THE GRID LEAK EXPLAINED

Amateur Wireless And Electrics

YOUR LICENCE

No. 22 SATURDAY, NOVEMBER 4, 1922 Price 3d.

CONTENTS

SMALL LOUD SPEAKER
(Fellows Magneto Co., Ltd.)

Amateur Wireless and Electrics

No. 22 November 4, 1922

Experimenting with a Crystal

Finding a Circuit to Utilise the Current Wasted by the Crystal

THE majority of present-day wireless experimenters confine their energies to the thermionic valve and its attendant circuits, etc., but there are doubtless many others who do experiment with crystals, and the purpose of this article is to set before them a little theory, dealing with

Silicon Crystals.

crystal reception, which can be put into practice by any experimenter.

It is a familiar fact to all wireless enthusiasts that a crystal passes a comparatively large current in one direction and only a very small current in the other, the ratio of these currents being somewhere in the neighbourhood of 40 : 1. It is this property of a crystal which is utilised in wireless reception.

Galena Crystals.

The currents induced in the receiving aerial are of very small magnitude, and are alternating at a frequency very much above those which the ear can detect. The purpose of the crystal is to rectify these currents and to turn them into others suitable for aural reception. By having a crystal in series with the phones a current is obtained in one direction and an inappreciable one in the other, producing the well-known sound which is heard in them.

But we are only using one-half of the induced current; the other half is going to waste. Why should not a circuit be devised to utilise this waste half?

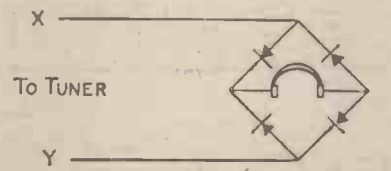


Fig. 1.—Circuit with Four Crystals.

Fig. 1 gives a circuit in which full rectification is obtained. Four crystals are used —a slight complication—being two pairs in parallel. From the diagram it will be seen that full rectification is obtained.

It will also be seen that at any given instant the current is passing through two crystals. A casual glance would make the reader think that having the crystal resistance doubled would balance the advantage gained from having complete rectification, which in itself doubles the useful amount of current.

But this is not so, and may be shown to be incorrect by the use of mathematics.

Suppose the resistance of the crystal = x ohms and the resistance of the rest of

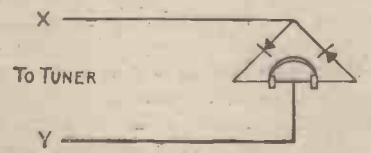


Fig. 2.—Circuit with Two Crystals.

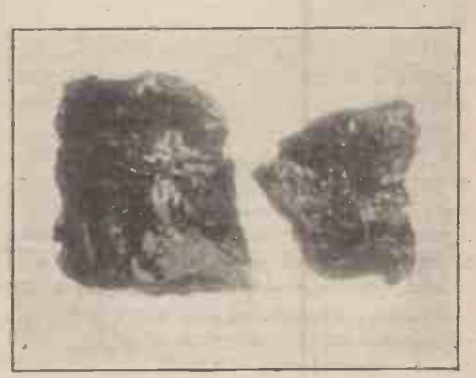
the circuit = y ohms, then in the ordinary course of things, using only one crystal, the total amount of current (C_1) is proportional to $\frac{1}{x+y}$.

Using the circuit of Fig. 1 the total amount of current (C_2) in the same time is proportional to $\frac{2}{2x+y}$. Therefore,

$$C_1 : C_2 :: 2x + y : 2x + 2y$$

Thus whatever be the resistance of the crystals and of the rest of the circuit, the current C_2 is always greater than C_1. That is, the circuit shown in Fig. 1 is more efficient than the crystal circuit employed in the generality of cases.

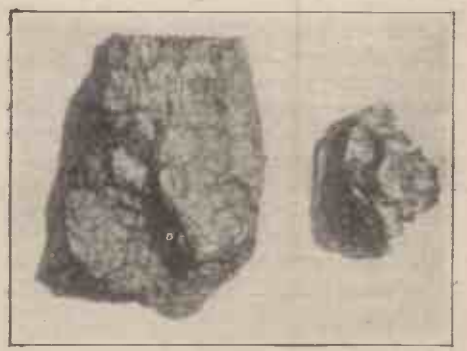
This circuit also has the advantage over



Zincite Crystals

the orthodox one of, in the case of one crystal failing while working, the circuit still continues to function as with a single crystal.

A variation of this circuit is shown in Fig. 2, where only two crystals are used, being connected as shown. Thus complete rectification is obtained, one-half of each cycle passing through each ear-piece. Whether this circuit has any advantage



Bornite Crystals.

over the usual one could be determined by experiment.

The results of readers' experiments with circuits similar to those above described would be interesting, especially in comparison with ordinary circuits. R. W. E.

Measuring Instruments in Amateur Sets

GENERALLY a small receiving set utilises no measuring instruments—an elementary outfit includes neither ammeter, voltmeter, fuses, nor even a switch—but measuring instruments, if suitable, can be used to improve the set and increase the life of the batteries and valves appreciably. To commence with, if a very sensitive instrument that would read micro-micro-amperes of high-frequency current were available, it would be a competitor of the present receiving sets and telephones, but at present no instrument that will answer the purpose has been invented.

Uses of Measuring Instruments

The chief instrument in general use is a voltmeter for accumulators; this would indicate when the cell needed recharging, and, in fact, give an indication of the condition of the cells. The type of instrument that can be used will be discussed later.

Of equal importance is a filament ammeter; this is useful more particularly to save the valve than the battery, as the approximate current consumed is known from the type of valve used, and this is generally good enough to use for assuming the battery current. From the valve point of view this is not good enough. If a valve filament will work safely on, say, .6 amperes, running it at .7 amperes will appreciably reduce its life, while .5 amperes will lower the efficiency of the valve. An experimental man may be able to decide the normal current in his valve by the appearance of the filament, but this is by no means accurate.

The anode battery may be tested with a voltmeter; if all cells are available the same voltmeter can be used for filament accumulators and anode battery, or if in larger numbers of cells the voltmeter must be able to read them. A voltmeter reading to 50 or 100 volts will read the total voltage of the battery. The type of instrument suitable is considered later.

A milliammeter for measuring the anode battery current is not required for ordinary work, but if characteristics of the valves are to be plotted this is necessary.

Ammeters to indicate the aerial current in transmitters are not considered here. It is sufficient to state that they must be of the thermal type, either hot-wire or radiation type.

Types of Instruments

For this work moving coil instruments are almost indispensable. Small watch type, or small switchboard type moving iron instruments are practically useless.

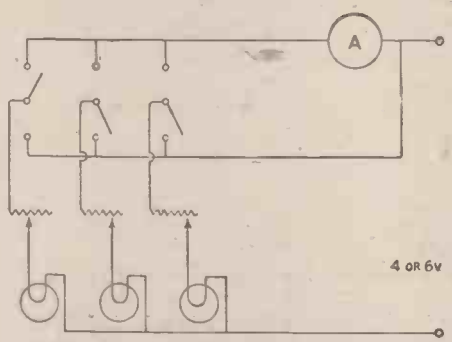
Voltmeters

For accumulator testing a cell-testing voltmeter is the best instrument; this is a moving-coil instrument reading usually to three volts, with or without a central zero. Its resistance is high, of the order of 100 ohms per volt, so the current taken by the instrument is too small to affect the state of the cell.

Instead of a cell-testing voltmeter, a switchboard-type instrument may be used, the range being sufficient to read the total battery volts, generally four or six.

Ammeters

The filament ammeter should also be a moving coil instrument, and for first-class work there is probably nothing better than a small Weston, model 267. These are sector-shaped, about 4 in. across, and are



Circuit Diagram showing Arrangement of Switches.

used by the Marconi Company extensively. They are expensive, but are sometimes obtainable second-hand or ex-Government disposals. Two of the writer's instruments are a Weston voltmeter to 10, and a similar model ammeter to 5. These were purchased for 15s. each, nearly new. If a single-valve set is used no trouble is experienced in connecting it in series with the filament. If two or more valves with only one rheostat are used it is also straightforward, the ammeter reading the sum of the currents, and provided the valves are of similar make and can be relied on to be practically identical for this purpose. If several valves are used with their own rheostats it is a more complicated matter, but it can be accomplished by switching if required. A number of single-pole change-over switches are required, one for each valve; these are connected as shown in the diagram. When the switches are open the valves are "off." On putting switches "down" the valves light up without a reading on the ammeter. On putting the switches "up" the particular filament controlled is put on through the ammeter and a reading may be taken.

Ranges

The range must be high enough to read the total current if the filaments are all in parallel through the ammeter, but if the last method of connection and switching is carried out the ammeter need only read to 1 ampere; care must be taken that only one switch is "up" at one time. If, for example, three valves are used and the ammeter reads 5 amperes, all the switches may be kept "up" without harm. A word of warning is here advised. If three valves are used with separate rheostats one-third of the total ammeter reading will not necessarily give the current per valve. One may have more than normal and one less, and the ammeter would read as if all were at normal brilliancy. Alternatively to the above switching arrangement, the ammeter may simply be connected in each circuit as required; this is troublesome and slow.

The anode voltmeter may be of practically any range, provided it is high enough to read the lowest unit accessible, say 4.5 or 15 volts.

E. H. W. B.

Testing Phones

THE following method of testing earphones is less difficult and perhaps more efficient than testing by the "weak battery" or sixpence and penny method.

The two leads from the earphones are connected to the two terminals of an ordinary electric bell. No battery whatever is put in circuit. The clapper is pressed forward to the bell and then quickly released. It will vibrate several times before coming to rest. A similar vibration will take place and will be heard plainly in the phones. The explanation of the action is that there is a small amount of magnetism in the magnet of the bell when it is not connected to the battery which usually works it. When you cause the armature of the bell to vibrate the magnetism is disturbed and sets up currents in the coils of the magnet core. These currents work the diaphragms of your phones, and you hear a sound agreeing with the vibration of the armature of the bell.

J. H. L.

An Improvised Blowlamp

SHOULD the reader not possess a blowpipe and lamp for soldering, a good substitute is a pipe lighter (flint type) and a blowpipe, both of which can be purchased for about a shilling. Methylated spirit is, of course, to be used instead of petrol, as it does not give off a smoke and cause soot to deposit on the work.

R. B.

A Cheap Experimental Transmitter

PROBABLY many readers of AMATEUR WIRELESS have at times practised the transmission and reception of messages in the Morse code in order to improve their efficiency in the interception of ship and other commercial messages, and have a neighbour or neighbours living a few doors away who are also interested in the same study and desire to co-operate. Some no doubt have rigged up a land line telegraph set for this purpose between their houses, whilst others have invited their neighbours into their homes and probably rigged up such a set between the house and the garden.

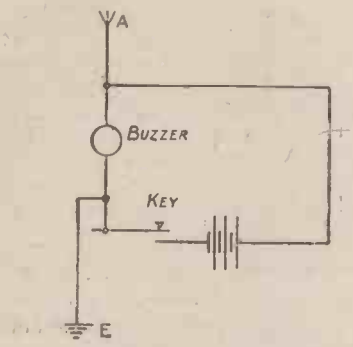


Fig. 2.—Circuit Diagram of Simple Transmitter.

They have probably wished that they had not got to go to this trouble and expense for their practice and desire to abolish the unsightly wires, and possibly they would be interested in a method of carrying out such practice under actual wireless conditions.

The problem has been broached to the writer by one or two wireless enthusiasts, and it was asked could such a transmitter be erected with little or no extra expense, and could it be done so as not to cause serious interference to close-by neighbours listening-in to broadcasting. The answer to all the large army of "ether-droppers" who possess a simple crystal receiving set and ask these questions is, "Yes."

Those who possess a crystal receiving set are almost certain to possess a buzzer for use when adjusting the crystal, whilst those who indulge in land line practice are equally certain to possess such an article.

An ex-Army buzzer, in conjunction with a 4-volt dry battery, has been tested by the writer with the object of ascertaining whether the note of the buzzer could be heard in the wireless telephone over certain short distances, the receiving station in one instance using a valve set consisting of one detecting and two L.F. amplifying valves, and the other being a simple crystal detector.

The crystal receiver was the first test and was stationed 75 ft. away. The instrument received the spark note of the buzzer satisfactorily, although there was no great volume of sound, but the Morse message could be received and read quite comfortably, and was as clearly received as a large number of ship transmissions.

As regards the valve set, this was a station 350 ft. to 375 ft. away. The note of the buzzer was audible, and could be read with all the valves in operation, but it is questionable whether it would have been heard comfortably with a reduction of more than one of the valves.

It would therefore appear that (1) a buzzer can be used for the purpose of transmission over short distances if connected up as illustrated in the photograph; (2) it has an effective range with a crystal receiving station of at least 75 ft. if used with a double wire aerial 20 ft. high and 40 ft. long (the size of the aerial used in the above-mentioned experiments); (3) there is no danger of interference to other receiving stations by its use; and (4) all that is required in addition to the receiving set is a buzzer and push-button or key.

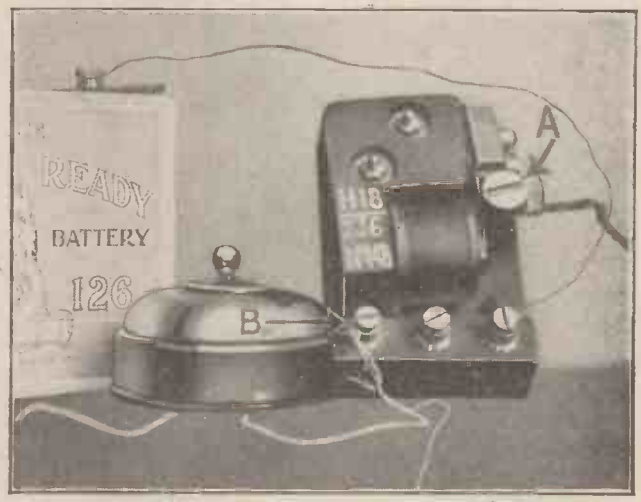


Fig. 1.—Photograph of Transmitter.

The photograph (Fig. 1) illustrates the apparatus and the type of buzzer used in these experiments. It is an ex-Army type purchased for 2s. 6d. No modification was made to the buzzer in any respect whatever. The connections are shown in the diagram (Fig. 2).

The earth wire was looped tightly round the set-screw A, which is the screw by which the note of the buzzer is adjusted. The aerial wire was inserted under the head of the screw B together with the wire from the dry battery which is shown in the photograph. Although a push-button can be used for transmission, it is advisable to purchase a transmitting key when the operator becomes more efficient.

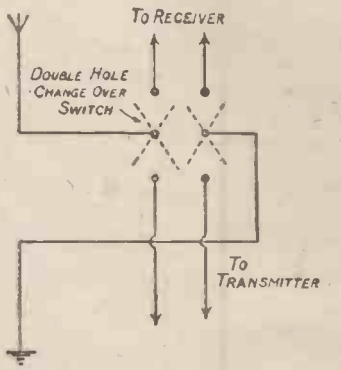


Fig. 3.—Connections of Change-over Switch.

To produce good clear signals the buzzer should be tuned up to the highest note of which it is capable, and this will also be found to give it a greater effective range.

Should the experimenter be using the buzzer as a transmitter, and wishes permanently to incorporate it in his receiving set, this can be done by using a double-pole change-over switch; a diagram of the necessary connections is given in the diagram (Fig. 3). By fixing a screw to the trembler or armature-carrying bracket the connection can be made permanent. A. J. C.

A very effective substitute for engraving on ebonite panels may be provided in the following way: With the assistance of a paper-punching machine, such as is used in most offices, a number of neat round discs are made out of a visiting card. Holding a disc with the point of a pen-knife, a number or initial is carefully inscribed with a fine pen and drawing ink. A shallow countersunk recess is made in the ebonite with a drill slightly larger than the disc; a spot of shellac varnish suffices to hold the punching in position. This method is far superior to even the neatest figuring in paint. J. L. B.

TELEVISION.—III

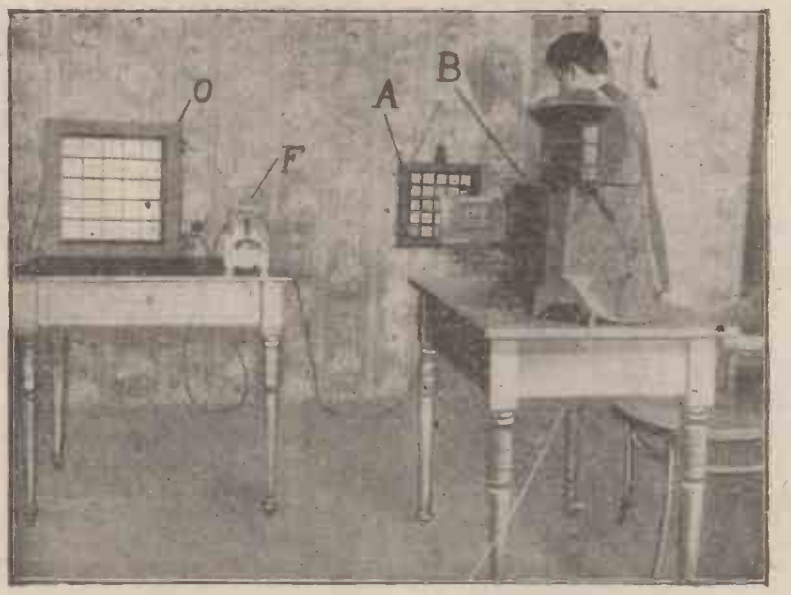
FURTHER EARLY APPARATUS

EVEN with such a large number of elements the reproductions obtained would leave much to be desired, it being estimated that to transmit and receive a picture measuring 3 in. by 2 in., with a grain as fine as that of an ordinary newspaper illustration, would require at least 60,000 elements and a similar number of connecting lines.

The Many Difficulties

Apart from any question of cost, however, the electrical difficulties in such a system, if transmission is to be carried on over any distance, appears to be almost insuperable. Also the manufacture of such a large quantity of similar selenium cells would be commercially impossible. In spite of the obvious impracticability of such a system of television, numerous modifications have been patented, but very few attempts have been made to construct actual working models.

As the use of a mosaic of electric globes does not offer a very sensitive method for recording variations of current, Prof. Kerr suggested a receiver based upon his discovery of the rotation of a beam of plane-polarised light reflected from the pole of an energised electro-magnet. In this method each square in the receiver was a piece of silvered soft iron which formed the end of a small electro-magnet. The surface formed by this mosaic of silvered iron cores was to be illuminated by plane-polarised light reflected by glass. The beam from each magnet face would be received by an analysing prism, these prisms forming the televisionary screen proper. The intensity of the analysed light depends upon the rotation of the plane of polarisation by each little magnet face; the degree of this rotation depends upon the strength of the current which flows round each magnet winding. As each magnet was to be connected to a corresponding selenium cell of the transmitter the intensity of the light passing through each prism at the receiver would therefore be governed by the varying amounts of light falling upon the mosaic of selenium cells. Mr. J. H. Gordon, experimenting with this type of receiver, found that owing to the small magnets and the small current available in a selenium-cell circuit it was not possible to produce a degree of rotation sufficient for purposes of television.



Prof. Rhumer's Selenium Television Apparatus.

The references are: *A. Selenium Transmitting Screen. B. Projection Apparatus. F. Battery. O. Selenium Receiving Screen.*

Another type of polarised-light receiver depending upon the changing of the refractive index of a liquid by means of a magnetic field was described by Rignoux and Fournier for a proposed television apparatus, but in this case also the current strength required for working was too large to be practicable.

The first receiver designed by Messrs. Ayrton and Perry consisted of a number of small magnetic needles whose movements closed or opened small square apertures through which light passed to illuminate a screen of very fine ground glass. The movement of these needles was controlled, as in an ordinary telegraph instrument, by the current flowing through the wire with which it was connected

Later Experiments

Later experimenters have endeavoured to construct apparatus in which one or more rapidly moving selenium cells could be made to do the work of the large number of stationary cells, thus reducing the expense and obviating the use of a multitude of connecting wires.

In any system in which moving elements are employed persistence of vision is relied upon in the ultimate reproduction of the picture. This means that the operation of building up the secondary picture must not occupy more than one-tenth of a second.

The arrangement of Messrs. Ayrton and Perry's modified television apparatus was somewhat as follows: At the transmitting station there was a transparent screen upon which an image in black and white could be projected. At the back of this screen a selenium cell was passed with rapid to-and-fro motion in such a way that every part of the screen was covered in turn. According to the amount of light which fell upon the selenium cell as it moved about behind the varying densities of the projected image more or less current flowed through the line wires to the receiver.

At the receiver the varying current was made to open and close a shutter (by means of an electro-magnet) in a small tube into which light was admitted. A lens was fitted at one end of the tube and was capable of throwing an image of a square hole on a screen. When the selenium cell passed behind a light portion of the image on the transmitting screen its resistance was reduced, and sufficient current passed fully to open the shutter of the receiver. When passing behind a dark portion the shutter remained closed. It is obvious that this method necessitates the employment of two distributors which would automatically connect that receiving tube to the line which occupied the same position on the receiving screen as that behind which the selenium cell was at any instant passing on the transmitting screen.

Theoretically this method is quite feasible; it is only when attempt is made to put the idea into practice that the difficulties are realised. In a demonstration model the transmitter and receiver were connected together in order to dispense with the intricate mechanism required for working the distributors. It was found that, although at slow speeds a record of the passage of the selenium cell could be obtained, the system could not be worked with sufficient rapidity to give a continuous visual impression. M. J. M.

(To be continued)

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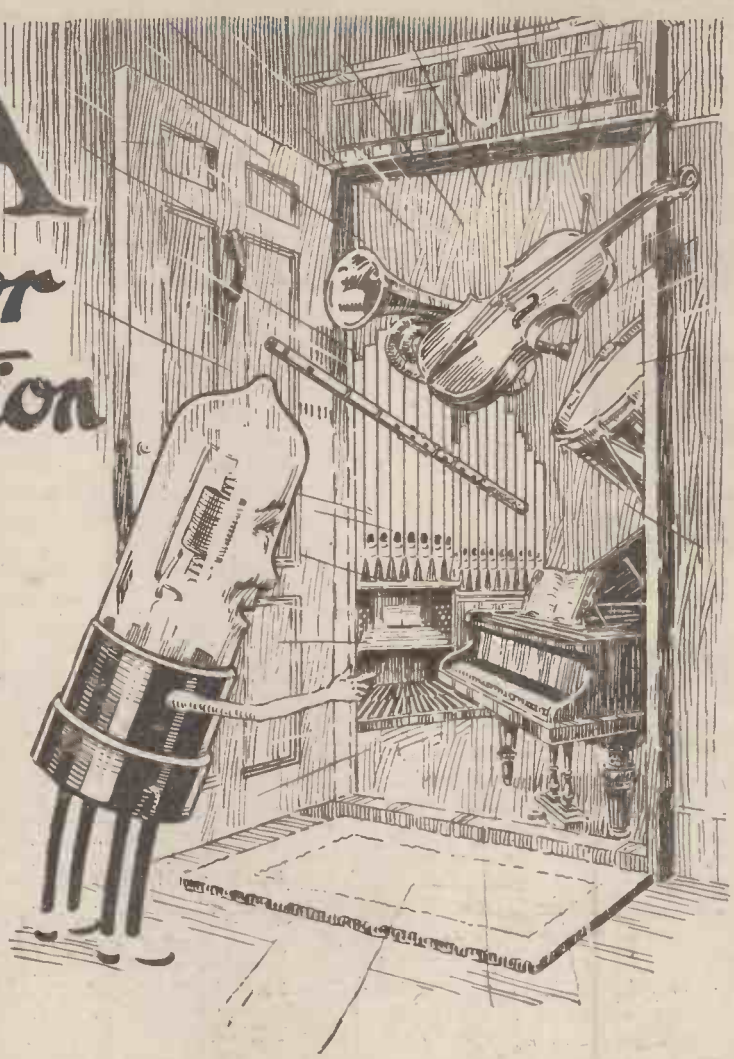

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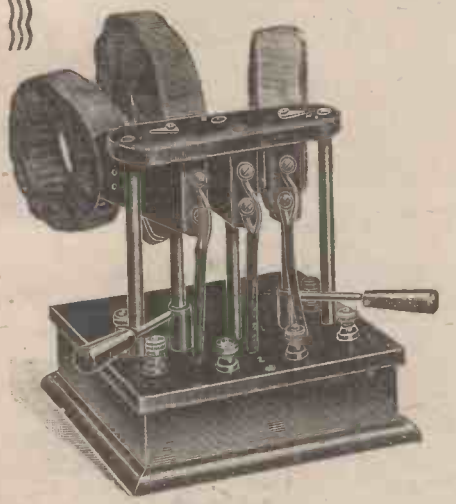

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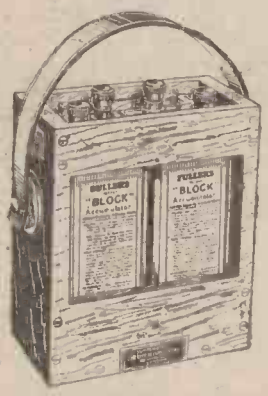

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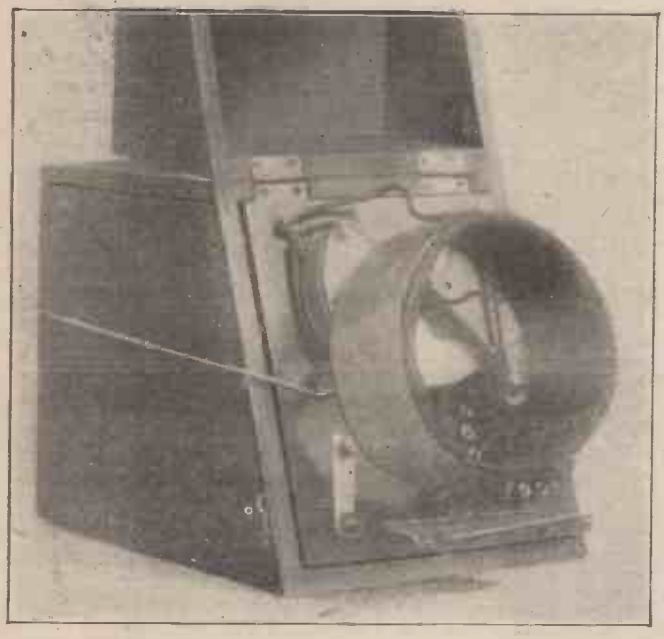
The Choice of a Tuner

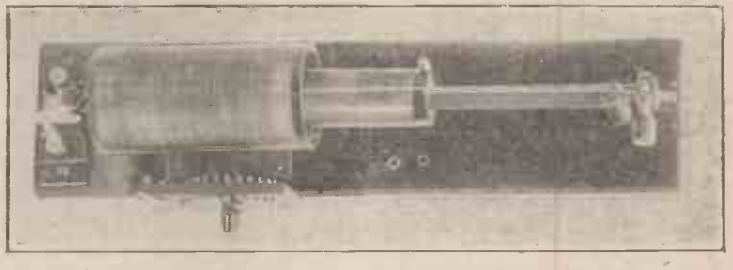
EARLY in his wireless career the amateur will have to choose a tuner suitable for his own special requirements. No hard and fast rules can be laid down, as different types are suitable for different purposes, and each has its own particular use under special circumstances.

Classes

Roughly speaking, tuners can be divided into two main classes—(*a*) those coils which have the length greater than the diameter, and (*b*) those that have the diameter greater than the length.

Each of these groups can be further subdivided as follows: (*a*) into single-layer coils and bank- or pile-windings; (*b*) into basket, or pancake, coils; honeycomb, duolateral and Burndept coils. These groups sometimes overlap as, for instance, a single-layer coil can come in group *b*.





Left.—Single-layer Tapped Tuner. (*J. McIntyre & Co.*)

Right.—Basket-coil Tuner and Receiver. (*Stanley Prince & Co.*)

Bottom.—Loose-coupler Tuner with Cord and Pulley Control. (*L. McMichael, Ltd.*)

Single-layer Coils

For a long time single-layer coils were used almost exclusively by amateurs, but they have several inherent disadvantages. The greatest of these is that to attain any moderately high wave-length a very large former is needed. As far as size is concerned, they are quite suitable for wave-lengths up to about 3,000 metres, but after this they become unwieldy.

The disadvantage of large size was to some extent obviated by the introduction of banked, or pile-winding. This is the same as a single-layer coil with several turns wound above each other. This type is quite efficient but rather difficult to make satisfactorily.

Basket Coils

Many amateurs nowadays favour the simple basket, or pancake, coil. These are very easily and quickly constructed, which is a great convenience to the experimenter. Beginners will be well advised to use this type to begin with as it gives very little trouble in construction. To obtain high wave-lengths several moderate-sized coils may be joined in series, making a nice, compact tuner.

Honeycomb Coils

Honeycomb, duolateral and Burndept coils are all extensions of this type, designed particularly to cut down self-capacity effects, which are detrimental to signal strength. They are not easily constructed without special apparatus. If the amateur does not want to make his own apparatus—and he must do so to enjoy wireless to the full—he can buy any of these types at a fairly reasonable price. They are usually mounted on plugs for convenience in changing coils.

We therefore come to the following decisions. If the experimenter wants to make his own apparatus he will probably do best with basket coils, or perhaps, for some special purposes, with single-layer coils. If, on the other hand, he prefers to buy his tuner ready-made he should get duolateral or Burndept coils.

Relative Efficiencies

Much has been written on the relative efficiencies of these different types, but if they are properly constructed no appreciable difference in signal strength will be noticeable on a one- or two-valve circuit. When using a very selective circuit with three or more valves some difference is produced. It is doubtful, however, whether the little extra efficiency obtained by using special coils balances the extra cost, from the experimenter's point of view any way.

D. SISSON RELPH.

Fixing Crystals

FOR mounting crystals in brass cups it is advisable to fix the cups in a vice or, failing that, between two pieces of wood tightly screwed together, of course leaving the bottom of the cup exposed to view and accessible. Apply a small quantity of Fluxite to the inside of the cup, heat the cup with a blowpipe and lamp, drop the Wood's metal into cup, causing the metal to melt. Then place the crystal in the cup and hold in position with a piece of wood until the metal has become solid. It is necessary to hold the crystal down, otherwise it will float, and when cool will drop out, leaving the metal still in the cup.

In the case of several small pieces of crystal to be fixed, the writer has found a good way is to put the pieces in position in a small piece of soft cork, and when the metal is melted press the end of the cork, holding the small pieces into the molten metal and allow it to remain there until the pieces have become embedded in the cooled metal, when the cork will come away minus the crystals, which will be in the desired positions.

R. B.

All About the Valve.—IV

A Continuation of the Series of Articles Explaining the Principles and Action of the Thermionic Valve

APART from minor modifications in constructional features, such as variations in the shape and location of the plate, the Fleming two-electrode valve remained substantially unaltered until the introduction by de Forest in 1906 of an additional electrode or control grid.

The "Audion," as the new tube was christened, was soon found to be extraordinarily sensitive, besides possessing other characteristic features of merit, which contributed in no small measure to the subsequent rapid extension and development of wireless science as a whole.

Nomenclature

It is a misnomer to call the three-electrode tube a "valve" in the same sense as the word is applied to the original two-electrode Fleming detector. In the latter the detecting action was, strictly speaking, a one-way valve effect. To negative pulses of current the valve was "open" in one direction only. The most perfect detector, acting simply as a valve rectifier, can only possess a maximum efficiency of fifty per cent. In other words, it can only utilise one-half of the incoming cycle. The three-electrode tube, on the other hand, in its simplest form, without retroactive coupling, shows an amplification ratio of from five to eight, a theoretical efficiency of 500 to 800 per cent. It is therefore a true form of relay or amplifier in addition to being a detector, so that the term "valve" is inadequate properly to describe its functions. The word "triode" has been applied to the three-electrode tube in contrast with "diode" as describing the two-electrode form. More commonly the generic expression "thermionic tube" is correctly used.

Potential Operation

The triode is a potential-operated device, as distinct from current-operated detectors. A unique feature is that it forms a relay which operates without any perceptible lag due to inertia effects. The only moving parts are the electrons, and their mass is negligible so far as friction or other retarding effects, invariably present in other forms of relay, are concerned. The response then to an applied impulse or stimulus is immediate.

Another most valuable feature lies in the fact that the output effect in the plate circuit is absolutely quantitative up to the saturation-point of the characteristic curve, and is strictly proportional to the voltage applied to the grid, the precise ratio between input and output being determined by the characteristic curve for all values of input. For this reason the triode will amplify speech frequencies without appreciable distortion, and so will preserve both the quality and timbre of transmitted speech or music.

Before examining the three-electrode tube

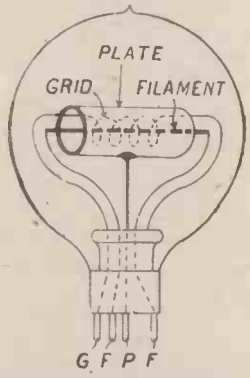


Fig. 9.—Three-electrode Valve shown Diagrammatically.

in detail it will perhaps be as well to summarise its uses as follows:

(1) As a rectifier or detector of ordinary or "spark" signals.

Photograph of Three-electrode Valve.

(2) As an amplifier or relay for either high-frequency currents or for audio-frequency currents, as in telephony.

(3) As a generator of local oscillations for use in receiving C.W. signals by the heterodyne method.

(4) As a generator of sustained oscillations of large amplitude, either for the transmission of C.W. telegraphy or as a telephony transmitter.

Types

There are in general two types of three-electrode tubes:

(A) Soft tubes containing a considerable amount of residual gases within the bulb, such as the Lieben-Reisz type and the early form of Round tube. These are now practically obsolete on account of irregularity in working (unless under the most careful attention and adjustment).

(B) Hard tubes in which the highest possible degree of vacuum exists in the globe. The original Audion was "hard," but the degree of vacuum was not so high as has since been attained in such tubes as the well-known French or R "valves" in general use during the war. The term Kenotron has been applied to such highly-exhausted tubes by Dr. Langmuir, who was the first to devise a pump that would exhaust a thermionic tube to the requisite degree to ensure absolute steadiness in working. In modern hard tubes the pressure of the gas-traces left in the globe is less than the one-millionth of a millimetre of mercury. In such instances the current is a pure electron-stream without any appreciable secondary effects arising from internal gas molecules.

The Amateur's Valve

The ordinary three-electrode tube or triode in general use amongst amateurs to-day is of the hard type. In this form, shown diagrammatically in Fig. 9, the metallic plate or anode is cylindrical in shape and surrounds both the stretched wire filament and the grid or control electrode. The latter consists of a spiral of wire closely surrounding the filament.

The action of the control or grid upon the electron stream from the filament may be explained as follows. Assuming that there is a steady positive potential applied to the plate, and that the grid is at zero potential, there will normally exist a steady stream or flow of electrons from the glowing filament towards the plate.

In their passage a certain number of electrons strike against the spirals of the grid and remain lodged there. As each electron represents a definite charge of negative electricity, a comparatively small number of such "captives" will be sufficient to give the grid a negative potential (if the grid is insulated).

D. ALCASE.

FL — ··· — ONM, Meteo Europe

MANY amateurs who are beginning to appreciate their Morse code will have often taken down for practice those long, puzzling jumbles of figures which they know to be meteorological messages.

An explanation of all codes used for such reports would fill many issues of "A.W.," so this article will deal with the coded weather report for Europe sent on 2,600 metres spark by the Eiffel Tower, at 11.30 G.M.T., as being of most use and interest.

The code is represented by three groups of two, five and three "letters" respectively. These are: M M, B B B D D, F N b.

M M, the first group of two letters, serves to represent the index number of the observation stations. Forty-three meteorological stations throughout Europe send in their prevailing conditions to F L.

The index numbers for these stations are given in Code I.

CODE I.

01 = Paris	23 = Dantzig
02 = Madrid	24 = Tynemouth
03 = Vienna	25 = Perpignon
04 = Stockholm	26 = Skudesnaes
05 = Stornoway	27 = Corunna
06 = Clermont	28 = Florence
07 = San Fernando	29 = Fano
08 = Munich	30 = Mahon
09 = Harparanda	31 = Cracow
10 = Thorshavn	32 = Holyhead
11 = St. Mathieu	33 = Berne
12 = Algiers	34 = Helder
13 = Warsaw	35 = Parata
14 = Bronno	36 = London
15 = Blacksod Pt.	37 = Hamburg
16 = Biarritz	38 = Ile d'Aix
17 = Tunis	39 = Brussels
18 = Prague	40 = Valencia
19 = Vardo	41 = Rabat
20 = Seydisfjord	42 = Lisbon
21 = Scilly	43 = Horta
22 = Nice	

B B B. These letters stand for the height of the barometer. An initial 7 is added in all cases, while a decimal point is inserted before the third figure.

Example: (7) 69.8.

D D. The direction of the wind. See Code II.

CODE II.

