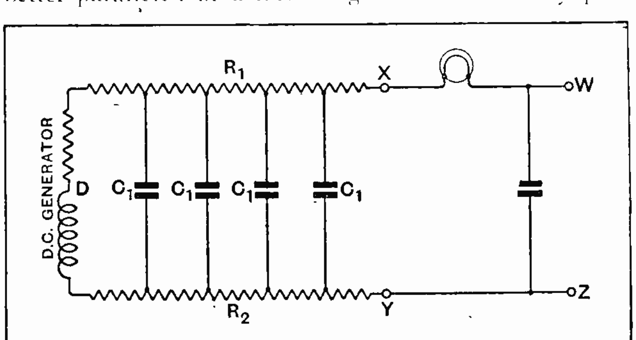

Fig. 2.—Distributed resistance and capacity in the mains assists in smoothing the current supplied.

The output to the receiver with a single-stage filter is WZ. The nature of the terminal impedance of the filter, *i.e.*, the portion which follows WZ, depends upon the type of receiver. If a transformer is used in the low-frequency part of the amplifier, as shown in Fig. 3, the output circuit can be represented as shown in Fig. 4, where the valves are replaced by their equivalent resistances. The complete circuit is portrayed in Fig. 5, and it is clearly one of some complication.

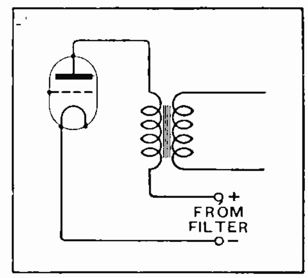

Fig. 3.—Typical output circuit of receiver.

As this article is to explain in simple terms the action of a one-stage filter, it behoves us to make the conditions as simple as possible. We shall therefore assume that the influence of the input and output impedances can be neglected. So long as the input impedance is low and the output impedance high compared respectively with R and C, they can be disregarded for the steady state.

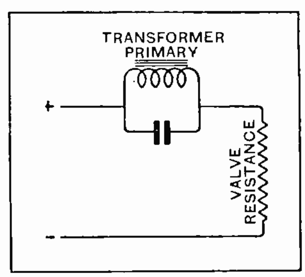

Fig. 4.—Equivalent circuit of output from receiver.

In analysing the action of the RC combination of Fig. 1, we are concerned only with steady alternating currents or ripples superposed on the direct current. At the mains we have an alternating voltage due to the alternating current. If now the impedance of R to A.C. is large compared with that of C, the greater A.C. voltage drop will occur on R. Thus the A.C. volts on C will be so small that little A.C. will flow through the output circuit *r*.

If we assume R = 1,200 ohms and C = 10 mfd., then at a frequency of 200 cycles the impedance of C is

$$\frac{1}{2\pi f C} = \frac{1}{2\pi \times 200 \times 10 \times 10^{-6}} = \frac{10^3}{4\pi},$$ or approximately 80 ohms.

The voltage relationship is shown in Fig. 6. The voltage across the resistance is OA, this being in phase with the current. The voltage across the condenser is OB, and is 90° out of phase with the OA. Its value is $\frac{80}{1200}$ that across the resistance, *i.e.*, the voltage across the condenser is $\frac{1}{15}$ that across the resistance. Thus we have a definite smoothing effect, since the greater part of the A.C. voltage is spent on the resistance R. The total A.C. voltage across the mains is given by OC, the

D.C. Mains Filter Circuits.—

diagonal of the rectangle. However, OA and OC are very nearly equal, so that we can say that the A.C. voltage across the condenser, and therefore that applied to the receiver circuit, is $\frac{1}{15}$ the A.C. ripple. Hence we have effected a smoothing of 15 times. In certain cases, where the H.F. and detector are not supplied by the mains, this may be adequate, and the apparatus resolves itself into a 30-watt lamp and a 10-mfd. condenser.

It is usual to employ an inductance in place of a resistance to break down the A.C. voltage. This has the advantage that the D.C. drop through the smoothing element can be made much smaller than with a resistance, and a greater degree of smoothing can be attained. The case of an inductance is illustrated in Fig. 7, which is identical with Fig. 1 except that an inductance L replaces the resistance R.

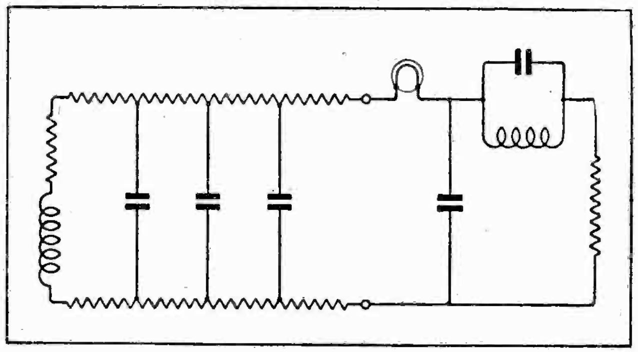

Fig. 5.—Complete equivalent circuit of mains and receiver output circuit.

Assuming for the moment that the resistance of L in Fig. 7 can be neglected, and taking its inductance as 20 henries, the impedance at 200 cycles is $\omega L = 2\pi \times 200 \times 20 = 8{,}000\pi$, or approximately 25,000 ohms. Now, from our previous calculation we found the impedance of a 10-mfd. condenser at 200 cycles to be 80 ohms. The voltages are respectively ωLi and $\frac{i}{\omega C}$. These voltages across the two components are opposite in phase, as shown in Fig. 8. The voltage on the circuit is substantially equal to the drop across the inductance.

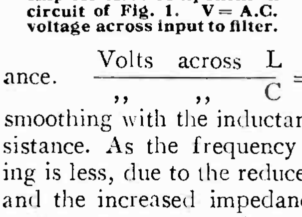

Fig. 6.—Vector diagram showing voltage relationship for A.C. component in circuit of Fig. 1. V = A.C. voltage across input to filter.

$$\frac{\text{Volts across L}}{\text{,, \quad ,, \quad C}} = \frac{25{,}000}{80} = 314.$$

Thus the smoothing with the inductance is 20 times that with the resistance. As the frequency decreases below 200 the smoothing is less, due to the reduced impedance of the inductance and the increased impedance of the condenser. For example, at 100 cycles the smoothing with the RC combination is $\frac{15}{2} = 7.5$, and with the LC combination $\frac{314}{4}$, or approximately 80. It should be observed that one varies inversely as the frequency, and the other as the square of the frequency. The effect above 200 cycles is just the reverse, *i.e.*, at 400 cycles the values are respectively 30 and 1,250. These examples clearly illustrate the advantage of using an inductance in preference to a resistance.

Now, a pure inductance cannot be constructed, *i.e.*, any inductance has the other two electrical attributes, namely, resistance and self capacity. Suppose we examine the influence of these three quantities separately. The inductance *per se* is a quantity which depends upon the number of turns, the diameter and length of the coil, and upon the iron core. The latter should have an air gap if large direct currents pass through the winding, to avoid magnetic saturation. The iron should consist of laminations, since we are dealing with alternating currents of audio-frequency. The permeability of the iron, by virtue of which the inductance of the coil is augmented manifold, depends upon three things: (1) the D.C. feed current, (2) the value of the ripple current, (3) the frequency of the ripple current. In fact, the state of the iron is identical with that in an intervalve transformer, where the A.C. magnetisation is superposed upon the D.C. magnetisation. The influence of the D.C. feed on the permeability is illustrated in Fig. 9, which is reproduced from a former issue.[1] Provided one keeps away from the saturation point a differential permeability of about 280 may be expected at 500 cycles.[2]

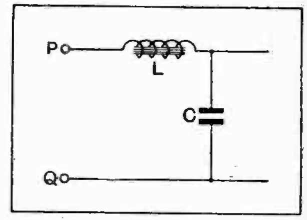

Fig. 7.—Filter circuit with choke instead of resistance.

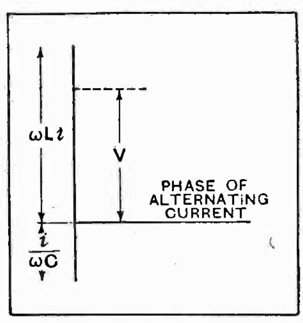

Fig. 8.—Vector diagram of filter circuit in Fig 7.

Turning now to the resistance of the inductance, this can be divided into two components: (1) that due to the coil itself, (2) that due to the iron loss. The latter augments the overall resistance considerably at the higher frequencies, and assists in the smoothing process. Fortunately, it does not cause a D.C. volt drop. Since the hysteresis and eddy current losses in the iron increase with the frequency, the effective resistance and therefore the smoothing also increase.

[1] The little loops should be wholly to the left of the main curve.

[2] See "Intervalve Transformer Cores," *Wireless World*, July 14th, 1926.

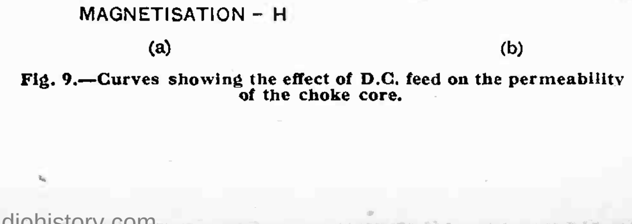

Fig. 9.—Curves showing the effect of D.C. feed on the permeability of the choke core.

D.C. Mains Filter Circuits.—

Lastly, we come to the self-capacity of the inductance. Obviously if this is large the equivalent condenser will by-pass the higher frequencies, thereby reducing the impedance and therefore the smoothing. Thus it would appear to be advisable to wind the coil in sections to reduce the self-capacity to a minimum. By calculating the impedance due to self-capacity, it can be shown that under normal conditions it can be neglected. In certain cases, however, radio-frequency disturbances are superposed upon the supply. Where high-frequency amplifiers are fed from such a system, it may be necessary to wind the inductances for low self-capacity and in addition to insert an H.F. choke (also of low self-capacity) in series, as indicated in Fig. 10.

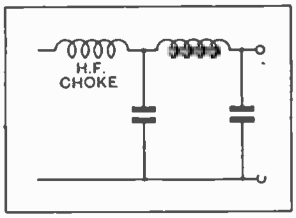

Fig. 10.—Circuit showing the addition of a condenser and H.F. choke when radio-frequency disturbances are superposed on the supply.

Having dealt with the one-stage filter, we pass on to a cursory examination of a two-stage filter. When the inductive reactance is large compared with the capacity reactance, the output from the first stage, *i.e.*, W_1Z_1 in Fig. 11, can be regarded as the input to the next stage, the addition of the second stage having little mutual influence on the first. If the inductance and capacity are identical in both stages, the smoothing is readily calculated, as indicated below. In the case cited previously, the smoothing or reduction in voltage at 200 cycles was 314. Thus, if we apply an alternating voltage V_1 to the second stage, its value at the output of this stage will be $\frac{V_1}{314}$. But the applied voltage V_1 is only $\frac{1}{314}$ that applied to the first stage. Moreover, the ratio of the voltage output from the second stage to the voltage applied to the first stage is $\frac{V_2}{V_0} = \frac{V_1}{314} \times \frac{1}{314} = \frac{V_1}{10^5}$, *i.e.*, the smoothing due to a two-stage filter having $L = 20$ henries, $C = 10$ microfarads is one hundred thousand at 200 cycles per second.[3] More generally, if the smoothing of the first stage is x and that of the second y, the overall smoothing is xy. The reader will realise that this mode of treatment is only approximate, and applies to certain conditions. In the general case, where low frequencies are concerned the second or any subsequent stage would influence the first and other stages.

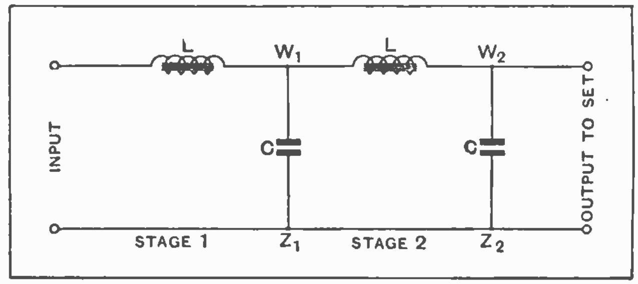

Fig. 11.—Circuit of two-stage filter.

[3] In practice one is more likely to find an inductance of 5 henries due to the influence of the D.C. feed in reducing the differential or A.C. permeability. The smoothing would then be $\frac{1}{16}$, the figure quoted.

South Africa to California.

Mr. A. S. Innes (FO A4E), of Yeoville, Johannesburg, claims to be the first South African transmitter to establish communication with North America during the daytime. On June 22nd, at 4.30 p.m., he worked with the Californian station 6AZS, which reported his signals very steady and at strength R7. Mr. Innes was using a Mullard VO/250 transmitting valve, but does not state the power of his station.

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Two Corrections.

We regret an error in printing the address of 2BRJ on page 177 of our issue of August 10th. Mr. D. W. Heightman's correct address is "Belowda," Park Way, Clacton-on-Sea.

We also understand that the wavelength of AGA (Nauen) is now 14.9 metres, and not 13.5 as stated on the same page.

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Amateur Transmitters, New Zealand.

We have received a revised list of amateur transmitters in New Zealand, and give below those which are additional to the list published in the R.S.G.B. Dairy and Log Book for 1926. In the case of 1AB, 1AJ, 1AN, 1AV, 1FE, 2AH, 2AJ, 2AP, 2AT, 2BD and 3AG, the names and addresses correct those previously published.

TRANSMITTERS' NOTES AND QUERIES.

Auckland District.

1AB S. Waite, 54, Marlborough St., Dom Rd., Auckland.
1AJ N. C. Shepherd, 1, North St., Whangarei.
1AL B. Adair, 33, Arthur St., Ponsonby, Auckland.
1AM J. C. Isherwood, 17, Clyde St., Whangarei.
1AN H. B. Arthur, Sentinel Rd., Herne Bay, Auckland.
1AO R. G. White, 125, Grafton Rd., Auckland.
1AQ — White Island, Tauranga.
1AV F. C. Reardon, 154a, Hobson St., Auckland.
1AW Maxted, Thames.
1AY C. Woskett, 10, Ethel St., Eden Ter., Auckland.
1FC R. F. D. Burrell, Auckland.
1FE L. F. Wool, c/o PWD Te Aroha.
1FS L. R. Dickson, Bucklands Beach, Auckland.

Wellington (2nd) District.

2AA A. S. Brown, Christian St., Dannevirke.
2AH R. V. Roberts, c/o 11, May Ave., Napier.
2AI R. White, Napier.
2AJ Val Parminter, 286, Cuba St., Wallington.
2AK L. Rowson, Power Station, New Plymouth.
2AL L. M. Mellars, Box 178, Wanganui.
2AP J. L. Armstrong, Maungataniwha P. Bag, Wairoa.
2AR A. Rennie, Wanganui.
2AS H. Russell-Boyle, 1, Breakwater Rd. (Box 26) Napier. (Ex-GC 6YT.)
2AT A. T. Halloran, 1, Hinau Rd., Hataitai, Wellington.
2AY F. J. Bitossi, 32, Devon St., Wellington.
2BD N. R. Cunningham, Box 147, Masterton.
2BE S. Strong, P.O. Waipukurau.
2GB Gribbon, Buller St., New Plymouth.

Canterbury (3rd) District.

3AG W. H. Claxton, 387, Gloucester St., Christchurch.
3AP D. Cooper, Wills St., Ashburton.
3AQ R. H. Clark, Greenhithe, Coopers Rd., Shirley.
3AU O. Hills, 97, White St., Rangiora.
3AV S. Wills, Jnr., 164, Moore St., Ashburton.
3AX F. W. Twemlow, 119, Rossall St., Christchurch.
3CC Portable of 3AK.
3XA C/o 3AG, Rolleston House Society of Radio Engineers, Christchurch.

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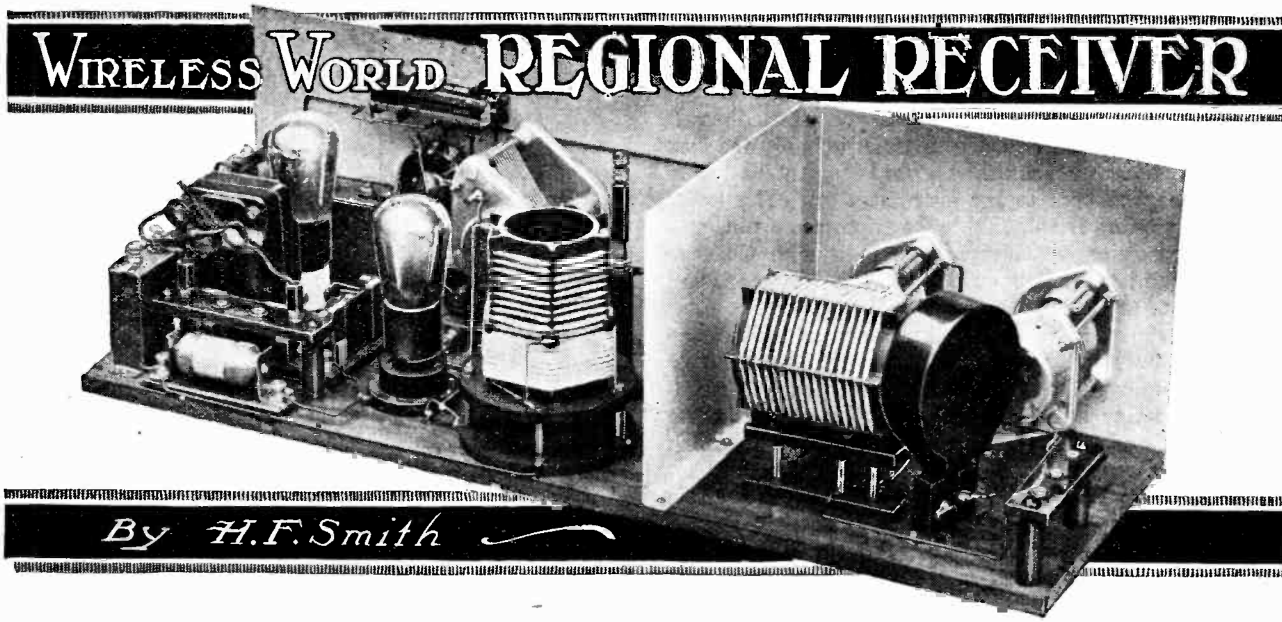
New Call-signs and Stations Identified.

2AV (Ex-2AFA) E. Thomas, 7, Turdu Rd., Morriston, Swansea.
2GW G. S. White, "Moonrakers," Hardenhuish, Chippenham, Wilts. (Change of address after September 29th.)
2TI H. Bevan Swift, "Sleveen," 45, Ena Rd., Norbury, S.W.16. (Change of address.)
5DA G. Gore, 33, Waverley Ave., Wembley, Middlesex. (Change of address.)
5HK H. S. Beckett, 44, Redmires Rd., Lodge Moor, Sheffield. (Change of address.)
5YT E. R. Salt, 82, Dalling Rd., Hammersmith, W.6.
5YX N. C. Smith, 116, Chesterton Rd., Cambridge.
6AP A. C. Porter, 16, Cambridge Rd., Lee, S.E. (Change of address.)
6HO H. L. Holt, 25, Lamb St., Longsight, Manchester.
6MC (Ex 2BLM) J. C. Martin, 38, Hope St., Coventry, until August 31, after which date his address will be 15, Avondale Rd., Earlsdon, Coventry.
6WO M. S. Woodhams, 90, Railway Terrace, Rugby, welcomes reports on weather conditions, barometer, and fading phenomena from all distances.
2ADC C. A. Harper, Cropwell Bishop, Nottingham.
2BOQ A. Cross, 337, Anlaby Rd., Hull.
EB 4GR G. Regnier, 17, Boulevard Fren Orbon, Liége.
NU ZZZ8 A. K. McConnaughey, 230, Payne Ave., Cuyahaga Falls, Ohio.
EN OAX "Zero," Kiosk Willemsplein, Rotterdam, will welcome reports from British amateurs.
SU 1CV H. A. Urbina, 863, Clemenceau St., Montevideo, Uruguay. (Change of address.)

WIRELESS WORLD REGIONAL RECEIVER



By H. F. Smith

Construction of Long-wave Coils and Operating Details.

(Concluded from last week's issue.)

THE base into which the interchangeable H.F. transformers are plugged consists of an ebonite ring, the dimensions of which were shown in Fig. 4 (Z). It is fixed to the baseboard by means of three screws, and carries four sockets and one pin, the latter acting as the connection to H.T. positive (marked B in the practical wiring plan), which corresponds with the odd socket on the transformers. As already stated, this prevents any possibility of incorrect insertion. As in the case of the grid coil base, the shanks of these sockets and pin are sunk into the ebonite to prevent contact being made with the base, or, alternatively, the base may be raised by means of ebonite washers under the securing screws.

The long-wave aerial-grid coil is section wound in a slotted "Becol" former, its construction being shown in Fig. 7. A total of 16 slots, slightly over 3-64in. wide and a full quarter-inch deep, are cut in each rib with a hacksaw, or they may, of course, be turned in a lathe. If a saw is used, its blade should make a cut slightly less than the width required, in order that the slot may be finished off smoothly with a narrow flat file.

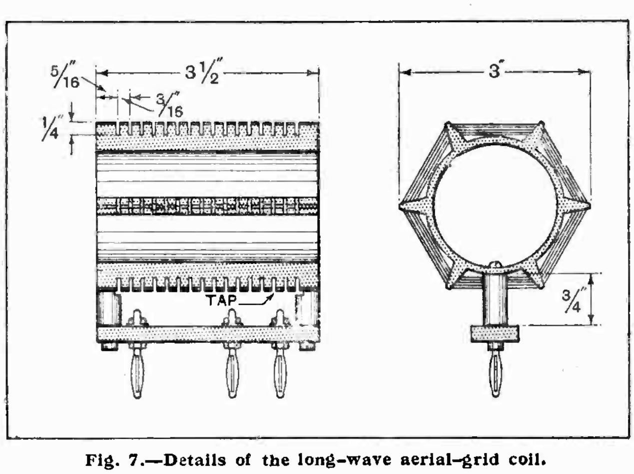


Fig. 7.—Details of the long-wave aerial-grid coil.

The wire used is No. 9/40 Litz, each strand of which is single-silk covered, with a double silk covering overall, and the finished slot should be of a sufficient width and depth to take 18 turns of this wire, each section forming a "pancake" with two turns laying side by side. When one slot is fitted, the wire should be crossed over to the next, making a continuous winding in the same direction without any breaks. The winding is made an easier matter by slightly bevelling the openings of each slot with a file. The finished coil is mounted on an ebonite strip of the same dimensions as the base into which it is to be inserted (see Fig. 3, X), and which is fitted with three pins. The tapping for connection to the "untuned" aerial pin is made at the junction between the third and fourth slots. Distance pieces of $\frac{3}{8}$in. ebonite tube, $\frac{3}{4}$in. in length, separate the coil and mounting strip. A "flat" is filed on each of these tubes to give clearance for the windings.

The Long-Wave Intervalve Coupling.

An exactly similar coil (minus the tapping) is used as the secondary winding of the long-wave H.F. transformer. It is mounted on an ebonite ring, 4in. in external and 2in. in internal diameter, which is fitted with the same pins and socket as the short-wave transformer. It is secured by three screws passing from its under-side into the point of junction between a rib and the tubular body of the former. Wood screws will do quite well here, provided a hole of suitable size is drilled, and they are warmed with a soldering iron before being driven home. The disposition and ultimate connections of the primary,

Wireless World Regional Receiver.—

neutralising, and secondary windings are shown in Fig. 8. The first, with 45 turns of No. 38 D.C.C. is separated from the secondary by six narrow strips of insulating material, measuring $1\frac{3}{8}$in. long, $\frac{3}{8}$in. wide, and with a thickness of $\frac{1}{32}$in. Presspahn, or even waxed cardboard, may be used, but Paxolin or Pertinax is probably the best material. The strips should be scored longitudinally, so that they may be bent to lay over the ribs. The lower end of the winding is soldered to its appropriate pin, and the other extremity is temporarily secured with Chatterton's compound or sealing wax to the top of the spacing strip adjacent to its connection.

Six more strips, of the same dimensions as before, are now placed over the angles formed where the primary winding passes over the ribs. Two of them carry a No. 8 or 10 B.A. screw at their upper ends for connection to the windings and pins. The neutralising section, which is similar to the primary, is supported on this second set of spacers. No attempt should be made to wind these coils very closely, as it is desirable that they should occupy a space of about one inch. All the windings of each transformer are wound in the same direction.

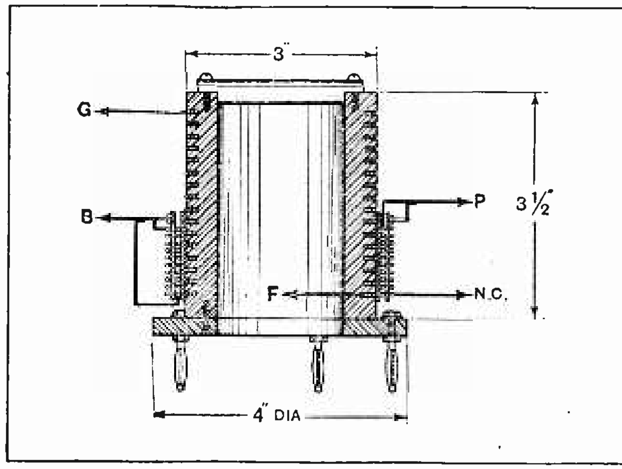


Fig. 8.—Section through the long-wave H.F. transformer, showing arrangement of windings. A crossbar of $\frac{1}{2}$-in. ebonite tube is fitted.

Wave Range, 700/2,000.

The long-wave transformers, as described, cover a waveband of slightly over 700 to well over 2,000 metres, with a tuning condenser of 0.0005 mfd., and thus, practically speaking, any wavelength between 200 and 2,000 metres may be received. If there is no objection to sacrificing the wavelengths between about 550 and 700 and those over about 1,800, condensers having a maximum capacity of 0.0003 mfd. may be substituted for those

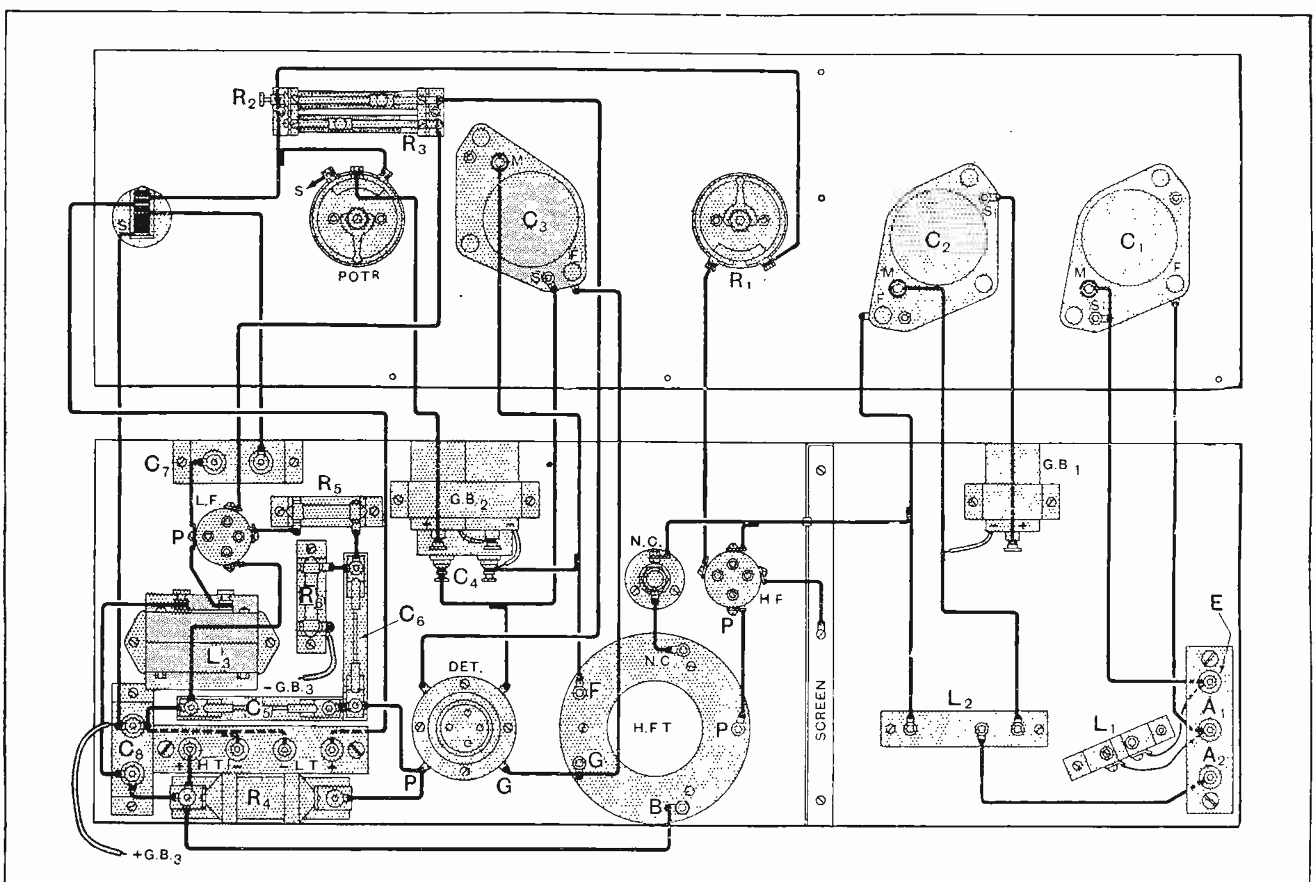


Fig. 9.—The practical wiring plan. Lettering corresponds with Fig. 1. Connections to metal panel and negative L.T. are shown at S.

Wireless World Regional Receiver.—
specified (except in the aerial circuit) without any other disadvantage. Indeed, their use will make for easier operation on the normal broadcast waveband.

It is not considered necessary to illustrate the screen, which is a single rectangular piece of No. 18 gauge aluminium, with two flanges for securing it to baseboard and panel. A ¼in. hole is drilled immediately opposite the grid terminal of the H.F. valve holder, at a height of one inch, to pass the necessary connecting wire. Allowing for a baseboard ⅝in. thick, the measurements are 8in. by 6⅝in.

Selection of Valves and Wiring.

The wiring of the set, shown in Fig. 9, does not call for any comment, as it is perfectly straightforward. Solid leads are used throughout, except for the flexible connections to the movable aerial coil holder. The negative L.T. terminal is joined to the metal panel through the frame of the jack, and contact with it is picked up at the various points marked S. As already noted, the frames of the Pye variable condensers (but not the vanes) are automatically connected to the metal panel, as is the screen, to which the H.F. valve filament is joined. No bushings are necessary for the particular make of filament rheostat and potentiometer shown, as their construction is such that there is no metallic contact with the panel if a clearance hole is drilled for the spindle.

The question of valves has already been dealt with. Of the various types which are suitable as H.F. amplifiers may be mentioned the Cossor 610 H.F., Marconi and Osram D.E.8 H.F., Mullard P.M.5X., and Six-Sixty S.S.12. For detection, Cossor 610 R.C., Marconi and Osram D.E.H. 610, Mullard P.M.5B, and Six-Sixty S.S.13 will give good results, while any power or super-power L.F. amplifier within the limits already mentioned may be used.

Operating Hints.

It is suggested that the "aperiodic" aerial arrangement (aerial connected to A_2) should be used for preliminary adjustments. With the neutralising condenser set at zero and the H.F. valve turned "off," it should be possible to tune in the local station at least at telephone strength by rotating C_2 and C_3. Adjust the potentiometer for maximum volume. Now turn N.C. until signals disappear or are reduced to minimum strength. Retune, and repeat the operation, after which the set will probably be correctly balanced. If there is still a tendency towards self-oscillation, make further slight adjustments of the neutralising condenser when listening with the H.F. valve "on." The same procedure may be repeated with the long-wave coils in position. It frequently happens that the correct setting of N.C. is not identical on both ranges, and the writer has found it convenient to fit a ⅜in. cardboard disc, marked with an arbitrary scale, under the nut fitted on the collar of the condenser. A pointer, made of wire, is secured between the locking nut and the control rod. This simple arrangement saves a good deal of time when changing from one waveband to another, provided the correct settings are either memorised or marked on the scale. It has another use: as is well known, the sensitivity of a receiver of this kind may be increased by partially unbalancing, and it is a fairly easy matter, after a little practice, and when there is some visual indication, to know how far "off balance" the condenser may be set for a given wavelength without allowing the valve to go into oscillation. Risk of causing interference is certainly minimised by adopting an indicating device of this kind.

The efficiency of detection will be increased very appreciably by substituting a somewhat larger condenser—say, 0.0003 mfd.—for the anode by-pass capacity (C_5) of 0.0001 mfd. as specified, although there will be some lowering of tone. This, however, will only be noticeable when the loud-speaker is of an exceptionally good type. A clip-in condenser, which is easily interchangeable, was specially chosen for this position, in order that a larger value may be substituted when extreme range is desired. A similar make of condenser is used as a coupling between detector and L.F. amplifier, so it is an easy matter for the constructor to try other capacities (with different grid leaks if necessary), to suit both his own taste and the capabilities of his loud-speaker. The anode resistance is also interchangeable; one of 0.5 megohm will give slightly higher amplification than that specified.

It is realised that the amateur who has no lathe may find some difficulty in preparing the ebonite rings used for mounting the H.F. transformers; they may be cut from sheet by means of a fretsaw, but this is rather a laborious process. No doubt, however, some of those firms which specialise in the manufacture of components for *Wireless World* sets will be willing to supply parts and unwound formers, as well as complete coils.

BOOK REVIEW.

Italian Wireless Year Book and Directory, 1927.

The second edition of the *Radio Annuario Italiano*, the only Italian Wireless Directory, contains a mass of information useful alike to the amateur and the trader. A brief review of the progress of radiotelephony and telegrahy in Italy is followed by a summary of the laws and regulations passed since 1903 and information concerning tariffs and general statistics. There is a comprehensive list of the commercial and official land stations in Italy and her colonies and of the broadcasting stations of Europe. The first part concludes with various useful notes on wireless matters, including codes and abbreviations used in Morse transmissions, and particulars of the personnel and functions of the Ministry of Communications and other Ministries and Corporations concerned with wireless telegraphy and telephony.

The second section of the book comprises a directory of wireless traders, manufacturers and agents. The book is published by "Radio Novita," Via Porto Maurizio 12, Rome, price 35 lire, or 9s. 6d. post free.

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Book Received.

The Elements of Telephone Transmission, by H. H. Harrison, M.I.E.E., M.I.R.S.E., comprising a Mathematical Introduction, Elementary Theory of Alternating Currents, Wave Transmission and Practical Transmission Conditions, pp. 147, with 72 diagrams. Published by Longmans, Green and Co., Ltd., London, price 5s. net.

RECENT INVENTIONS.

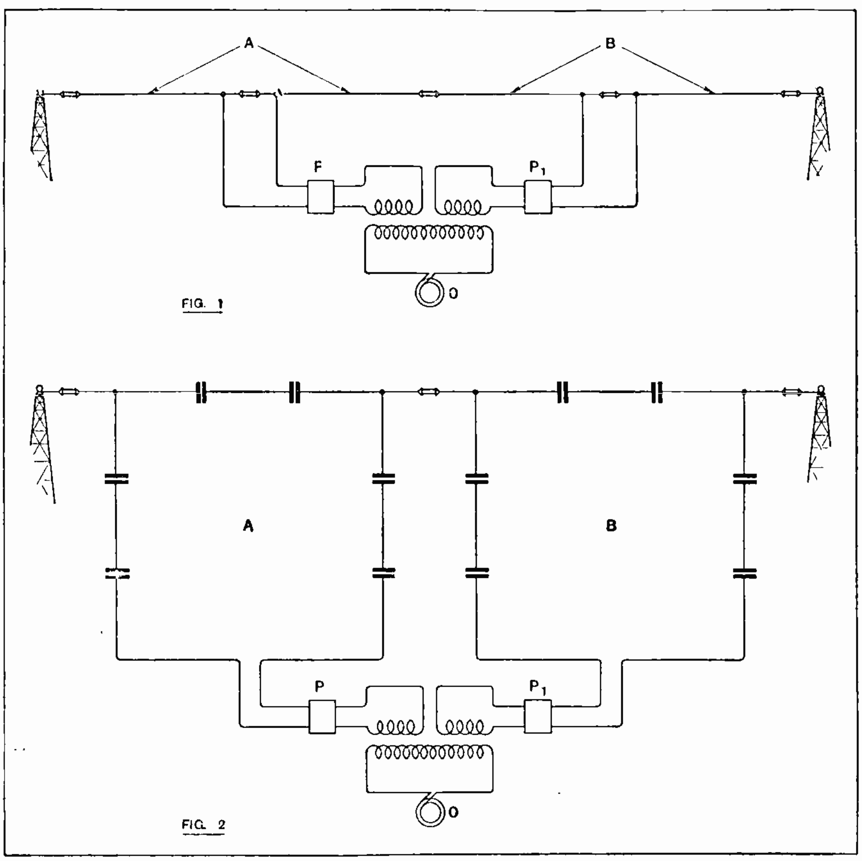
The following abstracts are prepared, with the permission of the Comptroller of H.M. Stationery Office, from Specifications obtainable at the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1s. each.

Polarised Radiation. (No. 251,946.)

Convention date (*U.S.A.*), *May 9th*, 1925.

An aerial is designed to emit horizontally polarised waves as opposed to the usual type of radiation in which the electric field is substantially vertical. In its simplest form, Fig. 1, the radiating system consists of two horizontal wires A and B, each energised centrally from a high-frequency source O. The feed lines contain phase-adjusters P, P_1.

In Fig. 2 the two hertzian oscillators A and B are replaced by loops, tuned by means of series condensers as shown. As before, the radiators are energised centrally from the power source O. In Fig. 1 the distance between the central insulators of the wires A and B corresponds to half the signal wavelength, whilst



Polarised and directional radiation produced by two interfering circuits. Adjustable phase displacement between the two circuits is provided. (No. 251,946.)

their height above the ground is at least one-eighth the wavelength. The loops in Fig. 2 are similarly spaced apart, and the height above ground of the uppermost side is at least a quarter wavelength.

By adjusting the phase-changers P, P_1, the currents in both the wires A, B may be arranged to flow in the same direction or in opposition. In the former case the effective radiation is vertically upwards, whilst in the latter it is directed upwards at an angle of 45° in the length direction of the radiators. If the currents in the loops of Fig. 2 are adjusted so that both flow clockwise, the radiation from the vertical sides is neutralised, and the upper horizontal radiators are alone effective, as in Fig. 1. Patent issued to the British Thomson-Houston Co.

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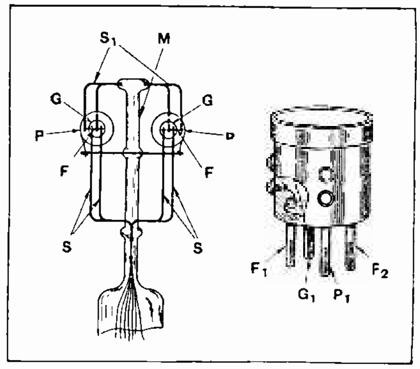
Multi-stage Valves. (No. 271,558.)

Application date, February 24th, 1926.

Relates to the construction of a multi-electrode valve, to the means for supporting the various electrodes inside the bulb, and to the disposition and arrangement of the electrodes for making connection to the external circuits.

