Wireless Weekly, 6d. Net. Wednesday January 7th, 1925

Wireless Weekly

Vol. 5. No. 12

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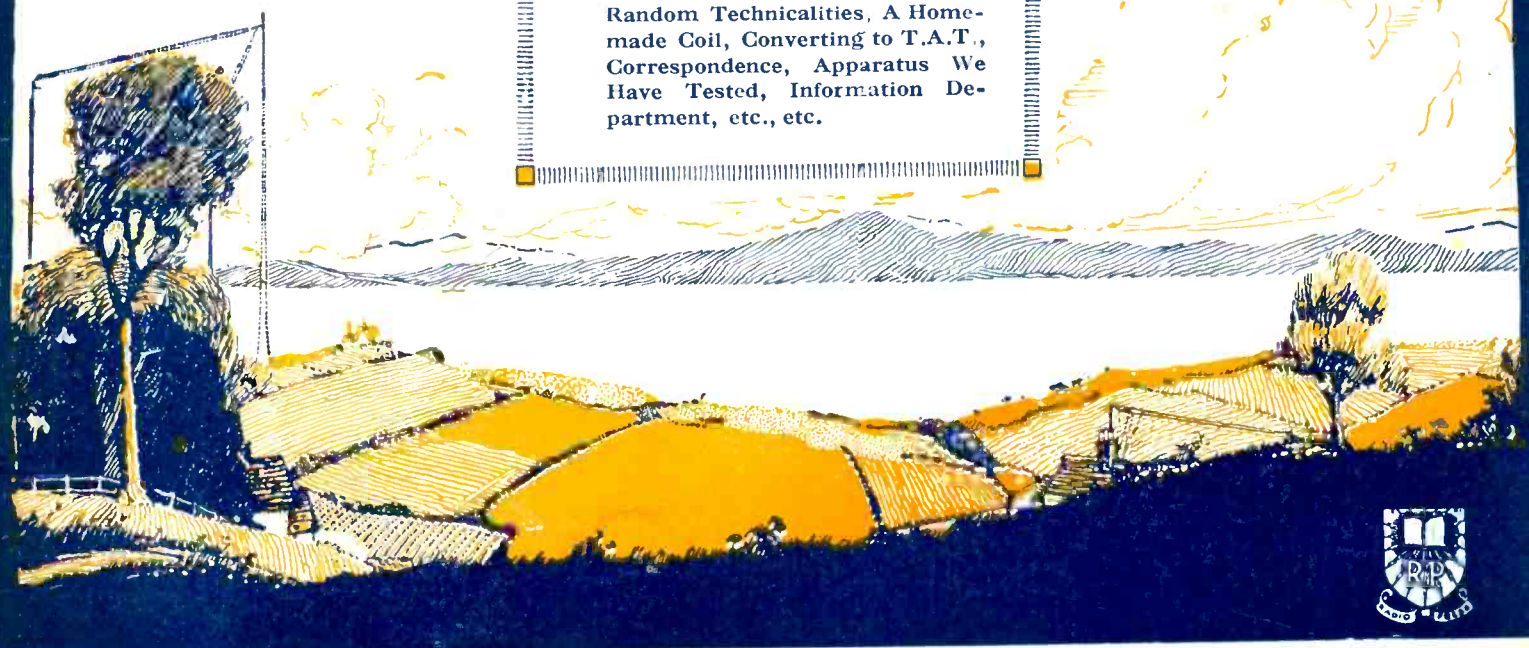
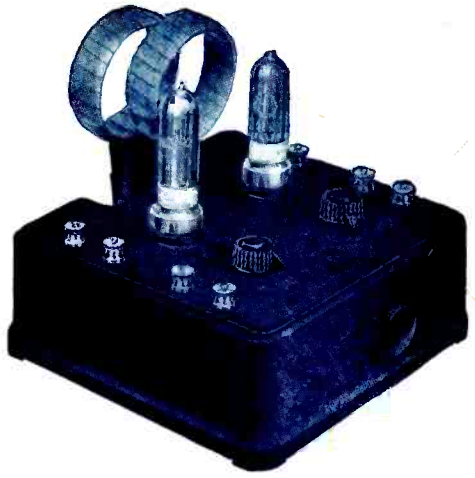


The Negadyne

By A. D. COWPER, M.Sc.

Inexpensive Burndept Loud Speaker Equipment

The Ethophone-Duplex: £5 5s. The Burndept Junior: £2 15s.



No. 1503. Ethophone-Duplex, without valves, coils, batteries, etc., **£5 5s.**, Marconi Licence, £1 5s.

No. 331. Burndept Junior Loud Speaker 2,000 ohms resistance, **£2 15s.**

PEOPLE who want to listen to broadcast from their local station on a loud speaker but do not want to spend a great deal will be very interested in the five-guinea Ethophone-Duplex and the Burndept Junior, a loud speaker which costs little more than the price of two pairs of good headphones. Where cost is a consideration these two Burndept instruments command attention. Better value in wireless apparatus would be hard to find.

The Ethophone-Duplex is a two-valve receiver which will work a loud speaker about 20 to 25 miles from a main broadcast station, and about 100 miles from the high-power station, though in many cases better results are obtained under favourable conditions. Tuning is effected by a new type of variable condenser. The reaction coil is controlled by a geared coil-holder giving vernier movement. The dual rheostat enables one to use bright or dull-emitter valves without altering the instrument in any way. The Ethophone-Duplex will receive on any wavelength between 250 and about 5,000 metres. For the money you could not build such an efficient receiver. The instrument is fully guaranteed.

The Burndept Junior, a new Burndept accessory, is a sweet-toned loud speaker that gives sufficient volume of sound for ordinary domestic requirements. The diaphragm is of the "floating" pattern and is adjusted by means of a knurled nut in the base. A black crystalline finish makes the instrument particularly neat in appearance.

Write now for particulars of the Ethophone-Duplex and the Burndept Junior. Demonstrations can be arranged with any Burndept Agent.

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Wireless Weekly

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A Memorable Presidency

THE Radio Society of Great Britain is to be congratulated upon the acceptance by Sir Oliver Lodge, F.R.S., of the position of President for the forthcoming year. Sir Oliver Lodge's decision is one more proof of the prestige of the leading amateur society, and will do much to strengthen its position.

The constitution of the Radio Society of Great Britain provides that no President may occupy the position for more than two consecutive years. While we have no quarrel with the rule itself, we think that experimenters throughout the country will view with regret the fact that under this rule Dr. Eccles has had to vacate the Presidential chair. His two years of office have been marked by many notable changes in the Society, and only those closely associated with the organisation have even an approximate realisation of the immense amount of work he has, personally, done in improving the status of the amateur.

First and foremost the new constitution owes very much to Dr. Eccles, who has not merely presided at numerous committee meetings, but has given of his own very valuable time many weeks in perfecting it. The General Committee of the affiliated societies—one of the most important advances in the amateur organisation—owes its inception to him, while as an *ex officio* member of all committees, he has given freely his expert advice on innumerable points.

So far as licences are concerned, the strong and yet tactful attitude he has adopted has contributed much toward the clearing up of many anomalies. Much of this success has been due to the fact that Dr. Eccles is held in high regard both by the authorities and the amateurs who have entrusted their interests to him.

Within his period of tenure of this office Dr. Eccles has seen the Society take its own offices in Victoria Street. The organisation necessary for the successful conduct of this part of the Society's activities has been the subject of his personal supervision throughout, and to this alone he has given up many hours each week.

With such an example before them, experimenters throughout the country should seriously consider whether they are giving adequate support to the parent and to the affiliated societies. We have criticised freely, and shall continue to do so, the activities of the Radio Society of Great Britain, believing that such criticism is helpful. We feel too keenly the need of well-organised effort on the part of the amateurs to pass by without comment the various developments. Our criticisms in the past have received full support from our readers, and we feel sure that they will join with us in thanking Dr. Eccles, on behalf of the amateurs of the country, for the great assistance he has given to the movement during his period of office.

CONTENTS

The Calculation of the Natural Wave-Length of an Electric Circuit

By JULIUS FRISH, M.Sc., M.I.E.E

An article of value to all who prefer to design their own apparatus.

I SHALL endeavour in this article to show how to calculate the natural wavelength of an electric circuit with the minimum of mathematics and without assuming much previous knowledge of electricity.

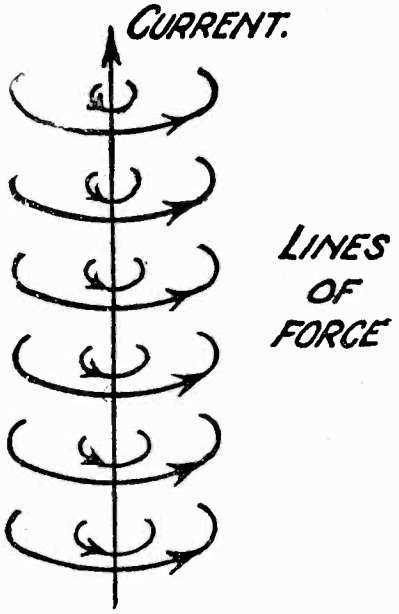


Fig. 1.—Distribution of field around a straight conductor.

The centimetre-gramme-second ("C. G. S.") method of measuring length, mass and time will be adopted. Also to save space a million will be written 10^6, a thousand 10^3, and so on.

The first thing to be noted is that in wireless work both frequency and wavelength are spoken of. The relation between these quantities is, of course, that velocity equals wavelength × frequency; just as the velocity of a train equals the length of a truck × the number of trucks coming out of a tunnel per second.

Velocity of Electric Waves

The velocity of electric waves is the same as that of light, i.e., about 300,000,000 (3×10^8) metres per second, so that a frequency of a million per second would give a wavelength of $\frac{300,000,000}{1,000,000}$ or 300 metres.

Magnetic Field

It is found experimentally that when a current flows in a wire the space round the wire has magnetic properties, and is called a "magnetic field." (See Fig. 1.)

A magnetic field is a portion of space in which a magnet, a compass for instance, is attracted or turned in some definite direction. The strength of a magnetic field is measured in a unit called "lines of force per square centimetres."

It is found experimentally that if a conductor of electricity is moved in a magnetic field so as to cut the lines of force at right angles, a voltage is generated in this conductor proportional to the rate of cutting lines of force. This gives us the unit of the "volt" which is the result of cutting 10^8 lines per second.

Lines of Force

Further, it is not necessary to be too insistent on being able to see the lines of force cutting the conductor; they may be just inserted or withdrawn from a turn of wire or loop in the electric circuit, so that the above definition may be stated by saying that if the lines are varied through a turn or turns of a circuit, each turn has a voltage generated in it equal to the rate of variation of the lines through it, a variation of 10^8 lines per second making a volt in each turn.

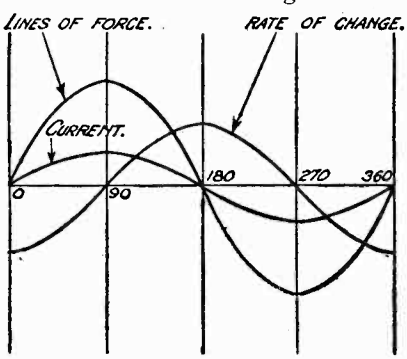


Fig. 2.—Illustrating the relation between magnetic field and its rate of change.

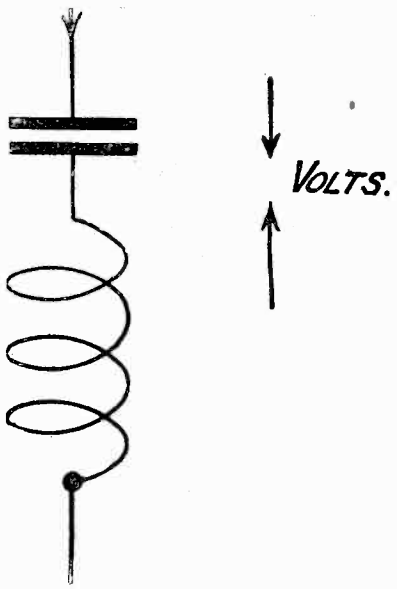


Fig. 3.—Relation of voltages produced across a coil and a condenser.

It follows from these two statements that a current can never vary, however slightly, in an electric circuit without causing a voltage in that same circuit, which voltage always tends to oppose the change of current, i.e., when the current starts to decrease in an electric circuit (and all electricity must flow in a circuit) the number of magnetic lines through that circuit is diminished and thus generates a voltage in the circuit in such a direction as to tend to keep the current flowing.

Self Induction

This tendency is called the "self induction" of a circuit; when it is wished to accentuate

the effect, the wire forming the circuit is wound in a coil so as to make the lines due to each turn cut all the other turns.

The self induction of each turn is the number of lines going through that turn for each ampere in the circuit, the self induction of the whole coil is the sum of that of each turn; and as the lines through each turn are generally those made by all the turns, the self induction of a coil increases as the square of the number of turns.

Self induction is measured in units called henries and equals :—

Number of lines through the coil when one ampere is flowing × turns in the coil ÷ 10^8.

A micro henry is one-millionth of a henry.

Now imagine such a coil carrying an alternating current, i.e., a current which varies harmonically from a maximum in one direction to a maximum in the opposite direction. The lines are a maximum when the current is a maximum, but their rate of change is a maximum when their number is going through zero (see Fig. 2), so that the voltage across the coil generated by these self-made lines is a quarter of a wave behind the current.

Condensers

The next phenomenon I want to introduce you to is quite different. It is what happens when you connect a battery, say, to a condenser which consists of two parallel plates near to, but not touching, each other. If you were very quick, you could find that at the moment of contact a little electricity flowed into one plate and out of the other, but unless the battery were of a sufficiently high voltage to spark across between the plates, this flow of electricity would stop almost immediately. The quantity of electricity which flows into a condenser is proportional to the voltage applied to its plates, and the capacity of a condenser is defined as the amount of electricity which flows into it for each volt applied across it. It is very like pumping gas into a steel bottle, the capacity of the bottle could be measured by the quantity flowing in for each pound to the square inch pressure applied. Capacity so defined is measured in farads.

Now apply an alternating voltage to the condenser plates, the electricity forced in during the positive half of the wave will come out during the other half, and so a condenser appears to let an alternate current flow through it and to stop a continuous current; though it would be more accurate to say an alternating current flows in and out of a condenser, not through it.

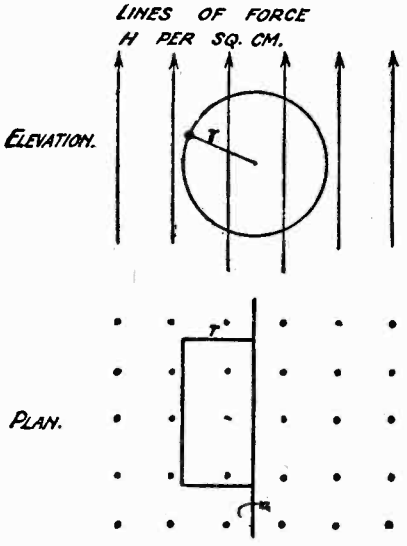


Fig. 4.—Illustrating the method of rotating the coil for obtaining an expression for self-induction.

Here again the voltage across the condenser plates will be a maximum when the current is zero, as at that moment electricity has been flowing into it for half a wave and is just going to reverse and come out again.

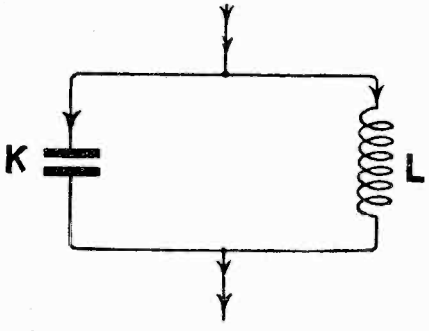


Fig. 5.—Division of current through parallel paths.

So that if we put a self induction coil and a condenser in series and make the same alternating current flow through both, the voltage on the condenser and on the self induction will be a maximum when the current is going through zero, but they will be in opposite directions; the volts on the self induction will be opposing the current which is just growing up from zero, whereas the pressure in the condenser will be aiding the growing current as it is in the direction to let the stored up electricity out again.

It is seen that the frequency of alternation of the current has an opposite effect on self induction to that which it has on capacity. At no frequency, *i.e.*, a continuous current, self induction is no hindrance, as the self-made lines of force, however numerous, do not vary. Continuous current is, as we have seen, entirely interrupted by a condenser.

Rate of Change

On the other hand, as the frequency gets higher the effect of the self induction increases as the rate of change of the lines becomes greater. The condenser, however, has less and less to do, for if the current or rate of flow of electricity is the same, the time during which it flows in any direction is less, and therefore the quantity of electricity it has to accommodate is less the higher the frequency.

As explained above, all electric circuits must have some self induction, which impedes the flow of an alternating current, but if to such a circuit we add the right amount of capacity a voltage will appear at its terminals equal and opposite to that made by the self induction, and will therefore neutralise the effect of the latter and let the alternating flow of electricity surge round the circuit with the least possible obstruction.

Natural Frequency

In fact, could we eliminate *resistance* from the circuit, which plays the *rôle* which friction takes in mechanics, electricity once started oscillating at the appropriate rate would continue to do so for ever. This then would be the natural frequency or " note " of the circuit, and such a circuit would respond to this note and to no other.

It follows that for every circuit containing self induction and capacity there must be one particular frequency at which each nullifies the effect of the other. Or, putting it another way, there must be some values of self induction and capacity which balance each other for any particular frequency.

Having now explained the way the thing works, it only remains to put in the arithmetical constants to enable us to make all the necessary calculations.

Example

The maximum volts at the terminals of an inductance of L henries is calculated in this way :—

Imagine a rectilinear coil rotating in a uniform magnetic field about one of its sides as axis, place the coil so that the two sides of length r centimetres each adjacent to this axis revolve in

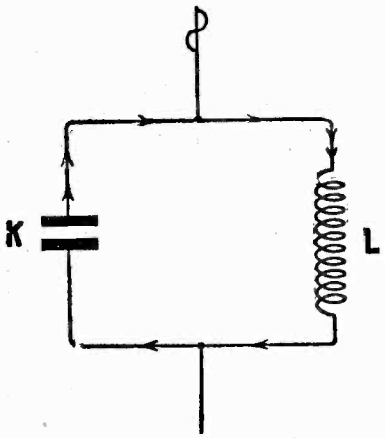


Fig. 6.—True direction of current flow in an oscillatory circuit.

the plane of the lines and so do not cut them (see Fig. 4), so that the volts would only be generated (by cutting lines) in the remaining side of length l centimetres. Let the magnetic field have H lines per square centimetre, and let the coil rotate at n revolutions per second. The speed of the side l through space $= 2\pi rn$ centimetres per second. The maximum rate of cutting lines would then equal $H \times l \times 2\pi rn$ per second. This, divided by 10^8, is the volts in the coil.

$H \times l \times r$ is the maximum number of lines through the coil. Therefore the volts =

$$\frac{\text{maximum lines}}{10^8} \times 2\pi n.$$

Now instead of revolving the coil in a magnetic field keep it stationary and put an alternating current in it. This current (of maximum value C amperes) will make lines of force through the coil, which will vary in just the same way as the lines did when it was revolving. By the definition of the henry, L is the number of 10^8 lines for one ampere, so LC is the maximum number of 10^8 lines for a current whose maximum value is C amperes. n, the revolutions per second, is the frequency, written $\sim$, therefore the maximum volts at the terminals of the inductance $L = 2\pi \sim LC$.

Condenser Discharge

Taking now the case of the condenser, if the current varies harmonically and its maximum value is C, its average value over half a wave is, from the mathematics of harmonic motion, $C \times \frac{2}{\pi}$ In half a wave the condenser changes from full in one direction to full in the opposite, so that from empty to full takes a quarter of a wave, or $\frac{1}{4\sim}$ seconds, in which time electricity equal to $C.\frac{2}{\pi}.\frac{1}{4\sim}$ flows into it. The voltage at its terminals will therefore be $C.\frac{2}{\pi}.\frac{1}{4\sim}.\frac{1}{K} = C \times \frac{1}{\frac{\pi}{2}\sim K}$ where K is the capacity in farads.

Resonance is attained when the volts on the self induction and the volts on the condenser are equal (and opposite), as in Fig. 3, *i.e.*, when $2\pi \sim LC = \frac{C}{2\pi \sim K}$ from which

$$\sim = \frac{1}{2\pi}\sqrt{\frac{1}{LK}}$$

Now the wavelength = velocity ÷ frequency $= 3 \times 10^8 \times 2\pi\sqrt{LK}$ metres $= 18.85\sqrt{LK} \times 10^8$.

If L_1 is in *micro*-henries and K_1 in *micro*-farads, the wavelength $= 1885 \times \sqrt{L_1 K_1}$ metres.

It will be seen that the effect of self induction is greater the greater the self induction, whereas the greater the capacity of a condenser the *less* effect it has on the circuit. If the two are put in series so that the same current flows through each, the volts at the terminals of the self induction are proportional to the self induction of the coil, but the volts on the condenser are greater the *less* the capacity.

Constant Wavelength

Thus to keep the wavelength of a circuit constant, if the self induction is increased the capacity must be proportionally decreased.

All the above is on the assumption that the self induction and capacity are in series, in which case the current in each is the same, but the pressure across each is controlled by its individual value.

If, instead of this, the two are placed in parallel in a circuit, as in Fig. 5, then the opposite is true; each has the same volts across it, but the current divides according to the values of L and K.

The expression in the last column can again be used, but in this case the currents, which were alike and both called " C " when in series, will now in general be different, and we can write

$$2\pi \sim LC_L = \frac{C_K}{2\pi \sim K}$$

When they were in series the volts on each were opposite in direction, and could be made of equal magnitude by adjustments either of the values of L and K or of the frequency. Now they are in parallel they share the

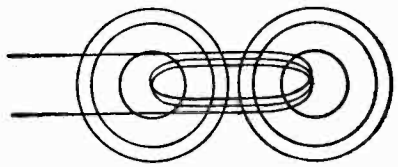


Fig. 7.—This arrangement of turns gives the highest self-induction.

same volts, so the currents are, at any instant, opposite in direction, and can likewise be made equal in magnitude by similar adjustments; for instance, $C_L = C_K$ when $2\pi \sim L = \frac{1}{2\pi \sim K}$ *i.e.*, when $\sim = \frac{1}{2\pi}\sqrt{\frac{1}{LK}}$ which is seen to be identically the same frequency as that which did the trick when the two were in series.

Deception

So you see that the arrows in the nice little picture (Fig. 5) are all wrong! There need be no current in the outside circuit at all, only an alternating voltage of the right frequency, for the currents in L and K to be enormous. As before, were it not for resistance, the currents would be infinite. This parallel circuit can therefore be " tuned " in the same way as the series circuit, and exactly the same expressions for wavelength, etc., hold good.

A word should now be said about connecting two condensers or two inductances together. This may be done in series or in parallel.

1. Two equal condensers in series, capacity half that of either alone because, of the voltage available to charge them, only half is across each and therefore only half the electricity goes in.

2. Two unequal ditto of capacities K1 and K2. Capacity in series $= \frac{K1 \times K2}{K1 + K2}$

3. Two or more condensers in parallel capacity the sum of the individuals.

4. Two or more inductances in series—the sum of all.

5. Two inductances in parallel. $\frac{L_1 \times L_2}{L_1 + L_2}$

The capacity of a condenser depends on the total area of its plates and inversely on the distance apart of the plates, and also on what is between them.

$$K' = \frac{kc\,A}{d} \times \frac{9}{10^8}$$

K' is capacity in microfarads.
A is the total area of the space

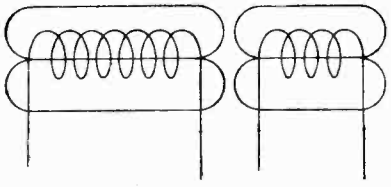


Fig. 8.—Separating the turns reduces the self-induction.

between the plates in square centimetres.

d is the distance apart in centimetres.

kc is the "specific inductive capacity" of what is between the plates; for air *kc*=1, for other substances it varies somewhat, but for certain glass it is about 7; for paper about 2; for mica about 6.

Aerial to Earth Capacity

In the same way an aerial has a capacity to earth approximately equal to some constant × its length ÷ some function of its height above the ground. The self-inductance of a coil depends on its diameter and on the number of turns squared; it also depends on whether the turns are all bunched together so that all the lines of magnetic force link all the turns, also the lines would then have the shortest possible return path outside the coil. If the turns of wire are, on the other hand, spread out in a single layer along a tube, the strength of the magnetic field is not much increased by the number of turns, as each turn, though bringing its extra magnetising force, also brings an equivalent extra length of magnetic circuit to magnetise.

For the bunched coil, the self-inductance in microhenries is *approximately* $\frac{ks \times d \times T^2}{100}$ when *d* is the diameter of the coil in centimetres T is the number of turns. *ks*=one for air and other non-magnetic substances (i.e., everything except iron, nickel and cobalt). For iron *ks* decreases with the density of the lines of force, but is always many thousand times that for air.

For long single layer coils, *l* centimetres long and having T turns, $L' = \frac{d^2\,T^2}{100\,l}$ microhenries *approximately*.

In the same way the loop consisting of an aerial, earth wire, and earth has self-induction which is proportional to the length of the aerial and increases with its height.

A New American High-Power Broadcasting Station

PLANS are now complete for the erection of an American broadcasting station with a power equal to that of 5XX Chelmsford.

It is hoped that the new station will commence operations on or about April 1 of this year, and under favourable conditions, should be heard in this country.

WCCO is the call sign of the new station, which will be situated 18 miles north-west of Minneapolis. The aerial towers will be 200 feet high, and of the three-legged type, set in concrete bases.

The studios, of which there will be three, are going to be situated in Minneapolis, and special telephone lines have already been laid between the city and the broadcasting plant.

When WCCO is completed, it will be one of the most powerful stations in the United States, and will be international in its scope.

The programmes to be broadcast from WCCO are going to be of a novel character, and will be a departure from the usual type of wireless programme.

In this connection, it may be interesting to note that there are several American broadcasting stations which provide programmes of a nature unfamiliar to British listeners. WOR-Newark, has a morning gymnasium class each morning at 7 a.m., as does KDKA-Pittsburg.

Many of the American radio stations commence operations at 10 a.m. or earlier, American time, and continue at intervals throughout the day until 11 p.m.

Some American stations not very well known to British amateurs are WGR-Buffalo on 319 metres, WSB-Atlanta on 429 metres, and WEBH-Chicago on 370 metres.

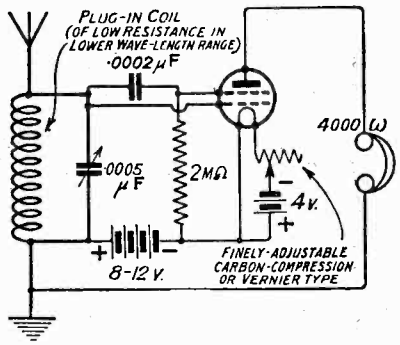


Fig. 1.—The "Negadyne" circuit.

SO-CALLED "negative resistance" or reaction effects (up to and beyond the point where self-oscillation commences when a tuned oscillating circuit is present) can be obtained in a number of ways besides the familiar method of direct magnetic coupling of a "reaction-coil" with the grid-tuning-inductance of a triode. Besides the various methods of electrostatic reaction available, and such arrangements as the Hartley oscillator, etc., possible with an ordinary three-electrode valve, there are, amongst others, the familiar American "dynatron" arrangement (using in effect *two* anodes), and the "negatron" device worked out by J. Scott-Taggart several years ago, for which a special type of valve is necessary, but in which self-oscillation is obtained with the use of a *single* inductance arranged as part of an ordinary oscillating circuit.

The "Numans Oscillator"

Recently a Dutch investigator has devised a very simple method of obtaining self-oscillation (and therefore the so-called "negative-resistance" effects) by the use of a four-electrode valve of the type developed some time ago in Holland and France for use in ordinary receiving circuits with but moderate plate-potentials. An interesting account of this has been given in our contemporary, *Experimental Wireless*, No. 15, Vol. II, under the name of the "Numans Oscillator." A complete explanation of the *modus operandi* of the negative-resistance effect does not appear to have been published yet: a suggestion is given elsewhere, based upon a determination of the actual characteristics of four-electrode valves operating under the conditions obtaining in these circuits.

Connections to the Grids

The essential point is that, in place of connecting, as usual, the inner grid of an ordinary four-electrode valve directly to a tapping-point on the high-tension battery (or, as in some circuits, to the L.T. plus on the positive side of the filament-resistance), and using at the most a magnetic coupling to the A.T.I. of a coil inserted in this circuit (as in certain Dutch circuits), in these "negative-resistance" circuits the grids are connected directly together by an ordinary grid-condenser, and a tuning inductance (together with its tuning condenser

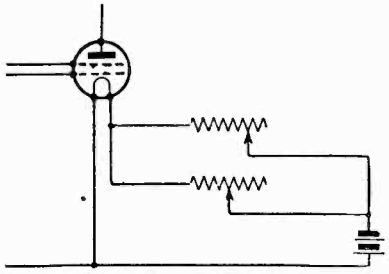


Fig. 2.—The reaction control.

to complete a proper oscillating circuit) is placed across the *combined* grids and the "earth" or filament. The inner-grid is given a steady mean positive potential by means of a small H.T. battery, of the usual size adopted in an efficient four-electrode receiving circuit (5 to 12 volts or so), the resulting grid-current flowing either through the tuning-inductance or through a special radio-choke. The grid-condenser serves to keep this comparatively high positive potential from the outer grid, the customary grid leak to the L.T. positive maintaining its mean potential slightly positive with respect to the negative end of the filament in practical "Negadyne" circuits.

An essential feature is the provision of a steady positive plate-potential to the outermost electrode, the "plate" of the four-electrode valve, by the same small H.T. battery which serves

The Negadyne

By A. D. COWPER, M.Sc., Staff Editor.

to maintain the inner-grid potential and mean grid-current; this battery is sometimes tapped for fine adjustment of both potentials. The plate current to this outer positive electrode is controlled by grid-potential and by the usual process of grid-condenser and grid leak rectification of H.F. oscillations on the outer grid.

Applications

It occurred to the writer, as soon as the details of this simple negative-resistance circuit were available, that, in addition to the various applications suggested for heterodyne wave-meters, coil calibrations, etc., there was a suggestion here for an effective single-valve reaction-circuit, if only this powerful direct reaction effect could be got under control.

Simple Reaction Control

Experiments with an ordinary Dutch type of four-electrode valve not only amply confirmed the original statements as to the power and immense wave-length range of this oscillating circuit, given suitable inductances and capacities, but soon showed that the necessary fine control over reaction effects and oscillation could be obtained in the simplest way possible, giving an effective and at the same time an absurdly simple and easily-tuned receiver, when directly connected to the usual outside aerial and earth. The resulting circuit, for which is suggested the expressive name of the "Negadyne"—to recall the fact that it is essentially a negative-resistance circuit—is indicated in Fig. 1, which also gives the essential constructional details to reproduce it.

This article throws interesting light on the little understood principles of 4-electrode valve working and gives practical circuits evolved in the course of the research.

Filament temperature

The fine control over reaction required in a practical receiving circuit is provided very simply by fine adjustment of the filament temperature. A really finely adjustable carbon compression type of filament resistance is indicated; or, if available, the so-called "vernier" type of filament resistance with a separate fine adjustment. An effective alternative is provided by putting two filament resistances in parallel, as, e.g., an ordinary wire resistance in parallel with a 30-ohm carbon-compression type, as indicated in Fig. 2. The first is then set at a value just below that which will permit self-oscillation, and fine adjustment is carried out on the second.

The H.T. battery

The small high-tension battery has, in practice, the same value for both inner-grid and outer plate-circuits, and for ordinary Dutch types of four-electrode valves obtainable here, and also for the Marconi-Osram D.E.7 type (developed for a very different type of circuit), a value of from 8 to 12 volts is required, though some results can be obtained at times with only 4 volts (one flash-lamp battery). Naturally the highest value which will give satisfactory results and good control will be chosen, so that a satisfactory output is obtainable.

Oscillation

The grid-condenser and grid leak are of usual values; the value of the latter is anything but critical, and it is entirely unnecessary to have it "variable." As there is, if anything, rather an embarrassingly powerful reaction effect available, there is no need to use loose-coupled circuits or small series aerial condensers merely to give free oscillation, except on the very short waves.

Plug-in coils

With ordinary plug-in coils (preferably those of reasonably low resistance on the shorter waves), ranging from a six-turn coil to No. 1,500, controlled oscillation and excellent sensitive reception resulted, on practical trial of the circuit; and powerful oscillation was obtained down in the audio-frequency region even with the telephones themselves shunted by a small capacity, or with an intervalve L.F. transformer winding.

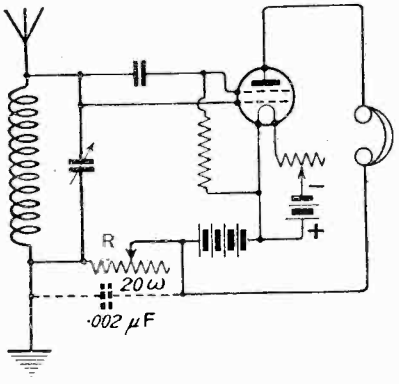


Fig. 3.—An alternative method of control.

Simplicity of control

The advantage of being able to use any size or form of tuning inductance, without a separate reaction coil, and with no other reaction control than a filament resistance, is fairly obvious.

An alternative method of control some may like to try is indicated in Fig. 3, where R is a non-inductive resistance variable up to 20 or 30 ohms—*i.e.*, another filament resistance of the carbon compression type.

Results

With the circuit of Fig. 1 it was an easy matter to go round as many of the main B.B.C. stations as one wished for, on the single valve and on a poor low 70-ft. test aerial in the country. Three or four of the B.B.C. relay stations were tuned in, and several of the Continental stations, Madrid in particular coming in with his usual strength. WGY, 380 metres (Schenectady),

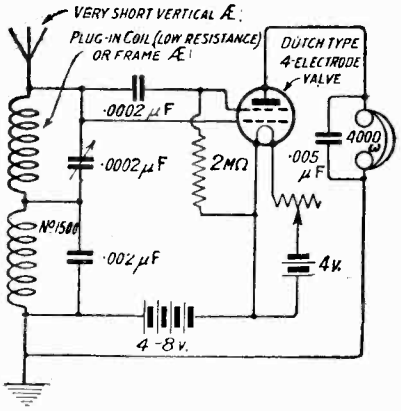


Fig. 4.—A single-control super-regenerative receiver.

was picked up on the low aerial before one a.m., and followed intermittently for over an hour on the high regular aerial (some 100 ft. long, single-wire). Religious addresses, interspersed with choir-singing by female voices, were quite distinct, as far as the swaying of the aerial in the wind, and consequent detuning effect allowed. Another fainter station on about 360 metres was also heard, but not identified. It may have been WRL, or any one of the many lower-powered stations on that wavelength. A 25-turn coil of No. 18 wire was used here, and 8 volts H.T. The valve was the ordinary Dutch pattern with $3\frac{1}{2}$ volts on the filament.

A Simple Super Arrangement

Fig. 4 gives working details of a single control super-regenerative receiver which is surely the simplest and easiest to operate of any! The adjustment of the relative intensity of H.F. and quenching-frequency oscillation is produced solely by adjustment of filament temperature, as the quenching oscillation starts first with cooler filament, and the only subsequent adjustment over quite a range is that of the tuning condenser. A very short aerial, or earth lead alone, should be used, unless a small frame-aerial be preferred. The possibilities for portable sets are obvious. Moderate loud-speaking was given at 35 miles from 2LO by this, with a 2-ft. square frame-aerial (of 10 turns spaced at $\frac{1}{4}$ in.), and with only 4 volts H.T. on the single 4-electrode valve.

And Yet Again

BEFORE really getting down to business, I cannot refrain from giving you a piece of news about our old friend the loud-speaker joke. You may remember that I traced its history several months since, showing how it was first made by myself two years ago; how, after making a glorious round of our own weeklies and those on the Continent, it travelled across the Atlantic and won a prize quite recently in one of Uncle Sam's scientific papers. It still keeps cropping up, usually in its original form—Who was the first wireless enthusiast? Adam, because a loud-speaker

. . . Adam was first in the field . . .

was made from his spare parts—though sometimes there are slight variations of the theme. I really thought, though, until the other day, that its popularity was dying out, for I had seen it in very few publications for some weeks. Apparently, however, it has taken on a new lease of life, for only a few days since one of our own dailies gave it a prominent place as something bright and novel. The only thing that worries me is the thought of the scores of people who must have received payment for my joke. Really, it ought to have brought me in a steady income all this time if only I had had my rights. Life is full of little things of this kind.

The General's Hour

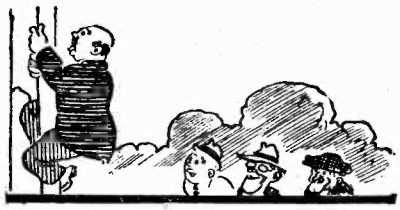
For some few weeks past General Blood Thunderby, the world-famous President of the Little Puddleton wireless club, has been going about as though he owned the place. He has treated the other members of the club with what I may call a condescending courtesy, letting it be plainly seen from his manner that he regarded them as beings on a plane altogether lower than his own. It has, in fact, been quite obvious that for some reason, until lately unknown to the rest of us, our warrior was growing daily more pleased with himself. Most of us hoped that it was merely a passing phase, though Scrabbits, the hatter, was heard to announce that he hoped that the General would go on getting prouder and prouder, since he had grown out of his hat three times in the past fortnight.

The Secret

We simply could not make out what was at the bottom of it all, until one day the secret leaked out. The *Little Puddleton Gazette* had decided to publish a series entitled "Visits to Famous Amateurs' Dens," and the General had been informed that he was to be the first person visited. This fact and the editor's promise to send copies of the first article to all the greater papers of the world so puffed up General Blood Thunderby that he became scarcely fit for ordinary mortals to talk to. As soon as we knew the secret we tried to take him down a peg or two, pointing out that each of us was on the *Gazette's* list for a visit. He assured us that he was perfectly aware of the fact, but there was all the difference between being the first, and merely one of the also rans. If we were to believe him, it was to be a case of General Blood Thunderby first and the rest nowhere.

No Soul

I should explain that Muggleson, the editor of the *Gazette,* is one of the two men in Little Puddleton who have no claims to fame as wireless experts. He has, of course, a receiving set, but this is merely the broadcast type, and he is content to listen night after night simply to 2LO. He maintains that what he wants is music worth listening to, and he sees no point in spending his evenings with Svsktziska or



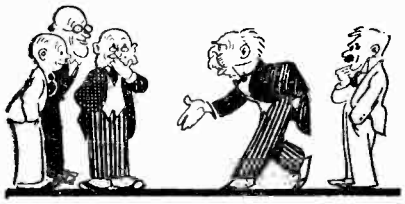
. . . In these days of "cat" burglary . . .

Pzremzyl, since he cannot appreciate music that consists chiefly of spark signals, atmospherics and mush. This shows that the man has no soul. What real wireless man cares a tuppenny hang about the quality of the music so long as it comes from some vast distance? Anyhow, neither Muggleson nor Winkleby, who is his chief reporter, sub-editor, compositor, proof reader, sales manager and office boy, has what one might call a very deep knowledge of the only subject that is really worth knowing. I would like very much to have been present during the visit to the General's station, which was conducted by Winkleby. The General had, of

course, written his own account of the wonders of his installation, but as this would have occupied seventeen pages of the *Gazette* the editor decided that it could hardly be used.

The Interview

We had all been waiting for Winkleby to make his little journey to Simla Villa. Last Thursday afternoon Gubbsworthy dashed into the club, crying,



. . . We nudged each other and smiled . . .

"He's gone." This was the signal for a little band of picked men to make its way stealthily into the grounds of Simla Villa. Poddleby, who, despite his tendency to adiposity, displayed an amount of agility which is rather suspicious in these days of "cat" burglary, swarmed up noiselessly on to the verandah.

Foul Work

Arrived there, he gently detached the lead-in from its terminal, and did the same with the earth wire. Then he replaced them, but not quite in their proper positions, for, when his dirty work was done, the lead-in was attached to the lower terminal and the earth lead to the upper. We then crouched in the bushes and awaited results. They were not long in coming. First the trumpet of a loud-speaker crashed through the window, and, though flung at random, smote Gubbsworthy shrewdly upon the ear. It was followed at intervals by such miscellaneous jettison as a high-tension battery, a lot of naughty words, two variable condensers, and Winkleby's hat. Finally the French window was flung open, and Winkleby was seen making a hasty retreat before the General's wrath by shinning over the verandah and dropping into the garden.

So He Said

The General did not appear at the club for a couple of days. When he did so he manfully strove to retain his former pose of superiority, but it was obviously an effort for him to do so. We asked how the "visit" had gone off. "Splendidly, my dear fellows, splendidly," roared the General. "It generally happens when somebody comes round to hear your set that it won't work half as well as it ought to. When young Winkleby came round to see me I was able to give him a real treat. Seldom has my apparatus been so wonderfully efficient. Any station that he liked to name I brought in in a moment at full loud-speaker strength. You will hardly believe it when I tell you that I got WGY at five o'clock in the afternoon." We didn't.

Discretion

We nudged each other; we smiled; we exchanged meaning glances. The General became livid with fury, and, as there were lots of heavy bits and pieces lying about on the club wireless table, we discovered

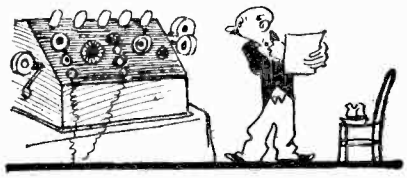
pressing business elsewhere, thinking discretion the better part of valour.

The Blow Falls

And yesterday, my friends, No. 1 of the "famous stations" series appeared in the *Little Puddleton Gazette*. I cannot give it you in full because it occupied several columns. These are the general lines that it took: "Little Puddleton has always stood in the forefront as regards wireless. It has ever been the endeavour of the members of its famous club to never in any circumstances, or however discouraged by reverses, let the grass grow under their feet.

The Club Motto

The motto of the club has always been Cicero's noble and inspiring word, *Excelsior*. . . As President of the club, General Blood Thunderby owns a set as fine, if not finer, as any in the world. . . . The General's receiver is a "five-lamper," in which grids are used for the purpose of distance amplification. The filaments of the lamps are lit up by a 100-volt 6-ampere hour battery, whilst the high-tension unit supplies a steady



. . . There are lots of knobs . . .

current of 10 millikilowatts to the aerial tuning rheostat. Perfect purity of tone is obtained on the no-frequency side of the set by the use of resistance-mendacity coupling. . . . There are lots of knobs. . . . Vernier condensers are used for regulating the filament current. . . . Any station can be brought in at will. During my visit I heard the operator at KDKA speaking fluent French, whilst amongst the German stations WBZ and 5WA were perhaps the best. . . ." This, I think, will take some living down. General Blood Thunderby has gone for a holiday on the Riviera.

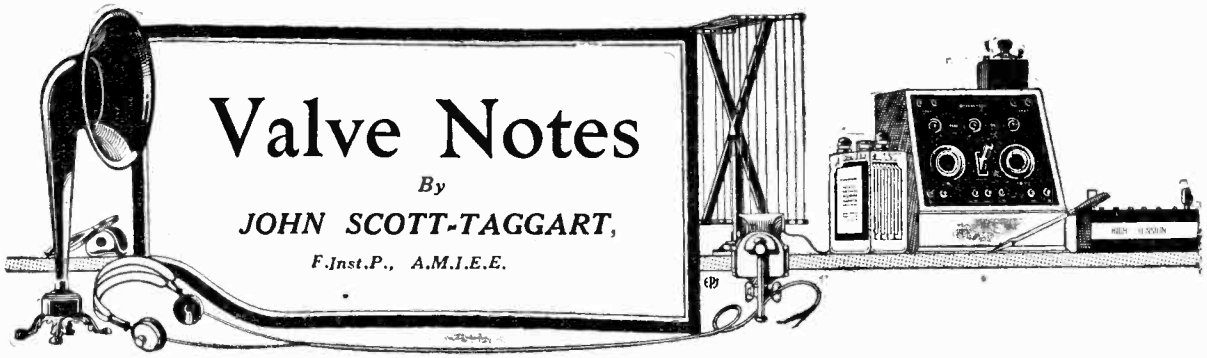
WIRELESS WAYFARER.

The R.S.G.B.

Sir OLIVER LODGE, D.Sc., LL.D., F.R.S., who has accepted the Presidency of the R.S.G.B., for 1925, will deliver an Address before the Society at a meeting to be held at the Institution of Electrical Engineers, Savoy Place, W.C.2, at 6 p.m., on Wednesday, the 21st, January, 1925. Tea will be served at 5.30 p.m. The title of the address will be "Matter and Radiation."

* * *

An Informal Meeting of the Radio Society of Great Britain will be held at the Institution of Electrical Engineers, Savoy Place, W.C.2, at 6 p.m. on Wednesday, the 14th January, 1925, when Mr. Stanley Ward will give a talk entitled "Some notes on Short Wave Reception."



Valve Notes

By

JOHN SCOTT-TAGGART,

F.Inst.P., A.M.I.E.E.

Inverse Duplex Circuits

SOONER or later the average experimenter will want to try to use more than one valve in a dual capacity. He will, in fact, want a double dual or treble dual circuit, and he will naturally want to know the best way of getting the effect he desires.

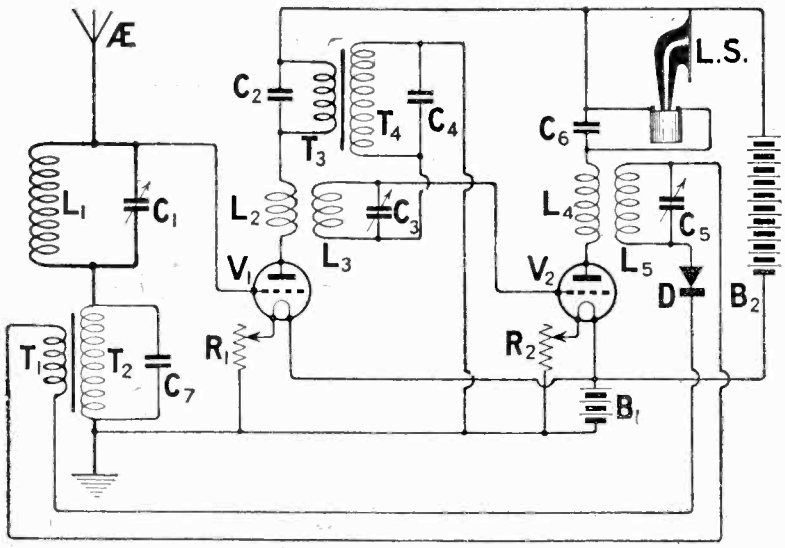


Fig. 1.—A circuit in which the two valves are being used as simultaneous high- and low-frequency amplifiers.

Let us take, first of all, the case of two valves being used as simultaneous high- and low-frequency amplifiers. It will simplify matters if we use a crystal detector for rectifying, and a suitable circuit is illustrated in Fig. 1.

An Example

In this arrangement I have shown the first valve coupled to the next by means of an air-core transformer L2 L3, the grid circuit of the second valve V2 being tuned. In the anode circuit of this valve we have the primary L4 of another similar transformer L4 L5. The secondary L5 is shunted by a variable condenser C5, and the crystal detector D and the primary T1 of the step-up iron-core transformer T1 T2 are shunted across the oscillatory circuit L5 C5. It will be seen from the diagram that the high-frequency oscillations will be amplified by both valves before being applied to the crystal detector. The resultant low-frequency currents are now fed into the primary of the transformer T1 T2, and thus into the grid circuit of the first valve by the now well-known method of connecting the transformer secondary in the aerial circuit. The amplified low-frequency currents in the anode circuit of the first valve pass through the primary T3 of a second step-up iron-core transformer T3 T4, a fixed condenser C2 of, say, .001 μF or .002 μF capacity being shunted across the primary winding to by-pass the H.F. currents. The secondary T4 is connected in the grid circuit of the second valve, the position of this secondary being such that it is at the earth potential side of the circuit L3 C3.

The second valve now acts as the second stage of low-frequency amplification, and the final low-frequency currents pass through the loud-speaker L.S., which is shunted by a fixed condenser C6, which may have a value of .002 μF.

Low-frequency Oscillation

I would like to raise a general objection against circuits of this kind, unless they are very properly designed and operated. The danger of low-frequency oscillation is so great that even when stabilising devices are used, trouble may occur, and in any case the use of these stabilising devices often means that, instead of two stages of high-frequency amplification, we are only getting the effect of one, thus nullifying the whole effect of using both valves as dual amplifiers.

The Second Valve

There is one objection which may be raised to the circuit of Fig. 1, and that is that the second valve is largely overworked, compared with the first valve. It will be seen that the E.M.F.'s applied to the grid of the second valve are those produced by the incoming signals, and those of the low-frequency currents produced by the rectification of these incoming high-frequency currents. In both cases the currents have already

been amplified before being fed into the grid circuit of the second valve; the high-frequency currents have been amplified by the first valve and the low-frequency currents also have been amplified by the same valve. The first valve, on the other hand, has a comparatively light task, because

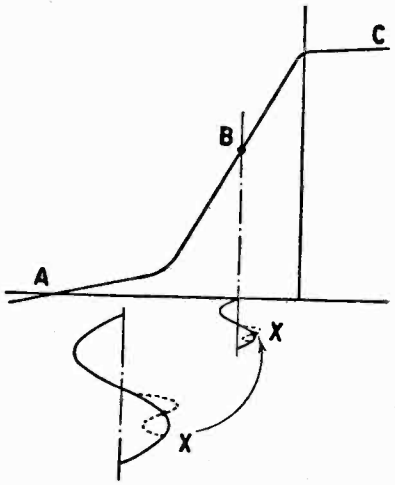


Fig. 2.— Showing imposition of the H.F. component on the L.F. current.

the high-frequency currents applied to the grid circuit are simply those due to the incoming signals, and are consequently not nearly as strong as those applied to the grid circuit of the second valve. Also, the low-frequency currents fed into the grid circuit of the first valve are those produced directly from the crystal circuit, and are consequently much weaker than the corresponding low-frequency currents applied to the second grid after amplification.

Graphical Explanation

An examination of Fig. 2 will show what may happen, due to overloading a dual amplifying valve. The curve ABC shows the anode current characteristic curve which shows, graphically, what happens to the anode current at different grid voltages. The operating point should be near B, half-way along the steep, straight portion of the characteristic curve, and this curve should lie to the left of the vertical line, or ordinate, through zero grid volts, to avoid that fatal distortion effect which is responsible for so much buzzing.

Below the curve will be seen a complete cycle of low-frequency alternating current, and a point X on the positive half-cycle. Obviously, when signals are being received, the high-frequency oscillations in the grid circuit will vary the grid potential above and below a normal value, this normal value not being the steady grid potential (which should always be negative) but the particular potential given to the grid by the low-frequency currents. Consequently, at all points on the low-frequency cycle high-frequency oscillations will be super-imposed, and the maximum voltage on the grid is obtained when the positive half-cycle of the high-frequency current adds itself to the positive half-cycle of the low-frequency current. If, for example, the positive half-cycle of high-frequency current is 1 volt, and the low-frequency positive half-cycle is 2 volts, then the maximum voltage applied to the grid of the first valve will be 3 volts.

Grid Potential

With a suitable valve this will not give very much trouble, because the straight portion of the characteristic curve will be long enough, but if the valve is unsuitable, or the normal operating point on the curve is badly chosen, distortion may occur through the grid potential rising or falling to such values that the representative point on the curve goes round one of the bends. This will cause loss of signal strength, distortion and buzzing of the reflex circuit.

If we suppose that an amplification of three times is obtained both for the high- and the low-frequency currents, we will see that the grid of the second valve in Fig. 1 will be given a maximum positive half-cycle of 6 volts in the case of the low-frequency currents and 3 volts in the case of the high-frequency currents. This means that the grid potential of the second valve is varied from its normal value to 9 volts more positive, and then 9 volts more negative. This means a sweep of 18 volts on the grid of the second valve, which is three times that on the grid of the first valve.

An entirely different valve operating under different conditions would be required to accommodate this big increase in grid voltage variation. In ordinary actual practice the voltages experienced are very much less than those stated, and, provided the incoming signals were not too strong, the Fig. 1 arrangement would give quite good results.

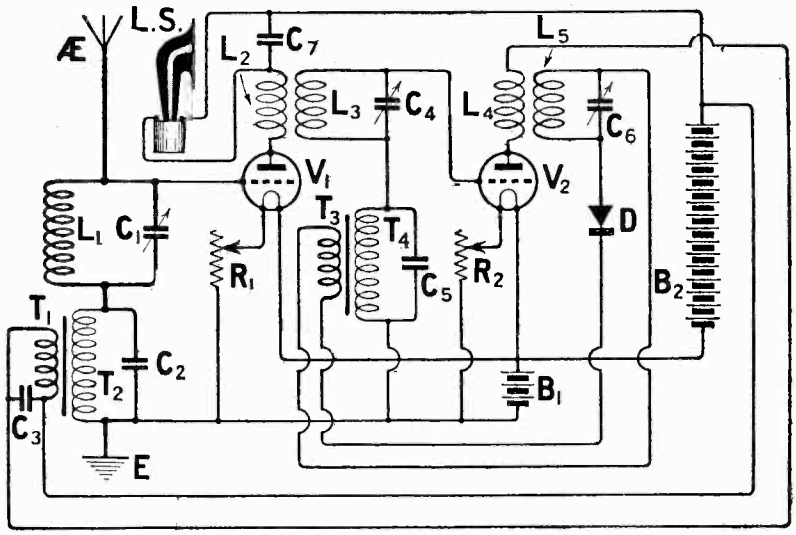


Fig. 3.—A modification of the Grimes Inverse Duplex circuit.

Grimes Inverse Duplex

It is, however, possible to experience considerable trouble with this type of circuit, and consequently the arrangement of Fig. 3 is to be preferred. This circuit is generally called the Grimes Inverse Duplex circuit, and the principle of the arrangement is that instead of one valve being overworked, both valves are worked to more or less the same extent.

(*Continued on page* 450.)

Converting your Set to T.A.T.

How to utilise the latest development in High-Frequency Amplification.

By R. W. HALLOWS, M.A., Staff Editor.

A VERY important contribution to the study of the problems of high-frequency amplification was made recently by Mr. John Scott-Taggart in his new T.A.T. system, details of which appeared in November *Modern Wireless*. The name is an abbreviation of "tuned-aperiodic-tuned," for the scheme consists essentially in the alternation of tuned and aperiodic high-frequency couplings. It is well known that a valve in a high-frequency circuit in which there is little damping will oscillate readily if both its plate and its grid are tuned sharply to resonance. In the T.A.T. method no high-frequency amplifying valve has both its plate and its grid sharply tuned. If the grid is tuned, the plate is untuned, and if the grid is untuned, the plate is tuned.

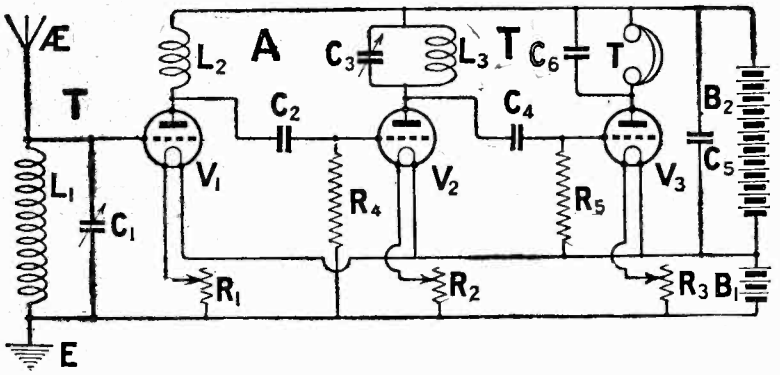


Fig. 1.—A three valve T.A.T. circuit using tuned anode coupling.

Amplification

Naturally, the degree of amplification obtained by two high-frequency valves in such a circuit as that shown in Fig. 1 is not so great as it would be if the plate of V1 and the grid of V2 could be tuned. But actually the loss is not nearly so great as it might at first sight appear. If, instead of the choke coil between the plate of V1 and H.T. plus, we wire up a circuit consisting of an inductance of appropriate size with a condenser in parallel, we shall find that it is impossible to hold the set down unless considerable damping is introduced by means of a potentiometer. Now damping, besides reducing signal strength, has also a disastrous effect upon selectivity.

Now using T.A.T., it is quite possible to employ four or even six stages of high-frequency amplification without the set becoming too much of a handful, and though we do not get the full amount of amplification theoretically possible from each valve, we do obtain from a number combined in this way a degree of amplification very difficult to obtain in any other way.

Converting Existing Sets

The present article is written with a view to suggesting to those who already possess sets with two tuned stages of high-frequency amplification a very simple way of converting them at will to T.A.T. It should be noted that the method is applicable equally to sets with tuned-anode coupling and to those employing high-frequency transformers. The very simplest way of employing T.A.T., though not by any means the most stable—this, by the way, is a great aid to searching with two tuned H.F. stages—is to use ordinary anode coils or transformers and to set the variable condenser of the first anode at zero. Provided that the "natural wavelength" of the inductance or the transformer primary is some way from that to which the set is to be tuned, it will be found quite an easy matter to pick up a desired signal (provided that it is fairly strong) without the occurrence of oscillation.

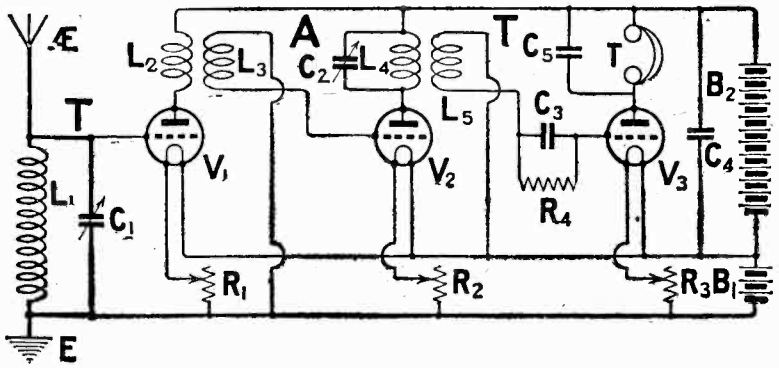


Fig. 2.—A T.A.T. circuit in which H.F. transformer coupling is employed.

To obtain the full stability given by the T.A.T. method, the coupling between V1 and V2 should be as nearly aperiodic as possible; and the best way of ensuring this, if reactance capacity coupling is used, is to employ a

choke coil wound with resistance wire. Where transformer coupling is fitted, the tuned transformer should be replaced with one wound to a very high resistance. If the existing tuning condenser for the first anode has a small minimum capacity, no harm will be done by leaving it connected up and setting it at zero. If, on the other hand, it is of doubtful quality, it would be advisable to provide some simple means of cutting it out altogether. This can be done, as shown in Fig. 4, by means of a switch or of a swing hook fixed to one terminal and engaging when desired with a second.

Fig. 3.—A photograph of a choke coil made on the lines suggested.

The conversion of tuned-anode sets, either temporarily or permanently, is a very simple matter. All that one has to do is to make up a resistance wound choke coil with the number of turns suitable for the wavelength which it is desired to receive. Unlike the inductance wound with copper wire, that whose turns are of resistance wire has no well-marked natural wavelength; it responds almost equally well to a wide band of frequencies. By using fine Eureka wire it is not difficult to make a coil which will give almost the same efficiency on all normal wavelengths used by broadcasting stations; that is, between 300 and 500 metres.

Constructional Details

In making both inductances and transformers that are aperiodic there is a convenient rule which should be noted. Using a former 1 in. in diameter, the number of turns required either for a choke coil or for the primary and secondary of an aperiodic transformer is approximately one per metre. For broadcasting the optimum wavelength should be taken as 400, which is roughly midway between the extremes used, in this country at any rate. When speaking of broadcasting, by the way, I did not take into account the long-wave stations, such as 5XX or Radio Paris, or the very short ones, such as KDKA on 68 metres. I refer merely to the ordinary band of wavelengths lying between 300 and 500 metres.

Choke Coil

The Fig. 3 photograph shows a very simply-constructed resistance wound choke coil. The former is a piece of ebonite rod 1 in. in diameter and 4 in. in length. In the centre of each end a 4B.A. tapped hole is made and a short piece of studding is inserted to act as a centre for winding purposes. Close to one end two 4B.A. screws are inserted, as seen in Fig. 5, each being provided with a tag which can be made of thin sheet metal or from a piece of wire. The wire used should be No. 40 double silk-covered Eureka. The end of this must be soldered to the "in" tag. If you are not familiar with wire of this fineness, the idea when you first handle it of soldering it to anything may come as rather a shock. Actually it is a much simpler job than might be imagined. Put a tiny spot of flux on the tag, and take care that the point of the iron is well tinned before soldering operations are begun. Get the bit quite hot, and you will find

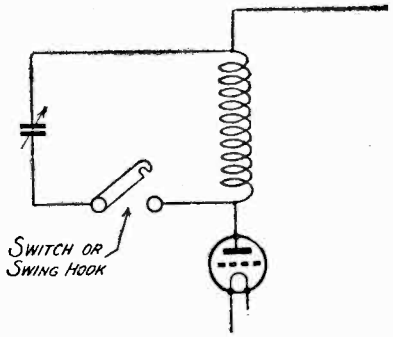


Fig. 4.—A suggested arrangement for cutting out the variable condenser in a tuned anode circuit.

that the soldering of the wire to the tags is accomplished without any great difficulty. Now bring the wire across to the place at which the windings are to begin, running on two or three turns. When these are in place secure them by means of a small dab of sealing wax, as shown in Fig. 5. Then proceed with the winding. There is no need to count the turns for the exact number is not vastly important. No. 40 double silk-covered wire makes 142 turns to the inch. If you deduct 10 per cent. from this number to allow for the fact that your turns will probably not lie so closely as those put on by a professional, you have in round figures 130 to the inch. For 400 turns, therefore, the length of the windings should be approximately 3.1 inches.

Insulation

A transformer can be made in exactly the same way, except that four screws with tags are required instead of two. Between the primary and secondary

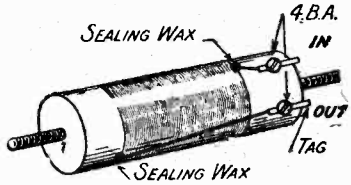


Fig. 5.—Showing method of securing the wire in the choke coil.

windings there should be a layer either of Empire cloth or of waxed paper. The choke coil is fitted to an ordinary plug and socket mounting by the simple process of making a 4 B.A. tapped hole in the top of the latter and screwing into this the piece of studding nearest to the tagged screws. Short lengths of wire are then soldered to the tags and taken to the screw contacts of the mounting.

The Finished Winding

The second piece of studding is, of course, removed when winding is finished. The best way of mounting the transformer is to use a valve leg template and to screw four valve pins into one end. The connections to these pins must be the same as those of the tuned transformers which have been in use on the set.

Resistance Wire

Actually the choke coil shown in the photograph was made from a broken-down Marconi aperiodic transformer. These components, which are occasionally obtainable from dealers in surplus goods, are wound to an optimum wavelength of 600 metres. They cannot, therefore, be used as transformers or as choke coils for broadcast reception as they stand. They are wound with wire very much finer than that referred to above—I believe it is either No. 47 or No. 50 Eureka; anyhow, it is con-

siderably finer than a human hair. To convert one of these transformers to a T.A.T. choke, proceed in the following way:

H.F. Transformers

Strip off the primary winding first of all, then remove the insulation covering the secondary. The secondary winding has a length of 2.2 inches, and, as this gives an optimum wavelength of 600 metres, about one-third of it must be removed to make the coil suitable for broadcast reception. Strip off the required number of turns, and then make fast with sealing wax, as described previously. Remove the two screws at the top of the former. You will probably find that, either in stripping off the primary or in reducing the secondary to the required size, you have broken the fine wire running to one of the remaining pair of screws. Solder this on again—the job is much simpler than it sounds—and bring the top end of the windings down to the other screw contact. There

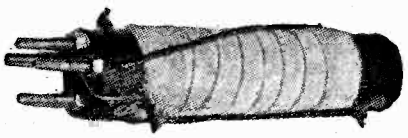


Fig. 6.—Photograph of a transformer made by the author.

is a threaded hole in either end of the former into which a 4 B.A. tap can be run easily. Make a similar hole in the plug and socket mounting, and fix firmly to it by means of a short piece of studding. Connect up the two screw contacts with those of the mounting, and the job is finished.

Protection

Both choke coils and transformers wound with fine resistance wire should be given a protective coating of sticking plaster. This is simply wound on puttee-wise, and once it is in place there is very little chance of injury to the windings or to their contacts with the tags.

By means of these aperiodic chokes and transformers any existing set with two separately tuned stages of high-frequency amplification can be converted at will to T.A.T. I venture to prophesy that those who try two stages of T.A.T. in place of two ordinary H.F. stages will not be long before they experiment with four!

□ □ □

Radio Notes and News

A Rand wireless amateur has established communication with America, says a Johannesburg Exchange telegram. This is the first known time that African signals have been received in America.

* * *

M. Leon Deloy, the noted French radio amateur of F8AB, reports that he has tried receiving messages from American amateurs with a loop.

"We have made several attempts to receive American amateurs on a loop 30 metres by 10. Reception is a little less strong (with our ordinary receiver—a high frequency valve and detector) than on an aerial.

"The reception of American amateurs on waves of 75 to 80 metres and of KDKA is remarkably good. At 11 o'clock at night on December 11 we received with one high-frequency valve, detector and one low-frequency valve both amateurs and Pittsburgh, and with a loud speaker we heard the signals throughout the whole house."

M. Leon Deloy, reporting on his recent experiments, stated:—

"Continuing the study of the daylight experiments with very short wavelengths, we have succeeded in making ourselves heard at eight o'clock in the evening, then at 7 and finally at 6 o'clock, Greenwich time, by our correspondent at Hartford, Connecticut, U.S.A. These results were obtained on waves of 35 and 48 metres. The power used was in the neighbourhood of 500 watts. The intensity of the reception in America was R2 at 6 o'clock on 35 metres; R5 on 35 metres and R6 on 48 metres at 7 o'clock; and R7 on 48 metres at 8 o'clock. Reception was effected on two valves. We have every reason to believe that until this time not a single amateur station in Europe had been received in America during the day; or at 6 o'clock, Greenwich time, which is about 1 p.m. for our correspondent. Our signals covered about seven-tenths of the distance from Nice to Hartford, or about 4,500 kilometres in full day. These results, its seems to us, are due in a great measure to the employment of waves much shorter than are usually used."

* * *

One of the best known Italian radio amateurs has a model transmitting and receiving set in his home at Bologna, known as station ACD. The equipment is entirely home made, and it is the first Italian station to communicate with the United States. Mr. Adriano Ducati, the amateur, is now travelling in Argentina to study radio conditions there and to prepare exchanges of messages with Argentine amateurs.

* * *

According to the *Daily Chronicle*, the London office of a Dutch valve manufacturing firm has received news that on January 8 the station at Hilversum, Holland, will begin transmission as a high-power station. Famous orchestras and artists have been engaged to perform daily at Hilversum, which will work on a wavelength of 1,050 metres, and will employ the call-sign HDO. The programmes are to be framed to interest British listeners.

Random Technicalities

By PERCY W. HARRIS, Assistant Editor.

Some Notes of general interest to the Home Constructor and Experimenter.

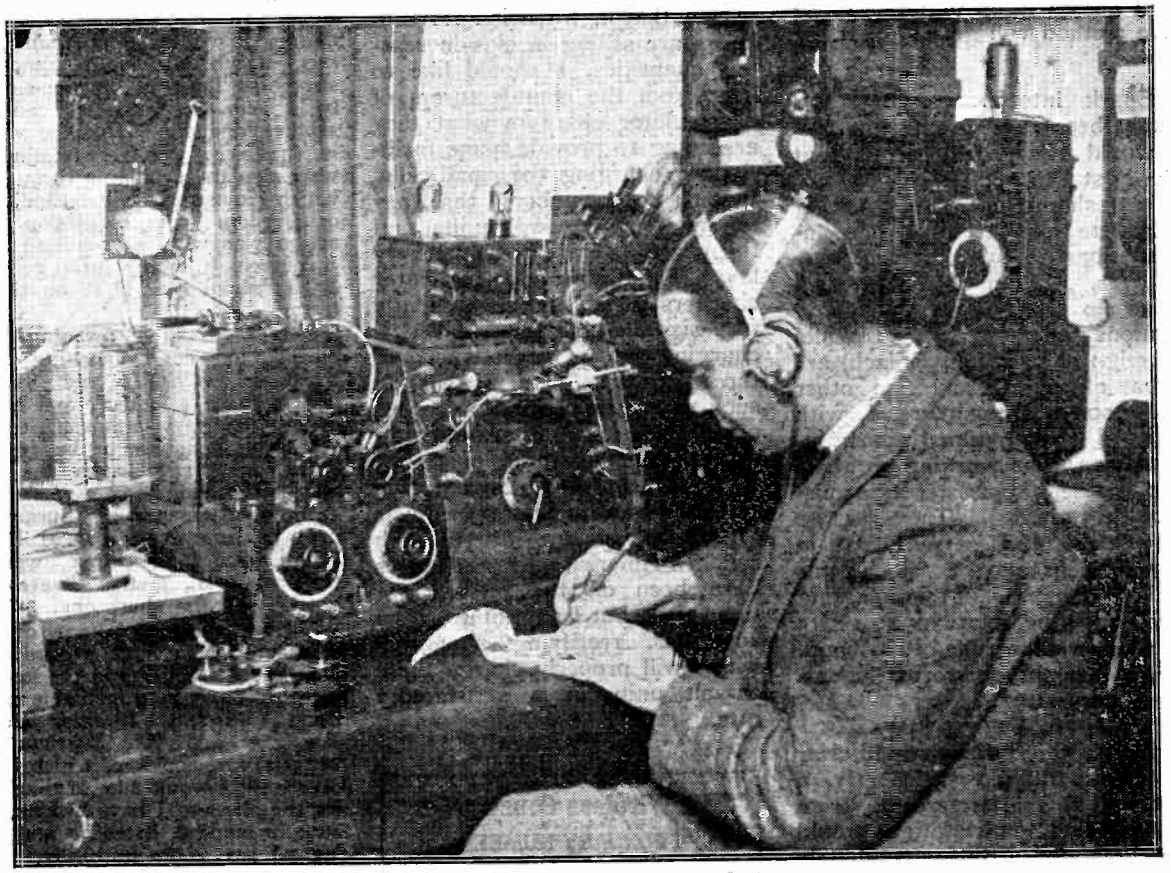
I SUPPOSE the gales of the last few weeks have done more damage to wireless aerials than any since broadcasting in this country began. Many masts which proudly reared themselves above the houses a few weeks ago are now prostrate in the garden (in many cases in the next garden too), while gimcrack affairs which have been the source of worry to many fond parents for months past still stand up as perkily as ever.

* * *

I have been led to wonder whether this is due to the fact that many of the amateurish-looking masts are very lightly stayed, if they are stayed at all, while the more elaborate affairs have guy ropes tight all the way round and secured at several points. If any single guy rope should fail, the whole structure collapses, as the tension on the remaining guy ropes "pulls it off its perch." An unstayed mast, if properly secured at its base, will sway in the wind by reason of its flexibility, and will take up a strain in the way a stayed mast often cannot do. My own fifty-footer at the bottom of the garden is unstayed and is still quite secure, although during the height of the gale I have watched the top of it bend about in an alarming fashion.

* * *

Speaking of masts reminds me that some twenty-five years ago, when the Poldhu station was first erected, the aerial system was supported upon a ring of masts with a series of interlacing stays which had, if nothing else, the merit of ingenuity. Unfortunately, the designer of this system overlooked the fact that the breaking of any one stay



The well-known amateur Mr. E. J. Simmonds, of Gerrard's Cross, who was the first to establish two-way communication with Australia, is seen here with some of his apparatus.

might upset the balance, and, as a matter of fact, it had not been standing very long before a fierce gale blowing across The Lizard broke one of the mast stays, whereupon the whole structure fell to the ground with a loud crash. After this the wooden lattice towers were erected, and these stood for many years until just before the war, when they were supplanted by steel masts of a more modern type.

* * *

Whenever Mr. Shaughnessy has been tackled on the matter, he has always stated that the Post Office were doing their best to eliminate harmonics and mush from their arc stations. So far as harmonics are concerned, these have been very considerably reduced, but the mush is as bad as ever, and I am sometimes inclined to think, worse. The serious student, who would listen to continental broadcasting, is driven nearly frantic each evening by the filthy mush from Northolt and Leafield, a form of interference which is so broad that no wavetrap or other selective method will get rid of it.

* * *

Spark interference, too, has lately been very prominent, and I would like to feel certain that the Post Office is really watching ship to shore working, and taking adequate steps to keep these installations on their proper wavelengths. As an old operator, I have no difficulty in identifying stations giving rise to the trouble. Foreign ships (often French) are great offenders, and the other afternoon a French vessel, with quite a sharply-tuned spark installation, was working right on top of the Manchester transmission (375 metres). There was no question of lack of selectivity in my own instrument, as it was quite capable of eliminating properly tuned stations 10 or 15 metres on either side of the band, even when the interfering signals were very strong.

* * *

If only the stations would clear up their traffic expeditiously, a lot of this interference from badly-tuned spark stations would be eliminated. But unfortunately many new operators seem to think that it is necessary to call a dozen times and to send their own call another dozen times, even when the station with which they are communicating is practically in sight. I have heard a ship call a coast station continuously for about a minute when the weakest call would have done all that was required. Again a number of vessels have taken to the habit of repeating their messages a second time without waiting to see whether the first transmission had succeeded. It is over a dozen years since I had charge of a ship board installation, but my hand still itches to get hold of the key knob, and tell these careless "ops" what I think of them.

* * *

The British coastal stations are admirably handled. The North Foreland station, "one of the busiest in the world," shows a pretty economy in Morse signalling when handling its traffic. The French stations, as ever, seem all over the place, both in wavelength and operating.

* * *

Now that high-tension accumulators are selling in ever-increasing quantities, I should like to hear from the manufacturers of accumulator chargers what they are doing to provide home facilities for charging the small cells. It must be remembered that they are made up in 24-volt units, and the charging rate must be very low. The ordinary accumulator chargers which serve excellently for six-volt batteries, with a charging rate of perhaps two or three amperes, are useless in such cases, unless we dissemble our batteries and charge them in a number of parallel banks so that the charging current will split up into a number of channels giving only a low rate to each cell. In America such appliances have been on the market for some time, but I am not aware of any A.C. rectifying apparatus which will properly charge these 24-volt units at a satisfactory rate.

* * *

APPRECIATION OF THE W1 RECEIVER.

SIR,—After trying many circuits 2-, 3- and 4-valve reflex and otherwise, I rewired my set finally as a W1, 3-valve set (Radio Press Panel Card No. 1), varying the original layout by doing away with the 1 and 2-valve terminals, using it as a 3-valve set only. I tune only by means of a Sterling Baby Loudspeaker; I also have separate H.T. leads to each valve.

With 30 volts H.T. on the detector, which is a repaired Cossor valve, and the filaments turned only just on, all B.B.C. main stations, including Belfast, and many relay stations are heard easily all over the house, while all the German broadcasting stations, Brussels, Copenhagen, Vienna and Madrid are almost all equally loud. French stations, both high and low wavelengths from Petit Parisien to Eiffel Tower, are, upon occasion, almost as loud, and quite as clear as Chelmsford and London. C.A.T. is used on wavelengths up to about 1,000 metres.

On Tuesday evening (December 16) an unlogged German station came in on approximately 280 metres much stronger than Brussels, which is usually almost as strong as London. It appeared to be a very tragic sketch, and the sobbing and sighing of the woman in the piece was very distinct, as were also the sybillants throughout, which seems to be a good indication of freedom from oscillation. Reaction was with a 75-coil at about 55 degrees from the aerial coil, and I had about 45*v*. H.T. on the detector.

Later in the evening, and during the early morning hours I received WGY and KDKA, very faintly, it is true, and accompanied by heavy atmospherics, but still loud enough to be readable (X's permitting) across the room and easily readable at 2 yards away from loud-speaker. Surely this must be a record for a D. 2L.F. set! These results, of course, were on the 300/400 metres wavelength bands, not the short one.

Having learnt all I know of wireless—and I have made a good round dozen successful sets in the last few months—from your valuable magazines (*Wireless Weekly, Modern Wireless,* and *The Wireless Constructor*) and books, of which I have nearly all, I would like to thank you for the pleasure I have had and still have in reading, listening and making.—I am, yours faithfully,

PERCY VARLEY.

Kingston-on-Thames.

Supersonic Heterodyne Reception in Theory and Practice

By JOHN SCOTT-TAGGART, F.Inst.P., A.M.I.E.E.

Operating the 5-valve Supersonic Heterodyne Receiver.

THE builder of a supersonic heterodyne receiver need have no fears of trouble in tuning, particularly if the set is of such a simple design as that which was described in my article appearing in the December 24th issue of *Wireless Weekly*. Full constructional details were given in that issue of a 5-valve set which will give loud-speaker results on several stations, particularly if a little assistance is given from an ordinary aerial.

Few Controls

There are three controls only in the set, and one of these is permanently adjusted to a certain value. Looking at Fig. 2 on page 368 of *Wireless Weekly*, December 24, 1924, it will be seen that there are three condenser knobs, C1, C3 and C5. The first knob, C1, tunes the frame aerial circuit, while C3 controls the local oscillator. The variable condenser C5 tunes the long-wave input side of the second valve. The reason why this condenser (C5) is variable is that it is essential that the tuning of the circuit L6 C5 in Fig. 7 is similar to that of the circuit L8 C7. Unfortunately, these long-wave transformers are not usually very well matched, and, moreover, the fixed condensers, in any case, would not be sufficiently matched to be serviceable. In American designs they appear to have used fixed condensers across their transformers, but in actual practice this leads to serious inefficiency with the ordinary components available, owing to one of the circuits being out of tune with the other. The remedy is either to make your own transformers and take off, or put on, turns so that a fixed condenser across it will tune to the desired wavelength, or to provide a variable condenser across one of the transformer secondaries.

This is what I have done, so that the condenser C5 in Fig. 7 is merely for the purpose of setting the tuning of the circuit L6 C5 so as to be equal to that of L8 C7. The wavelength to which these circuits are tuned is probably about 10,000 metres on this particular set.

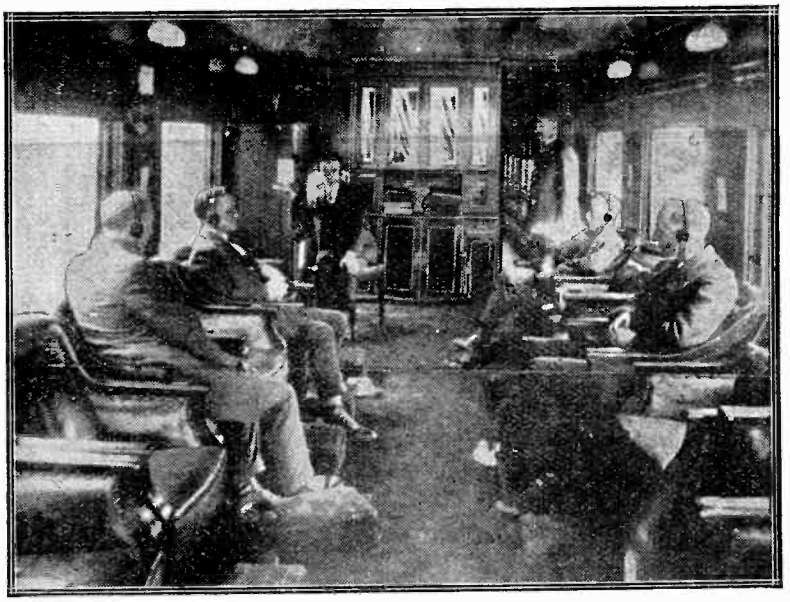
Operation

When first tuning-in the receiver, the condenser C5—i.e., the right-hand condenser in Fig. 2—may be set to what you would expect to be .0005 μF, the condenser itself having a value of .001 μF.

As regards the oscillator, no trouble at all should be experienced with this, provided all contacts are properly made. There is no trouble about the possibility of reverse reaction, or anything of that sort. It is, of course, vital to see that all the contacts of the valves and coils are correctly made. While speaking about this question of contact, it is important to point out that the low-capacity type of valve-holder and transformer holder, such as those used in this set (H.T.C.) is liable to break contact, and this may be due either to the little metal strips which press against the valve pins not pressing hard enough, or having a dirty surface, or, what is perhaps more difficult to trace, the little tongues of metal may be loose and there is no proper contact between them and the points to which connection is made on the valve-holder ring. We have had several faults of this kind in our test department in connection with other sets, and I have experienced the same trouble myself.

Contacts

Provided care is taken to be on the look-out for bad contacts of this kind, the holders are otherwise of excellent design. It is, however, necessary to see that these little metal strips press firmly on the valve pins or transformer pins, and also to see that there is good contact between



Our photograph shows passengers on one of the C.N.R. expresses listening to the Company's broadcasting station, CNRA.

them and the points to which connections are made.

It is as well to see that the little metal strips have not been pressed in through the constant insertion of valves. It is an easy matter to pull them out a little if there is fear of bad contact.

Coils

Coils should also fit very securely into their coil-holders.

Operating the set for the first time, I inserted a No. 25 coil in L_2 (Fig. 7), while in L_3 and L_4 I connected two 75 coils. All three coils were of Tangent manufacture, and with this type of coil it was found that the condenser C_3 would cover the whole broadcast waveband (300 to 500 metres). If with other coils the wavelength range is different, it is a convenient matter to substitute two other coils, but both should be of the same size. This is not absolutely vital, but the rule is a good one to follow in the case of a beginner.

It will be seen from Fig. 7 that the oscillations are induced from the coil L_3 into the coil L_2, the coupling being fixed. The degree of coupling, however, can be varied by altering the size of the coil L_2. For example, if it is desired to obtain only loose coupling between the receiver circuit and the oscillator circuit, a small coil could be inserted in L_2. I found, as a matter of fact, that a No. 25 coil was too big, although perfectly good results were obtained with it. I consequently inserted a home-made coil of 15 turns, and also tried 8 turns.

The best results were obtained with 15 turns for the coil L_2. It is a simple matter to take turns off a No. 25 existing make of coil, or the coil manufacturers may be asked to supply 15-turn coils.

Method of Tuning

There are one or two scientific methods of tuning which could be adopted, but which would take some time. If a wavemeter is available, or there is a nearby broadcasting station, the transformer L_5 L_6 (the left-hand one in Fig. 2) may be pulled out and telephone receivers may have their two contacts placed in the top and bottom holes of the transformer holder, so that the telephones are now in the anode circuit of the first valve. Under these conditions the aerial condenser may now be tuned until the loudest signals are obtained.

Telephones

The telephones may now be disconnected from the anode circuit of the first valve and the long-wave transformer inserted. The oscillator C_3 is now adjusted until signals are heard in the telephones, which should be connected across the proper terminals. If nothing whatever is heard try a different adjustment of the condenser C_5. This should be done systematically, unless you hit on a good adjustment straight away. The systematic way of doing it would be to try a different adjustment of C_5 every few degrees and turn the condenser knob C_3 backwards and forwards to see if signals are heard. If nothing is heard move the condenser dial C_5 round a few degrees and try again with C_3. This procedure may be followed until signals are heard. The moment signals are received adjust the condenser C_5 until the loudest results are obtained. It should be possible to tune out the incoming signal by means of C_5 alone, a certain point on the dial giving the maximum results. Unless you obtain this effect you are not getting the supersonic-heterodyne effect at all, i.e., if the tuning on C_5 is absolutely flat and signals come in about the same strength all the way round with, perhaps, a little louder results when the condenser is at zero, then the receiver is not working as it should, and the fault is very likely in the oscillator, which is probably not oscillating.

Variable Condensers

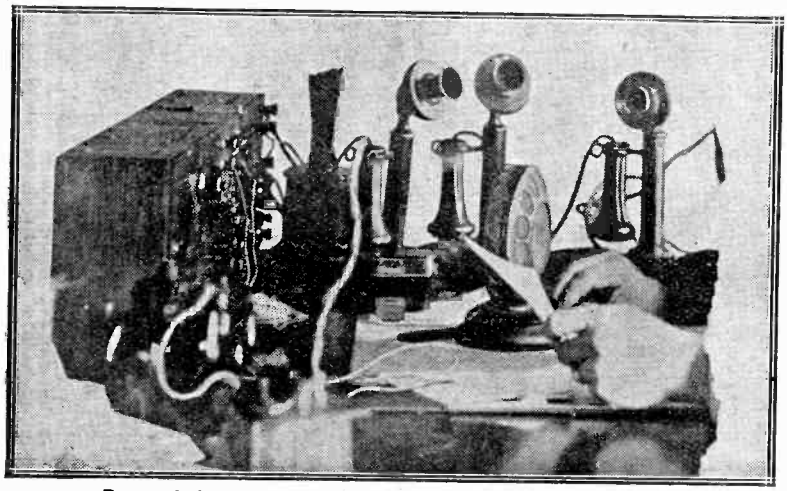
Assuming, however, that the oscillator is working all right and that maximum signal strength is obtained on a certain adjustment of C_5, then you can try altering the tuning of the aerial condenser C_1 and the oscillator C_3.

You may experience some little difficulty when first tuning in the receiver, but after ten minutes there should be no difficulty at all. The golden rule is to adjust C_5 to the best position the moment you receive signals. You have then only two controls, and these should be varied together: that is to say, if you desired to receive a station on a longer wavelength, the aerial condenser is turned to a higher value, and the oscillator condenser is likewise tuned to a longer wavelength.

Interference

It will be found that there are two points on the oscillator condenser dial at which you will receive signals, and that in between these two points (exactly halfway) you may hear a "plonck." This plonck is due to the coupling between L_2 and L_3, and the worse the plonck the worse the interference you may be causing to neighbours.

With a frame aerial the amount of this interference is not very much, and when signals are actually being received there is no interference at all, because the local oscillations are of a fre-



Part of the apparatus at CNRA showing the microphone.

quency widely different to that of the incoming signals. When searching, however, interference is quite likely, and great care must be exercised. To keep the plonck down to reasonable limits, or to cut it out altogether, which, of course, is the best thing to do, a smaller coil L2 is employed.

Oscillator Adjustments

It will be found, for example, that a No. 25 coil will give a good loud plonck in between the two points at which signals are received. Just about the plonck position you may hear what sounds like signals, but which is really due to you heterodyning the carrier wave and the incoming signals at an audible frequency, this being passed on through the receiver and giving weak signals. These, however, are horribly distorted and weak, and you should immediately come off that adjustment and work on one of the two adjustments of the oscillator which gives good, clear, loud signals.

Aerial Tuning

The aerial tuning is the most likely to be deceptive, because under certain conditions you may get louder signals when the aerial is out of tune than when it is in tune. If you have followed the theoretical articles I have written on the subject in preceding issues of *Wireless Weekly* you will appreciate why this is so. An experiment which will illustrate the phenomenon is to take out the coil L2 and to short-circuit the coil-holder. In these circumstances the local oscillations have to be forced into the differently tuned frame aerial circuits. The local oscillations may not be strong enough, and to get them strong enough the frame aerial circuit has to be detuned by means of the condenser C1, so as to bring the tuning more into line with the tuning of the oscillator. This, of course, will detune the circuit for the incoming signals. If the signals are weak you will not be likely to fall into the trap of wrongly tuning your aerial condenser, but when strong signals are being received it is often possible to obtain the signals with the aerial condenser quite out of tune, due to the effect just mentioned. The tuning of the aerial circuit may appear erratic when signals are strong and full loud-speaker results are already being obtained. The reason is that stated above.

Oscillating

If the coil L2 is made too small the ploncking will disappear, but the signal strength will be reduced to too great an extent, and a happy medium has to be found, and this, in my experience, is a No. 15 turn coil. The little plonck which may be noticeable is apt to be disconcerting to the beginner, and he may think that his oscillator is not working properly, and that it is conking out. It must be remembered, however, that the plonck part on the oscillator condenser is not used, and that even though the plonck may be obtained, perfectly good results will be obtained on either side of the plonck point. This plonck point, as a matter of fact, is where the aerial condenser is in tune with the oscillator condenser, and serves as a means of telling when these two circuits are in tune. You should, however, keep off the plonck point to avoid causing interference to nearby receivers.

The Frame Aerial

The frame aerial is that designed by Mr. Fuller, the details having already been published in these series of articles.

Miscellaneous Points

As regards the types of valves to use, I have no special recommendations; either bright or dull emitters may be employed. The high-tension voltage will depend upon the type of valve used, but about 80 volts is sufficient for general purpose valves.

It is a good plan when first tuning in the receiver, and you are not accustomed to its operation, to join the normal outdoor aerial to the earth terminal or lower frame terminal of the receiver, no earth being connected to the set at all. This will bring up the signal strength very greatly in many cases, and also increase the range of the receiver.

You should also try simply connecting an earth lead to the lower frame aerial terminal. This often increases signal strength.

Do not forget to turn the frame aerial in a suitable direction to pick up the station to be received. Merely pointing the frame at the station is not sufficient, because very often the waves become deflected by surrounding objects, such as houses, trees, etc. The turning of the frame aerial should be accompanied by correct tuning on C1 and C3, and the wavemeter, of course, is invaluable for a preliminary setting.

If more powerful results are obtained, ordinary aerial tuning may be employed, in which case I would still prefer to leave the frame in circuit and to connect between the aerial and earth of the external antennæ system an inductance coil which may be placed inside the frame aerial so as to induce currents into it. A few turns wound round the frame will do excellently. This, however, should not be done unnecessarily because of the interference I have already spoken of. It is also possible to connect an ordinary earth lead on to the lower frame aerial terminal (the frame being in circuit) and connecting the aerial through a .0001 μF fixed condenser to the upper frame aerial terminal on the set.

Interruption

In most cases, however, it will be found that the set being so sensitive a great deal of undesirable signals will come in when the outside aerial is employed.

While it is quite true that an outdoor aerial will often give louder results than a frame aerial with a supersonic heterodyne receiver, yet in most cases the main aerial will be discarded because of the interference which is brought in.

CAPT. PLUGGE TO BROADCAST FROM 2LO.

Capt. Leonard F. Plugge, Member of the General Committee of the Radio Society of Great Britain, will broadcast from 2LO, on Thursday, January 8th, at 7.10 p.m. The subject of his address will be "The Importance of an International Agreement on the use of identification call signs by European Broadcasting Stations."

This transmission will be simultaneously broadcast from all stations including the high powered station of Chelmsford on 1,600 metres. Reports of reception and expressions of opinion will be acknowledged if addressed to:—

The Secretary, The Radio Society of Great Britain, 53, Victoria Street, LONDON, S.W.1.

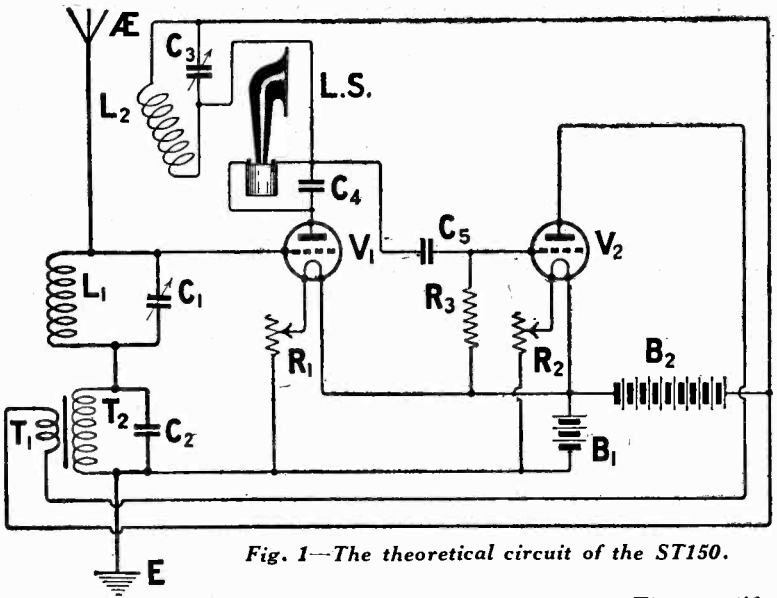


Fig. 1—The theoretical circuit of the ST150.

ST150 Circuit on the Omni Receiver

IN Fig. 1 is shown an interesting two-valve reflex circuit, which in "More Practical Valve Circuits," by John Scott-Taggart, F.Inst.P., is numbered ST150. The first valve amplifies at both high and low frequency, while the second valve acts as a detector.

The aerial is tuned by the coil L1, and variable condenser C1 of .0005 μF capacity, the incoming oscillations being applied direct to the grid of the first valve V1. These appear in amplified form in the anode circuit of V1, which is tuned by L2, and C3 of .0005 μF. The loud-speaker L.S. is not affected by these H.F. currents, which are by-passed by the fixed condenser C4, whose value may be .002 μF. The H.F. currents are communicated to the grid of V2 through the fixed condenser C5 of .0003 μF. The grid leak R3, whose resistance may be 2 megohms, is connected across the grid and filament of V2, the resultant low-frequency pulses in the anode circuit of this valve passing through the primary winding T1 of the L.F. transformer T1 T2. The secondary winding T2 of this transformer is placed in the joint aerial and grid circuit of the first valve, and the low-frequency currents induced in it by the primary T1 are communicated to the grid of V1, which accordingly amplifies at low frequency. The amplified L.F. currents in the anode circuit operate the loud-speaker L.S. (which may be replaced by telephones), and pass thence to the high-tension battery, the coil L2 offering no impedance to low-frequency currents. C2 is an H.F. by-pass condenser of .001 μF capacity.

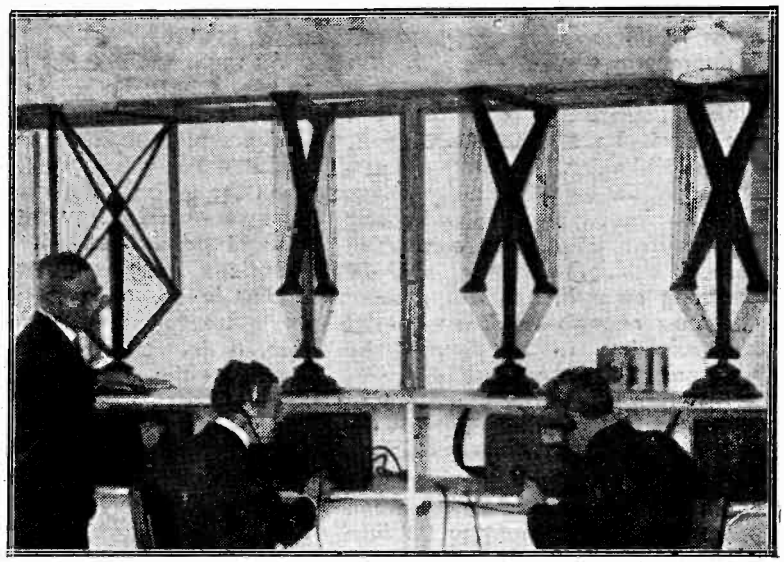
ST75 Circuit

The circuit resembles that of ST75 in many respects, and it is interesting to note the respective advantages and drawbacks of the two. The wiring key for circuit ST75 was given in the issue of *Wireless Weekly* for October 1.

Connections Required

The connections for wiring up the circuit shown are given in the following list:—

51—17	23—39
15—17	23—41
25—26	41—42
25—30	33—34
30—37	33—24
29—38	6—22
29—52	21—24
17—12	4—19
4—31	27—14
31—47	27—35
43—40	



A loud speaker in each apartment and four plug sockets in the walls simplify radio for tenants in one of New York's newest block of flats. A central station on the top floor boasts four radio sets and an operator. Four stations are tuned in, and every tenant has the choice of plugging in on one of them. Our photograph shows two of the sets being tuned.

Another Circuit which those readers who have built the Omni Receiver will be able to experiment with.

Coils

The aerial coil L1 is plugged into the centre socket of the three-coil holder on the left-hand side of the cabinet, while the anode coil L2 is inserted in the front moving socket of the same holder. Suitable sizes for the usual broadcast wavelengths are :—Aerial coil, No. 35 or 50; anode coil, No. 50 or 75. The most suitable sizes should be found by experiment.

If it is desired to tune in 5XX, a No. 150 coil should be employed for aerial tuning and a No. 250 for the anode.

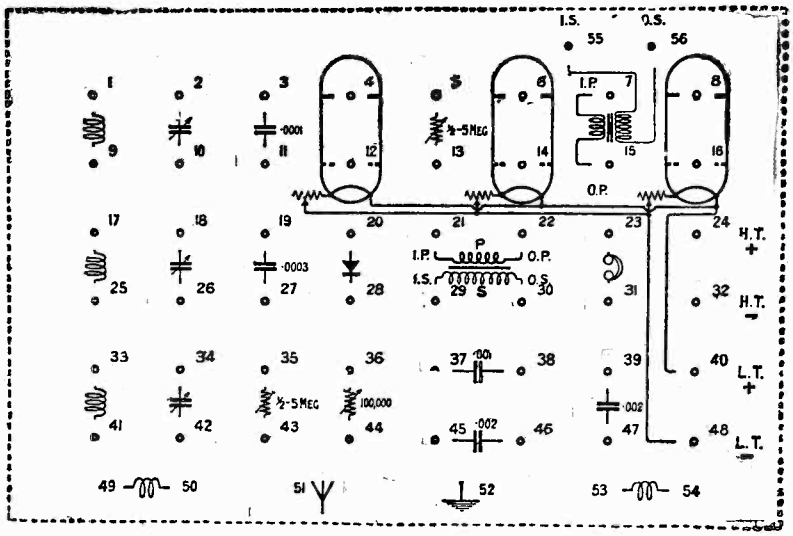


Fig. 2.—The terminal board.

