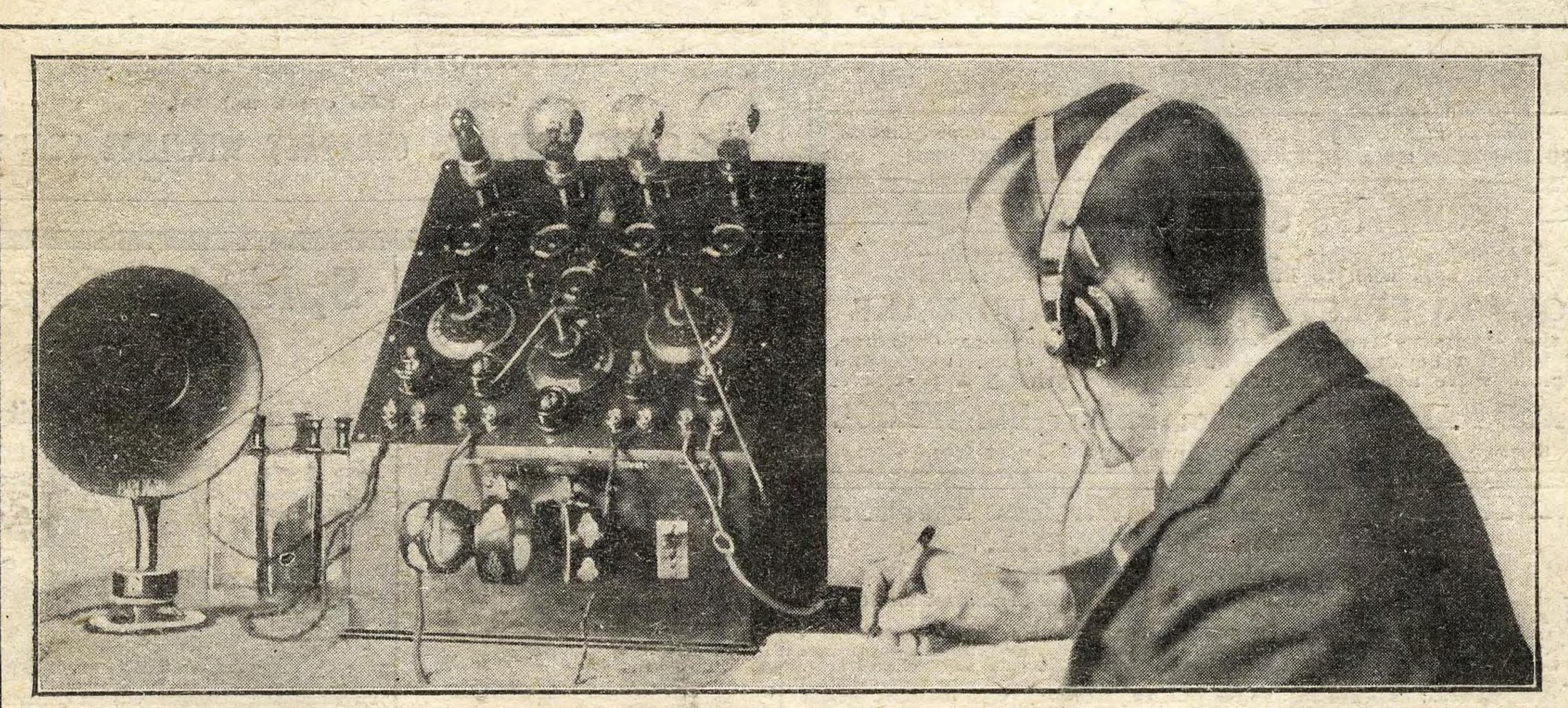
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Vol. II, No. 33

SATURDAY, JANUARY 20, 1923

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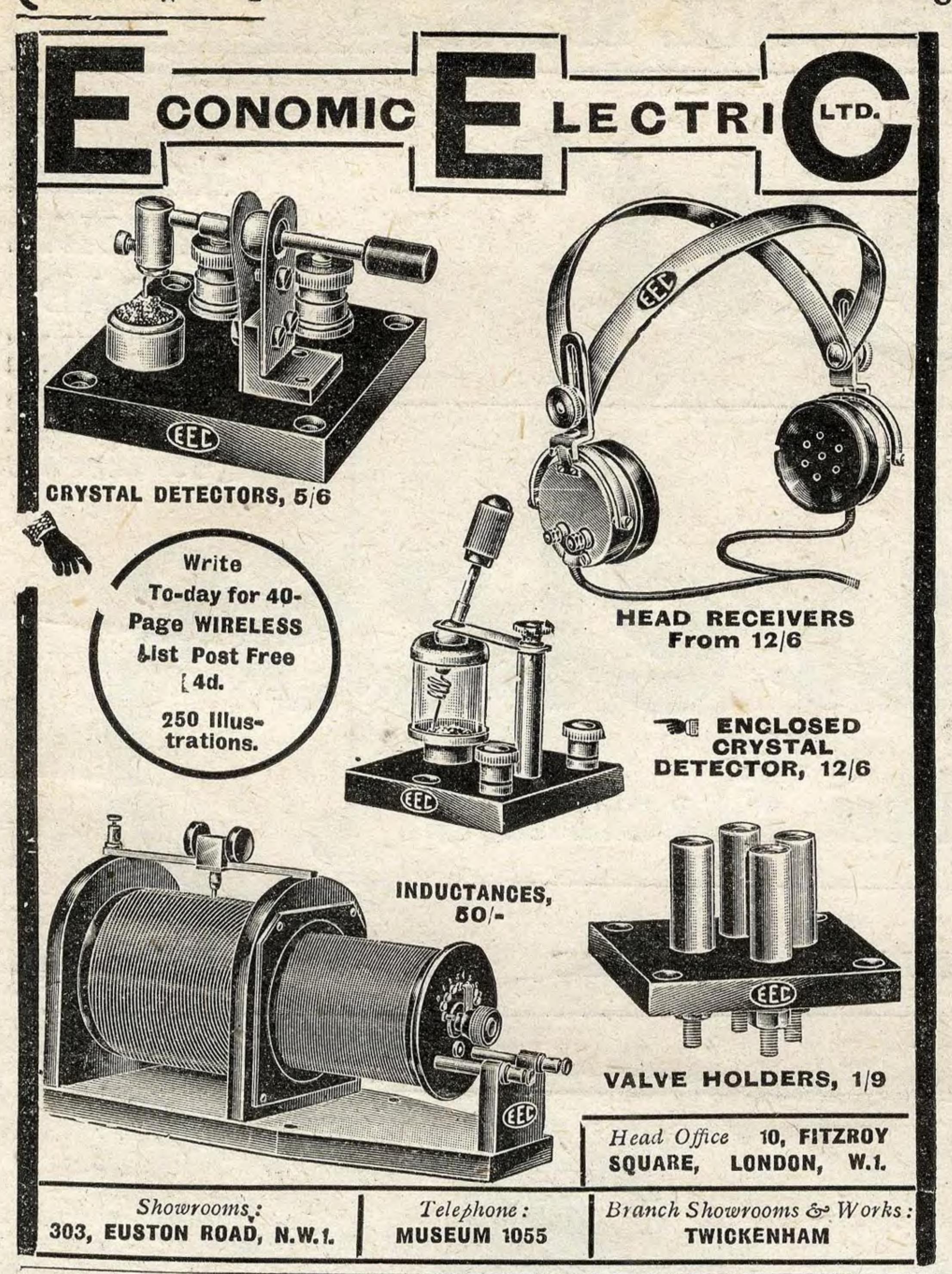
What Causes Fading?
More About Vario-couplers
Loud-speaker for Eight Shillings
Repairing a Low-frequency Transformer
Notes for the Novice—Some Simple Definitions

High-frequency Amplifiers
A Variable Grid-leak

5 L P: An Amateur-equipped Transmitting and Receiving Station
Cigar-box Valve Panels
A Simple Series-parallel Device
Loose-coupler with Dead-end Switch
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Radiograms, Information Bureau, Correspondence. Broadcast Telephony, etc.

THERE IS A SPECIAL ANNOUNCEMENT ON PAGE 64



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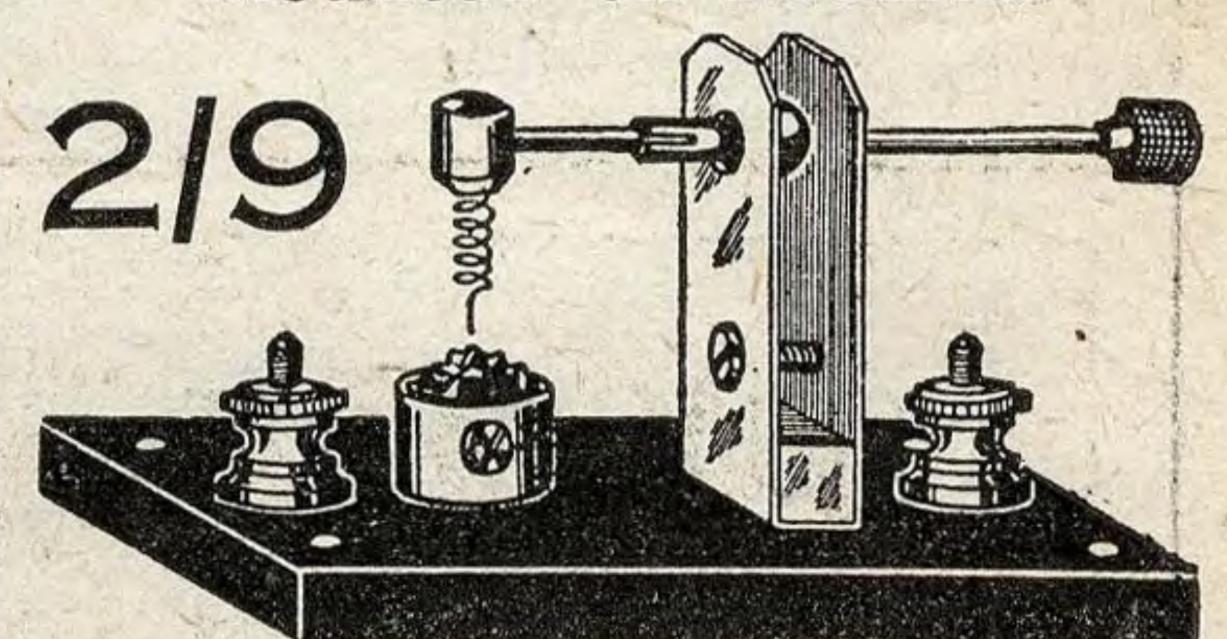


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Electrucs January 20, 1923 Vol. II, No. 33

WHAT CAUSES FADING?

HE problem of fading is of great interest, and though no solution has as has been made by recent investigations.

Tests

Amateur tests carried out in a district some 200 miles from the nearest broadcasting station seem to make it clear that no blame for the trouble can be laid at the door of the transmitting stations, and the theories involving that link in the chain of broadcasting communication must therefore be ruled out. This leaves the two alternatives—the receiving apparatus and the medium through which the waves travel in their passage from the transmitting aerials.

The tests were made within a radius of none of the experimenters reported perfect and leak has been tried, also shorting of conceivable that its wave will come in reception of the whole programme, there the grid condenser when fading takes practically as strong as the carrier wave of was no similarity in the experiences re- place, and potentiometer control of the broadcasting station. Before long a' garding fading. An item would be heard leak, but these expedients have not been point is bound to be reached when these excellently at one point, and serious fading found to improve matters. two waves will neutralise each other, so trouble would be met with at another point Adherents to the belief that the atmo- far as listeners-in on the particular sets in respect of the same item, while a few spheric conditions are to blame are which are receiving both are concerned; minutes later the position would be quite numerous, and one of the most popular that neutralising would cause fading—are

fading occurred synchronously at all the stations.

yet been arrived at, some little progress. Two of the stations where the tests were made were, however, only a few hundred yards from each other, yet there was a wireless reception from the ground has considerable difference in the reports by been much better when the aeroplane was the operators. While apparently absolv- above the clouds than when below them. ing the transmitter, the tests cannot be In addition, during the amateur tests mensaid to have helped much in pointing the tioned above a white mist lay on the way to a solution.

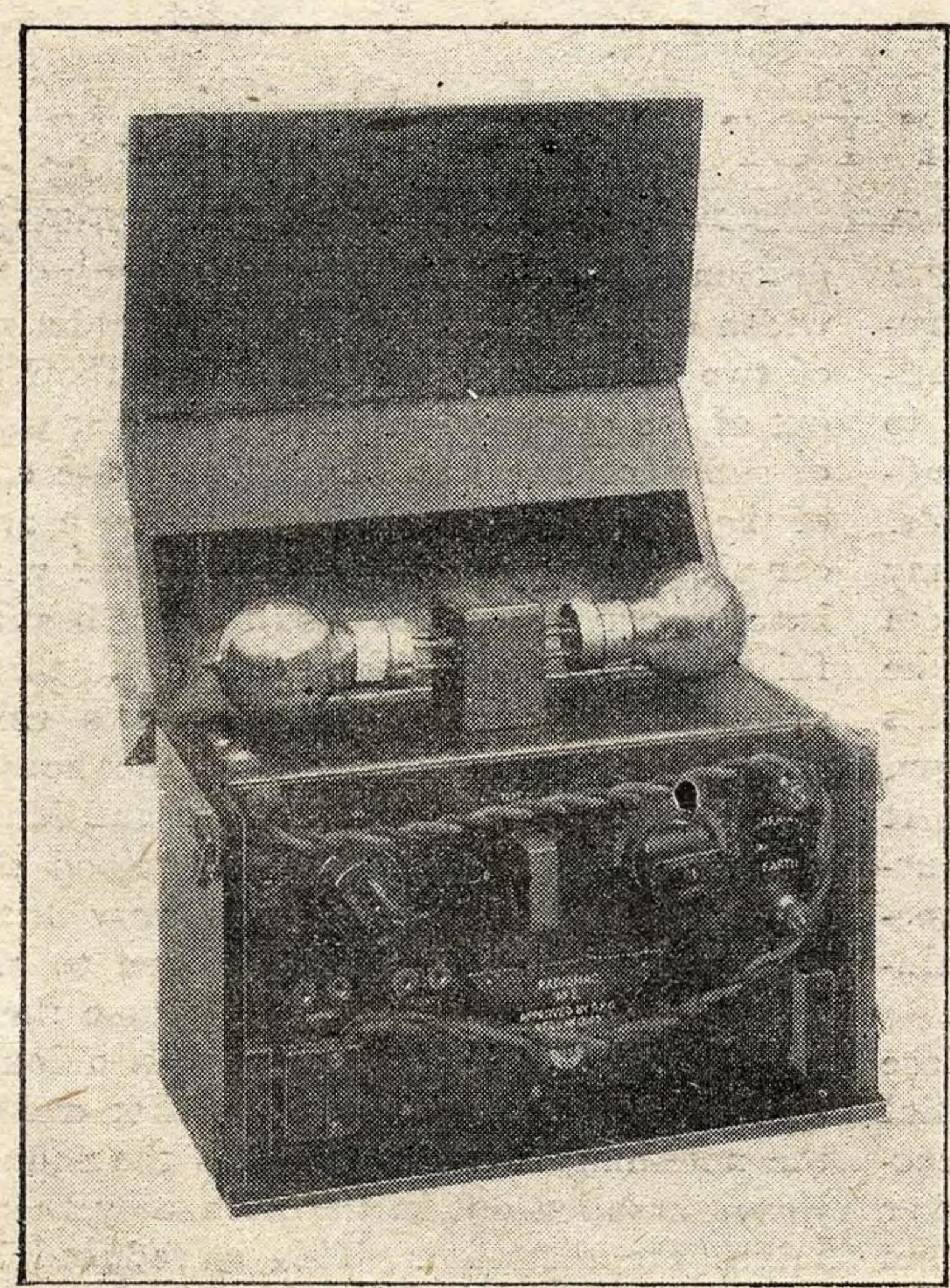
Theories

In some quarters it has been argued that the phenomena is due to the blocking of the grid condenser, caused by the use of grid leaks of insufficient value, the idea being that an overcharge, such as atmospherics, paralyses the valve for the time being, and the leak can only work away to four miles, and it was found that, while gradually relieve it. A variable condenser

passing backwards and forwards over a district may take away part of the energy of the transmitting station. It is only right to point out, however, that in aeroplanes ground at some of the receiving stations, while at the others the conditions were clear. The results did not bear out that the mist had any effect.

Are Our Neighbours to Blame?

A rather interesting speculation is that fading is due to the behaviour of near-by receiving stations—those who offend in the matter of oscillations. If such a station at a very short distance be oscillating, it is reversed. On one or two occasions the suppositions is that clouds of moisture any rate, that is the theory. G. A. F.



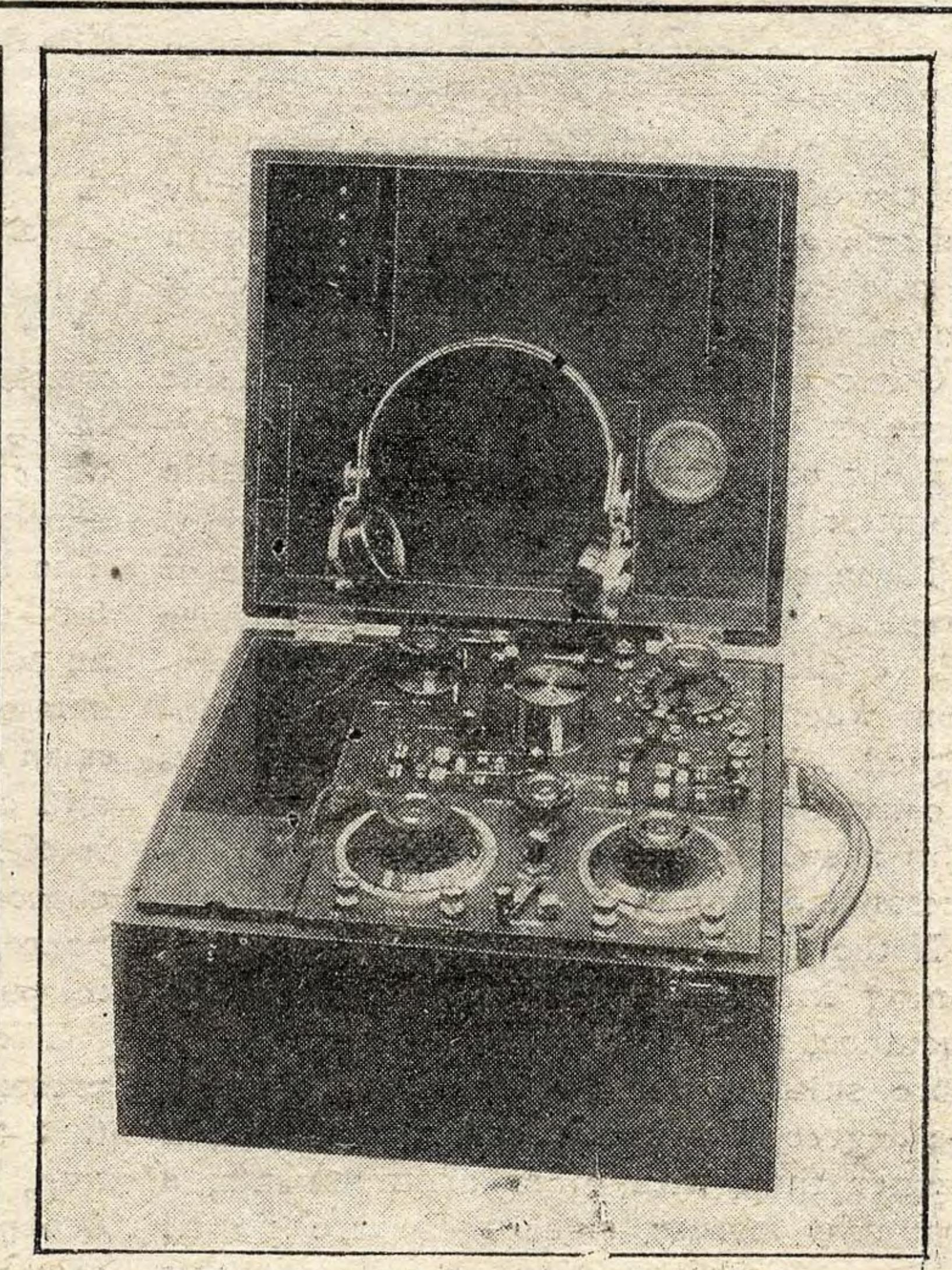
Radio Mac II Converted Set.

CONVERTED APPARATUS

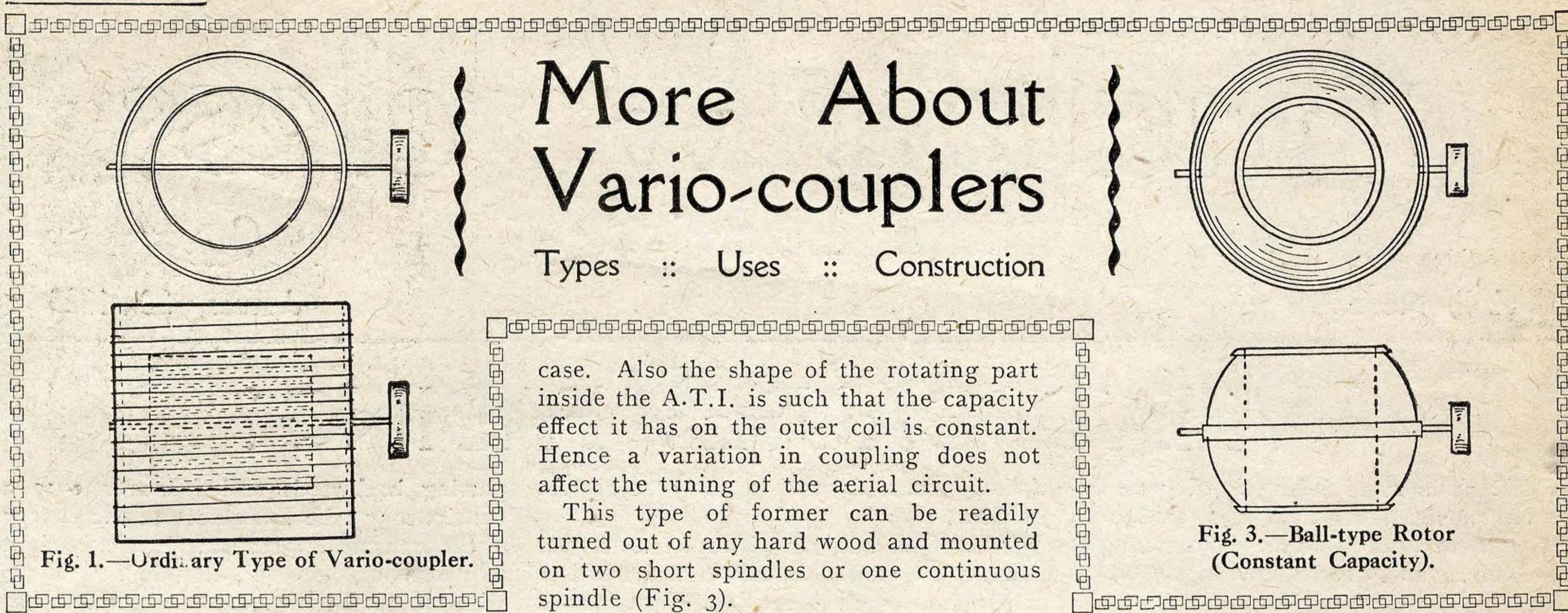
THESE self-contained sets are ex-Government instruments modified so as to be suitable for broadcast reception. That on the left was originally a B Mark II detector-amplifier, but the wavelength range is now from 300 to 1,000 metres. A variable condenser is provided for fine tuning, and duolateral coils can be plugged in.

The other photograph shows what was formerly a C.W. Mark III transmitting set which is now a two-valve receiving set. The coils remain exactly as before. A variable condenser has been added, so that the range of wavelength is from 300 to 1,500 metres. A variometer is embodied to render very close tuning possible.

The instruments are retailed by Leslie MacMichael, Ltd., and were exhibited at the "Model Engineer" Exhibition.



C.W. Mark III Set after Conversion.



More About Vario-couplers

:: Uses :: Construction

case. Also the shape of the rotating part inside the A.T.I. is such that the capacity

This type of former can be readily turned out of any hard wood and mounted on two short spindles or one continuous

It is not advisable to use the spindle as

effect it has on the outer coil is constant. Hence a variation in coupling does not affect the tuning of the aerial circuit.

spindle (Fig. 3). the connections for the coil, for however

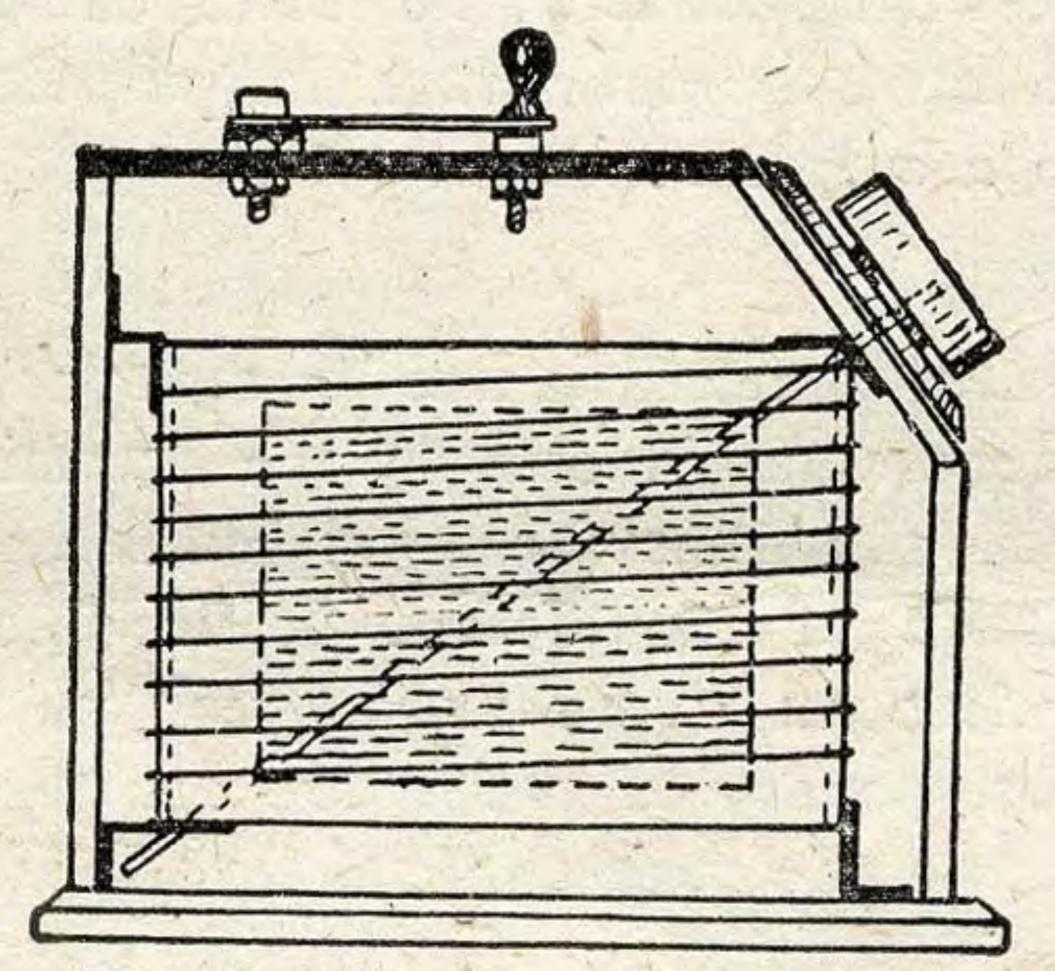


Fig. 2.—Fine-coupling Device.

on which the coil turns passes through the centre of the windings (Fig. 1). It is necessary with this arrangement to leave a space between the turns for the spindle to pass through, which means a loss of efficiency since the continuity of the coil is broken. This can be overcome by adopting the following method of pivoting the inner coil. The axis is fixed to opposite points on opposite circumferences on the smaller coil, and rotates in bearings at similar points on the larger coil. (This will be clearly understood from the illustration, Fig. 2.)