02 = NNE	20 = SW
04 = NE	22 = WSW
06 = ENE	24 = W
08 = E	26 = WNW
10 = ESE	28 = NW
12 = SE	30 = NNW
14 = SSE	32 = N
16 = S	00 = Calm
18 = SSW	

Intermediate numbers indicate a variation between the two points, while numbers over 32 generally mean a very unsettled wind.

F = force or type of wind on the Beaufort scale given in Code III.

CODE III.

0 = Calm	7 = Moderate gale
1 = Light air	8 = Fresh gale or high wind
2 = Slight breeze	9 = Strong gale
3 = Gentle breeze	10 = Whole gale
4 = Moderate	11 = Storm
5 = Fresh breeze	12 = Hurricane
6 = Strong breeze	

N = the barometic tendency (+ or —) and weather. See Code IV.

CODE IV.

0 = + Sky clear, fine	5 = — Sky clear, fine
1 = + ¼ Sky covered with cloud	6 = — ¼ Sky covered with cloud
2 = + ½ Sky covered with cloud	7 = — ½ Sky covered with cloud
3 = + ¾ Sky covered with cloud	8 = — ¾ Sky covered with cloud
4 = + Overcast	9 = — Overcast

Finally, "b" indicates the characteristic of the barometic tendency.

It must be clearly understood that the letters M M, B B B D D, F N b never actually appear in the telegrams, but only serve to represent the figure position and meaning.

To avoid any misunderstanding the report for September 3, 1922, is given in full below:

R = a division sign between each group of figures.

T = the Morse code abbreviation for "0."

— · — · — · — is the Morse code break sign.

T1R6123TR242 — · · · · — · — ·
T3R5852TR121 — · · · · — · — ·
T4R6528T8R31x — · · · · — · — ·
T5R635TTRT4T — · · · — · — · —
T6R585T2RT41 — · · · — · — · —
T7R59528R21T — · · · · — · — ·
T9R68216R41T — · · · · — · — ·
10R62626R332 — · · · — · — · —
11R64832R222 — · · · · — · — ·
12R59100RTT1 — · · · · — · — ·
13R5783TR241 — · · · · — · — ·
14R62117R411 — · · · · — · — ·
16R64312RT42 — · · · — · — · —
17R57732R21T — · · · · — · — ·
18R58886R131 — · · · · — · — ·
19R69T16R992 — · · · · — · — ·
2TR58204R4T2 — · · · · — · — ·
21R65T28R941 — · · · · — · — ·
24R63224R13T — · · · · — · — ·
25R6T526R432 — · · · · — · — ·
26R54T2TRT91 — · · · · — · — ·
28R54T2TR432 — · · · · — · — ·
29R613T3R24T — · · · · — · — ·
31R58616R131 — · · · · — · — ·
32R63614R141 — · · · · — · — ·
33R58312RT4T — · · · · — · — ·
34R62632R111 — · · · · — · — ·
36R64528R242 — · · · · — · — ·
38R631T4R4T4 — · · · · — · — ·
39R614T2R342 — · · · · — · — ·
41R687TTRT51 — · · · · — · — ·
43R81TTTRT2T — · · · · — · — ·

The letter *x* denotes a missing observation. As an example, the three underlined stations are decoded below

a. 05R635TTRT4T
b. 17R57732R210
c. 36R64528R242

	Baro^mm.	Wind.^D	Wind.^F	Weather.	Baro^m. tendency
a. Stornoway	763.5	calm	calm	+ overcast	0
b. Tunis . .	757.7	N	slight breeze	+ fine + ¼ sky covered with cloud	0
c. London .	764.5	NW	slight breeze	+ overcast	2

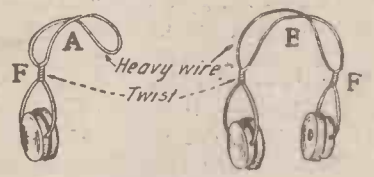
After the code message a plain language report in French is sent at a rate of about 12 words per minute, providing excellent Morse practice.

G. H. R.

From America

Simple Headbands

A SIMPLE head-band may be made by bending a piece of No. 10 wire into the shape shown at A in the illustration, and twisting the wire together as at F. With a pair of pliers the two ends should be bent to fit into the two holes in the sides



Simple Headbands.

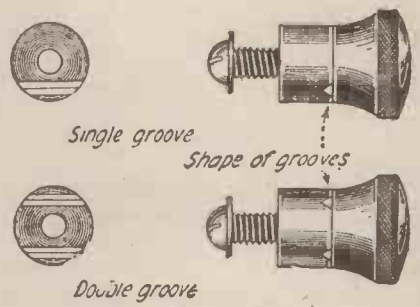
of the receiver case, allowing it to swing freely. With a little adjustment it will fit the head snugly and is a very light and cheap arrangement.

A double head-band may be made as at B.—*Radio News.*

A Phone Binding Post Kink

THE sketch shows how the writer uses an ebonite top binding post for telephone connection. A good many people prefer a binding post of this type, but the cord tips ordinarily supplied on phones are hard to grip in these posts.

By simply filing a groove across the brass



Binding Posts with Grooves.

base as shown, to a depth equal to about one-half the diameter of the cord tip, these posts work fine with phones.

If it is desired to attach two sets of telephones in parallel use two double-grooved posts, connecting one side of each headset to each binding post.—*Radio News.*

Three-valve High-frequency Amplifier.
(*W. J. Henderson, London.*)

GRID CONDENSER

Why and how a small leaky condenser is inserted valve to the top of the aerial tuning coil—a

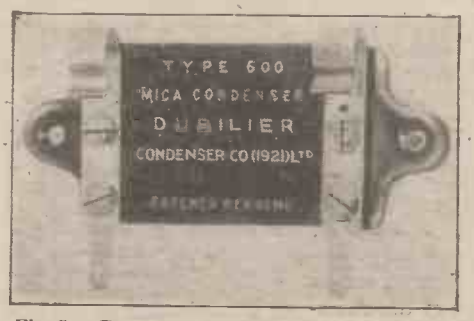


Fig. 7.—Commercially-made Condenser with Clip for Leak.

THE action of a detecting valve is to convert high-frequency alternating currents, received from a distant station via the aerial, into unidirectional-pulses of current which can affect the magnets in a telephone receiver. We may add *high*-frequency amplifying valves *before* the detector to magnify the weak alternating current from the aerial, or we may add *low*-frequency amplifying valves *after* the detector to magnify the rectified pulses; but in neither case will satisfactory results be obtained unless the detecting valve is working properly. Obviously, then, the first thing to be done when we are installing a valve receiver is to get the detecting valve working properly.

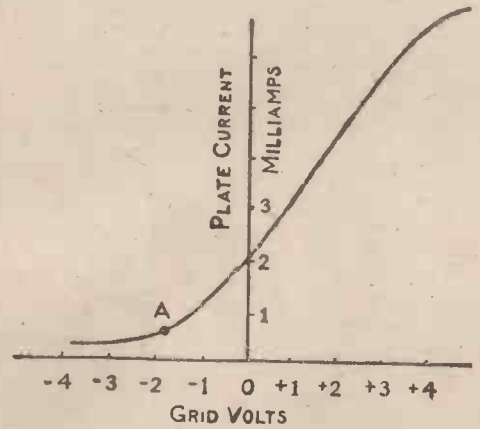


Fig. 1.—Graph showing Characteristic Curve of Valve.

In order to explain how a valve of the ordinary hard type (say an R or an "Ora") works the reader's attention is directed to Fig. 1, which is a simple, graphic way of showing what would take a long time to express in words. Horizontal measurements denote the potential in volts of the grid with respect to the filament, while vertical measurements denote the currents which pass from plate to filament. By following the curved line we see exactly how the plate current varies with varying voltages on the grid. Different valves have different characteristic curves, but most specimens have curves very much like the one indicated. At the point A, where the grid has a slightly negative potential, the curve bends sharply, and it is just at this bend where the valve functions best as a detector.

Valve as Detector

The obvious way, therefore, of using a valve as a detector is to adjust the grid voltage with a potentiometer to the right negative value of one or two volts, as shown in Fig. 2. We have the grid normally at the potential indicated by the point A in Fig. 1, but owing to the trains of high-frequency oscillations which are set up in the tuning coil by the waves received from the transmitting station the grid potential oscillates about the point A. There are corresponding variations of current through the plate circuit, there being a decrease when the grid-potential is below its normal value and an increase when it is higher. It will be seen from the shape of the curve that the increases of plate current will be greater than the decreases. The net result is that at each train of high-frequency oscillations there will be a momentary increase of current through the phones lasting as long as the train does. In the case of spark transmission or telephony, these trains or groups of oscillations follow each other at an audible frequency, causing variations of current through the phones at the same frequency which are heard by the ear.

The Use of a Grid Condenser and Leak

Although a grid potentiometer gives quite good results, and indeed is preferable when soft valves are used, a simpler and more convenient device is generally used with ordinary hard vacuum receiving valves, such as the French R type. This consists of a small leaky condenser inserted in the lead connecting the grid of the detecting valve to the top of the aerial tuning coil, as shown in Fig. 3.

The condenser C itself is best made with a good insulating dielectric and the necessary leakage given by shunting it with a very high re-

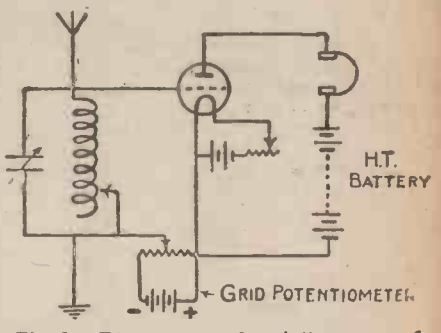


Fig. 2.—Diagram showing Adjustment of Grid Voltage.

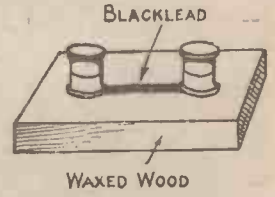


Fig. 5.—Pencil-line Grid Leak.

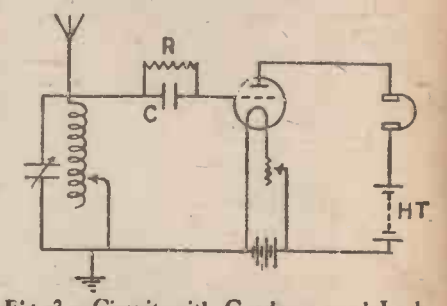


Fig. 3.—Circuit with Condenser and Leak.

R AND GRID LEAK

in the lead connecting the grid of the detecting and how to make both condenser and leak.

sistance R known as the grid-leak. Rectification of the received high-frequency oscillations is affected as follows: When the top of the tuning inductance is positive a positive charge flows into the grid-condenser C, repelling a positive charge on to the grid of the valve; this positive charge on the grid is promptly neutralised by the stream of negative electrons from the incandescent filament. When, however, the top of the aerial-tuning-inductance becomes negative, a negative charge flows into the condenser, repelling a negative charge on to the grid. Now this negative charge on the grid, being of the same sign as the electrons, repels the electrons approaching the grid from the filament, with the result that there is an accumulation of negative electricity ("space charge") in the space between the filament and the grid. Thus when a rapid series of alternate positive and negative pulses arrive the positive ones are annulled, but the effect of the negative ones is cumulative, and the grid becomes negatively charged, with the effect that the current which passes through the phones is decreased for the duration of the train. There are a few hundred or thousand of these trains of high-frequency oscillations per second to produce an audible note, and at each train the current through the phones is decreased.

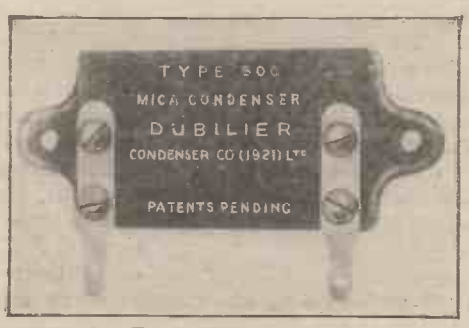


Fig. 8.—Another Grid Condenser.

Three-valve Low-frequency Amplifier. (*W. J. Henderson, London.*)

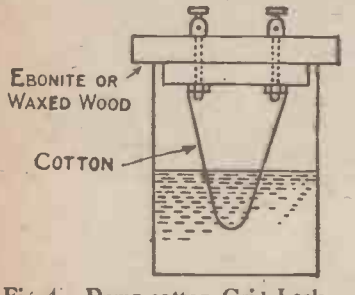


Fig. 4.—Damp-cotton Grid Leak.

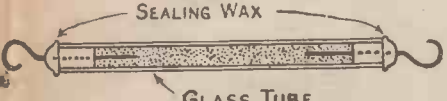


Fig. 6.—Powder Leak.

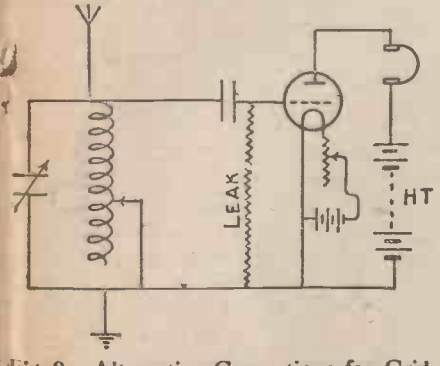


Fig. 9.—Alternative Connections for Grid Leak.

In order that the grid potential may return to its normal value in the intervals between the wave-trains the grid-condenser is shunted by the leak R, which is of such a resistance as to allow the negative charge to leak at the right rate. Theoretically we should need a different value of leak for each pitch of note in the receivers, but in practice it is found that it is quite sufficient to strike a happy medium which works satisfactorily at all pitches.

Practical Grid Condensers and Leaks

Grid-condensers have a small capacity, usually between .00001 and .0001 of a microfarad. Two plates with an area of overlap of about 10 square centimetres and separated by a sheet of mica about the thickness of an ordinary postcard will give quite good results. There are several ways of making up grid-condensers, and a variety of materials are suitable for their construction.

A popular form of condenser consists of a few strips of copper foil interleaved and separated by sheets of mica; alternate sheets are connected together and the whole clamped tightly between two plates of ebonite. There may conveniently be four strips of copper foil 1.5 cm. wide and 4 cm. long, this giving an area of 12 sq. cm. for each set of plates. Tinfoil, zinc or brass plates may be used instead of copper, and mica dielectric may be replaced by glass or a couple of thicknesses of waxed paper.

A grid-condenser can be made for practically nothing, and there is little to gain by using expensive materials, the only important points being correct capacity and sufficient insulation.

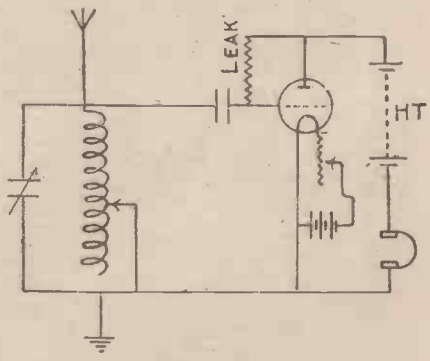


Fig. 10.—Another Grid-leak Connection Diagram.

The grid-leak is simply a resistance of 2 or 3 megohms (1 megohm = 1,000,000 ohms). Even the thinnest wire has far too great a conductivity for the construction of grid-leaks for receiving valves, so that we have to resort to substances which are only poor conductors for their construction. A piece of damp cotton forms a readily-made grid-leak and a method of mounting it is shown in Fig. 4. The cot-

ton is kept damp by the water soaked up, and the correct resistance is obtained by varying the depth of the water in the jar until the results are best. Another simple but effective leak is shown in Fig. 5. Here two terminals are screwed into a piece of wood, previously boiled in paraffin wax for preference, and blacklead or stove polish is rubbed over the surface of the wood between the terminals until the best signals are obtained. If the application of blacklead is overdone the excess may be removed by scrubbing with a piece of cork or india-rubber. It is important to see that the blacklead reaches right under the terminals; in fact, it is best to blacklead the places where the terminals come before inserting the terminals.

Pencil Leak

A modification of this form of leak may be made by screwing two terminals into an ebonite base, cutting a straight groove between them and rubbing a lead pencil into the groove until the resistance is right. Another piece of ebonite may be clamped down on to the first and the edges sealed with paraffin wax; in this way the leak is preserved from moisture and should remain fairly constant. Grid-leaks can also be made by blacking a strip of paper with indian ink, allowing to dry and connecting between two terminals. The strip is narrowed by cutting until the correct resistance is obtained.

A further method of grid-leak construction is shown in Fig. 6. A piece of glass tube about 4 millimetres in diameter and 4 centimetres long is filled with a mixture of lampblack and chalk, contact being made by sealing in a stout piece of copper wire at each end with sealing-wax. By varying the proportion of lampblack to chalk in the mixture almost any desired resistance may be obtained; final adjustment is made by altering the distance between the ends of the copper wires in the mixture. Before being mixed the ingredients should be thoroughly dried in an oven; they are then powdered and well mixed together. The actual proportions are best found by trial, it being remembered that the less the proportion of lampblack the higher the resistance of the leak.

Figs. 7 and 8 show typical forms of commercially-made condensers conveniently made up so that the leak can easily be attached.

Experiment

It is best to try various sizes of grid-condenser and leak before selecting final valves, as valves vary in their properties. Figs. 9 and 10 show two alternative connections for the grid-leak. Both are about as good as the connection shown in Fig. 3. The writer connects his leak to the positive terminal of the H.T. battery, as shown in Fig. 10, as this seems to reduce the hum induced by the house-lighting or close-by power mains.

E. H. ROBINSON.

Broadcasting - - The Situation

THE publication of the "articles" of the Broadcasting Company, of the terms upon which the British manufacturers may join that company, and of the other particulars to be found on page 471 of our last issue, have had the effect of encouraging the public to believe that broadcasting is about to start. We know that the broadcast receiver licences are prepared and will be on sale very shortly. The manufacturing trade does not view with very great favour the size of the royalties which they, if they become members of the Broadcasting Company, must pay to that company; and there is still another matter of the genuine wireless amateur to be settled. It can be settled fairly in only one way.

We have been told, by those in close touch with the matter, that the amateur is certain of generous treatment at the hands of the Post Office, and that every genuine applicant for an experimenter's licence will get it. On the other hand, we hear of painstaking amateurs who have succeeded in producing very creditable sets being refused the experimenter's licence.

Our advice in every case of refusal is to repeat the application. Of course, the applicant must be quite certain that the circuit he gives is one that will not allow of re-radiation. The Post Office is well within its rights in refusing a licence where the circuit is not a safe one.

Any reader who has made a set should apply, not for the broadcasting licence, but for the experimenter's licence, and if he does not get it at the first application he should try, try, try again. In the midst of his annoyance at any delay to which he may be put, he will remember the position of difficulty in which the Post Office finds itself. All the present arrangements are but temporary. The Post Office, the Broadcasting Company, the manufacturers and the public are but learning, and all four will know their position—what is possible and what is not possible—so much better in the course of a few months' time. Meanwhile, patience—but plenty of perseverance!

Should royalties be paid to musical composers for the transmission of their work by wireless in concerts? This question was raised at an International Congress held in Paris.

Continental Telephony

IN addition to the regular local and amateur transmissions there are several of which the average experimenter is unaware. Messrs. Burndept, Ltd., have kindly supplied details of these, and we give them below.

Readers will probably be interested in listening to the telephonic conversation from St. Inglevert, Le Bourget and Haren, Brussels. These stations are quite powerful, but they call for a little extra care in tuning. The station at Haren, call sign O P V H, telephones practically at every twenty minutes past each hour from 11.20 to 4.20, giving messages to the aeroplanes on the Brussels-Paris, Brussels-London, Brussels-Amsterdam lines. These messages, which are sent out on a wave-length of 900 metres, are both in French and English and give various weather reports. At 12 o'clock midday the Brussels Meteorological Institute, call sign O P O, transmits in slow Morse C.W. on 1,500 metres. This message is sent very slowly so that it can be read by amateurs. The Eiffel Tower station now transmits telephony at 7.20 a.m., 11.15 a.m. and 5.10 p.m. At 5.10 they generally put on one or two gramophone records, or on rare occasions give a good concert. This station is going to increase its strength very considerably in the near future. There are also occasional speeches nearly every day, sent out at 10.10 a.m. Konigswuster Hausen, Berlin, is sending out very good telephony each morning between 6 a.m. and 7 a.m. and between 11 a.m. and 12.30 p.m.; also between 4 p.m. and 5.30 p.m. on a wave-length of 2,800 metres. Other Continental stations are using wireless telephony, and these require very careful tuning in, which will be a matter of interest to the more advanced experimenters.

A New Station

A new station erected at Lausanne transmits on 900, 1,400 and 2,610 metres (the latter is not often used). Telephony on 900 metres is being transmitted from this station in connection with the aeroplanes running from Le Bourget on the Swiss route. The transmission can generally be heard in the morning when the aeroplanes are leaving Le Bourget. Telephony is also sent from Lausanne to Dijon on 1,400 metres between 11 and 12 o'clock midday.

Finally, as many important tests of telephony are now being carried out irregularly in this country on wave-lengths of 180 to 200 metres, tests which may be of considerable importance nationally, transmitting amateurs should carefully listen in

on all wave-lengths from 180 to 220 metres before switching on, and if they hear any trace, even of a faint carrier wave within 10 or 15 metres on either side of the wave-length they are going to use, they should not switch on. Experienced amateurs listening in on all these wave-lengths should on no account let their set oscillate. By using H.F. amplification and by carefully tuning in, without causing interference, some interesting experiments will be heard and communications giving the result of their listening in will be valuable.

CORRESPONDENCE

A New Type of Condenser

SIR,—With reference to the letter from the Victoria Electrical (Manchester), Limited, on page 452 of your issue of October 21st, may I state that a condenser working on the same principle was described in the *Scientific American* of May 30th, 1914.—W. J. G. C.

[Another correspondent writes to say that he has had a condenser of this type in use for a number of years, and that details of it have been published in an English scientific contemporary.—ED.]

"Good Joints"

SIR,—The article in No. 20 on "Good Joints" is certainly very interesting as well as instructive. I feel sure, however, that you will agree with me that the writer is in error in suggesting that internal wiring should be laced into a small cable. What has always been preached to and practised by myself is the importance of keeping all leads as far from each other as possible. If wires are bunched together in the manner mentioned, there is sure to be trouble ahead for somebody! In the interests of amateurs you may think fit to draw attention to "A. S. M.'s" little lapse in your next issue.—S. E. G. (Esher).

Crystal Reception

SIR,—I was very pleased to read K. C.'s letter in your issue of October 14 under the above heading. It seems to me that in these days of the valve many amateurs look down on the crystal. Only those who have experimented with the simple crystal receiver to any extent are aware of what surprising results can be obtained. The telephony I have heard seems to be clearer than when received on a valve. The Madame Melba concert was a good example; while signal strength was not to be compared with the valve reception there was no mistaking which was the clearer. It is a great pity that so many amateurs are content to hear telephony all over a room when there is a distinct lack of purity of note in the musical items. I admit that it is, from the present point of view, ridiculous to expect one to receive 2M T on a crystal at this distance (Derby) with any strength, even if at all, but unless we keep on experimenting with what might appear to be the impossible, we cannot expect to bring the crystal to a higher degree of efficiency.

I hope within the next few weeks to carry out various experiments with a crystal receiver and shall be pleased to inform you of the results.—LISTENER-IN (Derby Wireless Club).

Radiograms

SPEECH and music heard by amateurs in the Glasgow district recently is believed to have been transmitted from an unauthorised station just outside the city. No call sign or other evidence of identification was ever given during these transmissions, and experimenters have been greatly puzzled as to their origin.

■ ■ ■

At a recent Housing and Health Exhibition in Glasgow, demonstrations of broadcasting were given. According to the terms of their licence the promoters were prohibited from allowing any radiation outside the exhibition hall, and they therefore limited the transmitting power to one-fifth of a watt. Considerable surprise was felt when amateurs listening-in two or three miles distant from the exhibition reported having heard the concerts.

■ ■ ■

The American Bible Society have arranged to broadcast the Bible in serial form.

■ ■ ■

Experiments are being made in the Island of Inchkeith with what is described as a wireless lighthouse. By means of reflection wireless waves are concentrated into a beam with a radiation of about 100 miles, which revolves, and, in passing each point of the compass, assumes a distinctive signal.

■ ■ ■

On October 23rd an appeal for the preservation of H.M.S. *Victory* was made by Admiral of the Fleet Sir Doveton Sturdee, from Marconi House, on a wave-length of 360 metres.

■ ■ ■

The London Elementary Education Sub-Committee recommend that the inclusion of wireless telegraphy in the curriculum of an approved number of elementary schools be approved. So far permission has been granted to thirteen schools, and they have made a limit of twenty-five schools.

■ ■ ■

An interesting experiment in combined wireless and wired telephony will be made between the Council House, Bristol, and Marconi House, London, on November 3rd. The Lord Mayor of Bristol will make a speech by telephone to Marconi House, whence it will be broadcast.

■ ■ ■

Motor-cars and motor-boats generate oscillations which vary from 2 or 3 metres to 40 metres in wave-length, and can be heard by wireless experimenters listening-in on short-wave lengths.

■ ■ ■

An agreement has been entered into between the Commonwealth Government of Australia and Amalgamated Wireless (Australasia), Limited, having for its object a comprehensive plan of wireless development.

■ ■ ■

The Prince of Wales has consented to become the patron of the Wireless Society of London.

■ ■ ■

It is reported that the Prince of Wales has ordered the installation of a wireless receiving set at York House for his own use.

■ ■ ■

A radio dance will be given on November 25th by the Radio Society of Highgate.

■ ■ ■

Loud-speakers are to be installed in those New York parks which at present do not possess bandstands.

CLUB DOINGS

Fulham and Putney Radio Society

Hon. Sec.—J. WRIGHT-DEWHURST, 52, North End Road, West Kensington, London, W.14.

AT a meeting held on Oct. 20th, Mr. Calver gave the first of a series of lectures on the Elementary Principles of Wireless. The first lecture was entitled "Ether Waves and Rays." The society are moving their headquarters to Fulham House, Putney Bridge, which is the headquarters of the 47th (2nd Lon.) Div. Signal Company, and the wireless room has been placed at the society's disposal one evening each week.

Liverpool District Morse Code Practice Clubs

IT is proposed to organise several Morse code practice clubs in the Liverpool to Crosby District. Will any persons who are anxious to develop Morse reading send a stamped addressed envelope to Mr. S. Frith, 6, Cambridge Road, Crosby.

Plymouth Wireless and Scientific Society

Hon. Sec.—MR. G. H. LOCK, 9, Ryder Road, Stoke, Devonport.

AT a meeting of the above society held on Oct. 17th, experiments were carried out, using the lighting mains as an aerial. The results obtained were only fair, and it was agreed that an outdoor aerial was to be preferred. Particulars of the society may be obtained from the hon. sec.

Eastbourne Amateur Wireless Society

Hon. Sec.—W. F. G. WEST, 11, Bolton Road, Eastbourne.

THE above society has now been formed and the secretary will be glad to give full particulars of the association's object's and terms of subscription to all gentlemen who are interested and desire to seek membership.

Croydon Wireless and Physical Society

Hon. Sec.—MR. B. CLAPP, "Meadmoor," Brighton Road, Purley.

AT a meeting of the Croydon Wireless and Physical Society on Oct 7th, Mr. W. A. Saville gave a lecture and demonstration on different methods of reception, one special feature being a circuit to enable one to switch in or out at will extra L.F. valves. Another interesting piece of apparatus which was demonstrated was a Japanese valve which had two filaments, the lecturer explaining that they could be used separately or together.

North London Wireless Association

Hon. Sec.—MR. V. J. HINKLEY, Northern Polytechnic, Holloway Road, N.

ALL interested in wireless, whether beginners or expert, are invited to write to the hon. sec., or to attend one of the association's meetings which are held weekly at the Northern Polytechnic, Holloway Road, N.1., commencing at 8 p.m.

Stockton and District Amateur Wireless Society

Hon. Sec.—W. F. WOOD, 4, Berkley Square, Norton-on-Tees.

THE monthly meeting of the society was held on October 12th, when a lecture was given by Mr. R. King of the Middlesbrough Wireless Society, on "The Application of the Three Electrode Valve to Receivers."

Portsmouth and District Amateur Wireless Society

Hon. Sec.—MR. R. G. H. COLE, 34, Bradford Road, Southsea.

ON October 18th an address was given by Mr. Harrold, on "Detectors." Mr. Harrold dealt with the earliest form of detectors used, and various diagrams were passed among the members to illustrate these detectors.

Finchley and District Wireless Society

Hon. Sec.—MR. A. E. FIELD, 28, Holmwood Gardens, Finchley, N.3.

AT the meeting held on Oct. 16th, Mr. Treissler gave another of his lectures on the theory of wireless.

Durham City and District Wireless Club

Hon. Sec.—GEO. BARNARD, 3, Sowerby Street, Sacriston, Durham.

THE Secretary of this club would be glad to hear from any persons wishing to become members.

Eastern Enfield Wireless and Experimental Society

Hon. Sec.—Arthur I. Dabbs, 315, High Road, Ponders End, N.

THE inaugural meeting of the above society was held on Sept. 28th. The chairman announced that Mr. Balfour had very kindly offered the use of the room for meetings and moreover, was presenting the society with a complete three-valve receiving set with loud-speaker and aerial for use of the members at the meeting room. Arrangements were made for the application for the licence immediately. The secretary will be very pleased to give prospective members any information if they will write him.

Heckmondwike and District Wireless Society

EXHIBITION and demonstration Friday Nov. 10th, 1922, at 7.30 p.m.; Saturday, Nov. 11th, 1922, at 3 p.m.

The Radio Society of Highgate

Hon. Sec.—MR. J. F. STANLEY, A.C.G.I., B.Sc., 49, Cholmeley Park, Highgate, N.6.

ON Oct. 6 a debate was held on the very interesting and provocative subject "That in the opinion of this house, high-frequency amplification is more suitable than low-frequency amplification for amateur experimental purposes." Space forbids the publication of full details, but this proved to be a highly interesting discussion. The motion was carried by 8 votes to 7. Five members present did not vote.

A very successful demonstration was given on Oct. 7, to an audience of 120 people, this number being the maximum possible seating capacity of the 1919 club.

The Wireless Manufacturers' and Traders' Association of Great Britain

AN association with the above title has been formed with the stated object of protecting and furthering the interests of all engaged *bona fide* in the wireless industry, without fear or favour. The offices of the association are at 70, Central Buildings and 41, Great North John Street, Liverpool, and the southern section at Dundee House, 15, Eastcheap, London, E.C.3, from either of which further particulars may be obtained.

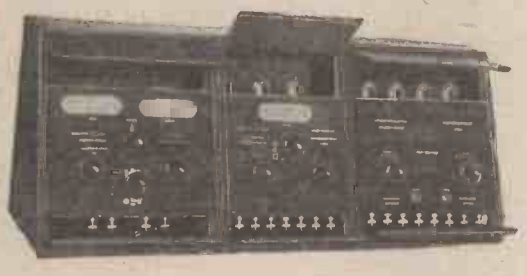
"POLAR"

"Polar" Prestige. "Polar" installations have been adopted by most of the leading shipping companies in this country, by the British Post Office, and by Colonial Governments.

"Polar" equipment is installed at North Foreland (G N F), Seaforth (G L V), and many other important stations.

Having built up our reputation on commercial wireless equipment, we are now applying our valuable resources and extensive experience to the manufacture of broadcasting apparatus.

"Polar" Radiophones. Under the title of "Polar" Radiophones we have a wide range of amateur receiving sets. They are well designed, soundly constructed and finely finished, and extremely reasonable in price.



The set illustrated shows our standard design with sloping ebonite panel, polished wood case, and silver lacquered fittings. Every type of unit required is available. **Prices from £2 15s. to £45 5s.**

"Polar" Accessories. "Polar" wireless accessories incorporate many new and exclusive features.

For example, the "Polar" variable condenser is an entirely new design operating on a new principle. The standard unit has a capacity variable from ·001 mfd. to ·0001 mfd., being equivalent to a 29 plate condenser of the ordinary type. Dimensions $3'' \times 3\frac{1}{2}'' \times \frac{7}{8}''$ deep. **Price, for panel mounting, 14/- ; or in polished wood case, 20/-.**

"Polar" Radio Supplies. By buying all your wireless supplies through the "Polar" organisation you will obtain the benefit of our exhaustive laboratory tests, which are used to discriminate between competing items. Everything sold under "Polar" auspices can be relied upon to be the best of its class.

Ask your wireless dealer to give you "Polar" wireless equipment, or apply direct to one of our branches or head office.

RADIO COMMUNICATION Co LTD

34-35, Norfolk Street, Strand, London, W.C.2.

Telephone : Central 1021 and 3005.

Telegrams : "Radipcomco, Estrand, London."

OUR INFORMATION BUREAU

Expert Replies to Readers' Questions. Hundreds of Replies are sent by Post.

TO ENSURE A PROMPT REPLY PLEASE OBSERVE THE FOLLOWING RULES

Write distinctly, give all necessary details and keep to the point. Ask one Question at a time—never more than two. Send a Stamped and Addressed Envelope. Send the Coupon cut from this page.

Re-radiation Test

Q.—Please give details of a suitable test to enable one to guard against re-radiation when employing a valve receiver with reactance coupling.—A. H. A. (London) (4537)

A.—A suitable test is given in the following. Obtain a test buzzer which has a high musical note, and a tapping key or switch and small battery connected to the buzzer in the usual way. Place this a few feet away from your receiver. At frequent intervals during the time of your listening in to any concerts, etc., switch on the buzzer. If the natural high note of the buzzer is heard in the telephones, the receiver is not heterodyning and therefore not re-radiating. If the note of the buzzer in the telephones is broken up and distorted in such a way that the natural musical note of the buzzer is unrecognisable, then one may be sure that the receiver is very probably causing interference to neighbouring receivers by re-radiation.—L. C.

The broadcast speech to the Boy Scouts by H.R.H. the Prince of Wales was not the Prince's first acquaintance with the Magnavox, as he addressed an enormous audience through its medium at San Diego, California, during his visit there last year.

The Wireless Society of London

AT the ordinary general meeting of the Wireless Society of London held on Wednesday, October 25th, the announcement was made that H.R.H. the Prince of Wales had graciously consented to become the Patron of the Wireless Society of London and its affiliated societies, and that he noted it was intended to change the title to that of the Radio Society of Great Britain in the near future. The president had acknowledged this communication on behalf of the societies, expressing the extreme gratification that will be felt by all connected with the society at this mark of His Royal Highness's interest in the work of wireless telegraphy.

Amateur Wireless And Electrics

Querist's Coupon Available until Saturday, Nov. 11, 1922

TELEPHONY TRANSMISSIONS

Eiffel Tower (F L), 2,600 metres. Daily, 5-16 p.m.

The Hague (P C G G), 1,085 metres. Sundays, 3 to 5 p.m.

Writtle (2 M T), 400 metres. Tuesdays 7 p.m.

ANNOUNCEMENTS

"Amateur Wireless and Electrics." Edited by Bernard E. Jones. Price Threepence. Published on Thursdays and bearing the date of Saturday immediately following. It will be sent post free to any part of the world—3 months, 4s. 6d.; 6 months, 8s. 9d; 12 months, 17s. 6d. Postal Orders, Post Office Orders, or Cheques should be made payable to the Proprietors, Cassell & Co. Ltd.

General Correspondence is to be brief and written on one side of the paper only. All sketches and drawings to be on separate sheets.

Contributions are always welcome, will be promptly considered, and if used will be paid for.

Communications should be addressed, according to their nature, to The Editor, The Advertisement Manager or The Publisher, "Amateur Wireless," La Belle Sauvage, London, E.C.4.

Special Note to Advertisers

ADVERTISEMENT INSTRUCTIONS and copy for "Amateur Wireless" should be at the Office by **First Post on FRIDAY morning at latest.**

* * *

Advertisements in the Miscellaneous Sale and Exchange column must be prepaid. The rate is **3d.** per word; minimum **3/-.**

PREPAID ADVERTISEMENTS.

B.A. Screws, Nuts, and Washers, assorted gross, 2s.; list, 2d.—J. H. Bennett, Station Road, Willesden Junction. [34 R

Huge Purchase of ex-Government Wireless Stock. Write for list giving full details. 150-watt dynamos, £1; hedgehog coils, 3s. 6d.; loud speakers, 200 ohms, 7s. 6d.; 1-in. spark coils, 10s.; 1½-in. spark coils, 12s. 6d.; morse tapping keys, 3s., etc. etc. etc. Three days' approval against cash, or please call. Write for detailed price list of all goods.—E. J. Galpin, 16, Loampit Hill, Lewisham, S.E.13, London. [3 s

Wireless Dealers throughout Great Britain are strongly advised to stock parts for making up wireless sets. Buy your parts direct from the factory at wholesale prices.—Newtonia Wireless Factory, 13 and 15, Whitcomb Street, London, W.C.2.