Two sets of filament, grid, and plate electrodes F, G, P are arranged side by side, as shown in the diagram, and are held in position partly by the supporting wires S, which are embedded in the glass stub as usual, and partly by wires S_1 carried by a special glass pillar M. In order to make various desirable external connections in the simplest manner, without removing the valve from its holder, one pair of filament leads F_1, F_2, one grid



Method of supporting and connecting up the filaments, grids and plates of multi-electrode-valves. (No. 271,558.)

lead G_1, and one plate lead P_1 are taken to the four pins of a standard valve-mount, whilst the leads from the remaining electrodes are taken to a set of terminals mounted on the side of the usual brass cap. The latter terminals are duplicated, so that certain of the electrodes can be connected in parallel or in series as desired. Patent issued to T. W. Lowden.

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Atmospheric Eliminators. (No. 259,255.)

Convention date (*Roumania*), *October 5th*, 1925.

During certain experiments on board a submarine, M. Geles found that short-wave signals hardly penetrated through the water, whilst long waves of the order of 5,000-6,000 metres came through with comparative ease. In particular he noticed that at a depth of from 3 to 7 ft. of water long-wave signals suffered very little attenuation, although atmospheric disturbances completely disappeared.

On these grounds he proposes to eliminate the effect of static and strays in an ordinary land station by using a frame aerial in conjunction with a receiver of high amplification, the whole equipment being enclosed in a screening cage having a conductivity equivalent to that of from 3-7 ft. of sea-water.

A cage of copper plate one-hundredth of an inch in thickness is stated to be suitable. For the reason previously given, the method is more suitable for long than short wave reception.

"NO CURRENT" REMOTE CONTROL SWITCH.

Easily Made-up Filament and H.T. Current Relay with Mercury Contacts.

By C. C. EVANS.

THE object of this switch is to enable listeners who have their loud-speaker or headphones in a different room to the receiver to switch it on and off at will without having to go to the receiver.

It is, of course, possible to take the filament leads to a switch at the point where the loud-speaker is to be used, but this unavoidably introduces resistance into the circuit, thus necessitating a filament battery of higher voltage than normally required, which is, of course, undesirable.

The switch about to be described stands close to the receiver, and opens and closes both H.T. and L.T. circuits at the will of the operator in another room simply by pressing a button.

This switch only uses current at the moment of switching on and off, and, since mercury contacts are employed, the contact is good and does not crackle.

Construction.

The general idea of the switch will be gathered from the photograph. The mercury cups are made by drilling holes ¼in. diameter and ¼in. deep in a piece of ebonite ⅜in. thick. Contact is made with the mercury through the 6.B.A. screws at the side. The connecting links are simply pieces of stout wire soldered to the heads of 6.B.A. screws, by which they are secured to the ebonite arm which carries them (Fig. 1).

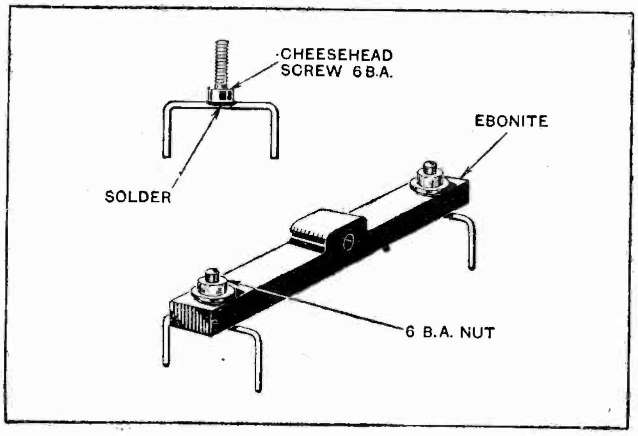


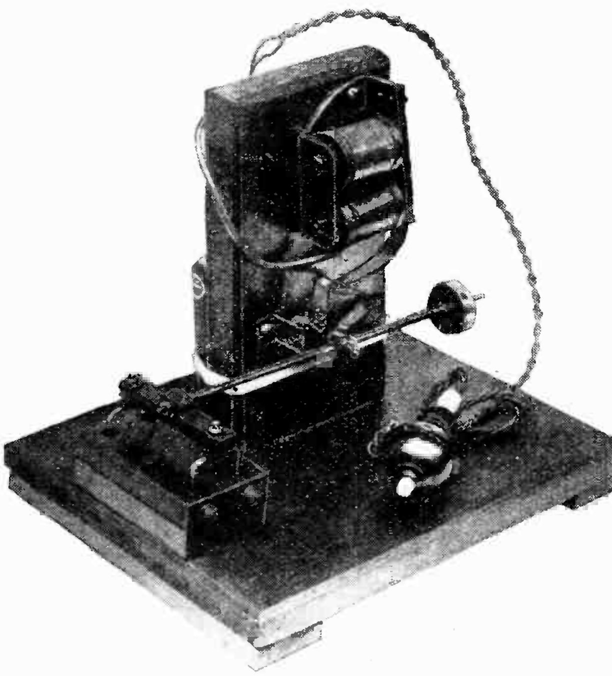
Fig. 1.—Ebonite arm and connecting links.

This arm is carried at the end of a piece of ⅛in. brass rod which is pivoted at about the centre and which carries a counterweight on its other end.

The boss about which this is pivoted has a small saw-cut in its upper surface, into which a piece of springy brass, A, ¼in. wide and about No. 30 gauge, has been soldered. This strip of brass is bent into the shape shown in the elevation.

When this component is mounted on its spindle the stop, seen in the photograph, is so placed that the links rest about ¼in. out of the mercury, and the counterweight adjusted so that the links lift smartly when released.

The operating magnet can be conveniently taken from an old electric bell, and after the hammer has been removed a strip of springy brass, B (Figs. 2 and 3), is soldered to the end of the armature and bent as shown.



General view of the relay. The battery for energising the magnet coils is mounted behind the vertical wood support.

This magnet is then mounted so that when at rest the extremity of this strip of brass is just in front of the notch on the spring brass strip carried by the boss.

Finally, a piece of spring brass, C, soldered to the stop and bent as shown in the diagram, is adjusted so that its extreme end is just lower than the notch on the piece carried by the boss.

The cycle of operation commences from the position shown in Fig. 3.

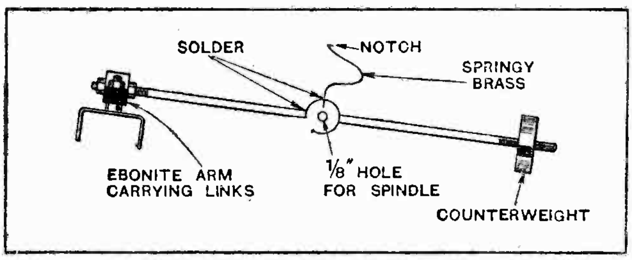


Fig. 2.—Pivoted arm with counterweight and spring catch.

"No Current" Remote Control Switch.

When the control button is pressed, the strip B, soldered to the armature, moves forward and engages the notch on the end of A, which it carries forward with it, finally placing it behind C as shown in Fig. 4.

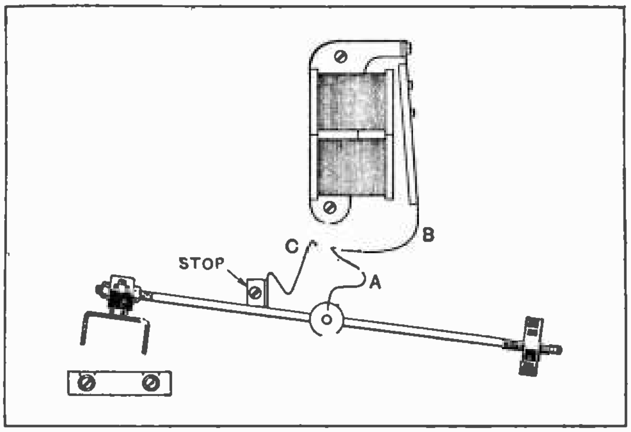


Fig. 3.—Complete assembly (" off " position) with retaining spring (C) and operating panel (B).

On releasing the control button, the spring B returns to its original position, leaving A engaged with C and the links in the mercury cups.

The next time that the control button is pressed B moves forward once more, but this time, since A is not there to prevent it doing so, it strikes C, at the same time slightly raising it, thus releasing A, which returns to its original position under the influence of the counter-weight, which lifts the links out of the mercury.

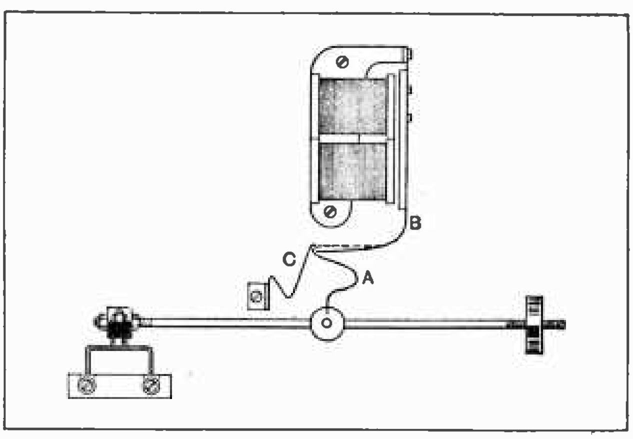


Fig. 4.—Operating panel (B) engaging spring catches (A) and (C). (" On " position.)

On releasing the pressure of the button once more, B returns to the position shown in Fig. 3, and is ready for another cycle of operation.

It should be observed that when B moves for the second time (*i.e.*, to turn the switch off) it moves through its natural path shown dotted in Fig. 4. It is only when engaged with A that it moves as shown by the full line.

Circuit.

The operating circuit consists simply of the magnet-windings, one or more pushes in parallel, and a 4-volt battery, which can either be the L.T. accumulator itself or a 4½-volt flashlamp battery secured to the switch by a rubber band as shown in the photograph. The leads supplying the receiver are fixed to the screws on the sides of the appropriate mercury cups.

Conclusion.

In conclusion it might be mentioned that in cases where there are several H.T. tappings this particular switch should be inserted in the negative lead, or, if it is desired to disconnect the battery entirely, more mercury cups can be added.

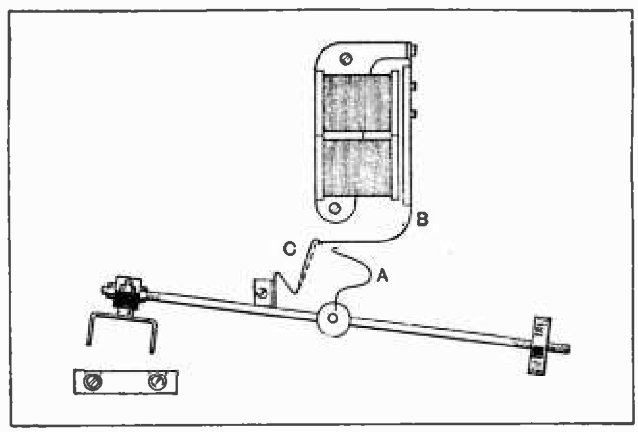


Fig. 5.—Operating panel releasing spring catches.

Any number of control pushes can be used, provided they are all wired in parallel. It is suggested that the loud-speaker leads terminate in a plug by the side of which is a push button, in the various rooms where it is to be used.

It is hardly necessary to mention that only one well-pronounced push of the button is required to operate the switch. If it is pushed twice, or fumbled it is liable to switch on and off again, or *vice versa*.

Catalogues Received.

R.I. and Varley, Ltd., Kingsway House, 103, Kingsway, London, W.C.2. Two leaflets dealing respectively with the R.I. and Varley resistance capacity coupler and H.F. choke.

Cressall Manufacturing Co., Eclipse Works, 31 and 32, Tower Street, Birmingham. 16-page art catalogue of Cressal asbestos woven resistance nets for radio and other electrical work.

Marconi's Wireless Telegraph Co., Ltd., Marconi House, Strand, W.C.2. Leaflet No. 1,073, describing and illustrating the Marconi 150 watt "Universal" Aircraft Telegraph-Telephone Set, Type A.D. 6H. Leaflet 1,072, dealing with short wave receiver, Type R.g.11. Leaflet supplementary to No. 1,069, describing aerial systems erected on submarines.

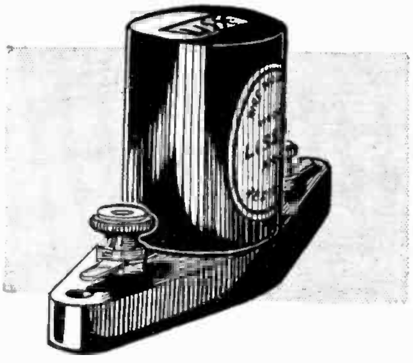
Blackwell's Metallurgical Works, Ltd., The Albany, Liverpool. Reprint of article "Using A.C. Mains," with constructional details for making up a Tartalum-lead A.C. rectifier. (A copy will be forwarded from the above address on receipt of 3d. in stamps.)

A Review of the Latest Products of the Manufacturers.

LISSEN WIRE WOUND ANODE RESISTANCE.

Wire wound anode resistances are now almost exclusively used for resistance L.F. coupling when the resistance is not required to be continuously variable and when the value of the valve does not exceed 500.000 ohms.

The new Lissen resistance is totally sealed so as to render the winding damp proof and is enclosed in a clean moulding. A flange provides for baseboard mounting and accommodating the terminals, which are fitted well down near the baseboard so as to facilitate wiring. An examination of the interior reveals that the silk-covered resistance wire is carried on a turned wooden spool, the connections to the terminals being brought out by stranded leads.



Lissen wire wound anode resistance. The terminals are conveniently placed near the baseboard to facilitate wiring.

Connected across a D.C. supply of 500 volts, a condition that can never arise in normal use, a 100,000 ohm spool passed a current of 5 mA., showing the resistance value to be correct. After 30 minutes with this current passing through the winding no temperature rise could be detected by the hand, while the resistance value remained steady.

The self-capacity of the spool in no way approaches the maximum value, which may be permitted when a 100,000 ohm resistance is used for audio-frequency intervalve coupling. Tested by substitution in the anode circuit of *The Wireless World* "Demonstration Receiver," there was no change in the tone of the output such as might result by the introduction of an inductive winding or one possessing excessive self-capacity.

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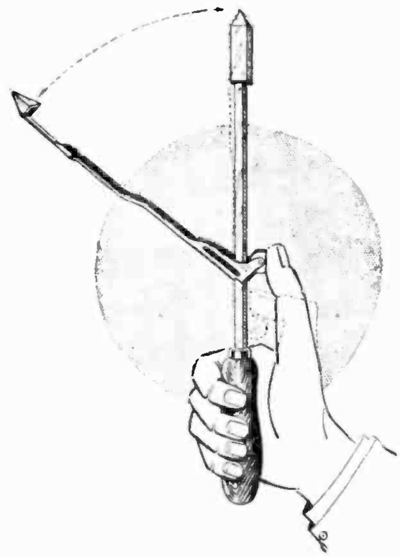
THE JUNIT SOLDERING IRON.

It is in soldering that many amateurs fail when engaged in the construction of receiving sets. Their failure in this respect is due entirely to the fact that soldering is attempted with a dirty iron, and the tinning is invariably removed by overheating.



The Junit "Peerpoint" soldering iron. The point which is removable when heating the iron is kept clean and well tinned.

An ingenious form of soldering iron has been introduced by the Junit Manufacturing Co., Ltd., Napier House, 24-27, High Holborn, London, W.C.1, in which the actual tinned point of the iron is in the form of a removable cap. The iron is heated with the cap removed, and the heat is transferred to the work through a well-tinned surface. The merit of the arrangement is obvious.

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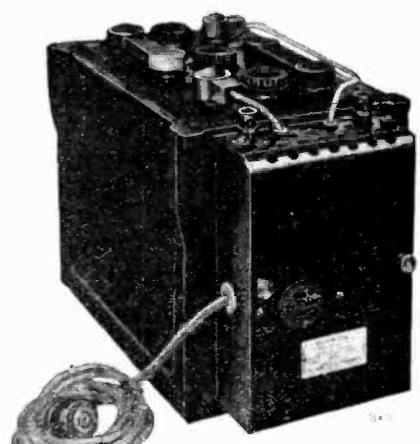
THE KUPOX BATTERY CHARGER.

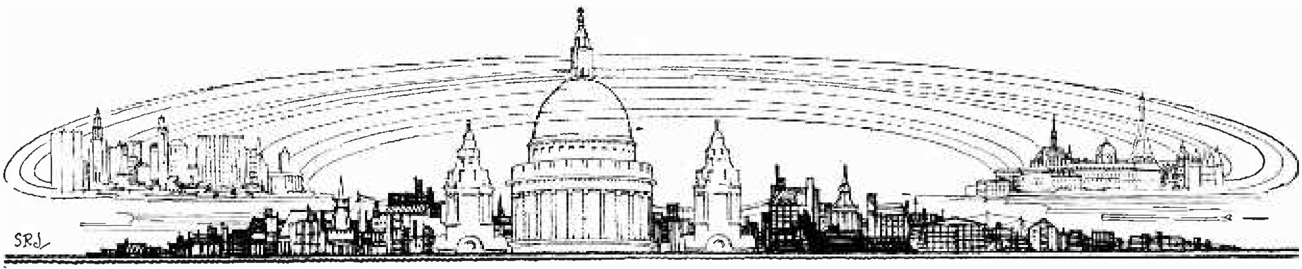
Although not yet available in this country, the Kupox rectifying equipment of the Kodel Radio Corporation would seem to rival present methods of battery charging from A.C. supply. For the adoption of a new rectifier in place of existing A.C. battery charging apparatus it must possess obvious advantages, and, without making possible criticism here of the performance of rotary, vibrator, arc and wet electrolytic rectifiers, the claims made for the Kupox rectifier are of importance.

As is the case with all rectifiers, the rectifying unit is connected to the secondary of a transformer having windings arranged to suitably adjust the potential and give the required current output. Unlike the usual form of electrolytic rectifier the Kupox unit is entirely dry, is stated to last indefinitely, and requires no attention while in use. As the unit is quite small in size it would seem that no heat is developed which requires dissipation during the process of charging. Various forms of rectifying units are to be produced to serve as replacements for the rectifying devices used in other forms of battery chargers.



A convenient form of Kupox battery charger. It is bridged across the battery terminals and the electric light adaptor is connected to the supply when the battery requires recharging.

It is understood that the distributing agents in this country are the Rothermel Radio Corporation of Great Britain, Ltd., 24-26, Maddox Street, Regent Street, London, W.1, and it is hoped to include a report on the performance of this interesting form of rectifier in an early issue.



CURRENT TOPICS

News of the Week in Brief Review.

THE KING'S HIGHLAND RECEIVER.

Balmoral Castle has been equipped with a new multi-valve set in preparation for the Royal sojourn in September.

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SIMPLER SETS.

Single-knob control will be one of the most prominent features at the National Radio Exhibition which opens at Olympia on September 24th.

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MOTOR-COACH WIRELESS.

A five-valve portable set with loud-speaker is at the disposal of travellers in a motor-coach now running in Monmouthshire. On a recent trip to Tewkesbury, in Gloucestershire, a dance was organised with the aid of broadcast music.

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EINDHOVEN SPEAKS TO AUSTRALIA.

Many listeners in Australia heard a special message from the Eindhoven short-wave station on August 13th, spoken by Mr. Faraker, representing the Australian Commissioner in London, whose recent visit to Australian war graves in France and Belgium was described.

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EXIT THE MEGAPHONE.

A chain of sixteen loud-speakers replaced the usual megaphones at the Stamford Bridge grounds on August 14th, on the occasion of the inter-county athletic meeting. Formerly news concerning each race has been conveyed by several men, each armed with a megaphone. Loud-speakers save time and make for accuracy.

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NEVER SAY "CHOKE."

The Italian wireless operator who absent-mindedly makes use of the words "buzzer," "set," "choke," "standard," and "tuning" is likely to suffer for his carelessness, in the light of an edict just issued by Signor Mussolini in his capacity of Minister of Marine.

It appears that the words mentioned are frequently employed by Italians, but the Premier insists that their Italian equivalents must be used, both in speaking and writing. This move is part of the general plan now under execution for the repression of all foreign words and phrases.

BRIGHTER PROGRAMMES FOR CENTENARIANS?

An Edmonton centenarian states that wireless makes her head ache. What about it, B.B.C.?

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GOOD NEWS FOR RATEPAYERS.

The Southwark Guardians have decided that the ratepayers' money should not be used for the installation of a wireless set in their Dulwich hospital. The cost of the apparatus can only be borne by public funds.

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TELLING THE WORLD.

From a wireless point of view Chicago may pride itself on being the noisiest place on earth. The U.S. Ninth Radio District, with Chicago as its headquarters, contains 233 active broadcasting stations out of a total of 694 throughout the States.

A WIRELESS TRAGEDY.

A Chesterfield miner died last week through drinking sulphuric acid from a wireless set accumulator.

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LISTENERS IN JAPAN.

The latest estimate puts the number of wireless licence-holders in Japan at 30,000. A monthly fee of about 2s. is charged on each receiver.

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WHEN IS A SET NOT A SET?

"It is only what he made out of a penny magazine. It's not a wireless apparatus at all," was the plea made by the father of a Nottingham boy who was last week fined 20s. for owning and operating a crystal set without a licence. The defendant admitted that the set had worked.

MAKING THE MOST OF SUMMER. Two enthusiastic members of the QRP Transmitters' Society photographed with a portable transmitter and receiver on the River Lea.

TELEVISION DEMONSTRATED.

Demonstrations of television and "nocto-vision" by Mr. J. L. Baird are among the promised features of the forthcoming exhibition in connection with the British Association meetings in Leeds from August 31st to September 7th.

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U.S. DELEGATES AT WASHINGTON.

Fourteen delegates have been chosen by President Coolidge to represent the United States at the forthcoming Washington International Radio Conference. The names include Mr. Henry Hoover, Secretary of Commerce, Major-General Charles M. Saltzman, U.S.A. Chief Signal Officer, Mr. Owen D. Young, of the General Electric Company, and Mr. John Hays Hammond, Jr.

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WIRELESS IN INDIAN MINES.

Mr. Keith Murray, a wireless expert, has arranged a series of tests in the Bengal coalmines to ascertain the possibilities of intercommunication underground. Working with a wavelength of 30 metres he will endeavour to show the possibility of doing away with wiring underground (says the Calcutta correspondent of *The Times*). The experiments have been arranged in the mines of the MacNeill Company, the deepest in India.

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WHERE BRITISH RAILWAYS LAG.

Why do British railways seem averse to the installation of broadcast receivers on express trains? The reason generally put forward is that the journeys are comparatively short and passengers do not need antidotes to boredom such as are necessary on long trans-continental runs like those of the Canadian National Railways. Now, however, that the railways in this country appear to be vieing with each other in endeavours to carry out the longest non-stop run, the question of installing suitable receiving equipment might well be reconsidered. The longest run is now from King's Cross to Newcastle, occupying nearly six hours.

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100-KILOWATT BROADCAST TRANSMISSION.

Probably the highest-powered transmission from a broadcasting station was that achieved at Schenectady on August 4th, when a new research transmitter built in the laboratories of the General Electric Company sent out WGY's programme with a power of 100 kilowatts.

The company has received a special licence from the Federal Radio Commission to continue transmissions on this power between 12 midnight and 1 a.m. (E.S.T.) until the end of August.

The development of the 100-kilowatt transmitter has been hastened to some extent by the production of a 100-kilowatt power radiotron by the General Electric Company. The new transmitter occupies less than half the space taken by the 50-kilowatt transmitter, heretofore the highest powered equipment. Two 100-kilowatt tubes are used in the amplifier unit, and three more tubes operate in the modulator unit. The 50-kilowatt transmitter, now operated at 30 kilowatts, in accordance with the Federal licence, uses seven 20-kilowatt tubes in the amplifier and twelve tubes of the same size for modulators.

The 100-kilowatt transmitter consists, essentially, of a radio power amplifier whose frequency is controlled by a quartz crystal and a modulator bank, together with its modulation reactors and speech input equipment. The frequency used is 790 kilocycles.

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STALLOY STAMPINGS.

Readers who desire to obtain Stalloy stampings for the Cabinet Moving-coil loud-speaker described by Mr. A. R. Turpin in our issue of August 10th are asked to note that these are procurable from J. Sankey and Sons, Ltd., 168, Regent Street, London, W.1 A mistake occurred in the address as printed on page 175 of the August 10th issue.

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AMERICA'S RADIO SHOW.

The Fourth Annual Radio World's Fair, to be held in New Madison Square Garden, New York, from September 19th-24th, will be, according to the promoters, the largest and most interesting industrial exposition ever held in the United States under a single roof.

Many countries overseas, including Australia, Japan, and China, will be represented in the exhibits.

It is stated that over 2,000 different types of receiver will be on view.

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BROADCASTING IN CALCUTTA.

The Calcutta broadcasting station is to be officially opened on Friday next, August 26th, by His Excellency Sir Stanley Jackson, Governor of Bengal.

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WORLD'S BIGGEST "S.B."

The most extensive simultaneous broadcast ever arranged will take place on September 21st when between 60 and 70 American broadcasting stations will be linked up to transmit the proceedings of the Annual Radio Industries dinner at the Astor Hotel, New York.

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WIRELESS FOR DENMARK'S ARMY.

The Danish Army is to make more extensive use of wireless by the introduction of twenty-five mobile telephony transmitters and receivers. Most of the equipment will be manufactured in Denmark.

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WIRELESS SETS FOR THE BLIND.

"Wireless has not only brought endless pleasure to blind people, but has literally changed their entire outlook. With the headphones at his ears, a blind man is equal in all respects to a man with sight; the whole world is open to him, and he can become acquainted with life from every aspect revealed by the microphone."

In these terms the National Institute for the Blind draws attention in its annual report to the revolution brought about by broadcasting. The Institute is doing its best to meet the very urgent need for wireless sets for blind people. As a result of appeals 362 instruments and 180 headphones have been received: these gifts and donations from various sources have enabled the Institute to distribute 796 wireless sets and 1,040 headphones to the blind throughout the country. The headquarters of the Institute are at 224-6-8, Great Portland Street, London, W.1.

Calls Heard.

London, W.C.1.

Great Britain :—G 2BA, 2BM, 2MA, 2MM, 2OD, 2OQ, 2RQ, 2TL, 2TZ, 2UY, 2VA, 2VG, 2VS, 2VW, 2XY, 2ZL, 5AD, 5AC, 5DC, 2GT, 5LO, 5KH, 5QS, 5RO, 5TH, 5TZ, 5SZ, 5US, 5YS, 5YX, 5YZ, 5ZY, 6AC, 6AH, 6AT, 6BL, 6CP, 6DR, 6HH, 6HZ, 6IA, 6LC, 6LL, 6LK, 6LT, 6MU, 6QD, 6QL, 6QV, 6RZ, 6TA, 6TV, 6TW, 6SO, 6SZ, 6UZ, 6UCT, 6VU, 6VV. France :—EF 8BU, 8AE, 8AEZ, 8TIS, 8JA, 8FBH, 8CA, 8MB, 8XH, 8WZ, 8OAK, 8JZ. Germany :—K 4GA, I3, U7, WG, 4MCA, OAO, KD9. Belgium :—EB 4ER, 4ET, 4AI, 4BX. Holland :—N OAM, OUS, P2, P5, P7. Canada :—NC 3CVO, 3CTR, 3CUX. U.S.A. :—NU 1LW, 1CH, 1PQT. 1CJ, 1AIR, 1AWE, 2GK, 2FD, 2CRB, 2FP, 2ARQ, 2EV, 2CMK, 2CIN, 2CDK, 2KKK, 2ARV, 4JK. 4RM, 8AMI, 8JZ. 8KF, 9FFB, 9DNC, WIR, WLW. Brazil :—SB 1AR, 1PI, 1AM, 1AD, 1AQ, 2AM, GHQ. Santa Fé :—F 1Z. Russia :—R CRL, CRJ, ROT. Spain :—EAR3, EAR9, EAR13, EAR26, EAR4. Denmark :—D 7ZCT, 7XE, 7XF. Austria :—EA GI, GP. Italy :—EI 1CE, 1CH, 1SS, 2AV. Poland :—T PA1. Luxembourg :—L 1AC, 1AG. Finland :—S 2CO, 2CP. Sweden :—SMTO, SMTU, SMTI, SMTZ. Norway :—NA 1A, 1B. Porto Rico :—PR 4SA, 5CB. New Zealand :—Z 3AA, 3AC, 3AD, 3AF, 3AH, 3AI, 3AQ, 3AZ, 4AA, 4AC, 4AM, 5AZ. Tripoli :—T 1TA. Irish Free State :—GW 18B. 13C. 15C, 11B. Portugal :—EP 1AE. Uruguay :—SU 8Z, UA3. Somaliland :—OCDA, OCDB. Various :—YIC, 5XTU, HIK, TMU, NIRE, POW, V 4J, VIR, KM, JSST, IC.

BM/BR44.

Bridgend, S. Wales. July 1st-August 1st.

Austria :—EA W3. Italy :—EI 1AY, 1BY, OC7, 1ZA. Belgium :—EB Y33, 4CO, 4DS, 4ZZA, 4AC. Germany :—EK 4AEN, AEQ. 4NW. 4DK, 4YO. Denmark :—ED 7XU. 7HM. France :—EF 8VVD, 8NN, 8NCX. 8KZ. 8GI. 8UGA, 8SSS, 8AKL, 8KU, 8MMP, 8KP. 8SSB, 8ARO, 8YX, 8LL. Portugal and Madeira :—EP 1AK. 3GB. Holland :—EN 0RZ, 0BC, 0PM, 0FR, 0FM, 0DJ. 0GA, 1NA, 0ZE, 2PZ. 0FLX. Sweden :—SMUK. Morocco :—FM 8MA. Finland :—ES 7CO. Russia :—EU 09RA. Argentina :—SA FC5. Brazil :—SB 1IC, 2XU, 5BMS. Uruguay :—SU CD. Various :—NC 1AR. AR, RKV. LP1, SPU, YR, SFV, STS, 1AW. 4AAL, PCG, NW, 2EC, GC, 6WL. AFX, 8TU1, EAM. FE LA1. FU, ZHC, MF. OHK, EACM. WNP. 1CNZ. GLO. OCLY, AH7, EL, A1F, HBC. NRES, 1NO.VOL, SAB.

(0-v-1) On 20-60 metres W. J. Rees.

The Experimenter's Notebook

The Choice of a Valve.

By "EMPIRICIST."

(*Concluded from page 220 of the previous issue.*)

ASSUMING that the experimenter has made himself familiar with the published data regarding the various classes of valve, there remains the question as to which valve should be selected for any specific purpose.

We may deal first with the case of so-called power valves. These are intended for connection to a loud-speaker, or for any other purpose where an output of considerable power is required (as opposed merely to the production of amplified voltage). In the consideration of a valve of this type a distinction must be drawn between its efficiency when reproducing a weak signal and its capacity for handling power without distortion. As an example we may compare the performance of two valves in a receiver which is sensitive enough to produce ample voltage from a strong local station for application to the grid of the last valve. If we insert our valves in such a receiver and adjust the volume until it is as loud as possible, while being free from distortion, we shall obtain a reliable estimate of the second characteristic of the valve; but if we tune the receiver into a very weak station and, in making the comparison, refrain from altering the tuning controls, so that precisely the same small signal voltage is applied to the grid circuit of each of the valves under test in turn, we shall get a comparison under the first heading which may give us an entirely different result. In fact, we may say, as a general rule, that if a valve is constructed so as to be capable of large undistorted output, it will be less efficient as a reproducer of weak stations than a valve of similar type in which the undistorted output is less.

Dynamic Characteristic.

Power valves are usually designed to have an internal resistance of less than 7,000 ohms, and not infrequently as low as 2,000 or 3,000 ohms. In comparing two valves which have equal internal resistances, the valve with the higher magnification factor is the better, though this does not quite constitute a complete survey of the problem. It is highly desirable that the valve used in the last position should have a straight characteristic of considerable extent, the limits being, on the one hand, the bottom bend, and, on the other hand, the point at which grid current begins to flow. Information on this point can be obtained from published characteristics, and it will be found that in general the lower the resistance of the valve the greater the "straight range."

A word may be said regarding the correct adjustment of grid bias in the case of a loud-speaker valve. Manufacturers' published characteristics are taken without any load in the plate circuit, and it is customary, in the case of a loud-speaker, to make the average impedance of the windings equal to the resistance of the valve, so as to get the optimum efficiency of reproduction. Needless to say, this cannot be achieved at all frequencies, and it is not intended to do more than emphasise that under practical conditions there is impedance in the plate circuit, and in consequence the valve will have a more gentle slope than appears in the published characteristic. If we assume that the theoretical conditions are complied with and that the loud-speaker is in fact a resistance equal to the internal resistance of the valve, then the "dynamic characteristic" has half the slope of the normal characteristic, and the correct setting of grid bias is not in the centre of the straight path of the normal characteristic, but at a point one-third of the way up, as shown in Fig. 4.

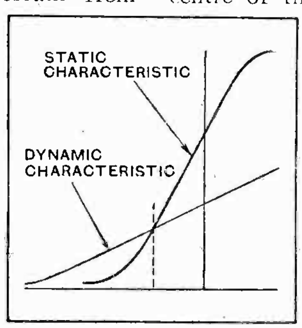

Fig. 4.—Curves showing correct setting of grid bias for a power valve with an inductive load in the anode circuit.

We next come to valves, which have been classified in a somewhat indeterminate manner as H.F. and L.F. amplifiers. These valves do not profess to have any very great range of straight characteristic, although the class of L.F. amplifiers may be used for a moderate volume of loud-speaker reproduction. Setting aside this use we may consider for what remaining purposes in a set various types of valves under this heading are suitable.

In a low-frequency amplifier employing transformers it may at first sight seem a matter of indifference whether a transformer of high ratio be used with a valve of low resistance or a transformer of low ratio with a valve of high resistance. In order to consider this question, two facts must be borne in mind; first, that, in the case of any given construction of valve in which only the density of the grid mesh is varied, the ratio of the magnification factor to the internal resistance is approximately constant; secondly, that, in the case of transformers of a

The Experimenter's Note-book.—
given type, but having varying numbers of turns on the primary winding, and consequently different step-up ratios, the appropriate valve internal resistance varies inversely as the square of the ratio. Thus, if we have a 3 : 1 transformer, which is recommended for use in conjunction with a valve of internal resistance of 24,000 ohms, a 6 : 1 transformer of the same type will operate in conjunction with a valve having an internal resistance of a quarter of this value, namely, 6,000 ohms. But the former valve, if constructed in the same manner as the latter, would have a magnification factor four times as great; hence, since the total magnification is equal to "magnification factor" × "step-up ratio," we shall obtain twice as much magnification from the valve of high internal resistance with the low ratio transformer as we obtain from the other combination. There is, further, the advantage of a lower H.T. consumption, which is by no means a negligible factor.

On the other hand, the use of a low impedance valve with a high ratio transformer has the advantage that there is less back voltage developed on the plate, and, in consequence, when this arrangement constitutes the second stage of a two-stage amplifier, there is less tendency to distortion due to capacity coupling through the electrodes of the valve. An added advantage of this arrangement is found when very large voltages are required in the grid circuit of the power valve, since a valve of the higher magnification type has a considerably smaller range of straight characteristic.

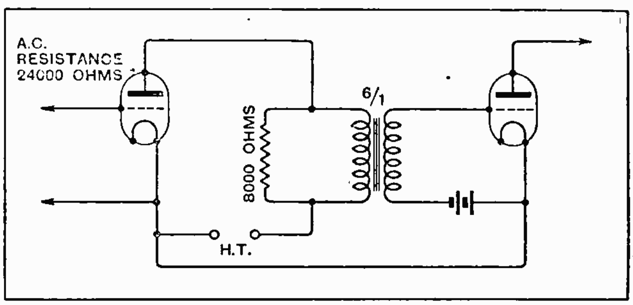

Fig. 5.—A detector valve of high internal resistance may be followed by a high-ratio transformer if the primary is shunted by a resistance of suitable value.

High Impedance Valve with High Ratio Transformer.

A useful method of obtaining the first advantage, when employing a high magnification valve, is shown in Fig. 5. Here a transformer of high ratio is connected in the anode circuit of a valve of this type, and the requisite damping to produce a flat characteristic is introduced in the form of a shunt resistance across the primary winding; thus if we have a valve of internal resistance 24,000 ohms, which, in order to operate with a 6 : 1 transformer, requires to have its internal resistance effectively reduced to 6,000 ohms, we must shunt the transformer with a resistance of 8,000 ohms. We shall then obtain a voltage in the plate circuit of the valve which is a quarter of its ideal value, but, as we are employing a 6 : 1 transformer instead of a 3 : 1, which would be suitable for the valve under normal conditions, we shall get an overall amplification which is one-half of the normal amount. Thus we get the effect of a low-resistance valve without the waste of anode current which would be entailed by its use.

On the whole we may say, then, that valves for use in the earlier stages of a set should be built to have as high a resistance as is consistent with an adequate range of working characteristic, and with as high a magnification factor as the particular form of construction will allow.

Resistance and Choke L.F. Couplings.

For the purposes of low-frequency amplification, where either a choke or a resistance is employed, there is an opportunity for using valves of exceptionally high magnification, and this class of valve has recently come into prominence to a considerable extent. If we can succeed in building an impedance, either in the form of a choke or a resistance, which is large in comparison with the internal resistance of such a valve, we get, practically speaking, the whole of this amplification at each stage, though there are complications, of a character by no means negligible, introduced as a result of the inter-electrode capacities of the amplifier. However, it may be said that the results obtained on these lines have led to a very great advance in the design of resistance-capacity amplifiers, and have established these valves of high-magnification factor firmly in the popular favour. The advantage offered by such valves, apart from their actual efficiency in operation, is their extremely low H.T. consumption, although this is offset to a slight extent by their limitation in respect of straight characteristic, which may be only half a volt, or even less.

The use of these valves in high-frequency circuits has, in the writer's view, not received the attention it deserves, since in such circuits the limitations of straight characteristic are never very severe, and the sensitivity of a properly neutralised arrangement extremely high. Neutralised circuits of adequate selectivity can be built in which a tuned anode construction is adopted, and a notable increase in magnification per stage results.

A word remains to be said on the subject of detector valves, and here, for the first time, it is possible to turn the flow of grid current to good account. Valves for grid condenser and leak rectifiers should be selected according to the nature of coupling device which it is proposed to employ after them. If a transformer stage is used, a valve of medium internal resistance suitable for the transformer in question may be employed, or else the means of Fig. 5 may be adopted to reduce the resistance value. Care must be taken to connect the grid circuit return to a suitable voltage point, and this will vary very considerably in the case of different valves. Experiment in each individual case is highly advisable, and the use of a potentiometer, for ensuring correctness in this respect, is of far greater utility than a variable grid leak.

Detector Valve Impedance.

When bottom bend detection is being employed, allowance must be made for the fact that the effective internal resistance of the valve is considerably increased by the necessity for operating at the foot of the characteristic. A transformer of conservative ratio or else a choke or

The Experimenter's Note Book.—resistance coupling should be selected for use in the first stage.

Reviewing the whole question, therefore, it would seem that valves of a medium internal resistance of, say, between 20,000 and 30,000 ohms, and having a high magnification of 20 or thereabouts, are of the greatest general use, except for the one special requirement of feeding the loud-speaker, where valves of very low internal resistance are indispensable. On the other hand, the use of valves having considerably higher internal resistances, and magnification factors of the order of 40, is strongly to be recommended wherever possible owing to their great efficiency and the decrease in high-tension current consumption. The technical difficulties bound up with the use of such valves are, however, greater, and the restriction on their employment due to the limited operating range must always be borne in mind. It is, therefore, unlikely that they will ever completely displace the valves of medium impedance.

