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T&R Bulletin

The only Wireless Journal Published by Amateur Radio Experimenters in Great Britain

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Amateur Radio and World Peace.

FROM time to time there comes striking evidence of the great help which Amateur transmitters have afforded in time of emergency, instances continually occur where ordinary means of communication have failed through earthquake, fire or flood, and the Amateur has filled the breach and maintained contact with the outside world often under extreme difficulty.

Comparatively few of us, however, are so situated that such service is required of us. Yet, do we realise that other and much greater part we are playing in human affairs? We mean, of course, our share in making for a better understanding between the Nations of the Earth.

Broadcasting is doing a great deal to this end, and its influence will widen as time goes on, yet broadcasting is an organisation, an impersonal, collective expression.

Amateur Radio, however, is something, the like of which has never before been known; the possibility of friendship between individuals of different race and tongue, without the necessity of crossing their respective frontiers. It is something so entirely revolutionary in human experience, so completely different, that we do well to consider its true significance. Every day individuals all over the world are meeting one another in completely informal intercourse, discussing technicalities, comparing experiments and exchanging pleasantries, seated the while in their own homes.

In countless instances lasting friendships are being formed, yet it is probable that the parties concerned will never meet in the flesh. We know of many cases where regular exchange of correspondence is taking place with National problems being discussed.

To the " Ham " the fact that the other fellow has a white or coloured skin, or if he be Christian or Bhuddist, Hindu or Moslem, whether he be rich or poor, Prince or schoolboy is of no consequence whatever. He is " Old Man " just the same. That his signal is a steady T9, is more likely to be the deciding factor in his favour!

Amateur Radio knows no Creed or Class, Politics or Colour Bar. Every Amateur knows that, scattered all over the earth he has a host of friends, known and unknown, and the common bond is Amateur Radio.

We have all unwittingly taken upon ourselves a great responsibility. We possess a tremendous power for international peace and goodwill; a power to further and cement individual friendships between those of different nationalities.

It is our firm belief that this existence of a large number of personal friendships will do more to ensure peace and preclude the possibility of war than a whole folio of Treaties and Pacts.

The trend of enlightened modern thought is towards internationalism.

Medicine, Astronomy, Meteorology and Archæology, for example, have long been internationalised. Transport, Broadcasting and other branches of Science are rapidly following.

Let us make certain that we who hold this unique position, are also in line with all that is best in modern thought and that we pull our weight in the march towards that ultimate ideal—The Federated States of the World.

The Hartley Oscillator.

By H. Clifford Hall (G2RU).

AN amateur without an oscillator of some description is like a dirt-track rider without a motor-cycle. Hence it is hoped that the following remarks about one of the most popular "Models" will prove of sufficient interest to warrant their insertion in the Bulletin.

Fig. 1 shows a simple self-excited Hartley oscillator, the action and general design of which are to be considered in the course of these remarks.

The main oscillatory circuit or "Tank" which feeds the aerial system consists of an inductance coil L and a variable condenser C, and is common to both the grid and the plate circuits of the valve. The function of the oscillator is to maintain oscillations of constant amplitude in the tank circuit. In order to do this the valve must release sufficient correctly phased energy along the feeders A and B from the plate and filament of the valve respectively.

This additional energy banishes the losses in the circuit and takes shape as impulses of current from the H.T. supply into the tank. Mention of motor-cycles suggests a very good mechanical analogy for this oscillator in the shape of an internal combustion engine, the action of which can more easily be pictured in the mind's eye.

The oscillating piston and crankshaft can represent the oscillatory tank circuit, both obeying the same law of harmonic motion. Similarly the inlet and exhaust ports represent the tank feeders A and B. Whilst the valves themselves serve the same purpose as the thermionic valve, namely, that of timing the admittance of fresh energy into the oscillatory system.

Visualising the action of an internal combustion engine will greatly assist the reader in following the cycle of events to be described later.

Consider the internal combustion engine and it is realised that the piston must receive fresh impetus at the exact moment it passes the top of its stroke, if its oscillations are to be maintained. In other words, fresh energy from an external source must be added at the completion of the cycle and at no other time. This necessitates correct timing of the valves, so that the new energy is applied in correct time relation to the oscillations of the piston.

The valves are operated by the piston itself, hence once the time relation, which is predetermined, has been fixed, the action of the engine as a whole is self-maintained. The action of an oscillator is very similar to the foregoing, as will be seen.

The high frequency voltage across the tank circuit is applied across the valve electrodes via the feeders A and B, and also C, causing it to release correctly-phased impulses of current from the H.T. supply.

These impulses enter the tank at each cycle and by balancing the losses in the circuit maintain continuous oscillations. An oscillator, therefore, is really an electrical engine, and when load is applied in the shape of an aerial it will pump vibrations through space.

Having obtained a general idea as to how continuous oscillations are generated, one begins to wonder how the tank oscillations control the valve and what form the feed impulses take. Curves have been plotted showing the phase relations and also the shape of the plate current impulses under different conditions of working. Before examining these, however, it is advisable to study more closely what happens in the tank and adjacent circuits.

It is beyond the scope of this article to delve deeply into the theory of oscillatory circuits, but one or two factors should be considered. First, the tank is essentially an oscillatory circuit due to the properties of inductance and capacity. The ohmic resistance is very low and the circuit oscillates freely at its natural frequency f,

$$\text{Where } f = \frac{1}{2\pi\sqrt{LC}}.$$

The natural frequency is affected to some extent by the presence of the valve and any aerial coupling arrangement, the capacities of which are shunted across the circuit.

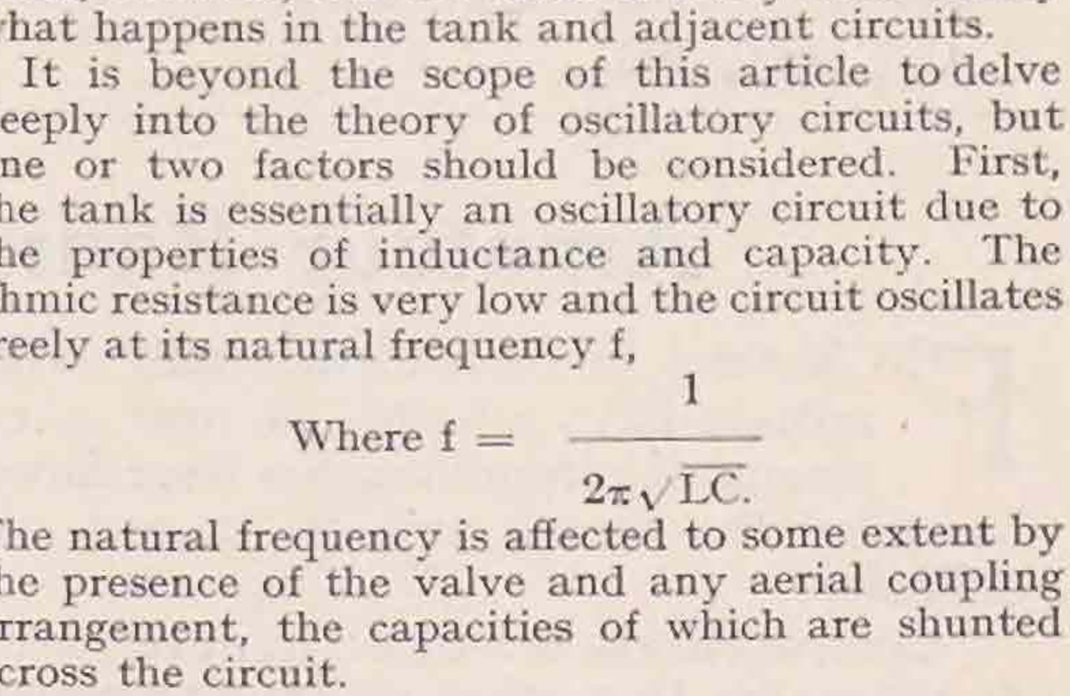


Fig. 1.

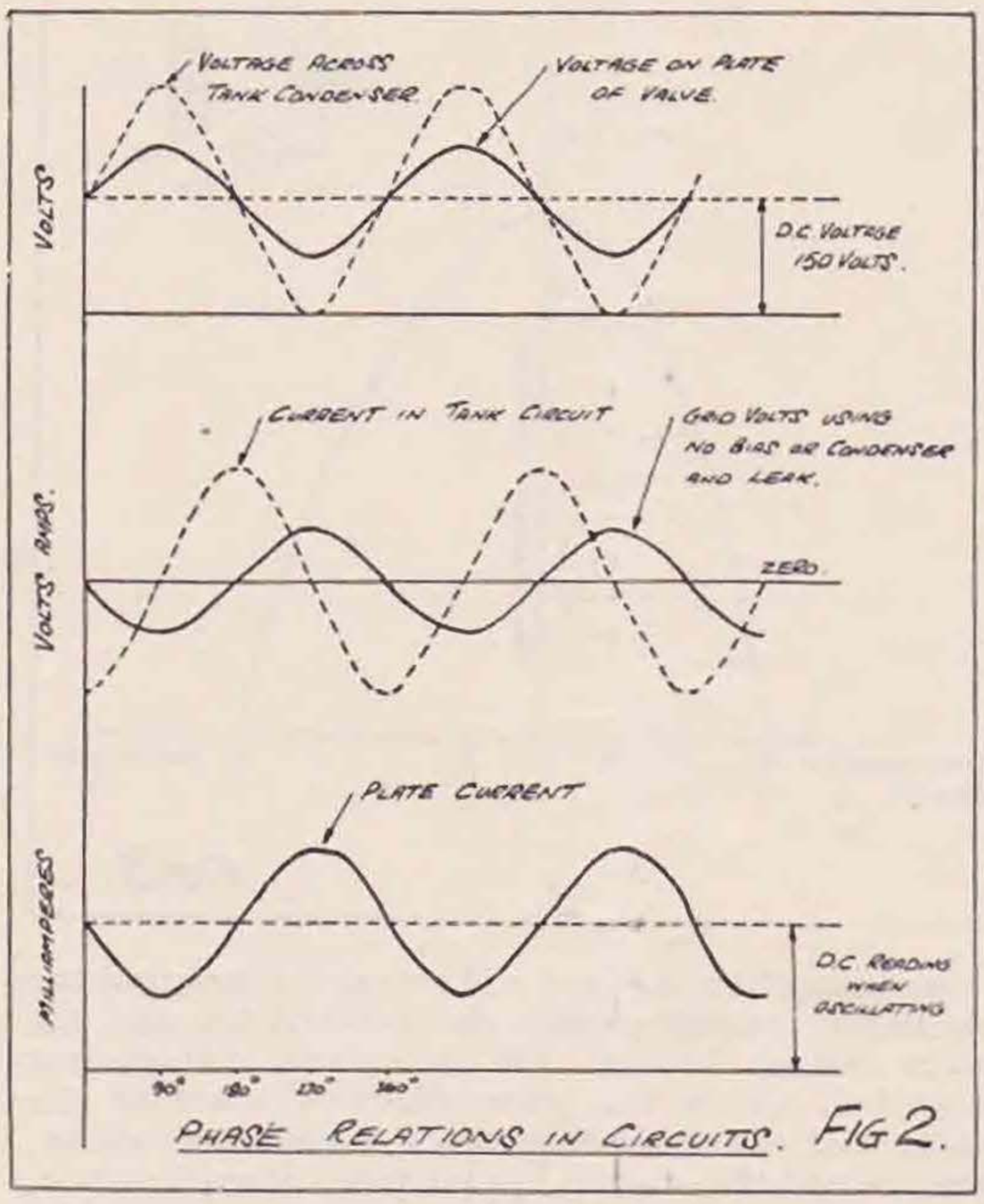
Second, the oscillations are natural, thus differing from the usual A.C. circuit where the voltage is impressed upon a circuit more or less tuned to resonance with the frequency of the supply voltage. Therefore, instead of the voltage and current being nearly in phase, they are actually 90 degrees out of phase. This is due to the fact that the circuit oscillates at its own natural frequency, and if either the value of L or C were altered, the frequency would change accordingly, there being no phase changes.

In the case of A, C, altering the value of either inductance or capacity would only result in shifting the phase relation between the voltage and the current, whilst the frequency would be unaffected.

As in the case of the internal combustion engine,

loss of energy occurs in the oscillatory system, so that even when "running light," oscillations are only sustained by the entry of new energy at each cycle. The losses in the tank circuit include the energy wasted in heating up the ohmic resistance, the production of eddy currents in surrounding conductors and that due to dielectric absorption, hysteresis and undesirable radiation.

These losses tend to damp out the oscillations at a rate determined by the decrement of the circuit. In other words, the high frequency voltage across the condenser would fall in value at each half-cycle until the oscillations were finally damped out. Once oscillating, however, this voltage is applied across the valve electrodes via the feeders A and B and also C, causing high frequency modulation of the otherwise steady D.C. current flowing through the valve.



PHASE RELATIONS IN CIRCUITS. FIG 2.

As explained previously, this results in impulses of current entering the tank at the psychological moment to assist in charging up the tank condenser, so that it reaches its full charge at each cycle. In this manner the tank oscillations are built up and self-maintained, hence the oscillator is known as a "self-excited Hartley oscillator."

As a preliminary to examining the curves, it would be as well to consider how the high frequency tank voltage modulates the plate current by studying the effect of, say, half a cycle of tank oscillation.

At the instant the tank condenser receives its maximum charge of, say, 100 volts peak value, the tank current is zero. Then with the filament tapped on to centre of coil, there are 50 volts across the plate-filament space of the valve and 50 volts across the grid-filament space. If at the moment considered the plate end of the coil is positive, the total voltage on the plate of the valve will be equal to the applied D.C. voltage of, say, 150 plus this induced voltage, and will be 200 volts. It is pointed out that whilst the oscillatory circuit and the H.T. supply are parallel circuits in their relation to the valve, the 50 volts mentioned cannot be treated as a parallel D.C. voltage because of the presence of the choke in the D.C. lead to the plate of the valve. The action of this essential piece of apparatus is to be considered later, so for the present it must be taken for granted that the plate voltage alternates above and below its normal steady value as a result of positive or negative induced charges from the oscillatory circuit.

At the instant considered the increase of plate voltage tends to increase the current through the valve, but as the 50 volt negative charge on the grid has a much greater effect on the filament emission the net result of the high frequency voltages is a reduction of plate current in phase with grid volts. Quarter of a cycle later, the tank condenser is discharging maximum current through the coil and the oscillatory voltage is zero, hence the induced charges on the valve electrodes have been removed so that the valve current is again normal. After another quarter of a cycle has elapsed, the tank condenser receives its maximum charge in the reverse direction and the current is again zero. The plate end of the coil is now negative and the grid positive in respect to the filament, so that the induced charges across the valve electrodes reduce the plate volts to 100 and the plate current increases in response to the 50 volt positive charge on the grid.

Now if the normal grid potential was zero by shorting the grid condenser and the valve was working on a straight part of its characteristic curve, the plate current would carry a high frequency ripple. The frequency is the same as that of the tank oscillations, but it is in phase with the grid voltage fluctuations which are 90 degrees out of phase with the tank current.

This high frequency component of the plate current is responsible for feeding the tank circuit and is controlled by the tank, a state of affairs analogous to valve timing in the case of the internal combustion engine.

Examination of the curves shown in Fig. 2 bears out the foregoing remarks, and it will be noticed that the feed current lags nearly 90 degrees on the tank current. So that at the instant the tank current falls to zero as the condenser becomes fully charged, an impulse of feed current from the valve flows into the condenser and "Topping up" its charge, so to speak, brings its voltage up to the same value at each half-cycle and so maintains continuous oscillations.

In order to see more clearly how the tank is fed, consider the blocking condenser C_p. As the filament emission increases in response to a positive induced charge on the grid, the plate current flowing through the H.F. choke and D.C. supply is prevented from immediately rising to the same value by the action of the choke. Hence the additional electrons are momentarily retained on the plate and right-hand plates of the blocking condenser C_p, resulting in a reduction of potential. Obeying the natural law that charges shall always be equal and opposite, electrons flow out of left-hand plates and augment the negative charge on the top plates of the tank condenser. Similarly, a reduction of emission due to a negative charge on the grid

places a positive charge on the top plates of the tank condenser, augmenting the existing positive charge due to the tank oscillations. So that, under the present conditions of working, the tank is impulsed twice per cycle.

Fig. 1 shows the self-charge on the tank condenser in full lines and the feeding charge due to the valve high frequency current in dotted lines.

It should be clear now as to how continuous oscillations are maintained in the tank circuit, and it is hoped that the reader will remain tolerant for a little longer. It still remains to consider how the oscillations are built up in the first place.

With the high tension applied to the plate of the valve, the fact of closing the filament switch causes current to flow through the valve, thereby reducing the plate potential. This effect may be very slight, but it suffices to reduce the charge on the blocking condenser C_p which is also shunted across the H.T. supply. As explained previously, this puts a small charge on the tank condenser which immediately discharges round the circuit through the coil. Now, due to the properties of capacity and inductance, the circuit has a natural time period, so that the condenser is recharged in the opposite direction in 1/2f. seconds. In other words, a slight shock to the electrical balance of the circuit sets it oscillating very weakly.

These initial charges, however small, apply induced charges across the valve electrodes which, as previously shown, result in further correctly-phased impulses entering the tank from the H.T. supply. So that the condenser voltage increases at each half-cycle until the normal working value is reached, when the circuit is said to be steadily oscillating.

This normal working value of tank voltage is determined by the constants of the circuit and the characteristics of the valve, which should be matched for maximum efficiency as will be shown later. The time taken in building up the oscillations is extremely short, but when keying in either of the H.T. leads, the oscillations will build up much quicker because the initial voltage applied across the tank condenser is much greater.

In order fully to understand the action of a Hartley oscillator it is necessary to study the action of the high frequency choke in the D.C. lead to the plate of the valve.

Now whether the choke acts as a capacity, an inductance, or both, the fact remains that its impedance must be high at the natural frequency of the tank circuit. This being so, any high frequency fluctuations of plate current in respect to induced grid charges set up an oscillatory voltage across the choke. The D.C. end of the choke Y remains more or less at the steady potential applied by the H.T. supply, namely, 150 volts. Normally, the plate end of the choke X is at the same potential less a slight voltage drop across the choke due to ohmic resistance only and which can be neglected for the moment. As explained previously, the fact of closing either the filament or the plate circuits (or the grid circuit) puts an initial charge on the tank condenser and sets the circuit oscillating, thus applying induced charges across the valve electrodes.

Now a positive charge on the grid would cause an immediate increase in filament emission, but due to the high impedance of the choke, the plate current flowing through the choke cannot immediately increase in proportion. Hence the additional electrons arriving at the plate are momentarily retained there and result in the plate potential falling below that existing at Y. Similarly, a negative charge on the grid would reduce the filament emission, but the inductive action of the choke prevents the plate current from falling immediately to the same value. Thus electrons are drained off the plate, leaving it positively charged above the potential at Y. This oscillatory plate voltage is 180 degrees out of phase with the grid voltage as shown in Fig. 2, and if the potential at Y remains steady whilst the plate potential at X is alternating above and below this value, it can be said that an oscillatory voltage exists across the choke.

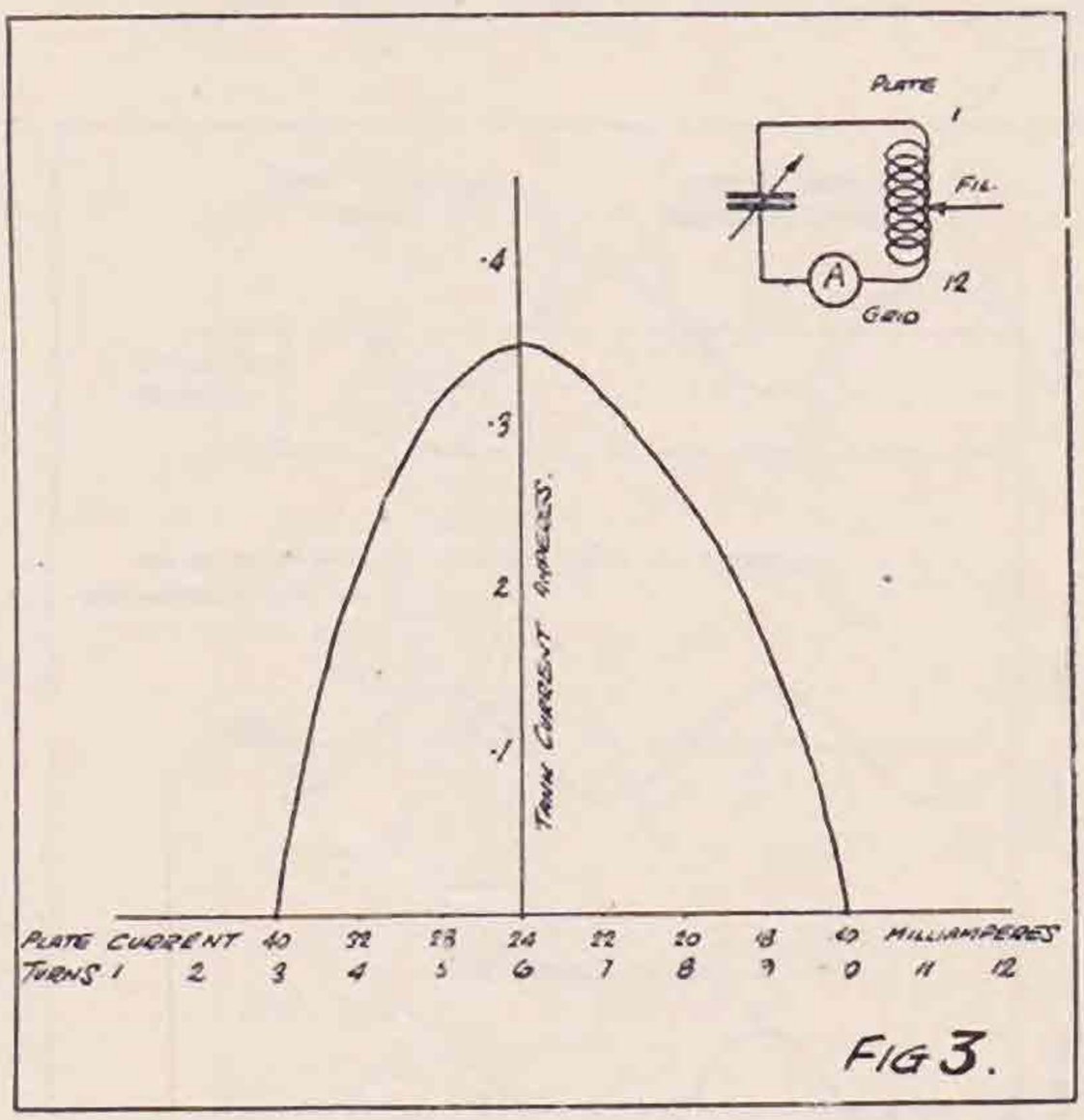


FIG 3.

An inspection of Fig. 1 will reveal the fact that the oscillatory voltage across the filament tap and the plate end of the coil, the oscillatory voltage just described across the plate filament space of the valve and the oscillatory voltage across the choke, are one and the same. For purposes of explanation, however, it was considered as being applied by the tank circuit, across the valve, but the discriminating reader will understand that it would be equally true to consider this voltage as being built up across either the choke or across the plate-filament space of the valve and applied across the tank circuit.