Operating the Receiver

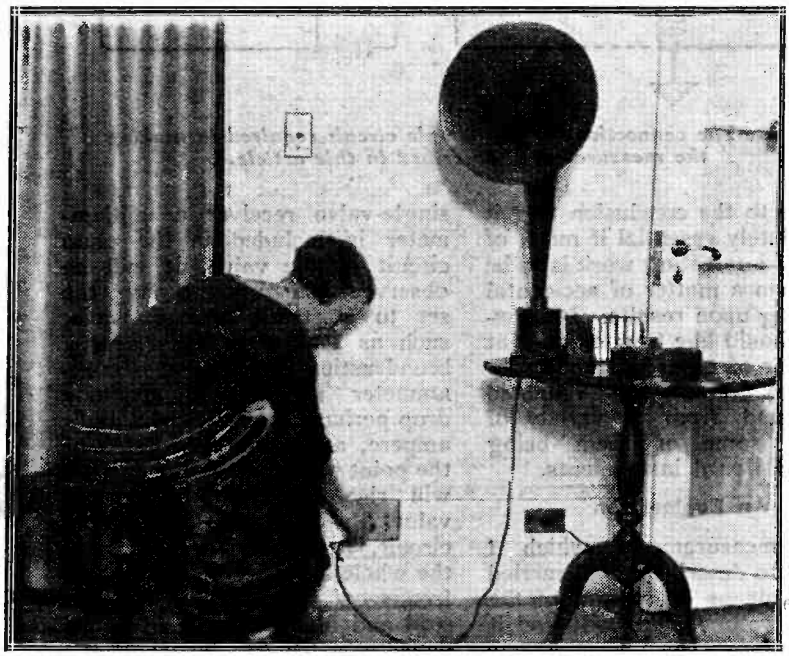
After connecting the batteries, etc., to the set, tuning may be commenced. It should be noted here that the use of a loud-speaker instead of telephones is advised with this circuit. If telephones are employed, however, they should be well insulated. Tuning is effected by variation of the capacities of C1 and C3, and by adjustment of the coupling between L1 and L2. The latter controls reaction, and care should therefore be exercised while making this adjustment.

If the receiver will not oscillate, even with the coils close to each other, it is probable that the connections to one of them need reversing. The leads to L2 may be reversed by disconnecting 23—41 and 33—24, and joining 23—33 and 41—24. If, on the other hand, it is found difficult to prevent oscillation when aerial and anode circuits are accurately tuned, it may still be beneficial to reverse the connections to one of the coils in order to obtain reverse reaction.

Experiments

Several interesting experiments will occur to the reader, such as variation of the voltage applied to the anodes of the valves, the application of separate H.T. voltages to the two valves, the introduction of grid bias on the first valve, etc. The effect of increasing the capacity of C4 condenser by connecting in parallel with it another .002 μF condenser may also be tried. The following extra connections become necessary for this experiment :—39—46 and 47—45.

The grid leak R3 should not be forgotten. Various values may be tried by adjusting the knob on the front of the panel. In general, the value will not be found at all critical however.



Our photograph shows all the equipment necessary for tenants to enjoy radio in one of New York's block of flats. See opposite page.

Some Simple Measurements

By G. P. KENDALL, B.Sc., Staff Editor.

The experiments which Mr. Kendall describes in this interesting article may be carried out by every experimenter who is the possessor of a milliammeter.

THE choice for any article of such a title as that which you have just read appears to call for a word of explanation, for I am fully aware that readers of technical publications are very apt to feel, and with some justification, that the use of the word "simple" in connection with the subject of measurements is only too often an example of "the pride which apes humility." Who does not retain memories of youthful sufferings from text books whose titles contained the word "elementary"? In commencing this article, therefore, which it is intended shall be the first of several upon similar lines, I want to give an earnest assurance that I have not taken the attractive adjective in vain, but that the whole of the experimental work involved is really and truly simple, and within the powers of anyone possessed of reasonable patience and just a little experimental skill. No mathematics whatever will be involved, since the experimental results will be read directly from the dial of a simple measuring instrument.

Measurements

The subject of measurements is very commonly regarded by the majority of experimenters of only limited means as entirely beyond their reach, and no doubt such a view is true of much of the more advanced work, where unusual and costly measuring instruments are required and a good deal of auxiliary apparatus. The experimental work which I propose to describe is such as can be carried out by anyone by means of one simple measuring instrument alone, and that an instrument which is very commonly possessed by experimenters who have passed out of the novice stage. The instrument in question is a milliammeter, and any good specimen will serve, provided that it possesses an open scale for readings of the order of two milliamperes, and further the scale should be clearly marked in tenths of a milliampere. This means that a fairly good instrument must be obtained, but its sphere of usefulness is so extended in wireless work that no one who decides upon the necessary expenditure will regret it. On the contrary, he is more likely to come to the conclusion that it is absolutely essential if much of his most interesting work is to be other than a matter of accidental stumbling upon results. In passing, I should like to mention that a number of types of good milliammeters are now to be obtained secondhand from a variety of dealers, some of them being Disposal Board instruments.

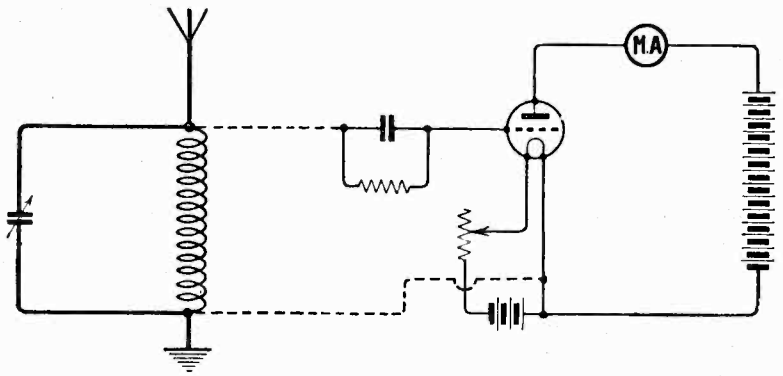


Fig. 1.—The connections of the simple circuit required in making the measurements described in this article.

An Explanation

The measurements which I propose to describe are all carried out by means of a form of the Moullin voltmeter circuit, and it is perhaps as well that a few words of explanation should be given on this very simple but extraordinarily useful arrangement. The original instrument is simply a calibrated valve detector circuit, with some means of indicating plate current, and its operation is extremely simple. Most of my readers will no doubt know that when signals are applied to the grid and filament of the ordinary grid condenser and gridleak rectifying valve, there is a drop in plate current, which varies in some proportion to the strength of the incoming signal. Thus, if in a simple single-valve receiver a milliammeter is included in the plate circuit of the valve, it will be observed that upon tuning the set to a strong carrier wave, such as that of a fairly nearby broadcasting station, the milliammeter needle will suddenly drop perhaps a quarter of a milliampere, and upon either side of the point of resonance the current will rise again to its normal value. By calibrating this simple circuit, it is possible to regard the whole arrangement as a high-frequency voltmeter, since the grid and filament leads from the detector valve can be connected across any circuit in which high-frequency oscillations are flowing, and it will be possible after a preliminary calibration to

estimate by means of the measured change in the anode current the voltage applied across the valve.

Comparative Results

This is the common laboratory use of the circuit, but I have found it possible to use a very much simpler procedure, which gives entirely satisfactory results from the point of view of the experimenter who aims at purely comparative results. For example, in comparing a series of different types of commercial tuning coils, one does not really wish to know so much what voltage is produced across them by a given signal, as rather what coil is better than another, and which gives the best results in any particular set of conditions.

Signal Strength

What I have done, therefore, is to measure by means of a fine reading milliammeter, the drop in anode current when tuned to resonance with a strong carrier wave, reading this in tenths of a milliampere, and arbitrarily calling this "signal strength." Such readings, of course, are not directly proportional to the high-frequency voltage across the tuned circuit, but exaggerate the differences between any given set of high-frequency voltages, just as occurs in actual practice whenever a valve detector is used. Since we are merely seeking comparative results, however, it need not concern us that our readings do not bear an exact proportion to the high-frequency voltage which we are measuring, although it is as well to realise clearly that we are merely obtaining a means of making reliable comparisons.

H.F. Oscillations

What we require, then, is merely a milliammeter, a convenient valve detector unit which can be connected across any tuned circuit upon which measurements are to be made, a reasonably constant high- and low-tension supply voltage for the valve, and a powerful carrier wave to produce the high-frequency oscillations in our tuned circuit. My own experiments lead me to believe that the carrier wave from a main broadcasting station will serve perfectly well for this purpose up to some ten or fifteen miles, provided that an outside aerial is used, but those who are less fortunately situated than myself will no doubt have to provide this constant source of signals for themselves, and I propose to give at a later date a few notes upon the use of a local oscillator for the purpose. In connection with the question of the strength of the carrier wave, a word of warning is necessary as to the actual valve circuits which can be employed. It will be realised upon consideration that reaction must be entirely eliminated if anything like true comparative results are to be obtained, in the great majority of the tests which we shall be considering, and therefore it is generally best to regard high-frequency amplification as strictly taboo and to use the valve detector directly across the circuit under measurement. An example of the masking effects of reaction will be seen in connection with the measurements upon the effect of variation of coupling between the primary and secondary coils of a loose-coupled tuner which will be described in a future issue.

The First Experiment

The first experiment is one of interest to every user of plug-in coils, and concerns the quality of the material used for the manufacture of coil plugs by certain firms. In making a series of comparisons between a number of commercial coils, I had occasion to suspect the quality of the plugs of a certain well-known make, since these coils seemed to be showing up extremely unfavourably, and I was at a loss to account for this upon examination of the method of winding, the gauge of wire, and so forth. To test my surmise I put a standard Burndept No. 75 coil upon one of these suspected plugs, and placed the band round the coil. This band is one of the type whose ends are held down by two screws which are inserted in the actual electrodes of the plug, so that the band is shunted across the coil itself, and if of poor insulation will have a very deleterious effect upon signal strength; a measurement of signal strength was now taken, giving the figure 1.2.

Plugs

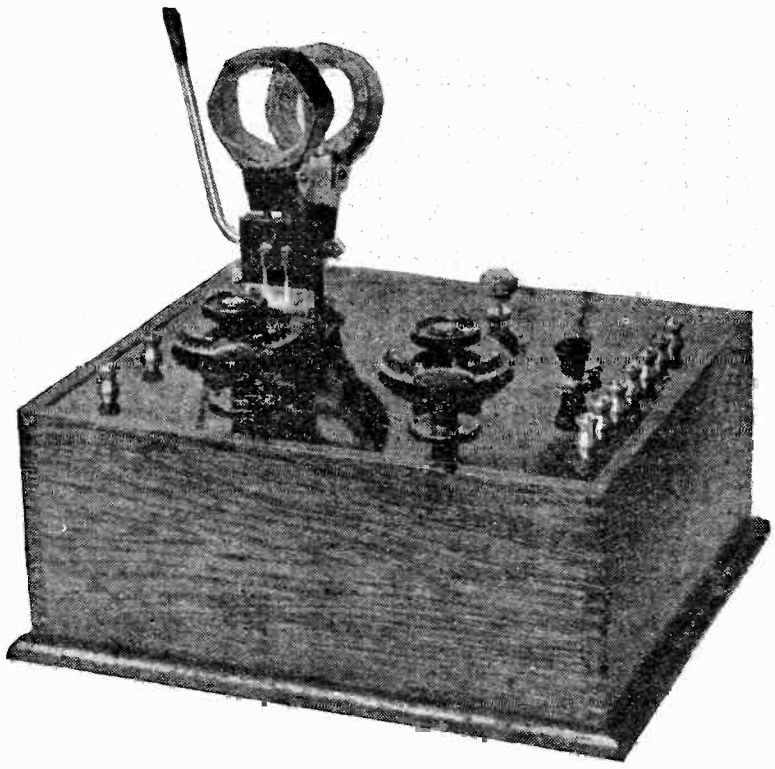
The coil was then taken off the suspected plug and mounted upon a good one, upon which no band was used, and the remarkable reading of 3 was then obtained. In confirmation, one of the coils which had given such poor results was again tested, and one end of the band was disconnected. It was then found that the reading rose from the previous 2 to 2.1, and the coil was next removed from its own plug and remounted upon the same one as was used in taking the comparative figures for the Burndept coil, and the figure 3 was again obtained, indicating that the coil was of perfectly sound construction, but that it had been completely spoiled as to performance by the bad method of mounting.

This example will serve to show how extremely useful this very simple method can be, and I hope to go on at a later date and show how it can be applied in a large number of ways to the problems which arise regarding the efficiency or otherwise of a great variety of tuning arrangements, coils, condensers, and so forth. Next week I will describe a simple unit which can be applied to these measurements, which is intended for the experimenter who does not already possess a suitable valve detector unit, and which forms, incidentally, an extremely effective and simple wave-meter for the measurement of the wavelength of a C.W. or telephony transmitter. At the same time instructions will be given for the use of the instrument in making the measurements which we have been considering in a general way in this introductory article.

Two-Valve of Nove

By JOHN W

An interesting receiver which e broadcasting to be heard



The valves are mounted inside.

THE method of obtaining high-frequency amplification requiring least adjustment and care, both in design and operation, is probably that employing the resistance-capacity principle. The disadvantage of this method is that it is ineffective upon wavelengths much below 1,000 metres, although in certain cases high-frequency resistance amplifiers have been made to operate satisfactorily upon wavelengths as low as 600 metres. The method as commonly employed is certainly of little use upon the broadcast wavelengths used by British stations, but when one considers the reception of Chelmsford or Radio-Paris, whose wavelengths are respectively 1,600 and 1,780 metres, the resistance-capacity method may certainly receive favourable attention. Probably the most popular coupling method for a high-frequency amplifying valve on the shorter waves is that known as the "tuned anode," and when carefully made a receiver operating upon this principle may be made to give excellent results. Another aspect to be considered when designing a receiver for the home is that of keeping all damageable parts out of the way, it being especially desirable to protect the valves by enclosing them.

A useful receiver for the reception of short- and long-wave stations may be made upon the lines of the set illustrated in the photographs.

Tuned Anode

The tuned anode system is employed for the reception of short-wave stations, while by moving a switch the resistance-capacity method is brought into action for the longer-wave signals, the only other alterations necessary being larger aerial and reaction coils, and an increase in the H.T. voltage applied to the first valve. As will be seen in the photographs, the only components appearing on the top of the panel are those controlling the receiver, the valves, anode coil, etc., being mounted on the under side out of harm's way.

By consideration of the circuit diagram, it will be seen that either series or parallel connection of the aerial tuning condenser may be employed as desired, by manipulation of the aerial lead. Parallel connection is effected by joining the aerial to terminal P, earth to E, while terminals S and E are joined by a piece of wire. To obtain series tuning, the link between S and E is removed, and the aerial lead joined to terminal S, P being left free, while the earth lead remains joined to E.

Switching

The valve V1 acts as a high-frequency amplifier, and the reader will no doubt have noticed the method of switching which has been adopted. When the switch is placed on the "long-wave" side the anode resistance is joined in series with the coil L2 and condenser C2, and the

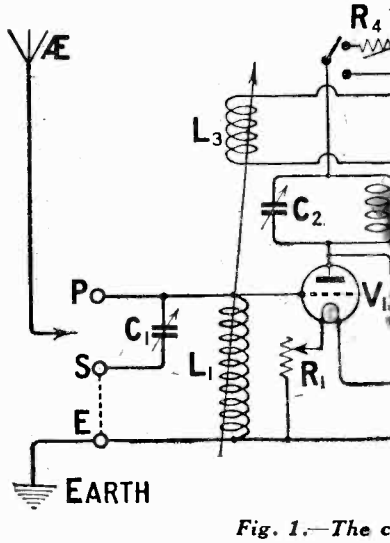


Fig. 1.—The c

e Receiver l Design

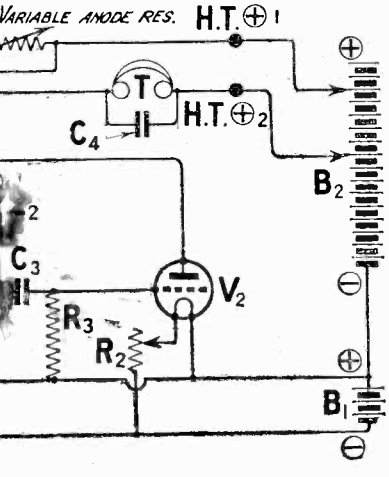
. BARBER.

nables either short or long wave with a minimum of trouble.

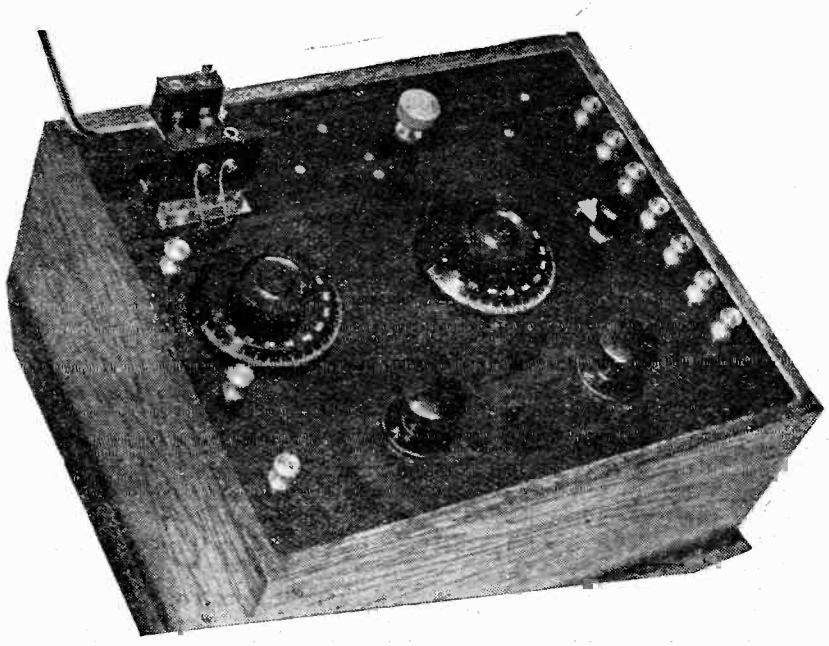
positive of the high-tension battery. The anode oscillatory circuit is thus left in circuit when receiving the longer waves, and it is found that no undesirable effects resulted, or at least none were observed upon lengthy trial. No appreciable increase in signal strength was noticed, by aural observation, when the anode oscillatory circuit was shorted.

L.F. Stages

No note magnifiers have been included in the set illustrated, the object being to illustrate the principle, and it is clear that any note magnifiers required may be added afterwards, or included on the same panel. The set was designed with the object of use with the amplifier described by the present writer in the December 10 issue of this journal, and the reader is referred to that article for the complete description. For the benefit of those who may desire to operate a loud-speaker, a circuit diagram (Fig. 4) is given which shows how two low-frequency amplifiers may be added on the same panel, utilising one stage of transformer and one stage of low-frequency resistance coupling.



ircuit adopted.



A view showing the controls.

Necessary Parts

The component parts necessary for the construction of this receiver are listed below, and for readers' information the names of manufacturers are given. It is clear, however, that any reliable make of component may be substituted for that named, provided that due consideration is given to its dimensions, as some alteration may be necessary if a component larger than the one specified is used. Values, where given, should be strictly adhered to, as any alteration here may result in the set not giving satisfactory results.

One ebonite panel, 12 in. by 10 in. by 3/16 in. (Radion mahoganite).

One cabinet of suitable size, at least 6 in. deep (Camco cabinet).

Two variable condensers (square law), one of .0005 μF and one of .0003 μF maximum capacity (Jackson Bros.).

One two-way coil holder (Magnum).

Two valve sockets (Magnum, anti-capacity type).

Two filament resistances (Burndept, Ltd.).

One variable anode resistance (Bretwood). No disadvantage will, in general, be found in using a fixed anode resistance, in which case a Dubilier 80,000-ohm resistance will be suitable.

One coil plug.

One switch arm and two studs (Bowyer-Lowe Co.).

Ten terminals (Burne-Jones).

One fixed condenser of .0002 or .0003 μF capacity, and one two-megohm grid leak.

If the grid condenser is provided with clips, one other clip will be required, but if not, it will be necessary to provide one pair of clips.

One .001 μF fixed condenser (Dubilier).

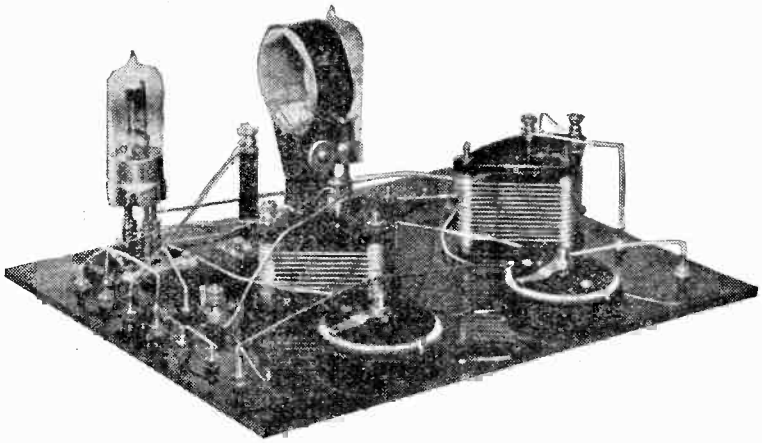
Filament resistances of the dual purpose type are incorporated in this receiver, but it is clear that should the constructor intend using only bright emitter valves, resistances of, say, seven ohms will suffice, while if dull emitters are exclusively to be used rheostats of, say, 25-35 ohms should be obtained. It is only in cases where a six-volt accumulator is

used and a sudden change from bright to dull emitter valves is made that a dual purpose rheostat is required.

Layout and Wiring

The layout of the panel is given in Fig. 2, and should present no difficulty. The position of the valve sockets and anode coil plug should be carefully noted, and if the constructor already possesses a valve of large diameter he should ascertain whether or no there will be sufficient clearance. If not, the second valve socket may be moved slightly away from the coil mount. The clearance shown in the drawing was sufficient for the valves and coils in use. The anode coil mount is so arranged that the coil, when inserted, will be at right angles to the plane of the aerial coil, and centrally disposed in relation to it.

Many readers, when making up a set from a Radio Press design, prefer some arrangement other than that given by the author; there can be no objection to this, provided that the constructor has some experience, that the general principle of the layout be followed, and that the essential shortness of certain wires be preserved. Grid leads must receive special attention, and anode leads are next to receive consideration, while the relative spacing is also of considerable importance. Fila-



Showing the valves and anode coil.

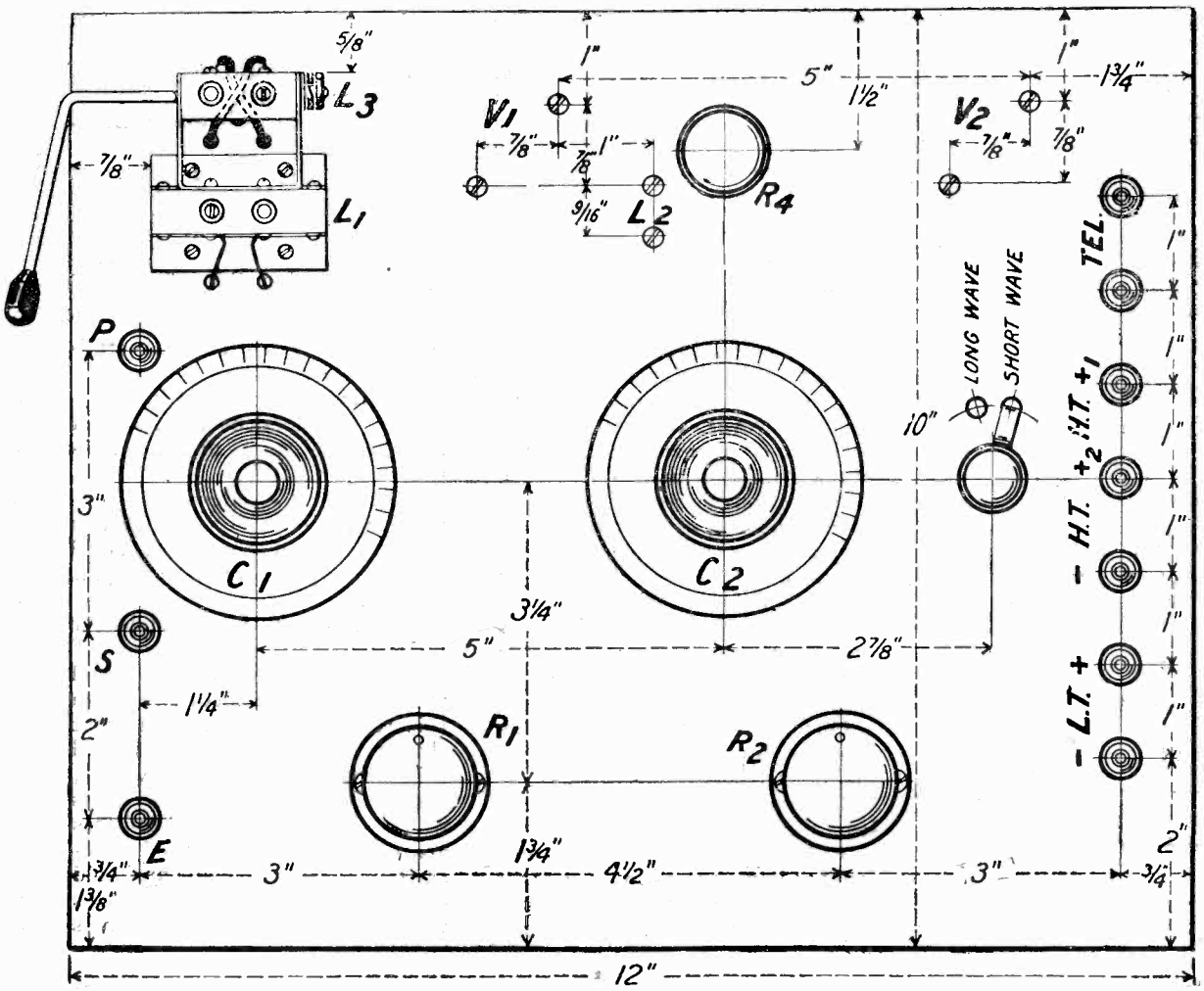


Fig. 2.—A half-size drawing of the panel, giving all necessary dimensions. Blue print No. 90a.

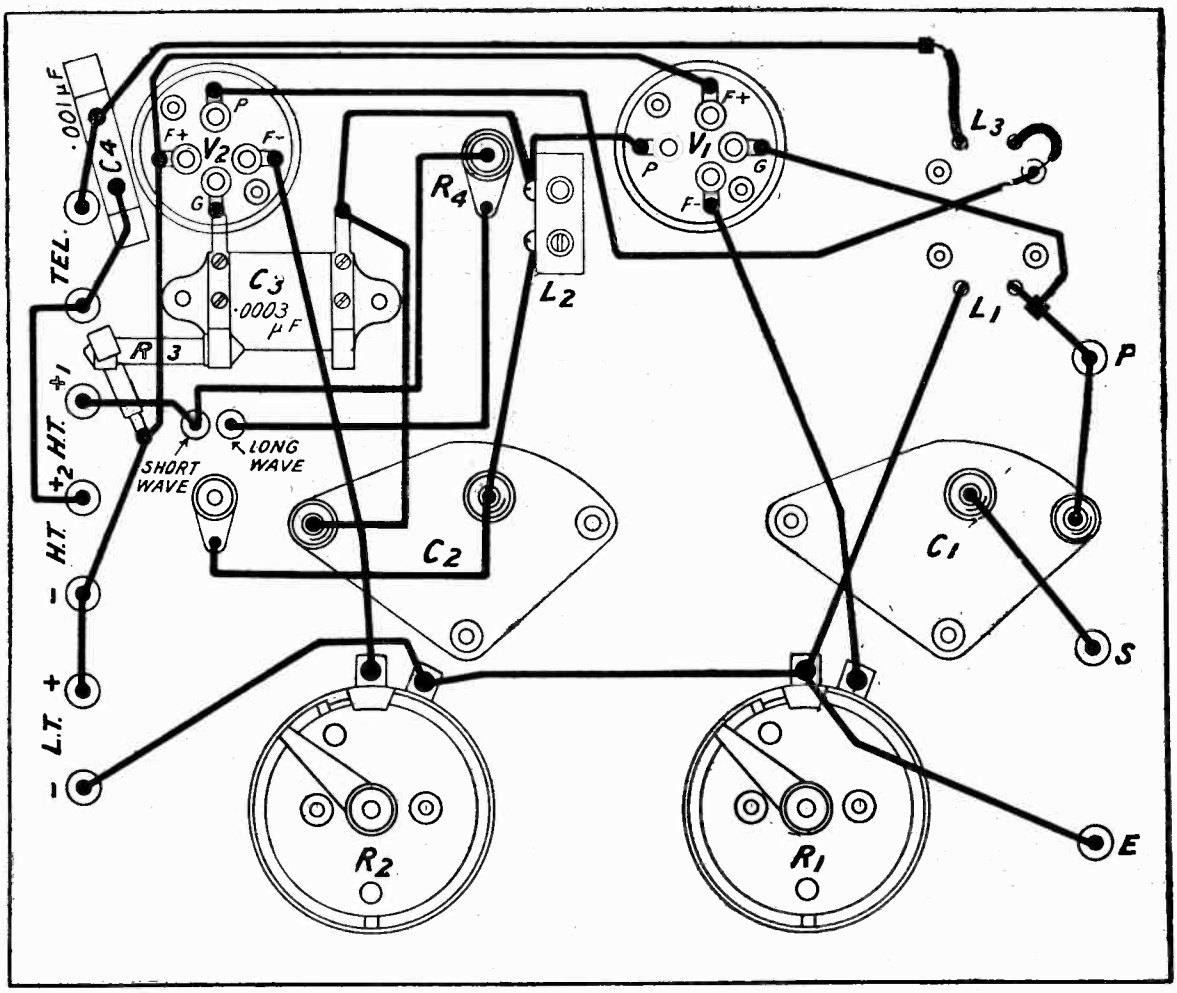


Fig. 3.—The wiring diagram, showing the necessary connections. Blueprint No. 90 b.

ment wiring is, in general, carried out first, these leads lying close to the panel out of the way of other leads.

Wiring

Wiring in this receiver has been carried out with No. 16 S.W.G. bare tinned copper wire, of circular cross-section. Square section wire may be used, if desired, or alternatively thinner round wire insulated with sleeving may be used. All joints should be soldered if the best results are to be obtained, as many cases of noisiness may be traced to leads fastened under nuts becoming loose or slightly oxidised.

Coils

The wiring diagram will make the connections clear, while the planes of the wires may be seen in the various back-of-panel photographs. When all connections have been made a test of the receiver under actual reception conditions may be carried out. Insert the valves and anode coil, which may be a No. 50 or 75 coil, the latter being a very useful coil in this position, and secure the panel in the cabinet. If a tray type of box, such as that illustrated, is used, there will be no need to screw the panel down, as it drops in on fillets and rests quite safely while tests are being made. It may afterwards be screwed down if desired. Using parallel tuning, a No. 35 coil will be required, on a standard P.M.G. 100-ft. aerial, for the lower of the short-wave stations, say, up to 400 metres, above which a No. 50 coil will be required. The size of the reaction coil will largely depend upon the resistance of the aerial, the coil being larger for a high-resistance aerial than for one of low resistance. For an average aerial a coil one size larger than the aerial coil may be employed.

Terminal Connections

The switch must be on the right-hand (short-wave) stud. Connections to batteries and so on are made, as indicated in Fig. 2. The top two terminals in the right-hand row are those to which the telephones are connected; the next pair are for positive high tension supply to each valve, and may be joined together for a preliminary test. The next terminal, reading downwards, is that to which the negative lead from the high-tension battery is joined, while the bottom pair are respectively joined to the positive and negative terminals of the accumulator.

Tuning

The filament resistances are then turned slowly from the "off" position, and tuning is carried out on both variable condensers simultaneously, keeping the reaction coil well away from that in the aerial circuit. On

hearing signals from, say, the local station, adjust the aerial condenser for the loudest signal, then find the best setting for the anode tuning condenser. Now bring the reaction coil slowly nearer to the aerial coil, retuning slightly on the aerial condenser, and note if there is an increase in signal strength up to a point, after which signals become distorted. If this is so, loosen the coupling between the aerial and reaction coils at once, as interference may be caused to other listeners owing to the set being in a condition of oscillation. If, however, no such effects are noticed when the two coils are close together, reverse the connections to the moving (reaction) coil by changing over the flexible leads to the moving socket.

Receiving Chelmsford

For the reception of the high-power experimental station at Chelmsford the switch is moved over to the left-hand (long-wave) stud, a No. 150 coil is inserted into the aerial socket, while the reaction coil, under average conditions, may be a No. 200.

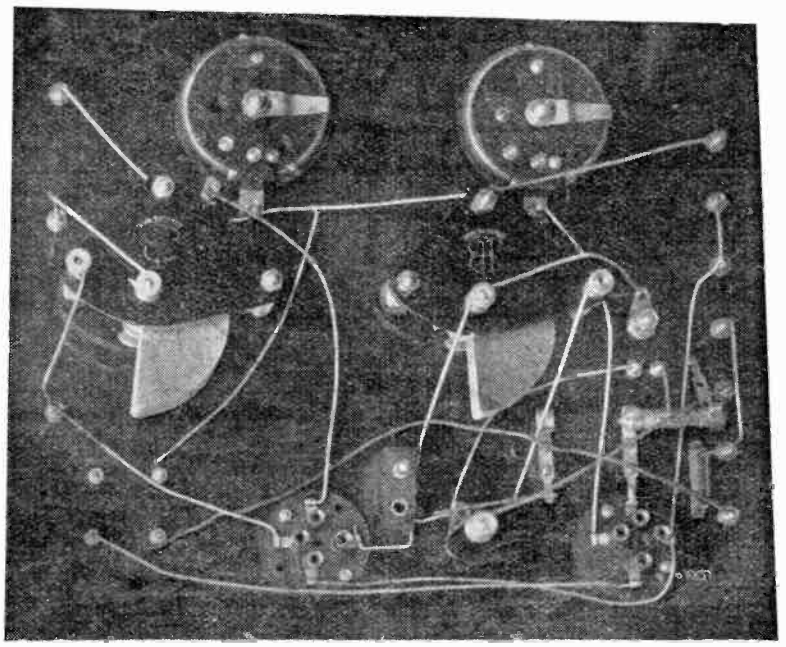
When the change-over from short to long waves is effected it will be necessary to increase the high-tension voltage applied to the first valve. This is effected by plugging the flexible lead from the terminal H.T.+1 into a socket of the battery corresponding to a higher voltage, whilst the anode resistance is adjusted to give the best results.

Results

The set, as described, has been in use on a 100-ft. aerial in S.E. London, about six miles from 2LO, and a short account of the results obtained is here given. 2LO, of course, is uncomfortably loud on telephones with both valves alight, and when listening to that station on 'phones the first valve may be turned out, the resulting signals being quite strong enough. When the amplifier, previously mentioned, is joined up, excellent loud-speaker signals are obtained.

Whilst writing this article, I am listening to Madrid on 'phones, with the reaction coil swung away to 90 deg., signals being perfectly clear and distinct, while every word of the announcer can be followed. With slight application of reaction, Hamburg can be heard, interfering with Madrid, there being only three metres difference in the wavelengths of these stations. When the amplifier is added, Madrid gives very clear signals on the loud-speaker with 90 deg. reaction coupling.

(Further results will be given in our next issue.)



A plan photograph of the wiring.

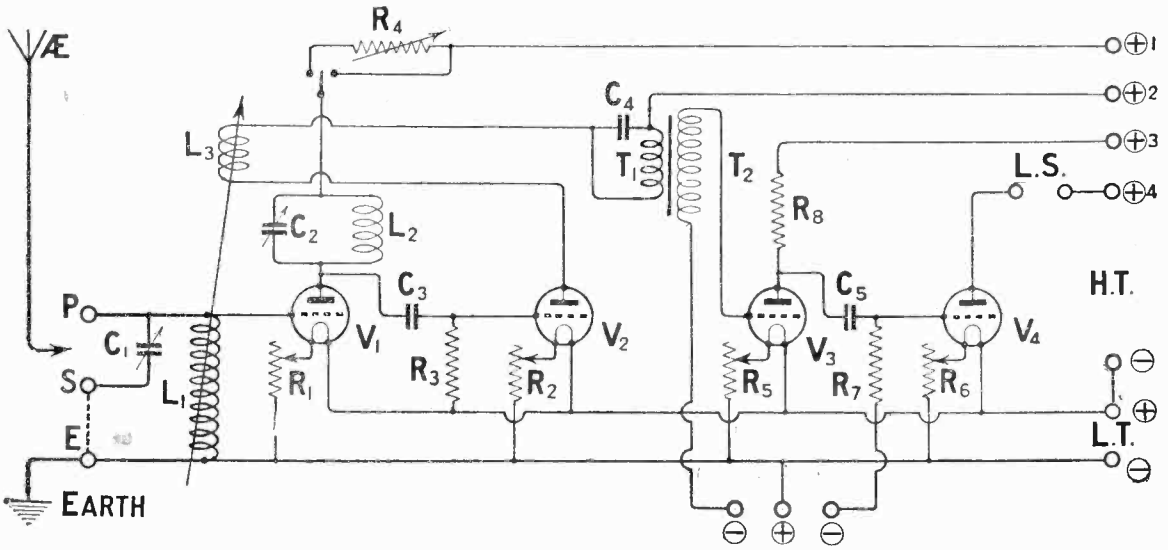


Fig. 4.—Showing the connections necessary when a two-valve amplifier is added, the last stage of L.F. being resistance coupled.

A Home-Made Coil

RECEPTION on short waves has become very popular of late, and a great many different kinds of low-loss inductance coils have been designed to enable these wavelengths to be received with efficiency. The great point about a coil for short wavelengths is that it should

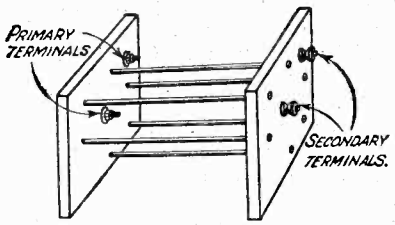


Fig. 1.—Details of the coil former.

have the smallest possible self-capacity and that resistance should be kept at a minimum by the use of stout wire. The coils to be described will be found quite easy to make up and efficient in use. In addition to this they have one good feature not shared by a number of other designs—they are exceedingly robust. Fig. 1 shows the finished former, which consists, as will be seen, of two ebonite end pieces, between which is a "skeleton" of hexagon section formed by six rods. These rods may be made of hard, well-seasoned wood, which has been thoroughly well shellacked, but if it is decided to use bare wire for the turns, they should be of ¼-in. round ebonite. In Fig. 2

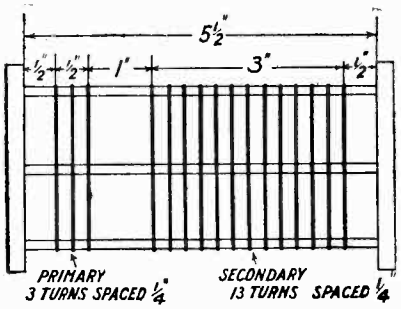


Fig. 2.—Illustrating the method of winding the coil.

is seen the method of winding the primary and secondary coils, both of which are placed upon the same former. The primary consists of three turns of No. 18 s.w.g. wire with a spacing of ¼ in. between turns. The secondary, which begins 1 in. away from the primary, has 13 turns of the same wire, also with ¼ in. spacing between turns.

The End Pieces

The layout of the end pieces is shown in Fig. 3. Each is made from a piece of ¼-in. ebonite, 4 in. square. Upon one of these is drawn with a scriber a circle 3 in. in diameter, whose circumference is divided into six equal parts by lines drawn from the centre at an angle of 60 deg., as shown in the diagram. In case no protractor is available, a condenser scale may be used for obtaining the angle, or a watch dial may be pressed into service, 60 deg. being equal to 10 one-minute divisions. Another method which gives quite good results is to use

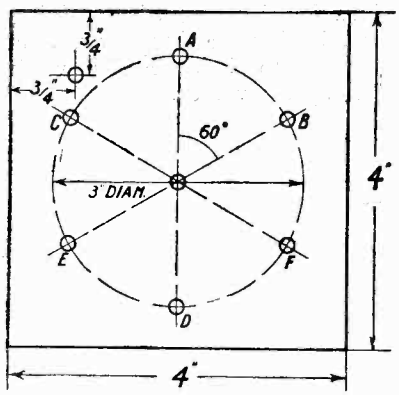


Fig. 3.—Layout of the end pieces.

a pair of dividers, setting their points at a distance apart equal to the radius of the circle. A punch mark is now made at A, one point of the dividers being placed in it. Marks are next made with the other point at B and C. The same process is then carried out from a punch mark made at D. It will be found that the distance between C, E and B, F is slightly greater than it ought to be, but this will make no difference to the efficiency of the coil. It is only necessary to lay out one of the end pieces. When this has been done, the two should be clamped tightly together and the drill run through both. All the holes on the circumference of the circle should be made 4 B.A. clearance and countersunk on what is to be the outside surface. Make two further 4 B.A. clearance holes, one at the centre of the circle and the other ¾ in. below the top and ¾ in. from one of the side edges. These are for the terminals.

Now cut out six lengths of ¼-in. or 5/16 in. round ebonite rod, making a 4 B.A. tapped hole in each end of all of them. The

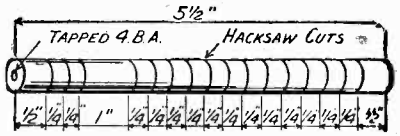


Fig. 4.—How the rods are grooved.

former can now be put together by running countersunk screws through the end pieces into the rods. When this has been done, mark out each rod, as shown in Fig. 4, and make light cuts with a hacksaw to hold the windings in place. Wind the primary in the following way:—Through the top rod of the former at the third notch, drill a hole with a No. 55 Morse drill. Pass the end of the wire through this, taking it straight down for 1½ in.

Winding the Coil

Then bend the wire and lead it to the shank of the central terminal, making a soldered joint. Fig. 5 makes this part of the process quite plain. Now wind the turns on backwards until all three are in place, cutting the wire and soldering to the shank of the other terminal. The turns should lie in the hacksaw cuts and they should be put on tightly, though

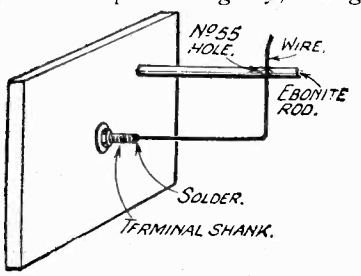


Fig. 5.—Secure the wire in the manner shown.

not so tightly as to bend the ebonite rods. The central terminal is thus attached to the "out" end of the primary and the other to the "in" end. In winding the secondary the process is similar. The anchoring hole is drilled at the notch nearest the

primary windings, the end of the wire being taken through the middle of the coil to the central terminal. Thirteen turns are then put on as before, the end being soldered to the central terminal. In the secondary, the central terminal is "in" and that near the corner of the end-piece the "out."

The reaction coil is made in the same way and contains, like the secondary, thirteen turns. Here, the length required for the ebonite rods is 4 in., since there is only one winding. In connecting the coils to the set, very short pieces of stout wire should be used for the primary and secondary. The reaction coil connection should be a short length of double flex of good quality.

The coils will be found delightful to use. The combined primary and secondary stands on the table and is not moved. The reaction coil is placed fairly close to the secondary end of it. It can be moved about in any direction with the greatest ease, so that the adjustment of the coupling to the amount required is quite a simple matter. To avoid the effects of hand capacity the coil should be moved by means of a stick or a piece of ebonite rod. If desired, a handle 8 or 10 in. in length may be screwed to one of the end pieces. A suitable variable condenser to use with these coils is one of 0.00025 μF in parallel with the secondary.

R. W. H.

THE ROMANCE OF WIRELESS

SIR,—Reference your Editorial in the *Wireless Weekly*, No. 10, Vol. 5.

Apropos the paragraph commencing "No novelist has yet seized upon the true romance of wireless. . . ." Apparently the writer of the Editorial is not conversant with the novel, "Looking Backward," by Edward Bellamy.

If he will turn to Chapter xi of that book he will find a remarkable forecast of broadcasting of to-day, or at least of what we are hoping broadcasting will attain. True, the results as described in the novel are obtained through the medium of the extension of the ordinary telephone system, but the prophecy of "music on tap" is, nevertheless, startling, and even more accurate than flights of fancy by better known authors, such as Jules Verne and H. G. Wells.

Wishing your paper and kindred publications every success.—Yours faithfully,

P. COCKROFT.

Leeds.

VALVE NOTES

(Concluded from page 431.)

As will be seen from the figure, the low-frequency currents produced after rectification are fed, not into the grid circuit of the first valve, as in Fig. 1, but into the grid circuit of the second valve. The amplified low-frequency currents which now appear in the anode circuit of the second valve are fed into the grid circuit of the first, which amplifies them, the loud-speaker L.S. being included in the anode circuit of the first valve instead of the anode circuit of the second.

It will be seen from Fig. 3 that the first grid receives the original high-frequency E.M.F.s and low-frequency E.M.F.s after a single stage of amplification.

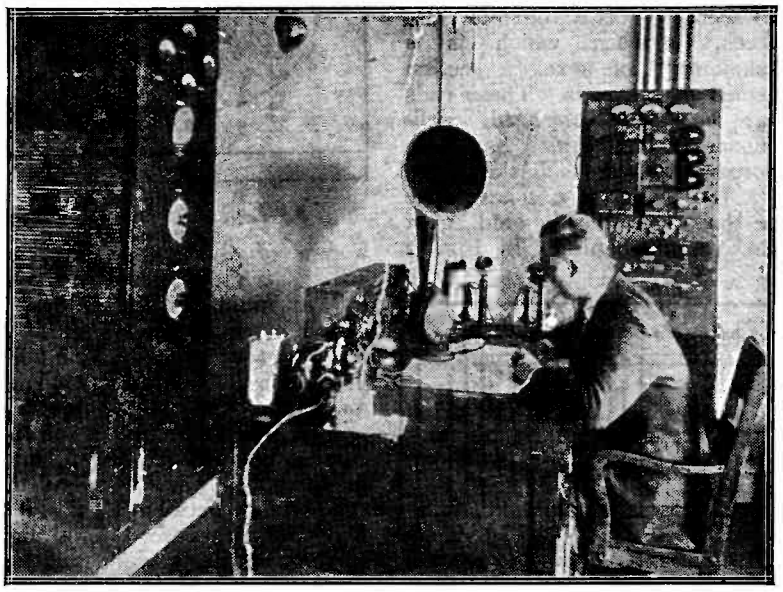
The grid circuit of the second valve receives the low-frequency E.M.F.s without amplification and E.M.F.s due to a single stage of high-frequency amplification.

Keeping to the original figures, the maximum grid sweep, in the case of the first valve, will be 14 volts, while the grid sweep, in the case of the second valve, will be 10 volts.

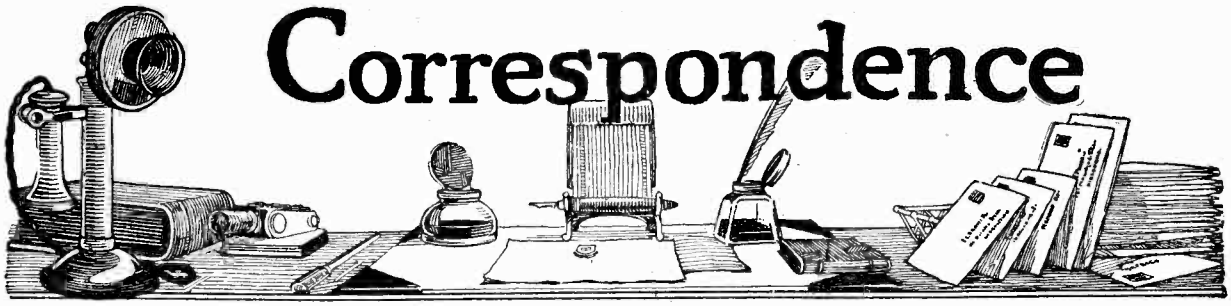
This does not even things up altogether, but the valves are worked more equally.

The figures I have quoted are not based on any relative measurements, but are merely given for the sake of explaining how, by inverse duplexing, it is possible to balance the work done by the valves.

CANADIAN STATION HEARD IN IRELAND



CNRA, the new station of the Canadian National Railways at Moncton, New Brunswick, by means of which it is hoped to relay British Broadcasting programmes to the chain of ten broadcasting stations supplying entertainment to the expresses of the Canadian National Railways, has been heard in Ireland, by Mr. McMurray, of Bangor, Co. Down. Our photograph shows the operating room of radio station CKCH, owned and operated by the Canadian National Railways. This station, located at Ottawa, Canada, is the most powerful radio broadcasting station in the Dominion.

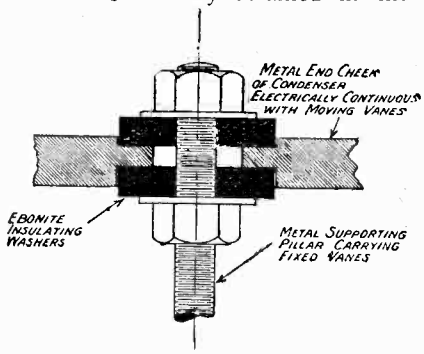


Correspondence

LOSSES IN CONDENSERS

SIR,—I have read with interest the articles that appear on pages 165, 179 and 209 of your issues of November 19 and 26 regarding losses in variable condensers, and I note that you attribute these losses to (*a*) metal end-plates instead of ebonite, (*b*) "very small" ebonite bushes.

With regard to (*a*), I feel sure that you intend your remarks to apply only to metal end-plates provided with insulated bushes to carry the rotor spindle, as there can be no possible objection to metal-end plates which are electrically continuous with the rotor, as otherwise such designs would not be used and specified by the National Physical Laboratory and by the Bureau of Standards (see Circular No. 74). The latter form of construction was adopted by my Company after a prolonged series of measurements of losses actually obtained in the various types, the great advantage being that rotor frame, dust cover, end-plates, and shaft are all electrically continuous and form a metal box which can be so connected in the circuit that it is virtually at earth potential, thus obviating all the usual hand-capacity effects.



This diagram shows the method of clamping the fixed plates of Burndept condensers.

With regard to (*b*), the fixed plates are supported inside this box by means of the *smallest possible quantity* of solid dielectric. In other words, best quality ebonite washers are used, and they are made as *small as is compatible with mechanical strength*, for the simple reason that losses, *i.e.*, bad power factor, are not usually due to poor *insulation* (see later remarks), but to *dielectric absorption*, which is proportional to the *mass* of the dielectric and to the potential gradient through it, and therefore, it is desirable to *keep the bushes small*. In order that the potential

gradient may be low, bushes should be so shaped and placed that capacity through them is small; this result is obtained by my Company in a manner which is made clear by the attached sketch, in which a stem (fixed plate support) is clamped to a metal end-plate by two grade "A" ebonite washers, the whole assembly being so shaped that comparatively few lines of dielectric strain pass through the ebonite, the concentration of such lines being from stem to end-plate, between the ebonite washers, where the dielectric is air.

Use on Short Waves

The effect of this construction ensures ruggedly constructed variable condensers in which losses are so low that circuits in which they are used will oscillate with ease at wavelengths of 40 metres and less, always provided that losses in other parts of the circuit are kept equally low. The following measurements taken on December 23 in my laboratory may be of some interest:—

Condenser A:—A Burndept Standard Air Condenser, with metal end-plates and steel dust covers. Nominal capacity, .001 mfds. Catalogue No. 417.

Condenser B:—A precisely similar condenser but made up with grade "A" ebonite end-plates.

Frequency of measurement = 1,000 cycles.

	Condenser A (Metal).	Condenser B (Ebonite).
Minimum capacity:—		
(I) Dust covers off	Mfds. 23.8	Mfds. 12.4
(II) Dust covers on	34.2	—
Maximum capacity ...	1017.8	992.6
Equivalent series resistance:—		
(*a*) Scale set at 100 mfds. ...	Ohms 12.0	Ohms 35.0
(*b*) Scale set at 500 mfds. ...	12.0	40.0
Power Factor:	Per cent.	Per cent.
(*a*) Scale set at 100 mfds. ...	0.074	0.220
(*b*) Scale set at 500 mfds. ...	0.015	0.050

Returning to my remarks that losses are not due to poor *insulation*, I would point out that at the high frequencies used in radio telegraphy it is a fact that low insulation resistance in a receiving condenser does not matter (of course I am speaking in terms of megohms). If we assume "low insulation" to be, say, 2 megohms, and the condenser to be set at a value of, say, .0003 mfds. on a wavelength of 300 metres, the reactance of the condenser will be 530 ohms, and really there does not seem to be much harm in shunting 530 ohms with 2 megohms, does there?

In conclusion may I be permitted to congratulate you upon the attitude you so often take up with regard to wireless apparatus, viz., that the *scientific* correctness of the design must not be subordinated to convenience in *mechanical* constructions.—Yours faithfully,

C. F. PHILLIPS,
M.I.R.E., A.M.I.E.E.
Chief Engineer and Director,
Burndept, Ltd.

*Roughly equals percentage of applied power lost in condenser.

"THE FIRST MILLION"

SIR,—Allow me to reply briefly to your comments on my letter published in December 17 issue of your valued journal.

(1) You controvert my statement that sets are constructed solely for the purpose of obtaining excellence of broadcast reception. What, I would ask, *are* they constructed for, if not for this specific object? Merely for the satisfaction to be derived from producing a scientific instrument, intended to be used not as a scientific instrument, but for contemplation or display as an *objet d'art?*

(2) You refer to your efforts to educate the public in the proper use of reaction. I gladly acknowledge the justice of this claim, but I maintain that the nuisance complained of persists *and grows*, despite all your efforts. Therefore, I still think it right that those about to take up wireless should be warned that good reception is by no means solely or mainly dependent on good set-construction, but is obtainable only on very rare occasions owing to the malpractices of set mis-users.

(3) Finally, I agree that my suggestion that reaction should not be permitted is a drastic remedy. But serious evils require drastic treatment, and at present I am unaware of any other effective suggestion for putting an end to the interference caused by those who do not know how to use their sets or (*and this is the real cause of the evil*) do not care what trouble or annoyance they cause their wireless brethren. —Yours faithfully,

P. C. MAYWOOD.

Teddington.

TRANSATLANTIC V.

SIR,—This is yet another appreciation of the wonderful "Transatlantic V" set described by Mr. Percy W. Harris in your June issue of *Modern Wireless*.

Although I have only recently completed it, I can honestly say that I have had every Continental station on the loud-speaker that I have tried for, Madrid being one of the best. The only modification I have provided is for reversed reaction by means of two "Clix." I thought this would be useful on very low wavelengths, but I have not needed it yet. The rest of the set is an exact copy, even to the components.

I have rigged up a simple device for cutting out the first H.F. valve when required. It consists of a four-pin adapter for the first valve socket, the grid and plate legs being shunted by a .25 μF condenser. I have found no advantage in using a second device of this sort for the second H.F. valve socket when using the detector valve only, just as good results being obtained by turning out the filament of this valve. Better results are obtained on the detector valve alone by using the plug-in fitting in the first valve socket than by simply turning out the two H.F. valves. Wishing you still more success,—Yours faithfully,

H. L. WILLEY, M.A., M.B.

Sheffield.

ALL CONCERT DE LUXE

SIR,—I herewith beg to report results obtained with the "All-Concert de Luxe" receiver (R. P. Envelope No. 4, by Percy W. Harris).

I bought the envelope immediately it was published, and completed the set on July 19, and have had nothing but praise for it ever since.

The stations which I have received so far include all B.B.C. (not including relays) stations, Eiffel Tower, Radiola, L'Ecole Superieure, Petit Parisien, Vox Haus, Hamburg, Breslau, Leipzig, Koenigsburg, Munich, and not forgetting Frankfurt.

In Stirling I can get any one of these stations while the British stations are operating, and Breslau is the only one on which I can say there is any interference from another broadcasting station, Glasgow being well in the background, but still audible.

There is no interference whatever between Radiola and 5XX.

The only attempt I have made with this set to get America was between midnight and 1 a.m. recently, and although I got a very strong carrier wave and a man speaking from 12.15 a.m. until 12.25, and from about 12.30 until 12.50 I was unable to make out one single word.

According to all the rules of the game my aerial is one of those on which I should expect to catch nothing but atmospherics. It is 100 ft. long, including 15 ft. lead-in, not more than 18 ft. high, and about twenty-two telephone wires cross its mid-point about 12 in. above; it has a lovely sag, and the solitary insulator at the free end is as black as the ace of spades, as it has never been cleaned since I put the aerial up a year past in March.

On an inside aerial in the town of Motherwell I recently had Glasgow, Edinburgh, Newcastle, Bournemouth, Frankfurt-on-Main, and Hamburg, and if anyone had told me about getting the last two stations on an inside aerial I would have told them how to get China and Chili as well.

Although I had some difficulty in tuning out Glasgow on the outside aerial I heard every item from Frankfurt from 9 o'clock until they closed down with their Hymn of Praise at 11 p.m. I also had Hamburg and all the other B.B.C. stations, including 5XX, on this aerial, which would be about 70 ft. long and 5 ft. of a lead-in and about 18 ft. high.

The earth consisted of about 12 ft. of the same wire, 3-20 enamelled copper, screwed down to the base of the water tap.

I built the "All Concert Receiver" when it came out in *Modern Wireless*, September, 1923; but whether it was due to lack of experience or to some other cause unknown, the results were not to be compared with this set.

I have been pottering about with all sorts of circuits ever since on the "hook up" principle, and whenever I wanted anything special I always fell back on the ST45.

But even at its best there was always something amiss. [The ST45 circuit is the one used in the All-Concert set.—ED.]

I have carried out the instructions in the envelope almost to the letter, the only alterations being the substitution of a Lissen variable grid-leak for the fixed one, and instead of having one H.T.+ I have three, one for each valve. This was so that I could comply with makers' instructions for the low-consumption valves.

The first night I tried out this set I picked up a station calling Java, and then the kind gentleman at the other end of the rainbow repeated all the numerals right up to ten without a mistake—at least, I never detected one—and then after selling more oranges he closed down, and I have never heard him from that day to this.

I haven't the foggiest idea where it was, but I had a No. 300 coil in the aerial and a 400-coil in the anode.

I have had one or two other stations as well, but I have been unable to identify them, so they are not included in the list.

I have waited a long time for a decent design for a three-valve set, but I am happy now; and to be candid with you, I wouldn't change it for any commercial set that I have seen.

I have it mounted in a mahogany box which is French polished, and the transfer lettering shows up beautifully on the ebonite; the general appearance has been admired by everyone who has seen it.

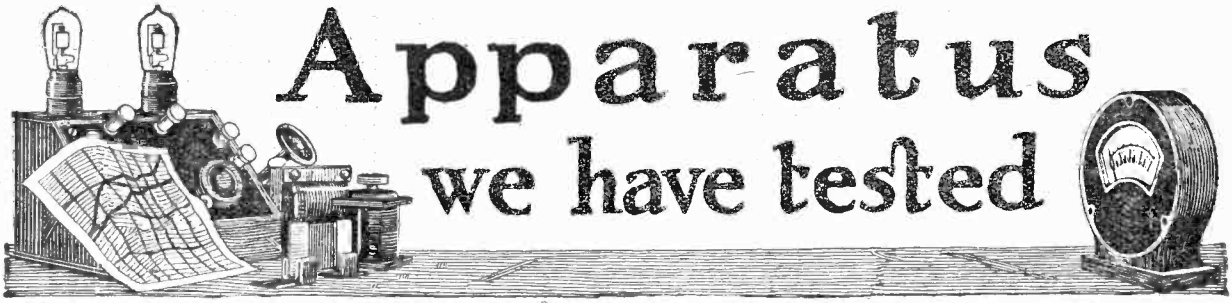
I should mention here that I do not use the variable gridleak when tuning, but merely alter the resistance until I obtain the best result on the local station, or when I change the valves.

I can strongly advise anyone who is desirous of building a three-valve set to get busy with this one, and they will be amply repaid for their work. Wishing you every success,

—Yours faithfully,

R. A. HUGHES.

Stirling.



Apparatus we have tested

Conducted by A. D. COWPER, M.Sc., Staff Editor.

Magnum Plug-in H.F. Transformer

Messrs. Burne, Jones & Co. have submitted for test two specimens of their plug-in high-frequency inter-valve transformers, covering the ordinary short-wave broadcast range from 300 to 600 metres wavelength, with a parallel variable condenser of .0003 μF capacity. These are neat instruments, highly finished, and wholly enclosed; of cylindrical form, $1\frac{3}{4}$ in. high by $1\frac{3}{4}$ in. diameter, and on the ordinary four-pin base. The connections are clearly indicated by engraved symbols on the base.

On test, both gave very closely the wavelength range indicated, and the degree of signal-strength selectivity and amplification associated with this type of fine-wire plug-in transformer. If used as a neutrodyned tuned-anode coupling device, the wavelength range will be, of course, slightly different to that given here.

A Three-Coil-Holder with Fine Adjustment

Lissen, Ltd., have sent for test a form of three-coil holder in which fine adjustment is obtained (by a tangent-screw micrometer device) of both of the outer coils, the inner coil being fixed as usual. This is mounted on an ebonite base $4\frac{1}{2}$ in. by $2\frac{1}{4}$ in., with holes for fixing on panel or cabinet; a row of six small terminal screws (which nip the end of the connecting wires in metal-bushed holes in the edge of the ebonite in a manner which will make for neat wiring) is arranged down one side. The coil-mounting plugs are circular in shape, and the outer ones rotate on a common horizontal axis. This rotational movement is controlled by tangent worm-screws working in a substantial thread cut in the periphery of the ebonite plugs themselves, and operated by small knobs at the ends of 3-in. spindles. The hand-capacity effects are thereby reduced to a minimum, and very fine adjustment of coupling is possible over a range of 90 degrees of arc by this slow micrometer movement. Short lengths of flex make the electrical connections to the terminals.

On test, the device was found to work smoothly and without shake or appreciable back-lash, and to

give narrow regulation of coupling. The largest sizes of coils could be controlled without any difficulty or instability, so that the coil-holder is particularly suited for long-wave work or with the large oscillator coils used in certain "super" circuits. The insulation resistance was found to be excellent, and the finish and workmanship all that could be desired.

Loading Devices for the High-Power Station

Messrs. British Thomson-Houston Co., Ltd., have submitted two loading devices for existing receivers to enable these to be used for the reception of the new high-powered long-wave station without serious structural alterations. These two accessories are designed, apparently primarily for B.T.H. receivers, to effect loading in a simple way.

The one device is a large loading-coil in the form of a narrow disc or slab, $3\frac{1}{2}$ in. diameter and only $\frac{3}{8}$ in. thick over the cheeks of the former. Connections are made by two slotted metal feet spaced at $1\frac{1}{4}$ in. apart. On trial, in series with an ordinary No. 35 coil to represent existing inductance in *e.g.*, a parallel-condenser-tuned crystal set, this received 5XX with a parallel tuning-capacity of .00025 μF, corresponding to a small or high single-wire aerial.

The other device is in the form of a cylindrical box $2\frac{1}{4}$ in. diameter by 1 in. deep, with a lid which has a knurled rim and can rotate through a small angle, operating thereby a simple selector-switch in the interior. This switches, at will, into parallel connection with the tuning inductance of the set, across which the device is placed by means of two short flexible connectors with ring terminals, an enclosed mica fixed condenser whose capacity was measured as approximately .0034 μF. This relatively very large tuning capacity sufficed, on trial, to tune an ordinary No. 60 plug-in coil—corresponding, *e.g.*, to the inductance of a tuning variometer in the original crystal adjusted at a medium setting—to the wave-length of 5XX. Actually, in a test made with a valve-receiver, a No. 60 coil would oscillate with this condenser and a No. 200 reaction-coil.

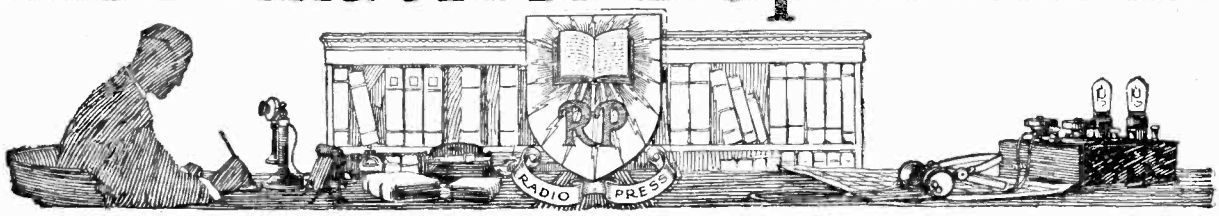
The general finish and workmanship of these units was of the highest order; the appearance, in their brown-moulded composition cases, was distinctly pleasing.

Ediswan Potentiometer

From Messrs. Edison Swan Electric Co., Ltd., we have received a sample of their type, WL. 561 potentiometer. This is a circular instrument, reminiscent of an ordinary filament-resistance, but fitted with the necessary three terminals. It is adapted for panel-mounting by two small screws, and is equipped with a knob bearing an indicator. The terminals are readily accessible, being arranged each on an extension-arm, and are of reasonable size. The resistance wire is wound in the form of a spiral on a flat fibre strip which is then bent round in the form of a circle, and enclosed drum-fashion between two ebonite end pieces. The variable tapping-point required is made by a contact-shoe at the end of a radial arm controlled by the knob outside.

On test, the resistance came out at about 240 ohms, sufficient for ordinary purposes in radio technique, and the device operated smoothly and silently. It can certainly be recommended for use where such an instrument is indicated.

Information Department



SUPPLIED BY RADIO PRESS SERVICE DEPT., LTD.

B. S. J. (NUNEATON) wishes to take up the subject of short wave reception, and asks for any general advice upon making a start.

It is best to build a completely separate receiver for this purpose, and we think that for a beginning you should study the article in the October 8 issue by Mr. Percy W. Harris, entitled "100 Metres and Below." You may find it necessary to make some alterations in your aerial system for the greatest efficiency on really short waves, and the first thing to try is a counterpoise earth, which very often overcomes a number of the difficulties which are met with in the case of a direct earth. Good results can be obtained with a counterpoise consisting of a single insulated wire hung perhaps 5 to 6 ft. off the ground, or a little more if conditions demand it, directly beneath the aerial, and preferably of slightly greater length than the aerial, say 120 ft. Difficulty is sometimes experienced if the natural wavelength of the aerial falls on one of the waves upon which it is desired to work, since it is often found that ordinary single-valve reaction sets will refuse to oscillate upon this wavelength. Some form of aperiodic aerial tuning reduces the difficulty, although it does not as a rule overcome it; and the only real remedy seems to be some alteration in the constants of the aerial, such as a reduction by, say, 10 ft. of its length. This, of course, assumes that the aerial is of considerable size to begin with, and in the case of a small aerial an attempt should be made to enlarge it, in case of a difficulty of this nature. We do not think you will obtain satisfactory results merely by trying to substitute suitable short-wave transformers in your Transatlantic Five Receiver.

U. A. B. (E.C.4) has a Family 4-valve Receiver (Radio Press Envelope No. 2), and experiences a certain amount of difficulty in freeing his results from distortion, and enquires as to the use of power valves and grid bias.

It is not as a rule necessary to use more than one power valve in this set, and this valve should be inserted in the fourth socket, counting from the left. It will be necessary to employ grid bias for this

valve alone, and this is best done by breaking the connection between the secondary of the transformer which passes the signals on to this last valve, and the filament circuit. Upon examination it will be found that one end of the secondary of this transformer is connected to the grid of the fourth valve, and the other end of the secondary is connected to the filament circuit. Break this latter connection, and take the wire from the transformer secondary to a new terminal upon the panel. Connect the negative of the grid bias battery to this new terminal, and connect its positive to the low-tension negative terminal.

Additional anode volts must also be applied, and this is best arranged as follows: Connect, say, a 72-volt high-tension battery to the ordinary high-tension terminals and connect an additional 36-volt unit in series between the loud-speaker and the terminal marked LS plus. Connect the negative of the battery to this terminal, and connect its positive to the free tag of the loud-speaker. The other tag of the loud-speaker remains connected to the other loud-speaker terminal.

K. S. J. (EXETER) has a Trans-atlantic Five receiver which is behaving in a manner which he finds extremely puzzling. It gives perfectly satisfactory results upon the high-frequency side only, but when used to work a loud-speaker it will, at times, quite without warning, suddenly begin to distort very badly and signals almost immediately die down to something like a quarter of their previous volume. Our correspondent has noticed that a strong atmospheric will often provoke the trouble, as also will a particularly loud passage in an orchestral item which is being received. He finds that the only cure for this condition, when once it has set in, is to switch off the set for a few moments.

This trouble is one which is quite commonly met with in low-frequency amplifiers of the resistance-capacity type, the usual trouble being a grid leak of too high a value. The grid leak is usually of some abnormally high value, and the substitution of the correct one of 2 megohms will no doubt cure the trouble. In some exceptional cases, however, a valve of rather unusual type requires a still lower value grid leak to overcome this choking, and one of, say, ½ megohm should be tried. Incidentally, grid leaks of quite low value are somewhat advantageous in this position, and a ¼ megohm is often recommended.

M. S. B. (PORTRUSH) possesses a receiver employing two high-frequency valves coupled by means of tuned transformers. He obtains very good results from a number of the B.B.C. stations, but is much troubled by interference from shipping. He is considering trying constant aerial tuning in the receiver and wishes us to express an opinion as to what the probable effects would be in the case of this set.

The principal effect which would be noticed in the case of an instrument of this sort on adding constant aerial tuning would probably be a considerable increase in the tendency to oscillate, and it would therefore be found that it would be necessary to turn the potentiometer considerably further towards the positive end in order to stop self-oscillation. Such additional positive bias is certainly not an aid to selectivity, and, therefore, we are inclined to think that in this instance constant aerial tuning might not be an advantage, unless some other method of controlling reaction were adopted. Probably a better expedient would be to use a loose-coupled primary and secondary circuit, with a little negative magnetic reaction upon the secondary coil, to check the tendency to oscillate.

Two Popular Envelopes and A Book

BY

PERCY W. HARRIS

Editor of "The Wireless Constructor."

Mr. Harris' reputation as a constructional writer and designer is second to none.

With an almost uncanny knowledge of the needs of the "home constructor," he is not only able to design sets which rank as the best of their kind, but he is able to describe them with a skill which enables even the beginner to follow his designs and obtain equally good results. Tens of thousands of sets have been made according to his designs, and every one has enhanced the reputation of the author and also that of Radio Press Ltd., who have the exclusive services of Mr. Harris.

Mr. Harris has two envelopes to his credit, Nos. 2 and 4 of the Radio Press Envelope series, each containing pages of photographs on art paper, sheets of instructions, wiring and panel blue prints, lists of components, and, in fact, all the features which have made Radio Press Envelopes the last word in guides to the constructor. He has also written a standard constructional work, "Twelve Tested Wireless Sets," which has had an enormous sale and which will strongly appeal to readers of "Modern Wireless" as all kinds of sets, from a crystal to a "Transatlantic," are fully described.

Read this letter from the South-West of Africa.

SIR,—I suppose you will be surprised at hearing from someone in the outskirts of the Empire, but I am only writing you a few words of appreciation of the Family four-valve set described in Radio Press Envelope No. 2. This compact little set is by far the best operating set I have yet handled. Having had nearly 15 years' wireless experimenting, I have naturally handled many sets.

As to results obtained, these exceeded anything like expectations. Cape Town (750 miles) comes in at good strength on H.F. and detector. With note magnifier added, signals are too loud for 'phones. The power of Cape Town is the same as 2LO, so these results are far better than could be hoped for. JB (Johannesburg), with ¼kw. in the aerial, comes in quite loud on two valves, his distance being 740 miles. Shipping comes in with a roar. 5XX comes in with fair 'phone strength on three valves. Three a.m. one morning I managed to pick up KDKA on three valves at good 'phone strength. All high-power Morse stations come in well, and I can get them any time of day or night on two valves.

Hoping you will find this interesting, and congratulating you most heartily on your design of a thoroughly reliable and efficient set.

Yours truly, PERCY F. SYMONS.

Windhoek, S.W. Africa.

And this one :

SIR,—About three weeks ago I purchased the envelope containing particulars regarding the "All Concert Receiver," and wish to give you my results.

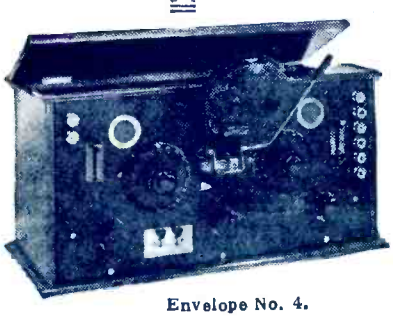
Without any wavetrap I am able to tune in 2BD at excellent loud-speaker strength, and with very slight interference from 5NO.

OTHER RESULTS: Radio-Paris, loud-speaker. 5XX, good; 5NO, excellent; 2BD, excellent; 5SC, good: these are all the B.B.C. stations which I have bothered with so far. Le Petit Parisien, loud in 'phones. Vox Haus? (woman announcer), fair loud-speaker. Hamburg, good loud-speaker. Breslau, fair loud-speaker.

I have had many more foreign stations than these, but have not heard their call signs.

HENRY R. MYERS.

Durham.



Envelope No. 4.

Twelve Tested Wireless Sets .. 2/6d. 2/8d. post free.
By Percy W. Harris.

Radio Press Envelope No. 2 .. 2/6d. 2/9d. ,, ,,
By Percy W. Harris.
(4-Valve Family Receiver)

Radio Press Envelope No. 4 .. 2/6d. 2/9d. ,, ,,
By Percy W. Harris.
(3-Valve All Concert de Luxe.)

All obtainable from wireless dealers and booksellers, or direct from the publishers, Radio Press Ltd., Bush House, Strand, London, W.C.2

Envelope No. 2.

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Wireless Weekly, 6d. Net. Wednesday January 14th, 1925

Wireless Weekly

Vol. 5.
No. 13

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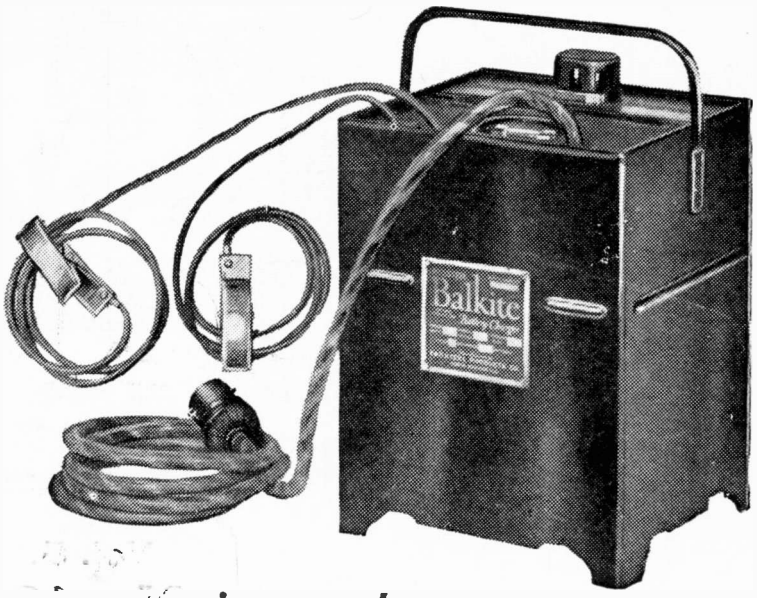
Making a Start in Transmission.

By PERCY W. HARRIS.

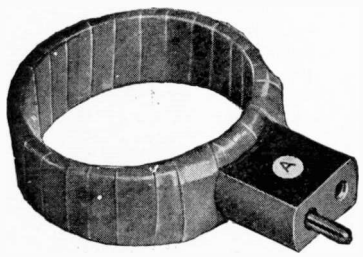
The *noiseless* Balkite Battery Charger



has no valves or moving parts

YOU would appreciate the convenience of being able to charge your wireless accumulator at home, and if your electric supply is 200-240 volt 50-60 cycle alternating current, the Balkite Battery Charger, a new Burndept accessory, will enable you to do so. The Balkite Charger is *absolutely noiseless* in operation and does not cause disturbances in any wireless receiver nearby. It is strong and simple, has no moving parts, vibrators or contact points, and there are no expensive valves to renew. There is nothing to adjust or get out of order. The Charger is designed in such a way that *both* half cycles of the alternating current are converted into the direct current for charging the accumulator. The charging rate being 2½ to 3 amperes per hour, a 6-volt 50-ampere accumulator will be completely charged in about 20 hours at an average cost of ½d. per hour, based on a cost of 6d. per unit. An accumulator in regular use left once weekly to charge overnight will be full up in the morning. The Charger delivers a taper charge, and cannot discharge, short-circuit or damage the battery by overcharging. The appliance has an adapter for plugging into any lamp socket and two spring clips for connection to the accumulator. When filled with a quantity of ordinary accumulator acid and a little oil it is ready for use, and the only attention it requires is the periodical addition of a little distilled water. The rectifying cell contains a rare metal called Balkite, which is specially produced for use in the Charger. The Balkite Charger is robustly constructed and "fool-proof"—there is nothing better for the purpose of charging accumulators from electric light supply. Write for full particulars.

No. 491. Balkite Battery Charger, 200-240 volts, 50-60 cycles (alternating current), without acid or oil, **£5 15s.**



Full particulars of Burndept Coils, together with prices and interesting laboratory data, are included in Publication No. 44, a copy of which will be sent free on request.

Set of 4 Extra Short Wave Coils (80-150 metres) .. .. **16s.**

Set of 4 Concert Coils (150-800 metres)... ... ... **16s.**

Set of 9 Coils, 2.5 to 1,000 (750-20,000 metres) ... **£3 15s. 6d.**

Prices of single Coils on application.

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Protecting the Public

DURING the last twelve months we have seen considerable progress towards an ideal which has always seemed to us highly important—the satisfaction of the customer in every wireless transaction. Much ground has yet to be traversed before this desirable ideal is attained, but no one can deny that the year 1924 showed really gratifying progress towards it.

Soon we shall look back to 1924 as the year when the valve manufacturers first realised that some steps should be taken to prevent use of a valve by unscrupulous people before delivery to the customer. Until that time it was quite possible for the small dealer who had no scruples in the matter to unpack his valves every night, use them in his own receiver, and put them back into stock next morning without the customer being any the wiser. By shielding himself behind the statement that "he could not be responsible for a valve after it had left the shop," he was frequently able to sell valves with burnt-out filaments.

By the end of the year two leading firms (joined within the last few weeks by a third) were selling their valves in special cartons, which allows a battery to be placed across the filament terminals so as to show that this is intact, while preventing the use of the valve in a wireless receiver. We hope it will not be long before every valve sold will be in some such packing.

Another matter established on a far better basis, so far as the satisfaction of the customer is concerned, is the sale of ebonite. We hope we shall be pardoned a feeling of satisfaction that Radio Press, Limited, has done more than any other body to secure for the public the sale of guaranteed ebonite, free from the surface leakage which, before we commenced our campaign, was looked upon as an inevitable accompaniment of sheet ebonite. The methods adopted in manufacturing ebonite for general commercial purposes were quite satisfactory years ago, and we are surprised that manufacturers were so long in realising the changed conditions brought about by wireless.

Every serious experimenter will confirm that in the last twelve months the quality of low-frequency intervalve transformers has been greatly improved. The low-frequency transformer is one of those components which, for some reason or other, is manufactured by all kinds and conditions of makers. It is a component which needs much skill in design, and which can be the source of an amount of distortion scarcely realised by those who have yet to hear how pure wireless reproduction can be. A receiving set made with the best modern transformers is incomparably better than any made a couple of years ago. While for purity of reproduction the resistance capacity method of coupling has yet to be excelled, it can be safely said that the leading makes of intervalve transformer give results barely distinguishable from those given by well-designed resistance-capacity coupling.

We note with satisfaction, too, that the general public—even that section of it which has comparatively little to spend on wireless components—seems at last to be realising the futility of buying cheap and shoddy material of unknown make. Transformers, fixed condensers, gridleaks, and many other components must, so far as the average man is concerned, be bought "on trust"—that is to say, it is quite impossible to judge the quality from the exterior appearance, and often very difficult to ascertain exactly whether the component is faulty or not without an elaborate test. The Radio Press Service Department has tested many hundreds of readers' sets within the last twelve months, and in a large number of cases the fault has been due to some minor component, such as a gridleak or fixed condenser, of unknown make and most appalling inefficiency. Fortunately the number of such cases is rapidly decreasing, and we hope it will soon reach the zero point.

CONTENTS

Making a Start in Transmission

By PERCY W. HARRIS, Assistant Editor.

This is the first of a series of articles designed to be of assistance to the experimenter who has recently obtained his transmitting licence. As is always the case with articles by Mr. Harris, the information given will be of a practical nature and full constructional details for efficient low-power transmitting sets will be published.

OF course, if everybody started their wireless experiments in the proper way (they rarely do in receiving and never in transmitting) a very thorough theoretical study would be made of transmission, and after a long interval a series of carefully planned experiments would lead up to the first tentative experiment in transmission through the ether. Human nature being what it is, the man who has obtained a transmitting licence rushes up some kind of

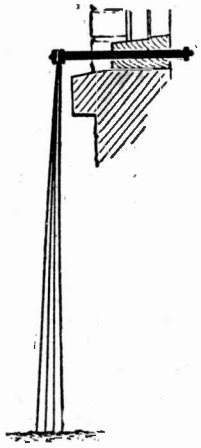


Fig. 1.—How the earth connection may be brought into the house to keep it clear of the wall.

circuit as quickly as he possibly can, and forthwith, using the full amount of power allowed by his permit (and a little bit more to make sure), calls up all and sundry and listens with great anxiety for his first QSL. If these first spasmodic attempts were followed by a more careful study of the various factors which go to make up successful transmission, there would be little complaint from the serious experimenter, but unfortunately a few of the amateur transmitters seem to be making little attempt at real experimenting, to judge by the alleged tests which are frequently carried out and long dreary gramophone recitals which churn up the ether on Sunday mornings.

At the same time a very large amount of careful experimental work is being conducted, and while a great deal of theoretical matter has been published in relation to transmitting circuits, there appear to be comparatively few articles published on this side of the Atlantic giving information which every amateur transmitter needs.

The Start

In point of fact, the only safe way to start transmission experiments is some point midway between the two extremes we have indicated above. If too much attention is given to theory at the beginning there is always a danger that the experimenter will degenerate into the didactic type of person who is willing to prove to you quite conclusively that somebody else's circuit, which he has never tried, is far inferior to his own, which only exists on the back of an envelope. On the other hand, too little attention to theory generally means a great deal of wasted time and effort in trying out unworkable schemes and useless circuits.

A Trouble

The real trouble, of course, is where and how to begin. Here most text books and articles give you little guidance. A man has no right to call himself an experimenter if his sole work consists in making a Chinese copy of some friend's transmitter and in working it without meters or other means of obtaining precise information of its efficiency and general capabilities.

The only useful way to tackle the problem is to analyse a transmitting set to find what elements are common to every transmitter and in some degree to standardise these so that general experimental work on old and new circuits can be carried out with a minimum of wasted effort, and the least possible expenditure of time, money and energy.

Efficiency

Amateur transmitters can be classified under two broad headings of "brute force merchants" and "efficiency experts." With the brute force merchants I have little sympathy. Many of them have no accurate measuring instruments, and achieve their

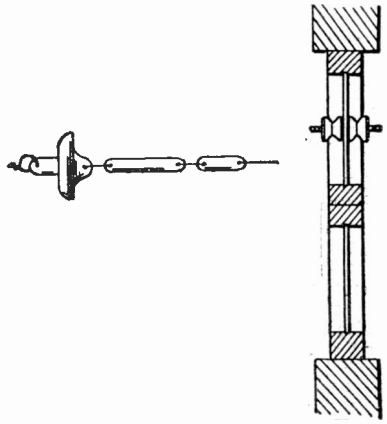


Fig. 2.—This diagram shows a good combination of insulators, and, on the right, a method of taking the lead-in through a pane of glass.

distance records (such as they are) by passing anything up to a kilowatt into their overloaded transmitting valve, thus getting into the aerial much energy, but with such low overall efficiency that they should be thoroughly ashamed of themselves. Few of them realise the sources of their power wastage, and would probably be staggered if the percentage ratio of output to input were measured and shown to them. It cannot be too fully realised that if we have

three different components in a transmitter, each of which is working at only 50 per cent. of its maximum efficiency, the working efficiency of the set may be 50 per cent. of 50 per cent. of 50 per cent., or, worked out as an overall efficiency, 12½ per cent. If these three parts are working at only 25 per cent. of their possible maximum, then the overall efficiency will be about 1½ per cent. !

The Better Way

The " efficiency experts " are much more interested in getting the maximum output for a given input than in merely piling up the aerial amperes without regard to how much is taken from the mains. As the great majority of amateur transmitters are licensed to use 10 watts only, the aim of these articles will be to show how to use this particular power efficiently, and I have no hesitation in saying that the distance possible to be covered by a well-designed 10-watt set is far greater than that obtained by many experimenters who habitually use over 100 watts.

Aerials

A great deal of nonsense has been written about aerials. It is all very well to say that the ideal aerial should be built in certain proportions, that there should be a minimum of this, that and the other, that the site should be selected so as to be far away from buildings, trees, telegraph wires and other undesirable objects. Ninety-nine experimenters out of every hundred have got to put up the best aerial they can in a certain space available, and have little choice of site and surroundings.

First of all, then, it is only possible to say, put up the best aerial you can in your particular circumstances. For transmitting purposes it is as well to aim at height, and all parts of the aerial should, if possible, be kept well away from the house, 10 feet being a good minimum distance. Similarly, at the far end the aerial should not come too near the mast, if this latter has many stay wires attached to it.

Except for very short wavelength work, the single wire aerial is not to be recommended. A twin aerial with the widest possible separation between the wires (not less than 4 or 5 feet), or a well made cage aerial, will generally give good results. Special precautions, too, must be taken in the matter of insulators. The voltages set up at the extreme end of the aerial are, of course, far higher in transmitting than in receiving, but it is not merely protection from a voltage breakdown that you need. A couple of good-sized shell insulators will stand all the voltage likely to be applied to the ends of

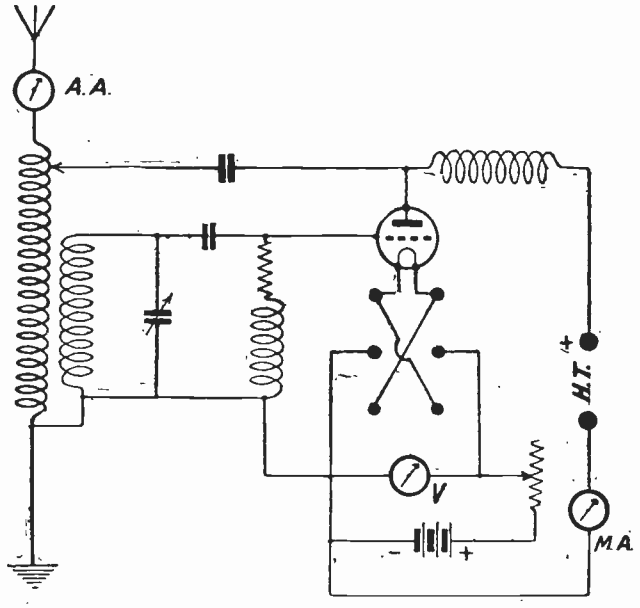


Fig. 3.—A typical transmitting circuit showing the positions of the meters.

an aerial using a 10 watt transmitter, but this is not to say that they are the kind of insulators recommended. These insulators may introduce very undesirable capacity leakages, for there is quite an appreciable capacity between the aerial wire and the supporting wire to which the insulator is attached. Long, thin porcelain rods (two or three in series) and a porcelain mushroom-shaped insulator forms a good combination which will stand voltage strain, and in addition will have a negligible capacity to earth.

Insulators in Series

Personally, at the moment, I am using the Everdry type of insulator behind a porcelain mushroom, and this seems quite satisfactory. As placing condensers in series reduces the capacity, you can, if you desire to use the shell or egg type, place a number of these insulators in series, but if you have many of them the total weight will be greater than need be, and, in addition, a quite unnecessary strain will thus be imposed upon the aerial wire.

Stay Wires

If stay wires are used, these should be broken up by small insulators, although personally I consider that the losses generally attributed to the use of stay wires without insulators are, on wavelengths from 150 to 200 metres, grossly exaggerated. If you can set up an unstayed mast satisfactorily, so much the better. If, as is so often the case, one end of the aerial is secured to a mast on the top of the house, be careful that no part of the aerial runs above the roof and close to it, or you will have a very low overall efficiency, so far as your aerial system is concerned.

Direct Earth or Counterpoise ?

Although a consensus of opinion goes to show that the most efficient transmission is generally effected by the use of an aerial counterpoise, I do not recommend you to start off by erecting such a system. It is often useful to combine a counterpoise with a direct earth, and the majority of transmitting stations could probably be improved, so far as their earth connection is concerned. It is probably best,

first of all, to experiment and make yourself thoroughly conversant with the phenomena attending the use of a direct earth, making your earth connection as good and sound as possible and afterwards progressing from this to a counterpoise.

Earth Resistance

Very little direct measurement has been carried out on earth systems, owing to the difficulty of obtaining accurate comparative data. Personally, I favour a number of buried wires underneath the aerial, the distance below ground being but a few inches. This method of making an earth is probably less affected by weather changes than that in which an old galvanised bath or a sheet of zinc is buried beneath the window, and there is reason to believe that the dielectric losses are less.

Power Supply

It is quite a mistaken idea to imagine that efficient transmission can only take place when the experimenter has access to the electric lighting mains. In many districts, of course, there is no electric lighting supply. We need both high- and low-tension current. For lighting the filament of the valve of a 10 watt C.W. transmitter, an accumulator of the size you are accustomed to use with your receiver will do quite well, for the low power transmitting valve takes an ampere or an ampere and a half, at the most, while excellent transmission can be effected on powers well over 10 watts, using a valve of the L.S.5 type, which consumes less than 1 ampere. The high-tension supply is always the biggest problem.

High Tension

If we are using, for example, as our 10 watt input, a plate-current of 20 milliamps at a pressure of 500 volts, we cannot very well use dry cells, for the cost (both the first cost and the running expense) would be prohibitive. A high-tension accumulator, besides presenting difficulty in charging, costs, in the smallest practical size for this voltage, at least £25, and when of this size is certainly a nuisance to look after. If we have direct current in the house this will give us, at the most, 250 volts and frequently only 100 volts; and if we have alternating current, while we can step up the voltage to any figure we like, we shall need rectifying and smoothing apparatus before it can be efficiently used.

Smoothing

Many experimenters beginning their transmission work are surprised when they find that the cost of rectifying and smoothing apparatus is quite considerable, and the mere possession of A.C. mains does not mean that one can start transmission for the expenditure of but a few shillings. In a later article we shall deal with the question of how best to use the A.C. mains, and meanwhile I will confine myself to the case of the man who wishes to begin some experiments and has no electric mains available.

I can only assume for the moment that he does not wish to

Fig. 4.—A combination of insulators.

instal a generating plant with his own dynamo.

Entirely from Low-Tension Accumulators

Fortunately it is now possible to build and run a thoroughly efficient 10 watt transmitter with low-tension accumulators as the sole source of power. In a subsequent issue I shall give complete constructional details of such a set now being operated at my own station, 2MQ. Before dealing in detail with this set, however, there are one or two other basic points on which I would like to dwell this week, and which are of considerable importance in whatever kind of set you build.

The Wavemeter

The first essential in every transmitting station, if really serious work is to be conducted, is a calibrated transmitting wavemeter. Such a wavemeter is easy to build and not too expensive. You will find the full constructional details for such a wavemeter in *Wireless Weekly* for October 29, 1924, page 48. The cost, if you have none of the parts to start with, will be a little over £5. Much unnecessary use of the ether is caused by experimenters calling up their friends and asking them what is their wavelength, a totally unnecessary procedure if a transmitting wavemeter is in the station itself.

Other Meters

There are three other meters essential in every well-conducted transmitting station. They are not cheap, but you *must* have them if you are to do any accurate work with your set. They are, an aerial ammeter, a plate milliammeter and a filament voltmeter. Good scales for these instruments are 0 to .5 or 1 for the aerial ammeter, 0 to 100 for the plate milliammeter and 0 to 10 for the filament voltmeter. The few pounds you spend on these instruments at the beginning will bring an excellent return, and so far as the filament voltmeter is concerned, you will probably save its cost by the increased life of the valve, obtainable by its use.

Aerial Ammeters

There are two general types of aerial ammeter available. They are the hot wire ammeter and the thermo-couple ammeter, or thermo-ammeter, as it is generally called. Do not make the mistake, whichever type you buy, of ordering an instrument with too big a scale. An instrument reading up to, say, 1½ amperes maximum will have rather a congested scale at the bottom, just where you want to make the most accurate observation. The hot wire ammeter depends for its action upon the expansion of a very thin piece of wire which heats up with the aerial current. By means of a spring and lever the needle is deflected in varying degrees by the varied expansion.

A Fault

The trouble about hot wire ammeters is that they have constantly to be adjusted, for the

zero points are very sluggish in action and susceptible to temperature changes. The thermo-ammeter depends for its action on the minute current set up at the junction of two dissimilar metals. Thermo-ammeters are much quicker in their response, and have certain other virtues.

There are points for and against both types, but this is not the place to enter into arguments about them. I have one of each type and I certainly prefer the thermo-ammeter.

A Voltmeter Point

If you light your valve filament from an accumulator, an ordinary filament voltmeter will serve. If, however, your valve filament is lit from A.C., as is so frequently recommended, the voltmeter will have to be an A.C. instrument. Strangely enough, this point is rarely made in books and articles on transmission, which leads me to think that comparatively few people are using these instruments in their work. They are, of course, obtainable commercially.

Use of A.C. for Filament Lighting

If we consider the filament of a transmitting valve, it will be clear to us that the whole of the plate current has to pass from the filament across the vacuum space. For reasons which will probably be obvious to most readers of this article, the emission is greater at the negative end of the filament than at the positive, there being a gradual increase of emission from the positive end to the negative end. The filament will generally burn out at the end where there is the maximum emission, and as with alternating current the filament is alternately positive and negative at each end, the wear is equalised. For this reason the lighting of valves by alternating current is generally recommended.

Personally, I have devised a little scheme by which the life of the valve, when lit from D.C., is increased, but I do not know that it has ever been put forward before. It merely consists in inserting a reversing switch between the accumulator and the filament, as shown in Fig. 3. If we wire up a set in this way and make a point each evening when we begin transmitting, of reversing the filament, it will be alternately positive and negative at each end and the wear will be correspondingly equalised. In this way the life of the valve is much increased.

Variable Condensers in Transmission

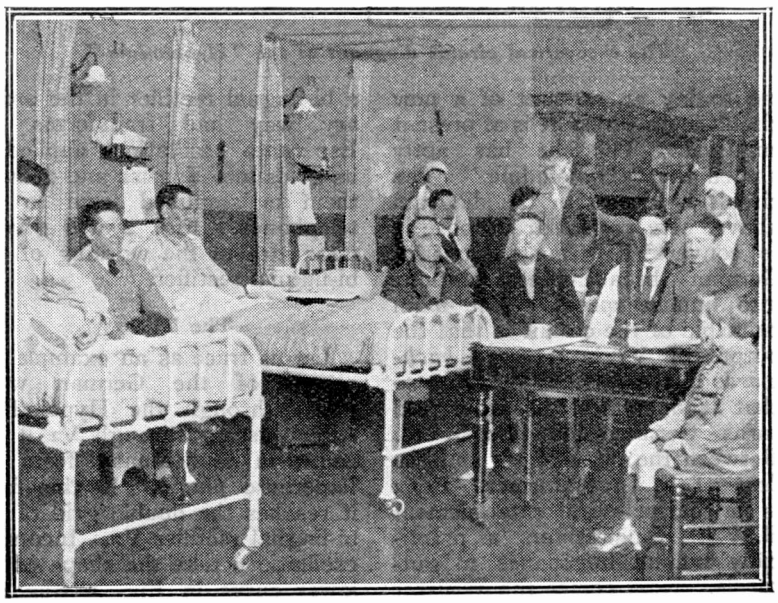
Owing to the high potentials induced in a transmitting set, the ordinary receiving variable condensers are rarely suitable, and I notice that one or two firms here (and several in the United States) are marketing special variable condensers for transmission purposes. They are, of course, rather expensive, as might be imagined. A scheme I am using and which I have not published elsewhere, is to use ordinary receiving condensers in series with high-grade fixed condensers of a value of .002 μF or more. In this way if we place in series with a .0005 variable condenser of the ordinary receiving type a .002 fixed condenser (such as the Dubilier type 577, which will stand 1,000 volts without breakdown and has very low, almost negligible losses) the total capacity will be at a maximum round about .0004 μF, and the minimum will be slightly less than otherwise would be the case. Condensers, say, of the Mansbridge type are hopeless for such a purpose, as not only are they liable to breakdown and consequent damage to the apparatus, but their losses are high when used in high-frequency circuits. This is no reflection on these condensers, as they are not designed for use in this way.