...Telephone Receivers Rewound up to 1,000 ohms, 5s.; 2,000 ohms, 7s. 6d. Cash with order.—M. E. Hampshire, 139, Sydenham Road, S.E.26. [6 s

To Obtain Amateur Transmitting Licence knowledge of Morse code is essential. Instructions given at your own residence if required. Write for terms; two or more pupils at reduced fees.—"Tutor," 232, Hornsey Road, Holloway, N. [5 s

For Sale.—3-valve amplifier, complete, £7; duo-lateral tuner, condensers, coils, complete, £4 10s.—Woodside Cottage, Hill Road, Bursley. [1 s

For Sale.—Two-valve receiver; installed complete with aerial, batteries, etc., £14.—Jefferies, 113, Landells Road, East Dulwich, S.E.22. [2 s

Aerial Masts, 20 ft. spruce, 6s. each, to clear.—Martin, 34, Cecil Road, Acton, W.3. [4 s

NOTICE!

Owing to an oversight the prices of Fuller's Standard Plate Type Accumulators were omitted from our advertisement of last week's issue. These should read as shown on Page 492 in this week's advertisement.
CITY ACCUMULATOR CO., 79, Mark Lane, E.C.3

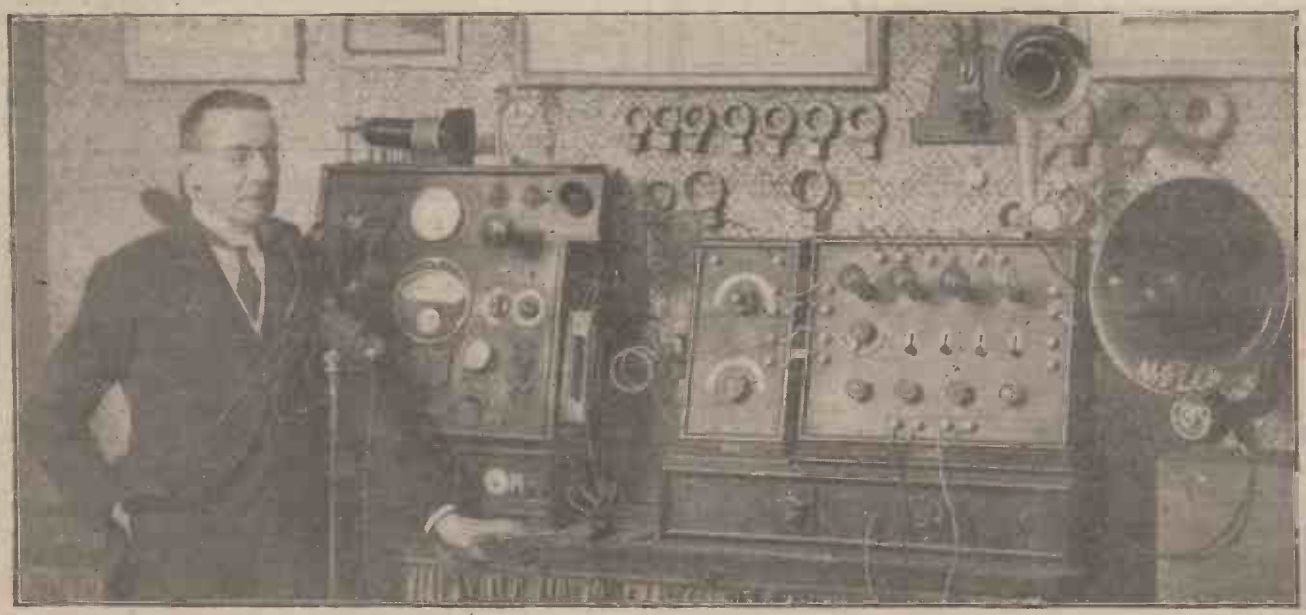
Printed and Published in England by CASSELL & COMPANY, LIMITED, Ludgate Hill, London, E.C.4. Sole Agent for South Africa, CENTRAL NEWS AGENCY, LIMITED. Saturday, November 4, 1922

THE BROADCAST LICENCE AN ACTUAL FACT

Amateur Wireless And Electrics

FREE POST REPLIES

No. 23 SATURDAY, NOVEMBER 11, 1922 Price 3d.



The Rt. Hon. Lord Mayor of Birmingham broadcasting a hospital appeal from the amateur experimental station of Mr. C. S. Baynton, 48, Russell Road, Moseley, Birmingham (Call sign 2K O)

CONTENTS

Amateur Wireless and Electrics

No. 23 November 11, 1922

SAVING A VALVE

Choosing Valves :: What to Do when the Filament Sags :: Safeguards

IT is scarcely possible to be too fastidious when buying valves, or, subsequently, in taking care of them. If accidents are avoided the life of a valve can be extended to a very appreciable extent if one is possessed of a little knowledge as to the various ways in which it is particularly liable to injury.

We may confidently expect some interesting developments in valve manufacture in the near future, especially with regard to the filament, but for the time being it is this part which chiefly needs the watchful care of the amateur if economy is not to be disregarded.

Choosing a Valve

A valve should be chosen which has a good straight and taut filament. This is a virtue often conspicuous by its absence in cheap valves, and it pays in the long run therefore to spare a little more cash and secure a good one.

The filament is the most vulnerable part of the valve, and rough usage will often make it develop a kink or make it sag in the middle, and then it will in all probability eventually touch the grid, thus putting an end to its proper function. Some amateurs have had the curious experience of finding a filament develop a sag quite suddenly, but generally it is a slow process which can be noticed before any harm is done, if one makes a habit of periodically examining the filament. So many beginners buy a valve, or valves, and having got them to work blissfully, leave them to the mercies of Time!

When the Filament Sags

When a filament sags, what is to be done? Hundreds of valves have been laid aside as useless because the filaments have sagged on the grids, and transmitting valves particularly seem to be liable to this defect. They are not useless, however, and here is a tip which has saved the writer pounds: When a filament begins to sag, turn the valve upside down. This is as efficacious as it is simple, for the filament soon begins to bend back to normal. One valve, the filament of which was exceptionally liable to sag, was kept in constant use for about eighteen months by inverting it frequently. The operation may present a little difficulty where cabinet sets with a horizontal panel are used, but it is well worth while to put up separate sockets somewhere, so that valves with sagging filaments can be plugged in upside down till the defect has disappeared.

In handling valves care should be taken never to jolt or jar them when the low-tension current has been switched off. This, in fact, holds good at all times, but it is particularly for a few seconds after the valve has been switched out that the filament is apt to respond in an undesirable manner to careless knocks. Switching on and off should always be done slowly.

Another defect in valves, chiefly in those used for transmitting, is perforation of the plates, due to a high-tension current of too many volts being employed, or to the periods of use being unduly prolonged. In either case the metal "runs" in parts, and tiny perforations appear. While they are of a very small size, efficiency is not likely to be impaired to any noticeable degree, but care should be taken to prevent the defect spreading, by reducing the voltage to the minimum consistent with efficiency.

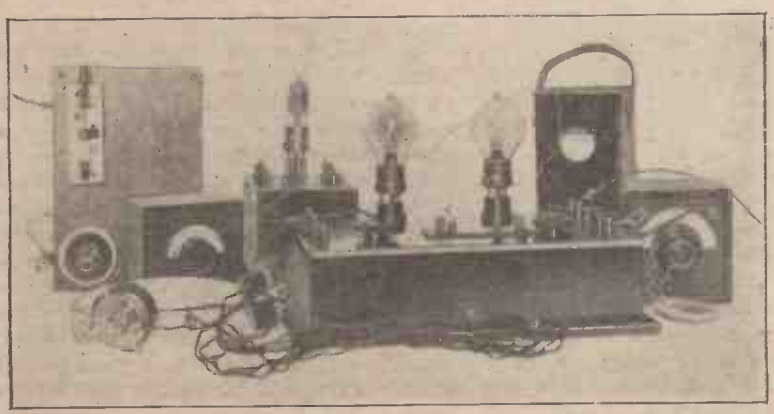
At present there appears to be no method in commercial use whereby the filaments of "blown-out" valves are replaced, and incidentally one imagines that a small fortune must await the inventor of such a method.

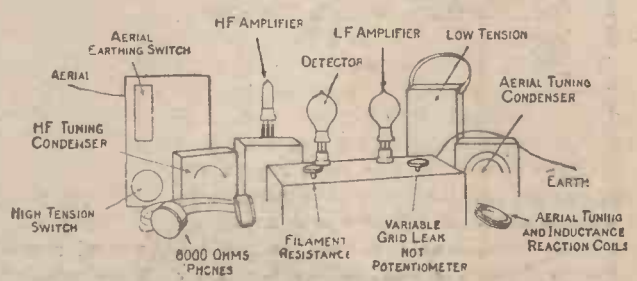
Safeguards

The amateur can at least safeguard himself to some extent against this all too common catastrophe in the following way: When experimenting with new circuits, and there is some uncertainty as to where the high-tension leads should go, put in series with them an ordinary flash-lamp bulb. Then if inadvertently the wrong terminal is touched the bulb will blow out. One can afford to blow-out flash-lamp bulbs if it means the saving of valves.

L. B. P.

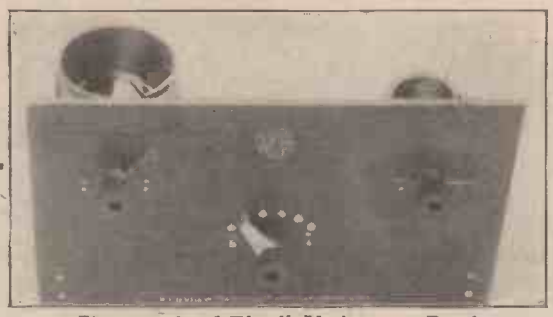
An Interesting Amateur Set Employing High- and Low-frequency Amplification.





Photograph and Key Diagram of the Three-valve Receiving Set constructed by Mr. J. Seabrook, of the South London Wireless and Scientific Club.

The Variometer: Why Not Use It?



Photograph of Elwell Variometer Panel.

WHY not use a variometer for tuning your set? It is the simplest and most efficient of all tuning devices. Just turn a knob through 180 deg. and your whole wave-length range is covered!

A coil and slider is inefficient for several reasons: the plunger cuts into the wire, increasing its resistance, and may eventually cut right through it; the grains of copper thus rubbed off short-circuit the turns; also the plunger touches more than one turn at a time. A coil with tappings brought out to switch-points is somewhat better, close tuning being effected by a variable condenser shunted across the coil.

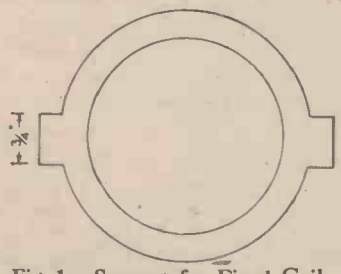


Fig. 1.—Support for Fixed Coil.

But condensers are expensive, and used in this way they are not efficient because, in a circuit containing a large amount of capacity, the signals set up a lower potential on the detector than in a circuit containing a lesser capacity and greater inductance; also, too much capacity broadens the tuning.

Tens and units switches are an improvement, but they do not give quite such close tuning. In both these methods the coils contain "dead" turns which absorb energy, and there is also the inconvenience of having to use two handles in tuning.

None of these disadvantages applies to the variometer. With this simple and efficient little instrument a considerable wave-length range can be covered merely by the half-turn of a single knob! Moreover, it can be made to work with perfect smoothness, not stiffly like a switch arm.

The variometer consists of two coils connected in series, arranged so that the coupling between them can be varied. In the one to be described the coupling is a maximum when the two coils are in the same plane and their windings running in the same direction. When in this position there is considerable mutual inductance between them, the total inductance being greater than the sum of that of the two coils separately. When they are at right angles there is no mutual inductance, and when turned through another 90 degrees the mutual inductance has a negative value, the total inductance being less than that of the two coils separately.

The variometer consists of two honeycomb coils, which may either be wound round pins on a wooden former (as described in AMATEUR WIRELESS of June 17) or on a winding machine. They should be made ½ in. wide and 2 in. internal diameter. If efficient coils are desired they should be wound with fairly thick wire, say 24 gauge d.c.c. High-frequency cable will give even greater efficiency, but is very expensive and is not an essential.

The inner coil is wound first, then the wire is cut off and string wound on to form a layer about ¼ in. thick. The outer coil is wound on top of this. On completion the whole must be dipped in melted paraffin wax or shellac varnish, and when set, the string carefully removed, thus separating the two coils. The end of the inner coil and the beginning of the outer must be connected by a few inches of flexible wire (if high-frequency cable is used it need not be cut; just leave a loop of it between the two sections of the coil when winding).

The outer or fixed coil may be mounted in the standard way, if desired, but this is somewhat expensive and is not necessary for a variometer. A simple method is to cut with a fretsaw in three-ply wood a ring the same size as the coil, leaving a tab at each end as shown in Fig. 1. The coil is then placed on this, and tape is

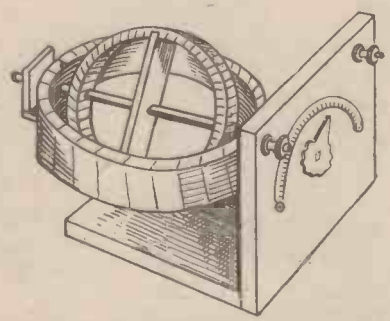


Fig 5.—The Variometer Complete.

wound round both coil and wood to hold them together. Rubber tape will be found rather too thick and messy for this, and ordinary black tape fastened on with thin glue will make a much neater job. The inner coil should also be taped in the same way, but without a wooden support.

To hold the inner coil a piece of wood should be cut as shown in Fig. 2. The coil can be pulled slightly oval to enable it to be slipped into the slots at the ends.

The two coils have now to be fixed in position so that the inner one will revolve with the outer. Place one inside the other and push a thin spindle (preferably of wood or ebonite) carefully through the windings. A spot of glue on the spindle where it goes through the strip which holds the inner coil will fix the latter to the spindle. An ebonite knob with pointer may be fixed on the end of the spindle, or

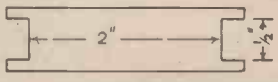


Fig. 2.—Support for Moving Coil.

Fig. 3.—Support for Spindle.

Fig. 4.—Pointer.

a serviceable one can be cut out of cigar-box wood with a fretsaw, shaped as shown in Fig. 3.

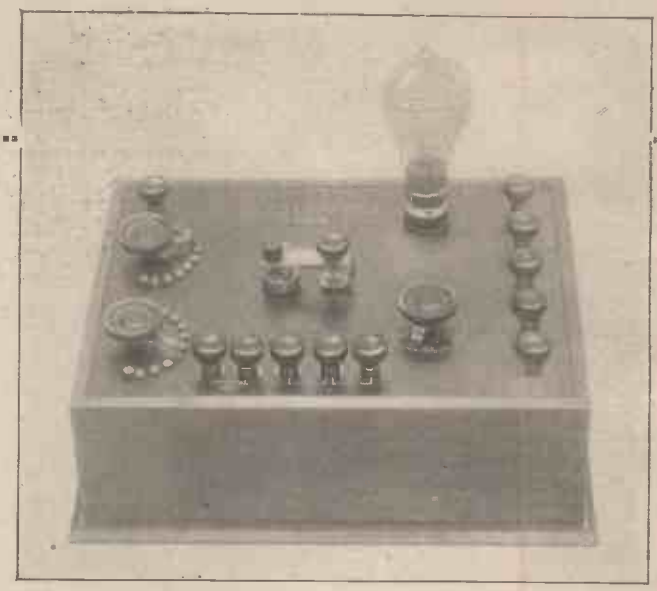
To mount the variometer on a panel a hole is made in the latter to take the spindle. Two small pieces of wood, cut as shown in Fig. 4, are fixed at right angles to the tabs on the outer coil holder. The first is then screwed to the back of the panel, the second one forming a bearing for the spindle. A scale (0 deg. to 180 deg.) fixed on the front of the panel, and two terminals for the ends of the windings complete the apparatus, which is shown complete in Fig. 5.

A small variometer of this type may with advantage be made to replace a variable condenser in any set. It must, of course, be connected in series with the existing coil, not in shunt like the condenser. The writer made one for this purpose with twenty turns of 24 d.c.c. wire on each coil, which answered admirably. Larger ones may be made to cover a greater range; for instance, one with forty turns on each coil made a useful short-wave tuner with a range of about 300 to 900 metres. A set of honeycomb coils may be used in conjunction with such a variometer to cover any range. If the variometer is required to tune to a lower wave-length the two coils should have equal inductances; less turns must then be put on the outer coil to compensate for its greater diameter.

E. L. S.

JAMMING

BALANCED CRYSTAL WORKING



Crystophone Valve and Crystal Receiver.

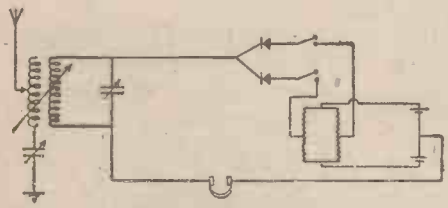
THERE are two methods which can be adopted for the elimination of interfering signals, and it depends upon whether the interference is weak or strong which of these methods is used.

If the interference is weak the coupling between the primary and secondary of the receiving coils should be reduced by moving the coils farther apart. This has the effect of weakening all signals.

At first sight it would appear disadvantageous to weaken the strength of the signals one wishes to receive, but it will be found much easier to distinguish weak, clear signals than loud signals accompanied by interference, even though the interference is weak. By loosening the coupling the interference can be rendered so weak as to become inaudible.

The cutting out of strong "jamming" is a much more difficult proposition, and the chief purpose of this article is to explain the method adopted by ship stations for overcoming this difficulty. This is known as the "balanced-crystals" method.

Those who desire to fit this arrangement to an existing crystal set will be able to do so at a cost not exceeding five shillings,



Circuit Diagram for Balanced-crystal Method of Obviating Jamming.

and will thereby greatly increase the efficiency of their set.

The following items are required:

Two carborundum crystals.

Two dry cells (1.5 volts each).

Two potentiometers.

Carborundum crystals need an initial voltage to bring them to their most sensitive point, this voltage being supplied by the cells and regulated by means of the potentiometers, the latter being merely variable resistances.

The two crystals, which work in conjunction with steel plates, are joined in parallel, and mounted so that they rectify in opposite directions, as shown in the diagram, where the crystals are shown as black triangles, and the steel plates as thick black lines.

Now, a crystal working at its critical point will, practically speaking, only allow a current to pass through it in one direction, but it is obvious that if we connect two crystals, as shown in the diagram, and rectifying in opposite directions, the currents flowing in one direction will flow through crystal No. 1, and the currents which are "choked back" by this crystal will find an easy path through No. 2.

So far we have accomplished nothing; all we have done is to counteract the rectifying action of crystal No. 1, and the whole of the incoming oscillations are passing through the phones; the phones being unable to respond to oscillatory currents, the net result is nil.

If, however, the initial voltage across either of the crystals is now reduced by inserting a little more potentiometer resistance, this crystal is rendered insensitive to weak signals. Weak signals, therefore, have now only one path, through the crystal, which is still functioning at its critical point; rectification takes place accordingly, and the signals are heard in the phones.

As the former has only been put just off its critical point, a strong signal will raise it above this point and cause it to function as before; both crystals, therefore, will respond to strong signals, but only one will respond to weak signals; the result is that strong signals are "balanced out," as previously explained, and the weak signals are rectified.

For normal working one of these crystals is switched off, both being used simultaneously only when it is desired to cut out strong interference.

This arrangement has another advantage, in that there are always two crystals available, and that by merely switching over it is possible to use the one which is giving the best results.

The potentiometers are made of about 100 turns of thin resistance wire wound on an ebonite former of about 6 in. by 1 in. by ¾ in., and are fitted with sliders, in the same way as the ordinary simple tuning inductance.

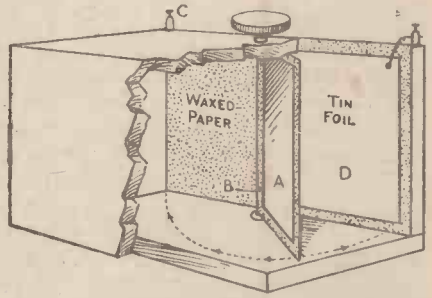
With regard to arranging the critical points of the crystals, the most practical way, when loud interference occurs, is to adjust the potentiometer of each crystal, separately, to the point where loudest signals are heard, then switch both crystals in together, when the signals should "balance-out," nothing being heard in the phones. One crystal must now be thrown just off its critical point by a slight movement of the potentiometer slider, and the weak signals will be heard quite clearly.

The diagram shows a two-circuit receiver, with its separate, tuned, aerial circuit, which allows signals to be tuned down in the case of weak interference, but the balance crystals arrangement will work equally well on the simple, single-circuit receiver.

KATHODE.

A Variable Tin-foil Condenser

THE capacity of the condenser shown in the sketch is varied by the plate A being turned on its metal axle B. The plates are sheets of tinfoil 3 in. by 4 in. glued or pasted on to sheets of waxed paper. A wire is carried from the bottom



Variable Tin-foil Condenser.

of the metal road B to terminal C, and another from plate D to terminal E. The diagram shows the instrument with part of the box removed.

R. O.

All About the Valve.—V

This Article (the fifth of a series) deals with the "Space Charge"

THE conditions produced by the stream of electrons from filament to plate is a setting up of a static field of force which opposes or "blankets" the passage of the remaining electrons proceeding from filament to plate. As this negative grid charge still further increases, the time comes when the static field opposes an insuperable obstacle to the passage of any further electrons, and the plate current accordingly diminishes to zero unless the steady plate voltage is further increased to meet the new conditions.

A Conflict of Electrons

This particularly represents the case when the grid, instead of being merely insulated, has a definite negative voltage applied to it from an external circuit. Under such conditions the space between the filament and the grid is crowded with a conflict of electrons, some emerging from the filament, others being driven back towards the filament by the repulsion effect of the negatively-charged grid. This congested condition has been termed the "space charge."

On the other hand, if from an external source a positive voltage is applied and maintained upon the grid, such a charge represents the interposition between the plate and filament of a static field of force which, instead of repelling the electron stream, will attract, accelerate, and augment it. Some few electrons will strike the grid and lodge there, but with the increased velocity the vast bulk of the stream will shoot through the wide spaces of grid spiral towards the greater area and greater attraction (owing to the higher steady voltage) of the plate. Moreover, owing to its close proximity to the filament, the attraction of the positively-charged grid results in the gathering in, as it were, of flocks of electrons which might otherwise feebly return to the filament after a short cyclic path in the outer darkness. Such erring wanderers are instead shepherded together by the influence of the grid and guided onwards to their ultimate goal in the plate.

This directing and accelerating process increases, as the positive voltage on the grid is raised, until a time comes when all the available electrons are gathered in and directed to the plate. For such a grid voltage, a given value of plate potential, and a steady amount of filament current, the electron stream is at its maximum, and the plate current has reached saturation point.

Filament Current and Plate Tension

Any increase in filament current will, however, result in the liberation of further electrons, which, if the positive grid charge is likewise increased, may also be guided to the plate, giving rise to a still higher plate current, which has now a

Prof J. A. Fleming, D.Sc., M.A., F.R.S., Experimenting with Transmitting Valves.

higher saturation value corresponding to the new conditions.

Similarly an increase in the value of the plate tension is followed by a rise in the value of the saturation current.

Obviously the whole of this process is somewhat difficult to follow in the mind's eye, and therefore it will be necessary to

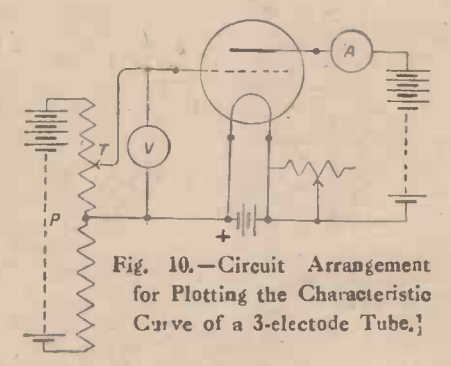


Fig. 10.—Circuit Arrangement for Plotting the Characteristic Curve of a 3-electode Tube.

commit it to paper in the form of a curve.

The most useful correlation of these variable factors is that which shows the proportion existing between the applied grid voltage and the resultant plate current. Such a curve is called the grid-volt plate-current characteristic.

Fig. 10 shows the circuit arrangements for determining such a curve for any given tube. The arrangement is very similar to that previously shown in Fig. 6 for a two-electrode valve. In this instance, however, as it is necessary to impose voltages on the grid, which vary from a negative value relative to the filament to the positive value relative to the filament, the negative end of the filament battery is permanently connected to the midpoint of the potentiometer, so that the tapping T from the grid can be adjusted either above or below the zero point.

Starting with the point T midway along the potentiometer, the potential of the grid is the same as the negative end of the filament. Proceeding, the tapping T should then be moved downwards in successive steps of 2 volts, as indicated by the voltmeter V, and the corresponding readings of the plate ammeter plotted off on squared paper.

In the case of an Osram R valve so tested by the writer, the plate current sank to zero for a negative grid potential of about 10 volts.

Similar readings are next taken for positive values of grid potential, starting with T at the midpoint and moving it upwards along the potentiometer.

(To be continued)

D. ALCASE.

Manchester Broadcasting

THIS week a series of broadcasting experiments is to commence at Trafford Park, Manchester, and a musical programme will be transmitted every Monday, Wednesday and Friday at 8 p.m. From the results of these experiments it is hoped to discover what are the best transmitting conditions.

An Appeal

THE Royal National Hospital for Consumption at Ventnor, Isle of Wight, a fine up-to-date institution, in a glorious position facing south, accommodating one hundred and sixty patients and a staff of forty, is appealing for a wireless set, or sets, or for a subscription towards them. The Secretary, Ventnor Hospital Wireless Fund, 18, Buckingham Street, Strand, London, W.C.2, will be very glad to hear from any who can help.

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Sullivan Headphones					
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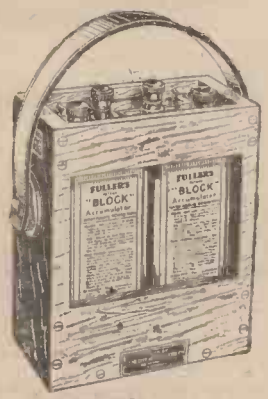

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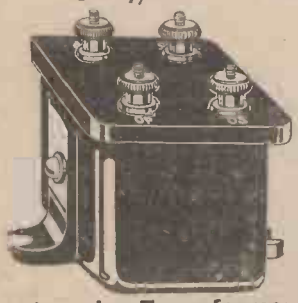

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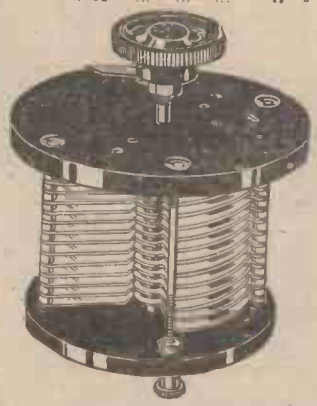

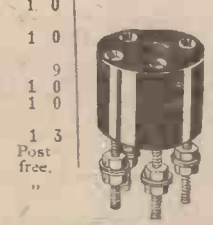

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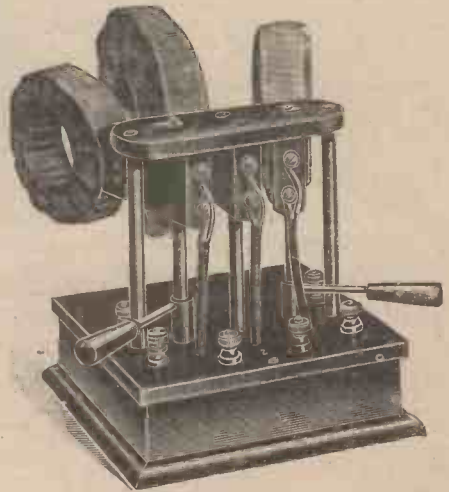

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Three Practical Ideas

Mounting Crystals

A NOVEL way of arranging the crystal in a detector, while being the simplest for amateurs who have not too many tools, is one which gives results equal in every respect to the more elaborate cup and set-screw type.

An old (burnt-out) pocket-lamp bulb is procured and the globe broken off. The plaster or porcelain filling is scraped out and the crystal, wrapped in tinfoil, is jammed in tightly.

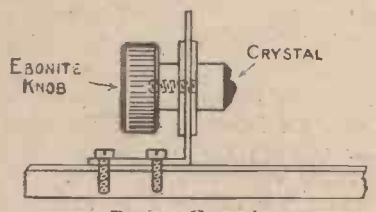
This simple cup is then screwed into one of the holders made for these miniature bulbs, and a connection made to the screw on the side.

This arrangement enables one to change a crystal in a few moments by simply unscrewing one "globe" and inserting another. H. R.

Rotary Movement in Crystal Detectors

IN the case of a detector which requires a rotary movement, a very good way is to have the cup moving and not the contact screw.

The sketch below explains this better than words could. By unscrewing the



Rotary Crystal.

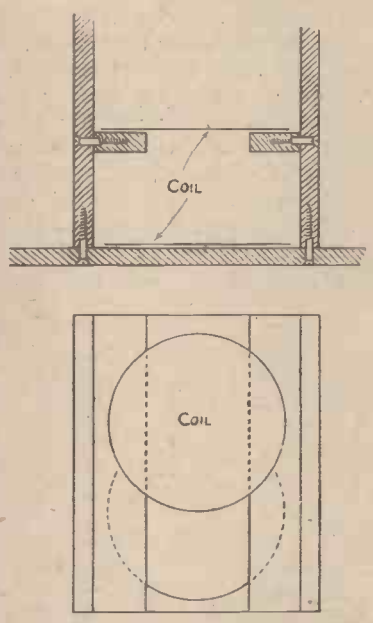
knob the crystal can be moved so that any point on its surface can be touched by the metal contact. This is an improvement on the common ball-and-socket movement, as once the sensitive point is found the crystal is held in position by tightening the knob. J. T. D. W.

An Inductance Coil Stand

THIS tuning stand, which can be used in conjunction with either slab or basket coils, is extremely simple in construction and the cost is very small. The drawings need little or no explanation.

The coil placed on the base remains stationary, whilst the coil which rests on the projecting strips can slide along, thus tightening or loosening the coupling. For short wave-lengths basket inductances should be used, and for the longer wave-lengths the slab coils function well.

These inductances can be purchased quite cheaply, and basket coils specially wound for the reception of the Dutch concerts can be purchased from 2s. 6d. (for 2)



Section and Plan of Inductance Coil Stand.

from most of the advertisers in this journal. T. L.

Making a Microphone Amplifier

IN this article complete instructions are given for constructing an amplifier which will magnify any signals which can be received and at the same time preserve all their clarity of tone.

The amplifier needs a small current of about .04 ampere at 2 volts pressure from an accumulator or Daniell cell. It consists of—

(1) A sensitive microphone.
(2) A telephone transformer.
(3) A pair of ex-Government telephones of 150 ohms each.

The microphone is so arranged that all, or nearly all, of the sound-waves produced by the receivers from the "set" impinge upon its diaphragm. To obtain this desirable effect, disconnect each receiver from the headbands and fix one at each end of a thick-walled hollow tube 6-in. long and of an internal diameter which will just admit the receiver. The tube can be made from wood or cardboard, and if difficulty is experienced in obtaining one of the right internal diameter the edges of the receiver can be bound round with tape so as to increase their diameter within a limit of, say, a quarter of an inch. A hole is now cut in the centre of the side of the tube which just admits the microphone, and exactly opposite this hole is placed a piece of wood curved as shown in Fig. 1. The inside of the tube should now be carefully lined with tinfoil secured with shellac varnish. When the whole is absolutely dry, insert the telephones and microphone and seal up with paraffin wax.

When the sound-waves strike the diaphragm of the microphone and cause it to vibrate, the resistance of the closely-packed carbon granules inside is varied, thus causing variations in the current flowing in the circuit which includes the microphone.

If the 300 ohms resistance of the telephone was coupled in series with the microphone and the accumulator, large variations in the resistance of the microphone would not produce a large-percentage change in the resistance of the circuit. Consequently large variations of current could not be produced, and the signals in the phones would be weak.

To overcome this difficulty a transformer is used. The primary of this should be wound on a bundle of soft iron wires, 4 in. long and ½ in. in diameter. The primary consists of two layers of No. 20 S.W.G. double-cotton-covered wire; this should be insulated by silk ribbon from the core and the secondary winding. The

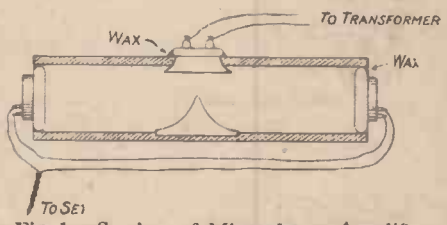


Fig. 1.—Section of Microphone Amplifier.

Fig. 2.—Diagram of Connections.

latter consists of ½ lb. of No. 30 S.W.G. double-silk-covered wire.

The completed transformer should be place in a suitable hard-wood box and the four ends led out to terminals on the top. The box is then filled up with molten paraffin wax.

The primary of the transformer is connected up in series with a 2-volt cell and the microphone; the secondary is connected with the 300-ohm phones (Fig. 2). As the microphone is the only considerable resistance in the primary circuit any change in its resistance causes a large variation in the current flowing through the primary. Thus comparatively large changes of energy are set up in the secondary, with, of course, a slight loss in the transformation of the energy. Thus small variations in the resistance of the microphone produce loud tones in the telephones A. W.

TELEVISION.—IV

SHALL WE EVER SEE BY WIRELESS?

A Continuation of a Series of Articles on an Absorbing Subject

THE non-production of a continuous visual impression was found to be due to the inability of the selenium cell to change rapidly from the state of high-resistance to that of low-resistance, and vice-versa. A lot of research work has been carried out during recent years with a view to eliminating or reducing the effects of this inertia of selenium cells, and several methods have been evolved of a fairly satisfactory nature. The best results have been obtained by what is known as the "compensate cell method" devised by Prof. Korn for photo-telegraphic work, and it is now possible to make compensated cells capable of responding to light variations at ordinary frequencies of about 800 per second.

Even this speed is, of course, totally inadequate for purposes of television; therefore, it does not seem at all probable that the problem of television will be solved by any system depending upon selenium for converting light variations into current variations. There are doubtless other photo-electric combinations that remain to be discovered, and which might prove suitable.

The question of accurate synchronism between the distributors at the transmitting and receiving stations forms another problem of great importance in this type of apparatus. In ordinary high-speed telegraphy synchronism has to be very nearly perfect in order to transmit and receive only a few thousand signals per minute. In television anything from 10,000 to 150,000 signals per second would have to be transmitted. Also each signal would have to be arranged in its correct position on the receiving screen. It is evident, therefore, that the matter of synchronism presents a very difficult problem.

Recent Suggestions

From a general survey of early attempts made to solve the problem of television it will be easily gathered that three important and separate questions will have to be elucidated by research if a practical working basis is to be found. They are (1) the discovery of some substance or combination of substances upon which light acts instantly and with extreme rapidity, enabling a current variation to be set up; (2) some method of illuminating a screen capable of being rapidly influenced by very feeble electric currents and possessing little or no inertia; and (3) obtaining complete synchronism between the transmitting and receiving apparatus.

The fact that apparatus capable of reproducing a simple image has been constructed in no way implies that the same apparatus can be sufficiently improved to enable a picture with varying degrees of light and shade and complete in essential details to be accurately reproduced.

Several new and original methods, however, have recently been proposed. Although these do not actually solve the problem they are very ingenious and promising in character, and contain ideas that offer great possibilities of development. The following is a description of a recent method devised by an American inventor, the arrangement of the various

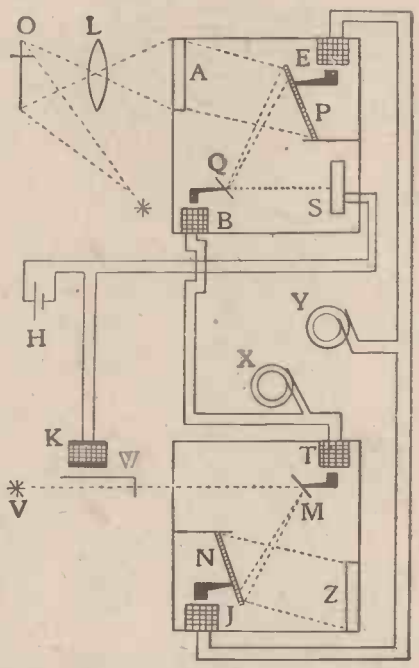


Fig. 2.—Experimental Apparatus in which Use is made of Vibrating Mirrors.

pieces of apparatus being shown in the diagram Fig. 2.

Vibrating Mirror Apparatus

At the transmitting end an image of the object O is thrown by means of the lens L upon the ground-glass screen A, the object being illuminated by the lamp D. From the glass screen the image is reflected by the mirror P. The reflecting surface of this mirror is about $\frac{1}{16}$ in. wide and 5 in. long. The reflection falls upon the mirror Q. These two mirrors are vibrated by electrical means, the mirror P vibrating from left to right and Q vibrating up and down. The method adopted for vibrating these mirrors is as follows: Attached to the mirror, which is pivoted at one end, is an arm terminating in a short but powerful permanent magnet. An electro-magnet, supplied with alternating current, is so arranged that the iron core and the permanent magnet are opposite. With each reversal of current the permanent magnet is either repelled or attracted, the mirror in consequence vibrating at the same speed as the current-frequency. At the receiving station two similar vibrating mirrors M, N are also provided, N vibrating from left to right and M vibrating up and down.