LAYING OUT AN H.F. STAGE.

Methods of Testing for Coupling between H.F. Transformers and Coils.

ONE of the most difficult small points to settle in arranging the layout of any receiver including a stage of high-frequency amplification is the exact relative positions of the tuning coils. It is absolutely essential, if the receiver is to be controllable, that there should be no coupling whatever between the aerial coil and the high-frequency transformer other than that officially provided by the amplifying valve. To set the coils with their axes at right angles and as far apart as can conveniently be managed is a very good start, but it is often found that even with these precautions the small amount of residual coupling is enough to render the set unmanageable.

Fortunately there is a very simple experimental means by which the final fine adjustments, eliminating all traces of coupling, can be made while the receiver is in course of construction. The basis of the method lies in setting one circuit in feeble oscillation and then tuning the other to resonance with it. If this results in the cessation of the oscillation, due to absorption of energy from the oscillating circuit by the other which is here acting as a tuned trap, it is evident that the position of zero coupling has not been found.

Some care is necessary in applying this test that the half-finished wiring shall not provide stray capacity couplings; a careless use of the test may result in the coils being set just off the correct position. The detector and low-frequency portion of the receiver should be completely wired, including a temporary arrangement for reaction across the detector, if this is not included in the design. The aerial coil should be connected to its condenser and the bottom end of the tuned circuit so produced should be connected to the filament wiring, but no connections should be made either to the grid or the plate sockets of the first valve-holder, nor should the neutralising condenser be connected up. In this way the stray capacities are exactly those of the finished set with the exception of those between the grid and plate of the H.F. valve, which will be balanced out later by the neutralising condenser.

Absorption Test for Stray Coupling.

Telephones and batteries are then connected to the half-finished receiver, and the detector circuit is set just oscillating by the reaction control, the tuning condenser being set somewhere near the middle of its range. By swinging the aerial tuning condenser slowly it will be found whether at any position the absorption by this circuit is sufficient to stop the oscillation. If such a point is found the relative positions of the two coils is altered slightly until variations in the aerial condenser have no apparent effect in checking the oscillations. To make this test reasonably delicate it is essential that the detector circuit should be *only just* oscillating; a low voltage on the plate of the detector will generally assist in obtaining the smooth reaction necessary for this.

In this way it is not difficult to find a setting of the coils such that the absorption due to coupling is not great enough to reduce the amplitude of the oscillation to the point of entire cessation. The test should now be carried a stage still further in order to find a position in which the absorption causes *no change at all* in the amplitude of the oscillation.

Evidence of Feeble Oscillation.

Up to this point the aerial tuning condenser has been rotated slowly, feeling for the point where oscillation stops; a mere reduction in amplitude would pass unnoticed. But if, now that the preliminary adjustment has been made, the condenser is rotated *rapidly*, a faint click will probably be heard in the telephones as the point of resonance is passed over, this click being due to the slight momentary increase in the plate current of the oscillating detector as the oscillation is slightly reduced in amplitude. The final adjustment of the coil positions is complete when the click can no longer be heard, or when a position has been found at which the click is a minimum.

It is frequently found that although the perfect "no-coupling" position can be obtained for one frequency, the click will reappear when the detector circuit is retuned. This indicates that in the original setting both capacitative and inductive coupling were present, but that they balanced out, their effects being equal and opposite. In such a case one may either leave the coils set as described for no resultant coupling on a middle wavelength and hope that the inevitable losses in the coils will prevent oscillation for the other wavelengths, on which there is a slight residual coupling, or one may erect a capacity shield between the coils as in the "Everyman Four," and then find the new setting required in the same way. With Litz coils this screen will probably be necessary, but with coils of solid wire it may usually be omitted, provided that the "no-coupling" adjustment has been carefully made for a middle wavelength.

A. L. M. S.

News from All Quarters: By Our Special Correspondent.

Concerts from Belgium.—5GB Cuts Out Talks.—Birmingham's Transmitter.—German Composers' Night.—Good News for Dancing Folk.—First Puccini Broadcast.

Our Honest B.B.C.

A programme "for a bored listener" is Bournemouth's feature on August 29th.

This is, I believe, the first time that the B.B.C. has officially recognised the existence of such a person.

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Week-ends on the "Continong."

The time when broadcast "trips" to the Continent will be a regular week-end occurrence seems to have been brought a bit nearer by the success of the relays from the Ostend Kursaal. Few better places than this could have been chosen for the tests; the Kursaal is on the sea front and is actually connected to the submarine cable running to the Isle of Thanet.

That these relays are the precursors of a series of transmissions from leading European cities will depend upon whether the Continental land-lines can be sufficiently improved.

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Is the Crystal Passing?

The sophisticated multi-valve set owner, who can "get Europe" any old night, may question the value of these Continental relays. Their real object, a Savoy Hill official tells me, is to introduce the delights of Continental reception to crystal users, who may thereby be persuaded to invest in valve sets.

There is no doubt that approaching developments in broadcasting, especially the regional scheme, will tend to leave the crystal listener rather in the cold. Is it fanciful to suggest that the next year or two will see the crystal set joining company with the hansom cab and the gingham umbrella?

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5GB.

By the time these lines are in print a large section of the British public will have enjoyed for the first time that peculiar thrill which comes from being able to listen to an alternative programme by the turn of a knob. On all too rare occasions 5XX has supplied this thrill, but the prospect of being able to enjoy the privilege "for ever and ever" has only come with the opening of 5GB.

No Talks!

Another thrill will be supplied to a number of listeners by the news that "Daventry Experimental" will shun talks of every kind, with the exception of news bulletins, including a special late bulletin at 10 o'clock.

For the most part, 5GB's programme will be made up of music and variety. This being so, it would be interesting to be able to determine to what extent the 2LO audience will be diminished or increased when the London station puts out a talk.

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Fate of Birmingham's Transmitter.

The present transmitter at Birmingham, which is more or less out of commission owing to the advent of 5GB, is to be used as a stand-by plant. The new Daventry station is essentially of an experimental nature, so breakdowns during the first few weeks will not be at all unlikely. If and when these occur 5IT will calmly take over and transmit its programme from Birmingham just as if the Daventry youngster had never butted in at all. Most of 5IT's engineers have proceeded to Daventry, but I understand that one at least will remain at the old plant in case of emergencies.

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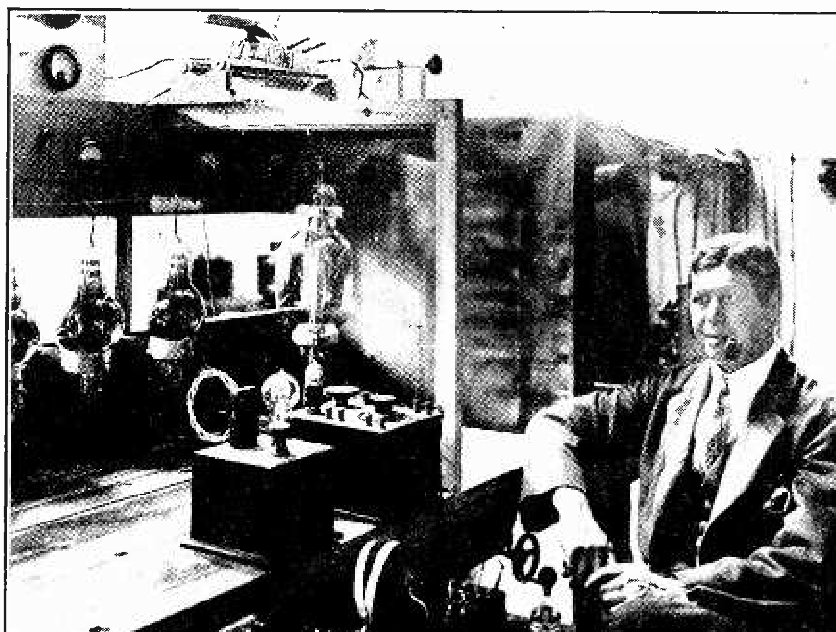
Bournemouth's Compensation.

One surprising aspect of the transmissions from 5GB is the strength at which they are received in Bournemouth, 120



AMATEUR BROADCASTING TO THE EMPIRE. Mr. Gerald Marcuse (2NM), the well-known Caterham amateur, who, on September 1st, will inaugurate telephony transmissions for the benefit of the Colonies on wavelengths of 23 and 30 metres. It is expected that the transmissions will take place on three nights a week, Mr. Marcuse providing his own programmes.

miles away. This is a much-needed consolation to Bournemouth listeners, who have had to revert to the old Morse-infested wavelength of 326.1 metres from their local station.

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Pavlova Broadcast.

The Pavlova ballet season opens at the Royal Opera House, Covent Garden, on September 12th, with "Don Quixote," Act I of which will be broadcast from London and Daventry.

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German Music Night.

Throughout Europe on Friday, September 9th, the broadcasting stations will dedicate their programmes to the music of Germany. This will be the second of the series of nights each devoted to the music of one of the countries subscribing to the Union Internationale de Radiophonie. I understand that all the British stations will participate. The composers whose works will be represented have been specially selected by the German broadcasting authorities.

It will be remembered that French works were featured on Sunday, July 24th. "British night" will be held some time in October.

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Yale Blues To-night.

A lesson in the new Yale Blues will be broadcast from 2LO this (Wednesday) evening by Santos Casani, the dance expert.

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From Solomon to Jutland.

"Down to the Sea in Ships," which will be broadcast from 2LO on August 30th, is a characteristic programme "illustrating the interest which the sea has for people of all ages through all ages." The broadcast has been devised by Amyas Young, and embraces sea events from the return of Solomon's treasure fleet to the Battle of Jutland.

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Motor Music.

What an opportunity we missed, those of us who failed to hear the programme broadcast from eighteen stations of the American National Broadcasting Co. on Saturday, July 23rd.

I quote from the advance notice: "The entire hour will trace in music the development of the Buick Motor Company from the earliest days of development, 1904, down to the present. Instrumental and vocal music typifying each period in this great development will be included in the program."

Doubtless listeners heard the plaintive "Honk! Honk!" prelude for solo horn. I have often been moved by it.

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How Long They Listen.

Time as an element which has to be considered in the production of power equipment for wireless operation is really a vital factor, according to the Radio Division of the American National Electrical Manufacturers' Association, which has just issued information showing how long the U.S. public listen to broadcasting in a given week.

The study, which is based on the percentage of listeners using radio receivers in excess of any given number of hours per week, shows that about one-tenth of 1 per cent. of all radio listeners use a set in excess of 140 hours each week, 1 per cent. use it in excess of 100 hours, 10 per cent. in excess of fifty hours, 20 per cent. in excess of forty-five hours, 30 per cent. in excess of thirty-five hours, 50 per cent. in excess of thirty-eight, and 80 per cent. in excess of thirty hours.

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High Power for John Henry.

John Henry will be heard by 5GB listeners on August 26th. On the same evening T. C. Sterndale-Bennett is giving a selection from his own compositions at the piano.

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A Hebrew Night.

A Jewish concert will be broadcast from 2LO on August 31st.

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For Dancers.

Dance music will be given from 5GB on Mondays, Wednesdays, and Fridays until midnight. In addition, every Saturday night from 8 to 10 o'clock the new Daventry is to broadcast a programme called "Dancing Time." Listeners who are fond of dancing will thus be provided with the necessary music, and non-dancing listeners will have what should prove a light and pleasing entertainment. On each occasion the London Radio Dance Band will play, and their items will be varied by singers and instrumentalists, including Florence Oldham, Sydney Nesbitt, and Harry Shalson.

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Back to 1770.

An eighteenth-century programme, arranged by Iolo Williams and entitled "1770," will be broadcast on Friday next, August 26th. It will include imaginary conversations between Dr. Johnson, Boswell, and Oliver Goldsmith: music by Handel, consisting of songs from Sheridan's play "The Duenna"; Bickerstaff's "Love in a Village," and other songs and scenes.

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Grand Opera.

"La Tosca," the first of the Puccini operas to be broadcast in full, will be transmitted on September 1st. The cast includes Rachel Morton, Tudor Davies, Harold Williams, Herbert Simmonds, William Anderson, Sydney Russell, and Alice Moxon. The Wireless Symphony Orchestra will be under the direction of Percy Pitt, and Mr. Stanford Robinson will conduct the Wireless Chorus.

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A Chinese Drama.

On September 2nd Cardiff station will give a play by Vivian Tidmarsh entitled "In Chinese Waters." The cast of seven will be all male, but as they range from a "Chinese pirate" to a globe-trotter, and from the captain of the steamship to the purser, there is much scope for difference of voice. This play will be a real thriller and will deal with piracy on the high seas.

FUTURE FEATURES.

London.

August 28th.—Military Band Concert.
August 29th. — "Pariah," by August Strindberg.
August 30th.—Musical Comedy Selections.
August 31st.—Jewish Concert.
September 1st.—"La Tosca," by Puccini.
September 2nd.—B.B.C. Promenade Concert relayed from the Queen's Hall.
September 3rd.—Concert Party relayed from Worthing.

Daventry (experimental).

August 28th. — "Judas Maccabæus," an oratorio by Handel.
August 29th.—Promenade Concert relayed from the Queen's Hall.
August 30th.—Promenade Concert relayed from the Queen's Hall.
August 31st.—Light Orchestral Concert.
September 2nd.—From the Musical Comedies and Comic Operas.
September 3rd.—Chamber Music.

Bournemouth.

August 29th.—A Programme for a Bored Listener.
August 30th.—Promenade Concert from the Queen's Hall.

Cardiff.

August 29th.—A Programme from Weston-super-Mare.
August 30th.—Promenade Concert relayed from the Queen's Hall.
September 2nd. — "In Chinese Waters," a play in two acts by Vivian Tidmarsh.

Manchester.

August 29th.—Promenade Concert from the Queen's Hall, London.
August 30th.—Orchestral Concert relayed from the Pavilion Gardens, Buxton.

Newcastle.

August 31st.—Concert by the Municipal Orchestra.
September 3rd. — Variety Programme.

Glasgow.

August 28th.—A Light Orchestral Programme of Schubert and Schumann.
August 30th.—"The Rising of the Moon," a play by Lady Gregory.

Aberdeen.

August 29th.—Promenade Concert relayed from the Queen's Hall.
August 30th.—"When the Curfew Rings," written for broadcasting by Arthur Black.

Belfast.

September 3rd.—A running commentary on the Ulster Grand Prix Motor Cycle Race.

SELECTIVE MORSE RECORDING.

The Hot-wire Microphone as an Interference Eliminator.

By G. G. BLAKE, M.I.E.E., F.Inst.P.

(Concluded from page 215 of last week's issue.)

CONSTRUCTIONAL details of the interference tester can be seen in the accompanying illustration (Fig. 4), which shows the demonstration apparatus used at the lecture referred to earlier in this article. This will be understood better by reference to Figs. 5 and 6, showing circuit diagrams of this portion of the apparatus. On the extreme left (Fig. 4) is a box A, from the top of which protrudes an electric light bulb Q, which is a mains high-tension unit for use with D.C. supply and from which the plate circuits of the three thermionic valves V, V_1 and V_2 are fed. This unit is described in detail later.

Next to this, and attached to the baseboard, are two 0.001 mfd. variable condensers C and C_1, which tune the "50 turn" grid coils I_2 and I_3. The two plate circuit inductances I and I_1 are "100 turn" coils. These, as can be seen in the illustration, are coupled tightly to the grid coils and fixed permanently in that position against one another by a binding of cotton. The value of the grid condensers C_4 and C_5 should be about 0.0003 mfd. The grid-leaks which bridge these two condensers are, in the writer's interference tester, made by graphite pencil marks across the roughtened surface of short strips of ebonite about 2in. long. When the apparatus is connected up to its batteries and source of H.T. supply it will be found that, in the absence of any grid-leaks, slow ticking noises will take place in the telephones (when their respective Morse keys are depressed), due to the discharge of the grid condensers through the unavoidable leakages. The speed of these discharges can now be accelerated by means of the graphite pencil marks, which can be gradually increased in width until any desired musical notes are produced in the phones T and T_1.

Adjustment of Grid-leak Values.

This preliminary setting of the grid-leaks should be attended to while the variable condensers C and C_1 are set at their maximum capacities. The grid-leaks remain in a more staple condition if the pencil lines are lightly rubbed into the interstices of the ebonite surface while they are being made. Having set the two circuits to give approximately the same note, preferably rather more bass than that which will be finally required, the frequency of the notes of either or both of the valve circuits can now be altered at will by reducing the capacity of their respective condensers C_1 or C.

Valves V, V_1 and V_2 are B.T.H. B4 (6-volt filament) or other make of valve with similar characteristics. The value of the fixed capacity condensers C_2 and C_3 is about 0.006 mfd. These can just be seen in Fig. 4 arranged on the baseboard near the microphone M. The Morse keys K, K_1 and K_2, as will be seen, normally short-

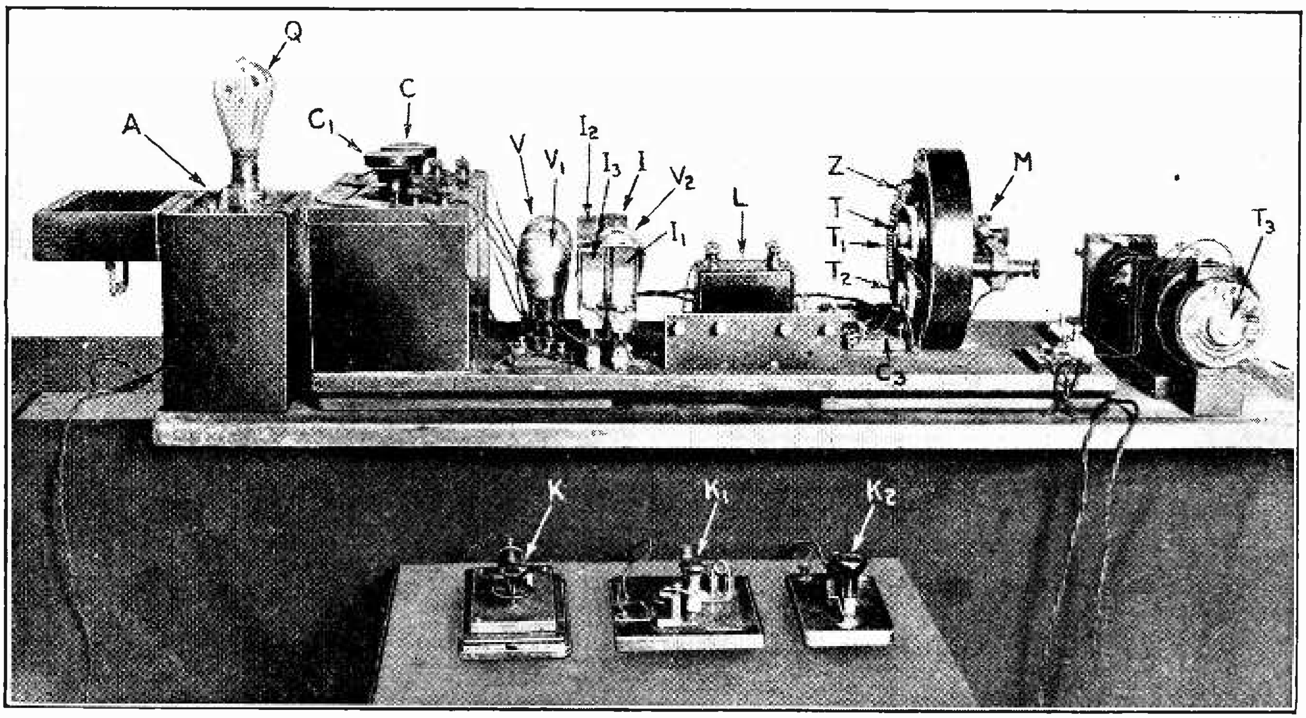

Fig. 4.—General view of interference tester.

Selective Morse Recording.—

circuit the Brown telephone receivers T and T_1 (wound to 2,000 ohms), the depression of a key allowing one of the telephones to come into operation.

The sounds from the telephones are collected within the microphone case M, and impinge upon a diaphragm D (Fig. 6). The microphone (a Skinderviken button or similar solid-back microphone) is included in the primary circuit of a transformer L, shown in Figs. 4, 5 and 6. The secondary currents from this transformer are amplified by means of a thermionic valve V_2, and are employed to operate a loud-speaker telephone T_3.

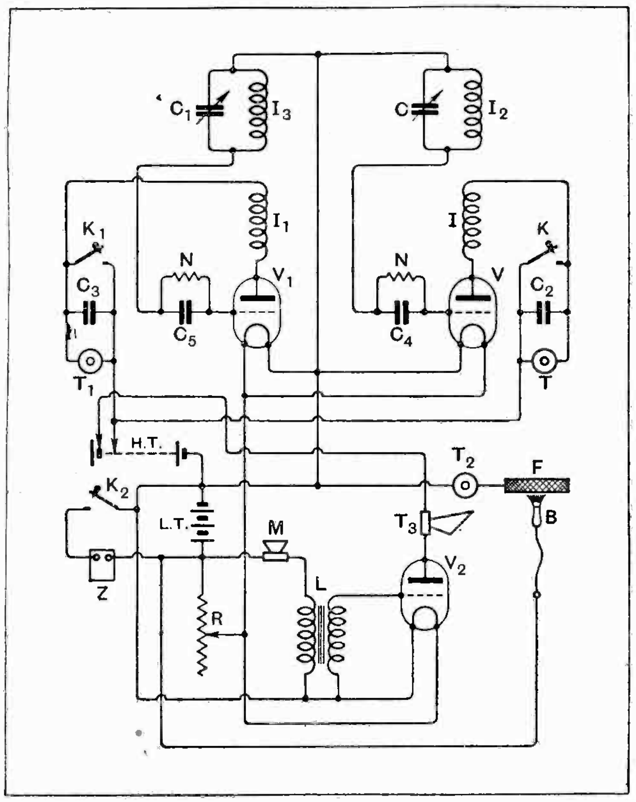

Fig. 5.—Circuit diagram of interference tester.

In addition to the two telephones T and T_1, mounted on the backboard of the microphone case M, there are a buzzer Z, such as is used in a wavemeter, and a telephone receiver T_2.

The buzzer is operated by a separate Morse key K_2, as shown in Fig. 5. Noises to represent atmospherics can be produced in the telephone T_2 by rubbing a steel wire brush along the surface of a coarse file F. These atmospheric noises and three sets of messages can be produced simultaneously by the operation of the three Morse keys and, after amplification, reproduced in the loud-speaker T_3. Even though each message be transmitted on a distinct musical note, the conglomeration of noises is too complex for any of the messages to be readable.

A hot-wire microphone and resonator will, however, readily pick out either of the messages and reject all the unwanted noises.

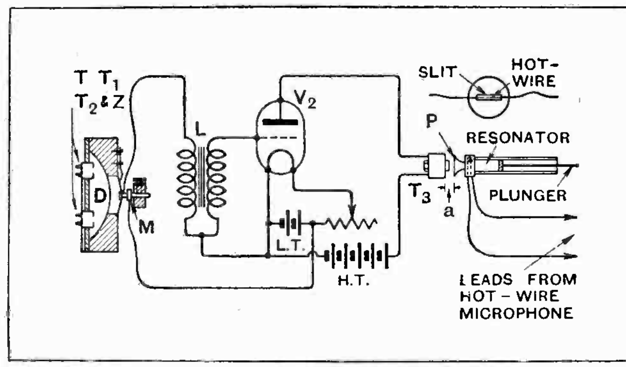

Fig. 6.—Circuit system for producing an artificial source of interference.

When it is desired to intermingle the signals from the circuits of the interference tester with those being received from some distant wireless station telephone T_2 is entirely disconnected from the L.T. battery and its steel wire brush and file, and is connected in circuit with the last valve in the set receiving the incoming signals; these sounds will then be intermingled with those artificially produced by the interference tester.

Fig. 7 gives a more detailed idea of the microphone and its case. Its backboard, I, consists simply of a circular disc of wood or stiff cardboard 7½in. in diameter, into four holes in which telephones T, T_1 and T_2, also buzzer Z, are inserted, and into which they fit tightly. The case, 2, is turned out of a block of hard wood, its back forming a concave chamber, where the various sounds from the telephones and the buzzer are collected.

At the centre of this concave chamber is a circular hole 4in. in diameter, over which a diaphragm of stiff drawing paper, 4, is stretched; Watman's hot pressed drawing-paper answers admirably. This should be

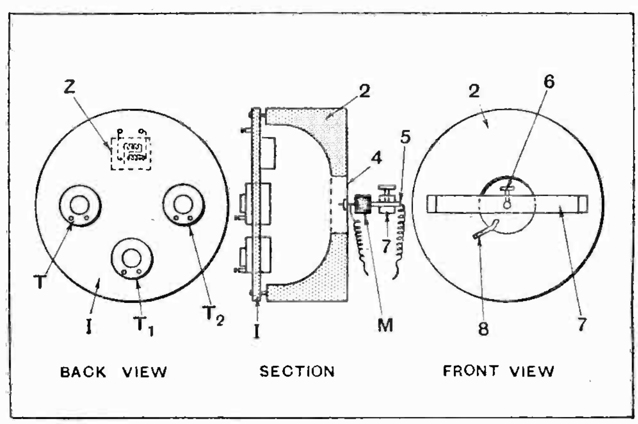

Fig. 7.—Constructional details of carbon microphone and telephone unit.

damped, and then while wet stuck on to the front of the case with glue; as it dries it will then contract and form a tightly stretched diaphragm. A microphone button M is attached to the centre of the paper diaphragm, so that all the movements of the latter are transferred to the small mica diaphragm of the microphone. The exact position of the microphone and the amount of tension between its

Selective Morse Recording.—
diaphragm and the paper diaphragm are adjusted by means of a set-screw, 6, which holds the brass projection rod, 5 (attached to the back of the microphone), rigidly in position in the solid cross-arm, 7. This cross-arm can, of course, be made either of metal or hard wood or other suitable material. A small brass damping spring, 8, is attached by screws to the front of the case, 2, which presses against the diaphragm.

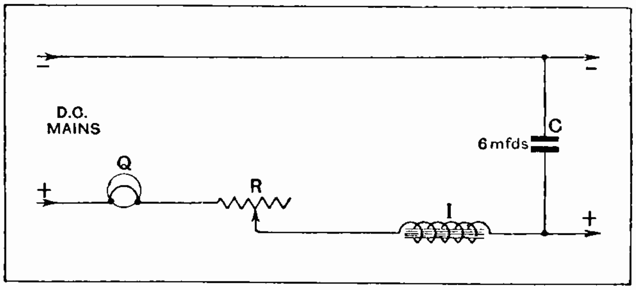

Fig. 8.—Smoothing circuit for obtaining H.T. supply from D.C. mains.

High-Tension Supply.

The high-tension supply for the interference tester can be obtained from any source, and the apparatus will function well on any voltage between 110 and 220 volts, within limits, of course; the higher the voltage the louder will be the signals, and therefore (when endeavouring to interfere with the signals coming in from a distant station) the more stringent will be the test.

Owing to the selective properties of the hot-wire microphone and resonator combination the supply can be taken, if desired, directly from a direct current main, all its ripple being left in. This, however, makes the apparatus very noisy and unpleasant to listen to, and, at any rate for lecture purposes, the author thought it advisable to quieten it down to some extent.

Fig. 8 shows the smoothing arrangement employed; no attempt was made to produce a perfectly silent H.T. supply (a matter of no great difficulty). The arrangement shown, which was put together out of odds and ends in a few minutes, was quite sufficiently effective to reduce the ripple to a very quiet and hardly perceptible hum, not loud enough to be offensive to the ear.

As will be seen by reference to Fig. 8, the lead from the negative main is connected directly to the negative H.T. terminal of the interference tester. The lead from the positive main is, for safety, connected through an electric lamp Q; any lamp will do (say, a 16-c.p. carbon filament lamp). For the same voltage as the D.C. supply, R is a variable resistance, which, though not essential gives some control over the voltage. On its way from this resistance the current is passed through an iron core choke I. From the choke, connection is made to the positive H.T. terminal of the interference tester. A capacity of 6 mfds. is connected across the two H.T. supply leads, as shown at C.

NEWS FROM THE CLUBS.

Transmission Tests in Essex.

Despite attempts on the part of the weather to frustrate their plans, the Southend and District Radio Society enjoyed a successful day with their transmitting and receiving equipment at Eastwood House, Rochford, on Sunday, August 14th, the apparatus being erected in a garage. The first test was carried out with 6WQ, of Westcliff. Thereafter 6QO, of Kelvedon, was received on a loud-speaker and the assembled members were regaled with some gramophone records. Mr. Mayer (2LZ), of Wickford, a member of the society, reinforced the transmitting apparatus with a broadcasting type microphone, modulator, and amplifiers; with these additions gramophone records were transmitted and reports were received indicating results far in excess of anything achieved on previous occasions.

A record attendance of 35 on this "field day" showed the increasing popularity of fixtures of this kind.

Hon. secretary: Mr. F. J. Waller, Eastwood House, Rochford, Essex.

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The Mid-Britain Conventionette.

On Bank Holiday, August 1st, between forty and fifty amateur transmitters and their friends belonging to the Mid-Britain area of the T. and R. section of the R.S.G.B. assembled at the Cock Hotel, Northampton, to inaugurate the first Area Conventionette. The chair at lunch was taken by the Area Manager, Capt. H. J. B. Hampson (G6JV), of Norwich, who expressed his great pleasure at the large attendance. The presence of so many ladies indicated the growing interest taken by them in wireless, and was a most pleasing feature of the gathering. The chairman read messages of greeting from the T. and R. Headquarters, G6NF, G5YK, and amateurs in Brazil and the United States, including Miss Marie Frankly, the lady operator of U 1II.

An interesting lecture on the building and adjustment of a low-power transmitter was given by Mr. Smith (G5YX), of Cambridge, who has carried out tests with stations all over the world on low powers and whose log might well be envied by transmitters licensed for ten times the power used.

Tea was served at 5 p.m., when the chairman presented to Mr. G. A. Jeapes (G2XY) a memento of the first Mid-Britain Conventionette and voiced the thanks of those assembled for the splendid work he had done in organising and arranging the meeting.

The day's programme concluded with a visit to 5XX Daventry, which had been arranged by Capt. Harrison and by the kindness and courtesy of Mr. Hotine, the B.B.C. engineer-in-charge, who personally conducted the party over the station, where the scrupulous care bestowed upon every detail from the huge generators to the smallest galvanometer was most noticeable. The reproduction from a cone loud-speaker in the control room elicited a fusillade of questions regarding the area of transformer cores and the ratio of their windings.

At 8 p.m. the first Mid-Britain Conventionette broke up with the tooting of motor horns and the shrill notes of whistles bidding their farewells, in code, to departing Conventionettists.

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Wireless Show at Hastings.

A wireless section is to be included in the attractions of a science exhibition to be held at Hastings in the White Rock Pavilion from October 5th to 8th inclusive. The wireless section will be organised by the Hastings, St. Leonards and District Radio Society, the secretary of which is Mr. N. G. Nye, 9, Stockleigh Road, St. Leonards-on-Sea.

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The Ever-Fascinating Topic.

At this evening's meeting of the Stretford and District Radio Society Mr. Sheffield will give a talk on the subject of valves.

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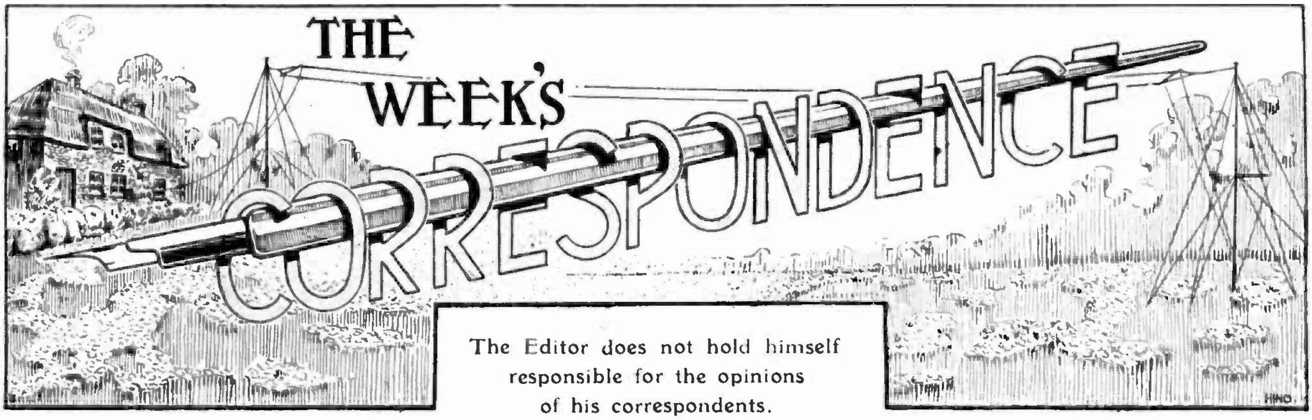
Change of Address.

Mr. R. E. Fabian, hon. secretary of the Northumberland and Durham Group of Radio Associations, has removed to 5. Egremont Drive, Sheriff Hill, Gateshead.



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

Correspondence should be addressed to the Editor, "The Wireless World," Dorset House, Tudor Street, E.C.4, and must be accompanied by the writer's name and address.

LOGARITHMIC SCALES OF AUDIO-FREQUENCY.

Sir,—Nowadays it is the practically universal custom to publish amplification/frequency curves of apparatus with both the amplification and the frequency plotted to a logarithmic scale instead of on ordinary square paper. The log frequency scale was first used for this purpose for studying the *lower* portion of the response curves of transformers, when this was attracting great attention. The opening out of the scale here certainly helped analysis of this part of it greatly. The log magnification scale was first suggested, I believe, by Mr. P. K. Turner (*Experimental Wireless*, February, 1927, p. 77), because "it needs a drop in amplification of at least 50 per cent. before any noticeable impression is made on the ear."

In my opinion the log magnification scale is only correct for showing the relative strengths of *separate musical tones*. Then this insensitivity of the human ear to changes in loudness will make it correct. In studying the "harmonic" range response (over, say, 3,000 cycles) of a resistance amplifier, we wish to be able to note especially the relative strengths of the harmonics to the fundamentals of any musical tone, be it the voice of the announcer or the sound of a musical instrument, where the smallest variation in the relative strengths of these will be immediately apparent to the normal ear. For instance, if one dulls the tone of a set even very little the loss in brilliancy of a violin or the realism of a voice is immediately noticed. Hence the slurring over of these harmonics which the log magnification curve gives to the eye is undesirable.

The log frequency graph also has this effect.

Therefore the logarithmic graph should only be used where separate musical tones are concerned, and the log frequency spacing only where the fundamental frequencies of tones are being studied (below 3,000 cycles or so).

For the plotting of the upper audio-frequency range, as is often done in the case of resistance amplifiers when, for instance, showing the effect of stray capacities on the curve, ordinary plain graph paper should be used. For experimental work in this direction I, for one, have found this way much better than the log scales. J. H. OWEN HARRIES.

Frinton-on-Sea,
August 3rd, 1927.

THE REGIONAL SCHEME.

Sir,—Whilst Capt. Eckersley in his article in your pages on the new regional scheme discussed mainly the organisation of the new regional stations, their location, signal strength, etc., it would be interesting to receive some assurances regarding the technical quality of the transmissions.

If alternative stations as well as alternative programmes are to be received, the regional stations must be situated well away from large, closely populated areas. For obvious reasons the studios will be connected to the transmitter by land line. Is it the intention to provide special and exclusive lines for this purpose designed for audio-frequency range currents, or will P.O. lines be used as at present?

The new stations should represent the very last word in design and construction, not merely from an efficiency point of view, but from the point of view of quality. The latter is just as important as the former, as, although the receiving end is now lagging behind the average quality of, say, 2LO's transmissions, the knowledge concerning distortionless reception and reproduction is becoming more widespread.

It should not be sufficient to say that the quality will be very much better than is capable of being reproduced on the average set. An attempt should be made to bring the provincial stations up to the level of, or better than, the best transmissions from 2LO, and the transmission characteristics should be published in simple, easily comprehended manner. Tests might be arranged so that listeners could determine the goodness or otherwise of their receivers, for such work would have a wide educational value, and would allay a good many fears regarding the standard of quality transmitted. WALTER LYMES.

Manchester.
August 12th, 1927.

EMPIRE BROADCASTING.

Sir,—May I contribute to the discussion on Empire broadcasting by advancing what I am sure represents the attitude taken by a very great number of Colonials?

It is very pleasant to see from the letters published in your journal that Colonial interests are so warmly and generously supported by radio enthusiasts at home—by many of those, in fact, who support the B.B.C. and have nothing to gain by the expenditure on an Empire S.W. station. This evidence of unselfish effort on our behalf is very greatly appreciated and will not be forgotten.

The view taken by Messrs. Hudson and Munn, and "T. S. W.," however, is completely logical. It is evident that the B.B.C. exists to supply those at home who finance it, and I would like to reassure those of your readers who are in doubt by reminding them that British residents in the Colonies have not a reputation for wanting something for nothing. We are more than willing to pay for what we get, and to subscribe to any Imperial scheme without expecting too great a return.

The wireless public in the larger Dominions is comparatively well off in that local broadcasting can be organised, though there is evidence already in your correspondence columns that there is no lack of demand for home programmes. But we in the smaller Crown Colonies and dependencies must rely on efforts at home for some central organisation. In this country, for example, we have no professional entertainments whatever, and although I understand a local S.W. station is under construction, it will serve mainly for the distribution of local news and information. The amateur talent available locally is naturally limited, and while it will be appreciated, it cannot replace professional programmes, especially those from *home*.

The cost of installation of a station, and of extra programmes to suit those Colonies in which time is considerably different from English time, could readily be borne by subscriptions from Colonial Governments, who would recover the money by local licensing. Colonial Governments already subscribe to several institutions founded for the general benefit.

Surely the legal difficulties which limit the B.B.C.'s functions can be overcome. Providing that the Colonies pay their shares, I imagine there would be no objection to the operation of the Empire station by the B.B.C.

Whatever other obstacles there may be I must add my evidence to refute the suggestion that the installation of the station should wait until S.W. broadcasting is out of the "experimental stage"—whatever that may mean. We might wait for a decade! The excellence of reception of th PCJJ transmissions all over the world is sufficient to indicate that it is by no means too early to begin. There is no disguising the fact that we are behind the times, and that we are losing prestige by continued delay. The effect on the native races in the Empire and on lesser nations of the absence of a British S.W. station, and the existence of foreign ones, is worth consideration.

Some of your correspondents place emphasis on the importance of broadcast speeches by great statesmen and politicians. This is undeniable, but in case this should be overstressed I would venture to remark that a very little of it would go a long way. Let us have *all* the broadcast speeches of the King, the Prince of Wales, and other members of the Royal Family, but spare us the politicians! We are all of us, after all, only transplanted "men in the street," and we want exactly the same kind of programmes that listeners at home enjoy. The great attraction of the scheme is that it will bring us into close touch with home, and too great a well-meant specialisation in programmes may diminish this effect.

There are only three or four S.W. sets in the Gold Coast at present, and consequently I have witnessed the effect on several other listeners on my set of hearing PCJJ and 2XAF for the first time. Your readers at home will have difficulty in conceiving the pleasure given by these foreign broadcasts, and by the *prospects of future British developments*. It really means so much in a country where sport in small communities is limited to occasional tennis (when a four can be gathered), where mails and periodicals arrive two to three weeks after despatch, where the majority are cut off from cabled news, and where no places of entertainment exist, or could be reached.