Gridleaks

In practically all transmitting circuits we need a gridleak. The ordinary type of receiving gridleak is quite useless in even a 10-watt transmitter, as, not only is its resistance too high, but it will not carry the current necessary. Good wire wound gridleaks are not cheap, but on the other hand they are less expensive than many experimenters imagine and can be obtained to carry current of 50 milliamperes or over without heating. This current is far higher than they would ever be called upon to carry in a 10-watt transmitter.

Temporary variable gridleaks, which are quite useful, are often devised by experimenters from jars containing liquid. A good value for a transmitting gridleak, if you are purchasing one, is 15,000 or 20,000 ohms tapped at a few points.

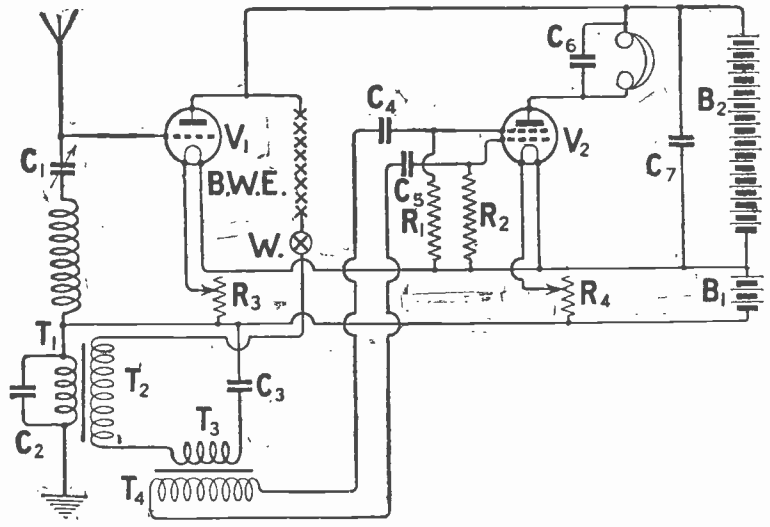
(To be continued.)



Patients in a ward at St. Bartholomew's Hospital listening to a programme from 2LO. A description of the set which was presented to "Barts" was given in "Wireless Weekly," Vol. 2, No. 9.

A Coincidence

A CORRESPONDENT whose achievements as an experimenter have secured him immediate election as honorary vice-president of the Little Puddleton Wireless Club sends round until they are giddy and then delivers them upside down to T2. By means of the second transformer T3T4, the detonated output, which, it should be remembered, is now in Esperanto, is led to V2, which functions as



The theoretical circuit diagram of the "Hypoiodine."

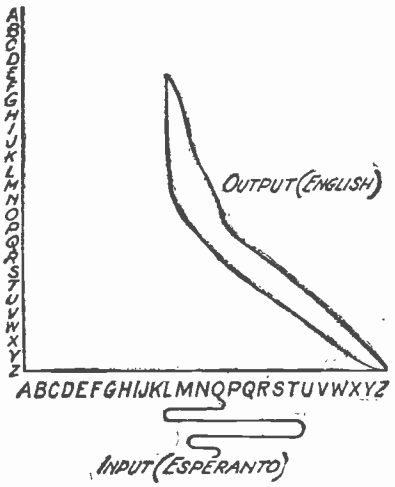
me to-day an account of a new circuit upon which he is at present engaged. This he has aptly named the "Hypoiodine." The circuit is shown in the diagram above. Its particular purpose is to convert the transmissions of German broadcasting stations into human speech. The main principle of the circuit is that the output of V1 is returned *backwards* to the valve by reflexing so that it detonates the input and turns German into Esperanto. Between the plate of V1 and the first L.F. transformer T1T2 is a barbed-wire entanglement B.W.E., which offers a practically infinite impedance to gutturals. Next comes the Whizzer W., constructed after the manner of the railway turntable and the joy-wheel, which whirls electrons a bi-lingual rectifier in the ordinary way and transforms the Esperanto oscillations applied to its grids into English and delivers them in amplified form to the telephones. Fig. 2 will give a clear idea of the working of the bi-lingual rectifier.

The Theory

Let us trace as an example the course of the German word *Feder* through the Hypoiodine. After passing through V1 it becomes in its detonated form the Esperanto *plumo*. In this form it reaches the double grid of the bi-lingual rectifier V2. Incoming oscillations take the shape of the lower curve in Fig. 2 (the one which looks like an eel doing physical jerks to make the spine supple). It will be seen that the first half cycle of the incoming oscillation has a value O. This raises the flow of anode current to a value which is also O. The succeeding half cycle, whose value is L, further raises the anode current until it reaches E. The M crest of the next half cycle lowers it to N, and as the O of the final half cycle is not required the plate current drops immediately to a zero value. It is essential that a very bright four-electrode valve should be used for V2. Valves provided with coated filaments are so *dull* that they never seem to get the hang of things properly, and they frequently give rise to a horrible form of distortion by rectifying into Cockney or Scotch.

Foreign Made Valves

On no account should foreign-made valves be employed for the purpose. One that I purchased cheaply, but a short time ago, turned everything into double



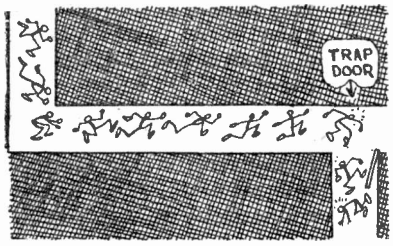
The characteristic curves of the bi-lingual rectifier.

Dutch. It should be noted that the Hypoiodine circuit if properly adjusted may also be used for rectifying the broadcasts of Mr.

John Henry, whilst a special deodorising attachment may be added to remove the staleness of the jests made by members of concert parties.

Great Minds

It has often been said that great minds think alike, and here we have a curious instance of the truth of this dictum. At the very moment when the postman delivered my correspondent's letter Professor Goop and I were engaged in experimenting on a circuit upon almost identical lines. I was all for calling it the "Planetodyne," planetes being Greek for a wayfarer; but the Professor pointed out that this would never do since all self-respecting wireless terms are pure bred, hybrids borrowing their component parts from at least two of the dead languages. We therefore decided to name it the



The principle of the Goop-Wayfarer Electron-Reverser.

Reversodyne, a name which satisfies the requirements of even the most exacting terminological purist. Our circuit differs in two important ways from the Hypoiodine. In the first place, instead of the cumbrous barbed-wire entanglement, which is very apt to mar reception by its scratchiness, we employ a medico-frequency choke which has the effect of throttling the undesired gutturals.

The Electron Reverser

Then again, we do not like the whizzer principle, for if electrons become giddy the stability of the set is liable to be affected. The device which we use is the Goop Wayfarer Electron-reverser, the principle of which is shown above. Electrons are led in the ordinary way through nice comfortable wires until thinking that all is clear they acquire high speed. At this point there is a sharp corner in the wire round which they rush with the utmost gaiety, only to find themselves confronted with an impassable barrier. Their attention is so riveted on this and to their efforts to apply the brake that they do not notice the trapdoor, through which they fall. They are thus reversed and delivered

. . . Convert German into human speech . . .

backwards and unharmed, save perhaps that they are a little out of breath, to T2. Their descent through the Goop-Wayfarer trapdoor and their subsequent fall curtails their high spirits, and so damps their ardour that the set is perfectly stable.

The Valve Question

The valve question in either the Reversodyne or the Hypoiodine is an exceedingly important one, and if it does not receive due attention a very distressing form of distortion will result. Ordinary valves as received from makers arrive in an exhausted state which renders them very liable to make serious grammatical mistakes whether they are employed as reflexing detonators or as bi-lingual rectifiers. The anode, too, suffers severely during the process of bombardment.

Special Manufacturing Processes

As previously mentioned, the Professor and I have shown that no valve can function properly in the state of exhaustion produced by a hard vacuum. Could you translate German on an empty

. . . Rectifying into Scotch . . .

stomach? Our special valves do not contain an aching void; on the contrary they are filled with a mixture consisting of equal parts of oxygen and vitamins which enables them to stand up well to their work. A little powdered ginger may be added from time to time should the valve show signs of fatigue. Nor again are the anodes subjected to the brutal process of bombardment. Instead of this they are talked through (did I mention that they were hat-shaped?) for long periods by ex-announcers of the B.B.C. specially retained by manufacturers on account of the purity of their diction and of the grammatical perfection of their speech. So high is the standard set that any "plate talker," as they are called, who is detected splitting an infinitive or saying "between you and I" more than twice in one day is immediately dismissed with ignominy.

The Results Obtained

I am, as you know, the most modest of men, and I never like to claim too much for the wonderful circuits that Professor Goop and I are continually giving to the world. I think, however, that I can claim that the Reversodyne is

. . . Could you translate German on an empty stomach? . . .

about to revolutionise the reception of Continental broadcasting. So far we have been able to receive detonated and rectified transmissions from every Continental station with the exception of those situated in Czecho-Slovakia and Jugo-Slavia. We have not been able to discover a bi-lingual rectifier stout enough to deal with the combinations of consonants of which the languages of those parts are mainly composed. However, we are not yet defeated, and a special valve with cast-iron grid and six-inch armour plated anode is being made up for us by a well-known firm. With this we trust to be able to cope with any European tongue.

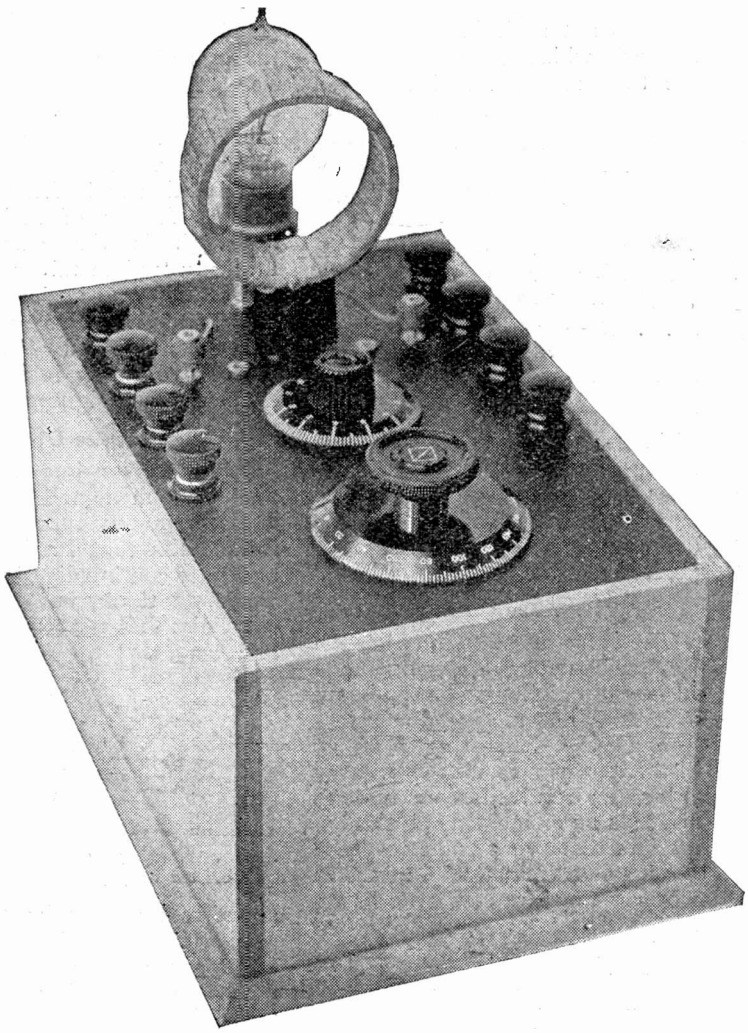
WIRELESS WAYFARER.

The R.S.G.B.

An Informal Meeting will be held at the Institution of Electrical Engineers, Savoy Place, S.W.1. at 6 p.m. on Wednesday, January 14, when Mr. Stanley Ward will give a talk on "Short Wave Reception."

A Useful Measuring Unit

By G. P. KENDALL, B.Sc., Staff Editor.



A graduated dial upon the filament rheostat is a desirable refinement.

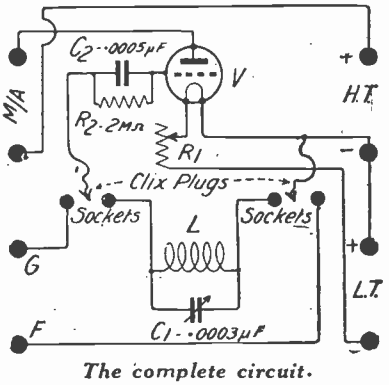
THOSE of my readers who may be new to experimental work involving the accurate observation or measurement of results are not likely to have realised that one of the most important aids to accuracy and speed in carrying out such work is the provision of such apparatus and appliances as will render the whole experiment as *easy* as possible to perform. As a matter of fact, the man who experiments in a careless and untidy fashion is always under a severe handicap as compared with the man who spends a good deal of time upon preliminary work, laying out a convenient set of apparatus, arranging his measuring instruments so that they shall be easily read, and so forth, because when the latter class of worker actually commences upon his experiments they are easily carried out and he can devote the whole of his energies to making accurate adjustments and noting their results. The other man, on the contrary, must devote a great deal of his energy to tracing stray wires which have come adrift, wondering why he does not get the same readings under the same conditions as he did last night, and so on. It may seem a very obvious point, and yet it is one which is very commonly overlooked by the amateur in scientific work, and in commencing the practical part of these articles upon a very simple type of measurement I should like to lay due stress upon the vital need for a convenient arrangement for carrying them out, so that the whole attention of the experimenter will be free for making the necessary adjustments and taking the readings of the milliammeter.

General Arrangements

The instrument whose construction is to be considered is very simple in its general arrangement, since it consists merely of a convenient detector panel, carrying the valve socket, filament rheostat, grid leak and condenser, with the necessary terminals for the batteries, the milliammeter, and the external connections to the circuit across which measurements are to be made.

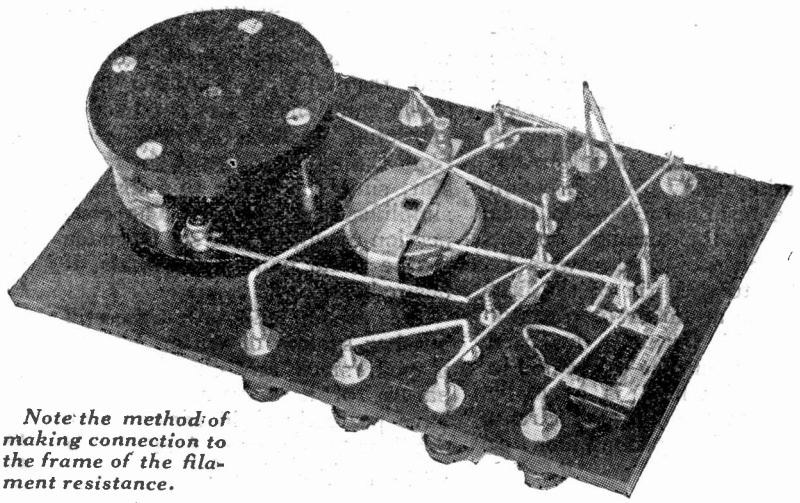
Use as a Wavemeter

This is all that is required for these Moullin circuit measurements, but I have also included in the unit which I use a closed oscillatory circuit consisting of a plug-in coil and variable condenser, in order that the valve may be connected across this circuit, whereupon the whole arrangement forms an extremely convenient and simple wavemeter for measuring the wavelength of a transmitter. The



The complete circuit.

This instrument is primarily intended to serve as a transmitting wavemeter and for the form of Moullin voltmeter measurements referred to by the author in his article last week, but it has a variety of other useful applications. The constructional details of the unit are given in this article, with the necessary practical instructions to enable readers to carry out the Moullin measurements.



Note the method of making connection to the frame of the filament resistance.

instrument is simply placed at a convenient distance from the transmitter, a suitable coil is plugged into the socket, and the variable condenser is rotated until the milliammeter needle is observed to dip suddenly, indicating that the local circuit has come into resonance with the transmitter and is picking up high-frequency currents. The variable condenser being adjusted to the point which gives the maximum deflection of the milliammeter below the steady anode current reading, we know that the circuit is in exact resonance with the transmitter, and can take a reading of the wavelength, provided that the instrument has been calibrated.

Another Application

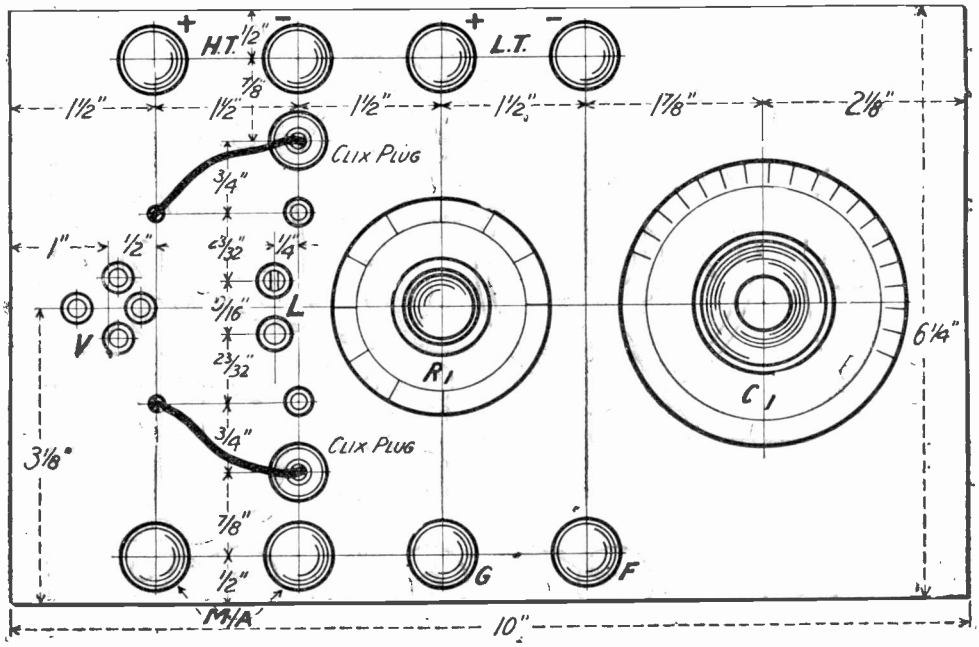
This application of the unit, of course, will only interest the holder of a transmitting licence, but the included tuned circuit has other uses besides which render it worthy of incorporation by those who have no interest in transmitting. For example, it will form an interesting experiment to determine the strength of radiation in various directions from a frame aerial to which an oscillating valve receiver is connected, by placing the unit at a convenient distance from the frame, revolving the latter, and noting the resulting signal strength readings upon the wavemeter circuit in various settings of the frame.

The Purpose of the Clix

Leads from the grid and from the filament circuit are brought out through two flexible connections, terminating in Clix plugs, and four Clix sockets are provided upon the panel so that the valve can be connected across either the closed circuit in the unit itself, or to the pair of terminals which can be connected by external leads to any circuit upon which measurements are to be made.

The Circuit

The circuit is illustrated in one of the diagrams which accompany this article, and should be consulted to provide an understanding of the terminal arrangement. This diagram will show how the plugs and sockets provide the



The lay-out of the original instrument is a convenient one, but it need not be followed in detail, and any available panel of approximate size will serve.

necessary alteration of connections, and it should be noted that the two terminals marked respectively "G" and "F" are those from which leads are to be taken to any external circuit upon which measurements are desired, such, for example, as the aerial circuit of a tuning unit. A connection from the terminal G would then be taken to the terminal on the tuner which would otherwise be connected to the grid of the first valve of the amplifier or detector which would normally be used with it. F would be connected to the terminal which is normally connected to the filament circuit of the receiving amplifier or detector.

Construction

Little need be said as to the actual construction of the instrument, since it is an exceedingly simple affair, and those who undertake its construction will no doubt be possessed of considerable experience. A dimensioned lay-out diagram is given of the panel, from which the drilling can be done, and the photographs and wiring diagram provide the remainder of the necessary information. One point may not perhaps be quite clear on the wiring diagram, and that is the arrangement of the lead from the filament rheostat to the socket of the valve. The rheostat which was used is of the Igranic pattern and the wire in question was taken from the somewhat unconventional position shown, viz., from the metal frame of the rheostat, simply because this slightly simplified the wiring. The connection could, of course, be made to the usual pair of terminals, if desired.

It is recommended that the stiff bus-bar system of wiring be employed, since any circuit of the nature of a wavemeter should have perfectly rigid wiring, and, needless to say, every joint should be properly soldered.

Necessary Materials and Parts

To duplicate exactly the original instrument the following materials and components will be needed:—

One ebonite panel, 10 x 6¼ in.

One cabinet to take above panel.

Eight terminals (Sterling ebonite topped type).

Two Clix plugs.

Four Clix sockets.

One grid condenser of .0005 μF (Dubilier).

One gridleak of 2 megohms (Dubilier).

Four valve leg sockets.

One filament rheostat (Igranic).

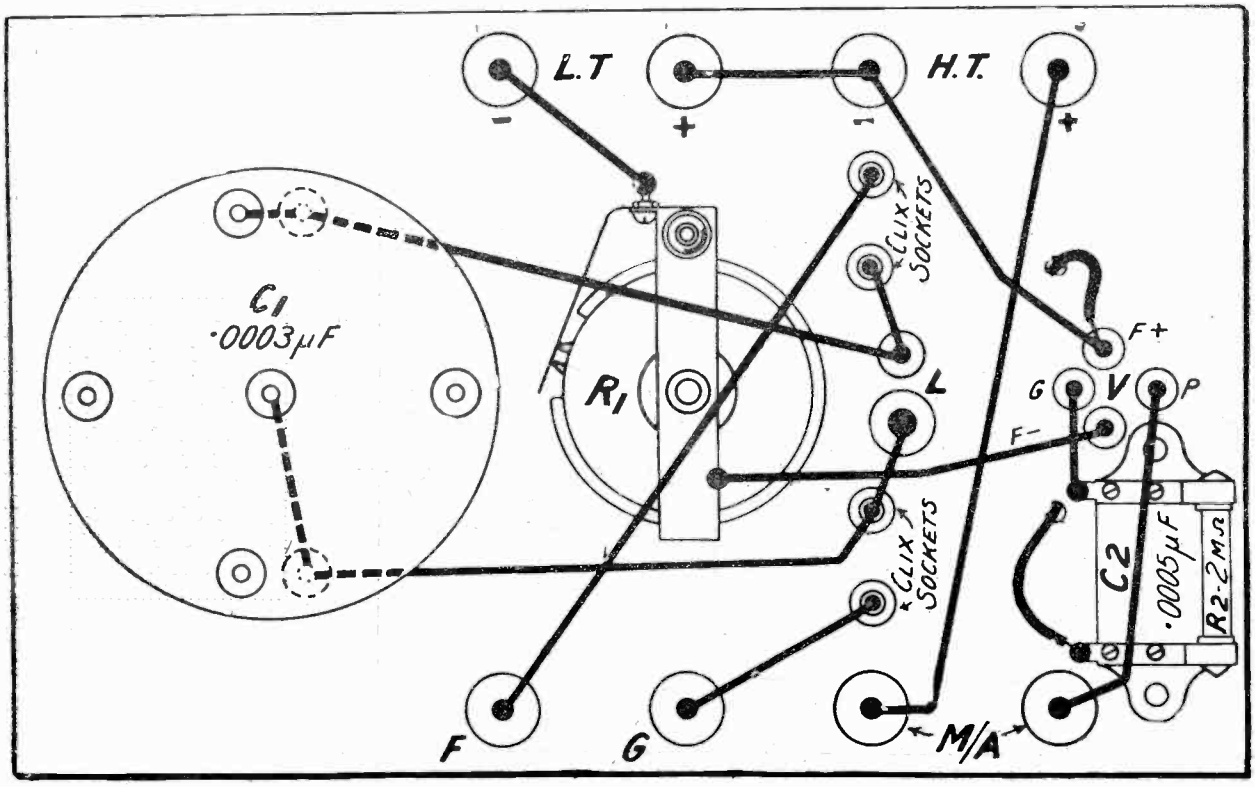
One variable condenser of .0003 μF, square-law type (Peto Scott).

The Variable Condenser

I have found that quite a considerable amount of difficulty may result in these measurements if the variable condenser is not provided with a particularly steady and reliable connection to the moving vanes, since the slightest irregularity here leads to a flickering effect on the milliammeter needle, which makes readings extremely difficult to take. In the condenser which I finally adopted, this connection is made by means of a metal spiral, so that the trouble is entirely removed.

To Use the Unit

When the instrument has been completed it may be tested as follows:—Connect high- and low-tension supply to the correct terminals, the voltage of each depending upon the valve which it is intended to use. Connect a pair of 'phones to the milliammeter terminals, and take leads from the G and F terminals to any convenient tuned circuit which can be adjusted to the wavelength of the local station.



The wiring of the unit. L indicates the coil socket.

For example, aerial and earth can be connected to an ordinary receiving set of any type which may be available, the variable condenser in the receiver connected in the parallel position, and leads from the two terminals on the measuring instrument can then be taken to the aerial and earth terminals of the set.

Preliminary Test

If all the valves of the receiving set are turned out, or alternatively the catwhisker of any crystal detector lifted from the crystal, upon tuning the circuit to the wavelength of the local station, signals will be heard in the 'phones. The 'phones are now replaced by the milliammeter, and it will be found that a reading can be obtained when the receiving circuit is adjusted to resonance. One can then proceed to plug-in different coils in the coil socket of the receiving set, and note the deflection obtained below the normal anode current when the circuit is tuned to the wavelength of the transmitting station, thus obtaining a means of comparing the efficiency of various coils, the " best " coil, of course, giving the greatest change in the anode current of the valve. Again, it provides a simple test for the efficiency of the tuned circuit of a receiving set, since if the same coil is used in two different sets and it is found that one gives very much poorer signals than the other, it is fairly obvious that there is some source of loss in one of the sets.

Type of Tuner Used

This is a somewhat unsatisfactory method of carrying out the measurements, however, and it is desirable to use some tuning panel upon which coils can be tested either in series or parallel with the aerial condenser, or as a secondary circuit coil loosely coupled to the aerial circuit, and so on. In all my own experiments I have used the " Experimenter's Tuner " which I described recently in Modern Wireless, and this seems ideal for the purpose. Of course, quite a simple panel could be used carrying merely a coil socket, variable condenser, and the necessary terminals for the connection of aerial and earth and the measuring instrument. The three-terminal system should be adopted for the aerial and earth connections, so that the aerial condenser can be connected in series or in parallel. Such a unit can be very quickly made, and will save one a great deal of trouble in carrying out comparative measurements upon various types of coils, and so on.

Experimental Precautions

The actual carrying out of the measurements is not quite so simple as I have perhaps implied in the foregoing description, since there are a great number of precautions which must be carefully taken to ensure anything like comparative results. In the first place, one must adopt some standard value for the anode current which represents the condition of " no signals," and a convenient figure, such as 2 milliamperes, should be decided upon.

Good Batteries Essential

This can then be maintained for the experiments by the use of a good high-tension battery (which should be fairly new) and the careful adjustment of the filament rheostat at the commencement of each set of experiments, to give the desired value of plate current. It will quite likely be found that slight variations take place in this figure in the course of any experiment covering more than half-an-hour or so, and it should therefore be made a rule to swing the tuning condenser away from the carrier wave of the station which is being used for testing, and to carefully test the " no signals " reading at quite frequent intervals. Any slight variation which is discovered must, of course, be corrected by the filament rheostat.

Valve Employed

It is further desirable that one particular valve should always be used for these measurements, and I have found the D.5.B. type very convenient. With the value of grid condenser and leak specified this valve gives a reading of .2 milliamperes, with approximately one hundred volts on the plate and a fairly suitable adjustment of filament. Of course, any valve available will serve the purpose, provided it is a fairly good detector, so that the readings shall be reasonably large.

It will quite soon be discovered that it is comparatively difficult to repeat any given set of figures upon successive evenings, and persistent experimenting has convinced me that this is due to an actual variation in the received signal strength, even at so short a distance as eight miles from a main station. The causes of such variation are probably various, and in my own case I am inclined to put them down to the varying use of reaction by a neighbour who is at present somewhat embittering my existence. Such possible variations must be borne in mind, and one should never carry out a series of experiments extending over several evenings without the use of some sort of standard for comparison. On the contrary, each complete experiment should be carried out as rapidly as possible, so that there shall be little chance of any variation of this sort. To guard against misleading results being obtained, consequent upon a variation of signal strength, a standard of comparison should always be used, and the signal strength with this standard should be frequently measured during the progress of the main experiment.

Use of a Standard

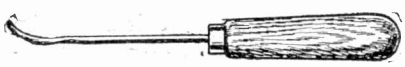
For example, when comparing a series of commercial coils, I always insert a standard coil in the socket between each measurement, and note whether the reading of this coil is remaining constant. Any variation which is noted is regarded, of course, as cancelling the whole experiment, so that it must be started again. Actually, however, I have found it quite easy to maintain constancy over a period of something like one hour with reasonably good high- and low-tension batteries, provided always that the aforesaid neighbour does not upset the whole scheme of things in the only too familiar manner. In my own case, a very strange error was finally located in the milliammeter itself, the form which the trouble took being that of a sudden and quite inexplicable drop of the anode current at certain settings of the tuning condenser when loose coupled circuits were being used. This drop was exactly that which would have been in place if the valve had broken into oscillation,

in consequence of the use of a reaction coil. It was finally discovered that the valve was actually oscillating, owing to the fact that the windings of the milliammeter had a natural wavelength somewhere about 300 metres, so that the readings which had previously been taken were utterly valueless. The trouble was easily removed by the shunting of a large condenser (the actual size used was 2 μF, but anything of this order will serve) across the milliammeter itself. This should always be done, whether the milliammeter is used in such measurements as this, or merely for taking the plate current of any receiver employing one or more high-frequency valves. Since shunting such a condenser across the milliammeter seems an extremely desirable arrangement, however the latter may be used, I did not incorporate it in the measuring panel itself. It seems that it should be used externally and connected directly across the milliammeter.

It is, of course, understood that in all measurements which are intended to show the efficiency of a coil, signal strength produced by a given primary and secondary coupling, and so on, no reaction shall be used, but I should like to add a further word of warning as to the importance of endeavouring to eliminate any other possible source of error. For example, when measuring the signal strength across the secondary of a loose coupled tuner, never be satisfied that you have discovered the maximum signal strength obtainable with the given arrangement until you have tried every possible variation of coupling between primary and secondary, very carefully retuning both primary and secondary circuit upon every re-adjustment of coupling. It will be seen that such measurements are therefore extremely laborious, but in no other way can really comparative results be obtained. Further, whenever you obtain results, carefully criticise all your arrangements, and ask yourself whether it is not possible that some unsuspected factor is present which may be leading to a false result. The force of this remark will become more apparent when we consider some of the measurements which I have recently carried out, notably a series upon the effect of even small quantities of moisture.

Fixing Panel Transfers

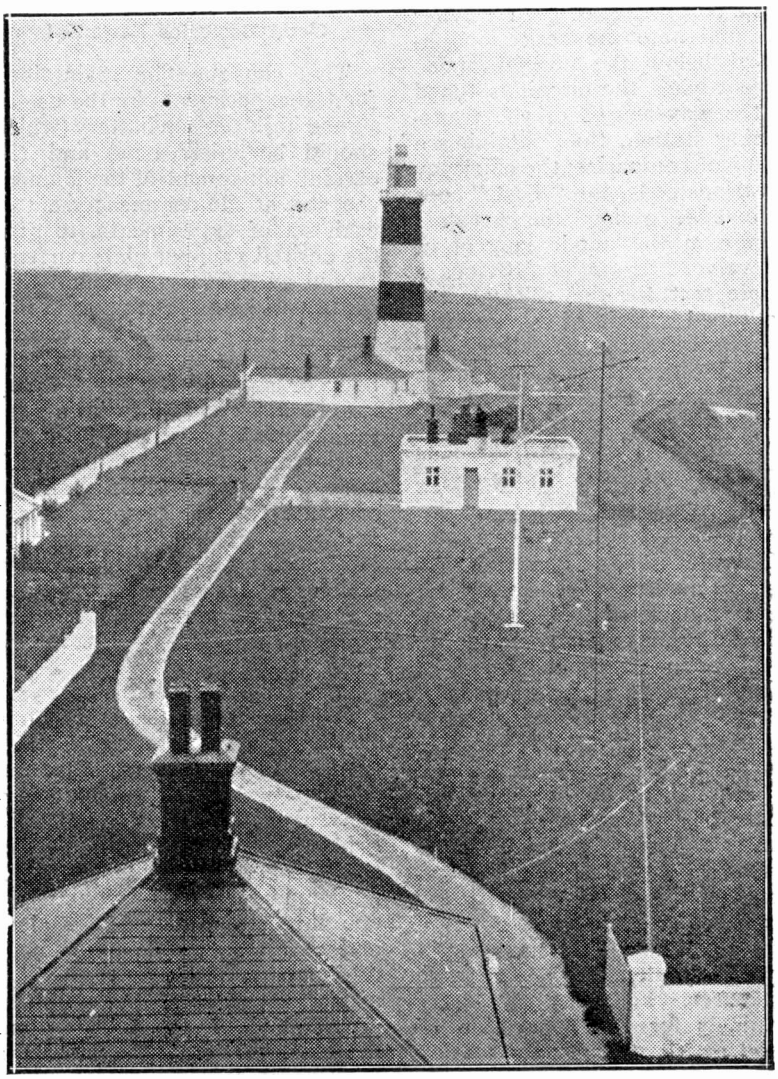
The writer, having occasion to use a large number of Radio Press panel transfers, looked round for a better method of fixing them than the orthodox way. The best method so far arrived at is the use of a small iron, or, rather, bit. Secure about 4 in. of fairly thick brass or copper strip 3-16 in. wide. One end is hammered over to form a kind of shoe ("dished," as it is usually called), and the other secured in a suitable handle.



The small tool used for fixing panel transfers.

The transfer is held down on the panel in the usual manner, and the bit inserted in a gas flame for a second or two, and then applied to the transfer, when one or two light touches will be found to be sufficient to secure the transfer to the panel. This little bit is very useful for fixing transfers against studs where usually there is only a very small space available, and in those positions where it is impossible to put a bulky piece of rag. The accompanying sketch shows the bit ready for use.

W. H. F.



The aerial arrangements at the Nash Point station, which are used in connection with the wireless beacon.

The Resistocap Unit

By R. W. HALLOWS, M.A.

THE resistance - capacity method is becoming very popular nowadays as a means of coupling low-frequency valves. The main reason for this is that with this type of coupling there is practically no over-emphasis of certain tones, so that distortionless amplification over a very wide range can be obtained.

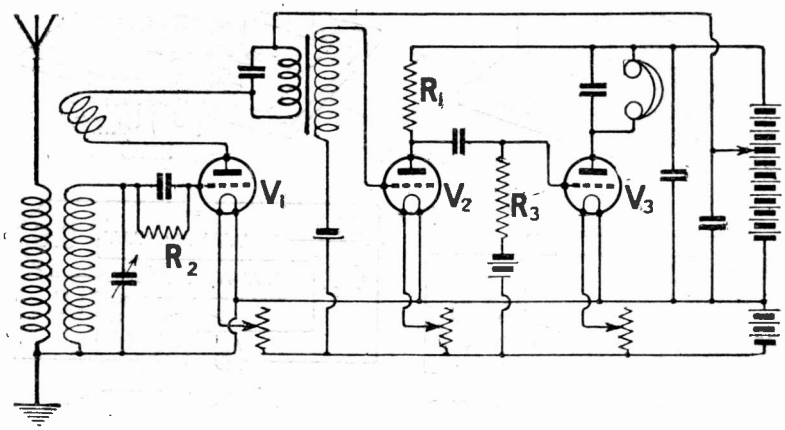


Fig. 1.—One transformer coupled, and one resistance coupled note magnifier form a good combination.

It struck me some time ago that it would be a good idea to make up some small resistance-capacity units which could be used in any set to replace existing transformers, if desired, and when I came to construct them I

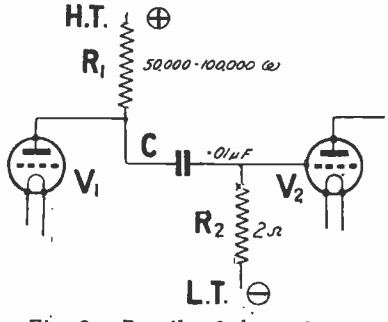


Fig. 2.—Details of the resistance coupling connections.

found that they were extremely useful in every way. One can use them, if desired, to replace permanently an existing transformer, or the set may be so arranged that by means of Clix terminals either the transformer or the Resistocap, as I have called this unit, may be brought into action. Where only one stage of note magnification is used it is probably preferable to employ transformer coupling. With two stages I have a strong liking for the combination shown in Fig. 1, which gives extremely good results. Amplification is obtained by means of the transformer between the first and second valves shown and the resistance-capacity coupling between the second and third valves gives a further amount of amplification without noisiness or distortion. Notice that in the circuit it is essential to provide two high-tension positive terminals, since a much higher voltage is required on the note magnifiers than on the rectifier. Between the plate of V2 and H.T.+ is the resistance R1, across which there is a drop in voltage. To compensate for this we require to use a higher value of H.T. for this valve.

Resistance Coupling

Fig. 2 shows diagrammatically the details of the resistance coupling. The actual coupling between the plate of V1 in the drawing and V2 is provided by a coupling condenser (C). Condensers up to .25 μF have been used in this position, but excellent results are to be obtained with a capacity of .01 μF. Now a condenser of this size can be obtained quite cheaply in the clip-in type with a mica dielectric. Since the grid of V2 is insulated by the coupling condenser C, a leak, R2, must be provided. A suitable value for this is 2 megohms, and it is essential that the leak used should be of the best quality, for otherwise its resistance may not be constant and it may be noisy. The value of the resistance R1 in Fig. 2 may be 50,000-100,000 ohms.

Wiring up the Unit

A wiring diagram of the Resistocap Unit is shown in Fig. 3. It will be seen that its four terminals correspond to those of a low-frequency transformer, so that connections can be made without difficulty. If the circuits are traced out it will be seen that the plate is connected *via* the terminal marked A, both to the coupling condenser (C) and to the anode resistance R1, the other end of which is taken to the H.T.+ terminal. The other side of the coupling condenser is connected to the grid terminal from which a connection is taken to one end of the gridleak R2, the other end being connected to the L.T.– terminal.

To make a Resistocap Unit a

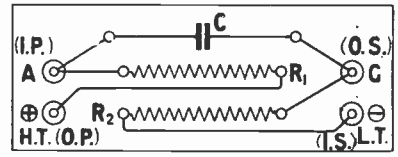


Fig. 3.—The wiring of the Resistocap Unit.

piece of ¼-in. ebonite 5 in. by 2¼ in. is required. This is marked out and drilled, as shown in Fig. 4. At the top is the clip-in condenser, whose clips are fixed by 4 B.A. screws placed in holes 3 in. from centre to centre. Anode resistances vary somewhat in length, so that the distance between the centres of the second

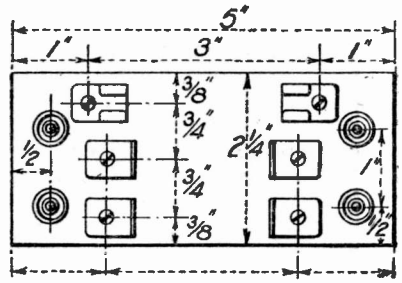


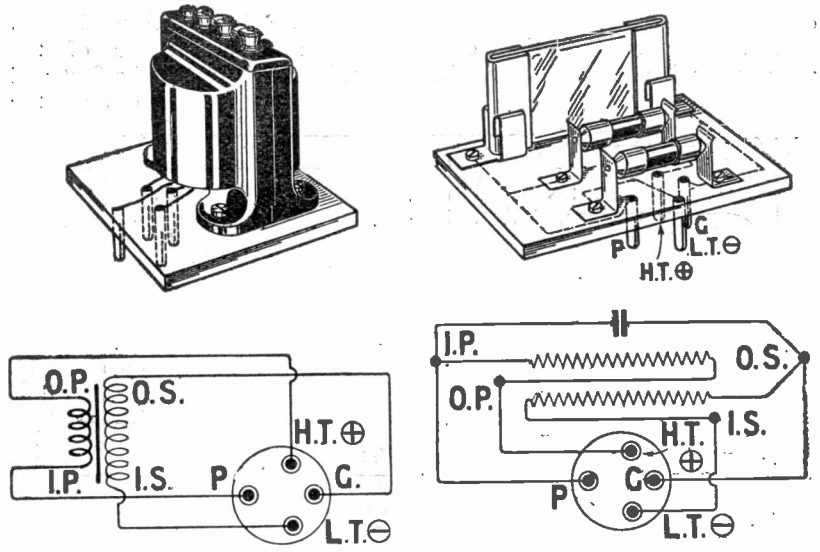
Fig. 4.—Drilling dimensions.

pair of holes may have to be altered. The space given there,

namely, 2½ in., is about the average. The same remark applies to the gridleak. The four terminals are placed in two pairs, ½ in. from each of the short edges and 1 in. apart. All the holes shown are 4 B.A. clearance. One of these units can be made up in half an hour in the workshop, and the time spent will be amply repaid, since the couplings turned out are so compact and can be wired up in the set in a couple of minutes.

Interchangeable Units

If it is desired to make resistance capacity and transformer couplings very rapidly interchangeable, the idea shown in Fig. 5 may be used. The transformer is mounted upon a small block of ebonite provided with four valves legs spaced in the ordinary way to which leads are taken from its terminals. It simplifies matters if the plate connection of the transformer is made to the plate leg and the grid connection to the grid leg. One of the filament legs becomes H.T.+ and the other L.T.−. The Resistocap Unit may have a similar mounting and is connected up on the same lines, as shown in Fig. 6. To interchange one circuit for the other all that one has to do is to pull out the transformer and to plug in the Resistocap.



Figs. 5 and 6.—Illustrating how the interchangeable units are mounted and connected.

2OD

Our photograph shows Mr. E. J. Simmonds, of Gerrard's Cross, whose success in long distance transmission and reception is well known.

Valve Notes

By

JOHN SCOTT-TAGGART,

F.Inst.P., A.M.I.E.E.

Selectivity

AS a result of recent experiment with a view to obtaining greater selectivity, I have developed a new method of coupling valves for high-frequency amplification.

Excluding the T.A.T. system the usual arrangements consist of tuned anode circuits, choke coils, resistances and transformers having one or other, or both, windings tuned.

Anode Trap Coupling

The new method I have called "anode trap coupling," because the circuit involved is somewhat similar to that in wavetraps.

While giving equally good signal strength, the arrangement about to be described is extremely selective, and is yet perfectly simple to work, only one control (a variable condenser) being necessary.

The Arrangement

Fig. 1 shows the arrangement of the anode trap in use. It will be seen that instead of using a tuned anode circuit, the anode of the first valve contains an inductance coil L2, consisting of a few turns, to which is coupled the inductance L3, usually containing many more turns. The inductance L3 is shunted by the variable condenser C2, which tunes the circuit L3 C2 to the incoming wavelength.

Coil Values

For ordinary broadcast wavelength purposes (300 to 500 metres), the coil L2 may be a plug-in coil of from 8 to 25 turns, while the coil L3 will usually be a No. 50 plug-in coil, while C2 may be a .0003 μF or .0005 μF variable condenser. If plug-in coils are used, L2 and L3 may be placed absolutely side by side. An alternative arrangement is to use a high-frequency transformer and to tune the secondary of it. This will not usually give as selective results, because the primary has usually about the same number of turns as the secondary, whereas the fewer the turns the greater the selectivity in the anode trap arrangement.

It is, of course, often also possible to use low-loss coils wound with thick wire and having about 10 turns wound round the middle of the larger coil.

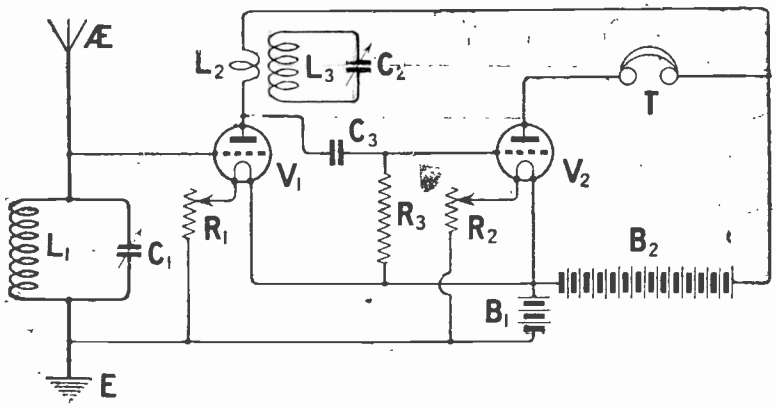


Fig. 1.—Illustrating the arrangement of the anode trap.

Operation

The anode trap coupling method shown in Fig. 1 is operated in just the same way as a tuned anode circuit in that the circuit L3 C2 is the controlling factor, and all adjustments may be made by altering L3 or C2, or both.

The effect of this arrangement produces the same result as if the coil L2 were tuned, the circuit L3 C2, of course, is not connected to anything else.

Without the circuit L3 C2, the coil L2 acts simply as a plain inductance, and since it contains only a few turns, the high-frequency potentials communicated to the grid of the second valve are negligible, the coil acts little differently from a plain wire. If the coil, of course, were much larger, it might act as a choke coil, and so serve as a means of coupling the valves together.

If the circuit L3 C2 is not tuned exactly to the same wavelength as the incoming signal, the impedance of L2 remains normal, and no signals will be heard. If,

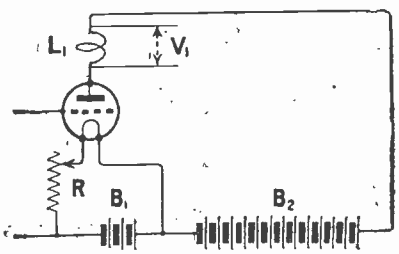


Fig. 2.—When H.F. potentials are applied to the grid the E.M.F.'s across L1 will be small.

however, the circuit L3 C2 is exactly in tune, the signals will be as loud as if a tuned anode circuit were employed, but the selectivity will be extraordinarily marked, even when no reaction is used in the circuit at all.

Fig. 2 shows the simple coil L1 in the anode circuit of the valve. If high-frequency potentials are

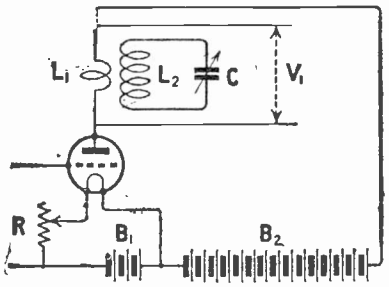


Fig. 3.—The impedance of L1 will rise when L2 C is tuned to the aerial circuit.

applied to the grid circuit, the E.M.F.'s V1 established across L1, which consists of only a few turns, will be negligible. If, on the other hand, we can couple sufficiently tightly to L1 a tuned circuit L2 C, as shown in Fig. 3, the impedance of L1 will rise to a very high value when L2 C is tuned to the same frequency as the currents applied to the grid of the valve. In this case the E.M.F.'s V1 established across L1 will be large.

A Two-Valve Reaction Circuit

A simple two-valve circuit using reaction is illustrated in Fig. 4, the reaction coil L4 being coupled to the aerial inductance L1. The trap method of anode coupling is shown.

This trap coupling method must not be confused with the high-frequency transformer in which only a few turns appear in the primary, nor must it be confused with such circuits as the Cockaday.

The actual oscillations in L3 C2 are not applied to any subsequent arrangement, the circuit L3 C2 being free, although having such an important inductive effect on the anode circuit of the valve.

Sharp Tuning

Without reaction the selectivity is very high, but with reaction it is still higher, and in many cases to get the best results it will be necessary to have a vernier condenser fitted to C2 in Fig. 4.

The same combination of a small inductance coil and an oscillatory circuit may be used for tuning the aerial circuit, the "aperiodic" coil being in the aerial circuit and coupled to it is the tuned circuit. Leads from the aperiodic coil go to the grid and filament of the valve or other apparatus.

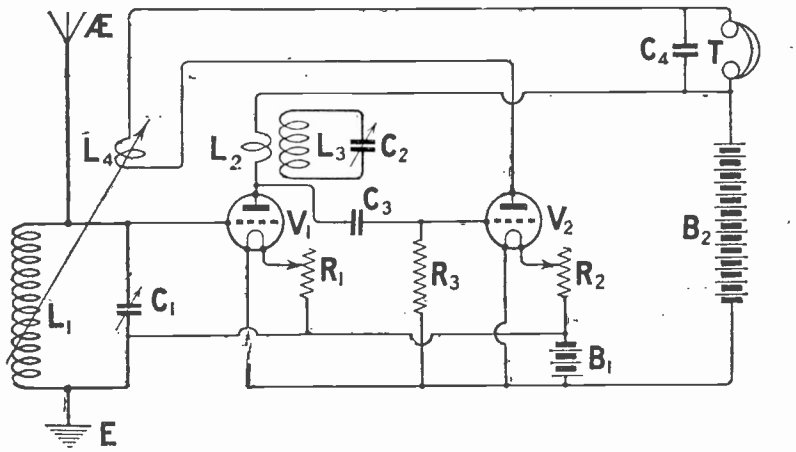


Fig. 4.—An even more selective circuit is obtained by the use of reaction.

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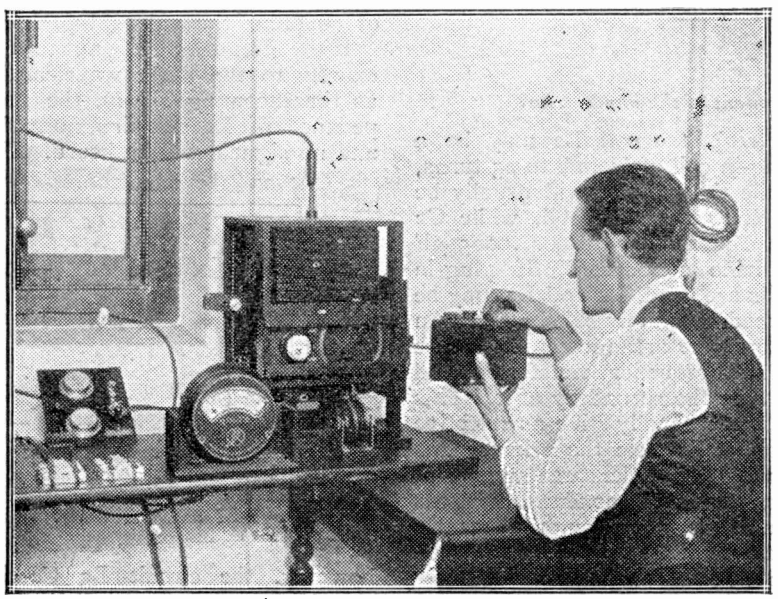
NASH POINT WIRELESS BEACON



The six months' tests of the first British experimental wireless beacon at Nash Point, Bristol Channel have proved very successful. The beacon sends a signal intermittently on a fixed wavelength so that ships that have lost their bearings can locate it. Our photograph shows the quenched spark set.

Some further results with the Low Loss Tuner for Short Waves

SIR,—I thought you would like to know that I have made up the "Low Loss Tuner for Short Waves," Mr. Percy W. Harris (*Wireless Weekly*, November 19, 1924), and I have received KDKA three nights in succession without difficulty, starting at 11.30. I have been using an old condenser, as there seems to be some delay in getting the one suggested, but hope to try it out soon.

My standard set is the "Transatlantic V," and is very good for WGY; I have been able to get him every time I have tried so far, once on the loud-speaker for an hour and a half. Valves used:—Two Cossors, Mullard detector, DE 5b and LS5.—Yours faithfully,

H. L. WILLEY.

Sheffield.

Your Lead-In

IT is surprising to find when visiting the houses of friends and acquaintances how very inefficient a large number of aerials are. Sometimes, of course, inefficiency is the result of circumstances which cannot be helped. An aerial, for instance, may have to be low on account of crossing telephone or telegraph wires, or it may have to be short because the size of the garden will

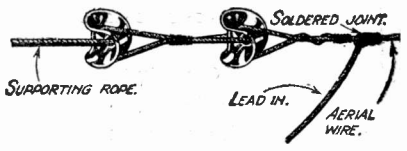


Fig. 1.—A common form of down-lead connection.

not allow it to have a big span. In the majority of cases, where the aerial is not up to the mark, the defect is often to be found in the lead-in. One of the commonest aerial arrangements is that seen in Fig. 1, where the down-lead is attached to the aerial wire by means of a soldered joint.

The Joint

Now such a joint, unless it is exceedingly well made, is apt to be a source of trouble in time to come. Unless every strand of both down-lead and aerial are firmly soldered there may be considerable resistance at the joint. Further, as time goes on, the effects of the weather may cause the joint to corrode badly, in which case there will be a marked falling off in signal strength, and it may be difficult to

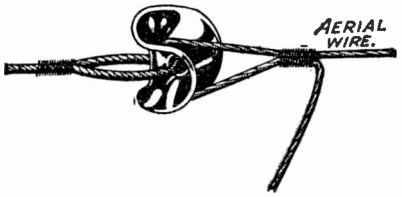


Fig. 2.—A better arrangement for connecting the down lead.

obtain oscillation on short waves. By far the best method is to avoid the soldered joint altogether in the way shown in Fig. 2. The aerial cable is passed through the insulator, then bent back upon itself and bound with fine copper wire, as shown. A little solder may be run into the binding turns to make everything secure. In this way the aerial and the down-lead are made all in one piece.

Double Wire Aerials

But what is to happen in the case of double-wired aerials? Fig. 3 shows a good way of dealing with them. The first wire A is bent back upon itself and bound, as in Fig. 2, its length being sufficient to take it to the terminal of the lead-in tube. The other wire B is fixed in the same way to the insulator, but it is cut off rather shorter. The two are then soldered together at a suitable point. We have thus one wire continuous with the lead-in whilst the other is joined to it by a soldered connection. To make this connection soundly proceed as follows. At the place where the joint is to be made separate the wires of the down-lead by twisting them backwards. Then clean each separately with emery cloth. Unstrand the wire of B for about 2 in. Now solder each strand of B separately to a strand of the lead-in. Finish off by giving a good coating of stove enamel, and wrap the joint tightly with rubber tape.

The Down Lead

It is generally desirable that the down-lead should be insulated since as it swings in a wind it may make contact with the walls of the house or with the sides of the window frame. Enamel-covered wire has the great advantage in that the metal is protected from the effects of the weather, and therefore does not corrode. In soldering enamel-covered cable great care must be taken to see that every strand is properly cleaned before any attempt is made to use the iron.

The Lead In

Even if the down-lead itself is all that it should be there may be inefficiency in the aerial system owing to defects at the point of entry into the house. One often sees the lead-in wire, usually none too well insulated, brought in by simply passing it through the open window, which is subsequently jammed down upon it.

Construction

With such an arrangement it will generally be found that long-distance reception is difficult to accomplish, and is not to be advised in any circumstances. An exceedingly efficient lead-in arrangement can be made in the following very simple way. With a ½-in. auger bit bore a hole through the woodwork of the window frame. Do not go right through from one side or you will split the wood away at the exit of the bit. As soon as its point shows remove it and complete the job from the other side. The result will be a clean-cut hole. Into either end insert a panel

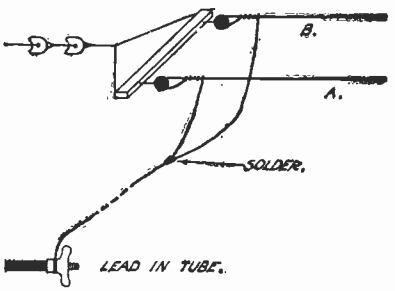


Fig. 3.—How the wire may be joined in a double wire aerial.

bush with a 2B.A. clearance hole. Cut off a piece of 2B.A. screwed rod 2 in. longer than the thickness of the window frame. Pass this through the bushes and provide it with terminal nuts at both ends. Wing nuts, which can be obtained in the B.A. sizes from any good tool shop, are better than the ordinary milled-headed type for securing the lead-in and the wire which runs to the aerial terminal of the set, for they can be secured very tightly with no great effort. Care must always be taken to see that both the end of the down-lead, which is attached to the terminal outside the window, and the terminal itself are quite clean. An occasional rub with a piece of emery cloth given to both will ensure that a good contact is made at this very important point.

R. W. H.

Some Experiments with an Ultraudion Receiver

By STANLEY G. RATTEE, Member I.R.E., Staff Editor.

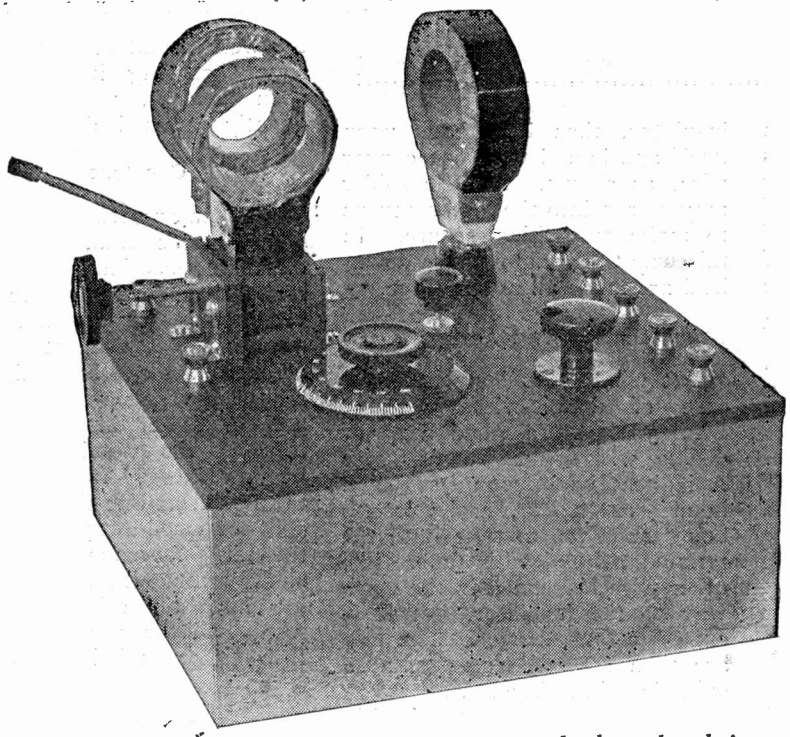


Fig. 1.—The Ultraudion circuit as constructed, the valve being beneath the panel.

THE receiver illustrated in Fig. 1 was made for the purpose of testing, with British valves and components, a circuit which is frequently put forward in American journals as excellent for general reception. The results show that its behaviour is so erratic, and its tuning so critical, that none but the more advanced experimenter would be able to obtain anything resembling satisfactory results; further, the circuit is so prone to burst into oscillation that unless handled with extreme care considerable interference can be caused to neighbouring listeners.

As to results, the receiver is just as sensitive as any *good* single-valve reaction set, but its principal attraction lies in the extreme selectivity which may be obtained; in fact, it may be said to be too selective for use by the average experimenter, the tuning of 2LO in a S.E. London suburb, for instance, being a very critical operation.

Practical Details

For those readers who care to try the circuit sufficient information will be given, though no constructional details of the receiver itself will be published. The circuit as used is shown in Fig. 2, and will be recognised by the advanced reader as the Ultraudion. It will be seen that aperiodic aerial coupling is used whilst the secondary is tuned by a .0005 μF variable condenser. The grid leak is variable, and it is essential that it should be so, otherwise the circuit will oscillate in such a way as to be out of control. In connection with this component, it is interesting to note that no less than four variable grid leaks of well-known manufacture were tried in the receiver illustrated, yet not one of them worked sufficiently well to give a satisfactory control of reaction. The fifth, which is incorporated in the receiver and doing useful work, may be seen in the photograph, and permits that fine control which seems to be so essential before any results can be obtained at all. C2 is the usual grid condenser, and, after many substitutions, the best value found for this was .0003 μF capacity. L3 is a radio frequency choke consisting of a low-capacity coil of 250 turns.

Coupling Effects

By varying the coupling between the coils L1 and L2, some mild control of reaction is obtained, though it will be found that in most cases there is an optimum coupling for each wavelength, any variation of which will at once cause signals to be lost, or else render them so weak as to be useless; in the same way the tuning upon the condenser C1 is equally sharp, a variation of two degrees being sufficient to lose signals altogether.

Instability

Extreme care should be taken in choosing the valve, and various makes should be tried. In the writer's case, of the valves tried the most satisfactory, in so far as control was concerned, were the Cossor white top and Marconi R, with 4 volts as L.T. and 20 volts H.T. A French dull-emitter valve and also a Myers with 50 volts H.T. gave equally good results, with the peculiar phenomenon that increasing the H.T. to 100 volts in the case of the French D.E. did not seriously affect the general control of the receiver. It was found in all cases that the best results were obtained when the valve was working a little below its normal brilliancy. In the hope that the receiver would prove less critical, the secondary coil was earthed, but further experiments indicated that this connection did not affect the general disposition of

Some interesting notes on a popular American circuit which scarcely suits British Bright Emitter valves.

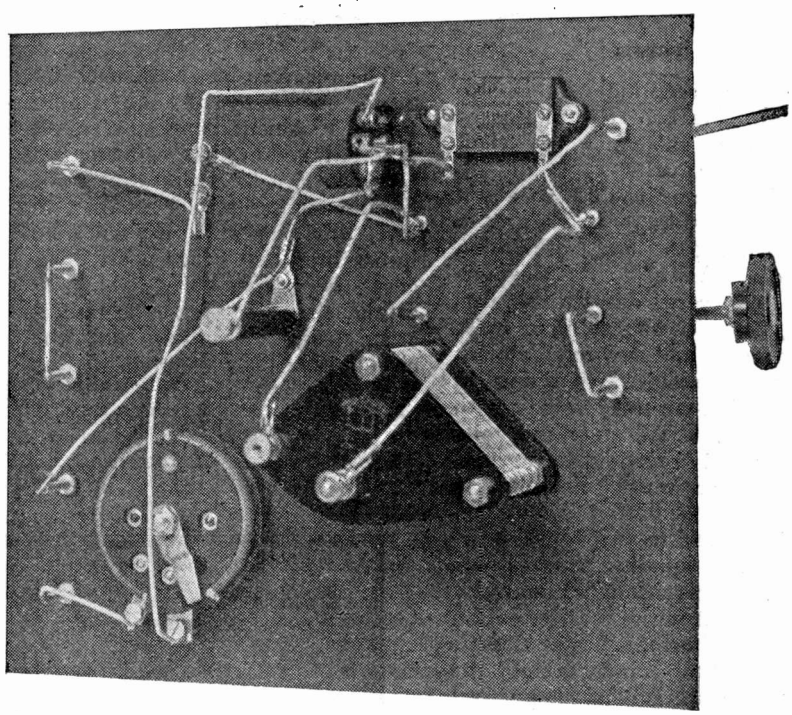


Fig. 3.—Back-of-panel wiring.

the circuit in the least. As a whole, the circuit proved to be quite sensitive, satisfactory signals being received from a number of distant stations both with an earth connection to the secondary and without it.

Stations received in S.E. London with this receiver were 2LO, 5WA, 5IT, 5XX, and Radio Paris, tuning being equally sharp upon all of them, and in no case was interference experienced from 2LO or any other station. The reception of London was accomplished, using a Marconi

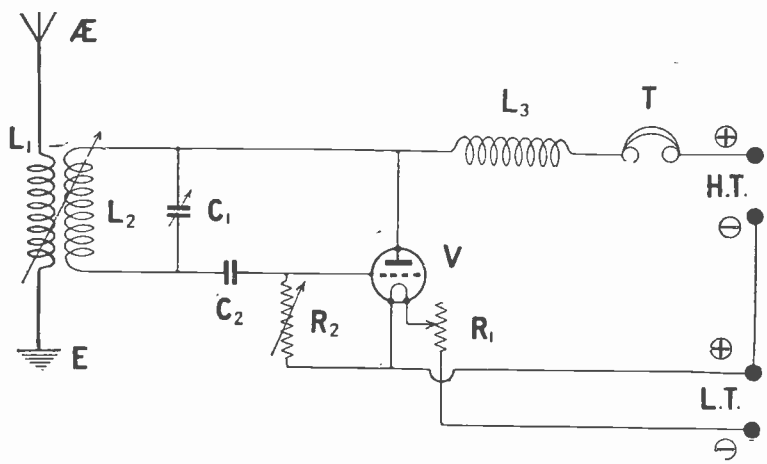


Fig. 2.—The circuit used.

R valve with 4 volts L.T. and 20 volts H.T., with a 25-turn coil as the aperiodic aerial coil (L1) and a 75-turn coil for the secondary; reception was as critical as even the most fastidious could wish, whilst the optimum coupling of the two coils appeared extraordinarily sharp, any attempt at tightening or loosening coupling losing signals altogether without the ability of retuning upon the condenser. Oscillation while tuned to this wavelength was very fierce, though none the less controllable by varying the grid leak and valve brilliancy.

High Selectivity

Using the same valve, coils and batteries, quite the usual single-valve strength of signal was received from 5WA without a suggestion of interference from 2LO. The same peculiarity of optimum coupling was observed though the receiver showed a greater tendency to oscillate, control being again given by varying the value of the grid leak and position of the arm of the filament resistance.

Using a Cossor (white top) valve with the same batteries, the same reception of this station was obtained, though it was found that a considerable increase in the resistance of the grid leak was necessary before oscillation could be produced.

For the reception of 5IT it was found necessary to change the aerial coil (L1) to an even smaller value, and a Gambrell a/2 was chosen with a B coil as secondary; subsequently the B coil was changed for a Gambrell C coil. Reception on this wavelength was even more critical than in the two previous cases, it taking some considerable time before any signals could be heard at all, though there was a better control of oscillation brought about, probably by the relatively slight increase in wavelength. Optimum coupling was again ob-

served both with B and C coils in the secondary circuit.

Valves

For the reception of this station both Marconi R and Cossor white top valves were tried, each with 4 volts L.T. and 20 volts H.T., and each gave about the same results with regard to signal strength and oscillation control. As a further experiment, a Myers dull-emitter was tried, but with any value of H.T. between 10 and 20 volts violent oscillation resulted. Using a French dull-emitter valve with 4 volts as L.T. and 45 volts H.T., good reception was obtained after much difficulty in controlling oscillation; the reduction of H.T. to 20 volts, however, gave equally good signals with a more reasonable control.

Compared with the reception of these shorter wave B.B.C. stations, the tuning-in of the long-wave station at Chelmsford was a simple matter, though none the less a tedious business.

Chelmsford

The coils for the 1,600-metre wavelength were a No. 100 for the aerial coil, with a No. 150 for the secondary, tuning being again sharp, with the same phenomenon of optimum coupling. Oscillation was fairly well under control, though not by any means perfect when using Marconi R and Cossor white top valves with 4 volts L.T. and 20 volts H.T., and French and Myers dull-emitter valves with 4 volts L.T. and 50 volts H.T., the grid leak again serving to control the tendency to oscillate.

Radiola

Using the same coils as for 5XX, and the same valves with their respective voltages as before, Radio Paris was received at quite the usual strength one would expect from a single-valve reaction circuit, without interference from 5XX. Oscillation on this wavelength was slightly less marked than on 1,600 metres, though still very recalcitrant, whilst the optimum coupling effect was more critical.

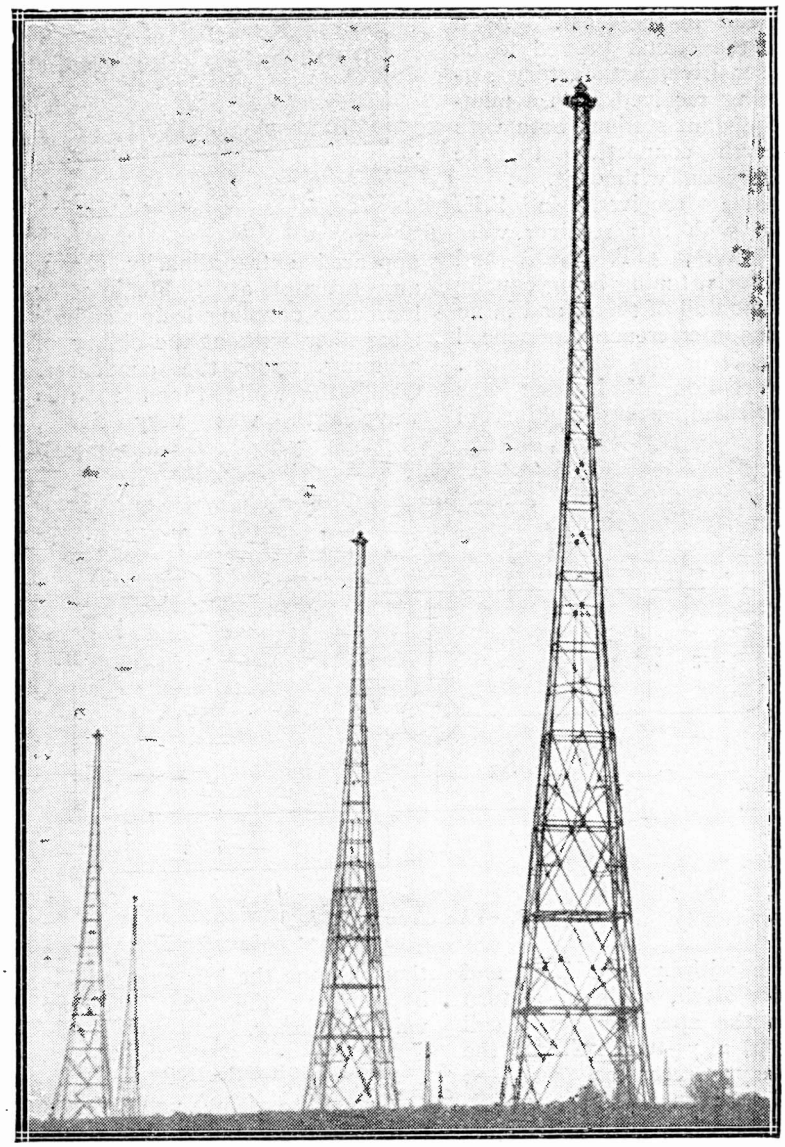
During these experiments various values of choke (L_3) were tried, but a No. 250 coil seemed to satisfy all requirements in the best possible manner.

Other Tests

The receiver has been used by other members of the Radio Press technical staff in quite different conditions. Their results with it confirm my own. Should any reader care to try this circuit, it will be interesting to hear what success he has been able to attain, though it must be understood from the outset that the circuit is in no way advocated as being one suitable upon which to construct a receiver, the purpose of this article being merely to convey to readers the benefit of another's experience.

In no circumstances is it suggested that any other than experimenters of long experience attempt to work this circuit on account of its tendency to oscillate, and so cause considerable interference; further, its tuning is such that only those readers who are familiar with sharply-tuned circuits, such as short-wave receivers, would in all probability be able to get any station other than the local broadcasting station, and even that with considerable difficulty.

ONGAR WIRELESS STATION



Our photograph shows the elaborate masts which support the aerial system at the well-known Ongar station.

Experimenting on Five Metres

By WILLIAM A. BRUNO.

In this article, which is a continuation of that published in the Vol. 5 No. 11 issue, the author, an American contributor, gives further details of his 5-metre transmitter, and the method of measuring the wavelength of such short waves.

ONE of the most important factors to take into consideration when building a C.W. transmitter for experimenting on very high frequencies is the length of the wires to be used for interconnecting the various parts, and the elimination of all

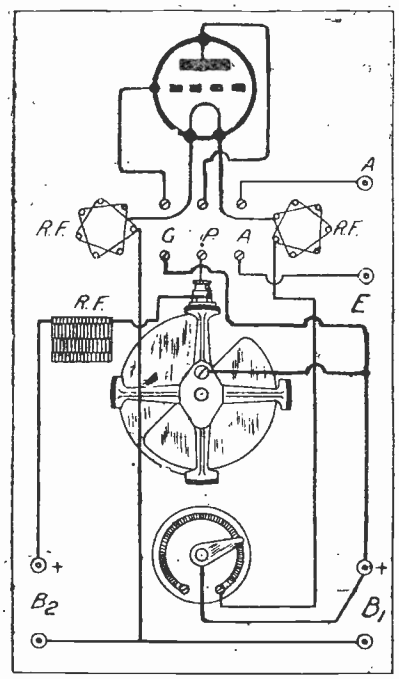


Fig. 1.—The back-of-panel layout of the 5-metre transmitter.

metal, not part of the circuit, from the immediate vicinity of the oscillating circuit.

Short Leads

The length of the connecting wires is very important for two reasons. First, every inch of wire introduces resistance losses. Second, if you use any more wire than is absolutely necessary, you are apt to be disappointed when you measure the wavelength of your set, as described in this article. You will remember how, in the first article, we described an experiment in which we absorbed the whole output of the transmitter with a small closed loop of wire, held near the oscillator coils. This should prove to you the bad effect of any unnecessary metal parts anywhere in or near the transmitter.

Panel Layout

Fig. 1 is a layout of the rear of the panel. While other experimenters have suggested more compact forms, a great deal of appearance has been sacrificed, and we believe that this arrangement pleases the eye, while it is electrically efficient.

The coils marked R.F. in Fig. 1 are the three radio frequency chokes as described in the previous article, and A, P, and G are the aerial, plate and grid inductance terminals.

In the set built by the writer, provision was made to vary the coupling between the coils, but no use was made of this feature and at this writing these coils are about ½ in. apart.

We assume that with the information given so far you have been able to build this interesting outfit and are operating it successfully.

You certainly are wondering how these short waves may be measured. It is a well-known fact that these waves (and theoretically all radio waves) may be accurately measured with the ordinary yard-stick.

This statement seems amazing; still, it is very easily understood, once the theory of the travel of radio waves is considered.

Basically, we are dealing with an alternating current oscillating at a very high frequency.

We may represent the "rises" and "falls" of this high-frequency alternating current in the usual manner. (Fig. 2.)

We know that electricity travels at the rate of 186,000 miles per second, or 300,000,000 metres per second.

Now we will draw a line (Fig. 3) and assume that it is 300,000,000 metres long, or

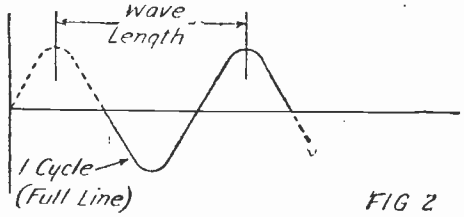


FIG 2

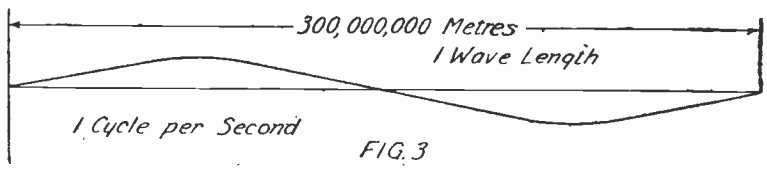


FIG. 3

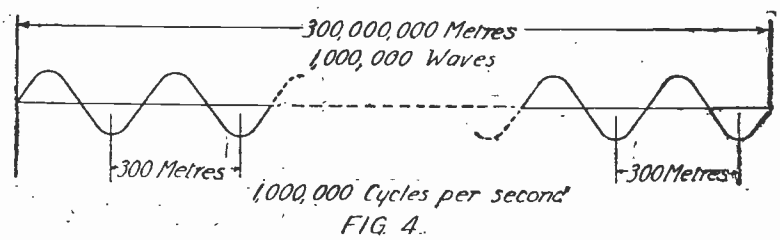


FIG. 4.

Illustrating the relation between the velocity, the frequency, and the wavelength of electric waves.

186,000 miles. (The distance ether waves travel in one second.)

Now assume that we are producing alternating current at a frequency of one cycle per second, and that this current is being radiated from an aerial. Each "peak" above the line in Fig. 3 would leave the aerial, and one second later would have travelled 300,000,000 metres away. At this instant, another "peak" would leave the aerial, travelling 300,000,000 metres behind the first one. The wavelength, or distance between these high spots as they travel away from the aerial, would then be 300,000,000 metres.

Then let us assume that we are able to increase the frequency of our transmitter until we are sending out 1,000,000 cycles, or 1,000 kilocycles in one second. Fig. 4 shows a line which we imagine to be 300,000,000 metres long (distance covered by ether waves in one second).

At this frequency, or any frequency, each wave still travels 300,000,000 metres away from the transmitter in one second. During this one second 1,000,000 more waves have left the transmitter, following the first wave. The distance from wave to wave, or the wavelength, then equals 300,000,000 metres divided by 1,000,000 waves, or 300 metres. By increasing the frequency of the C.W. transmitter, the waves leaving the aerial are crowded closer together, and the wavelength is shorter. Since 300 metres corresponds to 1,000,000 cycles per second, we can write the following formula for frequency:—

$$F = \frac{300,000,000}{M}$$

Where F is the frequency and M the wavelength in metres.

In our case we are mainly concerned with the 5-metre waves and therefore show in Fig. 5 a hypothetical curve of a current oscillating at this frequency.

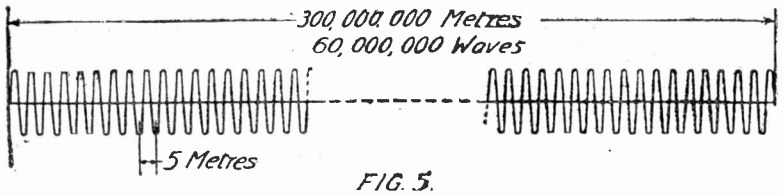


FIG. 5.

A pictorial representation of the connection between velocity, frequency and wavelength in the case of 5-metre waves.

By referring to Fig. 5 you will note that at every 2½ metres the voltage of the transmitted energy drops to zero potential.

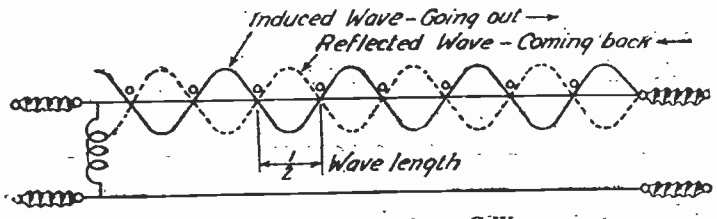


Fig. 6.—Showing the result of connecting a C.W. generator across two parallel wires.

Now, then, if these waves could be made to stand still long enough for us to pick out the spots where the voltage was zero we could measure the distance from one zero-point to another, and get the wavelength with the famed yard-stick. Fortunately, such a method has been discovered, and takes its name from its inventor, Lecher.

Before describing this very interesting method of measuring short waves we must delve again into the theory of oscillating currents.

Parallel Wires

If a C.W. generator is connected across a pair of parallel wires, carefully insulated, a wave will travel down the wires, and when it reaches the far end will be reflected back again. The result is shown in Fig. 6.

The zero point of each wave going out will always meet the same point of some other wave coming back at the points marked O. If, as shown in Fig. 6, the reflected wave is 180 deg. out of phase with the induced wave, then all voltages along the line are equal and opposite. If, however, the two are in phase, we shall get stationary waves of potential one half wavelength apart.

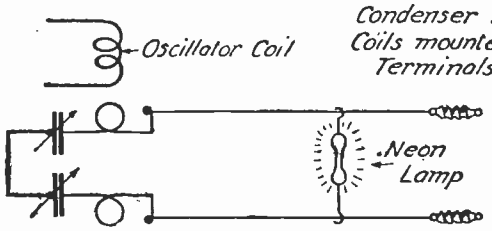


FIG. 7.

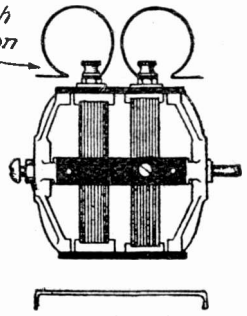


FIG. 7A.

Diagrams showing the apparatus used in measuring short wavelengths, and its arrangement.

We are now ready to undertake intelligently the measurement of the waves generated by our miniature transmitter.

Run two parallel wires, about 25 ft. long, where convenient, 6 in. apart, and stretch them as tightly as possible. Attach good insulators at the ends of the wires and connect the two near ends to the dual condenser on which two single coils of wire 3 in. in diameter are mounted. (Fig. 7.)

Obtain from a garage a spark plug tester and remove the little lamp from its casing, being careful not to break the wires nor to injure the lamp.

Use of a small Neon Lamp

This lamp is filled with neon gas and has the property of glowing when a high-frequency oscillation is applied to it. Place this lamp across the two wires and get the transmitter to oscillate. When the milliammeter shows maximum radiation, carefully

adjust the condenser in series with the long wires. When it is in resonance, the neon lamp will light up.

If you notice that the circuit is in resonance by the deflection of the milliammeter and the bulb does not light up, move it forward until it lights.

Method of Making the Wavelength Measurements.

Leave the bulb at the point on the wire where it seems to light up brightest. Now take two pieces of wire and shape them into a "bridge," as shown on Fig. 7A. Place one of these bridges on one side of the lamp and move it backwards and forwards with a long insulated rod to a point where the short-circuiting of the two long wires will have no effect on the lamp. Now place the other U-shaped wire on the other side of the bulb and move it until the little lamp will merrily light up.

By referring to Fig. 8 we will see what is happening.

The lamp is at a point where the voltage of the waves is at its maximum, and the bulb glows brightly. The little bridges are at points where the voltage is zero, and consequently there is no tendency for current to flow across, and no energy is absorbed by the bridges. The neon lamp absorbs very little energy, and does not affect the relation between the outgoing wave and the reflected wave. If you now take your yard-stick (ruled in metric system; 1 metre equals 39.37 in.) and measure the distance between the two short-circuiting wires, you will have exactly one-half of the wavelength of the oscillations in the wires. By applying the formula given before, you will be able to obtain the frequency at which your transmitter is operating.

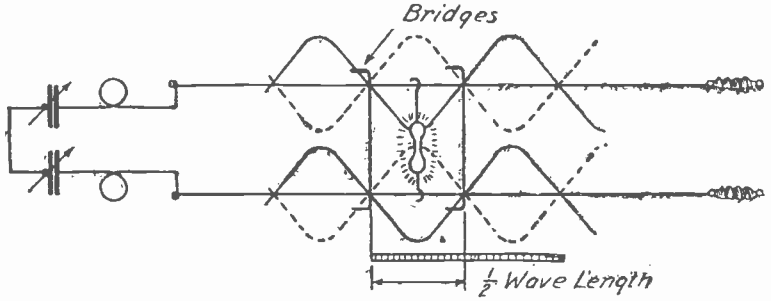


Fig. 8.—Illustrating the theory of the method of measuring short wavelengths.

It is very simple now to calibrate your transmitter condenser by repeating the measurements for as many settings of the condensers as you desire. The same applies to the wavemeter or resonator described in Vol. 5, No. 11. This calibration is very helpful if you wish to go on experimenting with short waves, especially when you will build a receiver for them.

In a future article we will discuss the method of "Keying" this transmitter.

□ □ □

A Reader's Results

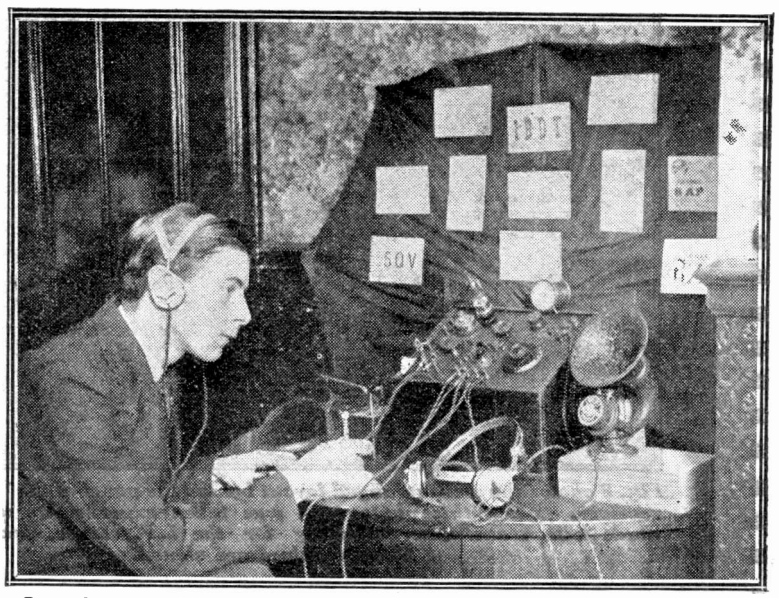
SIR,—It may interest you to learn that I succeeded in almost uninterrupted reception of WGY, Schenectady, U.S.A., on the mornings of December 27 and 29, 1924, between 1.30 a.m. and 3 a.m. on a one-valve reflex circuit similar to Fig. 13 in *Wireless Weekly* dated December 26, 1923, with the exception of a loose-coupled aerial coil, also the 'phones were placed between L.T.+ and H.T.—. The reception on the 29th ult. was singularly free from atmospherics, Morse causing trouble by fading in three instances. With this exception the volume and clarity was equal to a good crystal set on the local station. A church service was being transmitted, and at 1.30 the congregation were singing "Noel." This was followed by a lesson from the 19th chapter —— (here Morse interfered). The sermon lasted about twenty minutes, each word being clear and strong. Another hymn, then the organ played the "Stars and Stripes," after which WGY announced that they were going over to the Waldorf Astoria Hotel for band selections, which came through with no distortion whatever and faded only through Morse on two occasions.

Coils used, No. 25 aerial (parallel), .001 condenser, 35 grid, .0005 condenser, 54 reaction, .0003 condenser, all home-made on a 2-in. former, duolateral type. A home-made transformer with 5,000 turns on the primary, 15,000 on secondary, 47 gauge, enamel covered wire, was used.

Other results obtained cutting out Birmingham, situated only three miles distant. Le Petit Parisien, Brussels, Posts and Telegraphs, Madrid and most of the B.B.C. stations all at good 'phone strength.

—Yours faithfully, T. G. BAGLEY.

Birmingham.



Our photograph shows Mr. T. A. Studley, of Harrow, who, using a one-valve set, has received Chili 9TC (situated near Valparaiso), and thirty-six American amateur stations.

A "Super 5" a Heterodyne

By R. TINGEY, I

Mr. Tingey, whose name will be tion with the Radio Press Serv following article a description of receiver. Full constructional d super-set will be given

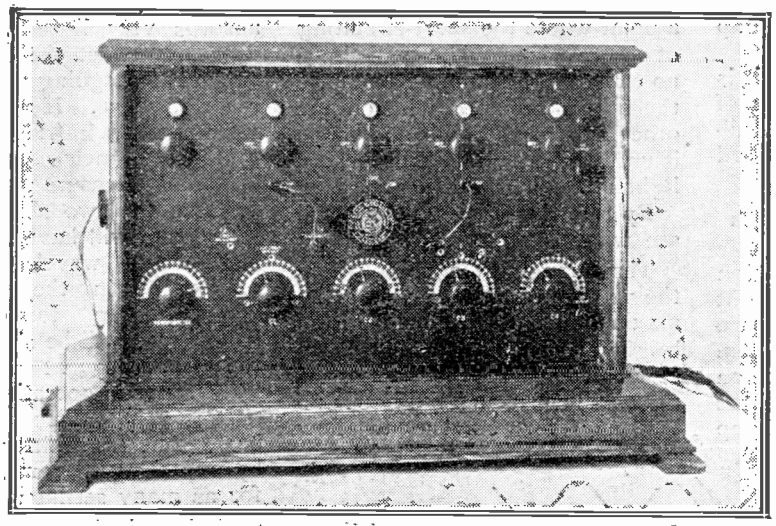


Fig. 1.—The "Super 5" receiver is of very handsome appearance.

THE sets about to be described have several interesting features. They have been on the market for some time and have stood the test of constant reproduction, there being, as a matter of fact, about a hundred in use at the moment. The complete set is no longer on the market, and, as the author has now the honour of being a member of the Radio Press staff, the results of research work on the set are published in this paper, so that they may be generally available.

Separate Units

The portion known as the "Super 5" (Fig. 1) is a 5-valve receiver. The Super-Heterodyne, containing an extra four valves, can be plugged on to the standard set. The change over from the ordinary set to super-heterodyne occupies only five seconds. No extra H.T. or L.T. is required.

We will consider first the "Super 5" receiver. When all valves are in use, we have two H.F., one rectifier, one transformer coupled L.F., one resistance coupled L.F.

Using any Number of Valves

By means of two wander plugs any number of valves, from one to five, can be used, also any combination of valves to suit any district. For example, near a local station the rectifier and one or two stages of low-frequency can be used. Further out one or two H.F. can be added. This switching method is efficient, as it is free from most capacity defects.

One Positive H.T. Tapping

Another feature is that the H.T. is not tapped, 120V being used throughout on both sets. This reduces the number of variables, but requires, of course, that suitable valves be used. The valves used are Cossor red top for H.F., Marconi R4B for rectifying, and Marconi LS5 for the L.F. valves. Actually in the photographs Western Electric valves are shown, these being used at the time the photographs were taken. So far as the H.F. valves are concerned, many makes serve equally well, but the use of the R4B for the rectifier is in itself a feature of the set. A large number of valves has been tried, but none comes near the R4B on this set for the purpose; 9 volts negative grid bias are used.

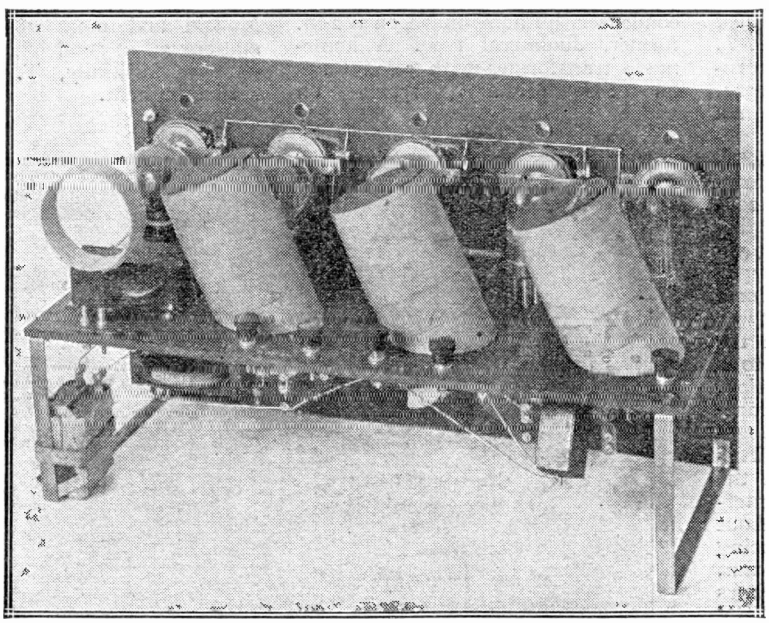


Fig. 2 shows the well-arranged layout behind the panel of the "Super 5" receiver. When this photograph was taken experiments were being made with transformer coupling for the L.F. stages, and Western Electric valves are shown.

and a Super= e Receiver

Member I.R.E.

at once recognised in connec- ce Department, gives in the a nine-valve super-heterodyne etails of how to build this in our next issue.

The H.F. Transformers

It will be seen the H.F. transformers are of special design, the directions of windings, angles and distances being of the utmost importance. They are plugged into sockets, and are interchangeable for different wavelength ranges. Oscillation and reaction are controllable in two ways :—

1. The potentiometer controls the 2 H.F. valves, and, owing to the arrangement of coils, the control *always* comes at about 160°—170° out of 180° of the potentiometer, oscillation of the first two valves being produced near 180°.

2. The tuned circuit in the plate of the rectifier valve (" reaction "), when brought into tune with the wavelength being received, produces oscillation, so that by this means all valves may be adjusted to their best operating point.

H.F. transformer coupling is used throughout.

Use of Frame Aerial

If it is required to use a frame aerial the frame is plugged-in in place of the first " aerial transformer."

The theoretical circuit shown in Fig. 5 is " straight," the author being very keen on simple straight circuits, making each valve perform its one function, and that to its best advantage. In this way operation and control of many valves are simplified.

Signals come in with good L.S. strength using only three valves on an indoor aerial within six to eight miles of a main station. On a frame aerial the results come in equally well. On an outdoor aerial the following results have been obtained by users of this set who are not wireless experts.

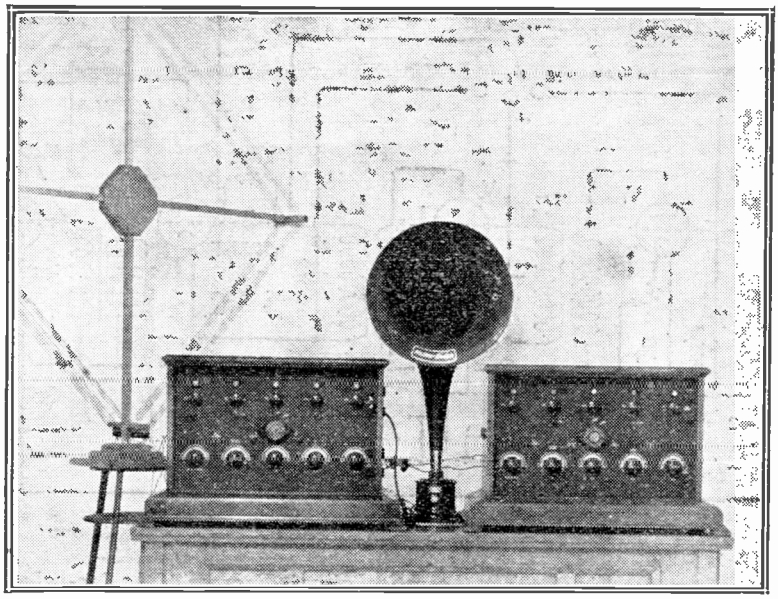


Fig. 3.—The " Super 5," together with the super-heterodyne, makes a very interesting and efficient installation. Note the frame aerial.

Results Obtained

Using all 5 valves on an indoor aerial in the Earl's Court, London, district, all B.B.C. stations have been heard on the L.S. In Jersey, on an outdoor aerial, all B.B.C. stations were received easily, Bournemouth being best. Another Jersey man got WGZ and WHAZ on the L.S. At Newlands Cairns, Guildford, on 20-ft. wires thrown over bushes, using the car frame as earth, London (30 miles) was so loud it could be heard 200 yards from the L.S. in the open.

One of the chief charac-

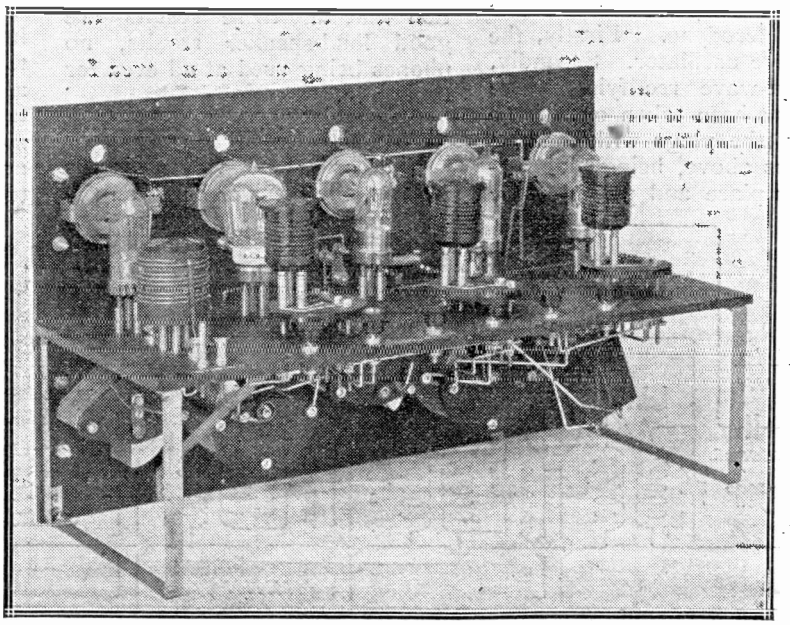


Fig. 4.—The back of panel arrangement of the super-heterodyne unit.