N this article it is intended to deal only

with those arrangements which have a

secondary or reaction coil rotating inside

The most usual type is where the axis

the primary coil.

It is obvious that the continuity of the winding is unaffected since the axis does not pass through the turns on either coil. Further, the control knob has to be turned through half a revolution (180 deg.) to change the coupling from maximum to minimum—from tight to loose. This 2 to I ratio is especially valuable when the degree of coupling has to be very exactly defined, as is the case with the reception of telephony. Suitable sizes for the coils (for short wave work) are:

Outer or primary coil, 3½ in. outside diameter by 21/2 in. long.

Inner or secondary coil, 21/2 in. outside diameter by 2 in. long.

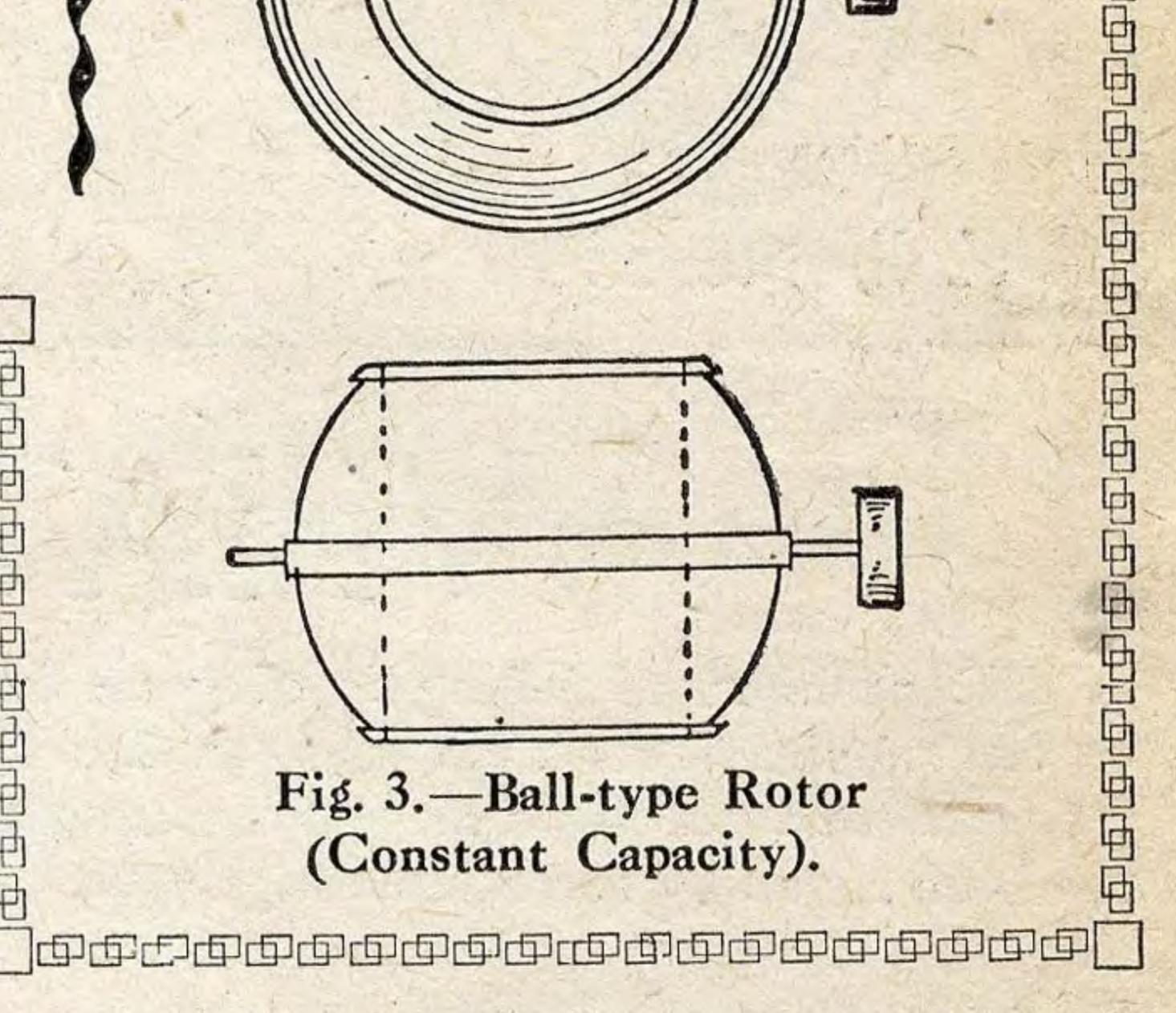
These sizes give a maximum degree of coupling which is not too tight to cause self oscillation, an important consideration where broadcast reception is concerned. The illustration, Fig. 2, shows a convenient way of mounting these coils with a switch for varying the primary inductance on top of the containing cabinet.

If the coils are to be used as an aerial tuning inductance and closed circuit in- minium horn from an old phonograph. ductance, the "ball" type of inner coil is more suitable for two reasons. Firstly, the degree of coupling can be made much greater than with other arrangements, a desirable feature since there are no ill

carefully the rubbing contacts are made noises are produced on turning the control knobs.

Since the coil need only rotate through 90 deg., connections can be established by flexible wires (covered) soldered to the ends of the winding.

It is advisable to note that the wind-



ing must be put on in two parts and joined at the centre, as it is only possible to wind "up the hill." The winding should be started at each end and continued upwards (inwards), and the two ends then soldered together and tucked inside.

ovamono

Dielectric Constant of Mica

I N an article in the "Physical Review," J. R. Weeks, Jnr. states that for samples of mica, without visible air films, the dielectric constant ranged from 6.4 to 9.3. For sheets having air films the values were from 2.9 to 5.6. Sheets split from the sample which had given the value 2.9 were measured and the results varied from 6.6 to 8.4. Similar experiments confirm the belief that the low results are to be attributed to the presence of air. This probably explains the reason for the wide divergence between values of the dielectric constant of mica given in handbooks.

A Loud-speaker for Eight Shillings

WHY do loud-speakers cost so much? portion of the horn where it begins to I have just constructed an instru- widen out. After several trials—soldering ment, for the modest sum of eight shil- of two aluminium surfaces being thought lings, which gives results quite equal to out of the question—a piece of rubber tube those obtained from factory-built loud- of sufficient size was slipped over the end speakers costing three or four pounds. of the horn and then rubber and horn and The basis of the apparatus is an ex-army ear-piece were tightly bound together with loud-speaker which was purchased from bare copper wire. The result is not beautian advertiser in AMATEUR WIRELESS for the ful to look at, but it answers. With three sum of seven shillings and sixpence. This stages of note magnification Paris time is an ear-piece with extra large diaphragm, signals can be heard all over the house, and came, I fancy, from a trench-set. It and London, Paris, Birmingham and Manis of 200 ohms resistance. The horn, pur- chester broadcasting really do "flood the chased at a second-hand store for three- room with music." There is very little pence, is an ordinary tulip-shape alu- distortion, which is probably due to the

The fixing of the horn to the ear-piece presented some difficulties. It is essential that there should be an air-tight connection, because the action of a loud-speaker effects arising from tight coupling in this of air between the diaphragm and that good design.

good design of the horn. Of course there must always be some distortion in a loudspeaker, apart altogether from that due to the note-magnifiers, because as the soundwaves broaden out in the horn they themdepends on setting in motion the column selves are distorted. This is reduced by ERNEST LANGMEAD.

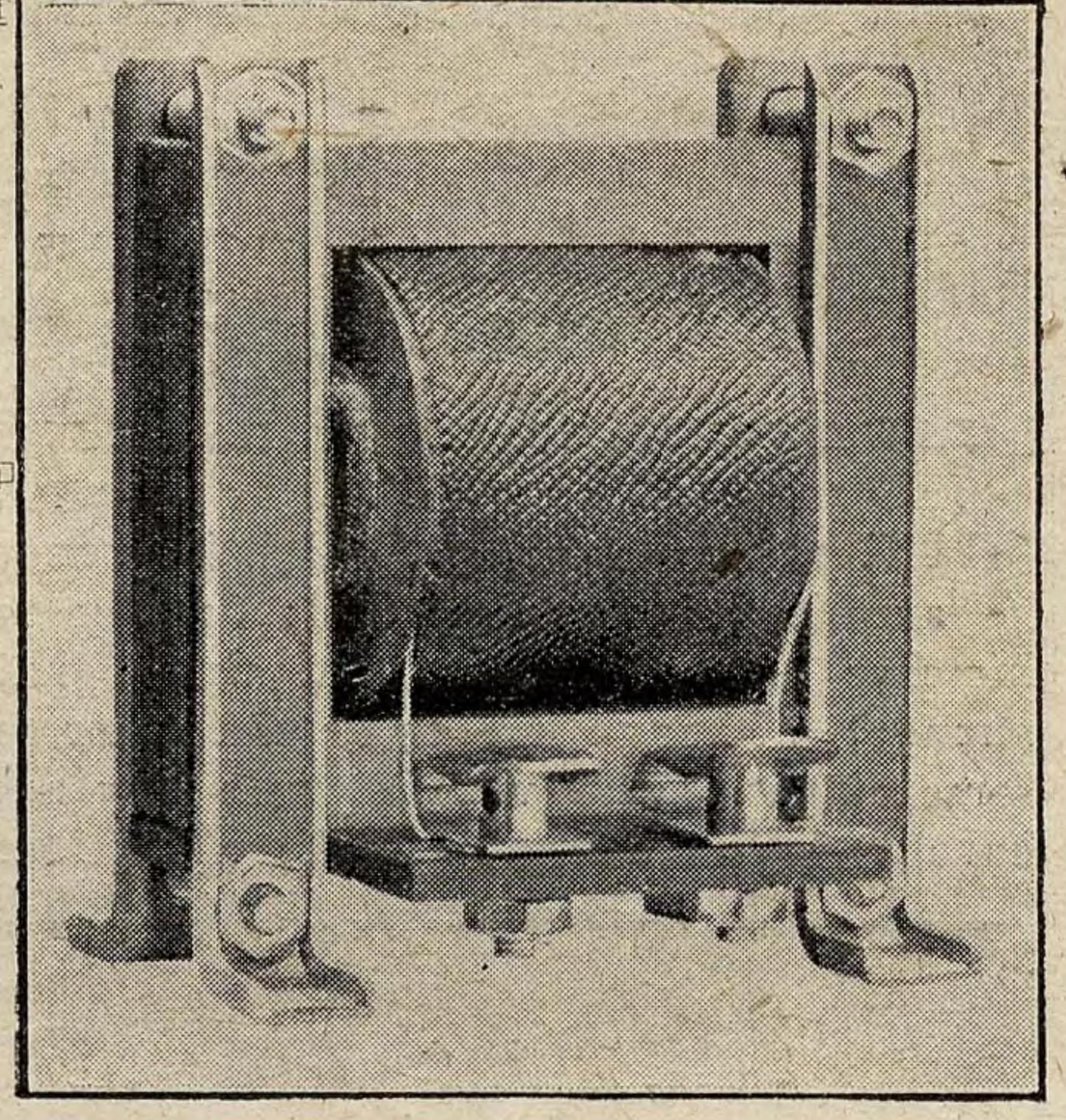
العالم والمراج والمر

Repairing a Low-frequency Transformer

OW many amateurs have thrown away low-frequency transformers as useless after they have given out!

One day whilst working on three valves, one H.F. and one L.F., I was interrupted by a scratching noise which rapidly grew in volume, succeeded by a loud final click and—silence. In fact, my L.F. transformer had ceased to function. At first I had visions of another fi going on a new transformer, but I thought that I would a 1.5 volt battery and a pair of phones.

the secondary is O.K. I repeated the test with the primary, but no loud click. Subsequently I found that the primary windings had gone where the wire was started next to the iron core. As the wire is finer than hair I did not see how I could find the break, so with a small penknife I scraped away a little insulation from the visible portion of the wire nearest to the core, and with resin-cored solder soldered a length of fine copper wire on. I then have a look inside first just to see what tested with the phones and battery once could be done. First I connected the more, using the new piece of wire as one secondary of the transformer in series with terminal and the outside lead of the primary as the other. A welcome click A click was heard in the phones and was heard, which proved that I had estabanother upon disconnecting, so, I thought, lished connection again, despite the fact nals with a roar and rattle. A. G. W.



Low-frequency Transformer. (Igranic Electric Co., Ltd.).

that there were probably several dozen turns lying idle. The next thing to see was-would it work. I connected up as usual and switched on. In came the sig-

IN the last article mention was made of the rate at which electrical vibrations are set up in a transmitting aerial. This is commonly referred to as the "frequency" of the vi-

brations, or of the wave which they produce. This wave travels through space at the same velocity as light. There is, in fact, a great deal in common between wireless waves and light waves, although you can "see" one and not the other. One thing, for instance, which they have in common is their speed. They both travel at the enormous speed of about 186,000 miles per second! Moreover, that speed does not vary for different kinds of light waves (giving rise to the sensation of "red" or "blue" or "green," for instance), or for different kinds of wireless waves-"long" or "short" waves as they are called.

"Vibrating" the Aerial

Now it is not a very difficult thing to imagine this wave motion being set up in the space surrounding a transmitting aerial. We know what a wave on the sea looks like: a series of hills and hollows, ups and downs, and we can depict a wireless wave similarly. If you make a point on a sheet of paper with a pencil, and then from it draw a "waggly" line across the page, you may make these represent the transmitting aerial and the wireless wave set up by it when it is vibrated electrically. Now the hills or crests of this wavy line must be a certain distance apart, and this distance is usually called the wave-length. It may be defined as the distance between any two successive crests.

If the aerial is vibrated very quickly the successive crests of the resulting wave

Notes for the Novice.—III

Some Simple Definitions

will be very close together—that is, the wavelength will be small. If the aerial is vibrated more slowly the crests will follow each other at longer intervals that is, the wavelength will be longer. In other words, the greater the frequency the smaller the wave-length. This can be demonstrated quite easily. Assume that the wavy line runs from the pencil point to the edge of the paper and that there are 1,000 wave crests in this distance. If, now, you superpose on this another wavy line having only 500 crests extending over the same distance, it will be obvious that the distance between the latter crests must be twice the distance between the former. That is, when you halve the frequency you double the wavelength. Similarly, if you double the frequency you halve the wavelength, and so on.

Wavelength and Frequency

Suppose you want to set up a wireless wave having a wave-length of one mile. Well, since the wave, whatever its length, will travel at a speed of 186,000 miles per second, it follows that you will have to vibrate your aerial at a rate of 186,000 times per second in order to do so. Or, again, if you want to transmit on a wave of half a mile length you will have to vibrate your aerial at twice the former rate, that is, at 372,000 times per second. This can be expressed as a general law by

saying that frequency = \frac{180,000}{\text{wave-length.}}

In working this as a formula, of course, the wavelength must be expressed in miles. In practice, however, it is more customary to calculate wavelengths in metres or feet.

It is also customary in practice to speak of "oscillations" instead of "vibrations." Instead of saying that you "vibrate" the aerial at a certain "rate," the phraseology of wireless ordains that you should say that you "oscillate" it at a certain "frequency."

Maintaining Oscillations

When you vibrate, or oscillate, an ordinary violin string you must take care that it doesn't come into contact with anything. If you touch it with a stick, or a book, or your finger, it will cease to oscillate. You must protect or shield it from anything which would tend to prevent it from oscillating. The same is true with respect to an aerial in which you want to maintain oscillations; it must be shielded from anything which might prevent it from oscillating also. This is usually referred to as "insulating" the aerial. "OLD HAND."

Whilst listening-in to an American broadcasting station, Mr. J. E. Samuel, of Aberystwyth, distinctly heard the clapping of hands of people in the room when an orchestral item was encored.

The directing of aircraft by ordinary wireless means is said to be giving better results than the system of transmitting signals from a cable laid along the line of route.

High-frequency Amplifiers

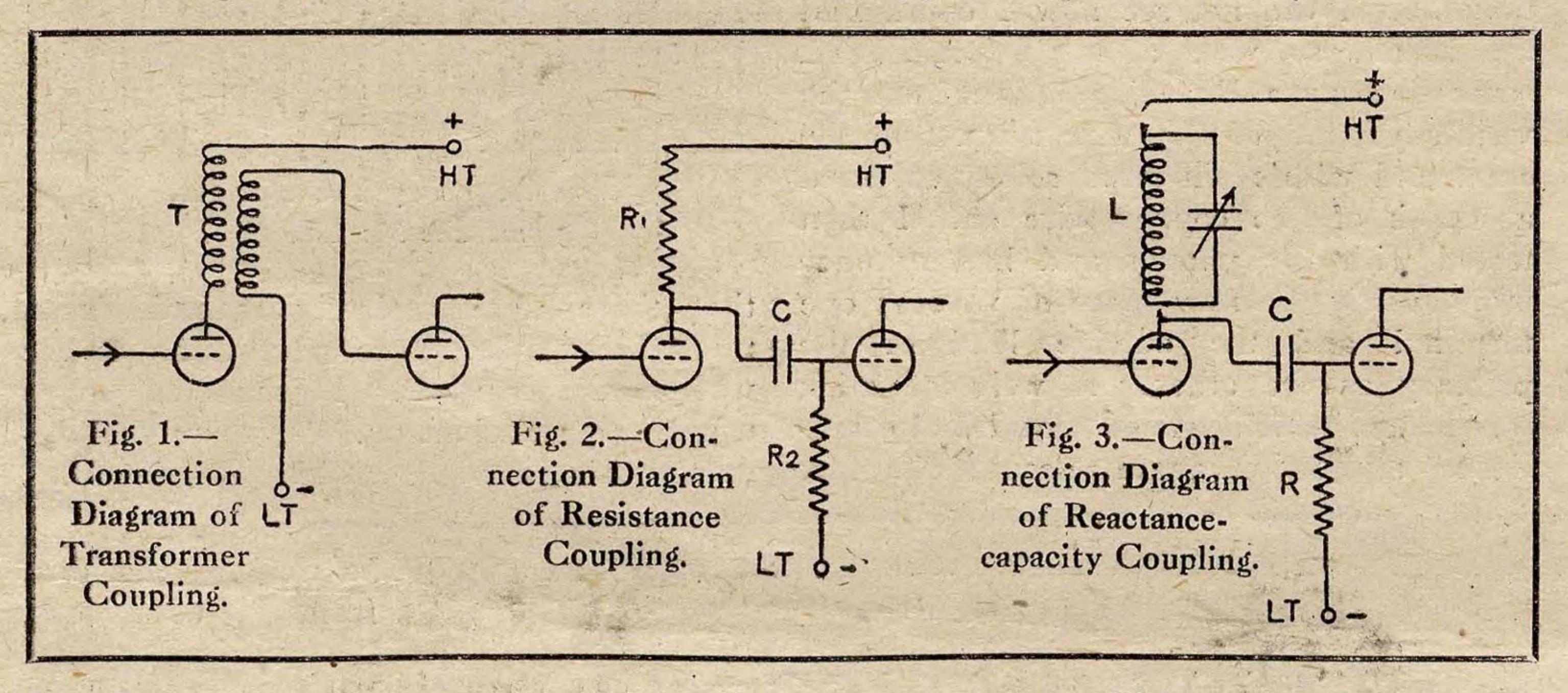
Transformer-coupled :: Resistance-coupled :: Reactance-capacity Coupled

THE object of using a high-frequency fix into valve holders so that they may the anode circuit. In the resistanceincrease the range and not the signal some extent. Very weak signals may not have enough energy to make a rectifier

listening-in.

strength, although it does do the latter to Owing to the number of transformers required for receiving on all wavelengths this type is expensive to buy and trouble-

amplifier in a receiver is usually to be changed easily and quickly when coupled type these currents do leak away a little, and if the resistance is raised there is not sufficient voltage on the anode for the valve to function properly. The inductance, however, has a fairly small direct-current resistance.



function, and so they are not heard at all. If by means of a high-frequency amplifier these signals are magnified before reaching the rectifier, then they will have enough energy to make themselves wavelengths, and signal strength is nearly audible.

Types

There are three types of high-frequency amplifiers in common use: (1) transformer-coupled, (2) resistance-coupled, and (3) reactance-capacity-coupled. They all magnify signals before they are rectifrequency which corresponds to their denser may be of about .0002 mfd. capawavelength. This is why they are some- city and R2-about 2 megohms. This type fiers of rectified signals called "audio lengths below about 1,000 metres. frequency amplifiers" or "note magnifiers."

Transformer Coupling

In the first type the magnified radionext valve, which may be another high- the exact wave-length of the incoming frequency valve or a rectifier, by means of a transformer. This is connected up may be .0002 mfd. and R about 2 in the same way as a low-frequency transhigh-frequency transformers have no iron coupled to the inductance L to produce core.

As the frequencies of incoming signals vary so greatly over even a small band

some to make. When properly designed, however, they give very good results. If wound with resistance wire the transformers cover a slightly larger band of as good. Some experimenters say that these transformers do not "transform" at all, but have an entirely different action.

Resistance Coupling

The second type makes use of a resistance in the anode circuit, as shown in Fig. 2. This resistance should be as large fied, and it will therefore be understood as possible for the H.T. voltage and is that the magnification takes place at the usually about 50,000 ohms. The contimes called "radio-frequency ampli- is not quite as efficient as the transformerfiers," to distinguish them from ampli- coupled type, and is of no use on wave-

Reactance=capacity Coupling

The reactance-capacity type is the most efficient and the most popular with experimenters. The connections are shown frequency impulses are conveyed to the in Fig. 3. The inductance L is tuned to signals. The grid coupling condenser megohms. The advantage of this type is former and is shown in Fig. 1. These that a reactance from the rectifier may be beats for C.W. reception, without radiation.

The principle upon which it works is as of wavelengths, one transformer will follows: Although any inductance has only be suitable for receiving signals be- some resistance, when tuned to a certain tween certain limits of wave-length. It wavelength it has an infinitely high reis therefore necessary to have a set of sistance to currents at that frequency, and transformers, each wound with different in the case of an amplifier all the ampliamounts of wire, for receiving over a fied impulses pass to the grid-coupling large range. They are usually made to condenser and do not leak away through

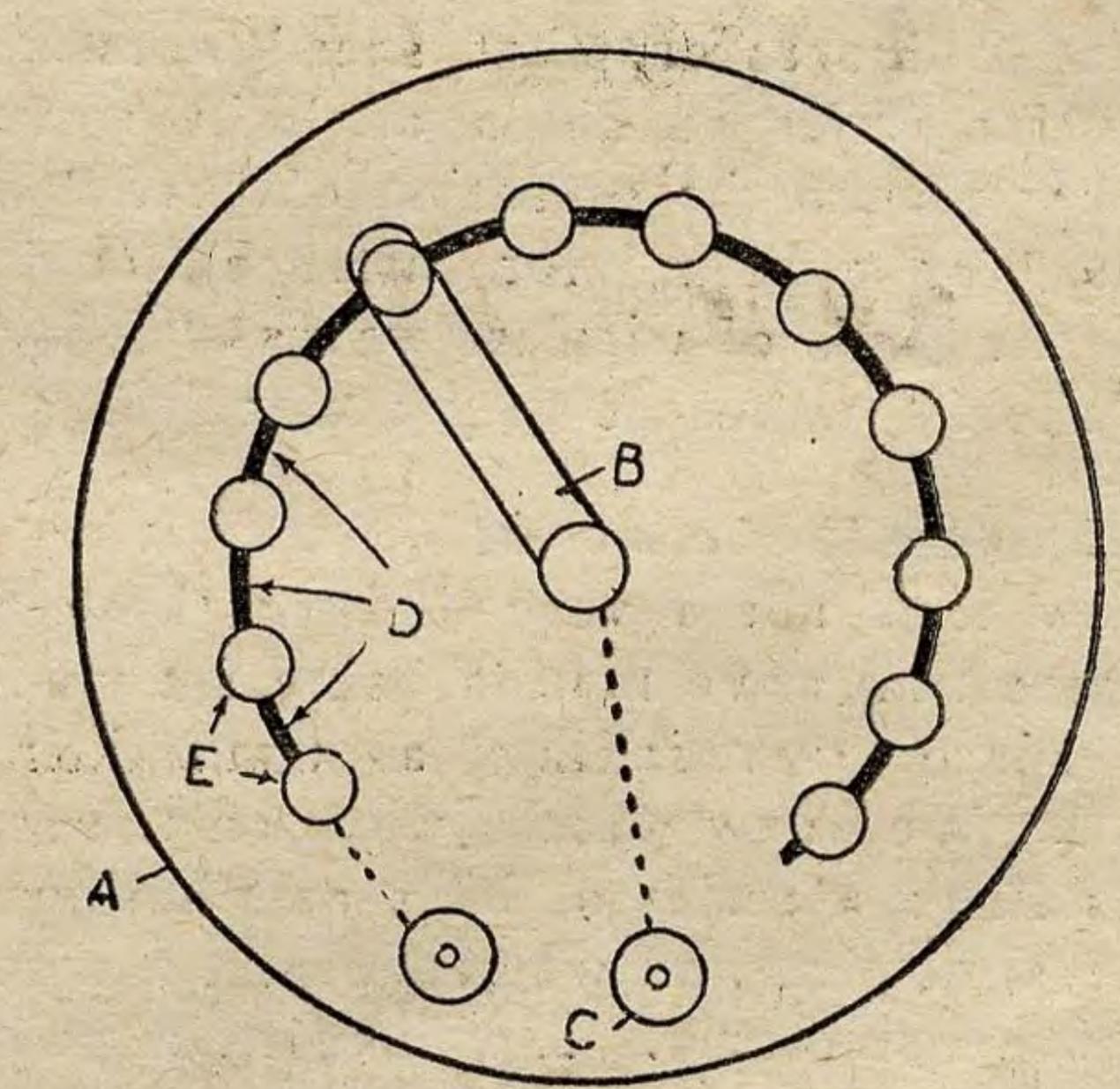
Oscillation

All types of high-frequency amplifiers are liable to self-oscillation and howling, due to an excessive negative charge on the grid or grids. This can be overcome by connecting all the grids in parallel and taking a lead to a potentiometer, so that they may all be given a small positive charge if necessary. The potentiometer is placed across the accumulator. The inductance for a reactance-capacity type amplifier may be a basket-type coil, with a tuning condenser of not more than .0003 mfd. capacity. As with the transformer type, different coils will be needed for different wavelengths, but they are easier and cheaper to make than transformers. RADION.

000000000

Variable Grid-leak

HE accompanying sketch shows an idea for a variable grid leak which works very well. As will be seen, it consists merely of a circular base which may be ebonite or fibre, on which is mounted a switch arm that is connected to one of the



Variable Grid-leak

terminals c. The leak D is an indian inl line and contact is made to it by the contact studs E which are screwed down tight. The farther round the switch arm is placed the longer leak is placed in circuit. The first contact stud, of course, is connected to the other terminal. H.R.

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Crystal Detectors on Ebonite. Well made, two designs. 2/6 (by post, 3/3) and 3/3 (by post, 3/9). And they are worth it!