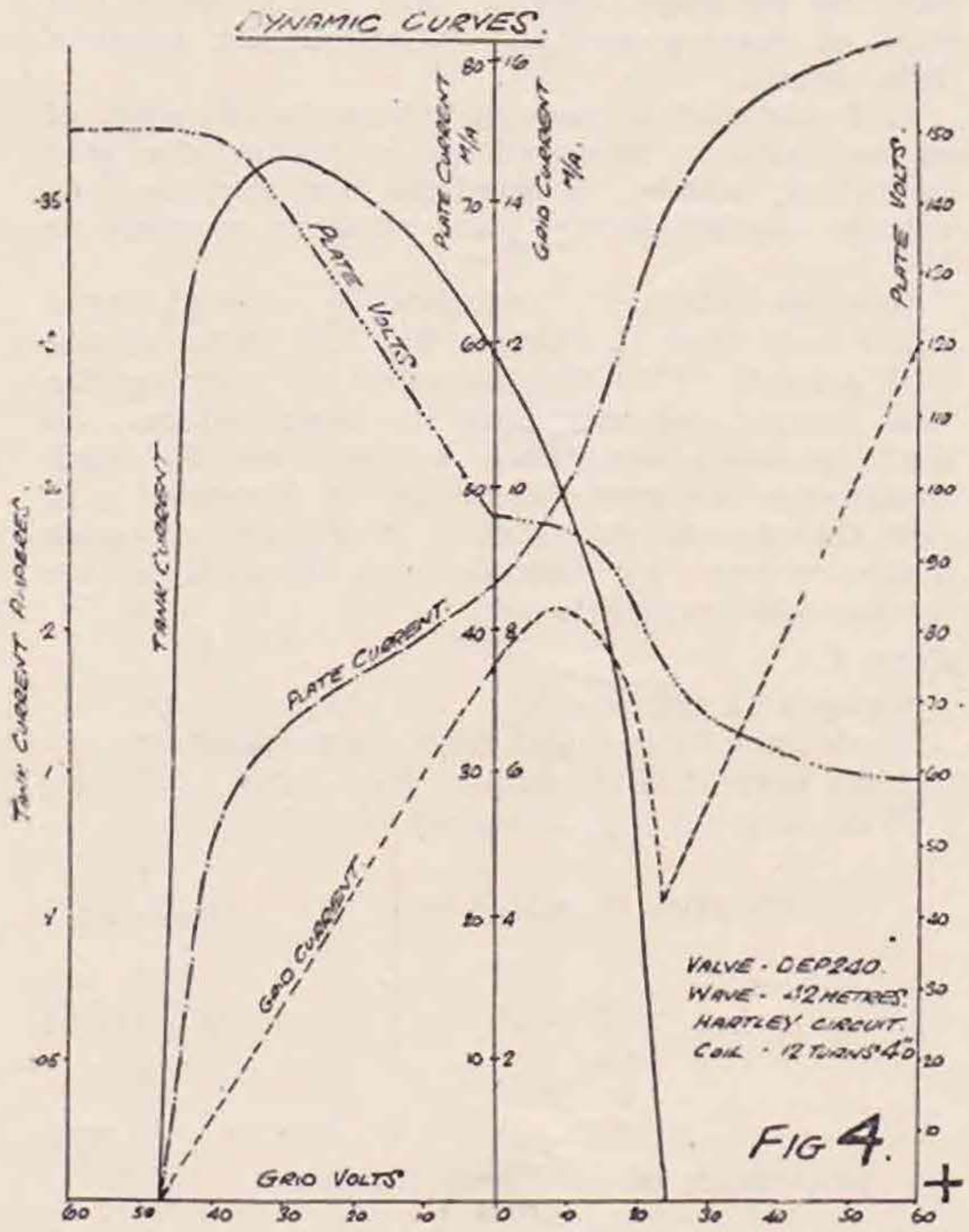
The filament tap or feeder B is at zero potential and the oscillator is stabilised by earthing this lead. The high frequency potential is also zero along this lead from the centre tap on the tank coil across the by-pass condenser C_b, and at the D.C. end of the choke, Y. The D.C. potential at Y is 150 volts, hence with a tank voltage of 100 volts the high frequency voltage across the plate-fllament space of the valve and across the H.F. choke is 50 volts peak value. Therefore the plate voltage must alternate at high frequency between 100 and 200 volts. This high frequency voltage builds up to comparatively high values and in some cases even exceeds the D.C. voltage applied to the plate, so that the plate actually becomes negative. It is

possible to determine the distribution of high frequency voltage across the choke by using an absorption wavemeter or neon tube. It will be found to be a maximum at X and falls off to zero as Y is approached. The amplitude of the H.F. feed impulses through the choke at any instant equals the voltage across the choke at that instant, divided by the impedance of the choke.

It is hoped that the foregoing remarks in conjunction with Figs. 1 and 2 will prepare the way for a few practical considerations, including one or two curves the writer plotted out in a very rough and ready manner.

The oscillator used in the experiments was exactly as shown in Fig. 1, the tank coil having twelve turns on a four-inch diameter former. The valve was an Osram DEP 240, which is a low resistance valve of about 2.500 ohms resistance, with 150 volts on the plate. A grid leak of 20,000 ohms resistance was used and the oscillator was tuned to approximately 42 metres.

The curve shown in Fig. 3 was plotted first in order to find the correct filament tapping point on the tank coil, which is that giving maximum tank current, thus denoting that the maximum feed current is being obtained for a given plate voltage, and that the phasing conditions are correct. As this oscillator develops such low power, it was found that a hot-wire ammeter placed too much load on the circuit and resulted in misleading con-



clusions ; a better indicator of maximum tank current being the plate milliammeter, which should be inserted on the D.C. side of the H. F. choke. Providing the oscillator is functioning correctly, the minimum reading denotes maximum tank current, because the customary grid leak and condenser applies self-grid bias, hence minimum plate current denotes the highest grid bias obtainable, resulting from maximum grid excitation.

The exact position of the filament tap on the tank coil largely depends upon the valve characteristics. With the low impedance used, this point was dead central for various coils, indicating that the circuits were balanced to a nicety. For efficient working and stability the filament tap is always at a voltage nodal point. In other words, at zero potential.

The curves of Fig. 4 were plotted in an endeavour to find out the effects of grid bias. They are dynamic curves taken under actual working conditions, except that dry cells were substituted for the usual grid leak and condenser. This enabled the grid bias to be adjusted over a wide range. The resulting effects on the tank current, the plate current and voltage and the grid current are shown. By reducing the plate current and increasing the tank current, grid bias greatly increases the efficiency and stability of the oscillator. Using a grid leak and condenser is a simple and cheap means of obtaining bias by utilising the positive half-cycles of the grid excitation voltage.

When the grid is isolated by a condenser, the positive half-cycles of the grid swing voltage cause electrons from the filament-plate stream to collect on the grid. Now if no leakage occurred, this negative charge would build up to an excessive value and make the valve cease to function. If a high resistance connects the grid to earth, however, the negative charge builds up to a certain value sufficient to force a grid current through the resistance.

Fig. 4 shows that about 30 volts bias is required to produce maximum tank current, hence the grid leak resistance should be such that the high frequency voltage across B and C produces this value of bias.

A grid leak and condenser act as an automatic bias regulator, and having once found the correct value of grid leak resistance, any subsequent alteration to power automatically readjusts the bias in proportion.

Studying the curves of Fig. 4 will yield much further interesting information, but this must be shelved for the time being.

Attempts were next made to find out the form taken by the plate current whilst feeding the tank circuit, and to this end the curves of Figs. 5 and 6 were plotted.

Now, as shown previously, the plate voltage varied at the tank frequency over a wide range from perhaps double the applied D.C. voltage to zero. Hence the usual static characteristic curve is useless for our purpose. But if the oscillatory tank voltage is known, it is possible to make use of a series of static curves within the limits of the plate voltage and trace out the form taken by the plate current from them. The curve obtained in this manner is really a dynamic curve and represents more or less truly the actual shape of the feed current impulses in the plate current under working conditions. The method used for plotting these curves will be explained at the end of the article. For the moment we are merely concerned with the shape of the feed impulses.

Fig. 5 shows that the feed impulses in the plate current take various forms, depending upon the extent of grid excitation. These are only plotted

out very approximately, but they serve the purpose in view.

For example, a 20-volt grid swing, which is a 10-volt oscillatory voltage across B and C, releases one negative impulse per cycle, the positive half-cycle of grid swing being inoperative. This means that the tank is impulsed once per cycle. The fact that the feed impulse takes shape as a reduction of plate current is immaterial as regards its effect on the tank circuit. These impulses have an amplitude of about eight milliamperes and are sufficient to maintain a tank voltage of about 20 volts. The

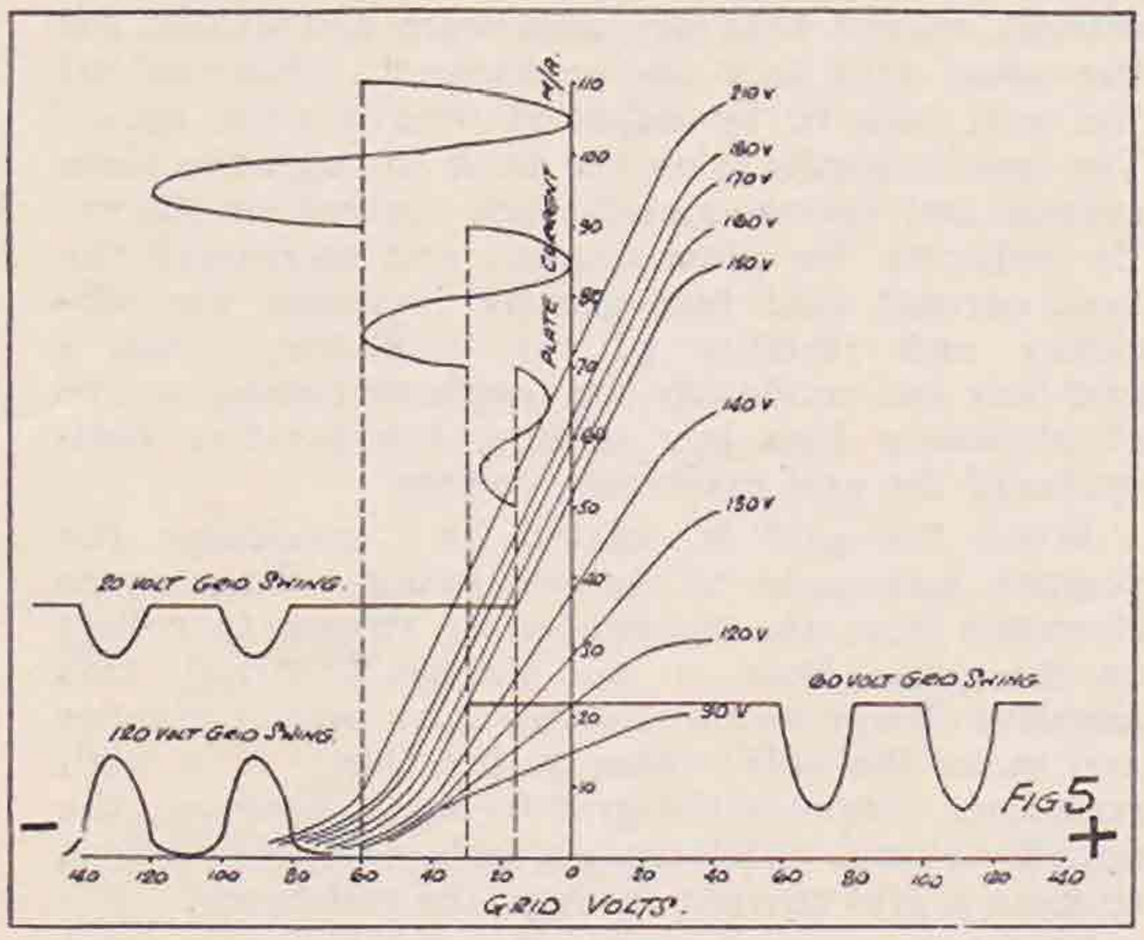


plate current milliammeter would read about 28 milliamperes. The effect of a 60-volt grid swing is similar, except that the impulses have larger amplitude, namely, about sixteen milliamps, and as is to be expected, they will maintain a larger oscillatory tank voltage of about 60 volts. It will be noticed that the plate current as indicated by the plate milliammeter has fallen to half its previous value, now being 14 milliamps. This is due to the increased grid excitation automatically increasing the grid bias, as explained previously.

It is obvious that the valve characteristics greatly affect the shape of these impulses, so much so that a 120-volt grid swing releases two impulses, the bulk of the energy being in a positive sense. The tank therefore receives two impulses per cycle, the negative being very small compared to the positive impulse.

Examination of the curve in Fig. 6 shows that the amplitude of the positive impulse is about 18 milliamperes whilst the plate current is only about 10 milliamperes. Hence increasing the grid excitation has still further increased bias, so that plate current only flows when positive half-cycles come on the grid. In other words, the self-applied grid bias is sufficient to effectively stop all current through the valve, until neutralised by a positive half-cycle of grid swing. This makes for increased efficiency, and if the impulse was a pure half-sine wave, the efficiency would be about 70 per cent. It is possible to bring this up to nearly 90 per cent. by still further increasing the grid excitation, when the impulse curve becomes hollowed out as shown in Fig. 6. Under these conditions, the valve only passes current for very brief periods whilst the grid is positive, and none at all when the grid is negative. For example, a 400-volt grid swing releases a very small impulse at the commencement and another at the conclusion of a positive half-cycle on the grid. During the rest of the time no plate current flows at all. Hence the tank oscillations are maintained by extremely small feed impulses of current through the valve, so that the efficiency is very high indeed. Unfortunately, such high efficiency cannot be obtained in practice owing to unstability when trying to load the oscillator. For reasonable efficiency with good stability, the feed impulse should be similar to that shown for a 120-volt grid swing, when the efficiency is about 75 per cent.

It has been shown that the oscillatory plate voltage is 180 degrees out of phase with the grid voltage. Hence when a positive grid swing reaches its peak value, the plate voltage reaches its negative peak value, or minimum voltage. Therefore, if these oscillatory voltages approach in value the D.C. voltage on the plate, the actual voltage on the plate becomes very small. With high oscillatory voltages in the tank it is quite likely that at the time when peak values occur the plate voltage falls to zero, or even becomes negative.

This naturally affects the plate current, so that instead of increasing in response to a positive half-cycle of grid swing, the plate current commences to fall in value as the peak values are approached. This causes the hollowing-out effect on the impulse curve and incidentally increases the efficiency by reducing the plate current. Fig. 7 is added in the hope of making this somewhat obscure point a little clearer.

It should now be clear as to how the efficiency of an oscillator is increased by increasing the grid excitation, bearing in mind the fact that the D.C. voltage applied to the plate remains constant at 150 volts.

Grid excitation was increased by substituting a larger coil, thus increasing the L/C ratio of the tank circuit. This has the effect of reducing the tank current and increasing the tank voltage. So that the oscillatory voltage across B and C, which constitutes the grid excitation, is increased. In case this sounds paradoxical, it is quite a simple matter to prove by approximating the tank voltage for two different sized coils.

CASE 1.

Using a 12 turn coil.
Tank capacity is .00015 mfds. approximately.
Tank current is .35 amps. (See curve in Fig. 8.)
Wavelength is approximately 42 metres.

$$\text{Impedance of condenser} = \frac{1}{2\pi \times f \times C}$$

$$= \frac{1}{44 \times .00015}$$

$$= \frac{1}{.0066}$$

Impedance of condenser 150 ohms.

Voltage across condenser = Impedance × current.
Therefore 150 × .35 = 52 volts approx. (RMS value).
This gives a grid swing of 72 volts peak value.

CASE 2.

Using a 20-turn coil.
Tank capacity is '00004 mfds. approximately.
Tank current is .2 amps. (See curve in Fig. 8.)

Wavelength is approximately 42 metres.

$$\text{Impedance of condenser} = \frac{1}{2\pi \times f \times C}$$

$$= \frac{1}{44 \times .00004}$$

$$= \frac{1}{.00176}$$

Impedance of condenser = 560 ohms.

Voltage across condenser = Impedance × current.
Therefore: $560 \times .2 = 112$ volts approx. (RMS value).

This gives a grid swing of 160 volts peak value.

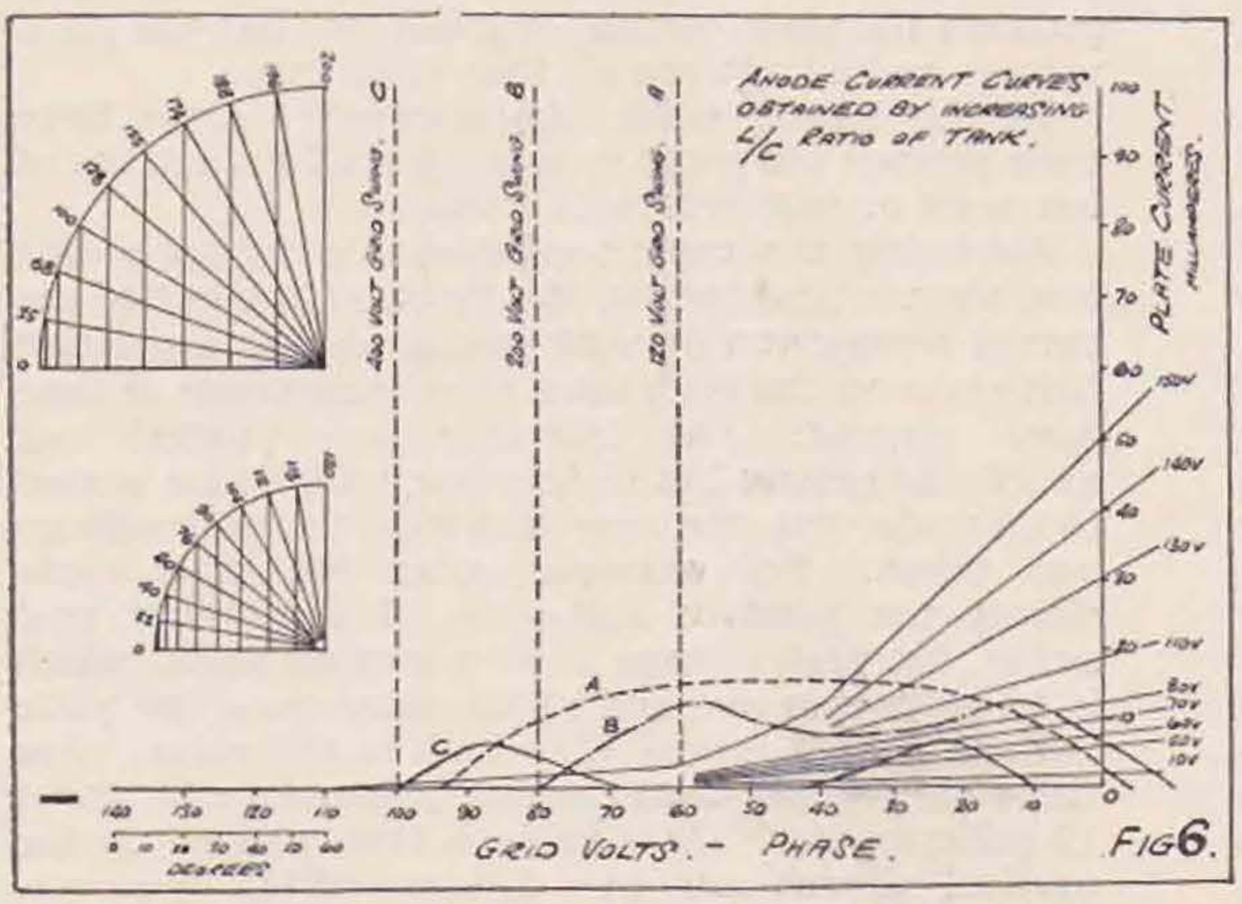


FIG 6.

The above examples show that whilst increasing the L/C ratio of the tank circuit reduces the oscillatory current from .35 amperes to .2 amperes, the oscillatory voltage across the tank is increased from 52 volts RMS value to 112 volts RMS value. So that the grid swing is increased from 72 volts peak value to 160 volts peak value. Hence, within

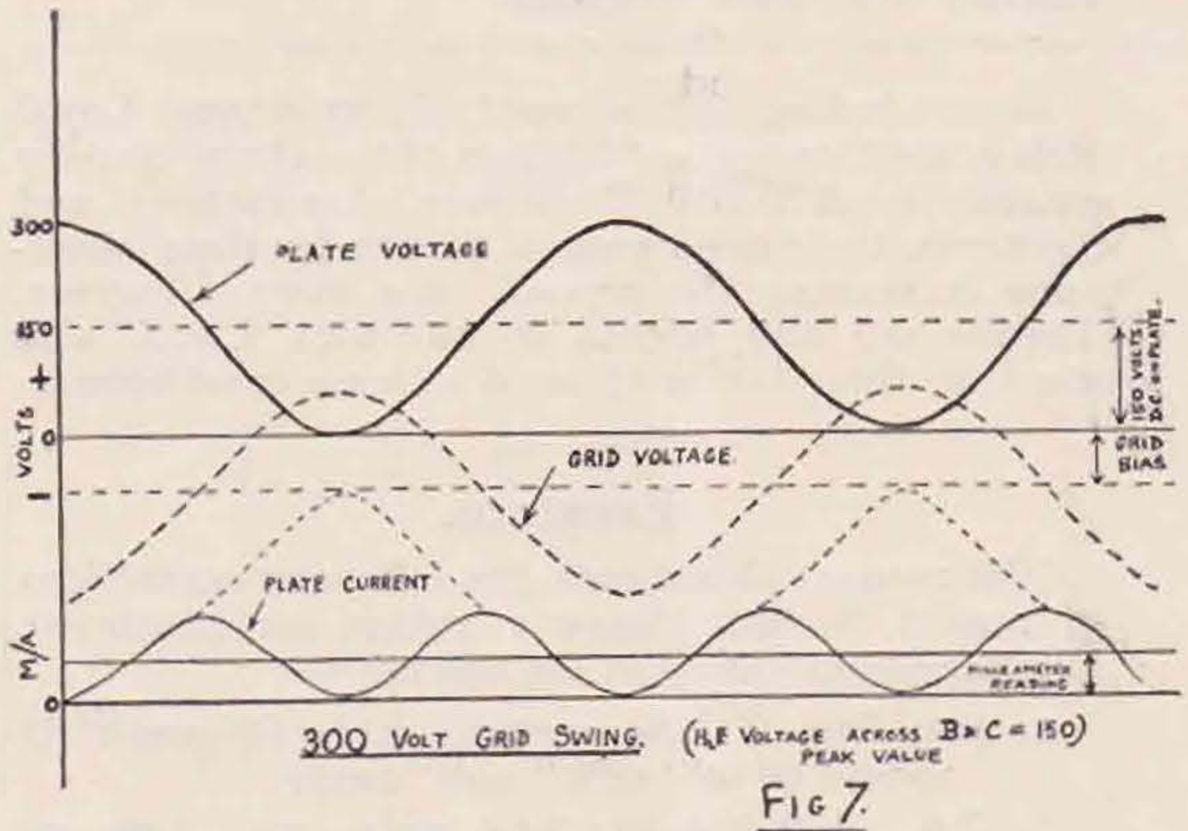


FIG 7.

limits, increasing the L/C ratio of the tank circuit increases the efficiency of the oscillator. Apparently, then, the correct L/C ratio is not that giving maximum tank current, but that which gives sufficient grid excitation to produce an impulse through the valve similar to that shown for a 120-volt grid swing. Fig. 8 shows the tank current curve obtained for various sized coils. It will be seen that a 12-turn coil gives maximum tank current, but in order to obtain higher efficiency a larger coil should be used. In practice, it will be found that 16 or 18 turns will increase the efficiency to 70 per cent. or so without sacrificing stability. In other words, in order to obtain a large feed impulse with a small plate current, that is a slightly flattened half sine wave impulse, the L/C ratio should be such that the tank current lies between the values A and B on the curve in Fig. 8.

It must be borne in mind that high resistance valves having a larger amplification factor would not require the same grid excitation as a low resistance valve in order to obtain the requisite shaped impulse. Therefore, it is probable that, when using high resistance valves, a lower L/C ratio tank circuit can be used, with the result that larger tank current can be obtained. This suggests the

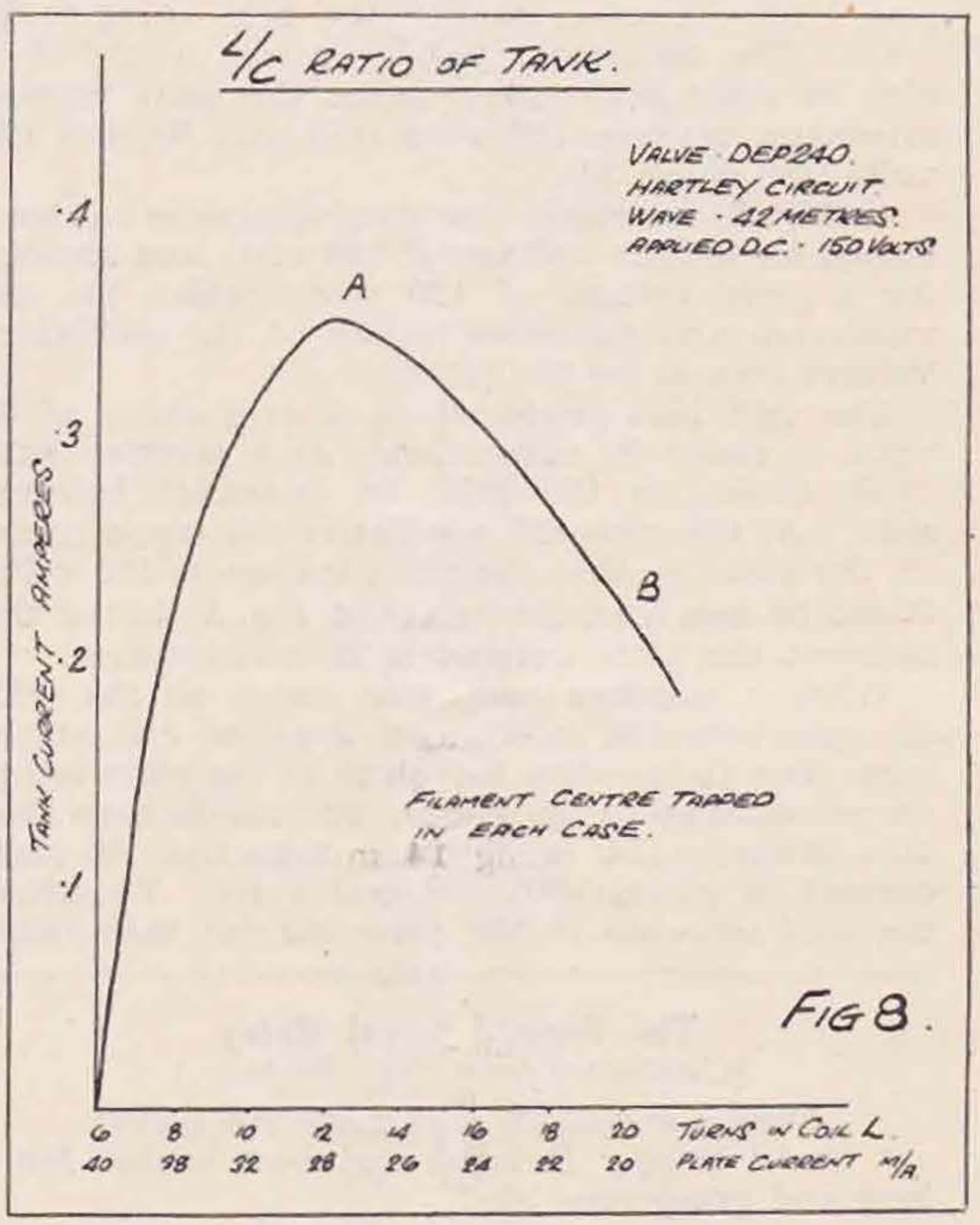


FIG 8.

idea that a current-fed aerial system might prove to be the most efficient radiator. The only grounds for suggesting this is that presumably higher voltages would be obtained in the aerial.