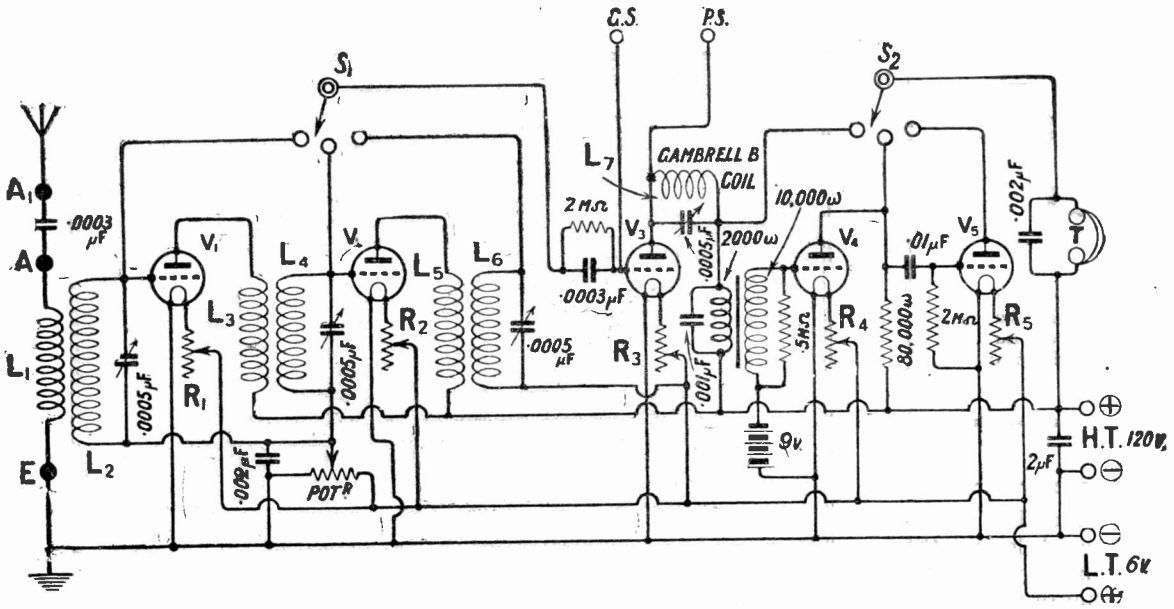


Fig. 5.—The theoretical circuit diagram of the five-valve receiver.

teristics is absence from noise, and there is a dead quiet background.

The Super-Heterodyne

Now we will consider the Super-Heterodyne.

There are five leads which are plugged into this set from the five-valve receiver—1, H.T. + ; 2, L.T. − and H.T. − (common) ; 3, L.T. + ; 4, a lead from the grid socket of the rectifying valve ; 5, a lead from the plate socket of the rectifying valve.

There are 5 valves on the Super-Heterodyne. Firstly, the short-wave oscillator. Secondly, the short-wave rectifying valve which has been taken out of the receiver (the plugs with leads 4 and 5, as above, being plugged-in in its place and put into the Super - Heterodyne). Thirdly, the long-wave high-frequency valves (two), and finally the L.W. rectifier, making a total of 9 valves in all.

Results

Constant results obtained on this combination on a frame aerial are all B.B.C. stations within 5 miles of the local station while the local station is working, all the usual Continental stations, and 3 American stations. It is well to mention that all these results are good loud-speaker results, no phones being used at all even for tuning in.

Valves

The order of valves is as follows, the receiver being on the left, the super on the right : First on left, S.W. H.F. ; second from left, second S.W. H.F. ; second from right in Heterodyne, S.W. rectifier ; first on right, oscillator ; third from right, first L.W. H.F. ; fourth from right, second L.W. H.F. ; fifth from right, L.W. rectifier ; third from left, plug ; fourth from left, first note mag. ; fifth from left, second note mag. You will notice that the S.W. H.F. and the S.W. oscillator are at extreme ends and so cause no interference with each other. In fact, a receiver working in the next room cannot hear the oscillation, even when an aerial is used—a great advantage. The signals in the first set thus work from left to right, and those in the S.H. from right to left. When using this

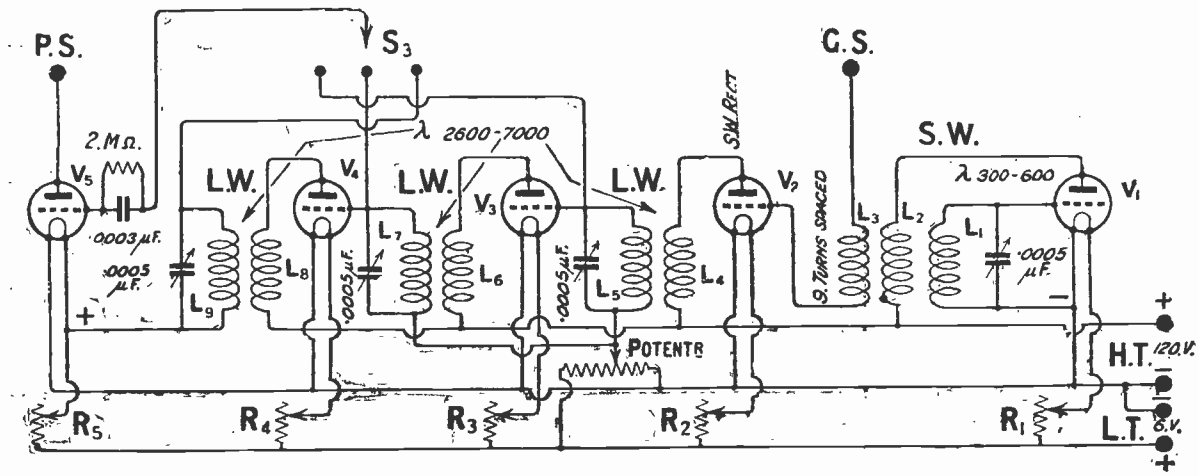


Fig. 6.—Theoretical circuit arrangement of the super-heterodyne unit.

method no elaborate shielding is necessary. The working of the Super-Heterodyne is as follows. The extreme right-hand valve is connected from both plate and grid to a plug-in transformer, the grid circuit being tuned. This oscillates, and around this transformer is placed a cylinder with about 9 turns of wire. The details of this were described in *Wireless Weekly* of November 26, 1924, page 201. A wire from the grid socket of the rectifier in the first set goes to these 9 turns, and so to the grid of the rectifying valve, which is now the second valve from the right in the Super-Heterodyne set. The next 3 valves are L.W., using M.H. transformers 2,500-7,000 λ tuned on their secondaries with .0005 μF condensers.

The plate of the L.W. rectifier goes back to the plate socket of the S.W. rectifying socket on the " Super 5 " set and so the currents are amplified at low frequency after passing through the closed reaction circuit, which, of course, now has to be L.W.

It is not necessary to have variable condensers on the L.W., but it makes it more flexible and enables L.W. to be received on it direct, and also allows one to counteract any variation there may be on the transformers.

The same plugging system is used on the Super-Heterodyne, enabling one, two, or three L.W. valves to be used as required.

The valve or valves not in use are turned out in addition to changing the position of the wander plug.

EDITOR'S NOTE. — Constructional details of this set will be published in a subsequent issue.

International Agreement on the Use of Call-Signs by European Broadcasting Stations

By Captain L. F. PLUGGE, B.Sc., F.R.A.S., F.R.Met.S.

The following are the salient points of a talk broadcast from 2LO on Jan. 8th.

AT present we count in Europe some 50 stations which I might term " regular broadcasting stations," inasmuch as they give a programme every day. Out of this number England stands first, both in the number of stations, in the continuous hours of transmission of each of these stations, and, I might also add, thanks to the efforts and enterprise put forward by the B.B.C., our broadcasting service stands very high for the quality and variety of programmes, and the importance of topical events transmitted.

The Programme Difficulty

However, as has often been said, it is difficult to provide a programme which will at the same time content a million people, and this difficulty is to be overcome in radio telephony by providing a choice of programmes from various stations. With the great number of stations at present working in Europe this condition is now satisfied, and, apart from interference which, with the education of the listener and the improvements made to transmitting and receiving apparatus, is getting less and less, it is possible for the listener with an efficient set to choose his own programmes.

Recognising a Station

There is one difficulty for the listener, however, and that is the difficulty of recognising the station to which he is listening. Some of the stations do not announce their identity more often than twice, once at the beginning and once at the end of a transmission. As in some cases these transmissions last up to three hours, it is often very difficult, apart from a special study, to recognise which station has been tuned in. I was recently visiting some of the Continental broadcasting stations, and I brought up the subject with one or two, and found that these stations were what I might call shy of giving out their names too often. They regarded it as a kind of advertising, and considered that it could be overdone. I think this was misplaced modesty.

Call Signs

Many stations have apparently no call sign allotted to them, but, on the other hand, some do announce their name more often than others. But, again, this name appears to be inconsistently allotted, as some stations use the name of a town, others the name of the company owning the station, and some a coined word derived from the company's initials.

Repetition

It ought to be possible for any listener to tune in any station and to know with certainty that after waiting a specified number of minutes he is going to know without doubt to which station he is listening. On the other hand, I am fully aware that the repetition of call-sign may become wearying to nearby listeners, but these will realise that the giving out of the call-sign is a necessity and that, if it were not given out, it would merely be replaced by a moment of silence; thus they are not losing any of the transmission because of the repetition.

Agreement Necessary

In America this repetition of call-signs is to-day a standard feature, and it is imperative that some such agreement should be reached in Europe. The use of call-signs is not the only method of identification. There are many ways by which this might be assured, but to me one thing appears definite, namely, that a standard method should be adopted.

With the increasing power used by Continental stations, the number of listeners tuning in these stations in England is great; yet I receive scores of letters from listeners who give me examples of programmes they have heard at definite times and dates, and ask me if I can identify the transmitting station. There is no doubt that this state of affairs must cease.

A Coil Testing Stand

THOSE who wind their own coils, as so many people do nowadays, must often feel the need of some means which will enable them to test the coils before they are mounted and finished off. Here is a simple little appliance which forms a most useful addition to the "gadgets" used in connection with the layout board described recently by the present writer in *Wireless Weekly*.

Constructional Details

Cut out a piece of any kind of wood $\frac{3}{8}$ in. or $\frac{1}{2}$ in. thick, making

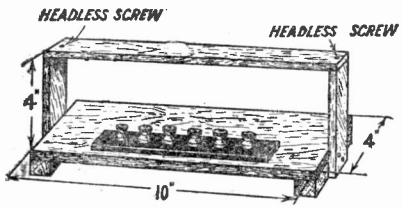


Fig. 1.—Shows the main dimensions of the wooden frame.

it 10 in. long by 4 in. wide. At the lower side fix two small battens so as to raise it about $\frac{1}{2}$ in. from the surface of the table. At either end fix an upright made of similar wood 4 in. in height by 1 in. in width. Turn a screw into the top of each upright leaving about $\frac{3}{8}$ in. projecting, and cut off its head with a hacksaw. Next cut out a strip of $\frac{1}{4}$ in. ebonite 7 in.

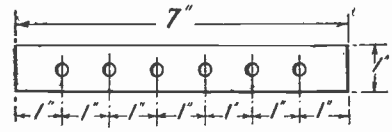


Fig. 2.—Details of the ebonite terminal strip.

long by 1 in. wide. Mark out and drill this, as shown in Fig. 2. The holes seen in the diagram are all 4B.A. clearance. Other holes of suitable size should also be made at the corners for the screws to fix the strip to the base of the coil stand. Fix the strip in position on the base making its front edge lie about $\frac{3}{4}$ in. from the edge of the base. Through each of the 4B.A. clearance holes pass the point of a scriber so as to make a prick in the wood. Remove the strip and drill a $\frac{1}{2}$-in. hole right through the base at each point where a prick was made with the scriber. Now mount six terminals on the ebonite strip and fix it in position. The $\frac{1}{2}$-in. holes will allow the nuts and shanks of the terminals ample clearance. Cut out a hard wood strip 10 in. long by 1 in. wide and $\frac{1}{2}$ in. in thickness. Round off the edges carefully and drill in each end a hole through which the headless screw will just pass comfortably. The stand is now finished.

Method of Use

Fig. 3 shows the stand in use for testing a trio of newly-wound coils. They are simply threaded on to the horizontal strip which is easily removable from the uprights, leads being taken to each of the pairs of terminals. In this way a set of coils can be tested out on the wavelengths for which it is designed, so that any errors that may have been made will be discovered and rectified before

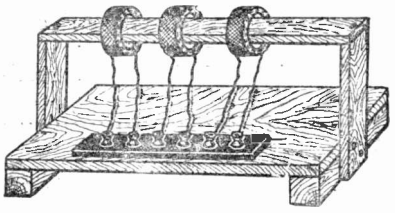


Fig. 3.—The complete stand.

finishing off and mounting are undertaken. The stand is also very handy for testing out the tri-coil circuits which have been described recently in *Wireless Weekly* and *Modern Wireless*.

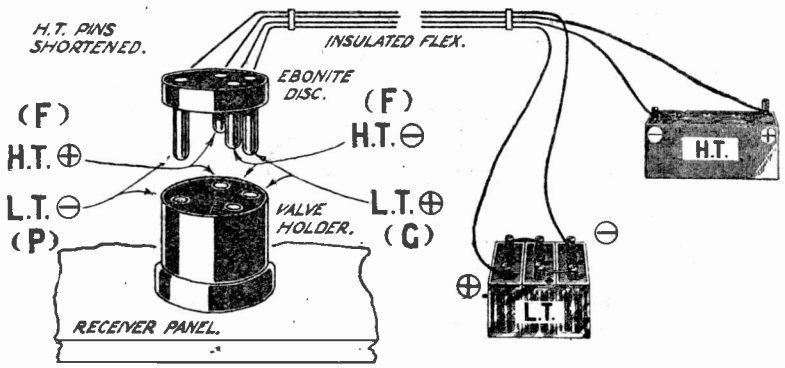
R. W. H.

□

Valve Holders for Battery Plugs.

A VALVE holder may be usefully employed to link up both H.T. and L.T. batteries instantaneously to a receiver, as described in this article. Instead of the usual four terminals with which the set is equipped, mount a valve holder, as shown in the diagram. Take the L.T.+ lead to the grid socket and the L.T.− to the plate socket. The H.T. + is taken to one of the filament sockets and the H.T.− to the other. Next make a plug from a piece of ebonite, $1\frac{1}{4}$ in. in diameter by $\frac{1}{4}$ in. thick and mount the four valve pins, as shown, to suit the valve holder. Take the leads from the batteries to the pins corresponding in position to the sockets of the valve holder. To prevent accidents when inserting the plug into the socket, shorten the two filament pins, as shown.

H. B.



This pictorial diagram illustrates how the scheme is carried out.

□

Valve Mounting for Experimental Work

THOSE amateurs who do a considerable amount of experimenting with various circuits, etc., will appreciate a form of baseboard mounting for valves which will enable them to connect up rapidly one or more valves to various pieces of apparatus, and which will also help to lessen the shocks to which valves are often subjected in such cases, due to work being done on the same bench, or even to accidental knocking of the valves.

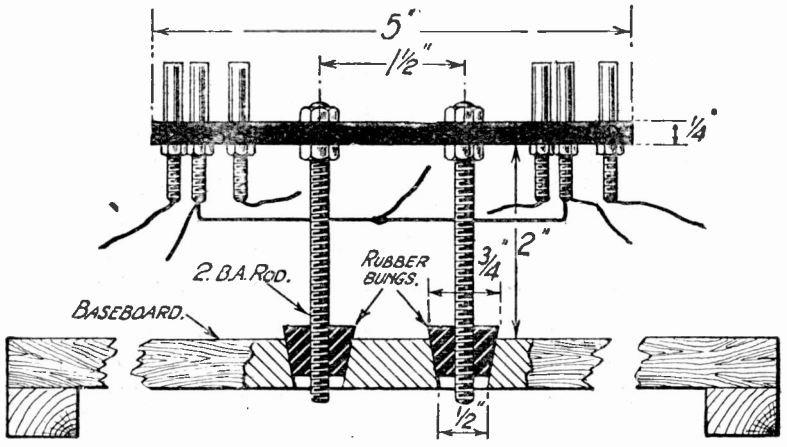


Fig. 1.—Constructional details of the valve mounting.

Mounting

The form of mounting to be described has also been found successful in reducing the unpleasant microphonic noises heard in the telephones when some types of dull emitter valves are used. As will be seen from Figs. 1 and 2, it consists essentially of a strip of ebonite upon which may be mounted valve-holders, or simply valve sockets, this strip being supported by two lengths of 2B.A. screwed brass rods passing through two rubber bungs inserted into holes in the baseboard. The rubber bungs are of the type used in chemical laboratories, and should be fairly soft and flexible. They may be purchased already bored from most laboratory outfitters, and a No. 5 size (about ¾ in. diameter at the wider end) will be found suitable if ½ in. holes are drilled in the wooden baseboard. The diameter of the hole through the bungs should be about 2B.A. clearance, so that when they are fitted into the holes in the baseboard the 2B.A. screwed rod is gripped firmly. No additional method of securing the rod to the rubber bungs is then necessary.

For supporting two valves the ebonite strip may be 5 in. by 1¼ in. by ¼ in. Holes are drilled symmetrically near each end to take the valve sockets, and two holes 1½ in. apart to take the 2B.A. rod.

Connections

Two of the shanks of the filament sockets, one from each valve, are connected by soldering to a piece of square section tinned copper wire. One end of a rubber-covered flex lead is then soldered to the centre, as shown in Fig. 2. (This lead will usually go to L.T.+.) To the shanks of all the other valve sockets flex leads about 4 in. to 6 in. long are soldered. These will usually be found of sufficient length in most cases. The reason for using flexible leads is obvious, since if more rigid wire were employed the advantages of the shock-absorbing mounting would be lost.

Any Number of Valves

The same method of mounting may be applied to a single valve or more than two valves quite easily; if, for instance, it is desired to mount four valves, the ebonite strip may be 10 in. or 12 in. long, the two supports being arranged between the first and second and the third and fourth valves.

D. J. S. H.

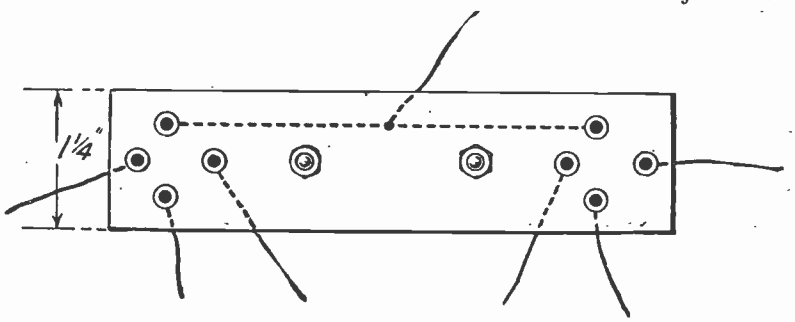


Fig. 2.—The ebonite strip showing how the flexible connections are made.

Drilling Templates

SIR,—Many firms now issue with their components a drilling template made of paper with full-sized holes punched in it. To find the exact centre of these holes so that one can mark the panel with a centre punch is something of a work of art. Would it not be of much greater value to their customers if these firms were to issue their templates with very small holes instead of full-sized ones, so small that the point of a centre punch would just go through? The template could then be placed on the panel and the centres of the desired holes marked with the punch in a few seconds. If the templates were made of thin transparent material (celluloid), the template could be easily adjusted to existing marks on the panel.—Yours faithfully,

M. D.

Stafford.

Some Further Results Obtained with a "Two-Valve Receiver of Novel Design"

By JOHN W. BARBER.

Constructional details of this receiver, together with a short account of the capabilities of the set, were given in our last issue.

IN accordance with a practice frequently adopted by writers in Radio Press journals, the receiver, as described in our last issue, was tested by another member of the Editorial Staff, on a single-wire aerial, 60 ft. long, of average height 38 ft., in south-west London, about nine miles from that station. The first station to be received was undoubtedly German, operating on a wavelength slightly above that of the Brussels station, about 280 metres. Signals were received at very good 'phone strength, the music and speech being quite clear and free from distortion.

Breslau

Newcastle was the next station to be received, at moderate strength in the telephones. Interference and mush, however, spoiled reception, and so an attempt was made to receive some other station. This resulted in the reception, at good strength, of Breslau, and later, of Madrid, both with no interference from stations of the British Broadcasting Company.

Glasgow was the next station to be received, signals being fairly strong in the telephones. On this wavelength interference from ship and shore spark stations is usually troublesome, but on this occasion seemed less intense, thereby enabling the programme to be comfortably heard.

Loud Speaking

In most of the above cases, with the exception of Newcastle, the addition of the two-valve amplifier, referred to in last week's article, would have produced good loud-speaker results.

A further period of searching on my own aerial, which, by the way, is not of a highly-efficient type, resulted in the reception of comfortable signals from the Glasgow station, and upon addition of the amplifier, the strength was all that could be desired. After the London station had closed down, a Spanish talk from Manchester was received, signals being perfectly clear.

5XX

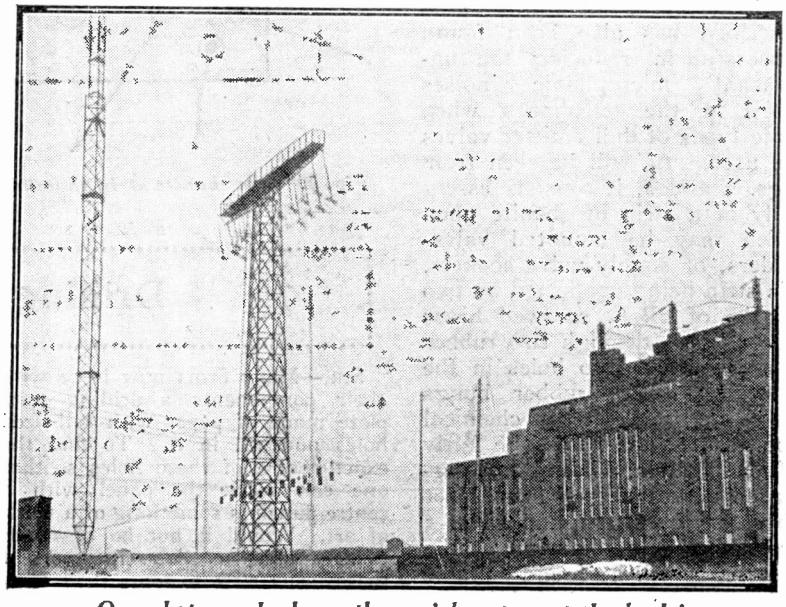
Some tests were next conducted upon the experimental high-power station at Chelmsford, upon an evening when all the shorter wave stations were conducting a simultaneous programme, 5XX giving dance music from the Savoy Hotel. With the switch on the left-hand (long-wave) stud, this station tuned in at about 70 deg. on a .0005 μF square-law condenser, using a No. 150 coil in the aerial socket, with a Gambrell G in the reaction socket. A No. 250 coil may replace the G coil.

Some interference tests were then conducted, in the following manner:—The long-wave aerial and reaction coils were left in position, the switch being placed on the short-wave side. The anode circuit was tuned to resonance with the signals from 2LO, which were of good strength, when the aerial circuit was tuned to 5XX. In this position no interference from 5XX was noticed during transmission, but when music ceased at London for a minute, Chelmsford's programme could be heard faintly.

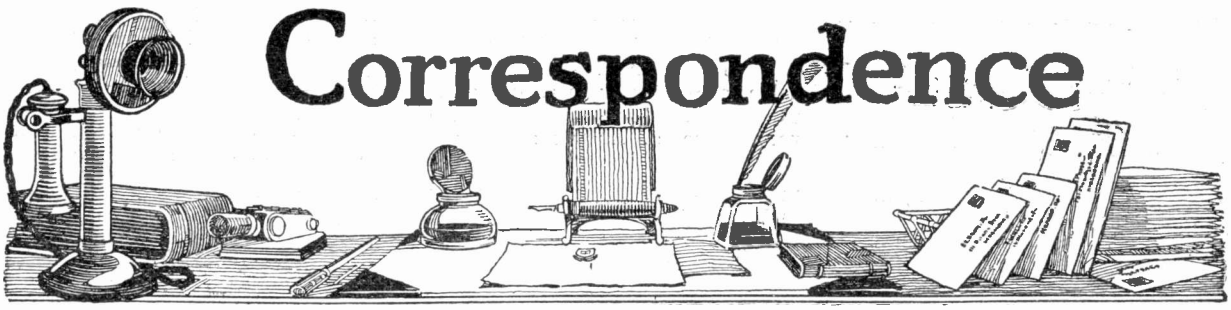
Selectivity

The switch was then put on the long-wave stud, and 5XX then came in at excellent strength, there being no trace of 2LO during the playing of an item, the anode oscillatory circuit being left tuned to 2LO. When an item from 5XX ceased, 2LO could be heard clearly, but not loudly. On detuning the anode circuit, signals from London were almost eliminated, and caused no interference during a quiet passage from Chelmsford.

It is thus clear that reception of Chelmsford or London may be effected without trouble, while for distant signals, good results may be obtained under quite average conditions.



Our photograph shows the aerial system at the lead-in of the Nauen Station.



Correspondence

A SINGLE VALVE AT SEA.

SIR,—Being a regular reader of *Wireless Weekly,* I am wondering if the following would interest your numerous readers. From time to time I have noticed that not a few of my comradios in England get quite sarcastic about "test reports" and doubtless say to themselves: "If the guy who tested that set would come down and connect up to my aerial, he wouldn't get those results from 2LO, etc.," and what makes me smile is that these critics are, or rather should be, proud owners of two, three and in some cases four valve sets. Atmospherics seem to be a temper-damaging element in England; to quote one Cornish reader, "fearfully deafening noises." Well, to the few listeners-in out here they are constant companions day and night, all the year round. When I can't hear them I start looking around for faulty connections, so after all atmospherics have their uses. I have had 5XX at good 'phone strength in Karachi and 2LO at 1,280 miles. I have been travelling around now on this East of Suez run for quite a while, and have managed to have the B.B.C. broadcast every evening in comfort, my eastern limit being Karachi. My set comprises just a single valve, straight circuit, with reaction on to the aerial. One and all are, I think, familiar with this circuit, so I will not waste time describing it. Here are extracts from my "log" for a recent night's transoceanic experiment, which was clearly received from 5XX.

10.45 p.m.—Captain Eckersley announces, "That's a very slow waltz" (heard quite plainly here).

10.49 p.m.—Capt. E. announces, "That's some atmospheric."

10.58 p.m.—Pittsburgh announces, "Switching over to Phili."

10.59 p.m.—Capt. E., "You will notice now they are switching over to Philadelphia."

11 p.m.—Philadelphia starts.

11.2 p.m.—C. E., "Someone oscillating badly." Capt. E. says he (the oscillator) is stupid; quite agree. Can hear him here.

11.3 p.m.—Dance music coming through well.

11.7 p.m.—Can hear oscillator howling plainly here.

11.11 p.m.—Philadelphia playing fox-trot. Capt. E. says, "Don't know about you, but I could dance to that quite easily."

11.18 p.m.—Capt. E. says, "Can't get a word in 'edgeways' here; they will go on." Philadelphia playing fox-trot.

11.23 p.m.—The oscillator at it again.

11.25 p.m.—Philadelphia now playing "The Miserié" from "Il Trovatore" to fox-trot time (sounds excellent here). Capt. E. says, "It will go bad shortly."

11.29 p.m.—Capt. E. says, "It's gone bad—oh, very bad. Stand by a moment and hear what they've got to say; think they are switching to Pittsburg. There's the oscillator again."

11.31 p.m.—Capt. E. says, "*There he is again,*" and gives a little homely advice about oscillators.

11.33 p.m.—Capt. E. says, "He hopes no one has been bored."

11.34 p.m.—Capt. E. says, "Good-night."

This is no freak reception; fading did not take place, although atmospherics to some would be "logged" as fierce. In time one becomes accustomed to such atmospherics and can sit and enjoy the broadcast through them. I sincerely think from the workings of this single valve set a little lesson could be taught, "that one valve properly handled is a match for a five-valve set haphazardly handled."

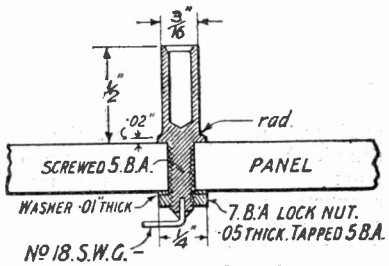
Wishing your valuable paper every success.—Yours faithfully,

"Ex. W. 74."

600 miles S.E. of Suez.

VALVE LEGS

SIR,—I was interested in reading Mr. Hood's method of mounting valve legs in order to reduce as far as possible their inter-capacity, in your issue of August 20, because some time ago I went very carefully into this question in connection with



The arrangement suggested by Col. Dennis.

the use of four-pin valves in the original Transatlantic receiver.

Putting aside for the moment any reduction of capacity which can be effected by modification of the size and shape of that portion of the legs above the top of the panel—and a good deal can be done in this direction—it is clear that the best possible arrangement is to screw the legs into tapped holes in the panel. But if this method is adopted there is serious risk of loosening the legs when the leads are subsequently soldered to them unless the precaution is adopted of soldering a short length of wire into a hole drilled in the stem of the leg, the soldering being done before the leg is screwed into the panel. The short length of wire should be bent, after screwing in the leg, in a direction away from the other legs, and the leads soldered to it.

The sole objection to this method is that, if lacquered legs are used, there is the difficulty of screwing them firmly home in the panel without scratching them or at least destroying the lacquer.

If the legs are to be inserted into a clearance hole and secured by nuts underneath the panel, I think that Mr. Hood will find that the minimum inter-capacity, consistent with reasonable strength, is obtained by the use of thin, small brass nuts and washers—lock nuts—made from lock-nuts and washers for a B.A. thread two sizes smaller than the standard nuts for the valve stem, tapped out.

Ebonite or fibre nuts, if used, would have to be very much larger in both diameter and length than the brass nuts referred to, and in using them the inter-capacity of the legs is increased in two ways which are apt

to be overlooked, viz. :—(1) By the necessity of having a much greater length of the screwed part of the leg projecting below the under side of the panel; and (2), by introducing between the under part of the legs a mixed dielectric having a much higher mean dielectric constant than air alone.

I attach a rough sketch of the method of attachment of the legs which I adopted after careful trial. The flange on the valve leg might be considered superfluous at first sight, but it was found necessary in order to prevent the leg from bedding into the ebonite when screwed hard up; and as it is only of the same diameter as a standard valve leg, and very thin, the added capacity is inappreciable. The nuts and washers are also as thin as possible.

The chief object of this letter is, however, to point out the fallacy of the ebonite nut.—Yours faithfully,

MEADE J. C. DENNIS, Col.

Co. Wicklow.

INTERESTING EXPERIENCES

SIR,—The following experiences with a home-made five-valve set should be of interest to your readers. The circuit used is quite straightforward—aerial circuit is variometer tuned, two H.F. valves are employed with tuned anode coupling. Two P.A.2 power valves with 200 volts H.T. follow the detector.

Some time ago I remember reading in *Wireless Weekly* an account of some experiments with shrouded transformers showing that the alleged screening effect was not all that was to be expected.

Here is an interesting effect that was observed the other day which reminded me of the article I had previously read.

The writer was giving a demonstration at a club. Not satisfied with the volume obtained and with the hope of making a big noise, a commercial four-valve set was rigged up and a two-valve power amplifier added, followed by a Magnavox Junior. An Amplion loud-speaker was connected to the "phone" terminals of the set so that by means of a switch it was possible to change over to the Magnavox with its power amplifier. In addition to this, there was a switch for connecting the output terminals either after the detector, first L.F. valve or second L.F. valve.

When a station was tuned-in on the Amplion the change-over switch put the Magnavox and amplifier in operation, with the result that a colossal L.F. howl commenced. Cutting out a valve made little difference, and the howl only stopped when the power amplifier followed the detector.

The remarkable thing is this. The Amplion was switched on again following the four-valve set. It happened that the power amplifier was left with the valves alight. Imagine my surprise when listening near the Magnavox to find that it was also reproducing music, the volume being nearly as great as that of the Amplion! This meant that the magnetic coupling between the four-valve set and power amplifier must have been strong, in spite of the fact that the transformers of the amplifier were over a foot away from those of the set, and in addition, were enclosed in steel cases which were "earthed." (In fairness to the transformers, it should be mentioned that the wiring from the set to the amplifier was not carefully carried out.)

Although the transformers in the set are not shrouded and the cores are not "earthed," one would not have thought that two shrouded and "earthed" transformers of excellent manufacture following even one of these and placed over a foot away from it would have picked up sufficient energy to work a loud-speaker at moderate volume!

Trusting that some of these experiences may benefit others. I think that by comparing each

other's observations we can best progress.—Yours faithfully,

A. D. TROUNSON.

Redruth, Cornwall.

BROADCASTING AND ADVERTISING

SIR,—I am afraid that I cannot agree with many points in your editorial in the December 31 issue of *Wireless Weekly*.

With regard to the fact that a newspaper or a large stores may offer to provide a complete evening programme, such offer cannot possibly be classed as advertising by the B.B.C., provided that the names of the firms concerned are not mentioned in front of the microphone.

Personally, I consider this to be one of the finest ways of raising the standard of the B.B.C. programmes in general, which is no doubt what every listener desires.

Let the people providing the programme advertise it to their hearts' content, and then I cannot see any reason for accusing the B.B.C. of breaking its rules and conditions.—Yours faithfully,

EDGAR M. DENT, F.R.C.O.

London.

[Other readers' views are invited.—ED.]

A SINGLE-VALVE RECEIVER FOR BRIGHT OR DULL EMITTER VALVES

SIR,—I am writing to congratulate you on the excellent single valve set which was described by Mr. Stanley G. Rattee in *Wireless Weekly*, Vol. 4, No. 24.

We are situated thirteen miles north of Manchester, and this station is really too loud for the 'phones. Liverpool, Leeds, Bradford, London, Glasgow and Cardiff are the only B.B.C. stations I have yet picked up. I have only had the set one week. Radio-Paris, Brussels, Hamburg and another German station not known have been heard.

I think it is an excellent one-valve receiver, and I strongly recommend it to readers who wish to have a simple valve set.—Yours faithfully,

G. M. WILD.

Rochdale.

NEUTRALISING ACID

SIR,—Your contributor in the December 31 issue gives one the impression that French chalk will effectively neutralise weak sulphuric acid, which is hardly the case.

This substance usually consists of a magnesium silicate, and is nowhere nearly so effective as chalk (carbonate of lime).

After many years' experience of manufacturing sulphuric and other acids on a commercial scale I should for preference use weak ammonia (1 part household ammonia and 3 to 5 parts water) for all such purposes, especially on clothing and carpets.

In case one's hands become covered with sulphuric acid, it is usually best to wash them at once in a copious supply of cold running water and then to wash in weak ammonia or weak washing soda (carbonate of soda) solution. If burns have been received, carefully dry and then put on carron oil or some such remedy.

This applies mostly to fairly concentrated acid; the usual battery acid is easily got rid of by washing the hands in running water and then well lathering with soap, which usually contains sufficient alkali to effectively neutralise the acid.—Yours faithfully,

CHEMRADIO.

Timperley.

We are advised that the Dubilier Condenser Co., Ltd., have now moved to Victoria Road, North Acton, London, W.3.

Apparatus we have tested

Conducted by A. D. COWPER, M.Sc., Staff Editor.

"Klutch" Terminal

Messrs. Henry Joseph & Co., Ltd., have sent for our inspection a sample of an easy-release terminal, the "Klutch." This is a small device of brass that, we understand, can also be obtained with a nickel finish, which holds a telephone tag or connecting wire in a light (but electrically effective) grasp between the cheeks of a spring clip. A slight tug on the wire, such as that made by an absent-minded listener who has forgotten the headphones and their attachments, will release it instantly from the terminal and obviate a disaster. For rapid changes of wiring in experimental work there are also obvious applications.

The device was found to operate as indicated, and gave good, firm connections that could be immediately released, with 'phone-tags of different sizes, spade-terminals, and ordinary connecting wires of fair gauge. The terminal would accommodate more than one 'phone-tag at a time. It can be held by the ordinary type of screw terminal, or secured directly on the panel by a No. 4 B.A. screw.

Edison Swan Headphones

Messrs. the Edison Swan Electric Co., Ltd., have sent for test a pair of their No. WL. 535 type headphones. These are of 4,000 ohms resistance, have double headbands and aluminium-cased receivers and are of light weight. The usual type of swivel-adjustment fitting is provided. A cord of generous length is supplied with the 'phones. On trial, these were found to be far more free from discomfort after lengthy use than is usual with this type of head-band fitting, and the 'phones were of most commendable sensitiveness, a marked improvement in signal strength being noticed in changing over to these from other types repeatedly and alternately when receiving distant stations. The general finish and workmanship were of the highest class.

Combined Valve-Holder and Rheostat for Vertical Panel-Mounting

Home-constructors who favour the compact American type of re-

ceiver with vertical panel and with the valves concealed behind the panel, will find their constructional work much facilitated by a very neat form of combined valve-holder and filament resistance, the "Macitone Valvestat," a sample of which has reached us from H. Clough & Co. (Bacup), Ltd. This device is adapted for installing behind a vertical panel actually by the familiar one-hole fixing method with bush and large back-nut. The moulded former carrying the resistance-spiral (of usual type) has a bracket-extension which provides a valve-socket, in which the valve is inserted vertically and close behind the panel, above the resistance. If placed at the lower edge of the panel the base of the valve would come about 3 in. above the floor of the cabinet. Connection is already made to the one-valve socket for L.T. supply; the other sockets, and the input point to the filament resistance, are equipped with small tinned soldering tags for connections. A neat knob and bevel dial are provided for outside control; a small circular opal window enables the temperature of the filament to be observed.

The filament resistance is of the flat spiral type, and is provided with a spring contact-finger, secured by a substantial set-screw, which on trial gave smooth and silent contact. The resistance was around 7 ohms maximum; positive stops and "off" position are provided. The insulation of the valve-holder on severe D.C. voltage test proved excellent. For those who are interested in compact designs, and who do not mind the task of soldering connections, this instrument can be strongly recommended.

Auxiliary Resistors for D.E. Valves

Lissen, Ltd., have submitted for test samples of their "Lissenstat Resistors" for addition to existing sets and to filament-resistances designed for use with ordinary bright-emitter valves, so as to make them available for use with the extremely low-consumption .06 type of dull-emitter valve.

These resistors consist of a small disc-former, 1-in. diameter, with a bushed centre-hole to fit over the existing L.T. terminal. In the samples submitted the hole was not quite No. 4 B.A. size, so that they required reamering out a trifle to fit on ordinary No. 4 B.A. terminals. A short side-arm carries a small terminal with soldering tag for more permanent connections. On the shank of this terminal is pivoted a contact finger, which makes contact with the turns of a spiral fine-wire resistance wound, in an exceedingly neat manner, as a tiny basket-coil enclosed in the disc-former between insulating cheeks. The resistance can, accordingly, be varied conveniently over the whole range in spite of the small size of the fitting and compact design.

On test, the effective resistance was found to be about the 30 ohms which are required in such a case, and this could be varied at will by means of the contact finger. When installed in addition to the usual 5·7 ohms resistance, the latter acts as a fine adjustment in the most convenient manner.

The little device can certainly be recommended for those who desire to advance to the modern D.E. valve, or who wish to mix their valves on the same multi-valve receiver.

"Ledion" Crystal

Messrs. Ledion, Ltd., have sent for trial a sample of their "Ledion" crystal. This is a bright, coarsely-crystalline galena of fairly uniform appearance, which is not unduly brittle on fracture to obtain fresh surfaces. On trial, it showed the usual proportion of sensitive spots and quantitative rectification powers on a uniform transmission, associated with a good galena. It is packed in small sealed boxes.

Information Department

SUPPLIED BY RADIO PRESS SERVICE DEPT., LTD.

A. F. E. (KINGSTON) wishes to insert a Marconiphone Ideal low-frequency transformer in his receiver, and is somewhat puzzled as to the correct ratio to employ.

The design of this transformer is such that with a general purpose valve the low-ratio type should be used immediately following the detector, this being the one of 2.7 to 1 ratio. We would suggest that for your second low-frequency valve, viz., the one in the anode circuit of which the loud-speaker is connected, you should use a small power valve, and in this case the second low-frequency transformer should be of the higher ratio, the one of intermediate ratio being suitable.

B. M. A. (HULL) submits details of his aerial system, and asks for criticisms, in view of the fact that he is unable to receive stations other than the local relay.

Our correspondent's sketch shows that the end of the aerial from which the down lead is taken is supported by a short pole attached to the gable end of the house, at a height of 29 ft. from the ground, while the free end is taken to the roof of a summer house where it is only 11 ft. from the ground. This is generally regarded as a most inefficient arrangement, and the first step which should be taken is the raising of the free end to a height at least equal to that of the house end.

With regard to the material of which the aerial is constructed, it seems to us that the wire (No. 22. bare copper) is rather on the thin side, and it would be worth while to substitute the conventional 7/22 enamelled copper or phosphor bronze wire.

We observe that our correspondent has only one very small insulator at each end of the aerial, and that these are of some moulded material, whose insulating efficiency may be open to suspicion. We therefore suggest that at least two good porcelain insulators be fitted at each end of the aerial, and that attention should be paid to the leading-in point. It should be remembered in this connection that most insulating materials of the nature

of ebonite are prone to deteriorate when exposed to the atmosphere of a town, and surface leakage of quite a considerable amount will result.

A. J. Q. (KILMACANOGUE) is using a resistance capacity low frequency amplifier and is having considerable difficulty in removing the trouble known as "choking." He finds that if he increases the value of his high tension supply about 50 volts, signals become distorted and the set ultimately chokes up in such a way that signals practically disappear. Upon investigation with a milliammeter in the plate circuit of the valve, he finds that the first symptom is a considerable rise in the plate current upon increase of the high tension value, followed by a fall as the choking cut process takes place.

It appears from our correspondent's letter that he is using Dutch valves of a type which we believe to be the soft rectifying variety, and if this is so, the symptoms which he describes are perfectly natural, and we fear can be removed only by the use of a more suitable type of valve. Such valves are entirely unsuited to resistance capacity amplification.

W. I. R. (CRIGGLESTONE) asks our views regarding the soldering of connections to the ends of grid leaks of the cartridge type.

This certainly does not seem to be a very desirable practice, and we think it should not be done unless it proves impossible to adopt any other method of making connection to the grid leak. No doubt, if a really hot iron is used and the joint very quickly and cleanly made, it is quite possible to make the connection without injury to the grid leak, but unless the constructor possesses a good deal of skill with the soldering iron, this is by no means easy. Any experimenter, therefore, who has not full confidence in his soldering powers should rather use separate pairs of clips mounted directly upon the panel in those cases where he cannot place the grid leak directly in the clips of the condenser. Incidentally, we believe that clips of the type which are fitted to Dubilier condensers can now be obtained separately, and one of these may be used to support one end of the grid leak, the other end being gripped in one of the clips of the grid condenser itself.

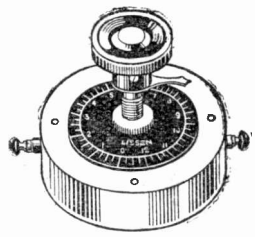
E. T. U. (EASINGWOLD) asks our advice in view of the fact that he has had repeated experiences of the burning out of all three of the valves in his set, although he uses only a 6-volt accumulator and turns the filament rheostat to the minimum position at all times. The valves were ordinary bright emitters of a standard make.

The first step which our correspondent should undoubtedly take is to return the valves to the makers, and ask them whether there is any chance of the valves themselves being defective, and if the answer is in the negative, as we think it will be, in view of the number of failures, attention should be turned to the filament resistances, which may quite possibly be of a pattern which is occasionally met with wherein the resistance element is of so low a value that even when turned to the minimum current position little reduction is produced in the voltage applied to the valve, and consequently if almost the full 6 volts are applied to a 4-volt valve a short life is inevitable.

LISSENIUM

THE CONDENSER AND THE COIL—

This new LISSEN Mark 2 MICA VARIABLE CONDENSER & LISSENAGON (pronounced LIS-SEN-AGON) coils.



two LISSEN things which together make the finest tuning combination there is.

This LISSEN Condenser

with its open scale and delightful tuning characteristics—the condenser which it is safe to prophesy will achieve a great use **because it fills a great need.**

On short wave work, where tuning is so critical, its open scale results in small changes of capacity for a given movement of the pointer. On long wave work you have immediately available with the same knob control the great advantage of being able to put a comparatively high capacity (the condenser is **conservatively** rated at .001 maximum) across the inductance without any H.F. losses through the extra shunted capacity. The inductance is thus made to cover an extremely wide range without any decrease of signal strength.

With ordinary condensers every receiver really needs two condensers—one for short wave work, and one of high capacity for long wave work. This LISSEN condenser performs the functions of both such condensers, and with greater efficiency and convenience. Its open scale and perfect capacity curve make tuning delightfully easy—it tunes along a straight line wavelength curve—it is a low loss condenser — it is dustproof — it will be noiseless for ever — it is immune from stray capacity effect—it can be used for table or panel mounting without alteration— **BUY IT, AND YOU WILL KNOW WHAT A PERFECT CONDENSER IS LIKE.**

17/6

Negligible minimum, maximum rated at ·001. **This LISSEN Condenser gives you every capacity you will ever need —it supersedes all other Condensers—and it is totally unlike them.**

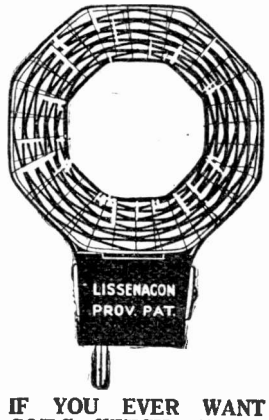
LISSEN ONE HOLE FIXING, OF COURSE.

COILS WHICH OSCILLATE EASILY.—

Some coils have to be kept right close together to get them to oscillate. In that case every movement of one coil detunes the other because of the mutual interaction between coils when they are so close. Some coils cannot be kept far apart because the magnetic linkage is comparatively weak—the magnetic field may be closely concentrated in the centre of the coil, and the field may not extend. In the case of **LISSENAGON** (pronounced **LISSEN-AGON**) coils, however, the magnetic field, in addition to being very strong in the centre of the field, is also distributed on each side of the coil—**the field is strong along the edges.** This accounts for the strong magnetic linkage obtained with **LISSENAGON** coils in reaction circuits, so that the coils can be kept far apart. **LISSENAGON COILS ARE COILS WITH PECULIAR EFFICIENCY.**

LISSENAGON TUNING CHART.
Note the Intermediate Coils 30, 40 and 60.

TABLE I. Wavelength range when used as Primary Coils with standard P.M.G. Aerial and .001 mfd. condenser in parallel.			TABLE II. Wavelength range when used as Secondary Coils with .001 mfd. condenser in parallel.		
No. of Coils.	Minimum Wave-length.	Maximum Wave-length.	Minimum Wave-length.	Maximum Wave-length.	PRICE.
25	185	350	100	325	4/10
30	235	440	130	425	4/10
35	285	530	160	490	4/10
40	360	675	200	635	4/10
50	480	850	250	800	5/-
60	500	950	295	900	5/4
75	600	1,300	360	1,100	5/4
100	820	1,700	500	1,550	6/6
150	965	2,300	700	2,150	7/7
200	1,885	3,200	925	3,000	8/5
250	2,300	3,800	1,100	3,600	8/9
300	2,500	4,600	1,400	4,300	9/2



IF YOU EVER WANT COILS WHICH INTENSIFY TUNING — USE LISSENAGON COILS.

LISSEN LIMITED

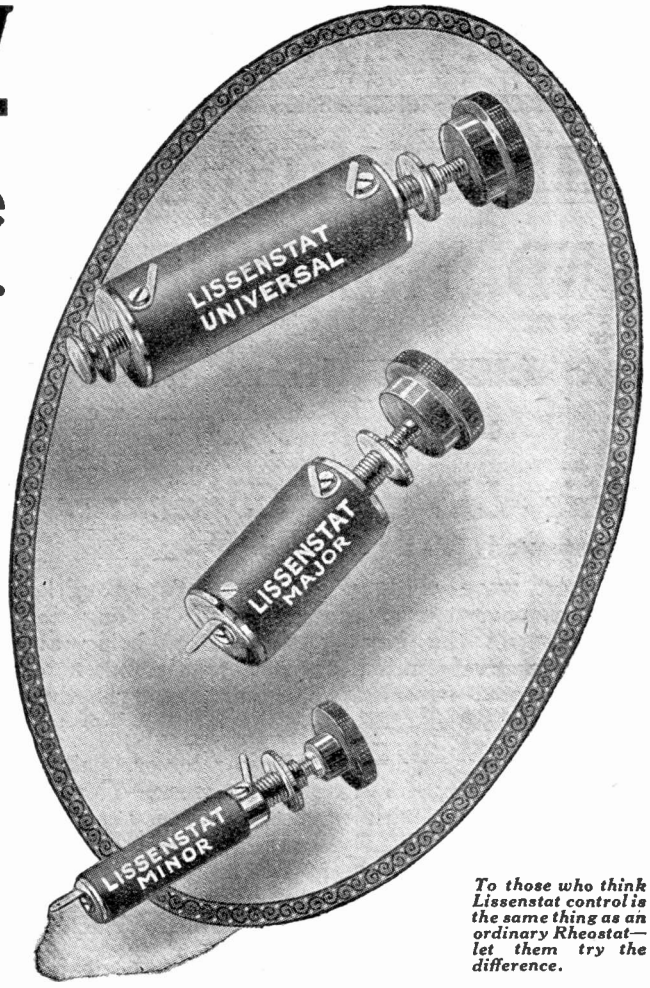
30-32, Woodger Road, Goldhawk Road, LONDON, W.12

DON'T MIX YOUR PARTS—There is a LISSEN Part for every vital place

LISSENIUM

Put a fine edge on your tuning

The advantages of LISSENSTAT control are so great that those who want fine detection and know how to get it will have nothing else but LISSENSTAT control for the filament current of the valve. Not only does it keep valves quiet, pass a steady, unvarying current, remain noiseless from the first turn to the last, but by its critical control of electronic flow it gives the valve a capacity to detect as no other rheostat can. LISSENSTAT control adds range to a receiver because you can feel for the point of critical detection and unerringly find it.



To those who think Lissenstat control is the same thing as an ordinary Rheostat—let them try the difference.

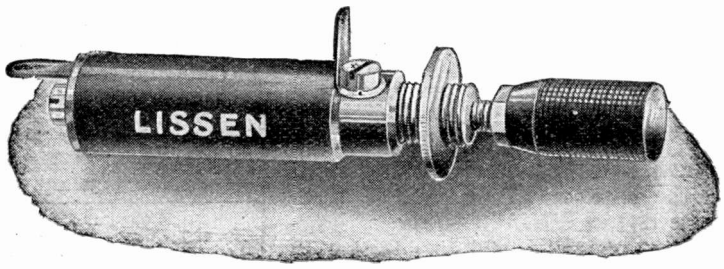
Sold in three models :—

LISSENSTAT MINOR (patents pending) is replacing many thousands of inefficient rheostats—provides **LISSENSTAT** control at a popular price **3/6**

LISSENSTAT MAJOR (patents pending) gives the most acute tuning possible .. **7/6**

LISSENSTAT UNIVERSAL (patents pending) with its protective device for dull emitters **10/6**

Minute Grid Currents



The leak which gives you the necessary control over the minute currents flowing in the grid of your valve is the LISSEN Variable Grid Leak (pats. pending). See that you get the one with the nickel fittings. This is the latest type, and it represents a very high degree of efficiency in the control of grid potential. Its fitting in a receiver is very necessary if the operator is keen on getting that extra sensitivity which results in clear, strong signals when otherwise they would be weak and obscure. Every resistance value required of a leak is covered. **LISSEN ONE-HOLE FIXING, OF COURSE** **2/6**

LISSEN Variable Anode Resistance, 20,000 to 250,000 ohms, same outward appearance as the LISSEN Variable Grid Leak **2/6**

Smooth out your Loud-Speaker distortion by putting the LISSEN Variable Grid Leak across the secondary of the last Transformer, or across the Loud Speaker itself—first position is the better.

LISSEN LIMITED

30-32, Woodger Road, Goldhawk Road, London, W.12

Telephones—Riverside 3380, 3381, 3382, 1072. Telegrams—"Lissenium, London."

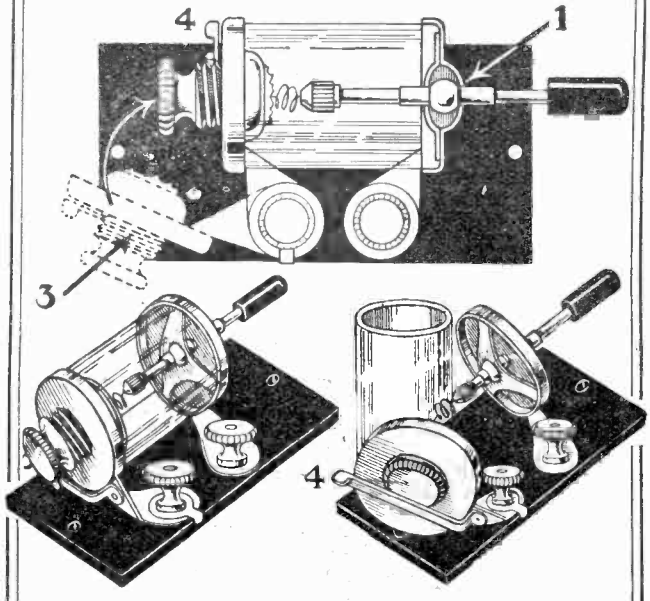
BUILD—WITH YOUR OWN HANDS—WITH ALL LISSEN PARTS.

The Very Latest IN Crystal Detectors

GECOPHONE

(Registered Trade Mark)

PATENT "UNIT" CRYSTAL DETECTOR



Important and Unique Features

(1) The universal ball joint is not dependent upon the usual crude support between the tube and pedestal, but is SELF-CONTAINED in a special spring cage. The detector arm is SELF-CENTERING, having a perfect movement, enabling CONSTANT CONTACT to be maintained. THE CAT'S WHISKER WILL REMAIN IN PERMANENT POSITION AT POINT OF ADJUSTMENT.

(2) The tube housing and pedestal are built in one unit.

(3) The Crystal is BREECH FED, and can be adjusted or replaced from the OUTSIDE of tube by simply removing the screwed plug.

(4) INSTANT ACCESSIBILITY. By merely lifting the small lever the pedestal can be swung clear of the tube—giving instant accessibility to ANY PART, without dismounting or disarranging ANY OTHER part.

PRICES.

Cat. No. **B.C.32.** For Panel Mounting **2/-** each

Cat. No. **B.C.34.** Mounted on Base **2/6** each

NOTE.—Prices do not include Crystal.

"GECOSITE" CRYSTALS for use with above, price 1/3 per piece.

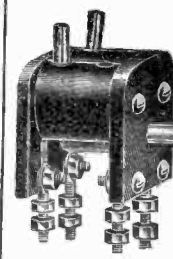
SOLD BY ALL GECOPHONE SERVICE DEPOTS, ELECTRICAL & WIRELESS DEALERS, STORES, ETC.

Wholesale only: The General Electric Co., Ltd.
Head Office: Magnet House, Kingsway, London, W.C.2.

DUCO Regd.

VERNIER COIL HOLDER

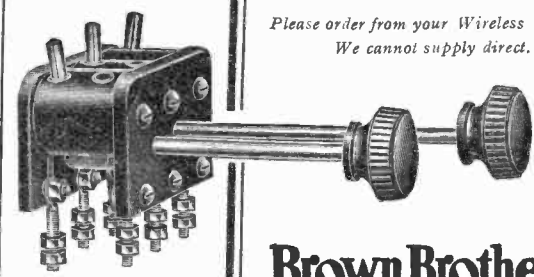
(Prov. Patent.)



No. RC50/4 Two-way each **5/-**

Provides Vernier control of moving member in any position. No backlash. Vernier control is in operation always—throughout the whole range of movement. Connections are enclosed within the holder and led down to the securing screws, thus obviating loose and broken wires. Guarantees tuning of extreme accuracy. Solid ebonite. Heavily plated fittings.

Please order from your Wireless Dealer. We cannot supply direct.



No. RC50/5 Three-way each **7/6**

Brown Brothers Limited

Allied Companies: Thomson & Brown Brothers, Ltd., Brown Brothers (Ireland), Ltd.

Wholesale only: Head Offices and Warehouses:
GREAT EASTERN ST., LONDON, E.C.2
118, George St., Edinburgh, & Branches.

ALL POST FREE AT COMPLETE MARK OF RELIABILITY TRADE ENQUIRIES INVITED. CALLERS' PRICES

Ebonite Panels.

Matt.	3/16
9" × 6"	2/2 1/10
12" × 9"	4/6 3/9
12" × 12"	5/9 5/-
15" × 9"	5/6 4/9
15" × 12"	7/6 5/9
4" × 4"	8d. 6d.
7" × 5"	1/6 1/2
6" × 6" × ¼"	10d.

Any size cut. Sq. in. ¼" 1d., ¼" 1d.

Terminals.

Mill-Pol. Brass	2d.
4 B.A. Standard	1d.
Lacquered	2d.
Spade type, doz.	3d.
Telephone type	1½d.
Multiphone 4w.	9d.
,, 6-way	1/-
Refty spring	3d.
2 B.A. Small	1d.
Contact Studs	½d.
Spring Washers	½d.

Aerial Wire 7/22's

Enamld.	Bright
100'	3/6 2/6
,, Electron	1/8
,, Mars	9/6
Lead-in 4d. yd.	

Insulators.

Shell, 2½" × 2½"	4d.
Reel 1d., Egg	1d.
Crystor type	9d.
,, Lead-in 4"" & 6" do.	4/- 9d.
9" 1/-, 12" & 15"	1/3

Valve Holders.

Type A 7d., Polar	1/3
Screwed 8 nuts	8d.
Ebonite ,,	10d.
Do. Open Type	6d.

Coil Pegs.

Ebonite	10d.
Superior	1/3
Narrow	7d.
Basket	1/-
Moulded type	6d.
Coil Formers	2½d.
Basket type	1½d
Coil Mounts	4d.
'Athol' Ebonite	1/3
Do. Porcelain	1/-

Basket Coil Sets, 6—1/9, 4—1/-.

Iron Core Chokes.
1,000 ohms .. 9d.

Condensers

Dubilier	
Mullard	(Usual
Edison-Bell	prices)
Mansbridge 1 m.f.	1/6
2mf. 1/6, 1/36 mf.	9d

Headphones.

4,000 ohms. Brown's	
'F,' B.T.H., Siemens, Brandes,	Sterling,
Ericsson, all	25/-
General Radio	20/-
Fellowes	18/6
Air weight	10/6
,, Adjustable	12/6

H. T. Batteries.

With Wander Plugs.	
60v. 8/-	36v. 4/10
30v. 4/-	15v. 2/-
4v. F.L. Btry	5d.
66v. Ever-Rdy	13/6
36v. 8/-	16v. 3/6

Siemens same price.

British Wires.

swg.	dcc.	sec.	dsc.
18	1/11	2/11	3/5
20	2/3	3/4	4/2
22	2/6	3/9	4/7
24	2/11	3/10	5/-
26	3/4	4/2	5/9
28	3/9	4/9	6/6
30	4/10	5/4	7/6
32	5/6	6/-	8/9
36	8/-	8/6	12/-
40	17/-	14/8	20/-

Mica .002 Doz.
3"x2", 1/- 2"x 1½" 4d.

Orders 5/6 value, carriage paid. Under 5/6, 2d. per 1 - packing, etc.

Variable Leaks.

Filtron 0-7meg.	3/-
Watmel 0-5 meg.	2/6
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Engraved 3" ..	7d.
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Transformers L.F.

Radio Inst. (new)	25/-
Silvertown ..	21/-
Igranic 21/- &	20/-
Burndept (new)	24/-
Reliability 10/- &	12/6
Ferranti ..	17/6
Xtraordinary	8/-
Tangent 12/6 &	14/6
Royal ..	20/-
R.A.F. Modulation.	
Telephone & 10/1R	
"Unidyne" all	8/-
H.F. Tangent ..	5/6
McMichael's ..	10/-
Oojah 900 ..	5/6
,, 300 m.	4/6
Formers only ..	1/-

Fil. Resistances.

Good quality	1/6
Igranic ..	4/6
Vernier type ..	7/-
Ormond 2/- Ajax	4/-
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Microstat ..	2/6
Peerless Jnr. ..	2/6

Mic-Met-Detector 6/-
Amplion Jnr. .. 27/6

Var. Condensers.

.001 panel type	6/6
.00075 (Knob &	5/9
.0005 dial in-	5/-
.0003 cluded.	4/6
.0002	3/6

Stock "Square-Law," "J.B," "Ormond" & "Utility" usual prices
Vernier, no dial 2/6
5 vane 3/3, 7 3/6
Polar types .. 10/6

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Eureka Transformers	
No. 2 ..	22/6
Concert Grand	30/-
R.I. Chokes ..	10/-
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Bank of 2 ..	1/6
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Tapping Keys	2/-
H'dphone Cords	1/-
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All "Igranic" "Lissen," "Burndept," 'Edison-Bell,' 'Atlas' & "Sterling" Goods.

Coil Holders.

Ashley fixed ..	2/6
,, moving ..	3/6
Igranic 3 Set ..	8/6
Ebonite 3 Coil	3/6
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Single moving	1/7
,, Fixed type	8d.
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Switches, Ebonite

,, Tumbler 1½	1/-
D.C.O. ..	1/6
S.C.O. ..	9d.
Dewar D.C.O.	3/3
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Utility 2-way ..	4/-
3w 5/- 4w 6/- 6w	8/-
Lever Type Stocked	
Miniature Turn	6d.
Lissen 2-way..	2/6
,, Series parl.	3/6
Double-arm do.	2/-

N.P. Switch Sets.
D.C.O., 1/6 S.C.O., 9d

J. H. TAYLOR & CO.
5, Radio House, Macaulay St., Huddersfield
Telephone 341
Telegrams "Thorough," Huddersfield.

INDISPENSABLES TO MAXIMUM RADIO EFFICIENCY

PARAGON CURTIS

GOOD COMPONENTS DESERVE A GOOD PANEL

PARAGON Radio Quality Post Office Specification "The Best Made." **EBONITE PANELS**

Uniform Fine Grain, Dead Matt Finish. GUARANTEED Non-Metallic Surface, free of leakage.

Tested and Recommended by MODERN WIRELESS.

Special panels for Receivers described in this or any previous issue of RADIO PRESS PUBLICATIONS—CUT, EDGES SQUARED and GROUND, ¾d. per square inch. Prices for drilling and engraving upon request.

Home Constructors who wish to be certain of perfect reception should apply for our 16 pages Catalogue of "Essential Raw Materials and Accessories," post free on request.

STANDARD SIZES.

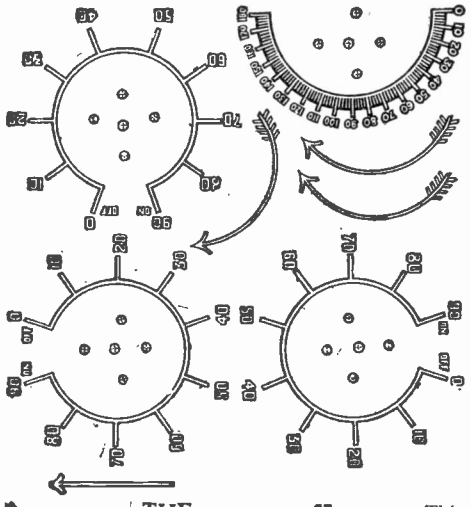
8 ×	6 ×	¼	2/6	24 ×	10 ×	¼	14/6	18 ×	6 ×	¼	6/9
8 ×	6 ×	½	3/3	24 ×	12 ×	¼	17/6	12 ×	8 ×	¼	6/-
10½ ×	8½ ×	¼	5/3	8 ×	5½ ×	¼	2/9	10 ×	8 ×	¼	6/9
12 ×	10 ×	¼	7/3	10½ ×	7 ×	¼	4/7	7 ×	5 ×	¼	2/3
12 ×	12 ×	¼	8/6	12 ×	6 ×	¼	4/6	10 ×	9 ×	¼	5/8
14 ×	12 ×	¼	10/-	22 ×	11 ×	¼	15/3	9 ×	5½ ×	¼	5
16 ×	12 ×	¼	11/6	15 ×	9 ×	¼	9/-	10 ×	5 ×	¼	3
18 ×	12 ×	¼	13/-	12 ×	11 ×	¼	8/3	12½ ×	9½ ×	¼	7/6

PARAGON POLISHED MAHOGANY EBONITE

Is NOT a composition, but GUARANTEED POST OFFICE QUALITY EBONITE, and is of similar specification to the now universally used PARAGON EBONITE.

PANELS CUT to SIZE, Squared, edges ground, 1d. per square inch.

Valves and Coil Holders, Condenser Dials and Knobs, in Polished Mahogany Finish to match.



THE "NU-GRAVING" PANEL MARKING PROCESS.

This name on every envelope is your only guarantee against spurious imitations. Nu-graving is guaranteed for an indefinite period against chipping or cracking.

Series 10. Complete as shown, 6d.

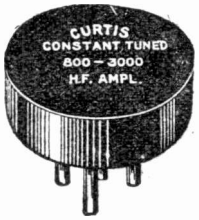
PARAGON-CURTIS ONE-PIECE MICA CONDENSER.

Guaranteed uniform accuracy under all conditions and at all temperatures.

Extract from a recent "Wireless Weekly" Test Report—**"There was observed but a negligible greater high-frequency loss in this type than in a standard air-dielectric condenser . . .** An exceedingly strenuous test was applied to one of the samples, which was actually placed in water nearly at the boiling point for the better part of an hour. After this heroic treatment, the condenser showed a capacity which did not differ materially from that shown before, and it was still possible to get a valve to oscillate readily with this as the main tuning capacity across the grid-tuning inductance."

.0008 to .006, 2/6; Complete with Grid leak Clips, 2/9; Grid leak, 1/6.

CURTIS CONSTANT-TUNED H.F. AMPLIFIER

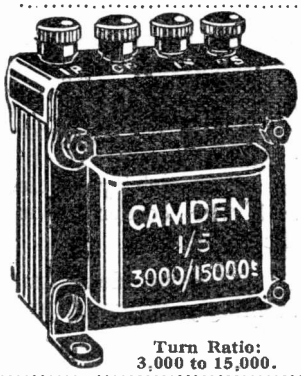


No Tuning Condenser Required.

The Curtis "Constant-Tuned" High-Frequency Amplifier is the only automatic high-frequency amplifier which guarantees high efficiency for two stages of radio amplification on any wave-lengths between 300 and 3,000 metres, and requires no additional controls. For the greater convenience of the constructor and to conform to existing panel designs, the CURTIS CONSTANT-TUNED is designed with the orthodox 4-pin plug for panel mounting and must be connected in accordance with the circuit diagram supplied.

"Using the Curtis Amplifier and the Duodyne Circuit I receive all British Stations with an indoor aerial on a Set made by myself."
J. S.—Tufnell Park.

Model A, 300 to 800 metres, 15/-, postage 6d.
Model B, 800 to 3,000 metres, 17/6, postage 6d.



Turn Ratio: 3,000 to 15,000.

WE HAVE NO HESITATION

in confidently recommending the

CAMDEN INTERVALVE TRANSFORMER

for maximum power amazingly free from distortion. This component carries our full guarantee.

Price - - 12/6

PETER CURTIS LTD.

75 · CAMDEN ROAD · N.W.1.

Telegrams: "PARACURTEX" — 'Phone: NORTH 3112.

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The PARAGON RUBBER MFG. CO. LTD.

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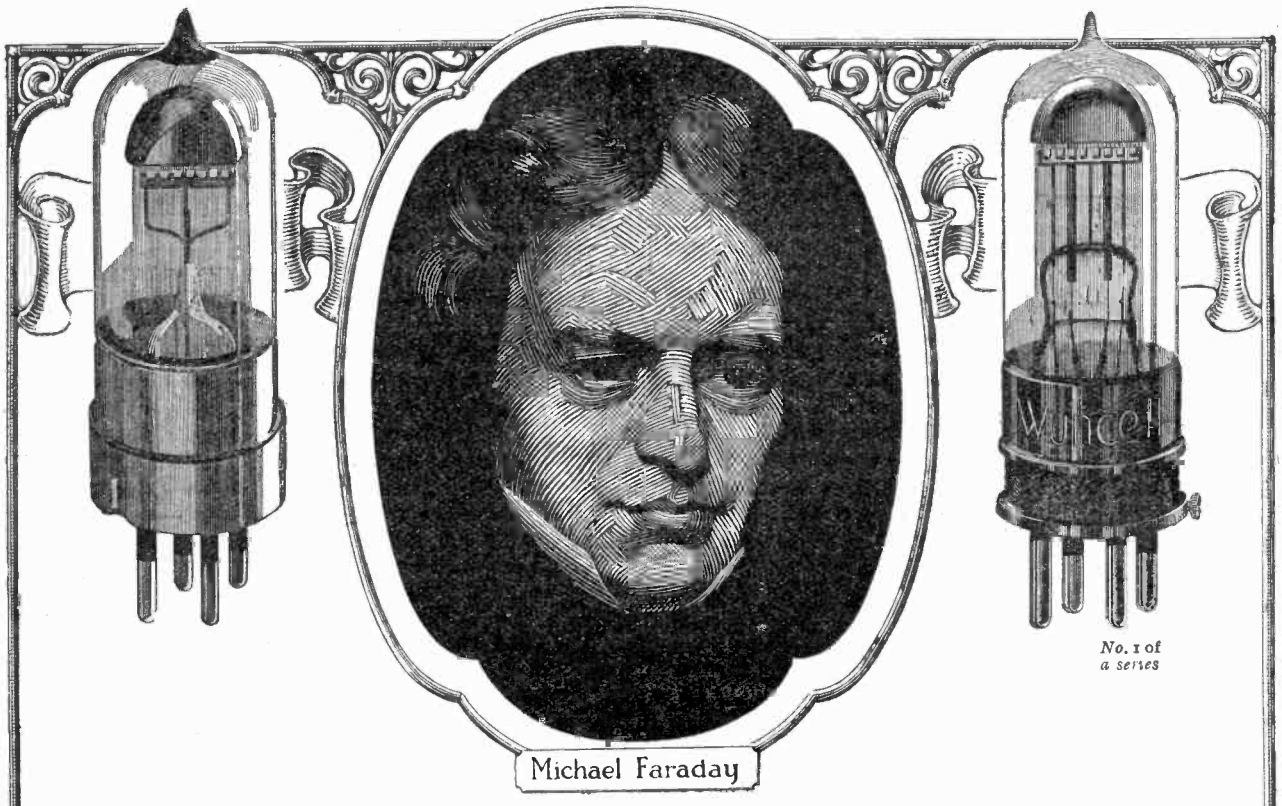


The birth of a great idea.

TO Michael Faraday we owe the discovery of induced currents. From his first simple experiment of winding two lengths of silk-covered wires around a wooden cylinder, and placing in circuit with the one a simple battery and between the ends of the other a galvanometer, has sprung most of the great electrical achievements of to-day.

Without Faraday's masterpiece there could have been no electric motors, generators, or transformers—in fact, the whole structure of electricity is closely interlocked with the corner stone of electro-magnetic induction.

Truly the birth of a great idea from one simple and seemingly insignificant discovery.

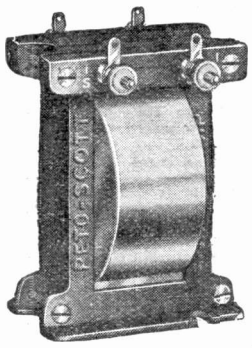
And in its way the invention of the Cossor Valve provides a striking analogy.

Here you see the inventor carefully considering the action of the thermionic valve. How its whole success is bound up in the efficient use of the electron stream given off by the filament. He, too, gets a great idea. If electrical measurements so conclusively prove that losses in electron emission mean losses in signal strength and sensitiveness, then why not re-design the Valve to keep these losses down to a minimum.

And so you see the inventor's dream crystallised into practical reality with the familiar arched filament almost totally surrounded by the hood-shaped anode of the Cossor Valve.

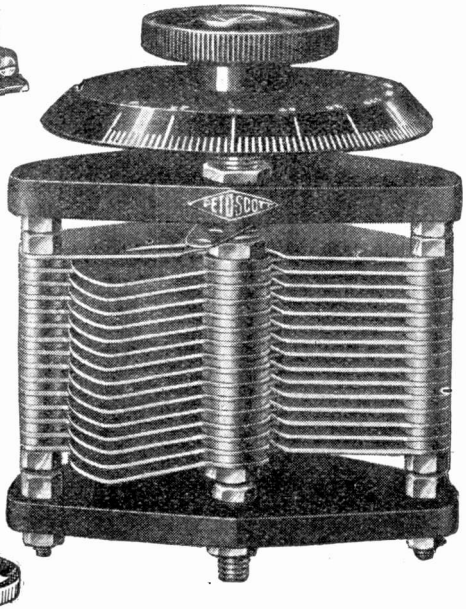
Cossor Valves

Advertisement of A. C. Cossor, Ltd., Highbury Grove, N.5. *Gilbert Ad. 2060*



The new Max-Amp

The wonderful Max-Amp Transformer has recently been redesigned and is now supplied totally enclosed in a stout metal shroud. For high amplification combined with a complete lack of distortion the Max-Amp is unrivalled. Technical readers should note that its primary is wound with silk-covered copper wire—that its laminations are completely insulated and **not** pierced by any bolts—that every Transformer carries a 12-months guarantee—that the price is only ... **19/6**

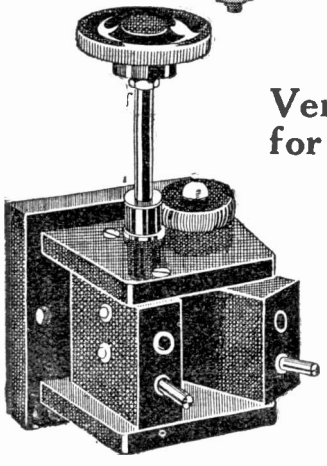


Peto-Scott Square Law Condensers

Solid ebonite end plates. A true straight reading. Two-piece self-centring dial. One-hole fixing to panel.

Prices:

.0001 mfds ..	7/-
.0002 mfds ..	8/6
.0003 mfds ..	10/-
.0005 mfds ..	10/6
.0010 mfds ..	11/6
Dual Condenser (each half .0003 mfds) ..	15/6



Vernier Coil-holders for 2 or 3 Coils

An excellent idea. Each moving coil driven by friction movement. Delicate adjustments easily obtained. Illustration shows only 2-coil holder, but same method is employed in 3-coil holder. Made from solid ebonite beautifully polished.

Prices: .. 2-coil holder .. **10/6**
3-coil holder .. **17/6**

Send 3d. at once for our 48-page illustrated Catalogue, essential to every experimenter, Post free 3d. Peto-Scott's Wireless Book contains over 80 circuit diagrams and much useful information. 1/3 (post free 1/5).

---Red Triangle Ebonite---

As specified by Radio Press and used frequently in "Wireless Weekly," "Modern Wireless," and "Wireless Constructor." Fully guaranteed free from surface leakage. Supplied in 16 stock sizes, ¼ in. thick at ¼d. per square inch, with velvet matt finish and ground edges.

Don't risk using a cheap and unknown ebonite or substitute, but send your order at once for a Red Triangle Panel. Delivery by return.

Special Radio Press sizes:

All Concert de luxe	16 × 8 × ¼"	8/-
Transatlantic V	22 × 11 × ¼"	15/-
All Britain ..	16 × 9 × ¼"	9/-
ST. 100 ..	12½ × 9½ × ¼"	7/-
Harris Crystal Set	9 × 5½ × ¼"	4/4
Puriflex ..	14 × 10½ × ¼"	9/2
Resistoflex ..	12 × 8 × ¼"	6/-
Transatlantic 4	16 × 8 × ¼"	8/-
Anglo-American	36 × 9 × ¼"	20/-

Packing and Postage 6d. per panel extra.

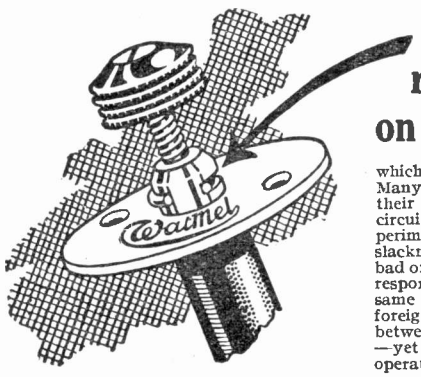
PETO-SCOTT CO. LTD.

Registered Offices:

77, CITY ROAD, E.C. (*For all Mail Orders*).

Branches:—**LONDON: 62, High Holborn, W.C.1; and 230, Wood Street, Walthamstow. CARDIFF: 94, Queen Street. LIVERPOOL: 4, Manchester St. PLYMOUTH: Near Derry's Clock.**

P.S. 2086



It's the refinement on the plunger!

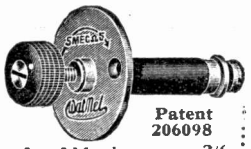
which makes the difference. Many mysterious noises have their origin in the detector circuit. After considerable experiment we discovered that slackness of the plunger causing bad or intermittent contact was responsible for them. This same slackness permitted foreign matter to house itself between the collar and plunger—yet another cause of noisy operation.

The WATMEL therefore is now designed to obviate this trouble. A small but strong spring is recessed through the collar and compresses on to the plunger. This device ensures good contact. Slackness is automatically taken up, and the point of contact is always bright and clean.

The advantages of the Watmel Variable Grid Leak, incorporated in the Detector panel, are already well known. The addition of the compressing spring makes the WATMEL super-excellent for assisting detection.

WatMel

All goods of our manufacture bear this mark. It is your only guarantee.



Patent 206098

5 to 5 Megohms ... 2/6
50,000 to 100,000 Ohms 3/6
Other Resistances to suit any circuit.

Send P.C. for Descriptive Folder. SEE THE TRADE MARK

WatMel

ON EVERY GRID LEAK. BEWARE OF IMITATIONS.

WARNING!

The Watmel Wireless Co. wish to notify the trade and public that their Variable Grid Leak Patent Application No. 206098 was contested in the Comptroller's Court, and on Appeal; in both instances the Patent Grant was upheld and costs awarded.

It is the aim of this Company to protect traders', customers', and also its own interests by securing Patent protection for the novelties in its specialities, as it is these novelties, invented by experts and exhaustively tested, which are the Hall Mark of all Watmel Products.

THE WATMEL WIRELESS CO.

332a, Goswell Road, London, E.C.1.

Telephone - - - - - - - - CLERKENWELL 7990.

AMPLIFY WITHOUT VALVES

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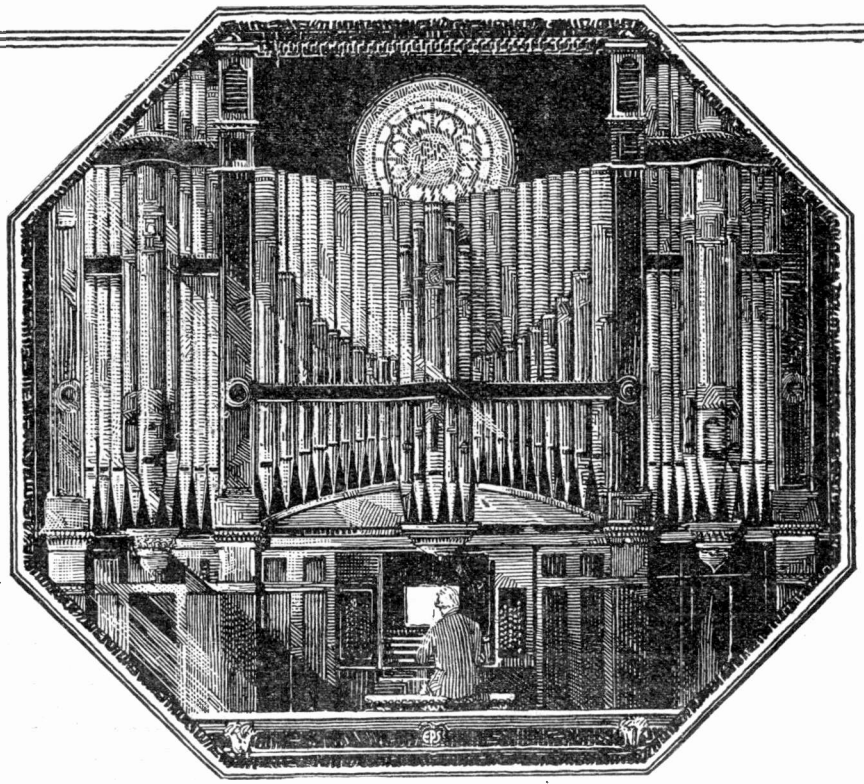
Filament Amps. 0.4
Anode Volts - 40—80



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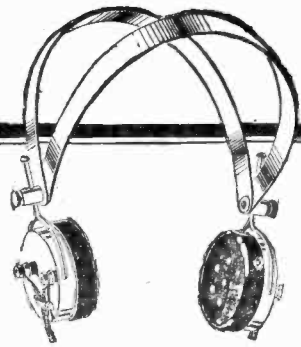

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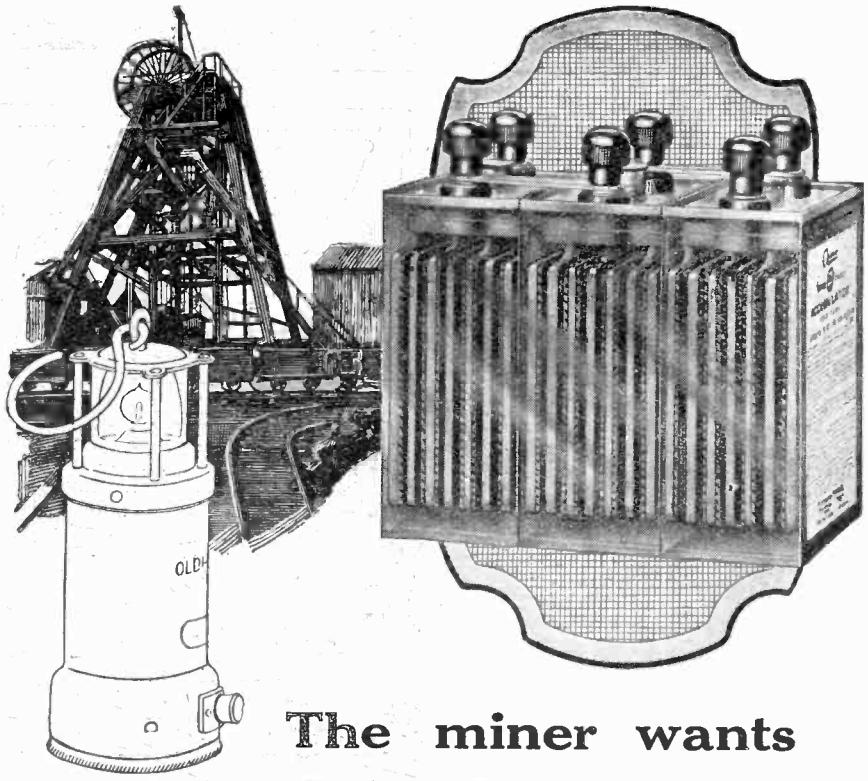

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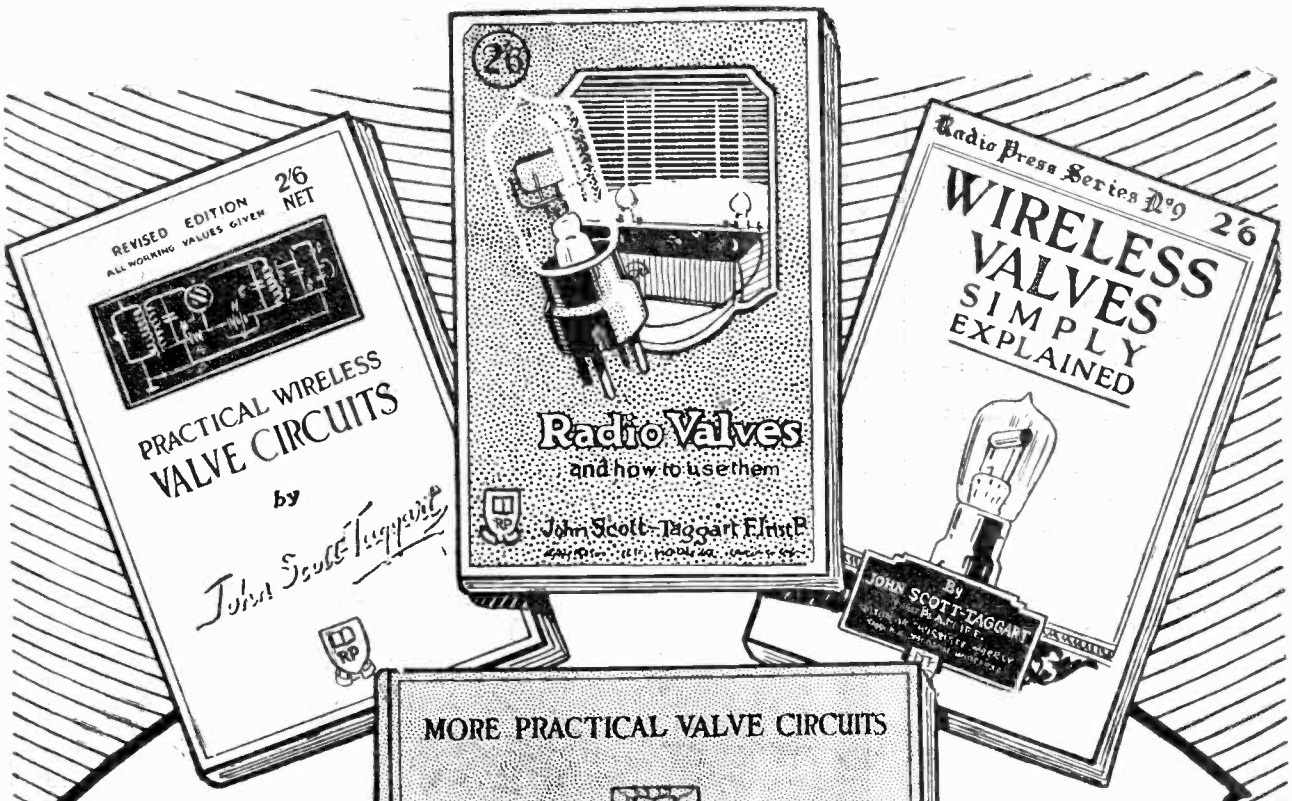

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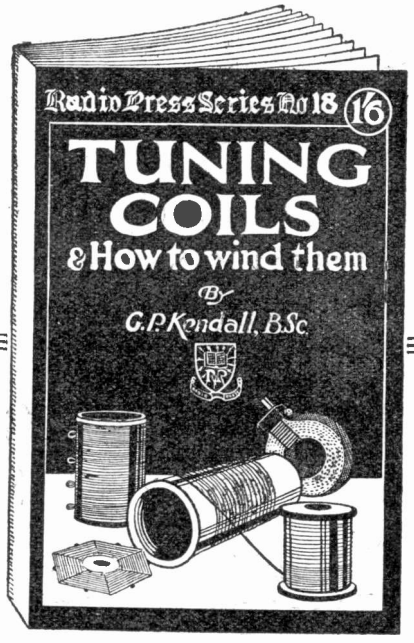

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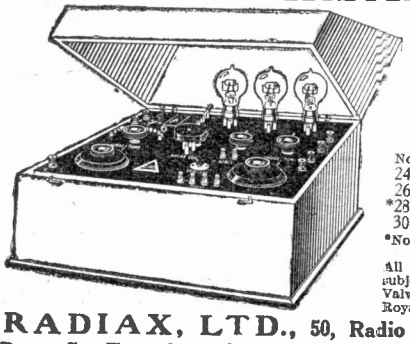

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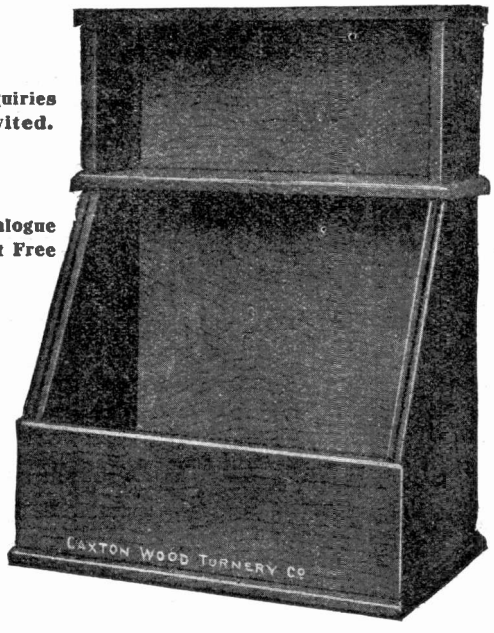

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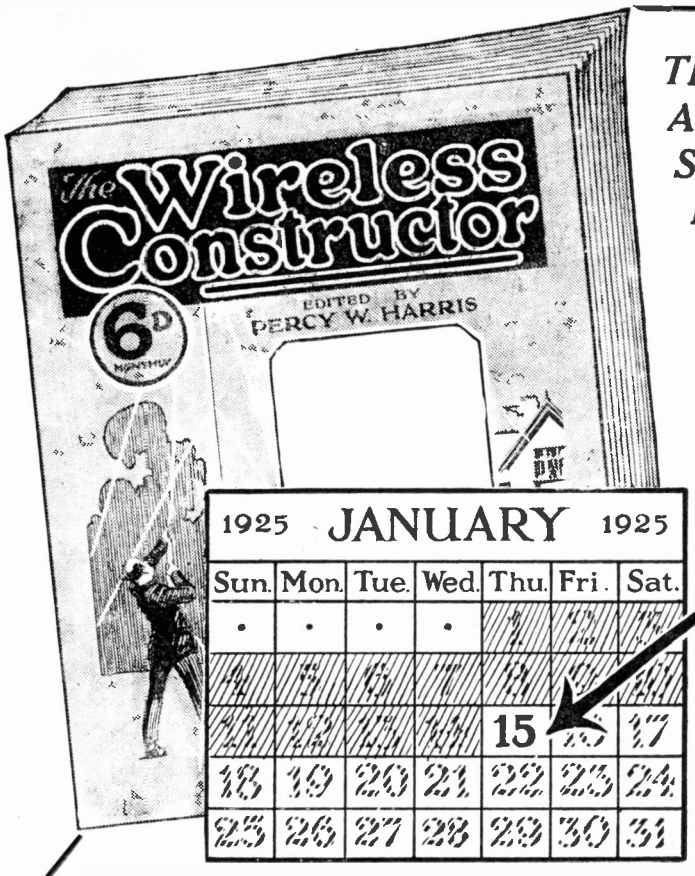

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THE ANGLO-AMERICAN SIX (Contd.).
By Percy W. Harris, Member I.R.E.

HOW TO GET THE BEST OUT OF A CRYSTAL SET.
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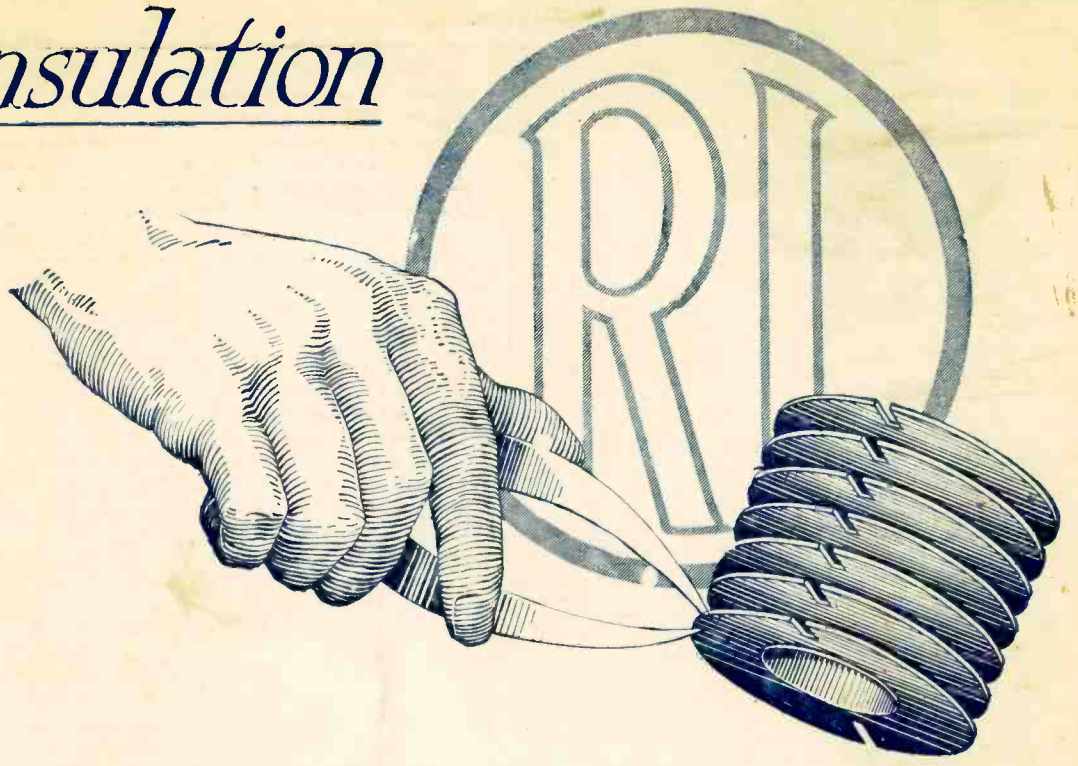

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Wireless Weekly, 6d. Net. Wednesday January 21st, 1925

Wireless Weekly

Vol. 5.
No. 14

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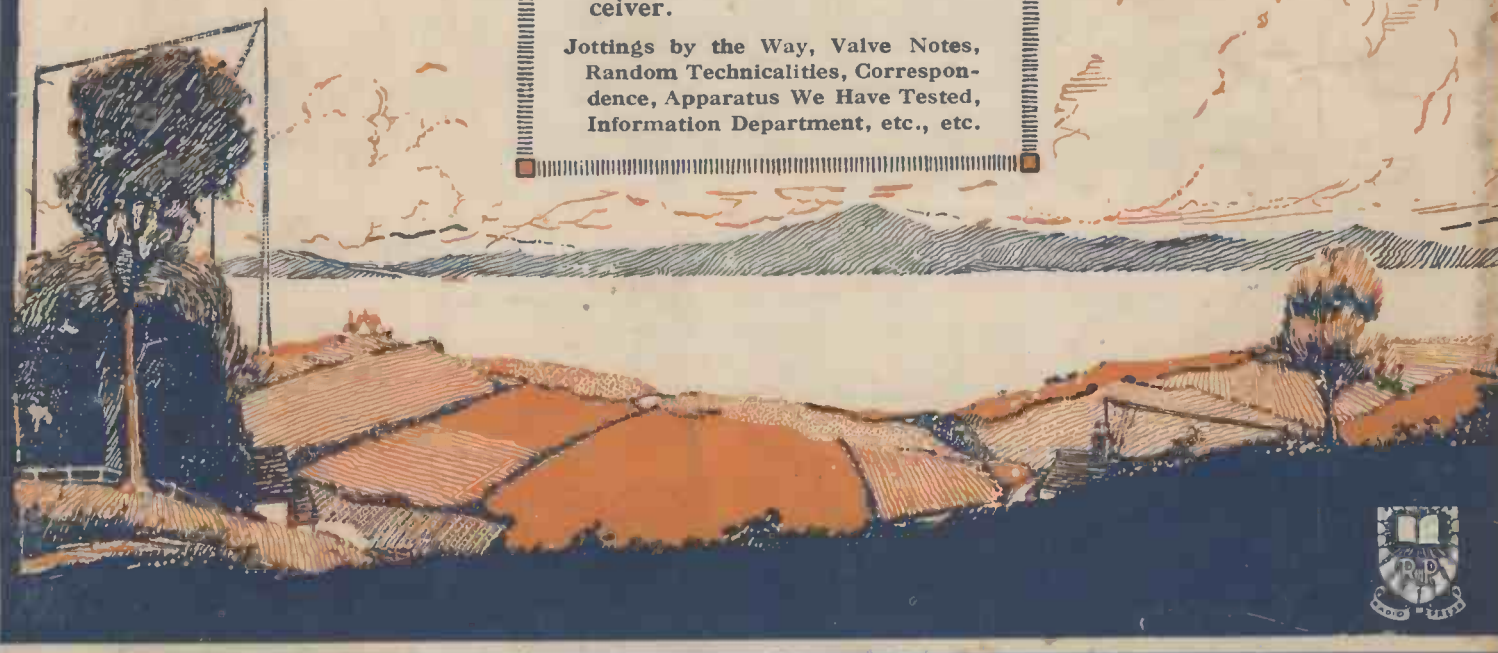

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By G. P. KENDALL, B.Sc.

Make the Ethophone-Duplex your standard of comparison for home-built sets

HOW do you judge your home-built receivers? In order to judge the progress you have made in home-construction; that is, that your latest effort is an improvement on its predecessor, it is essential to have an instrument of known efficiency. For this purpose, an Ethophone-Duplex is most suitable. This five-guinea Burndept receiver works a loud speaker without distortion about 20 to 25 miles from a main station and about 100 miles from the high-power station. When you have completed a new set, you could judge its tone and volume and whether there was any distortion by comparison with the Ethophone-Duplex. The possession of the inexpensive Ethophone-Duplex has a further advantage for the constructor.