Crystal Detector. Dust proof, glass covered, horizontal type. Very handsome design; our own pattern. 4/6 (by post, 5/3).

Detector for Two Crystals. Horizontal type, thoroughly well made. (Some people ask 19/6 for the same design!) I am sure you will be satisfied to pay 4/= (by post, 4/9).

Grid Leak and Condenser, .0003. Absolutely perfect in design and quality. It is not cheap, but does the work. Price 3/9 (by post, 4/3).

Our 5-piece Terminals beat the world. 1d. each (no post orders at present).

Terminals, with hole for telephone leads. Beautifully finished, complete with nut and washer. 2d. each (not less than I doz. sent by post, price 2/6).

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Terminals. Extra good quality, small size, 4 B.A., W.O. pattern. 8 for 1/= (by post, 1/4).

Terminals. 4 B.A. Small, round pattern, pretty design, with nut and washer. 8 for 1/= (by post, 1/4).

Very Large Terminals. Superb quality. 2 B.A. Complete with 2 nuts and 2 washers. 2 for 8d. (by post, 1/=). I can supply you with Terminals, various designs, all really good and cheap. No rubbish supplied.

Intervalve Transformers, low frequency, 5-1. On approval. 14/= (by post, 15/=).

Ebonite Dials. 0-180. Bored in centre. 1/= each (by post, 1/6).

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Fixed Condensers. First-class value, .0003, .0005, .001, .002, .003. Scientifically constructed. 1/3 each (by post, 1/6); also .004, 1/6 (by post, 1/9). These are with terminals on ebonite.

Slider Knobs and Plunger. 4d. (by post, 7d.). Slider, knob and plunger, with 13 in. brass rod. The lot, 7d. No post orders accepted.

Oojah Basket Coils, 7 in set, 5/= (postal supplies uncertain at present). H.T. Batteries. 30 volt, 6/= (by post, 7/6). H.T. Batteries. 60 volt, 12/= (by post, 13/6).

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H, S. PETTITT, 37, Robertson Road, BRIGHTON. 10/1/23. "Received Condenser parts to-day, and they surpass all my expectations."

SAMUEL LOWE, 22, Noble Terrace, GATESHEAD-ON-TYNE. 30/12/22. "The Condensers received by me were first class and people would not believe me when I told them the price." | denser value on the market."

R. H. FEUSTER-RUSSELL, 21, Hadlow Road. TONBRIDGE, Kent. 11/1/23. "... I consider them the most remarkable Con-

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ITOW can I charge my Accumulator at home? Instead of buying Coils, can I wind my own? How can I receive louder speech and music?

you don't miss Nº1

The answer to these and scores of many other similar questions will be found in No. 1 of the new monthly "Modern Wireless." If you don't need the information at the moment, you are quite likely to want it later—therefore, if you are wise, you will keep every number handy for ready reference.

But be sure that you start with No. 1, so that your files will be complete.

Every month "Modern Wireless" will consist of over 100 pages (in No. 1 there are 112 pp.) of informative and dependable articles from the pens of the best known Radio engineers and experimenters. If you wish to keep abreast of the wonderful developments that are daily taking place—you must take care not to miss a single issue.

Owing to the huge demand, there was some little delay in getting No. 1 out to time.

Edited by JOHN SCOTT-TAGGART, F.Inst.P., assisted by E. REDPATH and PAUL D. TYERS. and published on the 15th of every month. Sold by all Booksellers and Newsagents and published by

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- 1. "Northolt."
- 2. "Receiving Radio Signals from Electric Lighting Wires."
- 3. "The Transmission of Wireless Waves."
- 4. "A 4,000-mile Receiver."
- 5. "A Two Valve Broadcast Receiver." 6. "Valve Receivers Employing Crystal Detectors."
- 7. "An Experimental Station at Gerrards Cross."
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- 9. "A Simple Winder for Wave-wound Coils."
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- Conduct It." 20. "Directional Wireless."
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Oh Cou Wavelenek!

Broadcast Opera

Amateur Telephony

Short Waves

America are being picked up by

to hear Transatlantic transmissions, and lies largely with them. now they are picked up quite regularly by dozens of people. The truth is that until the possibility of hearing Uncle Sam's wireless voice was known not one owner of a wireless set in a thousand ever thought of tuning in the short wavelength at 2 ak emma. There is a certain amount of commercial and shipping work on 300 metres, but otherwise there is nothing to hear. Then until last summer the number of valve receiving sets in use in this country was a very small one indeed. It grew rapidly as the summer waned, and with the departure of the hot weather, atmospherics, which are particularly bad in America, ceased their usual spoil-sport antics. Winter nights are especially favourable for wonderful results.

But there is another point which is most remarkable—the more aerials there are in use for reception the better is our chance of picking up faint and distant transmissions. Even when the set is so perfectly controlled that it causes interference with no one else it is radiating weak waves which exactly correspond to the oscillations that it is receiving. Hence if two sets are working on the same wavelength within a fairly short radius their aerials will influence one another just as do the secondary and reaction coils of the set, each "boosting up" the signals received by the other. This "aerial reaction," as we may call it, may become one of the most important factors in wireless, for in the future stations may be designed to take full advantage of the interaction of twin or triple aerials.

Amateurs, though eclipsed to some extent by the prevalence of broadcasting, are by no means so silent as some correspondents imagine. If you care to tune long the promised improvement in the relapsed into blushing confusion.

DEPORTS con- that all our old friends are still very much orchestra, now, we tinue to come in evidence; 2 J Z, 2 L Z, 2 O D and 2 O N, in that telephonic for instance, transmit on most evenings, transmissions from and they are by no means the only ones.

amateurs in all It used to be thought that short waves parts of the travelled badly, but now that telephony country. The most surprising point has crossed the Herring Pond on a carrierat first sight is that these messages wave of 360 metres, we must revise our had never been heard until about two ideas a little. Most of the London amateurs months ago; then one observer who was are heard regularly in Paris on quite small working on short waves in the small hours receiving sets, and many of them are was amazed at hearing items of a broad- picked up in places as far afield as Berne, cast programme from Newark, New Jer- Nice and Cadiz. The lower wavelengths sey. Almost at once other wireless men are coming into their own, and many enbegan to announce that they were able thusiasts hold that the future of wireless

A correspondent asks whether by connecting a potentiometer directly across the accumulator he will not be practically "shorting" it. Many people seem to have a similar doubt, and certainly the little coil of wire does look as if it would give the L.T. battery a fairly free passage for its current. Ohm's Law shows that the current passed is equal to the voltage divided by the resistance. Hence if a 200-ohm potentiometer is shunted across a 60-volt accumulator the current passing is only 6/200th of an ampere, or 30 milliamperes, which is so small that we need not worry about it. At the same time a switch should be provided to cut out the battery, otherwise much of its "juice" will eventually leak away.

The President of the Sheffield Wireless Association, one of the most go-ahead in the North, has been bringing home to the members the iniquity of condition No 2 of the broadcast licence. Admittedly the new P.M.G. takes a wide view and grants experimental licences to most of the serious applicants for them; still this does not alter the fact that a monopoly has been established, and monopolies are seldom satisfactory things except for those that own them. Mr. Lloyd, in his address, pointed out that when 1,000,000 wireless sets were in use the Broadcasting Company would have a revenue of £,250,000 a year from licences alone, to say nothing of the royalties charged on complete sets and on parts. The whole position is unsatisfactory and calls for united and decided action on the part of wireless associations.

It is to be hoped that we shall see ere down to about 200 metres you will find quality of broadcast programmes. 2 LO's

believe, a permanent feature, is most pleasant to listen to, but some of its items do not seem well suited ! for broadcasting

and the L.T. Battery

Licence Clause No. 2

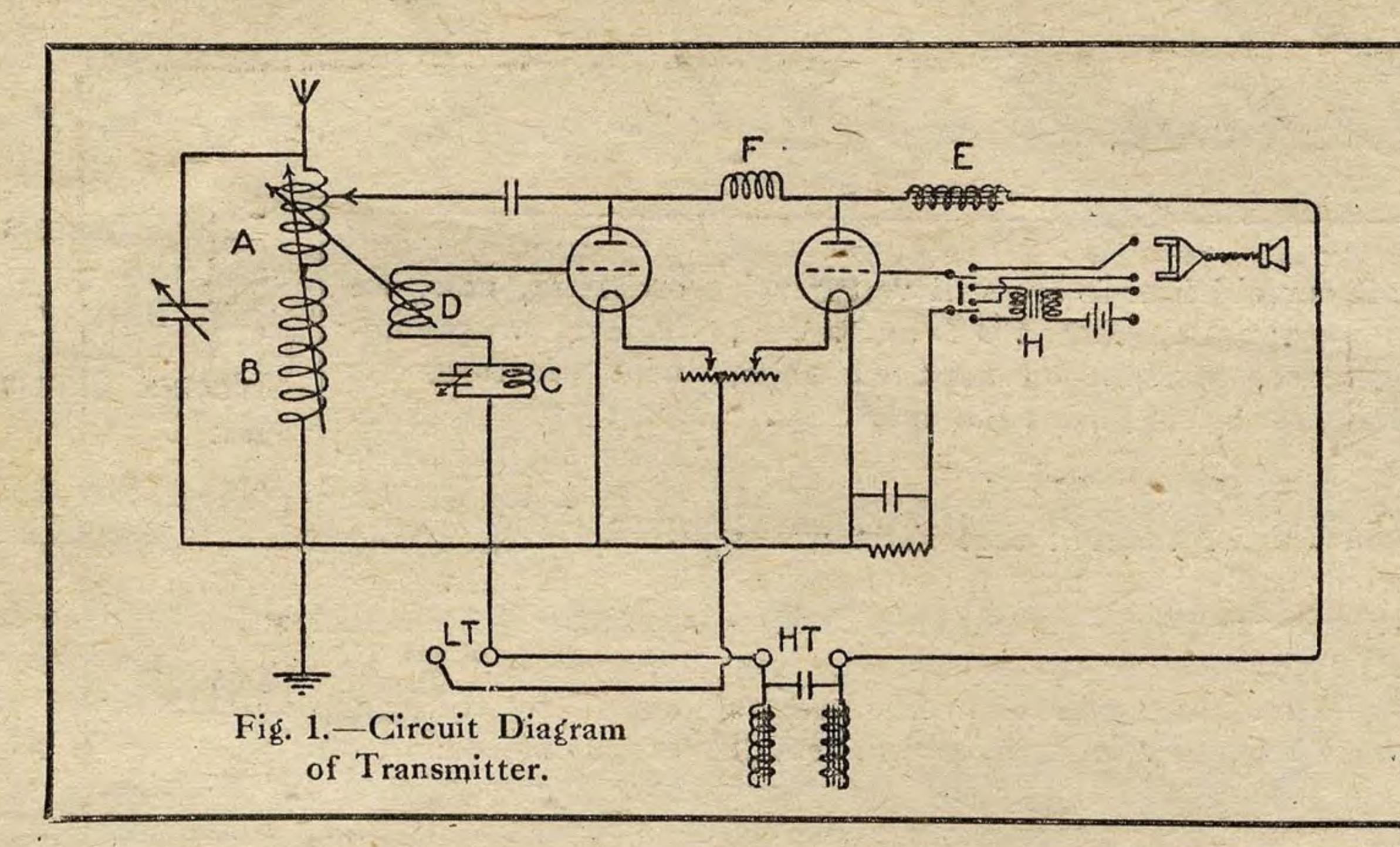
The Hello Girl

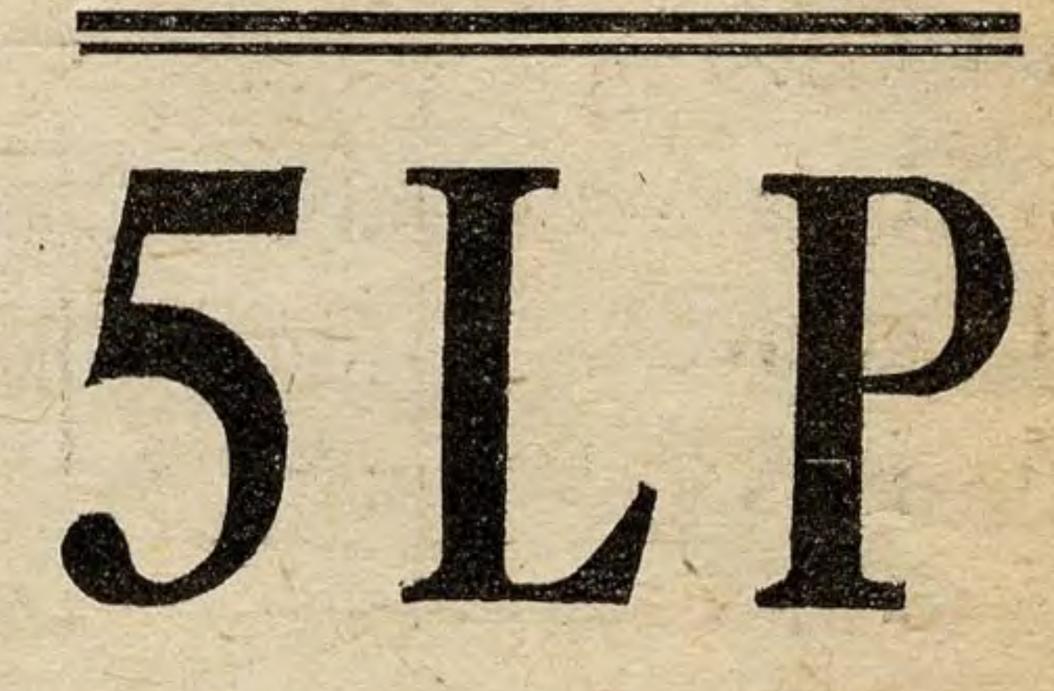
purposes. An occasional lecture on wireless subjects by an expert would be welcomed by thousands of enthusiasts. The gramophone and the pianola should be barred out as wireless "turns."

As I write it seems as if these pious aspirations are likely to be fulfilled, for the loud-speaker in the next room is delivering in the most delightful manner Mozart's "Magic Flute," transmitted direct from the Royal Opera House, Covent Garden. There was a slight delay in starting, then 2 LO announced "switching over to Covent Garden." Came a rather indistinct sound of the scraping of fiddles mingled with toots on the flute and with other more or less pleasant noises. It was the orchestra tuning up. (This, by the way, was the only part of grand opera that appealed to the late Shah of Persia.) A sudden silence, then an outburst of applause as the conductor took his place, and next moment the overture was in full swing. The effect of a salvo of hand-claps is most extraordinary if you are close to the instrument or have the phones on your head, sounding rather like strong atmospherics, but at a little distance you can almost imagine yourself in the theatre and you can hardly resist adding your own enthusiastic applause. The solos and the choruses are coming through to perfection. There was a little fading at the very outset, but no such effect is now noticed. The signal strength is only a trifle less than that of 2 LO's own transmissions, which, considering the size of the Covent Garden stage, is remarkable. The success of this experiment in broadcasting (and it is a very real success) marks the opening of an entirely new era in wireless. The B.B.C. has promised us future operatic programmes, and there is little doubt that in the future we shall be able to hear plays from the theatres, services from the great churches, and even speeches made in both Upper and Lower Houses of Parliament.

The telephone girl was listening-in for the first time. "Hello! Hello!" called the headphones. "Number engaged," she said automatically, then

THERMION.





An illustrated an amateur equitting and recommitting and recommitting of Mr. L. of Golders Gr. N.V.

LP is the amateur station owned by Mr. L. W. Pullman, and located in Golders Green Road, London, N.W. Its transmissions are well known to most wireless enthusiasts in the London area, and on this account alone the photographs on this page will be of considerable interest. Mr. Pullman's interest in wireless began twelve years ago, and during the ensuing time he has built and scrapped no less than nine sets, and yet with the present apparatus he makes no claim to special efficiency, so who knows but that this may follow the rest, though assuredly it will be followed by another.

Transmitter

The present transmitter, which is to be seen on the top of the receiving cabinet in the protographs, is a modified ex-army C.W. Mark III instrument. The tuning coil has been rewound with fifty turns of No. 18 wire tapped at the 3rd, 5th, 9th, 11th, 13th, 15th, 25th, 35th and 45th turns. The ball-reaction coil is wound with

No. 28 wire and the variometer with No. 18. The circuit, which is shown by the diagram Fig. 1, is of the ordinary choke-control type. In the figure referred to A is a variometer and B the main aerial inductance. The tuned variometer is indicated at C and the reactance coil at D; E and F are choke coils. The microphone transformer is shown at H, and it will be observed that in connection with this is a change-over switch and also a plug to cut the latter out. The low- and high-tension batteries are indicated by LT and HT respectively. A feature of the choke is that the core is movable in order to make it possible to vary the effect produced.

High-tension Generator

One of the most interesting points about the transmitter is the fact that the high tension current is obtained from a hand-driven generator, made by Evershed and Vignoles, which produces a current of 20 milliamps. at 1,000 volts with the greatest ease. The use of this instrument

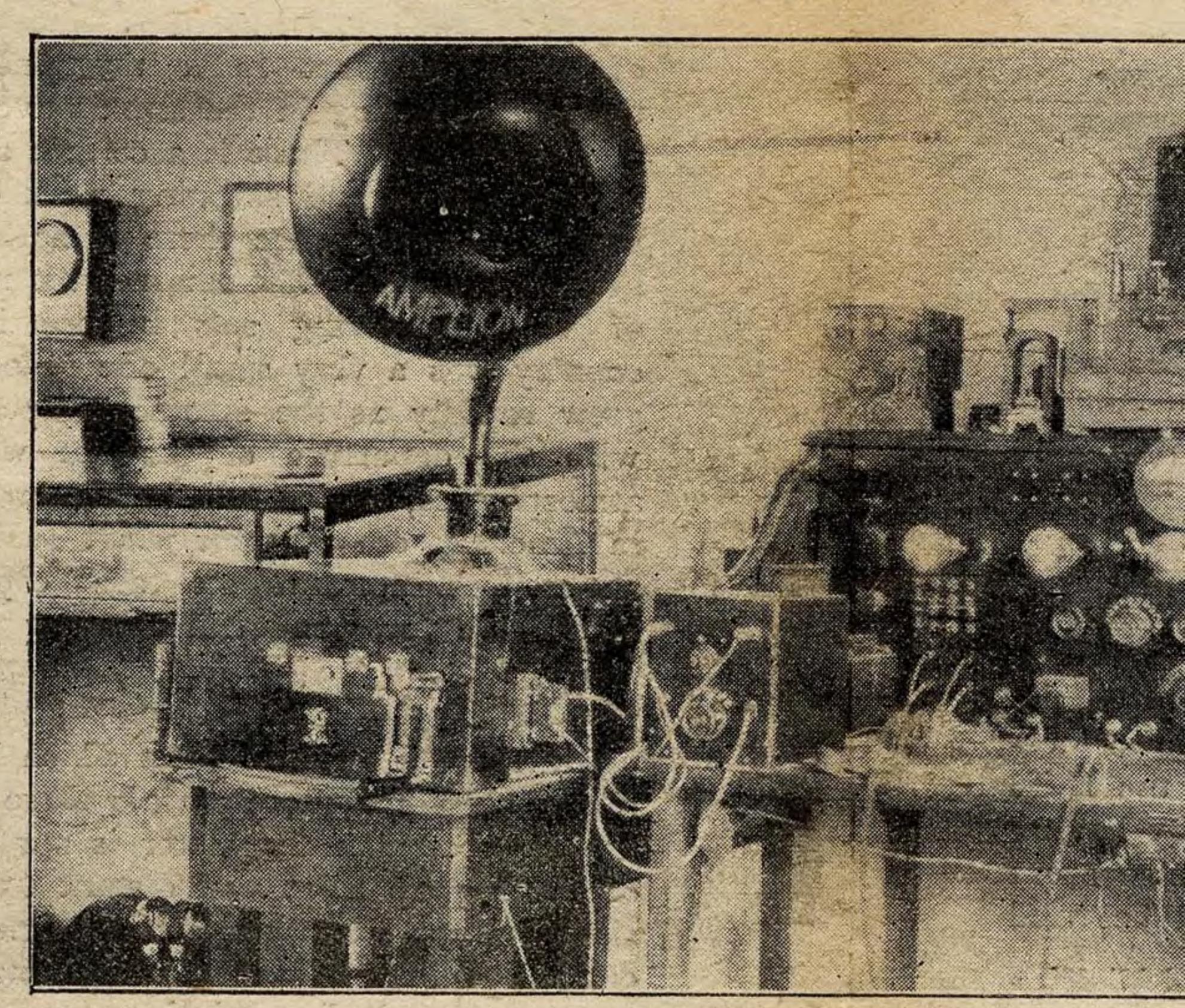
obviates the trouble and expense of a motor-generator or rectifier, and Mr. Pullman states that it gives excellent results.

Change=over Switch

Another point of interest is the changeover switch, which will be observed on the be seen on the leather the experimental cuit. The round the lightning arre

Receiver

The receiver is



Close-up Photograph of the Apparatus

REFERENCES

I to 5.—Valves. 6.—
H. F. transformer. 7.—
Three - way switch.
8.—Filament resistance for H.F. valve.
9.—Grid leak changeover switch. 10.—Grid
condenser. 11.—L.F.
transformer tappings.
12.—Filament resistance for detector.
13.—H.F. variable
tuning condenser.

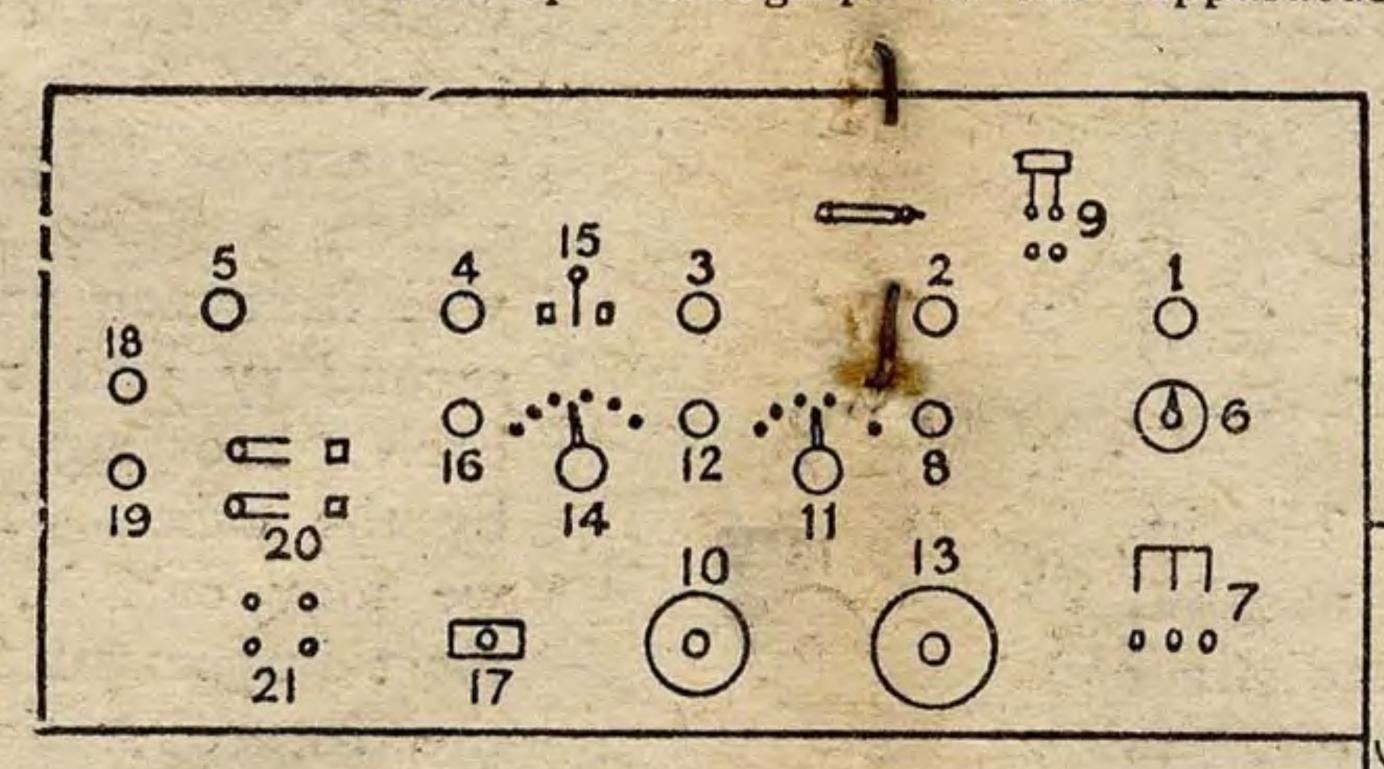
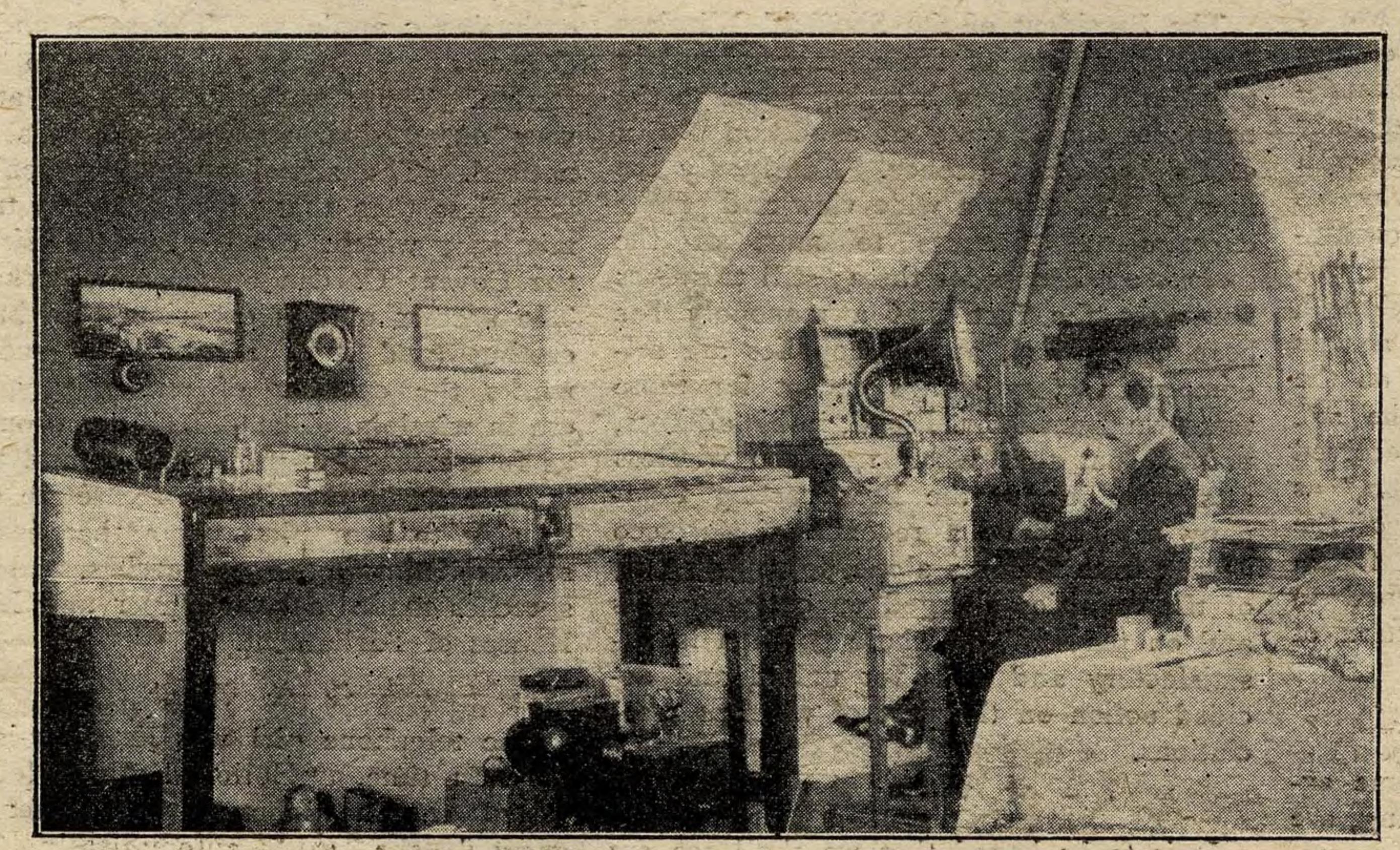