The effect of a British S.W. installation on radio trade will evidently be considerable. After hearing part of the recent 24 hours transmission from PCJJ (which was perfectly received at maximum headphone strength), two gentlemen decided to send home for components to make your Empire S.W. set.

May I suggest to the trade that no time should be lost in advertising in the Colonies and Dominions? It has been suggested to me by a recent S.W. recruit that firms supplying kits of components for S.W. sets might quote in advertisements a cable code word to facilitate rapid supply.

Atmospheric conditions here are exactly as described by Mr. Mountain, of Nigeria, in a recent issue of *The Wireless World*. So we must pin our faith to S.W. and hope for the best. In the meantime we look forward to Mr. Marcuse's transmissions. He and the Radio Society are to be congratulated on their enterprise, and will earn the gratitude of all overseas listeners.

Gold Coast Colony, West Africa. July 28th, 1927.
H. A. DADE, A.R.C.S.

Sir,—May I beg again the hospitality of your correspondence columns on the subject of Empire broadcasting?

I wish to reply mainly to a certain point raised by Mr. Bertram Munn and Mr. Hudson in your issues of 29th ult. and 6th inst. respectively. The point to which I refer is that of cost. Now surely neither of these gentlemen imagine that we are expecting a broadcast service gratis. I have not the knowledge of Dominion treasury affairs to suggest how they would bear their portion of the expense; but contribute they would, I feel sure. In the case of the Colonies, who have not their own broadcast station, the solution is easy. Licence fees could be transferred—less a small percentage to cover cost of collection—to the department in England providing the service.

We Britishers in Nigeria would scarcely mind paying to hear news from home three weeks earlier than through the mail when we are prepared to pay 8d. for one apple!

Granted that it is no affair of the B.B.C. but a matter for the Colonial Office. We want the goods and will pay for them. We care not who provides them. Judging by letters to the *Nigerian Daily Times*, there are large numbers of natives who also want the goods and will pay. The B.B.C. seems to be the natural organisation to carry out the technical arrangements of Empire broadcasting, but contributors to the B.B.C. funds need have no fears that we want them to pay. I should have thought this obvious.

Before I close I must withdraw the remarks in my former letter concerning the 400-metre Daventry station. I was ignorant at the time of the real reason for that station. However, that should be another argument in favour of better discrimination of ideas and news amongst Colonials.

Thanks for your persistent efforts to bring about Empire broadcasting. May they soon be consummated!

Bukuru, N. Nigeria. July 25th, 1927.
G. A. MOUNTAIN, A.M.I.E.E.

Sir,—I must apologise for once again seeking the privilege of your columns, but the latest official statement issued by the B.B.C. and given wide publicity in the daily Press on the subject of Empire broadcasting, as well as the letter by Mr. E. H. Robinson appearing in your issue of to-day's date, gives, in my opinion, sufficient reason for proceeding further with this matter.

Before discussing the purely technical aspect of the question it is as well to remember that one fact definitely stands incontrovertible: this is the need for an immediate Empire service, and in no small measure *The Wireless World* deserves the thanks of all those who have the good of the Empire at heart for having realised this need. Mr. Robinson, while admitting the desirability of an Empire service, professes doubt whether it will ever be possible. May I point out that the greatness of the British Empire has been brought about, not by people who were appalled by difficulties, but by those who "got on with the job," and I hope to show that a reasonably efficient Empire service is possible at the present time without "years of experiment."

Since the immediate necessity of catering for this need has, I contend, been adequately proved, it remains to consider in what manner such a service can be conducted. As a commercial engineer I am only concerned with hard facts, and because it will be facts alone which will determine the nature of such a service I will confine myself to such facts. First, what must be provided? As I see it: a central station within Great Britain capable of putting intelligible speech into any given colony at any time during the twenty-four hours. All factors being considered, the method which gives such a service with the greatest consistent height of signal above the interference level with the most economical first cost and maintenance charges must be the one adopted. This resolves itself into a consideration of wavelength to be utilised, always bearing in mind the economic factors bound up in the question of power necessary. In this connection we have three possible wavelength bands—5,000 metres and upwards, which we can term long, the existing broadcast band of 250-550 ms. or medium waves, and below 100 ms. or short. Space will not permit of a detailed discussion of the relative pros and cons of each method, but I submit that the short wavelengths have definitely shown themselves most capable of fulfilling the requirements outlined above. Mr. Robinson refers to the relayed transmissions of 2XAF by the B.B.C. While I agree that such efforts are very poor, I do not agree that the B.B.C.'s demonstrations in any way represent the true advance which has been made in short-wave transmission or reception, and, as one who was very closely concerned with these efforts of relaying in 1924, I can only say that the B.B.C. have much to learn in this direction to bring them abreast of modern practice. In passing, it might interest Mr. Robinson and also the B.B.C. to know that for the last eight weeks consistent loud-speaker reception of 2XAF has been possible at my station for 75 per cent. of the total transmission period with a quality better than that obtained from the reception of Manchester and Aberdeen. For the benefit of Empire broadcasting I have offered to demonstrate this, at my expense, to several of the London daily newspapers, but have met with no acknowledgment except in one instance, where they are first taking the matter up with the B.B.C.!

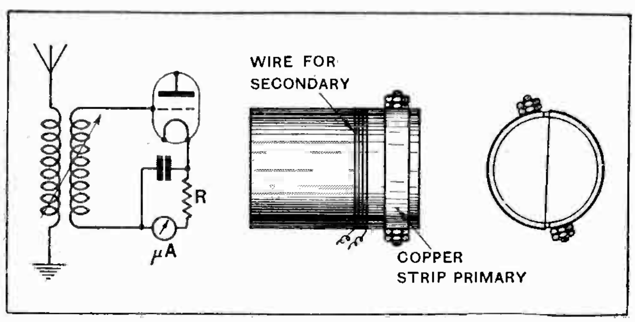
With regard to Captain Eckersley's statement, in an interview with the Press, that development in Empire broadcasting will take the form of increased reception efficiency on normal broadcast wavelengths, may I be permitted, in the hope that it will be answered, to ask the B.B.C. one question: Are they, or do they anticipate being, in a position within the next six months to demonstrate a receiver which, being within the compass of the ordinary listener, will give the same reception efficiency on American broadcast stations operating on their normal wavelengths as the present short-wave receiver will accomplish in the case of 2XAF and KDKA? If they are in a position to do this no one will be more pleased to congratulate them than myself; if they are not in this position, then I can see no further reason for the delay in establishing an Empire short-wave station, or for the continuance of the B.B.C.'s policy in deprecating short waves for such use.

Berkhamsted. G. LESLIE MORROW.
August 10th, 1927.

REMOTE INDICATING AERIAL AMMETER.

Sir,—The article by A. P. Castellain on "A Remote Indicating Aerial Ammeter" is of interest to me, as I utilised a somewhat similar arrangement about eighteen months ago. Possibly a few further observations based on my own experience may be of interest.

The first arrangement tried was a diode voltmeter, *i.e.*, a simple rectifying valve in series with a very high-resistance D.C. voltmeter, and connected to a few turns tightly coupled to the aerial inductance of the transmitter. This arrangement has the advantage of a uniform scale if the resistance of the D.C. voltmeter is several times the resistance of the diode. A condenser is necessary across the D.C. voltmeter. The diagram shows the arrangement.



Actually a W.E. "Peanut" valve, with grid and plate connected together, was used as a diode. This arrangement has the advantage that the calibration is independent of the filament temperature, provided the valve is run bright enough to give sufficient emission. It has the disadvantage of requiring more power than either type of triode voltmeter.

More recently a triode voltmeter has been tried using a D.E.3B type valve and grid rectification. This type is preferred to the anode rectification type as giving a scale which is almost uniform. With this valve a large condenser (1 mfd.) across the filament was found essential, otherwise sufficient H.F. energy was picked up to brighten the valve filament considerably. (The transmitter input is 8 watts.) I would strongly urge any transmitter using this arrangement to incorporate this condenser.

Next I would like to criticise the type of "current transformer" (if this term may be permitted; coupling mutual inductance would be more accurate, but is clumsy). I confess that, personally, I cannot see how the arrangement described gives any coupling at all between the primary and secondary windings, since the direction of winding of the secondary is parallel to the field produced around the primary.

However, assuming the arrangement works, the grave objection is that the secondary is a plain solenoid, and consequently large E.M.F.s may be induced in it by stray fields around the transmitter; true, these are (roughly) proportional to the aerial current, but only if the coils of the transmitter are kept fixed. If the arrangement is to be used to determine the optimum coupling of the transmitter, some type of "current transformer" which is free from this stray pick-up is essential.

Two types of mutual inductance are almost entirely free from this trouble. The first consists of a toroidal secondary with one or more primary turns threaded through it. A second form, more easily constructed, is to use an astatic arrangement. This may be readily constructed from a piece of 2in. diameter ebonite tube by pulling a saw blade across a diameter and sawing axially down the tube. Through the slots thus formed wire may be wound in a double D fashion as shown in the diagram.

I have found this arrangement perfectly satisfactory in operation. It is placed in the aerial lead, or feeder, where convenient, preferably some distance from the transmitter coils, since an astatic arrangement is free from pick-up only in a uniform field, and *twisted* flex leads run to the voltmeter. I have not determined the limiting length of these leads, but they may be made 2ft. or 3ft. long without trouble.

Finally, may I remind those using the device that we are measuring the current through the primary winding by the voltage induced in the secondary; this gives two results which should be carefully noted:—

1. The reading for a definite primary current, say 1 amp., is proportional to the frequency. Hence if the reading is, say, 3.0 on 45 metres for 1.0 amp., then a reading of 3.0 will be obtained for 0.5 amp. on 22.5 metres.

2. The reading for a definite primary current is proportional to the *product* of primary and secondary turns, and not to their ratio, as in a true current transformer. Hence doubling either primary or secondary turns doubles the sensitivity. For this reason, in referring to the arrangement as a "current transformer," I have used inverted commas.

FRANK AUGHTIE, M.Sc. (G 6AT).
Dudley, Worcester.
August 10th, 1927.

THE B.B.C. AT OLYMPIA.

Sir,—I have read with regret, in the current issue of *The Wireless World*, of the decision of the B.B.C. concerning their exhibit at the Wireless Exhibition this year. I think one of the greatest and most fascinating attractions at the exhibition last year was the working of the B.B.C. studio, to judge by the queue. To hear and *see* your favourite artist broadcasting was a real treat, and to mention the fact to anyone who was not present was to evoke the exclamation: "I do wish I could have seen them." I feel sure I am voicing the opinion of the great majority of wireless enthusiasts when I say "Please let us have a working model."

Dunmow, Essex. S. W. WEBB.
August 15th, 1927.

MARCONI ROYALTIES.

Sir,—I have just read the letter from Mr. Harold Knox on the subject of Marconi royalties published in your issue of August 17th. Mr. Knox seems to have rather missed the point of your comment in that, whereas the view you expressed was that it seemed unfair that the royalty charge should be the same on a luxury two-valve set costing £30 to £40 as on a purely utility article costing one-fifth of that amount, Mr. Knox implies that the *principle* of the royalty is unfair.

As one who draws royalties in respect of patents in another industry, I feel that it is necessary to make a protest against any suggestion that the owners of patents are not entitled to royalties for the use of those patents, and it is generally accepted in other industries that the owner of the patent is entitled to decide what the amount of the royalty shall be.

Ryde, I.O.W. "PATENTEE."
August 18th, 1927.

"The Wireless World" Information Department Conducts a Free Service of Replies to Readers' Queries.

Questions should be concisely worded, written on one side of the paper, and headed "Information Department." One question only should be sent at a time, and must be accompanied by a stamped, addressed envelope for postal reply. Any diagram accompanying the question should be drawn on a separate sheet. No responsibility will be accepted for questions sent in which do not comply with these rules.

"Threshold Howling" on Short Waves.

I have a short-wave receiver consisting of detector and one stage of L.F. amplification. The results obtained from comparatively strong signals are excellent, but when endeavouring to receive very weak transmissions difficulty is experienced owing to an objectionable howl when the receiver is just on the verge of oscillating. I have endeavoured to cure this by the addition of a potentiometer for fine control of the detector grid, but the "howl" persists. I should be obliged if you could suggest a cure for this trouble. L. R. T.

The difficulty of obtaining smooth reaction on the very short wavelengths is not at all uncommon and in the majority of cases can be traced to the use of a grid condenser having a comparatively high value and a grid leak too low in value. It has been found by experiment that this difficulty can be overcome in most cases by using a 0.0001 mfd. grid condenser in conjunction with a 5-10-megohm grid leak, and returning the low potential end of the leak to a potentiometer connected across the detector valve filament. A much better method to adopt, however, would be a reactor valve, and although it is admitted that this valve does no useful work as far as amplifying is concerned, it enables smooth regeneration to be obtained. This alone would justify its use, but it has a further advantage inasmuch as it enables the correct adjustment of grid bias to be employed for best detection. A circuit diagram showing the method of adding a reactor valve to a short-wave receiver was given on page 814 of our issue for June 29th last, and we suggest you refer to this for particulars of components, etc.

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Earth or Counterpoise?

I wish to try the effect of using a counterpoise with my receiver, as I understand that this has certain advantages over an earth connection in the matter of obtaining sharp tuning and giving greater freedom from the noises caused by my neighbouring tramway system. I shall be glad if you will give me some information concerning the construction of a counterpoise. A. M. R.

As you rightly say, a counterpoise can in many cases give much better results from the point of view of selectivity than an earth connection, and also the use of a counterpoise does much to eliminate noises due to earth currents which may be set up by a neighbouring tramway or any other electrical power or lighting system.

A good counterpoise may be made by stretching several wires at a distance of a few feet from the earth, underneath the aerial, the wires being parallel to the aerial and stretching, if possible, to a greater length than the aerial wire or wires. Needless to say, these counterpoise wires should be well insulated and connection must be made to the earth terminal of the set. This is a proper counterpoise, though it will be realised that such an arrangement is impossible to a very large number of readers; but it should be pointed out that in the case of interference from tramways, etc., such as we have mentioned, which is often due to earth currents, much can be done toward the elimination of the trouble by simply removing the earth connection from the set and attaching about 30ft. or so of rubber-covered wire to the earth terminal of the set, the wire being led away anywhere, such as under the carpet or round the skirting board of a room, the far end being left "free" and not connected to anything. This simple remedy will often cure an obstinate case of interference, and at the same time will often greatly improve selectivity.

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The "Everyman" or "All-wave" Four.

I have recently purchased the "Everyman Four" book, but am deterred from constructing the set by reason of the fact that distant reception is confined to the 200- to 600-metre band. Could I not mount the H.F. transformers on special interchangeable bases and construct transformers for long waves also? If so, please give me full particulars for constructing these transformers. H. V. J.

It would be impossible to slightly alter the details of design for these transformers so that they might be mounted on interchangeable bases. The point is, however, that aperiodic aerial coupling is used in this receiver, and, as has been pointed out in this journal, aperiodic aerial coupling is not very satisfactory on the long wavelengths. Many readers have desired to do as you wish to do, and so we turned our attention to the solution of this problem, the result being the production of the "All-wave Four," which appeared with full constructional details in our April 27th issue. This receiver covers a wavelength band of from 200 to 2,000 metres by using interchangeable H.F. transformers. The H.F. transformer used in this receiver is of the "Everyman Four" type, but suitably modified to fit the particular circumstances. The actual instrument described in the April 27th issue used two resistance-coupled L.F. stages, but since many readers desire to use a transformer in the last L.F. stage, as in the case of the "Everyman Four," we published a revised diagram on page 737 of our June 8th issue, giving full particulars also concerning the correct type of valves to use in the receiver. In your circumstances, therefore, you are advised to turn your attention to the "All-wave Four." The two back numbers which we have mentioned, namely, the April 27th and June 8th issues, may still be obtained from us at a cost of 7d. each, post free.

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Where to Use Resistance-Capacity Coupling.

My broadcast receiver (H.F., detector and transformer-coupled L.F.) gives good loud-speaker results from the local station, but distant ones are receivable only at telephone strength. I propose to add an extra stage of L.F. amplification and think that a resistance-capacity coupling would be better than a transformer. Could you supply me with the correct values of the anode resistance, grid leak and coupling condenser to use with one of the latest R.C. type valves? W. H.

When two stages of low-frequency amplification are used and one is resistance-capacity coupled it would be advisable to employ this immediately following the detector valve. The reason for this is twofold; in the first case, the use of a high A.C. resistance valve as detector will add to the general selectivity of the receiver, and secondly the first L.F. valve should be capable of handling a considerable grid swing, otherwise distortion would be present on strong signals. Should the sequence be reversed and the resistance-coupled valve be used in the second stage, the amplitude of the voltage applied to its grid would have to be kept within small limits, this being governed by the negative grid bias applied to the grid of the valve. The average R.C. type of valve does not require more than about ¾ of a volt negative when used as an amplifier. When the first L.F. valve is coupled to the output valve by means of a transformer it is usually necessary to employ a valve of lower A.C. resistance in the first position. Accordingly, the voltage variation which the grid of this valve will accommodate will be much greater than would be the case with a valve possessing a much higher A.C. resistance. When a 70,000-ohm valve is used in the detector position the anode resistance should be one of about 500,000 ohms and the coupling condenser about 0.002 mfd. With the above values a grid leak of between 2 and 3 megohms could be used.

It should be added that if you intend after all to use a 70,000-ohm R.C. valve in the second stage, the values of grid condenser and leak which we have given are the same.

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The Evils of Switching.

I should like to build a set with four valves, one H.F., detector, and two L.F., in which arrangements are made for cutting out one L.F. stage by means of switching or jacking, and should like your advice on this matter, as I do not wish to do anything which might mar the receiver from the point of view of sensitivity, selectivity, or quality of reproduction. M. H. R.

As you are doubtless aware, we strongly deprecate the use of switching in H.F. circuits, and we advise also that if it can be avoided it be not used even in L.F. circuits. The reasons are quite simple to understand.

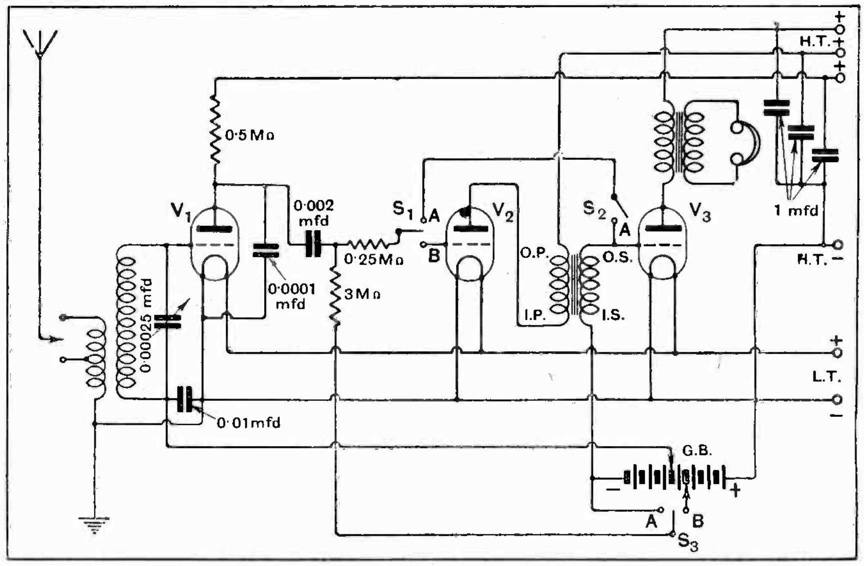
We will assume that your set is of a conventional type, and that it will use medium- or high-impedance valves in its H.F., detector, and first L.F. position, but, of course, will naturally use a modern low-impedance valve having an A.C. resistance somewhere about 3,000 or 4,000 ohms in the last stage. It is essential, as you know, that this type of valve be used in the last stage. If we arrange our switching in the usual manner, and cut out the last valve by means of a switch, or by means of jacks, then we shall have to run our loud-speaker after the third valve, which, as we have just said, will naturally not be of a low-impedance type. From the point of view of quality, this will never do.

You might ask why could not the third valve in the set, that is, the first L.F. valve, be a low-impedance type. The answer is that in the first place, we should be throwing away the amplification which will be obtained with a medium-impedance valve; but it might quite well be argued that this might not be a very serious matter. There is another and much more important reason, however, which is that if we used a low-impedance valve as first L.F. the plate current which would of necessity pass through the primary winding of the transformer which was connected in its plate circuit would have the effect of causing magnetic saturation of the iron core of the transformer, and so cause distortion, since most good transformers are intended for use after a valve of about 30,000-ohm impedance, which limits the plate current in the circuit to a value well below the danger mark from the point of view of magnetic saturation, this value usually being about 3 or 4 milliamperes. A low-impedance valve, even if of the 6,000-ohm type, will usually have a normal plate current exceeding this value. Needless to say, the result of magnetic saturation will be distortion.

It might be argued that there is always the possibility of using a choke or resistance stage after this valve, but even if this is done, it will not get us out of our troubles, because we are then dependent for amplification solely on the amplification factor of the valve, and the amplification of this stage will be absurdly low. If we try to get over the difficulty by using a high magnification factor valve, we shall be where we were before, because if we switched out the last valve we should be running our loud-speaker following a high-impedance valve, which would be fatal to the quality, as already stated.

The other method of switching to consider is to arrange for the elimination of the first L.F. valve when it is desired to cut out a valve, so that the last valve is always in circuit. This scheme is quite sound in the sense that it does leave the last valve always in circuit, but it usually means very complicated wiring to switches, and is often the cause of bad quality in the L.F. amplifier, due to incipient L.F. oscillation brought about by the necessity for "hanging" switches on to the grids of valves.

This scheme is illustrated below, which shows an ordinary detector and two L.F. set. Here we see three switches, S_1, S_2 and S_3. With S_1 at B, S_2 open, and S_3 at B, all valves are in use. By putting S_1 to A, closing S_2 and putting S_3 to B, the middle valve is cut out. It will be seen that we have S_1 hanging on to the grid, and the wire connecting to this, even if kept as short as possible, as it should be, will be apt to set up instability. It might be asked why not leave the wire connected to switch S_2 permanently connected to the grid of V_3. This would only result in an extra wire hanging on to V_3 at a time when all valves were in use, and would probably cause L.F. oscillation. As it is, there is already the wire running to switch stud, A, hanging on to the grid of this valve, which is bad enough.



If switching is a sine quâ non the above method should be adopted.

In addition, of course, we are compelled to have a switch for the adjustment of grid bias values when changing over from three valves to two valves, and although this switch is at low potential and will not, therefore, bring about any capacity effects, it is, after all, an added complication. By very careful attention to wiring, it is possible to arrange S_1, S_2 and S_3 as one switch, using a triple-pole double-throw switch, but in nine cases out of ten complications of wiring result in shunting capacities across the grid-filament circuits and the hanging of wires on to valve grids, which will result in poor quality if not actual L.F. howling. You are strongly advised, then, to leave switching out of your receiver altogether.

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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.

ALTERNATIVE PROGRAMMES.

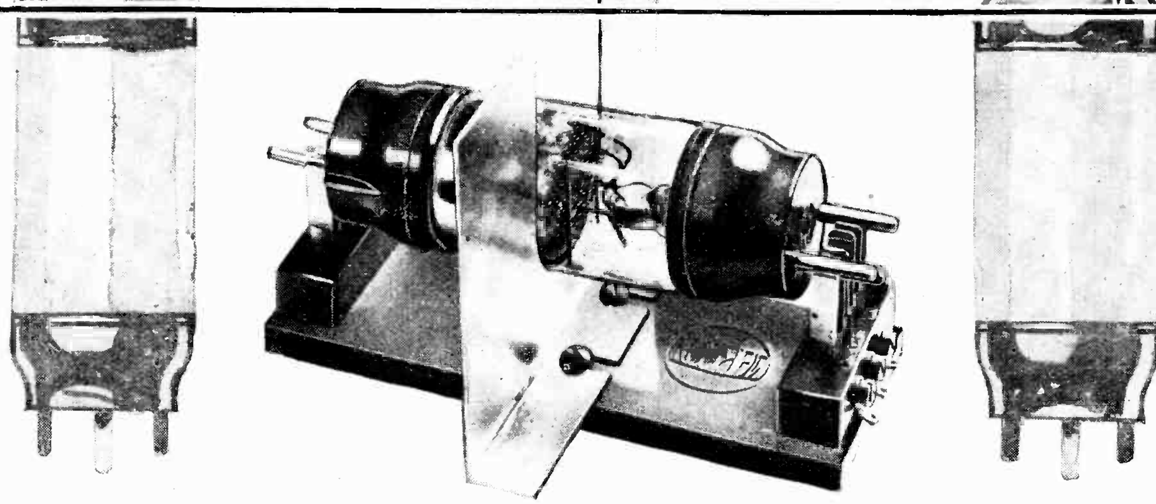
THE new Daventry station 5GB has now been working sufficiently long for us to be able to arrive at a first impression of its possibilities, and we believe that generally it has been welcomed throughout the country. We think, however, that the B.B.C. will find themselves compelled to modify their earlier statements of their policy in connection with the regional scheme and alternative programmes. Hitherto the B.B.C. have insisted that they consider themselves under an obligation to cater first of all for the crystal user and so arrange their stations and power that the crystal user shall be in a position to enjoy the programme alternatives. This, of course, is a laudable object when considered from certain points of view, but we have always maintained that broadcasting will gain in popularity in proportion as crystal sets are replaced by valve receivers with loud-speakers. The scope of the crystal receiver is, in fact, now being put to a severe test. Because it is not possible to obtain any extreme degree of selectivity with circuits in use with crystal receivers, we have received the statements of the B.B.C. and their assurances that alternative programmes would be available for the crystal user with considerable scepticism, and we believe that our views are now justified, because it has already been shown in practice that comparatively few users of simple crystal sets are able to receive at will the programmes of 5GB or their local station without interference one with the other. In many cases, of course, the crystal user will be no worse off than he was before, that is to say, where his local station, or 5GB (if that happens to be his local station), is so strong that he cannot tune it out in order to select another programme, he will still have one programme to listen to.

Listeners in the neighbourhood of 5GB, or at least those of them who have been interested in receiving transmissions from farther afield, are very much distressed now that they find the swamping effect of the new station deprives them of satisfactory reception of any other station. They are experiencing for the first time the discomfort which has been the lot of those who have lived under the shadow of a local station but with the additional factor of the power of 5GB, which makes matters a little worse for them.

Ultimate Effect of the Regional Scheme.

We are at a loss to see how it would have been possible to provide alternative programmes for all crystal users, however desirous the B.B.C. may have been of bringing about this state of affairs; but in point of fact we welcome the new station, even if only for the reason that we believe many people who hitherto have hesitated to acquire a valve set will now have received just that requisite impetus to force them to a decision in favour of loud-speaker reception from a valve set, and we are convinced that they will never regret the change-over. We congratulate the B.B.C. for having been instrumental in bringing this about, and we see, further, that even in the case of simple valve sets many users will be obliged to increase the selectivity of their receivers, probably by adding an H.F. stage, and having done so they will have unlocked for themselves the door which leads to distant reception and a side of wireless which we feel confident will in many cases amply compensate them for the additional trouble or cost involved. The coming winter will, we believe, bring about a great demand for increased selectivity in receivers, and since this necessitates an H.F. stage, with its accompanying increase in range, thousands should hear the foreign stations, which, perhaps, they have never heard before. This is all to the good, for in spite of the views often expressed by the B.B.C. that distant reception is not worth while and that it can never be popular, we ourselves believe that in this direction, almost as much as in local reception, lies the big future of broadcasting and its service to humanity.

THE NEW SCREENED VALVE



Their Advantages and Performance in Radio Circuits.

By N. W. McLACHLAN, D.Sc., M.I.E.E.

WE live in a scientific era and at times grow anxious and bored when scientific developments seem to be behind the clock. A few years ago some of us who had to generate oscillations by Poulsen arcs, microphone hummers, and the like, looked upon the introduction of the three-electrode valve generator as an inestimable boon. Not only did it generate oscillations, but it amplified and detected them. These two latter were great things compared with the relatively weak efforts afforded by other means. After a few years, experimenters began to see that the three-electrode valve was far from being a perfect instrument. Who has not been irritated by its infernal propensities for oscillating in an amplifier? Then the valve designer meets with difficulties in attempting to simultaneously reduce its internal resistance and increase its magnification factor. Its oscillating tendencies are curbed in a degree by the neutrodyne, but it is by no means a perfect remedy, a view which experimenters can corroborate.

Feed Back due to Valve Capacity.

As is well known, the oscillation of a receiving valve set is due to the energy being fed back from the output end of the amplifier to the input after being amplified many times. The feed back is again amplified and sent back, and the process goes on until the set oscillates. Oscillation will not occur if the attenuation or damping per stage is sufficiently large. This is concomitant with a reduction in amplification per stage. Thus for a large degree of amplification there must be many stages. In practice one soon reaches a limit.

Energy is fed back by the valve due to its inherent electrostatic capacity between grid and anode, this also involving the capacity of the holder and leads. The larger this capacity and the greater the magnification factor, the greater is the energy fed back. There is also energy fed back due to electrostatic and electromagnetic coupling between the parts of the circuits and the connecting wires. This can be reduced to a minimum by careful design, and by electrostatic and electromagnetic screening. The energy feed back of the valve is illustrated in Fig. 1, which shows a three-stage tuned anode amplifier. It is clear that there is a path for alternating current from B to A through the inter-electrode condensers C_0. The current fed back has

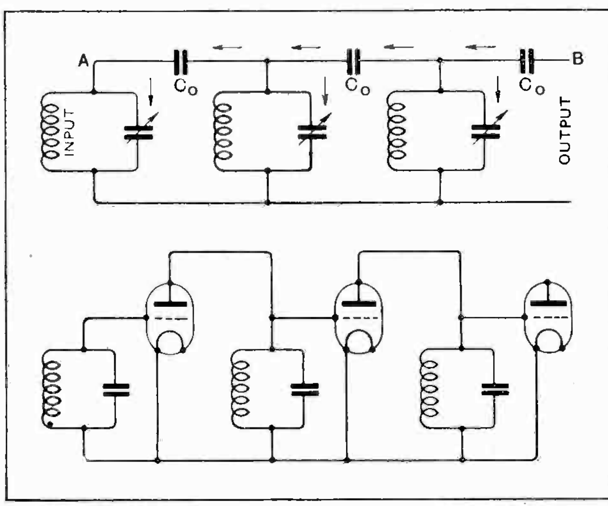


Fig. 1.—Illustrating the energy feed back due to the valve capacity C_0 of the grid-anode circuits. Unless the energy in its return path is sufficiently attenuated the set will oscillate.

The New Screened Valve.—

been amplified to a high degree. Thus if it is not sufficiently reduced or attenuated in its passage through the amplifier the amount arriving at A will be such that after re-amplification oscillation will ensue.

To secure large amplification at any given radio frequency it is essential to reduce the valve capacity to as low a figure as possible. Of course if there is a certain amount of capacity, however small—and it is hardly avoidable in view of connecting leads—the amplification per stage has an upper limit to avoid oscillation. In other words, with a practical valve in a receiving circuit the full amplification factor of the system cannot always be realised.

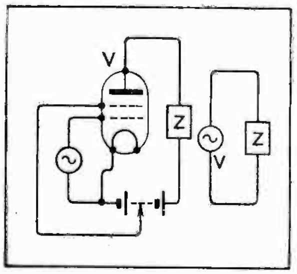


Fig. 2.—The valve as a constant current alternator. A constant current is set up in the anode circuit when a constant voltage is applied between the control grid and filament at varying frequencies.

The valve capacity can be reduced to a minimum by interposing a metal screen between the two offending electrodes. To be effective, this screen is connected to a suitable potential point on the system. In general it is connected to a point on the H.T. battery. Now this screen at a positive potential modifies the valve characteristic, so that we have no longer the three-electrode valve with its sting removed (capacity nullified). In place of this we have a device which in the meantime for simplicity we can consider under certain conditions to send a constant current in its anode circuit when a constant voltage is applied between the control grid and the filament at varying frequencies. Referring to Fig. 2, V is the valve which operates in such a manner that the current through impedance Z is constant at all frequencies, *i.e.*, V is a constant current alternator. Suppose Z to be a pure inductance the impedance of Z increases directly with the frequency. If we plot Z against frequency we get a straight line, Fig. 3. Since the current is constant, the E.M.F. or voltage on Z is proportional to Z. Thus the voltage on Z increases with the frequency as shown in Fig. 4. The reader should observe that this argument is valid, however large the inductance may be, provided the internal resistance of the valve is very large. Reference will be made to this later on when discussing the difference between screen valves and three-electrode valves.

That the introduction of the screened valve will give rise to marked changes in receiver design is certain. It is therefore incumbent upon the amateur to grasp at this early stage the underlying principles upon which this new valve operates. He must understand wherein lies the merit and how a high degree of amplification combined with stability and improved selectivity may be brought about.

Fig. 5 shows the form of construction adopted in the new Marconi and Osram screened valve. The filament is "V" shaped and is identical with that of the well-known D.E.5. Surrounding the filament is the control grid of more or less usual construction. The two filament leads and the control grid are taken out to a three-pin socket at the same end of the glass envelope. Just beyond the control grid is situated a circular piece of metal gauze, this being the screen. Behind this screen the anode is placed, being invisible (except through the screen) owing to the "gettering" on the anode end of the glass. The connections to both screen and anode are brought out at the same end to a two-pin socket. Thus the control grid and anode leads are separated as widely as possible by being brought out from both ends of the valve. Incidentally this practice first arose in the design of power valves for short wave beam stations. Since the valve has pins on both ends the usual simple socket of the three electrode valve cannot be used. Thus screened valve replacement will not be so simple as with the three-electrode type.

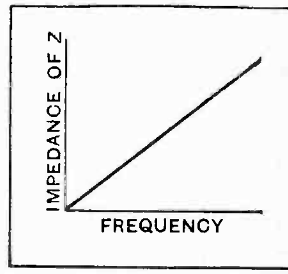


Fig. 3.—The impedance of a pure inductance increases directly with the frequency.

The screening is not perfect owing to the type of screen and the open mesh construction, but the anode-grid capacity is reduced to a fraction of a centimetre. If we assume a D.E.5 valve to have a capacity of 20 centimetres (including socket) and the screen valve a capacity of 0.08 centimetres, the ratio unscreened/screened is 250/1, which represents a great improvement.

Of course it must be realised that a perfect screen would prevent electrons getting to the anode. The open mesh allows the electrons to reach the anode more readily than a fine mesh, and this means a lower A.C. resistance but a higher mutual conductance. To get a very high *m* value, *both* resistance and mutual conductance must be large. This is clearly a problem in valve design.

Before entering upon a discussion of the application of screened valves in practice it is essential to study their characteristic curves. From these we can deduce within limits the performance of a circuit fitted with such valves. Having done this it is a simple matter to erect the circuit to test our theory. Fig. 6 shows the anode current-anode voltage curves for a screen voltage of +79 and

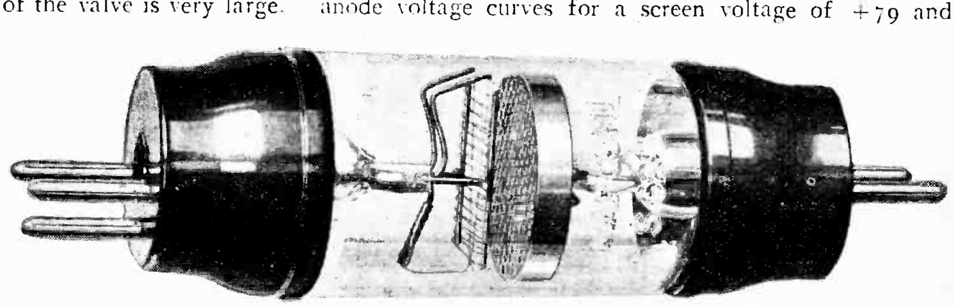


Fig. 4.—The new screened valve in the Marconi and Osram series type.

The New Screened Valve.—

various voltages on the control grid. The current at first rises sharply reaching a maximum value, after which it gradually decreases with increase in anode voltage. The slope at this portion of the curve is negative, so that between the points A and B the device has a negative A.C. resistance of approximately 70,000 ohms. If a suitable tuned circuit is connected from the positive of the battery to the anode, oscillations ensue provided the battery voltage is within the range AB. The centre of the straight portion is the most suitable place for the anode voltage. The condition for sustained oscillation is that the arithmetical value of the negative resistance shall be greater than the equivalent resistance of the tuned circuit at resonance (Fig. 7). This portion of the characteristic is due to the electron bombardment of the anode causing secondary electrons to be emitted therefrom, and these are attracted to the screen since it is at a higher voltage than the anode. Thus the electrons are attracted to and discharged from the anode simultaneously with a net loss in the anode current but a gain in screen current (see Fig. 6). As the anode

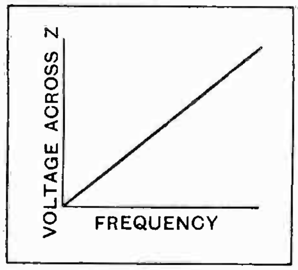


Fig. 5.—The characteristic or amplification curve for a screened valve with a pure inductance.

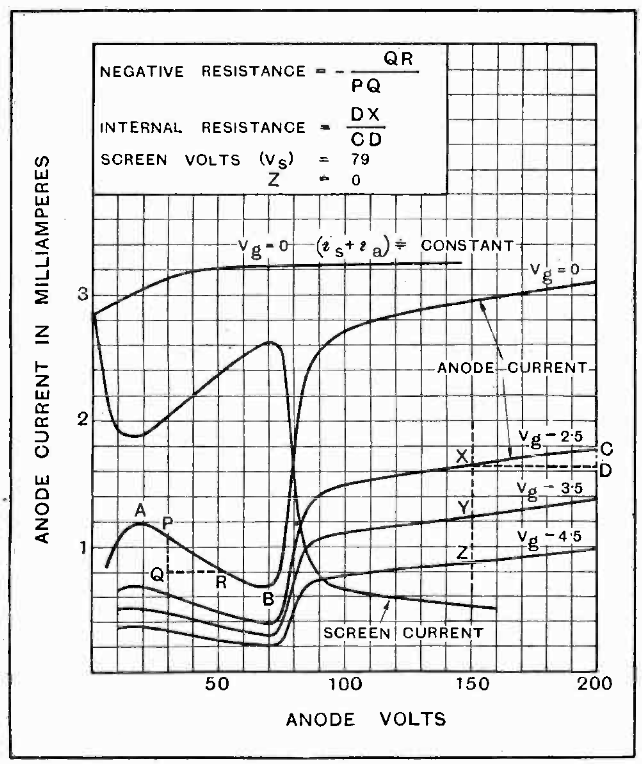


Fig. 6.—Characteristic curve of the Osram screen grid valve, showing anode current, screen current and total current for various values of anode voltage and a screen voltage of 79. The total current or electron emission is the screen current plus the anode current, $i_s + i_a$, which is substantially constant. The negative resistance $-\frac{QR}{PQ} = -7 \times 10^4$ ohms.

voltage increases the relative attraction of the screen grid for the electrons is reduced until ultimately the anode current increases after reaching a minimum value. At greater anode voltages the current rises abruptly, thereafter tending to reach a saturation value. It is this substantially linear portion of the characteristic which is used in practice. These quasi-linear portions of the curves for various grid voltages are almost parallel. As, however, the grid voltage becomes more negative, the change in anode current per grid volt change decreases. For example XY (Fig. 6) is greater than YZ.