On the other hand, a low resistance valve working at maximum efficiency would generate high tank voltages with consequent reduction of current. Hence, for the same reason as stated above, it is suggested that a voltage-fed aerial system would prove most efficient.

Several brief tests carried out by the writer failed to produce any concrete evidence that such was the case, but at any rate the foregoing may suggest a line of experiment for anyone interested.

A point of interest in relation to the above is that it was found possible materially to increase the useful life of an old valve, the emission of which

had fallen off, by merely increasing the L/C ratio of the tank circuit. This reduced the plate current and increased the efficiency of the valve so that it oscillated much better.

In case anyone is interested in the method used for plotting the curves in Figs. 5 and 6, it is hoped that the following explanation will make it clear as to how these curves were obtained.

In the first place, it is obvious that owing to the oscillatory nature of the plate voltage, the ordinary "Grid volts-plate current" static characteristic curve is useless for plotting out the plate current impulse. If the oscillatory voltage across the tank circuit is known, however, a series of static characteristic curves can be drawn for plate voltages lying between the maximum and minimum values.

For example. With an oscillatory tank voltage of 60 volts peak value, the voltage across B and C is 30 volts peak value. This means that the grid potential is alternately 30 volts positive and 30 volts negative to its normal potential as fixed by the grid bias. In other words, the grid swing is 60 volts. The oscillatory voltage across A and B is also 30 volts peak value, hence the plate voltage alternates between 180 volts (150 plus 30) and 120 volts (150 minus 30).

In Fig. 5, one static characteristic curve has been drawn for a plate voltage of 180 volts and another for a plate voltage of 120 volts, which are the maximum and minimum values of the oscillatory voltage coming on the plate.

The grid bias produced by a grid swing of 60 volts is about 30 volts, hence as a positive half-cycle comes on the grid, its potential becomes zero. At this moment a negative half-cycle comes on the plate, so that the plate voltage is 120 volts. It can be seen from the curves of Fig. 5 that at this moment the plate current is 20 milliamperes.

When a negative half-cycle comes on the grid, the grid potential is 60 volts negative and at the same time the positive half-cycle on the plate brings its potential up to 180 volts. The curves show that this causes a 14 milliampere reduction of plate current in phase with the grid volts. Therefore, the feed impulses in the plate current take shape as a reduction of plate current for every negative half-cycle coming on the grid. The other curves in Fig. 6 were obtained in exactly the same way, except that the values are different. Due to the valve characteristics, a 120 volt grid swing produces an increase of plate current for every positive half-cycle coming on the grid, which is a different state of affairs.

The curves of Fig. 6 were plotted with greater accuracy, it being assumed for the purpose that the tank oscillations were sinusoidal.

Fig. 5 shows that for grid swings of 120 volts or over, the static characteristic curves for plate voltages above the normal value of 150 volts are unnecessary, hence they have been omitted in Fig. 6. This is because the positive half-cycles on the grid produce the plate current impulse, so that the plate voltage reductions are all that concern us.

In this figure, static characteristic curves have been plotted for plate voltages from 150 in steps of ten volts or so down to 10 volts.

Assuming the tank oscillations to follow a sine law, the vertical lines in the figure to the left of the curves represent values of voltage during a positive half-cycle on the grid, after even increments of time have elapsed. The impulses are plotted out exactly as before, but in this case a time base is used to coincide with the time at which the grid voltage was taken. For example, after $\frac{1}{8}$th of a cycle during the positive half-cycle of a 120-volt grid swing, the grid voltage is 60 minus 42 volts, which is 18 volts negative and at the same time the plate voltage is 150, minus 42, which is 108 volts. For these values the plate current is found to be about 12 milliamperes. This value is then plotted on the vertical current scale at a distance of $\frac{1}{8}$th of a cycle along the horizontal time scale. In this manner the plate current impulse is plotted for a complete positive half-cycle of grid swing. The grid bias values are assumed to be as shown.

In conclusion, the writer ventures to express the hope that, after wading through this lengthy article, the reader who is new to the game might find much to help him or her in understanding how the Hartley Oscillator oscillates.

The Second Loyal Relay.

(*Continued from opposite page.*)

From Canada (St. Lambert) via G2VQ.

"Many Happy Returns and best wishes for a long and prosperous life."

(*Signed*) THE TRANSMITTING AMATEURS OF ST. LAMBERT, Quebec.

From N. India, via G6IZ and G6BB.

"Loyal and hearty greetings to H.R.H. the Prince of Wales from the members of the British Empire Radio Union situated in Northern India and Burma."

(*Signed*) Fox (VU2DR).

From Canada (Montreal, Quebec), via VE2CA and G5ML.

"To the Empire's greatest son, most humble and loyal greetings from the Montreal Branch of the Royal Empire Society."

(*Signed*) SIR HENRY GREY, President.

In concluding this account of our second Loyal Relay, the Council and Officers of the Home Society extend to all B.E.R.U. Groups, Associations and members, their most cordial thanks for their assistance in making the project once more a success. Thanks are also offered to our own E.L.S. who stuck to their job in spite of adverse conditions.

Erratum.

Will readers please note the following corrections in regard to Mr. Megaw's lecture on Electronic Oscillations produced in the last issue ?

1. P.4, Fig. 2 : the vertical scale of graph (b) should be in "mA," not "amps."
2. P.6, col. 2, line 10 : for 1 metre, read 3 metres.
3. P. 8, col. 2, line 52 : before oscillator, add electron.
4. P. 11, col. 1, title of Fig. 8 : for "A — oscillator-antenna, $\lambda/2$, $2\lambda/2$, $3\lambda/2$, etc.," read : "A — oscillator-antenna, $3\lambda/4$, $5\lambda/4$, $7\lambda/4$, etc."

SEE YOU AT CONVENTION.

The Second Loyal Relay.

By John Clarricoats.
Honorary Secretary, R.S.G.B. and B.E.R.U.

June 23, 1931.

"*President,*
Radio Society of Great Britain.
"*Prince of Wales sends sincere thanks to all members Radio Society of Great Britain and British Empire Radio Union for their Birthday congratulations which his Royal Highness much appreciated.*
Comptroller."

IN these words our Patron—H.R.H. the Prince of Wales—thanked the Society and its Overseas Representatives for their loyal greetings which were extended to him on the occasion of his recent Birthday.

Radio conditions for the two week-ends prior to June 23 were, unfortunately, poor for some parts of the Empire, with the result that the long-awaited messages from New Zealand, Australia and Hong Kong were delayed. The New Zealand message actually arrived via North America on July 7. We were extremely sorry to miss the greetings from these parts, but nevertheless we appreciate that no blame attaches to anyone, unless it be the custodian of the short waves!

As in former years, the handling of the Loyal Relay was in the hands of our Acting Vice-President and Publicity Manager, Mr. A. E. Watts (G6UN), and it was his privilege once again to deliver the messages to the Royal Palace.

It is with regret we mention that no Press publicity was permitted in connection with these messages. We are certain that if this could be authorised, a definite fillip would be given to amateur radio work in this country. However, we anticipate that the day is not far distant when some of the present irksome restrictions will be removed.

The messages as received, follow in order of date:

From Headquarters, R.S.G.B. & B.E.R.U.

"The President and Members of the Incorporated Radio Society of Great Britain and The British Empire Radio Union beg to present their loyal greetings to their Patron, H.R.H. the Prince of Wales on the occasion of his Birthday."

(*Signed*) H. Bevan Swift.
President.

From Headquarters, A.R.R.L.

"18,000 United States and 1,000 Canadian Radio Amateurs bonded together in their Organisation, the American Radio Relay League, unite in sending you felicitations on the occasion of your Birthday, June 23. Best wishes for a full measure of health and happiness."

(*Signed*) Hiram Percy Maxim,
President.

From Ceylon, via VU2AH, G5ML and G6WN.

"Loyal Birthday greetings to H.R.H. The Prince of Wales from members of the Radio Club of Ceylon and Southern India."

(*Signed*) Jolliffe (VZ7GJ).

From Jamaica, via G5ML.

"Jamaica wishes your Royal Highness many happy greetings on your Birthday, and hopes your Highness will honour us with another visit very soon."

(*Signed*) VP2PA

From Barbados, B.W.I., via G5BJ and G6RG.

"On the thirty-seventh Anniversary of Your Royal Highness' Birthday, your loyal subjects in Barbados join in expressing their sincere greetings and wish that the health and happiness which have been so valuable in all your travels may continue for many years to come."

(*Signed*) T. Archer (V1YB).

From Iraq, via G5BJ and G2OP.

"The Iraq Group join with fellow members in greeting His Royal Highness with congratulations and many happy returns on the occasion of his Birthday."

(*Signed*) Curtis (YI1CD)

From Nigeria, via G6VP.

"All Nigerian amateurs join in wishing H.R.H. The Prince of Wales respectful greetings on the occasion of his Birthday."

(*Signed*) Wilmot (FN2C).

From Shaibah, Basra, via G6WN.

"Loyal Greetings from the Land of Two Rivers. The Amateurs of Iraq send best wishes for many happy returns of your Birthday, June 23, 1931."

(*Signed*) Hamblin (YI6HT).

From Nairobi, via G2OP.

"The Radio Amateurs of Kenya, Uganda, and Tanganyika send loyal Birthday greetings and best wishes to H.R.H. the Prince of Wales."

(*Signed*) Cox (VQ4CRF).

From Horta, Fayal, via CT2AA and G6VP.

"On the occasion of the thirty-seventh Anniversary of Your Royal Highness' Birthday, the British Community of this Island join in expressing through the medium of Amateur Radio, our sincerest Greetings and Best Wishes for your future Health, Happiness and Long Life.

"We hope that your continued efforts on behalf of the Empire during all your travels may be productive of the results you so much deserve."

(*Signed*) British Vice-Consul,
Horta, Fayal, Azores.

From Canada (Thetford Mines) via G6YK.

"Best wishes and greetings to H.R.H. the Prince of Wales for health and happiness from the Radio Amateurs of Quebec Province."

(*Signed*) Alphy L. Blais (VE2AC).

(*Continued at foot of previous page.*)

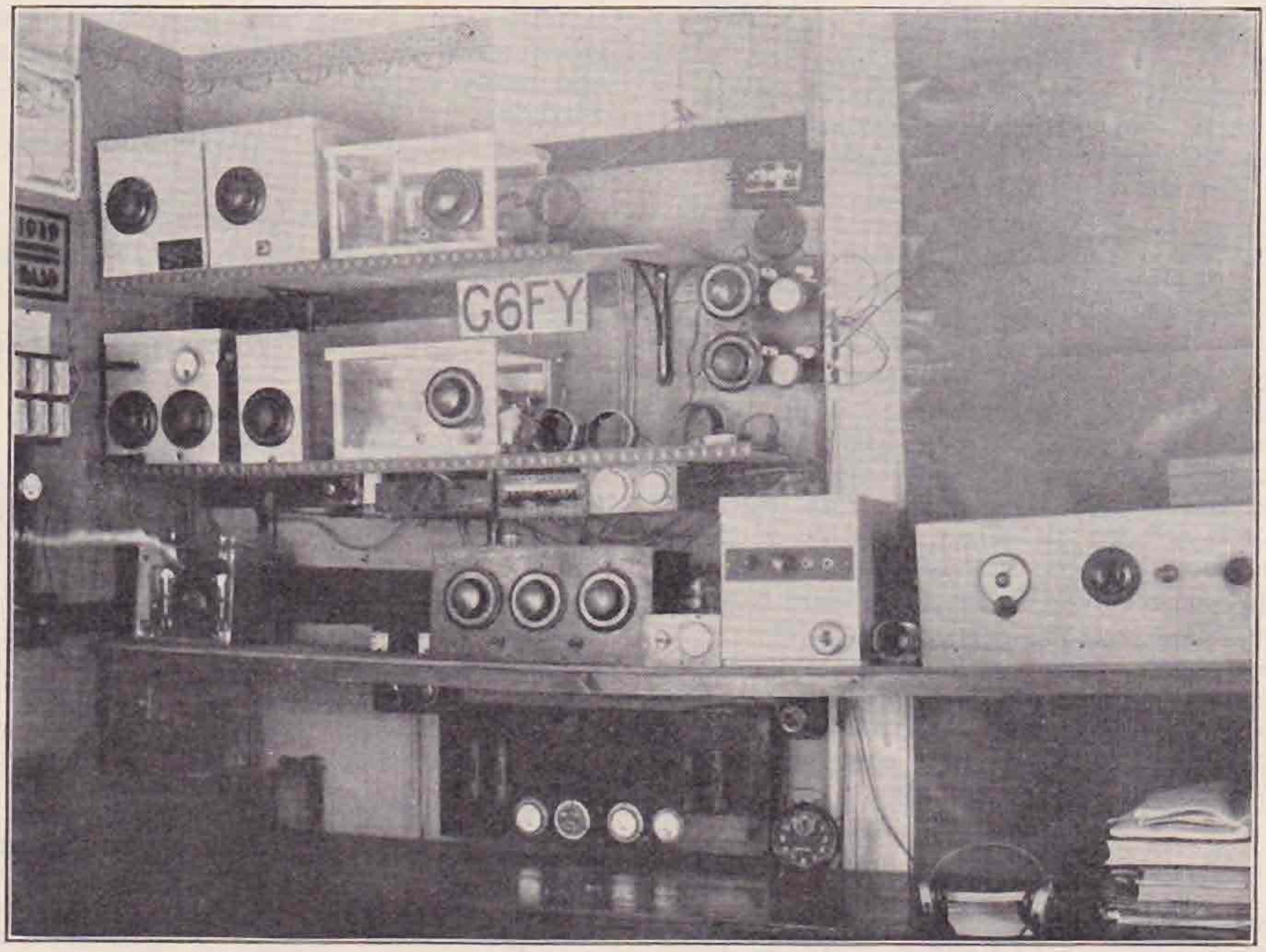
Station Description No. 15.

G6FY.

By "Topsnus."

AN excellent example of a 1931 type station is that owned and operated by Mr. R. A. Fereday, of Leytonstone, Essex. The station first made its debut in the early part of 1927 on the 2 M.C. frequency band. Little or no telephony was attempted in view of the notorious local supply mains, which distribute R.A.C. in its worst unsmoothed form. However, good work was achieved with C.W., and it was not long before transmission was commenced on the higher frequencies. On the latter all continents except North America and Australasia have been worked.

and practically. More than usual attention has been given to detail, as is evident from the numerous little refinements, which, although not absolutely necessary, give the final touches to the station. On the top shelf may be seen the 7 M.C. crystal oscillator followed by an amplifier and also push-pull power amplifier. A most ingenious system of interconnection has been devised. Power supply leads, etc., are brought out to spring contacts, each one making connection with the appropriate metal strips at the back of each stage; thus there are no straggling leads to fray one's patience, and each



Although the "wallpaper" bears witness to many DX contacts, the operator very wisely concentrates on the experimental side rather than indulging in useless card hunting. Being a member of the Ragchewing Club also proves that G6FY is not one of the "ga-ob-qru" fraternity. Activities are by no means confined to home affairs as the operator is a member of several foreign societies, and attends at sundry functions on the Continent.

Now we come to the station description proper. As can be seen from the photograph, the entire gear is constructed on sound lines both theoretically

unit may be taken down and replaced in a matter of seconds. On the middle shelf is seen a crystal oscillator and buffer amplifier, followed by the 3.5 M.C. frequency doubler, and finally the power amplifier. All stages here are in push-pull. In passing, the familiar biscuit-tin construction may be noted, also the generous use of glass panels in the power amplifiers. Another point decidedly worthy of note is the practically universal use of the famous CT25+. When occasion demands, Telefunken RE 504's are employed for QRP work. These, however, are not always obtainable. The maxi-

mum licensed power of the station (50 watts) is seldom used except for work on the 3.5 M.C. band. On the lower shelf a small portable receiver is noticeable on the extreme left. This incidentally gave a very good account of itself on a recent field day. Passing along, we come to the crystal monitor, and adjacent to it the ordinary tuning monitor, both indispensable adjuncts to the modern station. Next to this is the speech amplifier, and finally the station receiver. The latter follows the conventional SG-V-1 lines.

The local supply mains are D.C. (at least that is the official description !) and a generator is run to supply the necessary higher voltage. Pressure up to 1,000 volts is obtainable, which is applied to the power amplifiers and modulator. Intermediate stages are run off the mains and receiver H.T. in series. Mention must be made again of the trouble experienced with the mains and 'phone work. As fate wills it the supply is at its worst over week-ends, and Sunday 'phone on 2 M.C. is all too often accompanied by a background which the " T " code utterly fails to accommodate. In fact, and in all seriousness, the term " T-FY " is understood locally to represent the entire audio-frequency spectrum rolled into one ; further comment is superfluous !

Underneath the monitors and speech amplifier is the generator output switchboard, which accommodates all the necessary impedimenta associated with the H.T. and L.T. supply. Here it may be remarked that the generator itself is housed in the cellar; a hectic few hours were spent pulling up floor-boards in order to bury the leads to the radio room ! Further to the right is a mercury change-over switch which, amongst sundry other operations, connects the receiver accumulators in series with the mains for supplying the intermediate stages of the transmitter.

That, in general, concludes a survey of the station interior. Externally there is the average amount of suburban screening. For some little time a Zeppelin antenna has been in use, but it is shortly proposed to erect a Levy.

At the present time the 2 and 3.5 M.C. bands are being concentrated on. G6FY has always been an enthusiastic supporter of 80 metre work, and it will probably be remembered that he, amongst others, was operating on this band before it was generally opened, in connection with C.B. work. As for 2 M.C., most time is spent on 'phone work, and although, of course, there is abundant opportunity for further research, G6FY's telephony is of a high standard and fully justifies the amount of labour expended, especially in view of the mains difficulty.

In conclusion, it need hardly be said that visitors to G6FY are always heartily welcomed, and a real good ragchew is always assured, no matter whether the arrival hails from Tooting or Timbuctoo !

The Mighty Atom—(*Continued from page* 44.)

Having built the set, the question was, " How much power input ? " As there were no fixed condensers in the transmitter other than the tank circuit, it was considered that the limit of the high tension voltage was controlled by the spacing of the midget variable condensers and the rating of the valves. Thereupon two valves of the UX210 type were used and 600 volts applied to their plates. With some trepidation the key was pressed and luckily the transmitter oscillated, otherwise bang would have gone the milliameter fuse. Adjusting the frequency and bringing the aerial into tune, brought the milliamps up to 110, an input of 66 watts. The key was left down to see what part would give up the ghost first. Switching off, all components were inspected and the weakest part was found to be the tank coil, which was fairly warm. For obvious reasons this could not be made of the conventional ¼ in. copper tubing. After all this was only a minor detail and it was considered that the transmitter could easily handle an input of 75 watts.

Reducing power, a " CQ " was sent out, and ZL2GO came back (approx. 5,000 miles away), but he was not very QSA and his report was spoilt by QRM. Later reports from stations in the Eastern States (approx. 3,000 miles away) gave the tone as near D.C., and it is considered that this can be improved by reducing the tank coil to eight turns, which will probably bring the 7000 K.C. band just within the limit of the tuning condenser, the total capacity then being approximately .0002 mfds.

The weight of the transmitter without valves is 1¾ in. lbs., which makes it ideal for a portable outfit.

There is nothing more to add, except that " the mighty atom " secured first prize at the Exhibition as the best midget transmitter.

Station VK6FT is generally " on watch " from 12.00 to 16.00 G.M.T., and reports on his signals, as well as QSO's from other midget transmitters, would be welcome and appreciated.

Calibration Services.

A Calibration Service will be transmitted from G2NM, Mr. Marcuse's station at Sonning-on-Thames, Berkshire, on 3,583.13 K.C., according to the following schedule :—

At 11.00 every Sunday (Telephony).

At 23.00 every Sunday and Thursday (Morse).

Times are G.M.T. or B.S.T., as in force. The frequency has been checked and approved by the Post Office.

Strays.

The following announcement of 28 and 56 M.C. tests was received too late for inclusion in the July BULLETIN, but is given here for the benefit of any member who may have heard the station.

Test from XOK1AU (QSL via S.K.E.C.).

July 20, 21 and 22. 28 M.C. 17.00 to 17.10 G.M.T.; 17.15 to 17.25 G.M.T. ; 17.30 to 17.40 G.M.T.

August 10, 11 and 12. 56 M.C. 13.00 to 13.15 G.M.T. 28 M.C. (as above).

* * *

Don't forget to send your subscription towards the Gerald Marcuse Testimonial Fund before September 5.

* * *

The next Society's B.B.C. Quarterly Bulletin will be read at 7.20 p.m., on Thursday, September 10, and not September 11, as previously stated.

MAKE CONVENTION A SUCCESS.

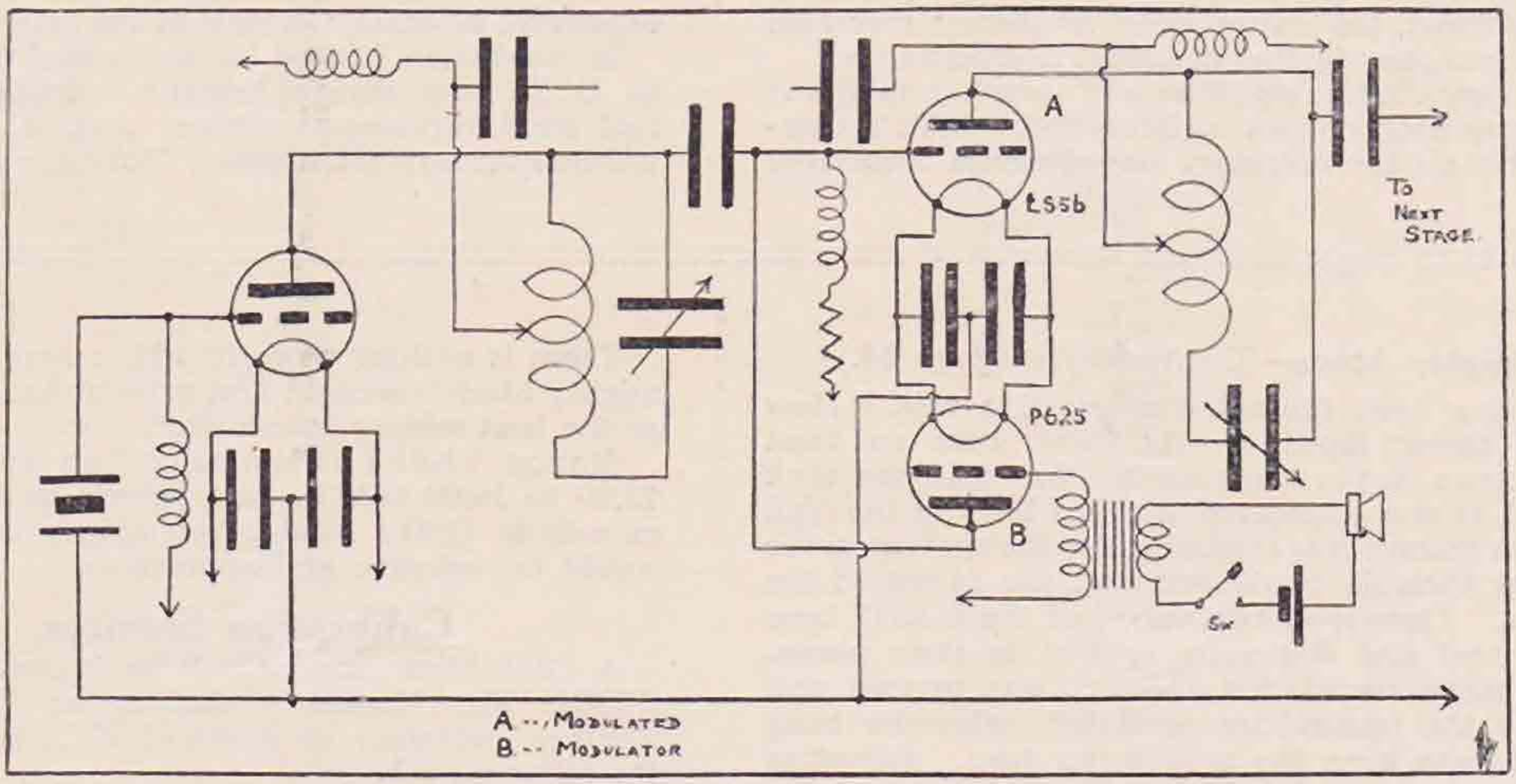
An Aberdonian Modulation System.