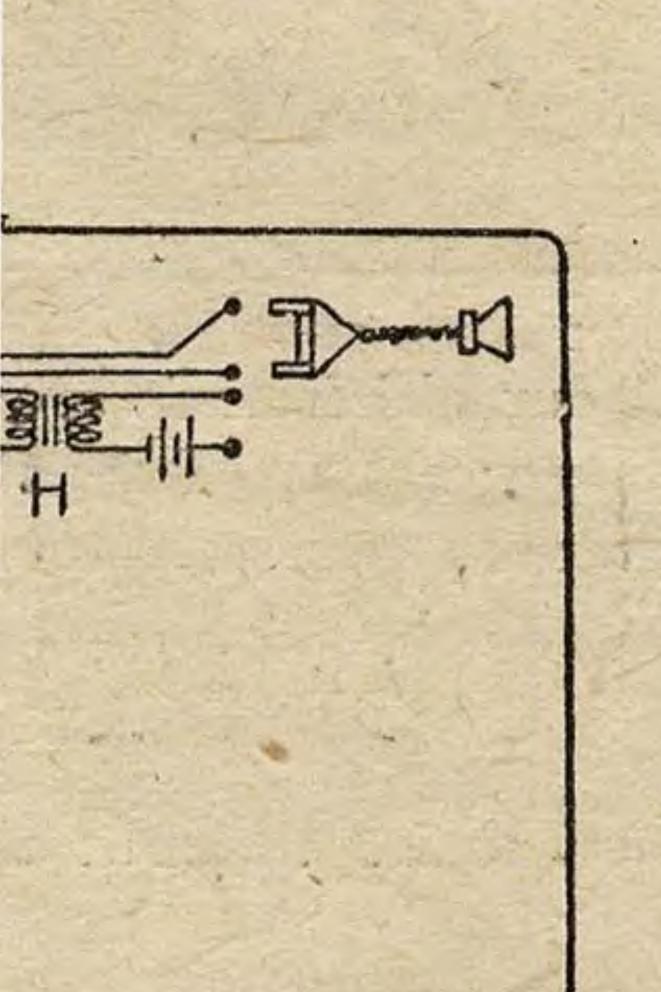
Fig. 2.—Key Diagram showing Disposition of Receivi

right of the transmitter. The switch is arranged to change over aerial, earth, and low- and high-tension positive and negative, so that when transmitting the receiver is dead. Pressure on the white button, to

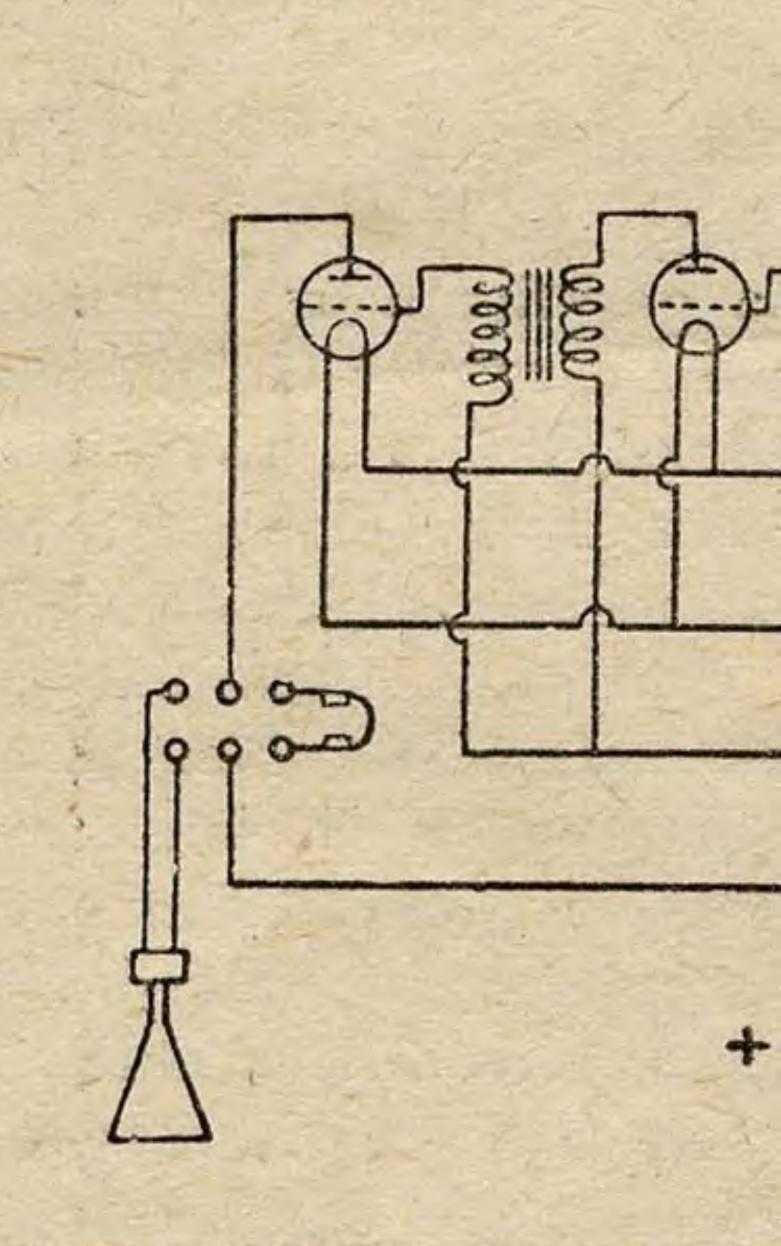
H.F., one detector The last three val of switches, can Armstrong super from which excell



General View of the 5 L P Wireless Den.



An illustrated description of an amateur-equipped transmitting and receiving station -that of Mr. L. W. Pullman, of Golders Green, London,



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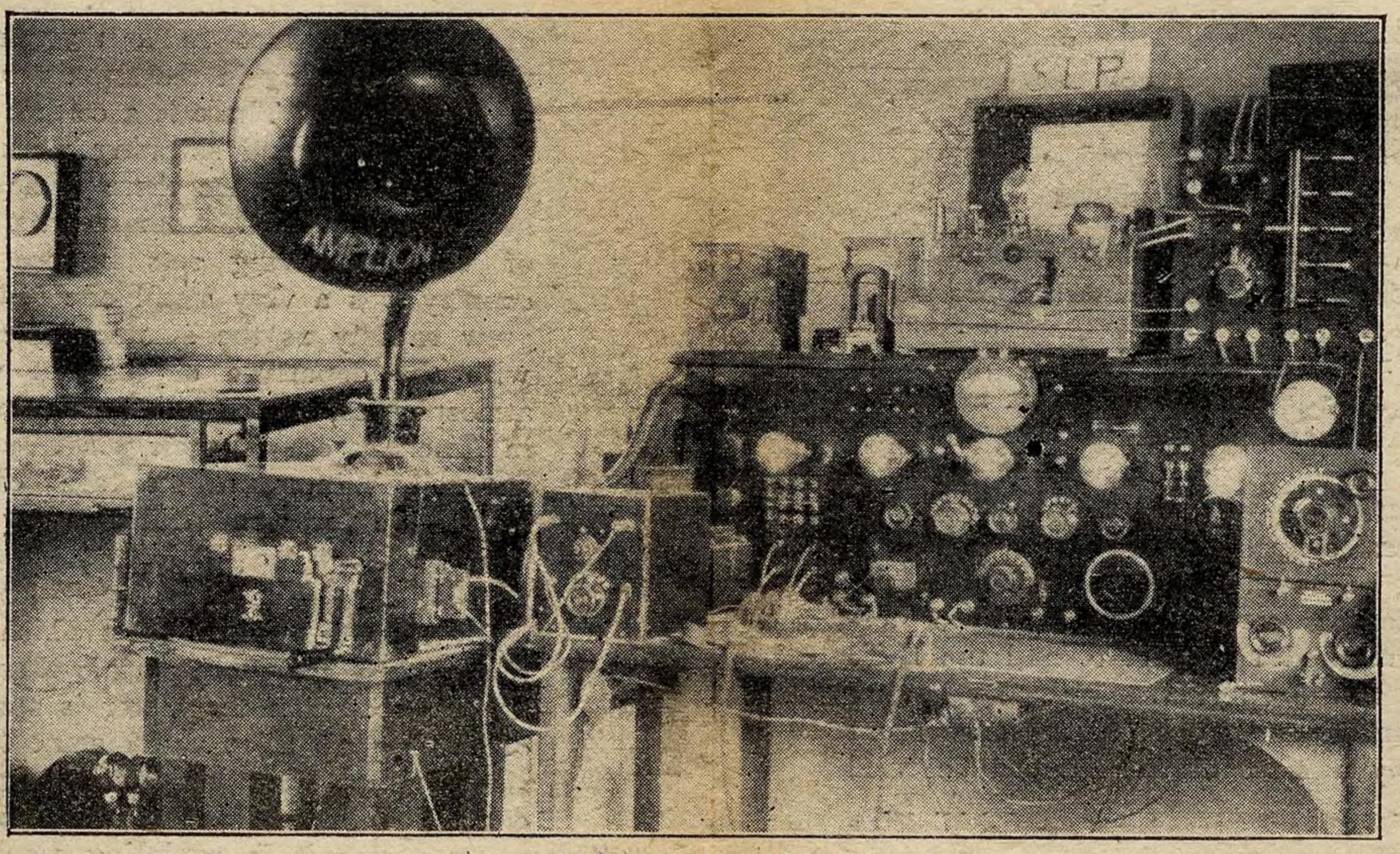
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obviates the trouble and expense of a motor-generator or rectifier, and Mr. Pullman states that it gives excellent results.

Change=over Switch

Another point of interest is the changeover switch, which will be observed on the be seen on the left of the switch, places the experimental artificial aerial in circuit. The round box just above contains the lightning arrester

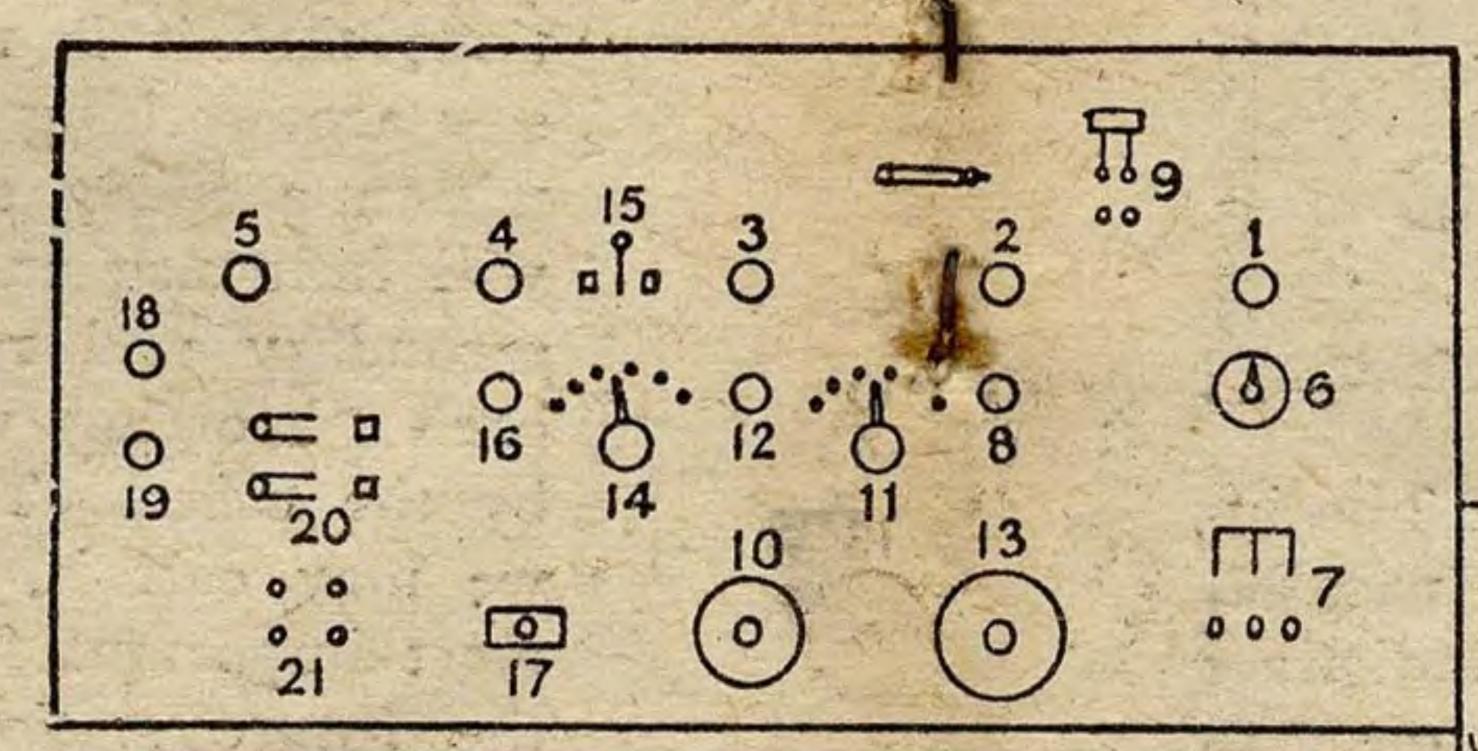
Receiver The receiver is a 5-valve set, having one



Close-up Photograph of the Apparatus

REFERENCES

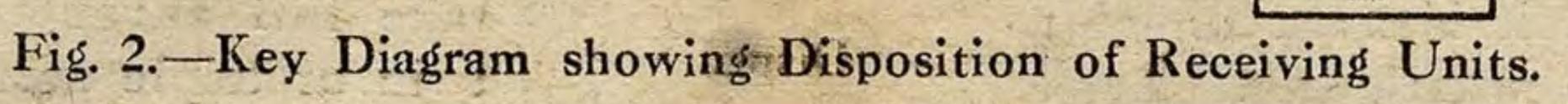
1 to 5.—Valves. 6.— H. F. transformer. 7.— Three - way switch. 8. - Filament resist. ance for H.F. valve. 9. - Grid leak changeover switch. 10. - Grid condenser. 11.-L.F. transformer tappings. 12.—Filament resistance for detector. 13. - H.F. variable tuning condenser.



REFERENCES

14.—Voltage variations on H.F. and D. 15.—Armstrong control switch. 16 .- Filam nt resistance for L.F. valves. 17. - Reactance-variometer condenser. 18.-Wavelength changing switch. 19.-Secondary

variometer. 20 .-Change-over switch to enable outside tuner to be used. 21. -Plugs for outside



right of the transmitter. The switch is arranged to change over aerial, earth, and low- and high-tension positive and negative, so that when transmitting the receiver is dead. Pressure on the white button, to

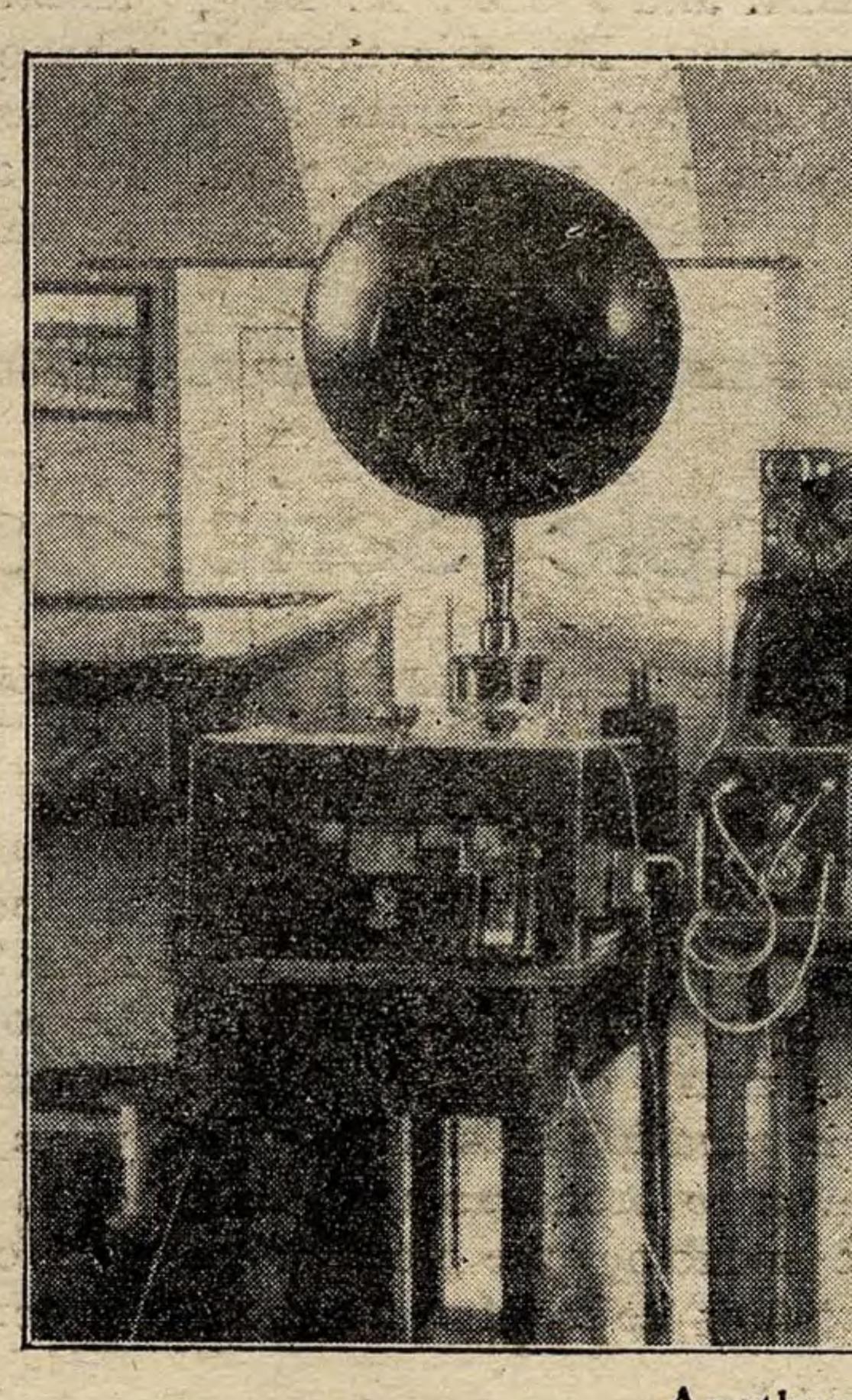
H.F., one detector, and three L.F. valves. The last three valves, by an arrangement of switches, can be converted into the Armstrong super-regenerative receiver, from which excellent results are obtained.

Receiving Valves

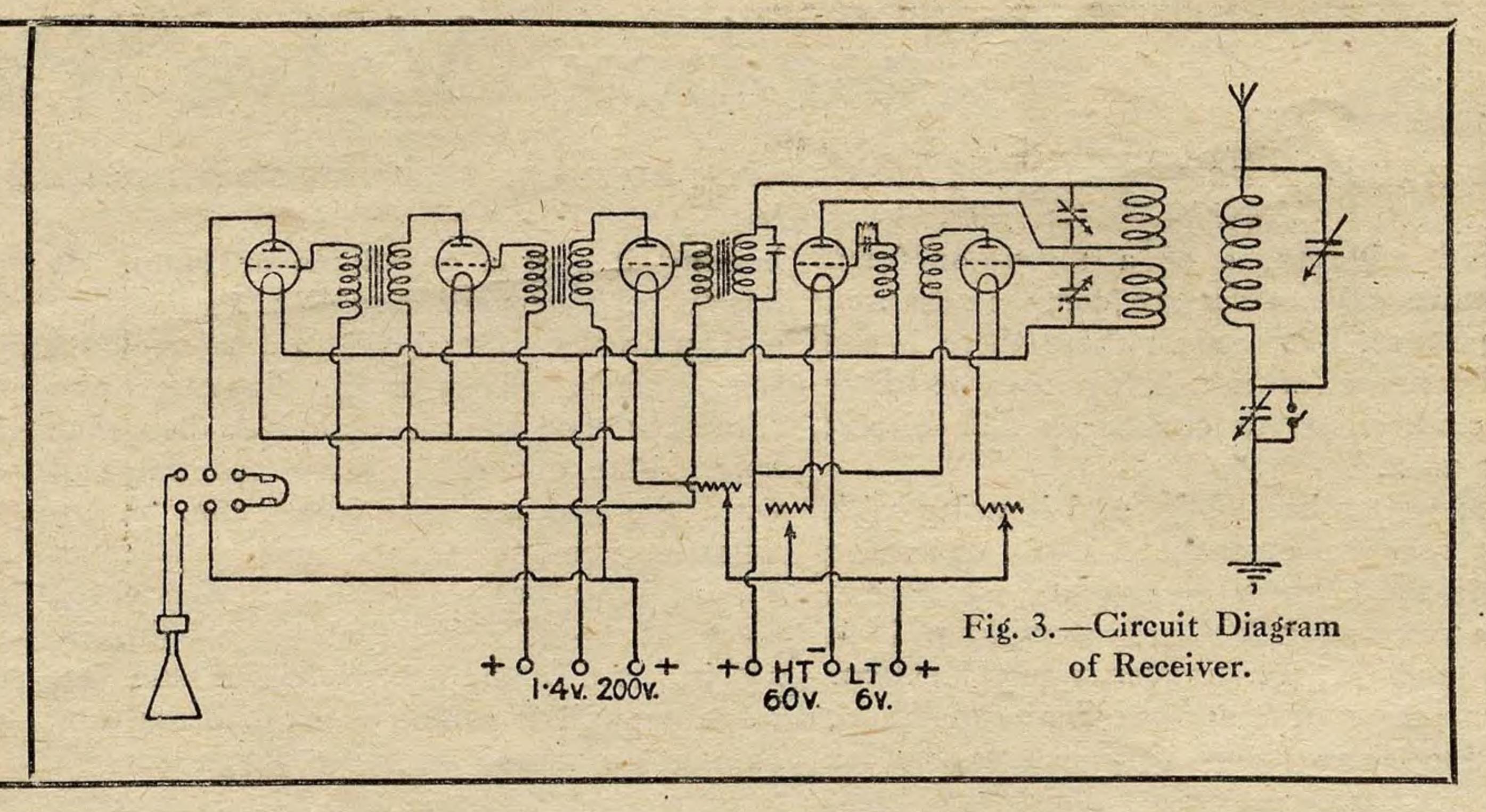
From right to left on the panel the H.F. valve with a H.F. varial transformer, and under this is th condenser. The next valve is the and above it and slightly to the double-pole switch is fitted which various values of grid-leaks to Below the detector valve there is variable condenser, and on the rig is a 5-way switch which controls pings on the first low-frequence former input.

Main tuning=Condenser

The main-tuning condenser is on the right front of the panel, ar arranged so that it can be operate junction with two vernier conde enable two telephony stations to b By the manipulation of the switch in the centre, either station can be to without re-tuning, even thou may be a difference of 100 metres wavelengths.



Another



of a Pullsults.

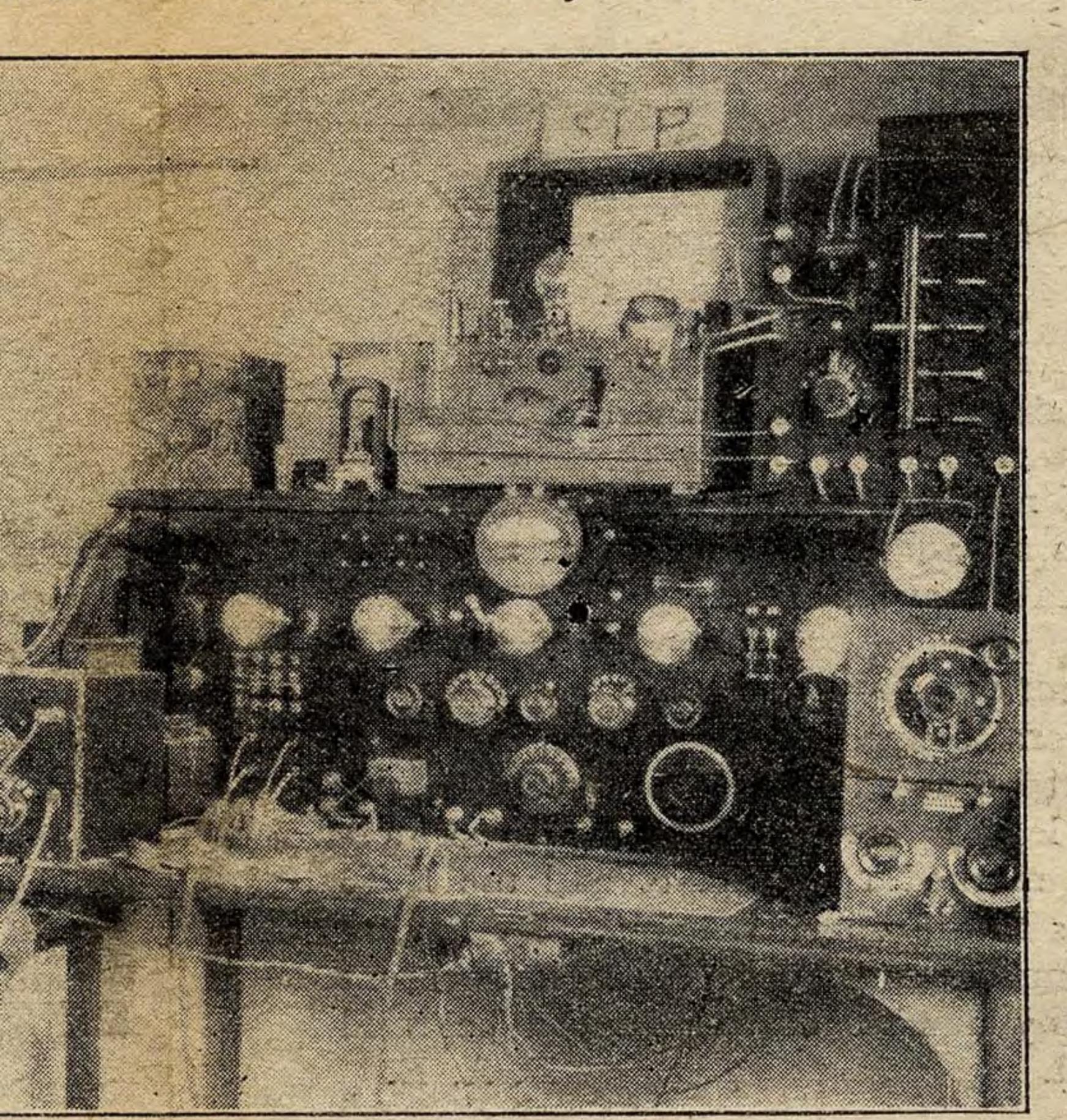
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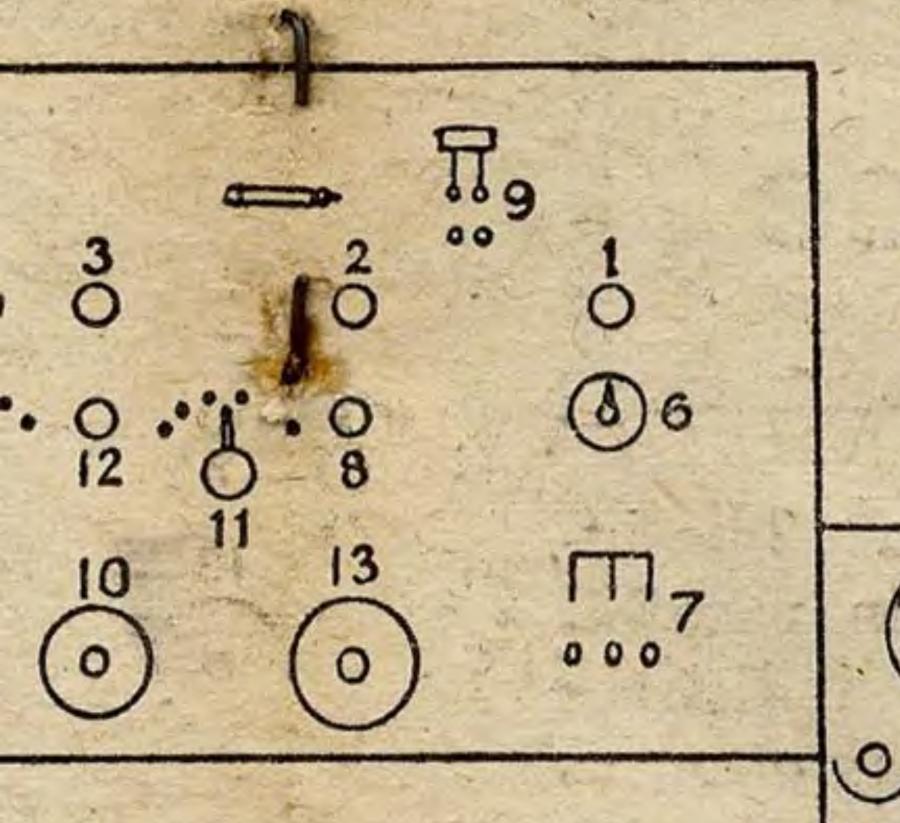
be seen on the left of the switch, places the experimental artificial aerial in circuit. The round box just above contains the lightning arrester

Receiver

The receiver is a 5-valve set, having one



Photograph of the Apparatus



REFERENCES

H.F. and D. 15.—Armstrong control switch. 16.—Filam-nt resistance for L.F. valves.