We shall see later that for several volts swing on the control grid this introduces distortion. For high

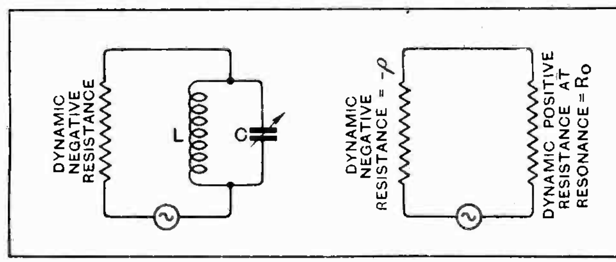


Fig. 7.—Illustrating the negative resistance effect of the screen grid valve. For oscillation $R_0 - \rho$ must be negative. At a frequency of a million (300 metres) oscillation will not occur with a low loss coil unless resistance amounting to a few times the coil resistance is added.

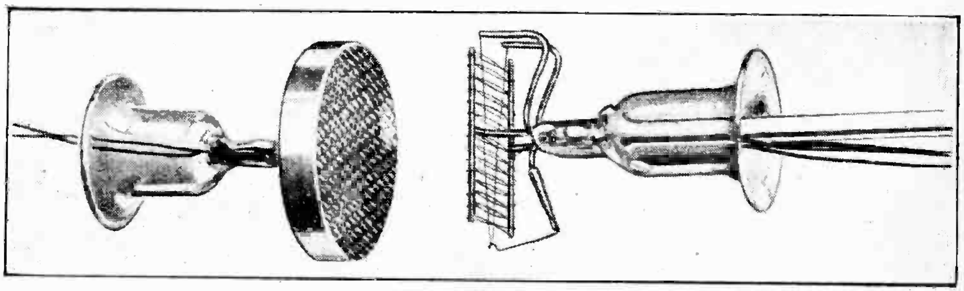
frequency work the valve is used in the vicinity of $V_g = -1$. The slope of the straight part of the characteristic, *i.e.*, $\frac{DX}{CD}$ is the valve A.C. resistance. At $V_g = 0$ it is 1.2×10^5 ohms, whilst at $V_g = -3.5$ it is 3×10^5 ohms. The ideal case would be when the characteristic curves were parallel to the horizontal axis. Under this condition the A.C. valve resistance would be infinite.

The change in anode current with grid voltage is the mutual conductance *g*. In Fig. 8 we have a mutual conductance curve showing the relation between anode current and grid volts for fixed screen and anode voltages. It will be seen that the relationship is curvilinear. Now the mutual conductance is the slope of the curve at any point. Since this varies from point to point it is clear that *g* cannot be regarded as a constant parameter, although it is substantially constant over a small part of the curve. It is this inconsistency of *g* which introduces distortion when the control grid swing is appreciable. For constant *g* the curve of Fig. 8 should be a straight line.

When the theory of the screened valve is examined we find that on the portion between 100 and 200 volts (Fig. 6) where the characteristic curves are nearly parallel lines there is no difference in the action between this type of valve and one with three electrodes. Any analytical difference which exists is merely one involving numerical values of internal resistance and magnification factor. In making this statement it is to be understood that the three-electrode valve would be neutrodyned to eliminate feed back by virtue of the electrostatic capacity between grid and anode.

The shape of the characteristic curves of a three-electrode valve in which anode current is plotted against anode voltage is indicated in Fig. 8a. The slope of the

The New Screened Valve.—lines is steeper than that of the screened valve, which indicates a lower internal reresistance for the three-electrode valve. Furthermore, the curvature of the lines of Fig. 8a is upwards, whilst that of a screened valve is downwards. Since we assume for purposes of calculation that the lines are straight, the only difference is the slope, *i.e.*, the internal resistance. This being the case we shall be on familiar ground if we forget the screen and carry on as before, but bearing in mind the altered valve parameters.



Arrangement of the electrodes showing the screen which surrounds the plate.

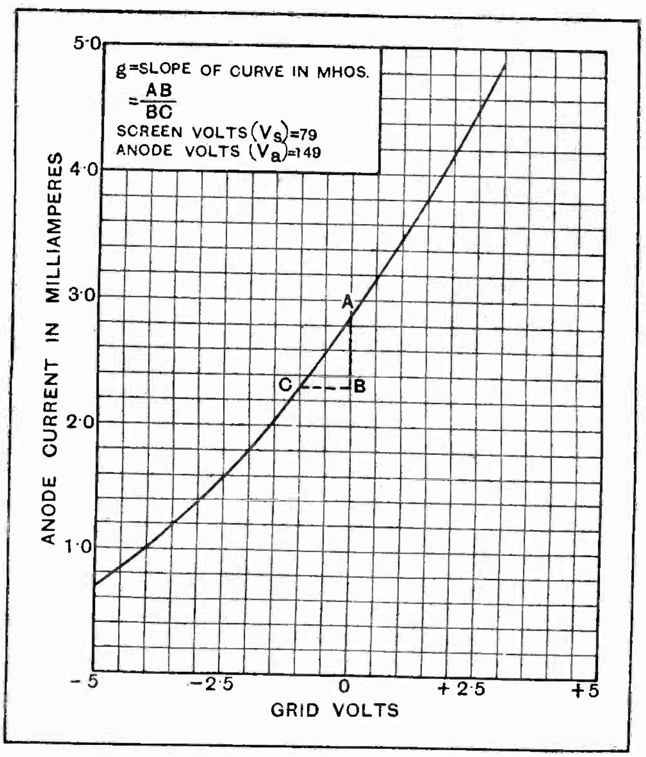


Fig. 8.—Curve showing the mutual conductance of the Osram screen valve.

The internal resistance of the screened valve varies with the grid bias, but has a value of about 1.2×10^5 ohms when the grid is at the same potential as the negative end of the filament. The magnification factor of the valve is found in the same way as that of a three-electrode valve. With the screened valve whose characteristics are shown in Fig. 6 the magnification factor varies with anode voltage and grid bias. When the bias is zero and the anode voltage 150 the magnification factor is about 70. This is about twice the value obtained with the present day three-electrode valve. For example, an Osram D.E.H. 610 has an *m* value of 40 and an A.C. resistance of 65,000 ohms, so that the higher *m* value of the screened valve is accompanied by a proportionately higher internal resistance. In other words, the ratio magnification factor/internal resistance is about the same for screened and for three-electrode valves.

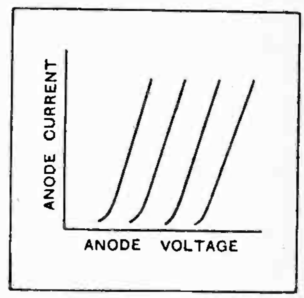


Fig. 8a. — Characteristic curves of three electrode valve for various values of grid bias. The curvature is opposite from that of Fig. 6 and the slope is much greater.

At the conclusion of this article in next week's issue a summary will be given clearly setting out the principles governing the operation of the screened valve as a high-frequency amplifier.

CATALOGUES RECEIVED.

Automatic Coil-Winder and Electrical Equipment Co., Ltd., Rochester Row, London, S.W.1. "Zeva" Electric Soldering Irons and Crucibles.

The Ever-Ready Co. (Great Britain), Ltd., Hercules Place, Holloway, London, N.7. General catalogue, 1927-28, of "Ever-Ready" dry batteries, accumulators, testing instruments, lamps, etc.

Van Raden and Co., Ltd., Great Heath, Coventry. List No. 1328, giving information and prices in respect of "Van Raden" accumulators for wireless work.

Siemens Bros. and Co., Ltd., Woolwich, London, S.E.18. Radio Battery Catalogue No. 650 (24 pages), containing general information regarding care and management of batteries for H.T., L.T. and grid bias.

The Formo Co. (Arthur Preen and Co., Ltd.), Crown Works, 22, Cricklewood Lane, London, N.W.2. Catalogue of "Formo" components for 1927-28 season.

Eelex, Eelex House, 118, Bunhill Row, E.C. Illustrated leaflet with prices of "Eelex" standardised plugs and sockets.

Wet H.T. Battery Co., 12, Brownlow Street, High Holborn, London, W.C.1. Price list of "Standard" Sac Leclanché wet H.T. and L.T. batteries.

H. Clarke and Co. (M/C), Ltd., Atlas Works, Old Trafford, Manchester. Folder No. 24, giving particulars of "Atlas" D.C. and A.C. battery eliminators.

Eric J. Lever, 33, Clerkenwell Green, London, E.C.1. Illustrated leaflet describing the "Trix" portable four-valve receiver.

C. S. Dunham, Elm Works, Brixton Hill, London, S.W.2. Catalogue of wireless instruments (9th edition) and loud-speakers.

HINTS and TIPS for NEW READERS

A Section Devoted to the Practical Assistance of the Beginner.

APERIODIC AERIAL-GRID TRANSFORMERS.

It is noticed that many amateurs fail to make the fullest possible use of the tapping points provided on the primary windings of aerial-grid transformers. In the majority of designs recently published in this journal it will be seen that either two or three of these tapping points are fitted, in such a way that different numbers of turns may be included in the aerial circuit.

The improvement of selectivity is probably the most important of the advantages gained by using a tapped winding; it will invariably be found that an unwanted transmission can most easily be eliminated by connecting the aerial to the point which will include the smallest possible number of turns in its circuit. This increased selectivity is often, however, obtained only at the sacrifice of signal strength. When maximum sensitivity, apart from selectivity, is desired, it is advisable to try the various tappings, remembering that a given primary inductance will be the best only over a limited waveband. Generally speaking, the number of turns should be reduced with the wavelength, and thus, with a three-tap winding, we use the lowest one for short waves, the intermediate for the middle of the scale, and join to the end of the winding for the longest wavelengths within the range of the set. These remarks apply particularly to such receivers as the "Everyman Four," the "Everyman Three," and the "Nucleus" unit.

Another advantage is gained by changing the aerial connection as suggested in the preceding paragraph; by following this plan it will be found that the dials of the condensers which tune the aerial-grid and H.F. transformers will tend to keep more closely "in step," thus facilitating searching for distant stations.

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A SIMPLE METHOD OF COMPARING CAPACITIES.

The intelligent wireless experimenter cannot go very far before he comes to the point where he finds that he wants to know the capacity of a condenser, either because he has to make one up for himself or has some old fixed condensers lying about the capacities of which he has not the slightest idea, or he may even have reason to doubt the capacity of a condenser as claimed by the maker. The elementary capacity bridge illustrated diagrammatically in the accompanying figure is so simple that almost any experimenter will have the necessary components to fix it up in a few minutes. The accuracy is, of course, not of a very high order, but it should be well within 5 per cent. Sometimes we are so much in the dark about the value of a fixed condenser that we should be glad to know whether it is nearer 0.01 mfd. or 0.001 mfd. The bridge illustrated consists of a straight bare piece of resistance wire AB about one yard in length stretched between two terminals A and B. A piece of 26 S.W.G. Eureka will do; the important thing is that it should be as uniform in thickness as possible. Across AB condenser C_1 and C_2 are connected in series, C_1 being a condenser whose capacity is sufficiently accurately known to warrant its being used as a standard, and C_2 being the condenser whose capacity is unknown and has to be measured. A buzzer F and a battery are also connected in series across the wire AB. A pair of telephones T is connected by one lead to the junction of C_1 and C_2, while the other telephone wire is pressed in good electrical contact with the resistance wire AB and is slid up and down it until a point P is found, when the note from the buzzer in the telephones practically disappears. This zero point P can generally be located quite definitely within half an inch. Measure the length AP and PB. The capacity of C_2 is then given by

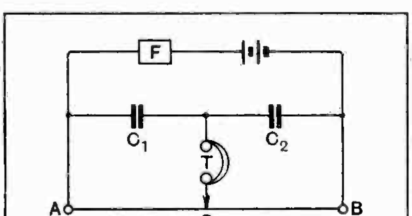

Fig. 1.—A simple capacity bridge.

$$C_2 = C_1 \times \frac{AP}{PB}$$

Of course this necessitates having a condenser C_1 in the first place whose capacity in microfarads is known, but we always must start from some standard in all methods of measurement.

The buzzer used should preferably have a steady high-pitched note, and if the buzzer itself emits much mechanical noise it is advisable to pack it in a box lined with soft material, otherwise the sound coming directly from the buzzer will confuse the sound in the telephones and make it impossible to decide upon the balance point.

It is very convenient to make the resistance wire exactly a metre or a yard in length and mount it on a long board alongside a wooden rule of the same length.

This method of measuring capacities is best adapted to condensers larger than 0.0005 mfd.

THE SWITCHING OF INDUCTIVE CIRCUITS.

THE electromagnetic field system of a modern loud-speaker brings to our notice a phenomenon which has been common knowledge to the electrical engineer for many years, viz., the energy which may be stored in an inductive circuit.

On closing the last switch in, say, the field circuit of a direct current dynamo, or the field coil of a loud-speaker or some such device containing iron surrounded by many turns of wire, the iron becomes magnetised and absorbs electrical energy during the process. Thereafter such energy as is absorbed by the circuit is only that required to overcome the resistance of the winding. Now, when we come to interrupt the current flowing the energy stored up in the field has to be dissipated; but electrical energy is basically the product of volts multiplied by amperes multiplied by time. By the rapid operation of a switch, the time factor is reduced and the current is made to diminish as rapidly as arcking will allow, hence a rise in the remaining factor, the voltage across the winding. This accounts for the pronounced arcking that will always be noticed at the switch contacts in these circumstances.

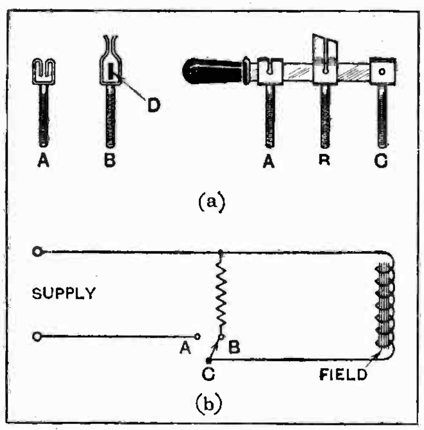

Fig. 2.—Safeguarding loud-speaker field windings.

Switching a six-volt loud-speaker field winding is not likely to produce a dangerous voltage rise, but switching a winding designed for 200 volts would be positively unsafe unless suitable provision were made to side-track or discharge the energy stored in the field.

The power engineer, in these circumstances, provides a non-inductive resistance, or approximately the same ohmic value as that of the winding, which is paralleled with the winding just prior to the interruption of the supply.

The actual design of the switch gear to perform this operation varies, but the principle involved, and, incidentally, a very simple way of rendering a normal switch suitable for this purpose, is shown in Fig. 2 (a).

Between the hinge contact C and the normal contact A is placed a contact B, which is so shaped that when the blade is right home in contact A it is not touching B. On withdrawing the blade, however, it comes into contact with B before leaving A, and remains so until clear of A. The diagram of connections for the arrangement is shown in Fig. 2 (b). From this it will be seen that when the supply is interrupted the "discharge" resistance is left across the field winding.

If one takes a single-pole, double-throw switch and rebends one of the outer contacts to the shape of B to comply with the above requirements, and fits it between the other outer contact and the hinge, a suitable switch will have been made.

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AN ELIMINATOR TIP.

THE presence of "hum" in a receiver fed from the mains is not infrequently due to the use of an unsuitable smoothing choke, the core of which may be magnetically saturated; under these conditions the component cannot fulfil its function properly. It is often possible to assure oneself as to whether the trouble is due to this cause by reducing very considerably the current fed to the set, either by the temporary substitution of an output valve of higher impedance, or by "over-biasing" this valve, and possibly others in the set, at the same time making a suitable reduction in the signal input.

If the hum is completely or almost completely eliminated by this change it may be assumed with some confidence that the choke is at fault.

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POTENTIOMETERS.

POTENTIOMETERS used either for adjusting the bias of a detector valve or an H.F. valve should be shunted with a condenser of about 0.1 μF. capacity. The figure shows how this may be done. Most potentiometers sold for this purpose have a resistance of several hundred ohms and may introduce losses sufficient to cause a slight reduction of signal strength and sharpness of tuning unless a suitable by-pass of low H.F. impedance is provided. Paper condensers are quite good enough for this purpose.

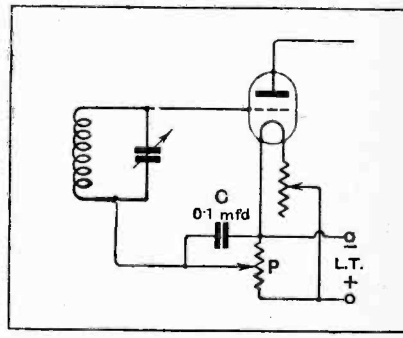

Fig. 3.—An H.F. by-pass condenser (C) connected across a potentiometer.

Even if the resistance of the potentiometer is too low to introduce serious losses its inductance will almost certainly be sufficient to upset the tuning slightly when adjustments are being made with it. The by-pass condenser is therefore desirable in any case.

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COUNSELS OF PERFECTION.

THE beginner must often feel that there is a tendency on the part of the expert to over-emphasise the need for attention to the small details of his wireless receiver, as he not infrequently finds that the temporary omission of something which he has been led to believe is essential makes no perceptible difference to results. The whole matter is really bound up in the inability of the human ear to record slight changes both in intensity and quality, and in the fact that the effectiveness of even the simplest receiver is dependent on the correctness of a large number of details. The difference in performance, whether any one of these is right or wrong, may very possibly not be noticeable, but the overall gain when three or four minor defects are remedied will be clearly evident. In the long run it pays to study the small details.

EXPERIMENTING WITH THE MAINS.

There seems to be an increasing tendency amongst wireless experimenters to use the domestic electric supply mains for various purposes, chief of which are the provision of H.T. supply and the charging of accumulators. This is highly convenient and also very cheap, but there are one or two precautions which must be observed in the interests of one's own apparatus and person and the supply system. First, and perhaps most important, never earth either of the main wires directly or through any conducting circuit. One side of the mains is definitely earthed by the supply company at the generating station or sub-station, but this does not mean that it is safe to connect it to earth at any other point; in fact, this is expressly forbidden. In the case of an A.C. supply this need not give us any serious trouble as we can work through a suitable transformer having a secondary completely insulated from the primary. Since only the primary is connected to the mains, the secondary may be connected to earthed apparatus with impunity. Care must of course be taken to avoid short-circuits on the secondary as much as on the primary side. Never use an "auto-coupled" transformer, *i.e.*, one in which the primary and secondary are connected together, as it will probably introduce serious complications.

Advantages of Loose Couplings.

With the D.C. mains, however, some careful thinking is necessary as our circuits have to be connected directly without the interposition of any safeguarding device of the nature of a transformer. The most common difficulty is that which arises when we wish to use the D.C. mains as a source of H.T. for a set and still to use an ordinary earth. The best way out of the difficulty is to use a loose-coupled aerial circuit. It is most important that no part of the aerial circuit should be connected to the rest of the receiver. Loose-coupled sets are sometimes made with a connection between the earth terminal and the common L.T. and H.T. leads of the receiver itself; this connection is not permissible when H.T. is being derived from the D.C. mains. Moreover, it is important to see that short-circuits are not possible through the aerial coil and closed-circuit coil touching if an adjustable coil-holder is used. The method in which a condenser is connected in series with the earth lead affords suitable protection if the condenser is a sound one, but does not overcome the difficulty which exists when there is a difference of potential between the "mains earth" and that of the receiver.

In connecting any experimental apparatus to the mains for the first time it is a very desirable precaution to insert a safety resistance in series with the supply, as shown in Fig. 4. This resistance may conveniently be a 60-watt lamp and should be inserted in the "live" main, *i.e.*, the one which is not nominally earthed by the company. If there is any doubt as to which of the main wires is on the earthed side, insert a lamp in each lead. Very little harm can occur under these circumstances even if there is a short-circuit in the apparatus being tried, as the lamps will limit the current to a safe value. When it is perfectly certain that the apparatus is going to work safely on the full mains voltage the safety lamps may be cut out, but it is still a good plan to insert in place of the lamp a fuse-block containing a piece of fuse wire which will blow at a current slightly in excess of the maximum current likely to be required for the experiment. This will save the house fuses and localise any mishaps to the room where the experiments are being made. These remarks about the use of safety resistances apply both to A.C. and D.C. mains. In the case of A.C. mains where a transformer is used the safety lamp should be connected in the primary circuit of the transformer, *i.e.*, the side connected to the mains, and not in the secondary.

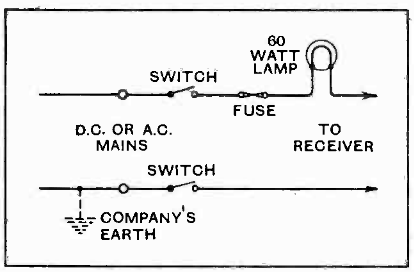


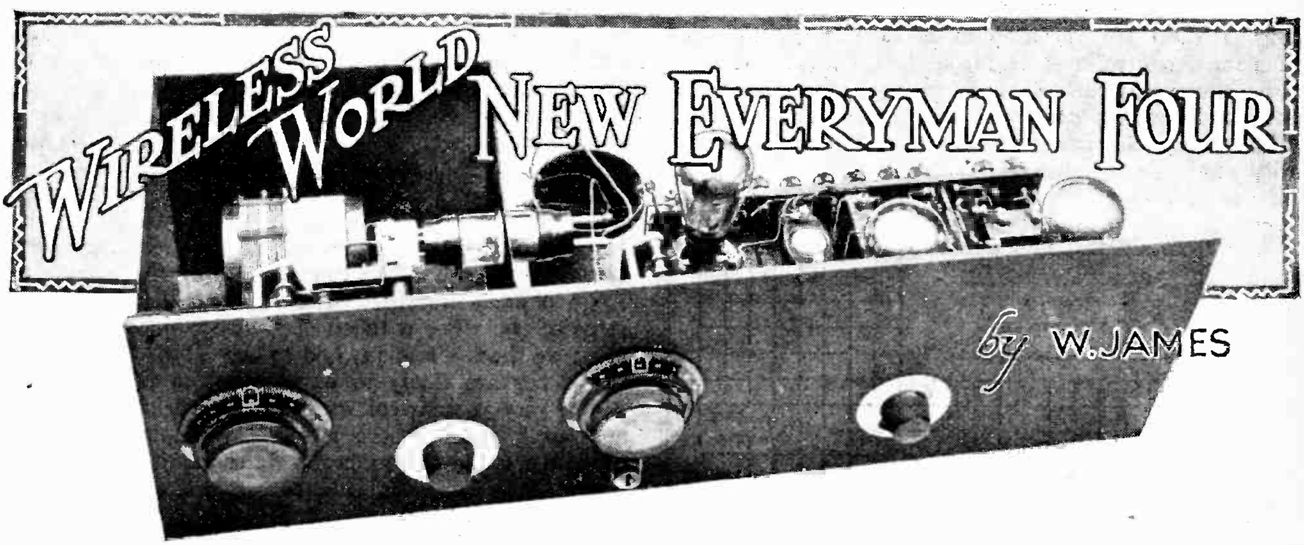
Fig. 4.—Safety devices are recommended when experimenting with the mains.

The other important precaution necessary in working with the mains is the avoidance of personal contact with live wires. The provision of a switch in the live main, or, better, a double-pole switch allowing the disconnection of both wires, permits the current to be cut off every time it is required to handle the high-voltage parts of the apparatus for alterations or adjustments. It is well to remember that electric shocks are particularly severe when obtained through moist fingers, so that particular care is necessary in experiments involving the use of liquids or electrolytes. Wireless experimenters have to exercise particular caution in the case of D.C. mains in which the positive side is earthed. If such mains are used to supply H.T. to a wireless set, the anodes of the valves will be at practically zero potential with respect to earth, while the filament batteries, etc., will be at full mains voltage above earth. It is therefore possible for the user to receive a nasty shock if he touches any part of the filament circuit while he is in any way in contact with an earthed conductor. The use of the D.C. mains in such a case is not, however, by any means precluded. It is necessary only to realise fully this possible source of trouble and insulate accordingly. For instance, under these conditions the copper or aluminium screens used in many modern H.F. receivers will be at some 200 volts above earth potential, and, to minimise the risk of shocks, it is as well to give the metal-work a thick coating of insulating varnish.

Testing for Polarity.

It is always well to ascertain which of one's main wires is earthed and which is alive. This is easily done with an ordinary "Osglim" neon lamp in the case of mains having a voltage of 200 or more. The neon lamp will light when connected between the live main wire and any ordinary earth connection, but, of course, it will not light when connected between the earthed main and earth. The small momentary earth current of a few milliamperes occasioned by this test will not matter.

If these simple precautions are observed there is no reason why the lighting mains should not be pressed into use for a multitude of purposes with safety.



Incorporating the New Screened Valve.

THOSE who have investigated the subject of instability in radio frequency amplifiers recognise two totally distinct causes; one is the back coupling provided by the valve and its holder, while the second is the coupling due to adjacent coils and tuning condensers and the effects of connecting wires, common batteries, and so on. In other words, there are two prime causes—one due to the valve, and the other to its circuit.

Experience has shown that it is of very little use minimising one of these stray couplings without minimising the other. Stability cannot be obtained by attending to the tuning apparatus and the circuit as a whole, and ignoring the valve coupling, neither can it be obtained by neutralising the valve coupling and failing adequately to deal with the circuit. This is where so many designs have failed.

Details of the New Valve.

In the "Everyman Four" receiver which I described in this journal over twelve months ago, stray circuit couplings were minimised by properly arranging the parts and by screening, while valve back coupling was neutralised by a special circuit arrangement. Thus the two causes of instability in radio-frequency amplifiers were dealt with in a manner sufficient for the correct functioning of the receiver.

High and uniform amplification was obtained with complete stability.

We have explained that instability may be due to the valve or the circuit. It would, therefore, appear that if a valve could be produced which had a negligible self-capacity (anode-grid) the problem of how to obtain satisfactory radio-frequency amplification would be vastly simplified. We were, therefore, extremely interested when samples of the new Marconi and Osram shielded valve came to hand, for this valve is supposed to be so constructed that its grid-anode capacity is negligible under working conditions. The valve has a normal D.E.5 filament and the usual wire grid, which are assembled on a glass foot placed at one end of the tubular bulb. At the other end of the bulb is another glass foot which carries a circular metal plate with dished edges (anode) and a wire mesh with an outer ring, as shown by the illustration. We therefore have a valve with three contacts (filament and grid) at one end and two contacts (screen and anode) at the other end. We tested this valve by applying 5 volts to its filament, positive 78 volts to the screen, and the usual range of grid and anode voltages.

From the figures which we obtained the curves of Figs. 1 and 2 were prepared. The top two curves of

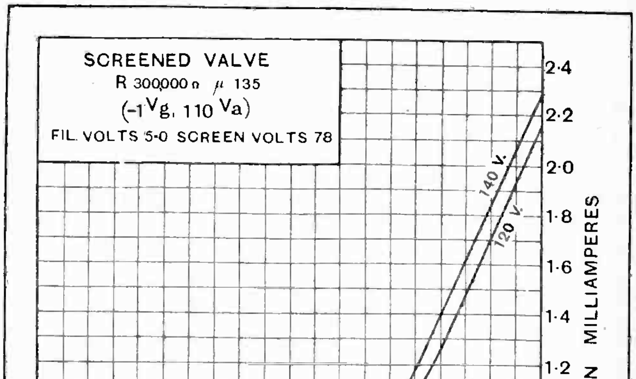


Fig. 1.—Variation of anode current and screen current with grid bias

Wireless World New Everyman Four.—

Fig. 1 show the variation of anode current with grid bias for anode voltages of 120 and 140, whilst the lower curve shows how the screen current changed whilst taking the anode current curve for 120 volts. The curves of Fig. 2 show the variation of screen and anode current with anode voltage for two grid bias values, as marked on the curves.

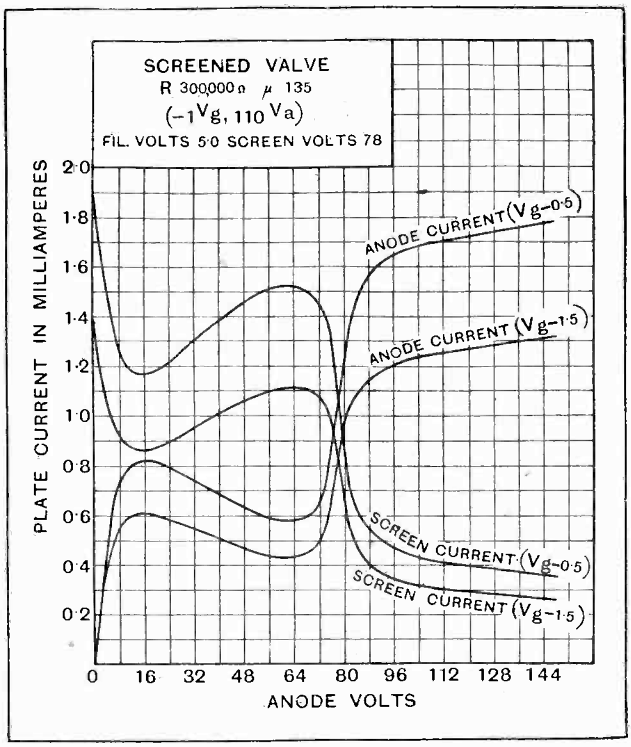


Fig. 2.—Variation of anode current and screen current with anode voltage.

At the moment we need not pause to consider the peculiar shape of the curves, as we are interested in the relatively flat part corresponding to the higher anode voltages. We are limited to the fairly flat part when amplifying, and, in fact, for a grid bias value of negative 0.5 volt, a suitable anode voltage is 120 to 130. Under these conditions we can tolerate a swing in anode voltage of about 40—that is, 14 volts R.M.S. for a sine wave, and as we are not likely to want to exceed this in practice we need not consider the matter further.

From the curves it is easy to find that the valve's voltage factor and anode impedance vary widely according to the particular voltages used. Average values would be 110 and 175,000 ohms. From these figures we see that this is no ordinary valve; the valve's voltage factor and impedance are much larger than is usual. We therefore have to enquire as to how best we can utilise the valve in order to obtain the highest magnification per stage.

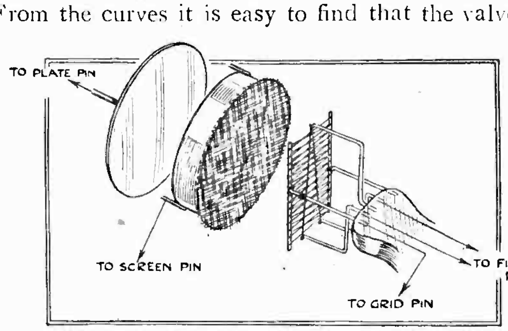


Fig. 3.—Arrangement of the electrodes of the new Marconi and Osram Screened Valve.

If we connect a simple tuned anode circuit to the valve's anode in the usual way we shall obviously obtain a magnification depending on the effective resistance of the circuit at the frequency considered. If this amounts to 175,000 ohms we shall obtain an amplification for one stage of 55. For a tuned anode impedance of 350,000 ohms we shall obtain 73, and so on. But what values of impedance are likely to be obtained in practice?

One very popular coil of 200 microhenries has a resistance of 5 ohms at 500 meters. With this coil and a condenser tuned to 400 meters we shall, therefore, obtain

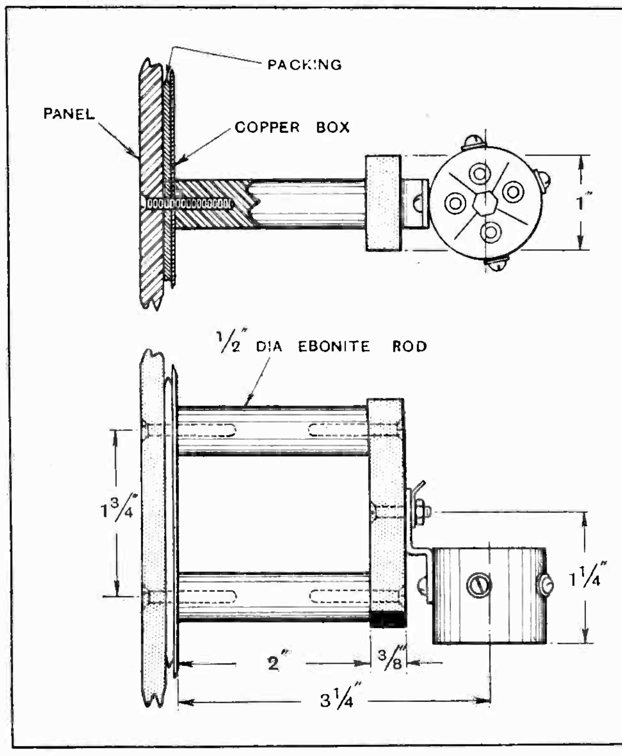


Fig. 4.—Valve support, comprising a porcelain valve holder mounted on an ebonite platform.

56. So much for the tuned anode circuit; we see that it is easy, *theoretically*, to obtain high amplification.

Those who have an "Everyman Four" receiver have a high-frequency transformer whose secondary has an effective resistance of about 350,000 ohms under working conditions, and the question might well be asked as to whether transformer coupling does not offer advantages as compared with the tuned anode. From the theoretical point of view, such a transformer can be made to give an even greater amplification for the stage, but the ratio will not be very great. When this optimum ratio is used, however, the amplification will be about 77. We can, therefore, successfully use a transformer to obtain enhanced magnification.

Wireless World New Everyman Four.—

There is now the question of selectivity. Which is better, a transformer or the plain tuned anode? Clearly a transformer will give the best selectivity, for, whereas a tuned anode has, in effect, a damping resistance equal to the valve's anode impedance connected across it, a transformer has this impedance across the primary only, and the secondary is not so heavily damped because of the turns ratio employed. We therefore score in amplification and selectivity by employing a properly designed high-frequency transformer, and we also save the expense of a grid condenser and leak.

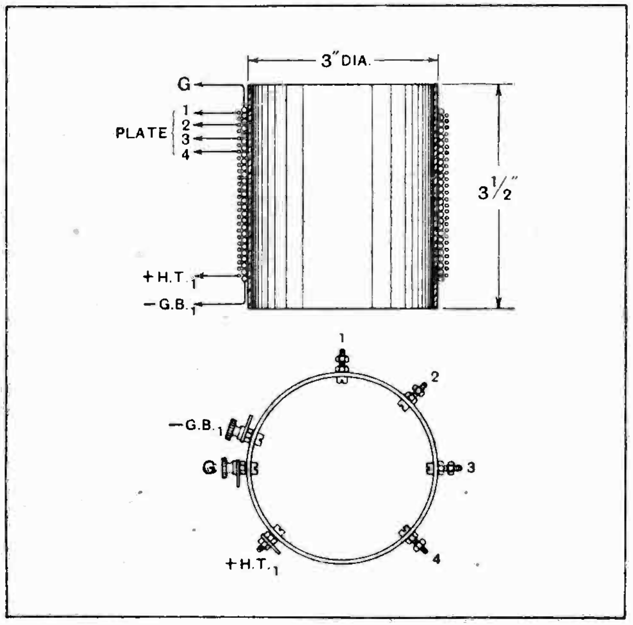


Fig. 5.—Winding details of the intervalve transformer. Terminal G and screws 1, 2, 3, 4, are at the upper end of the coil; terminals $-GB_1$ and $+H.T._1$ are at the bottom. The secondary has 68 turns of 27/42 Litzendraht, and the primary comprises 68 turns of No. 40 D.S.C., tapped at 38, 48, and 58 turns.

Passing on to practical considerations, since this is presumably no place for discussing theoretical principles, we have to determine by experiment whether the valve is so perfectly shielded, and whether the circuit itself can be so arranged, as to prohibit feed back entirely, or whether the minute coupling which remains in spite of all precautions is sufficient to cause self-oscillation when high impedances are connected to the anode and grid circuits.

Tests show that the valve is not perfect in this respect by any means, even with complete shielding, and oscillation can easily be produced by connecting an "Everyman Four" type secondary winding and a tuning condenser to the anode circuit. We have, therefore, to modify our ideas as to the magnification obtained, for with the values which were given above self-oscillation is always produced when the aerial-grid coil is the standard "Everyman Four."

A New H.F. Transformer.

We can, of course, obtain stability by using less efficient coils if we so desire—but at the expense of amplification. What we have to do is quite evident—we have to cut down the voltage variations of the anode. Using our standard "Everyman Four" type of coil we can arrange for this by reducing the number of turns in the primary from the optimum value mentioned above, to a value which will allow of complete stability. We have therefore designed a transformer having the usual Litzendraht secondary of 68 turns of No. 27/42 wire, and provided a primary of No. 40 gauge wire. The primary winding is tapped as in Fig. 5 for three reasons: First, valves vary, some having a very much higher anode impedance than that given above; secondly, different aerials

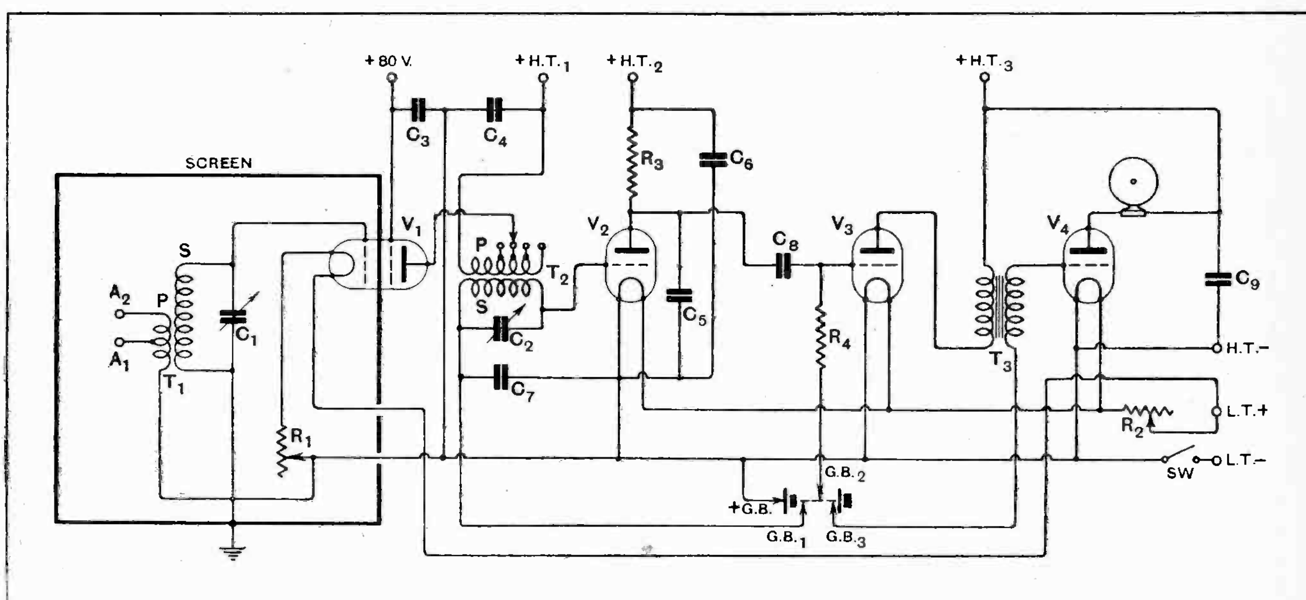


Fig. 6.—Circuit diagram. T_1, "Everyman Four" type aerial grid transformer, but preferably with a 75 turn secondary; T_3, special high frequency transformer; T_3, Ferranti A.F.3; C_1, C_2, ·0003 mfd.; C_3, C_4, C_6, C_7, 1 mfd.; C_5, .0005 mfd.; C_9, 2 mfd.; R_1, 10 ohms.; R_2, 2 ohms.; R_3, R_4, C_8, R.I. Varley resistance capacity unit; V_1, Marconi shielded valve; V_2, V_3, Cossor 610 H.F.; V_4, Marconi D.E.5a.