It will be noticed that the two magnets E J, which operate mirrors N P, are connected in series with the alternator Y, and the magnets T B, which operate mirrors Q M, are connected in series with the alternator X. The alternator Y has a frequency of five complete alternations per second, and the alternator X a frequency of sixty complete alternations per second.

The action of the vibrating mirrors at the transmitter is as follows: When the mirrors are at rest a very narrow strip of the picture projected upon the screen A will be reflected by the mirror P. In turn a small portion of this strip will be reflected by the mirror Q and condensed into a single ray of light. When the magnets B E are energised by alternating current the mirrors in consequence are vibrated. The result is that small portions of the picture in turn are rapidly condensed into a single ray of light, the intensity of the ray constantly varying according to the density of that portion of the image that is being reflected.

This single ray of light, constantly changing in intensity, is reflected by the mirror Q upon the selenium cell S, this cell being connected in series with the electro-magnet device K at the receiving station, the circuit being supplied with direct current from the battery H. The whole function of the transmitter is therefore to send to the receiving station a continuous but fluctuating electric current, the fluctuations depending upon the variations of resistance of the selenium cell, which in turn is governed by the varying densities of the image projected upon the transmitting screen A.

Receiving Arrangements

At the receiving station a reversal of these operations takes place. A single ray of light from the source V is focused upon the mirror N. From N, in turn, it is reflected upon the ground-glass screen Z as a small spot of light. As previously stated, the magnets J E and B T are in series with each other, and as they are both energised together it is evident that the movements of the two sets of mirrors will be in perfect synchronism. The spot of light reflected upon the screen Z, there-

(*Continued on page* 524)

The Broadcast Licence

BROADCAST licences are now obtainable by anyone with the ten shillings to spare, with no more ceremony than is involved in purchasing a dog licence. There is no special application form to fill in; you just go to the local post office, give your name and address, and pay your money and receive your licence. We reproduce both front and back of the licence herewith. Across the front of the licence is printed, in red, the following:

"Apparatus used under this licence must be marked——"

and then follows the approval mark shown on this page to the right.

We need emphasise only one or two of the conditions. No. 1 means that transmission is not allowable; No. 2, that the British Broadcasting Company's monopoly will extend to all the accessory apparatus except such things as batteries; No. 3, a very proper condition, forbids the use of valves connected in such a manner as to cause re-radiation; No. 6 makes it clear that the licensee may expect an occasional visit from the Post Office authorities to see that all is in order; No. 7 has been framed with an eye on war conditions and other emergencies.

We are somewhat surprised to find that only adults may become owners of broadcast receivers, but suppose that any case of difficulty is easily got over by the parent himself taking out the licence for a set which might actually be owned by his son, a minor.

There have been no developments during the week with regard to the amateur's position—at least, up to the time of going to press. We can only repeat what we have said on more than one occasion: If you feel you ought to have an experimenter's licence, apply for it, and apply for it again until you get it.

BROADCAST LICENCE.

A45051

WIRELESS TELEGRAPHY ACT, 1904.

Licence to establish a wireless receiving station.

Mr. *Blank Blank*,

of 003, *Nobody's Road, London*, (Address in full) is hereby authorised (subject in all respects to the conditions set forth on the back hereof) to establish a wireless station for the purpose of receiving messages at (address of Station)

for a period ending on the (date of expiration) next

The payment of the fee of ten shillings is hereby acknowledged.

Dated 2nd day of November 1922

Issued on behalf of the Postmaster General

(*for Postmaster*)

Signature of Licensee

Stamp of Issuing Office.

If it is desired to continue to maintain the station after the date of expiration a fresh Licence must be taken out within fifteen days. Heavy penalties are prescribed by the Wireless Telegraphy Act, 1904, on conviction of the offence of establishing a wireless station without the Postmaster-General's Licence.

2801 G&S 194

Front of Licence.

CONDITIONS.

1. The Licensee shall not allow the Station to be used for any purpose other than receiving messages.

2. Any receiving set, or any of the following parts, viz.:—Amplifiers (valve or other), telephone head receivers, loud speakers and valves, used under this licence must bear the mark shewn in the margin.

3. The Station shall not be used in such a manner as to cause interference with the working of other Stations. In particular valves must not be so connected as to be capable of causing the aerial to oscillate.

4. The combined height and length of the external aerial (where one is employed) shall not exceed 100 feet.

5. The Licensee shall not divulge or allow to be divulged to any person (other than a duly authorised officer of His Majesty's Government or a competent legal tribunal) or make any use whatsoever, of any message received by means of the Station other than time signals, musical performances and messages transmitted for general reception.

6. The Station shall be open to inspection at all reasonable times by duly authorised officers of the Post Office.

7. This Licence may be cancelled by the Postmaster-General at any time either by specific notice in writing sent by post to the Licensee at the address shewn hereon, or by means of a general notice in the London Gazette addressed to all holders of wireless receiving Licences for broadcast messages.

N.B.—Licences may only be held by persons who are of full age, and any change of address must be promptly communicated to the issuing Postmaster.

2801

Back of Licence.

Did You Get PCGG?

DID you get PCGG last Sunday week? Always rather a tricky fellow, isn't he? We had him fairly well, except that a fat spark got in, which wouldn't tune out. Found the best result by cutting out the loud-speaker and working straight on the phones. Rather a lot of howling during the first item. The sooner we all take our reactance coupling away from the aerial circuit the better. The dance intermezzo "Blossom Time" came in very well, though with the window of the wireless room streaming with rain and snow it seemed a bit out of place. "Tickle Toe" was a bit mixed, the soft parts being lost altogether sometimes. The piccolo solo, "Birds of the Field," was splendid. The Hague carrier wave seems to bring along those high-note things better than anything else. The cornet solo, Grieg's "Solveig's Song," was

(*Continued on page 522*)

"WORK" HANDBOOK

:: :: AND SOME MODIFI

ARISING out of the popularity attained by the new Handbook, "Wireless Telegraphy and Telephony," numerous letters have been received requesting advice in connection with various proposed modifications to the apparatus therein described. Obviously it was impossible within the limits of a small handbook to deal with apparatus to suit the varied requirements of so many readers, and the author purposes describing in the present article a few modifications and combinations of the "sets" specified in Chapters 7 to 10 of the Handbook, which will doubtless prove of service to the amateur and experimenter.

Considerations for Broadcast Reception

In view of the important recent developments in the matter of broadcasting, the first matter to be discussed will be the reception of speech, etc. from the proposed British broadcasting stations.

General considerations with regard to the number and situation of the stations are as follows:

There are ultimately to be eight stations, one at each of the following towns: London, Birmingham, Manchester, Newcastle, Glasgow (or Edinburgh), Aberdeen, Plymouth, and Cardiff.

Each station will be allotted a definite wave-length (between 350 and 500 metres), and will radiate a programme of music, news items, etc., for a period between the hours of 5 and 11 p.m. on week-days and at any time during the day or evening on Sundays, employing a power of 1,500 watts (1½ kw.).

To commence with, therefore, it will be seen that our receiving apparatus must be capable of tuning over a range of wave-lengths from 350 to 500 metres, and it should also be noted that for maximum efficiency this range should not be increased to any great extent, not more than, to say, 600 metres, otherwise the reception of the short waves will not be so good. It will be found very convenient to be able to tune in the 600-metre wave, as the almost constant transmission of "spark" signals from ship and shore stations affords a ready indication that the aerial and receiving apparatus are all in order.

The Short-wave Receiver

The above requirements are fully met by the short-wave receiver (as described in Chapter 8 of the Handbook), which is capable of tuning-in waves from about 150 to 600 metres. This range, it will be noted, also includes the amateur spark wave of 180 metres.

A correspondent has informed the Editor that, using the short-wave receiver (constructed by him in accordance with the particulars given), with crystal detector and a modest indoor aerial, he has successfully received speech and music from Writtle, twenty-five miles distant. With a good outdoor aerial this performance will certainly be improved upon, and as the power employed at the Writtle station is 250 watts only, it would seem that quite good reception of speech, etc., from the new 1,500-watt stations will be possible with this crystal set over distances up to 80 or perhaps 100 miles.

It will be appreciated, however, that until the new stations actually commence operations enabling actual tests to be made, the receiving range cannot be definitely stated.

THE series of diagrams shown on this page are modifications of the now famous Short-wave Receiving Set described in the "Work" Handbook, "Wireless Telegraphy and Telephony." In a later article the author will describe modifications of the Single-circuit Receiver and the Five-valve Amplifier. The particulars given are also applicable to other receivers of a similar type.

Photograph of Short-wave Receiving

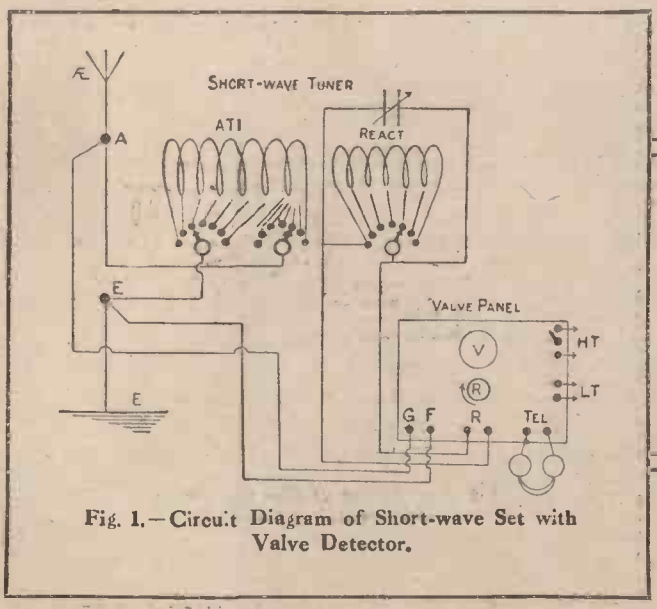


Fig. 1.—Circuit Diagram of Short-wave Set with Valve Detector.

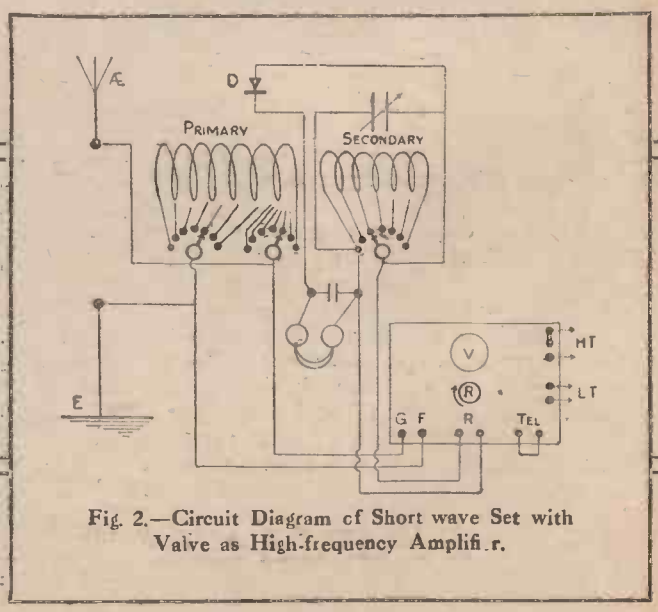


Fig. 2.—Circuit Diagram of Short wave Set with Valve as High-frequency Amplifier.

K RECEIVING SETS
ICATIONS THEREON

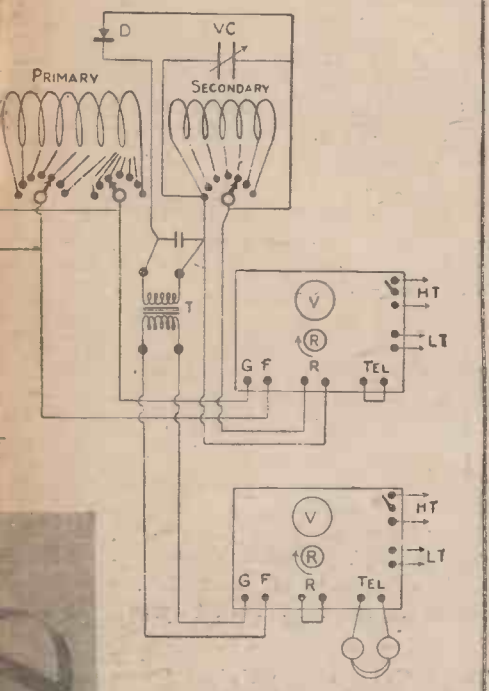


Fig. 4.—Circuit Diagram of Short-wave Set in Conjunction with Two Single-valve Panels.

Set.

Important factors in the successful reception of wireless telephony upon a crystal set are as follows:

(*a*) The height and general efficiency of the receiving aerial.
(*b*) Very careful tuning of the receiving set.
(*c*) The use of sensitive crystals and critical adjustment of same both as regards point of contact and mechanical pressure. Where a potentiometer and battery are used, the electrical pressure applied must also be most carefully regulated.
(*d*) The use of really good telephone receivers.

The Addition of Valves

As the question is sometimes asked, it is pointed out that the loud-speaking type of telephone cannot be operated by the very small currents present in the circuits of the crystal-receiving set.

As no doubt many readers will desire to add a valve (or valves) to enable speech, etc., to be more clearly received and from greater distances, some methods of arranging for this will be discussed.

The construction of the single-valve panel, as described in Chapter 9 of the Handbook, will enable the following three circuit arrangements to be tried:

No. 1 Circuit, in which the valve is substituted for the crystal detector and the existing secondary coil is made to function as the "reactance" coil.

No. 2 Circuit, in which the valve acts as a high-frequency amplifier between the aerial and secondary circuits of the receiver, the amplified oscillatory currents in the latter circuit being subsequently rectified by the crystal detector. This circuit is usually very effective, particularly for weak signals.

No. 3 Circuit, in which the valve amplifies the low-frequency impulses after rectification by the crystal detector. Excellent magnification of fairly strong signals is obtained by this method, but it is not so good for weak signals unless a preliminary stage of H.F. amplification is introduced.

The three arrangements outlined above are illustrated in Figs. 1, 2 and 3, and will, it is thought, be readily understood. Note, however, that when using the valve panel for amplification (H.F. or L.F.) the grid condenser and leak must be short-circuited and the "input" circuit connected to grid and *negative* side of filament. Reversing the 6-volt battery connections will effect this (Figs. 1, 2 and 3).

A very efficient arrangement for the reception of short-wave telephony consists of *two* single-valve panels (less grid condensers (and leaks) and the short-wave receiver (less potentiometer) connected up as shown in Fig. 4, thus providing for one stage of H.F. amplification, crystal rectification, and one stage of L.F. amplification. Common H.T. and L.T. batteries may be used, so that the extra cost is limited to the panel, valve and L.F. inter-valve transformer (T). If a self-contained cabinet-type set is preferred to the separate units, the construction of this is really only a matter of rearranging the components, illustrated in Fig. 4.

In the operation of a set such as illustrated in Figs. 2 and 4 it is important that the aerial and closed circuits should be maintained in tune whilst varying the wave-length, and that the coupling

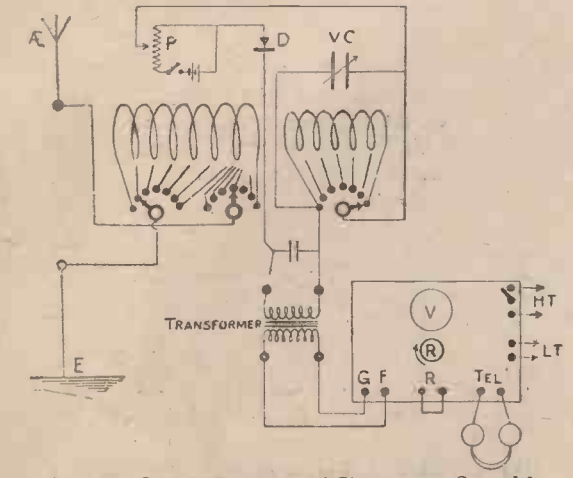


Fig. 3.—Circuit Diagram of Short-wave Set with Valve as Low-frequency Amplifier.

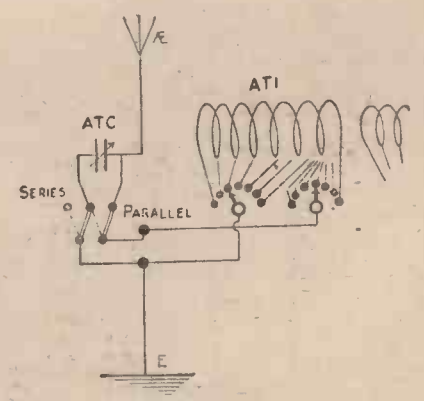


Fig. 5.—Details of Connections for Series-parallel Switch.

between them should be as loose as possible. Under favourable conditions the set will oscillate immediately the closed circuit is in tune with the aerial circuit, and should this prove the case when it is desired to receive telephony (during which the set must not be allowed to oscillate), the following methods should be tried to stop self-oscillation:

(*a*) Reduce coupling between coils to minimum value.
(*b*) Increase mechanical pressure on crystal.
(*c*) Reduce filament currents.
(*d*) If oscillations still persist try reversing the reactance coil connections and retuning the set.

Increasing Wave-length

Numerous letters have been received from readers desirous of modifying the short-wave receiver to enable longer waves to be received. In some cases an increase of 2,000 metres has been suggested.

On the other hand, some readers inquire with a view to receiving waves from 150 to 3,500 metres on the single-circuit receiver. (This will be referred to again later.) Now whilst any considerable increase in dimensions of coils, etc. is not advised on account of the reduced efficiency of the short-wave reception, there is no reason why the Dutch Concert on a wave-length of 1,050 metres should not be received upon a short-wave set without appreciably lowering its efficiency for the reception of the broadcast programmes on 350 to 500 metre waves. For this purpose two variable condensers, one having a capacity of .0015 mfd. and the other a capacity of .0005 mfd., will be required. The latter is to replace the tubular condenser originally specified, whilst the former, with suitable change-over switch, is required in the aerial circuit, as in Fig. 5.

Reference to this figure will show that the aerial-tuning condenser (ATC) may be used in series for short-wave reception and in parallel for waves greater than about 600 metres.

If the simple "reaction" circuit is adopted (as illustrated in Fig. 1), the existing tubular condenser across the reactance coil will be all that is necessary.

The above described arrangement (Fig. 5) used with an average aerial will tune in waves from 150 to about 1,200 metres, and is therefore suitable for reception of telephony as follows:

	Wave-lengths (metres).
New broadcasting stations	350 to 500
Amateur telephony stations	440
Mersey Bar lightship ... Croydon	450
Other air stations ... Aeroplanes in flight	900
The Hague	1,050
Amsterdam	1,100

E. REDPATH.

[A later article will deal with the single-circuit receiver and the five-valve amplifier.]

DID YOU GET PCGG? (*continued from page 519*)

fine too. Curious how good gramophone records are when brought by wireless; better than straight off the gramophone. It seemed to us that the fellow who told the children's story might have articulated a bit better; but that may have been the instruments and not he at all. At any rate the set went to sleep immediately after, and we missed the next item and half the one after that. Just rain shorting the aerial at the lead in. You never know what's going to happen next.

In trying to get the "'Tis the Day" record dead sharp—John Harrison records always come well—we got mixed up with Croydon, well off his usual wave-length. About 1,000 we should say he seemed to be. Did he butt in on you at all? We've long suspected that Croydon wanders about.

The Melba record was really the last heard. The loud-speaker was going again for that, and it was really very good indeed, though, of course, one doesn't expect much power for loud-speaker work at a 220-mile range. We were called away in the middle of the Waldtuefel waltz, but didn't mind much because it wasn't coming very well. The results during the whole afternoon were curiously uneven.

"God Save the King," which, of course, is the Dutch National Anthem as well as our own, wasn't down on the programme this week, and as we had closed down we don't know if it came in as usual.

ERNEST LANGMEAD.

CORRESPONDENCE

A Protest

SIR,—At a meeting of the Ealing and District Radio Society, held on Friday evening, October 27, it was unanimously agreed to send the following protest to the responsible authorities:

"That the Ealing and District Radio Society strongly protests against the inadequate representation that the wireless experimenter has received at the recent Broadcasting Company meetings, and asks that the position of the *bona-fide* experimenter be more explicitly defined."

Thanking you in anticipation of your support of the motion.—WM. FRANK CLARK, Hon. Sec.

Mr. William Le Queux, the master of mystery, has written the first novel to be cast in the atmosphere of wireless telephony, a subject with which Mr. Le Queux is thoroughly familiar, for he was one of the early amateur experimenters in wireless, the owner of the finest amateur wireless telephony installation in Great Britain, and he is a member of the Institute of Radio Engineers. The novel, which will be called "The Voice from the Void," will be published by the House of Cassell.

Radiograms

RECENT telephony heard in the West of Scotland includes vocal and instrumental items transmitted from amateur stations in Wakefield and Somerset. The experimental broadcasting from Trafford Park has also been received perfectly by some of the local enthusiasts.

▪ ▪ ▪

The wireless exhibition held by the Glasgow and District Radio Club proved a great success. A 5-watt transmitter was by special permission installed at the show, and concerts were radiated at intervals. Specially arranged congratulatory messages were received from Eiffel Tower and Northolt. An address by Professor Howe, of Glasgow University, was a feature.

▪ ▪ ▪

Marconi's Wireless Telegraph Company, Limited, state that the rates now for the ordinary and deferred half-rate services, "via Marconi," to all places in the United States of America, except New York City, will be amended by adding to the ordinary rate to New York City, which remains at 9d. per word, the respective landline charges to all points in the United States beyond New York City.

▪ ▪ ▪

The Signal Corps of the United States Army claims to have developed a method whereby statics may be eliminated. Use is made of what is termed a resonance wave coil which in appearance is a tubular coil about 7 ft. long. The coil also serves the purpose of an aerial.

▪ ▪ ▪

Considerable advance has been made in the science of television by the invention of C. Francis Jenkins, of Washington, U.S.A., of his prism ring apparatus.

▪ ▪ ▪

An improved selenium cell has been developed which, it is claimed, is so sensitive that the passing of a pencil between it and the light causes a very appreciable fluctuation in the current.

▪ ▪ ▪

A system of wireless transmission and mail delivery has been inaugurated in Australia.

▪ ▪ ▪

The Bureau of Standards, U.S.A., have developed an amplifier which can be operated from alternating current mains, the supply being suitable for both filament and plate. It is expected that details will be available shortly.

▪ ▪ ▪

A wireless equipped taxicab has made its appearance in Paris.

The American Institute of Radio Engineers has awarded the Liebmann Memorial Prize for 1922 to Mr. C. S. Franklin, research engineer of Marconi's Wireless Telegraph Company, Limited, for his investigations in connection with short-wave directional transmission and reception. The Liebmann Memorial Prize is awarded for radio work of conspicuous merit.

■ ■ ■

Horns for loud speakers are now being produced by reducing wood to a fibrous state and pressing it in steel dies.

■ ■ ■

Commander C. P. Edwards, the wireless expert to the Canadian Government, is now in this country, the stated object of his visit being in connection with a great new wireless station to be erected in Canada at an approximate cost of £250,000.

■ ■ ■

The Marconi Company, in conjunction with the Daimler Company, carried out experiments with two Daimler cars fitted with wireless apparatus on Tuesday, October 24th. The cars travelled from London to Chelmsford and back, the passengers listening to conversation and music from both Marconi House and Writtle.

■ ■ ■ ■ ■

Another claim for secret wireless communication has been made by M. Belin, the inventor of the system for transmitting photographs and documents over a telephone wire.

TELEPHONY TRANSMISSIONS

Writtle (2 M T), 400 metres. Tuesdays, 7 p.m.

Eiffel Tower (F L), 2,600 metres. Daily, 5-16 p.m.

Hague (P C G G), 1,085 metres. Sundays, 3 to 5 p.m.

CLUB DOINGS

Stoke-on-Trent Wireless and Experimental Society

Hon. Sec.—F. T. JONES, 360, Cobridge Road, Hanley.

AT a meeting of the above Society on Oct. 26th details of an interesting competition were announced. A series of dots and dashes were given, which, when properly spaced, form a short sentence. A prize of wireless

(*Continued on page* 526)

OUR INFORMATION BUREAU

Expert Replies to Readers' Questions. Hundreds of Replies are sent by Post.

TO ENSURE A PROMPT REPLY PLEASE OBSERVE THE FOLLOWING RULES

Write distinctly, give all necessary details and keep to the point. Ask one Question at a time—never more than two. Send a Stamped and Addressed Envelope. Send the Coupon cut from page 526.

Winding Inductances

Q.—Please give the sizes, gauge of wire and number of turns, etc. to cover a range of wave-lengths between 100 and 3,000 metres approximately.—A. R. H. J. (Manchester)—(4002)

A.—The following list of turns wound on a 2-in. former is approximate, and coils of the dimensions given will be suitable when used in conjunction with a .001 mfd. variable condenser. It should be understood that the height and length of an aerial govern its natural wave-length. It is not possible, therefore, definitely to state that a coil will tune to a certain wave-length when used in conjunction with any aerial. The coils given below will "tune-in" to the wave lengths mentioned when used with a standard aerial erected at a height of about 30 feet.

100 to 500 metres, 60 turns of No. 24 S.W.G. d.c.c. copper wire.

400 to 1,000 metres, 110 turns of No. 24 S.W.G. d.c.c. copper wire.

800 to 1,500 metres, 150 turns of No. 26 S.W.G. d.c.c. copper wire.

1,400 to 2,000 metres, 195 turns of No. 26 S.W.G. d.c.c. copper wire.

1,800 to 2,600 metres, 245 turns of No. 28 S.W.G. d.c.c. copper wire.

2,400 to 3,000 metres, 285 turns of No. 28 S.W.G. d.c.c. copper wire.

Wireless Society of London

WITH regard to the enormous increase in jamming which takes place on amateur wave-lengths, it has been decided to call together all amateurs possessing wireless transmitting licences to attend a meeting at the Institute of Electrical Engineers at 6.30 p.m. on Nov. 13. The whole situation will be discussed, and it is hoped that some arrangement will be arrived at whereby a considerable amount of the jamming can be obviated.

The next meeting of the society will be held on Nov. 22, when Mr. G. G. Blake, A.M.I.E.E., will lecture.

Captain Amundsen, the Arctic explorer, has not been able to keep in touch with Norway by wireless as was hoped.

"TELEVISION"—(*continued from page 518*).

fore, will occupy an exactly similar position as that portion of the image that is being reflected from the transmitting screen A.

As long as the ray of light from V is uninterrupted the surface of the screen Z is evenly illuminated. When, however, an image is thrown upon the screen A of the transmitter the shutter W of the electro-magnetic device K will be operated by the varying current flowing through the selenium cell S, and more or less light will be focused upon the mirror M. The intensity of the point of light reflected upon the screen Z will, therefore, vary in strict accordance with the varying densities of the image thrown upon the screen A. The numerous light variations will take place so rapidly as to present a continuous and accurate representation of the transmitted picture to the eye. M. J. M.

(*To be continued next week.*)

Club Doings (*Continued from page 523*)

apparatus to the value of £1 is offered for the correct solution, or the nearest solution. It is proposed to form a buzzer class from 7 p.m. to 7.30 p.m. on Thursdays, if sufficient members care to avail themselves of this opportunity.

Proposed Oldham and District Wireless Club

It is proposed to form a wireless club in the above district, and all interested are invited to write for particulars to Mr. J. Everitt, 146, Riffonden Road, Oldham.

North London Wireless Association

Hon. Sec.—J. W. S. Prior, Peabody Buildings, Essex Road, N.1.

On October 23rd a lecture was delivered by Mr. Power on the subject of microphones. Commencing with a description of the early instruments such as the Bell type and those making use of loose contacts between metal rods or carbon pencils, he proceeded to describe the various improvements which had led up to the instruments of to-day. Mr. Power had brought with him several kinds of modern microphones which he took to pieces and passed round for inspection, at the same time explaining their construction and action.

The Portsmouth and District Amateur Wireless Society

Hon. Sec.—Mr. R. G. H. Cole, 34, Bradford Road, Southsea.

The weekly meeting of this society was held on Oct. 11th. After the usual buzzer class, a lecture was given by Mr. R. G. H. Cole with regard to accumulator charging on the Nodon-valve system. Following upon this talk and discussion, Mr. Cole gave a further interesting talk with regard to his transmitting apparatus, and also upon the various receiving sets he had experimented with at various times. An interesting evening was spent on Oct. 25th, when Mr. Gull gave a lecture on "Broadcasting." Mr. Gull dealt with the present regulations made by the Postmaster-General, and various diagrams were drawn to demonstrate the requirements.

East Ham and District Amateur Radio Society

Hon. Sec.—Mr. W. Vice, 5, Thorpe Road, East Ham, E.6.

The Hon. Sec. cordially invites applications for membership.

ANNOUNCEMENTS

"Amateur Wireless and Electrics." Edited by Bernard E. Jones. Price Threepence. Published on Thursdays and bearing the date of Saturday immediately following. It will be sent post free to any part of the world—3 months, 4s. 6d.; 6 months, 8s. 9d; 12 months, 17s. 6d. Postal Orders, Post Office Orders, or Cheques should be made payable to the Proprietors, Cassell & Co. Ltd.

General Correspondence is to be brief and written on one side of the paper only. All sketches and drawings to be on separate sheets.

Contributions are always welcome, will be promptly considered, and if used will be paid for.

Communications should be addressed, according to their nature, to The Editor, The Advertisement Manager or The Publisher, "Amateur Wireless," La Belle Sauvage, London, E.C.4.

"POLAR"

"Polar" Prestige. "Polar" installations have been adopted by most of the leading shipping companies in this country, by the British Post Office, and by Colonial Governments.

"Polar" equipment is installed at North Foreland (G N F), Seaforth (G L V), and many other important stations.

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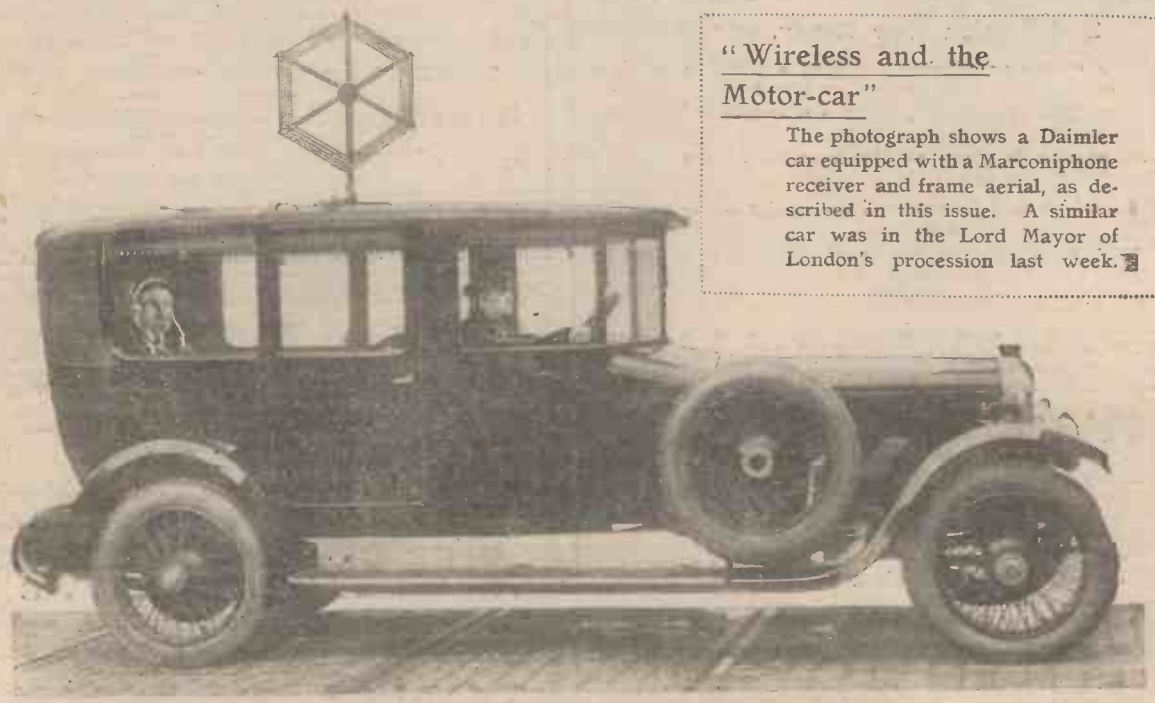
"ON YOUR WAVE-LENGTH," OUR NEW FEATURE

Amateur Wireless And Electrics

TURN TO PAGE 543

No. 24 SATURDAY, NOVEMBER 18, 1922 Price 3d.

SOME OF OUR CONTENTS



"Wireless and the Motor-car"

The photograph shows a Daimler car equipped with a Marconiphone receiver and frame aerial, as described in this issue. A similar car was in the Lord Mayor of London's procession last week.

Amateur Wireless and Electrics

No. 24 November 18, 1922

Using "Surplus" W.D. Apparatus

The Three-valve C Mark III Low-frequency Amplifier

THIS instrument, as shown by Fig. 1, is a complete three-valve low-frequency amplifier which can be used in many ways without modification. As may be seen from Fig. 2, there is a transformer between the input terminals (marked L_1 and L_2 on the instrument) and the grid circuit of the first valve. The primary winding of this transformer is provided with a tapping switch for varying the number of turns in the circuit. The resistance is low, however, so that to connect the amplifier as it stands to an existing receiver with detector valve, the latter should be provided with a telephone transformer in its plate-circuit just as if it were intended for use with low-resistance telephones. The low-resistance winding of this transformer should be connected to the input terminals of the amplifier. The amplifier can be fed from the same L.T. and H.T. batteries as are used for the detector valve.

Mode of Connection

In this connection it is well to emphasise the importance of the mode of connection of the parts of the detector valve that is to be used in front of the L.F. amplifier. If common L.T. and H.T. batteries are to be used for both the detecting and amplifying valves, it is essential that the negative terminal of the H.T. battery should be joined directly to one or other terminal of the L.T. battery, or, in other words, that the proper position of the telephones when used with the single detecting valve alone, or of the intervalve transformer when coupling on the L.F. amplifier, is between the H.T. terminal and the reaction coil.

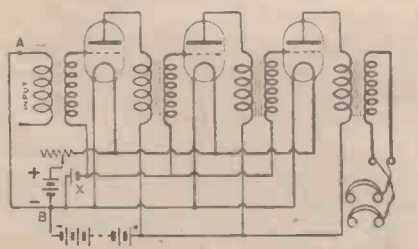


Fig. 2.—Connection Scheme of C Mark III Low-frequency Amplifier.

The cell X (Fig 2), connected in the common grid circuit of the valves, can often be dispensed with, although its use is frequently advantageous, depending upon the valves in use.

Alternative Arrangement

Alternatively, a proper intervalve transformer can be used between the detector valve and the first valve of the C Mark III amplifier, the first (earth-to-valve) transformer being dispensed with, and the intervalve transformer wired up in its place. This arrangement is somewhat more efficient than the one described above.

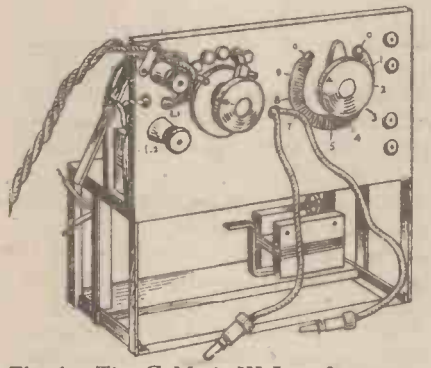


Fig. 1.—The C Mark III Low-frequency Amplifier.

As a further simplification, however, the detector valve may be coupled to the amplifier by means of a condenser used in conjunction with the secondary winding of the existing input (earth-to-valve) transformer T_1 in the manner shown in Fig. 3.

For this purpose both ends of the secondary winding of the input transformer T_1 must be disconnected, and the end that previously went to the grid-cell and the other transformer secondaries must be joined to the positive terminal of the H.T. battery, while the other end (previously joined to the grid) must be connected directly to the anode of the detector valve V_1 (Fig. 3), and also to the coupling condenser C. This should have a capacity of at least 0.01 microfarad, and its other terminal should be joined to the grid of the first valve of the amplifier and also to the leak resistance R. This latter should be arranged to have about 3 to 4 megohms resistance.

Using a Reaction Coil—

A reaction coil can, of course, be used, if desired, by connecting it directly in series with the wire leading from the anode of the detector valve in the usual manner. Alternatively, after the input transformer T_1 has been disconnected as above, the first valve of the C Mark III amplifier can be used as the detector valve by joining a grid condenser and leak in its grid circuit in the usual way.