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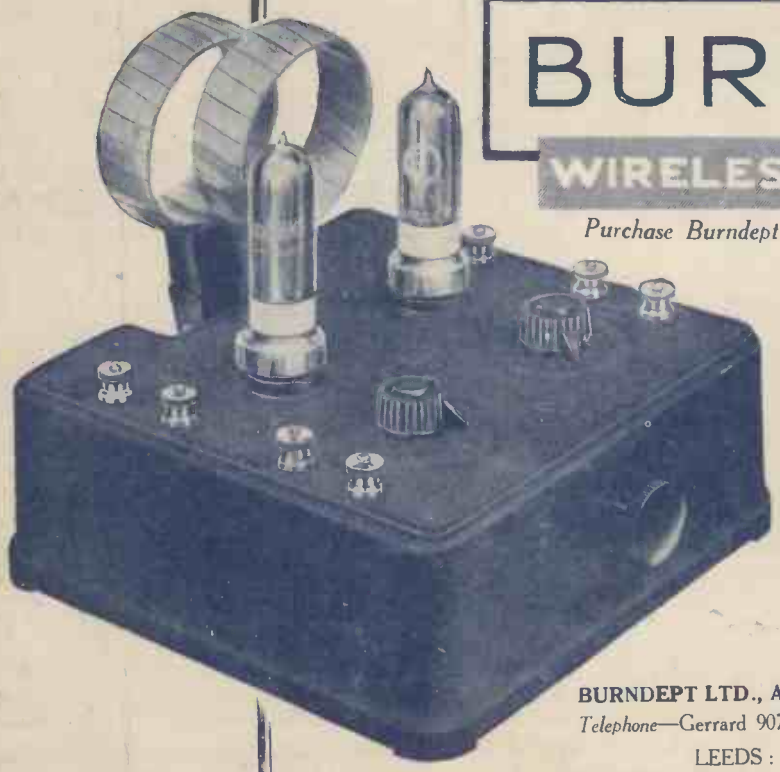

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EDITED BY JOHN SCOTT-TAGGART, F.Inst.P., A.M.I.E.E.

Vol. 5, No. 14 JANUARY 21, 1925. Price 6d. net.

Wireless and the Boy

"WIRELESS," said a schoolmaster recently, "has gripped the imagination of schoolboys to such an extent that they are neglecting their homework and spending every available moment either listening-in or building their own sets."

"Wireless," says another pedant, "is proving of incalculable benefit to the rising generation by transferring their interest from worthless fiction to the wonders of applied science. In building their own sets they are training their hands and eyes; by listening to distant stations they are hearing foreign languages spoken by natives; in hunting for foreign stations on the map they are quickening their interest in geography, while the instruments they make give pleasure to the whole family."

There are thus two sides to the question of the influence of wireless on schoolboys, but every thoughtful observer will agree that the benefits of wireless as a schoolboy hobby far outweigh the disadvantages. It is characteristic of the healthy boy to ride enthusiastically some hobby or other, and we must not forget that in many cases before the advent of broadcasting the hobby was often one of little value to the boy himself or his companions.

It is really surprising how many educational subjects are brought within the range of wireless reception. Take, for instance, geography. Hunting for the main and relay stations and comparing their signal strength with distance fixes indelibly in the mind of the student the relative positions of many great cities and towns in this country.

Seeking out the numerous amateur transmitters he may hear brings to his notice the names and localities of hundreds of smaller towns and villages, while the fascination of long-distance reception stimulates him to make a close study of the geography of the east coast of America. Berlin, Hamburg, Münster, Munich, Prague, Vienna, Madrid, Paris—to him these are no longer mere names. The keen wireless student can tell you just how far they are from London, as well as their general direction and relation to one another.

It is scarcely necessary to mention the many advantages of hearing foreign languages spoken by announcers chosen for their clear articulation. The quite simple valve set, well within the constructional capabilities of the average boy, will make audible on any good evening at least three foreign languages.

Physics is a branch of science which makes little appeal to the average boy, yet, soon after taking up the hobby of wireless he will seek to know more of the fundamental principles of this science. He may even have his interest in chemistry quickened by elementary investigations into the comparative merits of various mineral crystals used as rectifiers. Comparing the various loud-speakers available he will unconsciously train his ear to distinguish the finer tones in musical reproduction, while the inevitable diagram and sketches which accompany every wireless discussion will awake his latent artistic abilities.

Electricity, magnetism, meteorology, chemistry, physics, engineering, music, drawing—is not this a remarkable list to lay before those who take the narrow-minded view that wireless is detrimental to the progress of the modern schoolboy? We doubt whether any other hobby can compare with it for educational value.

CONTENTS

The Nature of High-Frequency Resistance and its Effect in Multi-Layer Coils

By SYLVAN HARRIS.

An article giving the opinion of our contributor on the effects of high-frequency currents on coils of varying types and characteristics, and covering coils of the multi-layer type.

BEFORE going into the subject of this article, it will be well to give an explanation of the whys and wherefores of skin-effect in conductors, such as wire with which the coil is wound, and explain why the skin-

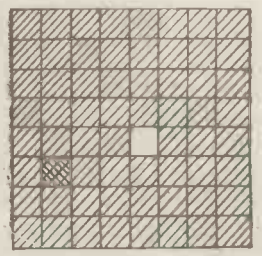


Fig. 1.—Illustrating the distribution of a current in a conductor.

effect raises the apparent resistance of the conductor or coil.

The ordinary resistance of a conductor may be calculated by the formula:

$$r = \rho \frac{l}{a}$$

when the path of the current flow

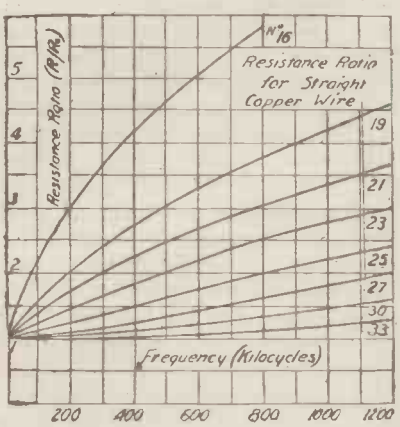


Fig. 2.—Curves showing relation between frequency and resistance ratio for straight copper wires.

is known, and the cross-section of conductor traversed by the current is uniform. Moreover, the *distribution of current* throughout the conductor must be *uniform*, that is, every square inch or square centimetre of the cross-section of the conductor must carry the same amount of current. In this formula, r is the resistance of the conductor, ρ its resistivity or specific resistance, l its length, and a its cross-sectional area at right angles to the direction of flow of the current.

Skin-Effect

If, however, the distribution of current throughout the conductor is *not uniform*, these simple relations do not hold. This can easily be understood from the following discussion. Imagine that a cross-section of conductor, supposed square, is divided into elements of area, and that each filamentary conductor has the same resistance and carries the same fraction of the total current. (Fig. 1.) The equality of the currents in each filamentary conductor is indicated by the equal shading in the small squares of the figure.

Heat Effects

Now imagine that the current in one of the filaments is removed and added to the current in another. The total current in the entire conductor is not altered, but the heat generated in the first-named filament becomes zero, for it now carries no current, and that generated in the second filament becomes *four* times as great. This, because the heat generated is proportional to the *square* of the current. Accordingly the total heat generation is increased, although the total current was not altered. From this it can be seen that any distribution of current in a conductor that is not symmetrical results in a resistance higher than that for a uniformly distributed current.

Current Distribution

The next thing to be considered is: What is it that causes a symmetrical current distribution in a conductor? It occurs only under the action of alternating currents, and becomes appreciable only when the frequency of the current becomes very high, more particularly in the radio frequencies. The current is forced from the centre of the conductor and is

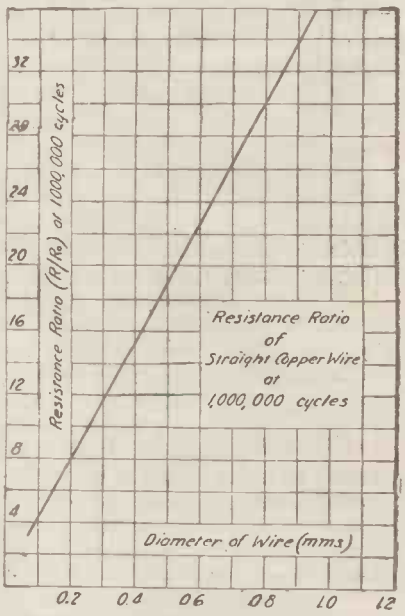


Fig. 3.—Curve of resistance ratios of straight copper wire plotted against diameter.

made to travel near and on the surface. In round wires of ordinary diameter at radio frequencies, the current may penetrate into the body of the conductor only as deep as, say, .001 millimeter.

Magnetic Field

The reason for it is found in the variations of the magnetic field set up by the high-frequency current flowing in the conductor. The interior parts of the wire are

linked by more lines of magnetic flux than are the parts nearer the surface of the wire. Hence the self-induced voltages near the centre of the wire are greater than those near the surface, and are in a direction opposed to the direction of flow of the current. The current, therefore, receives greater opposition near the centre. As a result it creeps toward the surface of the conductor.

Ohmic Resistance

Resistance, as defined above, for the uniformly distributed current is known as the ohmic resistance, which depends only on the nature of the conductor and its dimensions. The *effective* resistance of a conductor, however, may be very different from this value, since it depends upon

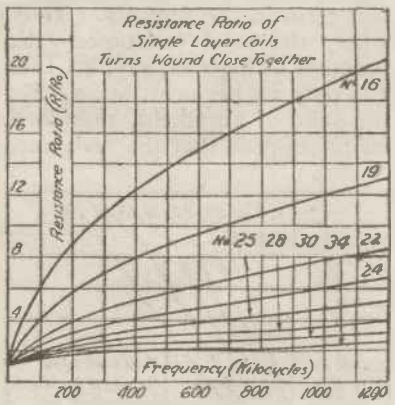


Fig. 4.—Relation of resistance ratio to frequency in single-layer coils.

the amount of heat generated in the conductor. It follows, then, that the effective resistance of a conductor "suffering" from skin-effect may be many times the ohmic resistance, and such is the case. The magnitude of the skin-effect is spoken of as the ratio of the effective resistance at high frequency to the ohmic resistance (at zero frequency), or in symbols, R/R_0.

Skin-Effect

The magnitude of this effect depends mostly on the dimensions of the conductor. Small wires have less skin-effect than large ones, although their ohmic resistance is considerably greater. Skin-effect also exists to a marked degree in flat conductors, such as strips or tapes. There is no doubt that it also exists in condenser plates.

Very exact formulæ are available (Rosa & Grover, Bulletin Bureau of Standards, Vol. 8) for

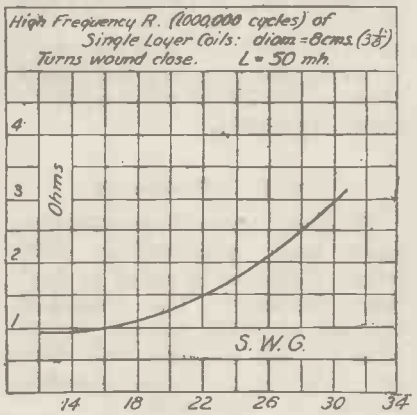


Fig. 5.—Showing the H.F. resistance of coils wound upon the same former with different gauges of wire to produce an inductance of 50 microhenries.

calculating the high-frequency resistance of straight wires, and from these formulæ the curves shown in Fig. 2 were computed.

Resistance Ratio

It is interesting to note that the skin-effect is generally greater for the larger wires than for the smaller. Furthermore, the resistance ratio increases steadily with the frequency. The ratio for very small wires differs little from unity, meaning that their resistances do not change very much with the frequency. This is the reason why very fine wires are used as standards of resistance for high-frequency measurements. The resistance of No. 32

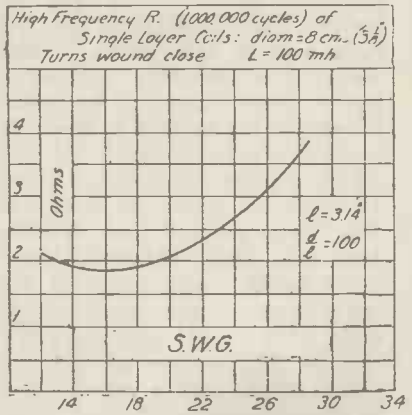


Fig. 6.—Curve produced under the same conditions as in Fig. 5, but using a coil of 100 microhenries.

wire does not change more than about 10 per cent. over a range of 1,000 kilocycles.

High-Frequency Resistance

In determining the actual high-frequency resistance of wires or conductors, all that is necessary is to obtain the D.C. resistance and multiply it by the resistance ratio. Thus, if No. 16 wire has a resistance to direct currents of 2.5 ohms per thousand feet, and (see Fig. 2) its resistance ratio is 6.4 at 1,000 kilocycles (1,000,000 cycles), the resistance of the wire at 1,000,000 cycles will be $2.5 \times 6.4 = 16$ ohms per 1,000 feet. This, of course, is for a straight wire insulated in space, so that there are no losses through insulating materials, and, moreover, is sufficiently removed from other conductors or circuits so that there is no transference of energy

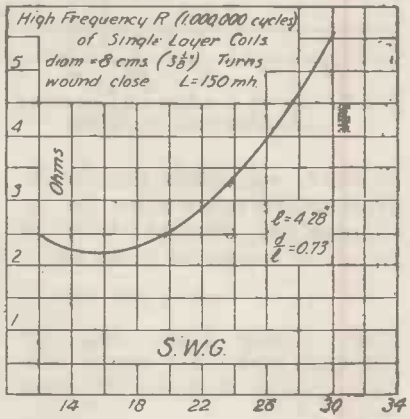


Fig. 7.—Curve using an inductance of 150 microhenries.

from the one to the other through the coupling between them.

It is interesting to note that if the resistance ratios for a given frequency, say, 1,000,000 cycles, be plotted against the wire diameter, we shall obtain a straight line relationship, as shown in Fig. 3.

Straight Wire

This may not be an exact straight line, but it may be considered straight for all practical purposes. Making this assumption it can be shown that the resistance ratio at 1,000,000 cycles is related to the wire diameter by the approximate formula

$$\frac{R}{R_0} = 37.8\ D + 0.3 \text{ (diameter in cms.)}$$

This simple relation can be utilised in obtaining an expression which will give the high-frequency resistance per foot of wire directly at 1,000,000 cycles, by remembering that the D.C. re-

sistance of round wire is inversely proportional to the square of the diameter of the wire. In other words, it can be shown that the D.C. resistance is given by

$$\frac{R_0 = 0.000062}{D^2}$$ ohms per foot.

Multiplying these two relations

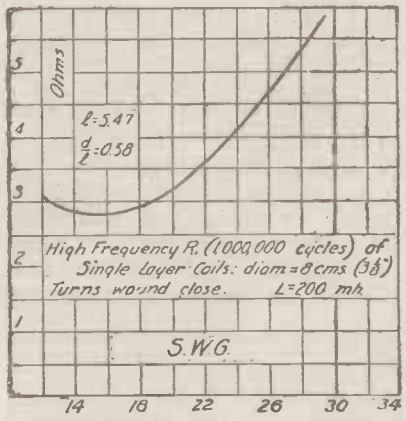


Fig. 7.—Curve produced when using a coil of 200 microhenries.

together, we obtain the simple, approximate relation for the resistance of straight wire at 1,000,000 cycles, as given by

$$\frac{R = 0.00234}{D}$$ ohms per foot.

This relation holds only for 1,000,000 cycles, but similar relations can be obtained for other frequencies.

Frequency Curves

The problem is much more difficult with coils. There is one formula available for computing the resistance ratio of single-layer coils (Bulletin Bureau of Standards, Vol. 4, L. Cohen) which holds over a considerable range of frequencies, and from which the curves shown in Fig. 4 were computed.

Internal Magnetic Field

Comparing these curves with those in Fig. 2, it will be noticed that the resistance ratios are very much higher. This is due to the fact that besides having lines of magnetic flux within the wire itself, forcing the current to the skin of the wire, there is present inside the coil a relatively strong magnetic field which forces the current to use only that part of the skin of the wire which is on the outside of the coil. As a result the skin-effect in coils may be many times that in the ordinary straight wire. These curves are complex and no simple relations can be derived from them as in the case of the straight wires. Hence the effect for every size wire and every condition of frequency must be computed separately.

Low D.C. Resistance

Whereas many experimenters have been constructing coils whose diameter is equal to 2.46 times the length, thus obtaining the lowest direct current resistance for the coil, this ratio does not hold for the high-frequency resistance. The ratio

$$\frac{\text{diameter}}{\text{length}} = 2.46$$

holds only for the D.C. resistance and is seriously affected by the skin-effect (or variation of the resistance with frequency) and the coil capacity.

On Fig. 5 have been marked the values of the above ratio for three coils of the same diameter, but of different inductance. The lowest points of the curves are chosen, viz., at No. 14 wire. These ratios vary from about ½ in the case of the 200-microhenry coil to 1 in the case of the 100-microhenry coil, and is likely to be a little larger for the 50-microhenry coil.

Errors

It is apparent, therefore, that attempting to arrive at the lowest resistance for a coil may result in rather high resistance, if the ratio 2.46 is adhered to. The reader must remember that these figures were arrived at by calculation and are subject to error on account of other losses in the coil which cannot be calculated, as, for instance, insulation losses. It has been pointed out before, however, that although these other losses cause errors in the calculation of the exact resistance, they should not materially change the position of the low points of the curves with respect to the wire size, at least in coils which do not have very great distributed capacity.

Formulæ are not known for computing the skin-effect in multi-layer coils, but we can use the formula for the single-layer coil as the basis of our argument. Let R_0 represent the resistance *per foot* of wire on the coil, and R/R_0 the skin-effect. Then, if **n** represents the number of feet of wire on the coil, and Ra/R represent the effect of coil capacity, the total resistance (apparent) of the coil is

$$n \times R_0 \times \frac{R}{R_0} \times \frac{Ra}{R} = Ra$$

Turns per Inch

The ratio R/R_0, due to the skin-effect is obtained from the curves in Fig. 4, or from

$$\frac{R}{R_0} = 1 + 9.28\ N^2\ d^3\ \sqrt{f}$$

from which the curves have been derived. Now, at radio frequencies, the quantity "one" is relatively small as compared with the last term in the formula. Thus, where the total resistance ratio becomes as high as, say, 40, then 1 is only 2.5 per cent. of 40. For the sake of argument, therefore, let us suppose that the resistance

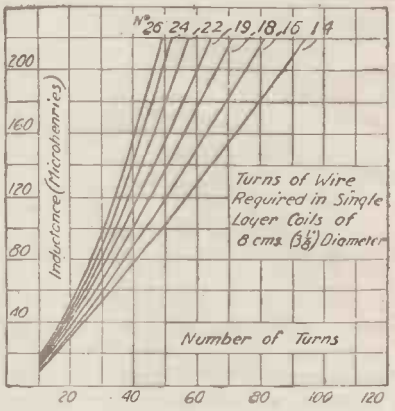


Fig. 8.—Showing number of turns required in single-layer coils of the same diameter to give different values of inductance.

ratio is proportional to the *square* of the number of *turns per inch* in the coil. (In the formula above, N is the number of turns per inch of length of the coil, f is the frequency in kilocycles, and d is the diameter of the wire in inches.)

Let us now consider two coils having the same inductance, but one of these having only a single layer of turns, and the other having two layers, each layer having the same number of turns. Both coils have the same

diameter and are made of the same size wire.

R_o is the same in both coils, since they are wound with the same size of wire. This is the D.C. resistance in *ohms per foot of wire.*

R/R_o has been more than *quadrupled,* since we have doubled the number of turns per

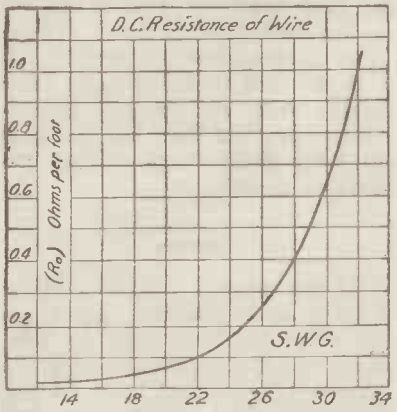


Fig. 9.—The variation of Ro and resistance ratio for single-layer coils.

inch by using two layers of turns, and the ratio is roughly proportional to the square of N.

Ra/R has increased a little, due to the capacity between layers and between turns.

Double-Layer Coils

Although we are not able to calculate the skin-effect in double-layer coils, it is reasonable to believe that since it varies as the square of the turns per inch in the *single-layer coil,* it *cannot vary less than this* in a multi-layer coil. Suppose, for the sake of argument, it does vary as the square of N. According to this, we see from the above that due to the skin-effect the resistance ratio has *at least* been quadrupled, meaning that the total coil resistance has at least been quadrupled if we should have the same length of wire in each coil. Added to this, we have the coil capacity raising the resistance still further.

Length of Coils

The next point to consider is the number of feet of wire in each coil. Fig. 8 shows the number of turns of wire required to give various values of inductance in coils having a diameter of 8 cms. ($3\frac{1}{8}$ inches). From these curves the turns required to give 100 microhenries have been picked off and inserted in the following table. (All the coils considered here are closely wound.)

Wire Size	Turns required in single-layer coil	Turns required in double-layer coil	Per cent. decrease in amount of wire required
14	49	39	20
16	43	34	21
18	39	32	18
19	36	30	17
22	34	29	15

This table shows that, whereas the resistance of the coil has been increased by more than 300 per cent., due to skin-effect, the decrease in resistance due to using less wire is less than 20 per cent. We cannot, therefore, hope to think of a low-loss coil having more than one layer of turns.

Spacing

Spacing the turns of the coil will help matters considerably, but when we do this we are defeating the purpose for which we are using multi-layer coils, that is, to conserve space. If the turns of the double-layer coil, discussed above, are spaced so that the distance between turns is equal to the diameter of the wire and insulation, we shall still have the same number of turns *per inch of coil length* as we had in the single-layer coil. The increase of resistance due to skin-effect, therefore, will be small, if any, but more wire will be needed in the coil to give us the same inductance due to the spacing.

The Resulting Coil

The resulting coil will, therefore, be little shorter than the single-layer coil of the same diameter and wire size closely wound, and its resistance will be somewhat higher. The enormity of the skin-effect can be seen more easily if we consider coils of three or four layers. The resistance of these coils is increased to at least nine and 16 times the resistance of the single-layer coil wound with the same wire and the same spacing between turns.

This great increase in the skin-effect moves the lowest point of the resistance curve of the coil toward the smaller wire sizes.

Increase in Skin-Effect

Fig. 9 shows the variation of R_o and the resistance ratio R/R_o for single-layer coils of the same diameter (8 cms.). Now if, for any reason, as, for instance, by doubling or tripling the number of layers, the skin-effect is increased to four, nine, or 16 times its value for the single-layer coil, the curve R/R_o will become very steep, as indicated by the dotted curve. When these values are multiplied together ($R_o \times \frac{R}{R_o}$) and then multiplied by the number of feet of wire, the resistance curve of the coil (Fig. 5) will become steeper on the left-hand side, and will begin to turn upward sooner. This causes the lowest point to move to the right.

Multi-Layer Coils

It seems, then, from all that has gone before, that in trying to design coils of the lowest resistance possible, multi-layer coils

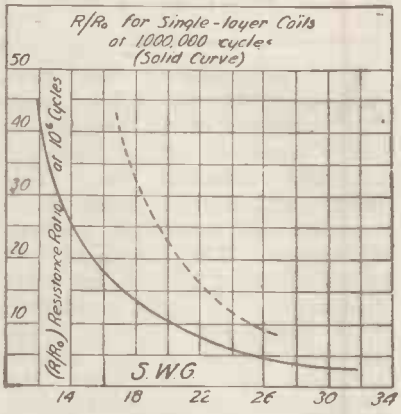


Fig. 10.—Showing the variation in R/Ro for single-layer coils at 1,000,000 cycles.

are out of the question. Much work has been done by many experimenters with multi-layer coils in trying to reduce their distributed capacity, but from what we have learned it seems that this is a small item compared with the skin-effect in coils, or the increase in their resistance with frequency. Even in the case of single-layer coils, writer after writer has advised that the turns be spaced *so as to decrease the distributed capacity* and so lower the coil resistance. It does this undoubtedly, but since the coil

capacity in the single-layer coil was very small in the beginning, we have not gained much by reducing the capacity. What has happened is that we have decreased the skin-effect *enormously* by spacing the turns, and have so lowered the resistance considerably. The attention of designers, therefore, should be directed more toward reducing the skin-effect by a proper choice of wire size and spacing in coils. This is an old story, but is not generally known to designers, judging from the resistances of many of the so-called low-loss coils on the market.

Since multi-layer coils are out of the question in considering coils of low resistance, we will consider only those types which are in effect single-layer coils. This also puts out of the question the spider-web type of coil, which is in effect a multi-layer coil, having only one turn to the layer. These turns are bent out of the circular shape, so that the coil may be wound around a group of pins arranged radially about a central supporting core.

The number of turns per inch of coil length in this type of coil is very great, since the coil is only one turn long, without considering the bends in the wire. Furthermore, since the turns near the middle, having a small diameter, contribute little to the inductance of the coil, the amount of wire used on this coil must be large compared with the ordinary single-layer coil. It is, therefore, an unfavourable arrangement, as far as concerns resistance, and it is probable that we would have to sacrifice too much in efficiency in using this coil for the saving in space that is effected.

All of the various types of coils can be analysed in this way, and it should not be a difficult problem for the designer to build a coil of low resistance or the purchaser to make the proper judgment in buying a low-loss coil.

Watch Your Workshop Tools

AT this time of the year, when the air is filled with moisture, tools are apt to suffer seriously unless they are carefully attended to. This refers particularly to those which are left in unheated outdoor workshops. The effects of rust on certain kind of tools are most destructive. A finely graduated steel ruler, for example, soon becomes almost useless if it is attacked by rust, since the graduations are rendered nearly illegible. Chisels, files, saws, drills and other cutting tools also suffer badly, the effects of rust being to blunt their edges and to ruin their efficiency.

Walls of the Workshop

Many constructors make a habit of hanging a great many of their tools on the walls of the workshop, using either nails or strips of leather for the purpose. If this is done they must be carefully looked over from time to time, for though the visible surface of a tool so housed may not be attacked, that which is against the wall may rust badly, and if the tool is not used for some time the damage may go on unsuspected.

Rust

The greatest preventative of rust is grease. An oily rag should be kept on the workshop bench, and each tool should be given a rub over with it whenever it is put away after use. This is not to say that tools should be kept always in a messy condition which makes them unpleasant to use. The thinnest film of oil is quite sufficient to safeguard them from the attacks of rust provided that it is renewed from time to time. Those who possess outdoor workshops will do well to bring their finer tools, such as gauges, micrometers and the like, indoors, and to keep them there during the damper months.

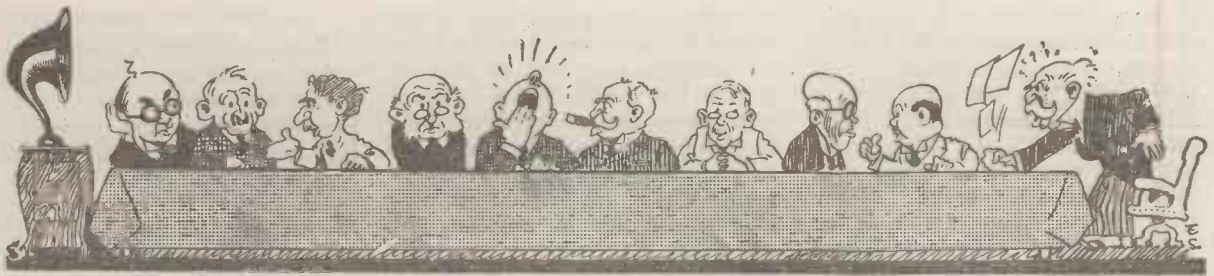
Lathes

If you possess a bench drill or a lathe never omit to cover them up when they are not in use. Keep all gears and running parts thoroughly greased, and do not forget to wipe over the lathe bed or the drill table frequently with an oily rag. It is a very good thing in the case of an outdoor workshop to dry it out thoroughly at frequent intervals by keeping a small oil stove burning for some hours. This prevents the walls from becoming saturated with moisture, as might otherwise be the case.

R. W. H.

BROADCASTING PLAYS

Our photograph shows Mr. Donald Calthrop, manager of the Kingsway Theatre, London, whence extracts of the revue "Yoicks" were broadcast recently.



JOTTINGS BY THE WAY

By Wireless Wayfarer

Bright Ideas

"THIS," said Poddleby, glancing up from the paper that he was reading as he sat in my study, "this is the age of really bright ideas. I find one described here which will make even you, Wayfarer, smile a little." I was too languid to arise and administer to Poddleby the chastisement for which he appeared to be asking, for during the previous four days I had been drenched to the skin in a thunderstorm, half blinded by lightning, reduced to a pulp by torrents of rain, frozen until I had chilblains on every finger, and tanned by the sun until I narrowly missed sunstroke. I am speaking, of course, of the seasonable weather which we have enjoyed during the past weeks. Instead, therefore, of beating him about the head with the coal shovel, I simply looked up and said, "Oh, really!" "Yes," said Poddleby, "Would you believe it, here's a fellow who has got a really brilliant inspiration about reflexes.

A Sign of the Times

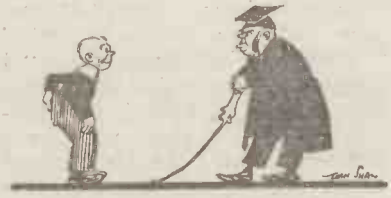
"He has a two-valver, and he finds that he gets far better results by replacing the first with two valves in parallel." "But," said I, "I have always understood that the whole idea of reflex sets was that with it you made one valve do the work of two." "I thought," remarked Poddleby, "that even you would see it. There seems to me to be something rather noble in making two valves do the work of two." "Perhaps," I said, "it is merely a sign of the times in which we live. Somebody has formed a trades union for valves and has started a movement for less work and more volts." "That brings me," Poddleby went on, "to something that I want to talk to you about. Have you ever heard of the super-heterodyne?" "Of course," I replied brightly, "Who has not? You mean the thing which uses thingamejigs and thingmebobs to avoid the whatyoumaycallit effect." Poddleby stated emphatically that my

Drenched to the skin in a thunderstorm

lucid explanation showed that I was thinking of quite a different circuit, and proceeded to describe to me in his own masterly fashion precisely what the super-heterodyne is, and what it does, and how and why.

Poddleby on the Super-Heterodyne

As you, reader, are no doubt seeking for information on the subject, having been like myself too indolent to read the numerous



Inserts corrugated paper before interviewing the headmaster

explanatory articles which have been laid before you, I will do my best to make things perfectly plain by recording what Poddleby told me. The super-heterodyne, it appears, gets its name from the fact that it was born in the States where everything wireless begins with "super" and ends with "dyne." The name is one of those blissful compounds of Greek and Latin words with which we are all familiar nowadays. "Super" means above, "hetero" means other, and "dyne" means power. Other authorities maintain that the component words should be divided into "super," "heter," and "odyne," in which case the first two have the significations already recorded, and "odyne" means a pain under the waistcoat. Super-heterodyne, therefore, means either "above other power" or "above other pains."

Take your choice

You must take your choice. The whole essence of the super-heterodyne system is that you must use lots and lots and lots of valves. For this reason it is heartily endorsed by valve manufacturers, ebonite makers, accumulator merchants, wire-drawers, transformer winders and other disinterested folk all over the civilised world. No self-respecting super-heterodyne set can be less than one yard in length; nor should it contain a smaller number of valves than ten. On this account it makes a very special appeal to the real wireless enthusiast who has found his style rather cramped by the fact that he could not go beyond the five or six-valver, and that any silly ass could make as big a set as his own. The super-heterodyne opens up almost a new world, for there is no need to stop at ten valves; you can make it a round dozen or almost as many more as you like.

How it Works

The working of the super-heterodyne set is perfectly simple. In the ordinary set containing two stages of high-frequency amplification you take such oscillations as your aerial condescends to bring in, and apply

them to the long-suffering grid of a high-frequency valve. Owing to the enormous rate at which they smite him the grid resents this and communicates its displeasure to the plate. Would you not howl if you were smacked a million times a second? How then can you blame the valve for doing the same kind of thing?

Preventing Howling

The only way of preventing howling in this kind of set is to supply a large amount of damping, just as the schoolboy does when he inserts corrugated paper before interviewing the headmaster. Like the corrugated paper, the damping has the effect of deadening the blows and so reducing the howling; but the result is that neither the beating nor the oscillations do their work properly. In the super-heterodyne set you take your high-frequency valves and, metaphorically of course, fling them

Small street urchins who put their fingers to their noses.

into the dustbin. To the aerial circuit you apply the rectifier unpadded with any kind of damping. So far so good.

Treating them Gently

And what of the output of this valve? Are we to reduce it immediately to sounds that the ear can hear? No, a thousand times No. That would spoil the whole idea. Instead (this is where the hetero comes in), we make use of a separate oscillating valve and with its help produce a beat.

Speed Adjustment

Over the oscillating valve Poddleby became rather involved, but I gather that it is rather like holding a bunch of carrots in front of a hungry donkey. The greater the moke's appetite and the larger the bunch, the higher will be its rate of progression. By suitable adjustment you can obtain any speed you like. You apply the oscillations so obtained to your rectifier valve, but adjust them so that a beat is obtained at round about 4,000 metres. As might be expected, it is the little wavelengths that howl at you. Is it not the small street urchins who place their fingers to their noses or make insulting remarks as you pass? The long, fat aldermanic waves are far too respectable to indulge in anything so puerile as howling, and one can amplify and amplify them again without their protesting in the least, and in the super-heterodyne you proceed to do so to the tune of three, four or five stages. Do not be afraid. They are guaranteed not to bite.

And So On, and So On

Having made these nice, tame oscillations as fat as can be desired, you rectify them once more with the help of yet another valve, so as to make them still tamer. You can then pass them through stage after stage of common or garden low-frequency amplification until you have all the noise that even you, reader, can desire. Such in a word is the super-heterodyne principle as I understand it from Poddleby, and as you, I hope, understand it from me. If you do, well and good; if not, I can only say that I am sorry, though I trust that your friends will not insult you as Snaggsby insulted me the other day. He came into my house looking rather excited, and said, "Look here, Wayfarer, I stood up for you at the club tonight with Gubbsworthy and Bumpleby Brown. They were maintaining that you had not the brains of a bluebottle." "Did you, Snaggsby," I cried, seizing his hand, "I thank you a thousand times. But tell me, how did you refute them?" "Well," cried Snaggsby, "I simply told them that they were liars. I said that you had." Anyhow, I hope that you have followed without the use of a wet towel round your head or the shedding of tears of anguish, the simple account of the super-heterodyne that I have given you.

Everybody's Doing It

But I have news to break to you, which is that Poddleby is at present engaged in the construction of a twelve-valve super-heterodyne set. He has asked me to give him my help in making it, and I foresee that I am in for rather a sticky time.

No more borrowed valves

Time was when I could borrow valves at will from Poddleby, but I fear that now he will want all his own back, and probably a few besides. Regretfully I have resigned Poddleby's invitation to assist him in the construction of his set, for the fact is that Professor Goop and I are engaged in the construction of a Hyper-superheterautodyne receiver which is intended to deal much more kindly with oscillations than the rather crude things which are being made up in thousands nowadays. In these, you let waves down in two successive bumps from high frequency to medium frequency and thence to audio frequency. In our circuit the process is far more gradual, and we find that waves treated in this kindly fashion show their appreciation and their gratitude by becoming so tame that they will eat out of your hand and

The Goop-Wayfarer Hypersuper-heterautodyne . . .

will do anything that you like to ask of them. The Goop-Wayfarer Hypersuperheterautodyne demands the use of at least nineteen valves; but this is all to the good, for the proud possessor of such a set can always hold his head high amongst the mob, and need fear no competition from wireless men of lesser calibre.

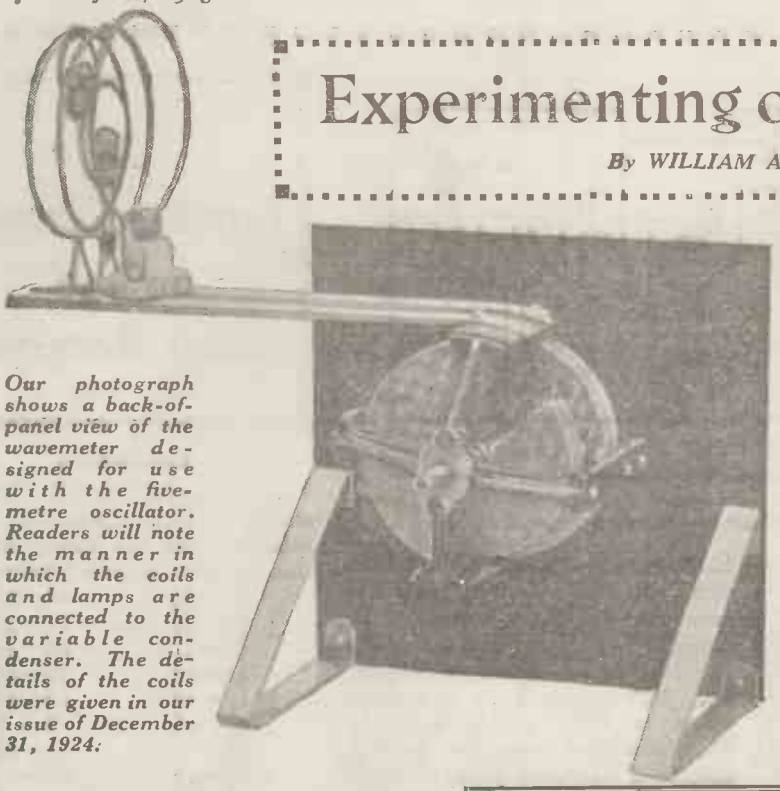
WIRELESS WAYFARER.

Experimenting on Five Metres

By WILLIAM A. BRUNO.

In our last issue we gave constructional details of how to build a transmitter which may be used for experimenting on a wavelength of five metres.

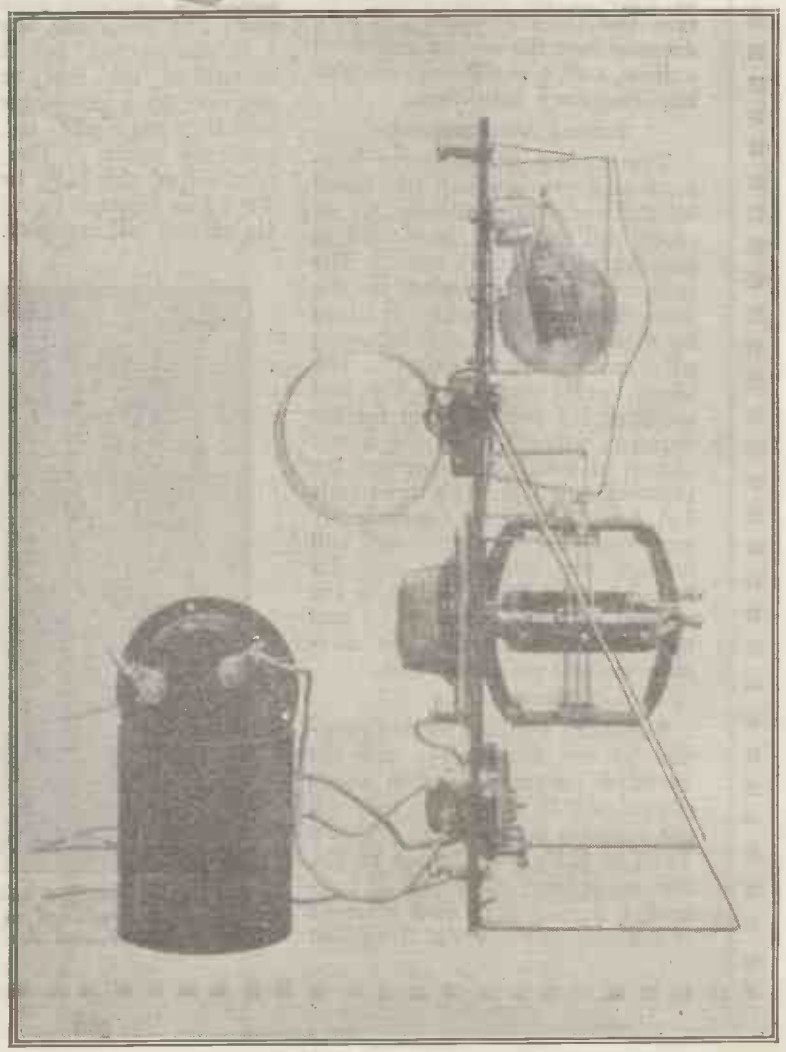
The photographs reproduced below show the wavemeter and how to mount the coils, the complete transmitter back-of-panel wiring and other details as indicated.



Our photograph shows a back-of-panel view of the wavemeter designed for use with the five-metre oscillator. Readers will note the manner in which the coils and lamps are connected to the variable condenser. The details of the coils were given in our issue of December 31, 1924.

A side photograph of the panel, with milliammeter, supported by an ebonite tube for purposes of insulation. Readers should take careful note of how the valve is connected, the pins having been removed.

This photograph shows a rear view of the panel indicating the positions of the various components. The small radio chokes seen to the left and right of the valve should be noted; the absence of valve legs will also be observed.



A Further Circuit on the Omni Receiver

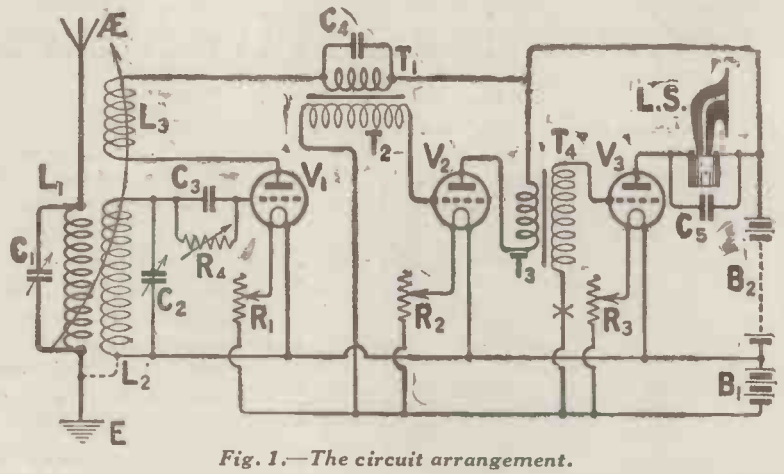


Fig. 1.—The circuit arrangement.

A LOOSE-COUPLED single-valve set, with well-controlled reaction, is, under good conditions, a very useful receiver, and if a two-valve L.F. amplifier is added much useful work may be done with this combination. Such a circuit is shown in Fig. 1, in which it will be seen that the first valve acts as a detector and the second and third valves are transformer coupled low-frequency amplifiers.

Tuning Arrangements

The tuning arrangement consists of a primary coil L1, tuned by the variable condenser C1 of .0005 μF capacity, connected in parallel with the coil. The primary L1 is coupled to the secondary coil L2, which is tuned by a condenser C2, also of .0005 μF maximum capacity. The usual grid condenser C3 and gridleak R4 are provided for the detector valve V1, in the anode circuit of which is connected the reaction coil L3. The three coils L1, L2, L3 may be conveniently arranged in a three-way coil holder, the secondary coil L2 being in the fixed socket in the centre, with the primary L1 and the reaction coil L3 in the movable sockets on either side.

Rectification

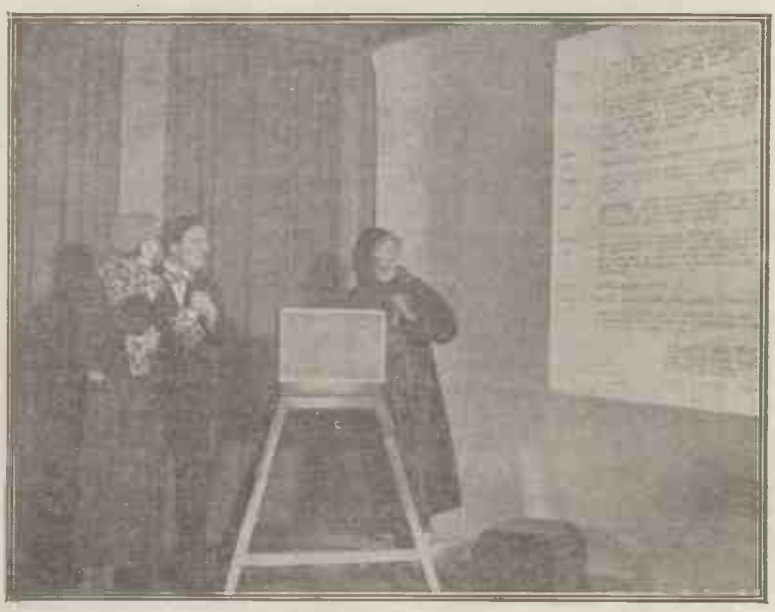
Incoming oscillations are rectified by the first valve, and the rectified currents in the anode circuit of this valve pass through the reaction coil and the primary T1 of an L.F. transformer T1 T2, the secondary of which is connected across grid and filament of the second valve V2. Amplified L.F. currents appear in the anode circuit of V2, which contains the primary T3 of a second L.F. transformer T3 T4, the secondary of which is connected across grid and filament of V3. A second stage of L.F. amplification is thus provided, and the further amplified currents pass through and operate the loud-speaker L.S. connected in the anode circuit of the last valve, and shunted by a condenser C6, for which .002 μF is a good general value. The primary winding of the L.F. transformer T1 T2 is shunted by a condenser C4 of .001 μF capacity.

Connections

This useful circuit may be readily wired upon the Omni receiver, and the wiring key for this purpose is given below:—

51—33	22—15
33—34	21—37
42—41	22—38
41—52	30—14
17—18	29—48
25—26	6— 7
18—19	15—23
27—12	23—24
19—35	32—40
27—43	31— 8
26—40	23—39
4— 1	31—47
9—21	56—16
	55—48

When the connections have been made according to the wiring key, and also the aerial,



The new method adopted in the production of plays at 2LO. The script is projected on to a screen, thus eliminating the rustling of paper, and also permitting the artists to raise their heads.

The merits of loose-coupled tuning will be appreciated by those users of the Omni who suffer from interference

earth and battery connections made, the set may be tried out. Suitable coil values are No. 35 or 50 as the primary or aerial coil, No. 50 or 75 in the secondary, and No. 50 for reaction. To cover the higher broadcast wave-band up to 500 metres, No. 50 should be used in the aerial, No. 75 as secondary and No. 50 for reaction. For 5XX a No. 150 should be used in the primary, with a No. 250 as secondary coil, and a No. 200 for reaction.

Coupling

First keep the primary and secondary coils fairly tightly coupled, and with the reaction coil kept well away from the secondary, tune in the local or nearest broadcasting station by varying the condensers C1 and C2. When signals have been tuned for maximum strength slowly bring up the reaction coil towards the secondary, retuning slightly on C2, to see if a correct reaction effect is being obtained. If not, try reversing the leads to the reaction coil by changing connections 4—1 and 9—21 to 4—9 and 21—1.

By loosening the coupling between primary and secondary coils, and the judicious use of reaction, very good selectivity may be obtained. The effect of making the connection 41—25 (shown dotted in the circuit diagram of Fig. 1) should be tried, while it will probably be found an advantage to use negative bias on the grid of the last note-magnifying valve by breaking the connections 55—48 and inserting grid cells at the point marked X on the circuit diagram.

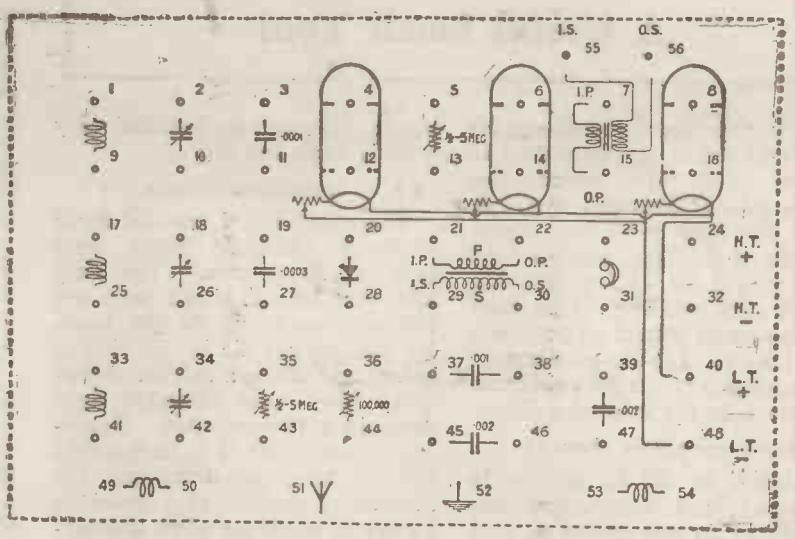


Fig. 2.—The terminal board.

Our photograph shows Mr. R. E. Jeffrey, dramatic producer at 2LO, superintending the production of a play broadcast from that Station.

Telephone Comfort

CERTAIN types of head-phones, though there is nothing to be said against their electrical efficiency, seem to be designed with no thought for the comfort of those who use them. It is when one is wearing the head telephones for long periods on end—at such times, for instance, when one is engaged in protracted endeavours to tune in American broadcast transmissions—that one realises how uncomfortable they can be.

Should the shape of the head-band be such that the ears are too tightly gripped by the receivers, it should be straightened out a little. Do not try to do this by taking one receiver in each hand and pulling them apart. If you do you may increase the distance between them, but you will very probably form at the same time a very uncomfortable depression in the middle of the headband. Instead, hold one receiver in the left hand and grip the head band, with the thumb of the right hand on its upper side. Then work right round the headband, straightening it slightly as you go.

A Useful Small Tool

A TOOL that I would not be without in my workshop is a 4B.A. die which has always proved its usefulness. A die of this kind costs only about a couple of shillings, and the constructor will do well to provide himself with one even if he does not possess or intend to purchase a die holder. Let me give one or two examples of the jobs that can be done with the help of a die.

Badly cut screw threads

A batch of 4B.A. screws is purchased in a hurry from the first shop that one comes to, and when they are brought home it is found that they are much too tight a fit for standard nuts. The die is fixed in the jaws of the vice and the screws are run through it with the help of a screwdriver. However badly their threads may have been cut in the first instance they will now go easily into the nuts. Or, again, the threads of a screw or of a piece of studding may have been accidentally damaged; this can be rectified very quickly with the die.

Damaged threads

The other day I wanted for a particular purpose some very long 4B.A. screws. The only kind that I could obtain were not threaded right up to the head. By placing the die in the vice as before and using a ratchet screwdriver they were threaded right down in a few minutes. Everyone knows that it is sometimes difficult to avoid damaging the threads at the end of a screw or a piece of studding when shortening is done with the hacksaw. In such cases they become very difficult to start. Before cutting is done run on the die. Its removal after cutting has been made will make the threads perfectly clean and render the screw quite easy to start.

A tip

If a die holder is purchased it should be of the kind which takes a guide or collet. This is a small metal bush fitting on to the front of the holder. The rod to be threaded passes through it before coming to the die, and its end is thus presented perfectly straight to the cutters. Without a collet it is not at all easy to avoid going crooked, especially if the rod to be threaded is rather a tight fit for the die. R. W. H.

Our photograph shows one of the operations in the manufacture of the B.T.H. headphones. The end of the stirrup is being bent to prevent the slides from coming off.

WIRELESS CONTROL FOR AEROPLANES

Experiments are being conducted for the purpose of ascertaining whether it is definitely possible to control the paths of aeroplanes by radio waves. Because there has always existed a certain risk of collision between aeroplanes flying in different directions, especially at night, means are being searched for that will overcome this very serious objection to night flying.

The latest attempts have been to lay electrified cable along the ground the length of the route taken by the flyers. The apparatus to be tested is to receive the radio waves emitted by these electrified cables. By means of this apparatus the pilot is immediately and automatically warned if he has deviated from his path in even the slightest degree. A more advanced mechanism provides for a method of utilising these radio waves from the ground cables automatically to steer the aeroplanes, thereby leaving the pilot free to concern himself merely with his altitude and the condition of his motors.

If these experiments are successful it makes for the establishing in the near future of greater, better and safer aeroplane transportation.

The Institution of Electrical Engineers, North Midland Centre.

A Faraday Lecture, on "World-Wide Radio Telegraphy," will be delivered by Prof. G. W. O. Howe, D.Sc., M.I.E.E. (James Watt, Professor of Electrical Engineering in the University of Glasgow, Scientific Adviser to *Wireless Weekly*), on January 27, 1925, at 7.30 p.m., in the Great Hall, the University, Leeds. Chairman: Dr. J. B. Baillie, O.B.E., M.A., D.Phil., Vice-Chancellor of the Leeds University. Admission is free and by tickets obtainable in advance from the Hon. Sec., 65/67, Prudential Buildings, Park Row, Leeds, or from the Municipal Electrical Engineer of any town in the West Riding of Yorkshire.

Loose-Coupling and Signal Strength

By G. P. KENDALL, B.Sc., Staff Editor.

This article shows that coupling between primary and secondary bears an important relation to signal strength.

Most experimenters of experience will have noticed that when using a loose-coupled circuit that there appeared to be a definite optimum degree of coupling between the primary and secondary coils, well worth finding with the aid of a little careful search. To investigate this point, I have carried out a series of measurements with large and small coils in a loose-coupled tuner, which was recently described in Modern Wireless, under the title of "An Experimenter's Tuner," the Moullin circuit being connected across the secondary coil and measurements of signal strength taken with variations of the degree of coupling between primary and secondary. The results certainly surprised me, familiar as I was with the fact that the degree of coupling was capable of making quite a noticeable difference in signal strength.

A Useful Experiment

The experiment is unquestionably one which is well worth repeating by anyone who uses loose-coupled tuning, to determine the best settings for his own particular coils and tuner. The result of the experiments in my own case are summarised in the accompanying set of curves (Fig. 1), and a few words of explanation are necessary to enable the reader to interpret them correctly. Along the horizontal line the separation of the coils measured in inches between the outer edges is recorded, the coils being mounted in a holder which separates them from each other at an angle. It might seem a somewhat more scientific method to express this separation as an angle between the coils, but I decided against this upon considering the very irregular shape of the field surrounding most coils, and tried the much simpler method mentioned. Vertically the signal strength is recorded, the figures being actually the reduction (measured in tenths of a milliampere) of the plate current of the Moullin valve, when the tuned circuits were adjusted to resonance with the local station's carrier wave.

Effect of small Aerial Coil.

The curve A was obtained by using a quite small aerial coil across which a considerable capacity had to be shunted, and a secondary coil of the correct size. It was noted that as the coils were separated, the signal strength increased up to a maximum, which was reached when their edges were separated to the distance of one inch, and that beyond this point it fell in a fairly regular manner with further separation. In the case of curve C, the same secondary coil was employed, while the aerial coil was a size larger than before, this being the combination which I generally employ.

Optimum Separation

In this case the signal strength rose rapidly as the coils were separated until their edges were two inches apart, where it remained very nearly constant over the whole range of possible adjustment beyond that point. The actual maximum appeared to be at about three inches separation, only a very slight fall being observed from this point to the maximum separation of the coils, this being at a separation of

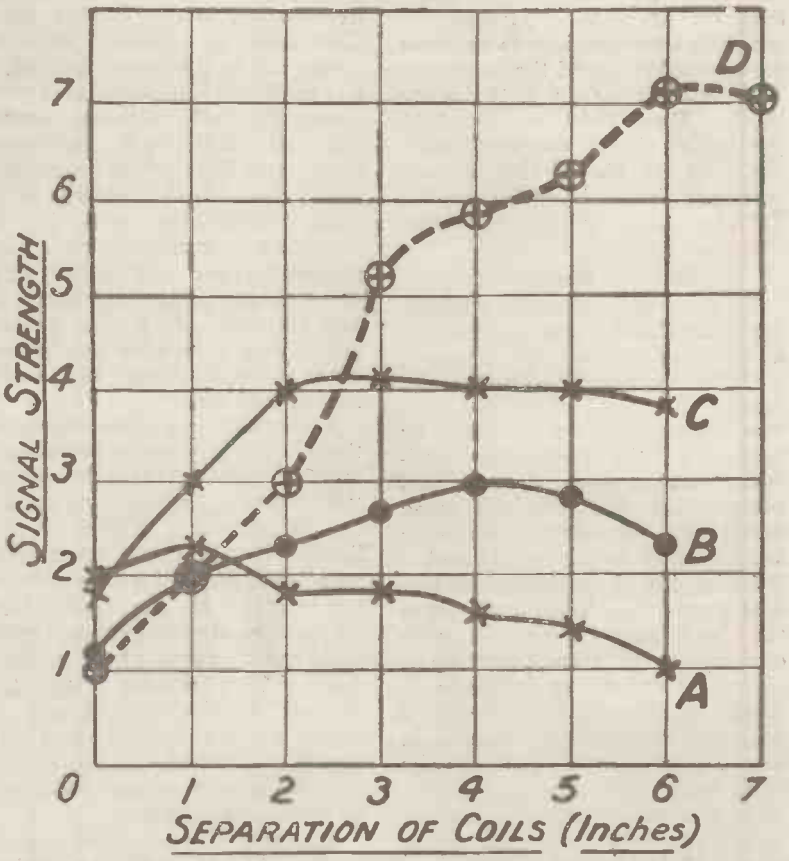


Fig. 1.—The curve D is a good example of the errors which may be introduced by concealed reaction effects.

about six inches, representing very nearly a right angle between the coils. Curve B was obtained with two coils of a different make, each of approximately the correct size for the aerial and secondary circuit respectively, and here it was observed that a much wider separation was necessary to obtain the maximum signal strength, and that the fall upon moving the coils still further was sharper than in the previous case. This confirmed the deduction which would naturally be made upon inspection of these coils, since they were of a smaller and more compact type than the previous ones, and they would be expected to produce a more concentrated magnetic field.

Selectivity

From these three coils one would come to the conclusion that for the maximum signal strength one should use the set of coils corresponding to curve C, but that if one desired to obtain the effect of increased selectivity consequent on progressively weakening the coupling, the pair used for curve A would appear to be preferable, since the aerial coil for curve C was so large that no practical separation of the coils was sufficient to produce a real weakening of the coupling. It is interesting to note before leaving these three curves, that the initial signal strength when the coils are placed side by side was very similar in each case, the differences only being found when the coils were separated.

Effect of Reaction.

To show the extremely misleading results which may be obtained if reaction effects are present, whether produced directly by means of a reaction coil or in a less obvious manner by tuned or semi-tuned high-frequency amplifying stages, the curve D was plotted. In this case the same aerial and secondary coils were employed as for curve A, and a reaction coil of quite a small size was placed at a wide angle from the secondary coil. It was observed that a steady increase of signal strength, or perhaps it would be more correct to say, a progressively greater decrease in anode current, took place as the coils were separated, until they were practically at right angles, only a very slight reduction being produced by further weakening. What apparently took place was that as the aerial coil was removed from the secondary, the damping effect of the aerial was removed from the secondary circuit, reaction effects became more and more pronounced, and finally at some point the circuit passed into oscillation, so that the readings obtained were absolutely valueless, as far as they indicated the merits of that particular combination of coils, or degree of coupling.

Continental Notes and News

The now famous Bill passed in the French Chamber the early part of December, granting a monopoly on radio to the French Government, has come in for almost as much comment in the French Press as would some new method of debt-evasion by the Germans.

The radio clubs and associations are, of course, particularly up in arms about the affair, and many and bitter are the letters flowing into the President of the Council, to various Senators and Deputies, and even to the Ministers of the Cabinet. "L'Union Française de la T. S. F.," headed by M. Daniel Berthelot, one of France's most famous electrical and radio engineers, and on whose roll can be counted many of the most illustrious of French savants, points out in a letter addressed to a group of Ministers that this monopoly will certainly stamp out all individual endeavour along new lines of research; will make such hopeless delays in all radio legislation and in all executive questions concerning amateurs; and will in all ways serve to discourage and break up any interest which the general public may now have in wireless, that it will drive the entire industry to ruin.

Various others have expressed themselves in equally pessimistic manner, among them being the "Office des Producteurs de Blé du Sud-Ouest" (Office of the South-Western Grain Producers), who have requested a broadcasting station in the south from which they plan to get their grain and other commodity markets daily. They maintain that this station particularly should be under private control, and that any Government meddling will only be a very serious hindrance to farm production.

Practically every radio organisation in France has voiced violent protest, and, as one paper says, "All France has spoken. It is hoped that the supporters of the monopoly Bill will understand."

* * *

After various difficulties were overcome, the Grimeton station—the largest in Sweden—was finished recently. The complete system actually consists of two stations; one at Grimeton which will be used for transmission, and one at Kungsbacka which will be used solely for reception. As a matter of fact, both stations will be controlled from a distant centre at Gôteborg.

The Grimeton station is equipped with duplicate plants which can be operated together or separately, although the object in having two plants was to establish a reserve so that in the event of any mishap occurring there will be no great interruption to the service. Each of the plants has an Alexanderson type of high-frequency generator with a capacity of 200 kilowatts. The wavelength of 18,000 metres has been selected because it is not commonly used in Europe.

The aerial at Kungsbacka, which station was completed last Spring, consists of 13 kilometres of copper wire supported on 90 posts.

The transmitting aerial was so arranged that it is horizontal above the ground at a height of 110 metres. Almost 1,000 tons of lumber and iron were used in making the masts, which are equally spaced 380 metres apart. The earth system is made up of 200 kilometres of 3 millimetre copper wire buried about 50 centimetres in the ground.

Power will be supplied from generators at Yngaredsfors and Trolhaettan at a pressure of 40,000 volts, which will necessarily be cut down to 2,000 volts for the transmission sets.

Random Technicalities

By PERCY W. HARRIS, Assistant Editor.

Some Notes of general interest to the Home Constructor and Experimenter.

"SPEAKING from experience, now that we have solved the problem of eliminating disturbances from the Poulsen Arc emission, that system may be said to be by no means obsolete."

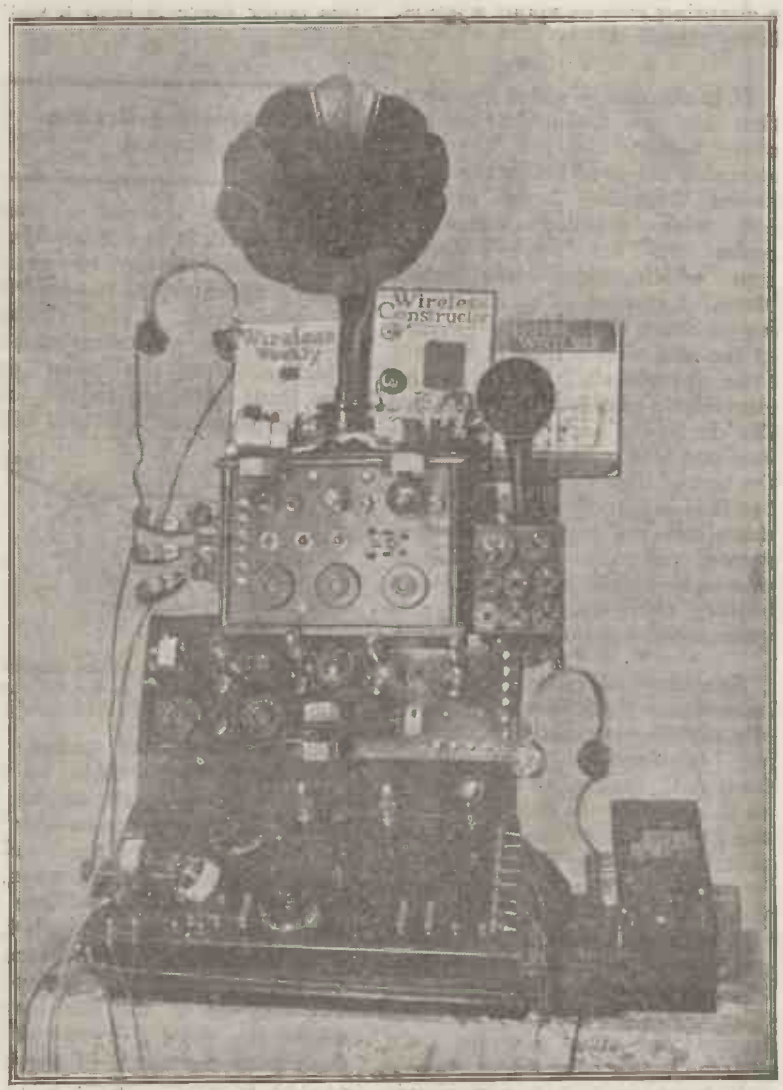
The statement I have just quoted was made by Mr. E. H. Shaughnessy, O.B.E., M.I.E.E., Chief Engineer of the General Post Office, in his address to the wireless section of the Institution of Electrical Engineers recently. The next time you have your reception of distant broadcasting stations completely spoiled by the mush from Northolt read that paragraph again. It rather reminds me of the budding Christian Scientist who went down to breakfast one morning with a terrible cold in the head. When spoken to about it he was highly indignant. "There is no such thing as a cold," he said.

There really can't be any mush. Mr. Shaughnessy says the Post Office have solved the problem of eliminating disturbances from arc stations. As the Americans say, can you beat it?

* * *

An interesting point regarding cat-whiskers has been put to me by Mr. Norman Hall, of Gateshead. He points out that it is really quite silly to supply silver cat-whiskers with treated galena crystals. Galena, as most readers know, is a sulphide of lead. Silver is particularly susceptible to the effect of sulphur, as you will know if you have carried a piece of rubber (which contains sulphur) in your pocket with a silver watch. The bright silver will be blackened in no time. If then we use a silver cat-whisker on a substance containing sulphur—particularly one which often has much free sulphur, as is the case with some of the modern crystals—we are bound to get tarnishing almost immediately.

I came across an interesting case of what appeared to be loud-speaker distortion the other evening. One of my loud-speakers was giving a rattle on some notes, and for some time I could not trace the source. After a little time I found the children had hung some glass beads over an ornament near by, and this was vibrating and shaking the beads on certain notes. It occurred to me that the vibration of ornaments near to a loud-speaker, especially when signals are loud, may often give rise to distortion, or what appears to be distortion, and I mention the case as it may



This photograph, contributed by Mr. F. G. Lean, shows what he calls "three of the best." The sets are, reading downwards, the "Wireless Weekly" Omni Receiver, the Four-valve Family Receiver, and the Three-valve Dual Receiver.

possibly solve the problem that you yourself may have come across.

* * *

I have just been trying the latest in battery chargers—the Balkite, which Burndept's are marketing in this country. It is a most interesting device, and consists of a metal case with a lead connected to a plug for your lamp socket, and two other wires with strong spring clips for attaching to the battery. It is received in a dry state, and it is necessary, to put it into operation, to remove the vent plug and to fill it up to within half an inch of the top with ordinary accumulator acid. It is then only necessary to switch on the current, whereupon the A.C. from the mains is rectified by full-wave rectification, a charging rate of about 2 amps. being standard.

* * *

It is absolutely silent in operation and as fool-proof as any other battery charger, the only attention required being the occasional "topping" up of the cell with distilled water to make up for any evaporation which may have taken place. I started off by running it for 56 hours without a break, and at the end of this time it had not even warmed up. It is really an electrolytic rectifier, and I believe the electrodes are made of tantalum and lead. How it will stand the test of time I do not yet know, but it is satisfactory to know that there are no expensive replacements, and so far it gives indication of being the best thing yet in battery chargers. Its price is quite moderate for such a device.

* * *

Speaking of battery chargers reminds me that there is no generally satisfactory method of charging high-tension accumulators from A.C. mains, at least, so far as this country is concerned. In the States it is possible to buy an attachment to the Tungar rectifier by which high-tension accumulators can be charged with ease, but the British Thomson Houston people tell me that it is not on sale in this country. I believe this company is developing something special for the purpose. Of course, if you have direct current in the house it is a very simple matter to charge high-tension accumulators. The high-tension accumulators I ordered some little time ago have not been delivered yet, so that I am still unable to report any experiences with them. Deliveries generally of wireless goods are in a pretty poor state at the present time, and you are lucky if you get anything of importance within two or three weeks.

* * *

I have just obtained one of the most ingenious wireless accessories I have yet seen. It consists of a combined filament resistance and potentiometer. There are five terminals, three for the potentiometer and two for the filament resistance. Two concentric knobs are provided, the smaller of the two controlling the potentiometer movement, and the larger the filament resistance. On this latter there is both a coarse and a fine adjustment—or rather an ordinary adjustment and a vernier. On turning the filament resistance knob the tongue is moved over the wire in the usual fashion, and when we turn back another tongue is rubbed along a single wire wrapped round the periphery. The device is attached to the panel by the now popular one-hole fixing method; in this case the poor solitary hole seems to be working overtime!

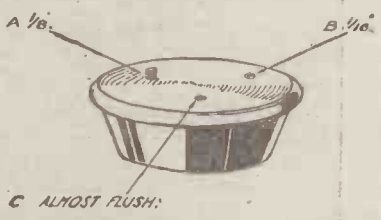
* * *

When are the valve manufacturers going to give us a .06 ampere type of valve in a proper low capacity mounting, such as is used in the V.24 or S. type of valve? Such a valve is badly needed now that short-wave reception is so popular amongst the more advanced experimenters.

□ □ □

Extracting Broken Screws

WHEN metal screws break it is not always an easy matter to extract them preparatory to the insertion of new ones. The drawing shows a little workshop problem which occurred the other day. The leads attached to the loud-speaker attracted a kitten, which



When screws break off as shown in this illustration it is by no means easy to remove the embedded half.

leapt at them and pulled the instrument off the table, so that it fell with a crash on to the floor. The three screws securing the tripod stand to the receiver were broken in different ways, as seen in the drawing. One (A) had a portion about ⅛ inch long protruding above the surface of the metal; the second stump (B) was only about half this length, whilst the third (C) was almost flush with the metal of the base of the receiver. One and the same job then presented three distinct problems, for each screw called for a different method of treatment.

Three Useful Methods

It was hopeless to think of extracting A with an ordinary pair of pliers, for the stump was quite tight in the threads, and the jaws would not have obtained a sufficient grip upon it. The tool used was a pair of parallel-jaw gas pliers. With this it was possible to obtain a very firm grip and to remove the broken piece without difficulty. The protruding portion of B was too short and too irregular to enable it to be gripped with any kind of pliers. Here a slot was cut in the top of the stump with a jeweller's hacksaw, and removal was effected by the careful use of a fine screwdriver. The third screw, C, defied all efforts at extraction, and the only possible way of dealing with it was to drill it out. The jagged top was filed flush, and a drilling centre was marked in it with a centre punch. A No. 34 drill was run in carefully, and the resulting hole was subsequently threaded with a 4 B.A. tap. These are the three most useful methods for extracting broken screws. The last method, that of drilling out, is much easier than might be thought at first sight. When it is resorted to the screw used to replace the broken one will generally have to be two sizes larger.

R. W. H.

A "Super-5" and Super-Heterodyne Receiver

By R. TINGEY, Member I.R.E.

Below are given full constructional details of the "Super-5" receiver, a general description of which was given in our last issue.

IN my article last week I gave a very general description of the two sets, one of which could be used as a very efficient five-valve receiver, whilst the other may be added to convert this set into a nine-valve super-heterodyne.

I will now describe in detail the construction of the five-valve receiver. Constructional details of the super addition will be given later.

Constructional Details

The following components are required. The components specified are those actually used in my own set.

1 ebonite panel, 20 in. x 12 in. x ½ in., and one 20 in. x 8 in. x ¼ in. (American Hard Rubber Company).

Cabinet, oak or mahogany (Shule and Company).

3 special neutrodyne high-frequency transformers, Nos. 1, 2, and 3. Made by Lissen Company and Radi-Arc Company.

1 B Gambrell coil (Gambrell Bros.).

1 coil socket and pin for reaction coil by Ormonds.

20 valve sockets by Ormonds.

1 special on and off switch (Radi-Arc Company).

4 variable condensers .0005 μF, square law, specially made for this set with safety leads by Jackson Bros.

1 potentiometer, 180 deg., by Fuller's United Electrical Company.

5 opal windows by Fuller's United Electrical Company.

1 low-frequency transformer, group 1 (Western Electric).

5 filament resistances, Igranic, for bright-emitter valves.

5 fixed condensers, two of .0003 μF, two of .002 μF, one of .001 μF (Dubilier).

3 grid leaks, two of 2 megohms, one of 5 megohms (Dubilier).

1 anode resistance, 80,000 ohms (Dubilier).

11 ebonite capped terminals, 2 B.A., two nuts and a washer on each, by Stevens.

Some short lengths of sisto-flex.

½ lb. 16 S.W.G. bare tinned copper wire.

20 Clix plugs by Autoveyors, Ltd.

Some brass strips ½ in. x 1-16 in. about 6 ft. in length.

1 T.C.C. 2 μF condenser.

1 T.C.C. .01 μF condenser.

2 4.5 volt dry cells for grid battery.

About 6 dozen 4 B.A. nuts.

About 4 dozen 4 B.A. screws, ½ in.

Short piece for wanderplug.

4 Meccano angle irons as

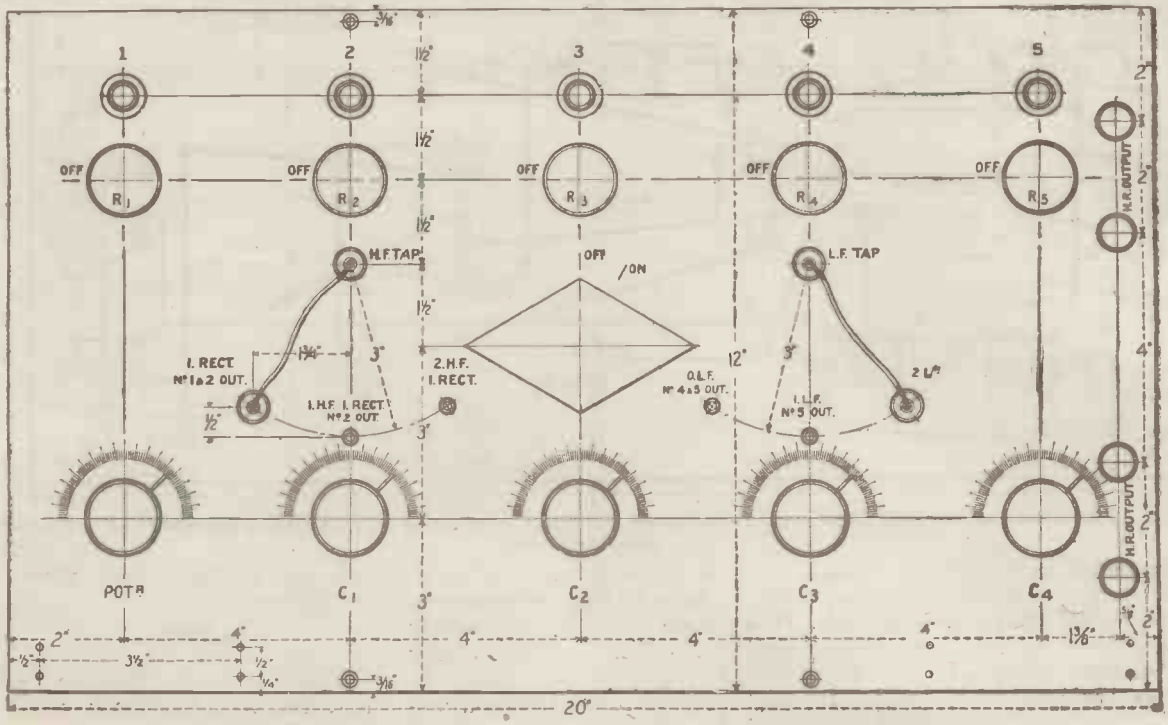


Fig. 1.—The layout of the panel and drilling dimensions. Blue print No. 94a.

an alternate means of fixing the shelf to the front panel.

Radio Press transfers, or engraving by Sugdens, 45, Farringdon Street, who have the details.

Drilling and Mounting

The drilling of the panel must be executed in accordance with the drawing showing the layout of the panel. Great care should be exercised in this operation, and accuracy will save the reader endless trouble, especially in connection with the high-frequency Clix plug-sockets, which must be in a line and at their correct placing and distances.

With the panels drilled, counter-sink where needed, and mount the shelf panel to the front panel, using the 4 B.A. screws for this. Then fix the Meccano or brackets made from the ½ in. by 1-16 in. strip brass. Then mount the components, fixing each one in its proper position. Here the reader should experience no difficulty, providing he refers to the drawings for their respective positions. The only components that are not to be mounted until the wiring is completed are the four .0005 μF variable condensers. The reason for leaving these out until the wiring is complete is to allow the reader to get at the various points to be wired, which are otherwise covered by these four variable condensers.

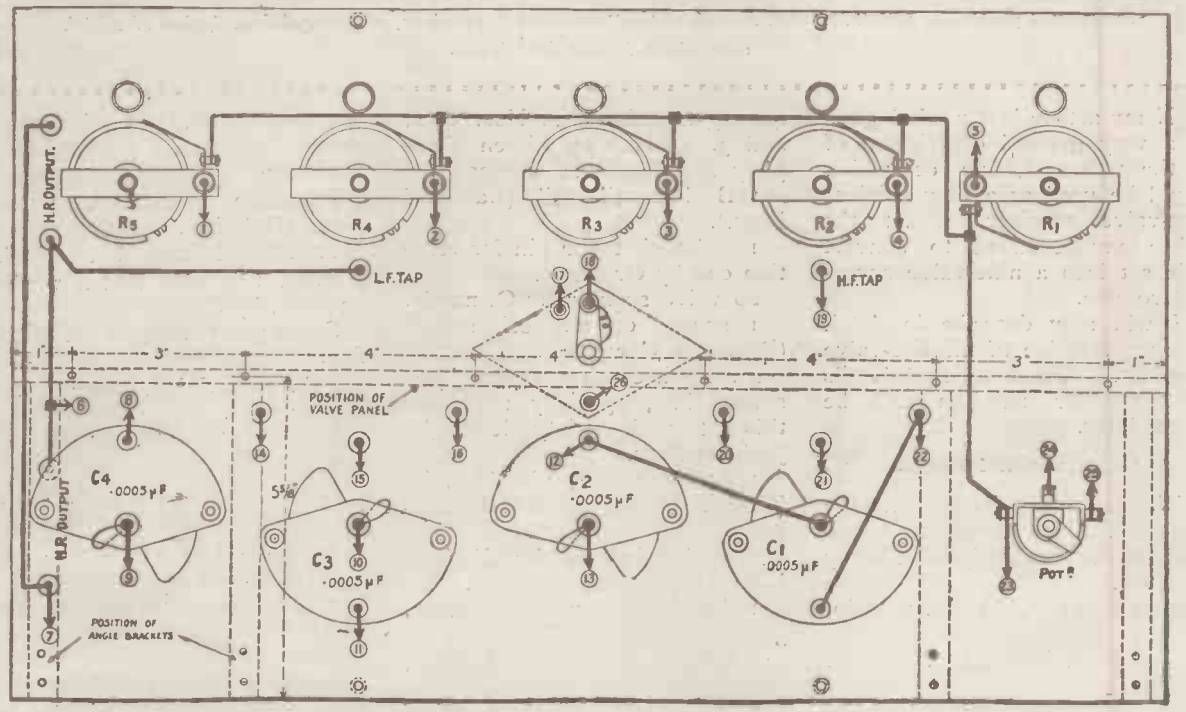


Fig. 2.—The wiring arrangements behind the main panel, which should be used in conjunction with the valve panel seen in Fig. 3. The numbers on this drawing indicate that these connections are continued to similar numbers on the valve panel. Blue print 94b.

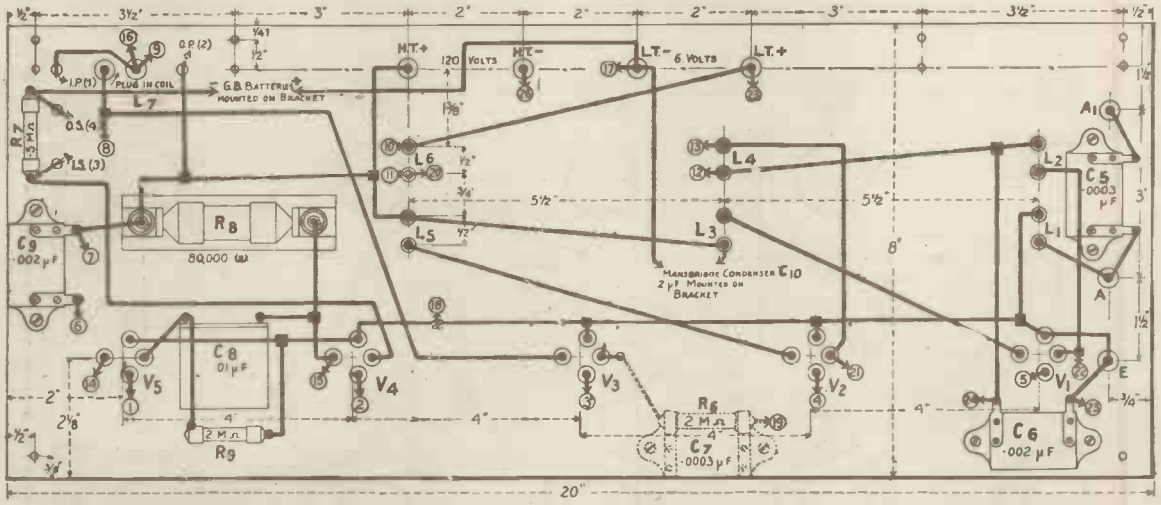


Fig. 3.—The wiring af the underside of the valve panel, the lower edge being that which fits against the front panel. Blue print 94c.

The Wiring

It will be noticed that, in spacing, the high-frequency sockets and other components are well

spread out, thus giving the reader plenty of room for wiring without fear of getting any of the wires foul of one another. This spacing also tends to enhance the appearance of the set in addition to an increase in efficient working.

First wire the low-tension circuit—that is, the common low-tension leads feeding the negative of each valve and the switch

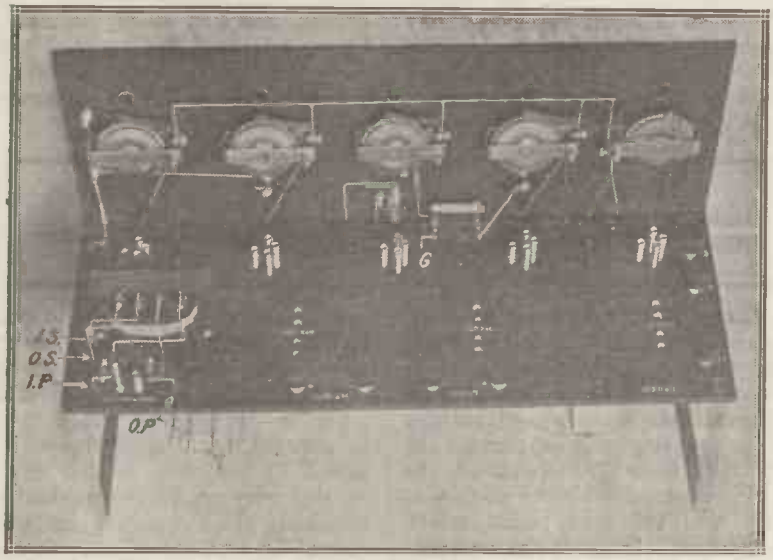


Fig. 4.—A photograph showing the wiring on the upper side of the valve panel, which should be used in conjunction with Fig. 3.

—and then the positive low-tension feeding each filament resistance. This latter common L.-T. lead also goes to the potentiometer and earth, and it can all be wired with one wire. The L.-T. plug also goes to the potentiometer. Grids and plates are next wired, starting from the aerial end of the instrument and working towards the low-frequency end. Then all the remaining points are joined, working towards the low-frequency side.

Condensers

Finally, the variable condensers are mounted, and joined up to their respective points. The high-frequency transformers, in this set, are a special feature, and it is very important that they should be in their right order. There are three of them, and they are all different. The angle of these coils, the direction of each winding, and the number of turns on each winding, and the gauge of wire are all arranged so as to balance out any undue oscillations. The reaction coil itself does not move, but reaction is controlled by bringing the reaction coil into tune.

The circuit is so well balanced that oscillation occurs as soon as this reaction coil is brought near the wavelength that is being received.

The Detector

It is very important that an R4 B valve should be used as a rectifier and two power valves as note magnifiers. It does not much matter what valves are used for the high-frequency. The valves I have used in the original set are 2 Cossor red top for the high-frequency, an R4 B for the rectifier, and 2 B.T.H. B4 for the power valves. By the use of the R4 B valve, the high-tension is kept at 120 volts throughout. The best high-tension supply is obtained from accumulators, and on this particular set I used Fuller block high-tension accumulators. These are supplied in boxes of 30 volts; four boxes are used, making 120 volts in all.

Switching

The special on-and-off switch not only cuts off the high and low-tension batteries, but also disconnects the high-tension from the low-tension. This is to prevent the accidental burning out of the valves by placing them, or attempting to place them, in their sockets incorrectly.

It will be noticed that the variable condensers used in the photograph were not J.B. condensers, but were specially built up by myself. Since making this set I have found the J.B. more satisfactory.

Operation

Reading from left to right, the handles at the bottom of the instrument are as follows: First, the potentiometer, which controls the strength and clarity of speech when either the first or second valves are in action. It will usually be found that for the best reception this should read about 160 deg. The second handle marked C1 is the aerial condenser. This is always needed irrespective of the number of valves in use. The third condenser, C2, is the second tuning control when one or more high-frequency valves are in use. The fourth handle, C3, is the third tuning control when both high-frequency valves are in use. The fifth handle, C4, is the reaction tuning condenser, and is always needed, irrespective of the number of valves in use, and, like the potentiometer, controls the strength and purity of the signals. Any number or combination of valves can be employed. This is controlled by the two plugs on either side of the on and off switch. It is advisable, before turning the switch on, to see that the filament controls are either off, or nearly off,—that is, turned as far as possible in an anti-clockwise direction. Now

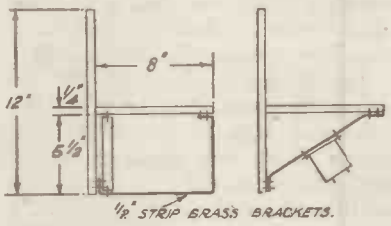


Fig. 5.—Details of the panel supporting brackets, showing manner in which the condenser C10 and grid cells are mounted.

turn the "on-and-off" switch on; next, turn all the filament controls gradually on. It will usually be found that they need not be more than three-quarters in, the general rule being that they should be as near off as possible, while still maintaining strong and pure reception.

Using all Valves

When starting to use the set for the first time, it is as well to tune all five valves. Connect the two wanderplugs in the

extreme right-hand sockets in both cases. Place the reaction coil condenser at zero and the potentiometer at 180 deg., and tune the three middle condensers until oscillation occurs, gradually increasing on one and following up on the others until the carrier wave of the station that is required is heard. Then reduce on the potentiometer until oscillation ceases, retuning on the three condensers each time, and if oscillation occurs, again reduce on the potentiometer, until the station is heard at its best. Then, as a final adjustment, bring up the reaction condenser until the speech is heard at its loudest.

Reduction in Number of Valves

After obtaining reception on five valves, as described above, the strength of reception can be economically reduced. (*a*) If the station is a distant one, 50 miles or more away, by cutting out one or more of the low-frequency valves. This is done by placing the two plugs of the right-hand side in the sockets marked L.F. Tap and 1 L.F., and turning out the valve that is not in use by means of No. 5 filament control.

L.F. Valves

Should it be required to cut out the other low-frequency valves, this can be done by moving the plug in the 1 L.F. socket to the zero L.F. socket, and turning out valve No. 4. Note that all the condensers and potentiometer are still in action.

(*b*) If the station to be received is close, the plug on the left-hand side is removed from the 2 H.F. one rectifier socket and placed in the "1 H.F. one rectifier" socket, and No. 2 valve turned out. This throws No. 3 condenser out of action, and it will be found necessary to retune on the remaining adjustments. Should it now be required to cut out the other H.F. valve, the plug which is at present in "1 H.F. one rectifier" is inserted into the socket "one rectifier," and No. 1 valve turned out. Nos. 2 and 3 condensers, and the potentiometer, are now out of action, thus leaving only C1 and C4 in use, and slight readjustments will be necessary.

Results

High- and low-frequency variations can be carried out independently of one another. As soon as the reader has got into the way of working this set, he will find it very simple to operate and very easy to get whichever station he desires, using the loud-speaker only. This is the set I use myself, and I never use headphones at all, even for the reception of American signals. During the last two months I have been able to get either WGY or KDKA or WBZ any night that I have tried, but the strength, of course, varies, and so does the interference.

With the addition of the super-heterodyne attachment, to be described later, all these results can be obtained on a loop, only with very much greater selectivity. It is well that the reader should get used to the operation of this set before he makes the addition of the superheterodyne.

I shall be delighted to receive reports of results that readers have obtained from this set, and would mention again that it is a set which has had a commercial career, and has stood the test of being operated by people who know nothing whatever about wireless and at great distances from broadcast stations.

D.C. Mains as H.T. Supply

A Reader's Experiences.

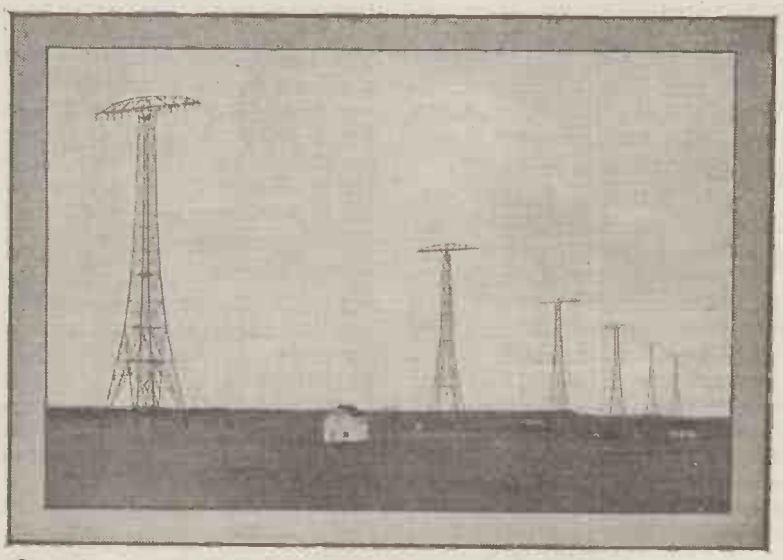
SIR,—With reference to your recent article describing a Neon lamp outfit for obtaining H.T. from the mains, it may be of interest that there are difficulties in using two Osglim lamps in parallel, due, I understand, to their resistance varying considerably and the lamp with lesser resistance taking all the current. I have tried half-a-dozen lamps and failed to find a pair that would light. I have used as chokes two G.P.O. 1,000 ohm chokes in series in each lead (obtained from J. H. Taylor & Co., Huddersfield, at 9d. each), and there is practically no hum, but I have some difficulty in controlling oscillation. I understand there is a different type of Neon tube with which no difficulty is experienced when used in parallel, but I don't know the make. I am sure further notes on this very promising method of obtaining H.T. would be welcomed by many readers. It has one great advantage. You cannot burn out valves by a short.

Whilst writing may I be permitted to express my appreciation of the new photogravure method you have adopted?

D. L. WHITE.

Birkenhead.

A NEW SWEDISH STATION



Our photograph shows the masts at the new long-distance telegraph station referred to in "Continental Notes."

Valve Notes

By

JOHN SCOTT-TAGGART,

F.Inst.P., A.M.I.E.E

IN my last week's "Valve Notes" I outlined the use of anode trap coupling, and stated that trap tuning might be

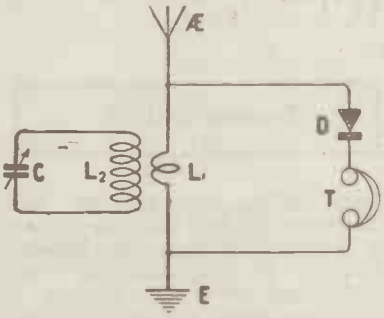


Fig. 1 shows the method of applying trap tuning to the aerial circuit.

used on the aerial circuit. This has been done with great success by Mr. W. H. Fuller, who is a member of the Radio Press staff, and has been assisting in certain work on selectivity.

Trap Aerial Tuning

The arrangement is illustrated in Fig. 1, and shows a small inductance coil L1 consisting of, say, 20 turns, and a larger coil L2 tuned by the condenser C.

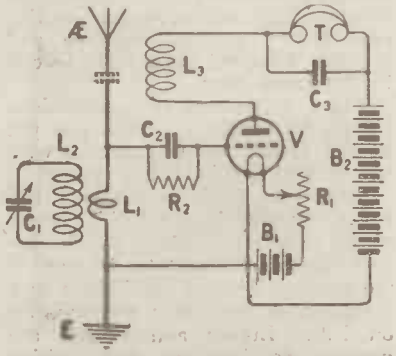


Fig. 2.—In the case of a single valve the reaction coil L3 may be coupled to either L1 or L2.

A crystal detector and telephones are shown connected across L1. When the circuit L2 C is tuned exactly to the incoming wavelength, signals are heard in the telephones T, but if L2 C is even slightly out of tune with the incoming frequency, then the coil L1 will act as a virtual short-circuit, and no signals at all will be received in the telephones.

Selectivity

The selectivity of this arrangement is remarkable, and should be tried by all investigators and experimenters, especially those who are experiencing trouble from interference from the near-by station or from shipping, etc.

The condenser in Fig. 2 is shown without a reference letter. The coil L2 has a value depending upon the wavelength to be received, but a No. 50 coil will be suitable for most of the usual broadcasting stations, while C1 may be a .0003 μF or a .0005 μF variable condenser. The advantage, of course, of this arrangement is that it is also independent of the size of aerial, and that the condenser C1 may be calibrated with the wavelength of different stations. This greatly simplifies the operation of the receiver for the beginner.

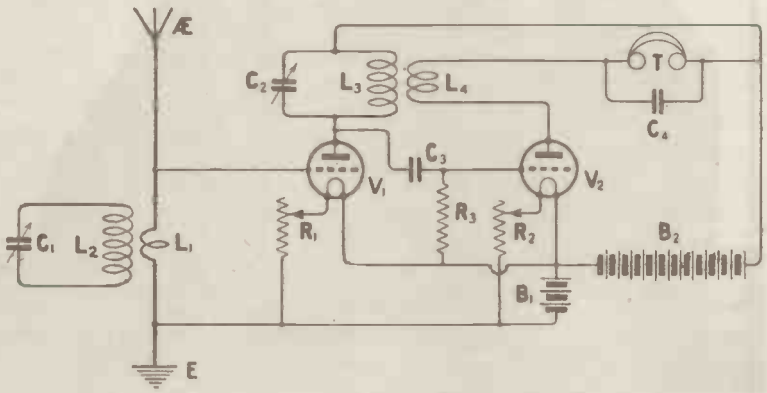


Fig. 3.—Trap aerial tuning applied to the ST34 circuit.

Fig. 2 shows the coil L1 in the aerial circuit of a simple single-valve receiver, the coil L2 being coupled to L1 and being shunted by the variable condenser C1.

Coil Values

The coil L2 may be an ordinary plug-in coil placed side by side with the coil L1, which may be a plug-in coil having from 8 to 25 turns. If the latter value is used, it will usually improve signal strength if a condenser of .0003 μF is connected in series with the aerial. If a smaller coil is used this is not necessary.

Types of Coil

The coil L2 may be a low-loss coil wound with thick wire on a former of skeleton shape, while L1 may consist of about 10 turns wound over this other coil.

I have found, however, that ordinary plug-in coils are quite suitable if placed side by side, and they may be tied together with string, or if sockets are available so much the better.

Converting Existing Receivers

In most cases experimenters will care to plug-in a small coil for the aerial circuit, disconnect their condenser, and then tie a

No. 50 coil side by side with L1 and tune on this extra coil. It is a simple matter to convert temporarily any existing receiver for the purpose of testing for selectivity.

Reaction

The arrangement, of course, may be applied to any kind of a circuit, whether reaction is used or not. In Fig. 2 the reaction coil L3 may be coupled either to the coil L1 or to the coil L2. The coupling between L1 and L2 may be fixed, the coils being placed side by side, and L3 being brought up against L1. If desired, a three-coil holder could be used with success.

In Fig. 3 the same arrangement is applied to the ST34 type of circuit, using a tuned anode with reaction. The earth side of the coil L1 is shown connected to the negative terminal of the filament accumulator B1, but greater stability in certain cases may be obtained by connecting it to the positive terminal of B1.

I would be very pleased indeed to hear from readers of *Wireless Weekly* the results of their experiments with this type of aerial tuning and the trap method of coupling valves, as described in my "Valve Notes" of last week.

Our photograph shows a 30 Kilowatt Silica Transmitting Valve, made for the Admiralty, compared with the peanut valve held alongside.

□ □ □

Transatlantic V

SIR,—With reference to your correspondent, Dr. Willey, *re* above, in January 7 issue of *Wireless Weekly*, it may interest your readers to know my method of using the above receiver to enable the following combination of valves to be used: 2H.F., D., 2L.F., 1H.F., D., 2L.F., D., 2L.F., D., 2H.F., D., 1H.F., D.

The only materials required are two valve pins with knobs (wander plug tops are used) and about 8 in. of flex. If the set is wired up as in Mr. Harris's article and M.H. transformers used, the following is the procedure: To cut out one stage of H.F., the first valve and first transformer are removed and the grid pins of the valve and transformer shorted with the flex. To cut out two stages, the first valve and second transformer are removed and the pins plugged in as before. The potentiometer in this case should be full negative and reaction obtained by a suitable coil in the usual way.

The transformer connections should be verified and the pin put in the socket which connects with the grid of the following valve.

Jacks are used to cut out the 2 L.F. or plug in the L.S. in place of the switch. Six American broadcast stations is the total bag up to the present, besides the British and Continental and relay stations, all on L.S. Zurich and Madrid are present as loud as the British stations. WGY, WBZ and KDKA can be heard any evening on the L.S. after the B.B.C. have closed down.—Yours faithfully,

JAMES CONNELY.