By H. J. Powditch (G5VL).

SOME months ago, whilst enjoying the hospitality of a London station, we listened to the 1.75 M.C. phone transmissions floating round that favoured district. This article is not in any way a criticism of either London or the phone there, and the above is only mentioned to explain how the "Fone-bug" was resuscitated after some years' torpor. To tell the whole story, one London station brought the writer to earth with a nasty bump by remarking that he could not understand his remarks over the air owing to a lack of the "B.B.C. Announcer" vocal characteristics possessed by the owner of the before-mentioned station.

For the station who wishes to have phone available for occasional use without great alterations or expense the following scheme is suggested. The total power required to modulate some 100 watts is round 1.5 watts of filament current, and the transmitter is available for either C.W. or phone without adjustment. A switch in microphone circuit is all that is required. These remarks apply to CC sets using buffer or FD stages which are later amplified, but the ordinary 10-watter is convertible on the same lines.

Modulation of 80 per cent. or more can be obtained without speech amplifiers, although these can be used if desired.



Obviously some "mike practice" was required. But, in the present hard times, would it run to the installation of the rectifiers, transformers, valves and dodahs associated with phone work? It would not! A hasty tracing of leads to the lower storeys of the bird cage enclosing transmitter had shown on the ground floor (somewhere about where the tray and sand is usually found) an array of gear which was used to modulate the 10 watts used. After allowing for the fact that some of the gear probably consisted of rotary transformers, either just back from re-winding or waiting to go away for the purpose (a permanent feature of the station), the remainder, brought up on a QRO standard, seemed out of the question. Study of the diagram of a C.C. transmitter disclosed several 10-watt valves in the earlier stages and, whilst appreciating all the virtues of 100 per cent. modulation and two pages of diagrams in QST for the attainment of this, it seemed something might be done to achieve readable phone of fair quality by attacking these low power stages.

Reference to diagram will show that a valve is inserted to act as a H.F. leak upon an early stage. This method will not meet with the approval of the purists—and again let it be emphasised that the method is not put forward as anything but a compromise between simplicity and results.

The affair acts as a H.F. leak upon the input to a following stage. The modulator valve is not worked as a variable grid leak, and the troubles connected with the keeping of filament batteries at high potential from earth do not arise.

The most important point is to find a valve for modulator which will suit the valve used in the following stage. Grid bias will help to match the impedance, but this must not be overdone. The valve should roughly match the G–F resistance of the one following. Leak bias for the modulator is not suitable, and battery bias is required.

For those who may use LS5B's in the modulated stage, P625 will make a suitable modulator.

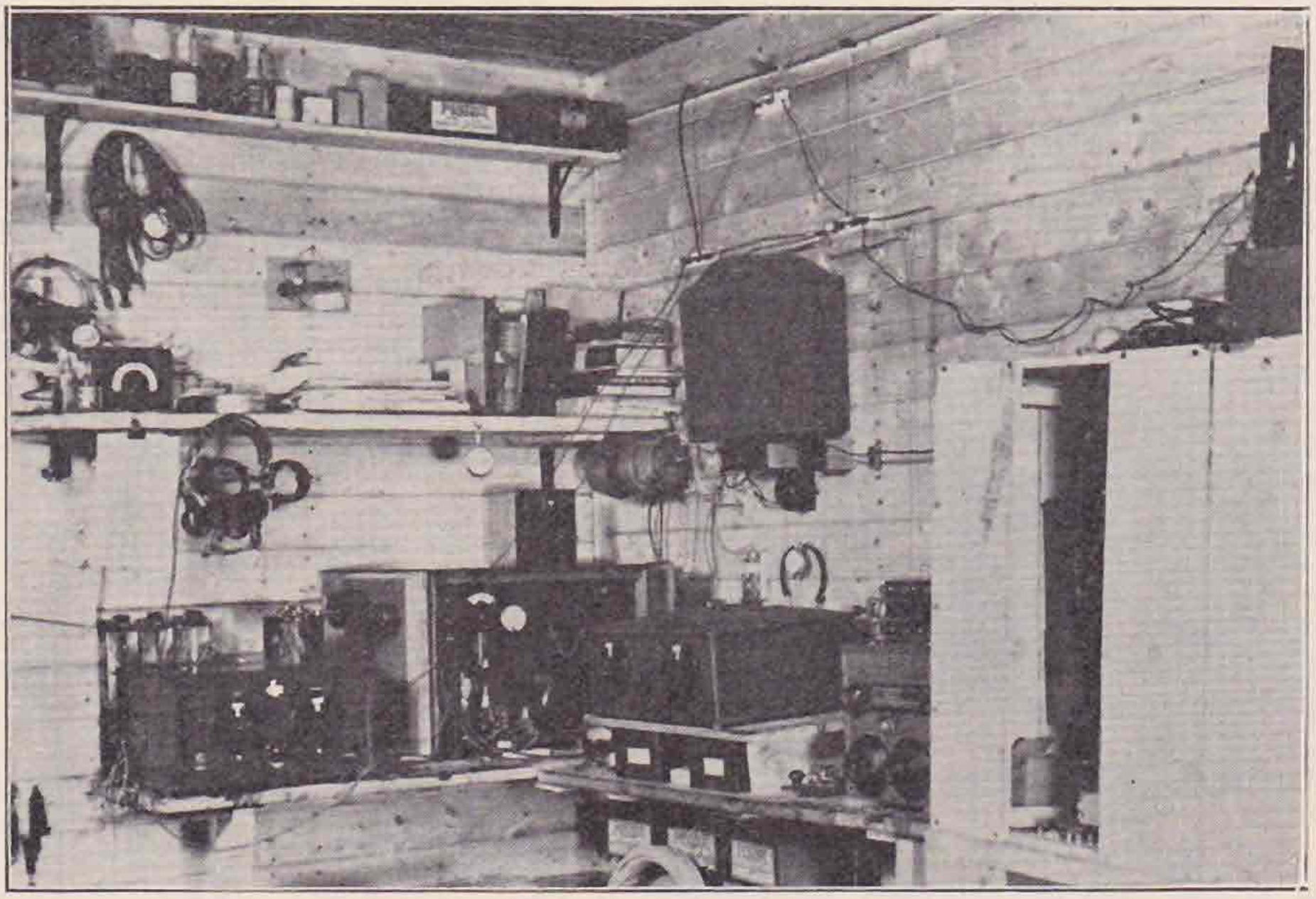
Adjustment is simple. Find the bias which,

(*Continued at foot of opposite page.*)

Station GKN.

BRITISH ARCTIC AIR ROUTE EXPEDITION.

The photograph shows the interior of GKN, which is the base station of this Expedition and is located at Angmagssalik, Greenland—the operator is Captain P. M. H. Lemon.



(Reproduced by courtesy of "The Times.")

The transmitting apparatus is R.A.F. type 57 (modified) and is used for C.W. only with an input of 100 watts from a D.C. generator. Communication is usually maintained with GKM at Aldershot. The transmitter, together with generator, is clearly shown in the picture, and also the two receivers in use—one being an "Eddystone" all-wave four, and the left-hand one a 3-valve SG-V-1 by the same company. It is interesting to note that this station was the medium by which the news of the discovery of Mr. Courtauld was conveyed to the outside world.

The radio apparatus is used for communication with the various sub-camps in different parts of the Arctic, and its vital importance to the Expedition will be understood when it is stated that the meteorological section of the Expedition will remain at the main base on the top of Greenland for a whole year, and this is the first occasion that an expedition has spent a winter at such a high altitude in the Arctic.

At one time GKN was effecting contact with amateur stations, but this has now been forbidden by the Danish Government, under whom the radio apparatus of the Expedition is officially licensed.

An Aberdonian Modulation System.

(Continued from previous page.)

with no speech, will just show a reduction of output in the modulated valve. Then slightly increase bias again till this reduction disappears and output is normal, or as near as it can be got from the bias taps available. This will be about the right condition for a trial, some later adjustment can be made to get the best modulation with various outputs.

It should be noted that the modulator is left permanently connected and the filament is always on. The valve is across the plate circuit of preceding stage, and so will affect the tuning of this stage if switched off or with filament cold. To avoid retuning and to have the phone arrangements instantly available, the LT is kept normally on and only controlled by the on and off switch for the whole set.

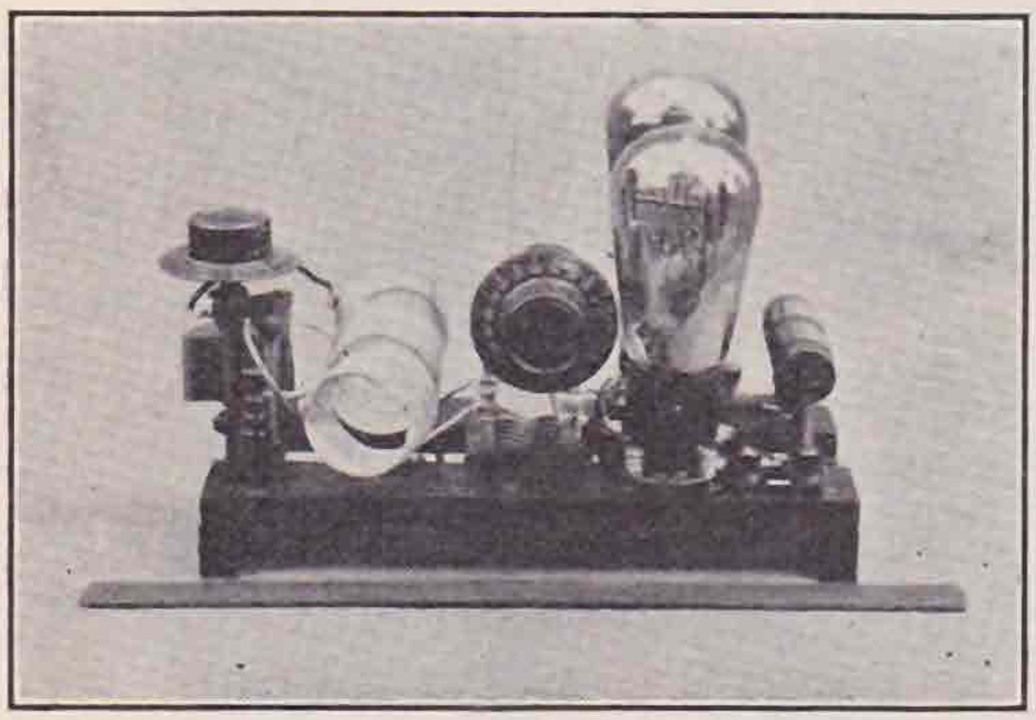
The writer believes that a system of this sort was patented by G2OM in the early twenties, and this fact should be remembered when experimenting on similar lines.

The Mighty Atom.

By Fred Tredrea (VK6FT).

IT was decided to build a miniature transmitter as a novelty for the Annual Wireless Exhibition of the Wireless Institute of Australia (W.A. Div.), held in May, 1931. Although physically small, it was hoped to make the transmitter as powerful as the average amateur outfit, consequently what circuit to use was a matter of some cogitation.

After perusal of a number of wireless publications it was decided that the best circuit for the job was the push-pull tuned plate resonant grid arrangement, which is symmetrical and contains no fixed condensers and a minimum of components.

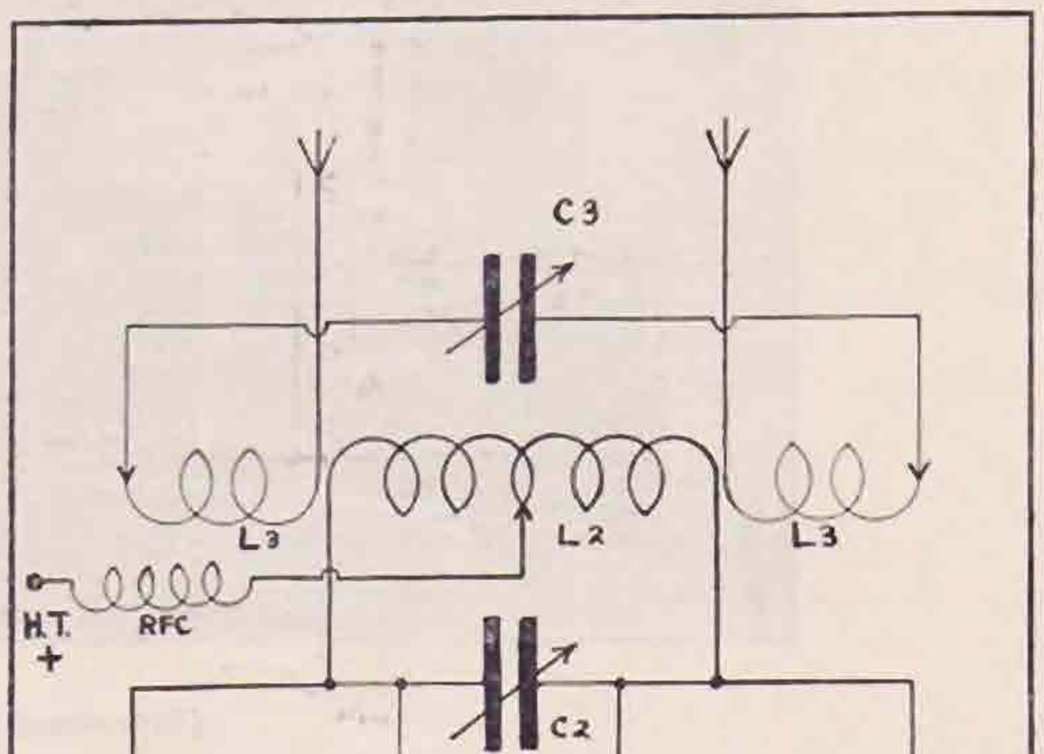


After purchasing the components, including two .0001 mfd. midget variable condensers for tuning the plate and aerial circuits, the whole outfit was laid out and it was discovered that the set could be quite comfortably rigged up on a baseboard 9¼ in. long by 3¾ in. wide; and accordingly the transmitter was duly built to these specifications. The grid coil was made resonant at a frequency slightly lower than the 7000 K.C. band and wound of 26-gauge enamelled wire on 1 in. diameter polished red erinoid, the miniature stand-off insulators supporting the split aerial coils being made of the same material of ½ in. diameter. The grid leak and radio frequency chokes were wound on matched formers of polished black erinoid 2¼ in. long by ¾ in. diameter. Eight miniature terminals were provided, the cap of each being of polished black bakelite and the shanks of 6 B.A. brass rod. Two of these terminals surmounted the stand-off insulators and besides supporting the aerial coils also accommodated the feeders; the remaining terminals were for the key, high and low tension supplies. The ten turn tank coil (7000 K.C.) and the two seven-turn aerial coils were wound 1½ in. diameter of 12 gauge aluminium wire; aluminium was used as it happened to be handy and its lightness was an advantage, besides adding a little "flashness," remembering that the transmitter was chiefly designed for exhibition purposes.

In order to increase the capacity of the tank circuit, a .0001 mfd. fixed air spaced condenser was shunted across the midget variable tank tuning condenser. This was an advantage, inasmuch that it spread the band over the condenser dial a bit more and its terminals were found very handy for mounting the coil and tuning condenser.

The aerial tuning condenser was mounted vertically and occupied only about 1½ square inches at the extreme end of the baseboard between the two midget stand-off insulators. The aerial tuning condenser was fitted with flexible leads and small clips, to enable it to tune either series or parallel.

The tank coil was immediately behind this, then the tuning condenser (half way along the baseboard), then the two valve sockets, and finally three sockets in a line an inch apart, to take the centre-tapped grid coil. The grid leak and radio frequency choke were accommodated underneath the baseboard.



L1. Grid Coil, 60 turns.
L3. Split Aerial Coils, 7 turns each.
C2. Variable Midget Condenser, .0001 mfds.
R1. Grid Leak, Wirewound, 12,500 to 20,000 ohms
RFC. Radio Frequency Choke.
L2. Plate Coil, 10 turns.
C1. Fixed Air Spaced Tank Condenser, .0001 mfds.
C3. Variable Midget Condenser, .0001 mfds.
R2. Centre Tapped Resistance, 60 ohms.
NOTE.—Diameters of Coils, Formers, etc., given in text.

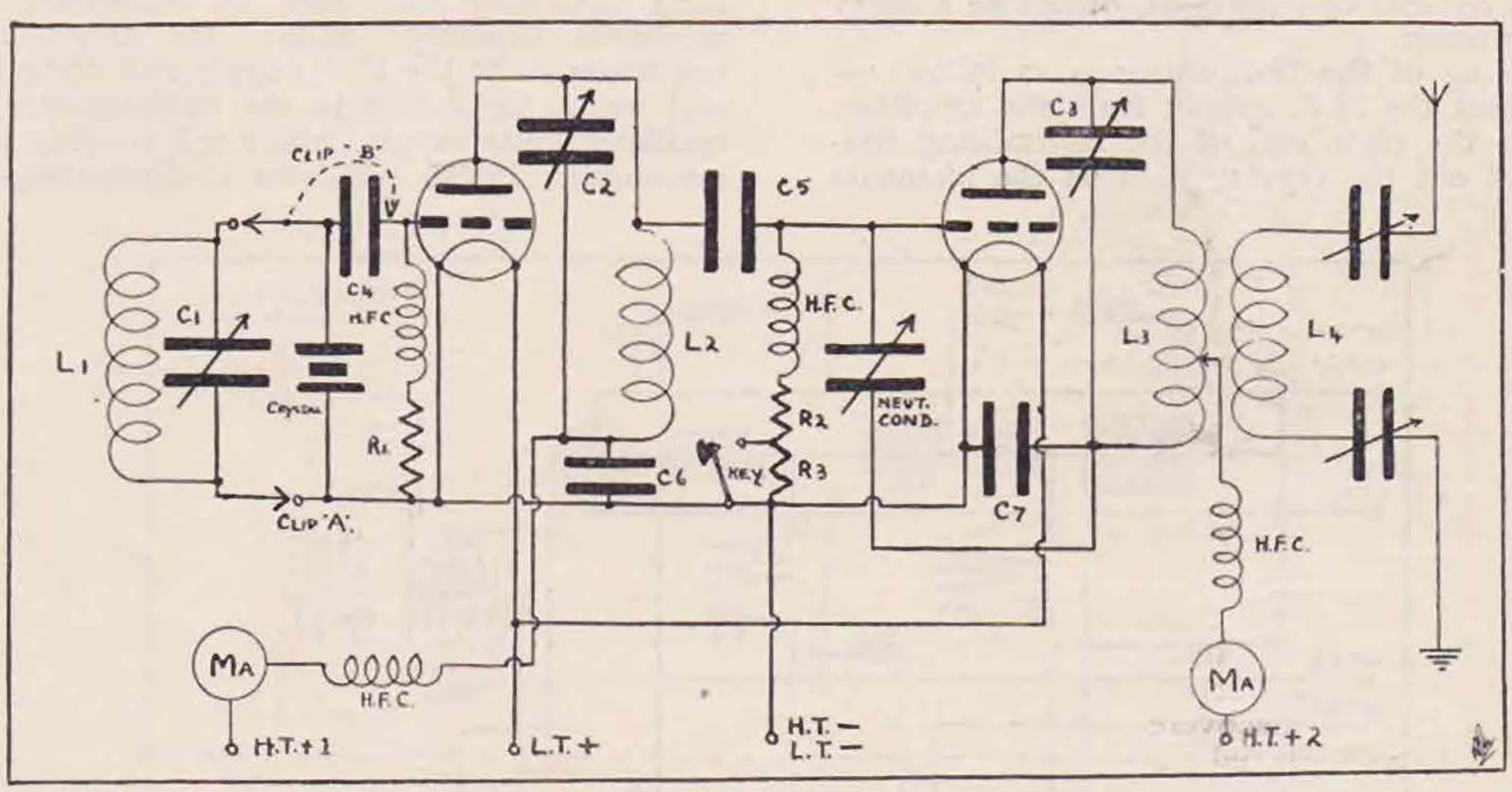
(*Continued on page* 41.)

Harmonic Control of the M.O.P.A.

By J. H. Harker (G6HK).

IN the Bulletin of May, 1930, there appeared an article on the subject of harmonic crystal control by the writer, and the following notes are the result of further work in this direction. They are essentially practical, and no theories are advanced.

The single valve transmitter with harmonic control is undoubtedly efficient for use with low or medium power, *for C.W. only*, and the one at this station worked efficiently for months without adjustment (in the 42-metre band) but it had one drawback (or is it a virtue ?) It was found that not only were defects of power supply, etc., smoothed, but that all attempts at speech modulation met with the same fate, control being too deep.



*C*1 ... ... *·00015 mfd.*
*C*2 ... ... *·00025 mfd.*
*C*3 ... ... *·00025 mfd.*
*C*4 ... ... *·0003 mfd.*
*C*5 ... ... *·0003 to ·001 mfd.*
*C*6 and *C*7 ... *·002 mfd.*
*R*1 and *R*2 ... *10,000 to 20,000 ohms.*
*R*3 ... ... *40,000 ohms.* (*across key*).

It was not desired particularly to use speech transmission, but the subject seemed to offer a good line for research, so experiments were commenced to ascertain if harmonic control could be applied to the conventional master-oscillator-power-amplifier system, first, in order to compare the depth of control with the single valve method, and secondly to find out what benefit would be derived from an oscillator-amplifier circuit, i.e., greater output for a given H.T. supply, and using the same type of aerial.

All the two-valve harmonic circuits that the writer has seen appear to depend on what appears to be harmonic selection, that is, an oscillator working at the fundamental of the quartz, followed by an oscillating amplifier working at the selected harmonic on the desired wave-length, which is controlled by a high-frequency line from the oscillator. The amplifier can work at its own frequency irrespective of the oscillator, the degree of control is doubtful, and in any case the oscillator is doing very little in the way of supplying additional output. In a M.O.P.A. the oscillator not only governs the frequency, but the amplifier is definitely an amplifier, and one obtains maximum efficiency from both valves, as will be shown later on. Normally the oscillator in a M.O.P.A. requires careful screening, but if harmonically controlled, *no screening of any kind is necessary*, which is a decided advantage.

The first consideration is the ratio of oscillator to amplifier, and for the benefit of those who are not acquainted with this circuit it may be said that the ratio is generally accepted as about 1 to 3 *. That is, to control, say, a 10-watt amplifier, a 3-watt oscillator is required. For the amateur of limited means this might be expressed rather differently, as follows : To use harmonic control, what is the *safe* dissipation rate for the oscillator, and will this give adequate control ? Full control can be obtained with a 1 to 5 ratio, and the main consideration is to keep the oscillator working cool, as it must be borne in mind that it is working in a state of constant input at no load, and a valve which can be worked at say, 30 Ma *when being keyed* in a self excited circuit cannot be worked as an oscillator at a *constant* dissipation of 30 Ma.