—In Conjunction with a Crystal

As well as for use in conjunction with a valve detector, as just described, this amplifier may be employed with a crystal detector. Any of the arrangements described above may be employed; that is, inserting in the crystal circuit instead of the usual telephones a step-down telephone transformer, while retaining the amplifier input transformer; changing the amplifier input transformer (earth-to-phones) for an intervalve transformer, and connecting its primary into the crystal circuit; or inserting in the crystal circuit the secondary winding of the input transformer and adding the coupling condenser and leak resistance on the lines already shown in Fig. 3.

By adopting one or other of the methods here outlined, this L.F. amplifier may obviously also be used in conjunction with any form of receiving apparatus, as well as with a simple single-valve detector as described.

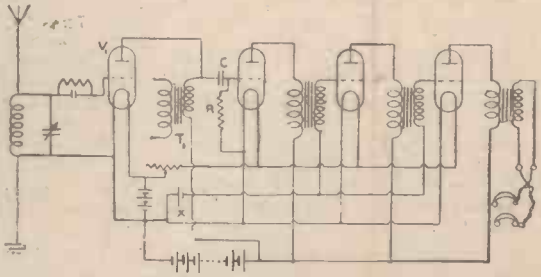


Fig. 3.—Addition of Detector Valve to C Mark III Low-frequency Amplifier.

L. H. T.

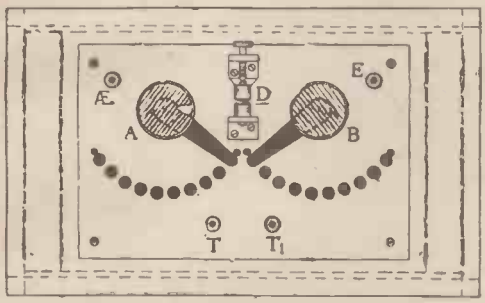
"Work" Handbook Receiving Sets

And Some Modifications Thereon *(Second article)*

The Single-circuit Receiver

THIS set as originally specified will effectively tune-in waves from about 600 to 3,500 or 4,000 metres.

Several readers have inquired regarding



Drawing of Single-circuit Receiver.

modifications necessary to enable waves from 150 to 3,500 metres to be received on the one set, but this plan is not recommended.

If an additional variable condenser (maximum capacity, say, .0005 mfd.) is provided and connected in series with the aerial circuit, the reception of the short waves will no doubt be possible, but in general will not be found very effective.

Modifications which can be recommended, however, are as follows:

(*a*) Wind the main inductance (ATI) with No. 24 d.c.c. copper wire in lieu of No. 28 specified.

(*b*) Provide a variable condenser (.001 mfd.) and series-parallel change-over switch, as shown in Fig. 5 (see page 521).

(*c*) Fit a reactance coil, consisting of a former approximately 4 in. diameter by 5 in. long closely wound to within, say, ¼ in. of each end with No. 28 d.c.c. wire and provided with 4 equal "tappings" connected to a suitable 4-point switch.

(*d*) Connect up as in diagram (Fig. 6) observing that the terminals marked G, F and reactance may with equal facility be connected to either the single-valve panel or to the five-valve amplifier, and should afford efficient reception of spark, C.W. or telephony on wave-lengths between about 400 and 3,000 metres.

The radio-telephony receivable will include:

Eiffel Tower	... ...	2,500 metres
Nauen	... ...	2,000 ,,
Amsterdam	... ...	1,100 ,,
The Hague	... .	1,050/1,085
Croydon air station Other air stations Aeroplanes (in flight)	...	900 metres

The variable condenser (ATC in Fig. 6) is to be used in series for the shorter waves, say, 400 to 1,200 metres, and in parallel for waves between, say, 1,200 and 3,000 metres.

It is to be noted that for the best reception of telephony the coupling between the ATI and the reactance coil must be adjusted so that the receiving set is just short of oscillation.

In this connection it is understood that the P.M.G. may decline to issue further permits for single-circuit receiving sets having reactance coils and therefore capable of self-oscillation with consequent re-radiation of energy from the receiving aerial.

This presumably is also on account of the interference which such re-radiation may cause to other adjacent receivers with the consequent annoyance.

The exact position in this matter is not quite clear at the moment, but is being inquired into, and it is hoped to publish further information when it is available.

Should the addition of H.F. and/or L.F. amplifying valves to the apparatus, as indicated in Fig. 6, be desired, this may conveniently be arranged for, as shown in Fig. 7, in which the first valve acts as a high-frequency amplifier, being "resistance-capacity" coupled to the second valve (the rectifier), which in turn is coupled to

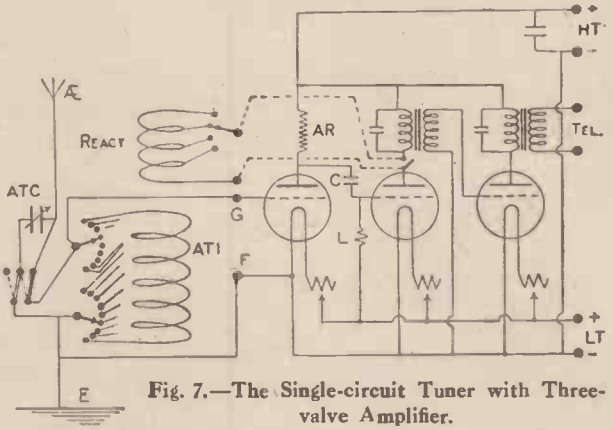


Fig. 7.—The Single-circuit Tuner with Three-valve Amplifier.

the third or L.F. amplifying valve by means of a step-up, iron-core intervalve transformer.

If a reactance coil is desired this should be connected in the anode circuit of the second valve between the anode itself and the primary of the intervalve transformer, and inductively coupled to the ATI.

The anode resistance (AR in the diagram) should have a value of 50,000 to 80,000 ohms according to the H.T. voltage

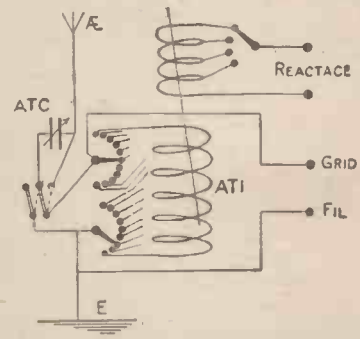


Fig. 6.—The Single-circuit Receiver with "Series-parallel" Condenser and Tapped Reactance Coil.

to be used, that is, 50 to 80 volts. C represents the grid coupling-condenser, approximate value .0005 mfd., whilst L represents the usual 2-megohm leak; the method of connecting in circuit is different.

The small fixed condensers across the primary windings of the intervalve and telephone transformers should each have a capacity of .002 mfd., and the reservoir condenser, connected directly across the H.T. supply, should be as large as possible, say, .05 to .3 mfd. It is suggested that a convenient method of construction would be to build up the three-valve amplifier as a separate and complete unit, in which case any type of inductance or "tuner" may be used by simply connecting to the terminals marked G and F.

If this suggestion is adopted it will be as well to provide terminals with "strap" for the reactance coil and to have the anode-resistance connections (or clip) easily accessible so that the resistance itself may be removed and a variable inductance substituted for trial of "resistance-capacity" against "tuned-anode and capacity" coupling (see Figs. 2 and 4, pages 520 and 521).

For this purpose another single-circuit tuner may be employed, in which case the winding should be done with No. 28 S.W.G. d.c.c. copper wire, as originally specified. A variable condenser (say .001 mfd.) may be found necessary for the longer wave-lengths, but this need not be provided until actual tests have been made.

When using this tuned anode method the ordinary reactance coil will not be required, and should be removed and the terminals shorted by means of the strap provided.

E. REDPATH.

(The next article will deal with the 5-valve amplifier.)

Electrons, Pulsations and Waves

WHEN the first thunderstorm took place on this earth of ours it made wireless waves. That thunderstorm must have taken place a very long time before men were created, so there must have been electrons pulsating and ether waves moving when primeval man first began to open his eyes and ears, and used his brain to understand what he saw and heard.

The Forces of the Electron

One of the most striking properties of an electron—as has been explained in a former article—is its intense dislike for any other electron. The force of repulsion is gigantic, and were it not for the corpuscles of positive electricity that exist in the heart of every material atom, all the electrons would have flown away and vanished out of the world long ago. We know very little about these positive "corpuscles." They have a great deal to do with the stability of the world, but they have little to do with the ordinary phenomena of electricity, which is a matter of the ebb and flow of the negative particles or electrons.

There are times when a cloud, for reasons that may be told later, gathers an enormous number of electrons, and as it gathers them they crowd up together so much that the total force with which they are pressing on the outer edges of the cloud is something that we have no means of measuring. We talk of millions of volts, but they mean nothing to us any more than the other big figures do. The pressures spoken of and measured in volts are only the pressures caused by the repulsions between the electrons. The more the crowding of the electrons and the greater the number of volts.

The Flash of Lightning

If an electron cloud should happen to drift so near to another cloud, or so near to the earth that the electrons can force their way through the intervening mass of air, then they make the path through which they fly white hot, and we call it a flash of lightning.

That flash is not so simple as it seems. When the first attempts were made to measure the time it took for the lightning to pass it was estimated as a small fraction of a second, but we now know that in that minute fraction of time the electrons have swept from one cloud to the other, have overcharged the second cloud, flashed back again, and rebounded once more until the pulsations backwards and forwards die away into a state of equlibrium.

Seeing that every pulsation of electrons makes a wave in the ether and that each of these waves is a true wireless wave, and that all the flashes of lightning since the world began have been great electron pulsations, it naturally follows that wireless waves must have been the commonest of things since the beginning of time.

How is it, then, that we have only just found them out? How is it that such a journal as this must try to explain something that is so astonishingly old? The answer is quite simple. None of our senses can appreciate wireless waves. Some of us no doubt boast about our "common sense," but even the cleverest of us can only appreciate what is going on in the world by means of his special senses. They are said to be five: Seeing, hearing, feeling, smelling and tasting. The physiologists give us another, the sense of orientation, which tells a man when he is standing upright even when his eyes are shut. If we accept all six of them we have no sense-organ, eye, ear, skin, nose, tongue, or the less-known semicircular canals, that can tell when an ether-wave of the wireless type is passing. That is why the waves caused by a lightning flash have evaded human notice so long. Had humanity been without ears and eyes both thunder and lightning might still be things beyond our ken.

There is nothing new under the sun: and in this article Mr. Frank T. Addyman shows that "wireless" existed at the very commencement of things. As with everything else, it has been the manner of its application that had to be discovered.

But we have ears, and modern invention has been able to give us instruments that will turn the energy of the waves into sound energy and let us hear what is going on. It has been able to turn the sense-eluding ether disturbances into waves of sound.

How is this done?

Pulsations and Waves

Before trying to answer this question, let us be perfectly clear about the two words that appear at the beginning of this article: pulsations and waves.

Pulsations are movements of electrons and waves are movements in the ether.

Electrons and ether are so intimately linked with each other that every time an electron moves it causes a strain in the ether.

If the electrons move in a steady stream or current, then the ether all round the wire that is carrying the current is strained, and the strain can be shown by holding a magnetic needle near the wire, when it will point along the lines in which the strain is being felt. If, on the other hand, the electrons are pulsating backwards and forwards, as they are made to do in the aerial of a sending station, then the rapid changes in the ether strains cause ether waves.

When these waves fall on the electrons in the receiving aerial they begin to pulsate, and the problem of the wireless engineer is to devise an instrument sensitive enough to make the movements either audible or visible.

The first implement that was actually used to do this was a piece of copper wire bent round into a ring with the two ends nearly touching. When the waves were strong enough they made the electrons in the ring pulsate so strongly that they forced their way across the little gap and formed a spark. This was of no practical value, but it deserves mention, because it was with a device of this kind that Professor Hertz made his first experiments on electric waves.

Four Discoveries

Since that time there have been four discoveries, each of which has led to the invention of apparatus for receiving wireless waves. The inventions are naturally much better known than the discoveries, so there is no harm in speaking of the four as: coherer, crystal, magnetic detector and thermionic valve. Just at present we are all in love with the thermionic valve, though we cannot afford to use it. But even the ablest of our wireless engineers sometimes cast their eyes back on the other three. There are many unsolved problems about each of them that may prove of enormous value if some skilled amateur can find time to work them out.

But to go back to the discoveries. In 1889 Sir Oliver Lodge made a remarkable observation that when two brass nobs were so lightly pressed together that an electric current cannot pass between them, they will form a complete conductor as soon as an electric wave makes the electrons in the nobs pulsate.

Just a year afterwards the French scientist Branly devised a piece of apparatus that increased this effect enormously. He packed about as many copper filings as could be balanced comfortably on a shilling inside a piece of glass tubing. The filings were packed very loosely and a wire was sealed into each end of the tube, so that the filings formed an insulating gap between the two wire endings. The minute gaps between the filings formed an insulator until they were made to "cohere" by the passage of a wave. Then the whole mass of filings became a conductor. Unfortunately the filings re-

mained a conductor until they were shaken up again. The application was obvious. Fix a battery, an electric bell, and a coherer in a circuit. As the coherer is an insulator no current can pass. Make a spark in its neighbourhood, and the wave that follows will turn the coherer into a conductor, the current will pass and the bell will ring.

Unfortunately the bell will go on ringing until someone shakes the coherer, but it was easy enough to fix the coherer to the trembler of the bell, so that each wave gave a short ring that shook the coherer free as soon as it began to sound.

As soon as that strange genius Marconi touched this crude apparatus he changed it out of all knowledge. His coherer became some nickel and silver filings lying in a vacuum between two silver knobs, and the oscillation he marvellously intensified by his knowledge of resonance. The coherer gave way to other means of detecting wireless waves, chiefly because of its slowness, but science has not done with it yet.

Revealing the Signals

The telephone must have suggested itself as a means of hearing wireless signals at a very early time in the history of wireless. Unfortunately a telephone is not sensitive to rapid oscillatory currents. It cannot be used on the oscillations of the aerial; but if some device is introduced that stores up the energy of each alternate swing of the electrons and allows them to use their full force on the backward swing, then the quick succession of forward jerks becomes, for all intents and purposes, a continuous current, and a telephone sings with a sharp note as each train of waves falls on the aerial. Certain crystals when placed in contact act rather differently from the filings in the coherer. Instead of becoming a general conductor at the point where they touch, they form a contact which only conducts in one direction. The crystal is still used, and like its kinsman the coherer, may perhaps come into its own again when we know more about it.

The magnetic detector is much more difficult to understand, as it depends on one of the peculiar magnetic properties of iron known as hysteresis. But as none of these methods gives their best results unless the receiver is in tune with the sender, we must put off a description of the magnetic detector until we have tried to explain what electrical resonance really is and have given an explanation of those two mysterious entities, capacity and induction, on which electrical wave-lengths—in fact, the whole practicability of wireless—depend.

FRANK T. ADDYMAN.

All About the Valve.—VI

How the Characteristics are Arrived at

THE result of the readings described is shown in Fig. 11, with two other curves (the lower ones marked I and II), which show the variation of the current flowing in the grid circuit as distinct from the plate circuit, when the grid voltage is progressively increased.

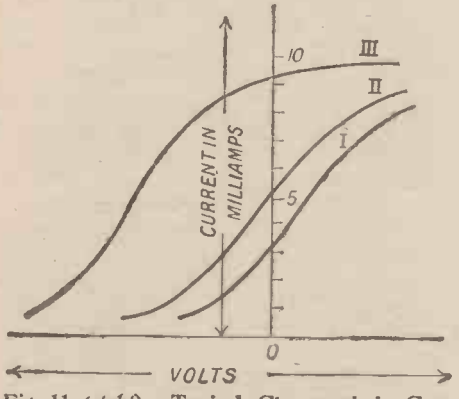
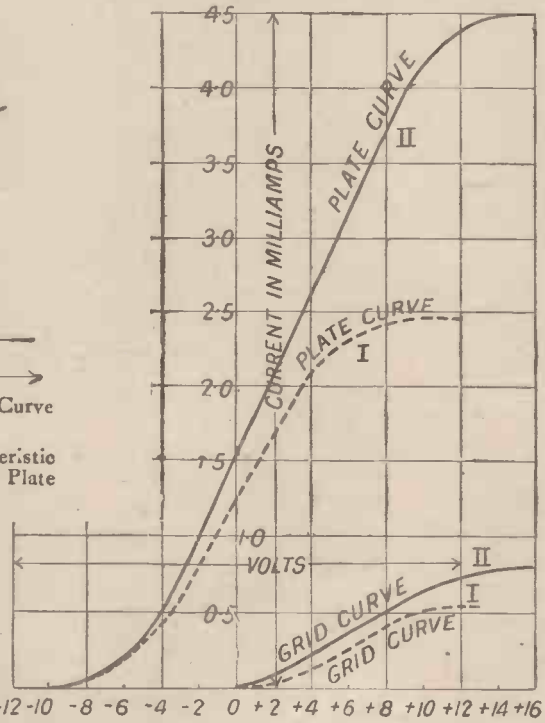


Fig. 11 (*right*).—Typical Characteristic Curve of a 3-electrode Tube.

Fig. 12 (*above*).—Family of Characteristic Curves showing the Effect of Varying Plate Potentials.

In all the curves a steady plate potential of 50 volts was used throughout. In plotting curve I a filament current of 0.36 amp. was employed, whilst the curve marked II shows the effect of increasing this current to 0.39 amp. (representing a larger emission of electrons from the filament). By varying the filament current over wider ranges, whilst maintaining the plate potential constant, a whole family of curves can be drawn in this way, showing the varying relation between input and output by using more or less heating current.

A similar family of characteristic curves can be drawn by using varying values of plate potentials, as shown in Fig. 12, whilst keeping the filament current steady. The relation between the plate current and the applied grid potential for each curve is plotted in the same manner as described with reference to Fig. 10, the separate curves representing a different value of steady plate high-tension in each case.



For instance, in curve I the plate potential was kept steady at 80 volts; in curve II it was raised throughout to 160 volts; whilst in curve III it was made up to a still higher value of 300 volts.

Plotting Valve Curves

The thorough understanding of how to plot such characteristic curves and a proper appreciation of the precise information to be derived from them is of the utmost value to all who desire to acquire an intimate knowledge of the working of the valve. In effect, they transform the valve from a somewhat mysterious gadget, whose mode of operation is often simply taken for granted, into a systematic and organised element of electrical "mechanism" whose workings are open to intelligent control and variation at the hands of any amateur who will lay himself out to use the master-key afforded by the curves in question.

Special Features

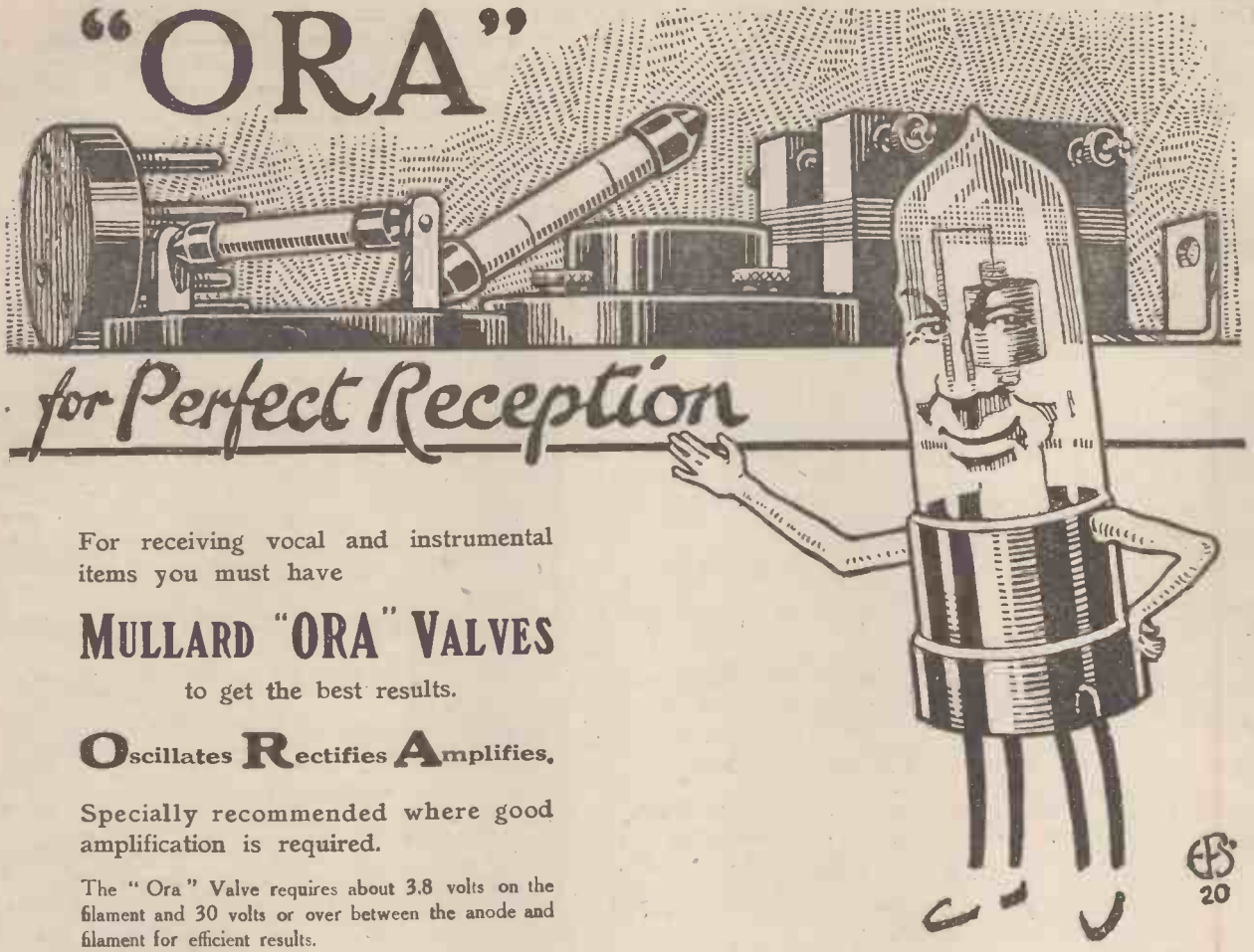
The first point to be remarked in connection with the characteristic curves in Figs. 11 and 12 is that in each case there exists a decided "bend" both towards the upper and lower limits of the curve. Roughly speaking, the curve remains more or less a straight line between these two points.

It is owing to the existence of these bends that the tube possesses its property of rectifying signal impulses.

When the grid potential is so adjusted by means of a potentiometer as to correspond with, say, the lower bend in the curve, the net effect (as already explained in detail with reference to the two-electrode valve) of an applied signal impulse is to increase the plate current during the positive half-cycle to a greater extent than it decreases it during the negative half-cycle.

(*Continued on page* 541)

"ORA"



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Brown "A" Type Headphones		
120 ohms	2 2 6	1 0
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8,000 ohms	1 16 6	1 0
Coil Holder, as illustrated	1 5 0	1 0
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Intervalve Transformers	1 5 0	1 0
Telephone Transformers	1 5 0	1 0
"Parliphone" Loud Speaker	1 12 6	1 3
Marconi "R" Type "Ora" Valves	15 0	Post free.
Valves	17 6	,,

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.0005 mfds. } for panel	18 6	free
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.0002 and .0003 mfds.	2 6	,,
.001 mfds.	3 0	,,
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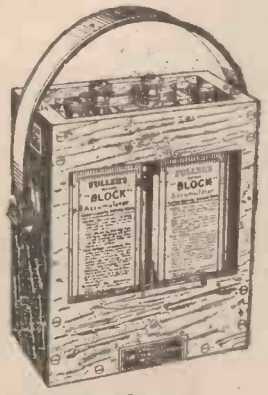
Filament Resistances ...	4 0	,,
Telephone Cords, best quality	3 6	,,
Ebonite Sheet, cut to size, per lb.	1 6	,,
Terminals, 4 BA. per doz.	3 0	,,



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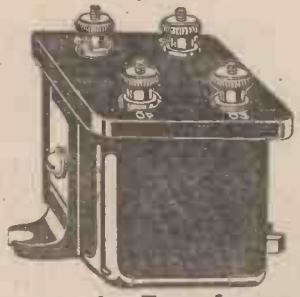
4 volt 40 amp. **£1 12s. 6d.**
Case 7/6 extra.



Intervalve Transformer
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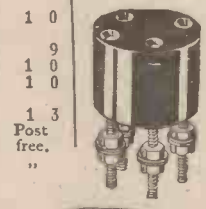

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YORKS : BARNSLEY BRITISH CO-OPERATIVE SOCIETY, LTD., Barnsley.
GLOS : BRISTOL WIRELESS CO., 52, Cotham Hill, Bristol.
S. WALES : SOUTH WALES WIRELESS INSTALLATION CO., LTD., 18, West Bude Street, Cardiff.
N. WALES, LANCS. CHES. & I.O.M. : THE "ALL-BRITISH" WIRELESS MANUFACTURES CO., LTD., 18, Vauxhall Road, Liverpool.

"ALL ABOUT THE VALVE" (*continued from page 538*)

This effect extends throughout the duration of a wave train (in spark signals) and causes a telephone "click."

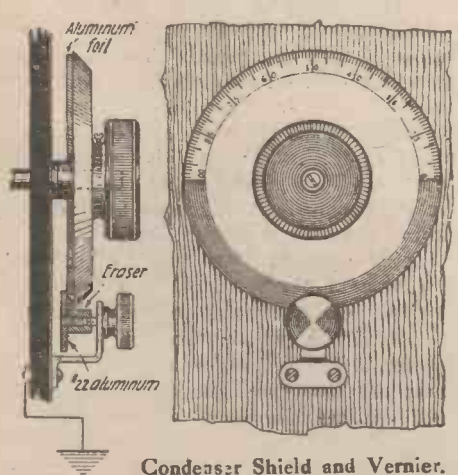
The reverse effect happens when the grid voltage is adjusted to the *upper* bend in the curve. Here the negative half of the signal impulse has a greater effect upon the plate current than the positive half, with the result that the plate current is effectively diminished during the persistence of a wave train. The result in the phones is, however, exactly the same, as they are operated by current variation, no matter in what direction.

The straight-line part of the curve represents the condition of affairs when the proportion between input and output is greatest—that is, where a given voltage variation will produce the maximum change in the plate current. This is obviously the most advantageous condition for pure amplification. Accordingly when the maximum possible amplification is desired, either for radio or audio frequencies, the tube should be worked on this part of the characteristic. As it happens, the point of zero grid potential is on a part of the curve which represents efficient amplification. In fact, as will be seen from a glance at the curve II (Fig. 11) the same maximum ratio of amplification exists roughly between − 2 and + 8 grid volts. D. ALCASE.

(*To be continued*)

A Condenser Shield and Vernier

THIS is a novel method of obtaining both a shielded and vernier effect by one instrument. With this shield and mechanical vernier a micrometer adjustment is possible and all body capacity is eliminated. It is easy to construct and is well worth the small outlay of money necessary.



Condenser Shield and Vernier.

An ordinary dial is given a thin coating of shellac and an aluminium leaf, cut so as not to come in contact with the shaft, is pressed down upon it. If the constructor possesses a metal dial which does not come in contact with the shaft, the above operation is unnecessary.

The vernier consists of an ordinary eraser obtained from the end of a pencil, a knob, a circular piece of aluminium cut from a No. 22 B. and S. aluminium sheet, a flat-headed screw and a brass support of the shape shown in the diagram. The different parts are put together and the support is earthed.—*Radio News.*

"First-nights"

AN enthusiastic audience, rounds of applause, a "star" artiste bowing acknowledgments, "calls" for the author—such are the usual incidents associated with a "First-night." But there are other episodes in life to which the term "First-night" could be applied, not the least being concerned with our hobby—wireless. To most of us, old hands or new-comers, dabbling in wireless, have come occasions which were in the nature of "first-nights." The reception of our first Morse signals, lamented Poldhu perhaps, a fragmentary telephony transmission, a successful long-distance reception, and hosts of other incidents so dear to the heart of the wireless enthusiast.

The First "First-night."

On a recent evening I had been entertaining some friends with a 2L O concert, and upon leaving one remarked: "It's as good as a 'first-night.'" It was a spontaneous expression, but one that stirred a little memory within me. In retrospection I slipped back to the memorable occasion in the old war days. Fresh from "Blighty," a "passed out" wireless operator, I was going to my first station after a "finishing-off" course at a wireless school behind the line. On a cold rainy night, by devious routes, endeavouring to heed the remarks as to sundry obstacles in the path of the unwary, I arrived. Down many stairs, wanting a more suitable name, an introduction of my head to the roof, which brought inward thanks to a steel helmet, and I was in—the station. An oil lamp was the illuminant in a dug-out, damp and not too roomy. Of the occupants two were volubly "strafing" some misguided operator—British or Bosche—who, by "sitting on his key," a pernicious habit with which I became all too familiar in a short time, was diligently jamming the practice message they were endeavouring to "take down."

The third member of the station *personnel*, rolled in his blankets, was in the arms of Morpheus. My initiation in active service wireless occupied the ensuing hour or two, "Traffic" was slack; this was a reputed quiet sector. With a pair of "Browns" on my head I listened to some faint Telefunken spark signals emanating from across the line, and then, overhead, a thud. "What's that?" said Innocence. "Shelling," said Experience. "Oh," said I, and awaited the next. It came with encores. I ventured to remark: "Pretty bad, isn't it?" "Bad? Cushy! Better here than standing to in the front line," came the reply with not a little irony. With mixed feelings I supposed it was.

That was a red-letter event in my wireless career, and although the "show" was bad, with a varied programme, however, and the audience unappreciative, it was a veritable "first-night." My train of thought veered round to the present, to broadcasting and all the possibilities it will bring, and here again that little expression was applicable.

The Audience

Let us consider the vast audience "listening-in" to the first broadcast programme. In town, hamlet and village, in mansion and farmhouse. Did ever an artiste have such a unique audience? True, the usual manner of appreciation will be denied them, but who can doubt the depth of the enthusiasm. With items to entertain both young and old the initial broadcast will, indeed be a "first-night." And how that occasion will be welcomed by the many hundreds of recruits to the ranks of wireless, anxious to know what their "sets" will do. Some will discover the limitations of their particular outfits, others will be profoundly elated with the results obtained. But in either case there will be a satisfaction that is common to new-comers in this wonderful hobby, the satisfaction that comes with one's first signals. How many will, I wonder, decide that a broadcast licence is insufficient for all they will want to know and do?

Youth and Age

On two consecutive days recently I was, while at lunch, an ear-witness of a conversation of which this is a typical extract: "Did it work?" "Ra-ther! got 2M T nicely; made a fixed condenser yesterday." "Oh, yes, it goes across the 'phones.'" "Bought your phones yet?" In both cases the speakers were of an age that one would think unlikely to be inclined to the intricacies of building sets. But Youth is not holding the field.

That a great camaraderie will be one result is beyond doubt. The many societies and clubs constitute the base on which it is being formed. C. G. G.

Simply-made Filament Resistances

THE ordinary trade manufactured articles, with a circular coil of resistance wire round a turned piece of ebonite, are not always of sufficient resistance for the regulation of a single valve. This is easily seen by considering the resistance required. Suppose one uses a 6-volt accumulator to light the filament, when the battery is newly charged it registers 6.6 volts, decreasing to 5.4 volts as it discharges. Now a valve usually works best with a filament voltage of from 3½ to 4½ volts, depending on the type. By Ohm's law we find that a valve taking ½ an ampere will need a resistance of nearly 5 ohms. This necessitates a length of (20 S.W.G.) resistance wire 25 ft. long, or other sizes as shown:

Size S.W.G.	Ohms per foot	Length To give 5 Ohms
30	1·7	3 feet
28	1·2	4 ,,
26	0·8	6¼ ,,
24	0·53	9½ ,,
22	0·33	15 ,,
20	0·2	25 ,,
18	0·12	42 ,,

From this table we see that a coiled wire resistance having about 6 ft. of 20 S.W.G. wire (as is usual in practice), only gives a total resistance of 2 ohms. A smaller size of wire cannot be used owing to the mechanical stiffness required to support the moving cont-

The two following methods overcome this difficulty, and at the same time are cheap and simple.

Flat Type

For the first type (Figs. 1 and 2) a length of bare resistance wire is wound on to an ebonite or wood "former" and spaced by winding thin string on at the same time. (This is an extremely simple operation in practice; in fact, very much easier than using covered wire and scraping off the insulation where necessary.) A suitable size for the "former" is 1 in. by 2 in. by ¼ in. thick. There is no need whatever to use ebonite from an electrical standpoint, as since the resistance of the accumulator is of the nature of 1 ohm, wood having a very much higher resistance is perfectly satisfactory. Ebonite, though, is better to work with, and can be tapped and drilled with greater ease, as well as making a better-looking job if the extra price is not important.

A moving radial arm is arranged to traverse the resistance wire; one contact being made to this arm, the other to one end of the wire.

Using 28 S.W.G. resistance wire, twenty turns will be required on a former 1 in. wide, 2 in. long by ¼ in. thick. This will allow a space at one end for the "off" position.

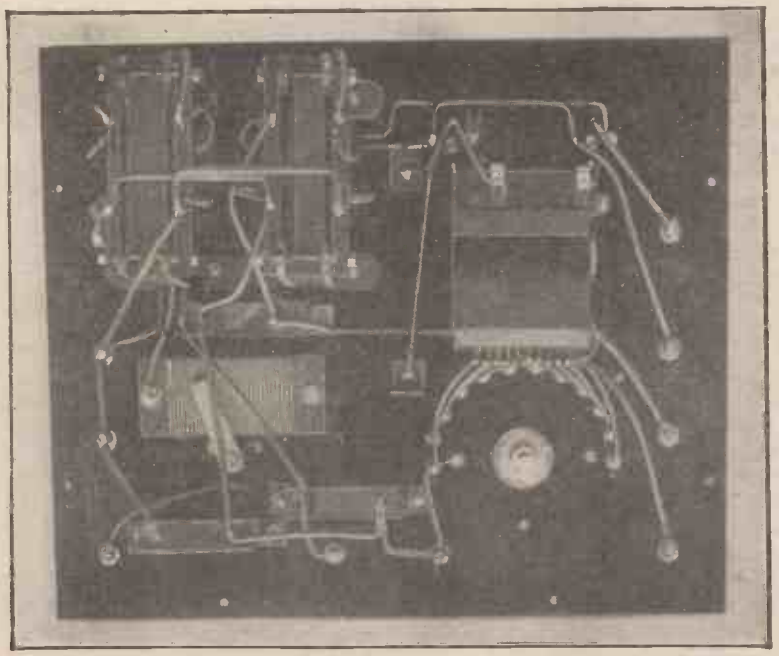
While this arrangement is quite suitable for the filament of an amplifying or magnifying valve, the objection is that there are really only twenty positions for the moving contact arm, and the difference between one position and the next is too large to give the fine adjustment required for a detecting valve.

Rotary Type

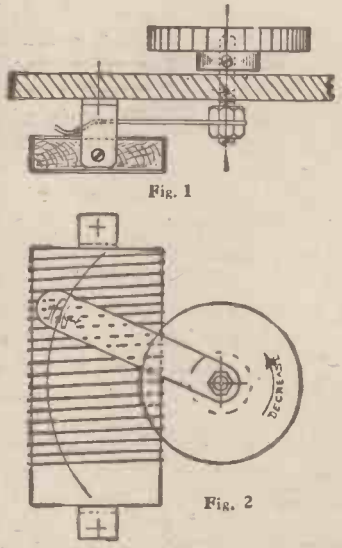
The rotary type (see Figs. 3 and 4) below overcomes this difficulty without, as one usually expects from the term rotary, requiring the use of a lathe for its construction. If a wood "former" is used a piece of curtain pole will serve admirably as long as it is fairly round. Ten turns of wire are wound on to a "former" 1⅝ in. diameter and 1 in. long (using 28 S.W.G. uncovered resistance wire and spacing it with thin string, which is afterwards removed). This gives the required resistance of 5 ohms. A space is left at the bottom of the former for the off position.

A spindle passed down a hole exactly in the centre of the former has a knob on the upper end arranged to stick through the panel, on which the resistance is mounted. This spindle carries on its bottom end a cross-piece of the same length as the diameter of the coil. At each end of this horizontal cross-piece there is fixed (soldered or bolted) a springy vertical contact arranged to rub on the resistance wire.

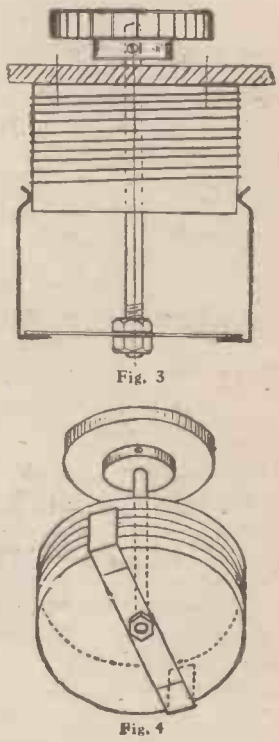
The spindle will thus push down and pull up for rough adjustment, while it can be rotated to get the final accurate resistance necessary in valve circuits. H. R.