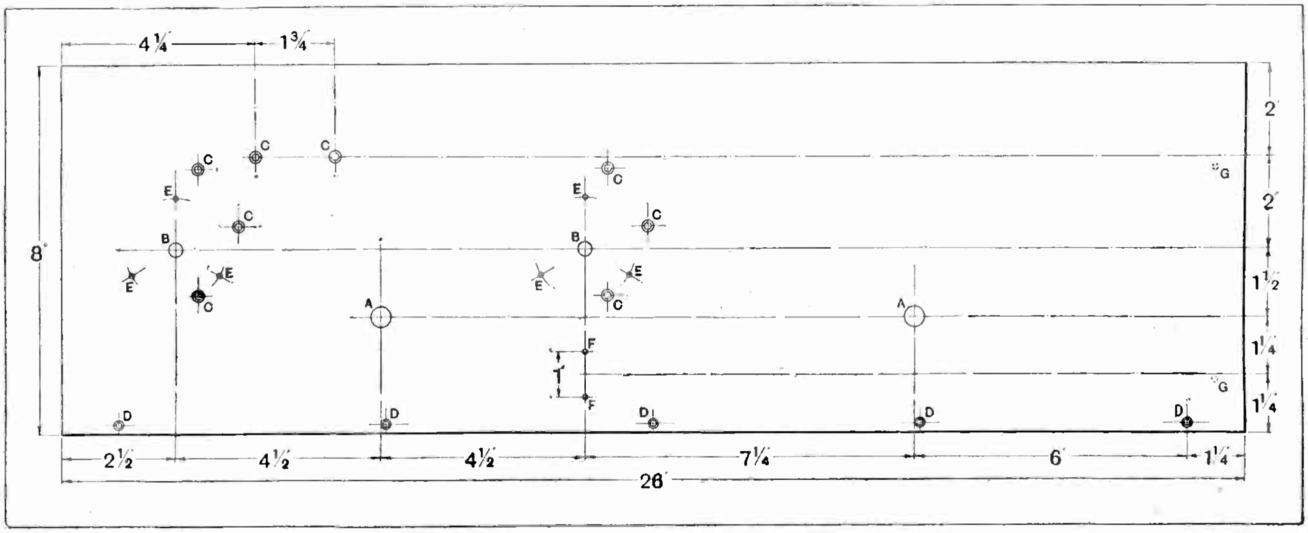


Fig. 7.—Details of ebonite front panel. The holes have the following diameters:—A, 7/16in. dia.; B, 5/16in. dia.; C, 5/32 dia. countersunk for No. 4 B.A. screws; D, 1/8 dia. countersunk for No. 4 wood screws; E, tapped holes for dials; F, 3/32 dia.; G, tapped 6 B.A. + 1/8in. deep.

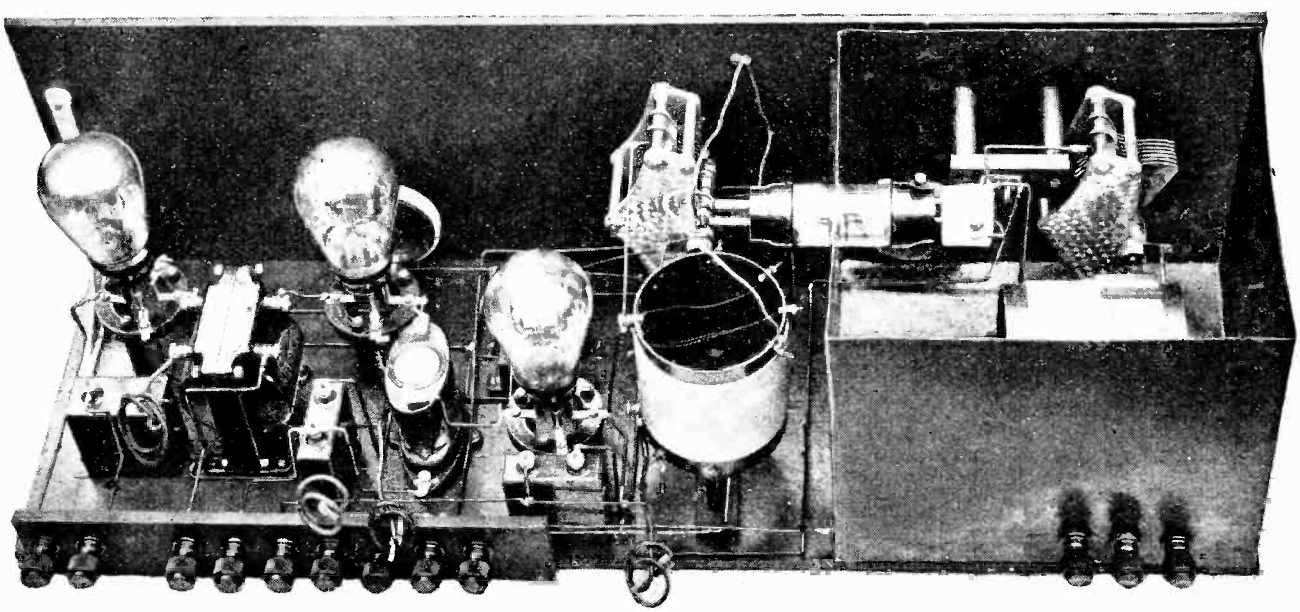
have different damping effects on the aerial-grid coil, and so for a given high-frequency transformer the tendency to oscillate will be much greater when a small aerial is used; thirdly, the most desirable degree of selectivity will depend on where the set is to be used. Those who live relatively near a broadcast station thus have a means for improving the selectivity of the set.

The position with regard to the new Osram and Marconi shielded valve is, then, that it is not a truly unilateral amplifying device, although it is nearly so. Because of this there is a definite limit to the amount of amplification which can be obtained per stage without oscillation. However, by proper design we profit by our loss, as it were, and gain in selectivity as we reduce the amplification from the theoretical optimum to the practical maximum at a given wavelength.

As to the actual magnification which can be obtained for the stage, we have to distinguish between pure magnification and the total magnification compounded of circuit amplification and regeneration.

Tests show a total amplification of about 35 for the stage; this includes a certain amount of gain through regeneration, but not the total amplification which would be obtained by so adjusting the circuit as to be just off the oscillating point. This compares with a pure radio frequency magnification of 40 for a standard "Everyman Four" coil, which is increased by a considerable amount by the regenerative contribution obtained when the balancing condenser is carefully adjusted.

Before leaving the theoretical side of the subject we would point out that the amplification obtained with the new valve and a given anode circuit will depend upon



A general view showing the arrangement of components

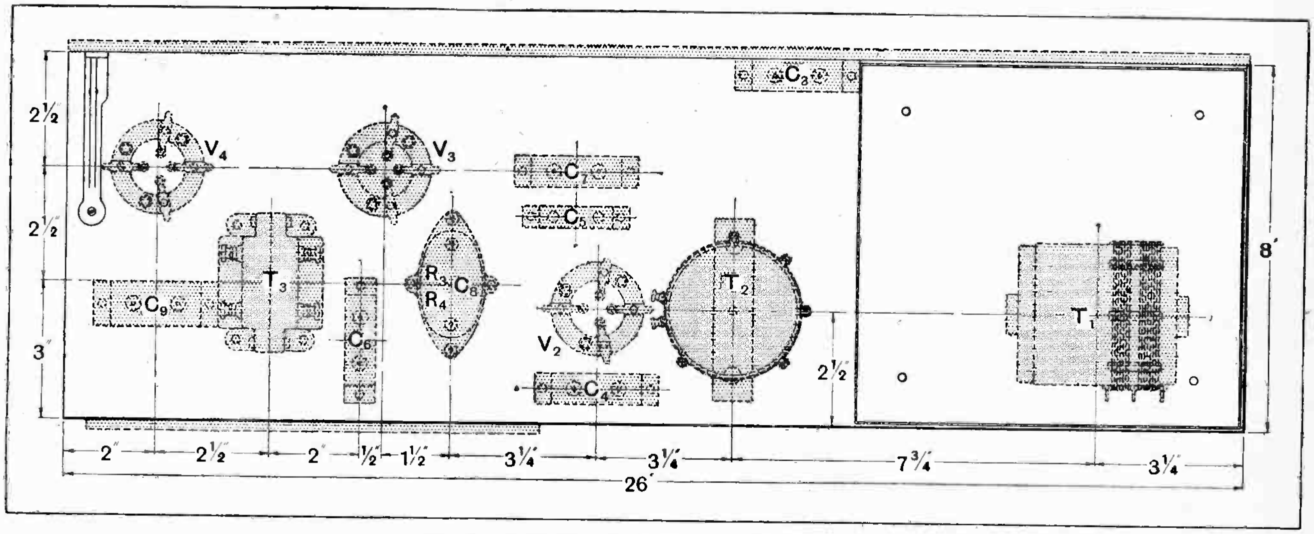


Fig. 8.—Arrangement of parts on the baseboard

the wavelength. Normally, the impedance of a tuned circuit decreases as the wavelength is increased, in other words, the amplification falls off at the longer wavelengths for a given coil and tuning condenser. The extent to which this happens depends entirely on the components used, and can be minimised by careful coil design.

The construction of the receiver illustrated here follows closely the lines of the original "Everyman Four."

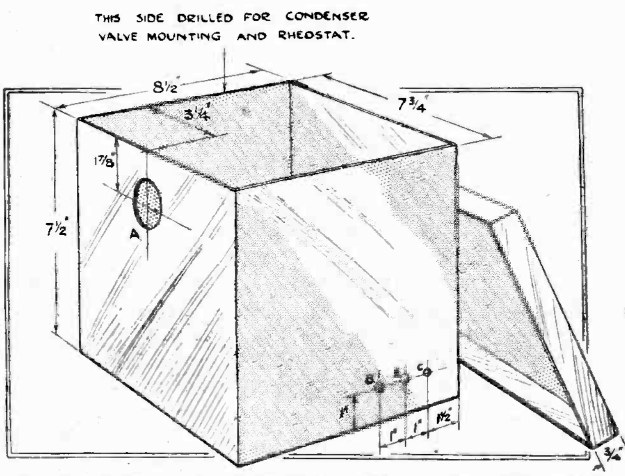


Fig. 9.—The copper screening box, with holes for terminals, connecting wires, valve, and the tuning condenser and volume control. A, hole 1⅜in. dia. for valve; B, holes 3/8in. dia. for ebonite bushes to take aerial terminals; C, hole 7/32in. dia. for earth terminal.

The circuit is given in Fig. 6. A standard "Everyman Four" aerial-grid coil T_1 tuned by an 0.0005 mfd. condenser C_1 is used to couple the aerial and the H.F. amplifying valve V_1. These are completely enclosed in a copper box, with the result that the inductance of the coil under working conditions is reduced. This coil should therefore have an extra 5 turns wound on its secondary if its wavelength range is to coincide with that of the high-frequency transformer. At the back of the copper box three terminals for the earth and aerial are provided. The earth terminal is fastened direct to the copper box so that the box is earthed, but the two aerial terminals have to be insulated by means of small ebonite bushes.

At the front of the set will be seen the aerial tuning condenser and the filament rheostat R_1 for valve V_1. These two items are mounted direct on the panel and are therefore in contact with the copper box, but it should be noted that a packing piece, of cardboard, is placed between the panel and the box in order that the lid of the box can be put on.

In Fig. 4 will be found details of the valve support. This comprises an Athol porcelain valve-holder and a platform which can be made of ebonite or wood. This is also screwed to the front panel, the screws passing through the panel, packing piece, and box.

Referring to Fig. 6 again, it will be noted that the rheostat R_1 is connected to the negative side of the filament battery, and that the box is connected to earth and negative L.T. along with one side of the tuning condenser and tuning coil. The grid of valve V_1 thus has a negative bias equal to the fall in voltage across rheostat R_1. This rheostat can therefore be used as a volume control since it will cut down amplification by increasing the impedance of the valve as more of it is included in the circuit. This form of volume control is very convenient, and incidently provides the grid of the valve with its negative bias.

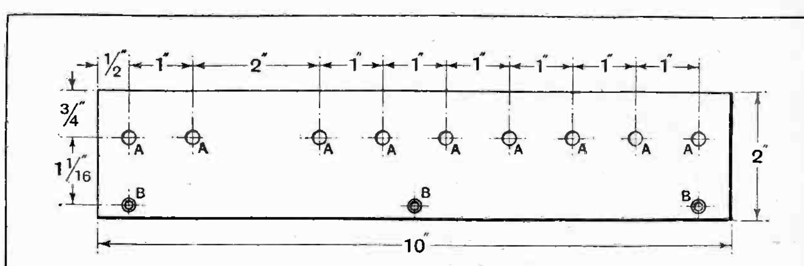


Fig. 10.—The ebonite terminal strip. A, 7/32in. diam.; B, 1/8 in. diam.

LIST OF PARTS.

2 Tuning condensers, 0·0003 mfd. (Igranic Elec.).
2 Ethovernier dials (Burndept).
3 Valveholders (Bowyer-Lowe).
1 Valveholder (Athol).
1 Rheostat, 10 ohms (Burndept).
1 Rheostat, 2 ohms (Burndept).
4 Fixed condensers, 1 mfd. (T.C.C.).
1 Fixed condenser, 2 mfds. (T.C.C.).
1 Fixed condenser, 0·0005 mfd., No. 620 (Dubilier).
1 Inter-valve transformer, 3½ : 1 A.F.3 (Ferranti).
1 16-volt G.B. battery, "Ever Ready" (Portable Elec. Lt. Co., Ltd.).
1 Bi-duplex wire-wound resistance-capacity coupler, type B (R.I. & Varley).
2 Paxolin tubes, 3in. × 3½in. (Micanite and Insulators).
50 yards Litz wire (P. Ormiston & Sons).
1 Copper box, 8½in. × 7¾in. × 7½in.
1 "Camco" aluminium bracket (Carrington Mfg. Co.).
1 "Camco" cabinet, 26in. × 8in. × 8in., oak (Carrington Mfg. Co.).
1 Ebonite panel, 26in. × 8in. × ¼in.
1 "Wearite" on-and-off switch (Wright & Weaire).
12 Ebonite shrouded terminals (Belling & Lee).

In the "List of Parts" included in the descriptions of THE WIRELESS WORLD receivers are detailed the components actually used by the designer, and illustrated in the photographs of the instrument. Where the designer considers it necessary that particular components should be used in preference to others, these components are mentioned in the article itself. In all other cases the constructor can use his discretion as to the choice of components, provided they are of equal quality to those listed and that he takes into consideration in the dimensions and layout of the set any variations in the size of alternative components he may use.

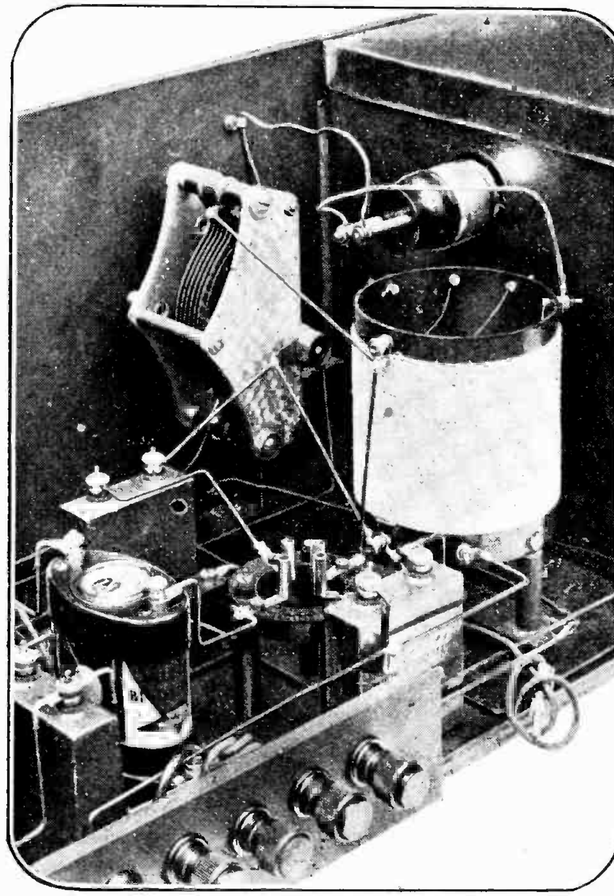
Connected between the special amplifying valve V_1 and the detector is a high frequency transformer. This is shown in Fig. 5. The secondary winding is a standard "Everyman Four" secondary having 68 turns of No. 27/42 high frequency cable, but wound on with the high frequency cable is a single strand of No. 40. To wind this coil, one end of the high frequency cable is soldered to the terminal marked $-GB_1$, while one end of the No. 40 wire is soldered to the screw marked $+H.T._1$. The two wires are then wound on together so that the fine wire primary lies in the space between the turns of the high frequency cable. When 38 turns have been wound a small hole should be drilled in the paxolin former and the fine wire primary passed through it and soldered to the screw marked 4 in the diagram. The two windings are then continued for another 10 turns, when once again the primary wire is passed through a small hole in the former and soldered, this time to the screw marked 3. A further 10 turns are wound and another tapping is taken from the primary, and finally, when the full 68 turns have been put on the end of the high frequency cable is connected to the terminal marked G, while the end of the primary is taken to the screw marked 1. Thus the transformer is very easily constructed and is highly efficient. It is supported in the same way as the standard "Everyman Four" coil.

The diagram shows a 1 mfd. by-pass condenser connected from the grid bias terminal of the coil direct to the filament of the detector, and also a condenser between the screen terminal of the valve and its filament. These condensers are necessary for stability.

The remainder of the circuit is straightforward, a resistance-capacity unit being employed between the detector and first L.F. stage with a transformer coupling between the first L.F. stage and the power stage. The values of the components used are given in the caption to Fig. 6.

When the parts have been arranged as in Figs. 7 and 8 the wiring should be done. Notice that the filament switch is so connected that it switches "off" and "on" all four valves, while rheostat R_1 is connected to the first valve only and rheostat R_2 to the remaining three valves. Covered wire should preferably be used with flexible wires for connecting to the anode and screen pins of the H.F. valve.

These two flexible wires are each connected to a valve socket, which affords a simple means of making contact with the anode and screen valve pins.



Close up view showing clearly the H.F. stage.

With the set wired, put one of the special amplifying valves in the H.F. position and connect the anode and screen wires. In the detector position put a valve of moderate impedance, such as the Cossor 610 H.F. valve, which has an amplification factor of 20 for an impedance of 20,000 ohms, or, when the utmost sensitivity is required, put an R.C. valve in this position. At V_3 use a

Wireless World New Everyman Four.—
valve having an impedance of about 20,000 ohms or less, and in the output stage a power valve such as a Marconi D.E.5.

they provide a further adjustment of signal strength and selectivity. Once the best tapping on the primary winding of the high frequency transformer has been found, tuning will be remarkably easy, since with the volume

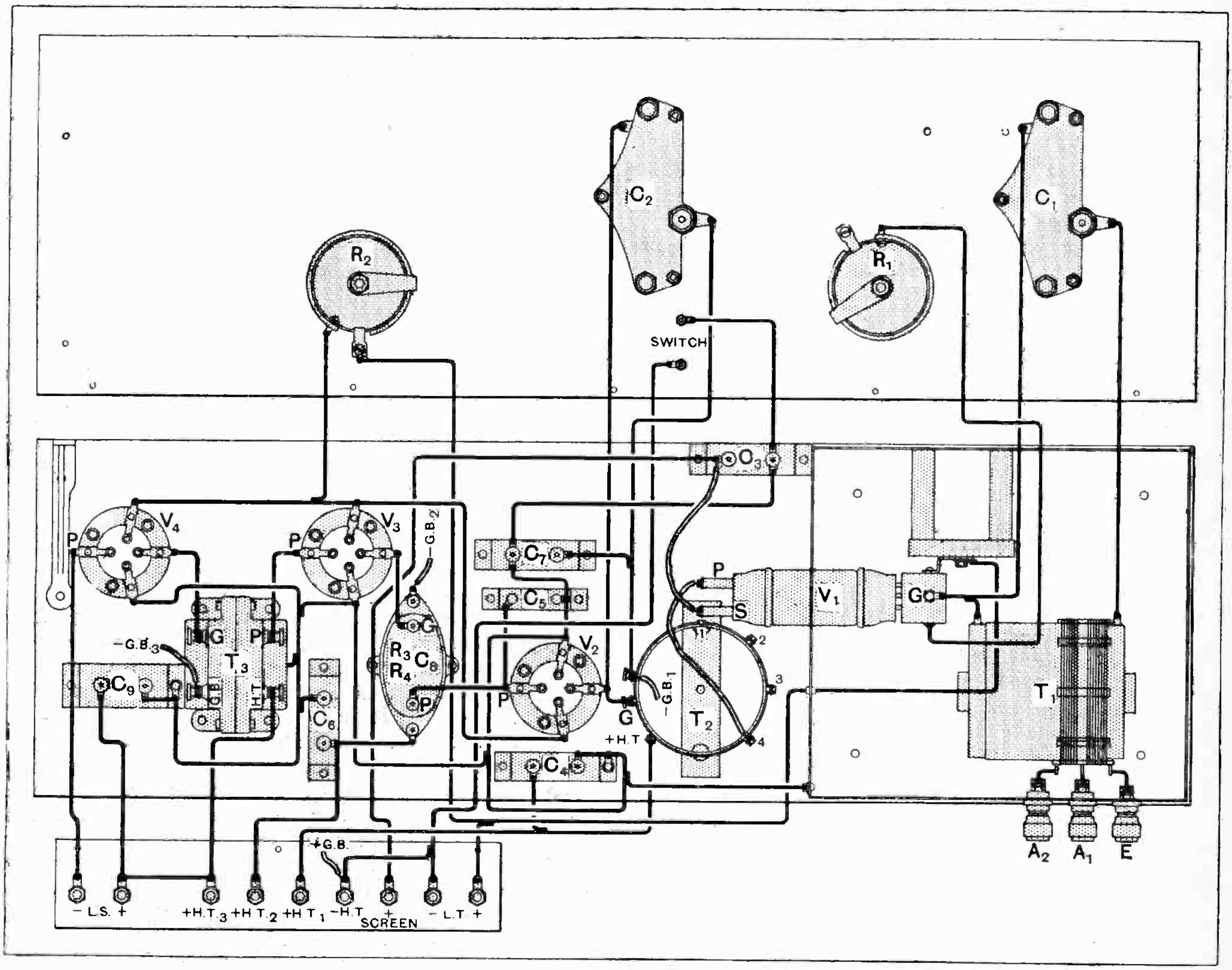


Fig. 11.—Wiring diagram.

A battery of 120 volts can then be applied to $+H.T._1$ and $+H.T._3$; +80 volts should be connected to the screen of the H.F. valve, and the best voltage for the detector at $+H.T._2$ will have to be found by experiment. The detector valve will normally have a grid bias of negative $1\frac{1}{2}$ volts with −3 volts for the first L.F. stage and about −15 volts for the power stage.

The stations are tuned-in in the usual way, but the following points should be noted; with the volume control rheostat turned nearly full on the tendency of the set to oscillate increases as more of the primary is included in the anode circuit of valve V_1. The amplification also increases so that under a given set of conditions the best results will be obtained with a certain proportion of the primary connected. This will have to be found by experiment as it will depend upon the particular valve used and the aerial-earth system.

The alternative aerial tappings are extremely useful as control the amount of regeneration can be carefully adjusted.

TRANSATLANTIC TELEPHONY.

Two-way Working on a Single Wavelength by Means of Speech-controlled Relays.

By OUR AMERICAN CORRESPONDENT.

IN the issue of this journal of June 15th, 1926, a description appears of the apparatus and methods in use at the American end of the transatlantic wireless telephony circuit. At that time experiments were still in progress, and there was no immediate prospect of a public service being opened on a commercial basis. Early in January of this year, however, the transatlantic telephone service was officially thrown open to the public, and is now in regular daily operation.

Many important changes have been made since the above-mentioned description appeared in these pages, not the least interesting of these being the shifting of both the American and British transmitters on to a common wavelength, which is about 5,600 metres.

During the initial experiments two different wavelengths were employed, and these were varied somewhat from time to time, with the object of finding those best suited to operating conditions. The Rugby transmitter was then on a wavelength of about 5,770 metres, whilst the American transmitter at Rocky Point, Long Island, was on 5,260 metres.

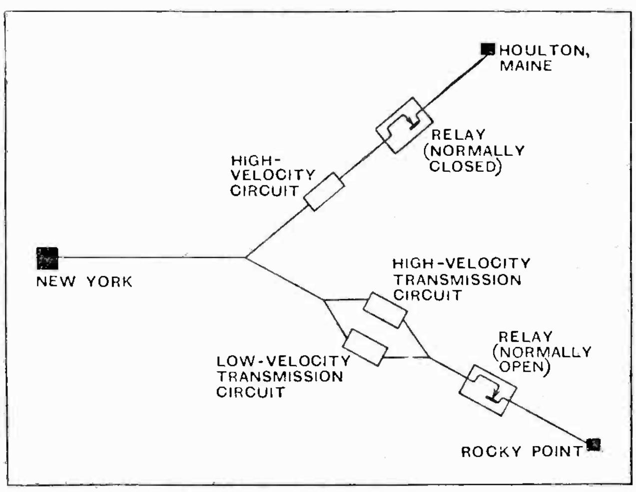


Fig. 1.—Arrangement of voice-operated relays in transmission circuits between New York and the transmitting and receiving stations at Rocky Point and Houlton, Maine.

At first glance it would seem but natural that duplex telephony should be conducted on two different wavelengths, as is done in telegraphy, in order to avoid mutual interference, but on reflection it would also appear that, in the case of this particular system, there could be no objection to both transmitters working on the same wavelength, since neither transmitter emits a carrier wave.

In the single side-band, carrier-eliminated system of wireless telephony, nothing at all is radiated from the transmitting aerial until the microphone is spoken into, and then the impulses represented by only one set of speech side-bands are transmitted.

Thus, since two people cannot both speak at once and be mutually understood, it would appear to be a simple enough matter to put both transmitters on the same wavelength. There is, however, a difficulty in connection with the receiving stations. Immediately a speaker at one end of the circuit commenced to speak, his words, radiated by the powerful transmitter, would be picked up by the associated receiving station and brought back to him in his telephone receiver.

Not only would the effect be deafening, but it would also, as experiments have shown, take the form of an echo effect. That is to say, owing to impedance effects in the receiver and its associated circuits, lines, etc., the speaker's words would come back to him a fraction of a second after he had actually uttered them. Both these effects are extremely disconcerting to a speaker, as anyone who has experienced either of them well knows.

Voice-operated Relays.

The engineers of the American Telephone and Telegraph Company have overcome this difficulty by means of a novel system of relays, the arrangement of which is indicated diagrammatically in Fig. 1, which illustrates the layout of the communicating lines between New York and the transmitting station at Rocky Point and the receiving station at Houlton, Maine.

In the line to the transmitter there is a relay which, when at rest, keeps the line "open." This relay is arranged to be voice-operated, so that immediately speech currents flow along the line the relay closes the circuit to the transmitter and the speech is radiated.

The method by which this relay is controlled by the human voice is extremely ingenious. Immediately before the relay are placed two parallel transmission circuits, one a high-velocity and the other a low-velocity circuit. They consist mainly of capacity and inductance, capacity preponderating in the high-velocity circuit and inductance predominating in the low-velocity circuit.

Speech currents coming from New York thus have two alternative paths, and they divide equally between them. The currents travelling by the high-velocity route operate the relay and close its contacts, so that by the time the other half of the speech currents has arrived at the relay by the low-velocity route, the circuit to the transmitter is closed and the speech currents go out into the ether.

The type of relay used is such that its response to the closing current is instantaneous, and it does not open again until a brief interval after speech has ceased. When listening in close proximity to Rocky Point this relay can be heard faintly as it operates.

In the receiving line from Houlton there is a similar relay, which, however, normally remains closed. On the New York side of it is placed a high-velocity circuit similar to that in use in the receiving line, so that speech currents from New York, branching down the receiver line, reach

Transatlantic Telephony.—

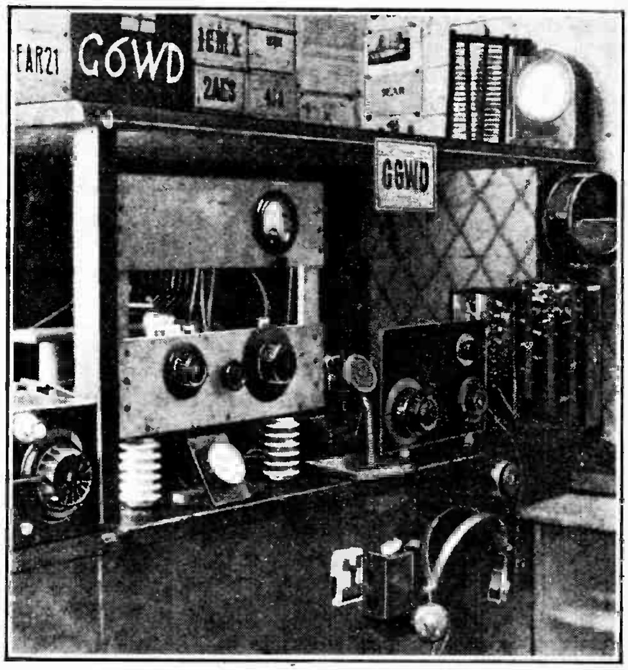
the relay simultaneously with their arrival by the high-velocity route at the transmitter relay, and simultaneously with the closing of the latter relay the receiver line relay is opened.

The receiver relay remains open all the time speech is going out, but closes again immediately the outgoing speech currents cease. Thus the speaker's words cannot come back to him, but if he pauses for an instant in his speech it is possible for the speaker at the other end to interrupt him.

Avoiding Side-tone.

A local advantage of this method is that line and other incidental noises cannot be radiated from the transmitter to interfere with speech being received from the other side of the Atlantic. Such noises are sometimes quite sufficiently disconcerting as they are, but if they were also radiated from the near-by transmitter the effect would be equivalent to high-power amplification of them, and received speech would, in all probability, be entirely drowned.

A further great advantage of the system is the economy of wavelengths which can be effected. The longer wavelengths are already so congested that it is only with difficulty that a channel for a new service can be found, so that any means of economy is highly welcome.



The compact transmitting and receiving equipment at G6WD. The aerial is a quarter-wave Hertz tuning to 45 metres.

CHOOSING H.T. VALUES.

It is by now fairly well known that the best value of high-tension voltage for low-frequency valves, and especially for the output valve feeding the loud-speaker, is the highest value that the makers of the valve will allow, or even, if results are more important than valve life, a higher voltage still. For reacting grid detectors, too, it is generally considered necessary to juggle with plate and grid voltages until smooth reaction, combined with sensitivity to faint signals, is obtained.

But there are still many who have not realised that *any* voltage (above a small necessary minimum) will do for an anode detector, provided that the correct grid voltage *for the anode voltage chosen* is applied. Only when an attempt is made to obtain a large output from the detector is a high plate voltage *necessary*, though it is usually *convenient*, provided that the grid-bias can be varied continuously by means of a potentiometer, to use the same voltage as on the L.F. valves, to save one connection to the high-tension battery. If the grid-voltage is fixed, or can only be varied in steps of 1½ volts, it will, of course, be necessary to make fine adjustments by varying the H.T. voltage.

The Case of the High-frequency Valve.

The choice of voltage for the plates of high-frequency amplifying valves, however, is a little less obvious. Since here there is no appreciable power to be handled, as there is in the L.F. stages, there is no real need for the grid-bias, which, in turn, demands a high plate voltage. On the other hand, too low a plate voltage generally results in a loss of signal strength.

If the plate voltage on any valve is slowly increased from a low value, the impedance of the valve will steadily become less up to a certain point, after which any increase in the plate voltage leaves the impedance practically unchanged. So long as the impedance of the valve continues to drop, the valve is becoming more efficient, and so gives better amplification, but there is no point in increasing the voltage above that value which just gives the minimum impedance. If, for convenience, it is desired to apply a higher voltage (in order, for example, to use the same voltage as is given to the detector and L.F. valves), the excess voltage should be compensated for by an equivalent negative grid-bias.

The actual value of the most economical working voltage must be found for each valve. The quickest way of doing this is to connect the grid to the negative end of the filament and read the plate current for a series of different plate voltages. On plotting these results as a curve, it will be found to be a straight line above a certain plate voltage. The nearest convenient voltage above this will give all the amplification that the valve can provide, with the minimum expenditure of plate current.

If for any reason it is preferred to apply to the plate a voltage in excess of the value so found, a negative grid-bias should be applied, this bias having not more than the value found by dividing the excess volts by the amplification factor of the valve.

Proceeding on these lines, it is perfectly practical to design a multi-valve receiver with one plate voltage throughout, and still to have each valve working at its utmost efficiency.

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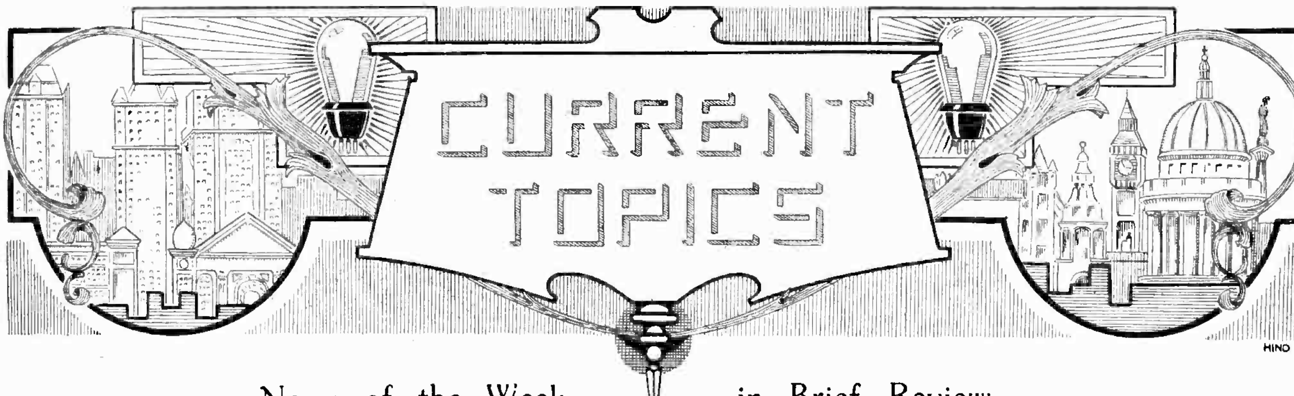

News of the Week in Brief Review.

SADDER AND WISER.

Fines of 15s. each have been levied on nine Bedford wireless "pirates."

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1 IN 30.

In one year the number of broadcast receiving licences held in Australia has been nearly doubled. On June 30th there were 225,230 licences in the Commonwealth, *i.e.*, one licence to every 30 persons.

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ALL-WELSH REGIONAL STATION ?

The success of the Daventry experimental station has brought about a new demand for a similar station to serve Wales with programmes in Welsh. A single high-power station, it is urged, could provide Welsh programmes throughout the Principality.

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CUTTING OUT SPARK.

The port of Antwerp will open a new era of wireless efficiency early next year, when work will be begun on the modernising of the pilot wireless service, which is at present inadequate and capable of communication only with ships nearing the Scheldt.

TELEVISION DEMONSTRATION.

At the Tenth Annual Model Engineers' Exhibition, to be held at the Royal Horticultural Hall, Westminster, from September 17th to 24th, a demonstration of television and "noctovision" will be given by Mr. John L. Baird.

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VALVE TYPES BY COLOUR.

New standards of wireless nomenclature have been adopted by the Standards Committee of the U.S. National Electrical Manufacturers' Association. The radio division of the association has adopted the following colours for valve sockets to permit of ready identification: Dark red for general-purpose valves, green for detectors, and orange for low-frequency amplifiers.

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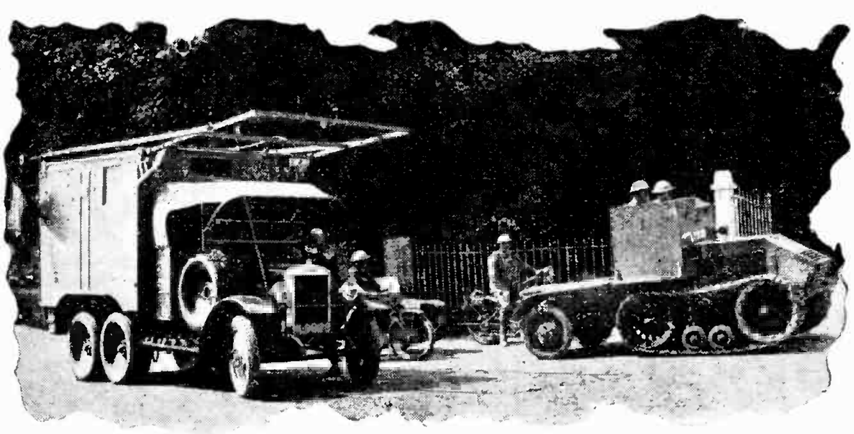
INDIA MAKES A START.

The opening of the Bombay broadcasting station has made it necessary for the Indian Broadcasting Company to announce that they do not deal in wireless receiving apparatus. The demand for receivers is rapidly growing, and the newspapers are publishing minute instructions for the erection of aerials, the installation of sets, and the burial of "earths."



THE EARS OF THE ARMY. One of the new mobile wireless cars (on left) photographed during manœuvres in Hampshire last week.

AUTO-ALARM APPARATUS.

Over two hundred ships are now being fitted with the new Marconi auto-alarm apparatus.

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AMATEUR TRANSMITTER BURNT OUT.

The many British wireless amateurs to whom the name of Max Howden will summon up memories of the first exchanges of amateur signals between this country and New Zealand will be sorry to learn that Mr. Howden's famous station 3 BQ has suffered disaster. A fire occurred for some unknown reason, with the result that the entire transmitting plant was destroyed in a few minutes. Fortunately Mr. Howden's short-wave super-heterodyne set was out on loan at the time!

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BIG U.S. CONTROVERSY ENDED.

A long and expensive litigation has been ended in the United States by an agreement which has been reached between the Radio Corporation of America and the Atwater Kent Manufacturing Co. Under the agreement 7½ per cent. of the sale price of all radio receiving sets manufactured by the latter company since January, 1923, and to be manufactured in the future will be paid to the Radio Corporation. The Corporation's claim was on account of basic patents in its possession.

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INDIAN BEAM STATIONS SUCCESSFUL.

The short-wave wireless beam stations which have been built for the General Post Office by Marconi's Wireless Telegraph Co., Ltd., at Grimsby and Skegness for high-speed wireless communication with India have successfully passed their seven days' official Post Office test, and the company has been informed by the Post Office that they are issuing the preliminary certificate of acceptance. The scheme to link up Great Britain with Canada, Australia, South Africa, and India by means of high-speed wireless telegraph services, decided upon by the Government in 1923, has thus been successfully completed.

The English transmitting station of the Indian service at Grimsby and the receiving station at Skegness are connected, as is the case with the other beam services, by land lines to the Central Telegraph Office at the G.P.O. in London, from which the actual operation of the station is automatically controlled. The corresponding transmitting station in India, which is situated at Kirkee, near Poona, 75 miles east of Bombay, and the receiving station at Dhond, 48 miles east of Poona, are similarly linked with the Central Telegraph Office in Bombay, so that the English and the Indian terminal offices are in immediate touch with each other and messages placed in the high-speed signalling instruments at the G.P.O. in London are instantaneously recorded at the Bombay office, and vice versa.