17.—Reactance-variometer condenser. 18.—Wavelength changing switch. 19.—Secondary

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Change-over switch
to enable outside
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—Plugs for outside
tuner.

howing Disposition of Receiving Units.

The last three valves, by an arrangement of switches, can be converted into the ceiver Armstrong super-regenerative receiver, on, to from which excellent results are obtained.

Receiving Valves

From right to left on the panel there is the H.F. valve with a H.F. variable-range transformer, and under this is the tuning condenser. The next valve is the detector, and above it and slightly to the right a double-pole switch is fitted which enables various values of grid-leaks to be used. Below the detector valve there is another variable condenser, and on the right there is a 5-way switch which controls the tappings on the first low-frequency transformer input.

Main tuning=Condenser

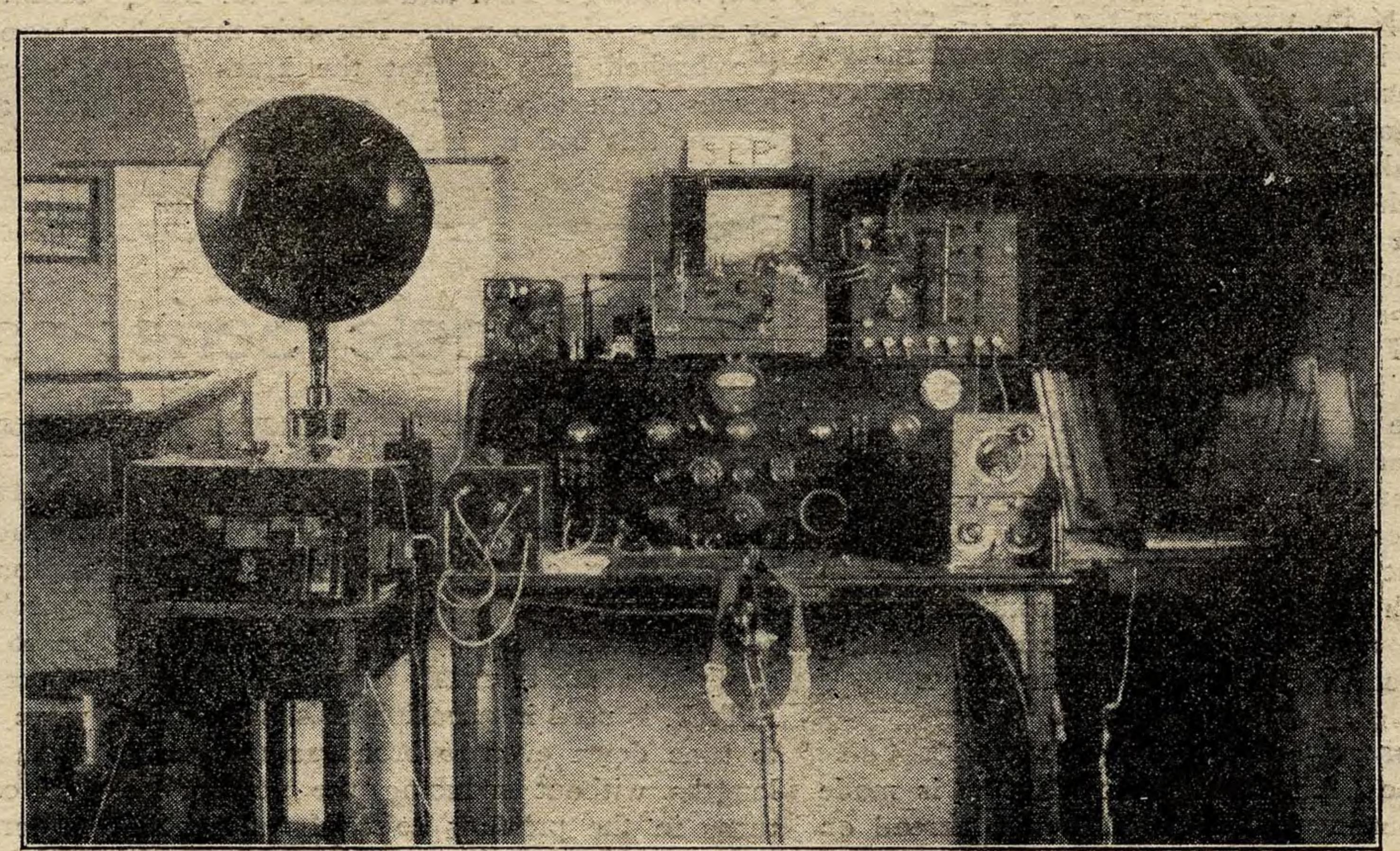
The main-tuning condenser is in a box on the right front of the panel, and this is arranged so that it can be operated in conjunction with two vernier condensers to enable two telephony stations to be tuned. By the manipulation of the switch, shown in the centre, either station can be listened to without re-tuning; even though there may be a difference of 100 metres in their wavelengths.

Wavemeter

On the top of the receiver and at the extreme left the wavemeter is to be seen, which is of the well-known Townsend type. In the glass-topped case, to be seen on the left in the photographs, is a stand-by set, which ordinarily is never used, being merely kept as a standard for reference.

All the wiring is carried out with 16-gauge wire, and all condensers are sheathed in metal cases with the latter earthed. Panels are coated on the back with tinfoil, the foil being cut away where necessary to clear parts; the tinfoil is also earthed. The same system is carried out with the low-frequency transformers, all these being placed in metal cases and earthed. The diagram (Fig. 2) with its accompanying references will make the disposition of the apparatus clear. A circuit diagram of the receiver is shown by Fig. 3.

Mr. Pullman considers method and neatness to be essential for really successful results to be obtained.



Another Photograph of the Apparatus.

Cigar-box Valve Panels

to be used.

THE advantages of a three- or four- heating it over a gas flame or lamp. It close to the other side of the ebonite. valve cabinet set are compactness and has to be done very carefully, as the fibre Brass or copper washers should be placed appearance, but against these there is the easily breaks. Bend the rod to make a on the rod on each side of the ebonite to disadvantage of not being able to alter semicircle of about 2 in. diameter, and ensure easy working. Connection to the the connections to enable another circuit then near each end make a 6 B.A. clearance moving arm is made by soldering a strip hole. File one side of the rod flat and of copper foil (about 3 in. long by 1/8 in. The writer has made, and is using with wind the grooves with about No. 24 re- wide) to the end of the brass rod; wind a great success, a series of small one-valve sistance wire, securing each end to a couple of turns of the foil round the rod, panels made from cigar-boxes which can 6 B.A. brass bolt ½ in. long. Cut out a and solder the free end to a piece of stout be connected together, providing both piece of 1/8-in. ebonite about 31/2 in. by copper wire, which is held down to the high- and (or) low-frequency amplification. 2½ in., and in the centre drill a hole just ebonite by a 6 B.A. bolt. This makes a A number of cigar-boxes are obtained, large enough to take a piece of brass tube positive connection. the "50" size being very convenient for having an inside diameter large enough. The rheostat is secured to the supports the purpose, having dimensions of, to take a 2 B.A. brass rod easily. A piece by 6 B.A. bolts as in Fig. 3, taking care roughly, 9 in. by 5 in. Soak off the paper of this tube $\frac{3}{16}$ in. long should be pressed that the rod does not bind in the hole in with warm water, taking care that the into the hole in the ebonite and its edges the ebonite panel. A small knurled knob

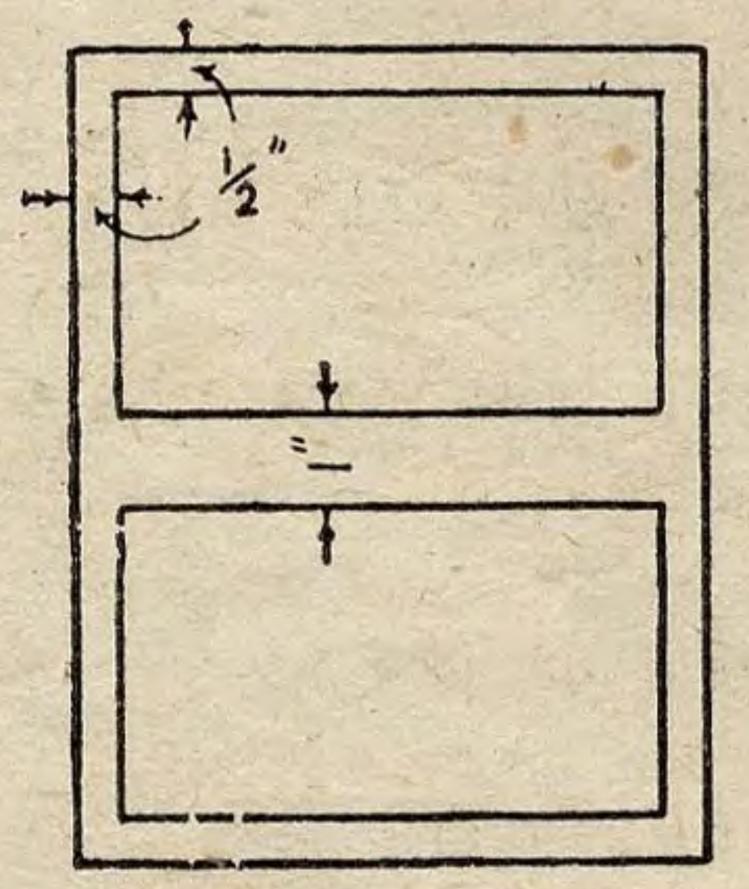


Fig. 1.—Lid of Box Cut Out.

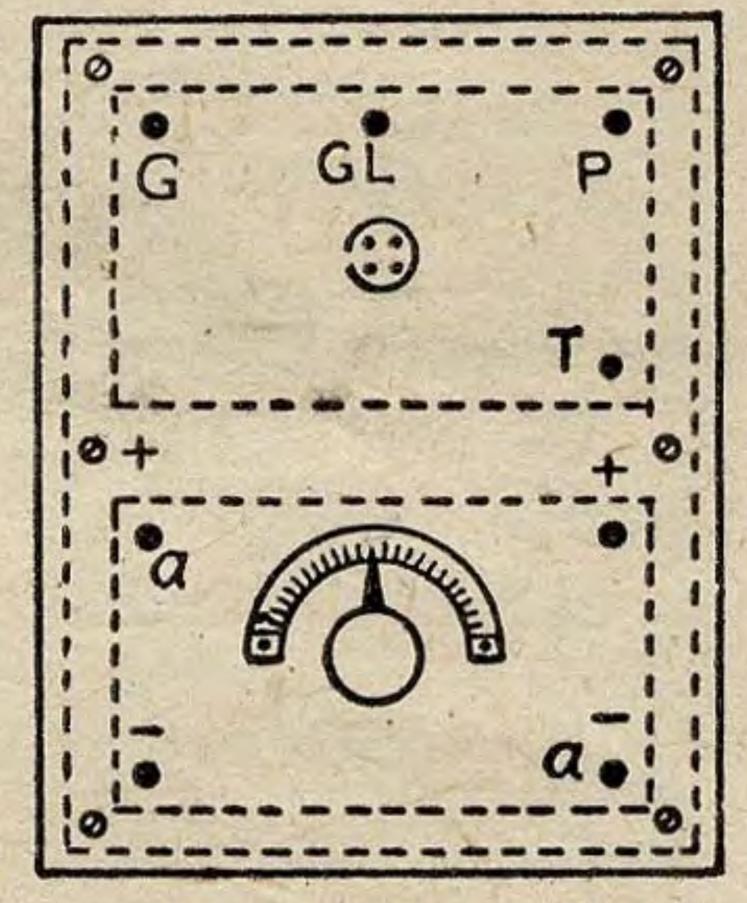


Fig. 2.—Box with Ebonite Panels Fitted.

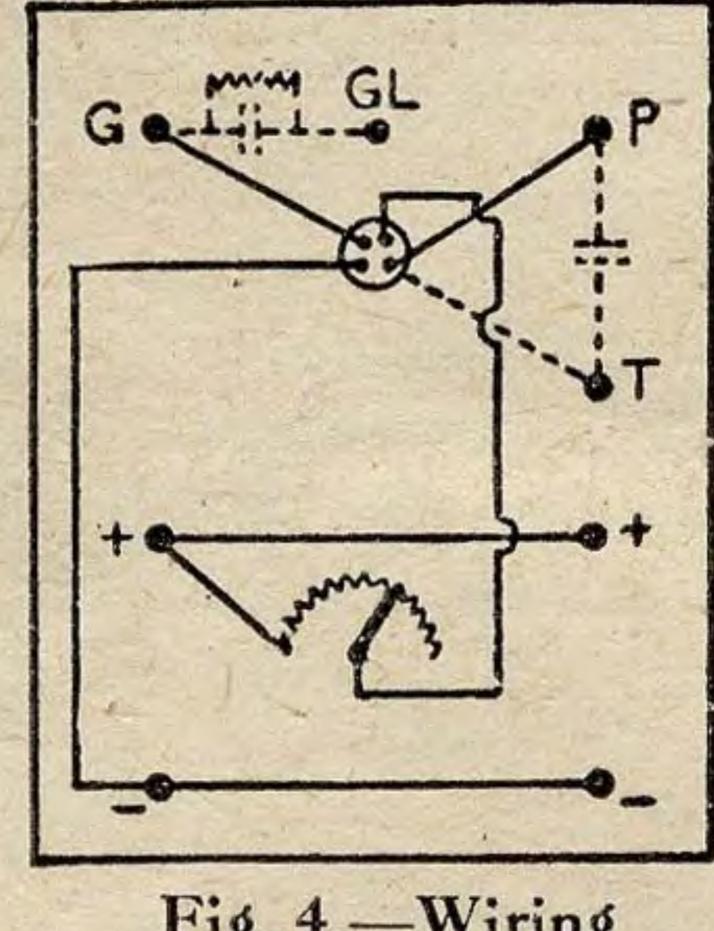


Fig. 4.—Wiring Diagram.

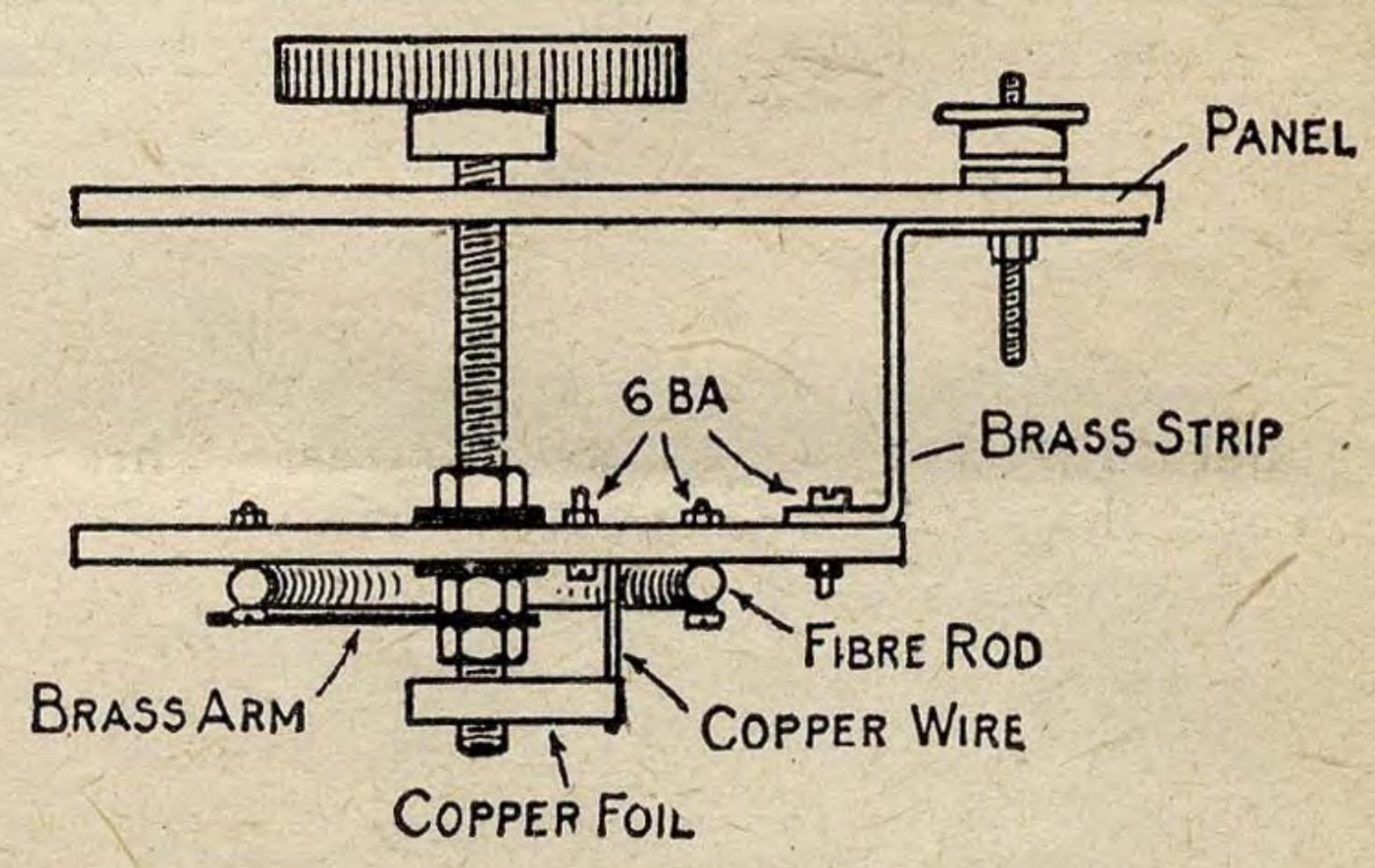


Fig. 3.—Enlarged Detail of Filament Rheostat.

obtained and the lids carefully hinged.

Panels

A sheet of ebonite 1/8 in. thick should be obtained, and a piece 1/2 in. longer and 1/4 in. wider than the box lid cut out. This is secured by small brass wood screws at each corner and the middle of each side as shown in Fig. 2. Holes are now drilled to take the valve socket, terminals, and for the filament rheostat rod (this should be 2 B.A. clearance). The terminals marked are the same for all panels, with the exception of the two marked GL and T. For the rectifying valve panel the terminal GL must be put in, as this is to be connected to a grid-leak and condenser which is placed across terminals GL and G. If desired, the grid-leak and condenser may be cut out by connecting direct to G instead of GL. The panel to which the phones are to be connected must have a terminal T and a small blocking condenser connected across P and T.

Rheostat

by putting a 4-in. Whitworth thread on turns in the primary coils of the aerial- larger coil. I find, for example, that when a piece of 4-in. round fibre rod (red fibre tuning inductance to something very small this is done both Lympne and Le Bourget is better than the black, as it is not so indeed; and matters become worse when it come in well enough to be heard on three brittle) and bending the threaded rod by is desired to listen to amateur transmis- valves (I H.F., I R., I L.F.) with a loud-

boxes are weighted during drying to pre- burred over to hold it securely. This is should now be fixed on the projecting rod, vent warping, and with a fretsaw cut out to make a brass bush for the rod, which and as an additional refinement a pointer the lids as shown in Fig. 1. Small brass otherwise would very quickly wear the and scale may be fitted. hinges (if not already fitted) should be ebonite. Mount the resistance coil, flat side uppermost, on to the piece of ebonite, Connections securing it by the two 6 B.A. bolts. Firmly General connections are shown in Fig. 4. fix a small strip of strong, springy brass It will be noted that in the diagram the about 1½ in. long on to a piece of brass plate lead is connected to the lower terrod, screwed 2 B.A. and about 2 in. long, minal marked T in Fig. 2, and the H.T. by means of two nuts. Put this through phones to the upper terminal. By having the bushed hole so that the brass strip all connections brought out it is apparent makes contact with the resistance wire. that any number of circuits can be tried Secure this rod by means of another nut at will.

E. A. E.

A Simple Series-parallel Device

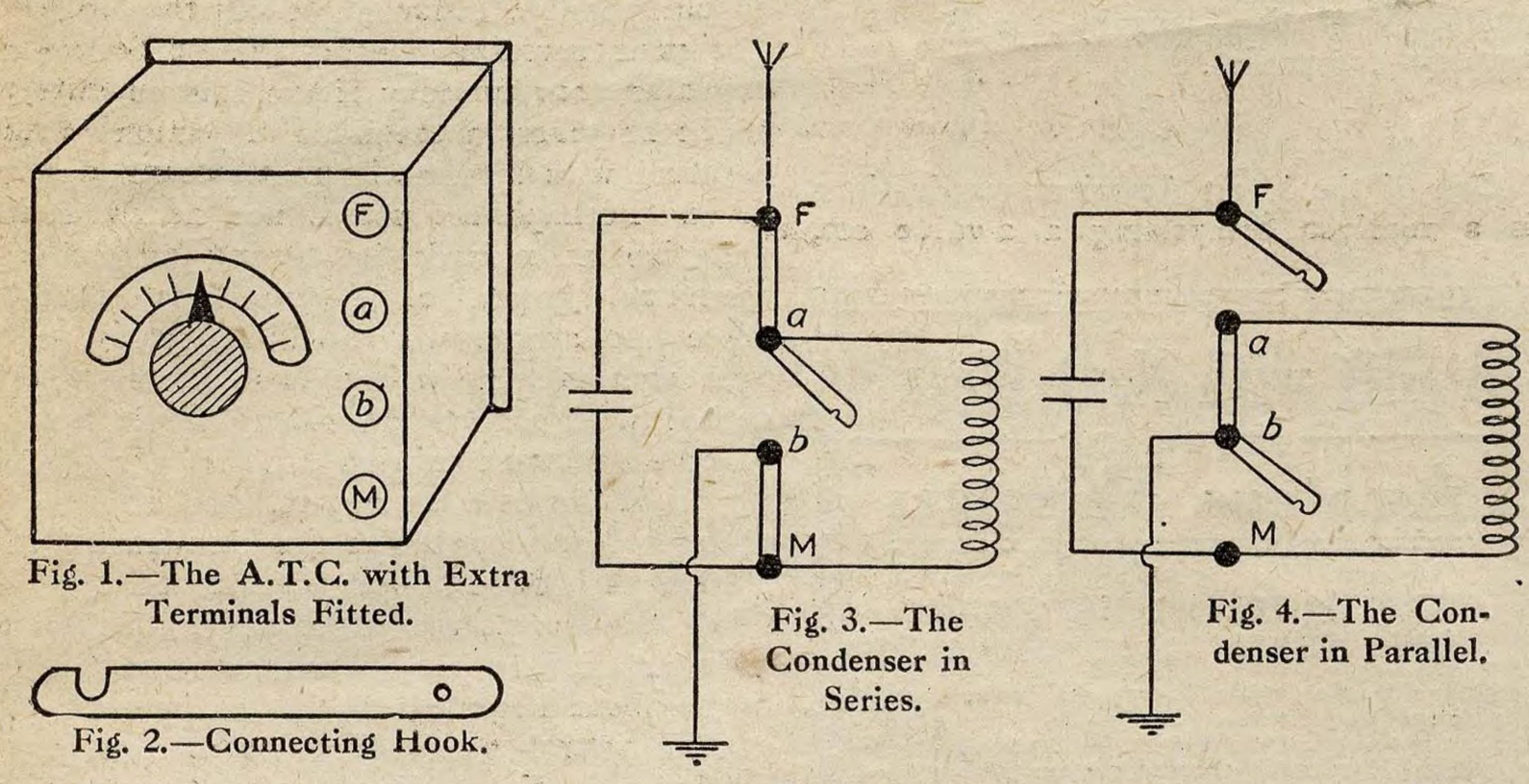
reception of short-wave telephony. If a speech come in, whilst tuning has often to condenser of .ooi microfarads, which is be so finely done that it is most difficult about the most usual capacity for the to keep the set from oscillating. Even to tune down even to broadcasting wave- often be found an improvement to throw The filament rheostat (Fig. 3) is made lengths without reducing the number of the condenser into series and to use a

I T is surprising to find how few people sions on round about 180 metres. The inrealise the advantages of wiring the troduction of a large capacity in parallel aerial-tuning condenser in series for the means that weak signals and indistinct A.T.C., is used in parallel, it is impossible when dealing with the longer waves it will to make their speech plainly audible. do in little more than half an hour.