Liverpool.

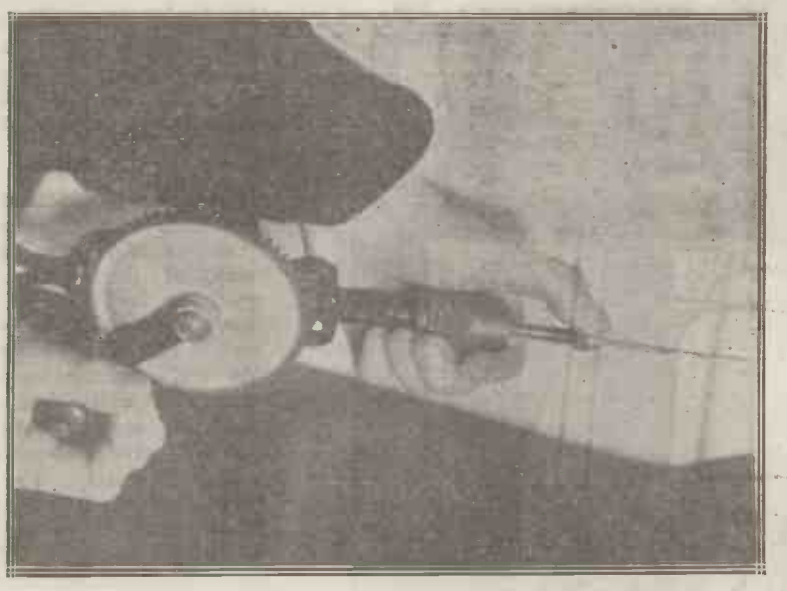
A Chuck for Small Drills

A valuable accessory for the wireless amateur's workshop.

The size of this useful chuck may be gauged from the photograph above.

THERE comes a time to the amateur mechanic when even the ordinary hand drill seems too clumsy a tool, and some extra fine and accurate drilling is wanted. Many chucks, too, especially those which have suffered rough usage, will not take very fine drills without considerable wobbling.

The tiny tool illustrated alongside was discovered by a sort of accident when making some other purchases at a well-known tool shop in Fetter Lane, Holborn. (The price, by the way, is 2s.)



Showing how the small chuck is fitted into the larger chuck of a hand-drill.

This little arrangement is tubular, so that a drill can be inserted to project only just as much as may be desired. This is a great advantage where fine accurate work is required, and it saves a lot of the strain which is so apt to bend or snap a thin drill. In addition to that it is easy to adjust the amount projecting when making a hole for tapping, so that the drill will go only just so far into the material.

When purchasing, it is advisable to specify whether one wants to use it for drills about 1/16 in. or for very fine ones indeed, as the article is made with varying internal capacity, and each size does not afford very much latitude as to the gauges of drills that it will accommodate.

Aerial Insulation

AT this time of the year aerial insulation is apt to be affected seriously by the condition of the atmosphere. In foggy weather a layer of grime and soot is deposited upon the insulators which is apt very much to impair their efficiency, for soot, being mainly composed of carbon, is very far from being an insulating substance. If this deposit is allowed to accumulate there may be a steady decline in signal strength which is so gradual that it is hardly noticeable until the amateur finds that he can no longer bring in distant stations. The remedy is a simple one. The aerial should be lowered occasionally and a good scrub given to the insulators. Whilst the aerial is down attention should be paid to the soldered joint, if there is one, of the down-lead, for "weathering" may have caused corrosion to set in at this point. The connection between the down-lead and the rod running through the tube in wall or window frame should also receive attention. It is surprising sometimes to find what an enormous effect upon reception the smallest corrosion of the surfaces of contacts may have.

R. W. H.

Making a Transm

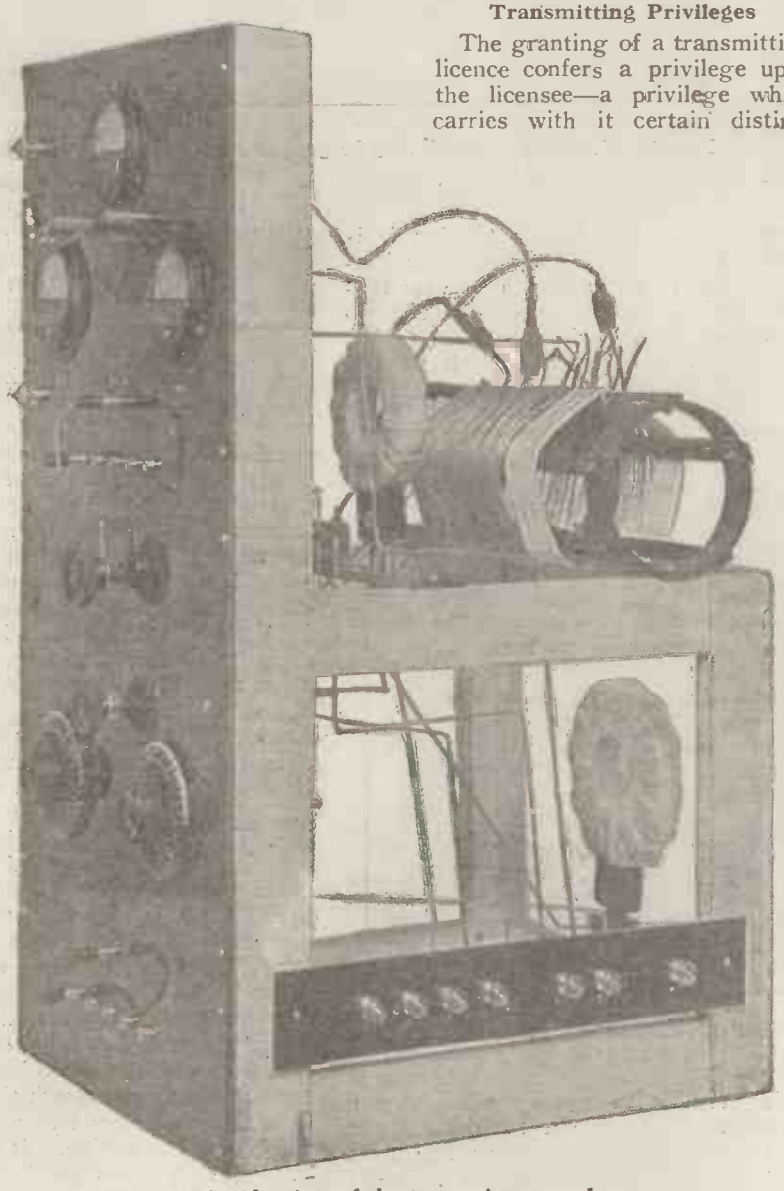
By PERCY W. HARRIS, Me

In this, the second of a series of Mr. Harris describes the con transmitter panel, which can well-known transmitting circu

LAST week, in a preliminary talk on the subject of making a beginning in transmission, I mentioned that without suitable meters the experimenter is working in the dark. I would like again to draw attention to this fact, for some readers in perusing this article may say to themselves, " It's all very well, but I can't afford to buy all those meters! " To this I would say in reply, that if you cannot afford the essential instruments don't start transmitting. If you were to drive a motor-car along a dark road without lamps on the plea that you could not afford suitable illumination for your car, you would probably cause a great deal of trouble to other users of the road and would get little sympathy when you ran into trouble. In the same way, by carrying out transmission experiments without meters, you may occasion a lot of worry to yourself and others, and if anything goes wrong you can expect very little sympathy from more experienced users of the ether.

Transmitting Privileges

The granting of a transmitting licence confers a privilege upon the licensee—a privilege which carries with it certain distinct obligations. It is " up to you ," to see that the privileges are not abused and to uphold the status of the amateur transmitter.



A side view of the transmitter panel.

Some Notes on Meters

Of the three meters mentioned in the previous article (filament voltmeter, plate milliammeter and aerial ammeter) the first can be dispensed with in many experiments, but its use will probably lengthen the life of your valve quite considerably and afford much data which would otherwise be lost to you. Without a plate milliammeter it will be impossible to measure your input, and without some form of aerial ammeter, the comparative efficiency of various arrangements cannot be estimated.

A Fallacy

Many experimenters still refer to their aerial ammeters as " radiation meters," a ridiculous way of describing them, not excused by the fact that they have been officially so referred to in Navy handbooks. We do not radiate amperes—it is power in watts that is radiated, and the aerial ammeter cannot possibly give you aerial watts or radiated watts. The only way you can find out the actual power you radiate is to ascertain correctly the radiation resistance of your aerial, as well as the current in it.

Radiation Resistance

A word on radiation resistance may be useful here. The losses in an aerial can be divided under two headings—losses in ohmic resistance in the aerial wires and

a Start in mission

ember A.R.E., Assistant Editor.

f articles on practical transmission, nstruction of a neat and efficient be used for practically all of the its with a minimum of alteration.

earth connection (as well as in the apparatus connected directly in the aerial circuit), and the energy usefully radiated. Obviously, we must aim at making our radiation losses as high as possible and our ohmic resistance losses as low as possible.

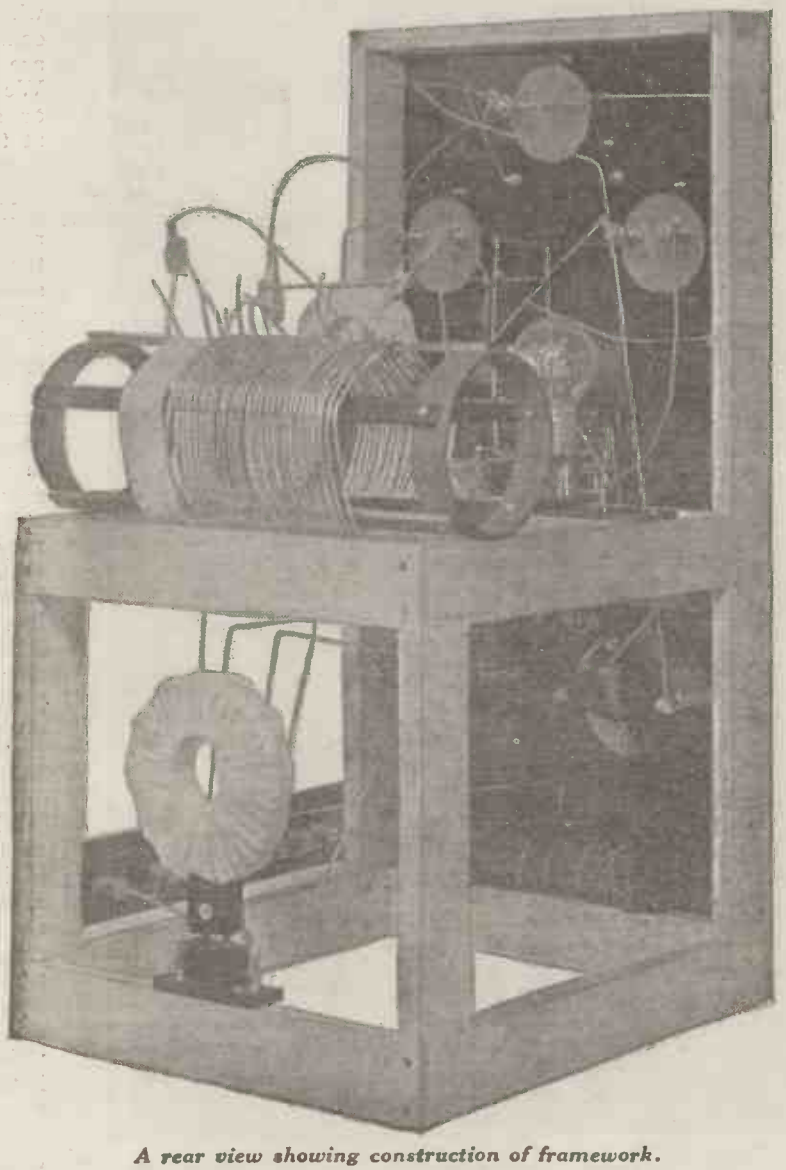
An Illustration

To illustrate this point further, let us consider a resistance of 10 ohms through which a current of one ampere is passing. To pass a current of one ampere through 10 ohms requires a pressure of 10 volts, the power consumed in this resistance is therefore $10 \times 1 = 10$ watts.

If, however, at the same time that 10 watts of energy are being expended in the resistance, another 10 watts are being radiated, 20 watts will be consumed in this arrangement. Our measuring instrument will show what appeared to be a total resistance of 20 ohms, because to pass one ampere would require 20 volts. The radiation losses can therefore be compared with the resistance losses and expressed in ohms, in which case we should say the total resistance of the system would be 20 ohms, of which 10 ohms would be ohmic resistance and another 10 ohms the radiation resistance.

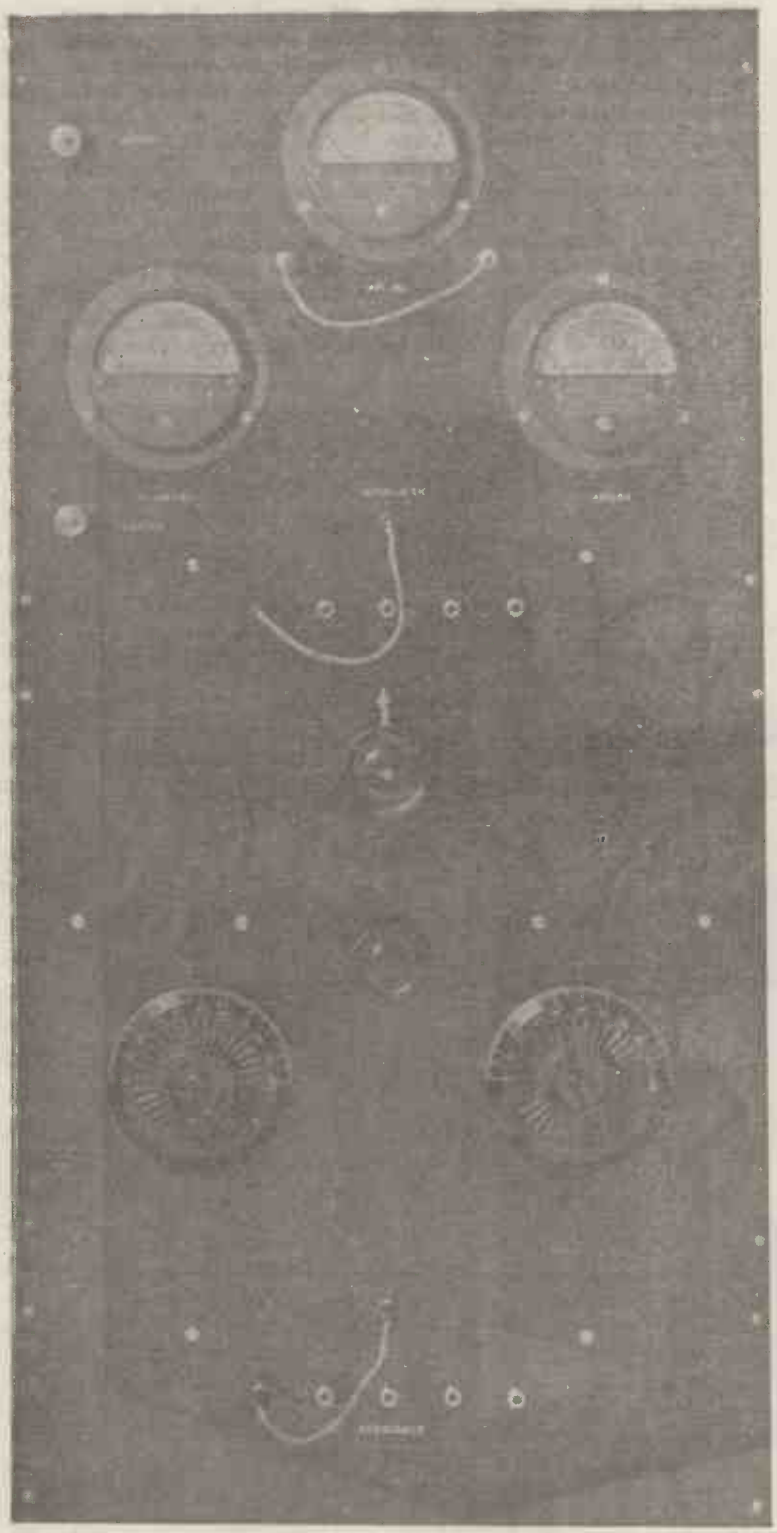
Misleading Changes

If now we were to decrease the radiated efficiency of this system so that nothing was being radiated, and still applied 20 volts to the ends of the resistance, the current would rise to 2 amperes. Again, we might decrease the ohmic resistance and increase the radiation resistance, and still get our one-ampere current reading. I mention these simple analogies to make perfectly clear what apparently puzzled many beginners in transmission, that the actual amperes reading of the aerial ammeter is no indication whatever of *absolute* efficiency. It may, however, be an indication of *relative* efficiency. It is perfectly futile for one transmitter to say to another, as I often heard it expressed, that "I am getting 2 amps. in the aerial, old man!" This means nothing or a great deal, according to his efficiency of radiation. Another man may say, "I am only getting half an amp., old man!" Yet he may be radiating far more power than the first-mentioned experimenter. Where the aerial ammeter is so useful is in a given set of conditions, where slight changes are made in the circuit. We may, for example, introduce some modification of the circuit, which will result in an increase of aerial current on the same wavelength and with the same aerial and earth system. This will indicate an increased efficiency. Doubling



A rear view showing construction of framework.

the aerial current will mean quadrupling the power. In making comparative tests, however, it is essential to keep to the same wavelength. Many experimenters have found that on going from the old wavelength of 440 metres or so, down to the newer wavelengths round 100 metres, the aerial amperes have been reduced very considerably. One reason for this is that on the shorter waves the radiation resistance goes up, and as we increase the radiation resistance, so for the same power input we shall diminish the aerial amperes.



The front of panel arrangement.

A Strange Effect

Before leaving the subject of the aerial ammeter there is another important point that requires consideration. So long as we work our aerial above its fundamental wavelength (the fundamental wavelength of the average transmitting aerial is generally round about 100 metres or less) we may get very misleading indications. It is quite possible for the distribution of current in an aerial to be such that at the point where the ammeter is situated no current whatever is flowing, although considerable quantities of energy are being radiated at that time. We can have a node or antinode, or something between the two, at that particular point.

Thermo-ammeters

If you can afford it, I would recommend you to obtain a thermo-ammeter rather than the so-called hot-wire ammeter. Hot-wire ammeters are very sluggish in denoting any change in current strength, and are subject to serious temperature errors, caused by the changing of atmospheric temperature of the room in which they are used. Furthermore, they possess in themselves a high resistance, which is the very last thing we want to introduce in series with our aerial. Thermo-ammeters, on the other hand, have a fairly low resistance and respond very readily to changes. They can be compensated against temperature errors and are much more satisfactory all round.

Costs

The trouble about such instruments is that the cost is rather high. The Weston Antenna ammeter costs for the range up to 1.5 amperes about £5. Another excellent instrument is that made by Ernest Turner, and used in the panel about to be described. This make is not so well known as the Weston, but is thoroughly reliable, and is used extensively by the Royal Air Force. The cost of the Turner instrument (which, by the way, can be obtained with a scale up to .5 of an ampere only—a very satisfactory reading for low-

power work) is £5 6s. 8d. The dimensions of the two instruments are the same, and both work on the thermo-ammeter principle.

The Weston plate milliammeter, with range up to 100 milliamperes, costs just over 2 guineas. A filament voltmeter by the same maker and of a size to correspond, reading up to 10 volts, costs about the same. Ernest Turner makes similar instruments at similar prices. The appearance of these latter can be seen on my own panel.

Cost of Meters

Thus we see that buying instruments of suitable make we must spend something under £10 for meters. Excellent instruments, however, can frequently be obtained secondhand, although most of the good disposal measuring instruments have been bought up by those who appreciate their value. A post-card to one of the dealers in disposal apparatus will show whether or not suitable ranges are still available.

A Standardised Transmitter Panel

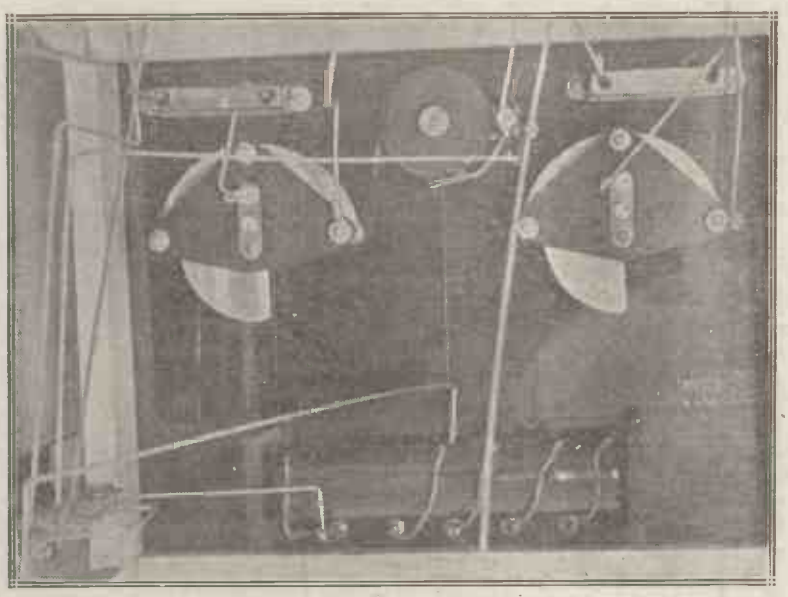
The panel and framework illustrated in this article are constructed with a view to providing a neat and serviceable arrangement, which can be tried with practically any transmitting circuit with a minimum of alterations. The three meters (aerial ammeter, filament voltmeter and plate milliammeter) are mounted on the upper part, the whole panel really consisting of three separate ebonite panels joined together.

There are two 12 in. × 10 in. panels and a lower panel measuring 12 in. × 8 in. The frame is made up of wooden battens of the dimensions shown, and the three panels are screwed on the front. The upper panel carries, as indicated, the three measuring instruments, terminals for aerial and earth, and the tapped grid-leak. The panel immediately below this carries two variable condensers, a double-pole double-throw switch for reversing the filament connections, as indicated in my last article, the filament resistance, and the two fixed condensers in series with the variable condensers, after the manner described last week.

The lowest panel carries a tapped resistance, which acts as the back-load on the key.

Gridleaks and Resistances

The gridleak is wire wound and vitrified, and was manufactured by the Zenith Company. Its resistance is 15,000 ohms and is tapped at approximately 10,000, 5,000 and 2,500 ohms. Such transmitting leaks are very satisfactory, and will carry far more current than is likely to be put through them without heating. Their cost is approximately 19s. 6d. each. The back-load on the key is another wire-wound resistance, this time of 30,000 ohms, tapped 15,000, 10,000, and 5,000 ohms. It is also manufactured by the Zenith Company at the same price. The trade name for these resistances is " Zenite " rods.



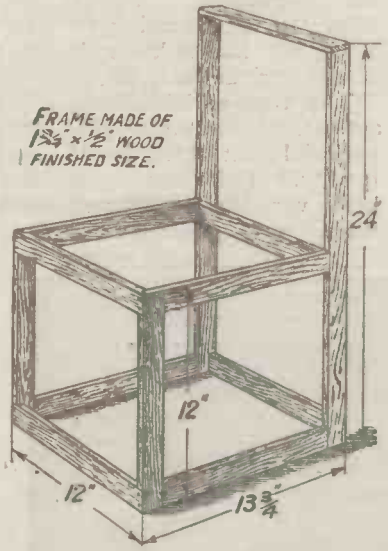
Disposition of parts behind the condenser panel showing back-load resistance for keying.

Filament Resistance

The filament resistance in this set is the Polar type, which will carry without heating all the current taken by the filament of a low-power transmitting valve. The double-pole double-throw switch is of the Utility pattern. The voltmeter is connected across the wires which lead to the middle contact of the change-over switch, and is, of course, connected above the filament resistance. This means that whichever way round the valve filament is connected, a reading will be given of the voltage across the valve legs. When the switch is turned to the middle position the filament circuit is broken, whereupon the voltmeter will automatically indicate the voltage of the accumulator. This is very helpful and interesting to many of us, who like to know the state of our various batteries.

The two variable condensers are each of about .0005 μF. It is essential that these be of good quality. I do not recommend here variable condensers with metal end plates which are connected to the fixed plates, the spindle carrying the moving plates being separated from the end plate by a narrow washer of inferior material. From this, it should not be imagined that it is impossible to construct an efficient condenser with metal end plates. Nevertheless, nine-tenths of the variable condensers so made are useless on this instrument. It is only fair to point out, however, that the Burndept variable condenser is in quite a different category, being properly designed with very low losses. Those shown in my own instrument are Bowyer-Lowe. In series with each of these condensers is placed a Dubilier-type 577 mica condenser. These are tested to 1,000 volts and have negligible losses. The ordinary type of Dubilier fixed condensers, such as is used as a grid-condenser or across telephones, is totally unsuitable here. Excellent

as they are for the purpose for which they are designed, they will not stand the voltages likely to be impressed on them in this set, and, furthermore, there



Frame details.

are other technical reasons why they should not be used.

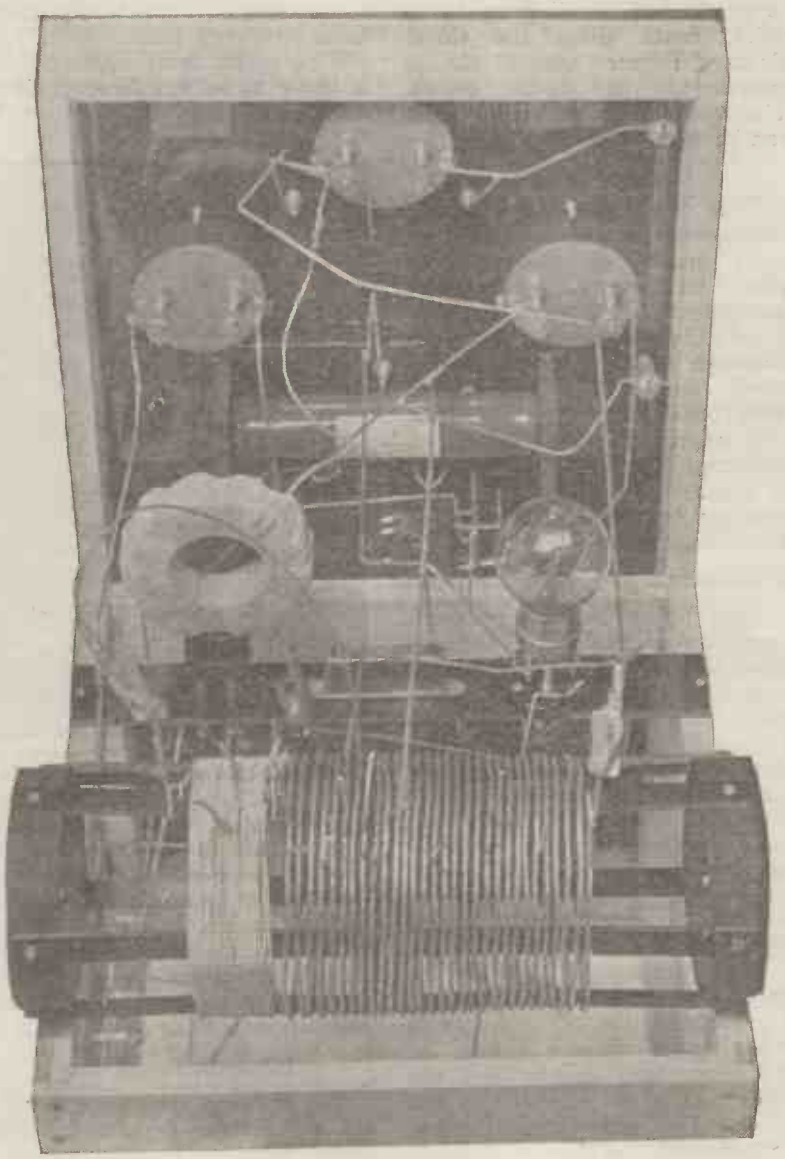
Dials

The Bowyer-Lowe condensers have, in the past, been supplied with metal dials. If you have such condensers with the metal dials, change them for ebonite for this set. The metal dial is connected to the rotary plates, and therefore if these latter are charged to high potential, which may be the case in some circuits, you are liable to sustain a severe shock in touching the dial. An ebonite dial will obviate this trouble. The firm will supply them with suitable ebonite dials on request, or you can purchase a Radion dial if you already have these condensers on hand. Radion dials are used in this set.

Constructional Details

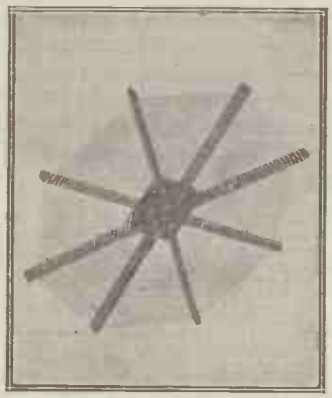
Such constructional details as the experimenter may require will be gathered from an examination of the photographs and drawings which accompany this article. The side of the frame carries a Radion strip with terminals reading from left to right, as follows:—Three key terminals (one for the lever and one for each back contact), L.T. negative and positive, and H.T. negative and positive. A transverse strip behind the upper panel carries a .002 μF Dubilier mica condenser, type 577, which acts as a grid condenser, a socket for the valve (a low-capacity socket should be used here) and a socket for the plug-in coil, which acts as a radio-frequency choke in series with the gridleak (if this is used between the grid and the filament, and not across the grid condenser, as happens in some circuits). A further socket is mounted, as shown at the back, to carry a radio-frequency choke in series with the H.T. positive lead.

The radio-frequency chokes, it will be noticed, are at right angles to the main coils and well separated from one another. The tuning coil former is of skeleton construction, made up on three pieces of 4-in. ebonite tube, joined by five pieces of 3/16 radion and secured to the frame. With the aid of a small rat-tail file, grooves were filed in these ebonite strips at a spacing of 6 to the inch. These grooves enable ordinary flexible aerial wire to be wound into them, giving a spaced inductance of low ohmic resistance. Tappings are taken off by soldering short lengths of No. 16 tinned copper wire at various points, and contact with these tappings is made by Burndept clips, flexible leads going to the correct parts of the circuit.



A rear view of the set.

(To be continued)

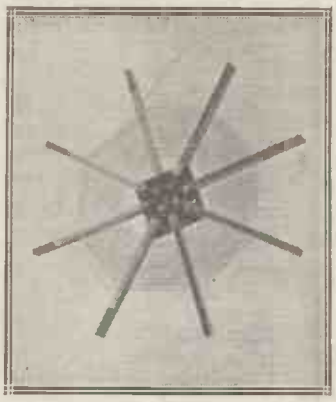


The 25 turns coil which was tested by Mr. Kendall.

An Efficient Low-Loss Coil

By D. J. S. HARTT, B.Sc.

Constructional details are here given of how to build a low-loss spider coil which, when tested by Mr. Kendall, gave very satisfactory results on measurement of signal strength.



A 15 turns coil wound by the same method.

THE writer, in an attempt to improve reception on an existing receiver, has tried various types and combinations of coils, and, as a result, some coils of the type shown in the accompanying photographs have been constructed, and found to be very efficient in use.

An advantage possessed by these coils is that two of them may be coupled very closely if desired, and if mounted as described later an effective variation from a tight coupling to a very loose coupling may be secured. Also tappings may readily be made if they are required. While they are necessarily somewhat bulky, due to the method of winding, their efficiency is ample compensation for this and for the trouble taken in making them.

Pancakes

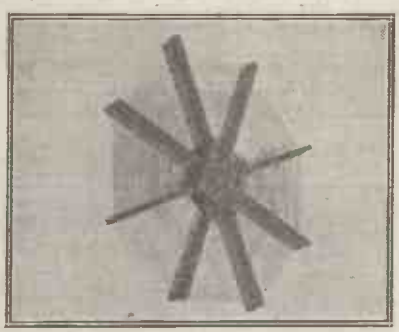
It will be seen from the photographs that they consist essentially of a flat spiral helix of wire wound on an eight-rayed ebonite former to give sufficient support, compatible with mechanical strength, and at the same time providing only a small amount of solid dielectric in the actual support.

Gauge of Wire

They are wound with No. 18 gauge bare tinned copper wire, each turn being spaced from its neighbour by a distance equal to about three diameters of the wire. On the face of each strip of the ebonite former slots are cut to accommodate the wire, these slots being sloped towards the centre of the coil in order that the wire may be wound on tightly in order to prevent its slipping out.

The Former

The former is constructed from six pieces of good ebonite, 6 in. × ½ in. × ¼ in., one piece 12 in. × ½ in. × ¼ in., and a square of ebonite 2½ in. × 2½ in. × 3-16 in. The long strip is fixed centrally to the square of ebonite, and parallel to one edge, by means of two countersunk 4 B.A. screws, each secured on the other side by a nut, so that its



Two coils are here seen tightly coupled as used by the author in a modified Reinartz receiver.

½ in. wide side is at right angles to the surface of the ebonite square. Two of the 6 in. strips are each fixed centrally, and at right angles to the long strip, by one countersunk 4 B.A. screw and nut. The four remaining strips are mounted in a similar way, using two screws and nuts for each, so that they are symmetrical about the centre.

Internal Diameter

The internal diameter of each of the coils shown in the first two photographs is 3½ in., and the slots are cut so that in one complete turn the wire is moved a distance from the centre equal to three times its diameter. In other words, the first slot to take the wire in each strip is at a distance from the centre greater than that of the first slot in the preceding strip by one-eighth of 3 times the diameter of the wire. It is difficult to obtain this accuracy in the actual construction, but with care it may be approached sufficiently near to obtain the desired effect.

Cutting the Slots

After the position for the first slot in each strip is marked, all the strips are numbered, taken off the ebonite square, clamped tightly together, and then the positions for the remaining slots marked on all at the same time. The slots are cut with a hacksaw, using two blades clamped together. It saves time if several of the strips are held firmly together and a number of slots cut simultaneously.

The former is next reassembled and the winding commenced. This presents no difficulty, and may be done rapidly if another person gives assistance in paying out the wire.

Commencing the Winding

The beginning of the wire is secured by soldering to the head of one of the screws, and the winding carried out fairly tightly, the end being secured by passing through two small holes drilled in one of the strips.

In the larger coil, seen in the

first photograph, there are 25 turns, while in the smaller one (second photograph) there are 15 turns. The coils may be mounted vertically and arranged to slide on two horizontal parallel rods of ebonite or even of brass, fixed on supports at each end, and arranged to pass through the centres of the coils through suitable sized holes drilled in the square of ebonite of the former.

Tight Coupling

If it is desired to clamp them together to secure a tight coupling, thin strips of good mica may be fixed on to the face of each strip of ebonite by means of a dab of shellac at each end. These are shown in the photograph of the smaller coil, but they may be dispensed with to advantage if the slots are cut of sufficient depth to enable the wire to be sunk just below the top surface of the former.

Wavelength Range

Using a single-wire aerial, 50 feet long, and of average height 38 feet, which has an abnormally short natural wavelength, the larger coil, when employed as a direct circuit tuner with a condenser of .0005 μF maximum capacity in parallel, gives a tuning range of from 300 to 530 metres. Under the same conditions the smaller coil tunes from 180 metres to 310 metres.

Adaptation

When used as the inductance of a crystal set this larger coil gives increased signal strength from 2LO (nine miles) as compared with the more usual types of coil. A combination of two coils, such as is shown in the third photograph, has given very good results on a Reinartz receiver (similar to that described by Mr. Percy W. Harris in the March, 1924, issue of *Modern Wireless*), no plate coil being used and ample reaction control being obtained with a three-plate vernier condenser. With this particular combination the tuning range is from 230 to 480 metres, using a .0005 μF condenser across the grid coil. With a few more turns on the grid coil this combination will easily cover the broadcast band of wavelengths.

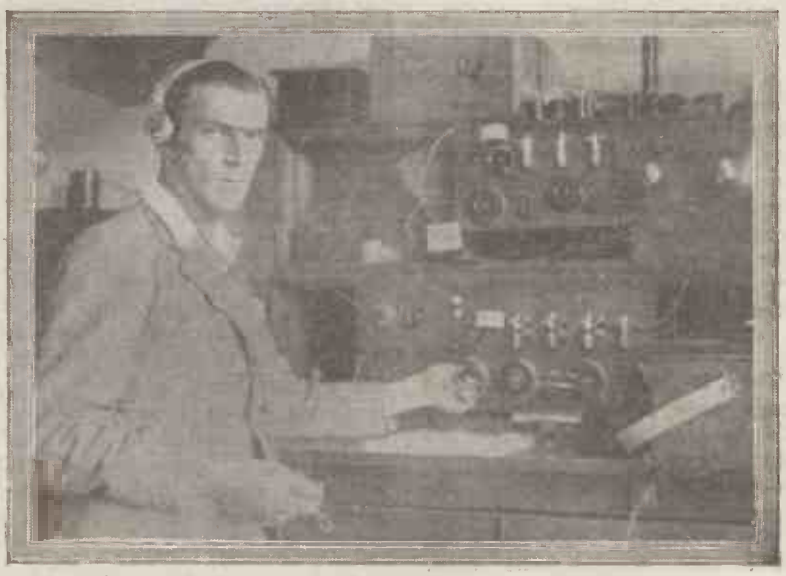
With fewer turns this type of coil may be used for reception on the shorter wavelengths. Sufficient has been said to indicate their efficiency, and, in conclusion, it may be mentioned that Mr. Kendall has tested the larger coil shown in the first photograph by the Moullin voltmeter method, as described in the January 7 and 14 issues of *Wireless Weekly*. On comparison with an experimental standard of high efficiency, which was in itself superior to any commercial coil yet tested, this coil gave a signal strength of 4.6, as against 4.2 of the standard.

Do Not Neglect Your Earth

NOT long ago I was called in by a friend who desired me to trace, if possible, a mysterious defect in his receiving set. The symptoms briefly were that its range and signal strength had fallen off, and that it had become most unstable. Nothing could be found amiss with the set itself or with its components, and after a careful examination the aerial was found to be perfectly efficient. The earth lead was a short length of stout cabled wire running to the surface of the ground immediately below the suspended wires of the aerial. "What sort of earth plate have you got?" I asked. My friend replied that there could not be any quarrel with that since it was a biscuit tin of the largest size buried three feet down in the soil that was always damp. He had installed it two years previously, and had always found it most satisfactory. As no other reason for the trouble could be found I thought that it might be as well to have a look at the earth plate, and we proceeded to dig down to it. When it came to light the mystery was explained at once, for it was a very sorry-looking biscuit tin that we found. The metal had been so attacked by the effects of corrosion that there was practically no connection between it and the earth lead.

In certain kinds of soil, owing probably to their acidity, metal is destroyed by corrosion very much more rapidly than in others, and the best of earth plates may become practically useless when it has been buried for a year or two. If, therefore, your signal strength falls off or other symptoms arise which seem to point to a faulty earth contact, it is as well to dig down to the earth plate in order to make sure that nothing of the kind described has happened.

R. W. H.



Mr. Edward C. Davies, who is well known as an experimenter in long-distance reception, is seen here with some of his apparatus.

SUPERSONIC HETERODYNE RECEPTION

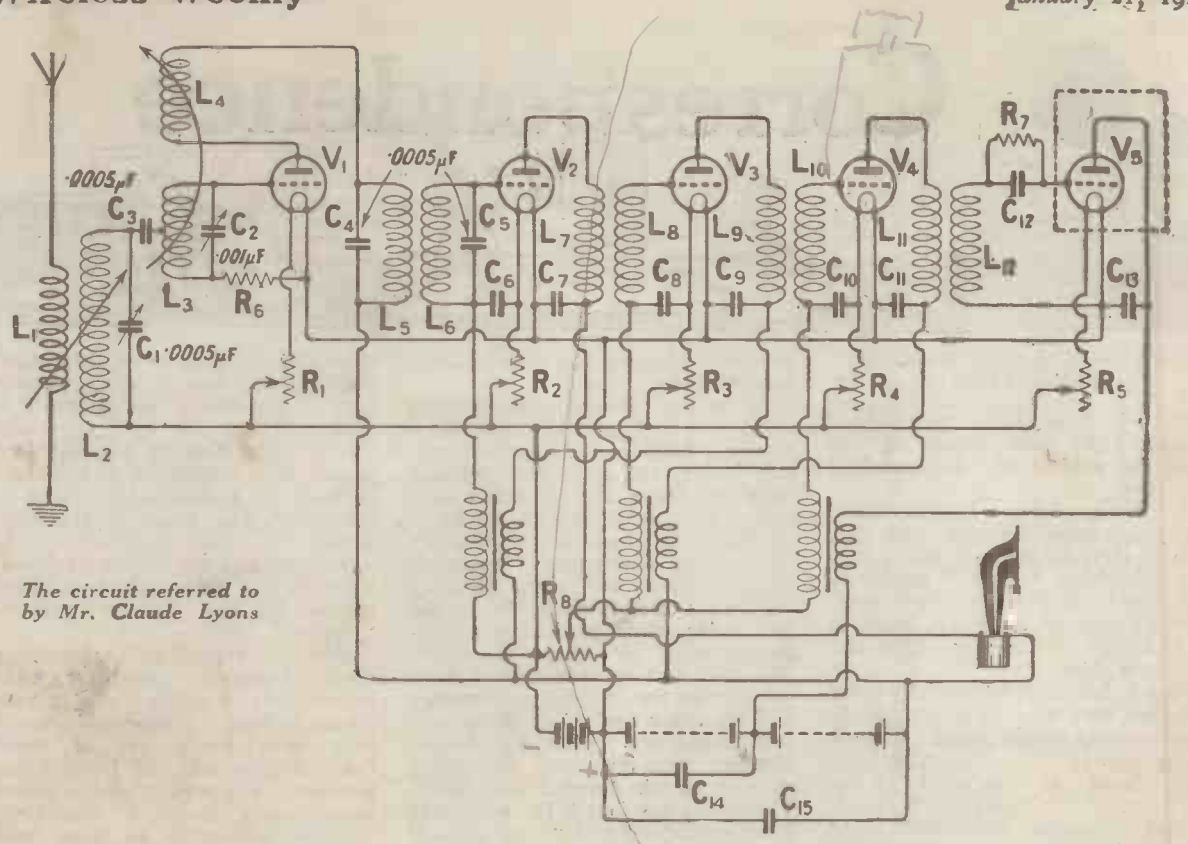
SIR,—I have been very much interested in your recent articles upon the subject of "Supersonic" receivers.

I have been experimenting with very great success with this type of receiver for over two years. For selectivity, "D.-X." reception, and great volume, combined with extreme ease of operation, there is undoubtedly no receiver which can approach this.

May I, however, respectfully point out that they are, as a rule, made unnecessarily complicated? In your Valve Notes for November 26, 1924, issue you referred to the "Tropadyne" circuit, which circuit I had sometime previously incorporated in a five-valve Supersonic receiver, and you may therefore be interested to hear how satisfactorily same works.

As is well known, the original Armstrong Supersonic-heterodyne receivers employed a separate oscillator valve, and a separate detector valve to detect the inaudible beat note. This usage of two valves to do the work which can successfully be done by one valve is wasteful. Many attempts were made of using two tuned circuits connected to the first valve, thus producing a self-heterodyning or autodyne valve. The idea was to tune one of these circuits to the incoming frequency and the other to the oscillating current frequency. It was found, however, that invariably the tuning of one circuit detuned the other. The writer has found, however, that when employing this "Tropadyne" arrangement, which has two independently tuned circuits in the grid circuit of the first valve, that manipulating one has no effect whatsoever on the other. Of course, it is essential that the grid condenser C_2 in your diagram on page 209 should have connection to the nodal point of L3 within a fair degree of accuracy. The value of this condenser C_2 may conveniently be 0.0003 μF and the leak 1 megohm; these values have given excellent results in the writer's portable "super."

Now, in regard to the intermediate frequency amplifier, the majority of diagrams given in your recent articles on supersonic reception have made use of tuned (variably) output and input transformers. The writer uses air core transformers correctly wound as regards inductance to give, with a "Dubilier" 0.0005 μF *fixed* condenser shunted on both primary and



The circuit referred to by Mr. Claude Lyons

secondary windings, a C/L constant exactly 30 kilocycles (10,000 metres).

The writer uses three such radio-frequency stages, followed by the usual valve detector, making in all five valves. The three radio-frequency valves are then "reflexed" on the Grimes Inverse Duplex method, using a fairly low transformer ratio (Marconiphone "Ideal" 2.7/1). The result has been a five-valve receiver which is far superior in all respects to any other the writer has heard in operation.

Furthermore, the writer has an arrangement whereby a "Formo" plug-in crystal detector can be plugged in the last valve-holder with no appreciable loss in signal strength; but this is not often employed as crystals are somewhat fiddling things at times. You will thus see that with four valves and a crystal and only two tuning controls it is perfectly possible to exactly duplicate the results obtainable with a standard nine-valve instrument, arranged Osc-v-3-v-3.

The great number of valves generally used in practice and mentioned in published diagrams and information, etc., has, in my opinion, been the leading factor which has kept this wonderful receiver in the background. Few can afford a seven, eight or nine-valve instrument, especially if they are mistaken enough to be using "bright" valves with their enormous consumption of L.T. and H.T.

I am enclosing a circuit diagram of my five-valve Super, which you may think of sufficient interest to print for the benefit of your readers. Jack switching is also incorporated on the audio-frequency side, giving 0, 1, 2 or 3 stages of amplification; this has been omitted as the circuit as it stands will probably be sufficiently complicated for the great majority of your readers to follow. Furthermore, as there is no saving in L.T. current or "life" of the valves if the stages of audio-frequency amplification are not used, and the volume can be controlled by the potentiometer if same is too tremendous, it may be that this is a refinement which is really not worth incorporation. It has been carried out on my instrument purely because I frequently wish to use only radio-frequency amplification with telephones; even then the amplification is frequently too great when the receiver is in its most sensitive condition to listen-in with comfort.

My diagram shows the instrument coupled up to an aerial; but it is usually used on a 3-ft. frame aerial consisting of nine turns of bare stranded "Mars" aerial wire spaced 1 in. apart. A coupler having an untuned or "aperiodic" primary (eight turns No. 24 S.S.C.) and 50 turns of the same wire as secondary, on a 3-in. external diameter ebonite tube former, the winding being spaced ½ in. apart, is used.

On the frame aerial all B.B.C. and relay stations come in at such tremendous volume that I have had to purchase a specially large loud-speaker to handle the volume.

American stations can be received at will, subject, of course, to static-signal strength ratios being favourable. Not only stations on the Atlantic side of the U.S.A., but also many stations on the Pacific coast. This is surely very remarkable for a five-valve (or four-valve-crystal) receiver?

B.T.H. 3-volt valves, drawing 0.06 amps., are used from a small 4-volt accumulator (20 actual amp. hours). When I reflect that the wattage consumed is only 1:2 per hour, compared with that of another receiver which I have now discarded (3-v-2), the wattage of which was 27 *per hour*, and that my last 6-volt accumulator required a motor-car or hand truck to take it to the charging station, I am amazed that people continue to use straight-for-

ward English circuits with bright valves, and with from ten to twenty controls or adjustments; also this is a superior and much more efficient receiver.—Yours faithfully,

CLAUDE LYONS.

Liverpool.

H.T. BATTERIES

SIR,—The remarks of Mr. Percy Harris in "Random Technicalities" of January 7 issue are of great interest, and upon the subject of high-tension batteries I may say I am in entire agreement with him. Further, the experience of many with whom I come in contact proves that these unsatisfactory results are by no means exceptional.

Ignoring my expensive experimental work, in which I must admit I often ask too much from any battery, I will deal entirely with the results obtained with the family three-valve set used for receiving the usual broadcasting.

In the first place, I obtain my supplies from a source which enables me to know they have not been in stock for months and that they are absolutely unused. During the last eighteen months I have had four sets of batteries, all of which were manufactured by leading makers, none of which were cheap. Going into the question of costs, I find that H.T. batteries alone have cost somewhere between 2d. and 2½d. per hour, which is much too high. Unfortunately, I am unable to use accumulators, otherwise I would have gone over to them months ago. At present I require another set of batteries, and I am entirely at a loss to know what make to purchase.

I fail to find any reason why manufacturers are unable to produce to-day batteries equal to those produced two to three years ago, and unless we are given a better product I am afraid that they will find importers of batteries selling at considerably less than present prices doing large business in the very near future, but I hope not.—Yours faithfully,

EXPERIMENTER.

London.

LECLANCHE CELLS AS H.T.

SIR,—On reading your notes (in *Wireless Weekly*, 31st ult.) about the H.T. batteries of to-day being so rotten, I wondered if you had tried Leclanche wet cells for plate voltage.

I have used them on a four-valve loud-speaker set here since last March. Up to the present they have not been touched in any way. In all I have 96 cells, three being used as bias cells. The last two valves I use are B.T.H. B4, with full H.T. voltage. The H.F. and detector valve vary 60-70 for H.F., 40-60 for detector; all have separate H.T. + tappings. The L.T. is made up of three large glass accumulators.

The primary cost of the Leclanche battery is rather great, being about £12, and the room they take is also great. The floor space of mine is 12 in. by 8 ft. Of course, they could be put into a cupboard on three shelves quite easily.

With them the set is very silent. I do not use any smoothing condensers whatever. Also a slight short now and again does not materially hurt them.

Would it be possible to get the manufacturers to make smaller cells, say, ½ pt. (mine are 1½ pt.); they should be cheaper and would take up less room. I am a constant reader of *Wireless Weekly*, *Modern Wireless* and *The Wireless Constructor*, all of which are very helpful to me in my experiments. Wishing you and your excellent books every success.—Yours faithfully,

ERIC BROMLEY.

Kent.

Apparatus we have tested

Conducted by A. D. COWPER, M.Sc., Staff Editor.

Back-of-Panel Two-Coil Holder

A two-coil holder adapted for mounting behind a vertical panel in the American type of cabinet, which is becoming increasingly popular on this side, with outside control by knob and pointer, has been submitted for our examination by Messrs. Goswell Engineering Co., Ltd.

This has the stationary coil-plug mounted on two short brass columns which are fixed by screws to the panel, and a horizontal spindle passing through the panel and the centre of this plug, carrying the moving coil-holder about 1¼ in. behind the first, and giving a circular motion in a vertical plane to the moving reaction-coil past the fixed A.T.I. coil. A very useful device is provided in the reaction-coil-holder, in that the connections are made to two small coloured plugs of the "wander-plug" type, which are inserted in sockets on the sides of the plug fitting to make the anode connections. The direction of reaction can thus be reversed in a moment—a device of considerable value in multi-valve experimental receivers, and which might receive considerable extension. Connections are made to the fixed coil by means of small soldering tags at the base of the brass columns. A strong spring friction device, adjustable by nuts equipped with the proper lock-nuts, renders the movement of the reaction-coil smooth and secure, so that, on trial, the largest coils could be controlled.

The insulation resistance proved, on test, to be excellent, and the device gave the necessary smooth control over reaction. With the ordinary type of knob fitted, the fingers of the operator came within half an inch of one of the A.T.I. terminal-pillars during tuning operations; with critical or sensitive circuits this is likely to result in considerable annoying hand-capacity effects, and should be guarded against by the use of a long extension handle.

"Ledion" Coils

We have received from Messrs. Ledion, Ltd., sets of their "Ledion" basket-coils for test; one set of five coils ¼ in. thick; another of the same number but ½ in. thick, and two large coils for the recep-

tion of 5XX in the two thicknesses respectively. These are all wound in a diamond basket-weave, self-supporting and without wax or varnish, of green cotton-covered wire of the usual small gauge used in commercial inductances.

The wide coils, intended for ordinary plug-mounting, tested on an ordinary panel with a variable tuning-capacity, range from .0003 μF (approximating to the standard P.M.G. aerial) to .0008 μF (*i.e.*, with a tuning-condenser of the usual size, .0005 μF across the coil), gave the wavelength ranges recorded: 28-turn coil, 280 to 460 metres; 40-turn, 365 to 560 metres; 50-turn, 510 to 860 metres; 64-turn, 640 to 950 metres; 80-turn, 830 to 1,220 metres; large 148-turn, 1,440 to 2,360 metres; and to 2,900 metres with .001 μF tuning capacity.

The narrow coils for basket-coil mounting gave:—36-turn coil, 290 to 455 metres; 44-turn, 340 to 540 metres; 56-turn, 440 to 740 metres; 64-turn, 520 to 870 metres; 80-turn, 670 to 1,040 metres; large 148-turn, 1,340 to 2,160 and 2,630 metres.

Evidently the coils have been adjusted to give ample overlap, and on trial it was found possible to choose a suitable reaction-coil from the series in each case, with the smaller coils; the large 5XX coil required a similar one for oscillation with direct-coupled aerial. It was noticed that the lower numbers oscillated freely with moderate reaction, showing a reasonably low H.F. resistance.

With careful handling the coils appeared to be strong enough for use without separate support, though provision should be made at once when bringing them into use to secure the ends.

A Microcondenser

The Sterling Manufacturing Company of Ohio, U.S.A., has sent for our examination a sample of the "Sterling R.311 Microcondenser."

This is for use in circuits where a minute adjustable capacity is required—though not continuously variable by a controlling-knob—as in the original American version of the Hazeltine Neutrodyne circuit using high-frequency transformers with a tapping on the tuned secondary for neutralising connections.

An extraordinarily low minimum capacity is needed in this particular type of circuit, and but a very small range. The small instrument submitted obtains this low minimum by putting two small condensers in series, each being of low minimum through the provision of ample clearance and the isolation of terminals on opposite sides. The whole instrument is only $1\frac{5}{8}$ in. long by 1 in. wide, and $\frac{1}{8}$ in. thick, consisting of two shaped end-plates mounted on a thin ebonite rectangle with terminals actually $1\frac{3}{8}$ in. apart. A tiny, flat double-ended propellor-shaped rotor-piece turns on an isolated centre-screw, so as to engage the shaped ends of the fixed plates, a piece of fairly stout mica dielectric separating the plates. When turned cross-wise, only the capacity between the edges of the plates, in series, is effective; at 90 degrees to this position the blades are both fully engaged, and the maximum series capacity results.

On measurement the minimum capacity (eliminating that of the leads, etc.) was around 0.9 $\mu\mu$F, the maximum 2.7 $\mu\mu$F giving an available range of 1.8 $\mu\mu$F, which is adequate for the purposes indicated. The insulation, on test, was excellent.

The R.S.G.B.

Sir Oliver Lodge, F.R.S., D.Sc., the newly elected President of the Radio Society of Great Britain, will deliver an address entitled, "Matter and Radiation," at an Ordinary Meeting to be held at 6 p.m., on January 21 at the Institution of Electrical Engineers, Savoy Place, W.C.2.

Information Department

SUPPLIED BY RADIO PRESS SERVICE DEPT., LTD.

J. R. E. (ILFORD) is very much troubled by interference produced by induction from neighbouring power mains and asks for any general remedies.

The severity of the symptoms reported makes it seem probable that great difficulty will be experienced in achieving anything like complete elimination of the trouble, but some of the following expedients will probably produce considerable relief. In the first place, try a loose-coupled circuit, both with and without an earth connection to the batteries of the receiver. Also try the effect of connecting in series with both the aerial and the earth leads small condensers of the order of .0002 μF each, both in the case of an ordinary direct-coupled circuit, and in the case of the loose-coupled circuit recommended.

It is quite possible that changing the earth connection will also lead to an improvement, and this should be tried. If the present connection is to a water pipe, a buried earth should be tried, and also, if circumstances permit, a counterpoise or earth screen. If no relief can be obtained in any other way, it would be worth while to experiment with a frame aerial, since the set which our correspondent is using seems to be sensitive enough to be used in this way and yet permit fairly good results to be obtained. We do not think that in this particular case low-frequency amplification should be attempted at all, since it is evident from our correspondent's letter that the trouble is at any rate partly due to direct picking up of the induction troubles by the low-frequency amplifying stages.

R. A. I. (HORNSEA) is building a choke-coupled low-frequency amplifier and proposes to use ordinary iron-cored intervalve transformers as the coupling units, and enquires as to the correct method of connection to obtain the greatest possible value of inductance.

Provided that the transformer windings are both in the same direction, the desired effect will be produced if the outer end of the primary is connected to the inner end of the secondary. In answer to your question regarding the grid condensers, we think that it would be well to use the conventional values as in resistance capacity

amplifiers, with a fairly low resistance of gridleak, such as 1-megohm or even half a megohm.

F. A. J. (DUBLIN) wishes to carry out certain experiments upon the cause of what is known as fading, and proposes to use two receiving sets connected to two separate frame aerials, the two sets to be used for receiving two different stations, their outputs to be connected to the two separate earpieces of a pair of headphones. Our correspondent then proposes to note whether the signals fade simultaneously or independently, and to deduce, therefore, information as to the nature of fading in his particular case. He enquires as to our opinion regarding the probable interference between the two frames, and as to how far apart they should be situated.

Much will obviously depend upon the amount of reaction which is used in the two sets, but we think that if the frames are separated at, say, the opposite ends of the room, little trouble will be experienced unless one of the sets actually oscillates. Of course, entirely separate high- and low-tension batteries should be used for each set.

B. R. K. (HENLEY) has built a Four-valve Family Receiver with which he finds that he can obtain no signals whatever with the detector valve only, and with the H.F. valve in operation signals are weak, the set oscillates in a very uncontrollable manner, howls a good deal, and the potentiometer appears to exercise no control over reaction.

Our correspondent's difficulty will be located in the potentiometer, and a new one should be tried. Experience has shown that this is by far the most common fault in the Four-valve Family Receiver, and whenever one of these instruments behaves in a peculiar manner, oscillating regularly, howling easily, and giving weak signals the potentiometer should be inspected. In some cases the results of a defective potentiometer are decidedly unusual, such as was recently reported by a reader, in whose set the H.F. and detector appeared to be functioning only a little below their correct efficiency, so that he did not suspect any trouble at this point, but he was much troubled by self-oscillation at low-frequency in the circuits of the last two valves. All the usual remedies for L.F. howling had been tried, without success, and it was only upon the fitting of a new potentiometer that the trouble was removed. The effect of the defective component in this case was, of course, to remove the connection from the battery circuit to earth, which is so valuable as a stabilising agency in many low-frequency amplifying circuits.

S. G. W. (CLAPHAM) has just built his first set, and is somewhat puzzled by the expression "spark signals" and "continuous wave signals," which he understands refers to morse signals, and asks how one can distinguish between them by their sound.

Spark signals do not as a rule possess a very musical sound, but may range between a harsh buzz and a fairly clear whistle, while their pitch is not altered by varying the tuning of the receiver, and if the set is made to oscillate they are always heard with a more or less rough and hard sound. C.W. signals, upon the other hand, cannot be heard until the receiver oscillates, and have a clear musical note which can be adjusted plainly between the highest and lowest audible note by varying the tuning of the receiver.

LISSENIUM

How to get sharp-tuning coils—

THE secret is in the making. The impedance of a circuit tuned to a frequency corresponding to a given wavelength should be as near infinity as possible, but on each side of the optimum point the impedance to the same frequency should be as near zero as possible. If, instead of nearly zero, this impedance is appreciable, signal voltage will be built up and signals heard on each side of the optimum point—in other words, the coil will be a flat-tuning, or unselective one. As well as responding to a *broad* (instead of a narrow) band of frequencies, flat-tuning coils do not respond as *strongly* to a desired frequency as one well-known make of coil does, so that with the wrong make of coil you lose *signal strength* as well as *selectivity*.

THE design and making of a plug-in coil largely determine the sharpness of its response to a given wavelength—the air spacing, the disposition of the conductors, the dielectric absorption, and many other interesting considerations. YOUR COIL IS THE PRODUCT OF ALL THESE, and the manner in which they have been dealt with by the maker gives you the strong signal strength and the extreme sharp-tuning qualities you notice when using LISSENAGON (pronounced LISSEN-AGON) coils.

LISSENAGON TUNING CHART.
Note the Intermediate Coils 30, 40 and 60.

TABLE I. Wavelength range when used as Primary Coils with Standard P.M.G. Aerial and .001 mfd. condenser in parallel.			TABLE II. Wavelength range when used as Secondary Coils with .001 mfd. condenser in parallel.		
No. of Coil.	Minimum Wave-length.	Maximum Wave-length.	Minimum Wave-length.	Maximum Wave-length.	PRICE.
25	185	350	100	325	4/10
30	235	440	130	425	4/10
35	285	530	160	490	4/10
40	360	675	200	635	4/10
50	480	850	250	800	5/-
60	500	950	295	900	5/4
75	600	1,300	360	1,100	5/4
100	820	1,700	500	1,550	6/5
150	965	2,300	700	2,150	7/7
200	1,885	3,200	925	3,000	8/5
250	2,300	3,800	1,100	3,600	8/9
300	2,500	4,600	1,400	4,300	9/2

If you ever want coils which intensify tuning—use Lissenagon Coils.

The best tuning combination you can get—LISSENAGON COILS with the LISSEN MARK 2 MICA VARIABLE CONDENSER.

PARTS WHICH BUILD INTO SOUND THE INVISIBLE ACTIVITIES OF MINUTE ENERGY—don't mix your parts—there is a LISSEN part for every vital place.

Advt. of LISSEN LIMITED, London.

All Brandes products carry our official money-back guarantee, enabling you to return them within 10 days if dissatisfied. This really means a free trial.

. . . . every one of these advertisements will show an added advantage in the construction of Brandes Headphones.

The lock-nut on the receiver yoke is a clutch that tightens and holds the receivers firmly in place when satisfactory adjustment has been obtained. This point prevents the receivers from slipping, keeps the headphones in correct balance without possibility of working askew and makes the headband follow the natural line of the head. The whole family can wear the headphones with comfort.

British Manufacture. (B.B.C. Stamped.)

Matched Tone means a technical improvement in telephone construction which should at once grip your attention. If you are intent on better broadcast reception, if you wish to gather the more distant signals with increased strength and clarity, then Brandes Superior *Matched Tone* Headphones are certainly what you want. Matched by ear, the two receivers of ordinary headphones cannot gain an exactly similar degree in tone and volume by a margin of eighty degrees. Brandes, matched by special apparatus, obtain corresponding sensitivity and volume in each receiver to within five degrees and a consequent increase of tone purity accuracy and strength. For just home stations or trans-atlantic and trans-continental telephony, get Brandes *Matched Tone* Headphones. *Ask your Dealer for Brandes.*

The *Table-Talker* is another Brandes quality product at moderate price. Designed to meet the need for a simple radio loud-speaking device to entertain a group of people in an average size room, its full round tones are wonderfully clear and pleasing. It is matched to the unit so that the air resistance produced will exactly balance the mechanical power of the diaphragm. This means beautiful sound-balance. Gracefully simple of line, it is finished a shade of neutral brown. 42/-

Brandes

The Name to know in Radio

Superior Matched Tone Headphones.

25/-

THE . SAME . SOUND . IN . BOTH . EARS

Names famous in combination No. 3.

Dante and Beatrice

DANTE and BEATRICE have an honoured place in the illustrious gallery of associated personages.

To-day the two great organizations, MARCONI and OSRAM, have combined to produce a range of wireless valves unexcelled in design and performance. . . . If the faithful reproduction of speech and music is to be enjoyed to the full, get "The Valve in the Purple Box."

Read the 40-page wireless book, The Book of M O V. Free from your dealer or The M.O. Valve Co., Ltd., Hammersmith, London, W.6.

HOW TO ORDER YOUR VALVES.

For 2-volt Accumulators.

Purpose.	Type.	Price.
†G.P.	D.E.R.	21/-
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For 4-volt Accumulators.

G.P.	R.	12/6
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†G.P. = General Purpose.
†L.S. = Specially suitable for low frequency amplification for Loud Speakers.
•Can be used with Dry Batteries.
∴For Resistance – capacity Amplification.

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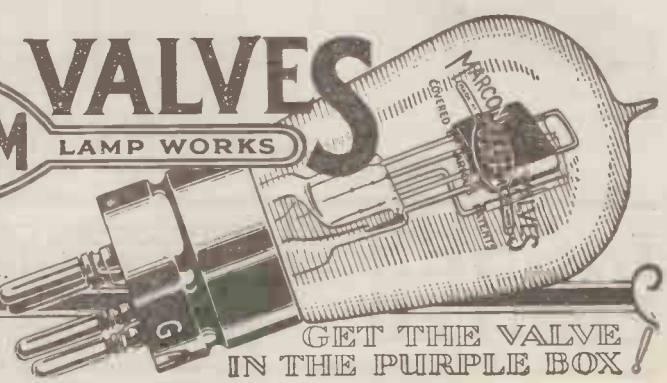

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A contrast—and a comparison.

Here a "Type 600" is being shown in contrast with one of ten high-power condensers recently built at our works. These are the biggest mica condensers in the world. The contrast is one of size and load-capacity only. In quality of materials employed; skill in design and workmanship; rigorous testing before dispatch; and guarantee as to performance, the "Type 600" will stand the closest comparison, point for point, not only with the big condenser shown but with any other Dubilier Product large or small.

BE ADVISED—SPECIFY DUBILIER.

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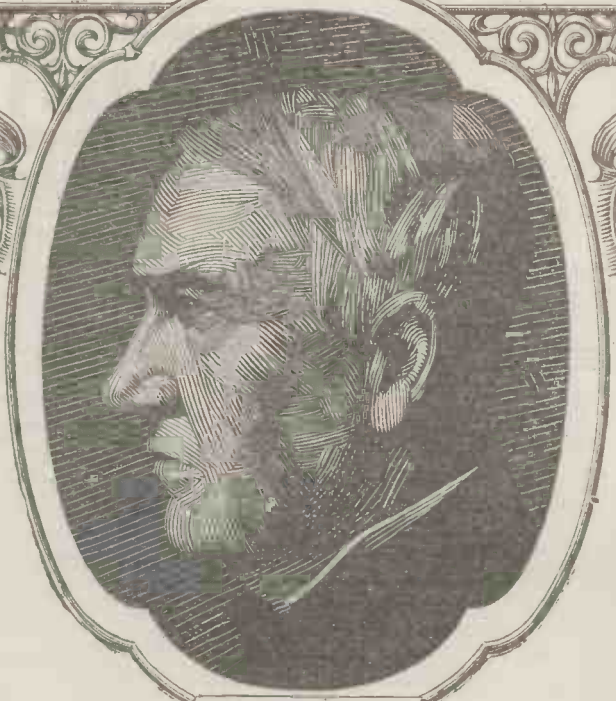
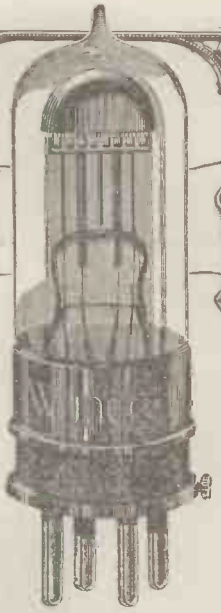
Cossor
Bright Emitter



Thomas Edison



Wuncell
Dull Emitter

Edison's Bamboo Filaments.

AMONG all Edison's marvellous contributions to mankind—from the phonograph to the carbon microphone—none has been more spectacular than his invention of the first electric lamp.

This wizard of electricity saw that, although the arc lamp was an established success, electric lighting could not progress until it was brought into the people's homes. It is said that Edison's experiments to discover the electric lamp cost him £10,000, and certainly he was many years on the problem before he attained success. Although the first filaments were of carbonised cotton, he discovered that bamboo, of all substances, gave him the best results!

It is indeed a far cry from carbonised bamboo to the wonderful filaments inside the new Cossor Wuncell Dull Emitter. About as far as the latest De Havilland is from the flimsy contraption flown by Wilbur Wright at Dayton one-and-twenty years ago.

The Wuncell filament glows at a temperature of only 800 degrees—certainly the nearest approach to the cold valve yet reached. In addition to low current consumption this also means an extraordinary long life. Before buying any more Valves be sure to read our Wuncell Folder—full of interesting facts you ought to know about dull emitters. Get one free from our Dealer, or send a postcard for one to us.

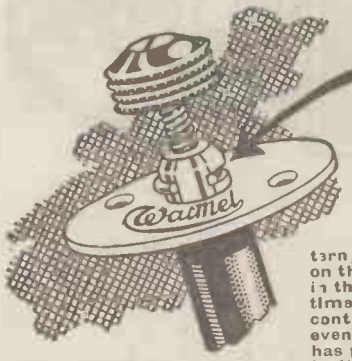
Wuncell Valves cost 21/- each, from all Dealers (23/6 if supplied with inbuilt resistance for use with 2, 4, or 6 accumulator, without alteration to wiring of Set).

No. 2 of a Series.

Cossor Valves

Advertisement of A. C. Cossor, Ltd., Highbury Grove, N.5. *Gilbert Ad. 2119*

A RECENT TEST REPORT



"We have tested samples of a new pattern of their well-known variable grid-leak in which the possibility of a certain irregularity of action when the instrument has been in use for some time and is showing, perhaps, some looseness in the spindle through wear, is effectively eliminated by the provision of a spring-contact to the central spindle at the knob end of the instrument.

"Thus, in this latest pattern, a spring brush bears down on the spindle through a slot cut in the end bush, and makes at all times effective and silent electrical contact with the screw spindle, even when, by long use, the latter has perhaps become a little loose in its bush.

"On test, the samples showed a steady variation in resistance value from about 0·6 to 4 and 0·7 to 4 megohms respectively, the values being fairly reproducible, and they were silent in operation. This small addition should prove a valuable feature in these grid-leaks."

WatMel

All goods of our manufacture bear this mark. It is your only guarantee.

WATMEL Coil Former

For winding any type of inductance. Price **4/6**

Patent 206098

5 to ·5 Megohms ... 2/6
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Other Resistances to suit any circuit.

Send P.O. for Descriptive Folder.
SEE THE TRADE MARK

WatMel

ON EVERY GRID LEAK.
BEWARE OF IMITATIONS.

WARNING!

The Watmel Wireless Co. wish to notify the trade and public that their Variable Grid Leak Patent Application No. 206098 was contested in the Comptroller's Court, and on appeal; in both instances the Patent Grant was upheld and costs awarded.

It is the aim of this Company to protect traders', customers', and also its own interests by securing Patent protection for the novelties in its specialities, as it is these novelties, invented by experts and exhaustively tested, which are the Hall Mark of all Watmel Products.

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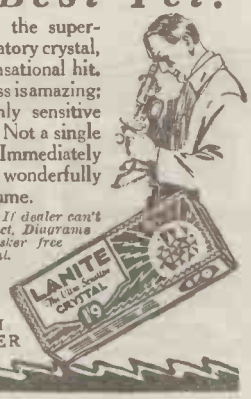
Order to-day. If dealer can't supply, order direct. Diagrams and special whisker free with every crystal.



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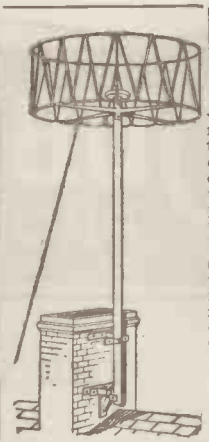

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THE "PERFEX" OUTDOOR AERIAL shown on the left will increase range, volume, purity and selectivity, and obviate interference from passing electric trams or trains. With one mast only, its compact form enables it to be erected anywhere, irrespective of space. Complete with downlead ready for attaching to mast ... ... **£3 : 15 : 0**

THE "PERFEX" LIGHTSHADE AERIAL, as illustrated, is a non-directional Indoor Aerial in the form of a handsome silk-covered Lightshade, for which it can also be used. Suspended 6 ft. above a multi-valve set, it has a range of 20 miles, and if hung in the room above the set, a range equal to the average single wire Outdoor Aerial is obtainable.

Complete with downlead and fittings for suspension **£4 : 5 : 0**

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Can be obtained from all Wireless Dealers or direct from the Patentees and Manufacturers:

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The COLVERN Neutrodyne Condenser

Extract from a Test Report by A. D. Cowper, M.Sc., in "*Wireless Weekly*," December 17th, 1924.

"On practical trial was found to be admirably adapted for its purpose; the 'zero' capacity was minimal, and the effective range ample for its purpose. Both with the type of neutrodyned tuned-anode H.F. coupling with plug-in coils, and with the convenient modification introduced lately by Mr. P. W. Harris, using a mushroom H.F. plug-in transformer for anode and neutrodyning coil together, satisfactory neutralisation of valve capacities resulted, and complete stability with light aerial-coupling and sharp, selective critical tuning."

PRICE
3/6

Overall size under panel 2½ in. diameter.

One-hole fixing and supplied with an anti-capacity extension handle.

The COLVERN General Purpose Vernier provides a means of obtaining perfect balance of all tuned circuits. Fit one to the secondary or reaction circuits, and you will appreciate what accurately tuned circuits can do for your reception. An enthusiast writes:—"H.F. Tuning is now a pleasure of greatest ease." Another says:—"My set was constantly howling and I could not get clear signals. With the COLVERN fitted I can quickly get splendid clear reception."

Price 2/6.

If your local dealer cannot supply, kindly send his name and address when ordering.

COLLINSON'S PRECISION SCREW Co. Ltd.,
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Telephone—WALTHAMSTOW 532.

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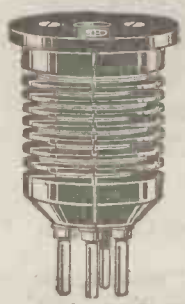
If Efficiency's the aim
M.H. Products you must name.



M.H. H.F. TRANSFORMERS,

plug-in, in six ranges of wavelength. 10/- each. A complete set in case 55/-. Any number of each transformer supplied matched, at no extra cost, if specified when ordering.

M.H. NEUTRODYNE UNIT.

Similar to the H.F. Transformer, but wound to the special requirements of the neutrodyne circuit. 10/- each. Any number supplied matched, at no extra cost, if specified when ordering.

M.H. VARIABLE CONDENSER.

Aluminium plate, square law, with or without Vernier.

0.001μF	Vernier	17/6
	Plain	11/6
0.0005μF	Vernier	15/-
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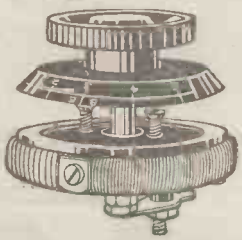
0.0003μF	Vernier	14/-
	Plain	8/6
0.0002μF	Vernier	12/6
	Plain	7/6



M.H. DOUBLE FILAMENT RHEOSTAT.

For use with either Dull Emitter or Bright Emitter valves alternatively. Similar to the ordinary M.H. type Filament Rheostat and also provided with an off position. The dial is engraved RED on the Bright Emitter segment and WHITE on the Dull Emitter segment. 7/6.

M.H. CRYSTAL.

A natural galena of special selectivity. Each piece is carefully selected and tested on distinct telephony. Contained in a dust-tight metal box with a glass top. A well-made non-corrosive spear-point catwhisker is packed with each crystal. 1/6.

M.H. STANDARD DE LUXE BROADCAST RECEIVER.

Contained in a handsome Oak or Mahogany cabinet with folding door completely enclosing the panel. Self-contained control for either Dull or Bright Emitter Valves. On a normal aerial this set will receive all British and most Continental Broadcast; two optional amplifying valves enable telephone or loud speaker to be used as desired.

The only external connections are neat plugs for aerial earth and loud speaker or telephones.

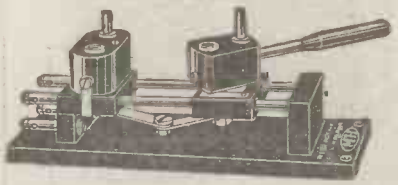
Set £33 0 0 (Marconi Royalty 50/-).
Complete equipment, less aerial, £48 16 0.

(2-Valve Set)

M.H. HOME ASSEMBLY SETS.

Two, three, and four valve sets and one and two valve amplifiers of sound design for Home Assembly purposes. Supplied complete with a Reversine 2-coil holder and an H.F. Transformer for Broadcast wavelengths. A handsome polished cabinet containing drilled and engraved ebonite panel and all accessories, with instructions for assembling the set.

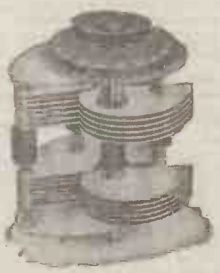
2	Valve	£6 15 0	(Marconi Royalty		25/-)
3	,,	£9 10 0	(,,	,,	37/6)
4	,,	£12 5 0	(,,	,,	50/-)
1	,, Amplifier	£3 17 6	(,,	,,	12/6)
2	,, Amplifier	£7 10 0	(,,	,,	25/-)



M.H. REVERSINE COIL HOLDER,

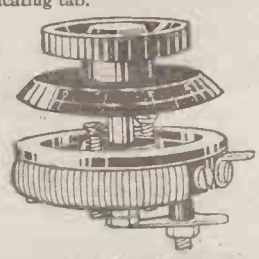
perfect in action, taking the standard Duolateral coils. This coil holder enables the moving coil to be completely reversed in both its physical and electrical relationship with the fixed coil. It is a perfect variometer as well as a loose coupler and means of applying reactiou.

2-coil 21/-



M.H. DUAL VARIABLE CONDENSER

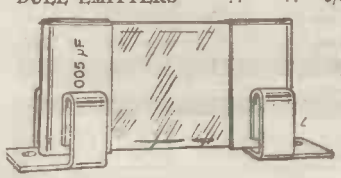
for tuning two stages of H.F. Amplification. Aluminium plate, square law, each half 0.0003 μF capacity. All variable condensers supplied in cartons containing the condenser, fixing screws, template for panel drilling and zero indicating tab. 19/-



M.H. FILAMENT RHEOSTAT.

A distinctive type made for either Dull Emitter or Bright Emitter Valve purposes. The spool is a separate unit and solidly constructed holding the resistance unit on its circumference. An off position is provided for.

BRIGHT EMITTERS 5/6
DULL EMITTERS 6/6



M.H. FIXED CONDENSER.

The M.H. standard interchangeable value type condenser. Made of high-grade ruby mica and tin foil. Connection is made by the two nickel-plated metal ends to two nickel-plated spring clips which go directly under terminal nuts.

0.0001 μF to 0.001 μF 1/9 each.
0.002 ,, ,, 0.01 ,, 2/3 ,,
(Two clips are supplied with each condenser.)

Manufacturers of Wireless and Scientific Apparatus.

L. McMICHAEL LTD

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Elusive signal strength!

SMITH AND JONES both build the same Set. Both follow literally the instructions contained in the constructional article and both use the same components. Smith gets good results and Jones gets not a whisper. What is the reason? The panel. Or, Robinson's Set used to give splendid results—all the B.B.C. Stations with 'phones on the table. Now he cannot pick up more than three or four. What is the reason? The low grade ebonite panel has probably absorbed some moisture from the atmosphere.

Perhaps you are a Jones or a Robinson and have been worried with poor results.

The remedy is to use a guaranteed panel material like Radion—the highest grade ebonite in the world. No matter where you buy it—whether in Glasgow or in Brighton—its quality is identical. Its wonderful lustre repels moisture and need not be removed before use (this saves hours of tedious sandpapering). It is so tough and strong that a thickness of $\frac{3}{16}$" is ample. Its insulation superiority has been endorsed by the leading experts in this country and in America, while its dielectric constant has been reduced to 3·9.

Your next Set is worthy of a good panel. Don't run the risk of poor results by using a piece of ordinary ebonite. Everyone knows that there is good ebonite and bad ebonite on the market, but few are in the position to be able to judge one from the other. The only safe way is to ask for Radion in one of its 21 different sizes. Remember that you can get it in black and mahoganite with dials and knobs to match. If your Dealer is out of stock he can get it for you by return, or, if you prefer it, we will supply it direct.

RADION

PANELS AND DIALS

Size	Black	Mahoganite	Size	Black	Mahoganite	Size	Black	Mahoganite
6"×7"	3/6	4/3	7"×14"	8/–	10/3	8"×26"	17/6	21/3
6"×10½"	5/3	6/6	7"×18"	10/6	12/9	9"×14"	10/6	12/9
6"×14"	7/–	8/6	7"×21"	12/3	15/–	10"×12"	10/–	12/–
6"×21"	10/6	12/9	7"×24"	14/–	17/3	12"×14"	13/3	16/–
7"×9"	5/3	6/6	7"×26"	15/–	18/6	12"×21"	19/9	24/3
7"×10"	5/9	7/3	7"×30"	17/9	21/6	14"×18"	19/9	24/3
7"×12"	7/–	8/6	7"×48"	28/–	34/6	20"×24"	39/6	48/–

SPECIAL NOTE: All Radion Panels are $\frac{3}{16}$" thick. In addition to the sizes listed above we can supply by return any special size cut to measure at the following prices: Black 1d. per sq. inch; Mahoganite 1½d. per sq. inch.

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13a Fore Street, London, E.C.2

Wireless Weekly Small Advertisements.

EXCEPTIONAL OPPORTUNITY FOR REAL BARGAINS.

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New Magnavox Loud Speaker - -	4	5	0
New Cosmos Crystal Set - - -	1	8	0
Brown's A type phones, 120 Ohms -	1	2	6
3-valve Mark IV Amplifier - -	4	0	0
3-valve Aircraft Receiver - -	3	17	6
5-valve Aircraft Receiver with 5 new V24 valves, remote control - -	13	0	0
Mark III Tuner complete - -	5	0	0

Carriage paid anywhere in U.K. Approval.
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TO make your Amplion Junior equal to a five-guinea model in tone, volume and appearance write Maddison, Wood Horn Mfc., 2a, Ronalds Road, N.5.

AGENTS Wanted.—Wireless valve repair business. Deal with the actual repairers. Lowest grade terms. All types repaired. A hard vacuum guaranteed. Also old valves bought for cash, 9d. each. Cossors, 1/- each.—M. & G., 60, Churchfield Road, Acton, W.3. Telephone Chiswick 2681

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HEADPHONE REPAIRS. — Rewound, remagnetised, readjusted. Lowest prices quoted on receipt of telephones. Delivery three days. Est. 26 years.—Varley Magnet Co., London, S.E.18.

WIRELESS POLES.—500 Larch Poles suitable for Wireless Masts—30 feet long and upwards. In lots to suit purchasers. Trade only supplied. Prices on application. Apply—R. G. Parker, Cocklarachy, Huntly, Aberdeenshire.

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Solid Oak. Well made and Hand Polished.

FLAT. Inside Measurements	SLOPING. Panel	Price	FLAT. Inside Measurements	SLOPING. Panel	Price
7×5×5	4/-	8/6	10×8×5	5/9	10/6
8×7×5	4/9	8/6	12×10×5	7/6	10/6
12×8×5	5/9	10/6	15×10×5	7/6	10/6
15×12×5	7/6	10/6	15×12×5	9/-	12/6
18×12×5	9/-	12/6	18×15×5	10/6	15/-

POST Solid Mahogany 20% ext. Any size made to order FREE. Fitted with best qual. ¼" Matt Ebonite 1d. per sq in
J. W. WALKER, 9, MANOR PARK PARADE LEE HIGH ROAD, S.E.13

PARIS AND OTHER STATIONS
Clearly heard on Loud Speaker Nr. London using the "MIRACLE" MASTER 2-Valve Set. £3-12-6 plus Royalties. 1, 2, 3 & 4 Valves. Trade Supplied. Send stamp for particulars.
WORLD'S WIRELESS STORES, Watlington.

REGISTERED TRADE MARK
REPAIRS
TO HEADPHONES
TO LOUD SPEAKERS
TO COILS
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Rewound to any Resistance and made equal to new. Price quoted on receipt of instruments.
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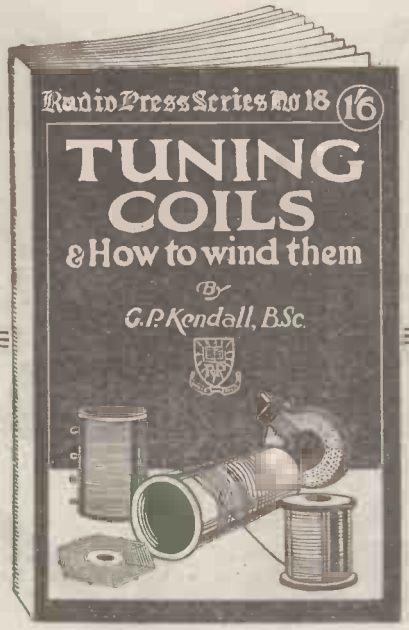
'Phone: Woolwich 888.

RADIO PRESS INFORMATION DEPT
2/6 QUERY COUPON
WIRELESS WEEKLY.
Vol. 5. No. 14. Jan. 21, 1925.
(This coupon must be accompanied by a postal order of 2/6 for each question, and a stamped addressed envelope.)



THERE is probably no single Component in any Receiving Set able to exert so much influence as an Inductance Coil. A highly efficient Coil (or Coils) will often make all the difference between mediocre results and really good loud reception.

Even if you feel that your present Set is giving tolerably good results, the chances are that it will be worth your while—presuming that you are using plug-in coils—for short-wave lengths to use a set of home-made basket coils. Such coils as these have particularly low self-capacity.

This new book by G. P. Kendall, B.Sc. (staff editor) contains concise details for making every type of Coil used in Wireless to-day. Further, the advantages and disadvantages of each type are discussed in such a manner that the reader is able to make an immediate decision as to the actual coils suitable for his requirements.

All necessary data, such as diameter of tubes, gauge of wire, number of turns, etc., are given—the results of the author's own experiments.

No experimenter can afford to be without such a comprehensive guide as this.

TUNING COILS AND HOW TO WIND THEM.

SERIES No. S 18

1/6

Sold by all Booksellers, Newsagents, or through your local Wireless Dealer or 1/8 post free, direct from Department S,

Radio Press, Ltd.

BUSH HOUSE, STRAND, LONDON, W.C.2.

Safety First

BEFORE you build your Set make sure that your panel is free from leakage. Safety First should be your watchword. A low-grade panel will nullify all your efforts and cause you endless trouble. Red Triangle Ebonite is fully guaranteed to be entirely free from leakage and to conform to the highest electrical standards. Its beautiful surface of velvet smoothness needs no tedious sandpapering before use.

Every Red Triangle Panel is supplied in a sealed wrapper bearing its distinctive label. Be sure you get Red Triangle Ebonite and accept no substitute. All ebonite appears alike and the only way you can tell the good from the bad is to look for the Red Triangle on every package. If your Dealer cannot supply order direct from us.

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6× 8, 3/–	7 ×10, 4/3	8×12, 6/–	12×14, 10/6
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7× 5, 2/3	8 × 10, 5/–	10×24, 15/–	12×18, 13/6

All ¼-in. Thick.

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All Britain, 16×9×¼	9/–	Neutrodyne Tuner, 12×10×¼ ..	7/6
S.T. 100, 12½×9¾×¼	7/–	Neutrodyne Receiver, 12×10×¼ ..	7/6
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Any Special Size Cut per return at ¾d. per Square inch.

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PETO-SCOTT CO., Ltd.,

Registered Offices. Mail Order and Showroom.

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BRANCHES: LONDON—62, High Holborn, W.C.1. PLYMOUTH—4, Bank of England Place. LIVERPOOL—4, Manchester St. CARDIFF—94, Queen St. WALTHAMSTOW—230, Wood St.

Red Triangle Ebonite

Gilbert Ad. 2133.

TOO LATE!!!

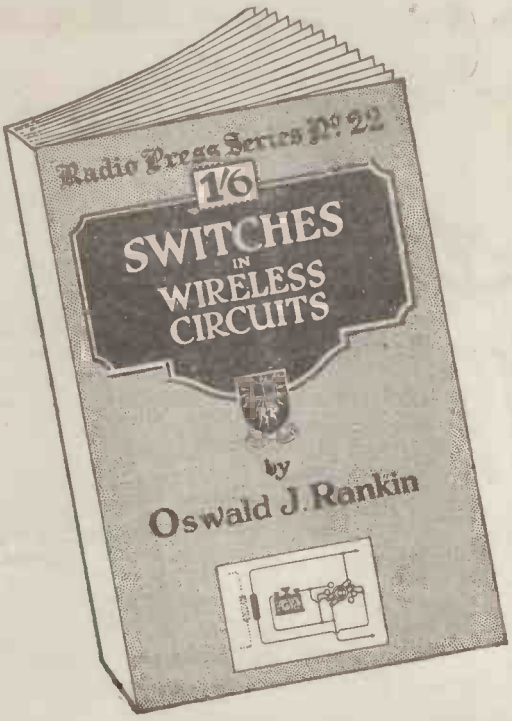
These are the words few people like to hear. **PLEASE NOTE.** Copy, blocks and orders for MARCH issue of THE WIRELESS CONSTRUCTOR (on Sale February 14th) should reach us without fail on or before January 24th.

BARCLAYS ADVERTISING LTD.

Advertisement Managers for

Modern Wireless, Wireless Weekly, The Wireless Constructor.

Bush House, Strand, London, W.C.2



Out to-day

Switches in Wireless Circuits

By Oswald J. Rankin.

THIS is the latest addition to the series of authoritative books on wireless published by the Radio Press Ltd., books well known for their accuracy and great simplicity in giving the Public in a perfectly readable manner just the information they need.

This exceedingly useful Book contains over fifty different switching arrangements covering practically every possible requirement.

The diagrams are shown both theoretically and pictorially, so that even the absolute beginner cannot possibly go wrong through lack of knowledge in diagram reading.

Every enthusiast has used up valuable time worrying out the most efficient way to switch some particular circuit, component or accessory simply and economically. Switching often presents many difficulties, but with this new Book, all difficulties arising from a desire to switch your set efficiently vanish.

Ask for the book with the distinctive yellow cover, the Radio Press Series No. S22, ***Price 1/6.*** Obtainable from all Newsagents, Booksellers, your local Wireless Dealer, or direct from the Publishers. ***Post Free 1/8.***

When ordering be sure and quote Series No. S22.

1/6
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RADIO PRESS

Switch and be Safe

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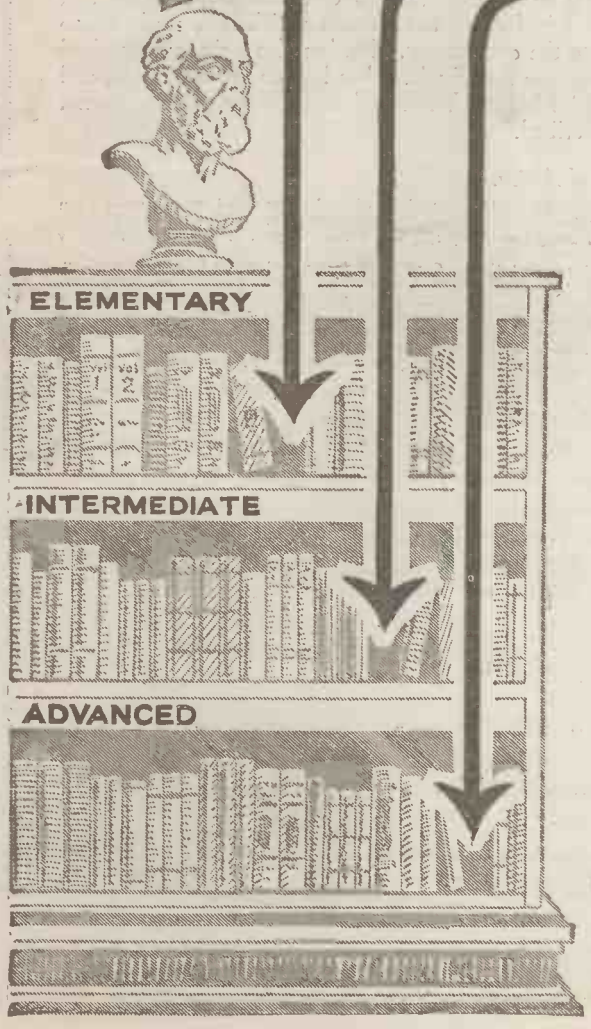

Put it there!

NO matter whether you are a beginner, amateur or expert in matters wireless, you will find one or more books that will be of very great assistance to you among the excellent series published by the Radio Press. It is quite likely that one of those illustrated above is just what you need now.

HOW TO MAKE YOUR OWN BROADCAST RECEIVER.

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An ideal book for the beginner, showing how he can build cheaply and well a Broadcast Receiver.

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Complete List "S" of Radio Press Series of Books will be sent post free on application. Obtainable from all Newsagents, Bookstalls, local Wireless Dealers, or direct from the Publishers. When ordering direct be sure and quote Series No. "S—"

Radio Press, Ltd.

BUSH HOUSE, STRAND, LONDON, W.C.2.

Barclays 1226

Two Popular Envelopes and A Book

BY

PERCY W. HARRIS

Editor of "The Wireless Constructor."

Mr. Harris' reputation as a constructional writer and designer is second to none.

With an almost uncanny knowledge of the needs of the "home constructor," he is not only able to design sets which rank as the best of their kind, but he is able to describe them with a skill which enables even the beginner to follow his designs and obtain equally good results. Tens of thousands of sets have been made according to his designs, and every one has enhanced the reputation of the author and also that of Radio Press Ltd., who have the exclusive services of Mr. Harris.

Mr. Harris has two envelopes to his credit, Nos. 2 and 4 of the Radio Press Envelope series, each containing pages of photographs on art paper, sheets of instructions, wiring and panel blue prints, lists of components, and, in fact, all the features which have made Radio Press Envelopes the last word in guides to the constructor. He has also written a standard constructional work, "Twelve Tested Wireless Sets," which has had an enormous sale and which will strongly appeal to readers of "Modern Wireless" as all kinds of sets, from a crystal to a "Transatlantic," are fully described.

Read this letter from the South-West of Africa.

SIR,—I suppose you will be surprised at hearing from someone in the outskirts of the Empire, but I am only writing you a few words of appreciation of the Family four-valve set described in Radio Press Envelope No. 2. This compact little set is by far the best operating set I have yet handled. Having had nearly 15 years' wireless experimenting, I have naturally handled many sets.

As to results obtained, these exceeded anything like expectations. Cape Town (750 miles) comes in at good strength on H.F. and detector. With note magnifier added, signals are too loud for 'phones. The power of Cape Town is the same as 2LO, so these results are far better than could be hoped for. JB (Johannesburg), with ¼kw. in the aerial, comes in quite loud on two valves, his distance being 740 miles. Shipping comes in with a roar. 5XX comes in with fair 'phone strength on three valves. Three a.m. one morning I managed to pick up KDKA on three valves at good 'phone strength. All high-power Morse stations come in well, and I can get them any time of day or night on two valves.

Hoping you will find this interesting, and congratulating you most heartily on your design of a thoroughly reliable and efficient set.

Yours truly, PERCY F. SYMONS.

Windhoek, S.W. Africa.

And this one:

SIR,—About three weeks ago I purchased the envelope containing particulars regarding the "All Concert Receiver," and wish to give you my results.

Without any wavetrap I am able to tune in 2BD at excellent loud-speaker strength, and with very slight interference from 5NO.

OTHER RESULTS: Radio-Paris, loud-speaker. 5XX, good; 5NO, excellent; 2BD, excellent; 5SC, good: these are all the B.B.C. stations which I have bothered with so far. Le Petit Parisien, loud in 'phones. Vox Haus? (woman announcer), fair loud-speaker. Hamburg, good loud-speaker. Breslau, fair loud-speaker.

I have had many more foreign stations than these, but have not heard their call signs.

HENRY R. MYERS.

Durham.

Envelope No. 4.

Twelve Tested Wireless Sets .. 2/6d. 2/8d. post free.
By Percy W. Harris.

Radio Press Envelope No. 2 .. 2/6d. 2/9d. ,, ,,
By Percy W. Harris.
(4-Valve Family Receiver)

Radio Press Envelope No. 4 .. 2/6d. 2/9d. ,, ,,
By Percy W. Harris.
(3-Valve All Concert de Luxe.)

All obtainable from wireless dealers and booksellers, or direct from the publishers, Radio Press Ltd., Bush House, Strand, London, W.C.2

Envelope No. 2.

Covers the Whole Field —

OVER a quarter of a million people regularly buy this magazine each month, and it is the magazine that even the advanced wireless man strongly recommends to his less experienced friends.

"The Wireless Constructor" caters for the wants of the wireless enthusiast of every age and stage. The youngster is shown how to construct wireless receivers efficiently and well from the simplest materials. The more advanced youth is able to add to his knowledge of wireless and improve his set to the satisfaction of the whole household, while even the advanced experimenter finds in its pages many useful articles, hints, and tips.

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6D. MONTHLY RADIO PRESS

The Wireless Constructor

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Bush House, Strand, London, W.C.2.

Barclays 1227

RP RADIO PRESS

It will pay you always to watch WIRELESS WEEKLY *Advertisements.*

YOU NEED THESE BOOKS

Practical Wireless Valve Circuits

Series No. S 10.

This is the first book of ST circuits and is called Practical Wireless Valve Circuits, by John Scott-Taggart, F.Inst.P., A.M.I.E.E. Price 2/6 (post free 2/8). Circuits ST 1 to ST 67 are published in this book, which is selling as well to-day as when it was published. No experimenter worthy of the name can afford to be without the two ST Circuit Books. They are friends which will never lead you astray. Each circuit in both books is fully described and criticised.

All component values are given in the new editions of Practical Wireless Valve Circuits and More Practical Valve Circuits.

"S.T." Circuits

These are too well known to need any introduction. This is the latest book of them:—

More Practical Valve Circuits

Series No. S 15.

By JOHN SCOTT-TAGGART, F.Inst.P., A.M.I.E.E.

Price 3/6 (post free 3/8).