Photograph of Under Side of Panel by General Radio Instruments, Ltd., showing Resistance in Position.



Figs. 1 and 2.—Elevation and Plan of Flat-type Filament Resistance.



Figs. 3 and 4. — Elevation and Under-side View of Rotary Resistance.

On Your Wavelength!

IT has been, on the whole, quite an eventful week, but then, if you use a wireless set regularly every week answers to this description, for no day passes without some little problem which may, or may not, find a solution. Adventure number one was not with batteries, or telephones, or atmospherics, or anything commonplace of that kind, but with—spiders!

There had been a white frost overnight, and the tree at the bottom of the garden was shedding rapidly both leaves and huge walnuts, which fell almost into the hands of the group of small boys waiting below. A new inductance had been blown together in the wee sma' 'oors, and ten o'clock seemed just the time to see what F L would do with it. On with the rheostat, over with the H.T. switch, and there he is, a drab and rather quavering ghost of the true "ten ack emma" call. Five valves, ye gods! and the set making no more noise than hertzite or galena can accomplish without the aid of expensive "toobs"!

Feverish examination of connections; tests of H.T. and L.T. batteries. Grid-leak inspected and exonerated. Earth quite as it should be. At this moment a ray of sunlight strikes the aerial, visible through the window, and discloses some really beautiful ornamentation, gratuitously provided by Nature's children. A spider has built a web from the aerial wire proper to the first insulator, and thence to the supporting wire. Another has bridged insulator No. 2 with the guys of a masterpiece in webs. Every strand is covered with hoar frost—and there you are! No more perfect "short" could have been designed.

The lowering of the aerial and some smart work with a duster are followed by vastly more power to F L's elbow, and the rhythmic beats now come in so that they can be heard yards from the phones. Note for future occasions: "Swat that spider."

• • • • • • • • •

Is anybody else bothered by harmonics from Leafield and Northholt? Or is the unfortunate amateur wirelessman the only one to suffer from their persistent and unwanted remarks that clash with reception on low waves? They are by no means the only offenders. Some of the big spark stations, though friends in need when one is calibrating, can be the very dickens at times. Not content with coming in strongly on their own proper wave-length, they insist on usurping the rôle of the poor and being always with one, be the tuning never so careful. The Government of the United States is prohibiting spark transmissions owing to the interference caused by their wide tuning. Let us hope that ours will shortly do the same. This is the one form of broadcasting that we do not want!

• • • • • • • • •

Poor Hague Concert! Why is it that at about 2.55 p.m. on Sundays every station working on 1,000-1,100 metres should feel called upon to calibrate? A running obbligato of "Vees" is certainly not an improvement to the music. And if you use any form of reaction you can hardly help oscillating to some extent, for C.W. stations on almost the same wave-length see to that. Really it's a rather unfortunate wave-length, for if you are anywhere near London Croydon *will* butt in in the most unseemly fashion. Just as the tenor is putting real soul into it our old friend the operator breaks the spell by tender inquiries as to the whereabouts of the prosaic Beer Harris. By the way, do the Americans call B beer? Barley water would be more appropriate in the Land of Prohibition.

• • • • • • • • •

Have you had trouble with your H.T. battery? The other night 2M T came in badly when a new battery was on tap. The insulation was apparently insufficient, for a couple of old photographic plates placed under the box supplied all that was necessary and worked a complete cure. *Verb. sap.*

THERMION.

RADIOGRAMS

AT a bazaar held at St. Luke's Church, Great Crosby, a series of addresses were given illustrating the principle of "Wireless Telegraphy and Telephony." A temporary aerial had been erected, and excellent signals and telephony were received.

Huddersfield Town Council has approved the erection of a wireless receiving set in the police station.

The Air Ministry have ruled that all civil aircraft making journeys of over 100 miles must in future be fitted with wireless apparatus.

Lord Gainford, who was P.M.G. in 1916, is the independent chairman of the British Broadcasting Company.

On Sunday, November 5th, by means of nine microphones placed in the Gothic Episcopal Church of St. Thomas, New York, people all over the United States and Canada heard for the first time the singing of the choir and the sermon of Dr. Ernest Steres. The installation was so perfect that even the chink of coins in the contribution plate could be heard.

The London County Council has given permission to the Staff wireless club for the erection of an aerial at the County Hall for the use of the society's apparatus.

Amateurs who heard the concert of 2Z Y on Tuesday evening, October 31st, are asked to report their results to Mrs. X, Radio Research Department, Metropolitan-Vickers, Trafford Park, Manchester, stating what circuit and apparatus they were using at the time.

A wireless piano has just been invented; the hammers strike tuning forks instead of wires.

At a meeting of Marconi's Telegraph Company on Saturday, November 4th, the resolution to increase the capital for conversion rights of certain stock was unanimously confirmed.

An international wireless exhibition is to be held at Geneva in April, 1923.

Excellent reception of 2Z Y (Metropolitan-Vickers, Trafford Park) has been, and is being, obtained by amateurs in Douglas, Isle of Man.

TELEPHONY TRANSMISSIONS

Eiffel Tower (F L), 2,600 metres. Daily, 5-16 p.m.

The Hague (P C G G), 1,085 metres. Sundays, 3 to 5 p.m.

Writtle (2M T), 400 metres. Tuesdays, 8 p.m.

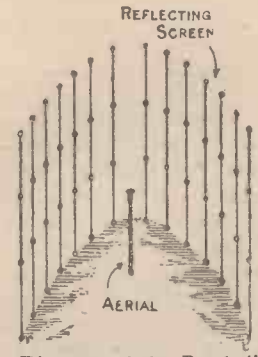
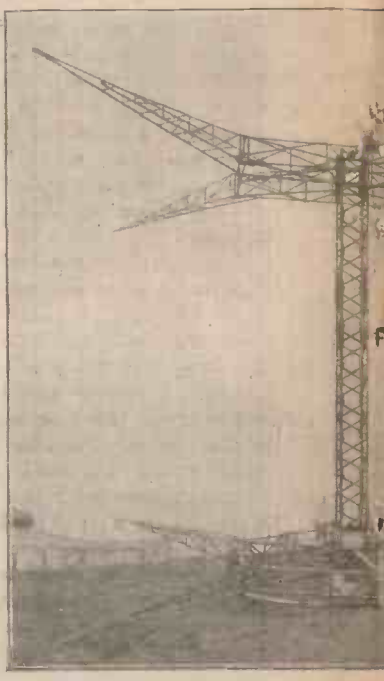


Fig. 1.—Diagram of the Parabolic Form of Transmitting Aerial System.

A FOCUSED WI

AN ELABORATE ROTATING AERIAL USED AS A LIGHTHOUSE



Photograph of the Experimental

(It was for experimental work at thi awarded the Liebmann prize a

FROM the very beginning of the science of wireless telegraphy the general trend of development has been steadily in the direction of utilising larger and larger wave-lengths in order to attain an ever-increasing range of transmission.

Direct Signalling

Now that direct wireless signalling to Australia has been established, the maximum possible range has been achieved, and attention is being directed more and more towards the possibility of using wireless energy of very short wave-length and extremely high-frequency.

This new departure represents a curious reversion to early principles. Hertz, when first investigating the properties of the newly discovered electromagnetic waves, made several attempts to focus them by means of parabolic reflectors or mirrors into directional beams or rays of energy. In utilising such optical methods he was no doubt influenced to a large extent by his knowledge that the new waves were analogous to light rays, as had been pointed out by Clerk-Maxwell when the latter foretold the existence of such waves many years before Hertz had succeeded in experimentally demonstrating their existence.

Early Experiments

The early experiments were unsuccessful, and with Marconi's invention of the upright aerial, attention was for many years thereafter almost exclusively devoted to the commercial requirement of increased range of transmission. This depended mainly upon the quantity of power that could be poured into the ether, and so elaborate aerial systems carrying huge wave-lengths of 20,000 metres and upwards were developed.

However, with the gradually increasing efficiency of transmitting apparatus generally, and particularly with the advent of the valve as a generator of continuous-wave signals, combined with a growing appreciation of the merits of directional propagation, the problem of utilising the shorter wave-lengths again came into prominence.

In the first place it has already become a vital necessity to take some step to relieve the already congested condition of the signal-laden ether, so as to diminish the increasing prominence of interference trouble due to this cause. In the second place, an approximately clear-cut beam of signal energy offers a possible solution to the problem of devising a system of wireless telephony which will be so highly selective as to be practically secret. When this has been accomplished wireless telephony will enter the commercial field as a strong rival to the existing line-telephone, but not before.

Parabolic Reflectors

In 1916 Marconi proposed the use of a number of upright aerials arranged in parabolic form about the transmitting aerial, which was situated at the focus of the system, as shown in Fig. 1. The energy from the transmitting aerial is reflected from each of the tuned auxiliary aerials and is thence directed outwards through the mouth of the parabola in the form of a directed beam, as shown in plan by the arrows in Fig 2. Just as in optics, the angle of incidence is equal to the angle of reflection, and, owing to the geometrical property of the parabola, every

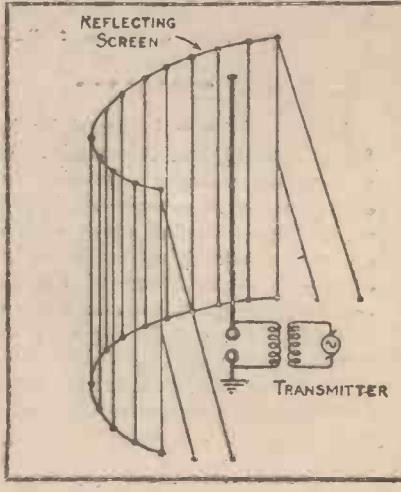


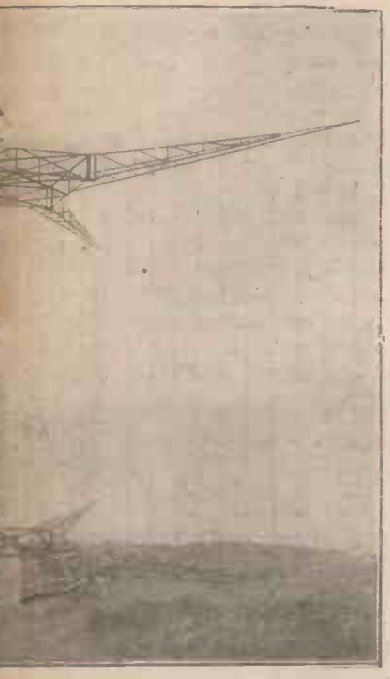
Fig. 3.—
Arran
Directi
mitter

Wireless Furniture

De Luxe Cabinet Receiver.
(*Telephone Manufacturing Co., Ltd.*)

IRELESS BEAM

DEVISING A SYSTEM OF SECRET TELEPHONY

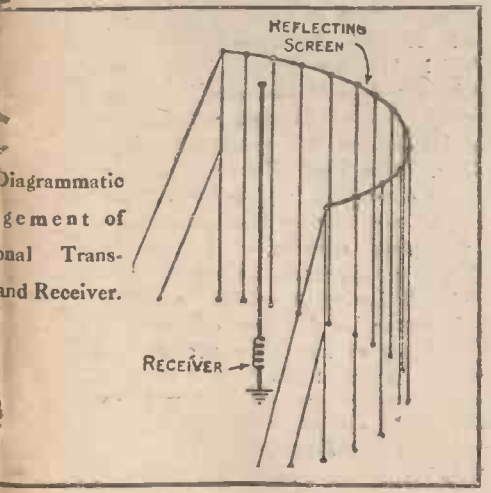


Directional Station at Inchkeith.

(This station that Mr. C. S. Franklin was [illegible] as mentioned in our last issue.)

element of the wave-front emitted by the focal aerial, after striking against a reflecting aerial, is returned along separate paths which are strictly parallel, thereby forming a concentrated beam of energy as shown. A similar reflecting system is used at the receiving end.

A year later (in 1917) Messrs. Marconi and Franklin improved this system by substituting for each of the single auxiliary antennæ, shown in Fig. 1, a series of two or more parallel and tuned wire strips or rods, located one above the



Diagrammatic [illegible] gement of [illegible] nal Trans- and Receiver.

other, the sets in turn being arranged so as to form a parabolic surface.

One such arrangement is indicated diagrammatically in Fig. 3. As there shown every set consists of three rods, each of which is insulated from the other, the whole series being arranged in a parabolic surface about the transmitter, which is located at the focal point.

A photograph is given of an actual reflector constructed on these lines, and erected upon the island of Inchkeith in the Firth of Forth, where it is used as a kind of wireless "lightship." A rotating beam of signal energy having a wave-length of only *four metres* is radiated outwards, the beam being arranged to make a complete rotation in a given interval of time. A distinctive signal is emitted for each point of the compass, so that a ship in foggy weather can readily determine its bearings from the signal received. The actual duration of each signal at the receiving-end lasts from four to six seconds (when the beam is making one revolution in two minutes), and this is sufficient to give an accurate bearing within two degrees at a distance of seven miles.

A careful scrutiny of the photograph will show that there are two parabolic screens, one screen facing the observer, the other pointing away from him. Each screen consists of a large number of "sets" of aerials, each set comprising two insulated wires one above the other. The dots seen in the phtograph are the insulating coupling-pieces. The whole girder system is mounted on wheels and rotates about a circular track-rail at the bottom.

The transmitting aerial proper is mounted on the top of the white box seen at the base of the structure in the foreground. A similar aerial is located at the focal point of the second screen, facing away from the observer.

It will be of interest to recapitulate some of the results that have been attained by the use of such reflecting aerials in combination with signal wave-lengths of twenty metres or under.

Recent Results

Early experiments made at Carnarvon in 1917 on a three-metre wave-length and a compressed-air spark transmitter gave a range of twenty miles, using the reflecting screen at the transmitting end only, and a single aerial for reception. Subse-

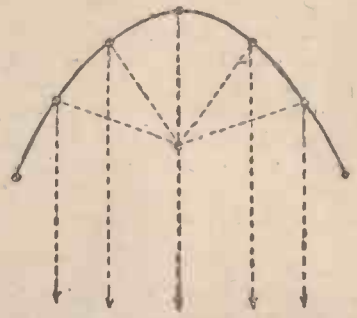


Fig. 2.—Diagram of Beam Projected from a Parabolic Reflector.

quently in 1919 experiments were made at the same station with telephony messages, using a valve transmitter and heterodyne reception. With this installation, and employing a carrier-wave of fifteen metres, clear speech was obtained over a distance of twenty miles.

Later, in June 1920, speech was successfully transmitted between Carnarvon across the sea to one of the Dublin packet boats over a range of seventy miles. More recent experiments carried out between

Wireless Furniture

Crystal Set Cabinet Receiver.
(Wireless Equipment Co., Ltd.)

two land stations, one at Hendon and the other near Birmingham, have resulted in clear speech transmission over a distance of practically one hundred miles. This is undoubtedly a remarkable performance upon a 15-metre wave-length.

It should be stated that comparative measurements of the range of such short-wave signalling sets show that when reflectors are used both at the sending and receiving ends, the energy received is about two hundred times more than is obtained without the aid of the reflectors.

Duplex Working

It is also a remarkable fact that signals can be received on the reflecting screen whilst the transmitter is actually sending, so that the system may be utilised for duplex working.

Again, in telephony it is noted that the effect of concentrating the signal energy along a directional path eliminates the distortion effect which so frequently mars the clearness of speech in non-directional systems.

The whole subject of short-wave transmission may be said at present to be merely in its infancy, but there is no doubt that the combination of extremely high-frequency radiations, together with directional transmission and reception by means of reflecting aerials of the kind indicated, opens out an enormous field of development and utility in the near future. W. T.

A Wireless-equipped Car

LAST week brief mention was made of some experiments that were carried out conjointly by the Marconi Company and the Daimler Company with a wireless-equipped car. We are now able to give some details of the equipment of this car. A photograph appears on the cover.

The receiving apparatus used is a Marconiphone 6-valve set, five of the valves being high-frequency amplifiers and the other a rectifier. The valves are of the special low-current consumption type. As will be seen by the photograph, the aerial is fitted on the roof of the car, and is so constructed that it can be raised and lowered at will by means of a hand-wheel.

The receiver itself is bedded in spongy rubber and mounted in a compartment under the floor boards immediately in front of the rear seats. Control is effected by means of three levers in the car interior, and on the control panel there is an indicating "pilot" bulb which shows the intensity of the filament lighting of the valves. The valve filament lighting is effected from the starting and lighting battery of the car. High-tension batteries of the usual type are fitted in the same compartment as the receiver. In order to prevent interference from the ignition and lighting equipment of the car the magneto and generator are screened.

Two pairs of double ear-pieces and two single ear-pieces may be employed, so that four persons can listen in at once.

The effective receiving range of the equipment is approximately fifty miles radial distance from a broadcasting centre when used with the frame aerial fitted to the car. When all the broadcasting stations are in operation a car fitted with this apparatus will, therefore, practically always be within range of broadcast.

The Transatlantic Preliminary Tests

BELOW is a report of the preliminary tests which took place between October 28th and November 2nd for the purpose of enabling the American Radio Relay League to select suitable stations to compete in the official tests to take place between the American and English amateur stations during the month of December. Power was limited to 1 kilowatt, and the wave-length from 200 to 300 metres.

Receiving Station.—Owned by Mr. J. H. D. Ridley, Woodside Green, South Norwood, S.E.25.

Apparatus Used.—Standard Burndept III receiver fitted with V.24 valves as amplifier and magnifier, and Q.X. as detector.

Tuning Circuit.—Burndept Mark IV tuner using triple-coil circuit and Burndept short-wave (concert) coils in conjunction with a separate heterodyne, which is in effect a Burndept heterodyne wavemeter. A No. S1 coil was used in the primary, which was in series with the condenser; S1 coil in the secondary with condenser in parallel and S3 in reaction.

Aerial.—Single wire 180 ft. long, directional N.W. 37 ft. high. Badly screened.

Earthing System.—Copper wire buried 3½ ft. deep, and also connected with the gas service piping of the house.

Extracts from Log

October 28th.—Started listening 3.15 a.m. G.M.T. Nothing heard.

October 29th.—Started listening at same time. Heard 2Z K calling "Test." Three valves used (1 H.F.). Strength very good and constant (R6). Signals were easily read 18 in. from phones. 0553 G.M.T. 2H J heard. Signals from this station swung in, and were audible for about 45 seconds at about R4. Earlier in the morning call 5V L was heard, but reception is probably doubtful owing to heavy jamming from Leafield harmonic.

October 30th.—No watch kept.

October 31st.—Station with call 9C T or 9C T E was probably heard, but was again jammed by G B L.

November 1st, 2nd and 3rd.—Nothing heard.

November 4th.—No watch kept.

The results were cabled to K. B. Warner, Secretary of the American Radio Relay League, and a cable has been received from him confirming 2Z K, 2H J, and 9C T E.

Wireless and the Lord Mayor's Show

MARCONI officials were in charge of the Daimler car that took part in the Lord Mayor of London's procession on Thursday of last week. The car carried a Marconiphone complete with frame aerial. A similar car is shown on our front this week, and a description of its wireless equipment appears elsewhere on this page. By means of a loud speaker those in charge were able to give the crowds the music and messages broadcast from the Strand. Here are the three messages as recorded by AMATEUR WIRELESS:.

"Hullo! Hullo! Hullo! Marconi House calling. Hullo everybody! A wireless message for *you* from the Lord Mayor of London. The Lord Mayor of London sends his greetings to the citizens of London, and expresses the hope that his year of office will see a boom in trade and a large decrease in unemployment."

"Hullo! Hullo! Marconi House calling. Hullo! Hullo everybody! Another message from the Lord Mayor of London. The Lord Mayor of London thanks the Overseas Dominions for supporting him on his Day. The Lord Mayor is deeply interested in education, and urges all the young life of the City to take advantage of the numerous courses of instruction provided by the Educational Centres."

"Hullo! Hullo! A third wireless message from the Lord Mayor of London. The Lord Mayor of London expresses the hope that the Prince of Wales will be able

to announce the realisation of his plans for raising half a million pounds for the hospitals of London."

The Lord Mayor's Show has a history. The reception of broadcasting by a portable receiver in that show and its trumpeting to all the sightseers marks an epoch in it.

CORRESPONDENCE

Broadcasting in France

SIR,—Enclosed I am sending you cuttings from the Paris *Matin* which might be of some interest to you at the present time, when arrangements for broadcasting are under consideration and discussion (very much!) in England.

From them you will see that a private company bringing an amateur ready-made outfit on the market has had the pluck to organise *daily* concerts of seventy-five minutes' duration with the best artists they can get in Paris, and this without any combine, or association, or licence fee, or anything. Whoever has got a set of any description is welcome to the entertainment. This attitude contrasts singularly with that of the manufacturers who have started the broadcasting combine in London. Apparently they want wireless to be something like the former gramophone craze; everybody to buy a box of tricks and in a few months to tire of it. I don't know if you are conversant with the situation over here, but I can assure you that there are very few schoolboys here at present that are not worrying about with screws, and coils, and wires, and valves, to get a better set than their friends have got, and the other day I saw a 4-valve set built without assistance by a boy of twelve, which could give points to a good many commercial sets on the market, both in finish and results. One thing is certain, that all these boys will grow up with as much experience of wireless in all its branches as we had of our primers, and this might be of some importance in future events.—V. DE BOND (Paris).

SIR,—It does not seem to be generally known in this country that the French broadcast scheme is already in operation and that excellent musical programmes are transmitted by the Société Française Radio-Electrique every evening between 9.45 and 10 p.m., on a wave-length of 1,565 metres. Music of good strength is obtained by using one high-frequency and one detector valve, with reaction. Where the valves are transformer-coupled it is better to react on to the transformer by means of a reaction coil in the plate circuit of the second valve. Using this combination with the addition of one low-frequency stage the music is sufficiently strong to operate a loud speaker. It may also interest your readers to know that the Eiffel Tower sends out a musical programme on 2,600 metres every day at 5.10 p.m., and several times a week at 9.20 p.m. Here, again, one high-frequency and one detector valve are necessary.—P. T. B. (Ware).

F L — - - - — O N M

SIR,—I beg to call your attention to the fact, that on October 15th this year the hours and the code of Meteo Europe from Paris, F L were changed. F L sends now Meteo Europe four times a day at:

4 h 00 m	G.M.T.	7300 m c.w.
10 h 05 m	,,	2600 m spark.
16 h 00 m	,,	7300 m c.w.
21 h 00 m	,,	7300 m c.w.

DR. RUDOLF SCHNEIDER,
Director of the Meteorological Institute of the Czechoslovak-Republic,
Prague II.

SIR,—May I be allowed to draw your attention to the article in the issue of AMATEUR WIRELESS for November 4th re "F L — - - - — O N M Meteo Europe."

The time of transmitting this report has since October 15th been altered from 11.30 a.m. G.M.T. to 0400, 1005, 1600, 2100, G.M.T., and is sent on a wave-length of 7300 metres C.W., with the exception of that at 1005 G.M.T., which is sent on 2600 metres spark.

There is also some alteration in the code of the message.

On looking up "Notices to Mariners" (issued monthly and weekly) I find the above alterations in the time, and am taking the opportunity of writing you so that you could correct in an early issue.—J. F. W. (Ayr).

Licences

SIR,—I have been reading your interesting correspondence in AMATEUR WIRELESS re the position of amateurs who have made their own wireless receiving sets, but who are unable to obtain their ordinary broadcast licence. A few months ago I made a single-valve receiving set with the help of your valuable paper. I applied for a broadcast licence to the Secretary, G.P.O., London, in the usual way, and a few weeks later I received an official receipt for my 10s., but no mention was made of the licence. I then wrote to the G.P.O., explaining my set, and after waiting for four weeks I have to-day received my broadcast licence, similar to the one reproduced in the last issue of AMATEUR WIRELESS. Perhaps this will be of interest to a great many amateurs who have made their own wireless sets and are unable to obtain an experimental licence.—J. T. (Plymouth).

Experimenting with a Crystal

SIR,—With regard to article, entitled "Experimenting with a Crystal," in the issue for November 4, may I suggest that your correspondent has neglected several important points in his theory of the "four-crystal circuit." He shows that $C_1 : C_2 :: 2x + y : 2x + 2y$.

This assumes that the current passed by a crystal is directly proportional to the applied E.M.F.; but this is not true, as may be seen by examining the characteristic curve of a crystal; doubling the applied E.M.F. more than doubles the current as a rule.

In the "four-crystal circuit" the E.M.F. is divided between two crystals, so that the current passed is less than half that passed by a single crystal. This effect would more than balance the advantage gained, as can be seen by giving approximate values to x and y. x, the resistance of a crystal is of the order of 100,000 ohms, while y, which is virtually the resistance of the phones, is generally about 4,000 ohms. This gives:

$C_1 : C_2 :: 204{,}000 : 208{,}000$

$C_1 : C_2 :: 1 : 1\frac{1}{61}$

The supposed increase of current is thus only about 2 per cent., while the decrease due to the curvature of the characteristic curve may easily amount to 10 per cent.

In any case, even if the circuit worked in theory it would be almost impossible to keep four crystals in sensitive adjustment simultaneously, and as soon as one breaks down the circuit becomes less than half as good as a usual single-crystal circuit.—E. L. S. (Earlsfield).

Television.—We much regret that owing to lack of space it has been necessary to omit the instalment of the article on the above subject from this issue.

OUR INFORMATION BUREAU

Expert Replies to Readers' Questions. Hundreds of Replies are sent by Post.

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Write distinctly, give all necessary details and keep to the point. Ask one Question at a time—never more than two. Send a Stamped and Addressed Envelope. Send the Coupon cut from page 550.

AROUND THE SHOWROOMS

THE limitations of the ordinary head set, by which only one person can listen in at a time, are very real, and the desirability of improving upon this has induced many manufacturers to provide means of attaching the ear-pieces to some form of amplifying horn. A good example of one of these accessories which we have had the opportunity of testing is the "Gramaphix" loud-speaker, which is a simple device for connecting the ear-pieces with the tone-arm of an ordinary gramophone so that advantage may be taken of the sound-amplifying qualities of the gramophone horn. The device is very simple, enabling instantaneous attachment of the headpiece to be made by means of spring clips. The price of the attachment is 10s. 6d., and the makers are the Lacland Electrical Manufacturing Agency (Dept. A), 68, Great Queen Street, Kingsway, London, W.C.2.

One of the most complete cabinet receiving sets we have had brought to our notice is the "Masterpiece"; a product of Wates Bros., 14, Great Queen Street, London, W.C.2. It consists of a cabinet over 3 ft. 6 in. wide and 4 ft. 10 in. high. On the left-hand side the panel opens downwards to form convenient shelves revealing the three-valve receiver. Various apertures are provided to hold the following accessories: headphones, luminous clock, books, pencil, ash-tray, etc. etc. On the right-hand side are two hinged doors with a multi-colour glass window opening on to the loud speaker. The smaller door below gives access for the loud-speaker and amplifier adjustment. On the lower left-hand corner another door opens the cupboard for holding the H.T. battery and accumulators, etc. The lower left-hand corner is fitted with shelves for holding books or ornaments, as desired. The only external wires are aerial and earth. The complete instrument is not only a highly efficient wireless set capable of reproducing wireless music or signals with perfect accuracy and plenty of volume for a large room, but it is also a very handsome piece of furniture.

CLUB DOINGS

The West London Wireless and Experimental Association

Hon. Sec.—HORACE W. COTTON, 19, Bushey Road, Harlington, Middlesex.

AT a meeting held recently Mr. Studt gave an interesting paper entitled "A 3-circuit Variometer Tuner." The lecturer explained many of the interesting uses to which the apparatus could be put, and the various methods of obtaining results in connection with experiments which are frequently being tried by many amateurs. Further he gave the detailed data to enable all members who cared to, to construct their own circuits. The secretary will be glad to hear from any gentlemen desirous of seeking admission to the association.

Wolverhampton and District Wireless Society

Hon. Sec.—J. A. H. DEVEY, 232, Gt. Brickkiln Street, Wolverhampton

AT a meeting of the above society held on a recent date a most instructive lecture was given by Mr. F. G. Redhead on "Psychic Phenomena and Wireless." The subject proved

(*Continued on page 550*)

CLUB DOINGS (*Continued from page 548*)

an exceedingly attractive one, the lecturer endeavouring to prove that a similar action took place with the human brain as that of wireless telegraphy, the various organs acting on each other by induction, the nerves and fibres being the conducting bodies. This was due to the electric forces of the brain. Telepathy, as he expressed it, was really a human wireless. The lecturer went on to say that the human brain is not only a transmitting and receiving machine for electric waves, but the human body is a complete electric generating station. A very animated and vivacious discussion followed

Liverpool Wireless Society

Hon. Sec.—MR. C. L. LYONS, 76, Old Hall Street, Loverpool.

AN interesting meeting of the above society was held recently. The question-box box was passed round and resulted in a very interesting batch of questions, which were very ably dealt with by Mr. S. Lowey, who illustrated his replies by very clear blackboard diagrams. The next step was then made with the series of short lectures which is proceeding in conjunction with the society's apparatus. At the last meeting the C. Mark III three-valve amplifier was fully described; on this occasion the Mark III tuner was described in detail by Mr. N. B. D. Hyde, the lecturer illustrating his remarks by very clear blackboard diagrams! and the receiving panel proper having been taken from the containing case, it was passed round for close inspection.

All inquiries for application forms, etc., should be addressed to the hon. secretary.

Mount Pleasant Radio Society, London

Hon. Sec.—MR. W. R. FLEMING, 156, Upton Park Road, Forest Gate, E.7.

THE inaugural meeting of the above society was held recently. It was decided to limit the membership for the present to civil servants. The officers of the society were elected and rules framed. Will any civil servants interested in wireless kindly communicate with the secretary.

The Fulham and Putney Radio Society

Hon. Sec.—J. WRIGHT DEWHURST, 52, North End Road, West Kensington, London, W.14.

AT a meeting held recently, Mr. Calver opened a discussion on aerials by describing a very compact set he had made, using a small frame aerial; he went into all details very carefully and gave a wiring diagram. A very interesting exhibit in the shape of an ancient coherer set was shown by Mr. S. W. Martin, and the working of this was explained to the young members by Mr. Winnett. Mr. Galton exhibited a quantity of home-made apparatus, including a variable condenser made from tobacco tins cut to shape with copper burrs as spacing washers; this piece of apparatus worked perfectly. Mr. Houston had on show a complete set of panels for unit system.

Stoke-on-Trent Wireless and Experimental Society

Hon. Sec.—F. T. JONES, 360, Cobridge Road, Hanley.

AT a meeting of the Stoke-on-Trent wireless and experimental society at the Y.M.C.A., Hanley, on October 5, Mr. Walley (member) exhibited his three valve set. With the aid of this set, members clearly heard items of the concert sent out by the Dutch station at The Hague and a host of morse signals from British and Continental stations. Mr. Walley has entirely constructed this set himself during the last seven days.

At a meeting of the above society held recently, it was announced that a temporary permit had been received from the G.P.O. pending the issue of the experimental receiving licence.

Bromley Radio and Experimental Society

Hon. Sec.—MR. J. FERGUSSON-CROOME, "Gowrie," Wendover Road, Bromley, Kent.

THE above society held its inaugural meeting recently, at 8 p.m., at 14, College Road, Bromley, when a good number of amateurs attended.

All interested in wireless in the Bromley district are earnestly invited to communicate with the secretary.

Ilkley and District Wireless Society

Hon. Sec.—MR. E. STANLEY DOBSON, "Lorne House," Richmond Place, Ilkley.

ON Oct. 2 the fifth general meeting of the above society was held, when the secretary read the report of the committee appointed to design and draw up the estimates for the society's receiving set. The report was adopted and the committee instructed to acquire and assemble the necessary apparatus, which will consist of a single-valve receiver and tuner built on the unit system so as to facilitate future extensions and rearrangement of circuits for demonstration purposes. The hon. sec., Mr. E. Stanley Dobson, was then called upon to give his lecture on "Capacity and Condensers."

The theory of electrically charged bodies was first explained, with its application to the action of the condenser. The units and measurement of capacity were dealt with, and the calculation of the capacity of condensers connected in series and parallel. The various types of condensers were next described in detail, examples of each being exhibited. The function and suitable values of all the condensers in a simple single-valve receiver were given, and the lecture concluded with a few hints on the use of vernier devices for tuning in short-wave telephony.

Hoylake, West Kirby and District Wireless Association

Hon. Sec.—MR. ROPER BRATTAN, 14, Kirby Park, West Kirby.

A GENERAL meeting of the above association was held on Oct. 23rd. Mr. Roper Brattan, with the aid of blackboard diagrams, gave a very helpful list of the various symbols used in wireless work, together with a particularly clear explanation of the variometer-type of tuning and of crystal-and-single-valve sets. Specimens of the latest Marconi valves were loaned by a member for the inspection of those present.

Fulham and Chelsea Amateur Radio and Social Society

Hon. Sec.—MR. R. WOOD, 48, Hamble Street, Fulham, S.W.6.

A MEETING was held on Oct. 17th, when Mr. Cox gave a short lecture dealing with transmission and reception of wireless, explaining each part by means of apparatus.

The secretary then gave a short lecture on reaction, its use and abuse, and the P.M.'s objections to the use of it.

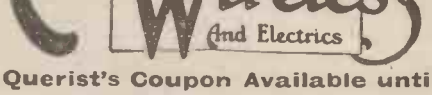
ANNOUNCEMENTS

"Amateur Wireless and Electrics." Edited by Bernard E. Jones. Price Threepence. Published on Thursdays and bearing the date of Saturday immediately following. It will be sent post free to any part of the world—3 months, 4s. 6d.; 6 months, 8s. 9d; 12 months, 17s. 6d. Postal Orders, Post Office Orders, or Cheques should be made payable to the Proprietors, Cassell & Co. Ltd.

General Correspondence is to be brief and written on one side of the paper only. All sketches and drawings to be on separate sheets.

Contributions are always welcome, will be promptly considered, and if used will be paid for.

Communications should be addressed, according to their nature, to The Editor, The Advertisement Manager or The Publisher, "Amateur Wireless," La Belle Sauvage, London, E.C.4.



Querist's Coupon Available until Saturday, Nov. 25, 1922

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Advertisements in the Miscellaneous Sale and Exchange column must be prepaid. The rate is **3d.** per word; minimum **3/-.**

PREPAID ADVERTISEMENTS.

Accumulators, plates, parts, accessories. Expert repairs.—Barnard, 45, Great Ormond Street, W.C.1. [12 r

Wireless Dealers throughout Great Britain are strongly advised to stock parts for making up wireless sets. Buy your parts direct from the factory at wholesale prices.—Newtonia Wireless Factory, 13 and 15, Whitcomb Street, London, W.C.2.

Working Drawings of wireless sets supplied. Sound technical advice.—Puckle, Buckhurst Hill, Essex. [11 r

Huge Purchase of ex-Government Wireless Stock. Write for list giving full details. 150-watt dynamos, £1; hedgehog coils, 3s. 6d.; loud speakers, 200 ohms, 7s. 6d.; 1-in. spark coils, 10s.; 1½-in. spark coils, 12s. 6d.; morse tapping keys, 3s., etc. etc. etc. Three days' approval against cash, or please call. Write for detailed price list of all goods.—E. J. Galpin, 16, Loampit Hill, Lewisham, S.E.13, London. [1 s

B.A. Screws, Nuts, and Washers, assorted gross, 2s.; list, 2d.—J. H. Bennett, Station Road, Willesden Junction. [17 r

Telephone Receivers Rewound up to 1,000 ohms, 5s.; 2,000 ohms, 7s. 6d. Cash with order.—M. E. Hampshire, 139, Sydenham Road, S.E.26. [3 s

Instrument Wires up to 47, silk, enamel, cotton; immediate delivery; post orders only.—Fine Wire Supplies, 41, Arlingford Road, Brixton, London, S.W.2. [16 r

Wires, all gauges; rock bottom prices. Send for list.—Empire Wire Company, 52, May Road, Gillingham, Kent. [15 r

Clearing Up! £75 worth of wireless apparatus for sale as a job lot to dealer or separately to amateur experimenters. Gear includes original "Work" 5-valve amplifier; valves; loud-speakers; Brown's telephones; Mark III receiver; valve panel; alternators; heterodyne; spark coils; short-wave transmitters; microphones; batteries and numerous useful sundries. Prices low for quick sale. Inspection any time or send stamp for typed list and prices.—Lieut. E. Redpath, 19, Niger Street, Barrow-in-Furness.

Maximum High Resistance Headphones, magnets Wolfram steel, adjustable earpieces, very sensitive, with cords and tags. On approval against P.O. 22s. Money returned if not satisfied. Price 25s. after first 3,000 sold.—Pinkerton, 1, Duke's Lane, Kensington, W.8. [4 s

Ex-Naval Rheostats, 8 or 260 ohms, easily adapted filament resistances or potentiometers; unmounted 1s. 6d., mounted 2s.; post free.—Monk, 4, Alma Road, Plymouth. [2 s

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Amateur Wireless And Electrics

TURN TO PAGE 565

No. 25 SATURDAY, NOVEMBER 25, 1922 Price 3d.