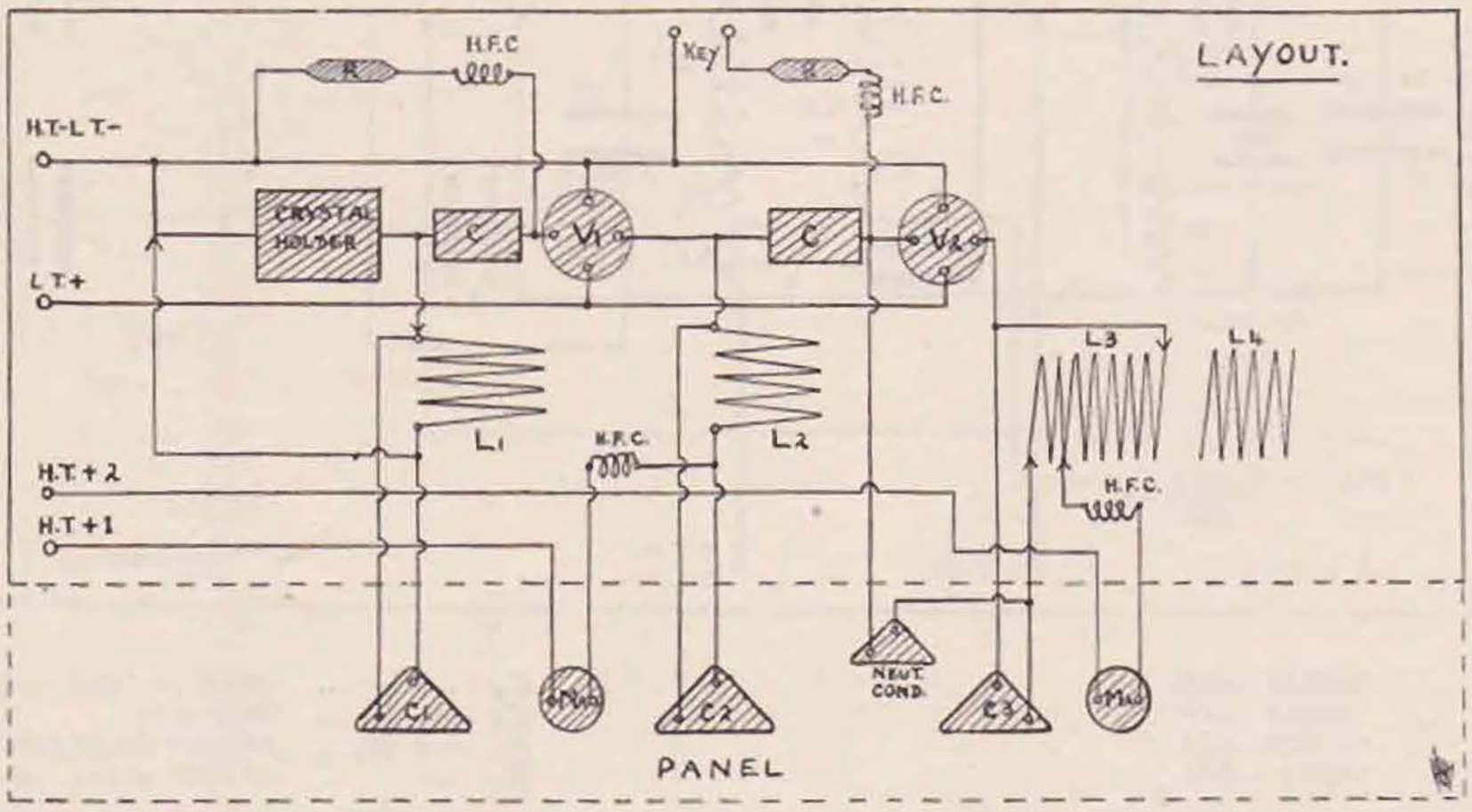
The circuit will be recognised as a conventional M.O.P.A. with the inclusion of the quartz crystal across the grid circuit of the oscillator valve. The values of the condensers are not critical. Various capacities have been tried, and different values

* A ratio of 1-3 is low to aim for, and 1-8 is quite easy to obtain. See G6CJ's articles in the May and June, 1931, issues.—Ed.

of resistances have been substituted, particularly in the oscillator section, with apparently no effect on the ultimate result, i.e., the stability of the oscillator. With regard to lay-out, this was varied considerably during the experimental stage, and the diagram illustrates a compact scheme, all the controls at this station being mounted on a front panel. The coils should, of course, be out of phase with each other, and coupling between the chokes themselves and the coils must be avoided. This can be done by mounting the chokes vertically and the coils horizontally at right angles to each other. All chokes at this station are mounted on valve bases, connections being taken to the filament pins, and the plate and grid pins removed. This is recommended for providing easy interchange of chokes. No special precautions need be taken with the neutralising condenser except as regards spacing of the plates. The one used here is a .0001 mf. midget variable which has been double spaced. If there is a grub screw in the knob this should be covered or enamelled, otherwise a nasty burn may result.

The tuning of the transmitter is as follows :—

Disconnect the H.T. supply from the amplifier, disconnect the plate end of the neutralising condenser, cut out the crystal, turn on the filaments



of both valves, connect H.T. to the oscillator valve and tune this end of the circuit as an ordinary T.P.T.G. into the 42-metre band. For the benefit of the novice and those who have not tried this circuit, resonance is indicated by a minimum reading in the plate milliammeter. The quartz crystal (which may be a spectacle lens, such as is used at this station) should be ground to a fundamental of 126 or other wave-length which gives a strong harmonic in the 42-metre band. A crystal of 168 or 84 metres fundamental is not recommended, as the even harmonic rarely controls.

Now place the crystal in circuit and decrease the grid condenser slightly to compensate for the addition of the crystal and plates (which act as a miniature condenser in parallel with the grid tuning condenser) and listen in the receiver for the harmonic at, say, 84 metres. If the crystal is obviously not controlling, search gently with the plate-tuning condenser and watch for a flick or series of flicks in the plate milliammeter: this will happen when the tuning passes over the harmonic frequency of the quartz. When the crystal is controlling it will be found that the condensers may be varied slightly without throwing the crystal off control. It is not difficult to obtain harmonic control of an oscillator *running at constant input*, as it is doing in this case. The next step is to bring the amplifier in tune with the oscillator. It will be seen that the plate circuit of the oscillator, the amplifier valve and *its* plate circuit form practically another T.P.T.G. circuit, and unless the plate is in tune with the grid it will not oscillate. It might possibly do so in certain circumstances, but certainly not when it is properly neutralised. Herein is the great advantage of this particular circuit—the amplifier will only work at the frequency of the oscillator, and if the oscillator is controlled by the harmonic of the crystal a constant frequency is assured, and no shielding of the oscillator is required.

With the oscillator running properly the neutralising condenser may now be connected, set at minimum capacity. Rotate the amplifier plate condenser (with the H.T. supply still disconnected) and watch for a flick in the milliammeter of the oscillator plate supply, which will roughly indicate resonance. If the oscillator is dissipating 2 or 3 watts a glow will be obtained in the bulb of the wavemeter. Now apply the wavemeter to the plate circuit of the amplifier *with the H.T. supply still disconnected*. With a low power oscillator a faint glow will be obtained, but with a 5 or 6-watt oscillator it will be quite bright. Now increase the capacity of the neutralising condenser slightly which will turn out the glow in the wavemeter, retune the amplifier plate condenser slightly and the glow will again be observed in the wavemeter, but less brilliant than before, or, in the case of low power, it may have disappeared. This should be done until there is practically no r.f. in the plate circuit of the amplifier. A simple test for this, if there is no visual indication, is to listen to the harmonic of the oscillator in the receiver, and then sway the aerial feeders violently or grasp one of them in the hand. If the note varies, then the oscillator is not properly neutralised, or there is coupling between the oscillator and the aerial circuit. If the latter

is the cause, re-arrangement of the coils may be necessary.

With the key up (the resistance across it will supply a few milliamps to the amplifier) the amplifier plate supply may be switched on. If the key is depressed when the power supply is switched on and the amplifier is *not* in tune with the oscillator it will do the amplifier valve a lot of no good and probably blow the H.T. fuse. With the amplifier plate supply reading, say, 5 or 6 milliamps, rotate the plate condenser slightly and see if the milliamps are at minimum. When a minimum reading has been obtained it is safe to press the key, but before doing so a slight load should be placed on the valve by roughly tuning the aerial circuit. When the key is depressed there should be a reading in the aerial meter sufficient to indicate that the amplifier is oscillating. The milliammeter will also indicate this, but if the needle shoots across the dial and hits the side of the case with a rattle, release the key quickly, as the circuits are obviously not in resonance, and the neutralising requires further attention.

When the amplifier is oscillating satisfactorily it will be found that the spacing wave and the marking wave are not together, and the frequency of the oscillator *may* have varied slightly so that the crystal is off control. Usually it will be found that the oscillator is still crystal controlled, but on pressing the key the marking wave is not, and final tuning is now required for that clear continuous note, slightly louder when the key is pressed, which indicates full crystal control. This is accomplished by means of the neutralising condenser, and the following, in the writer's experience, is the golden rule: When the marking wave is slightly above the wavelength of the spacing wave, increase the capacity of the neutralising condenser slightly until the two notes coincide—if the marking wave is *below* the wavelength of the spacing wave, decrease the capacity of the neutralising condenser until the desired result is obtained. When the note is clear and continuous, whether the key is up or down, final adjustments may be made to obtain maximum output, and if the aerial has been coupled to the transmitter as directed, the aerial meter will indicate this. Whether a high-frequency choke is used in the plate supply to the amplifier or not, final tests should be made by varying the position of the clip conveying the H.T. to the amplifier plate coil. Theoretically, this clip should be somewhere near the centre, thus dispensing with the choke, but it will be found in practice that there is one position which will materially increase the output as indicated by the aerial ammeter. When varying this clip, slight retuning of the amplifier plate circuit and the aerial circuit will be necessary, but the note can easily be followed, and no variation in tuning of the oscillator circuit should be necessary. The plate coil in use at this station consists of eleven turns of No. 12 gauge copper wire, self supporting, about 2½ ins. in diameter, and this coil and the aerial coupling coil are mounted on two glass rods. The best position for the H.T. clip appears to be two or three turns from the end of the coil (not the plate end), and a coil of small diameter is recommended as giving greater latitude in adjustment. Once the transmitter has been finally adjusted it will be found that it is quite independent of the aerial tuning. The output at this station when using a 10-watt amplifier is .45 amperes, and the aerial tuning can be varied from minimum to maximum, or the aerial cut out altogether, without varying the frequency of the transmitter, which, when properly tuned, will give results equal to an oscillator-frequency double-amplifier circuit, and be equally stable.

Various combinations of valves have been tried, with success, a pair of CT25X's giving great output. An LS5 is ideal as an oscillator as it may be run cold. Low power receiving valves work equally well so long as they are not over run, and at present an old DFA is being used at this station as an oscillator. The circuit, using different voltages and valves, has been thoroughly tested and results compared with the ordinary T.P.T.G. circuit, which show the superiority of the M.O.P.A. as regards output for a given input, and corresponding increase in signal strength and range.

Not every amateur possesses two milliammeters, but if the plugs are arranged in the plate supply to each valve the meter can be transferred to the amplifier after the oscillator has been adjusted. Two meters are useful, and enable one to see exactly what is happening, as, for instance, it will be found that when the amplifier is keyed, the input to the oscillator will normally increase slightly, indicating a slight load on the oscillator valve, but this is not important so long as the load is not too great, otherwise further neutralising may be required.

A glance at the circuit will show that it may also be used as an ordinary M.O.P.A. if the crystal and holder are removed (but a "can" *may* be required for the oscillator !); further, if clip "A" is taken off and clip "B" taken across the grid condenser, the circuit becomes an ordinary C.O.P.A. for fundamental crystal work (useful for 168 metres).

The transmitter as illustrated has been in use for nearly 12 months, and is most flexible for experimental work (the purpose for which our licences are granted), It has been tried without the crystal for comparison, with disastrous results to the quality of the note, as the power supply is all mains (D.C., somewhat rough), with no smoothing, and unless crystal controlled the note is described as T6 to T7. Once tuned, the circuit will stay "put"; the extra output is well worth the few additional components, and the amateur who tries it will not care to go back to the single valve self-excited circuit. There appears to be no reason why a 50-watt amplifier should not be controlled by this method, and an attempt will be made when greater power supply is available, as owing to the thickness of the quartz there is little danger of fracturing it.

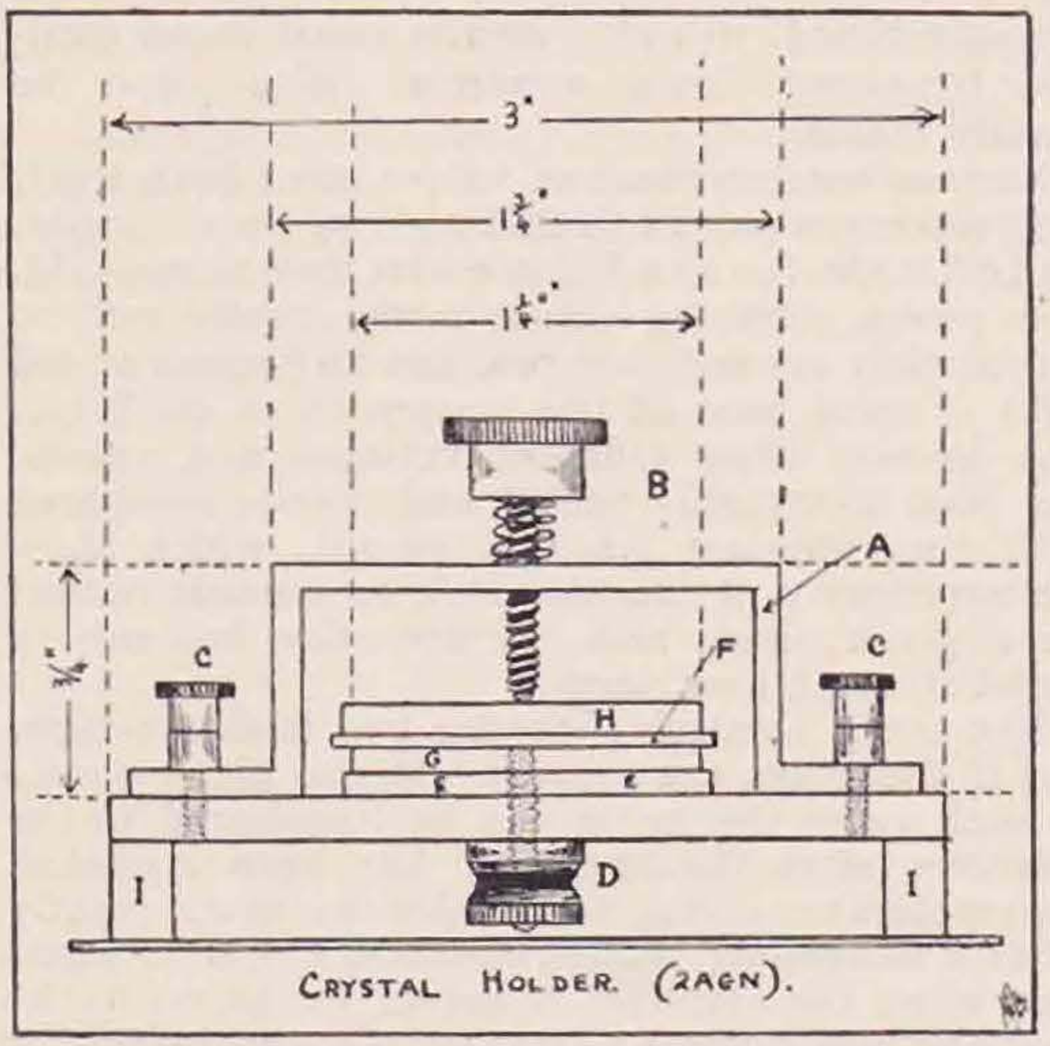
Thanks are due to Mr. Livesey, of G6LI, for his collaboration in a long series of tests extending over a period of several months during which valuable information regarding harmonic control was obtained. He was present at this station once when the drastic test was applied of rocking the whole outfit when working on full load to see if the note could be varied. In spite of the danger to the valves it withstood the test !

In conclusion, apologies for the length of these notes are qualified by the hope that they will assist in bringing to others the report "Ur sigs fb cc T9 om."

An Adjustable Crystal Holder.

By C. S. Brown (2AGN).

It seems that some method whereby the pressure of the top plate on a crystal may be varied is



CRYSTAL HOLDER. (2AGN).

highly desirable (and in some cases an air gap can be used to advantage) as it enables one to change frequency slightly when interference is bad. The holder to be described meets these requirements and is very easy to make. The material required is an ebonite base 3 in. by 2in., two pieces of $\frac{3}{16}$ in. brass 1$\frac{1}{4}$in. square, one piece of $\frac{1}{8}$in. brass $\frac{1}{2}$in. by 4$\frac{1}{2}$in., terminals and some thick felt. The figure will give the general outline. First of all, bend $\frac{1}{8}$in. brass, as shown at (A), drill and tap 2BA to carry adjusting screw and spring (B), then drill hole at each end and fasten down with terminals (C). Drill and tap 4BA, one of square pieces of brass, screw in terminal shank (D) and lock with nut. Grind top face of brass as level as possible and also grind the other square plate. Cut two pieces of the felt about 1$\frac{3}{8}$in. square, and in centre of one (E) cut a small hole for terminal shank and nut (D) to pass through, and fasten to base. Cut a hole in the other piece of felt about 1in. square, depending on the size of the crystal (the hole should be about 1/32in. bigger than the crystal). Lay this (F) on bottom plate (G), insert crystal in the hollow, place plate (H) on the top, and tighten down screw. Insert two spacers (I), and the job is complete. This holder is quite dustproof and has been used at this station for three months without cleaning (a necessary job every three or four days with an open holder) and has given every satisfaction. The maximum air gap possible with holder in use here is about 1/32in., but if thicker felt were used a larger air gap could be obtained.

Aerial Switching.

A novel scheme for aerial switching is suggested by Mr. Lucas (G2OI) giving a great variety of tuning circuits.

The diagram is self explanatory. The switches are of the well-known D.P.D.T. porcelain type. Two G.R. insulators act as supports for the meters, and also the aerial on feeders; two more hold the serial coil.

The whole outfit is mounted on three-ply and wired with No. 10 s.w.g.

The idea is simple, inexpensive and extremely low loss.

Some of the possible combinations are given in the table below, others will no doubt suggest themselves to the reader.

No. 1 at A. No. 2 at A. No. 3 at B.—No capacity in circuit.

No. 1 at C. No. 2 at C. No. 3 at B.—Series tuning.

No. 1 at B. No, 2 at B. No. 3 at C.—Parallel.

No. 1 at C. No. 2 at C. No. 3 at A.—Series parallel (one method).

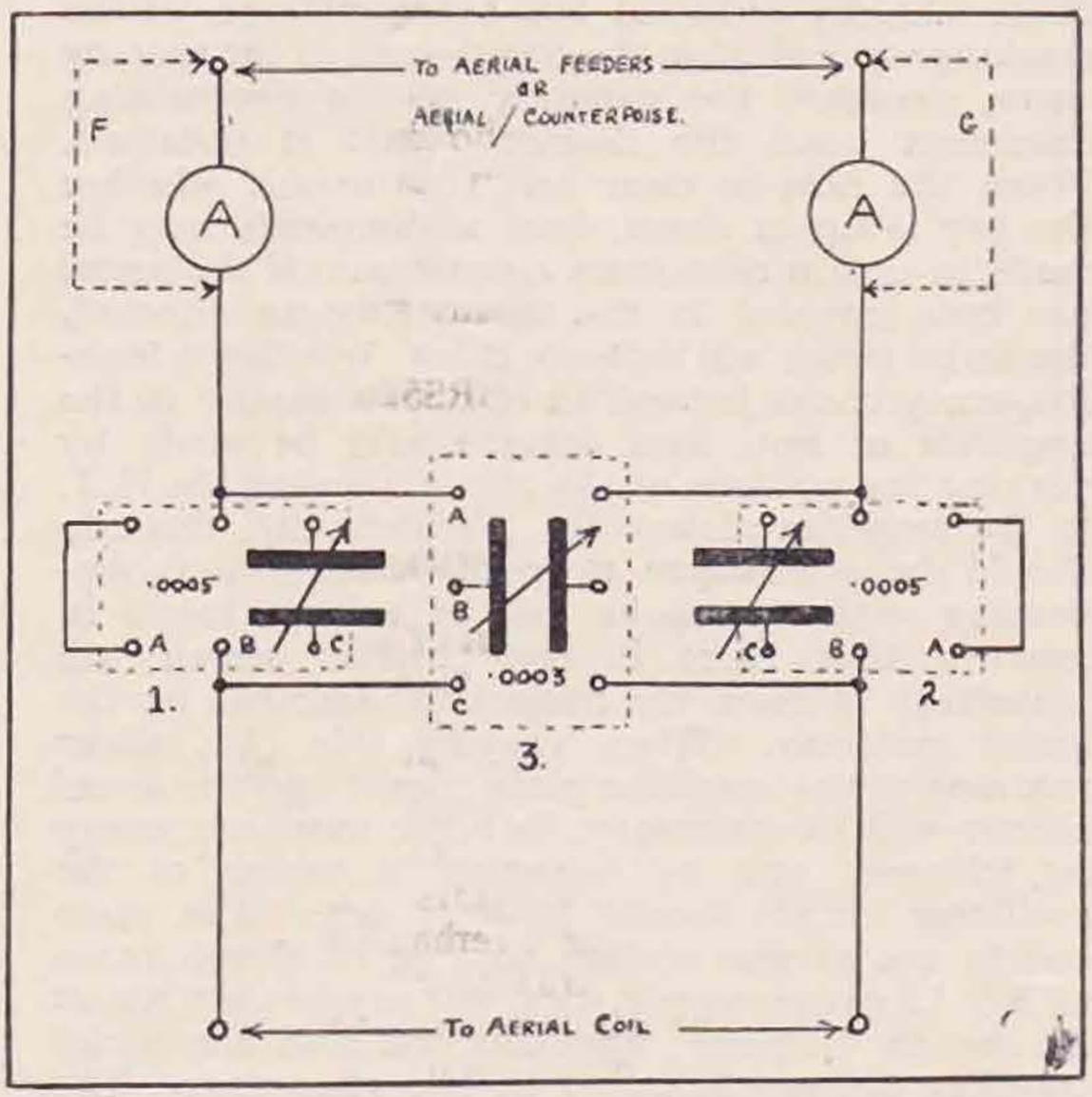
No. 1 at C. No. 2 at C. No. 3 at C.—Series parallel (two method).

No. 1 at C. No. 2 at A. No. 3 at B.—Aerial tuned. Counterpoise untuned.

No. 1 at A. No. 2 at C. No. 3 at B.—Aerial untuned. Counterpoise tuned.

The dotted lines F and G are wires for short circuiting the meters when necessary.

If feeders are used, the main leads should be kept equidistant.



Stray.

BRS486 is now G6GV (Barnfield, Prestwich, Lancs) and welcomes reports.

Contact Bureau Notes.

By H. C. Page (G6PA).

WHILE very little material has been received this month there is one bright spot, so far as 28 M.C. is concerned. ZL2BG sends a full description of his 28 M.C. apparatus, and also some very interesting reports he has received as the result of a number of "CQ" calls on the band. On March 29 he was working all the morning, and received two reports from stations in France. One from F8PQ, who reported his 28 M.C. signals pure DC, nearly crystal control R3, but fading to nothing. The other report comes from F8GW, who heard his signals at 23.00 G.M.T. QSA3, R3 to R5.

This is the most interesting report from abroad so far received this month. VU2FX sends a report for the Indian stations, as usual, but apparently they are not having much success just now, apart from the reception of a few commercial harmonics, their chief DX seems to be fan motors!

BERS14 at Ambala reports that up to May 29 only commercial harmonics were heard, but that on the 30th a station with a T2 note was heard at QSA2 with very bad fading, and interference. The first letter of the call sign was "S" but the remainder was lost. On changing to 14 M.C. the signal was inaudible.

VU2DR says he has heard nothing at all on 28 M.C., not even the usual harmonics from commercial stations.

VU2GD and VU2FX are both off the air for the time being.

Turning to matters nearer home, I regret to have to report that G5CV is afraid that he will not be able to carry on the Television Group unless more support is received very quickly. This seems to me to be a very sad state of affairs. Surely there are some men in the Society who are interested in the subject. Television is still in its infancy and must offer many opportunities for the exercise of ingenuity, both in operation and design.

G2ZN is unable to send any sunspot report this month as he has been away on holiday. He asks me to point out that it is BRS520 who is assisting him in his observations, and not BRS530, as stated in last month's notes.

Group Reports.

28 M.C. Work.

G6VP, Group Manager.

As I had foreseen, 28 M.C. is again claiming the attention of its erstwhile supporters, and one station after another reports progress. It is pleasing to note, also, that in most cases apparatus that was used in previous years and shelved during the off season, is being overhauled, and in many cases completely new transmitters are being built.

During the month a new British record of reception has been made, which should stimulate the energies of all who have receivers that will operate on this frequency.

On all other bands, at least the lower frequency bands, nothing now of any outstanding nature in the reception line seems left; but on 10 metres—well, amateur radio is still chock full of possibilities, and it is up to anybody to make history.

The record reception was made simultaneously by two stations who both were listening for CE3CH to a pre-arranged schedule. This was on the 10th inst. at 19.30 G.M.T. The stations claiming this honour are G6WN and myself.

It is of interest to note that the brothers G6WN and myself live within six miles of one another, and it may be, therefore, a case of more or less local reception. Whereas they received the Chilian station at R4 here, his signals were a full R7, and so good and stable that I called my second operator and passed her one of my ear-pieces.

The WN's were using an all A.C. three-valve set. I believe it's an O-V-2; here I was using a conventional Reinartz O-V-1, but with A.C. valves from D.C.

Their aerial is a 14 M.C. $2/2\lambda$ inverted L, with approximately $\frac{1}{2}\lambda$ on the perpendicular and $\frac{1}{2}\lambda$ on the roof. In my case my aerial is just over $\frac{1}{2}\lambda$ semi-vertical.

The WN's were, unfortunately, unable to connect. Here I had not completed my new transmitter then, so a unique opportunity was lost.

Signals and harmonics of 14 M.C. stations are now audible every day on 28 M.C., and it is to be hoped that tests will soon be arranged.

A new International 28 M.C. Group has been formed, and I feel sure that the tests they are running on September 6, 13, 20 and 27 will receive our wholehearted support. Please make a note of these dates and book them up solid for our friends and, incidentally, for yourselves.

The International 28 M.C. Group at present consists of:—

Capt. de Lisle Carey, VU2FZ.
J. C. White, VS7AI.
E. A. Bramwell, VS7PK.
A. M. Rahim, VS7AP.
J. S. Nicholson, VU2JP.
S. F. Sharpe, BERS14.
A. Weston, BERS52.
C. D. Connerton, VU2FX.

Further details will be sent to all interested as soon as received.

Group 1*B*.—G5SY reports no active work yet by any of his members, and he also wishes to correct the month they would like the tests to be held in. They think that March should be fixed for these.

Group 1*C*.—The only two stations active in this Group so far seem to be G6WN and G6VP.

G6WN have done a lot of work and send in the following log:—

6.7.31—19.45 G.M.T., heard EAM, QSA 5, R6, T6.; 20.00 G.M.T., heard CT1BG, QSA 3, R5, T 7.; 20.30 G.M.T., heard CT1AA, QSA 3, R3, T9.