Full of dozens of original circuits which you will find nowhere else, as they are copyright. Circuits ST 68 to 141 and also ST 150 and 151 appear in this extremely useful volume, which has had an enormous sale amongst experimenters.

Radio Valves and How to Use Them

Series No. S 12.

Mr. Scott-Taggart has stated that he regards this as his best book on the Valve from the point of view of the beginner. Radio Valves and How To Use Them, by John Scott-Taggart, F.Inst.P., A.M.I.E.E. Price 2/6 (post free 2/8). This book is by far the largest published by Radio Press, Ltd., at 2/6, and is full of very valuable information. The reader is presumed to know only what is contained in our Books, "Wireless For All" and "Simplified Wireless."

YOU NEED THESE BOOKS

Wireless Valves Simply Explained

Series No. S 9.

By JOHN SCOTT-TAGGART, F.Inst.P., A.M.I.E.E.

The most popular moderately priced Book on the theory of Wireless yet written. It contains the results of many years' patient research and experiments—but told in a non-technical language which the amateur can easily understand.

How reaction is caused—how to stop self-oscillation—how to select suitable circuits for various purposes—how to receive C.W.—the answers to all these and many other questions are clearly given.

If you want to know how your set works this is the Book you need.

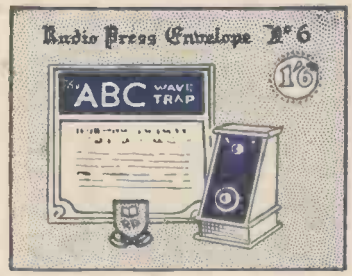
2/6 or 2/8 post free.

All Radio Press Books are obtainable from principal wireless dealers and through any bookseller, newsagent, or from Book Dept. S, Radio Press, Ltd.

Radio Press, Ltd. BUSH HOUSE, STRAND, LONDON, W.C.2

You can build this Trap to cut out local interference.

Now for a Change—Switch over to Bournemouth.



Anyone can build a wireless set from instructions contained in the Radio Press Envelopes. Build yourself the wavetrap described in Envelope No. 6. **These Envelopes may be obtained from your regular wireless dealer, newsagent or direct from Radio Press Ltd, Bush House, Strand, London, W.C.2.**

YES, but can you cut out your local Station? How often is that question asked by radio enthusiasts? The answer is to be found in the Radio Press Envelope No. 6, which contains full details for the construction of the A.B.C. Wave Trap—an instrument which is the result of much research by G. P. Kendall, B.Sc., into the question of the elimination of undesired signals. This instrument contains no less than 3 distinct types of wave trap arrangements, any one of which can be brought into operation at will. The contents of the Envelope include a general treatise on the experiments, instruction sheets, blue prints, photographs and working drawings. When tested 3 miles from 2LO the A.B.C. Wave Trap completely eliminated the London Station and brought in Bournemouth. Although theoretically a loss in signal strength must be admitted, it is so small that it is seldom apparent to the human ear.

This highly efficient Wave Trap gives a choice of working with either A, B or C type of eliminator circuits, and its great efficiency is obtained by the elimination of losses in design.

We have every confidence in telling our readers that the A.B.C. WAVE TRAP will enable them to cut out their Local Station without sacrifice of signal strength, provided always that their aerial and earth systems are of average efficiency

You can build this Wave Trap for about 30/- inclusive of handsome cabinet and coils which are built into the design. Normally Constructed to operate on the 300-600 metre band.

1/6 POST FREE 1/9

RADIO PRESS

Cut out your local station

Radio Press, Ltd.,
Bush House, Strand, London, W.C.2.

RP RADIO PRESS

Barclays Ad. 1215

Like a voice from the minaret

How willingly is the voice from the minaret obeyed! How willingly too is the first call of the Sterling "Baby" Loud Speaker answered! Everyone gathers round the instant it is heard.

The wonderfully clear and pure reproduction of the Sterling "Baby" charms listeners like a spell. In the interest and entertainment it provides hours slip by happily for all.

There's never been a better junior loud speaker—ask who you will. Ample in volume, sensibly sized, graceful in shape and perfect in tone. ***Test and compare it at your dealers.***

Supplied in Black, or in a particularly attractive Brown tinted finish, complete with flexible cord. 2,000 ohms resistance - **55/-**

STERLING BABY Loud Speaker

At your Radio Dealers

Advt. of **STERLING TELEPHONE & ELECTRIC CO., LTD.**

Manufacturers of Telephones and Radio Apparatus, etc.

210-212, TOTTENHAM COURT RD., LONDON, W.1 Works: DAGENHAM, ESSEX

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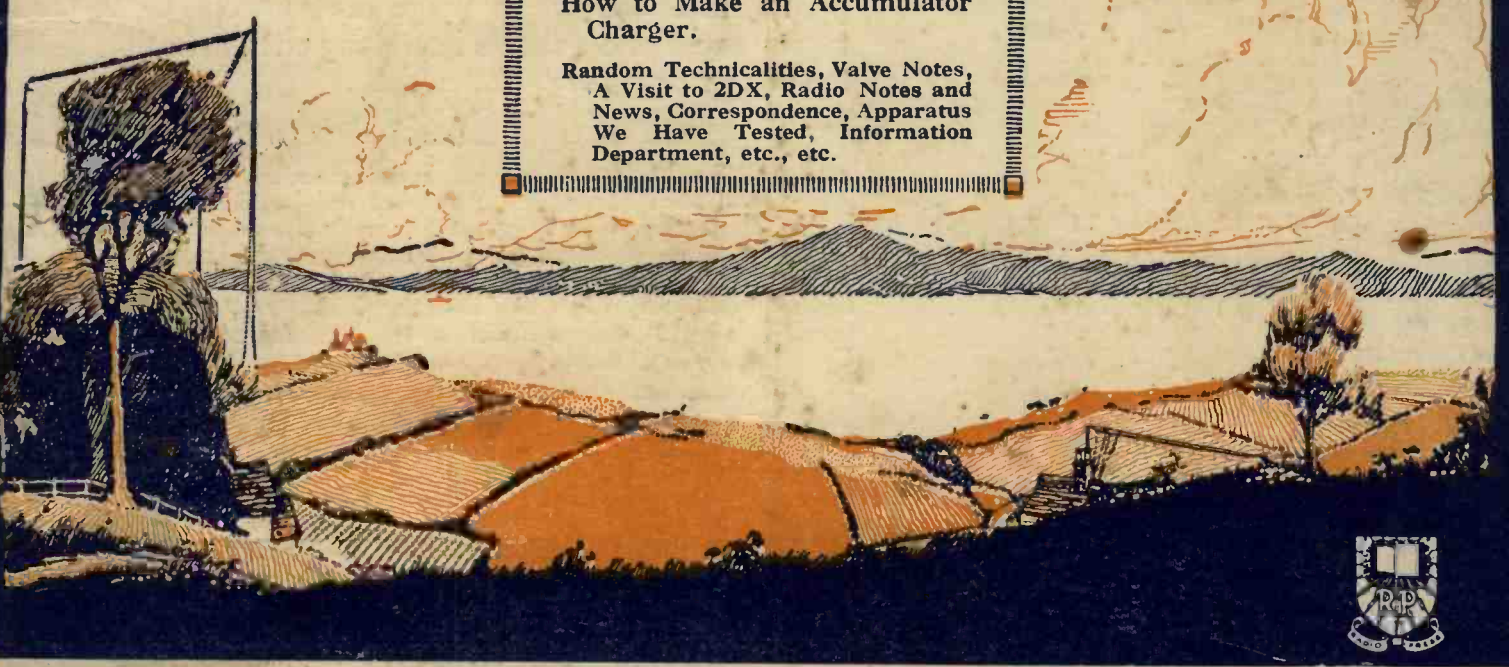
Wireless Weekly, 6d. Net. Wednesday January 28th, 1925

Wireless Weekly

Vol. 5.
No. 15

CONTENTS



How I Work with Australia *(Illustrated)*

By W. K. ALFORD.

Burndept Coils cover all wave-lengths from 80 to 25,000 metres

This is one of the Burndept single-layer Concert Coils. Note the neat wrapping, and the clear marking of the coil number.

Set of 4 Extra Short Wave Coils, one A, two B one C (80-150 metres) .. .. **16s.**
Set of 4 Concert Coils, S.1, S.2, S.3, S.4, (150-800 metres) .. .. **16s.**
Set of 9 Coils, S.5 to 1,000 (750-20,000 metres) **£3 16s. 6d**

Prices of single Coils—

Coils A,B,C, S.1, S.2, S.3, & S.4, **4s. 3d. each.** Coil S.5, **4s. 6d.** Coil No. 100, **5s.** Coil No. 150, **6s.** Coil No. 200. **7s.** Coil No. 300, **8s.** Coil No. 400, **9s.** Coil No. 500, **10s.** Coil No. 750, **12s.** Coil No. 1000, **15s.** Coil No. 1500, **24s.**

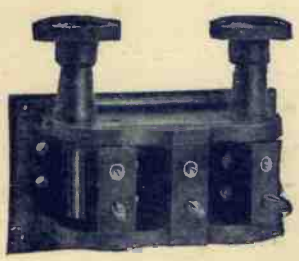
FOR reception on all wave-lengths from 80 to 25,000 metres, use Burndept Coils in your tuning apparatus. These Coils are most efficient and their use is a distinct factor in securing perfect reception. Experimenters and amateurs all over the world are using them and the fact that the reputation of these Coils is based on good results should convince you of the desirability of employing them in your apparatus.

Burndept Coils have extremely low self-capacity and high-frequency resistance and are consequently particularly suitable for short-wave reception. The principles of construction to which their high efficiency is due are protected by Patents 168249 and 191550. The spring socket fittings are non-reversible and make perfect electrical contact.

Write for Publication No. 44, which gives full particulars of the whole range of Burndept Coils, together with prices and an interesting chart indicating the wave-length range of the Coils.

Burndept Coil Holders

THESE coil-holders are very neat in appearance, being moulded in solid black bakelite, highly polished and beautifully finished. The moving holders are operated by means of a concealed 5 to 1 gear, the action being particularly smooth and giving vernier adjustment. The constructor who studies neatness as well as the efficiency of his apparatus will be very pleased with Burndept Coil-Holders. Since their introduction in 1921, their popularity has been unchallenged. Burndept Coil-Holders were the first to be made in England.



No. 133. Burndept Two-Coil Holder, unmounted, ... **18s. 6d.**
No. 135. Burndept Three-Coil, unmounted, **£1 5s.**

BURNDEPT
WIRELESS APPARATUS

BURNDEPT LTD., Aldine House, Bedford Street, Strand, London, W.C.2
Telephone: Gerrard 9072. *Telegrams*: Burndept, Westrand, London.
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Wireless Weekly

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The Post Office and Inventions

IT is characteristic of the British race to take things as they are and to suffer inconveniences willingly. Newcomers to wireless find it impossible to realise that only a few years ago considerable pressure of public opinion had to be exerted upon the Post Office before they would permit even a quarter of an hour's broadcasting from a low-power station near Chelmsford. On previous occasions we have commented upon several absurd regulations by which the British experimenter is bound, and which make him the laughing stock of our Transatlantic cousins. One anomalous regulation, perhaps more important than is generally realised, is that pertaining to the inspection of amateur transmitting stations by Post Office officials. As the regulations stand, the Post Office can, at any time, inspect in detail the apparatus and arrangements at any amateur wireless station, and, indeed, does make a practice of visiting experimental transmitting stations from time to time.

Transmitting licences, nominally, at any rate, are granted only to experimenters who have proved their *bona fides* and have proved their ability to conduct serious experiments. It is from such men that new inventions are likely to emanate, inventions which may have an important bearing upon the commercial development of the art, and which, quite conceivably, may solve many of the problems which confront those responsible for the conduct of high-power and long-distance wireless services.

At the present time long-distance services are being conducted in this country by a commercial company and by the Post Office themselves. It is common knowledge that the Rugby station, now being erected, will be one of the most powerful in the world, and if, as is the intention of the Post Office, this station is to conduct a regular service over great distances, then they will need to use many new inventions before a perfect service is obtained. They should, in fact, be glad to acquire, at reasonable sums, rights in good and valid patents which may be taken out.

Few inventors there are who do not hope some day to turn their inventions to some financial account. In the domain of broadcasting and the making of apparatus there exists quite an important market for wireless inventions, but in matters pertaining to long-distance and commercial services the likely buyers are few. Indeed, so far as this country is concerned, the possible buyers are limited to one or two commercial companies and the Government.

As matters now stand, the inventor must be prepared to lay his station open to the inspection of one of the possible purchasers of his invention. Let it be said right away that we do not question the integrity or courtesy of any inspectors to whom the Government entrusts this work. We are merely pointing out the anomalous position which exists. To the expert, quite frequently, a single glance at the transmitting set will indicate the line of research being undertaken, and may suggest ideas and possibilities which otherwise would not occur to him. Can it be wondered at that in a very large number of cases the knowledge that a Government inspector may visit the station causes the owner to make drastic alterations to his apparatus (temporarily, of course), with a result that the Government inspection becomes a farce.

The form of application for a transmitting licence calls for a statement by the applicant of the exact nature of the experiments he is desiring to conduct, together with full particulars of the circuit he intends to use. The farcical nature of this regulation is apparent to all, for if the licence is being genuinely granted for experimental work, then the applicant cannot possibly tell beforehand where his researches will lead him, or even the circuit which, in his particular circumstances, will prove to be most suitable at the moment.

Owners of existing transmitting licences, when applying for permission to experiment upon the shorter wavelengths which have aroused so much interest, are again required to state the exact purpose of the experiments they desire to conduct.

Finally, we would like to know just why the British amateur (as if he had not worries enough already) should have to submit to the arbitrary limitation of the size of his aerial to 100 feet in length? We can conceive of no technical reason for this limitation, and can only suppose that it was inflicted upon us some time ago for a reason which, whatever it may have been, no longer exists, and has been retained on the good old British principle: "There it is, let it be."

CONTENTS

American Reception on a Frame Aerial

By A. D. COWPER, M.Sc., Staff Editor.

Just what can be done with a " straight " circuit in expert hands is shown in Mr. Cowper's article below. At the same time, experiments of this kind need great patience and care and should not be attempted by the beginner on an outdoor aerial.

LOFTY claims are made by the advocates of some types of elaborate multi-valve receivers, particularly in connection with feats of reception on small frame aerials, which would appear to demonstrate their immense superiority to a straight single-valve-with-reaction circuit.

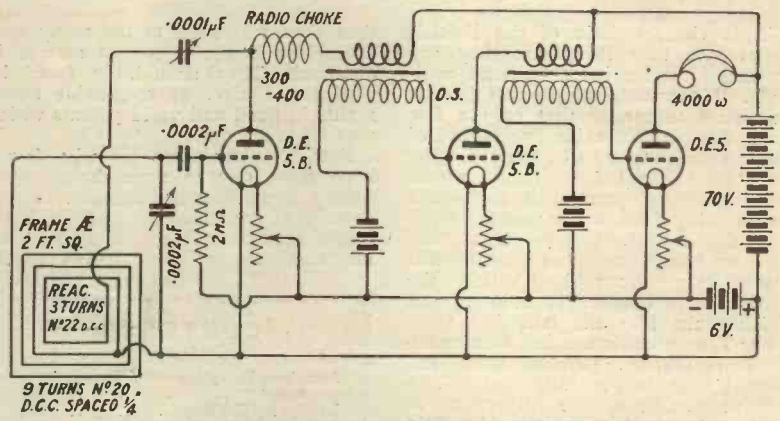
Observers, however, gifted with some patience and sense of fine tuning, and aided by the wavemeter, have long known that two, at least, of the many local broadcast stations can be picked up at intelligible strength in any reasonably favourable circumstances, on a small frame aerial and with a single valve. The experience of the writer is that with super-regenerative circuits the wave of the station can always be heard faintly by ordinary auto-dyne reception on a single valve, if useful signals are going to be given by super-regeneration.

The Ultraudion

Some time ago I described some experiments with a modification of the well-known De Forest Ultraudion circuit, by which it was possible, with patience and with a light hand, to go the rounds of a number of B.B.C. stations on a short vertical earth lead alone, that is to say, without aerial, and to hear some of these on a small frame aerial, all being on one valve.

The Personal Factor

The principal reason for the current low standard of reception on ordinary outside aerials, with detector valve alone, is (apart from the personal factor and the dearth of wavemeters) the impracticability of really fine tuning on a receiver fitted with the ordinary swinging reaction coil, and with high-resistance fine-wire inductances with heavy losses. The use of large parallel tuning condensers accentuates the trouble. With such equipment the heavy damping of the outside aerial, together with the resistance and dielectric losses in the coils and their mountings, involve so much loss of energy that excessive reaction has to be used to overcome it, a large reaction coil close-coupled with the A.T.I. being required. The result is familiar to any careful operator in that a continuous change of tuning with every adjustment of reaction coupling is called for, so that even an " easy " nearby station (such as Bournemouth, Paris, or Glasgow, in London), which gives a ferocious wave, cannot be isolated and resolved, except after an exasperating game of hide-and-seek.



A three-valve frame aerial circuit used by Mr. Cowper.

Reaction

Direct reaction on a frame aerial is readily managed in a number of ways, but the simplest is perhaps by means of the Reinartz device, such as a small fixed reaction coil fed *via* a variable reaction condenser from the plate of the detector valve; in a more refined form a radio choke is used in the plate circuit to divert the H.F. impulses this way. In this case, if low-resistance and low-loss inductances are used, without heavy aerial-damping, a surprisingly small reaction coil and reaction condenser capacity can be used. The immediate result of this is an extremely refined and sensitive control, and also complete removal of that irritating effect (produced by variation of reaction coupling) on the main tuning. The reaction requirements are, alas, much more independent of wavelength than usual. Those listeners who have never experimented with Reinartz reaction can have no conception as to the immense increase in power and range this one factor implies.

Reinartz Reaction

Accordingly, with Reinartz reaction applied to a small, low-resistance frame aerial, and with a high degree of audio frequency amplification beyond it to bring the feeble signals up to comfortable 'phone strength, one has a receiver of surprising power and range. The limiting factor appears to be rather the

problem of providing perfectly *silent* stages of L.F. amplification, and, of course, the usual atmospherics and Morse disturbances, rather than any natural limitation of the valve as a detector when operating with grid leak and condenser. Where the efficient multi-valve receiver should score is in (A) selectivity, over and above what modern selective tuners will give with a simple detector valve, or what a frame aerial naturally supplies; (B) silent amplification by using super-audio amplification as in the Armstrong super-heterodyne.

L.F. Amplification

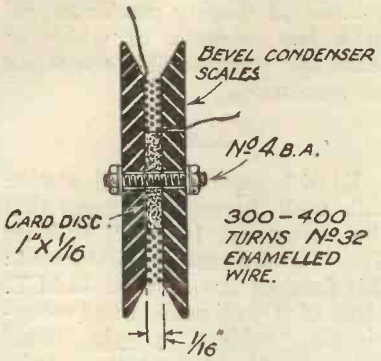
Experiment shows that with really high-factor L.F. amplifying valves, efficiently coupled with high ratio transformers of a design which minimises distortion, and properly operated as to H.T. and grid-bias values, an enormous degree of audio-frequency amplification can be obtained in *three* stages, *i.e.*, high-ratio detector valve followed by two high ratio note magnifying valves without introducing valve noises to a degree which compares unfavourably with the expected signals. By carefully weeding out the H.T. battery, which for such purposes should consist of easily renewable small units, and not of the conventional block of many cells, with grid cells in good order and with careful wiring, very little stray noise will be heard in such a circuit as shown in the diagram here, although the amplification is such that one must be extremely careful with a buzzer wavemeter in the same room, if one values one's ear drums; and an incautious touch or scratch on the panel, or even the slamming of the door of the room, produces an alarming roar by microphonic action.

A Check

With such equipment, therefore, it became possible to check up the surprising claims of some much more elaborate circuits, and to judge to what extent there is in operation any other factor than straight audio-frequency amplification following a sensitive detector valve.

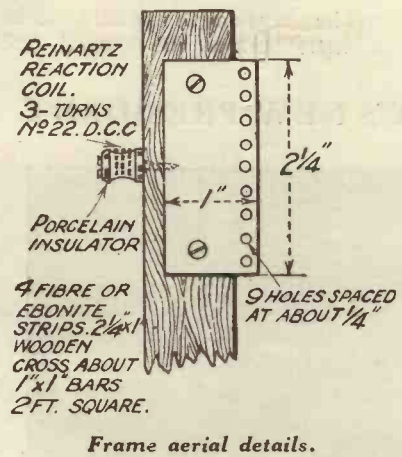
Actual Hook-up

The practical details of an experimental receiver are indicated in the diagrams. There is nothing very particular to note with regard to arrangement, or operation. The two-feet square frame aerial was chosen of nine turns, though the writer would have preferred to use more inductance here, and this size



The radio choke.

requires a .0003 μF tuning-condenser (or more in some cases) to cover effectively the upper broadcast band; this frame was chosen because many existing types of frame aerials are made of about these dimensions. The tuning condenser used was a J.B. ebonite end .0002 μF; the



Frame aerial details.

reaction condenser one of .0001 μF of the same make; these were mounted on a small vertical panel at one end of a large baseboard, on which the rest of the circuit was arranged. The radio-choke was a compact one of the type indicated, and mounted directly on the reaction condenser for convenience by a bent strip of brass nipped under the nut and centre terminal respectively. A No. 250 plug-in coil will replace this quite well. The first L.F. transformer was a high ratio Pye, the second one of lower ratio. Great care had to be taken with grid bias, etc., to avoid low-frequency oscillation, and the operator was best connected to local "earth" by a wire from the H.T. plus to the exposed metal telephone band for this reason. Nothing could be done in fine searching until the grid leak was taken to the L.T. minus, instead of the plus, as is more usual, on account of buzzing when just oscillating. As with all frame-aerial circuits without "earth" connection, casual body capacity effects were very marked, and 9-in. tuning handles, together with the removal of the frame aerial to a remote table with carefully arranged leads, are demanded. Merely handing the 'phones to another observer, or moving about the small room, would at times cause complete fading of a strong American station, or at least a howl.

Reaction Coil

It will be noticed that the reaction coil on the frame aerial consisted merely of three turns of No. 22 S.W.G. d.c.c. wire wound on small porcelain insulators at the back of the wooden cross which carried the aerial. The usual fibre or ebonite spacing-strips are used for the latter.

Trials

As it was familiar to the writer that reception over a few hundred miles was not extraordinary on a two-feet frame with a single valve, no time was wasted in picking up the local or near European stations, but search was made from just after midnight to about 2 a.m. on a frosty, rather foggy night (but with clear skies overhead), the receiver being located on the first floor of a small brick-and-tile cottage situated on high ground in rural Essex, but with some local screening. (It is in general a good position for reception, as more than twenty broadcast stations can be picked up any winter night on a really good aerial.) The lead-in of the usual aerial was some 15 ft.

away, and on the ground floor; experiment showed that it did not make any appreciable difference whether this aerial was short-circuited to earth or left tuned to 2LO. It was not lowered for the tests, as it might be taken to represent to some extent the "casual" relaying aerials which may vitiate any frame aerial test unless carried out in a balloon or on a mountain-top.

D.E.5B. valves were used for the first two stages, for their fine M of 20; the last was a D.E.5, which has a fairly high M and avoids distortion.

Results

Between midnight and one o'clock on the night of January 10-11 two strong waves were heard, with the frame aerial pointing east and west. The one was resolved into intelligible telephony, a children's hour talk by a man "Now then, girls and boys——," and by a woman later; parts of a children's story about a horse and his tail, etc., were heard later on, subject to the usual fading and some terrible jamming by noisy Morse.

Selectivity

The selectivity, as regards Morse stations, was much less than is usually expected, and there were many faint stations audible. An extremely noisy telephony station blurted in for a brief interval, just above 300 metres, but no call-sign was given. After 1 a.m. things were more lively, and on one occasion nine distinct waves were counted from just below 300 to about 370 metres, the upper limit of the aerial with a .0002 μF tuning condenser, all in a few seconds, of which at least two gave audible telephony on resolution.

KDKA

KDKA gave their full station call, with the announcement that the overture from "William Tell" would now be performed: this finished at 1.41 a.m., G.M.T. Most of it was audible and recognisable, subject to the usual fading, and was, on the whole, distinctly better than any of the early attempts exhibited via "S.B." by the B.B.C. A few minutes later the announcer said that Mr. —— Lloyd, the well-known Pittsburg singer, would sing two songs, and would first read the words of the songs, which were heard, though not clearly.

Other Stations

The wavelength appeared to be a little below the usual 326 metres. Between this time and 2 a.m. two other stations were resolved, one just below 300 metres, the other the familiar WBZ, whose music and station call were clearly heard. At times the strength of these stations was of the order that many people accept as comfortably loud for daily broadcast reception. Of course, tuning was extremely fine; and, as indicated, a station might fade out on handing over the 'phones to another observer (who checked several of the items), necessitating a slight retuning.

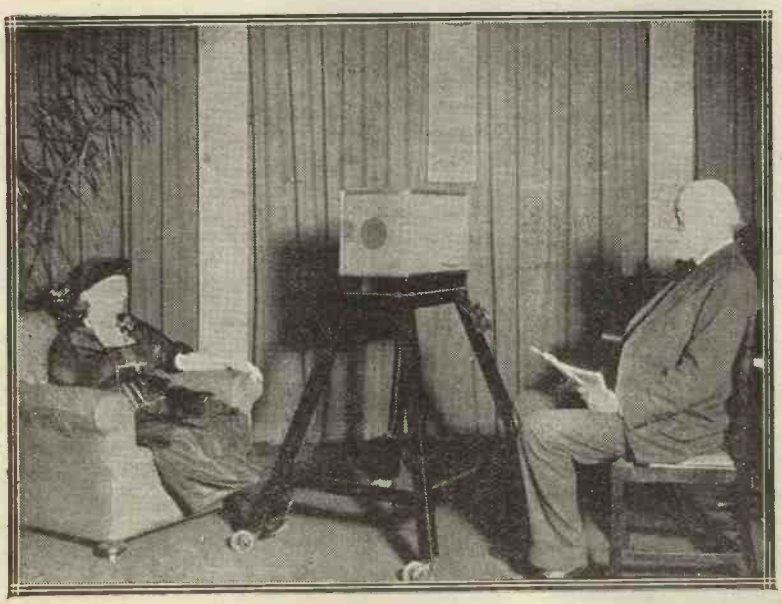
Conclusions

There seemed to be no purpose in going further with this, as the point appeared to be fairly well established that a simple valve with reaction *is* capable of receiving stations at 3,000 miles on a two-foot frame aerial, provided that efficient audio frequency amplification is used to bring the feeble signals up to a reasonable strength, and that accordingly there is, as the writer had long suspected, no specially great radio frequency amplification or other process of special efficiency operating in these much-advertised complex multi-valve circuits.

No Re-radiation

It is not suggested that these results could necessarily be duplicated in a town bristling with aerials and chimneys, etc. On the other hand, the hypothesis of re-radiation is ruled out by the relative isolation of the point of observation, and the consistency and number of the results obtained. During the two hours only two oscillators were noticed, and these but faintly.

THE RADIO SOCIETY'S NEW PRESIDENT



Sir Oliver Lodge, who has just accepted the presidency of the Radio Society of Great Britain, seated before the microphone at 2LO.

Record Wireless Feat in Pacific

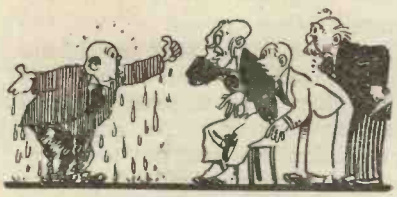
The Government wireless station on Esteban Island, British Columbia, has established a new record for communication with ships crossing the Pacific. It maintained two-way communication with the Royal Mail steamer *Makura* throughout her entire journey of 6,657 miles from Victoria to Sydney, Australia.

JOTTINGS BY THE WAY

By Wireless Wayfarer

In the Swim

LITTLE PUDDLETON has not gone scathless during the rains, tempests, storms and floods which have marked the coming of the glad New Year. Dozens of aerials have been torn up by the roots and deposited in greenhouses, chicken runs, and other people's gardens. For several days it was necessary to don gum boots in order to do one's shopping in the High Street, and then came the period of waders when the water rose another foot or so. But even this state of affairs did not deter the



. . . *"Why, we're afloat!" shouted Poddleby* . . .

stalwart members of the wireless club from attending meetings in the cosy ex-Army hut, which forms our premises. I am going to tell you the story of a wonderful adventure which befel us during this very exciting period. Bumpleby Brown had just finished a very seasonable lecture on the importance of keeping your earth wet, and Poddleby, who is rather an early bird, announced his intention of wading home. With a cheery good night he passed out through the door, his exit being followed by a resounding splash. In a few moments an exceedingly wet Poddleby returned to the club house gasping and spluttering and waving his arms wildly. When we had applied first aid to the apparently drowned by standing him upon his head in order to let the water which he had swallowed run out, slapping him hard on the back and working his arms and legs violently whilst kneeling on his chest, Poddleby's voice returned to him. "I say, you fellows," he gasped, "here's a pretty kettle of fish." "What's the matter?" we cried in unison. "Why, we're *afloat!*" shouted Poddleby. He explained that on making his exit duly provided with waders he had stepped into what should have been three feet of water, only to find himself completely submerged. When he rose to the surface he saw the club house rapidly receding from him, and it was only by superhuman efforts with the use of his best trudgeon stroke that he managed to regain it.

Little Puddleton's Ark

We rushed to the door. Poddleby's words were only too true. As we looked out we saw that we were passing Simla Villa, the General's residence, at a rate of knots. We shouted for help, but no help was, or could be, forthcoming. As we flashed down the High Street the inhabitants, who had retreated to their top floor rooms, either raised their hands aloft in horror or shouted to wish us *bon voyage*. In a matter of minutes we had left Little Puddleton behind, and there we were, a ship without a rudder alone on a waste of waters. Members of other clubs finding themselves in such an amazing predicament would probably have burst unanimously into tears or done something silly of that kind. But as you know, we of Little Puddleton have stout hearts, and it was resolved at once that we must make the best of a rather alarming situation. The first thing to do, of course, was to organise both ourselves and our resources.

The Admiral as Captain

Luckily the Admiral was amongst us, and he, being appointed without a single dissentient voice captain of our little barque, at once took charge of things.

Trippers First

Amongst the other members there was a lamentable lack of seafaring experience. But what we lacked in knowledge we made up for by our enthusiasm and will to win through. The Admiral ap-

. . . *Professor Goop was feeling a little seasick* . . .

pointed the General, who, after all, had made several voyages to and from India, as first mate and myself as second. My own knowledge of navigation is not extensive, though in my young days, when living in London, I always favoured the penny steamboats, which were then running, to trams or buses.

Settling down to it

As we were now aship the Admiral decided that iron discipline must prevail, and everything must be shipshape. The first necessity was to show the proper navigating lights. Gubsworthy had brought a hurricane lantern with him, and this was run up to the masthead, that is to say, to the top of one of the aerial poles, Snaggsby, who is

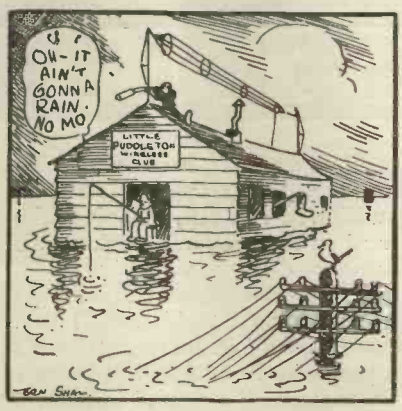
something of a climber, accomplishing the feat. The question of side lights was rather a difficult one. My own suggestion was that the General, whose ruddy countenance had not paled even in this predicament, should take his stand with his head protruding from a window on the port side, and that Professor Goop, who was feeling a little seasick, might be similarly stationed to starboard to provide the required green. As a matter of fact, I was the only one who could really get hold of the idea of port and starboard; the rest, going by their colours, would insist on calling them positive and negative.

The Port Light

Eventually, after some consultation, we found that Breadsnapp had a red pocket handkerchief, whilst Winklesworth, who is something of a dandy, was wearing green socks. He made quite a fuss at first about sacrificing one of these, but on my pointing out to him in stern words and with dark hints about a belaying-pin that his sacrifice was for the common good, he reluctantly consented. The handkerchief and the sock were draped over a couple of valves attached by a length of flex to the club accumulator and hung from the proper windows.

Land Ho!

The Admiral now proceeded to take his bearings by means of the stars. This was a little difficult since there were no stars. After some consideration he announced that his sense of direction told him that we were heading nor'-nor'-east. The rest of us felt instinctively that we were going west. It really did not matter very greatly in which direction we were proceeding since we had no means either of regulating our speed or of directing our course. My watch was first to be set, and I ordered Poddleby, who was already so wet that he could not get any wetter, to get on to the roof and to take the first spell as look-out man. Poddleby showed distinct signs of insubordination, but he cut so pathetic a figure that my heart was softened, and I stationed Gubbsworthy instead at one of the windows. The night passed rather drearily, though we tried to keep our spirits up by singing "The Animals Went In Two by Two" and "It ain't agonna Rain no Mo'." Just as daylight was filtering through, whilst the Admiral was working out with the aid of a map showing the



Keeping our spirits up by singing

world's wireless stations where he could eventually expect to beach her, there was a rousing cry from Bumpleby Brown, who was at this time doing duty as look-out. "Land ho!" he shouted, and we all leaped to the windows.

The Desert Isle

There could be no doubt about it. Right across our bows there was a stretch of the real solid stuff, and, before long, with a shock that threw us on to the floor, or rather I should say to the deck, we grounded. By this time we had got the transmitting plant working, and Poddleby was busy getting into touch with direction-finding stations. So far as we could gather from the bearings that they sent us, we appeared to be in the middle

Bumpleby Brown's "signal of distress" was nailed to the mast

of the Bay of Biscay. This, however, appeared improbable since islands there are few and far between, and most of us felt quite sure that we had arrived at Ararat. However, we landed and proceeded to explore. The territory to which we had come appeared to be an island about half a mile in circumference, and as the food question had by this time become acute we were relieved to find that the island was inhabited by quite a number of hens.

The Simple Life

These we chased and captured, and at the end of an hour you might have seen the General engaged in trying to remember how Boy Scouts light fires with damp wood, Professor Goop plucking a chicken and getting his whiskers full of feathers, Poddleby fishing with a hook made from his tiepin, and Snaggsby affixing Bumpleby Brown's shirt to the masthead as a flag of distress. I was on watch ready to give instant warning of the approach of savage tribes. Meantime we kept ourselves amused by means of the receiving set which, as the port and starboard lights were no longer required, we were able to bring into action.

Saved

At the end of three days there were distinct signs that the waters were receding; on the fourth we found that our island had ceased to be an island, and that there was a road of sorts leading from it. An exploring expedition was sent out to reconnoitre under my leadership. On reaching the summit of what had once been a neighbouring island, but was now a hill, we found ourselves looking down into a town that somehow seemed familiar. "Is it . . .? Can it . . .? Surely . . . yes," I said, "Why, it's Bilgewater Magna!" We descended into the town, told our story, which nobody believed, and returned with a lorry for the remainder of the party. All's well that ends well, but in this case the end was not all that could be desired. It is true that we were safely conveyed back to Little Puddleton and restored to the bosoms of our families; but what about our club house? It now rests in a field on the outskirts of Bilgewater Magna, and so far as we can see, unless a fresh flood kindly comes along and brings it back again, we shall have to walk six miles to attend our meetings.

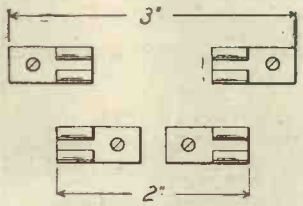
WIRELESS WAYFARER.

A Tip for Saving Space

WHEN one is making up either a complete receiving set or some small piece of apparatus the question of space is frequently rather an important one. Even such small parts as grid-leaks and fixed condensers of the clip-in type take up a great deal more room than they look at first sight as if they ought to require. If the clips for a fixed condenser are arranged in the ordinary way, as shown in the upper drawing, they require a space of no less than 3 in. long by ½ in. wide to accommodate them. By reversing the clips and mounting them as shown in the lower drawing, the necessary length over all can be reduced to about 2 in. The same method of space saving may be applied to the clips of grid-leaks and anode resistances.

Other Methods

Fixed condensers in moulded cases are provided with two lugs for fixing screws. Mounted in the ordinary way with a screw at each end, they require a panel space of 2½ in. by 1 in. As a matter of fact, one screw is quite sufficient to hold a fixed condenser firmly in position, and ⅜ in. can be saved by cutting off one of the lugs. Where wiring is done by means of square copper wire both lugs may be removed, the condenser being quite firmly secured by the two leads soldered to it. If treated



The lower diagram shows how fixed condenser clips may be mounted to economise in space.

in this way the condenser can be reduced in length to 1¾ in., a saving of ¾ in. in the panel space required.

R. W. H.

Making a Down-lead Join

WHEN erecting a twin wire aerial it is necessary to provide a sound join between the two wires constituting the down-lead, and some doubt is often experienced as to the best method of making this join both mechanically strong and electrically efficient. An ordinary soldered join, if well made, is quite satisfactory, but the following method is useful and ensures a reliable and neat join.

Take a brass crystal cup of the kind provided with three screws for fixing the crystal. Remove these screws, and, if necessary, enlarge the three holes so that a piece of 7/22 stranded copper aerial wire will just pass through each. Thoroughly clean the inside of the cup with emery paper, then cut short the screw passing through the base of the cup so that when it is inserted and screwed up tightly it just projects into the inside of the cup. Make one of the down-lead wires long enough to reach the lead-in device, and thread the crystal cup on to this

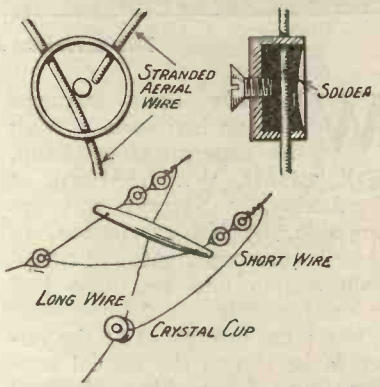


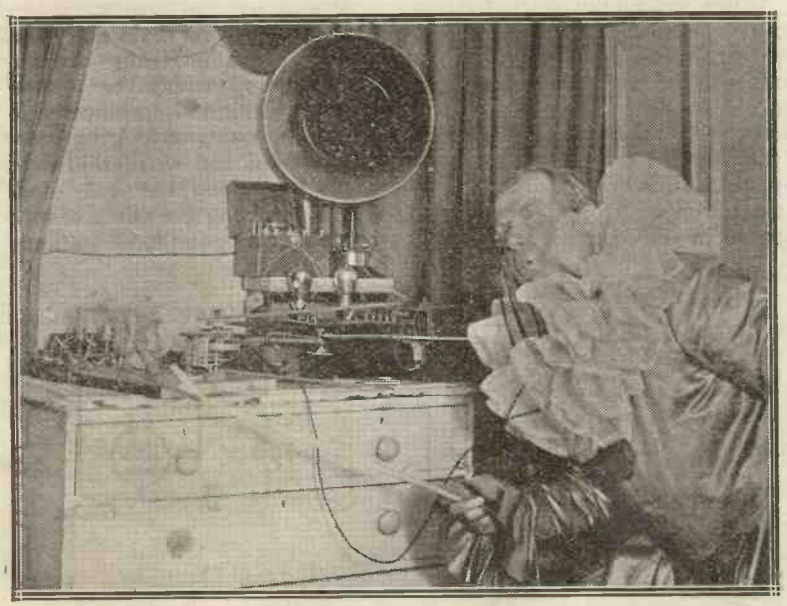
Diagram illustrating how the join is made.

through two of the holes in the side as shown in the above diagram. Into the other hole push the end of the shorter down-lead wire, hold it tightly in this position, and pull the crystal cup along the longer wire until the wires are arranged Y-shaped. Having found the position for the cup, note it, and then clean thoroughly with emery paper those portions of the wires which will be inside the cup.

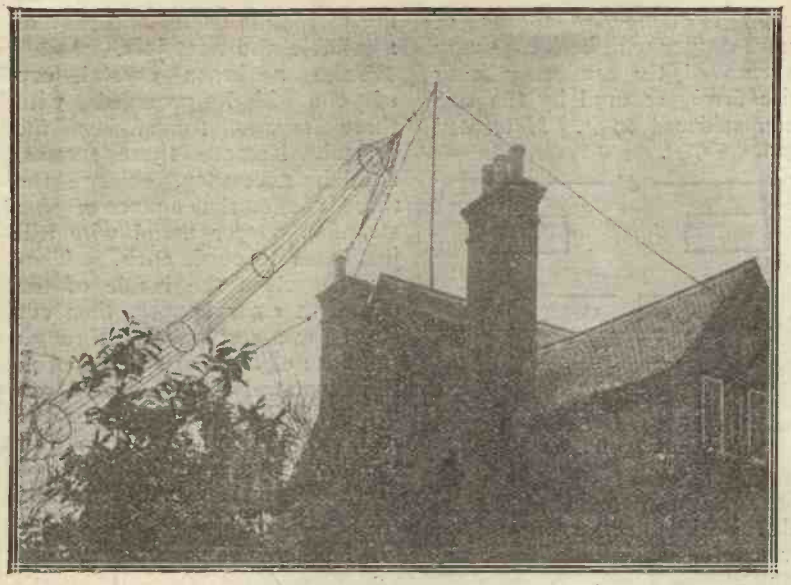
To complete the join, place a *small* quantity of Fluxite on the wires and the inside of the cup, hold a thick stick of solder over the cup, and, using a very hot soldering iron, melt into the cup sufficient solder to fill it, making sure that the solder adheres properly to the cup and to the wires.

A joint made in this manner will scarcely be affected by atmospheric corrosion, and it will not be necessary to varnish it or bind it with waterproof tape.

D. J. S. H.



Our photograph shows Mr. Dave Burnaby, of the "Co-optimists," tuning in KDKA with Mr. Harris' "Low-Loss Tuner for Short Waves."



The aerial at 2DX, Camberley.

"How I Worked Australia"

An Interview with Mr. W. K. ALFORD.

Including a description of the interesting transmitting and receiving station 2DX.

WE have been favoured with an invitation to visit the experimental station, 2DX, of Mr. W. K. Alford, at Camberley, in Surrey, and we are able, by his permission, to describe our experiences of actual transmission and reception just as we found it.

We were interested at the offset to be shown the official confirmation, from Mr. Maxwell Howden, Melbourne, Australia, of successful two-way working with his station on the evening of November 24 last—a distance of over 11,000 miles—and we understand that this constitutes a record, as yet unconfirmed, in that only 68 watts were employed, the aerial current being only .75 amperes on a wavelength of 98 metres. It appears that the previous evening Mr. Alford had performed a number of experiments with various modifications of the transmitting circuits in conjunction with 7EC of Copenhagen—the actual observed aerial current being kept constant throughout. One adjustment was reported as producing an extraordinary increase in signal strength, and this adjustment still existed when 3BQ was worked the following evening.

Real Measurements

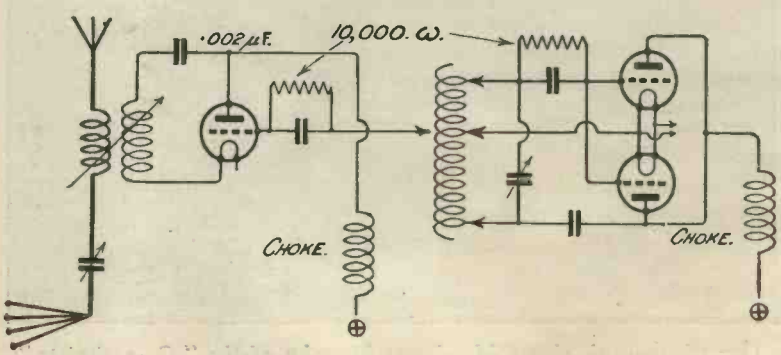
On arrival in Mr. Alford's "chamber of mysteries," we found an interesting array of everything pertaining to the wireless science, and were particularly struck by the large number of measuring instruments which must be of inestimable use. We noticed a particularly beautiful little instrument for the rapid determination of valve characteristics—this gave simultaneous readings of H.T., L.T., and grid voltage, together with anode and filament current—reducing the process, as Mr. Alford put it, to the simplicity of reading a gas meter! We also noticed an Elliott six-range substandard instrument and a very fine Telefunken standard variable condenser.

The Supersonic Receiver

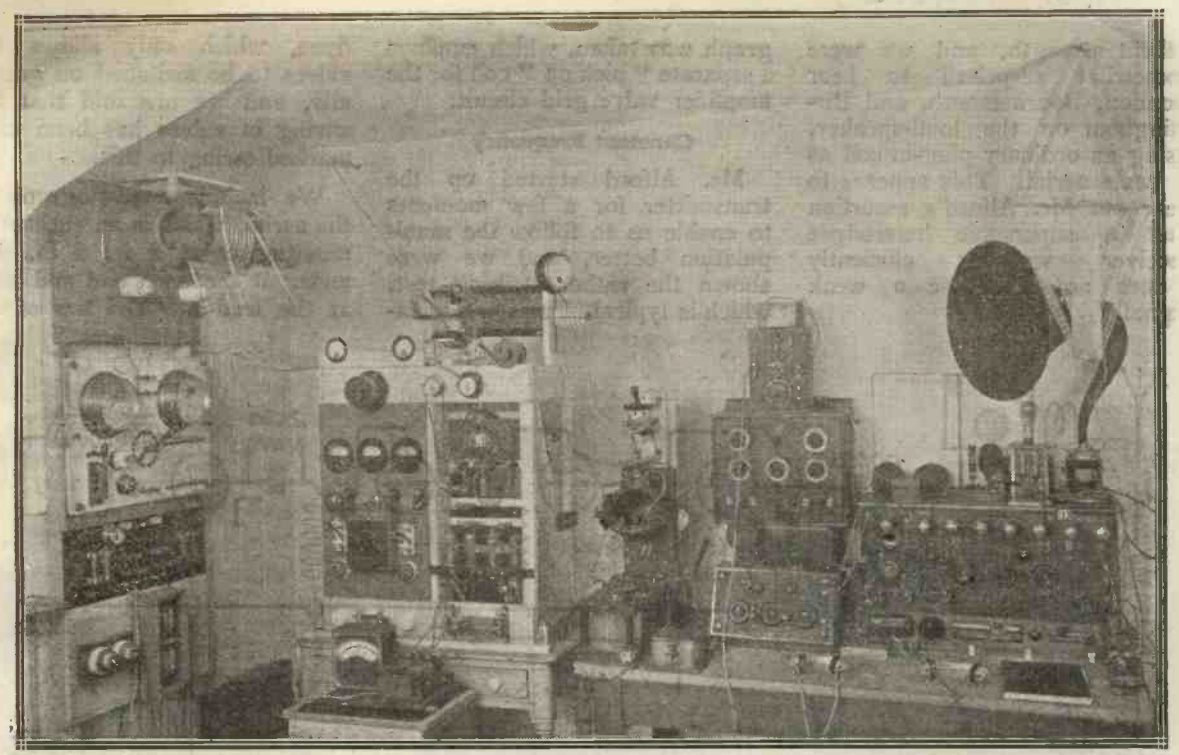
When we finally settled down to a systematic examination of the transmitting and receiving apparatus, we at once recognised an old friend in the form of the Armstrong Supersonic Heterodyne, designed and constructed by Mr. Alford, and of which a description with photographs appeared in the March, 1924, issue of *Modern Wireless*. We were informed that it had undergone considerable modification since that date in order that it might successfully function on ultra-short wavelengths. It now operates quite efficiently down to 18 metres, and Mr. Alford demonstrated to us the rather remarkable fact that an ordinary R type valve, complete in its cap, can be made to oscillate freely at this frequency. This valve, of course, functions as the frequency-changer in the super-heterodyne.

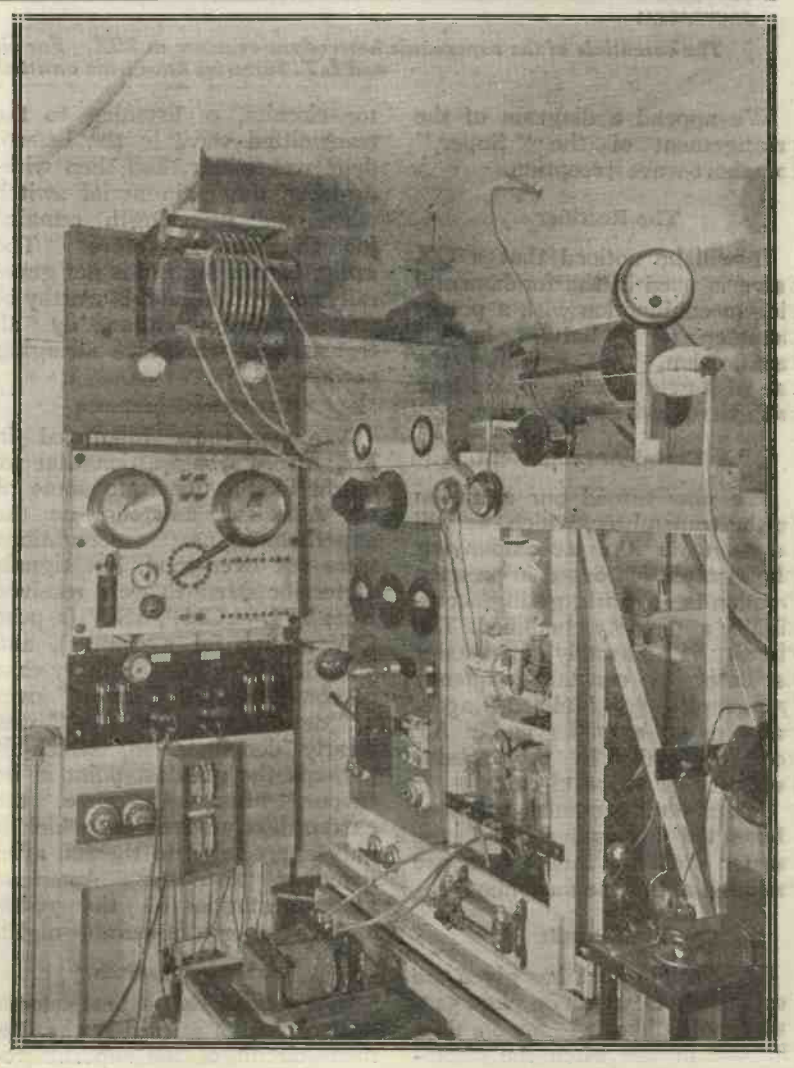
A Special Instrument

We were shown a second super-heterodyne in an unfinished condition embodying Igranic components, which we understood is designed specifically for operation on wavelengths below 100 metres, and which will eventually supersede the old model which is feeling the effect of more or less continuous modification.



The Master Oscillator circuit used at 2DX.





Above: The transmitting and receiving apparatus at 2DX. Notice the supersonic heterodyne receiver on the right.

Below: A close-up of the transmitting apparatus.

The general layout of the receiving apparatus is shown in the accompanying photograph.

Broadcast Reception

A demonstration of ordinary broadcast reception followed, using the " fundamental " end of the super-heterodyne as a H.F. and rect. receiver, and we were at once struck with the extraordinary volume and purity of 2 LO at 35 miles distant on the senior Magnavox loud-speaker. On inquiry, we found that the cause was the small instrument seen standing on the superheterodyne and next to the Magnavox. and incorporating two Myers' valves and an L.S.5. This, it appears, is a modified form of resistance capacity note magnifier, in which the second Myers' valve is used as a " grid-damper " to the L.S.5.

We hope that we may hear more of this after the formalities of patenting are complete.

Mr. Alford now changed over to the supersonic method of reception, using the loop aerial shown in the photograph. All the main stations came in at ex-

cellent strength, and we were somewhat surprised to hear London, Bournemouth, and Birmingham on the loud-speaker, using an ordinary plug-in coil as a frame aerial. This appears to bear out Mr. Alford's assertion that a supersonic heterodyne receiver working efficiently "does not recognise a weak signal."

graph was taken, which employs a separate "pick up" coil for the amplifier valve grid circuit.

Constant Frequency

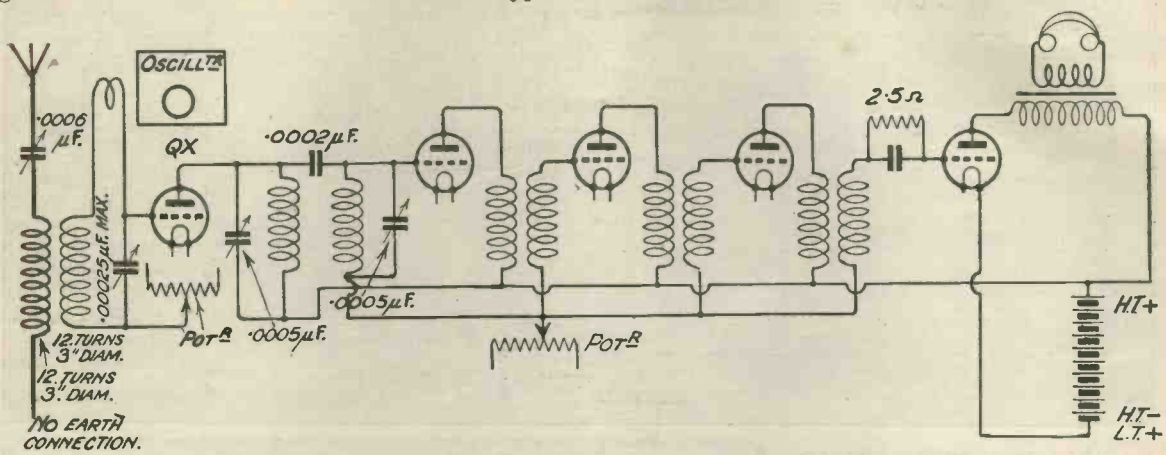
Mr. Alford started up the transmitter for a few moments to enable us to follow the manipulation better, and we were shown the rather striking test, which is typical of master oscillator circuits, of listening to the transmitted wave in the heterodyne wavemeter, and then withdrawing the main aerial switch when the wavelength remains just the same as before. The utility of this feature is not generally recognised, and is worthy of considerable attention by all transmitters who have swinging aerials.

dyne, which only allows the valves to be switched on gradually, and we are told that the saving in valves has been most marked owing to this.

We include a photograph of the aerial, which is an eight-wire tapering cage, 4 ft. 6 in. diameter at the open end and 1 ft. at the lead-in. The top of the pole on the house is about 70 ft. above the ground.

An eight-wire fan counterpoise is disposed directly beneath the aerial, and is adequately insulated, as is the aerial itself, with large "drip-ring" insulators.

"My work with Australia," said Mr. Alford, "was carried out without great difficulty simply because I have always made a point of adjusting every part of the installation—aerial counterpoise, transmitter, receiver, batteries—everything, in fact, so that it can be relied upon to work efficiently at all times, and not to let me down just when favourable conditions occur. Nothing is more exasperating than to find that a quarter of an hour's work is required to get the transmitter going, and that, after that time has elapsed, the good conditions have completely vanished."



The essentials of the supersonic heterodyne receiver at 2DX. For simplicity the filament connections and L.T. batteries have been omitted.

We append a diagram of the arrangement of the "Super" for short-wave reception.

The Rectifier

It will be noticed that a QX valve is used in the fundamental side in conjunction with a potentiometer for "bottom bend" rectification, thus avoiding the use of a grid condenser and leak with the possibility of noise.

A Useful Arrangement

We now turned our attention to the transmitter, which, as will be seen in the accompanying photograph, is housed in an open wooden framework, giving accessibility and safety combined. The circuit is normally a master oscillator or constant-frequency type employing a Mullard O.250c. valve as an amplifier and 2 AT 40's in parallel in the master oscillator or drive circuit.

The main inductances are seen above the big valve, and the master oscillator inductances are mounted above the switchboard.

The Circuit

The circuit which has given the best results is shown on page 542, but is more difficult to handle than the one in use when the photo-

American Amateurs

We were now interested in Mr. Alford's suggestion that we might like to listen to some of the American amateurs on the superheterodyne. Conditions were not over-good, but signals of terrific strength were received from 1PL—1CMP, 1SW (a pure CW station for a change), and 3CHG. The extraordinary ease of control of the "super" over a "detector and one step" was clearly demonstrated, which is perhaps the greatest point in its favour, after, of course, the extraordinary selectivity which is only appreciated to the full after listening to the American amateur stations on the 75-80-metre band on a favourable night.

A Master Switch

We noticed that a neat master control switch is used in the filament circuit of the superhetero-

THE INSTITUTION OF ELECTRICAL ENGINEERS

Wireless Section Meeting,

On Wednesday, 4th February, 1925, at 6 p.m.
(Light refreshments at 5.30 p.m.)
"The Optimum Damping in the Auditive Reception of Wireless Telegraph Signals."
By L. B. TURNER, M.A., and F. P. BEST, M.Sc.

Valve Notes

By

JOHN SCOTT-TAGGART,

F.Inst.P., A.M.I.E.E.

More Selectivity Notes

THERE is undoubtedly a greater tendency towards selectivity than ever before. This, no doubt, is due partly to the innate tendency in all real experimenters to extend their range and partly to the rapid increase in the number of broadcasting stations working on closely adjacent wavelengths. In the United States—the land of long-range reception — more importance has been attached to selectivity than has been the case in the British Isles. In many

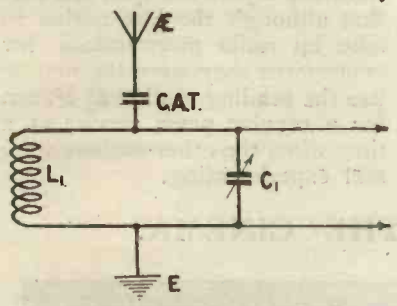


Fig. 1.—The C.A.T. method of increasing sharpness of tuning.

American towns there are sometimes several broadcasting stations working within a few hundred yards of each other and with wavelengths not far separated. I have a shrewd suspicion that there is more interference than we generally hear about, but, nevertheless, the American listener usually employs more selective apparatus than we do. It is, of course, only a natural stage in the forward movement, to develop selective receivers; but these, in my opinion, should possess selectivity without extra controls. The trouble with the old standard "loose-coupled" circuit is that there are two or three controls, whereas the popular single circuit arrangement possesses the very desirable feature of simplicity.

Some Suitable Circuits

To combine simplicity of tuning with selectivity is the ideal aim, and, fortunately, several methods of improving the selec-

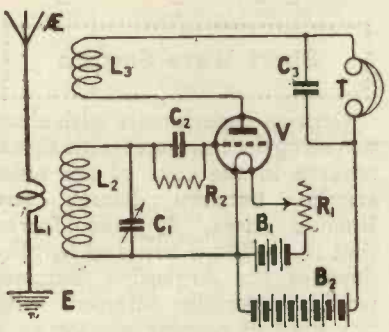


Fig. 2. — This arrangement gives good selectivity with little loss of signal strength.

tivity of the "single-circuit" tuner have been evolved.

Fig. 1 shows my C.A.T. tuning arrangement, which not only gives a big range of wavelengths with the parallel variable condenser, and ensures the readier reproduction of given designs, but greatly increases the selectivity of the receiver.

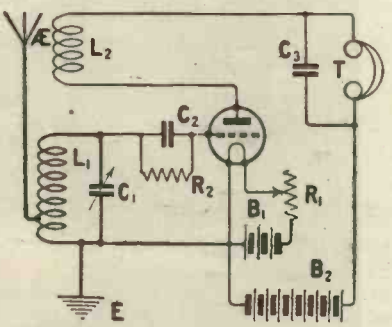


Fig. 3.—Another selective arrangement, which cannot however be applied to ordinary plug-in coils.

The free single circuit, consisting of an inductance and variable condenser, to which reaction is applied, forms a very selective arrangement and many devices for improving selectivity depend upon leaving the single oscillation circuit freer.

"Aperiodic" Aerial

Fig. 2 differs from the older loose-coupled circuit in that the aerial is (so called) aperiodic—there being no direct adjustable tuning of the aerial circuit. This aperiodic aerial arrange-

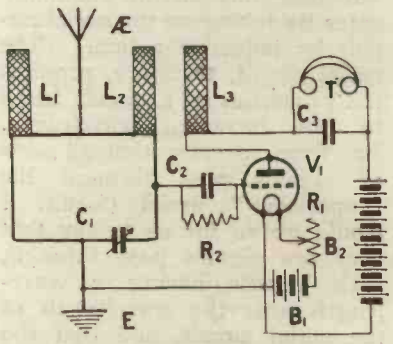


Fig. 4.—A circuit which, using plug-in coils, gives very fine selectivity.

ment gives greater selectivity with little loss of signal strength, and the figure shows reaction applied to the grid circuit, which is tuned.

The Aerial Circuit

The aerial circuit is often regarded as a general oscillator of signals which pass indiscriminately through L1 and are gracefully sorted out by the circuit L2 C1, which selects the desired signal. Others regard the aerial circuit as approximately tuned, the final selectivity being left to the tuned circuit.

Personally, I disagree with the first idea, and only partially with the second, which can only hold water when the coil L1 and the aerial capacity give a wavelength in the neighbourhood of that of the signals to be received. Usually, however, the coil L1 in

Fig. 2 is so small that the ordinary "wavelength" of the aerial circuit would be, say, only a third of that to be received. Yet the circuit will work excellently.

Inductive Tuning

My own opinion is that not only is the circuit L2 C1 tuned,

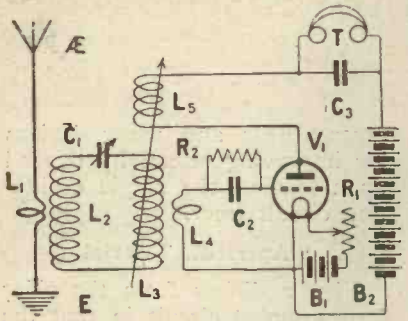


Fig. 5.—An extremely selective circuit which is very popular in America.

but that this circuit communicates its tuning to the aerial circuit by inductive action. The aerial circuit, therefore, acquires the properties of a circuit tuned to the incoming wavelength. Far from agreeing that all sorts of signals pass through the "aperiodic" aerial circuit, I would go so far as to say that very few signals pass through, such signals having a wavelength near the wavelength of the aerial circuit, and that the actual desired signals do not pass through the aerial circuit *until* and *unless* the circuit L2 C1 is tuned to their wavelength.

The whole subject of "inductive tuning" is intensely fascinating and largely unexplored. The trap coupling and aerial tuning devices described in these notes recently lend great importance to the little used principle.

Further Circuits

The arrangement of Fig. 2 has been developed into a number of selective circuits having a common principle. The Reinartz, Haynes and other circuits involve the same idea. Fig. 3 shows the aerial and earth connected not to a separate coil but to a bit of the grid coil L1. The disadvantage usually attributed to this circuit is that it is not applicable to plug-in coils. Nevertheless, the arrangement of Fig. 4 solves the problem, and also provides a variable tapping as the smaller coil L1 may be made any desired size. The coils L1 and L2 may be tried coupled together.

An American Circuit

Fig. 5 shows a circuit which is used in the U.S.A. for extreme selectivity. It will be seen that an intermediate circuit L2, L3, C1 is used, the aerial coil L1 being coupled to L2 and L4 to L3, both L1 and L4 consisting of very few turns.

Trap Tuning

Fig. 6 is a circuit using the new trap tuning described in these notes last week, which is exceptionally selective.

□ □ □

Short Wave Success

German experiments with short wavelengths have met with signal success in the case of the news service between Nauen and Buenos Aires. It was feared that the brilliant sun and lengthy days of the Argentine summer would materially interfere with any kind of regular service on a wavelength of 70 metres using an energy of only two kilowatts over the distance of 7,500 miles that lies between Nauen and the

These circuits are by no means final, but they will afford much scope for experiment and for far more selective results.

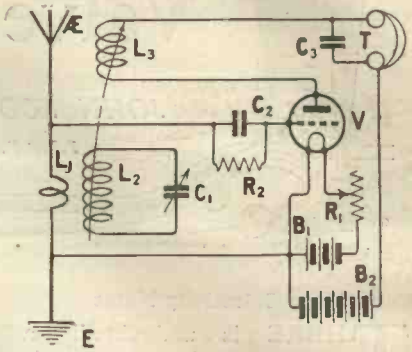
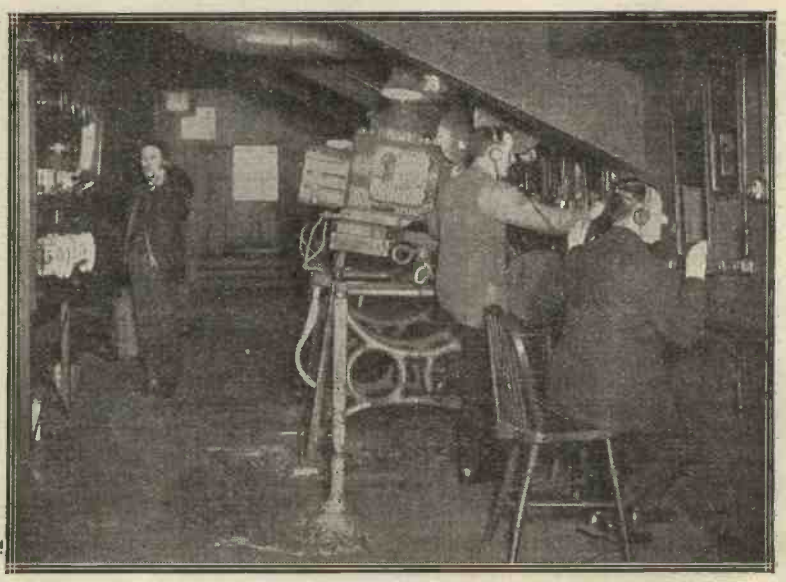


Fig. 6.—A circuit employing trap tuning is also a very effective means of obtaining selectivity.

□ □ □

receiving station at Villa Elisa. But by working during the Argentine night, irrespective of the time in Germany, it has been found possible to keep up a regular ten-hour service, using no higher energy than before, but on a wavelength of 30 metres. Germans lay stress upon the fact that although the last nation to take up radio programmes for amusement they were the first to use the sending station at Nauen for a regular news service at a time when the other nations were still experimenting.

RADIO AND THE CINEMA.



The operating room at the Shepherd's Bush Pavilion, where the synchronisation of Andre Charlot's revue with a film was tried recently. The operators showing the film were provided with headphones, whilst a loud-speaker was on the stage. Our photograph shows the manager on the right, watching the screen.

Random Technicalities

By PERCY W. HARRIS, Assistant Editor.

Some Notes of general interest to the Home Constructor and Experimenter.

EVERY now and then we find a boom in some special circuit or component part which, whatever the merits may be that attach to the particular device or method, is accompanied by claims which give a false impression of the real state of affairs. Take, for instance, the question of distortion in low-frequency amplification.

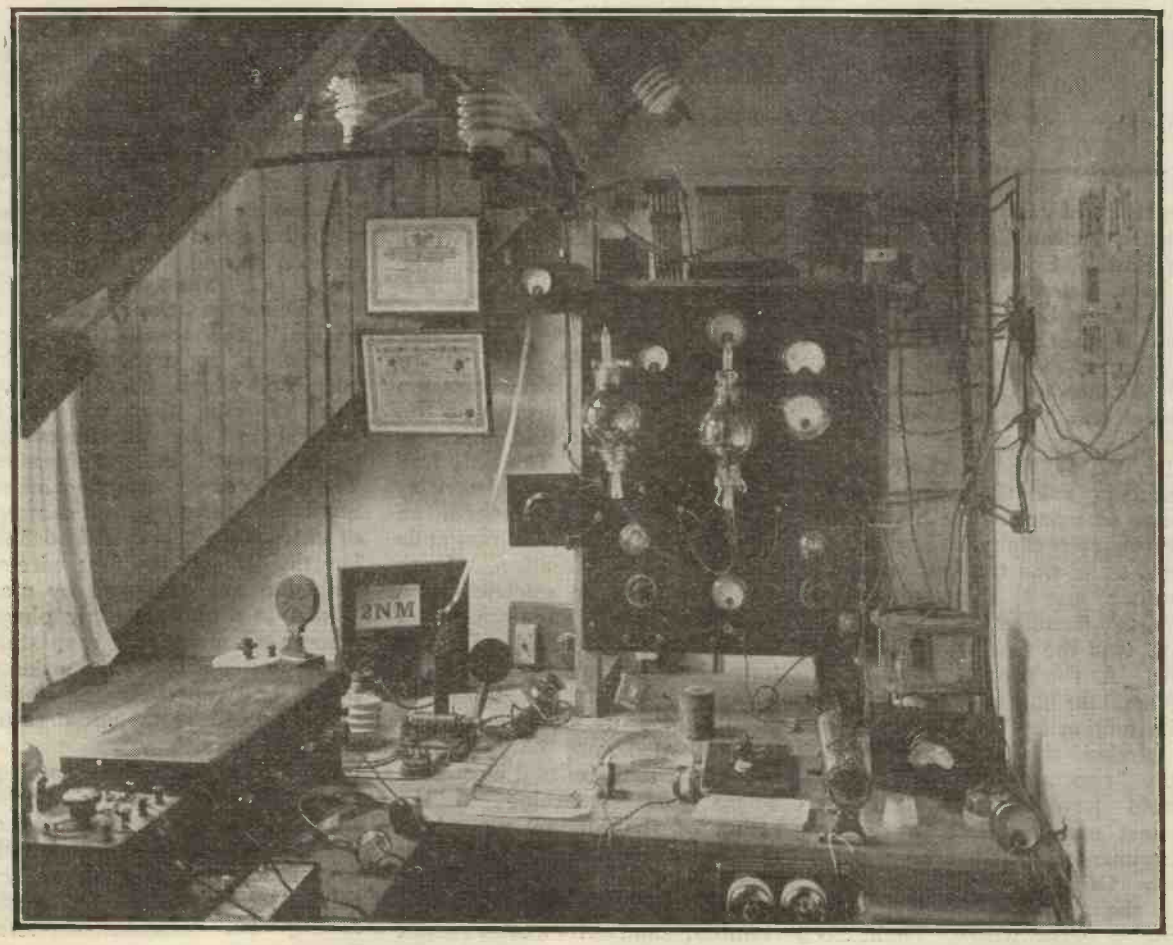
Every maker of an inter-valve transformer claims his to be distortionless, while a firm which is marketing a resistance coupling unit boldly announces that if you buy iron core transformers you are buying distortion. The tyro can well be pardoned a certain mystification, for one side or the other must be mistaken.

As a matter of fact, neither side is right. What the man in the street is concerned about is not the theoretical aspect of the case, but just what kind of results he, personally, is likely to obtain.

* * *

I have heard sets using resistance coupled note magnifiers giving horrible distortion, and on the other hand I have known sets with two stages of transformer amplification in which it was impossible for the average man to detect any distortion

BRITISH AMATEUR WORKS BRAZIL



2NM, the station of Mr. Gerald Marcuse, at Caterham, referred to in our notes on page 563.

whatever. Very often distortion occurs before the signals reach the note magnifying stages, and the impassioned advocates of resistance coupling entirely ignore the fact that there is not a single loud-speaker on the market without iron in its electro-magnetic circuit.

* * *

The great virtue of resistance capacity coupling for low-frequency amplification is that it is far easier to obtain distortionless, or nearly distortionless, reproduction by its use than by using transformers, but with a well-designed transformer amplifier, in which the transformer has been chosen to suit the valves (there is more in this than most people think), the reproduction can be particularly fine. The wonderful loud-speaker reproduction at the Albert Hall Wireless Exhibition was given by means of apparatus which had a good deal of iron in its make-up.

Much distortion in low-frequency amplification arises from the use of high-tension batteries which have developed an internal resistance far in excess of that they should normally possess. Many receivers will give excellent results with, say, 80 volts on the plates of the amplifying valves, and frequently such sets are used with a 120-volt battery. As this battery gets old, it will develop a high internal resistance which will cause a drop in voltage between terminals. The voltage, for example, may drop from 120 to 80—a still high enough figure to give good results. There is, however, a great deal of difference in the results obtained from a high-tension battery, nominally 120 volts but actually 80, and that given by a new high-tension battery whose nominal and actual voltage is 80. Shunting such a battery with a large condenser only partly eliminates the trouble.

Much distortion, too, arises from overloaded valves. With a large outdoor aerial near a broadcasting station, a set with one high frequency, a detector and two note magnifying valves may be grossly overloaded, and far better and purer results will be obtained by cutting out the high-frequency valve altogether. A very highly satisfactory set for use on the local broadcasting station, when this is not more than four or five miles away, is a crystal detector, one resistance coupled and one transformer coupled stage of note magnification. The two valves can be, for example, a DE 5B, and a B4 (or its equivalent in other makes). The current consumption of the set will then be only half an ampere, and the purity of reproduction, as well as the volume (if you use a good inter-valve transformer), will be all you can desire.

□ □ □

Matter and Radiation

Sir OLIVER LODGE'S Lecture to the R.S.G.B.

SIR OLIVER LODGE, the newly-elected president of the Radio Society of Great Britain, delivered his presidential address before the society at the Institution of Electrical Engineers, Savoy Place, W.C.2, on Wednesday, 21st inst. His subject was "Matter and Radiation."

Dr. W. H. Eccles, the retiring president, said the name Oliver Lodge was part of the history of wireless telegraphy. They might say that he was the first wireless amateur, just as their only other honorary member, Senator Marconi, was the first wireless engineer. At the present time, when the amateur had attracted universal attention by his contributions to wireless science, it was especially appropriate that they should have as president the earliest and greatest of radio experimenters. (Cheers.)

Sir Oliver Lodge remarked that the amateurs to-day were doing a great work. Their experiments were continuous, and it seemed that in ten years' time there would be seen a further advance as immense as that which had taken place already since he began his own experiments.

Radiation

Radiation, said Sir Oliver Lodge, was purely a phenomenon of the ether. There was no mechanical connection between ether and matter. The only link between them lay in electricity and magnetism; but neither an electric charge nor a magnetic field generated radiation. There must be both—an electric and a magnetic field superposed at right angles to each other. Then they had radiation, travelling with the velocity of light, at right angles to both. Atoms, when jostled, not only emitted radiation; they emitted electrons. There was something in the retina of the human eye which responded in this way, flinging away electrons at characteristic speed when it felt luminous tremors, and it was to that strange and, at present, hardly accountable, emission, that vision was due. He doubted if the electric tremors affected the nerves directly; they stimulated something specially adapted to respond to the vibrations. What stimulated the nerves was the shock of the electrons ejected by the atoms, which struck them with the speed of some thousand miles a second.

The Eye

"This is the Theory of Vision," the speaker remarked, "which is in process of being born, and which, I feel sure, contains the clue that has to be worked out by physicists and physiologists in combination. The eye is like a receiving instrument for detecting radio waves of extremely short and definite length. It was the first wireless receiving set employed by man. Vision is a photo-electric phenomenon. I make that rash statement, and say that the burden of proof, and especially the burden of disproof, rests upon future experimenters."

In seconding the vote of thanks proposed by Dr. Eccles, Admiral Sir Henry Jackson took the opportunity of expressing the Society's appreciation of the excellent work done by Dr. Eccles during his presidential term. This was referred to in our Editorial of January 7.

How to Charge Accumulators from A.C. Mains

By J. E. CARPENTER.

Full constructional details are given of how to build a satisfactory home charging plant for your accumulator.

SINCE broadcasting has become popular more and more people have become owners of accumulators and heirs to their attendant inconveniences, the chief of which is fetching and carrying from the charging station. Many people would buy charging sets but that they are rather expensive for the average pocket.

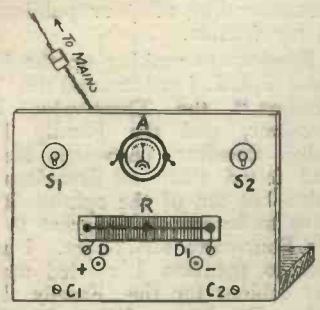


Fig. 1.—The lay-out of the board.

The charger described below was designed to charge accumulators from A.C. mains (in the writer's case 200 volts). It is economical and efficient, costing about three halfpence an hour to run and charging two 6-volt 60-amp. accumulators in about ten hours, *i.e.*, at a total cost of about eightpence each.

The Rectifier

The rectifier is of the chemical type, which, in spite of all that is said derogatory to it, proves quite efficient. The charger as described below has been used by the writer for over a year, requiring no attention during that time except an occasional fill-up with water, and has given excellent service.

The complete set should not cost more than about £3 to install.

Components Required

1. Transformer: Primary to suit mains (in the writer's case 200 volt 50 cycle); sec., 30 volt 8 amperes.

2. Switchboard: 1 ft. 6 in. long by 1 ft. broad by ¾ in. thick (mahogany or any hard wood).

Baseboard: 1 ft. 6 in. long by 1 ft. broad by 1 in. thick (deal).

3. Ammeter: 1-10 amperes (any reliable make).

4. Two ordinary tumbler switches.

5. Variable resistance, 10 ohms (this may be omitted).

6. 8 in. by 6 in. of aluminium sheet. 8 in. by 6 in. of lead sheet.

7. Four 2-lb. jam jars.

8. 1 lb. of ammonium phosphate.

Screws, wire, terminals, etc.

Construction of Switchboard

The switchboard is screwed to the baseboard at C1, C2; the transformer is mounted on the baseboard behind the panel. The ammeter is mounted in the centre of the switchboard two inches from the top, and each switch is mounted three inches from the side nearest to it and the top of the board. The two terminals D and D1 are mounted in any convenient position.

The whole lay-out may be altered to suit individual needs if necessary, but the above is convenient, and gives a symmetrical appearance (see Fig. 1).

If the resistance is included it is mounted above D and D1.

Details of the Chemical Rectifier

The chemical rectifier consists of plates of aluminium and lead immersed in a solution of ammonium phosphate—it is not advisable to use common borax, although it is cheaper, because it is not so efficient as ammonium phosphate.

Four lead and four aluminium plates are now cut each 2 in. by 6 in. One end of each plate is bored to take a 4 B.A. terminal.

The four jars are filled with solution—1 lb. of ammonium phosphate dissolved in water will be found to give a sufficiently concentrated solution. One aluminium plate and one lead plate are now placed in each jar, their ends being bent over the side of the jar to keep them in position opposite each other. Each pair of cells are now connected in parallel, *i.e.*, one lead plate is connected to the other lead plate and the one aluminium plate is connected to the other aluminium plate.

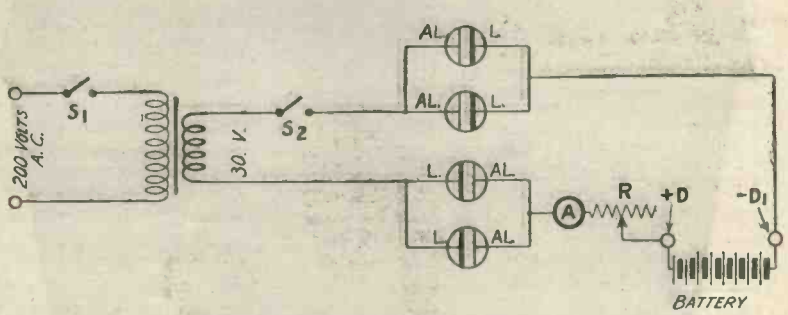


Fig. 2.—The circuit arrangement.

Assembly and Connections

The primary of the transformer is connected through the switch S1 to an ordinary lampholder through an adapter. All the connections on the switchboard are made through holes bored

through the switchboard and are carried behind it. One end of the secondary of the transformer is taken through the switch S2 to the aluminium plates of the first pair of cells of the rectifier. The other end of the secondary is connected to the lead plates of the second pair of cells of the rectifier. The lead plates of the first pair of cells are connected to the minus terminal on the switchboard. The aluminium plates of the second two cells are connected via the ammeter and the resistance to the plus terminal on the switchboard.

A glance at the circuit diagram (Fig. 2) will make these connections clear.

Performance and Upkeep

Without any resistance in circuit a direct current of 5 amperes at 20 volts is available for charging purposes at the two terminals D and D1. The accumulator should be connected to the charger as follows: The positive terminal of the accumulator should be connected to the terminal marked + on the switchboard and the negative terminal of the accumulator to the terminal marked −. Replace acid spilt from accumulators with pure acid of the correct specific gravity, but replace loss through evaporation with pure distilled water. The current delivered by the charger is suitable for charging two six-volt accumulators in series.

Control of Charging Rate

When the current is first switched on the ammeter will only indicate a current of about one ampere, but this will, however, have crept up to a steady five amperes at the end of fifteen minutes or so. The amperage may, of course, be varied by the resistance if that is included in the design. This is very useful when accumulators of small capacity are to be charged, for which five amperes is a rather heavy charging rate.

The only precaution necessary to ensure the efficient working of the charger is occasionally to fill up the rectifier jars with clean water to replace that lost by evaporation.

The handsome 4-valve T.A.T. receiver made by Mr. W. Lester; another photograph of the receiver is given on page 557.

A Reader's Four-Valve T.A.T. Receiver

SIR,—I am sending you photographs of my Four-valve T.A.T. Receiver which I made up from the description given by Mr. John Scott-Taggart in the issue of *Modern Wireless* for December, 1924. I am delighted with the results so far obtained, especially for loud-speaker work.

I only took up wireless for a hobby about ten months ago, during which time I have taken in all issues of *Wireless Weekly, Modern Wireless,* and *The Wireless Constructor.* I am glad to say all my knowledge of wireless has been gained through reading your most valuable books. I find them all full of sound, instructive, and very interesting reading from beginning to end, and have much pleasure in recommending all your publications to my friends.

Previous to making up the Four-valve T.A.T. I constructed the "All-Concert," the Three-valve Dual Receiver, and the Family Four-valve Receiver (Envelope No. 2), and found them all first-class circuits, but am of the opinion it will have to be something great to beat the Four-valve T.A.T. set. I would like to mention I started making the cabinet for the Family Four-valve Receiver. When I got my December issue of *Modern Wireless* and saw the T.A.T. set, which struck me as something good, and decided to wire it up on a 24-in. by 14-in. panel to suit the cabinet. The latter is 4 ft. high, 3 ft. 6 in. across the front, and 1 ft. 9 in. wide, made in oak, and is entirely my own design.

I use a switch in the L.T. circuit for lighting all valves, as it saves time when the filament rheostats are once adjusted. It will be seen from the photographs that I have fitted a plate-glass window in the centre of the front of the cabinet, and also a reflector inside, which enables a clear view of all the wiring to be obtained.

This is the first cabinet or piece of furniture I have made, beyond following constructional details in *Wireless Weekly* and *Modern Wireless* of small cabinets. When one's tools are very limited, as in my case, I consider such constructional hints very helpful.

All my friends say it is the best loud-speaker receiver they have heard, and they call it a "Rolls-Royce" wireless set.—Yours faithfully,

W. LESTER.

Uxbridge, Middlesex.

Making a Start in Transmission.

By PERCY W. HARRIS, M.I.R.E., Assistant Editor.

In this article further constructional details of a standardised transmission panel are given.

(Continued from page 524 of previous issue)

IN my last article I gave photographs of an experimental transmitting panel which I have found very useful in experimental transmission work. This week some constructional details and drawings are given. I do not propose to publish complete wiring diagrams of each transmission circuit, as the experimenter who has gained a licence for transmitting is quite capable of carrying out such wiring himself, provided certain technical data is made available.

Mounting Gridleaks

The " Zenite " resistance rods are sold as what appear to be porcelain tubes with flexible wires projecting through the vitrified surface. In order that they may be used in the present instrument, it is necessary to provide some form of mounting, and this, I have found, can conveniently be made as follows :—

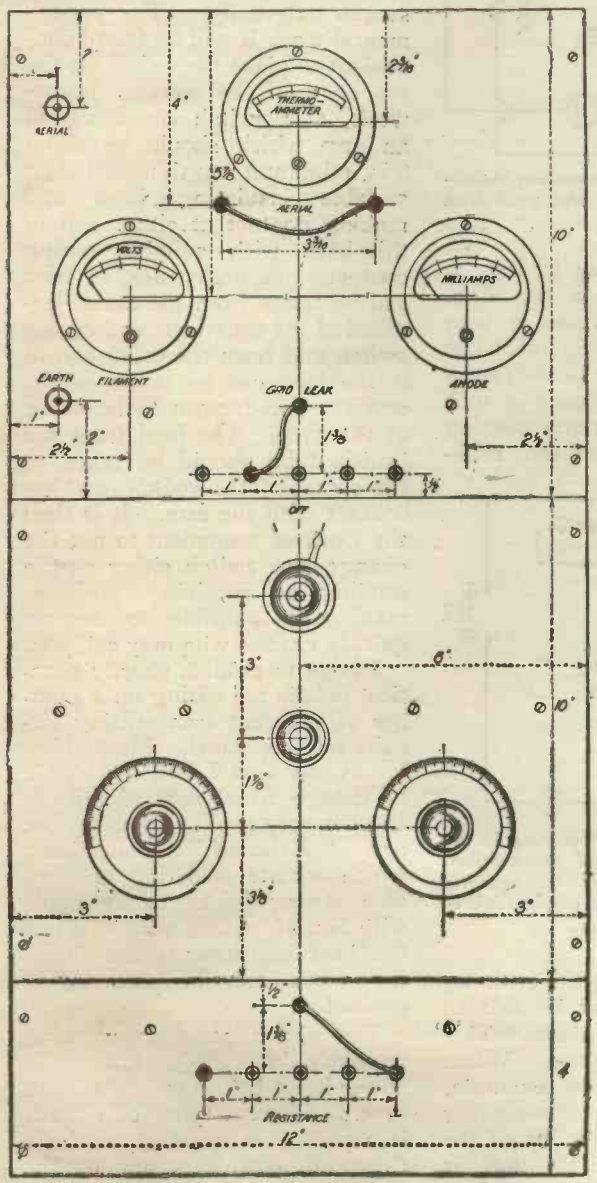


Fig. 1.—Dimensioned drawing of front of panel.

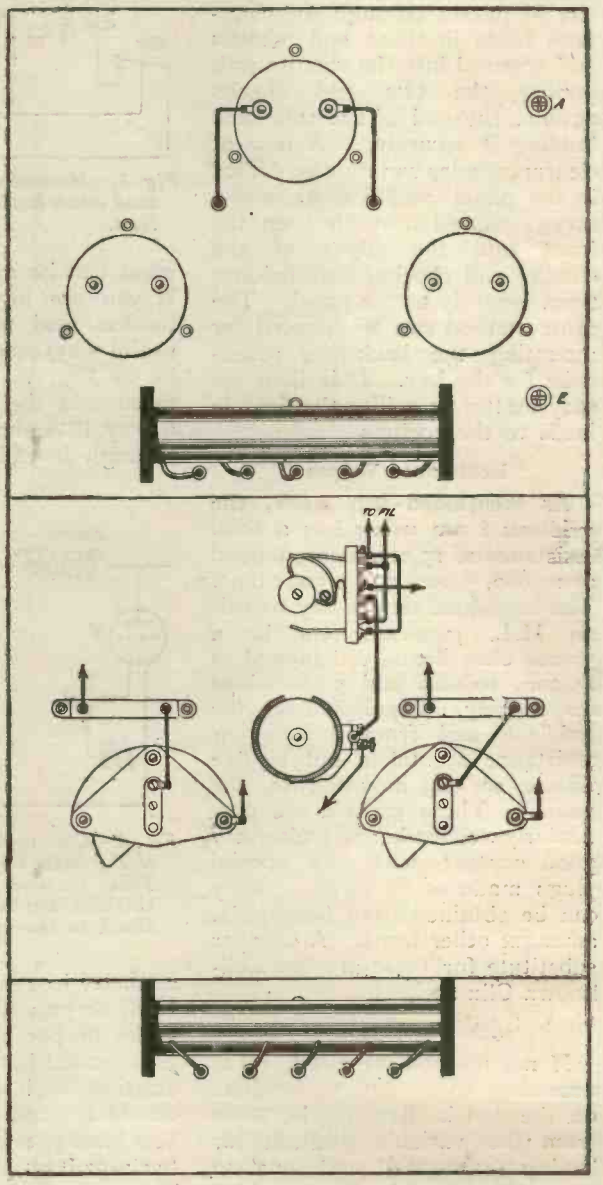


Fig. 2—Disposition of parts on back of panel.

Take two pieces of ¼-in. ebonite sheet, measuring 1½ in. square. Drill through the centre of each of these pieces a clearance hole for a 4 B.A. metal screw. Now take a piece of ⅜-in. ebonite rod, and cut it off to such a length that when inserted in the grid-leak tube it does not project at either end, but is slightly shorter than the tube itself. Now tap a hole at each end of this ebonite rod to take a 4 B.A. metal screw, and in one edge of each of the two ebonite squares tap a further hole to take a 6 B.A. metal screw.

Fixing

If, now, the two end pieces of ebonite are placed at each end of the gridleak tube with the ebonite rod inside, metal screws can be passed through the clearance holes in these end cheeks and screwed into the ebonite rod, pulling the two end cheeks against the end of the tube and holding it securely. A pair of clearance holes can now be drilled in the panel and 6 B.A. metal screws passed through from the front into the edges of the ebonite end cheeks, thus holding them securely to the panel. The same method can be adopted for mounting the back-load resistance for the key. It is then an easy matter to solder the flexible leads to the sockets.

Resistance Values

As mentioned last week, the gridleak I am using has a total resistance of 15,000 ohms, tapped at 10,000, 5,000, and 2,500 ohms. The back-load on the key to suit an M.L. generator can be a 30,000 ohm Zenite rod tapped at 15,000, 10,000, and 5,000 ohms respectively. Tappings from the gridleak and from the keying resistance are taken out to five Gibson sockets mounted in the panel. These sockets are particularly well made and make very good contact with the special plugs made to fit them. They can be obtained from Gamage's, amongst other firms. A cheaper substitute for these are the well-known Clix sockets.

Sockets

If my method is used, it is necessary to mount *six* sockets on the panels, five for the leads from the variable gridleak (or keying resistance), and one to take the flexible lead which makes contact with the grid leak or resistance. Two Gibson sockets are also used to enable the thermo-ammeter in the aerial to be shorted.

Details of Key Back-Loading

The position of the resistance in the circuit for back-loading the key will depend upon the particular keying arrangement used. If, for example, one is keying in the gridleak lead, then the arrangement can be made as in Fig. 3. If you are keying in the high-tension lead (sometimes a very useful way), the arrangement can be as Fig. 4. It is necessary to connect the resistance in such a way that the currents passing through it will affect the milli-

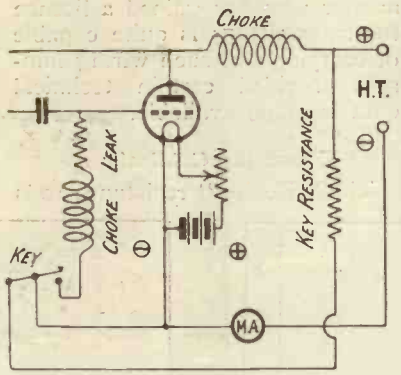


Fig. 3.—Method of connecting back-load when keying in the grid leak lead.

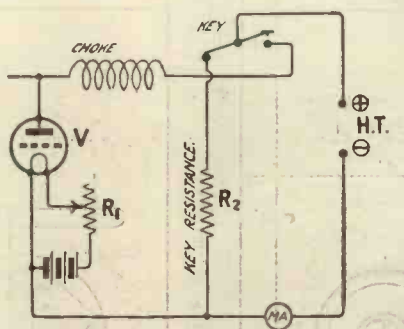


Fig. 4.—One method of keying in the H.T., with back-load connection. This method needs a carefully shielded keylever to avoid risk of shock to the operator.

ammeter just as does the ordinary load, or you will not be able to make proper adjustments. This is indicated in the figure. When starting work with, for example, an M.L. converter (presuming you have previously adjusted the back-load resistance so that it passes a current exactly equal to the ordinary load current), it is only necessary to vary the starting resistance of the machine until you get exactly the current you require (say, 30 milliamps), when the key is up. You can then rest assured of starting up on the power you want without a lot of preliminary adjustments "on the air," which are very annoying to other users and make your own work sound rather "sloppy."

Change-Over Switch

It will be noticed that no provision has been made in the set itself for a change-over switch for sending and receiving. This was not considered advisable, as it is always better to mount this switch externally. For experimental work it will be found convenient to place the switch on the top edge of the wooden framework, this switch consisting of an arm which should be about 6 in. minimum length mounted on suitable insulating base and making contact at either end of this base with suitable spring contacts. A heavy flexible wire can be taken from the aerial terminal of the set to one end of this switch and from the other end of it the lead can be taken to the receiver you happen to be using at the time. The lead from the lead-in tube should be taken to the centre of the switch, making contact with the arm. It is then the work of a moment to put the change-over switch either on the sending or receiving position, making it possible to answer quickly anyone who may call you.

I hope to publish shortly practical details for wiring up a number of different transmitting circuits on this panel. Meanwhile, I may say that I find it possible to change from one circuit to another very rapidly by using the new "Kriscros" connections, which obviate soldering and enable strong joints to be made with No. 16 square wire. When the best adjustments are found the wires can be soldered if desired.

The above panel is working regularly at 2MQ, and with power input below 10 watts, with several different types of circuit, is reported at good strength in Cornwall, Aberdeen, and on the Tyne.

Broadcasting in Czecho-Slovakia

By Capt. L. F. PLUGGE, B.Sc., F.R.Ast.Soc., F.R.Met.S.

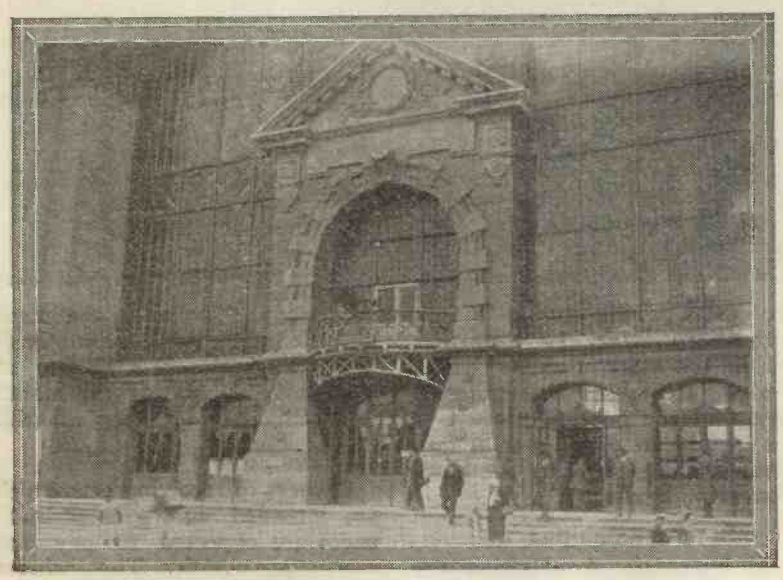
IT is only quite recently that Czecho-Slovakia has been gifted with what one might call a real broadcasting service. The driving energy behind the movement has been the *Radio Journal*.

The *Radio Journal* was the first wireless periodical to be published in Prague, and ever since its existence it has not ceased to fight Government Departments and other bodies, who were opposed to public wireless transmissions, for permission to form a broadcasting company and thus provide listeners over there with such entertainment.

The pavilion of the "Radio Journal" Co. at the Exhibition which was held at Prague recently.

The *Radio Journal* Broadcasting Co.

However, successfully overcoming the considerable number of difficulties, a company was finally formed under the name of the *Radio Journal* Broadcasting Company, Ltd. Funds were small at first, and the company had to make use of anything they could get hold of. For this reason the first station was erected at Kbel. Kbel is a name given to an aerodrome in the neighbourhood of Prague, on the landing ground of which a spark transmitting station on 900 metres had already been in use for some time during the war for aeronautical work. The officials of the *Radio Journal* made use of such gear as they possibly could, and, after a few months, they were able to send out their first programme on telephony. Results completely justified their efforts, and the interest taken in the matter generally, and as well as possibilities of the scheme, finally dawned on the local authorities. The company at last was granted a monopoly from the Government, and quite recently its capital has been increased to one million crowns (£7,000 approximately), the Government insisting, however, on holding 51 per cent. of these shares.



An Amplion loud-speaker placed on the gallery of the Industrial Palace of the Exhibition for the purpose of broadcasting the opening speeches.

The Kbel Station

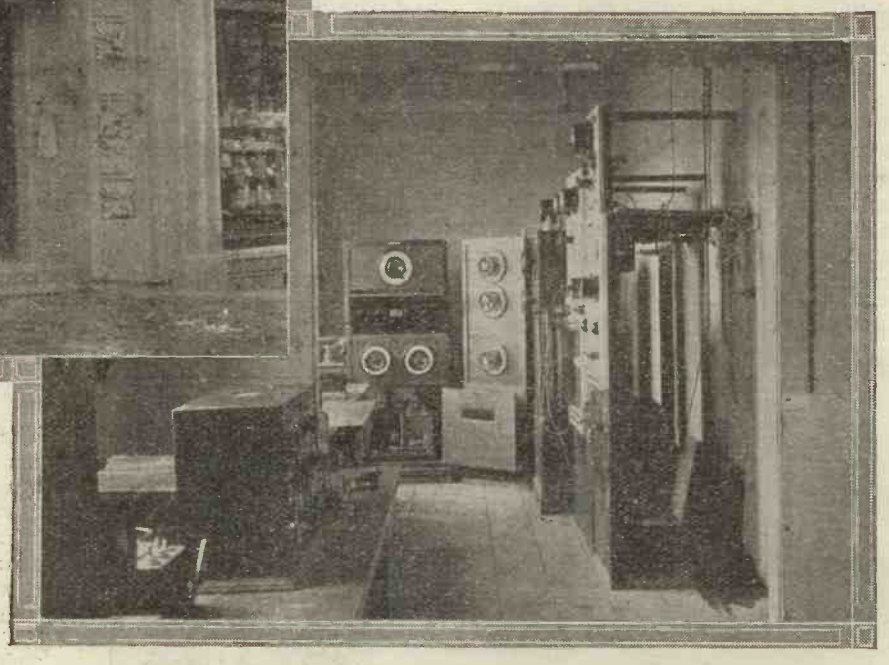
The Kbel broadcasting station is now working regularly on a 1,150 metre wavelength, and the power is approximately one kilowatt. Particulars of the concerts, Exchange quotations, and weather reports can be found in the current number of *Modern Wireless*.