CONTENTS

COMPACT TWO-VALVE AMPLIFIER
(*Metropolitan-Vickers Electrical Co., Ltd.*)

Amateur Wireless and Electrics

No. 25 November 25, 1922

BETWEEN TERMINALS

Some Considerations on the Importance of Properly-made Connections

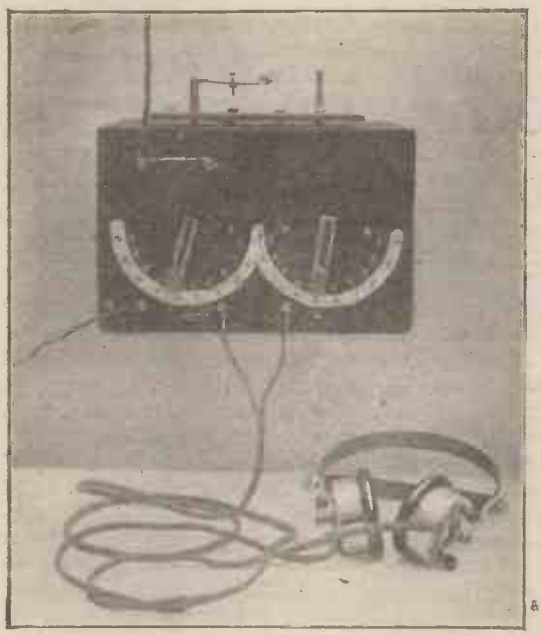
THE examination of a large number of "sets" during the last month or so has led to the conclusion that most beginners and some old hands as well have but the most elementary knowledge of the best methods of connecting up their instruments. Wiring is allowed to loop and stray about in all directions, often seriously interfering with tuning manipulations, and, as often as not, a mere turn of wire round a terminal, taking in but one or two of many strands, is considered sufficient. The excuse offered when protests are made is usually: "Oh, this is temporary."

Waste and Disaster

It cannot be too strongly insisted on that long leads and bad connections in low-tension circuits lead to waste of current and drop in voltage, whilst in high-tension circuits they are positively disastrous. High-tension electricity, even our so-called "high-tension" of sixty volts or so, will leak and waste itself if it is given the slightest chance, and high-frequency oscillations will vanish with hardly any provocation.

All wire used in making connections between terminals should be flexible and of ample gauge. The ordinary flex, which contains a large number of strands of very fine copper wire, is difficult stuff to use and is not to be recommended, though it undoubtedly looks very nice. The best wire is decidedly either the braided cable, in which a number of twisted strands or copper wire are covered with ample rubber insulation and the whole sheathed in braided cotton, or the rubber-covered "high-tension" cable of the motorist. Ordinary electric bell wire, or cotton-covered wire of sufficient sectional area is too stiff.

Whether braided cable or rubber-covered cable is chosen, the end where connection is made with terminals must be finished off neatly to give a positive and constant contact with no ends straying about to provide leak paths. If economy has to be studied, as it has with most of us, a good plan is to bare sufficient wire to form a neat loop, and then twist



Photograph of Simple Receiving Set made by Mr. F. E. Huson.

the free end round the standing part about twice so as to make an eyelet of the right dimensions to fit neatly on the terminal. This eyelet should then be soldered solid. This makes a "no-trouble" connection, which can be taken off the terminal twenty times in an evening without causing exasperation. The ideal way, of course, is to solder the ends of the wire into special copper eyelets; but the twisted, soldered eyelet made on the wire itself is good enough if it is properly made.

The Same Set in Course of Construction.

Short Cuts

All wire save that in actual contact with the terminals should be covered. It is a good plan, particularly when using braided cable, the covering of which is liable to frizzle out, to finish off the ends either with a binding of silk or cotton or with impregnated adhesive tape. This makes a neat job and adds a good deal to the appearance of the set. Battery connections should always be plainly marked. They are best finished off with coloured silk or cotton, red for the positive connection and blue for the negative. High-tension and low-tension connections can be readily distinguished without diving beneath the table to the batteries if the low-tension cables have one binding of colour and the high-tension three separate about a quarter of an inch.

All connections should be as short as possible and as straight as possible, with the proviso that they should not be allowed to stray over the top of the instruments. Permanent connections should be soldered and made with the very largest gauge wire it is convenient to use. Even connections of the most tentative and experimental nature should be made properly or the value of the experiment may be minimised. If a number of experimental connections are likely to be made it is well to provide lengths of wire progressing in length an inch at a time from, say, three inches to the longest likely to be necessary. These should have their ends finished off as has been indicated, and can be kept in a drawer or some other convenient place whence they can be readily taken whenever they are needed.

ERNEST LANGMEAD.

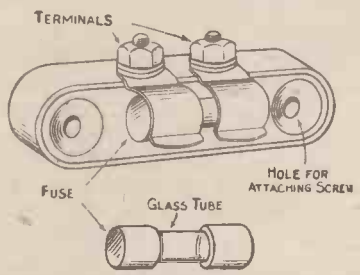
Be Economical: Use a Filament Fuse

A Device to Prevent the Burning-out of Valves :: Cost—20 Fuses = 1 Valve

I HAVE had the advantage of many weeks' experience with a new fuse (the "Cozwhy"), which has been introduced to prevent the burning-out of valves. It consists simply of very fine filaments of special alloy suspended in a glass tube between two turned brass caps. Connection is made either by means of spring clips or by the use of standard fuse-blocks supplied by the makers, these fuse-blocks consisting of polished ebonite mouldings with plated phosphor-bronze clips and connecting screws. Such a fitment will not detract from the appearance of the most expensive set.

The whole thing is designed so that the renewal of a fuse is a momentary matter, and need scarcely interrupt reception. Readers who have had to postpone reception until the morrow owing to a burn-out occurring when no spare valve was available will be interested in knowing that they can have some twenty-odd spare fuses for the cost of one spare valve.

The fuse should be mounted as near the valve as possible and in the local circuit, not in the main supply where two or more valves are used. Accessibility must be considered. In the case of fuses of low current-carrying capacity there is bound to be an appreciable resistance, although this is small in any case compared with the working value of the filament rheostat in the same circuit. However, it is probably due to this resistance that some users report better results when working on one side of the valve than on the other, and it



The "Cozwhy" Fuse and Holder with Detail of Fuse.

may be worth while to experiment on each side before finally connecting up.

Fuse Values

At present two values of fuse are available, of ½ and ¾ amp. capacity respectively. These cover most of the requirements of the types of valve most employed by amateurs. The ½ amp. size is suitable for use with valves rated to a maximum of .63 amp. Above this the ¾ amp. size should be used, and will be found an efficient protection for R type valves and others working from .65 to .75 amp. The makers' experience with amateurs has taught them that the currents employed with the same type of valve vary considerably, some users getting good results with low ranges while others find it necessary to force their filaments even above the currents specified by the valve manufacturers. It is not, therefore, possible to lay down an exact rule for the fuse-value to be employed with a given make of valve.

Those employing valves designed for the lower range of current consumption will do well to make a trial of the ½ amp. size, subsequently adopting the ¾ amp. size if they find the other does not allow them to obtain signals of maximum clarity. A good indication is afforded by the appearance of the fuse-filament itself, which should be watched carefully at first. When this begins to glow it is on the point of failure and the current should be reduced by means of the rheostat until the incandescence is no longer visible. Should the clearness of reception suffer appreciably by this current reduction it may be necessary to substitute the ¾ amp. fuse, bearing in mind that, while this affords a degree of protection even for valves designed to work as low as .5 amp., there cannot be the same security with such valves as when valve consumption and fusing value more nearly agree.

Precautions

In the interests of both valves and fuses, care should be taken to reduce the current by means of the rheostat before switching off. A sudden stoppage when working near their maximum range imposes severe and unnecessary strain on the very delicate wires employed in both the valve and the fuse.

Experimenters using fuses for the first time are cautioned not to abandon any normal precautions. Too often, also, the new-found sense of security tends towards recklessness, fuse after fuse being blown unnecessarily. Such experimenters are warned that the fuses have been designed as carefully as possible so as not to blow until the valve is *in danger*. The varying condition of the valve filament makes it impossible to guarantee that it will not fail eventually. The user of fuses should therefore continue to employ all the normal precautions, bringing the whole of the filament resistance into circuit before switching off, carefully distinguishing the H.T. from the L.T. plug, and bearing in mind the tendency of accumulators to recover their voltage when standing. With these precautions a state of affairs can undoubtedly be attained when fuses require renewal only for accidental causes—no oftener than valves did before their introduction—and the valves themselves will not fail unless from old age.

A. F. J.

[We understand that the City Accumulator Company, Limited, 79, Mark Lane, London, E.C.3, have acquired the whole of the selling rights of the "Cozwhy" fuse.—ED. AMATEUR WIRELESS.]

Calibrating a Slide Inductance

THE general arrangement of this useful little scale is clearly indicated in the diagrams Figs. 1 to 3. The only materials required for its construction comprise a strip of thin wood or ebonite 1 in. wide and long enough to fit tightly between the insides of the coil supports, a piece fo good quality white notepaper, a small piece of brass wire and some Seccotine.

Smear some warm Seccotine over one surface of the wooden strip, attach the paper as shown in Fig. 1, and fit it between the two coil supports in the position indicated in Fig. 2. Drill a small hole in the side of the slider at right angles to

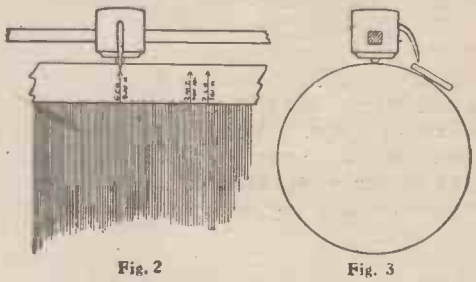


Fig. 2 **Fig. 3**

Figs. 2 and 3.—Details of Slider and Coil.

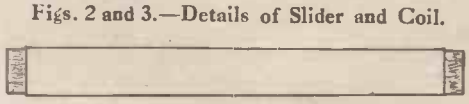


Fig. 1.—Wooden Slip with Paper Attached.

the rod and fit a small brass wire pointer which can be bent to any convenient shape. The position of the lower end of the pointer should be as nearly as possible to the scale without actually coming into contact with it.

As the various transmitting stations are tuned in as near perfect as possible, mark a small arrow directly under the pointer and add the station's call letters and wave-length. All the "likely" positions are then known, thus saving a great deal of time and trouble.

O. J. R.

SIX CRYSTAL CIRCUITS

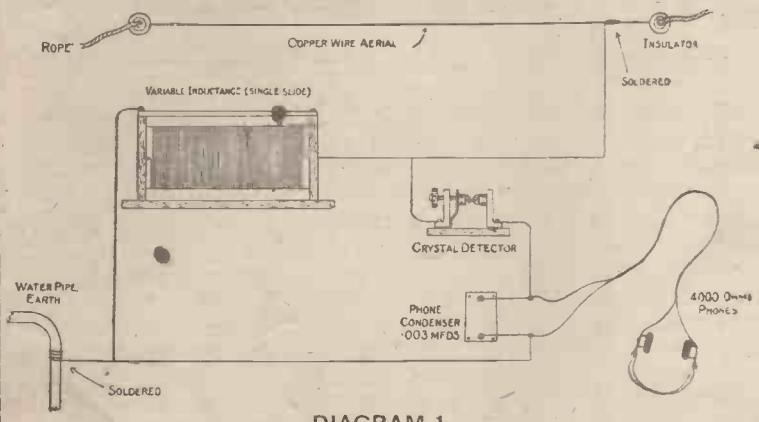


DIAGRAM 1

Diagram 1 (*above*) shows the method of connecting up a single-slide tuning inductance to a crystal detector. This manner of coupling is termed "direct-coupling."

Diagram 3 (*below*) shows one way of connecting up a double-slide tuner. This coupling is known as "auto-transformer" coupling. The circuit below may be improved as shown in diagram 4

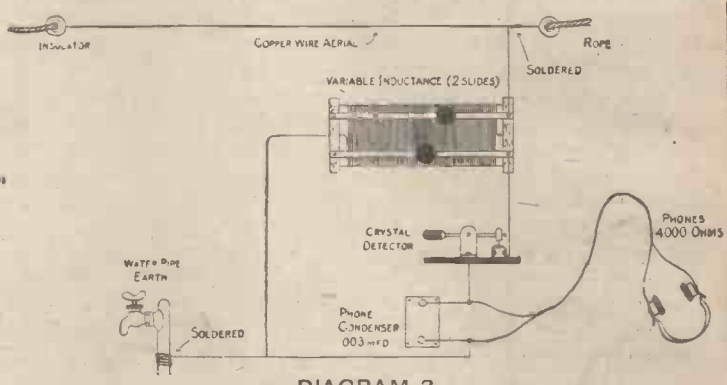


DIAGRAM 3

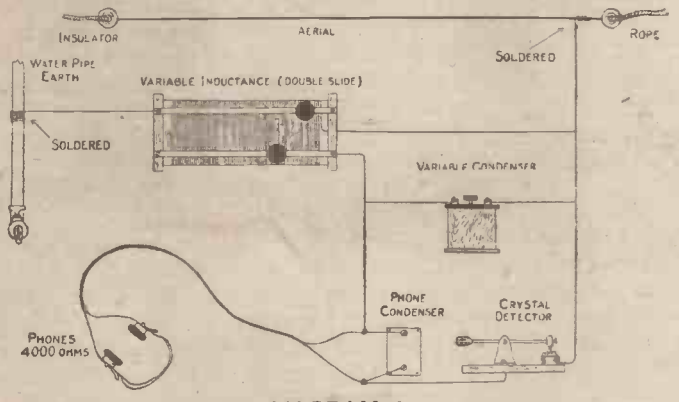


DIAGRAM 4

Diagram 4 (*above*) shows a circuit with a variable condenser connected in parallel across the "secondary." A "transformer step-up" effect between primary and secondary is effected which gives selective tuning and very efficient results.

Diagram 2 (*below*) illustrates a similar circuit to No. 1 except that in this instance a variable condenser is connected in series between the aerial and receiver. This method is inefficient as it is not possible to obtain correct tuning.

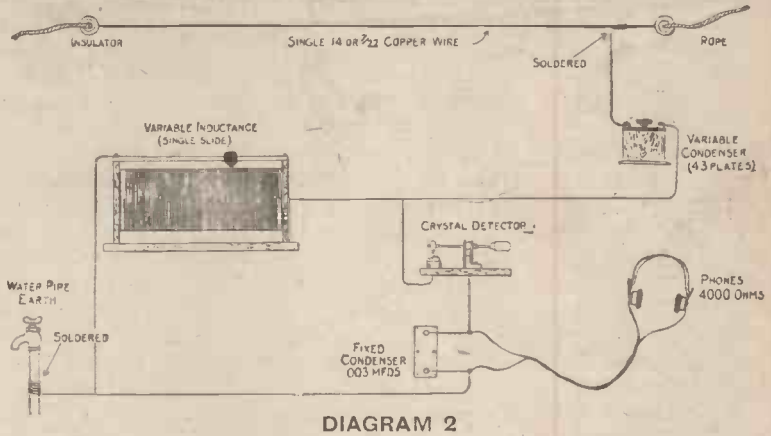


DIAGRAM 2

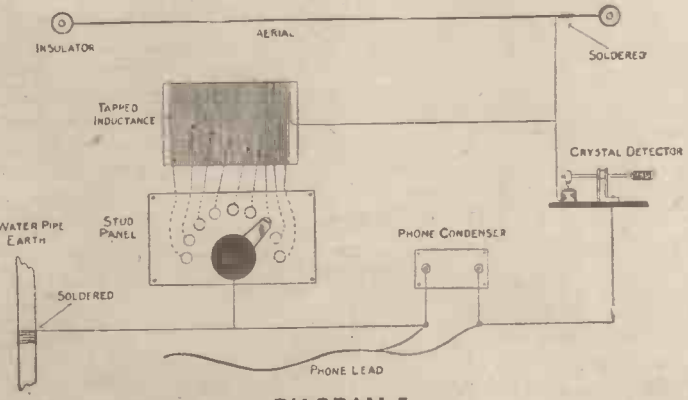


DIAGRAM 5

Diagram 5 (*above*) shows the connections for a tapped inductance employing only one switch arm. This circuit does not allow of very fine tuning.

Diagram 6 (*below*) illustrates an effective means of wiring up a tapped coil to two switch arms which facilitates fine tuning.

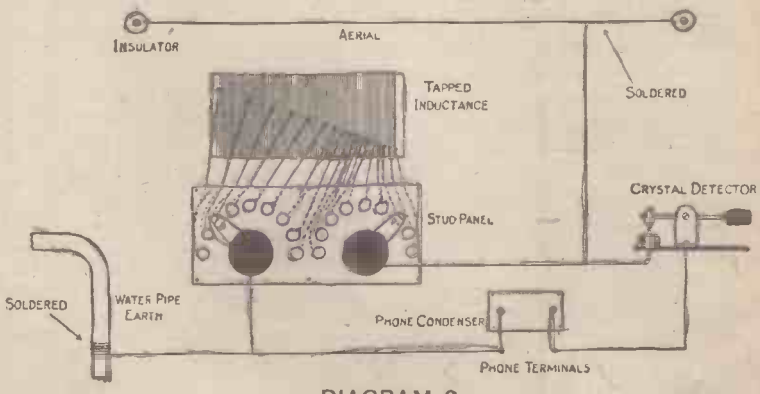


DIAGRAM 6

TELEVISION.—V

SHALL WE EVER SEE BY WIRELESS?

Suggested Apparatus for Employing the Cathode Ray Discharge

WHILE the idea of the application of vibrating mirrors is not original, having been used by M. Nisca (1900) and Szecepanik (1906), the above arrangement is both new and feasible. There are, however, one or two weak points, the chief being the use of a selenium cell. If we consider the size of the picture thrown upon the transmitting screen to be 5 in. by 5 in., and the portions separately reflected by the mirrors to be $\frac{1}{16}$ in. square (this grain obviously is too coarse for practical work), then the number of portions to be transmitted would be 6,400, making the total, if the image is repeated ten times every second, 64,000. As a selenium cell will not respond satisfactorily to variations above telephonic frequencies its use is ruled out, but, as previously stated, other substances will no doubt be discovered. Prof. Kempe, experimenting with a photo-electric cell, obtained from it a measurable current, although the cell was only illuminated by a light equivalent to one candle-power placed two and a half miles away. The frequency of the alternators could also with advantage be raised, that of Y (Fig. 2, page 518) from five to ten and that of X from sixty to about one thousand.

Utilising the Cathode Stream

Another system, suggested by Mr. A. A. Campbell Swinton, although rather more complicated than the method just described, also possesses features of great merit. The main principle of this method is the extreme susceptibility of the cathode ray discharge of an X-ray tube to magnetic influence, and the ability of these cathode rays to render luminous a phosphorescent surface. In Fig. 3 the cathode C of the X-ray tube normally sends a cathode ray discharge in the straight line direction 1 to 2, but upon energising the magnet E the rays are deflected in the direction 1 to 3. If the magnet is supplied with alternating current the cathode rays will be caused to oscillate, the frequency of the oscillations being identical with the frequency of the alternating current. If we place two such magnets at right angles to each other and energise them with alternating current at different frequencies, then the magnets will deflect the cathode rays at right angles to one another respectively.

Imagine a screen to be placed in front of the X-ray tube and one magnet to be energised with current at a frequency of ten alternations per second and the other magnet with a frequency of one thousand alternations per second. It is easy to see that the beam of cathode rays will work over the whole surface of the screen ten times every second or once in one-tenth of a second. Duplicate the X-ray tube and magnets and connect the magnets in series, and it will be evident that the movement of the two sets of cathode rays will be in synchronism and will fall upon corresponding spots on the two screens at the same time.

Cathode Stream Apparatus

Now let us see in what manner these synchronous cathode rays could be utilised

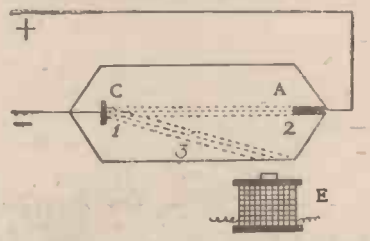


Fig. 3.—Diagram showing the Deflection of Cathode Rays by a Magnet.

for purposes of television. A diagrammatic view of the transmitting and receiving arrangements is shown by Fig. 4; the magnets and their various connections, already described, are omitted for the sake of clearness. The transmitter consists of two screens M and R, the screen M, of fine metallic gauze, being connected to the line wire. The other end of the line wire, at the receiver, terminates in the small metal plate H. The screen R is composed of a number of small cubes of the metal rubidium thoroughly insulated from each other. The space P between the two

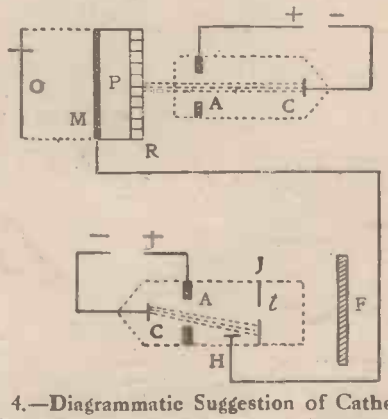


Fig. 4.—Diagrammatic Suggestion of Cathode-ray Transmitting and Receiving Apparatus.

screens, being supposedly gas tight, is filled with sodium vapour. Rubidium is a metal which, under the influence of light, becomes photo-electrically active, whilst sodium vapour under the influence of light becomes a ready conductor of negative electricity. The action of the transmitter is as follows:

The picture to be transmitted is thrown upon the back of the screen R, and, in passing through the gauze screen M, is divided into a number of portions, a portion being thrown upon each of the metal cubes of which R is composed. The cubes, therefore, are either illuminated or non-illuminated according to whether a dark or a light portion of the image is falling upon them. As the beam of cathode rays oscillates over the front surface of this screen it will impart to all the metal cubes in turn a negative electrical charge. With those cubes that are non-illuminated no further action will take place, but with those cubes that are illuminated the negative charge will pass away through the sodium vapour to the gauze screen M, and be conveyed by the line wire to the metal plate H at the receiver.

The Receiver

The receiver consists of an X-ray tube so arranged that the cathode beam, radiating from the inclined cathode C, falls upon the anode A in such a manner that normally they do not pass through the central aperture *t* in the diaphragm J. Upon the arrival of a negative charge from the transmitter the metal plate H will be negatively charged, repelling the cathode-ray beam and enabling it to pass through the aperture *t*, and so reach the screen F. By means of the magnets already described it will here take up a position similar to that cube at the transmitter from which the negative charge took place. The screen F is a fluorescent screen (a surface coated with some substance such as barium-platinocyanide, which lights up under exposure to the cathode rays), and as every time the cathode ray beam at the transmitter passes over a light-illuminated cube a spot of light will show at a corresponding position on the screen F at the receiver. The reproduced image will, therefore, consist of a number of points of light identical with the cubes illuminated by the original object O. The whole operation of building up the received image will, of course, be repeated ten times every second to give a continuous impression.

Obviously such a suggestion as the above would present numerous difficulties, but the ideas are well worth considering, opening up, as they do, a splendid field for some interesting experimental research work.

M. J. M.

(To be continued)

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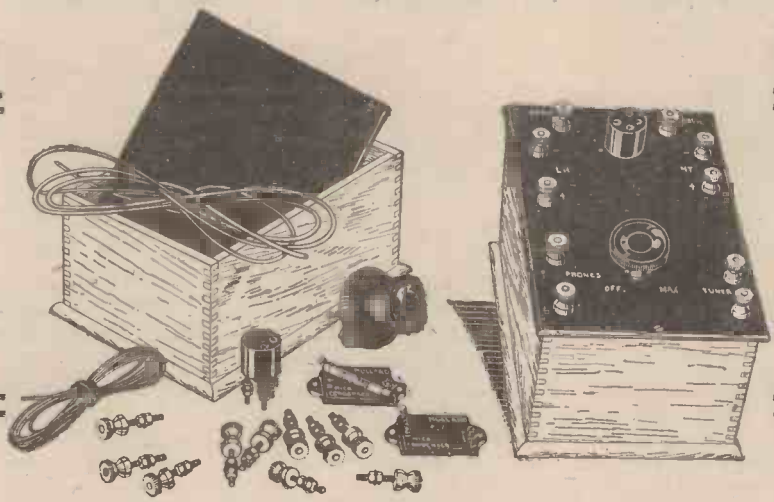

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See our Announcement on page 578

On Your Wavelength!

SOME of the amateurs are making excellent transmissions just now. 2K T, 2M L, and 2O D are quite in the first rank as regards both the quality of their modulation and the absence of generator hum. Have you noticed, by the way, that Croydon's generator is sometimes very noisy? Who is 5B C? Either he lives near or his transmitting set is marvellously efficient, for his Sunday evening concert on Nov. 12 came in with amazing strength and clearness. Even when all but two valves were cut out he was still very much there. 2O H, again, is remarkably good; he frequently converses with 2Z Y, who is 90 miles from him, using as little as two watts. With rather more "juice" he is distinctly heard 175 miles away at Bournemouth. His wave-length is 475 metres, and he transmits several times every day.

* * * *

Will any transmitting reader who is interested give me a call on round about 400 metres on Sunday evening between 8.30 and 9? My receiving station is 30 miles north-west of London, the aerial running due north and south.

* * * *

What *do* you think of the broadcast licence? If it is really meant to be taken seriously, then all existing sets or parts, such as telephones, loud-speakers and valves, must go to the scrap-heap unless experimenters own them, since they do not bear the B.B.C.'s hall mark! If we take this kind of thing lying down it will be astonishing, for there has been no more unconstitutional act since the imposition of ship money in Stuart days. Supposing for a moment that these conditions could be legally enforced, there is no reason why in a year or two's time a dressmaking combine should not force the Board of Trade to prohibit ladies from wearing clothes that did not show the monopoly mark D.M.C. Wireless amateurs are simply not going to stand this kind of dictation. They had no say in the framing of the regulations, and most of them would rather forgo broadcasting altogether than have it under these conditions. And then, remember, the B.C.C. has guaranteed a service *for two years only,* so that if you buy their branded products you cannot be sure that they will be of much use after that time.

* * * *

It is quite an easy matter nowadays to obtain a rough calibration of any receiving set since there are so many easily-picked-up stations working on fixed wave-lengths. Writtle, for example, transmits on Tuesday evenings on 400 metres; Marconi House can now be heard several times each evening on 360. On 600 metres you have the shipping chorus, of which there are several members, such as Grimsby, Ushant and the North Foreland, whose notes are so distinctive that even if you cannot read Morse you can always identify them once they have been pointed out. Croydon does not vary much from his 900 metres, though he can be heard more or less faintly over a considerable range; but the French air stations are not very constant in their wave-lengths. P C G G transmits on Sundays on 1,085 metres, and Paris can be heard by anyone at 10 a.m. and 10 p.m. on 2,600. If a note is kept of inductance values and condenser-scale readings it is not difficult to plot out a chart for the set on a piece of squared paper.

* * * *

The biscuit for the best question ever asked goes easily to a correspondent who sent to an American wireless paper the hopeful query, "Can you tell me how to hook up a motor lamp (large size) to my set, as I would like to have two stages?" The editorial comment was, "O-o-o-o-o-o-oh!" All salesmen and demonstrators know the dear old lady who inquires, "If I buy this set shall I be able to hear my son in Mesopotamia?" And when the "big bang" took place in Holland a week or two ago, how many of you were asked by friends whether you had heard it on your wireless sets? Truly the science of wireless enfolds many mysteries!

* * * *

Have any readers come across "dead spots," places, or entire districts where signals are either very weak or even altogether absent? Parts of Cheshire are supposed to be very bad for reception—it would be interesting if readers living here would report their experiences. In America there are one or two localities in which it is impossible to receive any signals but those which come from a certain direction. Possibly the cause is to be found in the presence of metallic veins or of magnetic ore, which act as deflectors.

* * * *

Many people—ladies especially—dislike the presence of accumulators in the drawing-room, and certainly if one is upset the carpet will be instantly "part worn" ever after. The solution is simple: don't have 'em there. They can be put out of the way in any odd cupboard downstairs and the "juice" brought by means of stout, well insulated wires and a neat wall plug to the set. So long as the sockets are marked + and −, or better still, are of different sizes, so that a wrong connection cannot be made, this method will be found entirely satisfactory.

* * * *

Some reputations are easily gained. The other night at a listening-in party a lady who had been airing her knowledge a good deal volunteered to read a Morse message that was coming through. After busy moments with pencil and paper, she read out a weather forecast in English. What Thermion heard was part of a press message in French, but gallantry sealed his lips, and the lady received quite an ovation!

* * * *

Polling day, 1922, must be marked in red letters by you fellows in the Midlands. You have certainly started your broadcasting with a big splash. I was tuning in for 2L O, one hundred miles away from Birmingham and thinking nothing whatever about it, when suddenly there came a voice, clear and loud, "This is the Birmingham Broadcasting Station, the Western Electric Company. We are transmitting on behalf of the broadcasting committee." You can bet your pet condenser that I didn't worry about 2L O any more. This was something new, and it turned out to be very good indeed.

Unfortunately I didn't keep a list of the various items, but it would have been a formidable one, seeing that I tuned in at 6 p.m. and had it all the evening, with intervals for rest and refreshment. It was still going strong when I switched off and went to bed at 11.15. The cheery announcer, with his clear articulation and breezy stories, pleased me particularly. The items by the members of the Birmingham orchestra were very good indeed, particularly the song "Il Bacio" and the violin solos. The piano, too, was excellent, both in accompaniment and in solo work. I have never heard the piano so good, except perhaps from F L, when atmospheric conditions were favourable. The announcer had a very good plan in giving the names of the performers. To give the names both before and after the item helps the man who has tuned in in the middle of an item, as he knows then what he has been listening to. The only criticism I have is that the room in which the Birmingham performers sang and played has a hollow, echoing sound. THERMION.

"Work" Handbook Receiving Sets

And Some Modifications Thereon *(Concluding article)*

The Five-valve Amplifier

THE principal questions which have arisen in connection with the five-valve amplifier refer to:

(a) Reception of short-wave radio-telephony (350 to 500 metres);

(b) Use of low-resistance telephones.

The original amplifier was designed to afford good reception over as wide a range of wave-lengths as possible, and the eight-slot type of H.F. transformers, as specified in the article, have proved effective on waves from about 1,200 to 14,000 metres. Subsequent experimental work made it evident that, for maximum efficiency on any particular wave-length, a specially wound transformer capable of being tuned by means of a small variable condenser in parallel with one of the windings was necessary.

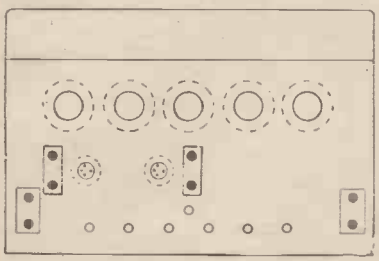


Fig. 8a

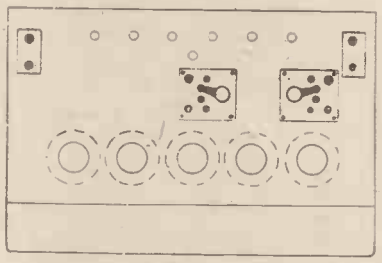
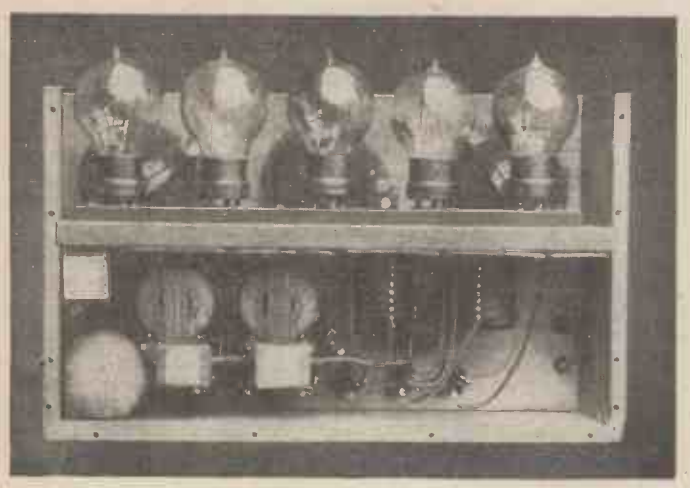


Fig. 8b

Figs. 8a and 8b.—Modifications to Five-valve Amplifier to Permit Use of (a) "Plug-in" and (b) "Tapped" H.F. Transformers.



Photograph of Back of Five-valve Amplifier.

It will be seen, therefore, that in order to secure the best reception of short-wave telephony the eight-slot transformers should either be specially wound and provided with tappings and a selector-switch, or alternatively be removed and the appropriate connections be made to valve-holders mounted on the front of the set to enable the plug-in interchangeable type of H.F. transformer to be used. In addition, provision should be made so that a variable condenser (maximum capacity, say, .00025 mfd.) may be connected across the primary winding of the transformer. Unless the containing box is made larger than originally specified, these variable condensers will have to be external to the amplifier itself and should be connected thereto by means of terminals mounted upon ebonite strips.

The two sketches (see Figs. 8a and 8b) show the methods suggested for fitting valve-holders and selector-switches respectively with condenser terminals in each case.

To ensure that the first tapping of the transformers will tune sufficiently low to include the shortest broadcasting wave (350 metres), the number of turns of No. 40 d.s.c. copper wire in the first primary slot should be 100. The second primary slot should contain 200 turns, whilst the third and fourth slots each contain 400 turns as originally specified.

If valve-holders and separate plug-in transformers are preferred, these may be obtained quite reasonably from advertisers in this journal, or the empty formers may be purchased and wound as follows, the same number of turns for primary and secondary being wound on either simultaneously in the one groove or as shown in Fig. 9.

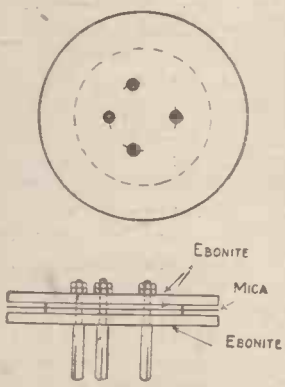


Fig. 9.—Design for 2-slot, "Plug-in" Type H.F. Transformer.

Diam. of Former (inside slot)	*Width of each slot*	*No. of turns (P & S)*	*S.W.G. d.s.c.*	*λ range (approx.)*
1½ in.	$\frac{1}{16}$ in.	50	38	300—450
1½ in.	$\frac{3}{32}$ in.	75	38	400—700
1½ in.	$\frac{3}{32}$ in.	110	38	600—1,000
1½ in.	$\frac{1}{8}$ in.	150	42	900—2,000
1½ in.	$\frac{3}{16}$ in.	200	44	2,000—4,000

A type of former recommended is illustrated in Fig. 9. Any reader having the two eight-slot transformers already on hand, and preferring the plug-in type, may fit four of the standard brass pins to each, so that they may be utilised in the valve-holders for the longer waves, say above 4,000 metres.

When operating the five-valve amplifier fitted with tuned H.F. intervalve transformers, the adjustment for best results will be found somewhat critical, and it will also be noticed that a variation of almost any adjustment on the H.F. side of the detecting valve will necessitate a readjustment of one or more other valves.

In view of this it is advisable to commence with only one H.F. valve and the rectifying valve in use, then when good results are being obtained add the second H.F. valve; tune the H.F. transformer connected to it, then readjust the condenser across the other H.F. transformer as found necessary, and lastly, add the L.F. amplifying valves.

By this means the adjustments are rendered easier, and the increase in signal strength due to the addition of each valve can be observed.

E. REDPATH.

Weights of Ebonite

THE following table gives the approximate weights and sizes per ounce and pound of sheet ebonite, and will prove a useful guide when purchasing:

Thickness	Square in. to 1 oz.	1 oz. = square with sides	1 lb = square with sides	Square ft. weighs
$\frac{1}{8}$"	11	$3\frac{5}{16}$"	$23\frac{1}{4}$"	13 oz.
$\frac{3}{16}$"	7·38	2·71"	10·8"	1 lb. 3½ oz.
$\frac{1}{4}$"	5·54	2·35"	9·41"	1 lb. 10 oz.
$\frac{3}{8}$"	3·69	1·92"	7·6"	2 lb. 7 oz.
$\frac{1}{2}$"	2·76	1·66"	6·64"	3 lb. 4 oz.

A. H. P.

Radiograms

ON November 15th the Duke of York opened the Marine Exhibition at the Agricultural Hall by wireless from Buckingham Palace. The ceremonies were so exactly duplicated that the Duke might actually have been there. He was formally introduced by a member of the committee and the bodyguard of bluejackets gave a salute immediately his speech was heard in the hall.

■ ■ ■

Pending the formation of the British Broadcasting Company, which will be completed in a few days, the Broadcasting Committee commenced a limited nightly programme from the London station on November 14th. This at present consists of two copyright news bulletins and official weather reports broadcast at 6 p.m. and 9 p.m. on a wave-length of 360 metres. Special messages indicating the progress of the General Election were broadcast on Wednesday and Thursday evenings.