10.7.31—19.30 G.M.T., heard CE3CH, QSA4, R4, T9.; 19.50 G.M.T. till 20.30 G.M.T., heard CE3CH, QSA3, R4, T9.; 21.15 G.M.T., heard CE3CH, QSA3, R3, T9.

11.7.31—18.08 G.M.T., heard WSC, QSA5, R5, T4.; 19.25 G.M.T., heard CT calling EU2HL, QSA3, R3.
12.7.31—11.25 G.M.T., heard EAM, QSA7, R7.
13.7.31—18.45 G.M.T., heard FYQ, QSA4, R6, T7.; 19.11 G.M.T., heard 1RR calling PDSY and SUZ, QSA3, R4, T6.; 20.30 G.M.T., heard EARCO, QSA4, R5, T4. Also three fone stations.
14.7.31—18.35 G.M.T., heard CT1BG, QSA3, R5, T7.; 19.05 G.M.T., heard HB9P? calling SU1AA, QSA2, R3, T6.; 19.20 G.M.T., heard UO? calling CT1BG, QSA3, R3, T9; 19.52 G.M.T., heard FYQ, QSA4, R5/6, T7; 20.40 G.M.T., heard CT1AA, QSA4, R4, T8.

G6VP has heard a good few harmonics, including FYQ, EAM, CT1AA, and a PAO station has been QSO G2JU and G6HP. At last he has got a "locked" amplifier going that seems reasonably efficient and that does "stay locked." In common with other experimenters on this band he found difficulty in controlling much energy when using a 3.5 M.C. crystal. This was found to arise from the fact that the grid circuit of the P.A. is so far out of resonance on account of the excitation already present through inter-electrode capacity, but by coupling the plate coil of the last FD tank, closely and still further deresonating the grid circuit of the P.A., it was found that good and stable control could be obtained.

G5VB joins this Group and is again on the air every Sunday on this wave.

Group 1F.—Although there is no report to hand from this centre. I have heard from G6HP direct. He has still further improved his apparatus, now using a Colpitt's oscillating amplifier. He states that indications point to much greater efficiency and output than with the conventional T.P.T.G. He is regularly operating Sundays and week days during the early evenings.

Fading, Blindspotting, and Skip.

G2ZC, Group Manager.

Owing to a mistake I must apologise for no notes having appeared last month, and I trust no inconvenience has been caused to either Group 2A, 2B, or any reader of our notes.

Group 2A.—G6MB thinks that gravitational forces of the sun and moon cause tides in the atmosphere, consequently the heaviside layer cannot have a true surface! He also states that weather conditions have *no* effect whatever on wireless signals! (If HL is effected by tides in the atmosphere, how, therefore, has atmospherical condition no effect on wireless signals?—G.M.)

G6BM and BRS473 support the sunspot theory, while BRS426 and G6NK support the "Tide" theory.

BRS504 suggests that the higher the frequency, the nearer to the vertical is the propagation angle.

(As four members support the "Tide" theory, can we have a Group discussion on this, the results to be published in C.B. notes?—G.M.)

Group 2A (report June, 1931).—G6MB suggests tides to a limited extent in the heaviside layer, with which theory BRS504 agrees.

BRS426 and BRS473 both think that there is only one layer that need be considered, but the rest of the group disagree.

G6MB finds points of maximum signal strength at approximately 1,500 and 3,000 miles and suggests these may be focus points for two separate layers.

Group 2B.—G2ZC wishes to thank G2IM for having acted so efficiently during the former's two months' absence.

Regarding the Group's earthquake data, already published, CT1BK forwards an interesting report, supporting the Group's finding in every way. We have been trying to find out if an earthquake gives previous warning by means of W/T, or whether the effects are simultaneous to, or come after the quake. It would appear that no previous warning is given, and that the effects so often noted by the Group come either with, or immediately after the earthquake. It has been suggested that the Group furnish a report, stating how each member would set about "curing fading," and G.C. will publish a summary of the methods to be employed.

G6YL has been working on 14 M.C. exclusively, and reports not only good DX, but a large number of local G stations as being not only audible, but also workable, and G6PP supports this. G6YL sends some interesting notes about the British earthquake, and CT1BK about the one in Portugal, so the group are having plenty of opportunity of gaining experience "on the spot," and G.C. has an offer of all available data from logs, of a station in India, whose co-operation is gladly accepted. G2IM sends a long, intricate report, summarising points about the heaviside layer, for and against each point.

Our honorary member, ex-CT1BL, sends the Group a circular report, which is of particular interest to the Group, regarding conditions in Brazil. G2ZC, having been on holiday, has nothing to report, but has brought home a new receiver which delights his heart on 7 M.C.

2 M.C. Work.

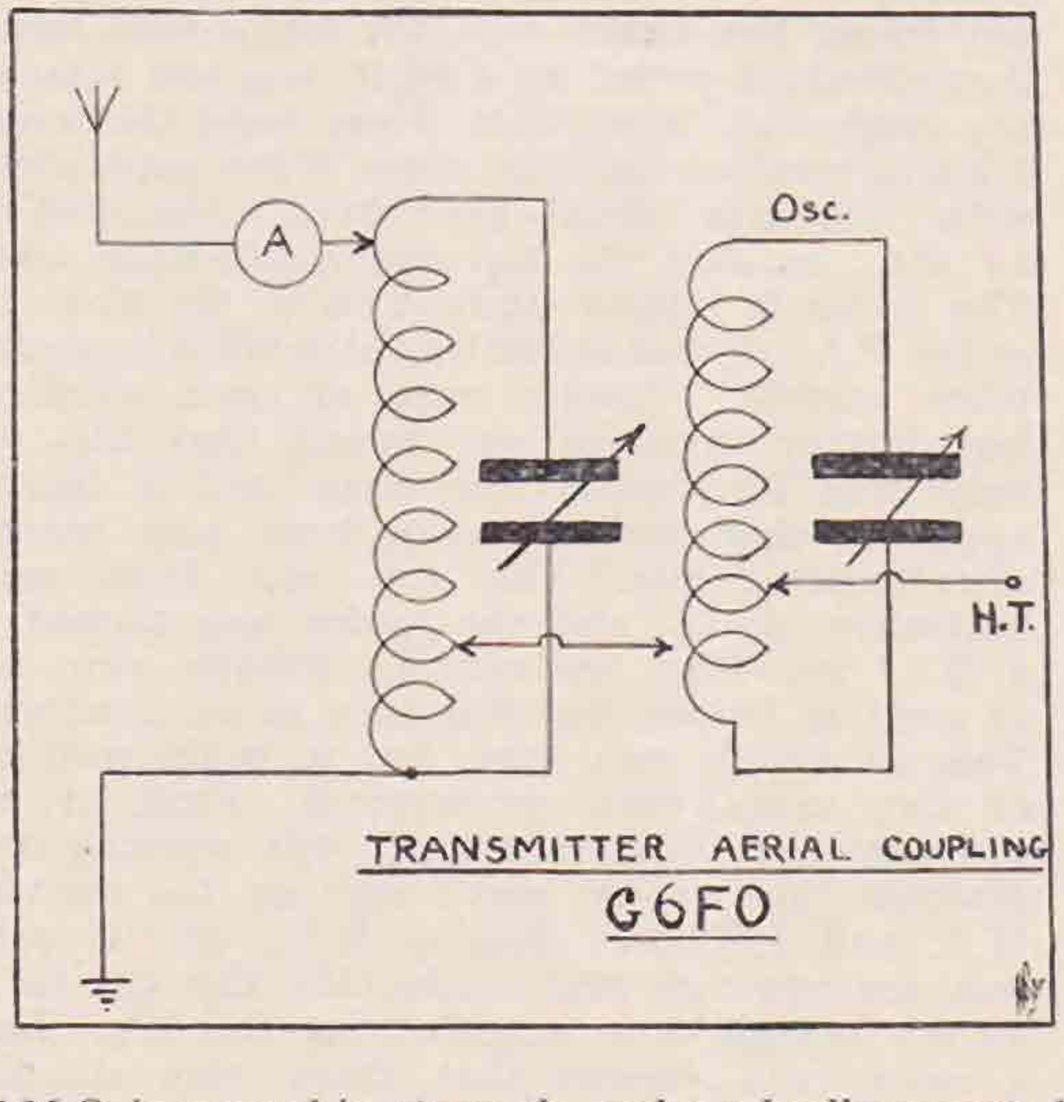
By G5UM, Group Manager.

Although the present period marks the height of the so-called summer season, activity in Group 10A does not slacken off. 2AZQ, however, has had to resign owing to pressure of business, and his place is taken by another Yorkshire station, G2FS, of Hull.

G6FO sends some very interesting material about his system of aerial coupling. He uses a separate aerial coil with the antenna and counterpoise tapped on to its ends. A tapping is taken from a point on this coil to the plate end of the oscillator coil, the two windings being well spaced so that their fields do not interact. The tapping points are so arranged that maximum radiation is obtained for minimum plate current, the aerial and oscillator coils being tuned exactly to resonance. On the receiving-side G6FO has put in a screened-grid valve as detector, and finds it excellent as low as 10 metres. The screen voltage is very critical, and should be about 15 or 20 volts. He uses a 60-volt H.T. battery, with a 50,000 ohm resistance in series and an earthing condenser of .01 mfd. A value of 5 megohms is necessary for grid leak. A noise-filter circuit is used consisting of an old L.F. transformer, with its primary and secondary windings in series, tuned by a .001 mfd. condenser, all in the plate circuit of the last L.F. stage. All hum, a high percentage of A.C. notes and most QRN are eliminated, and the resultant reduction

of 30 per cent. in signal strength is certainly found worth while. Readability is increased and even on the 7 M.C. band an R1 signal can be made QSA5. *Sketches are given.*

G5RX had an interesting if "shocking" experience on Earthquake Day, June 7. He was working on the 7 M.C. band at the time and was in communication with OZ7K at the moment of the tremor. OZ7K reported his signals to increase from R7 to R9 at that instant. It was noted that just before and after the tremor all signals on



7 M.C. increased in strength, and gradually reverted to their normal intensity about 15 minutes after. On 2 M.C. G5RX has been active, but reports that static has been particularly bad. The majority of contacts have therefore been made in daylight.

After a five months' QRT, G2FS has now found time for radio again. At the moment he is considering the advantages of various types of transmitter for the 2 M.C. band and will start up with 5 to 10 watts input very shortly.

BRS164 observes that QRN has been worse this year than for many years past. Distant stations remain at good strength, if their readability is reduced.

G5UM reports similar conditions, with plenty of distant stations, but plenty of static. The latter has seemed bad on all ranges.

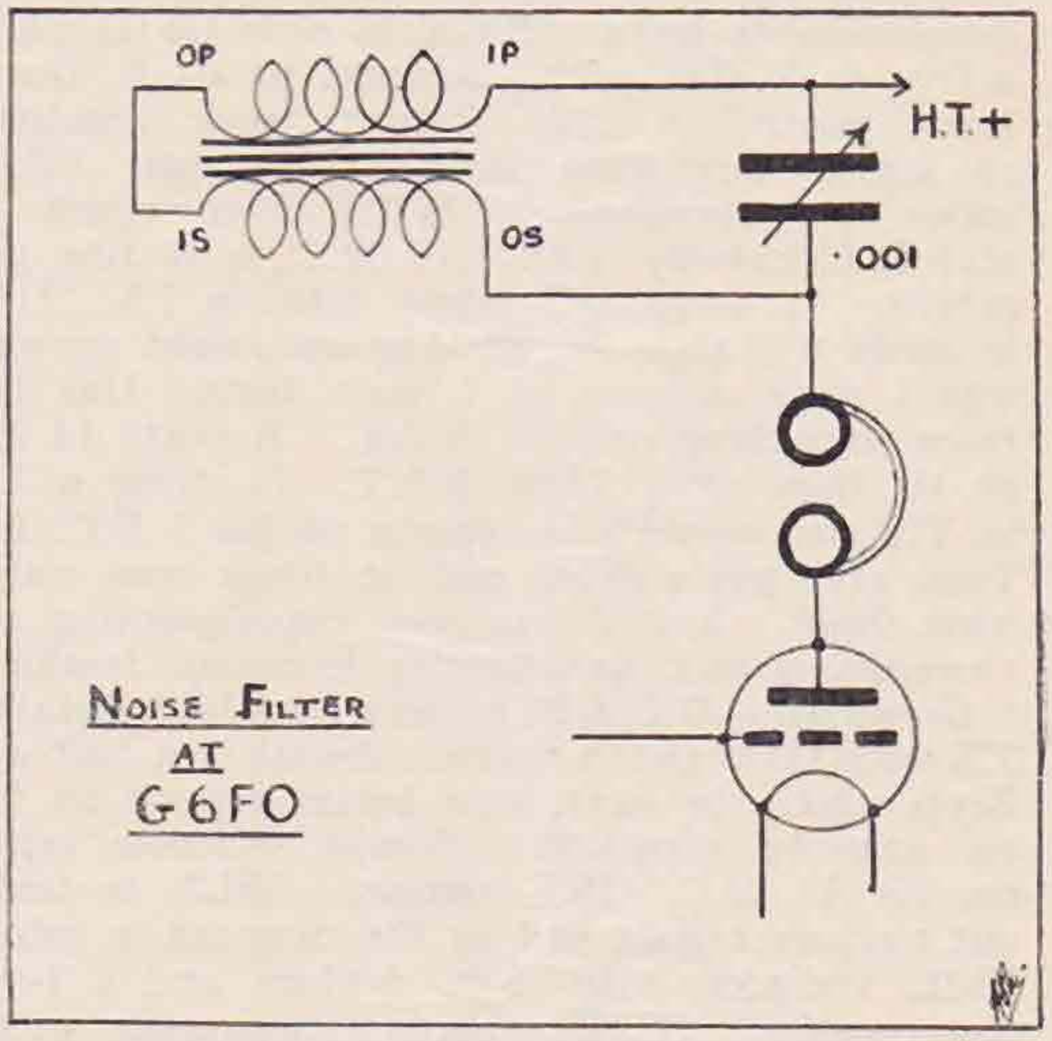
QRP Work.

By G2VV, Group Manager.

As mentioned last month, Group 8F was being formed by G2TJ. This group is now complete and below will be found their first report. All groups with the exception of 8C report this month, which is splendid, considering the time of the year. It is hoped that ZD2A, in Nigeria, will join this section soon. We still need foreign members, so come along B.E.R.U. men.

Group 8A.—G.C. G5RV has been testing QRO against QRP. During the recent earth tremor he was in contact with CM and noticed nothing unusual and the QSO was carried out as usual during the tremor period. G5VB is working on inputs of 1 to 3 watts and is obtaining good results. G2WP is rebuilding, but sends interesting note that F8WQ in Tours has been QSO W on .24 of a watt. G6MB is working on 3 watts and is getting fine DX towards the QRP Trophy. G5YH is using push-pull C.O.'s on 7 M.C. Is awaiting a 14 M.C. crystal and will report results later. G2ZQ active with QRP on 7 M.C., using T.P.T.G.

Group 8B.—G.C. G2VV has been active on 7, 14 and 1.75 M.C. Reports conditions not so good on 14 M.C. as last month and 7 M.C. still poor. 1.75 M.C. seems to have fallen off a little during the daytime. The 33-ft. V.F. Hertz is being loaded to enable a comparative test on 7 M.C. against 66-ft. V.F. Hertz, and will report on this later. G2OA resigns from QRP as he leaves for the realms of QRO. We are sorry to lose such an enthusiastic member. G5RX takes his place. He uses QRP and C.C. and requires particulars of controlling 7 M.C. crystal on 14 M.C. G5CM is working on 7 and 14 M.C. with 3 to 6 watts. Has been getting good results with a Triotron 2-volt H.F. valve in TX and 2 watts input. Says conditions steadily improving, especially on 14 M.C. Raises an interesting question concerning 1.75 M.C. When his TX is tuned to this band he gets a dead spot in the receiver on that wave even when the TX is switched off. The RX and TX are 10 ft. away from each other. Why is this? Can G5UM assist? Is using a 66-ft. V.F. Hertz for 1.75 and 7 M.C. work as 33-ft. V.F. only gives satisfactory results on 14 M.C. G6SO is using a P625 valve in the Ultraudion TX and gets .4 in aerial. Has put up a new 40-ft. mast and notices considerable improvement in reports received. [NOTE.—G5CM



contends that a high aerial is the secret of good QRP results]. 2ANU has been listening on 1.75 M.C. and 7 M.C. Reports good DX reception on 7 M.C. in early mornings. 14 M.C. good for DX at night, whilst he sends in a good log of G's heard on 1.75 M.C. 2AHB has passed his Morse test and awaits full permit. Has built new Ultraudion and intends to use a PM6 as oscillator at first and later a P625A. His input will be 1 to 5 watts. Has put up 33-ft. V.F. Hertz. His report on reception conditions are the same as G2VV, as the two QRA's are only a mile apart.

ARE YOU COMING TO CONVENTION?

Group 8D.—G.C. G5MR has done little work, but says 7 and 14 M.C. conditions seem very poor. Complains of QRN, quick fading and dead periods. G6BU also reports all conditions very poor, although 14 M.C. DX has been worked with 5 watts and a V.F. Herts 65½ ft. long. G5QY continues his wonderful DX work on 14 M.C. with 5 watts and is easily the best QRP station for DX work. It is worth noting the following. In a QSO with ZC6JM he reduced his input to 1.8 watts (180 volts at 10 M.A.) and was reported R6-7 QSA 5. With 0.72 of a watt he was R3-4 QSA4. During the QSO a severe thunderstorm took place at G5QY's QRA and he says that in some way this may have been the reason for the amazing reports. He, like G2VV, cannot seem to work South America, and plans alterations to his aerial. 2APR recommends 150 turns on a 1-in former in series with receiving aerial to. eliminate clicks in the receiver. He has recently completed a Super Het., but prefers the original Reinartz. Is now using a T.P.T.G. and is testing C.C. 2AGN reports bad conditions on 7 and 14 M.C. bands, but on June 14 an exceptional amount of DX was heard. Has been busy winding filament transformers and chokes for tests.

Group 8E.—G.C. EI7D has been devoting time to weather effects on QRP work. Reports all conditions bad and failure of all schedules. Regarding the weather effects, he says: "An anti-cyclone taking place between two stations whilst they are working together tends to improve reception and transmission at both ends, whilst a depression between the two mean bad results." Is following up these theories and will report further developments later. 2BCX is now G5JU and is active on 7 M.C. with 1.5 watts to a C.C. Goyder Lock controlled TX. Reports poor conditions at night, but good in the mornings. G5XM, using his "home-made H.T." from spark coil and L.T. battery with 1.75 M.C., is getting good results. Is using a Triotron UD2 in TX. G2OC is using a A.O.G. 65 ft. long and tight coupling, which gave success in 1 watt tests. Has been busy smoothing out his R.A.C. Reports 14 M.C. at its best after 22.00 B.S.T. Is using a DE5 in TX and would like reports on his 7 M.C. fone. Uses grid modulation and at times uses only 1 watt input. 2AOX has been experimenting with wavemeters and investigating harmonic freaks.

Group 8F.—G.C. G2TJ uses a parallel-fed Hartley TX with C.O. and 5 watts. Aerial is a half-wave Zepp which, he says, gets better reports in from an easterly direction. Would welcome reports on his 14 M.C. QRP signals. G5LN is testing out various aerials and at the moment is using a 40-ft. radiator with 8-ft. feeders and a 1-yard counterpoise. G2PF reports experiments with a push-pull portable TX. Conditions poor and no DX. G2QX uses T.P.T.G. and a P625 and 5 watts. G5IH busy with QRP C.C. work and hopes to be on 14 M.C. soon. Uses 2 watts from dry batteries to a T.P.T.G. G6QA working on ultra QRP of .25 watts and has received a report from Ceylon.

Antenna Group.

By G2OP, Group Manager.

In 1925, the good old days of 45 metres, when valves and components were inefficient but DX was and must have been good, I first tried a Hertz aerial after reading an article in the November issue of the "BULL" by our old friend G2SZ. It consisted of a half-wave top fed a quarter of the way along by a single wire feeder. About the same time some people used to feed at a third of the way along, and it is interesting to note that in the last issue of the "BULL" G2VV, under QRP work, still finds this to be most efficient.

Last year, after reading a most excellent article in "DX," the equally excellent official organ of H.A.R.T.S. (the Hong Kong Amateur Radio Transmitting Society), I was tempted to again try our old friend the Hertz with the single-wire feeder. Accordingly I pulled up a 66-ft. top and attached my single-wire feeder 9 ft. 2 ins. from the centre. I might mention that the whole of my experiments with this type aerial have been conducted on 14 M.C., so that the top was a full-wave affair. The feeder is tapped straight on to the plate coil of the P.A., so that the latter valve takes its normal plate current. Results were at once excellent, but further investigation showed that this was only true for certain directions, and it became apparent that the full-wave type bore marked directional effects. The top was then made half-wave, 33 ft., and the feeder was tapped on 4 ft. 7 ins. from the centre. Results were just as good as before, but this time in all directions. This all sounds very easy, but to begin with one or two snags were encountered. First, it was obvious that the arrangement was working as a Marconi type as the earth wire on the negative H.T. and L.T. was passing R.F., so the earth was disconnected, and incidentally this got rid of all my key clicks to neighbouring B.C.L.'s. Next a neon tube showed that there were standing waves upon the feeder, and according to the article this should not be. Further investigation showed that the feeder was exactly 33 ft. long and was itself acting as a perfectly good half-wave aerial, so a few feet were added on and the standing wave on the feeder disappeared. It was then decided to light the filaments by A.C. stepped down from the town supply. The centre tap appeared to be fairly dead, but the actual filament ends of the transformer were much too lively, in fact what was found to be happening was that the capacity effect of the transformer was again making a perfectly good feed to earth, and the note, although C.C., was modulated by A.C. and was not P.D.C. This effect was overcome by placing a choke in the H.T. minus lead. The next episode is well known to many of you and has been described as the "Ham and the Bottle." The aerial was lowered down to about 10 ft. above the garden wall, which itself is about 10 ft. high, and with the aid of a neon tube I proceeded to walk along the wall, which had a good covering of ice on it, and mark off the voltage loops in the dark. The story then got misconstrued by a perverted mind and finally it was alleged that the bottle did not contain neon, but a liquid which comes from Dublin, and Dublin alone, and further that the bottle and the Ham eventually crashed into the neighbour's cucumber frame!!! The voltage curve was measured off in daylight and the rough curve obtained was not very symmetrical, and later it was found that this was due to the feeder not coming away from the top at right angles. This was found to be very essential, otherwise

the field of the top will affect the feeder and partially upset the working of the system.

The position of the tap is very critical and is NOT exactly a third of the way along, although very nearly so. Mine was a 33-ft. top and the feeder 4 ft. 7 ins. from the centre, while one or two others who have tried this system have found 4 ft. 6 ins. from the centre somewhat better, but this small difference is no doubt due to local conditions.

The system is now known as the matched impedance single-wire fed Hertz, because there are no standing waves on the feeder and consequently no radiation from it when its characteristic impedance is matched by the impedance at its terminal. For 40 metre working all the above figures should be doubled. The one snag about it is that while it is really most excellent on one band working as a half-wave, it is not flexible, but I have yet to find the very efficient type which is also flexible. For those using push-pull, two of these aerials may be put up back to back and form an almost ideal arrangement. Don't forget to lead your feeder away at right angles to the top and, if possible, don't have any sharp bends in it.

Strays.

BRS563, whose temporary QRA is 12, Station Road, S.S., Blackpool, stands by every Sunday from 10.00 to 12.00 G.M.T. on 7 M.C. and will be pleased to arrange a sked for reporting on 20, 40 or 80 metres.

* * *

There has been an epidemic recently of British call signs being used by unlicensed American stations. The calls thus pirated include G6RV, G6GK, and G6BN, the last-named being owned by A. E. Bond, of Welshpool, and whose station has not been active for 12 months. The signals from these stations have only been heard in U.S.A., and as reports are nearly always R9, there can be little doubt that they emanate from the other side of the Atlantic. It is to be hoped, should this reach the eyes of the persons concerned, that they will desist from their foolish practice. G6TP has received a report from America on his C.W. signals on 20 metres. The station has not transmitted on 20 metres for some years and is at present engaged on 2 metre 'phone work.

HIC et UBIQUE.

Society Trophies.

We have much pleasure in announcing that the "Rotab" Trophy has been awarded to Mr. Harold Old, G2VQ, in recognition of the splendid long-distance work he has carried out during the past year, and particularly for his epoch-making achievement in effecting two-way contact with ZL3AR over 140 times.

Mr. Old, as Provincial Districts Representative, is probably one of the best-known of all British amateurs, and we are confident that his numerous friends at home and abroad will join us in congratulations.

Mr. Arthur Bartlett, G6RB, to whom Council have unanimously awarded the "Wortley Talbot" Trophy, also needs little introduction. For many years he has been one of the leading British stations, and during last winter organised with success the 3.5 M.C. groups. In recognition of his work on this band, and particularly for his achievement in effecting contact with New Zealand on this band, the Trophy has been awarded. It is our hope that the award will serve to lend a greater interest in 3.5 M.C. work during the coming season.