One of the strongest reasons for fitting some device which enables one to change over quickly from parallel to series is that it enormously increases the range of basket, slab, or honeycomb inductances.

speaker; whilst if the condenser is in A.T.C. itself, and it costs next to nothing parallel a second L.F. valve must be used to make. Also, it is a job that anyone can

> Between the existing terminals on the ebonite top of the condenser fit two more a and b (Fig. 1), placing them so that the four are evenly spaced. Now take three straps of the shape shown in Fig. 2, using



metres with the condenser in parallel, its available. Their length will depend on range with the condenser in series may be the distance between the terminals. gap between series and parallel depends terminal M and to a. are of them the smaller the "dead spot" middle one is connected up whilst the gether if a small vernier condenser is kept of this arrangement puts it in parallel.

parallel change device is to use a double- nected. The vernier condenser, if one is pole double-throw switch of some kind. used, should be connected to terminals F accomplishing the desired end will be necessary for very short-wave reception. found still better. It is mounted on the

If a coil will tune from 1,000 to 2,000 sheet brass, or even tin if brass is not

something like 500 to 900 metres. This The lead-in is taken directly to the means that with one small gap a single terminal connected with the fixed plates F coil can be made to cover all wavelengths (Fig. 1), the earth wire goes to b, and the from 500 to 2,000 metres. The size of the primary coil is wired to the moving-plate

largely upon the capacity of the aerial. A glance at Figs. 3 and 4 will show how The thinner its wires and the less there the hooked straps are operated. If the will be. In any case, it is nothing very upper and lower ones are free, the congreat, and it can be done away with alto- denser will be wired in series; the reverse

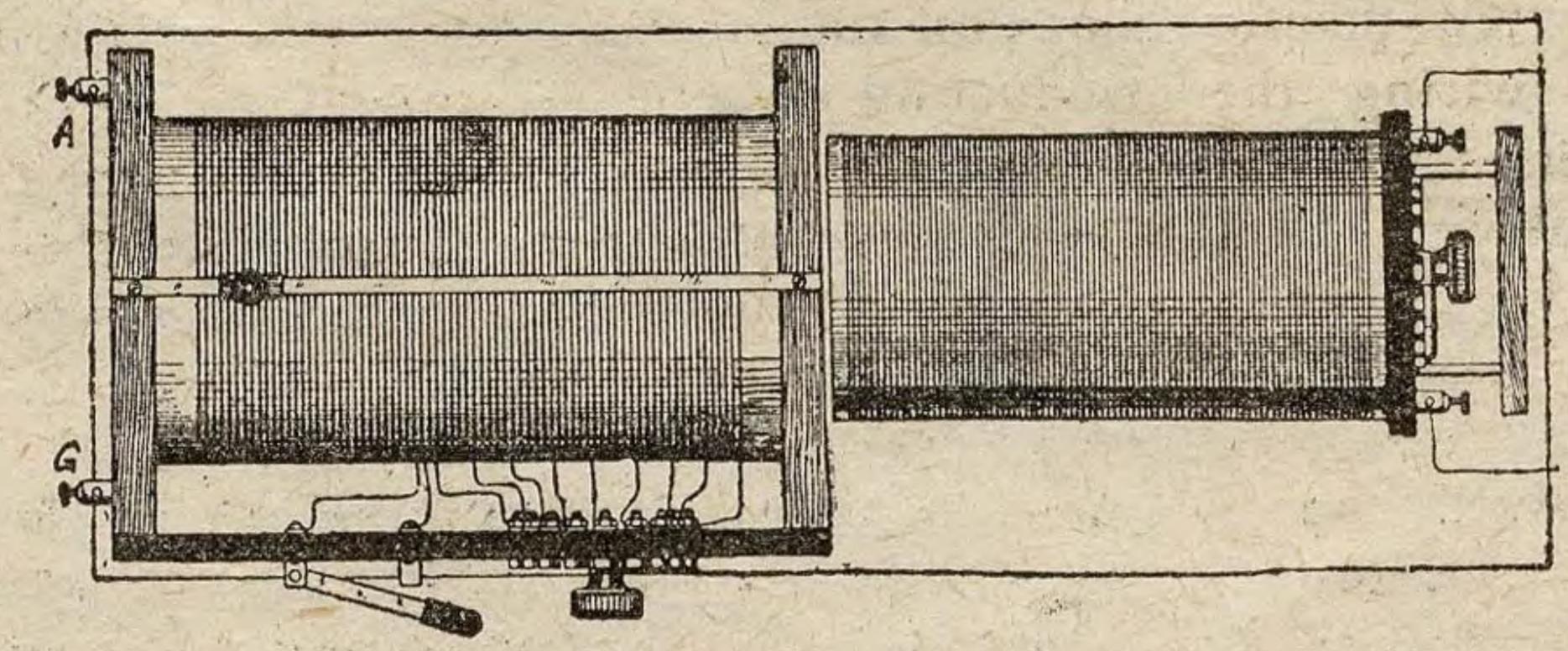
permanently wired in parallel. This change can be made in a moment, The commonest way of making a series- for the primary coil need not be discon-This is a perfectly satisfactory arrange- and M. Its use will be found to facilitate ment, but the means outlined here of considerably the critical adjustments

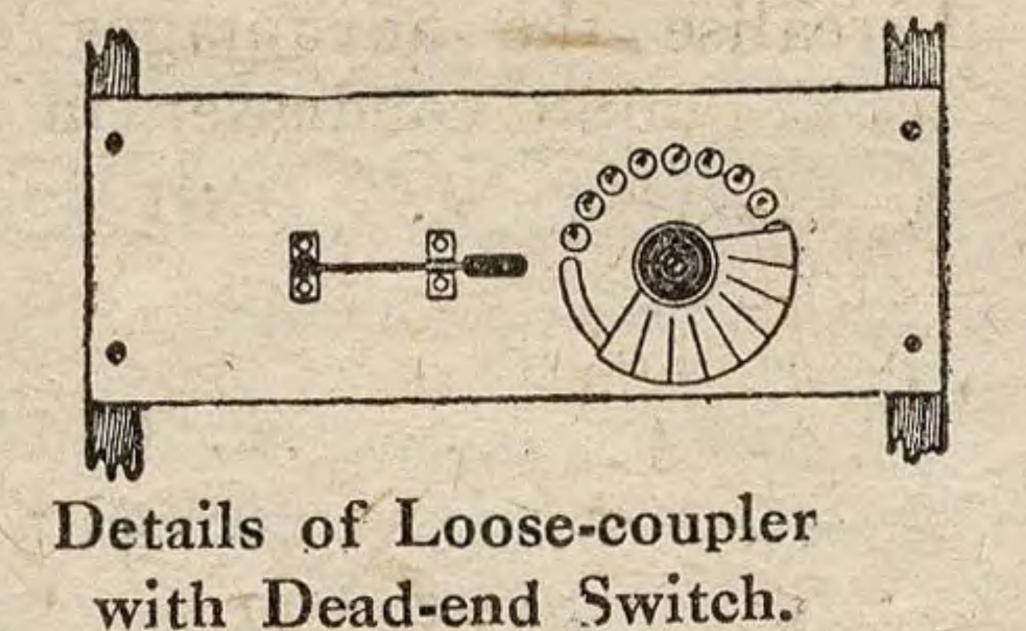
R. W. H.

Loose-coupler with Dead-end Switch

THERE is a certain amount of current cuit and signals in the receiver. By means

in the unused balance of the primary of the dead-end switch, as shown in the coil of a loose-coupler which is not in accompanying sketch, any portion of the





resonance with the aerial, that is not only a total loss in the secondary circuit, but which acts to retard the secondary cir-

unused coil may be cut entirely out of the circuit. The unused turns are short-circuited by means of the circular disc switch, device.

thereby permitting a much better tuning arrangement with increased volume of sound. By opening the single-pole knife switch, indicated in the drawing, the unused portion of the primary coil from the aerial circuit is disconnected.

With a coil of this kind any desired wave range may be obtained from 200 to 2,000 metres by simply varying the number of turns of wire out into the circuit with the circular disc switch. The minimum number of turns to be wound on the coil prior to tapping in the single pole switch would be fifty-five. This permits the reception of signals from transmitting stations of 400 metres and less. For reception of signals of over 400 metres wavelength, the minimum number of turns should be 150. Taps should be taken from the remainder of the coil at intervals of turns, and fastened securely to the contact points of the circular disc switch.—Radio News.

Radiograms

COME alterations have been effected in the aerial of the London broadcasting station which have considerably increased its range. Amateurs whose apparatus has heretofore been just beyond the range of 2 LO may now be able to get some. results.

It is hoped that Cardiff broadcasting station will be ready to start work by the time this issue of AMATEUR WIRELESS is in the readers' hands. The Glasgow station, we learn, ought to be completed by Jan. 25.

We hear from the Sterling Telephone and Electric Company, Limited, that this firm has opened a branch at 14, St. Peter's Square, Manchester, for dealing with orders from Lancashire, Yorkshire, Cheshire, and Derbyshire. Facilities have been provided for daily demonstrations of wireless apparatus.

The call sign of the Birmingham broadcasting station has been altered from 2 W P.1 to 5 IT.

Whilst a film was being shown in, America explaining the working of the three-electrode valve a lecturer accompanied the film with a running commentary on it. Soon the audience discovered that the lecturer was sitting silent among them, and it was then explained that he had delivered the same lecture in New York several days before, his words being recorded by an electrical

Flute," grand opera, on the night of Jan. 8. The selections were sent from wireless telegraphy. Covent Garden by means of a special cable and microphone placed in front of the orchestra, to Marconi House, from whence it was broadcast.

The deputation of the Empire Press Union which waited on the P.M.G. on Jan. 8 were unable to get much satisfaction regarding the Empire wireless is a receiver comprising a 2-valve set, system. The P.M.G. was able to state that the Government were reconsidering the whole question, but it had not been decided where the money for the new station was to come from, or what size it was to be.

The Canadian Marconi Company have decided to build a new station in Vancouver, the cost of which, when completed, is expected to be in the neighbourhood of 2,000,000 dollars.

The staff of the Metropolitan Water Board have decided to form a wireless club, and have planned to install a 6valve receiving set.

A group of medium-power wireless stations employing valve transmitters has been erected by Marconi's Wireless Telegraphy Company, Limited, at North Weald, near Ongar, Essex, for the purpose of conducting commercial wireless services with France, Switzerland, and Spain.

These stations have been brought to a high state of efficiency. Although only designed for European communication one of them has been carrying on a Transatlantic service to Canada. One of the other stations (GLO), which is used for communication with Madrid, a distance of about 720 miles, can be heard at Bandoeng, Java, 7,500 miles distant.

An amplifier, using a 60-cycle A.C. supply for anodes and filaments, has been developed by the Bureau of Standards, U.S.A. It has three stages of H.F. amplification, a crystal rectifier, and two note magnifiers.

Dr. Franklin Leroy Satterlee, an American X-ray specialist, has invented a non-regenerative set, which makes one detecting valve do the work of two stages. of high-frequency amplification.

With a two-valve set Manchester telephony has been heard so clearly in Glasgow that the indrawing of the announcer's breath was quite audible, also the opening and closing of switches at the transmitting station.

A very successful innovation was the The Italian-American Association gave anode, and 2 L.F. with short-wave loosebroadcasting of selections of the "Magic a reception in Rome to Senator Marconi coupler tuner.—A. T. N. (Thornton on Dec. 28, the twentieth anniversary of Heath).

> An American (Nebraska) is suing for an injunction to break up an alleged monopoly of the ether by the American wireless companies.

One of the latest American productions

A Gift with Next Week's

"WIRELESS TRANSMITTING STATIONS AND THEIR CALL SIGNALS"

is the title of a sheet which we shall present gratis with next week's "Amateur Wireless." You will get your copy of "Amateur Wireless"—a Special Broadcasting Number by the way, containing many extra pages—and with it you will receive this special presentation sheet, all for the usual price of threepence. The sheet alone is worth twice the amount.

"Wireless Transmitting Stations and their Call Signs" will be printed in two colours on . special paper; the paper has been specially chosen so as to ensure permanency, the idea being that the · sheet can be hung up on the wall alongside the · receiver. The sheet has two great features: one. • a Map showing the Positions of Most of the • Transmitting Stations in England, and the other [.] the fullest possible List of Transmitting . • Stations—amateur and otherwise—that it has been • possible to compile. The printed portion of the sheet measures no less than 22 in. by 221 in., and readers can be a sured of the extraordinary value which we have packed tight within those limits.

Editorially, next week's "Amateur Wireless" will appeal to the many thousands of people attracted by the new broadcasting and desirous of becoming wireless amateurs. The articles have been specially written to help and encourage them. Practical, informative, up-to-date, well illustrated, we promise our readers that the Special Broadcasting Number of "Amateur Wireless," to be published next week, will give them unstinted pleasure.

Will amateurs generally pass the good word along? Will they explain to any friends who contemplate becoming either amateurs or merely "listeners-in" that their best possible guide is "Amateur . Wireless"? Next week's issue will be a splendid . one for the new reader to start with. We trust that [.] we can rely upon the kindness of the constantly growing number of our readers to put in a good o word for us between now and next week. Newsagents and bookstalls will be carrying extra supplies of "Amateur Wireless." (We apologise, by . the way, for any trouble there has been in recent weeks in obtaining copies of this paper. Twice we have been quite out of print.) Will all our readers register their orders with their newsagent or bookstall for a regular weekly copy, and will they, in . addition, do us the great favour of suggesting . to their friends that they also become regular subscribers.

frame aerial, batteries, and loud-speaker, which is all contained in a suit-case, and can be operated anywhere.

o momentamento

CORRESPONDENCE

Minus the H.T. Battery

SIR,—On January 4th I received the 2 LO concert on the detector valve (Mullard "Ora") with 3.5 volts L.T. and without any high-tension supply. Is this unusual? My set is a 4-valver-made to for permission to fit its vehicles with your specifications—i detector, i tuned receiving apparatus.

A Seven-hours' Concert and French Transmissions

SIR,—Of course seven hours of unjammed and uninterfered-with reception is not possible every night of the week; but your correspondent G. T. (Bromley) must be very unlucky if the sample of a night he gives in the issue of January 13 is usual with him, as he seems to suggest it is. Perhaps his set is not nearly so selective as regards its tuning arrangements as it might be. It may be said that since the article which G. T. refers to was written the writer has beaten its record with almost untroubled receptions of nine and ten hours on a Sunday, starting with Radiola at 2 p.m. and ending with the amateurs when the broadcasting stations had closed down.

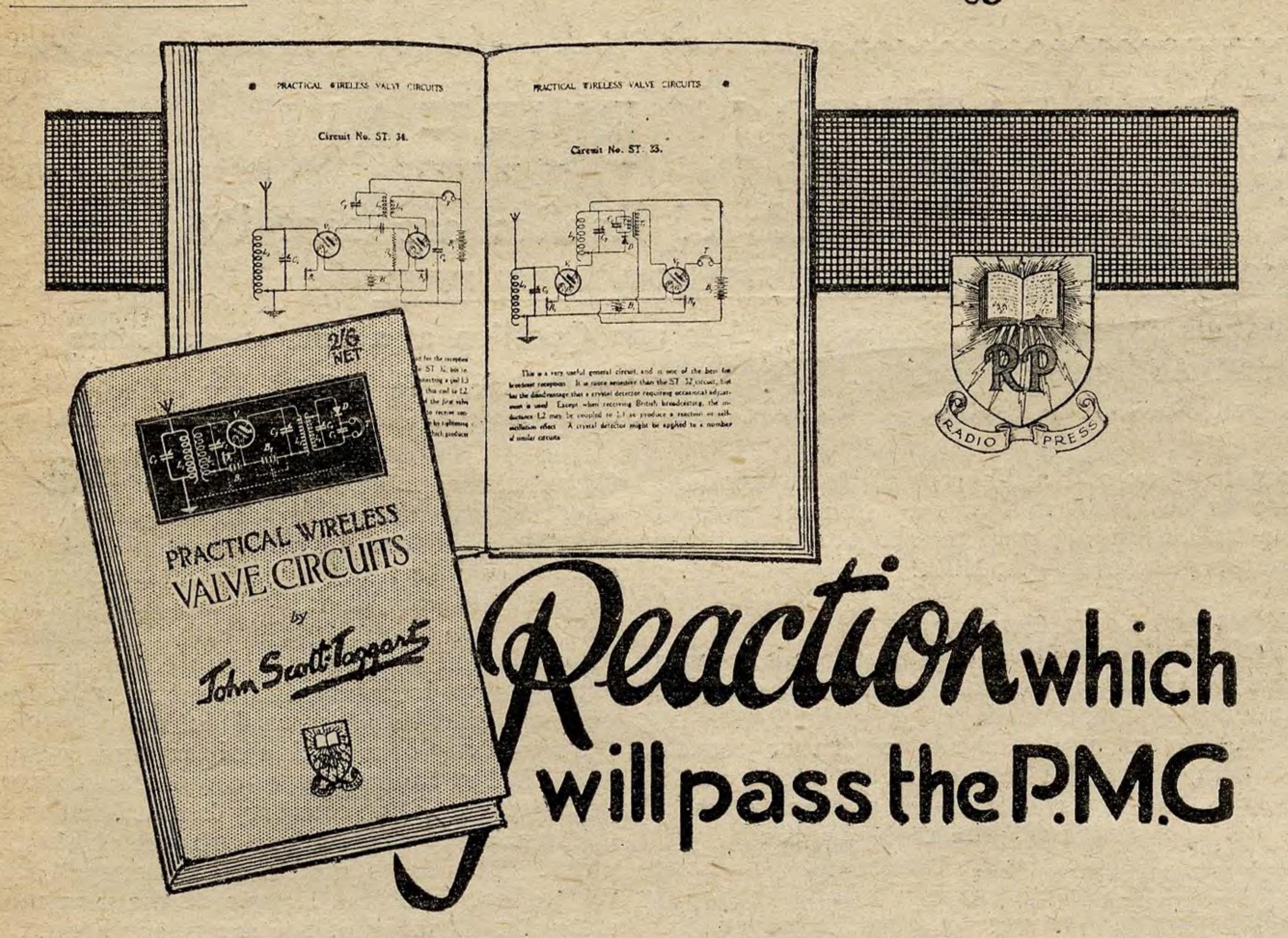
By the way, the correspondent who wishes to know what French transmissions he has been listening to can see by reference to your list of regular transmissions. The occasional 5 p.m. to 6 p.m. transmission is from Concerts Radiola, Paris. The one that ends at seven o'clock is from Eiffel Tower on 2,600 metres. Radiola always works from 9.45 p.m. to 10 p.m. or just after, and Eiffel Tower is sometimes on in the evening as well. Radiola is on 1,500 metres. If Radiola or Eiffel Tower are jammed or accompanied by much crackling, try cutting out reactance if it is being used.—E. L. (Pirbright).

Re-radiation

SIR,—Almost every evening one hears 2 LO repeat complaints from various districts regarding the misuse of reaction and other annoyances. Suffering very much from this disease myself, I have been working on the matter for some time. Result: Living about six miles from the Strand, I have received 2 L O each evening for the last month with a single valve and a frame aerial 13 in. square. A two-valve amplifier is attached and can be switched in if required, but the second valve of the amplifier has never been necessary. Writtle can be heard right through, and Birmingham is audible with the second amplifier valve. Users of outside aerials do not realize what pleasure it is to receive the news and concerts without the usual accompaniment of scratches, screams, etc. If any fellow sufferer is interested and can construct his own tuner I shall be very pleased to send you details. There is nothing more serious to make than a single-layer coil, so almost anyone can construct the instrument and rid themselves of the nuisances caused by the many ignorant knob twisters.-F. T. C. (Streatham).

[We shall be glad to have the particulars offered.—ED.]

A taxi-cab company in Paris has applied



CONTENTS

- 1. Crystal Detector Circuits
- 2. Single-Valve Circuits
- 3. Two-Valve Circuits
- 4. Three-Valve Circuits
- 5. Four-Valve Circuits
- 6. Five-Valve Circuits
- 7. Local Oscillators for Heterodyne Reception of CW
- 8. Valve Transmitter and Radio Phone Circuits

HE use of Reaction gives almost the additional strength of another Valve, but carelessly used it is a source of great annoyance to all other receiving stations within two or three miles. Therefore the P.M.G. has rightly banned all reaction coupled to Aerial circuits on broadcast wave lengths.

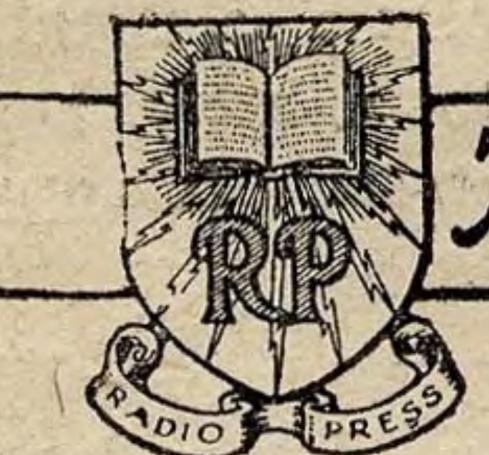
No need to cut it out altogether though, for in this new book by John Scott-Taggart—that eminent authority on Thermionic Valves—several circuits are shown for the first time which permit the fullest use of Reaction which cannot cause oscillation in the Aerial circuit.

If you are not now using Reaction, get this book and see how easily you can alter your wiring to obtain that maximum of efficiency so essential if you are to pick up those long distance broadcasting Stations.

Every diagram is clearly drawn, all necessary condenser values are given—further you have the assurance that every circuit has been tried and tested, that they are not mere "paper circuits." You'll need this book to understand your Set better. Get it to-day.

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Spacers, true to .001. Small, doz. 2d.; large doz
Spacers, true to .001. Small, doz. 2d.; large doz
Aerial Wire, 7/22 hard drawn copper, in 100 ft. lengths
Aerial Wire, 7/22 hard drawn copper, in 100 ft. lengths
Aerial Wire, 7/22 hard drawn copper, in 100 ft. lengths
Valve Legs, with nuts and washers, 1d. each; doz
Two Coil Holders, solid ebonite mounted on mahogany
Three Coil Holders, solid ebonite, with long arms to avoid capacity effects 9/6 Crystal Detectors, adjustable in every way 2/6 ditto, ditto, enclosed in glass case 4/6 Engraved Ivorine Scales, 0—180 4½d. Filament Resistances, extraordinary value, velvet action 2/6 and 3/6 Switch Arms, complete with knob, collar, washers, bush nuts, etc. 1st quality, 1/6; 2nd quality 1/- Valve Holders, turned ebonite, complete with
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Valve Holders, turned ebonite, complete with
nuts, 1/3; 2nd quality 9d. Crystal Cups. Plain 1d.; one, two, or three
screw 3d.
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Contact Studs, \frac{1}{4} in. by \frac{1}{4} in., complete with nut
and washer doz. 6d.
Insulators, 2-in. reels— 1d. each; white egg, 3d.; green egg, 4d.;
green shell each 4d.
Brass Nuts, 2, 3, 4, 5, 6 B.A., doz. 3d. Washers, doz 2d.
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Fixed Condensers, any capacity each 1/3 Crid Leak and Condensers combined each 3/6
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Making a Rectifier.

Q.—Please tell me if I can make a vibrating rectifier for 100 volts 50 cycles from steel strip as sample enclosed.—D.H.B.McC. (Leicester)

(4,606).

A.—The writer cannot recommend the use of the vibrating type of rectifier; it is an article that is gradually going out of use owing to its various unsatisfactory features. Not only is it difficult to get the vibrating tongue to oscillate in true synchronism with the frequency of the circuit, but the interruptions must be timed to occur at definite intervals before and after the zero points on the voltage wave, or the accumulators will discharge as rapidly as they are charged up. The chemical rectifier or Nodon valve possesses no such disqualifications and is cheap in first cost and upkeep. Directions for its

construction and a diagram of its connections are to be found in No. 29. Other means of electrification are the tungar valve and the motor generator.—A. H. A.

Direct and Loose Coupling

Q.—Will you please explain the advantages and disadvantages of direct- and loose-coupled

tuners?—S. W. S. (Cambridge).

A.—With a direct-coupled tuner signals reaching the aerial have a direct path to earth. Any signal from a near-by station, even if "out of tune" with the receiving aerial, will probably force its path through the receiver to earth and so be a cause of interference. If a loose-coupled tuner be used, however, the signals will still force through the circuit, and, being out of tune or resonance with the tuned aerial circuit, will be heavily damped, and

therefore incapable of causing a large inductive effect in any inductively-coupled circuit. By loosening the coupling between primary and secondary coils the damped signals will not be induced with any great force into the secondary coil, whereas tuned signals will still be induced into this coil and good results obtained. By employing a loose-coupled tuner, signals may be very slightly decreased in strength, but the selectivity of reception will repay any small loss. When tuning a loose-coupler, care should be taken that the secondary has at least twice the number of turns in use as those on the primary. This is to give a transformer "stepup" effect to obtain signals at the maximum strength. Tuning of the secondary should be effected by means of a small variable condenser.—L. C.

BROADCAST TELEPHONY

Some of these transmissions are commercial or official. Wave-lengths and times are liable to alteration without notice.

London B.B.C. Station (2 L O), 369 metres. Daily, 5 p.m. to 5.30 p.m., children's stories; 6.30 p.m. to 10 p.m., concert and news.

Manchester B.B.C. Station (2 Z Y), 385 metres. Daily, 4.30 p.m. to 5 p.m., concert; 6 p.m. and 6.15 p.m., kiddies' corner; 6.30 p.m. to 7 p.m., reproducing-piano recital; 7 p.m., news bulletin; 8 p.m. to 9.10 p.m., concert; 9.15 p.m., second news bulletin; 9.30 p.m. to 10 p.m., miscellaneous concert.

Birmingham B.B.C. Station (5 I T), 420 metres. Weekdays: 6.30 p.m., children's stories; 7 p.m., concert; 7.30 p.m., news bulletin; 8.30 p.m. to 9 p.m., interval; 9 p.m., concert; 9.45 p.m., second news bulletin; 10 p.m., final announcements. Sundays: 8 p.m., news bulletin; 8.10 p.m. to 9.45 p.m., concert; 9.45 p.m., second news bulletin; 10 p.m., final announcements.

Newcastle B.B.C. Station (5 N O), 400 metres. Daily, usually 6.30 p.m. to 8 p.m.

Croydon (G. E. D), 900 metres. Daily.
Writtle (2 M T), 400 metres. Tuesdays,

8 p.m.

Eiffel Tower (F L), 2,600 metres. Daily,
6.20 p.m. to 7 p.m. and 10.10 p.m. to 10.20 p.m.

(weekdays only).

The Hague (P C G G), 1,085 metres. Sun-

days, 3 p.m. to 5 p.m.

Paris. Concerts Radiola. 1,506 metres. Daily, 5 p.m. to 6 p.m., concert. Sundays, 2 p.m. to 5 p.m., concert.

Rome (I.C.D), 3,200 metres. Daily, 10 a.m. Königswusterhausen (L.P), 2,800 metres.

Daily, 4 p.m. to 5.30 p.m.

Amsterdam (P C A), 1,800 metres. Daily,
1.10 p.m.

Haren (O P V H), 900 metres. Daily, every hour from 11.20 a.m. to 4.20 p.m.

A film entitled "Via Radio" has been produced by the Scientific American in conjunction with the Educational Films Corporation. It explains to the layman all about broadcasting and the working of the radio compass amongst other things.

The National Association of Radio Manufacturers

AN association has recently been formed under the title of The National Association of Radio Manufacturers. The association has been brought into being for the avowed purpose of preventing those chaotic conditions which might arise in a new industry if the solution of all problems is left to individual effort.

It is stated that the association will not attempt to control the selling prices of the instruments marketed by its members, but that its main objects are to establish such fair and equitable conditions of trading as are essential to the well-being of a new industry, and to take up from time to time any question of common interest to the trade upon which united action appears to be desirable. A condition of membership is that the applicant must be a bona-fide British manufacturer of wireless apparatus, and must be eligible for membership of the British Broadcasting Company, Limited.

We are informed that the wireless section of the Daily Mail Ideal Home Exhibition, to be held at Olympia from March 1 to 24 (inclusive), will be under the control of this association. Intimations have recently been issued to members, and potential members, inviting applications for stands.