In the case of the stations built in India, however, "wired wireless" control has been adopted. By adopting frequencies sufficiently wide apart it is possible to work a number of control services on a single land line in addition to several telephone conversations without mutual interference.

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WIRELESS OVERCOMES DILEMMA.

One of the benefits which wireless confers on suffering humanity is that of atoning for mistakes and omissions. Two business men returning from the Continent in an Imperial Airways plane last week recalled an important omission in their business at Rotterdam. When half-way over the Channel the pilot rang up a Royal Dutch air liner which was flying towards the coast from London, and a few minutes later the two planes landed by arrangement at Lympne aerodrome, thus enabling the business men to transfer and proceed at once to Holland.

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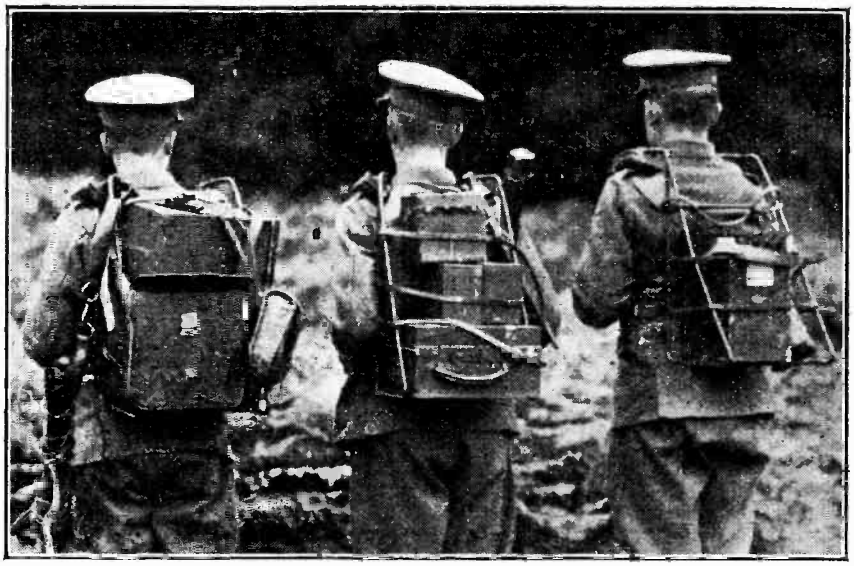
WGY'S 100-KILOWATT SUCCESS.

The 100-kilowatt transmissions taking place this month only from WGY, the famous Schenectady station, have evoked tremendous enthusiasm among American listeners. One important discovery, as shown by listeners' reports, is that atmospherics, even during severe electrical storms, have been completely over-ridden by the strength of WGY's high-power transmissions.

Fading is not appreciably improved by high power in areas within 300 miles where fading normally occurs on WGY's signals, but reports go to show that the station has been heard with good volume and clarity in parts of the country not reached since early in the spring.



THE MILITARY PORTABLE. Men of the 54th East Anglian Divisional Signals carrying a complete transmitting and receiving equipment, including batteries.

DEATH OF AMERICAN WIRELESS PIONEER.

A pioneer of wireless died on Sunday, August 14th, at Montclair, New Jersey. His name was Charles V. Logwood, and he will be remembered by many as the assistant of Dr. Lee de Forest at the time when the latter discovered the feed back circuit in 1912.

In a tribute to the deceased engineer, Dr. Lee de Forest said: "Logwood was an independent inventor of the super-regeneration circuits. In this respect his work antedated that of Armstrong. Interference proceedings in the Patent Office, however, disclosed the fact that an Englishman preceded all others in this field."

The late Mr. Logwood had specialised in wireless valve research for many years.

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BEAM TELEPHONY TO DOMINIONS.

"There is every prospect that before the end of next year it will be possible for telephone subscribers in England to call up subscribers in any of the Dominions by means of the beam system."—Mr. F. G. Kellaway, managing director of the Marconi Company.

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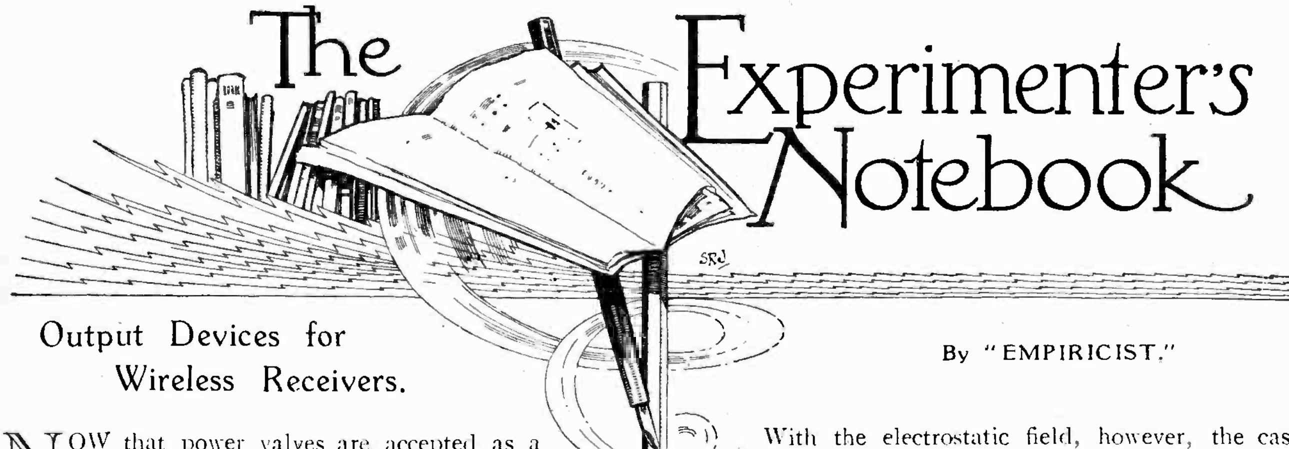
THAT HALF KILOCYCLE.

American broadcasting stations deviating from their authorised frequency by more than one-half kilocycle run the risk of losing their transmitting licence. To show that the Federal Radio Commission intends to exert its authority in the matter, the chairman, Admiral W. H. G. Bullard, has issued a circular letter to twenty stations reprimanding them for not adhering to the terms of their licences. The offending stations, seven of which are in New York, are forthwith required to show cause why their licences should not be revoked.

THE MILITARY PORTABLE IN ACTION. The apparatus used by the 54th East Anglian Divisional Signals can be quickly set up and dismantled. Note the fishing-rod aerial mast supported by a bayonet, which also acts as "earth."

The Experimenter's Notebook



Output Devices for Wireless Receivers.

By "EMPIRICIST."

NOW that power valves are accepted as a normal part of the equipment of a wireless receiver, the consequent high values of high-tension voltage and current being taken as a matter of course, the need for some means of protecting the windings of the loud-speaker from the effect of the current flowing in them, and also removing the possibility of accidental shocks to those handling the loud-speaker or its leads, has been increasingly felt. A further desideratum has been more recently appreciated, namely, the prevention of low-frequency reaction in all its forms, this being more troublesome as the power of the output currents is increased, and, in consequence, also, the stray fields and voltages which these currents produce in various parts of the apparatus.

Stray Fields in Output Circuits.

Two main types of output device have obtained general favour, namely, the output transformer and the choke-capacity coupling arrangement so often referred to in these articles. Both of these means ensure the protection of the loud-speaker windings from the flow of current and also provide for the connection of the loud-speaker leads and windings to a low-tension point in the receiver circuit. With regard to the reduction of interaction effects, however, the two arrangements function in a very different manner, and it is not by any means clear that this difference is generally appreciated.

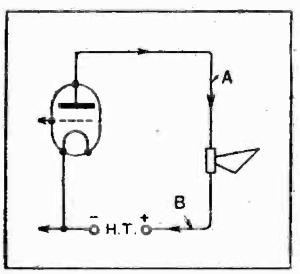


Fig. 1.—Alternating currents flowing through the loud-speaker set up a magnetic field if the leads enclose a loop of large area. The lead A has a fluctuating voltage which sets up an electrostatic field; lead B is at a steady voltage, since it is connected to H.T +.

First let us consider what effects these powerful currents flowing in the loud-speaker circuit are likely to have upon the receiver. In the first place, the leads to the loud-speaker will in general set up stray fields which are liable to affect the sensitive parts of the instrument. These stray fields will be of two kinds, electromagnetic and electrostatic; the former will only be found when the leads to the instrument embrace a large area, and we may consider the electromagnetic effect as negligible if twin wire is used for the purpose of connecting up.

With the electrostatic field, however, the case is altogether different, and may in a number of instances give rise to troublesome interactions.

Let us consider this point somewhat more closely. When a loud-speaker is connected in the usual manner to a set (see Fig. 1), one of the leads returns to a point of "earth" potential (H.T.+) and the other returns to a "live" point (the plate of the last valve). Obviously, the lead attached to the "earth" point has no electrostatic field, and in consequence we have only to consider that of the "live" point. This is frequently troublesome, and is liable to be more so when the lead to the loud-speaker passes in any direction other than that straight away from the receiver. The loud-speaker leads are long, necessarily, as it may be desired to listen at a point quite remote from the receiver installation, and we therefore have a possibility of trouble which can only be alleviated by screening or by some measure which eliminates the tendency at its source.

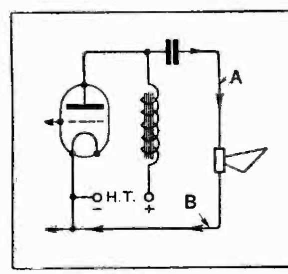


Fig. 2.—The choke-filter output circuit diverts the steady anode current from the loud-speaker but does not diminish electrostatic fields from the loud-speaker leads.

Such a measure is provided by the output transformer, when properly employed, but not by the choke-capacity device. This latter point has not generally been clearly grasped, but on consideration of Fig. 2 it will be quite evident that the only effect of this device is to divert the speech currents from their normal path through the high-tension battery into a shunt path to the low-tension battery, and thus there is a dead lead and a live lead as before and stray fields are unaltered.

The Output Transformer.

When we consider the case of an output transformer, however, matters are different for two reasons; first, it is possible, by stepping down the voltage to reduce the potentials across the secondary winding, and consequently it is possible to make any desired point of this winding "earthy" and in this way to control the nature of the electrostatic field of the leads, so that no harmful effect is produced. Fig. 3 shows an arrangement on these lines.

The Experimenter's Notebook.—

Considering the first point, we remarked that the electromagnetic effect in the loud-speaker circuit could readily be made negligible by employing twin leads. Inasmuch, therefore, as the danger from this source is small, stepping-down the voltage and stepping-up the current by means of a transformer will still do no harm, although the tendency is to multiply up the stray electromagnetic effect; the gain will be definite in the case of the electrostatic field, and the arrangement will be far safer under practical conditions. In order to get the complete benefit from the use of a transformer it is highly desirable to provide a centre tap to the secondary winding, which can be connected to an "earth" point, and to design the transformer so that the capacity between the windings is low. Under these conditions the voltages on the two secondary terminals are equal and opposite in relation to earth, and the electrostatic field due to the one is exactly cancelled out by that due to the other. In this manner the receiver is fully protected from the reaction effects of this character, provided the transformer itself is properly protected by an earthed metal shroud.

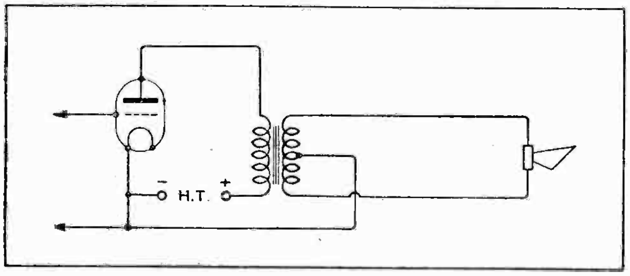


Fig. 3.—By means of a step-down output transformer with centre-tapped secondary, opposite voltages of low value are produced on the loud-speaker leads, thus cancelling the electrostatic fields. Twin leads must be used, otherwise an increased electromagnetic effect is probable.

Earthed Centre Tapping.

It may be of interest to note in passing a peculiar result obtained by the writer in the case of an output transformer which had no shroud. This was actually for use in conjunction with a high-resistance loud-speaker and was therefore of 1 : 1 ratio. Provision was made to earth the centre of the secondary, but when this was done a low-frequency howl was obtained; on connecting one of the ends of the secondary winding to earth the howl was accentuated, and on connecting the other to earth the howl ceased. Careful investigation showed that the cessation of the howl was due to the cancellation of the electrostatic field of the primary winding by that of the secondary, the satisfactory arrangement being such that opposite voltages were produced at the live terminals of these two windings under the conditions where the receiver was stable. In this case, therefore, an advantage was gained by the use of a 1 : 1 transformer, since if the voltage had been stepped down cancellation could not have been effected. On the other hand, if a screen had been employed round the transformer no cancellation would have been required and the full advantage could have been obtained from stepping down the voltage and taking a lead from the centre point of the secondary winding to earth.

So far all the advantages seem to lie with the output transformer, but when we come to consider the important class of oscillatory effect due to impedance in the common H.T. circuit of the receiver, the case is altogether different. These effects have been reviewed in previous articles, but they are so important that it will do no harm to mention them again. In Fig. 4(a) is shown a loud-speaker connected to an amplifier in the ordinary manner so that the speech currents flow through the high-tension battery. These currents will in general build up a voltage across any impedance that may be found in the H.T. battery or supply unit, and this latter voltage will be transferred back to an earlier point in the circuit (in the circuit diagram to the primary winding of the first inter-valve transformer). A retroactive effect will thus be obtained which will be regenerative or anti-regenerative according to circumstances.

Choke *v.* Transformer Output.

In Fig 4(b) a choke-capacity coupling arrangement is employed, and by this means the speech currents are diverted so as to flow directly to L.T. negative and not through the high-tension source at all. There is, therefore, no voltage set up by the output currents except as the result of a residue which flows through the choke which feeds the last valve.

In practice this property of the choke-capacity device is of the greatest importance, and it will be immediately clear to anybody who studies these circuits that an output transformer is no protection whatever against this effect (see Fig. 4(c)). The reason for this is that the impedance of the output transformer is not high like that of a choke, inasmuch as it is controlled directly by the impedance of the loud-speaker connected across the secondary winding; the speech currents, therefore, flow through the primary winding just as readily as if the loud-speaker were connected directly in circuit, and in their course they also flow through the high-tension source and have an undiminished tendency to the production of the characteristic oscillations due to H.T. impedance.

Considering the two output devices, therefore, it is clear that each has its merits. It might be possible by combining the two systems to obtain full advantage of both, and this would probably be the ideal output arrangement. In practice, however, matters will usually resolve themselves into a choice of one or the other, and while these will be finally determined by the particular circumstances of the case, the writer would unhesitatingly select the choke-capacity system as more satisfactory. In the first place, the retroactive effect due to the electrostatic field of the loud-speaker leads is troublesome only in exceptional cases, and, in any event, it is possible to use lead-covered cable or the special "flex" referred to in the issue of August 10th (page 185), and thereby adopt another expedient for reducing this trouble. On the other hand, the difficulty due to battery reaction is fundamental and cannot be removed except by some filtering device such as is offered by the choke-capacity system, and in view of the fact that H.T. batteries deteriorate in the course of use it is a safeguard against future trouble

The Experimenter's Notebook.—
even when none is experienced when setting up the receiver in the first place.

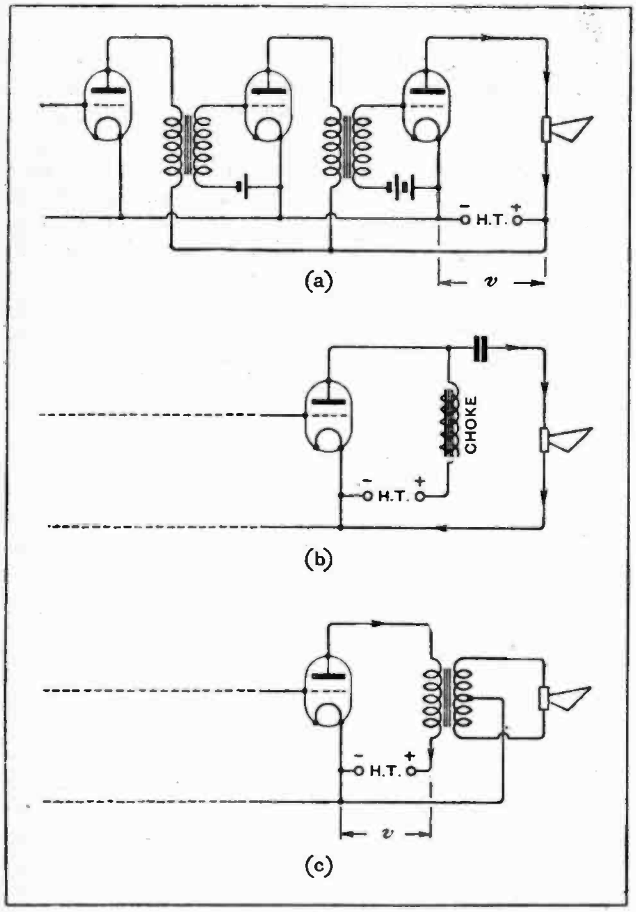


Fig. 4.—(a) The voltage v set up across the H.T. by the loud-speaker current is transferred back to earlier stages of the amplifier and may tend to cause oscillation. (b) Alternating current flowing through choke is negligibly small and therefore practically no voltage is set up across the H.T.; loud-speaker currents flow direct to filament. (c) Transformer coupling is identical in effect with that of circuit (a).

A final word is possibly indicated as to the comparative properties of the two devices in respect of fidelity of reproduction. In this respect there would not appear to be very much to choose as regards the practical side, though theoretically it would seem possible to attain greater perfection with the choke-capacity arrangement than with the output transformer. In the case of the former, all that is required is to design a choke whose impedance is high in comparison with that of the loud-speaker at all frequencies under consideration, and also having due regard to the steady currents flowing through its winding. The condenser in series with the loud-speaker must furthermore be selected to have an impedance low in comparison with that of the loud-speaker at working frequencies. This is obviously unattainable at the very lowest frequencies, though there is no difficulty in satisfying practical requirements. It may be noted moreover in passing that an accentuation of moderately low frequencies is obtained as a result of the employment of the condenser, since the inductance of the loud-speaker forms with the condenser a series resonant circuit for some very low frequency. This effect is, however, not desirable, and the frequency of resonance should be chosen as low as possible.

Magnetic Leakage.

The disadvantage which constitutes a limitation in the case of the transformer is the magnetic leakage between the windings. This tends to cut off the high frequencies when the number of turns of the two windings is increased beyond a certain amount; it is therefore impossible to satisfy the condition that the impedance of the transformer windings shall be high, and the reproduction on the low frequencies in consequence not quite as perfect as if the transformer were not in use, while tending at the same time in the direction of choking off the higher frequencies. This criticism is, however, considered rather from the ideal standpoint, and there is no doubt that practical output transformers are designable which will give a quality of reproduction indistinguishable from that obtained by the direct connection of a loud-speaker in circuit.

R.M.S. VALUES.

WHEN an alternating current is given a numerical value it is obvious that certain conventions must be used, since the actual current flowing is continuously variable.

Readers will find a full account of the mathematical properties of sine waves (which are assumed when we speak of alternating current or voltage) in any of the text books dealing with elementary alternating current. Suffice it to point out here that the maximum instantaneous value of the current or voltage will be 1.414 ($= \sqrt{2}$) times the nominal or R.M.S. (= Root Mean Square) value as would be indicated by any of the normal types of meters in use which will read A.C. at all.

There are one or two cases in which the relation between the maximum and R.M.S. voltages interest us. We may want to use a valve of the L.S.5 type as a rectifier in a mains unit, with grid and anode coupled together. Now this valve has a rating of 400 volts D.C. for its anode, but we would not be doing the valve justice if we applied more than $\frac{400}{1.4}$ = approx. 250 volts A.C. to it for rectification.

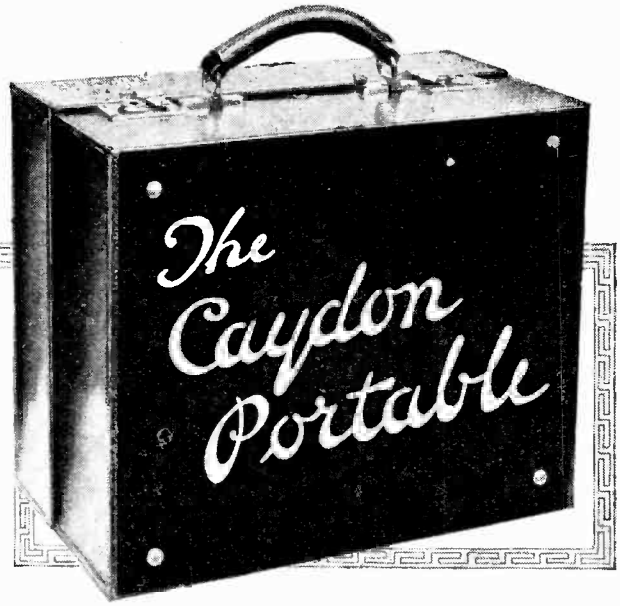
Again, the smoothing condensers of an eliminator which come before the chokes receive practically the peak A.C. voltage values and should be of proportionally higher voltage rating.

It sometimes happens that we know the R.M.S. value of a voltage which we are applying to the grid of a valve, in which case the grid-bias must be at least 1.4 greater than would be the case if we were considering the peak values.

The heating effect of an alternating current is the same as that of a direct current of the same nominal value.

D. K.

Broadcast Receivers



The Caydon Portable

A Well-built Receiver Giving High-quality Reproduction.

THE Caydon Portable is a five-valve receiver designed for reception on both long and short wavelengths. It is built into a neat leather case and is entirely self-contained, valves and batteries being carried in the base and a frame aerial and high-grade loud-speaker in the lid. There are no external controls which might be damaged in transit or advertise the contents of the case, and as may be seen in the title photograph the appearance when closed is no different from that of an ordinary attache case.

The makers claim for this instrument that the quality of reproduction is above the average for a portable set, and is equal in this respect to a high-grade permanent receiver working from an outdoor aerial, that the range is such that broadcasting can be received anywhere in England at full loud-speaker strength with a choice of programmes in most places, that no effort or expense has been spared to produce an instrument of the highest quality and finish, and that the performance of finished sets is uniform. After a careful examination of the instrument we have no hesitation in endorsing these claims.

A neat and well-finished appearance is one of the outstanding features of the Caydon Portable.

In support of their claim of uniformity, the makers invited us to visit their works and choose at random from stock one of the finished receivers. This we did, and were at the same time afforded an opportunity of seeing sets in course of construction. High-grade components are used throughout, including Ferranti transformers, and wiring is carried out to a predetermined plan with absolute uniformity in each case.

Subsequent tests have convinced us of the justification of the other claims made of the instrument. Of the excellent quality of reproduction there can be no doubt; the loud-speaker is a Celestion, and it is supplied from a power valve with 108 volts H.T., two facts which prove that the quality is no illusion. On hearing the set for the first time this feature is the first to receive favourable comment.

Range and Volume.

In operation the set is certainly lively and the range is good. Daventry comes in at full strength in London (65 miles) with "plenty in hand," and there can be little doubt that adequate volume would be obtained anywhere in the country from this station. Radio Paris also comes in well on the long waves, though it is probable that best results will be obtained in the southern counties. On short waves the volume from 2LO up to 15 miles (the maximum range tested) is as much as the loud-speaker will take, and it is necessary to make use of the directional properties of the frame as a volume control. With careful "wangling" of the controls Bournemouth can just be tuned-in in London (95 miles), so that one would estimate the useful range on a main station at 40 to 45 miles.

Acoustically, the set is remarkably stable, and with the loud-speaker working at full volume the lid can be closed down without causing microphonic howling, even though the sound vibrations may be felt by touching the case. It is equally stable electrically, except when using critical reaction. The limit of permissible reaction is heralded by a growl, which is really an asset, since it effectively

The Caydon Portable.—warns an unskilful operator that he is doing something he ought not to do!

The construction of the set affords several points of interest. The leather case is reinforced throughout with 3-ply wood, and the sides do not flex under the weight of the batteries. The valves are arranged in a separate compartment running along the front of the cabinet, and are accessible after moving a cover strip held down by a single knurled screw. A larger cover shields the remainder of the "works" and carries a calibration panel of ivorine upon which notes of dial settings may be made in pencil.

The controls are three in number; the first tunes the frame aerial, the second the H.F. stage, and the third affords a critical control of reaction. Although there are two H.F. stages only one is tuned, the other being "aperiodic"; both H.F. stages are untuned when the range switches are set for long waves. The H.F. stages are followed by a detector and two transformer-coupled L.F. amplifiers.

We found that the L.T. battery is so mounted that it is vertical while the set is being carried but horizontal when in use. Thus the acid covers only one-third of the area of the plates during discharge; the plates are liable to be damaged and the discharge period reduced. When this drawback was pointed out, however, we were informed by the manufacturers that it would be overcome in future models by using an accumulator of different form.

The price of the complete instrument, including valves, batteries, and royalty, is 35 guineas, and the manufacturers are Messrs. Campbell and Addison, 40, Howland Street, London, W.1.

TRANSMITTERS' NOTES AND QUERIES.

International List of Amateur Transmitters.

We would again remind our readers that, in conjunction with the R.S.G.B., we are now revising the lists of Amateur Transmitting Stations for publication in the next edition of the R.S.G.B. Diary and Log Book.

We welcome all possible assistance which will enable us to make these lists as complete and reliable as possible, but at the same time would ask those sending in additions or corrections not to put too much trust in ancient lists.

We recently welcomed with joy and gratitude a long list sent by a well-intentioned reader, but, unfortunately, discovered on checking it with our own records that a very considerable proportion of the names and addresses related to stations for which the cards in our files were marked "dead," "closed down," or "gone away." The sender of this list must have taken considerable trouble in preparing it, for which we are most grateful, but his source of information must have been almost pre-historic.

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Australian Amateur Seeks Tests.

An opportunity to arrange DX tests on 20 or 32 metres with British and Continental amateurs is sought by Mr. E. S. Yorstow (OA 3ES), of "Hoversta," Hawthorn Road, Caulfield, Victoria, Australia. 3ES employs 30 watts in a Hartley circuit. All reports are acknowledged.

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Reports from Canada.

Mr. G. Kitley, of 57, Vicarage Road, Plumstead, S.E.18, who has just relinquished his call-sign G 2BQW, states that he is shortly proceeding to Canada and will resume wireless experiments over there. He will be glad to furnish reports on British transmissions received in the Dominion.

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Short Waves from Rio.

Experimenters on waves of the order of 15 metres may be interested to learn that the Meteorological Office at Rio de Janeiro is now transmitting its "Meteoro Lopes" from the Sepitiba station (SPU) on a wavelength of 15.56 metres.

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New Call Signs and Stations Identified.

2AI W. J. H. Kempton, 34, Raglan Rd., Plumstead, S.E.18.
2NU A. J. Hall, 33, Hazelbrouck Gardens, New North Rd., Hainault, Essex. (Change of address.) Stands by for calls on 23 metres between 7.0 and 11.0 p.m. B.S.T.
2BXU (Ex 5VU) S. W. Butters, "Walla-Brook," Guy Rd., Beddington, Surrey.
5UO R. C. Simmonds, 164, Footscray Rd., New Eltham, S.E.9. (Change of address.)
6SV M. Savage, College House, Horringer, Bury St. Edmunds.
5WX A. G. Watkins, "Hainault," Laburnham Rd., Maidenhead.
LA 1J Bjarne Lindemann, 24, Nubbebakken, Bergen, Norway, wishes to get into touch with British stations and is, incidentally, the youngest amateur transmitter in Norway.

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QRA's Wanted.

EF 8CSB, AFB, ED 7AE.

TRADE NOTES.

Interesting Formo Handbook.

A 72-page handbook, with blue prints, has just been issued by the Formo Company, Crown Works, 22, Cricklewood Lane, London, N.W.2, dealing with the correct use of Formo components. The contents include short illustrated articles on condensers, coils, and low-frequency amplification, together with details for the construction of Formo two- and three-valve receiving sets. The price of the Formo handbook is 1s.

Marconiphone Removals.

The Marconiphone Co., Ltd., advise us that their Manchester offices have been transferred from 17, Whitworth Street West, to 10, Dolefield, Manchester. (Telephone: Manchester City 1488 and 7035.) The company's Newcastle offices have been transferred from 21, Moseley Street, to Powdene House, Pudding Chare, Newcastle. (Telephone: Newcastle Central 1107.)

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Stolen Post.

Mr. C. D. Melhuish, radio manufacturer, of 8, Great Sutton Street, Goswell Road, London, E.C.1, arrived at his office on Tuesday, August 16th, to find that the morning's mail had been stolen. Those of our readers who may have addressed letters or orders to Mr. Melhuish on the 13th or 15th of the month are requested to write again, stating whether postal orders or cheques were enclosed, whether they were crossed, and what amounts they represented.

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Ferranti OP2 Transformer.

In a reference to the new Ferranti Output Transformer, Type OP2, on p. 211 of our issue of August 17th, the ratio was erroneously given as 25 : 2. The OP2 has a 25 : 1 ratio.

Books Received.

"Further Motor Cycle Reminiscences," by "Ixion." Impressions of some thirty years and 300,000 miles on the road. Written in the author's own inimitable style, and containing many grains of truth among the chaff. Pp. 118, with 60 sketches by F. Gordon Crosby. Published by Iliffe & Sons Ltd., London. Price, 2s. 6d. net.

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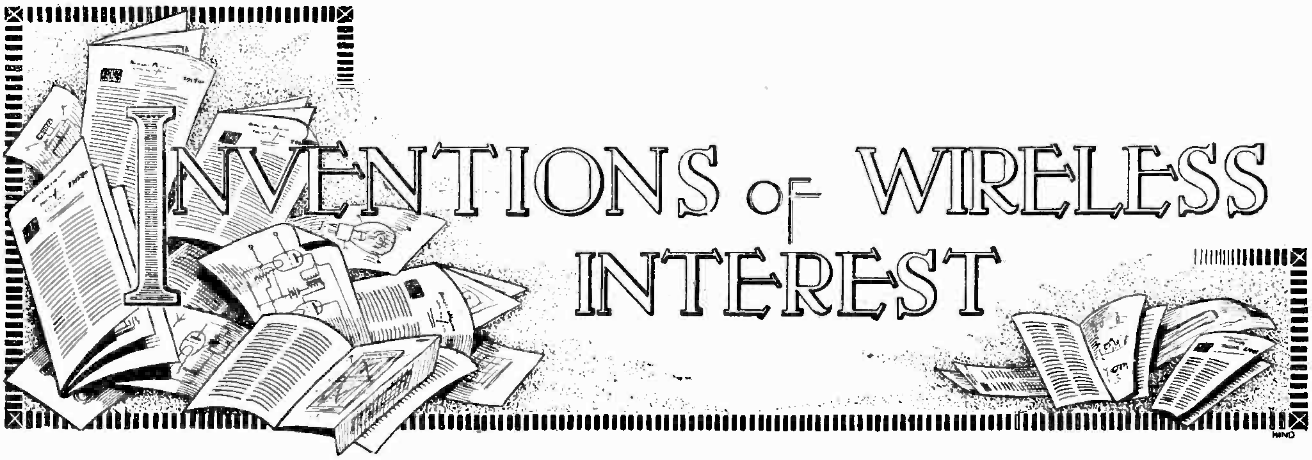
Radio Annuario Italiano, 1927.—The Italian Wireless Directory and Year Book, pp. 576, including directory of the Italian wireless trade and industry, with numerous illustrations. Published by Radio-Novità, Rome, price 35 lire, or 9s. 6d. post free.



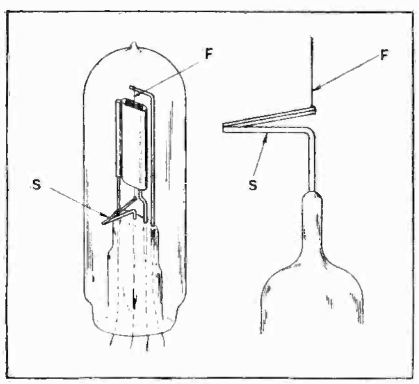
The following abstracts are prepared, with the permission of the Comptroller of H.M. Stationery Office, from Specifications obtainable at the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1s. each.

Mounting Valve Filaments.
(No. 271,584.)

Application date, March 8th, 1926.

In order to prevent microphonic noise due to vibration of the filament under different tensions, the usual spring support is replaced by a bimetallic strip S, which is arranged to extend or contract at the same rate as the filament. This holds the latter under a tension which is automatically kept uniform.

As shown, the bimetallic strip is connected between the filament F and the lead-in wire, in which position it is heated by the filament current. It may, however, be located at the top of the valve, as in the case of a looped filament, and is then heated by radiation. As the filament expands the upper end of the strip curls downwards so as to take up the slack. Patent issued to Mr. E. Y. Robinson and Metropolitan Vickers Co.



The use of a bimetallic strip for maintaining valve filament basin. (No. 271,584.)

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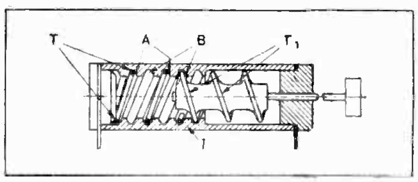
Micrometer Condensers.
(No. 271,920.)

Application date, January 27th, 1926.

Balancing-condensers such as are used for neutralising H.F. amplifying circuits are naturally designed to cover only a small range of capacity value. They should, however, be capable of very fine adjustment, which should not be subject to variation by mechanical vibration or similar disturbances These features are ensured in the present invention by making the two interacting surfaces in the form of spirals, arranged to have a variable degree of overlap.



Small capacity condenser consisting of a spiral engaging in a two-start thread. (No. 271,920.)

An insulating tube I is formed with two sets of interposed screw-threads A and B cut parallel to each other. A metal helix T, forming the first capacity element, is located at one end of the tube and lies within the spiral thread A. A worm T1, forming the second capacity element, works to and fro in the thread B. Both elements are substantially circular in cross-section.

The effective capacity of the unit varies with the overlap of the parts T and T1, the insulating tube being made sufficiently long to avoid any overlap at the zero setting. One end of the tube I may have a screwed extension for mounting in a panel, or both ends may be pointed or provided with extensions suitable for use with a clip holder. Patent issued to B. Hesketh.

oooo

Darimont Cells.
(No. 266,662.)

Application date, May 26th, 1926 (*addition to* 241,729).

An improvement in the Darimont type of rechargeable cells consists in using as an exciter a mixture of sodium chloride or common salt, a caustic material such as caustic potash or lime, potash soap, an albuminous material such as cornflour, a fatty material such as linseed oil, and a mucilaginous or colloidal material such as dextrine. This is stated to thwart "Brownian" movements and to reduce the tendency to diffusion. Patent issued to L. Darimont.

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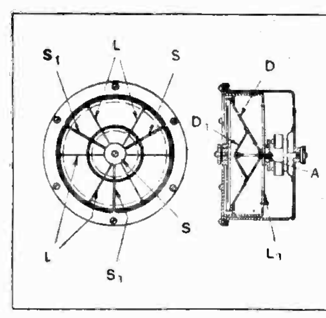
Loud-speakers.
(No. 271,976.)

Application date, March 18th, 1926.

The diaphragm D is of conical form with an apex angle of 120°. An auxiliary diaphragm D1 of similar shape, but smaller surface-area, is secured to the larger cone by a light rigid strut as shown. The arrangement is such that vibrations imparted to the apex of diaphragm D by the armature A are transmitted to the apex of the smaller diaphragm D1, and reach the junction of the two diaphragms in the same time as that taken by the original vibrations to pass direct through the larger cone to the same point.



Double conical diaphragm driven by link joining their apices. (No. 271,976.)

To prevent distortion the vibrating system as a whole is suspended back and front by two sets of resilient ligaments L and L1. The radial ligaments L extend from the periphery to a central hub S supported by a spider S1 from the framework. The rear ligaments L1 are connected radially between an extension ring on the framework and a central pin mounted on the apex of the diaphragm. Patent issued to E. A. Graham and W. J. Rickets.

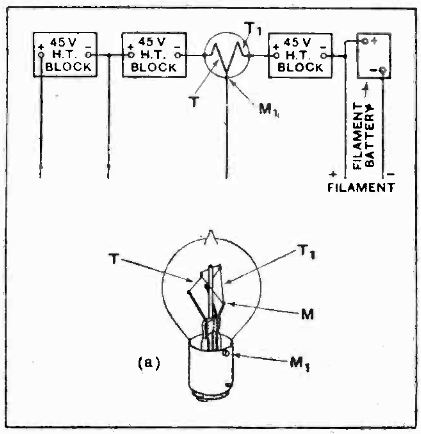
○○○○

Safety Device for Valve Sets.
(No. 252,181.)

Convention date (*U.S.A.*), *May* 13*th*, 1925.

A safety lamp consists of a two-part tungsten filament T.T 1 mounted in an atmosphere of hydrogen or other inert gas, the midpoint connection M being taken to an external terminal M1, as shown. The characteristic feature of such a glow-lamp is that whilst its resistance at the normal operating temperature is low, it automatically jumps to a high value should the filament current exceed a certain critical value.

The device is connected between two of the H.T. units supplying a multi-valve set, with the midpoint terminal M1



Protecting lamp with midpoint tapped filament connected in series with the anode batteries. (No. 252,181.)

connected in the plate lead to the detector valve. Should this lead accidentally " short " across to the filament, the rush of current is checked by the tungsten branch T1. Similarly, a short-circuit between the plate leads of the detector and the last amplifier is rendered harmless by the action of the tungsten branch T. Finally, a short between the 135-volt lead and the filament will include the two branches T, T1 in series. The safety lamp also serves to prevent damage should the full battery voltage by any chance be applied directly across a transformer winding. Patent issued to British Thomson-Houston Co.

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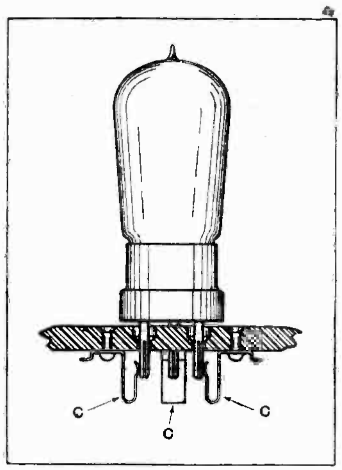
Valve Holders.
(No. 272,361.)

Application date, August 28*th*, 1926.

Resilient metal clips C are mounted underneath the panel and make contact



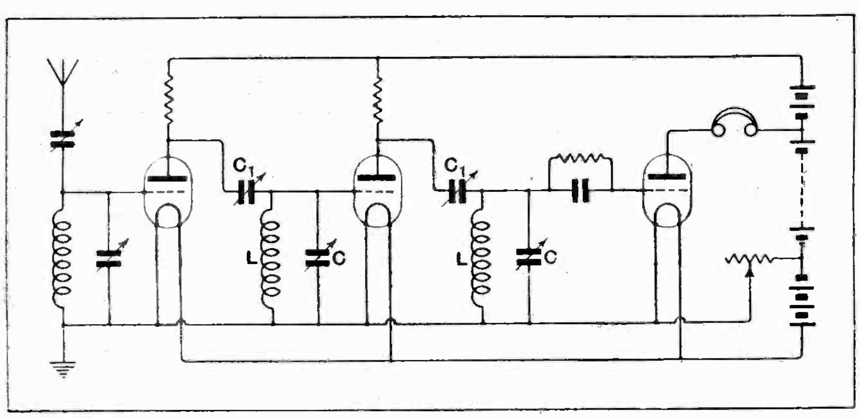
Contact can be made only with the spring connectors when the pins have passed through the locating holes. Accidental contact between the filament pins and the H.T. supply is thus avoided. (No. 272,361.)

with the valve pins only where these are fully inserted through holes bored through the panel surface. No contact can take place unless the pins pass completely through, and thus an attempt to force the valve into a wrong setting cannot lead to the usual disaster of a burnt-out filament. Patent issued to A. J. Stevens and Co. and H. C. Willson.