Council decided to postpone the award of the two trophies for 28 M.C. work (the "Powditch" Trophy for transmitting and the "Somerset" Challenge Cup for receiving) for the present on account of the very few contacts made during the past year on 28 M.C. and the unfortunate results of the 28 M.C. Tests in January. It is sincerely hoped that the coming season will show a return of better conditions on this frequency, when it is anticipated that keen competition will be shown for the possession of these trophies.

Which is the Best Aerial?

All entries for the G2DT 5-metre G-R Wavemeter (page 352, June BULLETIN) competition should be in by September 1 in order that the award may be made at Convention.

W.B.E. Certificates.

Certificates have been issued to:—SU8WY (W. E. Wale) and G2WV (J. B. Kershaw).

Correspondence.

The Editor does not hold himself responsible for opinions expressed by correspondents. All correspondence must be accompanied by the writer's name and address, though not necessarily for publication.

Radio and Earthquakes.

To the Editor of T. & R. BULLETIN.

DEAR SIR,—In the current issue of the T. & R. BULLETIN you publish a letter by Mr. W. E. F. Corsham (G2UV), upon the effect of earthquakes upon radio signals, in which he states that such occurrences appear to have a beneficial effect on the propagation of radio signals.

During the recently experienced earth tremor which originated off the N.E. coast and was physically apparent throughout England, I was operating my station (Sunbury) on the 14 M.C. band. Although I can hardly concur with G2UV's statement to the effect that QRM from the U.S.A. was fierce, I agree that reception conditions were quite good for that part of the world at that time. It is significant, however, that at 00.22 G.M.T. on June 7, I succeeded in making what was then my best DX contact, with CM2SV, of Habana, Cuba. The QSO lasted from 00.22 until 00.45 G.M.T. and at 00.27 the house was

sensibly shaken by the earth tremor. Furniture in the room definitely shook, and the transmitter, a solid affair, was moved bodily about one and a half inches. However, the QSO was successfully maintained under these conditions. Severe QRN was noticed upon the 14 M.C. band during the period of operation of the station, from 22,55 (June 6, 1931), until 00.55 G.M.T. (June 7, 1931). Contact was also obtained with W1AXA, and several W and VE stations were heard at moderately good strength during this period. The conditions appeared to be about as good around 22.00 G.M.T. on June 7 and the static persisted.

With regard to G2UV's closing remarks suggesting the adoption of a further code table for the identification of conditions pertaining during a QSO, I would respectfully suggest that the average amateur should first master the *existing* codes before attempting to use others. Not infrequently have I been told that my signals were "T7 fb stdi!" and "T8, CC," which leads one to believe that such simple codes as the "T" code are yet unmastered. Again, upon requesting "QTR?" I have generally met with a discreet silence! As with "QTH?" and several other well (*sic*) known "Q" signals!

In the cases mentioned by G2UV, plain language, I think, would be preferable and would avoid the chance of spoiling valuable data by the misinterpretation of an unfamiliar code.

May I conclude by congratulating the H.Q. staff upon the production of consistently excellent "BULLS" and particularly upon the fine appearance of the July, 1931, issue?

Yours, Radioly,
R. L. VARNEY (G5RV).

Assisting our B.R.S. Members.

To the Editor of T. & R. BULLETIN.

DEAR SIR,—During the past three months it has been my privilege to attend numerous District Conventionettes in company with Mr. H. B. Old (G2VQ), our Provincial Districts Representative.

At each meeting we have been impressed with the support given by our B.R.S. members, and from information gleaned I feel it is my duty to outline to our transmitting members some ideas which, if put into operation, will not only assist these potential transmitters, but at the same time produce an increase in Society membership.

First, I appeal to all who receive report cards from our B.R.S's. to send cards in return. Most of us who have held licences for some years have probably lost a good deal of interest in these "scraps of cardboard," but the new fellows appreciate them.

Second, I ask all who are able, to take a B.R.S. under their wing. Give him a chance to operate your station and teach him procedure. Where possible give two or three local B.R.S. members Morse lessons. In Nottingham at least one of our transmitting members is giving a ten-minute Morse lesson daily over the land line to a couple of B.R.S.'s.

Third, I suggest that the judicious use of telephony (speech only) on the 7 M.C. band during week-end will result in a number of non-members reporting on our signals. From personal experience I find that 25 per cent. of all listeners' reports on my own 7 M.C. telephony transmissions are received from non-members. Each one of these reports is followed up with a personal letter and a copy of "What is Amateur Radio?" Many new members are being obtained in this way, and whilst I have been for years, and am still opposed to gramophone recitals and badly modulated speech, I feel that any action which will benefit Amateur Radio in general is fully justified. This view is shared by a number of our leading members, and I shall look forward to an even bigger increase in the B.R.S. membership this winter, if our present members will follow up all non-members' reports on their telephony.

Last, I recommend all new County Representatives to get into personal touch with their B.R.S. members. Headquarters will supply a full list of members to each C.R. as soon as the elections are completed.

In concluding this letter I should like to point out that our B.R.S. membership is now nearing the 600 mark, which represents more than one-third of our total membership. This should, I think, convince everyone concerned that it is our duty to retain their interest with a view to increasing our strength as the leading Empire Amateur Radio Organisation.

I remain, yours sincerely,
JOHN CLARRICOATS,
Honorary Secretary (G6CL).

New Members.

CORPORATES—GREAT BRITAIN.

J. CUTHBERTSON (2ANS), 15, West View, Acklam Road, Linthorpe, Middlesbrough.
W. J. MORGAN (2BPI), 102, High Street, Penydarren, Merthyr Tydvil.
P. H. DUTTON (G5IX), 8, Somersby Grove, Skegness, Lincs.
H. W. MEDCRAFT (G5JV), 5, Sussex Road, N.7.
C. W. K. SANDS (G5JZ), "Springfield," Heathfield, Sussex.
W. LILBURN (G5LN), 40, Theresa Street, W. Stanley, Co. Durham.
J. TAMBLYN (G6QH), Barkla Shop, St. Agnes, S.O., Cornwall.
J. K. HANKINSON (BRS570), 1, Eden Road, Tunbridge Wells, Kent.
A. W. LEITCH (BRS571), 9, Hever Crescent, Bexhill-on-Sea, Sussex.
L. JONES (BRS572), No. 1 Coy., 4th Divisional Signals, Colchester.
J. E. SKETCH (BRS573), Glenside, Maesycwmmer, Nr. Cardiff.
A. C. BROWN (BRS574), Amulree, Clarkston, Glasgow.
R. G. DREWERY (BRS575), 274 ,Park Avenue, Hull.
J. E. SAYERS (BRS576), Struan, Clarkston, Glasgow.
A. P. KERFORD-BYRNES (BRS577), "Kenya," Salisbury Road, Holland-on-Sea, Clacton-on-Sea, Essex.
R. E. KNIGHT (BRS578), 37, Lonsdale Road, Barnes, S.W.13.
L. ROBINS (BRS579), Lansdowne House, Abergele Road, Colwyn Bay.
G. C. OXLEY (BRS580), 17, Lime Avenue, Huthwaite, Notts.
S. F. LAWES (BRS581), 68, Braemar Avenue, Filton Park, Bristol.
W. C. THOMSON (BRS582), 58, Kent Road, Mapperley, Nottingham.
J. B. WORMALL (BRS583), 304, St. Albans Road, Bulwell, Nottingham.
E. INGLETON (BRS584), 50, Campbell Road, Gravesend, Kent.
W. BROWN (BRS585), Hope Cottage, Carstairs Junction, Lanarkshire.
A. G. COLLEY (BRS586), Hillingdon, Stafford Road, Oxley, Wolverhampton.
T. L. HERDMAN (BRS587), The Grove, Kingswinford, Dudley, Worcs.
J. L. B. CHARLESWORTH (BRS588), 69, James Street, Barnsley, Yorks.
C. E. JEFFERIES (BRS589), 147, Waterloo Street, Burton-on-Trent, Staffs.
E. H. CLARKE (A), "Woodstock," Hawkinge, Folkestone, Kent.
A. A. HAMMOND, (A) 3, Bradford Road, Seven Kings, Ilford, Essex.

CORPORATES—DOMINION AND FOREIGN.

H. QUAEYHAEGEN (ON4NK), Th. Roucort, Str. 10 Antwerp, Belgium.
(We regret that owing to an oversight, Mr. Quaeyhaegen's QRA has been missed out of previous lists).
A. J. HIGGS (VK2GY), Commonwealth Solar Observatory, Mount Stromlo, Canberra, Australia.
G. R. VICTOR (ZS2Q), 10, Balfour Terrace, West Hill, Grahamstown, S. Africa.
G. F. WILLIAMS (ZU1N), P.O. Box 49, Wynberg, Cape, S. Africa.

WUFA

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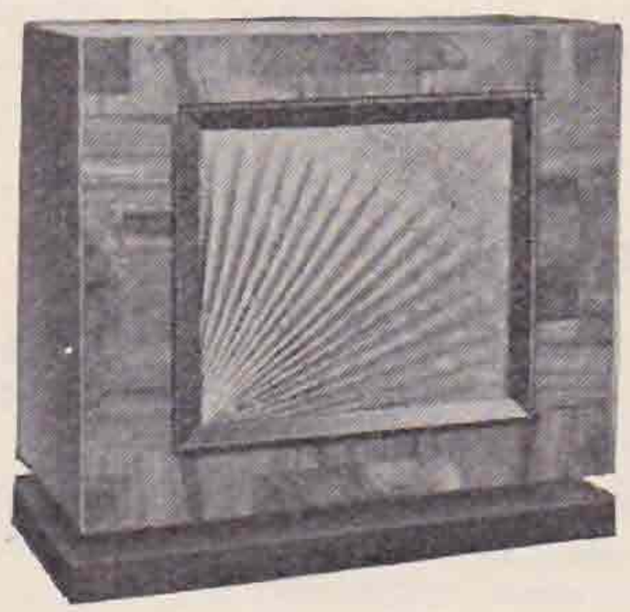
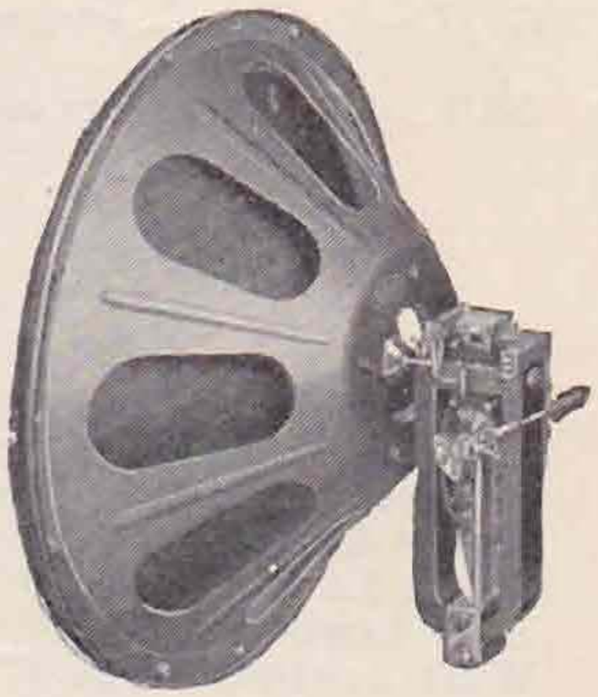


The SIX alternative resistances of the Wufa 60 Pole Super-Power Unit, enables it to be accurately matched to any type of output valve.

The adjustment of this unit is by a lever-operated cam, which, acting upon the two pole pieces, allows a fine adjustment. Huge volume can be handled without stress, at the same time the unit is extremely sensitive.



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Embodying the Wufa 60 Pole unit, this cabinet speaker of attractive modern design is fully qualified to take its place in any home. Excellent volume and reproduction. Polished Walnut cabinet. Gold Tinsel fret.

Price **75/-**

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Price complete - - - 40/-
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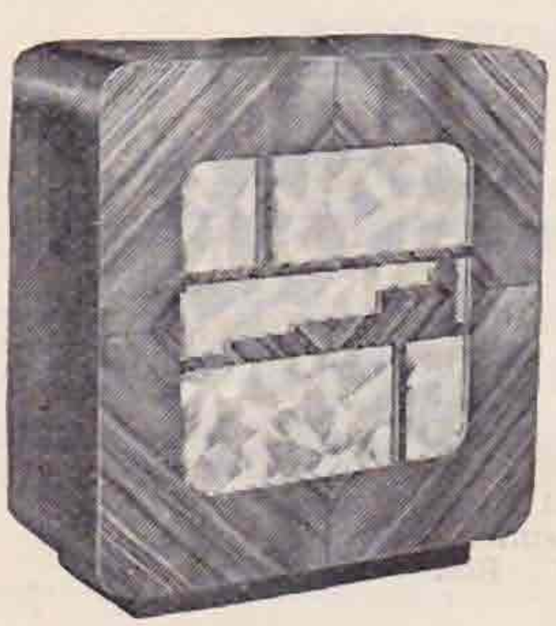

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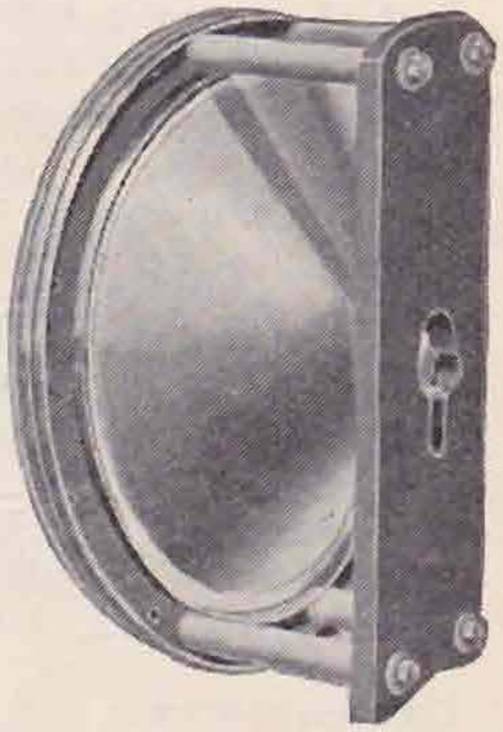

Your Dealer will willingly demonstrate any WUFA Cabinet Speaker or Unit.

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QRA Section.

Manager : M. W. PILPEL (G6PP).

New QRA's.

G2BY.—H. E. WHATLEY, "Lyndhurst," Great West Road, Lampton, Hounslow, Mddx.
G2IJ.—W. J. HOLROYD, 24, Cousin Lane, Halifax, Yorks.
G2RJ.—J. C. RUNGE, Kippington Court, Sevenoaks, Kent.
G2WG.—W. C. GOULT, "Holly Mount," Rayleigh, Essex.
G2YX.—F. E. B. JONES, "Greystones," Four Oaks Road, Sutton Coldfield, Birmingham.
G5IH.—G. C. TURNER, Causton Road, Cranbrook, Kent.
G5JU.—J. N. WALKER, 414, Fishponds Road, Eastville, Bristol.
G5JV.—H. W. MEDCRAFT, 5, Sussex Road, London, N.7.
G5JZ.—C. W. K. SANDS, Springfield, Heathfield, Sussex.
G6AC.—A. N. LE CHEMINANT, Training Squadron, School of Army Co-operation, R.A.F., Old Sarum, Salisbury, Wilts.
G6BR.—G. H. RAMSDEN, c/o J. M. & J. Sharman, Ltd., P.O. Box 295, Bradford, Yorks.
G6GV.—G. H. VICKERS, Barnfield, Prestwich, Lancs.
G6QC.—E. T. PETHERS, Nevil House, Herbert Road, Rainham, Kent.
2AHZ.—W. L. MILLAR, 3, Parker Street, Dundee, Scotland.
2AKB.—H. L. WILLIAMS, 9, Austral Street, London, S.E.11.
2AKN.—R. K. SHEARGOLD, "Glenmore," Marygate Lane, Shepperton, Middlesex.
2ALR.—H. J. LONG, Stanton Harcourt, Eynsham, Oxford.
2API.—J. A. GUY, 42, Grosvenor Buildings, Manisty Street, London, E.14.

The following are cancelled :—2APG, 2AYN, 2BCX, 2BXP.

Please send all new QRAs, changes of address, etc., to G6PP, 54, Purley Avenue, London, N.W.2. Telephone : Gladstone 1282.

English County Representatives.

The following have been nominated and subject to Council's ratification, will take office as County Representatives from September 24, 1931 :—

NORTH LONDON	S. Buckingham ...	G5QF
SOUTH LONDON	A. D. Gay	G6NF
EAST LONDON ...	T. A. St. Johnston	G6UT
WEST LONDON	H. V. Wilkins ...	G6WN
BERKSHIRE ...	G. Marcuse ...	G2NM
CHESHIRE ...	J. Davies	G2OA
ESSEX	F. Stollery	G5QV
LINCOLN ...	A. E. Livesey ...	G6LI
MONMOUTH ...	H. Harding ...	G2HH
NORTHUMBERLAND	N. E. Read... ...	G6US
SURREY ...	R. J. Denny ...	G6NK

Invitations have been extended to certain members to take over counties or groups of counties, from which nominations were not received. The full list of new C.R.'s will appear in the September BULLETIN, but elected C.R.'s will be advised direct from H.Q. at the earliest possible moment, in order that they may get in touch with the members in their county prior to Convention.

WELSH COUNTY REPRESENTATIVES.

Council have decided, in view of the apparent apathy of members in Wales, to appoint County Representatives for all Welsh counties with a view to reviving an interest in Amateur Radio in the Principality. The following gentlemen have been nominated, and will take office as from September 24, 1931, subject to their agreement being received by Council.

BRECONSHIRE ...	G. R. S. Farnie ...	2AHK
GLAMORGAN ...	B. F. Phillips ...	G5PH
CARMARTHEN ...	Lt.-Col. E. C. Jennings	G5OC
DENBIGHSHIRE	A. M. Ralli ...	G2II

Other Welsh County Representatives will be appointed from time to time by Council.

SCOTLAND.

Mr. Jack Wyllie has again been nominated as Scottish Manager, and will take office as from September 24, 1931.

DISTRICT REPRESENTATIVES.

These are being appointed by Council, and it is hoped to publish a full list of all such officers in the September BULLETIN.

As more than one nomination has been received for the position of Representative in the following counties, a ballot becomes necessary.

COUNTY.	NOMINATIONS.	CALL SIGNS.
GLOUCESTER...	R. A. Bartlett ...	G6RB
	W. B. Weber ...	G6QW
WILTSHIRE ...	Lt.-Col. W. S. Palmer	G2BI
	G. S. White ...	G2GW
	A. N. Le Cheminant	G6AC

Balloting is confined to members resident in the counties concerned, and all ballot forms must be returned to Headquarters not later than August 29, 1931.

BALLOT FORM.

To the Hon. Secretary,
R.S.G.B.,
53, Victoria Street, London, S.W.1.

ENGLISH COUNTY REPRESENTATIVE.

I wish to record a vote in favour of Mr.....

as Representative for the County of.....

I certify that I am a fully paid Corporate member of this Society.

Signed .....

Address .....

.....

Call Sign .....

Date .....

Empire B.E.R.U. News.

B.E.R.U. Representatives.

Australia.—H. R. Carter (VK2HC), Yarraman North, Quirindi, N.S.W.

B.W. Indies, Bahamas, Bermuda, and British Guiana.—H. B. Trasler, No. 2 Mess, Pointe à Pierre, Trinidad, B.W.I.

Canada.—C. J. Dawes (VE2BB), Main Street, St. Anne de Bellevue, Quebec.

Ceylon and South India.—G. H. Jolliffe (VS7GJ), Frocester Estate, Govinna, Ceylon.

Egypt and Sudan.—H. Mohrstadt (SU1AQ), No. 1 Co. Egypt Signals, Polygon, Cairo.

Hong Kong.—P. J. O'Brien (VS6AE), 12, Kent Road, Kowloon Tong, Hong Kong.

Iraq.—H. W. Hamblin (YI6HT), Wireless Section, R.A.F., Shaibah, Basra, Iraq.

Irish Free State.—Col. M. J. C. Dennis (EI2B), Fortgranite, Baltinglass, Co. Wicklow.

Kenya, Uganda and Tanganyika.—H. W. Cox (VQ4CRF), Box 572 Nairobi, Kenya.

Malaya.—G. W. Salt (VS2AF), Glenmarie Estate, Batu Tiga, Selangor, Malay States.

Newfoundland.—Rev. W. P. Stoyles (VO8MC), Mount Cashel Home, St. John's East.

New Zealand. — D. W. Buchanan (ZL3AR), 74, Willis Street, Ashburton; and C. W. Parton (ZL3CP), 69, Hackthorne Road, Cashmere Hills, Christchurch.

Nigeria.—Capt. G. C. Wilmot (FN2C), 1st Battalion Nigeria Regiment, Zaria, Nigeria.

South Africa.—W. H. Heathcote (ZT6X), 3, North Avenue, Bezuidenhout Valley, Johannesburg.

South Rhodesia.—S. Emptage (ZE1JG), Salcombe, Plumtree, Southern Rhodesia.

AUSTRALIA.

By VK2HC.

THERE are several stations working to schedule now on the 56 M.C. band, but there is nothing to report on 28 M.C. The 14 M.C. band is rather dead, and only W and Pacific DX is available in spasms around 06.00 G.M.T. The 7 M.C. band is very patchy, but there had been some good W QSO's when conditions were favourable. There is considerable activity on 3.5 M.C. with varying conditions, and good local ZL QSO's are plentiful.

Quite a number are on 200 metre phone work, and doing excellently. The W.I.A. H.Q. have nearly completed the sub-standard frequency meters, and a considerable amount of technical instruction is being undertaken by divisions of the W.I.A. It is pleasing to note the rapid increase in the number of CC signals.

BRITISH ARABIA.

By BERS25, C Flight, 8 (B) Sqdn., R.A.F., Aden.

Conditions on the 14 M.C. band are still very bad, and as the summer is well advanced, they are not likely to change to better, for a month or more. Some very consistent stations still push their way through, however, and are heard almost every evening. The set is in use every day, and the operator would be pleased to give reports at special times by arrangement.

CEYLON AND SOUTH INDIA.

By VS7GJ.

Conditions on both the 7 and 14 M.C. bands during this month have been bad, and one never knows when and for how long the blanket will lift, in order to work D.X. stations. Mr. Nicholson, VU2JP, S. India, reports that the 7 M.C. band is still noisy, but is improving. He has worked many VK with QRP 3.6 watts, but QSO's are subject to rapid fading and wipe out.

Mr. G. H. Todd, VS7GT, Northern Ceylon, reports conditions on 14 M.C. band shows no signs of definite improvement, as deep fading continues, with patchy intervals when DX stations may be heard and worked. Conditions appear definitely better at full moon.

VS7GJ made all arrangements for transmitting birthday greeting to H.R.H. the Prince of Wales, but no report has been received of direct communication via VS7 stations. VU2AH, however, is to be congratulated on his success on getting the message through the same evening to G6YK.

IRISH FREE STATE.

By EI7C.

In spite of summer conditions and atmospherics, several EI stations continue to be active on 14 M.C. On that band DX has been rather poor, with the exception of North and South American signals. On most evenings these stations can be heard and worked from 22.00 G.M.T. till midnight, though all reports say QRM is bad on the other side. On several nights during the month, 14 M.C. has been quite blank after European signals have faded out. EI8B succeeded in working Uruguay, this being the first time that country had been worked by an EI station. 7 M.C. has been very poor, and QRN makes it difficult to copy even loud signals. The lower frequency bands, 3.5 and 1.7 M.C. have been completely deserted, owing to the absence of foreign signals, and also to the fierce QRN.

KENYA, UGANDA, AND TANGANYIKA.

By VQ4MSB, via G2CJ and G2OP.

VQ4MSB is now in Kampala, but does not expect to be on air for some considerable time. VQ4CRE is rebuilding, but there is no news of VQ4KTA, who should be on 14 M.C. ere long. VQ4CRF is active, and passed birthday message to G2OP.

WE WANT TO SEE YOU AT CONVENTION.

The Incorporated Radio Society of Great Britain.

Headquarters Society:—BRITISH EMPIRE RADIO UNION,
53, VICTORIA STREET, LONDON, S.W.1.

APPLICATION FORM.

The Hon. Secretary,

Sir,—I beg to make application to be enrolled as a member, and shall be obliged if you will submit my name to your Council. I agree, if elected, to act and abide by the Rules of the Society as expressed in its Articles of Association and By-laws.

Signature.....

Name in full (please use Block Letters) .....

Address (to which all communications may be sent) .....

Nationality..... Age (if under 21).....

Call Sign.....

NOTE.—*Members not having Call Signs are allotted B.R.S. (British Receiving Station) Numbers, which are used for identification purposes only.*

Proposed by..... Seconded by.....

NOTES.—*Applicants who do not know any member may accompany their forms by references in writing by persons to whom they are known. Such persons should be householders, and should state profession and length of acquaintance with applicant.*
The Council reserve the right to refuse any application without reason.

UNDERTAKING TO BE SIGNED BY APPLICANT.