Messrs. Derbyshire and Co., chartered accountants, of 4, Southampton Row, London, W.C.1, are acting as secretaries to the newly formed organisation, and will be pleased to furnish further particulars to any duly qualified British manufacturers who would like to consider the question of membership.

Care and Management of Primary
Batteries is the title of an article which
will be of interest to wireless enthusiasts
in the current issue of "Work" (3d.).
Other articles include: "A Self-feeding
Table Fountain," "Two Accessories for
the Gramophone," "Practical Upholstery,"
"Making a Table for Table-tennis,"
"Using Gas Economically," "Piano
Tuning and Repair," "Silver Work for
Amateurs," "Cleats for Use in Cleaning
Joints," "American Notes Illustrated."

We have received a handsome little catalogue from Radio Instruments, Limited, 12, Hyde Street, London, W.C.1, dealing exclusively with broadcast cabinet receivers, ranging from a small 4-valve set for table use to a handsome 7-valve Chippendale cabinet set. A copy may be obtained on request.

When the captain of the American ss. Hatteras died during the voyage to New York, the burial service was wirelessed from the ss. President Adams, 250 miles away, as the Hatteras had no clergyman on board.

The transmission of pictures by wireless has reached the stage that it is now possible to transmit and reproduce coloured drawings.

H.C. COPPER INSTRUMENT WIRES

Enamd. 2/8 3/3 3/6 3/11 4/6 6/6 8/- 1b.
S.C.C. 2/11 3/10 4/6 — — — — 1b.
S.S.C. 3/7 5/- 6/3 7/3 9/9 15/6 20/- 1b.
H.D. Aerial, 7/22, plain. 4/-; enamd., 5/- 100 ft.

Terms:—Cash with Order. Postage extra.

HORROCKS & ASPIN, 12, Schwabe St., Rhodes, Manchester.

In replying to Advertisers, please make a strong point of mentioning "Amateur Wireless."

FILAMENT RHEOSTAT.

Reliable

Superior

6/-,

Post free.

in a few minutes, 2d. each, Broadcasting Fee 6d. extra.

Make Your Own

easily and securely attached

to Pocket Lamp Batteries

Terminals, which can be

Expert knowledge will make your Set twice as sensitive NOW how it works and you Shows how to make every component necessary without 1/6 the aid of special tools. G.P.O. Box No. 519. SINGLE Over 130 pages of sound explanation telling exactly how 2/6 the Valve works and how to get the best results from it. VALVE PANEL RADIO PRESS DIRECTORY 20,000 Call signs with names of Stations (commercial and 2/6 AT

Read this before buying your Set. Tells you exactly what 6d. Radio is and the Set you'll need.

A practical Book showing how to build Crystal Sets, and explaining full theory of Radio in everyday language.

can easily correct any faults and tune it up to a high state of efficiency. The requisite knowledge for this can be gained from books issued by the Radio Press. Here are some of them—all can be relied upon for dependable information. From all Booksellers or direct from the Publishers.

Radio Press, Ltd. PUBLISHERS OF AUTHORITATIVE WIRELESS LITERATURE DEVEREUX COURT. STRAND. W.C.2:



0005 for panel mounting complete with knob, scale and pointer 8/-, in cabinet 15/-. Rectifying Crystals. Chrystagod, the super Hertzite, 2/-. Hertzite, 1/3. Box of Post Free. 6 Crystals, 1/-.

ESTABLISHED 25 YEARS 28, Woodbridge Street, LONDON, E.C.1 EBONITE

1" Sheet—18"×18", 12/-; 12"×12", 5/6; 12"×9", 4/-; 9" × 6", 3/:; 4" × 4", 10d, ANY SIZE CUT. Knobs, 2 B.A., 4d, each; Valve Holders and 8 Nuts, 1/- each; Coil Holders, 1/3 each; Rod and Tube; \stacks" and \frac{1}{2}" Sheet; Cheap Accumulators; Phonss; H.T. Batteries; Loud Speakers. CARRIAGE PAID OVER 10/-

BAILEY & ROBINSON 9, Esplanade, REDCAR

COMPONENTS

Gives

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Results.

Full particulars,

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Clarophon

Pamphlet,

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Double Head

RECEIVERS.

British Made.

Complete with

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28/", post r -

All Component Parts offered by the Cheapest Firm in England.

Condensers for Panel Mounting.

Capacity	Assembled	Unassembled
.001	14/-	10/6
.0005	9/-	6/-
.0003	8/3	5/-
.0001	6/6	3/6
Vernier	5/-	2 -
	Ebonite plates 2/	- pair.

WRITE FOR OUR LISTS.

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15, Grape Street, Shaftesbury Avenue,

'Phone: Reg. 3636.

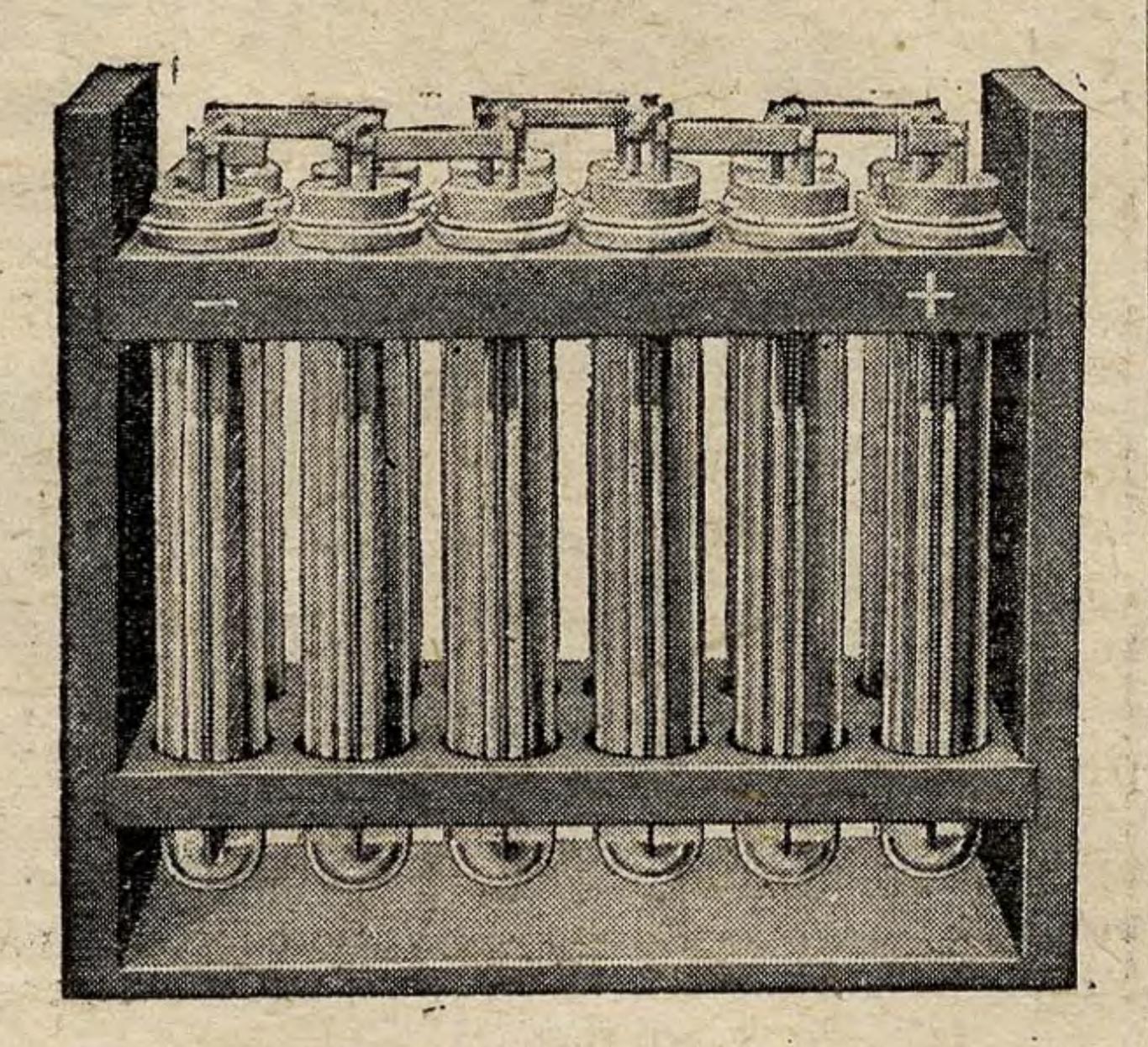
Also at 15, Kingston Road, Wimbledon, S.W.19. 'Phone: Wimbledon 1030.

BATTERIES

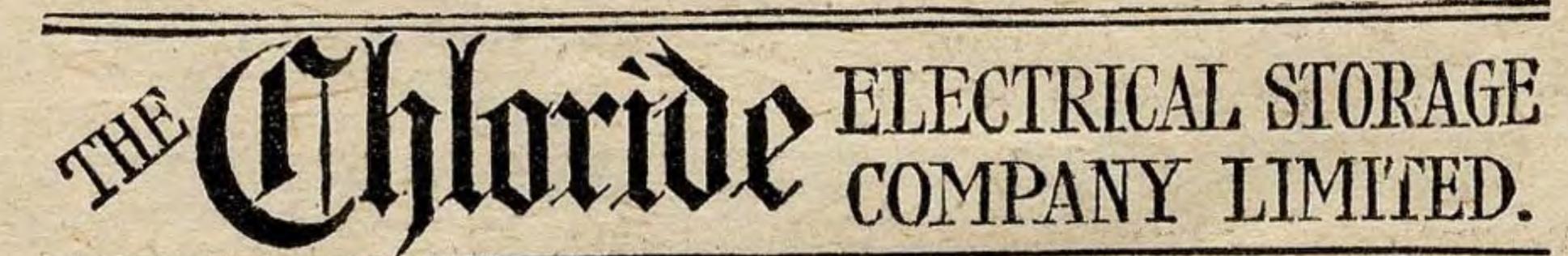
Valve Sets

24v. 28v. 32v.

Type B.K.



Owing to the demand for these batteries, all orders will be dealt with in strict rotation. Prices approximately one shilling a volt. :: Ask for Leaflet 4030 ::



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219/229, SHAFTESBURY AVENUE, W.C.2.

PRICES AND PARTICULARS ON APPLICATION.

CLUB DOINGS

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Leeds and District Amateur Wireless Society.

Hon. Sec.-D. E. PETTIGREW, 37, Mexborough Avenue, Chapeltown Road, Leeds. On Jan. 5 the chairman called upon Mr. T. Brown Thomson to lecture upon the "Transmission of Photographs by Wireless." The lecturer sketched the methods that have been used since 1847, paying particular attention to the efforts of Knudsen in 1908. Mr. Thomson expressed his belief that it would soon prove to be possible to transmit an ordinary negative without the use of special plates, and advocated the use of undamped waves for such a transmission. Various methods of transmission, using spark, arc or valve, were briefly considered, and arrangements of receiving apparatus examined. The great problem of synchronisation between the transmitter and receiver was closely considered.

Wandsworth Wireless Society.

Hon. Sec.-F. V. COPPERWHEAT, 9, Birdhurst Rd.,

Wandsworth, S.W.18. By the courtesy of Captain E. S. Davis members of the above society were accorded an interesting evening on Wednesday, Dec. 20, at "The Pavilion," Marble Arch, better known probably as 2 B Z. On arrival the party were ushered into the private theatre and several films of an educational character were shown, these being interspersed with broadcast music. During the changing of one of the films the opportunity was taken of recording wireless telephony and music on a dictaphone, and the reproduction was amazing for its clarity. The announcement that loud-speakers could be made out of tooth-powder tins caused no small comment, but upon producing the instrument so named and subjecting it to severe working conditions those

Battersea and District Radio Society.

present had to admit that this was possible where

2KL was concerned. After partaking of some re-

freshment kindly provided by the host, the party

proceeded to the power house. This was a very

extensive one with several generators, main dis-

tribution panels, air compressors and battery rooms.

Hon. Sec.—F. J. LISNEY, 66, Newland Terrace, Queen's Road, S.W.8.

All amateurs in the district are invited to join the above society. Particulars can be obtained from the secretary.

Tottenham Wireless Society

Hon. Sec.—R. A. Barker, 22, Broadwater Road, Bruce Grove, Tottenham, N.17.

On Jan. 3 Mr. H. Winter gave a very excellent lecture, his subject being "Telephone Receivers."

All persons interested in the above society should apply immediately to the secretary for particulars.

Bournemouth Radio and Electrical Society.

Hon. Sec.-L. O. Sparks, "Maranoa," 3, Cotlands

Road, Bournemouth.

THE above society has now been formed, and all those interested in wireless or any electrical matters are invited to communicate with the secretary, who will be pleased to supply them with any information required.

Croydon Wireless and Physical Society.

Hon. Sec.-B. Clapp, Meadmoor, Brighton Road,

A MEETING of the Croydon Wireless and Physical Society was held on Jan. 6, at which Lieut. D. Sinclair delivered a lecture entitled "The Signals Organisation of Our Airways." Lieut. Sinclair explained very fully the methods by which the machines on the air routes are controlled and their positions determined by wireless telephony. He said that the wavelength of 900 metres was now used exclusively for communication with aircraft. Any messages required to be sent from one aerodrome to another are transmitted either by wireless telegraphy via the Air Ministry (G.F.A.) on a wavelength of 1,400 metres or by private landline, whilst weather reports are sent by the Air Ministry on a 1,680 wavelength. Some very excellent lantern slides were shown illustrating the aerials and apparatus at the W/T stations at several of the aerodromes in England.

Ipswich and District Wireless Club.

Hon. Sec.-H. E. BARBROOK, 46, Foundation Street,

Ipswich. On Jan. 8 a very successful and interesting evening was spent, when a good number enjoyed what will be known as the first demonstration of broadcasting grand opera by wireless. The club set was used on this occasion, with the addition of a two-valve note magnifier, a microphone amplifier and loudspeaker, thus enabling all present to "listen-in" without the trouble of headphones. Mr. Bird was the operator for the evening, and having tuned in 2 LO was picked up, the reception being very clear. The opera transmitted was the "Magic Flute," and the tuning of the orchestra was clearly heard, as was also the tapping of the conductor's baton. The music and singing came through with very little distortion, although the words of the singers were rather difficult to follow.

Hon. Sec.—F. T. Jones, 360, Cobridge Road, Hanley. A MEETING of the above society was held on Jan. 4, a lecture being delivered by Mr. R. W. Steel on "Sources of Electrical Current." In the opening portion of his address he explained the nature of electricity by means of the electron theory. He

"Sources of Electrical Current." In the opening portion of his address he explained the nature of electricity by means of the electron theory. He then went on to describe the various methods of producing electricity, classifying them under four main headings—electrical, chemical, thermal and dynamical.

Thames Valley Radio and Physical Association.

Hon. Sec.—E. A. Rogers, 17, Leinster Avenue, East Sheen, S.W.14.

On Jan. 4 Mr. Jocelyn lectured on "Induction." With a series of experiments and liberal blackboard sketches the lecturer proved both interesting and instructive.

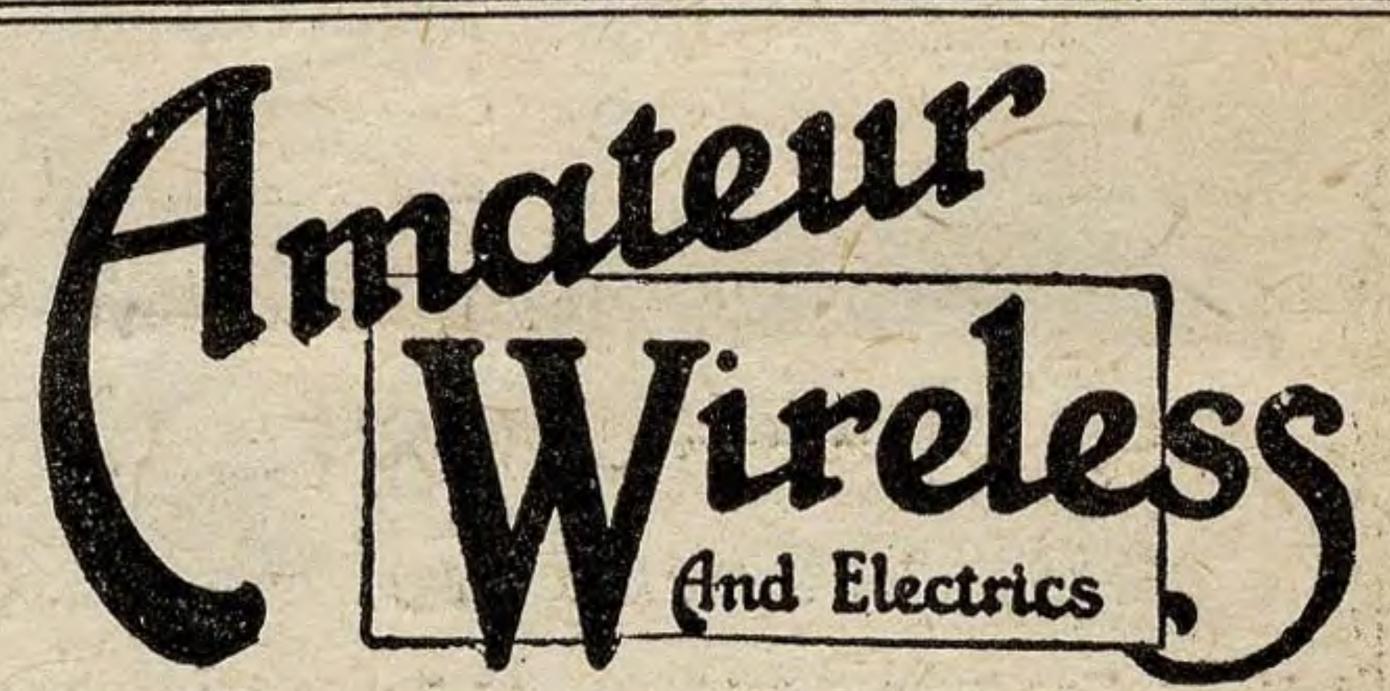
ANNOUNCEMENTS

"Amateur Wireless and Electrics." Edited by Pernard 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, 4s. 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 CouponAvailable until Saturday, Jan. 27, 1923

IMPORTANT

WE HAVE OPENED VERY COMMODIOUS PREMISES AT

54, Gracechurch Street, E.C.3

for the demonstration and sale of all types of Wireless Receiving Sets and "Claritone" Loud Speakers.

Amateurs and Experimenters will be able to obtain every part required for any type of Set including;

Transformers, L.F. and H.F.
Headphones, all types, all resistances
Condensers, variable and fixed, all capacities
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Radial Switches, 5-, 10- and 15-way
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parts and in sheet

Valves, M.O. and Mullard's
Brass W.O. and Telephone type Terminals,
Nuts, Washers, Contact Studs and all other parts
Accumulators
Dry Batteries
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Insulators
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Cotton and other Tubings, all colours
Etc. etc.

PRICE LIST FREE ON APPLICATION

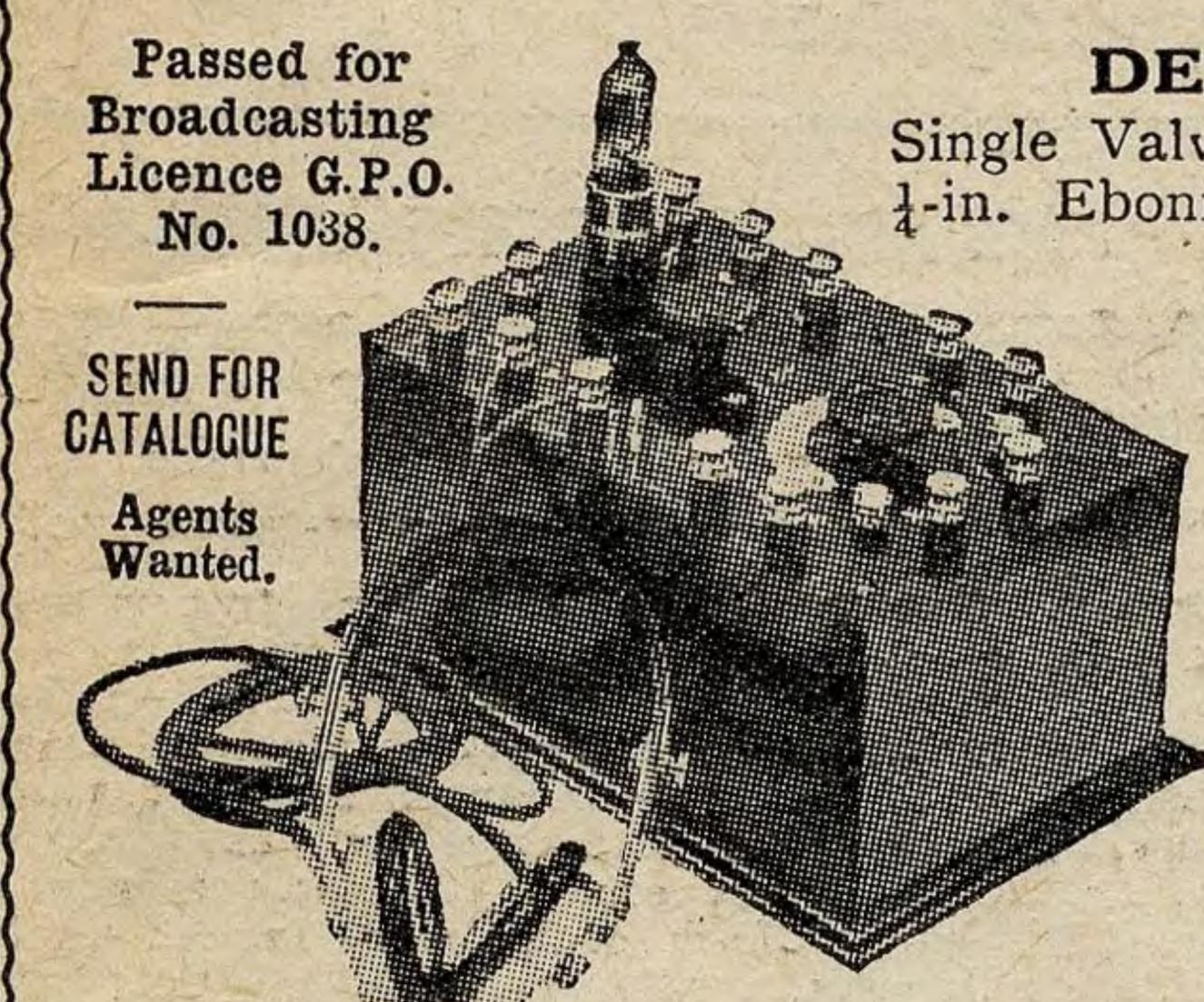
PETTIGREW & MERRIMAN, Ltd., 122-124, Tooley Street, London, S.E.1

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BROADCASTING RECEPTION SETS

One-Valve Set Complete for Working, £7 10s.



DESCRIPTION:

Single Valve, mounted on polished ## 1-in. Ebonite Panel with Variable

Condenser. smooth acting resistance, grid leak and condenser and all terminals clearly engraved in white, in a Mahogany Polished Cabinet 9 in. by 5 in. by 5 in. by 5 in. £3 15 0

A TAPPED COIL for wave-lengths up to 900 metres with 2 terminals for coils for any higher wave-lengths.

Total £7 10 0

The coil is enclosed and the tappings are brought out to an 8-way switch mounted in the front of the cabinet.

ACCESSORIES INCLUDED:

Siemens' 54-volt high-tension Battery with plugs		
for altering the voltage	15	0
4-volt 50-amphour low-tension Accumulator in		
case with carrying strap	1 4	0
One pair of Sensitive Headphones of 4,000 ohms		
resistance	1 1	0
	15	0
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Plus B.B.C. Royalties.

WIRELESS INSTALLATIONS Ltd. 15, Aldersgate St., London, E.C.

We are now in the position to supply

EDISWAN A.R. 6 volt VALVES

from Stock at

FULL MAKERS' DISCOUNT

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METROPOLE GARAGE, WIRELESS SHOWROOMS, Opposite HOTEL METROPOLE, BLACKPOOL. FOR ALL RADIO REQUISITES

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The Finest Stock of Quality Wireless Accessories in the North. Astounding Prices & Real Service.

SHEET EBONITE, ½ in. & 3/9 per lb.!!

WATES' CRYSTAL RECEIVING SET Costs but £5—Receives Broadcasting within 30 miles.

SUPPLIES up to three headphones with music or speech from a Broadcasting station 30 miles away.

The movement of one switch arm will enable to receive Telephony or Telegraphy with remarkable clarity.

Dimensions 9 in. by 9 in. and $8\frac{1}{2}$ in.high.

Complete in highly polished mahogany case, with Sterling Headphones, 100 ft. 7/22 Aerial, 2 Econ Aerol Insulators, 1 Aluminium Pulley.

Price £5 - 0 - 0

including all Royalties and Taxes.

NO EXTRAS.

First cost is all—no batteries to need recharging.

Send at once for list or call for demonstration.

We supply complete Receiving Sets (Crystal or Valve) also all component parts, of which the following is an abbreviated list:

> "Ideal" Va've Accumulat.r, 4 volt 50 amp. 24/- per set (Carriage, 2/-) "Ideal" Valve Accumu-

lator, 6 volt 50 amp. 35/- per set

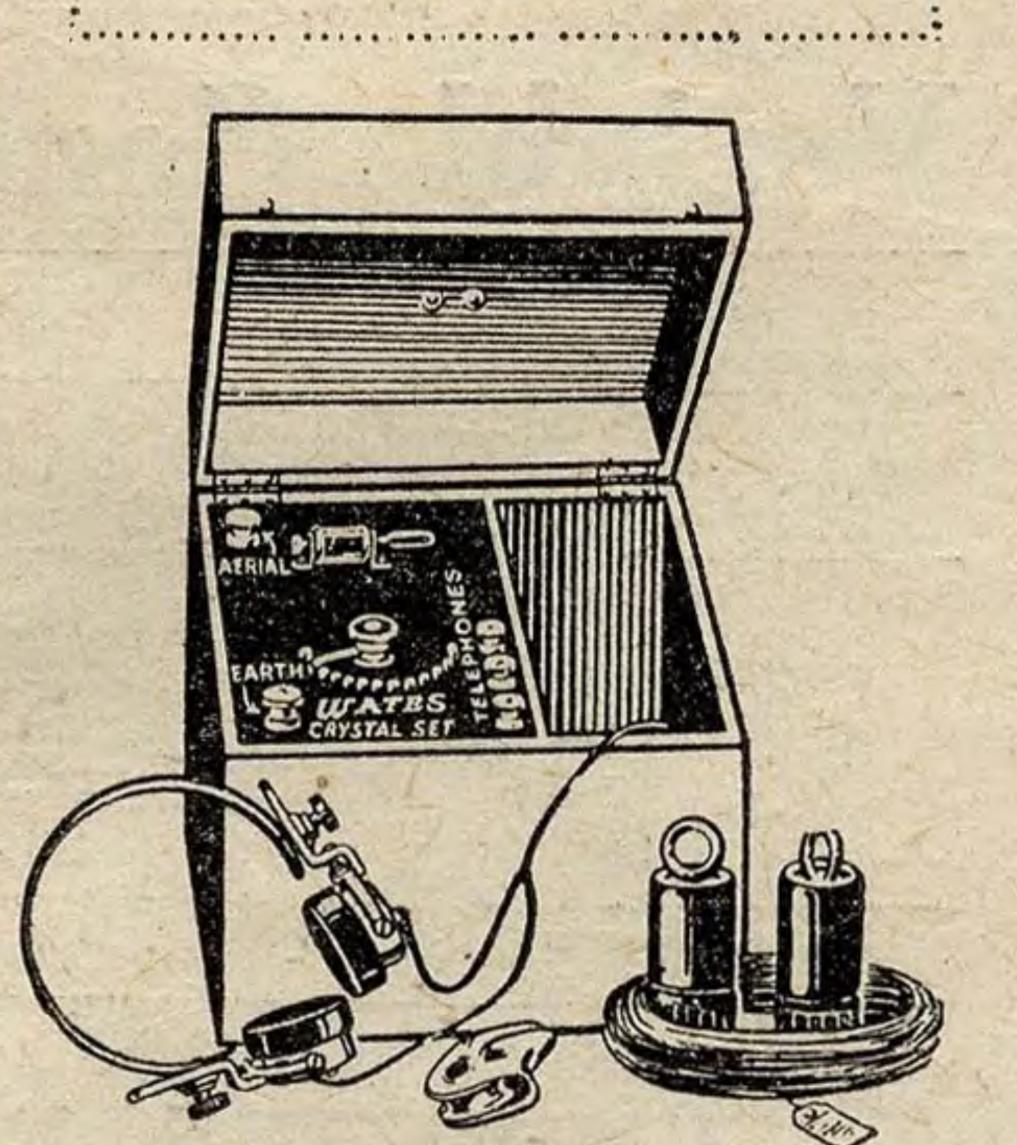
(Carriage, 3/-.)