■ ■ ■

Darlington Public Library have issued a list of books dealing with wireless telegraphy and telephony, all of which can be borrowed from the Lending Department.

■ ■ ■

Mr. Kellaway, ex-P.M.G., speaking at Bedford recently, stated that the Broadcasting Company would not be allowed to take the property of the Press.

■ ■ ■

A statement, which must be taken with reserve, has been made by members of the Society of Motion Picture Engineers, to the effect that the broadcasting of moving pictures by wireless has been successfully demonstrated, and its universal adoption may be expected within the next year or so.

■ ■ ■

An achievement in the history of wireless communication has been placed to the credit of the Marconi International Marine Co., Ltd. and the giant White Star liner *Majestic,* which arrived at New York on Tuesday. On approaching New York the *Majestic* cleared its Marconigrams to the Chatham (Mass.) wireless station with high-speed automatic transmitting apparatus, this being the first time that automatic wireless transmission has been used from a liner. This innovation was made because of the large number of business and private messages which passengers on Transatlantic liners desire to send when they are approaching the coast of America. Hitherto only hand transmission has been used by wireless apparatus at sea, but the amount of traffic has recently grown so enormously on the *Majestic* that it has been found necessary to introduce automatic working. The *Majestic* is the first liner to be fitted in this way, and if the Marconi traffic on other transatlantic liners increases to the extent it has done on the *Majestic,* it is probable that they also will be fitted with automatic transmitters. The maximum speed of the automatic apparatus used is 240 words per minute.

■ ■ ■

In connection with the broadcasting of messages by 2L O on the occasion of the Lord Mayor's Show, the sounds of the passing bands, conveyed by the transmitting microphone on the seventh floor of Marconi House, were heard clearly in many London and suburban districts and at the following provincial towns: Towcester, Tamworth, Rye, Peterborough, Horsham, Reading, Margate, King's Lynn, Nottingham, Ramsgate, Coventry, and Cambridge. Many correspondents also heard the cheering of the crowds and the marching of the troops.

■ ■ ■

The Liverpool Marine and General Insurance Co., the pioneers of insurance for wireless apparatus, has settled its first claim. Mr. H. Moss was the insured person, whose apparatus was injured in the recent gale.

■ ■ ■

Daily consultation by wireless between S. S. Van Dyck and heart specialists of the United States was conducted when Henry W. Kibble, an official of the Cadillac Motor Co., was struck down with rheumatism of the heart when returning from the Argentine.

■ ■ ■

Strong protests against the scale of subsidies made by the British Broadcasting Co. figured in the meeting of the Radio Association at the Hotel Cecil on Nov. 10.

■ ■ ■

An appeal to amateurs to stop the annoyance caused by the unskilled use of reaction was transmitted from Writtle at the conclusion of the concert on Nov. 7.

■ ■ ■

Amateurs in the western part of Scotland continue to make good reception of English telephony. Where valve sets are in use, Marconi House and Trafford Park are usually heard to advantage, while, using a single valve, speech from Writtle was received excellently on a recent occasion.

"A Focused Wireless Beam" Correction.—In the article with this title that appeared in the last issue of "A.W." the diagrams referred to in the text as Figs. 1 and 3 were inadvertently given their wrong figure numbers. The diagram styled Fig. 1 should be Fig. 3 and *vice versa.*—ED.

The Wireless Society of London

A MEETING of amateurs using transmitting apparatus was held at the Institution of Electrical Engineers on November 13th, and the following letter from the G.P.O. was read:

"SIR,—The Postmaster-General's attention has been drawn to the large and increasing number of transmissions, chiefly of music, from private experimental stations which are apparently not for purposes of *bona-fide* experiments but for purposes of advertisement and entertainment. Such transmissions are contrary to the understanding on which the permits are granted and not infrequently cause interference with genuine experimental work.

"As a result of representations from the Wireless Society of London on behalf of wireless experimenters generally, the conditions of the grant of transmitting permits were relaxed. The great majority of the holders of experimental transmitting permits are members of the Wireless Society of London or of an affiliated society, and the Postmaster-General will be glad if your society would consider what steps they can take to make clear to the holders of such permits the necessity in the general interest of strict adherence to the conditions of their permits.

"Failure to observe such conditions may not only involve the withdrawal of the particular permits, but will inevitably lead to a demand for the imposition of more stringent conditions generally.—I am, sir, your obedient servant,

"(Signed) F. J. BROWN.
for the Secretary."

As a result of the above letter several schemes were considered, and finally it was decided that the trouble could be obviated by reverting to a lower band of wave-lengths in the neighbourhood of 150 to 200 metres. It was felt that before anything definite could be arranged, the decision should be made known to all affiliated societies and their views obtained. After reports from the affiliated societies have been received a committee will take steps to interview the Postmaster-General.

Transatlantic Tests

The society are busy organising transmission tests, and arrangements have now been made whereby a number of experiments will be carried out with French amateurs. Our friends across the Channel, and particularly in the South of France, have kindly consented to listen in for the English amateurs and report strength of signals. The transmitters will therefore be in a position to know the range of their transmissions and what chances they have of being received on the other side of the Atlantic.

(*Continued on page* 570)

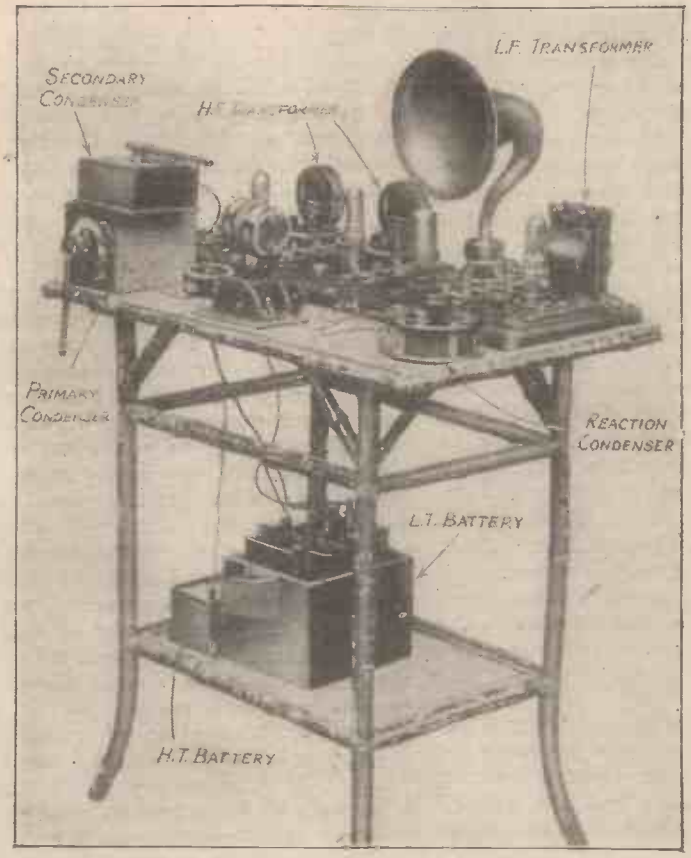


Fig. 2.—Photograph of the Units Arranged as a Four-valve Receiver.

"AMATEUR WI IDEAL RECEIV

THE first instalment of a series of articles which Mr. R. missioned to write for "A.W." This series will descri unit set so designed as to meet every possible need of the a stalment is introductory and generally descriptive; later artic various units of the set.

THE chief reason for the popularity of wireless as a hobby is to be found probably in its astonishing cheapness. A set that will give results sufficient to interest and to act as a foretaste of what may be expected from more refined apparatus can be put together for a few shillings; whilst even a beautifully finished "five-valver," capable of bringing signals from the other side of the world, costs no more than a good gramophone, and considerably less than a piano of even moderate quality. Running expenses, whatever the type of set may be, are so small that they are almost negligible.

When the amateur makes his first incursion into the realms of wireless he is faced with the problem of paramount importance, and that is the question of what type of set to make or buy. In most cases the state of his finances is the chief factor in bringing about a decision. He purchases the best set that he can afford—crystal, single valve, or perhaps an apparatus with one or more stages of amplification.

Conversions

For some time he is delighted with its performances, but sooner or later he desires to make improvements. He longs to increase his range, or to obtain signals of greater strength. Nothing is more tantalising than to find that certain desirable stations are just out of reach; the carrier-waves can be detected, but the mightiest feats of tuning do not suffice to extract from them the signals or the music that are known to be there. Though in some cases amplifiers can be added, the results are not altogether satisfactory. The enlarged set has a hotch-potch appearance, and as some of its components are now being asked to do work for which they were not designed they are not giving their best.

Progress

If it is decided to convert the set into something more sensitive it is often found that very few of its parts can be used, so that the so-called conversion becomes in effect a scrapping of a good deal of existing apparatus, which must be replaced by new components. The possessor of a simple crystal set with single- or double-slide tuning inductance who wishes to adapt his outfit for valve work is in much the same position as the man who, on taking an ancient pair of boots to be repaired, was told by the cobbler that they were not quite hopeless as the laces were in excellent condition. He can use the headphones and their condenser, but that is about all.

Again, anyone who buys a receiving set of any kind will find that as his knowledge of the working of wireless increases, he yearns to make experiments with new circuits. There are, for instance, about half a dozen different ways of wiring up the grid-leak, and one can tell only by experiment which of them best suits a par-

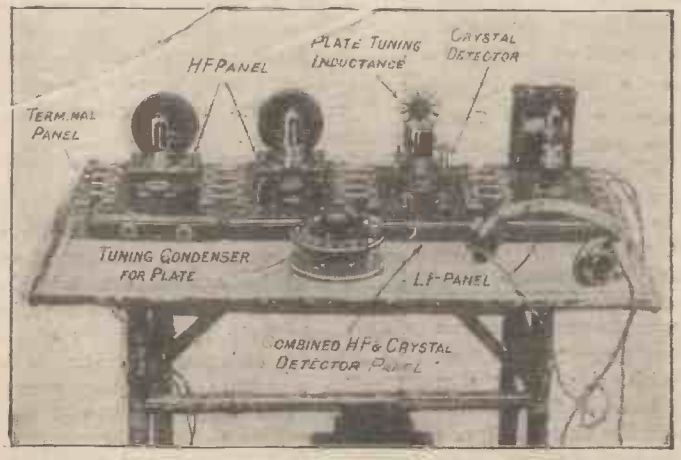


Fig. 3.—Photograph of Set Arranged for Crystal Reception and Valve Amplification.

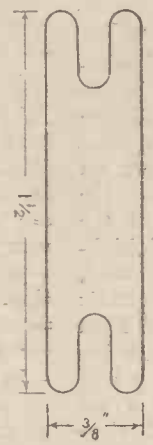


Fig. 1.—Panel Connecting Piece.

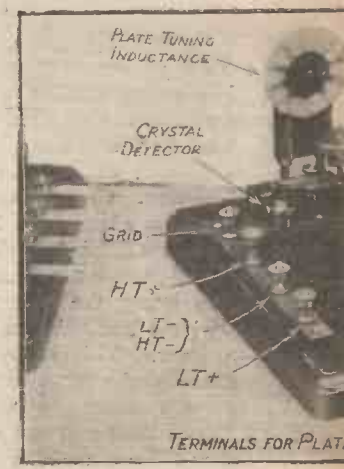


Fig. 4.—Crystal Detector Panel

RELESS" ING SET

W. Hallows has been specially com- be how to make, assemble and use a ateur experimenter. The present in- es will deal in great detail with the

ticular type of valve. With the boxed-in set it is a laborious business to make changes in the wiring. The would-be experimenter on removing the top of the cabinet finds himself faced with such a nightmare jumble of leads that his courage fails him; he hastily replaces the ebonite panel, resolving, perhaps wisely, to let sleeping dogs lie.

Elastic Receivers

Fortunately there is a way out of all these difficulties. The unit set, which is built up like an expanding book-case, kills every problem-bird with one and the same stone. It consists of a number of panels, identical in size and shape, each of which does its own particular job. Make the first one, which may consist of the simplest crystal rectifier, and you have a complete working set, which can be brought gradually to its highest state of efficiency before further refinements are added. You can construct further units as spare time and finances permit, and each of them will bring the set one stage nearer to the goal of perfection. When several panels have been made up, any combination of them may be tried in a matter of seconds, whilst in a set such as that which will be described in these articles the wiring is so readily accessible that circuits can be altered at will.

Desirable Features

This set was designed originally as a means of saving time when experiments were in progress. Prior to its birth the bench was littered with a medley of valve-holders, rheostats, transformers, condensers and coils. Though the results were quite good the appearance of this jumble was lamentable, and the scores of leads running in all directions prompted one fair visitor to inquire why it was called a *wire*less set. To remove, say, a valve rectifier and to insert a crystal in its stead demanded no little thought and quite an amount of labour. There was, too, always the chance that in a fit of temporary insanity one would make a wrong connection, followed either by the burning-out of fifteen shillings' worth of valve or by a long and agitated investigation into the reasons why the set would not work.

By mounting each stage on its own panel one has everything to hand in the neatest and most compact form. To change a panel not a wire need be touched. The units are connected by deeply notched brass strips of the shape shown in Fig 1. When adding a panel one simply loosens the heads of four terminals, slips the new-comer into place, and tightens down. It is absolutely impossible even for a beginner to connect up the set wrongly, for the proper pairs of terminals always come opposite one another, and the brass strips will bridge no others.

Fig. 2 shows a photograph of the set arranged as a four-valver, with two stages of high-frequency amplification, a rectifying valve, and a note magnifier. In Fig. 3 the rectifying valve has been replaced by a panel containing a crystal detector and a high-frequency valve with tuned plate. The set has thus been changed in a moment to 3 H.F., crystal rectifier and 1 L.F. A third photograph (Fig. 4) shows a unit with crystal detector and high-frequency amplifier.

The panels are made of the blocks used by electricians for mounting switches. A stock size, 9 in. by 6 in., with a depth of about 1 in., is very convenient, and these can be obtained from any electrical supply shop in polished hard wood for about one shilling each.

The terminals are mounted on ebonite strips 1 in. wide and 8 in. long. Below each terminal a ⅛-in. hole is bored through the wood; this ensures perfect insulation by keeping the brass well away from the material of the panel—a necessary precaution, since even seasoned wood is strongly hygroscopic, and may in damp weather be the cause of all kinds of unexpected "shorts." As the panels are hollow all wiring is done underneath their surface, the leads being brought to the terminals by means of the ⅛-in. holes, already mentioned. Rheostats and condensers are also placed under the panel out of harm's way, the only exception being the grid condenser, which is fixed to the top of the rectifying panel, so that the leak, which is of the cartridge type, may be changed in a moment to suit any particular valve.

Economy

One of the greatest features of the set is that not a pennyworth of material need be scrapped when subsequent additions, conversions and improvements are made. You may, for example, start with a detector mounted on a panel, which contains also a coil that serves as a tuning inductance. The panel is thus a complete set. Later on it may be adapted, as will be shown, for valve use. In this case a valve-holder and filament resistance are added, and certain alterations are made in the wiring. The one-time aerial tuning inductance coil stays in its place, but it now performs the function of tuning the plate of the high-frequency valve, which amplifies incoming wave trains before they go to the detector for rectification.

The more advanced reader can begin straight away with the valve rectifying panel, to which other units of various kinds may be added from time to time.

with H.F. Valve and Tuned Plate.

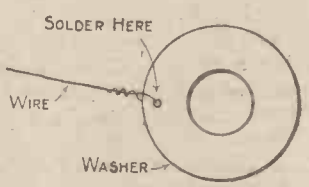


Fig. 5.—Terminal Washer with Wire Attached.

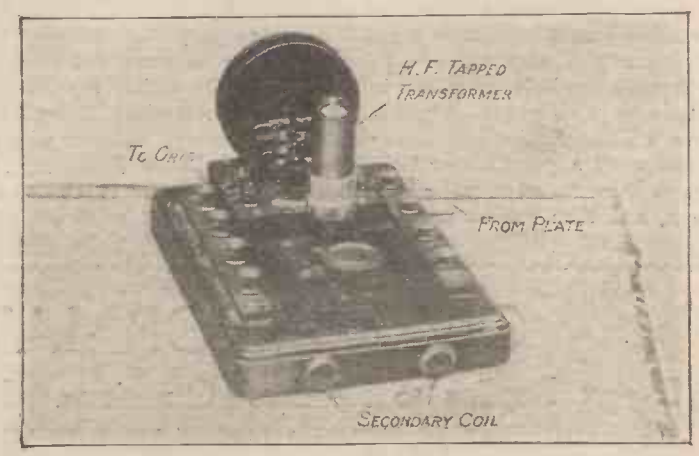


Fig. 6.—High-frequency Transformer-coupled Unit.

All leads from batteries, as well as those from the secondary coil and condenser of the tuning inductance, are taken to the terminal panel, seen on the left of the photographs. This is a fixture, being screwed to the table. It is a most convenient arrangement, for any panel that one slides up to its brass strips is automatically and instantaneously connected up and ready for work.

The table used is a bamboo affair measuring 30 in. by 18 in.—again a stock size—which just takes any combination of four panels, and provides ample room for the condensers and the tuning inductances. The lower shelf holds both low-tension battery and accumulator, as well as spare coils, and any "bits and pieces" that one may wish to have at hand.

The tools needed to construct this set are few and inexpensive. A soldering iron, a ½-in. bit for wood boring, twist drills for ebonite of $\frac{3}{32}$, $\frac{1}{8}$ and $\frac{3}{16}$ in., a 4 B.A. tap, a pair of pliers, a screw-driver and a hack-saw make up the necessary outfit. Ebonite can be cut quite easily and neatly with an ordinary stiff-backed saw; if your workshop does not contain one you will probably find that the lady of the house has one for meat-cutting purposes in the larder. A fretsaw, the cheapest pattern of which will do quite well, comes in very handy for cutting holes in the top of the wooden panels to allow of the insertion of valve-holders, and so on.

If there are any little jobs, such as soldering a wire or tapping a hole to take a B.A. screw that you do not feel equal to tackling unaided, the handyman of any cycle repair shop will do them for a few pence. But, as a matter of fact, both of these are quite easy. Use the $\frac{3}{32}$-in. drill for ebonite work for 4 B.A. screws, take a tapered tap (which can be bought for eightpence), insert its point into the hole, and, taking care that it is going straight, screw it slowly home.

After a few experiments with a soldering iron—buy one of rather small size—you will discover that there is no great difficulty in soldering a wire to a washer, which is one of the best ways of making connections to terminals. Scrape the wire and washer bright, and bore a small hole through the rim of the latter. Pass the wire through the hole, as shown in Fig. 5, and twist it up tight with pliers. Then dab on a little fluxite. Heat the soldering iron until a greenish or bluish flame begins to show round it, put a little fluxite on to it, and then run on some solder, so that the surface for about ¾ in. from the point is well tinned. Now pick up a little solder with the point and apply it to your joint. If the iron is held on the joint for a few seconds, to give it time to heat up both the wire and the washer, the solder will run on quite easily, with the result that a good firm connection is made. Be careful when you have finished to wipe off all traces of the flux.

The next article will explain the making of the terminal panel, as well as of both crystal and valve rectifying units. Succeeding articles will describe the construction of various types of high- and low-frequency amplifying units, and will show the uses of many combinations. The photograph, Fig. 6, shows a transformer-coupled high-frequency panel.

R. W. HALLOWS.

CORRESPONDENCE

Manchester Broadcasting Range

SIR,—Among the Radiograms in the issue of the 11th inst. you state that the Trafford Park Broadcasting has been heard in the West of Scotland. I thought it might be of interest to your readers to know that here, in the most northerly place in the United Kingdom, I received the Wednesday and Friday transmissions quite clearly on a home-made set, using only one valve.—C. C. (Shetland Isles).

Repairing Valves

SIR,—The writer has read with interest the article in No. 23 of "A.W." on "Saving a Valve," and takes this opportunity of pointing out that it is possible to repair the ordinary thermionic valve. The writer holds more than one patent for the processes, and has satisfied the largest users that the repaired valve is the equivalent of a new one in every respect. No advertisements have appeared yet, but it is hoped shortly to make the fact that the repairing of valves is a commercial operation as widely known as possible. There are already some hundreds of valves, both for transmission and reception, renewed under the writer's process in use.—A. H. S. C. (Birmingham).

"Gramaphix" Loud-speaking Device

SIR,—It has been brought to our notice that in your issue (No. 24) of Saturday, November 18th, in an article headed "Around the Showrooms," you state that the makers of the Gramaphix are the Lacland Electrical Manufacturing Agency, of 68, Great Queen Street, London, W.C.2. This is not a fact; we are the sole manufacturers of this attachment, and further, our agents for London and the Home Counties and South Wales are Messrs. Pettigrew and Merriman, of Tooley Street, London, S.E.1.—B.N.B WIRELESS LIMITED (65, Renshaw Street, Liverpool).

"WIRELESS SOCIETY OF LONDON" (*continued from page 567*).

The French amateur stations will be transmitting between midnight and 3 a.m., and the English stations between 3 a.m. and 6 a.m. The experiments will be carried out from December 22nd until December 31st each night.

We shall listen in for the American transmissions from December 12th until December 21st.

The Marconi Company have kindly promised to transmit bulletins from their Carnarvon station each day, giving the results received this side, and during the transmissions by our experimental stations New Brunswick will transmit results which have been collected on the American side. Carnarvon will receive these reports and re-transmit them so that English experimenters can readily pick them up.

A number of transmitters throughout the country have already expressed their desire to carry out transmissions.

The society is working very closely with the American Relay League, and Mr. P. Coursey, together with the hon. secretary, Mr. Leslie McMichael, are taking a very active part to ensure the success of the scheme.

New French Broadcasting

THE French wireless station located at Levallois-Perret, near Paris, has just recently (on Nov. 6th for the first time) undertaken a regular broadcasting scheme which starts each evening at 8.45 p.m. and ends usually at about 10 p.m. This station is owned by the Société Française Radioelectrique, which is associated with several other French firms for broadcasting purposes under the new name, Radiola Concerts.

These daily concerts, which are given by famous French singers and opera artists, are performed at the headquarters

of the Radiola Company at 79, Boulevard Haussmann, in Paris, wherefrom music and speech are transmitted by land line to the transmitting apparatus at Levallois. One part of the transmission is usually devoted to the reading of several Parisian newspapers, such as *Le Matin* and *Le Petit Parisien*. Some short stories, as well as items of wireless interest, are very often included. Also a short account of the correspondence received by the company from listeners in is frequently given.

Transmission is on a wave-length of approximately 1,500 metres, and is being clearly and easily received throughout France. It can certainly be received as well within a wide area of the British Isles, as reports of successful reception from amateurs in the southern part of France as far as Nice have already been announced by the speaker, who is always pleased to receive any criticism and reports of interest on his transmission.

M. T.

CLUB DOINGS

The Hornsey and District Wireless Society

Hon. Sec.—MR. H. DAVY, 134, Inderwick Road, Hornsey, N.8.

A MEETING of the society took place on Oct. 13th, Mr. Davy lecturing on the thermionic valve when used as a detector.

At a meeting on Oct. 16th, one of the members brought his set to the club for the purpose of demonstrating the possibilities of a single-valve receiver. The meteorological report from G F A at 8 o'clock was utilised as practice in Morse reception, and later some musical telephony from 2O N and 2K T was received. Applications for membership are cordially invited by the Hon. Sec.

Clapham Park Wireless Society

Hon. Sec.—MR. J. C. ELVY, 12, Tavistock street, Strand, W.C.2.

THE seventh general meeting was held at headquarters on Oct. 11th. The secretary invited discussion and advice on the various apparatus for tuning in. This discussion tended to lead those experimenters who had prompted the inquiries to devote their efforts to the slab and honeycomb type.

Ilkley and District Wireless Society

Hon. Sec.—E. STANLEY DOBSON, "Wire House," Richmond Place, Ilkley.

A MEETING of the above society was held on Oct. 23rd. Mr. L. E. Overington addressed the meeting on the subject of "Electro-magnetic Induction." The theory of conductors in magnetic fields was dealt with fully by the aid of blackboard diagrams, and the application of these principles to solenoids, etc., was explained. Faraday's discovery of electromagnetic induction by means of the iron ring experiment was described, and its development in the form of the transformer and induction coil, self-induction, skin effect in conductors carrying H.F. current, permeability, hysteresis and flux density were dealt with fully.

The Peckham Wireless and Experimental Association

Hon. Sec.—MR. GEO. SUTTON, 18, Melford Road S.E.22.

ON Sept. 27th Mr. Middleton gave a great many useful little tips on surfacing and working ebonite, which were much appreciated and of which a note was made for future guidance.

On Oct. 18th the members busied themselves with their scheme of the "Agenda Committee." Five members were elected, whose sole duty is to ascertain the special needs of the other members in the various stages of wireless progress. Should a member desire to know how to construct a crystal set, the committee member for the elementary grade would ascertain the special circumstances of his case, and report to the secretary, who then would take steps to ensure that at an early "elementary" meeting that member's difficulties would be fully gone into.

Proposed Mitcham Wireless Society

WILL ladies and gentlemen interested in wireless communicate with Mr. S. J. Miller, 56, Melrose Avenue, Mitcham, Surrey, with a view to the formation of a Wireless Club or Society in the neighbourhood.

The Fulham and Putney Radio Society

Hon. Sec.—J. WRIGHT DEWHURST, 52, North End Road, West Kensington, London, W.14.

AT a meeting held on Oct. 27th Mr. Calver drew attention to the appeal from St. Dunstan's for assistance to the blinded soldiers in matters relating to wireless. It was proposed that the secretary write to Capt. Ian Fraser and also the local secretary, offering to assist any local member of St. Dunstan's in wireless matters by putting him in communication with one of the members.

The Manchester Radio Scientific Society

Hon. Sec.—H. D. WHITEHOUSE, 16, Todd Street, Manchester.

AN ordinary meeting was held on Oct. 25th, when Mr. J. R. Halliwell gave a lecture entitled "Impressions of the All-British Wireless Exhibition." The lecturer concluded with a frame aerial demonstration, using a 3-valve set. The Metropolitan Vickers Station, Manchester (2Z Y) came through very well.

The Leeds and District Amateur Wireless Society

Hon. Sec.—MR. D. E. PETTIGREW, 37, Mexborough Avenue, Chapeltown Road, Leeds.

AN instructional meeting was held on Oct. 6th when Mr. G. P. Kendall, B.Sc., gave a lecture entitled "The Elementary Principles o Tuning," which (as all subsequent lectures at Instructional Meetings) was specially arranged to meet the needs of the section of the members having only elementary knowledge of wireless matters. Mr. Kendall thoroughly examined his subject, his very clear and concise remarks being greatly appreciated by a large audience.

A general meeting was held on Oct. 27th, when Mr. H. F. Yardley, M.I.R.E., gave a demonstration of wireless apparatus. The lecturer switched on a multi-valve receiving set, and music was received from the amateur experimental station 2L A, and rendered audible to the meeting by means of a Magnavox loud-speaker.

The Brighton Radio Society

Hon. Sec.—D. F. UNDERWOOD, 68, Southdown Avenue, Brighton.

A MEETING of the Brighton Radio Society was held on Sept. 21st, at 7.30 p.m., when a motion was entertained from the Sussex Wireless Research Society to become amalgamated with the Brighton Radio Society. It was unanimously decided to adopt the recommendation of the executive committee, and a special committee was formed to effect the fusion. The advantages of this unity in the interests of the science in Brighton will be appreciated by everyone. Any gentlemen interested in wireless in Sussex are invited to communicate with the Hon Secretary. Amateurs in the district are invited to listen in on Friday evenings from 7 to 9 p.m., when 2K A, the society's transmitting station, usually carries out tests.

Burnham, Highbridge and District Wireless Society

Hon. Sec.—L. LOTT, 52, High Street, Burnham-on-Sea.

A MEETING was held on October 3 to consider the formation of a local wireless society. There was a good number of local amateurs present, and it was decided unanimously to form such a society. A committee was appointed, and meetings are to be held every fortnight, with a buzzer class each week. Annual subscription, 5s. Associates, 2s. 6d.

Bradford Wireless Society

Hon. Sec.—MR. J. BEVER, 85, Emm Lane, Heaton, Bradford.

THE opening meeting of the session was held on Friday, Oct. 6, a number of new members being present, when Mr. Whiteley gave a lecture on "Popular Wireless." The lecture took the form of a historical survey with special reference to wireless in the Mercantile Marine. Special reference was made to the excellent performances of the Radio Communication Conpany's commercial apparatus, and the whole lecture was illustrated by lantern slides specially prepared by the lecturer.

Bristol and District Wireless Association

Hon. Sec.—Mr. L. F. WHITE, 10, Priory Road, Knowle, Bristol.

A MEETING of the association was held on Sept. 29, when a discussion took place between the members regarding the proposed construction of a receiving set. It was eventually agreed that to adopt the unit system would prove most satisfactory for experimental purposes, and that no difficulty should be experienced in making the receiver portable should occasion arise. The hon. secretary will be glad to give full particulars of the association upon application.

North London Wireless Association

Hon. Sec.—MR. V. J. HINKLEY, Northern Polytechnic Institute, Holloway Road, N.7.

THE 102nd meeting of the association was held on Oct. 16th. Mr. F. S Angel delivered the

ANNOUNCEMENTS

"Amateur Wireless and Electrics." Edited by Bernard E. Jones. Price Threepence. Published on Thursdays and bearing the date of Saturday immediately following. It will be sent post free to any part of the world—3 months, 4s. 6d.; 6 months, 8s. 9d.; 12 months, 17s. 6d. Postal Orders, Post Office Orders, or Cheques should be made payable to the Proprietors, Cassell & Co. Ltd.

General Correspondence is to be brief and written on one side of the paper only. All sketches and drawings to be on separate sheets.

Contributions are always welcome, will be promptly considered, and if used will be paid for.

Communications should be addressed, according to their nature, to The Editor, The Advertisement Manager or The Publisher, "Amateur Wireless," La Belle Sauvage, London, E.C.4.

Querist's Coupon Available until Saturday, Dec. 2, 1922

first paper of his series—"The Elementary Principles of Radio Telephony." The lecturer started by discussing the nature of electricity as a form of energy. He then performed some experiments dealing with static electricity. After showing that different kinds of charges were produced by friction between various materials, he went on to talk about static induction. From this point he led up to the action of a condenser and showed an arrangement to illustrate the difference there is in the dielectric constant of various materials by means of weights hung at the centres of horizontal cords and rubber strips. By means of an electroscope with a plate capable of being moved nearer to the leaf system, Mr. Angel demonstrated that the capacity of a condenser increases as the thickness of the dielectric is diminished.

Borough of Tynemouth Y.M.C.A. Radio and Scientific Society

Hon. Sec.—GEO. J. S. LITTLEFIELD, 37, Borough Road, North Shields.

THE third annual general meeting of the above society was held on September 18th. Full particulars of the society will be gladly sent to anyone interested on application to the hon. secretary.

Liverpool Wireless Society

Hon. Sec.—MR. C. L. LYONS, 76, Old Hall Street, Liverpool.

A MEETING of the above society took place at The Royal Institution, Colquitt Street, Liverpool, on Thursday, September 14. A demonstration was made of the society's instruments, Mr. C. G. Williams explaining the C. Mark III three-valve amplifier. The question box was then sent round and a very interesting batch of questions resulted, which Mr. N. D. B. Hyde dealt with in his usual lucid manner, illustrating his explanations with very clear blackboard diagrams. Mr. F. P. Owen next demonstrated to the society a very compact portable receiver, consisting of both crystal and single-valve detector. This instrument was entirely home made, including the outer case, switches, tuning coils, etc., and every item, including the L. T. and H. T. batteries, were housed in the one outer case. Although operated in conjunction with the society's indoor aerial, signals were received on the valve detector. The first meeting of the winter session was held on Thursday, October 12th, at the Royal Institution, Liverpool, when Professor E. W. Marchant, President of the society, delivered an address.

The Radio Society of Highgate

Hon. Sec.—J. F. STANLEY, 49, Cholmeley Park, Highgate, N.6.

ON Nov. 3rd Mr. J. F. Stanley gave a lecture on "A Simple Wavelength Calculator." This calculator is in the form of a chart, from which the values of inductance and capacity required for any given wave-length can be read off. The construction and use of this chart were fully explained by the lecturer.

Walthamstow Amateur Radio Club

Hon. Sec.—R. H. COOK, 30, Ulverstone Road, Walthamstow, E.17.

AT a meeting held on Oct. 15th, Mr. Nickless (2 K T) gave a very successful demonstration of telephony reception on his 5-valve set with loud speaker. More recently Mr. A. J. Smith gave a lecture on "Alternating Current and the Thermionic Valve," carefully showing by diagrams the working of the thermionic valve as a detector and amplifier.

Cheap and Simple Picture Framing is the title of a useful article in this week's issue of "Work." Other articles include such a variety of subjects as Fixing up a Shower Bath, Cleaning and Restoring Oil Paintings, Silver Work for Amateurs, Practical Upholstery, Making a Shaving Mirror, etc. etc. Threepence weekly. Well illustrated.

TELEPHONY TRANSMISSIONS

Writtle (2M T), 400 metres. Tuesdays, 8 p.m.
Eiffel Tower (F L), 2,600 metres. Daily, 6.20 p.m.
Hague (P C G G), 1,085 metres. Sundays, 3-5 p.m.

"All About the Valve"—It has been necessary to hold over the seventh instalment of this article owing to the great demand on our space.

An unfortunate mistake occurred in the advertisement on p. 526 of our Nov. 11th issue. Messrs. Hall made an offer of variable condensers, but owing to a mistake in the manuscript supplied, wrong capacities were attributed to a series of variable condensers offered by the firm. We are repeating the essential part of the advertisement herewith so that readers can see the correct capacities and the prices at which the goods are offered:

VARIABLE CONDENSERS.

Capacity	Complete Parts	Mahogany Cabinet
.001 ...	7/- ...	3/6
.0075 ...	6/- ...	3/3
.0005 ...	5/3 ...	3/-
.0003 ...	3/3 ...	2/9
.0002 ...	2/3 ...	2/6
.0001 ...	2/- ...	2/3

Ebonite top and bottom, 1/6 pair extra.

Embracing every feature that makes for better reception

HG 1. 120 Ohms ... £1 10 0
HG 2. 500 Ohms ... 1 11 0
HG 3. 2000 Ohms ... 1 12 6
HG 4. 4000 Ohms ... 1 14 0

MOST important, perhaps, are the adjustable pole-pieces enabling instant adaptation for the reception of signals of varying character and volume.

Weak signals can be made stronger and loud signals can be modified at will. The adjustment permits a degree of uniformity not possible with ordinary headphones. In the

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HIGH-EFFICIENCY
Wireless Telephone Head Sets

moving armatures with delicate levers or reeds which possess a natural period of their own are eliminated.

The electro-magnetic combination influencing a stalloy diaphragm, although simplicity itself, is exceptionally efficient, and with the adjustment provided, the consistent clarity and articulation of speech reception is remarkable.

A most convenient and advantageous feature is the detachability of the receivers from the headband. In an instant the receivers—each with an ample length cord—may be removed, so that two people can each use a single receiver simultaneously without discomfort. The universal movement of the ear-pieces also makes for greater comfort in use.

Only advanced production methods and big output on a comparatively small profit make the low price possible.

The "Graham" Head Sets, together with the celebrated "Amplion" Loud Speaker, may be seen and heard at the West End Showroom.

We would appreciate a visit to enable us to demonstrate our Wireless products without any obligation whatever. Our experience is entirely at your service.

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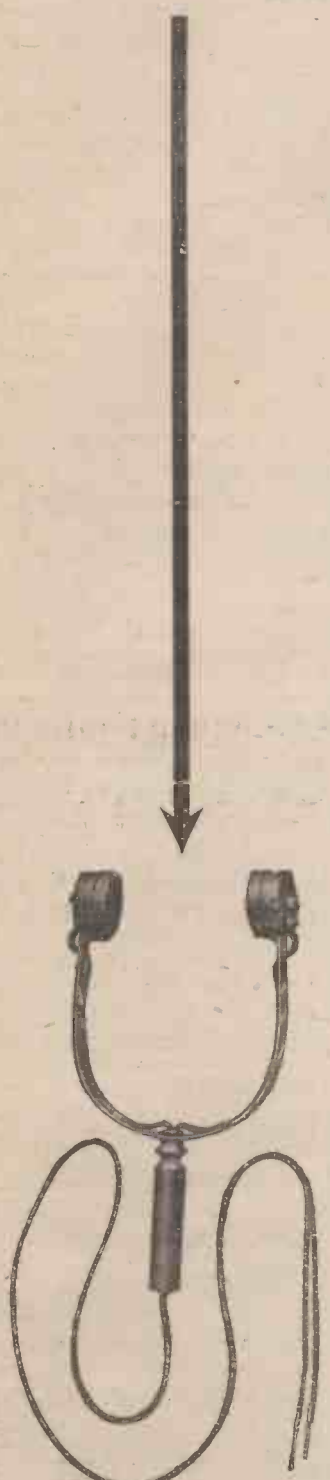

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