I, the undersigned, agree that in the event of my election to membership of the INCORPORATED RADIO SOCIETY OF GREAT BRITAIN, I will abide by and observe the Rules, Regulations and Articles of Association of the Society, and that in the event of my resignation from the Society given under my hand in writing, I shall, after the payment of all arrears which may be due by me at that period, be free from this obligation. I further agree to observe strictly the terms of any licence issued to me by the responsible authorities to operate transmission or receiving apparatus.

Witness my hand this.....day of..... (*signed*).....

SUBSCRIPTION RATES.

Corporate Members and Associate Members (Town) ... £1 1 0 per annum.
Corporate Members resident outside 25 mile radius Charing Cross ... ... 0 15 0 ,, ,,
Corporate Members resident outside British Isles ... 0 12 6 ,, ,,
Non-Corporate Members—Associates ... ... 0 10 0 ,, ,,

Associate Members are not eligible to vote or receive individual notices of the Society.
Certificates of Membership and copy of the Articles of Association are issued to all members upon election.

NO ENTRANCE FEE.

A copy of the Articles of Association may be inspected at the Headquarters of the Society, 53, Victoria Street, London, S.W.1, by applicants upon request.

FOR OFFICE USE ONLY.

Approved by Council.....

First Subscription Paid.....

B.R.S. Number Issued.....

NIGERIA.

By ZD2A, G. W. WILMOT, 1st Nigerian Regt., Zaria.

It is regretted that notes have been so scarce from here lately, but there has been very little to report for the last two months. This is the worst time of the year for radio, owing to almost daily thunderstorms and bad static.

On the few occasions when work has been possible, very few stations have been heard. Owing to the later hour of daylight in Europe, stations can be worked much later now, and the best hours are from about 17.00 to 22.00 G.M.T. Stations have also been heard lately between 06.00 and 07.00 G.M.T., though all very weak.

NORTHERN INDIA AND BURMA.

By VU2DR, via VU2AH and G5BJ.

Conditions here for the last two months have been poor, and with the exception of J and AU, little has been done by VU2DR, Barrachpore.

Local conditions are better, and it has been possible to work VU and VS with some regularity during the early evenings. Europeans have been audible, but inconsistent from 17.00 to 19.00 G.M.T., and it has not been possible to effect QSO.

The 28 M.C. band still appears to be suffering from its usual quietness, and for a month the usual commercial harmonics have not been heard.

The monsoon season is now commencing, and instructions are being issued to the VU, DR's to record the change of conditions very carefully on all bands. Atmospherical depression over very wide areas and at very great distances probably are responsible for the monsoons, and it is hoped that with the co-operation of those amateurs situated at the various centres of depression, to formulate interesting data on the effects of the monsoons on wireless waves.

VU2AH (Karachi) records nil on 28 M.C. band, 14 M.C., VK and ZL disappeared about two months prior to the last report. Europeans came in at the beginning of May, ZU's, VU's and VS's then faded out. This state of affairs lasted until June 4, when the Europeans faded out EU excepted, and ZU and VS stations reappeared. AU and J also received at good strength. VU2AH complains that he does not handle as much traffic as he would like to for India.

2AHS reports that similar conditions with periods almost exactly the same existed during the early months of 1929 and 1930.

SUDAN.

By ST2D, via G5BJ.

Conditions generally have been very poor through-out the month. Only a few European and African 14 M.C. stations are heard in the early morning and evening. 7 M.C. is full of QRN and QRM, and only QRO signals push their way through. ST2D is now CC and has phone on 14 M.C. and 7 M.C.

Strays.

G6IZ DE OZ7WO: "Compliments to G Hams for ur fb QRI." Tnx OZ and may your valves never die!

* * *

G5JU, J. N. Walker, 414, Fishponds Road, Eastville, Bristol, is transmitting on 7120 K.C., using crystal control, and would appreciate reports.

Apparatus Worth Buying.

The CLIX new "Vicegrip" wander plug is now on the market and sells for 1½d. each, engraved, red or black. This plug departs very considerably from general plug design inasmuch as the contact material is of hard drawn wire and creates a powerful spring contact, the elasticity of which is not likely to be lost after heavy and frequent use. The

wire connection is held in position by a new fixing device which does not depend solely for its goodness of contact with the plug upon the tightness with which the insulator is screwed up. The plug will fit all the usual sizes of battery sockets and the contact seems extraordinarily sure when home. An illustration is produced herewith.

* * *

New Mullard Valves.

The Mullard Wireless Service Co., Ltd., announce the release of two new full-wave rectifier valves, types D.W.3 and D.W.4. Both are rated for a maximum rectified output of 120 mA, the maximum anode voltages being 350 volts for type D.W.3 and 500 volts for type D.W.4. The filament consumption of both valves is 2 amperes at 4 volts, and they are priced at 17s. 6d. and 22s. 6d. respectively.

The company have also released a new output valve of the super type, the P.M.202. This is a two-volt valve and the filament consumes 0.2 amps. Under the usual form of rating the anode impedance is 2,000 ohms and the amplification factor 7; the maximum anode voltage is 150.

EMPIRE CALLS HEARD.

Calls Heard Lists will, in future, contain only British Empire calls (including Great Britain) and those of British ships at sea and British Expeditions.

VS7GT, G. H. Todd, Northern Province, Ceylon:
g2gm, g5bj, g6xq, gboh, su1aa, vq4crf, vs6ae, vu2fx, yi1cr, yi1rm, zc6jm, zs6y, zt6x.

* * *

BERS25, Aden: June 1 to 12:
g2by, g2cj, g2gf, g2ow, g2rv, g5is, g5mu, g5nı, g5qy, g5rq, g6dh, g6fo, g6mn, g6oh, g6pp, g6rg, g6vp, g6wl, g6wn, g6wy, g6xj, g6xq, g6yk, su1aa, su1ch, su1aq, vs7gt, xyi6kr, yi1cd, yi1rm, zc6jm.

* * *

By ST2D, 7 M.C.: su1ts, ve1bl.—14 M.C.: g2cx, g2ig, g5bj, g5mu, g5vl, g6oh, g6us, g6vp, g6wn, g6xn, g6yk, su1aa, su1aq, su1ch, vq4crf, xyi6kr, yi1rm.

NOTES & NEWS FROM THE BRITISH ISLES.

DISTRICT No. 2.

Representative : T. Woodcock (G600), " Santos," George Street, Bridlington, Yorkshire.

MONTHLY meetings were revived (locally) on July 9, when the following No. 2 (H) District members were present at G2KM's shack :— G2UG, 2FS, 6PS, 5DR, 6UJ, 2KO, 2TK, 2KM, 600. Discussion took place with reference to making more use of the 3.5 M.C. band and a plea for genuine experimental work (only) on the 2 M.C. band. A decision was reached regarding the forthcoming No. 2 District Conventionette whereby, if permission can now be obtained, to visit the Moorside Edge (Slaithwaite) B.B.C. station ; the Conventionette can conveniently be held at Leeds (in preference to Hull), in October or November. This decision will no doubt meet with much enthusiasm by the Leeds and Sheffield members.

DISTRICT No. 3.

Representative : Joseph Noden (G6TW), Coppice Road, Willaston, Nantwich.

Although this district seems to obtain very little in the way of reports from its members, I can say there is still a fair amount of activity, and I think those who missed the Field Day just outside Chester on July 6, missed a treat. It really turned out to be an international gathering, and although the day was rather moist, we were rather lucky in the way we chose the country inn to stay at, for the kindly help of the landlord and the genial Squire helped to make the day a success. Many good Continental contacts were made, and I think I am voicing every one of the party when I say our thanks are due to G2OA for the way he organised it, and whose full report appears elsewhere in the Bulletin.

DISTRICT No. 7.

Representative : H. A. M. Whyte, (G6WY), " Killiney," Worsley Bridge Road, Beckenham, Kent.

The chief event in this area was the District Conventionette, which I will deal with after the general report.

I was pleased to get 15 reports for the letter budget this month, but there are still several very active stations who did not report, and I hope that some of those who did not bother will support it next month. In case any of you do not know, reports should now be sent to G6WY by the 16th of every month. Activity seems to be at a low ebb at this time of the year, and all stations are waiting for the shorter evenings to blow dust off their apparatus and start seriously once again. Everybody who attended the Second Conventionette at Tunbridge Wells on July 5 enjoyed themselves, and I must thank G6GZ and G6PA for the hard work that they put into the arrangements. We were favoured with the company of G6CL, G2VQ, G6UT, and the brothers G6WN. Thirty-four were present for lunch and the meeting, and a photograph was taken just before lunch. G6CL spoke on The Future of Amateur Radio, and the Recent Progress of R.S.G.B. and B.E.R.U., and pointed very clearly to exactly what is expected of us if we wish to increase the privileges given to amateurs at the Conference in Madrid in 1932, and how careful we must be not to use our stations for anything except experimental work on the 1.75 M.C. band. G2VQ described the work of Empire Link stations, and pointed out that any station can put in an application for E.L.S. provided he is crystal-controlled and is licensed for 50 watts. Any station can apply for high power permits to me, who will pass them to the Council of the Society. It must be understood that the station must be crystal-controlled, with a high power licence. G6WY then explained the letter budget scheme, and appealed to all to do their utmost to report regularly. It was decided to hold a 1.75 M.C. party for the members of District No. 7 on a Saturday evening in October, and the idea of a similar one on 3.5 M.C. was suggested and agreed upon. It was decided to hold regular meetings in the most active towns of the District, Gillingham probably being the first. G6GZ then spoke on behalf of his District, No. 8, but unfortunately the local town band decided to pass the open windows, and I think a lot of us missed some of what he said ! The meeting ended with a general discussion.

DISTRICT No. 12.

Representative : T. A. St. Johnston (G6UT), 28, Douglas Road, Chingford, E.4. Telephone : Silverthorn 1557.

The arrangements for the Field Day on Sunday, August 16, have now been completed. Two portables—on cars—will be on the air, G2NU and G6SG ; the 1.75 M.C. band will be used. Meet at 9 a.m. at Chingford. Will all those intending to be present notify the D.R. Additional cars are wanted. Local stations will be worked on fone or CW, and reports will be appreciated. The stations will operate on the Essex-Herts border. Stations G2QW, G2NU and G6UT recently had the pleasure of a visit from Mr. and Mrs. D4LAL. The next district meeting will be held at Chingford on Tuesday, August 25.

DISTRICT No. 13.

Representative : H. V. Wilkins (G6WN), " Hillsview," 81, Studland Road, Hanwell, W.7.

This month's area meeting saw 19 members and visitors gathered together and is the best one held as yet.

The next will be on August 19, also at G6WN at 7.30 p.m. Only a personal report of conditions can be given as reports are so few, but this is to be expected at this time of the year. The conditions on 7 and 14 M.C. seem normal, but 28 M.C. has been extraordinarily good during the evening hours and quite a number of harmonics of European stations have been heard. G6VP and G6WN have succeeded in receiving the first signals from Chile on 28 M.C. CE3CH, working to schedule, was heard on Friday, July 10, by G6VP at R7, and G6WN at R4, but as yet not worked.

DISTRICT No. 14.

Representative : H. Harding (G2HH), Treve Cottage, Ebbw Vale, Mon.

The monthly meeting was held at Ebbw Vale in June, and there was a good gathering.

The May Conventionette was discussed, and it was decided to make earlier and better preparations for the Conventionette next year.

G2HH was re-elected to represent the area for the R.S.G.B., and would become county representative under the new scheme.

As G2XX was leaving the district, G6FO was elected to control the letter budget.

The only station reporting activities this month was G2PA, who, while testing on the 14 M.C. band with 9 watts on the effect of barometric variation on conditions, worked five continents. He reports conditions fairly good, but best when the barometer is falling, irrespective of the pressure. Having received a transoceanic permit he is rebuilding in easy stages, hoping to be active in August.

G2HH has been concentrating on improving the receiving side of the station and is now satisfied and prepared for winter working with a 4-valver—SG-U-RCC and transformer. Finds that resistance control of the detector anode voltage the best reaction control.

QSL Section.

As is to be expected, the flow of cards through the section during the last few weeks has been steadily diminishing, owing, no doubt, to the bad conditions and rival attractions of the great outdoors. The average number of cards received per week, however, is still much higher than numbers for corresponding periods in previous years, and reflects in no uncertain manner the fact that amateur radio is still as popular as ever, and that membership of R.S.G.B. is making rapid strides from month to month.

J. D. C.

Liverpool Area Field Day

THE Liverpool area held their first Field Day on July 5. At 11 a.m. the precincts of Chester Station, the meeting place, took on the appearance of a car park as the enthusiastic members gathered prior to moving to Huntington, a quiet place three miles up the Dee from Chester.

It was interesting to see, on taking the roll call, that our field day had taken on the appearance of an international convention, America, Germany and Sweden being represented by ex-W3AJC, D4LYT and Mr. Von Manchoff respectively.

As might be expected, rain started to fall on our chosen site almost before we had started on the aerial, and our spirits were in danger of getting damped when good news was brought that the landlord of the local hostelry had offered us one of the smoke rooms in the said " pub " (someone remarked that this would save a lot of walking !).

The gear was therefore transhipped and a make-shift aerial 14ft. high was installed.

At 12.30 G.M.T. the first test call was made on 7 M.C., and what excitement among the sixteen hams present when XOZ7K replied ; he reported us R5 T9. Our transmitter was an Ultraudion, supplied by G2OA, the plate supply being 300-volt accumulators. Two PA stations were worked during the afternoon, and at 16.45 a break was made for tea. The operators on duty contacted with G2BM, through whom an R.S.G.B. greeting message was sent, and as the rest had retired for tea, it was decided to cut this QSO short, as the operators had visions of all the grub disappearing.

After tea OH, D and G5PS were worked, good reports being received in every case.

An attempt was made on 14 M.C., but QRN was so fierce that we hurriedly returned to 7 M.C.

We were very pleased to have had great co-operation from the local landowner who, as soon as we had arrived, drove up in his Rolls to inquire whether we required any more poles or anything. You can further imagine our delight when at 9.45 p.m. he again drove up and ordered " drinks all round," and expressed the hope that when we hold another field day we would go nearer to the Hall.

Empire Link Stations, 1931-1932.

In order that the Convention may approve the E.L.S. appointments for 1931-1932, it is requested that all present E.L.S. members who wish to continue their work shall immediately forward their names, and particulars of Link Traffic handled during 1930-1931, to the Honorary Secretary.

It can be gauged how interested everyone was in that. Although we all had many miles to go, it was 10.20 p.m. before we finally broke up.

The results showed that in an emergency a group of amateurs could soon fix up an efficient radio station, whilst using but low power and extremely simple gear and aerial equipment.

In summing up, our thanks go to our late President, Mr. Marcuse, for arranging the permit; G2QB for selecting such an excellent site; to the members who brought equipment; and last, but not least, to all the members who turned up and who made such an enjoyable day possible.

G2OA.

Bristol Conventionette, June 13, 1931.

European Notes.

News from Europe is somewhat scarce this month, owing probably to the time of year. New stations continue to come on the air in Switzerland, and more are expected in the near future. Two Swiss hams attended the D.A.S.D. Convention at Hamburg, which, as previously reported, was a great success. Military service somewhat affects radio activity in Switzerland, and HB9P and HB9T will be off the air until the end of October doing military service.

The R.E.F. is busy in France arranging for the International Congress of short wave amateurs which is to be held in Paris in September. As soon as the complete programme is compiled copies will be circulated to all sections of the I.A.R.U. We understand that the Congress opens on September 23. Communications with regard to accommodation in hotels, etc., during the Congress should be addressed to " Secrétariat du R.E.F. 19, Rue Claude Vellefaux, Paris, 10 éme."

The Citroen Expedition to Central Asia has just reached Kabul in Afghanistan, and is to be heard on 36 and 23 metres, using the call sign FPCF. The Expedition has already been heard in France by F8BU.

STRAYS.

PA0FB, J. Adama, Waalsdorperlaan 42, The Hague, transmits on 28 M.C., using about 40 watts, and would like QSO's or reports on his signals. He is generally on that frequency at about 16.40 G.M.T. His only QSO so far has been with PA0GG, of Rotterdam, but he has heard UOWN and HAF8B.

Notice to Contributors.

The Editor is pleased to have manuscripts submitted to him for publication, but would remind contributors that, owing to lack of space, a delay often elapses between the receipt of the MS. and the date of its appearance in these pages. All matter intended for publication should be written on one side of the paper only and preferably typewritten (double spaced). Diagrams should always be shown on separate *sheets. Rough sketches can be re-drawn by our draughtsmen. Photographs, if any, should not be smaller than ¼-plate as otherwise the reproduction will be poor.*

EXCHANGE & MART.

Rates 1d. per word, minimum 1/6. First line in capitals if desired. 2d. per word where all capitals are required. Minimum 3/-.

QRP CONVERT HAS FOR DISPOSAL the following Valves, which may be obtained from G6CL:—1 DO-40, in use 5 hours, £3 10s.; 1 O/30A, in use 10 hours, £1; 1 " Metal " T50, in use 5 hours, £1 10s. The lot for £5.—CT2AA.

AMERICAN RADIO MAGAZINES.

Short Wave Craft. 14s. 6d. per year, post paid.
Television News. 14s. 6d. per year, post paid.
Radio Craft. 12s. 6d. per year, post paid.
Subscriptions to H. FREEMAN, Parr's Advertising, 121, Kingsway, London, W.C.2.

BRS366 for neat and snappy QSL cards at competitive prices. — QRA: " Inglenook," Orlando Drive, Carlton, Nottingham.

TANTALUM AND LIONIUM.—Make your own Battery Chargers for alternating current. Simple, reliable. Lionium Rectifying Electrodes, 2-4 amps., 10s., 5-10 amps., 15s. Also Transformers, Blue Prints, 1s. each, and complete Chargers.—BLACKWELL'S METALLURGICAL WORKS LD., Liverpool.

G6MN for good QSLS.

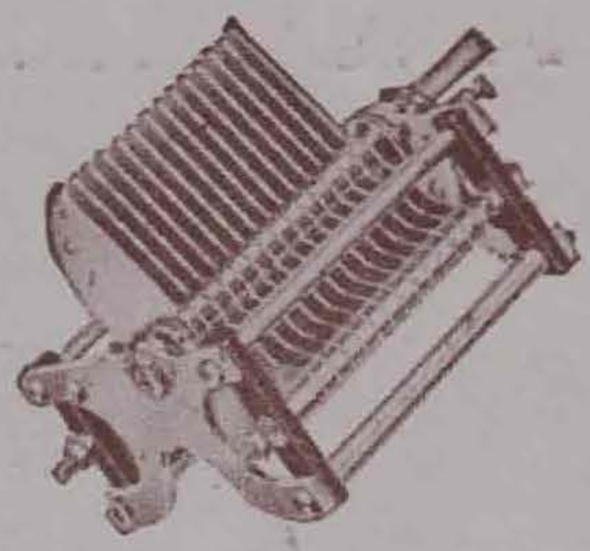
VALVES.—6-volt Valves, all guaranteed OK. 2 DE5 at 2s. 6d. each; 1 PT625 at 7s. 6d.; 1 PM256 at 2s. 6d.; 3 CT25X at 6d. each; 1 6.60 at 1s.; and 10 American Receiving, CX301A, UX112A, UX121A, UX171A at 2s. each; 2 R5 type at 6d. each. One Truvox L.S. complete 72" horn in cabinet at 30s. (cost £4 17s. 6d.); 1 Ormond Unit with chassis on baffle at 10s.; postage extra.—G6WY, " Killiney," Worsley Bridge Road, Beckenham, Kent.

FOR Sale, T.C.C. 2 mfd. Condensers, working voltage 800 volts D.C., size 6×3×1. Brand new at 4/- each.—EDGLEY & EDGLEY, 37, High Street, Walton-on-Thames.

PATENTS AND TRADE MARKS.

PATENTS obtained, Trade Marks and Designs registered, British and Foreign.—GEE AND CO., Patent and Trade Mark Agents (H. T. P. GEE, Member R.S.G.B., A.M.I.R.E.), 51-52, Chancery Lane, London, W.C.2. Telephone: Holborn 1525.

CYLDON TRANSMITTING CONDENSERS



CYLDON Transmitting Condensers, the finest in the world, are fitted with standard square-law type vanes double spaced to avoid breakdown on high voltages. Of selected raw materials, they are tested over every stage of manufacture to ensure maximum results. All CYLDON condensers are superior to other makes whether for Transmission or Reception, and their extra cost is amply justified by their outstanding performance and quality. Build with CYLDON.

CONDENSERS BUILT TO SPECIFICATION AT SPECIAL RATES

TRANSMITTING TYPES.

List No.	Max. Cap.		Solid Brass
TR4	400	25/-	£2 4 0
TR35	350	19/6	£1 14 6
TR25	250	17/6	£1 10 6
TR2	200	16/6	£1 9 0
TR15	150	15/6	£1 7 0

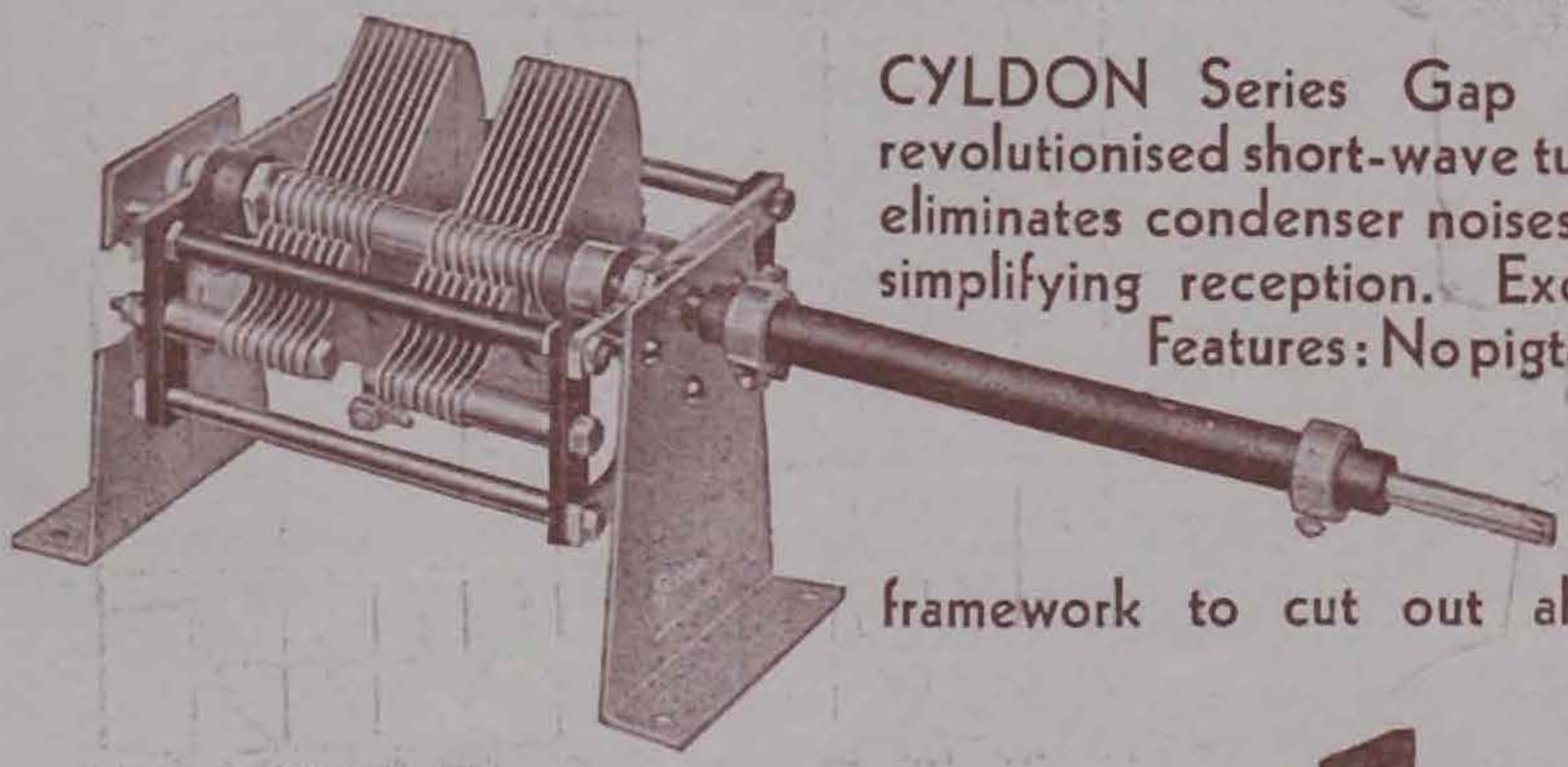
ALWAYS USED BY THOSE WHO KNOW SHORT WAVES

SERIES GAP TYPES.

List No.	Max. Cap.	Min. Cap.		Solid Brass
S.G.1	100	5	15/-	£1 6 6
S.G.15	150	7	16/6	£1 9 0
S.G.2	200	9	18/-	£1 11 6
S.G.25	250	12	19/6	£1 14 6
S.G.02	20	4	14/-	£1 4 6

Extension Handle Outfit 4 6 *extra*

Revolutionises Short-wave Tuning



CYLDON Series Gap Condensers have revolutionised short-wave tuning. Their design eliminates condenser noises, at the same time simplifying reception. Exclusive CYLDON Features: No pigtail; absolute silence in operation; no backlash; and provision for earthing framework to cut out all hand capacity.

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