Filament Resistances

Variable Condensers (of

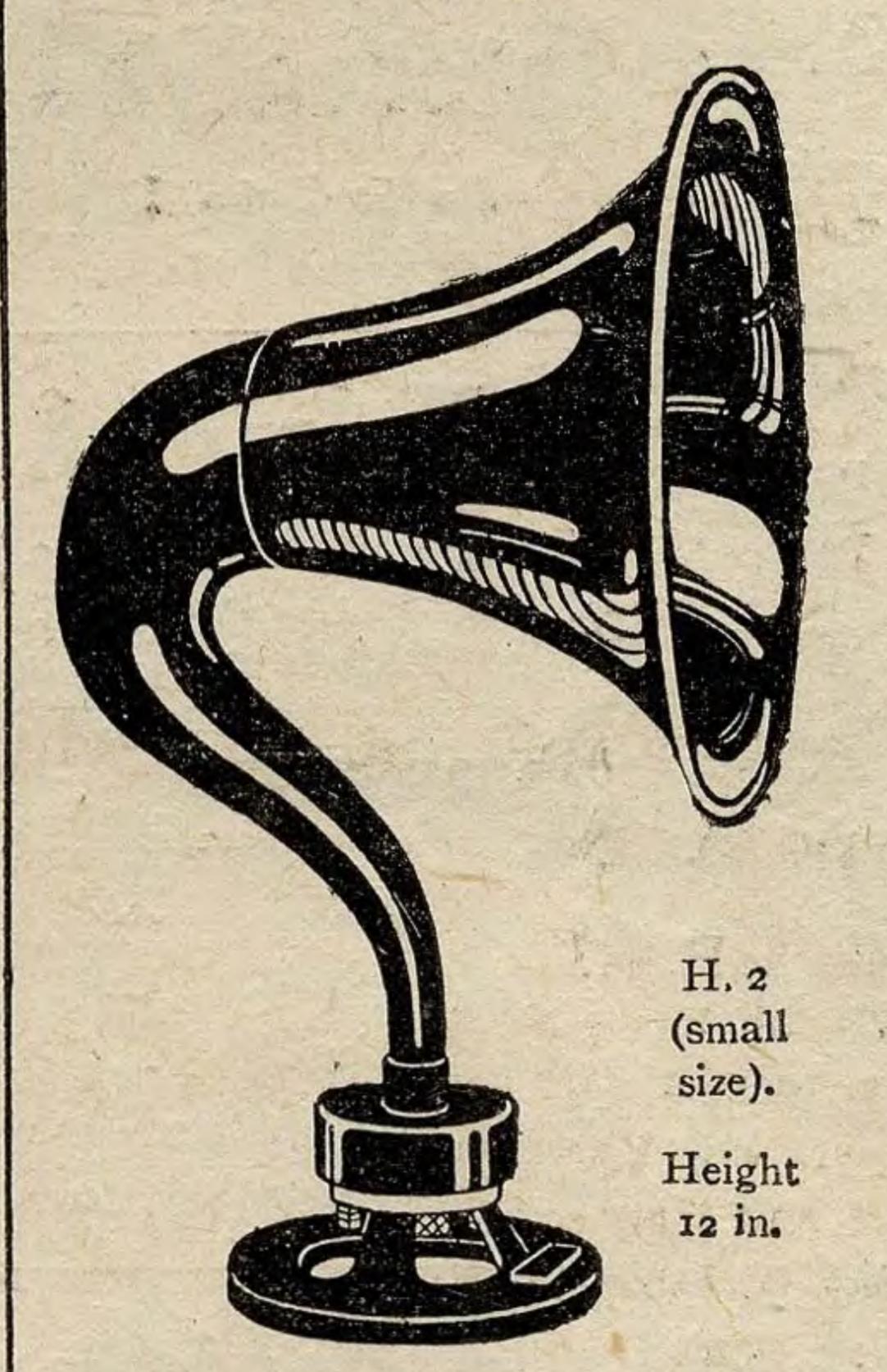
rom ... 6/- each
Fixed Condensers, from 2/6 each
Pyramid H.T. Battery,
15 volt ... 3/6 each
Pyramid H.T. Battery,

go volt with variable plug connection ... 7/- each Three-coil Holder, complete unit ... 20/- each



Wates Bros. 13/14, Great Queen Street, KINGSWAY, LONDON, W.C.2.

The "BROWN" LOUD SPEAKERS



Illustrated Catalogue of Headphones, Loud Speakers and Amplifiers, post free.

with new improved Curved Horns

THE requisites of a Loud Speaker are pure tone, clear articulation, and good volume of sound. The BROWN Loud Speaker possesses all these qualities in a marked degree. Type H. 2 has been designed to meet home requirements, both as to volume of sound and price.

PRICES

H. 2 (Small), Low Resistance. 120 ohms, height 12 in. £300

H. 1 (Large), Low Resistance. 120 ohms, height 21 in. £6 5 0 (High Resistances for either size, 2/6 to 5/- extra.)

THE BROWN MICROPHONE AMPLIFIER.

This amplifier gives a magnification much greater than that obtained from a two-valve amplifier.

Prices

Low Resistance (120 ohms input), £6 0 0 High Resistance (2,000 ohms input), £6 2 5

Our apparatus can be obtained from all wireless dealers.

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HEADPHONES

Genuine French Telephones, most sensitive obtainable, 6 Tungsten poles in each earpiece. 4,000 ohms with cords (Double Receivers) ... post free

66 EBONITE"

Postage Free. Any Size cut.

4" thick		:: Mat	t surface
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	s. d. 1 3 2 8 3 9 5 3	12 × 10 17½ × 8½ 18 × 18 36 × 18 7 1b	£ s. d. 7 6 9 6 12 10 1 3 0 1 3 0

4,000 ohms 22/6 POSTAGE 9d.

Variable Condensers

French "Brunet" Headphones

Approx. Capacity Microf ds.	Price.
·ooi	16/-
.0005	12/6
.0003	11/6
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Postage 1/- per set extra.

WIRELESS PARTS AND ACCESSORIES

Aerial Wire, 7/22 bare copper, stranded. Price per
100 ft. 3/ By post. 4/6.
Aluminium Vanes, 2 doz., 1/ By post, 1/6. 5/-
gross; by post, 6/
Basket Coils, 7 in set, 5/- set. By post, 5/6.
Brass Washers, 2, 3, 4 or 5 B.A dozen 20.
,, Nuts, 2, 3, 4 or 5 B.A dozen 4d.
Brass Rod (screwed)—
2 B.A., in 12-in. lengths each 5d.
3 B.A., in 12-in. lengths each 41d.
4 B.A., in 12-in. lengths each 4d. 5 B.A., in 12-in. lengths each $3\frac{1}{2}d$.
Copper Foil Sheets, uniform thickness,
12 in. by 3 in each 3d.
Crystal Detectors on Ebonite. Each 2/6. By post,
3/ Also 3/3; by post, 3/9. Crystal Detector, cup enclosed with glass cover, dust
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Ebonite Dials, with engraved scale 0.180, 1/- each.
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Egg insulators, 4 for 11d.; 2/6 per doz. By post, 3/6
207
Filament Resistances. Each 2/6 and 3/6. By post,
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Filament Resistance.—Suitable for one, two or three
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Grid Leak and Condenser, .0003, high quality, 3/9.
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13 Insulating Sleeving, 6 yds. for 2/2. By post,
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Knobs, with brass nut (2 B.A.), 4½d. each. By post,
7d., 6 for 2/- By post, 2/6.
Large Spacer Washers, 3 doz., 9d. By post, 1/

Lead-in Tubes, ebonite with brass terminals, 9 in., 1/2. By post, 1/6. 12 in., 1/4. By post, 1/8. Reel Insulators, 1d. each. By post, 2/- doz. Slider and Plunger, 5d. By post, 7d. Slider Knob, Plunger and 13 in. rod, 8d. the set. Cannot be sent by post. Small Spacer Washers, 6 doz. 1/-. By post, 1/4. Switch Arms, with polished knob, bushed 2 B.A. nur, laminated blade, spring coil washer, nuts and bush, 1/-, 1/6, 2/- each. By post, 1/3, 1/9, 2/-. Terminals, telephone, with nut and washer, 2/- doz. By post, 2/6. Terminals (large), aerial and earth, complete with 2 nuts and 2 washers (2 B.A.), 2 for 8d. By post; 1/-. Tin Foil, free from lead, Sheets 26 in. War Office Pattern Terminals, with nut and washer, 2/- doz. By post, 2/6.

Instrument Wires

British Made Copper Wires. Per lb.

~ ~ ~ ~	yds.	ohms	~ ~ ~	~ ~ ~	2 2 2		
S. W	.G. per lb.	CONTRACTOR OF THE PARTY OF THE	oo S.C.C	. D.C.C	. S.S.C.	D.S.C. I	inmld.
22	140	yds. 39	2/9	3/-	4/-	5/-	2/7
24	230	63	3/-	3/6	4/6	6/-	2/8
26	340	95	3/7	4/1	5/-	8/-	3/2
28	530	140	4/4	4/8	6/-	9/-	3/6
30	716	200	5/-	5/6	7/-	10/-	3/10
32	950	262	6/-	7/3	8/-	12/6	4/2
34	1,300	362	7/-	8/3	9/-	13/6	4/4
36	2,000	530	8/8	10/-	12/-	15/6	4/8
28 30 32 34	530 716 950 1,300	140 200 262 362	4/4 5/- 6/- 7/-	4/8 5/6 7/3 8/3	6/- 7/- 8/- 9/-	9/- 10/- 12/6 13/6	3/6 3/1 4/2 4/4

Wireless Crystals

"Hertzite" 1s	. 6d	Carborundum	6d
Zincite	6d	Molybdenite	6d
Silicon	6d	Iron Pyrites	6d
Bornite	6d	Galena	6d
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Copper Pyrites	6d	D	ram
Wood's Metal	25.	Tellurium 2s	6d
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Intervalve Transformers

Ratio 5 to 1
Post Free, ... 15/-

Celluloid Accumulators

We are introducing a new model consisting of individual two volt units. This MODEL to be known as T.9 has an actual capacity of 18 ampere hours, and an intermittent capacity of 34 ampere hours.

PRICE AS FOLLOWS

2 volt	•••	• • •	6/-	each
4-volt	•••		11/	9 ,,
6 volt			17	6

H.T. Batteries, 30 volt, 6/- (by post, 7/6). H.T. Batteries, 60 volt, 12/- (by post, 13/6).

Inductance Tubes

Cardboard

12 in. by 4 in., 80 each. Post 2d.

Mahogany Boxes

Polished		Post
4½ x 4½ x 3½ in.	3/-	3d
4½ x 4½ x 5 in.	3/6	6d
$6\frac{1}{2} \times 6\frac{1}{2} \times 4$ in.	4/8	1/-
13 x 6½ x 4 in.	8/-	1/-

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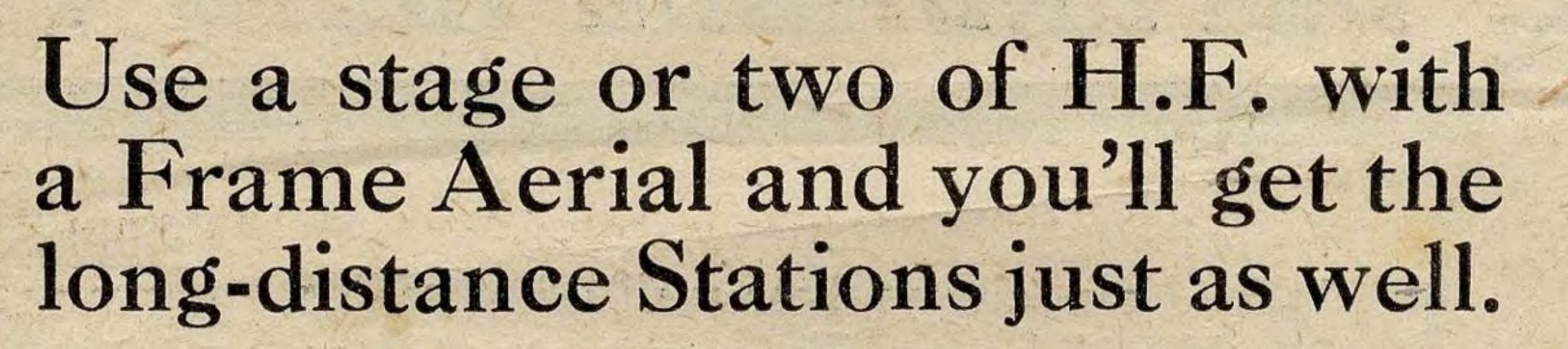
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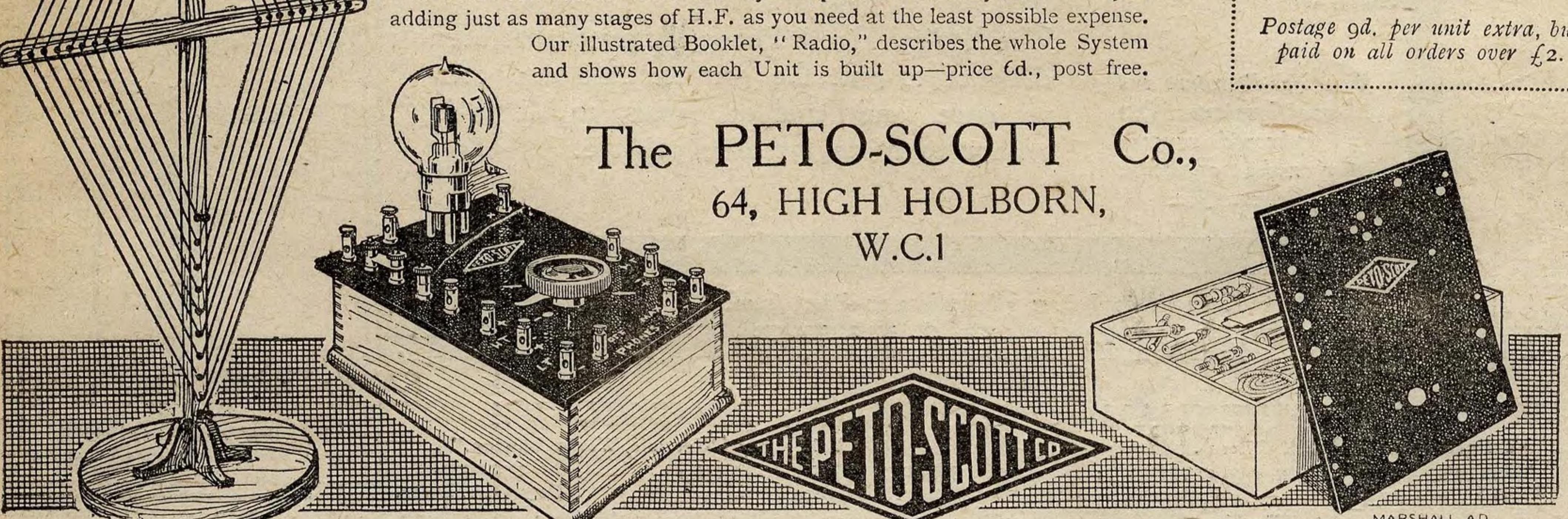
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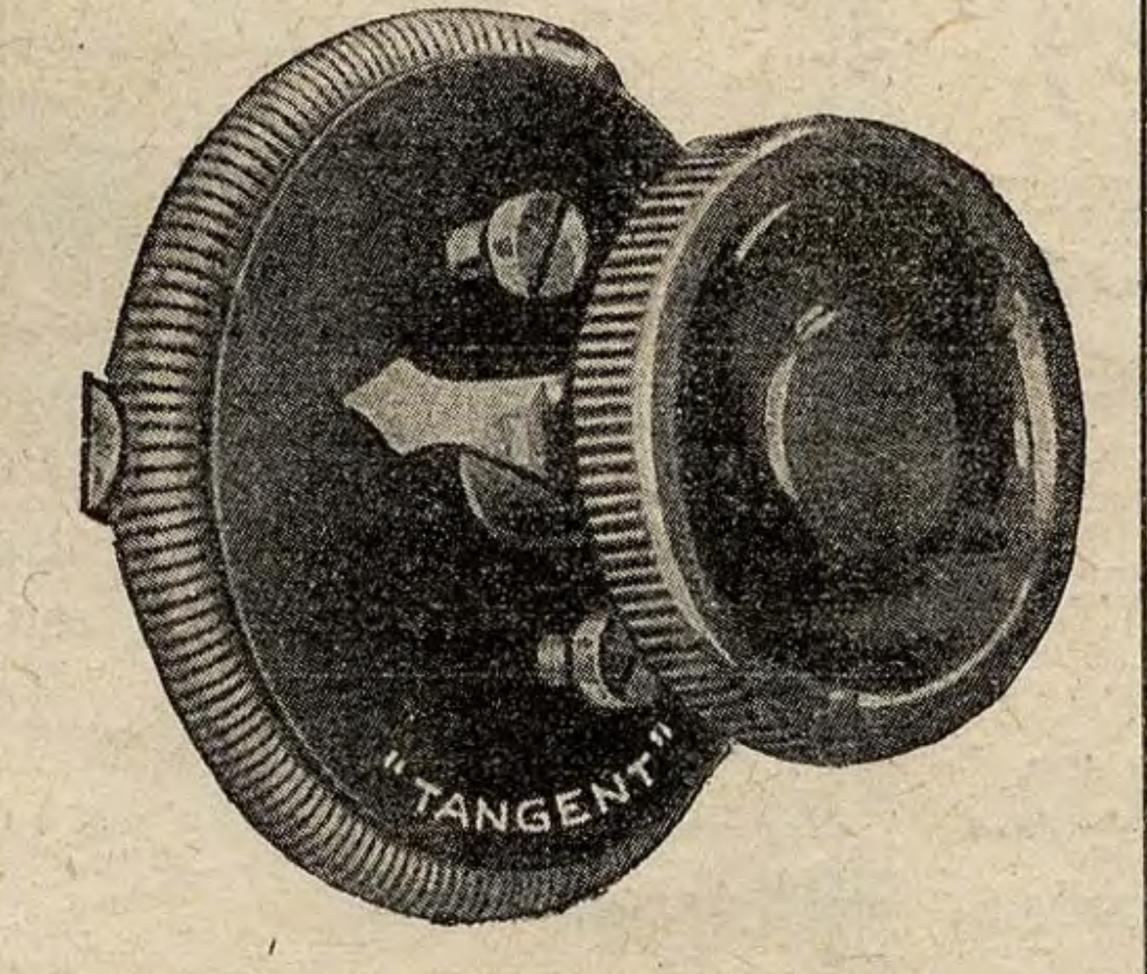
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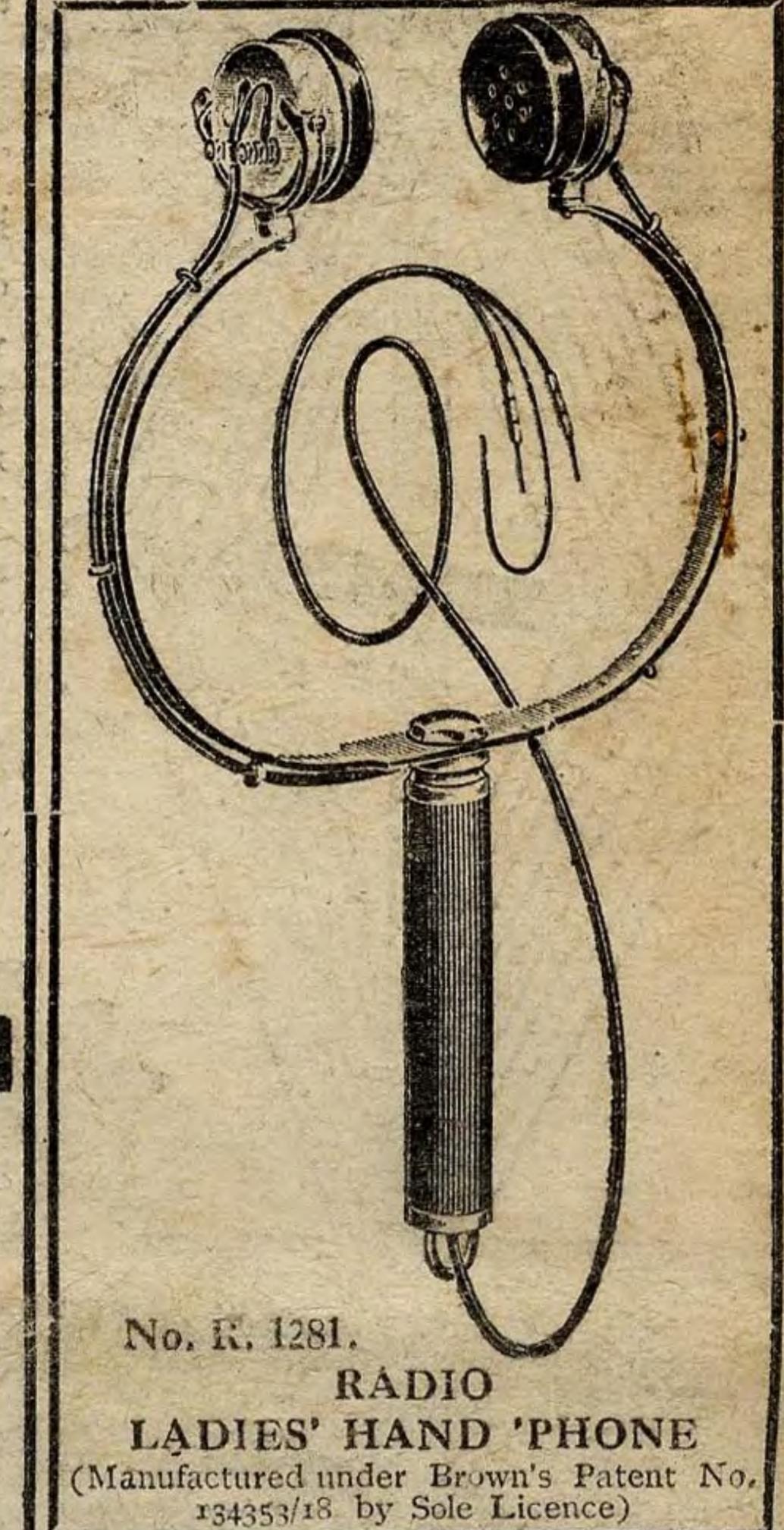


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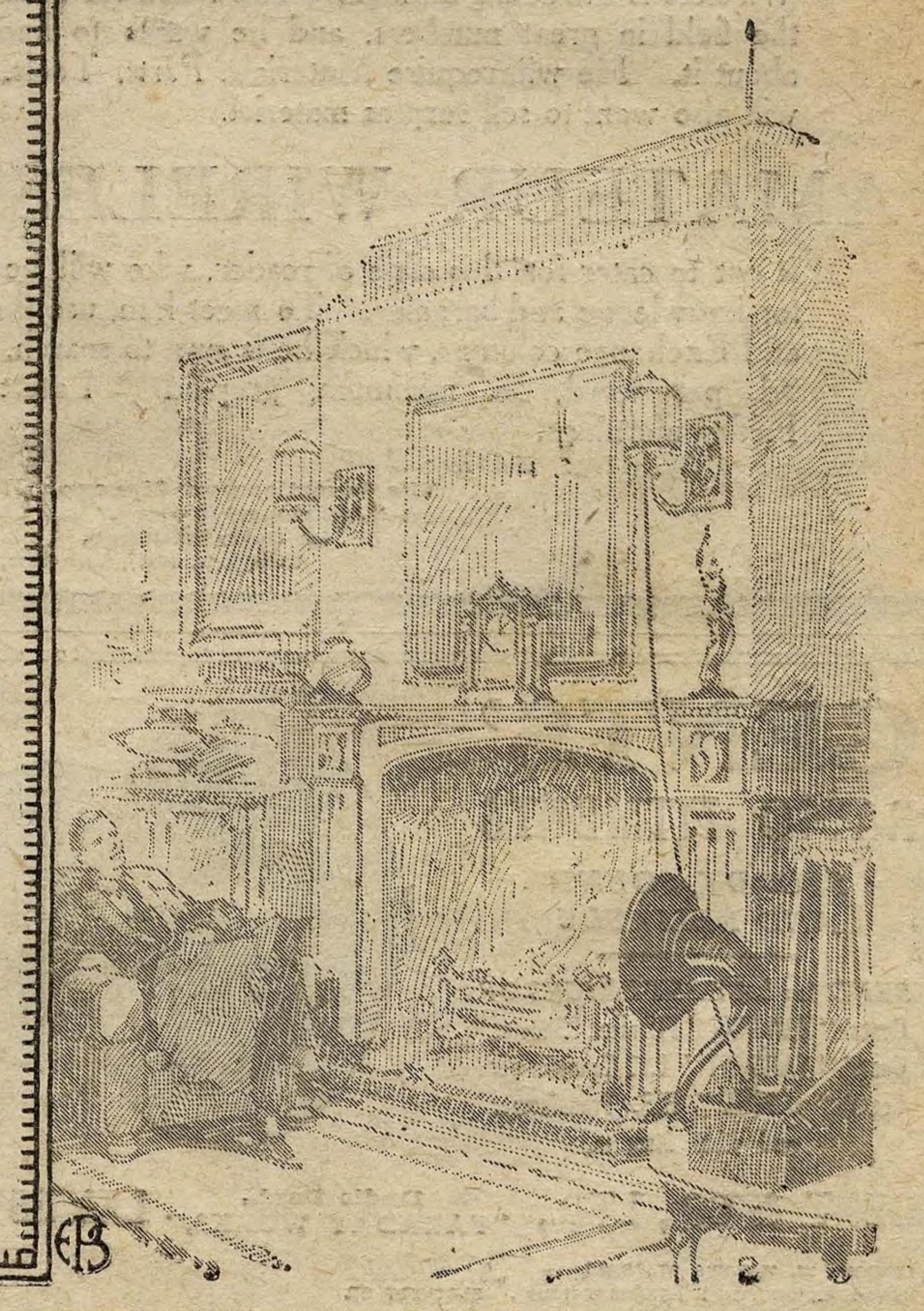
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