Resistance-capacity Couplings.
(No. 272,294.)

Application date, March 11*th*, 1926.

In order to increase the efficiency of resistance-capacity couplings, when used for high-frequency amplification, additional inductances L, shunted by variable condensers C, are inserted as shown. The usual coupling condensers C1 are also made variable. The object is to introduce a resistive impedance into the plate circuit, which can be made to equal the internal impedance of the valve by suitably adjusting the values of the added inductances and capacities. Patent issued to H. A. Gill.



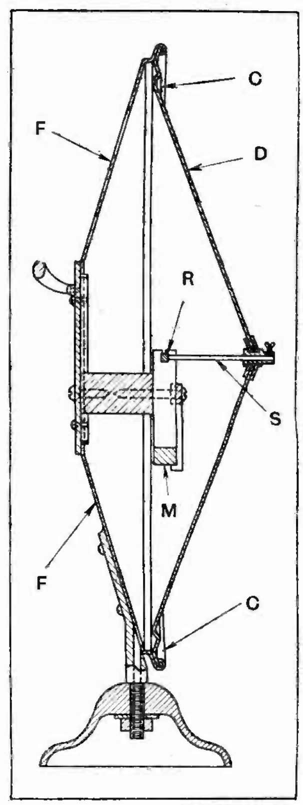
H.F. amplifier combining tuned and resistance intervalve couplings (No. 272,294.)

○○○○

Loud-speakers.
(No. 252,685.)

Convention date (*U.S.A.*), *June* 12*th*, 1925.

A conical diaphragm, made of long-fibred and well-aged paper of porous



Constructional details of conical diaphragm loud-speaker embodying a modified method of clamping at the rim. (No. 252,685.)

structure and free from loading, is creased as shown at C and is then snapped into the rim of the supporting frame F. The creasing allows the cone to vibrate as a whole with little or no bending and consequent freedom from distortion. The electromagnetic unit comprises a polarised reed R projecting from one limb of a permanent U-shaped magnet M into a gap formed in the polepiece of the other limb. A rigid rod S connects the vibrating reed to the centre of the conical diaphragm. Patent issued to the Hopkins Corporation.

News from All Quarters: By Our Special Correspondent.

A Visit to 5GB.—An Awkward Predicament.—Where 5GB is Overpowering.—Short Waves from Daventry ?—B.B.C. and the Libraries.

Daventry Experimental.

There is certainly a vein of paradox in the designation "Daventry Experimental." Taken at its face value, the name conjures up visions of valves dangling on wires, broken matchsticks plugged in H.T. sockets, and the usual paraphernalia of the test bench. But if such an impression lingered in my mind it was speedily removed last week when I visited 5GB. Anything more satisfyingly permanent in appearance it would be difficult to imagine.

oooo

A Visit to 5GB.

First seen on the Northamptonshire hill-top beside the towering masts of 5XX, the new station does look a bit puny and experimental, but a nearer investigation causes the visitor to sit up and take notice. Beyond the fact that nothing in the little transmitting room is duplicated, there is no suggestion of tentativeness about the spruce-looking apparatus which has been so carefully assembled during the last few months.

5GB is the first of the B.B.C. stations to adopt the idea of modulating at low power, with subsequent H.F. amplification, and, judging from the quality of transmission, it will not be the last.

oooo

Why Two Aerials?

Another unusual practice is the adoption of two separate aerials in parallel. There is a touch of comedy in the way this came about. Mr. H. L. Kirke, who has been largely responsible for the design and erection of 5GB, told me that such a scheme was undreamt of a week before the station opened. It was at this stage, when reception of the test transmissions appeared to be good in most districts, that a horrifying truth emerged. One of the 5XX lattice masts was found to be absorbing most of the radiation in the direction of Birmingham, the very place which, by forfeiting its local station, stood to lose most by the new order of things.

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An Eleventh-hour Move.

There were three courses open to the engineers: 5XX could be pulled down, but that would have been regrettable. 5GB's aerial could be moved to the Birmingham side of the 5XX mast, but London would then have been screened. Finally, 5GB could put up another aerial.

The last was decided upon, another aerial being run up at the eleventh hour. Both aerials are connected to the transmitter by power lines, the respective tuning inductances being housed in a little box at the foot of each aerial.

oooo

New Masts.

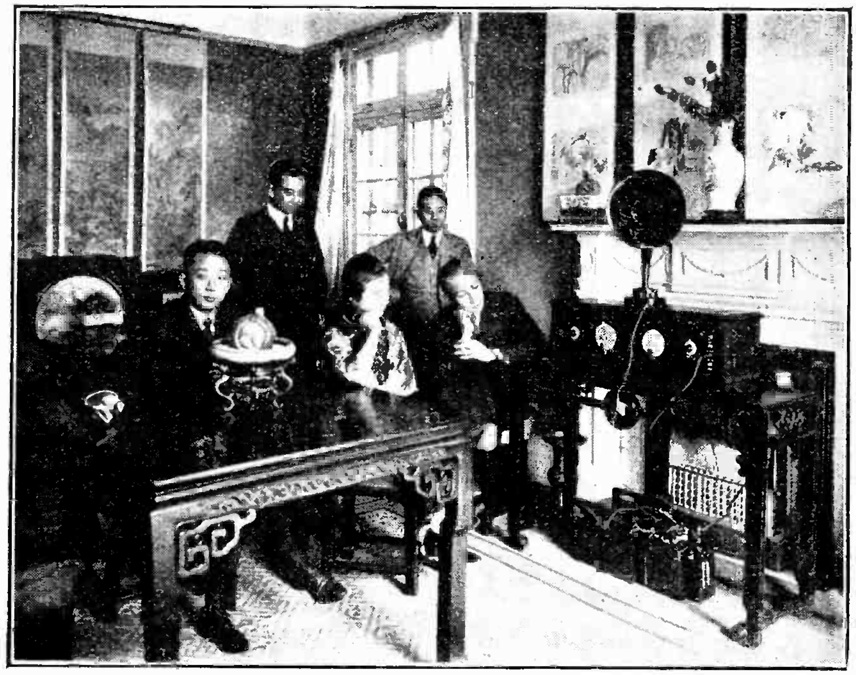
The present arrangement is not permanent, preparations already being in hand for the erection of two 335ft. masts to take a more usual form of antenna. I hear that the "new" masts are actually those which have done good service for many years at Poldhu.

The present power output of 5GB is 20 kilowatts.

oooo

Where 5GB Swamps.

Nearly four hundred letters were received at Savoy Hill on the first two days following the opening of 5GB. The large majority of reports from all districts, although a little conflicting, indicate that Daventry Experimental is a brilliant success: in some localities, in fact, its strength is a little too pronounced. In Rugby, Northampton, and



PEACEFUL MOMENTS IN SHANGHAI. Despite wars and rumours of wars, Shanghai residents can still seek distraction in the consoling delights of wireless, as this picture shows. Unfortunately, the only broadcasting station in the city is restricted to a power of 100 watts. It is owned by the American Kellogg Company.

other places within a dozen miles' radius, there are signs of swamping. It is difficult to see how this can be avoided except by the use of more selective receivers.

oooo

Woe in Bournemouth.

The experience of Bournemouth listeners is rather vexing. When 6BM was working on 491.8 metres they enjoyed a glorious freedom from Morse disturbance, yet 5GB's transmissions on the same wavelength frequently suffer from Morse signals. Add to this the fact that 6BM has returned to its old Morse-infested wavelength of 326.1 metres, and we can understand why there are drawbacks to living even in Bournemouth!

oooo

More Studios for Savoy Hill?

London now shares with Birmingham the onus of providing 5GB's programmes. This has caused a certain amount of congestion at Savoy Hill, where the seven studios are kept in almost continuous use.

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Short Waves from Daventry?

The rumour, which has come over from America, to the effect that the B.B.C. intends soon to broadcast with a short-wave transmitter on 24 metres sounds rather too good to be true. On enquiry at Savoy Hill, I was informed that the Corporation would not go beyond its recent statement that it hopes to begin short-wave transmissions to the Empire about the end of this year.

A short-wave station is already in existence at Daventry. It is the personal property of Mr. Leslie Hotine (2QM), the engineer-in-charge at 5GB.

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No Novelty.

An American broadcasting concern proposes to transmit a programme "from an insane asylum," so that listeners can hear "the weird, uncanny sounds of the inmates."

One would imagine that listeners would prefer something novel.

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Return of Tommy Handley.

Tommy Handley has not been heard by listeners for some time. He returns to the microphone on September 5th, when he commences a week's tour of the B.B.C. stations.

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Good for the Fish.

With the close of the herring fishing season at the end of August, Aberdeen station will discontinue the fishing news bulletin.

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County Programmes from 5GB.

5GB will broadcast the first of a series of county programmes on September 5th, when a Warwickshire programme will be given. This will include items by Warwickshire composers, folk songs by Harry Hopewell, and recitals from Shakespeare and Drinkwater by Margaret Madeley.

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Croyland Bells.

The bells of Croyland Abbey will be broadcast from Peterborough on September 18th.

FUTURE FEATURES.

London and Daventry.

SEPT. 4TH.—Albert Sandler and the Grand Hotel Orchestra, Eastbourne.

SEPT. 5TH.—"The New Morality," a Comedy in Three Acts by Harold Chaplin.

SEPT. 6TH.—Military Band Concert.

SEPT. 7TH.—The Three Choirs Festival, music by British Composer, relayed from Shire Hall, Hereford.

SEPT. 8TH.—Promenade Concert, relayed from the Queen's Hall, London.

SEPT. 9TH.—German Programme.

SEPT. 10TH.—Orchestral Concert.

Daventry (experimental).

SEPT. 4TH.—Opening Service of the Three Choirs Festival, relayed from the Cathedral, Hereford.

SEPT. 5TH.—Warwickshire Concert, relayed from Birmingham.

SEPT. 6TH.—Promenade Concert, relayed from the Queen's Hall, London.

SEPT. 7TH.—Light Orchestral Concert.

SEPT. 8TH.—Music from the Musical Comedies and Comic Operas.

SEPT. 9TH.—Promenade Concert, relayed from the Queen's Hall, London.

SEPT. 10TH.—Ballad Concert.

Bournemouth

SEPT. 6TH.—Promenade Concert, relayed from the Queen's Hall, London.

SEPT. 8TH.—Some Favourites, presented by the Station Orchestra and the Station Octet.

Cardiff.

SEPT. 9TH.—Promenade Concert.

Manchester.

SEPT. 5TH.—Promenade Concert.

SEPT. 6TH.—Scenes from Sheridan.

SEPT. 8TH.—"On with the Show of 1927," Lawrence Wright's New Style Entertainment, relayed from the North Pier, Blackpool.

Newcastle.

SEPT. 7TH.—"Glimpses of the Past," a series of Episodes Dealing with the History of Newcastle and District.

SEPT. 9TH.—Concert by the Municipal Orchestra.

Glasgow.

SEPT. 5TH.—"The Radioptimists," Glasgow's New Concert Party.

SEPT. 6TH.—Promenade Concert, relayed from the Queen's Hall, London.

Aberdeen.

SEPT. 7TH.—Scottish Programme.

SEPT. 9TH.—Promenade Concert.

Belfast.

SEPT. 9TH.—"A Bunch of Heather," Scotch Programme.

SEPT. 10TH.—"Home Life," a Musical and Orchestral Programme.

A Sandler Night.

Albert Sandler and the Grand Hotel, Eastbourne, orchestra will be heard by listeners to 2LO and other stations on September 4th. Dale Smith will sing two groups of songs, and Albert Sandler will play two violin solos.

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Praise for B.B.C. Talks.

So broadcasting is responsible for "a returning power of concentration." At all events, this is the opinion of the Lincoln Public Library Committee, which states that the beneficial effects of the educational programmes of the B.B.C. continue to be clearly discernible. More people, it seems, are resorting to the libraries for serious books dealing with questions discussed in the broadcast talks.

Additional interest is lent to this report by the fact that the education department at Savoy Hill recently distributed a questionnaire among libraries throughout the country in an effort to discover what effect, if any, was being produced by broadcast talks on the public demand for literature.

Forty-five libraries reported a definite increase in the demand for books mentioned in the adult education talks, while other libraries mentioned a growing desire for books dealing with music, science, and social subjects. The talks are said to have created a "run" on Pepys's Diary, Boswell's "Life of Johnson," and the works of Sir Walter Scott.

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Cathedral Broadcast from 5GB.

The opening service of the Three Choirs Festival will be relayed from Hereford Cathedral to 5GB on September 4. The sermon will be preached by the Right Rev. the Lord Bishop of Winchester.

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Famous Composers as Conductors.

Another interesting event in Hereford will be a concert of music by living British composers, to be relayed to 2LO and 5XX from the Shire Hall in that city on September 7. The programme includes works by P. Napier Miles, Delius, Herbert Brewer, Walford Davies, and Sir Edward Elgar. Miss Beatrice Harrison will play a concerto for violoncello (Delius), Miss Elsie Suddaby will sing a Gloucestershire song cycle, "For your Delight," by A. Herbert Brewer, which will be conducted by the composer, and Sir Walford Davies will conduct his "Children's Symphony" (Op. 53). The song cycle and "Children's Symphony" have been specially written for this Festival. The programme will conclude with Sir Edward Elgar's overture "Cockaigne."

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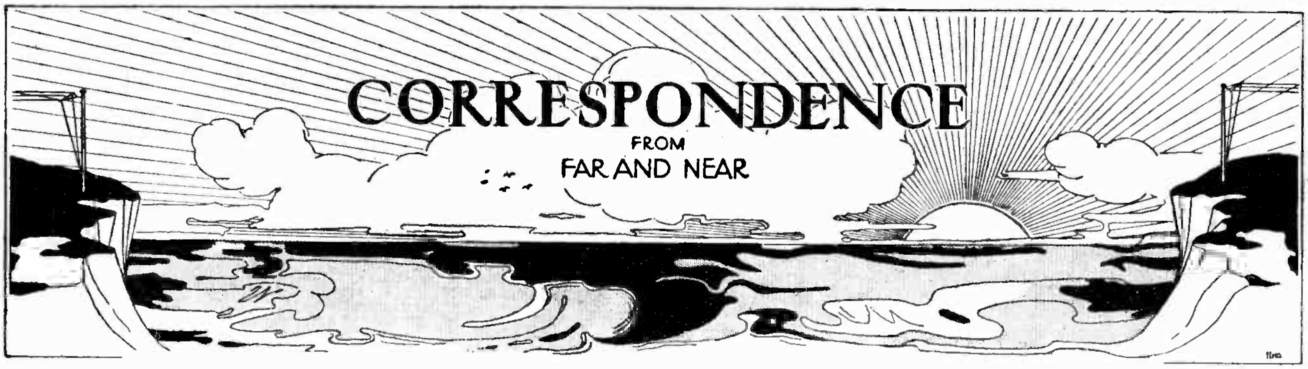
On a Saturday Night.

A popular concert will be relayed from the Kingsway Hall on Saturday, September 17. The band of the Coldstream Guards will play, under the direction of Lieut. R. G. Evans, the soloists being Miss Rosa Alba, Herbert Thorpe, and Gatty Sellars.



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

Correspondence should be addressed to the Editor, "The Wireless World," Dorset House, Tudor Street, E.C.4, and must be accompanied by the writer's name and address.

QUARTZ CRYSTAL CONTROL.

Sir,—I hope I may be permitted to comment on Mr. McMinn's letter on the subject of crystal control.

A dime is an American silver 10 cent piece, diameter about 18 mm., thickness just under 0.5 mm., or rather smaller than our sixpenny piece.

I do not think it follows that the loose electrode must be as light in weight as possible—it is the damping which must be kept small, and this can equally well be attained by using a slightly convex upper electrode, resting upon a node of the quartz crystal. In many cases a light electrode is a distinct advantage, but there are crystals which work better with a large heavy electrode suitably located.

Then I must challenge the statement "Obviously, of course, the amplifier must be neutralised."

Strictly speaking, this is perfectly unexceptional, but the word "amplifier" has come into use to describe any chain of valves delivering power under the control of a previous stage. 2SZ showed over a year ago (see *Experimental Wireless*, February, 1926) that crystal control could be effected through a chain of valves in cascade, such that each one would be in a state of independent oscillation apart from the control exercised by the crystal. Partial neutralisation of such a chain may be desirable or convenient, but it is emphatically not *necessary* to obtain splendid results. I believe I am correct in saying that 2SZ transmitted speech to the U.S.A. without a neutrodyne condenser anywhere in the set, and long-distance speech has been accomplished by many others using partial neutralisation.

Using the word "amplifier" to denote a chain of valves between a crystal and the main oscillator, such an amplifier need *not* be neutrodyned, and in practice the greatest output is attained with incomplete neutrodyning.

On Board s.s. *Regina*. A. HINDERLICH (G 2QY).

METRES OR KILOCYCLES?

Sir,—The proposed change from wavelengths to frequencies has caused a lot of unnecessary discussion, and many amateurs have apparently overlooked the great value of the lists of frequencies to the searcher.

The plan described below helps to identify stations without difficulty.

The average coil used on the broadcast band, and tuned with a 0.0005 condenser, will bring in stations from 200 to 600 metres (from 500 to 1,500 kilocycles); that is to say, stations on 100 different frequencies can be received.

By removing the last cipher we can give each of these frequencies a number, from 50 to 150, and by making a list on a card searching is greatly simplified.

If our dials show the lowed number for the higher frequencies, as is usual, this may cause a little confusion, and I have still further simplified matters by making out a list in which both wavelengths and frequencies are abandoned and arbitrary numbers used for each frequency.

Starting with Biarritz (200 metres, 1,500 k.c.), which is No. 1, Jonkoping is No. 2, and so on up to Zurich (588 m. 510 k.c.), which is No. 100.

Using logarithmic condensers, an average movement of 1½ degrees on the dials gives a change of 10 k.c.

A similar card can be used for the lower frequencies. In this case a movement of 6 degrees on the dials changes from one frequency to the next.

With this scheme failure to identify any station working on its correct wavelength is almost impossible.

Portsmouth, August 19th, 1927. FRANK PINK.

Sir,—One point in connection with this controversy appears to have been overlooked: in the current issue of the *Radio Times* we have both frequencies and wavelengths stated, the latter apparently to the nearest .1 of a metre. Whichever figure forms the basis of the calculation, the other seems to have been arrived at by dividing the original into 300,000. According to most authorities, the velocity of (medium λ) electromagnetic waves in air is less than 3×10^8 metres/sec., and assuming the figure 299,630,000 as being correct, and Daventry's frequency to be 187 k.c., the figure of 1,604.3 metres is about 2 metres out.

Therefore, I agree with Mr. Robinson that the B.B.C. should stick to wavelengths when dealing with the non-technical public, and if any scientist or experimenter wants to know the frequency let him divide the wavelength into his own pet figure for wave velocity, or, better, get a multivibrator working and measure for himself! L. J. VOSS.

Plympton, Devon, Aug. 18th, 1927.

B.B.C. AND THE NATIONAL RADIO EXHIBITION.

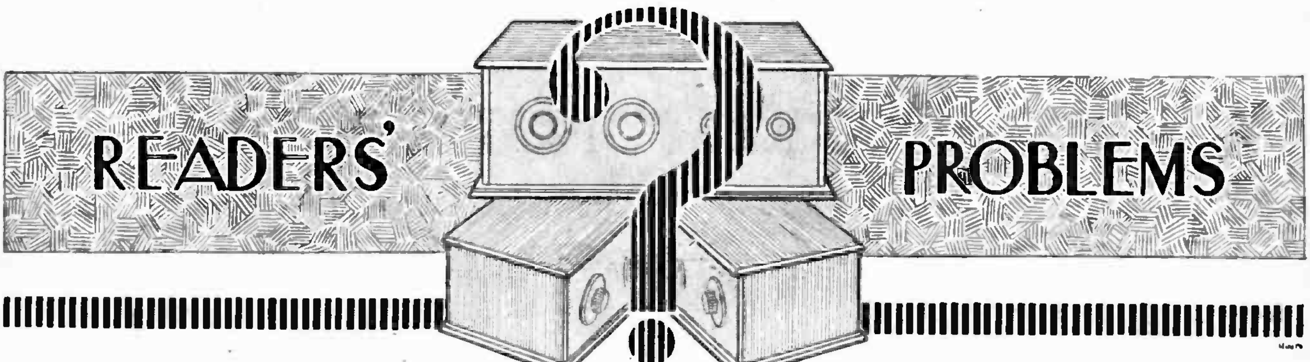
Sir,—Any disappointment experienced by Mr. S. W. Webb in consequence of the B.B.C. not repeating their exhibit of last year at the forthcoming exhibition will be more than compensated by the B.B.C. exhibit comprising replicas of the control and transmission rooms.

The control room has been rightly described as the "B.B.C. Brainbox," and is bound to create considerable interest.

Change, progress, variety are important factors necessary to ensure public interest in any exhibition, and many will agree that the B.B.C., instead of having the "same old show," has acted wisely in giving the public an opportunity of viewing radio from a new and different angle.

I can assure not only Mr. Webb but his friends that many pleasant surprises await them at Olympia.

Gloucester House, 19, Charing Cross Road, W.C.2. August 24th, 1927.
C. D. CLAYTON, Press Department. National Radio Exhibition, Olympia.



"The Wireless World" Information Department Conducts a Free Service of Replies to Readers' Queries.

Questions should be concisely worded, written on one side of the paper, and headed "Information Department." One question only should be sent at a time, and must be accompanied by a stamped, addressed envelope for postal reply. Any diagram accompanying the question should be drawn on a separate sheet. No responsibility will be accepted for questions sent in which do not comply with these rules.

A "Gramophone" Circuit.

I have been studying the diagram of a circuit given in the "Readers' Problems" section of your journal on page 827 of your issue dated June 16th, 1926. Would this be suitable for use in conjunction with a gramophone pick-up device? L. R. B. C.

The circuit in question would be entirely suitable, and the only alterations needed would be that the special microphone transformer shown in the diagram would have to be replaced by a transformer specially designed for use with the particular type of pick-up device you were intending to use, and, needless to say, the microphone would give place to the pick-up device. Otherwise, no alterations are necessary.

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Are "0·06" Valves Obsolete?

Why is it that one comparatively seldom sees the 0.06 type of valve used nowadays? At one time it seemed to be almost universal. R. L. E.

The type of valve you mention is still extensively used by some readers, and is no doubt a useful valve, but the reason for the declining interest is probably due to the better efficiency of the more recently produced valves. When speaking of efficiency we are referring to amplification factor based on a given A.C. resistance. For instance, one maker who produces an 0.06 valve of A.C. resistance 22,000, and amplification factor 7, now produces a 2-volt 0.1-amp. valve of A.C. resistance 17,000 and amplification factor 9. It will be seen from this example that the 2-volt 0.1-amp. valve is more efficient than the 3-volt 0.06-amp. type of valve. A further disadvantage of the 0.06 valve is that its filament is rather fragile, and that if used with a 4-volt accumulator, or three dry cells, a 30-ohm filament resistance must be used, and people are rather apt to overrun the valve and so ruin its filament, whereas the 2-volt valve is equally as economical, and it has a more robust filament, and if used, as it should be, with a 2-volt accumulator, is practically foolproof.

The 2-volt valve requires a filament wattage of 0.2 watts against the 0.18 watts of the 0.06 amp. valve. Most people, therefore, are using 2-volt valves in conjunction with a 2-volt accumulator when they require utmost economy and reliability, and are using 6-volt valves when they require the utmost efficiency. The 0.06-amp. valve is still available for those who favour a dry cell source of L.T. supply, or for any reason require an absolute minimum of filament current consumption.

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A Full-wave Crystal Receiver.

I wish to build a crystal receiver with a loose coupled tuner in which two crystals are used for full-wave rectification instead of the single crystal usually employed for ordinary half-wave rectification. I shall be glad if you will give me a suitable circuit, and also briefly explain the action of this receiver. B. R.

We illustrate in Fig. 1 a receiver such as you require. In the ordinary crystal set rectification is brought about by a crystal by virtue of the fact that it has the peculiar property of passing a large current in one direction whilst acting as a complete barrier to the passage of current in another direction. For the purpose of explanation we will assume that the crystal passes current freely in one direction, but absolutely prevents the passage of any current at all in the opposite direction. It will be seen, therefore, that the ordinary crystal set completely suppresses a one-half cycle of each L.F. oscillation, this half cycle being, as it were, wasted. In the circuit which we illustrate, however, both half cycles are used. The top crystal in the circuit passes, we will say, the first half cycle through itself and the telephones, but stops the second half cycle and then passes the third half cycle, and so on; the bottom crystal, which is reversed, stops the first half cycle, passes the second, and stops the third, and so on. Thus each alternate half cycle is made use of by each separate crystal, and so nothing is wasted. In our diagram we show two pairs of telephones for the purpose of clarity of explanation, but the same effect can be brought about in a single pair of telephones by separating each ear-piece, and connecting one ear-piece in series with the top crystal, and the other ear-piece in series with the second crystal. Another method is to employ two output transformers with their primary windings individually connected in circuit with one crystal, the output windings being connected in series with each other and with a pair of telephones.

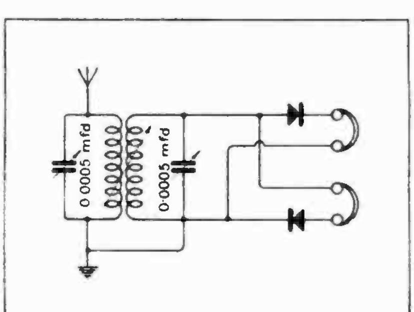

Fig. 1.—Crystal receiver designed for full-wave rectification

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Calculating Impedance at a Given Frequency.

I shall be glad if you can give me the formula for obtaining the impedance of an L.F. choke at any given frequency. F. I. D.

The formula which you require is, $2\pi fL$, where f equals the frequency in cycles per second, where L equals the inductance in henries, and where π is the usual mathematical symbol.

It will be seen, therefore, that before you can calculate the impedance of the choke for any given frequency, you will have to know its inductance. Many manufacturers give this information in connection with their products, while at the same time, others omit to do so, and in those cases, you will have to apply direct to the manufacturers for the inductance of their particular product.

Reaction and the "Everyman Four."

My "Everyman Four" receiver gives excellent results on the medium B.B.C. wavelengths, but I notice that when a change over is made to the Daventry wavelength the local station can still be heard in the background. Can you please suggest any simple method of overcoming this? P. G.

When the aerial is connected to terminal A_3 and the loading coil brought into circuit for the reception of Daventry, the high-frequency valve is cut out and the receiver becomes a detector and 2 L.F. combination. This results in a plain aerial tuning arrangement without reaction and it follows, therefore, that a powerful near-by station could shock-excite the aerial circuit, thus forcing signals through the receiver even though the wavelength of the local station was widely separated from that to which the aerial was tuned. This difficulty can be overcome by improving the selectivity of the aerial system and a simple way of achieving this would be the judicious use of reaction. Fig. 2 shows the "Everyman Four" circuit slightly modified to enable the above recommendation to be incorporated, and in view of the limited space available a Polar unit could be advantageously employed for the coils L_1 and L_2. By adopting this unit it will not be necessary to have a variable condenser; the amount of reaction being obtained by varying the coupling between the two coils. A high-frequency choke, H.F.C., should be connected between the anode of the detector valve and the resistance R_5 and the condensers C_3 and C_5 connected to the junction of the high-frequency choke and the resistance R_5. The feed back condenser C_9 could have a capacity of 0.0003 mfd., and the coils L_1 and L_2 should be a No. 200 and a No. 75 respectively, or their equivalent in the Polar range of coils. When using valves of the same filament voltage in all positions in this receiver, it is recommended that the "free" grid bias be dropped and a wander lead taken to an appropriate socket on the grid bias battery. A fixed resistor R_3 of about 10 ohms should be connected in the positive filament lead and a by-pass condenser C_8 of 0.01 mfd. included to provide a short return path for the oscillations in the detector grid circuit.

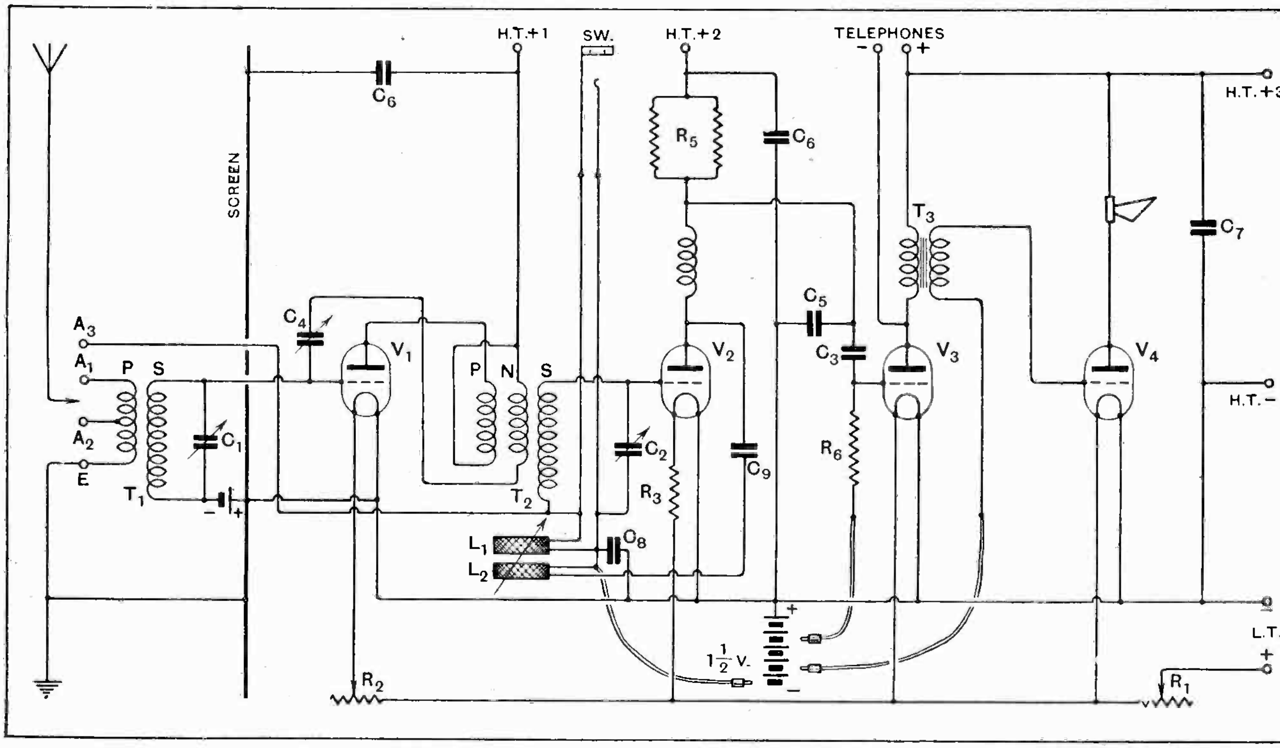

Fig. 2.—The "Everyman Four" modified to include reaction as a means to increase the selectivity of the aerial circuit in cases where transmissions from the local B.B.C. station and 5xx cannot otherwise be entirely separated.

Eliminating Eliminator Waste.

I have lately installed an A.C. battery eliminator, which gives me excellent results with my receiver. My actual receiver is a simple local station one, situated in a rather inaccessible position at the top of the house, and is switched on by a remote control unit. Is it necessary for me to switch off the mains from the primary of the transformer of my eliminator when the set is not in use? L. F.

Theoretically, when no load is being placed upon the secondary of an A.C. transformer, that is to say, when the valve filaments are switched off, and, therefore, the plate circuits interrupted by the fact of the valve being cold, there should be no current flowing from the mains through the primary of the transformer, although, of course, in practice there is a slight current even in the best of transformers. In a very large number of mains transformers, however, efficiency is none to high, and it is found that even on "no load" quite an appreciable current is taken from the mains which, if left flowing continuously day after day, will undoubtedly add up to quite an appreciable amount at the end of any given period. It is advised, therefore, that for this reason, and also for other reasons which we cannot enter into here, that the primary circuit of the transformer be broken. You should arrange, therefore, that you use an additional relay for breaking this circuit when switching off the receiver. This relay, of course, could be worked in conjunction with your existing filament relay.

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The "Sensitive Two" Again.

I notice that in a reply given to D. R. G. in the "Readers' Problems" section of your August 10th issue, reference is made to the "Sensitive Two" receiver, previously described in your journal. Can you tell me in which issues I can find details of this receiver? B. L.

The "Sensitive Two" receiver appeared in its original form on page 433 of our issue dated March 17th, 1926, and in a modified form on page 599 of our issue dated October 20th, 1926.

Modern Valves in the "Everyman Four."

I shall be glad if you can tell me the correct valves to use in the "Everyman Four" receiver, as, although I have studied the list given in the book, it occurs to me that several new valves have appeared on the market since the date the book was published.
C. T. D.

Although, as you rightly say, several new valves have appeared upon the market since the publication of the "Everyman Four" book, yet this fact makes no difference to the type of valve used in the "Everyman Four." In ordinary circumstances, the H.F. valve may be one having an A.C. resistance in the neighbourhood of 30,000 ohms. Naturally, in the interests of high amplification, you will choose a valve having the highest magnification factor for this given A.C. resistance; for example, the Marconi-Osram D.E.R. and D.E.5.B. valves both have an A.C. resistance in the neighbourhood of 30,000 ohms. The latter is a much more efficient valve, however, because it has an amplification factor of 20 against the 9 of the former, although both valves have roughly the same A.C. resistance. In cases where greatest selectivity is desired a valve having an A.C. resistance up to, but not exceeding 50,000 ohms may be used. Naturally, a certain amount of sensitivity will be lost, unless a valve is chosen which has a commensurate increase in amplification factor.

The detector valve should consist of one of the high A.C. resistance (70,000 ohms) valves specially designed to act as a bottom bend rectifier, and to be followed by a fairly high value of anode resistance. Here again the rule of choosing the valve with the highest amplification factor with respect to the required A.C. resistance which we have given holds good also. The third valve should have an A.C. resistance in the neighbourhood of 30,000 ohms, and, of course, as high an amplification factor as possible. The output valve, of course, must be capable of handling large power without distortion, and one having an A.C. resistance in the neighbourhood of 4,000 ohms should be chosen, the great point to look for being that it has a long straight portion of anode current grid volts curve.

With regard to the filament characteristics of the valves chosen, it must be remembered that, all other things being equal, a 6-volt valve is the most efficient, and a 2-volt valve the most economical; 4-volt valves occupy an intermediary position in each case. An exception to this rule is to be found in the fact that, in the case of anode bend rectification, it will often (but not always) be found that a 2-volt valve, owing to the lower resistance of its filament, has a more sharply defined bottom bend, and therefore makes a more sensitive anode-bend rectifier than a 4- or 6-volt valve.

It will thus be seen that the fact that the new types of valves by different makers are constantly appearing on the market does not raise any new difficulties in the choosing of valves for this or, indeed, any other receiver, since, whatever the new type of make of valve produced, the rules we have just given will always hold good, not only in the case of the "Everyman Four," but in the case of other receivers also.

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Super Selectivity?

Some time ago you published a circuit of a crystal receiver in which, by means of switching, a change-over could be made from normal crystal reception to the "balanced crystal" method of reception. I should be glad if you could kindly repeat that circuit as I have mislaid the issue in which it appeared.
R. S. G.

We reprint in Fig. 3 the circuit to which you refer. The switch marked S_1 merely gives a series or parallel aerial tuning, the left-hand position giving series tuning, and the righ-hand parallel tuning. S_2 enables a change-over to be made from direct coupling on the left-hand position of the switch to a loosely coupled circuit in the right-hand position of the switch. With regard to S_3, if this is placed to the left we have an ordinary crystal circuit, the single crystal on the left being of the ordinary "catwhisker" type or one of the new permanent detectors if desired. Putting S_3 to the right changes over to the balanced crystal circuit, S_5 and S_6 bringing either of the two carborundum crystals into circuit as desired. S_4 is merely the battery switch, which naturally must be open at all times except when the set is actually in use.

As you are doubtless aware, the advantage of balanced crystal reception is that whilst all tuning devices such as loose coupled circuits, etc., render it possible to select between stations transmitting on nearby wavelengths the greater selectivity of the circuits the greater the possibility of separating two stations working on very nearby wavelengths, the balanced crystal method of reception, however, enables a separation to be made between two stations which are working on exactly the same wavelength, and actually enables weak signals to be read from a distant station without interference from a nearby station which is working on exactly the same wavelength as the distant station, and, of course, giving much stronger signals than the more distant station.

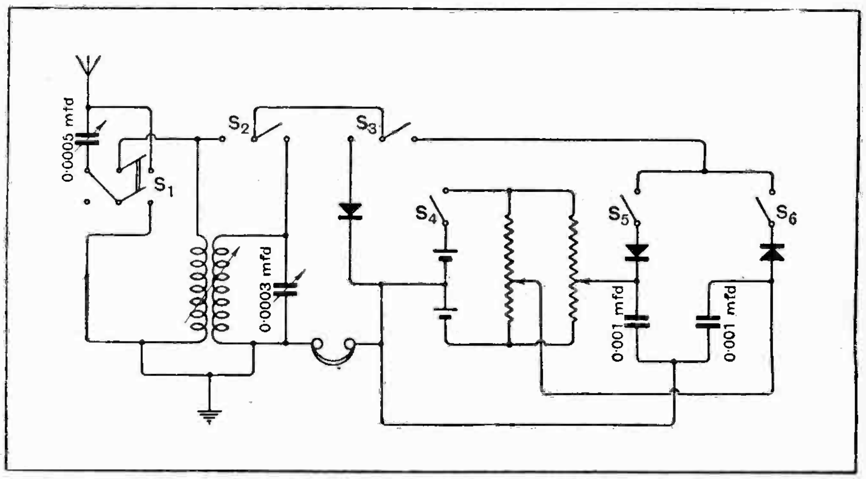

Fig. 3.—Super-selective crystal set in which ordinary or balanced crystals can be used at will.

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Four-electrode Valves and the Reinartz Circuit.

I have in use a single valve Reinartz receiver, described in your issue of June 16th, 1926. This instrument has given me every satisfaction, but I now wish to use it in conjunction with a four-electrode valve. Can you tell me what alterations I must make to the receiver?
S. W. E.

No alteration whatever is required in the wiring, it being only necessary to attach a flexible wire to the terminal on the side of the valve base (which, of course, connects internally with the inner grid), and connect it by means of a wander plug to a suitable tapping point on the H.T. battery; the positive potential required will be considerably less than that being used on the plate of the valve. Experiment must be made for the correct value of positive bias to give to the inner grid. You will, of course, be able to work with a smaller plate potential.

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Precautions with Metal Panels.

I propose to use a metal panel in building my "Everyman Four," the panel being made of aluminium. Will this be quite in order?
M. S. L.

There is no harm whatever in using a metal panel provided that the receiver layout is not altered, and that the panel components, such as variable condensers, be properly bushed to prevent any part of them being in metallic contact with the panel. You will apreciate, of course, that if, for instance, the condenser tuning the grid of the H.F. valve were not bushed, then the small battery supplying grid bias to this valve would be short-circuited. The panel may with advantage be earthed.