The success attended by the Kbel station decided the company to erect a second station at Komarow, near Brno, Moravia. This station is transmitting at present daily weather reports, but a daily transmission of concerts has not yet been arranged. The wavelength of this station is 1,800 metres, and the power used is approximately the same as that used for the company's station at Kbel.

Special Transmissions

Although it has not been possible for the *Radio Journal* Broadcasting Company to carry out any outside broadcast on the scale that we are used to in this country, the company has, nevertheless, sent out special transmissions on different occasions. For instance, a special performance was given on the occasion of the centenary festival of the great Czechian music composer, Smetana. The opening ceremony of the Congress of Bimco was broadcast (the First International Management Congress), and also a course of lectures from the Esperanto Institute.

The entrance to the offices of the "Radio Journal" Broadcasting Co. at Prague.



The 1 KW transmitter at the Kbel aerodrome station near Prague. This transmitter is of German manufacture.

Experimental Stages

Broadcasting in Czecho-Slovakia can be regarded as just emerging from its experimental stage. Another station near Prague is nearing completion. The transmitting gear to be used will be French, and supplied by the Société Française Radio-Electrique. This station, which will be erected at Strasnice, will adopt a wavelength of 450 metres and the power will be 500 watts. This station is expected to start transmitting within the next two or three weeks. It may be interesting to note that the gear at present in use at Kbel is of German manufacture, being made by the Huth Company, Berlin.

An Exhibition

An international exhibition was recently held at Prague, and the *Radio Journal* arranged a subsection where radio instruments made by firms or amateurs could be exhibited. It is in no small way due to this display, which helped to bring wireless to the notice of the public, that the difficulties put forward by the Government were overcome. In addition to this, the *Radio Journal* Broadcasting Company arranged for the broadcasting all over the exhibition of the opening addresses, transmitting them via their Kbel station. Up to date, however, the Ministry of Postes et Telegraphs, according to an early regulation still in force, controls and works all wireless transmissions in general. From the modulation down to the microphone, including amplification, the work is carried out by the company, as are the concerts in the studio and the arrangements for the Exchange and weather reports.

Finance

Funds for covering the expenses of the service are obtained in a manner similar to that used in our country, *e.g.*, by subscription. The price of a licence at present is 20 crowns per month (approximately 4s. per month).

Licences

Owners of receiving sets which are intended for greater audiences are expected to pay 100 crowns per month. This includes the use of Exchange reports, which are at present sent in code.

Among the plans which the Government of Czecho-Slovakia have in view is the erection at Prague of a high-powered station which will use approximately 5 kilowatts, with a view of covering a range which would include the whole of Bohemia and Moravia. The erection of stations is also contemplated at Bratislava (the town of three names—also called Pressburg and Pozsony—and at Kosice, Slovensko. It is expected, however, that several months will elapse before these stations will be transmitting regular programmes.

Although the Czecho-Slovakian programmes do not, as a rule, contain any events of striking importance, they are mostly of a sound musical character, and are especially filled with classical items.

Experimental Anode Resistances and Grid Leaks

By JOHN W. BARBER.

WHEN experimenting with resistance - capacity coupled amplifiers, it is often desirable to try the effect of a little higher or lower value of resistance, either in the anode circuit or as a grid leak. Some types of resistance sold commercially, while being excellent in every way, do not permit one to add or take away a little resistance. A very simple yet effective form of resistance may be made from "scrap," and may be varied quite easily, until the best value has been arrived at. All that is required will be two terminals, some Indian ink, and a piece of paste-board, such as a visiting-card.

Anode Resistances

For an anode resistance, make two holes ¾ in. apart, and paint round the holes with Indian ink. Insert the terminals, and ensure that the ink rings extend just beyond the base of the terminals. A nut should be screwed on to the shank of each terminal in order that good contact may be made. A pencil line may now be drawn across the card, between the terminals, and its thickness increased until the best value is found. A quickly applied coat of shellac varnish will keep the resistance reasonably constant.

Instead of pencil lines, Indian ink may be used, and is less noisy after some use.

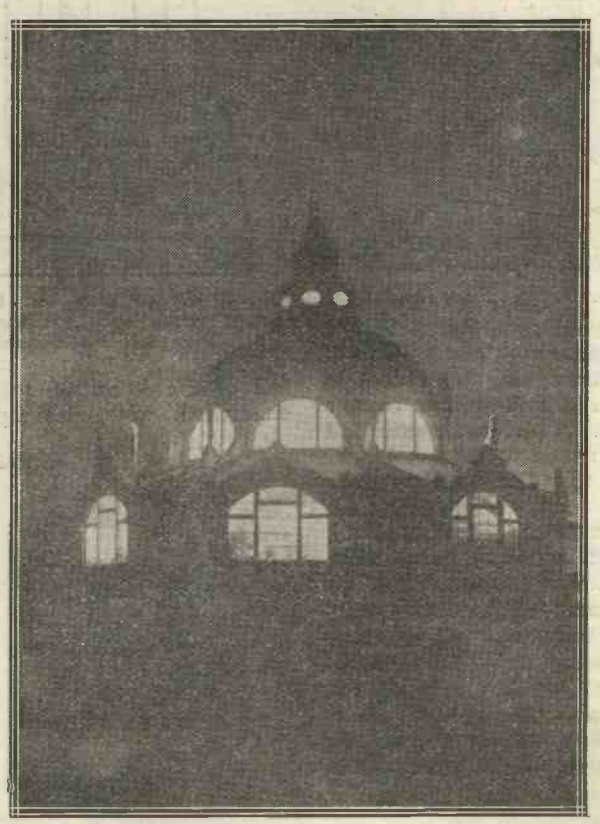
For a grid leak the terminals should be 1½ in. apart. In this manner the best value of resistance and leak may be found and the resistance amplifier operated at its best.

A Useful Measuring Unit

CALIBRATION

THE instrument described in Vol. 5, No. 13, must, of course, be calibrated from some standard before it can be used as a wave - meter for transmitting purposes. The method to be adopted will depend upon the nature of the standard, *i.e.*, whether it is a buzzer or heterodyne instrument. When a buzzer wave-meter is used for the operation, the milliammeter of the measuring instrument should be replaced with a pair of 'phones, after which the two instruments may be placed fairly close together, and it will be found that the usual buzz will be heard when the new instrument is in resonance with the standard. A calibration of fair accuracy can be obtained in this way, but a heterodyne standard is to be preferred. In this case a dip in the milliammeter reading will be the indication of resonance between the standard and the new unit, and the usual series of points should be plotted.

THE PRAGUE EXHIBITION



The pavilion at night. Night concerts were given by the "Radio Journal" before large audiences—British, French and Swiss stations being received on loud-speakers.

How to Build a Sensitive . . . . . Milliammeter

By J. F. CASTLE.

This instrument, of which full constructional details are given, may be made for the modest sum of five shillings.

AT first sight the cost of this instrument may seem absurd, as the prospect did to me at first. However, I am thoroughly satisfied with the performance of the finished instrument. It is of the moving coil type, and has a scale about 6 cm. in radius. The list of materials is as follows :—One piece of copper foil, 5 in. by 1 in., ½ oz. No. 40 S.W.G. copper wire enamelled; one half-metre of phosphor-bronze strip, about ½ mm. wide; one ex-army type magnet from telephone magneto

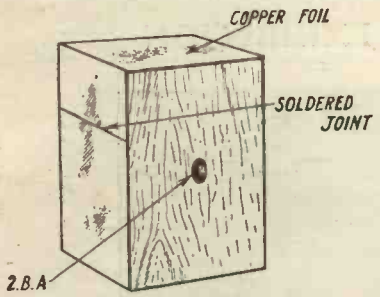


Fig. 1 shows details of the former on which the coil is wound.

(I think); a piece of fine aluminium wire about 30 S.W.G., about 10 cm. long; wood, screws, and two terminals. The coil is wound on a rectangular copper foil frame. A piece of copper foil is placed round a wooden block, as in Fig. 1, and soldered to make the frame. The dimensions must suit the magnet you obtain. I should not have the coil more than 1 in. wide on account of its large moment of inertia and consequent oscillation. The frame being made, put two pieces of card, one on each side of the wooden frame, and bore a hole to take a 2B.A. rod in the middle to act as a spindle for winding the coil.

Winding the Coil

Now fill up the angles with paraffin wax, so that the wire will not go down between the wood and the cardboard. Wind this

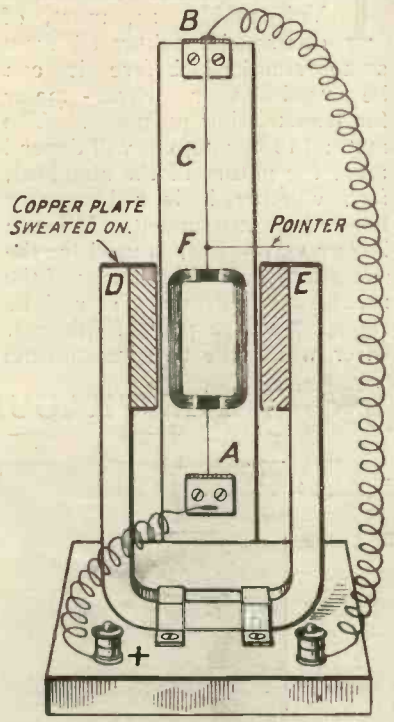


Fig. 2.—Illustrating how the component parts are arranged in the complete instrument.

full of the ½ oz. of 40 S.W.G. enamelled wire, leaving about

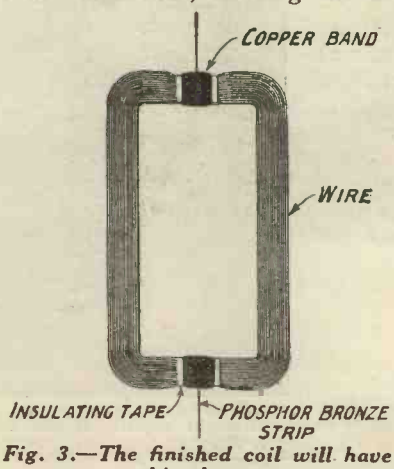


Fig. 3.—The finished coil will have this shape.

1 in. or so to make connections. Shellac the coil, and remove it from its wooden former. At the top and bottom wrap a narrow strip about ¼ in. wide of insulating tape, and over this a ring of annealed copper foil. Solder the two ends of the coil to these rings, and Fig. 3 will indicate the appearance of the finished coil.

The Magnet

The next thing is the magnet. This has to be fitted with iron pole pieces the same length as the coil. These may be filed to shape, and a copper plate sweated on

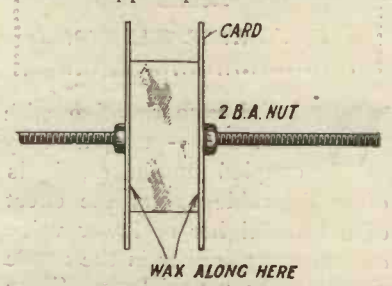


Fig. 4.—How the side supports for the coil-former are mounted.

the top to hold them to the magnet. It is useless to try and drill the magnet. I broke two drills while trying, and had to resort to the above method. The magnet has then to be mounted in a vertical position so that the coil is free to rotate between the pole pieces. A piece of phosphor bronze strip is soldered to a brass plate A (Fig. 2), which is attached to one terminal of the instrument. The other end of this piece is soldered to the ring at one end of the coil. This is a delicate job, and is best done with a very hot iron. The remaining strip is soldered, one end to the other ring on the coil, and the other end to a brass strip B on the wooden pillar C. This brass strip forms the other terminal.

A suitable scale is made of

cardboard, to be glued on the poles of the magnet at D and E. The pointer is made up of a piece of aluminium wire, flattened at one end to make the actual pointer, and at the other end as in Fig. 5. This is clamped on the phosphor bronze strip just above the coil at F. The brass strips A and B (Fig. 2) are then connected to the terminals of the instrument. The tension of the phosphor bronze may be adjusted by bending B. It is best to have it just tight enough to hold the coil fairly rigid laterally. It will be found that it turns easily enough.

Action

A word as to its performance. If an old flash lamp battery is taken to pieces and one cell is connected, the coil will be found to turn right over one way or another. By reversing the connections, it may be made to go the right way across the scale.

The positive terminal is then marked in some way. I have connected this in a two valve set to measure the plate current, and it sends the pointer right across the scale for about two or three milliamps. When the set oscillates it drops back about 2 cm.

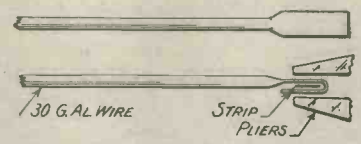


Fig. 5.—Details of the pointer.

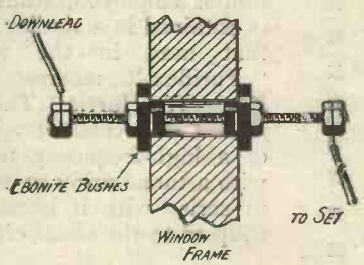
across the scale. The effect of grid bias can be shown most clearly. If you touch the high tension positive with a damp finger the needle goes right across the scale. This instrument can easily be calibrated with a borrowed milliammeter, and I am finding it most useful.

I hope these few suggestions will be of interest to fellow experimenters who have more enthusiasm than money. If anyone has any difficulty in making it I should be only too pleased to answer any queries in my power.

The luxurious 4-valve T.A.T. receiver, made by Mr. Lester, of which another photograph appears elsewhere.

A Simple Lead-In

A LEAD-IN which is simple to make, and very effective, is shown in the accompanying illustration. A suitable length of 2 B.A. screwed brass rod, six 2 B.A. nuts, and two ebonite bushes are all the materials required. The ebonite bushes should have 2 B.A. clearance holes drilled in them, or even larger holes would be an advantage. First drill a hole in a convenient place through the window sash or wooden framework of the window. This should be of such size as to provide a tight fit for the ebonite bushes, which are fitted in as shown. The 2 B.A. rod is then passed through and secured on each side by a nut.



The lead-in.

If the holes in the bushes are larger than 2 B.A. clearance, washers should be placed under each nut, the rod being arranged concentrically in the holes, and the nuts screwed up tightly. Two nuts are then placed on each end of the rod; the down-lead of the aerial is securely clamped between the two nuts on the outside, while the lead to the set is clamped between those on the inside.

If it is desired, the down-lead and the lead to the set may be soldered to the brass rod in their respective positions. If this is not done it will be advisable to keep these contacts clean, and tighten them up occasionally.

D. J. S. H.

A Two-Valv for Pure

By STANLEY G. RATTE

Full constructional details are her and economical receiver em

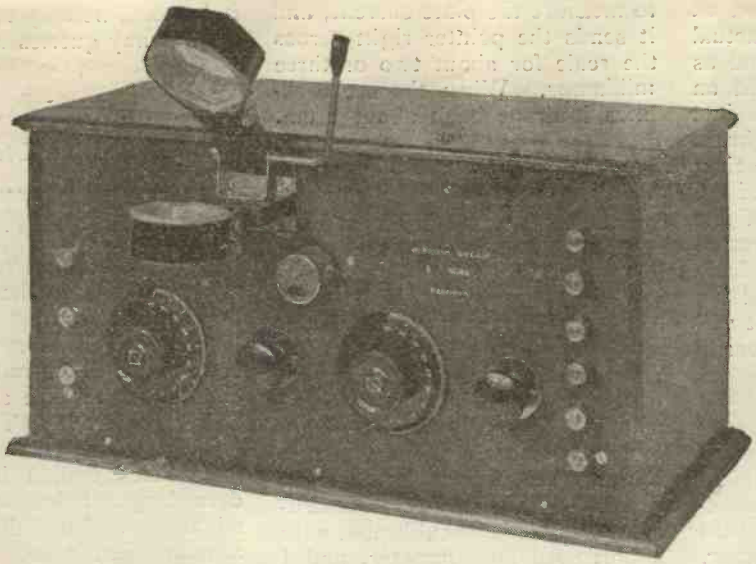


Fig. 1.—The handsome appearance of the receiver may be seen in this photograph. The novel form of crystal detector seen in the centre of the panel should be noted.

THE receiver illustrated in the photographs possesses two rather interesting features in that crystal rectification is employed, whilst reaction is obtained in a similar manner to that used in the well-known "Puriflex" receiver by Mr. Percy W. Harris. This method, it will be remembered, consists of a high-frequency transformer with a tuned primary, and having in series with it a reaction coil coupled to the aerial circuit.

Instability

Using this arrangement it may be found that the receiver has a tendency to oscillate, but with average careful handling, some regard to the value of H.T. used, and the inclusion of as small a reaction coil as possible, this tendency will in no way be more objectionable than in other circuits where reaction is incorporated. In order that there may be no difficulty in making the receiver oscillate with a small reaction coil, constant aerial tuning is used should it be desired.

Reaction

With this arrangement, though the reaction coil is in series with the primary of the H.F. transformer, it is not actually in the tuned circuit of the transformer, making therefore very little change in the tuning of that circuit when the coupling with the aerial circuit is varied. Another point is that, should the first valve show any tendency towards oscillating of its own accord, reversing the connections to the reaction coil will at once remedy the fault.

Design

The general make up of the receiver may be gathered from the photographs. Looking at the first illustration, the arrangement of the terminals is to this effect: The three to the left of the panel are for aerial and earth, with or without constant aerial tuning, whilst those on the right hand side are for the telephones and batteries; the valves, together with the transformer, are mounted at the back of the panel, accessibility being obtained by lifting the lid of the containing box. The crystal detector, which is of a new and ingenious pattern, is mounted as seen on the exposed face of the panel.

The Circuit

The circuit of the receiver is given in the theoretical diagram, wherein it will be seen that the aerial inductance is shunted by a variable condenser in the usual way, whilst coupled to that inductance is the reaction coil L_4. The high-frequency transformer is represented by L_2 L_3, with the primary L_2 shunted by the condenser C_2 of .0003 μF capacity; across the secondary of the transformer are the crystal detector and primary of an L.F. transformer.

Components

The receiver illustrated is made with the following components, and, though these may be of any good make, the names of the manufacturers are given for the information of those readers who desire to build a set to the specifications of the original receiver. Though the makes of the components are left to the choice and discretion of the reader the values must be as stated in the following list:—

One ebonite panel, 16 in. by 8 in. by $\frac{1}{4}$ in. (S. A. Cutters).

One 0.0005 μF variable condenser (square law) (Peto-Scott).

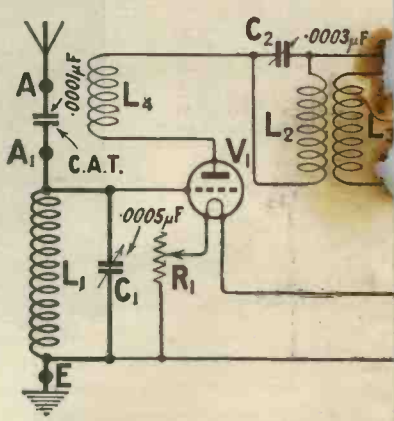


Fig. 2.—The theoretical circuit

ve Receiver Reception

E, M.I.R.E., Staff Editor

e given of how to build a compact ploying crystal rectification

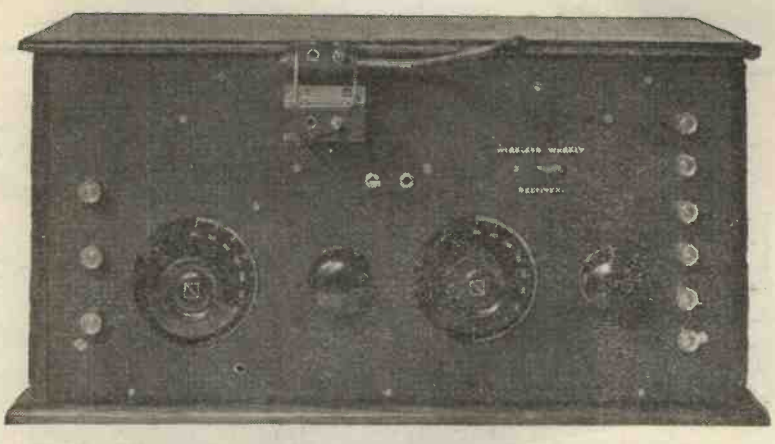
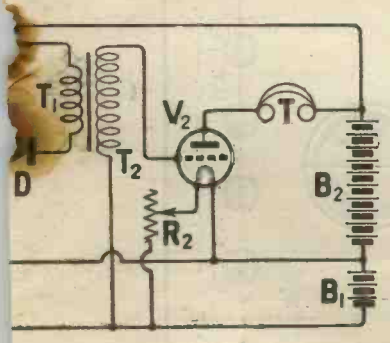


Fig. 3.—The receiver without its coils and with the crystal detector removed. The valves are fitted at the back of the panel, the box having a hinged lid.

One 0.0003 μF variable condenser (square law) (Peto-Scott).
One 0.0001 μF fixed condenser (Dubilier).
One crystal detector (Harlie Bros.).
One two-coil holder (Burne Jones).
Two H.F. transformers, 300-600 m. and 1,100-2,600 m.
Three anti-capacity valve holders (Burne Jones).
Two dual filament rheostats (Burndept).
One L.F. transformer (Radio Instruments).
Nine brass or nickel-plated terminals.
Set of plug-in coils for the wavelengths desired.
Quantity of square No. 16 wire for connecting purposes.

The Panel

This is made from the ebonite appearing first in the list of components, and is drilled in accordance with the instructions given in the panel layout.



arrangement of the receivers

Precaution

There are now on the market certain makes of ebonite which, besides having a glossy finish, are guaranteed to be free from surface leakage, and readers when buying ebonite should assure themselves whether or not the material purchased bears that guarantee. In cases where this specially prepared ebonite is not supplied, then the panel must be subjected, after the drill holes have been made, to a thorough rubbing on both sides with fine emery cloth in order to remove any impurities which may be embedded in the surface as a result of the tinfoil treatment which constitutes a part of the manufacture of most ebonite.

Wiring Up

The wiring of the receiver may be seen in the photographs showing the underside of the panel, and may be more clearly followed in the practical wiring diagram. It will be observed that stiff wire is used for connecting purposes, but in cases where readers prefer to use the somewhat easier method of soft wire and insulating sleeving there is no reason why this latter method should not be used so long as all leads are kept as short as possible, and are well spaced.

H.F. Transformer

The connections to the H.F. transformer are as given in the wiring diagram to give satisfactory results with the transformers tried, namely, a Magnum, McMichael, Ediswan, and Formo, but it may be experienced that with other makes these connections may be improved upon, and in any case before finally connecting the receiver the practice of changing over the connections should be tried, meaning IP or OP to the reaction coil IS or OS to crystal.

Coils for B.B.C. Wavelengths

The operating of this instrument is much the same as when using any other H.F. detector and L.F. combination, with the exception that with this receiver a little more careful manipulation is called for to obtain the best results.

For the reception of the B.B.C. stations using wavelengths up to 420 metres the aerial should be connected for constant aerial tuning—that is, to the terminal marked A in the panel layout, and the earth should be connected to the terminal marked E. A No. 50 plug-in coil should be inserted in the aerial coil socket, and a No. 25 coil in the reaction coil socket.

Operating the Receiver

The aerial and reaction coils should be turned to a right angle position and the H.T. battery connected. Plug a suitable H.F. transformer in the middle valve holder, and light the valves to a suitable degree of brilliance; it should be noted that the average H.F. transformer for broadcast-

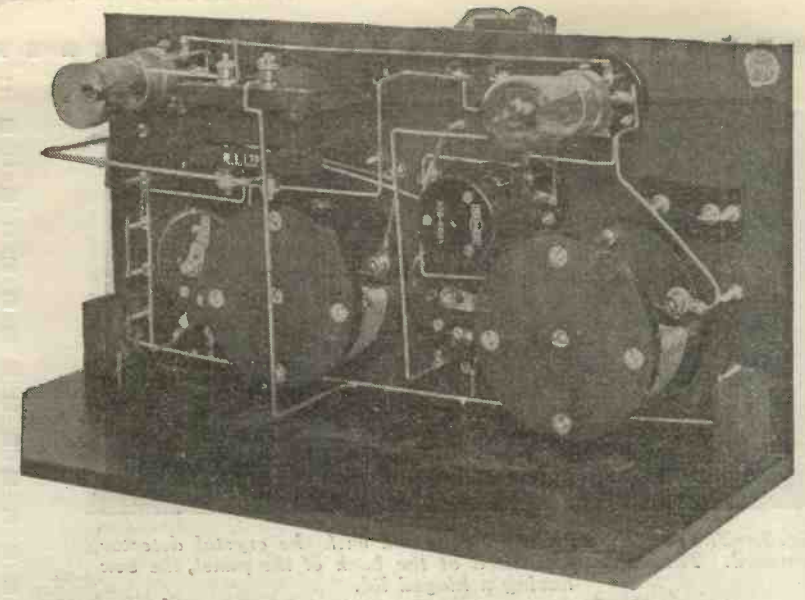


Fig. 4.—The panel is secured to a baseboard by means of two pieces of wood, and may therefore be removed from the box without the necessity of removing screws.

ing is wound to cover wavelengths from 300 to 600 metres, with a .0003 μF condenser, so for the reception of the B.B.C. stations, excluding the 1,600 metre station, only one transformer is required.

The next operation is to adjust the crystal detector until a really sensitive spot is found, and with the detector illustrated this is done by slightly turning a little black button in a clockwise direction.

To tune to the desired station the aerial tuning condenser is varied in conjunction with the condenser connected across the primary of the transformer, both of which are shown as C1 and C2 in the panel layout and wiring diagram. If the receiver shows any tendency to oscillate as the desired signals are approaching maximum strength the H.T. voltage should be reduced and the set retuned for the best results. With the maximum signal strength obtained in this way the moving coil should be brought nearer to the fixed coil, taking care that the set is not made to oscillate, and slight adjustments made on the condensers C1 and C2.

Should any tendency of the set to oscillate be uncontrollable, then the connections to the reaction coil should be reversed and the coil moved nearer to the aerial coil.

For the reception of the B.B.C. stations with wavelengths above 420 metres, the operation is precisely the same, but using in the aerial socket, coil No. 50 or 75 and coil No. 25 for reaction.

The 1,600 Metre Station

For the B.B.C. station on 1,600 metres the aerial coil should be a No. 150 (without constant aerial tuning) and a 100 or 150 for reaction, whilst the transformer should also be changed for one covering that wavelength. When receiving wavelengths above 600 metres the aerial connection may always be changed from the constant aerial tuning terminal A and connected to the terminal marked A1. If the receiver with

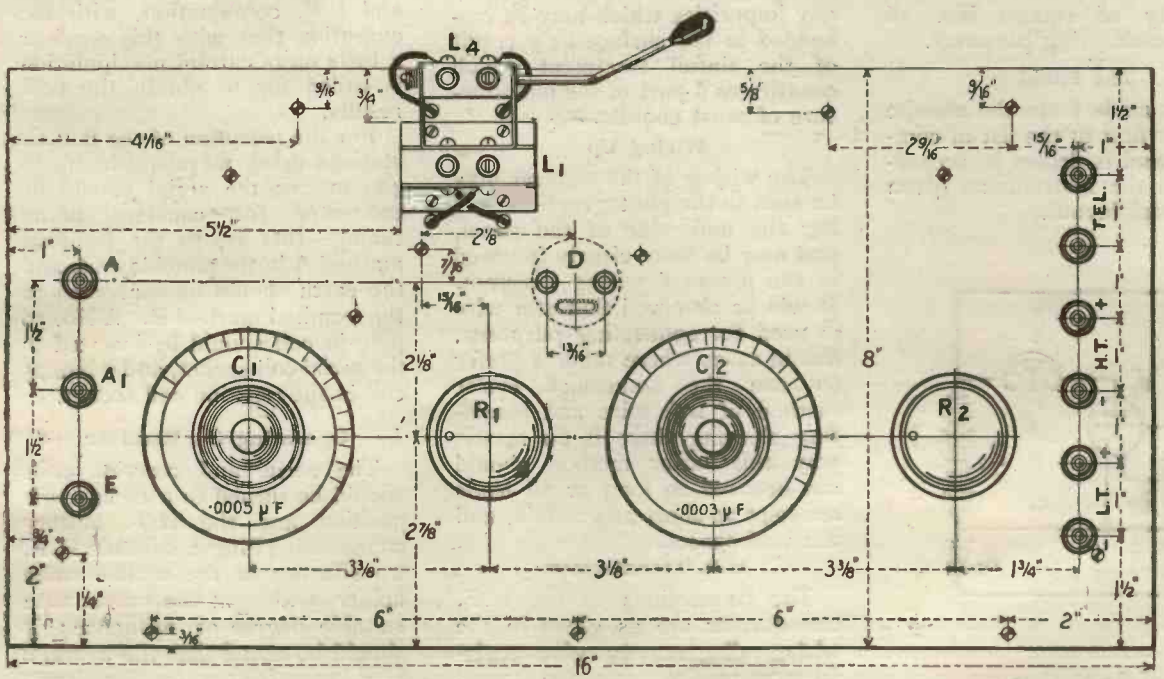


Fig. 5.—The layout of the panel together with drilling dimensions. The uses for the various terminals are also indicated. Blueprint No. 95a.

this arrangement shows any tendency towards self-oscillation, then the reaction coil should be changed to an even smaller number. It may, in fact, be understood that the smaller the reaction coil the less likely is self-oscillation to take place.

Radio Paris

For the reception of Radio Paris the same transformer and coils are used as in the reception of the 1,600 metre station. On indoor aerials, however, one size larger aerial coil may be needed for these longer waves.

Valves

It may be taken that any general-purpose receiving valve may be used with this receiver, and since suitable filament resistances are fitted these remarks also cover the range of dull-emitting valves. Care must be taken when using this receiver that no excess of H.T. voltage is applied to the plates of the valves, otherwise the operator will experience considerable difficulty in obtaining that fine adjustment of reaction which is so desirable in the reception of distant stations.

Test Report

Using the receiver in S.E. London with a No. 50 coil in the aerial and a No. 25 for reaction, loud-speaker signals were received from 2LO, whilst good telephone results were obtained from Cardiff, Bournemouth, Brussels, Petit Parisien, and Madrid. On changing the No. 50 for a No. 75, Birmingham and several German stations of unknown origin were received at good strength. Rome, Glasgow, Ecole Superieure, and a German station (probably Breslau) were received at fair strength after very critical tuning.

On the longer wavelengths 5XX was received at good volume using a No. 150 coil in the aerial without C.A.T., and a No. 100 coil for reaction. Radio Paris was also received when using these coils with slight interference from 5XX, whilst after very careful adjustment of the reaction coupling this interference was eliminated.

The receiver on the whole is critical in its control of reaction and as selective as one can hope for without the use of wavetraps. Any fresh adjustment of the crystal detector necessitates, of course, further adjustments to be made upon the two variable condensers, and at times calls for a variation in the coupling of the aerial and reaction circuits.

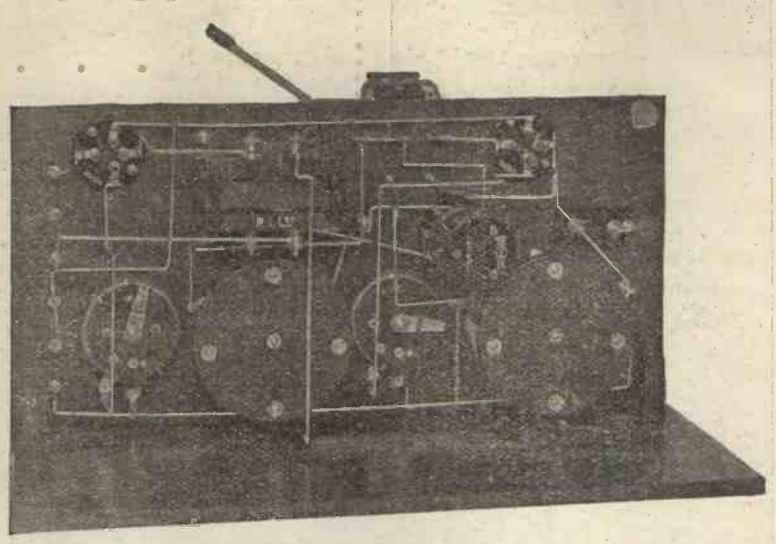


Fig. 7.—This photograph shows the wiring of the receiver and the disposition of the components.

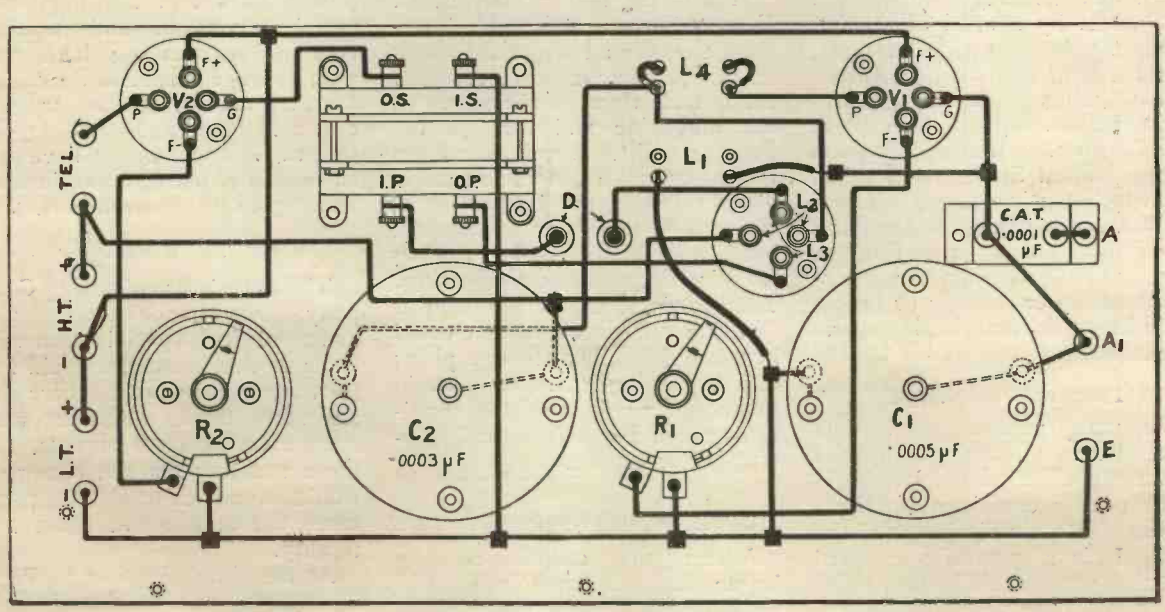
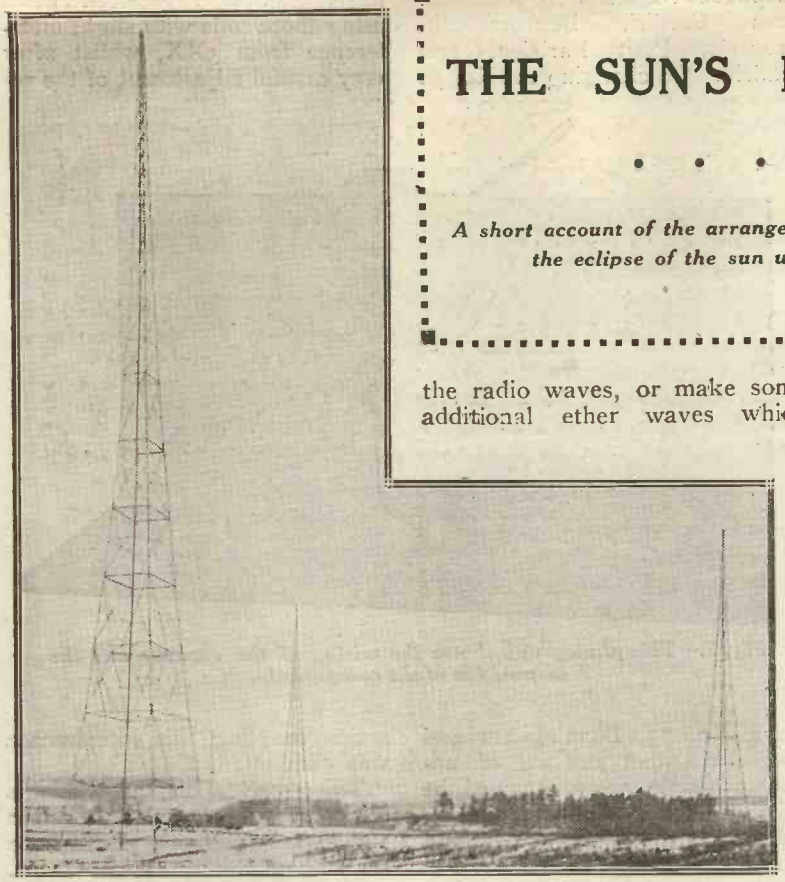


Fig. 6.—Practical back-of-panel wiring, of which full-sized drawings may be obtained upon quoting Blueprint No. 95b.

THE SUN'S EFFECT ON . . . . . WIRELESS

A short account of the arrangements made for observations during the eclipse of the sun which occurred on January 24.



Our photograph shows the new masts at the G.E.C. Works, Schenectady, N.Y., whence broadcasting is to commence shortly.

WHEN the sun was totally eclipsed on Saturday, January 24, over a certain section of the United States, a new sort of investigation was put into effect by several of the big American broadcasting stations, and the staff of *Scientific American,* working with the government meteorological bureau in Washington. Radio amateurs of the United States were called upon to listen in and see whether there was any change in receiving conditions during the time of totality, and whether the reception was better during, or before and after, this remarkable natural phenomenon.

Electronic Discharge

For many years now scientists have been advancing theories about the effect of the bombardment of the earth's atmosphere by the electronic discharge of the sun. It is a generally accepted fact that reception is better during the night time than during the hours of sunlight, and that the sun must in some way influence the radio waves, or make some additional ether waves which cause fading, frying, or other parasitic noises, and reduce the distance over which messages can be received.

It was the idea of Dr. E. E. Free, editor of *Scientific American,* to make an organised check on this peculiar effect of the sun. He issued, through the pages of the magazine and through the Press, a call to all radio amateurs and broadcast listeners to tune in shortly before the beginning of the eclipse, and listen to a special broadcast which several of the big American stations were giving. The broadcast was in the form of slowly read speech, which could be taken down by a stenographer; and beginning early, one could get a general idea of the conditions prevailing before the beginning of the eclipse.

Moon's Shadow

When the eclipse actually began and the moon's shadow passed across a narrow band of the earth's surface, listeners were able to note any change in the intensity, clarity, or regularity of reception, noting it down as the speech continued, until such time as conditions became normal—that is, as they were before the eclipse began. All these results will be tabulated carefully, and a full report will be published in one of the later issues of *Scientific American.*

Amateur Co-operation

Experimenters were asked to note with the utmost possible exactitude their location, the direction to the smallest degree of parasitic noises, or any other changes in reception conditions; the most minute description of their circuits, input, number of valves, etc., the exact seconds of time when there were any noticeable phenomena, if any; and the most accurate and clear description of any phenomena noted was required. Other supplementary information, such as the nearest power lines and lighting lines, aerial dimensions and position, type of surrounding landscape, with average reception conditions for that part of the country was also asked for, and anything else that the amateur might have considered of either direct or indirect bearing on his observations.

The B.B.C.

The British Broadcasting Company, we understand, also arranged for special transmissions so that amateurs could find for themselves whether there was any strengthening of what were comparatively local signals. If there was any marked change it would have been at about 4 p.m., when the eclipse was nearest to totality.

At the time of going to Press no reports upon results obtained are available, though we hope to publish these in our next issue.

Radio Notes and News

Three New Stations in Germany

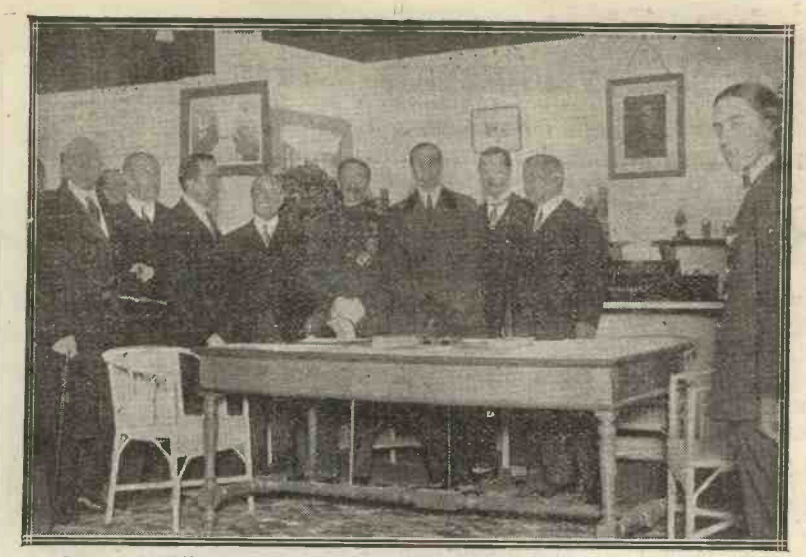
BROADCASTING is advancing by leaps and bounds in Germany. The comparatively new station working on 295 metres has recently been finished at Hanover; and plans have been completed for two other stations, one at Kassel and one at Dresden, both of which will be started shortly.

General Ferrie on History of Radio

That without the advent of radio, the famous Eiffel Tower would by now have been a thing of the past was one of the interesting statements made by General Gustave Ferrié, Chief of Radio Communications of the French Army, in a recent lecture before the Amitiés Françaises, in Liège. General Ferrié pointed out that the Eiffel Tower would have been of little value had it not been found that the aerial of the great radio station could be swung from its top, to make one of the finest radio aerials in the world.

General Ferrié called attention to the fact that while radio appears to an outsider to be rather a dry subject, full of mathematics and strange terms, there is actually no science in the world which has had the romantic and almost poetic development of this one.

Waves now have a place in all sciences, he continued, and showed to what vast futures the present development of radio and the consequent study of waves and wave-trains might point. In medicine, in communication, in power transmission, in lighting, in heating, and in fact in every conceivable branch of study, waves were part of the fundamental theory of the work. He was optimistic about the future of radio, and predicted that the year 1925 would see some very important events in radio history.



Our photograph shows H.M. the King of Spain (centre) at the stand of the Compania Nacional de Telegrafia sin Hilos at the Madrid Wireless Exhibition which was held recently.

Short Wave Work at Tunis

The military post at Tunis has been continuing its experiments in transmitting messages on short wavelengths. They are broadcasting regularly each week on a wavelength of 92 metres Morse signals, programmes of music and lectures.

Another Use for Valves

According to the *Daily Express,* thermionic valves, it has been discovered, can be used to melt masses of steel into white-hot liquid. This discovery was revealed recently by Dr. C. H. Desch, Dean of the Faculty of Metallurgy at the University of Sheffield.

"Two years ago," said Dr. Desch, "nobody would have dreamed of thermionic valves being used for furnaces, but within a few months there will be furnaces in Sheffield worked by these valves.

"Furnaces have actually been built in which the power for melting the metal is supplied by large thermionic valves, which are of special use in the manufacture of certain kinds of nickel alloys."

It was explained that a 200-volt direct current is passed into the valves, which convert it into alternating current of extremely high frequency—much higher in fact than can be obtained from a mechanical generator of alternating current. This current is passed through the metal, which may be said to melt itself.

"The melting metal," Dr. Desch added, "is often far hotter than the crucible in which it is being heated. A piece of Swedish iron was melted in this way before the crucible in which it was contained was thoroughly warm."

Amateur works Brazil

Perhaps the most fascinating of all wireless romances occurred recently when Mr. Gerald Marcuse established communication with the Rice Expedition in Brazil, a distance of approximately 7,000 miles.

The expedition, headed by Mr. Hamilton Rice, an American, left London last summer to search for the legendary "white Indians," supposed to exist somewhere in South America. It is now 1,000 miles up the Amazon.

Radio in Spain.

Spain was almost the last of the older nations to take up radio seriously; but now over 100,000 licences have been issued for the installing of receiving sets. There are many amateur broadcasting stations in the towns, employing up to the maximum power, which is 100 watts. It is prohibited for an amateur to use a set with a wavelength below 120 metres, so that very short wave transmission is practically impossible for them. All amateur transmitting sets are subject to a tax of 200 pesetas, which must be paid to the Spanish Government annually.

Recent Developments in Transmitting Valve Design

RECENT years have seen considerable developments in the design and construction of valves for wireless transmitting apparatus, the chief reason for this being the increase in the capacity of transmitting stations, which results in a demand for units of larger capacity.

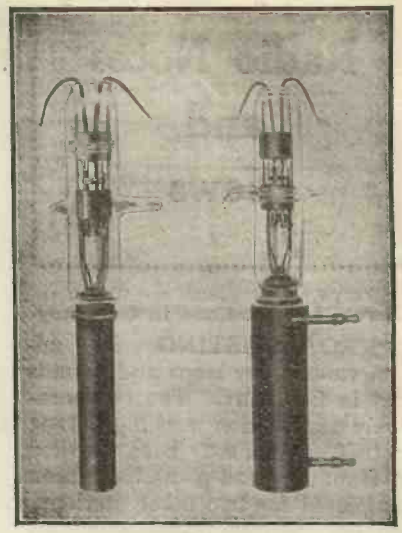
Valves in Parallel

Although a fair amount of success has been attained by connecting a number of ordinary transmitting valves in parallel, the capacity of these valves has been limited by the difficulty in dissipating the heat generated by the electronic bombardment of the anode. It has been found that the heat generated in each valve (in some cases from 1 to 2 kilowatts) is so great that the size of the bulb containing the electrodes must be considerably increased, not only to prevent the glass from melting, but to ensure that the extremely high vacuum inside the valve is not impaired; this results in inconveniently large bulbs which are extremely difficult to handle.

Water Cooling

The solution to the problem was obviously the design and construction of a valve in which the anode had not to lose its heat by radiation, but by some method of direct cooling, for example, by water. After extensive experiments and research work, such valves were produced by the research engineers of the M.O. Valve Co., Ltd.

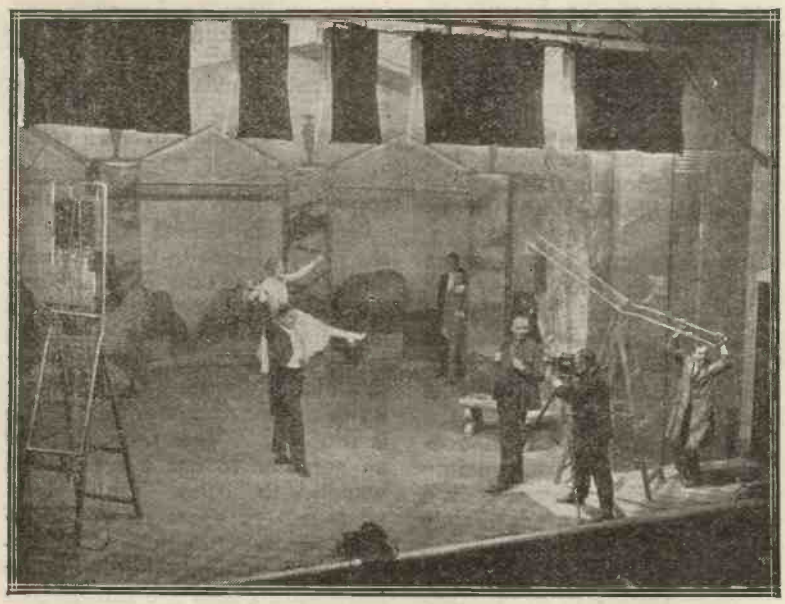
In the photograph is illustrated a "Marconi" water-cooled valve. On the left of the photograph the anode is shown. The anode is a copper tube 23 cms. long with an external diameter of 5 cms.; the tube is closed at one end, and on the other end is brazed a ring of nickel iron, on to which the large glass tube 70 mm. in diameter is sealed. Extensive experiments were involved in the determination of a suitable alloy of nickel and iron having approximately the same co-efficient of expansion as glass —an essential factor to obviate successfully strains in the glass which may cause it to crack. The cathode and grid are fitted inside the anode.



The Marconi water-cooled transmitting valve, showing anode on the left and the anode water jacket on the right.

On the right of the photograph is illustrated the complete valve unit and water jacket in which the anode is placed. Although the latter is at a high potential above earth (10,000 volts), no particular difficulty is found in preventing electrical leakage through the cooling water.

The British Broadcasting Company's high-power broadcasting station at Chelmsford is equipped with "Marconi" water-cooled valves, which are as illustrated and described here.

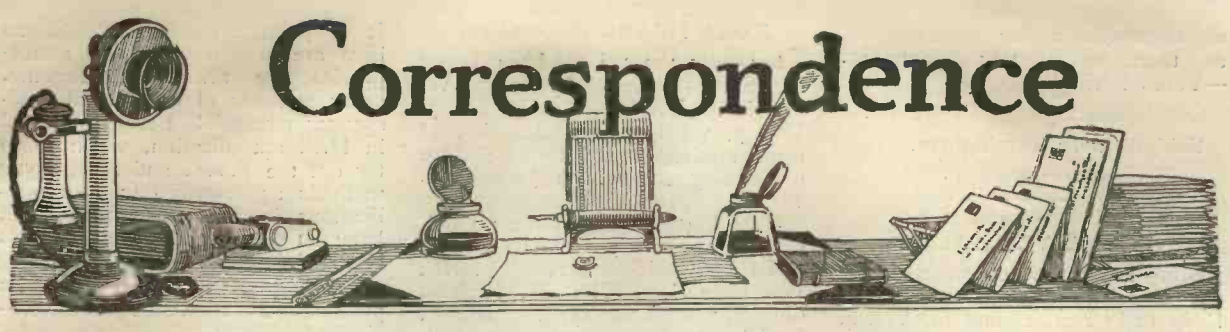


Our photograph shows the filming of a scene from Charlot's revue, taken with a view to synchronising the action of the film in cinema theatres with the music of the revue recently relayed to and broadcast from 2LO.

Wireless and the Vatican

A special wireless set for the reception of broadcasting has been presented to His Holiness the Pope, through his secretary of State, Cardinal Gasparri, by the Marconi Company. The apparatus, which has been installed in the Vatican, consists of a Marconiphone receiver and loud-speaker combination, with which His Holiness should be able to listen-in to all the capitals of Europe.

Appreciation for the set, which is one of the finest ever made, has been expressed to the Marconi Company by Cardinal Gasparri, on behalf of the Pope.



BROADCASTING AND ADVERTISING

SIR,—Without in any way wishing to contradict your editorial in the issue of December 31 last, I should like to raise a few points in connection with the broadcasting of concerts provided by others than the B.B.C., and also to reply generally to recent complaints and criticisms of the quality of British broadcasting.

It has always been the aim of the B.B.C. to cater for the maximum number of listeners, and we are apt to forget that that maximum is composed mainly of crystal set users and not of wealthy valve set owners and musical critics. When we grumble because we are not getting our money's worth let us remember that to the majority that money's worth is 30s. and not 50 guineas. When we scowl at a popular song or a latest dance hit or a promenade type funny man, let us think for a moment of the great army of 30s. broadcatchers who love popular songs, long to hear the latest dance hits and spend a fortnight each year listening to and laughing at a promenade funny man. And then perhaps we may forget our 50 guineas' worth and our preludes and fugues and enjoy a popular programme.

And so in furtherance of a policy of "the greatest happiness of the greatest number," the B.B.C. opened more relay stations, and again catering not only for numbers, but also for varied tastes, they determined to give the crystal user an alternative programme, and have therefore now built a temporary high-power station at Chelmsford.

Undoubtedly that is a fine policy, but it is an expensive one, and not being a philanthropic society, they are entitled to cut down expenditure by accepting good concerts when they are supplied free. There can be no question of sacrificing public interests, nor will such concerts be made disagreeable to the most exacting listeners by frequent reiteration of the name of the donors. Such a concert may, and, indeed, must, be an advertisement in so far as everything given to the public is an advertisement. But it must be borne in mind that the very fact of such a concert being a method of advertising will ensure that its quality is good—that and the control of the B.B.C.

And so I am sure that the 30s. majority will not throw down the headphones because a newspaper is

about to give a first-class concert, and therefore he must not complain.—Yours faithfully,

R. GOODE.

Solihull, near Birmingham.

ONE-VALVE REFLEX

SIR,—I recently constructed the one-valve reflex described by E. Redpath in Nos. 18 and 19, Vol. 4, which gives excellent results.

My object in writing is to point out an additional advantage I discovered in the set, which might interest others who have constructed it.

As there were no switches for cutting out the valve for use of plain crystal reception, I mounted a separate crystal and 'phone terminals on another piece of ebonite to connect to the A. and E. terminals, but afterwards discovered that this was quite unnecessary, as *by attaching the 'phones to the A. and E. terminals direct, with batteries disconnected, I got the ordinary crystal reception without altering the tuning.*

Wishing you every success.—Yours faithfully,

E. DENYER

Sydenham, S.E.

KDKA HEARD IN MALTA

SIR,—*Re* the "Low Loss Tuner for Short Waves," by Percy W. Harris in *Wireless Weekly*, No. 5, Vol. 5, we beg to enclose list of some stations heard to date since completing the set on January 1, 1925.

KDKA (three successive nights), G6LJ, 11 a.m.; G2NM, G6NF, G2FU, G2NB, G2KZ, NKF, WGH, 2XI, F8CN, H. Nicholls of Stocksfield-on-Tyne. G5NN, G5CC, 5 a.m.; unknown call, address 108, Abington Street, Northampton, 8AZ, 8EV, F8DI, 8AO, F8MT, OLL, ONL.

All the above were received strength 8 to 9. Weaker signals were not read, as those named above have occupied our time spent in listening on short waves.

With regard to ST100, this circuit gives excellent results here. 2LO and 6BM, etc., at really good 'phone strength. 5XX is pleasantly audible on the home-made loud-speaker described in *Wireless Weekly* some few weeks back. Using the first valve only of ST100, 2LO has been received at good 'phone strength, while 5XX is really excellent. As to crystal reception, using a Burndept crystal detector in a loose-coupled circuit, 5XX is intelligibly audible, as also are Radio-Paris and Radiofonica Italiana. It is pointed out that conditions here are semi-tropical and atmospherics are always troublesome, being at times of exceptional loud-speaker strength! Being interested in H.F. amplification, we hope to try out the T.A.T. and Neutrodyne methods as described in your publications in the near future, and hope to forward you results obtained.

Wishing Radio Press and its publications continued success.—Yours faithfully,

OPERATORS-MALTA.

RECEPTION OF CNRA

SIR,—Observing in January 7 issue of *Wireless Weekly* that the new Canadian station CNRA had been picked up in Ireland, I thought it would interest you to know that at 3 a.m. on January 7 I picked up that same station in time to hear his final announcements. Signal strength was good, signals being audible 6 ft. from loud-speaker.

The set used was one described in *Modern Wireless*, No. 3, 1923, namely, the four-valve receiver with wavelength range 200-5,000 metres, page 214. On it I have received all B.B.C. main stations, all French

stations, SBR, Zurich, Hilversum, Berlin, Frankfurt, Bremen, Nuremburg, Madrid, and, lastly, the stations WBZ, KDKA, WGY and CNRA. In conclusion, I wish to express my appreciation of the Radio Press publications.—Yours faithfully,

BERNARD C. BOWMAN.

Forfar.

AMERICAN RECEPTION ON THE ST100

SIR,—It will interest you to know that, using the ST100 circuit, I am able to receive all the B.B.C. stations, including Nottingham and Swansea. Madrid, Chelmsford, Bournemouth and, of course, 5PY come in very well on an Amplion loud-speaker. WBZ and WGY come in at good crystal strength when conditions are favourable. These two American stations can nearly always be got between 1 a.m. and 3 a.m. if conditions favour.

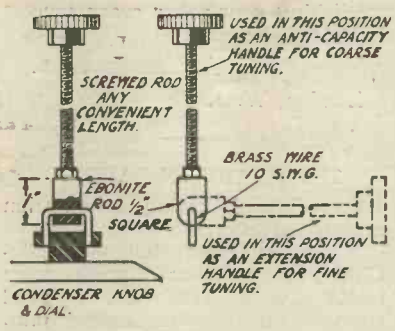
My aerial and earth system are good, but I use a 80,000 instead of the 100,000 ohm resistance. You are to be congratulated on the ST100 and many other circuits I have tried.—Yours faithfully,

R. ELWOOD.

Plymouth.

A NOVEL EXTENSION HANDLE

SIR,—I have pleasure in enclosing herewith a sketch of a small "gadget" which I trust you may find space for in your valuable paper. The sketch is almost self-explanatory. The construction is of the simplest, and fifteen minutes' work should suffice to produce the article.



The extension handle suggested by Mr. Gladney.

Two holes are required in the condenser knob, as shown, into which the ends of the brass "stirrup" are introduced. With the handle in a vertical position, it may be used for coarse tuning, and may then be swung through 90 deg., when it serves as an extension handle for fine tuning, and, as will be seen, is instantly removable from the condenser knob.—Yours faithfully,

H. GLADNEY.

Bolton.

SWEDISH AMATEUR'S TWO-WAY COMMUNICATION WITH AMERICA

SIR,—We have pleasure in informing you that the first two-way connection between Sweden and America was established on December 29, 1924.

The Swedish amateur station was SMZS, operated by Teknolog T. Elmquist, and the American 1CI; the power of the Swedish station being 150 watt and wavelength 80 m.—Yours faithfully,

E. M. EKLUND.

Stockholm.

SPARK INTERFERENCE

SIR,—I was very glad to see Mr. Harris's remarks *re* spark interference in his "Random Technicalities" in the January 7 issue of *Wireless Weekly*. Here in Liverpool, although I have a five-valve set, it is almost impossible to listen to any stations except Manchester

and Liverpool. There is a station with a very powerful spark which can be heard on Manchester's wavelength, is strongest between 550 and 650 metres (approximately) and absolutely blots out Birmingham, Belfast, etc., and even 5XX and Radiola. It is not the Seaforth station. This does not work so often and not for such long periods, but this other station is always on and off.

I am sure something could be done if people would write and give you their experiences, so that you would have something to go on.—Yours faithfully,

H. C. GRENSIDE.

Liverpool.

A LOW LOSS TUNER FOR SHORT WAVES

SIR,—With reference to your short wave receiver published in *Wireless Weekly* of November 19, 1924, it might interest you to know that I have built one of these receivers to the particulars laid down, and I cannot speak too highly of this wonderful instrument, being so simple to build for the average experimenter.

At present I am using the detector valve only, and coupling it to my amplifier and loud-speaker. I have received the American station KDKA on his short wave nearly every night at 11.30 at full loud-speaker strength, except when atmospherics make reception rather unpleasant.

I think that this particular set is one which can be handled by any enthusiast who is capable of twisting the condenser dial, and, in conclusion, believe that amateurs who have tried this will bear me out.

Wishing your paper every success for 1925,—Yours faithfully,

G. A. VANDERVELL.

London, W.11.

2KF HEARD IN SAIGON

SIR,—The following information may be of interest :—

A report from Saigon, Indo-China, states that signals from G2KF were received at good strength on two valves at 7 p.m. G.M.T., December 6, 1924, by a French experimenter there. The English station was in communication with Australian 3BQ at the time, and the reception was carried out through heavy atmospherics.—Yours faithfully,

J. A. PARTRIDGE, G2KF.

Colliers Wood.

PANEL TRANSFERS

SIR,—Concerning your "panel transfers," in connection with which some correspondence appeared recently in *Wireless Weekly*, I find the following the most convenient method of fixing them to the ebonite :—

Strip the transfer from the backing paper, moisten the *surface* slightly (until it is just "tacky") and press into position. (The sticky surface holds it in place.)

Then wet the back thoroughly until the lettering can be seen through quite distinctly and *slide* the paper carefully from the panel, leaving the lettering in position.

The lettering should not be touched afterwards until perfectly dry, or smudging will occur.

Wishing you continued success with all your publications,—Yours faithfully,

F. N. KING.

Keighley.

ST150 CIRCUIT ON THE OMNI RECEIVER

In the wiring key for this circuit in the January 7 issue, the connection 15—17 should read 18—17, and the connection 32—40 should be added.

Apparatus we have tested

Conducted by A. D. COWPER, M.Sc., Staff Editor.

Ediswan "Dulcivox" Loud Speaker

A small loud-speaker, designed for use in an ordinary living room, has been submitted for test by Messrs. Edison Swan Electric Co. This Type W.L. 321 "Dulcivox" loud-speaker is of 2,000 ohms resistance, stands about 19 inches high, and has a proportionately small curved horn. The sample submitted was finished in an elegant dull bronze, shading to black, giving a very pleasing effect.

The diaphragm is fairly large for a small instrument, and the adjustment of the magnets is effected by an extremely ingenious and mechanically sound device, which in practice was found to be very sensitive and stable. The top, carrying the diaphragm, is supported on a tripod, of which the length of one leg is variable by the usual screw and adjusting knob (here projecting through the top of the base, in a most accessible place). Powerful spiral springs steady this tripod and eliminate all shake or back lash. A slight tilting of the tripod then adjusts with great accuracy the distance of the diaphragm from the poles of the magnets in the lower part of the base.

The permanent magnets are circular, with consequent poles; the pole-pieces are finely laminated.

Points which give evidence of careful thought in the design of the instrument are the ingenious way in which the trumpet—always an embarrassing part of a loud-speaker for transportation—takes down in two sections, so that the whole instrument could be packed in a large handbag; the provision of a green baize covering for the bottom of the base avoids the possibility of scratching polished tables.

On trial, in comparison with other instruments of from one-half to three times its price, this instrument showed up quite well, though there was the slight tinniness and absence of rounded tone which is often observed when a trumpet of small dimensions is used on a loud-speaker of any design. It was powerful enough even with the small trumpet supplied with the instrument, and was able to handle considerable energy without rattling.

As the results were so favourable in comparison, it seemed to be of interest to test what performance this excellently designed little in-

strument could give when fitted with a trumpet of adequate size to do justice to the lower tones. Our standard gramophone-horn type of large, flaring trumpet with non-resonant taper tone arm was accordingly fitted to the "Dulcivox" base. The effect was quite remarkable, and the instrument now compared favourably with any of the others, even the most pretentious, and with our previous standard. In fidelity of tone, absence of both hardness and hollowness, as well as in power, when on a near-by high-powered transmission, loaded to the limit given by two stages of audio-frequency amplification, the last a power stage, the performance was excellent. The power was as great as that of any other type of domestic loud-speaker we have experimented with. It was impossible to stand directly in front of the trumpet when at full power, and more than fifty yards away down the road the Savoy band was still audible when the loud-speaker was to the far side in a ground-floor room with the window open, and still without distortion. We think the makers are a little modest when they state that this instrument is of the "Baby" type for use in an average living-room. Fitted with a trumpet of sufficient size to give really faithful reproduction, it is powerful enough for much more ambitious purposes. We can strongly recommend it, accordingly, for those who want both powerful and faithful rendering of broadcasting, with the provision that it be used with a large trumpet of the correct design.

New Pattern Watmel Variable Grid-Leak

Messrs. Watmel Wireless Co. have sent us samples of a new improved pattern of the well-known Watmel variable grid-leak. In these, the possibility of any irregularity of action due to wear (in continued use), which might result in some slackness in the fit of the controlling spindle, has been obviated by the provision of a small D-shaped spring, working in a slot milled in the bush, and bearing on the spindle. This provides a positive electrical connection at all times. On trial it was noticeable how smooth and silent the device operated, giving a convenient range of resistance-values for close control of a detector-valve.

Variable Grid Condenser

We have received from A. J. Baty a sample of a smaller pattern of the well-known two-plate variable condenser (which has been mentioned before in these columns), designed more particularly for use as a variable grid condenser for fine adjustment of the rectifying action in addition to or to replace the variable grid-leak so often used on a rectifying valve.

On test, this mica and air condenser showed a maximum capacity, when screwed up so that practically only mica intervened between the plates, of around .00023 μF, which is not on the large side for a variable grid condenser, where a value of e.g. .0003 μF might be desired at times for experiment; the minimum, as with the larger condenser of the same make, was exceedingly low.

The insulation resistance was but 4-10 of a megohm, as supplied and after reposing for a time in a damp laboratory; on careful drying for some time this value increased to 1.8 megohms, when screwed up tight. When the one plate and the mica of the other plate were no longer in contact this figure increased very considerably. In actual reception it was found, in some cases, unnecessary to use a grid leak, and satisfactory reception ensued. As a tuning condenser proper the reaction demands for bare oscillation considerably exceeded those of a reliable variable air-condenser.

Information Department

SUPPLIED BY RADIO PRESS SERVICE DEPT., LTD.

A. C. R. (GUILDFORD) is somewhat puzzled by the behaviour of a two-valve low-frequency amplifier employing resistance-capacity coupling, particularly in regard to grid bias. He finds that when he uses a small power valve in the last stage, no grid bias appears to be necessary, other than that which is provided by connecting the lower end of the grid-leak to the negative end of the low-tension battery, the filament resistance being in the negative lead.

This characteristic of low-frequency amplifiers is certainly a little puzzling at first, but it is due to the fact that with the usual value of grid-leak a considerable negative charge is built up on the grid of the valve, which may in many cases be quite sufficient for purposes of grid biasing. In consequence, it is often quite possible to dispense with the grid bias battery altogether, at a pinch, and to connect the grid-leak directly to L.T. The exact degree of negative bias which will be obtained in this way will naturally depend upon the value of the grid leak, and if it is of low value it is quite likely that the bias will be inadequate. This, of course, is the explanation of the sweeping statements sometimes made that grid bias *must* be used in any low-frequency amplifier, regardless of the system of intervalve coupling employed. It is perfectly true that a correct bias upon the grid of the valve is essential, but in some types of amplifiers this may be obtained without the use of any grid battery whatever. It is hoped that the answer to this question will clear up the confusion undoubtedly present in the minds of some experimenters on this point, but we do not wish to imply that it is a desirable practice to dispense with the grid battery altogether, and depend upon the more or less haphazard adjustment of grid bias by means of the value of the grid-leak.

I. L. T. (BIRMINGHAM) is building a super-heterodyne receiver and asks various questions about the suitability of a certain frame aerial for use therewith.

Since this receiver is not intended for portable purposes, we would strongly urge our correspondent to

use a larger frame than the 18-in. square design which he has in mind. It should be remembered that the receiving powers of a frame aerial increase enormously according to the size of the frame within certain limits. Nothing less than 2-ft. square should be used unless a really super-sensitive receiving set is employed, or for some reason of space, and a 3-ft. frame is better still. Probably a square with 3-ft. sides represents a good compromise between receiving efficiency and compactness, and if twelve turns are put on this frame, say ½ in. apart, a tuning condenser of reasonable size should serve to cover the broadcast band. Great care should, of course, be taken to insulate the winding of the frame, and a reasonably thick gauge of wire, such as No. 18, should be employed.

With regard to the directional properties of this frame, we would warn our correspondent that if he intends to use it in an ordinary living room, he will probably find that the direction for maximum signal strength is widely different from the direction in which the frame would be set upon if a compass were used for the purpose. We therefore do not think that it is worth while to incorporate the rather elaborate suggested arrangement of a compass upon the base, and a divided scale as an aid to picking up of distant stations. It is almost always necessary to actually swing the frame through a considerable angle before deciding upon the maximum signal strength, and this in the case of an ordinary building has little relation to the true direction of the station.

T. H. I. (ANDOVER) writes regarding his attempt to design a two-valve receiver using a form of Reinartz circuit with the addition of a single low-frequency valve, his aim being to produce a set which will be capable of useful work upon the broadcast band and which will also serve by the use of an interchangeable system of coils for short wavelengths. His main difficulty relates to the size of the variable condenser, since he objects to the use of verniers in parallel, but is aware that a condenser of a suitable size to cover the broadcast band will be too large for convenient working upon the shorter wavelengths.

A device commonly adopted in cases of this sort is to use a variable condenser, say of .0003 μF. maximum, in parallel with which small fixed condensers of suitable capacity can be switched or otherwise connected. For example, if the tuning condenser is actually of the value suggested, a series of fixed condensers of the same value will serve to extend the capacity range when working on longer wavelengths. This is naturally a somewhat crude device, and may prove decidedly inconvenient in use. Probably a better method is to use, where space permits, a double condenser of the type now so familiar for the simultaneous tuning of two intervalve circuits, bringing the connections from the two sets of fixed plates and the moving spindle out to sockets upon the panel, so that by means of plugs each section can be connected into circuit in any desired manner. For example, upon the longer wavelengths, the two fixed sections can be connected in parallel, the other connection going to the moving spindle, so that the whole arrangement becomes a variable condenser of twice maximum capacity of either of the sections. For intermediate wavelengths one section can be used alone, and for extremely short wavelengths the sections can be connected in series. In this latter case, one connecting wire will go to one fixed section and the other to the second fixed section, no connection being made to the moving spindle.

LISSENIUM

Is the high potential end of your coil well separated from the low potential end?—

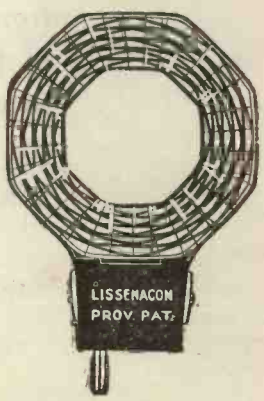
YOUR coil is not as good as it ought to be if its high and low potential ends are close together. Have a look at your coils—then take a look at LISSENAGON (pronounced LISSEN-AGON) coils.

With these well-known coils the points of high and low potential have carefully been kept far apart, with the intervening conductors so disposed that voltage is built up without leakage or loss.

You will notice a difference in signal strength and selectivity with LISSENAGON coils.

LISSENAGON TUNING CHART.
Note the Intermediate Coils 30, 40 and 60.

TABLE I. Wavelength range when used as Primary Coils with Standard P.M.G. Aerial and .001 mfd. condenser in parallel.			TABLE II. Wavelength range when used as Secondary Coils with .001 mfd. condenser in parallel.		
No. of Coil.	Minimum Wave-length.	Maximum Wave-length.	Minimum Wave-length.	Maximum Wave-length.	PRICE.
25	185	350	100	325	4/10
30	235	440	130	425	4/10
35	285	530	160	490	4/10
40	360	675	200	635	4/10
50	480	850	250	800	5/-
60	500	950	295	900	5/4
75	600	1,300	360	1,100	5/4
100	820	1,700	500	1,550	6/9
150	965	2,300	700	2,150	7/7
200	1,885	3,200	925	3,000	8/5
250	2,300	3,800	1,100	3,600	8/9
300	2,500	4,600	1,400	4,300	9/2



Next time you want coils, buy THE COILS WHICH INTENSIFY TUNING—LISSENAGON coils.

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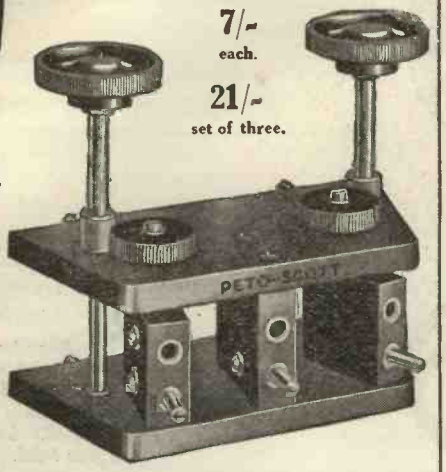
Matched in pairs at no extra cost.
Similar type but wound specially to Mr. Harris's Specification for use in the Six Valve Anglo-American Six and matched.

7/- each.

21/- set of three.



Slow Motion Coil Holder (3 coil).

For Panel mounting or Cabinet mounting. Knob gives vernier movement. Essentiail for accurate tuning. Superior workmanship .. 15/6
Two-Coil Holder, 10/6

Back of Panel Coil Holder

As used by Mr. Percy Harris, Mr. Barber and other authorities. The only satisfactory method of mounting coils at rear of panel. Friction drive gives vernier movement. Indication in front of panel shows position of moving coil. Price 12/6

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Coil Holder

For panel mounting. Very neat. Complete with nuts. 1/2

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For American-type Sets where components are mounted on baseboard. Complete with soldering lugs ... 1/3

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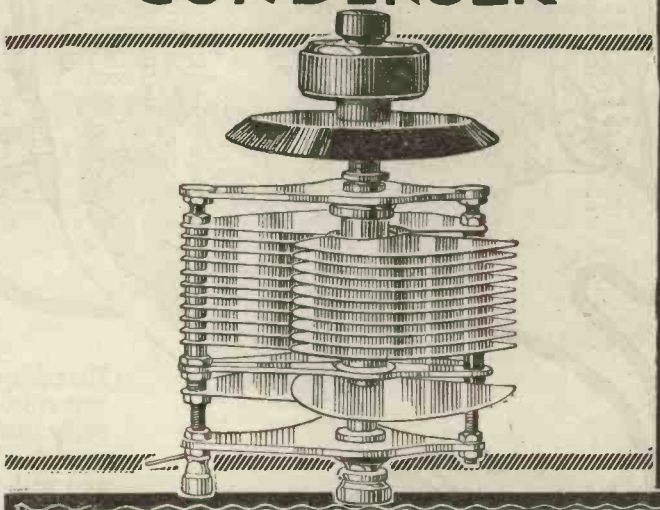
a New 4 point GECoPHONE Triumph

THE SQUARE LAW VARIABLE CONDENSER



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PRICES.

WITHOUT VERNIER			
Cat. No.	Capacity.	Price each	
		s.	d.
B.C. *200*	·0002 mfd.	9	6
B.C. *202*	·00025 mfd.	10	3
B.C. *204*	·0003 mfd.	10	3
B.C. *206*	·0005 mfd.	10	6
B.C. *208*	·00075 mfd.	12	0
B.C. *210*	·001 mfd.	12	6

WITH VERNIER			
Cat. No.	Capacity.	Price each	
		s.	d.
B.C. *201*	·0002 mfd.	14	6
B.C. *203*	·00025 mfd.	15	3
B.C. *205*	·0003 mfd.	15	3
B.C. *207*	·0005 mfd.	15	6
B.C. *209*	·00075 mfd.	17	0
B.C. *211*	·001 mfd.	17	6

1 Even tuning over entire condenser scale.

2 Minimum capacity unusually low. Maximum capacity as specified.

3 Insulation resistance high. Dielectric losses and high-frequency resistance reduced to minimum.

4 Mechanical construction exceptionally good, ensuring that fixed and moving vanes remain permanently in correct relative positions. Moving plates supported on ball-bearing. (*One-hole fixing.*)

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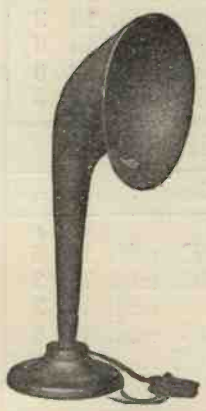
Brandes Superior *Matched Tone* Headphones are admirably versatile. It's hard to imagine them fitting snugly to the tenderest curly head and yet fulfilling their duty on the head of the expert who sits down to long hours of serious experiment. So comfortable and with a rugged strength of construction to protect their delicate adjustment, they are excellent for family use, Primarily designed for long-range telephony from expert technical knowledge, their *Matched Tone* feature brings in the most distant signals with purity and strength. The experimenter finds that they bring the best results in trans-atlantic and trans-continental reception. One gentleman writes from Walton-on-Thames: "I received Australia on Brandes and consider they are the most sensitive 'phones I have used. I am much pleased with their general performance." *Ask your Dealer for Brandes.*

. . . . every one of these advertisements will show an added advantage in the construction of Brandes Headphones.

Look at the illustration above. See how snugly the 'phones fit the head. A gentle pressure on the crown, a firm clasp to the ears, and the rest of the headband is held well away from the hair. This means long-wearing comfort and the shutting out of extraneous sounds. Strength and firm beauty of line typifies their finished construction.



The *Table-Talker* is another Brandes quality product at moderate price. Designed to meet the need for a simple radio loud-speaking device to entertain a group of people in an average size room, its full round tones are wonderfully clear and pleasing. It is matched to the unit so that the air resistance produced will exactly balance the mechanical power of the diaphragm. This means beautiful sound-balance. Gracefully simple of line, it is finished a shade of neutral brown and is twenty-one inches high 42/-

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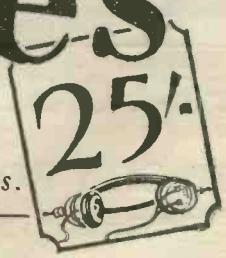
The Name to know in Radio

Superior Matched Tone Headphones.



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J. A. Fowler, M.I.Mech.E.,
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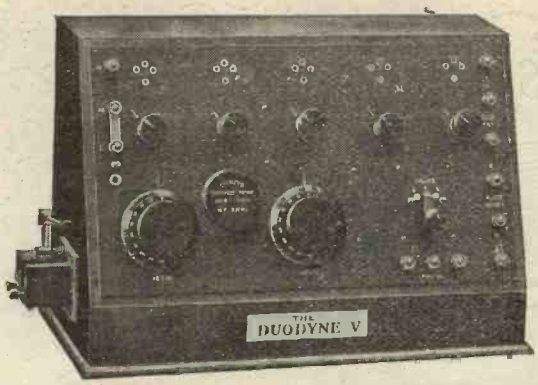

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TWO STAGES H.F. AMPLIFICATION. AUTOMATIC TUNING

Guaranteed Range under Average Conditions.

DUODYNE III	Headphones	3/4,000 miles.
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THE DUODYNE Long Range Receivers will discriminate between Radiola, Paris, and 5 XX Chelmsford, or used in conjunction with a CURTIS EJECTOR will tune in any Broadcasting Station at will, while operating 1½ miles from local Station or 200 yards from Relay Station.

The DUODYNE III (Instrument only) Panel Type **£10 0 0**
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Radio Quality. Post Office Specification. "The Best Made."
TESTED and RECOMMENDED by "POPULAR WIRELESS."
Uniform Fine Grain, Dead Matt Finish, Non-Metallic Surface.

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8 × 6 × ¼ .. 3/3	24 × 12 × ¼ .. 17/6	12 × 8 × ¼ .. 6/-
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12 × 12 × ¼ .. 8/6	12 × 6 × ¼ .. 4/6	10 × 9 × ¼ .. 5/8
14 × 12 × ¼ .. 10/-	22 × 11 × ¼ .. 15/3	9 × 5¾ × ¼ .. 3/5
16 × 12 × ¼ .. 11/6	16 × 9 × ¼ .. 9/-	10 × 5 × ¼ .. 3/3
18 × 12 × ¼ .. 13/-	12 × 11 × ¼ .. 8/3	12½ × 9¾ .. ¼ .. 7/6
24 × 10 × ¼ .. 14/6	18 × 6 × ¼ .. 6/9	

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PANELS CUT TO SIZE, Squared, Edges Ground, 1d. per sq. inch.
STOCKED BY ALL REPUTABLE STORES: But it must be in PARAGON SEALED CARTONS.

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Automatic Tuning—*No Condenser required.*

As used in DUODYNE and CURTIS Circuits.

The Curtis "Constant-Tuned" High-Frequency Amplifier is the only automatic high-frequency amplifier which, when connected in circuit, guarantees high efficiency for two or more stages of radio amplification on any wavelengths between 300 and 3,000 metres, and requires no additional controls, NOR MORE EFFORT, SKILL OR PATIENCE IN TUNING THAN IS REQUIRED FOR THE OPERATION OF THE USUAL ORTHODOX SINGLE STAGE TUNED ANODE CIRCUIT.

And with its automatic simplicity, combined with increased selectivity and power, is destined to make two or more stages of high-frequency amplifications a *sine qua non* of every Wireless Receiver for the Experimenter and Home Constructor, or the purchaser who prefers to buy a professionally constructed instrument.

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ESSENTIAL for perfect reception and ABSOLUTELY INDISPENSABLE for Tropical and extreme climates.

Guaranteed uniform accuracy under all conditions and at all temperatures.

PROOF—

Test Report by A. D. COWPER, M.Sc., Staff Editor "Modern Wireless."

ACCURACY

"On test, the capacities came out quite close enough to the nominal for ordinary radio purposes, the .001 uF nominal samples being about .00103 and .00091 respectively, and the .0003 uF nominal being actually around .00033 and .00026 respectively. **There was observed but a negligible greater high-frequency loss in this type than in a standard air-diaelectic condenser.**

PERMANENCY

"As this one piece casing offers apparently considerable advantages as to permanency and independence of damp, high temperature, etc., an exceedingly strenuous test was applied to one of the samples, which was actually placed in water nearly at the boiling point for the better part of an hour. After this heroic treatment, the condenser showed a capacity which did not differ materially from that shown before, and it was still possible to get a valve to oscillate readily with this as the main tuning capacity across the grid-tuning-inductance. Evidently there need be no fears as to possible deterioration in stock of these 'Paragon-Curtis' fixed condensers."

.0008 to .0006, 2/6 each. Grid Condenser, with clips, 2/9 each.
Grid Leak, 1/6 each.

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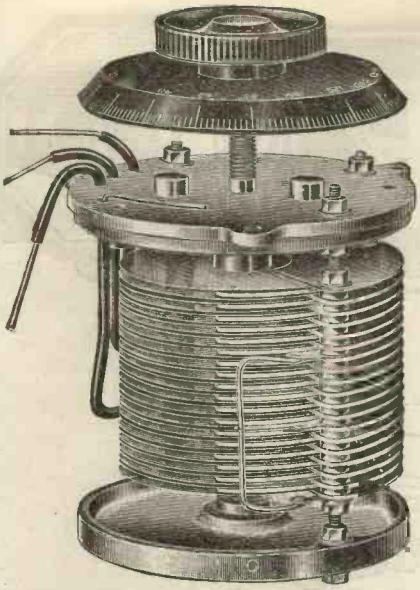
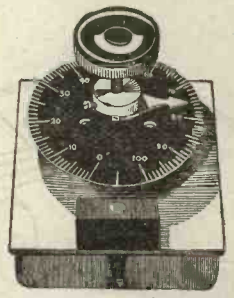


POLAR VARIABLE CONDENSERS



MULTIPLE CIRCUIT TUNING.

THE POLAR DUAL CONDENSER

Efficiency in reception depends to a very great extent on the sensitiveness of tuning circuits. Simultaneous tuning of two circuits, such as, for instance, two stages of high frequency amplification is a tedious process unless a dual condenser is used.

A dual condenser consists of two matched condensers mounted on the same spindle. The successful matching of two condensers entails precision work of the highest degree. The Polar Dual Condenser represents the last word in such precision work.

Scientifically designed by leading Radio Engineers, it is of robust construction, high insulation (each vane is insulated by means of an additional mica vane), fully enclosed and totally screened.

Minimum capacity of one section .00007 mfds.
Maximum capacity of one section .00026 mfds.

PRICE £1-8s., complete with knob and dial.

THE POLAR TRIPLE CONDENSER.

For simultaneous tuning of three circuits a Polar Triple condenser is required. It is built on the same principle as the Dual Condenser but with three matched condensers mounted on the same spindle instead of two.

PRICE £1-8s., complete with knob and dial. (Illustrated above with dust-proof cover removed.)

The use of these two condensers is not confined to any type of circuit. By connecting the sections in series or parallel a variable condenser is obtained having extremely wide capacity limits.

THE POLAR VARIABLE CONDENSER

constitutes an important advance in condenser design. It is a great improvement on the ordinary type of condenser in that the lower portion of the scale, which should always be used in tuning, gives for a large knob movement a small change in capacity.

Thus the crowding of capacity in the first half of the scale is avoided and A UNIFORM VARIATION OF WAVE FREQUENCY IS OBTAINED.

The Polar Variable condenser, being specially designed for the rigorous requirements of marine work, is the best type of instrument one can have for experimenting purposes.

It is wonderfully compact, its overall dimensions being only 3 in. × 3. in. × 1 in.

Apart from robust construction, high insulation, wide capacity limits and low price, the Polar Variable Condenser has the following advantage :

IT DOES NOT REQUIRE AN ADDITIONAL MICROMETER CONDENSER IN PARALLEL for precise tuning.

Every condenser is guaranteed.

The following capacities are available :

.001, .0005, .0003, .00025, .0002 microfarads.
All capacities are one size and one price : **10/6.**

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There are now vacancies on our Seagoing Staff for Junior Wireless Operators trained on our apparatus. Youths of good education, preferably between 17 and 25 years of age, wishing to enter the Wireless Profession should communicate with the Managing Director, London Radio College, 82-83, High Street, Brentford, Middlesex, who will be pleased to furnish particulars of the training course necessary to qualify for our service.

POLAR BLOK 5-VALVE SUPERSONIC RECEIVER.

The 5-Valve Supersonic Receiver, designed by Mr. John Scott-Taggart and described in WIRELESS WEEKLY, has been built on the Polar Blok principle.

The set proved exceptionally sensitive and selective.

The cost of parts for this set is £11 10s.

RADIO COMMUNICATION CO., LTD., 34-35, NORFOLK ST., STRAND, W.C.2.

Louden Valves

Filament Volts - 4.8—5
Filament Amps. 0.4
Anode Volts - 40—80

"Like the sweet sound that breathes upon a bank of violets"—*Twelfth Night.*

By many the 'cello is regarded as possessing the most beautiful tones of all instruments. From the sonorous bass notes of the C string to the soaring melodies of the D and A, we cover a range of notes which, both in compass and in quality, resemble most closely those of the human voice.

Some of the most beautiful of our programmes have been those in which the 'cello has figured either as a solo instrument or in concerted works.

To enjoy the 'cello by wireless, however, and to appreciate to the full the subtle inflexions of the artists playing, we need a good receiving set, a good loud speaker, and FIRST-CLASS VALVES.

The Valves which your set requires are those which will give you a first-class concert from your own Broadcasting Station rather than those whose chief claim is that they will receive concerts over stupendous distances.

That is why we recommend you to equip your set with Louden Valves—their supremacy in the matter of Silver Clear reception is literally unchallenged, and within a few months of their introduction they are being asked for at the rate of many thousands per week!

The beautiful pure notes of the Louden Valve are due to special features found in no other valve; be sure, therefore, to ask for Silver Clear Louden Valves by name.

The Plain Louden for detecting and Low Frequency Amplifying. The Blue Louden for H.F. Amplification. All Loudens are Silver Clear and free from mush. Their current consumption is very low and their life long.

PRICE 10/-

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Louden Valves - Silver Clear

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E.P.S. 9

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Price per pair 25/- (4000 ohms)

Obtainable from all Electricians and Radio Dealers

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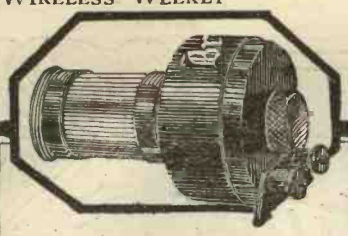
B T-H



Have you a Gramophone

—then why not use it as a Loud Speaker?

MANY wireless enthusiasts have overlooked the fact that any good Gramophone can be readily converted into a first-class Loud Speaker by the attachment of a BROWN Gramophone Wireless Adaptor (in either of its two types).

No alterations are necessary, merely remove the Sound box and fit the Adaptor. A rubber connection ensures that it will fit practically every type of Gramophone.

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Brown
Wireless Apparatus

The Living Artiste

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Concert Grand **30/-** **Portable Utilities Co., Ltd.** Eureka No. 2. **22/6**
Fisher Street, London, W.C.1. *(For Second Stage)*

Supreme **EUREKA** for Tone

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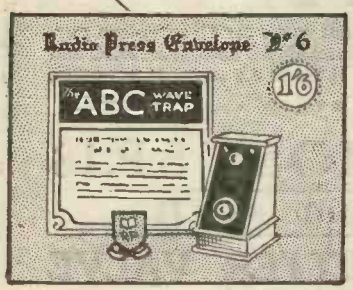
You can build this Trap to cut out local interference.

Now for a Change—Switch over to Bournemouth.



Anyone can build a wireless set from instructions contained in the Radio Press Envelopes. Build yourself the wavetrap described in Envelope No. 6. **These Envelopes may be obtained from your regular wireless dealer, newsagent or direct from Radio Press Ltd., Bush House, Strand, London, W.C.2.**

YES, but can you cut out your local Station? How often is that question asked by radio enthusiasts? The answer is to be found in the Radio Press Envelope No. 6, which contains full details for the construction of the A.B.C. Wave Trap—an instrument which is the result of much research by G. P. Kendall, B.Sc., into the question of the elimination of undesired signals. This instrument contains no less than 3 distinct types of wave trap arrangements, any one of which can be brought into operation at will. The contents of the Envelope include a general treatise on the experiments, instruction sheets, blue prints, photographs and working drawings. When tested 3 miles from 2LO the A.B.C. Wave Trap completely eliminated the London Station and brought in Bournemouth. Although theoretically a loss in signal strength must be admitted, it is so small that it is seldom apparent to the human ear.

This highly efficient Wave Trap gives a choice of working with either A. B or C type of eliminator circuits, and its great efficiency is obtained by the elimination of losses in design.

We have every confidence in telling our readers that the A.B.C. WAVE TRAP will enable them to cut out their Local Station without sacrifice of signal strength, provided always that their aerial and earth systems are of average efficiency.

You can build this Wave Trap for about 30/- inclusive of handsome cabinet and coils which are built into the design. Normally Constructed to operate on the 300-600 metre band.

1/6 POST FREE 1/9

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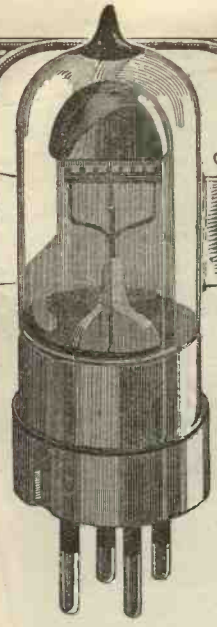
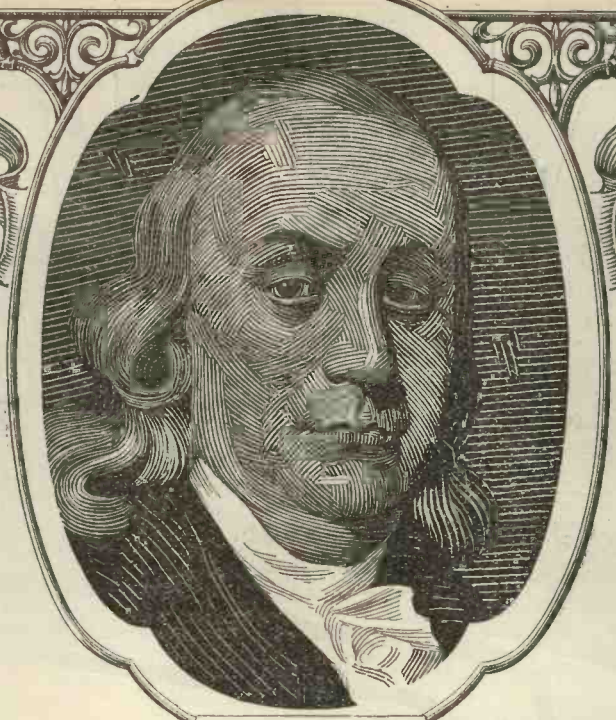
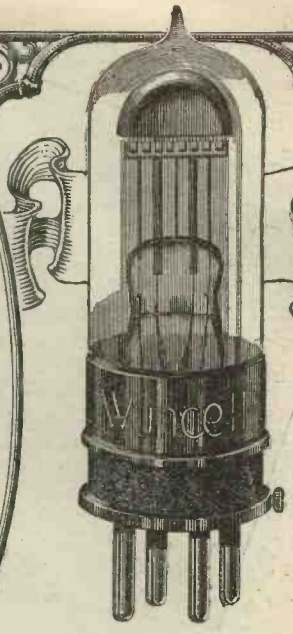


Cossor
Bright Emitter



Benjamin Franklin



Wuncell
Dull Emitter

Benjamin Franklin's Gift to Radio.

TO all wireless enthusiasts, Benjamin Franklin should be remembered as the first man ever to attempt the extraction of electricity from the atmosphere. His early kite flying experiments effectively demonstrated that in very damp weather when the atmosphere was heavily charged with electricity that a strong electrical current ran down the wet string.

To-day, in this country there are more than a million Benjamin Franklins busily engaged night after night in extracting electrical energy from the ether and converting it into enjoyment. Some do it by means of simple Crystal Sets and others by means of more efficient Valve Sets. Of all the Valve enthusiasts, by far the greater proportion are Cossor users—for there is no Bright Emitter Valve more popular in Great Britain.

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No. 3 of Series

Cossor Valves

Advertisement of A. C. Cossor, Ltd., Highbury Grove, N.5.

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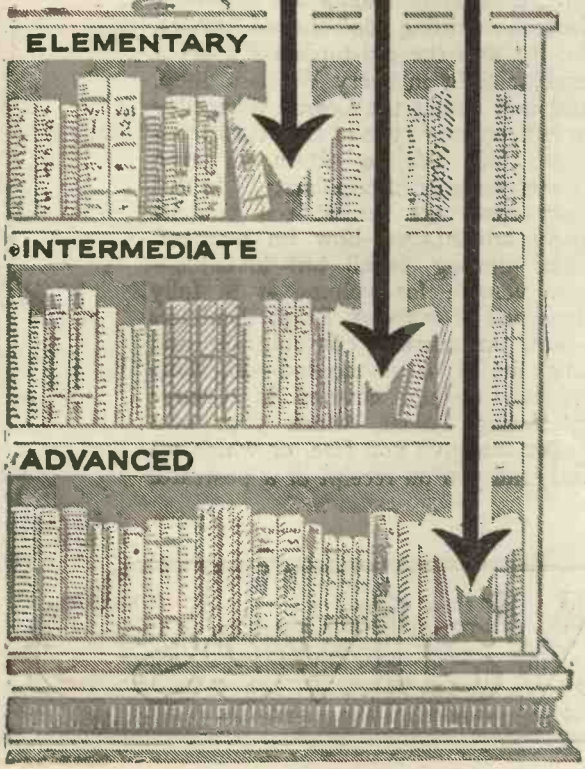
Put it there!



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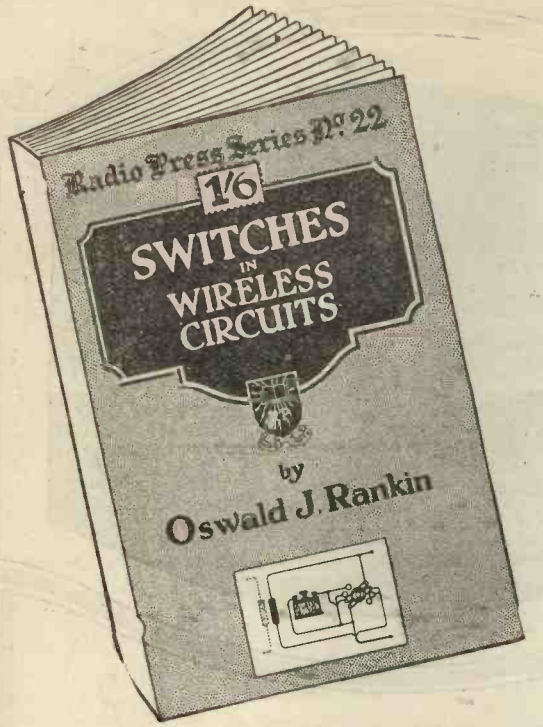

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Switch and be Safe

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RADIO PRESS

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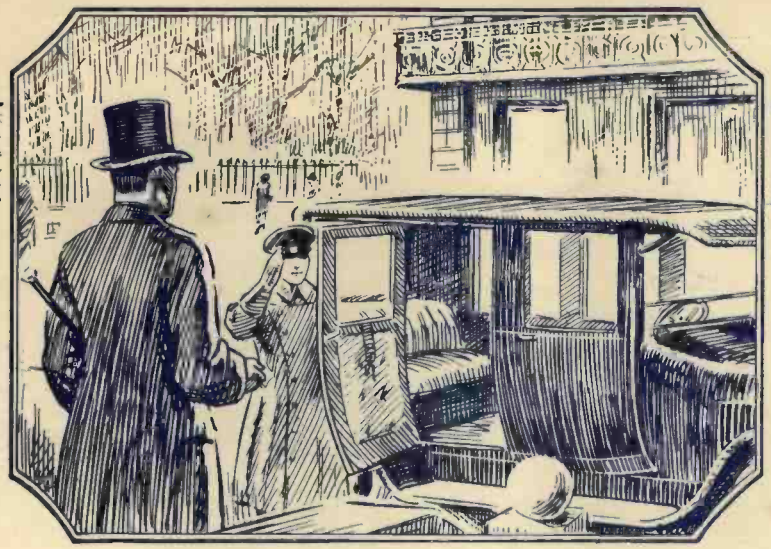

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