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CONTENTS

A DANGEROUS PRACTICE.

THE laws of this country make it an offence for a private individual to possess radio apparatus without a Government licence. In the case of transmitting gear a special permit is required, and this is only issued after the licensing authorities have satisfied themselves that the apparatus is to be used for the express purpose of conducting experiments.

Until recent years practically all amateur transmitting apparatus was home constructed, but of late the practice of purchasing complete installations has become commonplace not only in America (the home of the ready-made transmitter), but here in England. It is outside our province to comment upon this method of obtaining results with a minimum of effort, but in its wake is growing up a practice which *does* call for comment, for not only is it dangerous from an amateur radio point of view, but if continued may lead to serious national difficulties. We refer to the sale of transceivers and transmitters to persons who possess no authority to operate such apparatus.

During our visits to Scotland and the North of England last November, evidence was forthcoming that small foreign-made 56 Mc. transceivers were being sold over the counter to anyone with a few pounds to spare. At the time we expressed our concern at this state of affairs, but consoled ourselves with the thought that probably only a very few sets had been sold. Unfortunately this hopeful view was not justified, for recently our attention has been drawn to sensationally worded advertisements concerning these transceivers, in which full play has been given to such expressions as " What a thrill—what a joy—talk to your friends from your own home."

We believe we are voicing the wishes of members when we say that immediate action should be taken to prevent a continuation of this dangerous practice, for so long as it is allowed to continue piracy will be bred and every 56 Mc. transmission will become suspect.

Since the publication of the notice in our January issue, in which we drew attention to illegal transmission, several members have advised us that they have been innocent victims of this pernicious practice. In every case we have recommended them to notify the G.P.O., giving such information as they have available to assist the authorities in tracing the offenders.

We feel sure our members appreciate that it is in their own interests that piracy should be stamped out, and we are confident that we are not asking in vain for their fullest measure of co-operation.

J. C.

PIEZO-ELECTRICITY, QUARTZ CRYSTALS AND FREQUENCY STABILISATION*

II.—Quartz Crystals and Frequency Stabilisation.†

Introduction.

DURING recent years piezo-electric crystals have continually increased in importance; they have a great variety of uses nowadays, and in many cases have become indispensable. The direct piezo-electric effect is used in certain kinds of indicator, gramophone pick-up, microphone and loudspeaker; the inverse effect is applied to the generation of supersonic waves, and is also used in special types of oscillograph, voltmeter, etc. The first group of applications is of greater importance than the second, but the most important modern application of piezo-electricity is in wireless, for frequency stabilisation, standardisation and measurement, where extensive use is made of piezo-electric oscillators and resonators.

In this application, in particular, and also in most of the other applications mentioned, crystalline quartz stands pre-eminent among piezo-electric substances, chiefly because its relatively high piezo-electric "activity" is accompanied by other desirable properties. Quartz is an ideal substance for permanency: its occurrence among rocks that are disintegrating with age is a proof of its chemical stability; the hardness of quartz prevents wear and scratching in holding or clamping devices, and oxidation does not take place; hydrofluoric acid is about the only chemical substance that affects quartz to any appreciable extent, and is sometimes used to etch quartz for the purpose of detecting twinning. Tourmaline and Rochelle salt crystals are the only other piezo-electric substances which are useful as alternatives to quartz, the former being used in oscillators at very high frequencies, and the latter in piezo-electric microphones and loudspeakers.

"Quartz Crystals" and "Mounting."

The term "quartz crystal" is used to describe any portion taken from a piece of natural crystalline quartz for use as a piezo-electric element. The quartz crystals commonly used as piezo-electric elements in electrical circuits have generally the form either of thin rectangular plates or circular discs of small area, taken from X- or Y-cut sections of quartz, but other shapes and cuts are used for special purposes.

For use as a piezo-electric element in an electrical circuit, a quartz crystal is, in the simplest cases, mounted by laying it between two flat metal electrodes so that a small condenser is formed with the quartz as dielectric. One electrode is used to support the crystal, and the other electrode is laid on the upper surface, a small spring being sometimes added to ensure a uniform contact.

The actual method of mounting a quartz crystal in a particular case depends on the purpose for which the crystal is to be used, and is a matter to which careful attention must generally be paid. A quartz crystal must be mounted so that its vibrations are restrained as little as possible. Other disturbing factors, such as the intrusion of dirt, moisture, etc., must also be guarded against, as these have a deleterious effect on the vibrations and their frequency constancy.

A quartz crystal is sometimes used with an air gap between the crystal and one or both of its electrodes. Great care is, however, necessary in the use of an air gap with a quartz crystal, since supersonic air waves arise in the air gap, and these have important reactions on the vibrations of the crystal, both the frequency and decrement being affected by the size of the air gap. An adjustable air gap is very convenient in certain cases as a means of fine adjustment of frequency, but damping of the vibrations of the crystal due to the absorption of energy by resonance in the air gap, which occurs when its length is suitable for stationary air waves to be formed in the gap, may be a serious disadvantage.

In cases where it is desired to avoid the presence of an air gap the electrodes may be applied in the form of silver deposits on the surfaces of the crystal. This is an alternative method to that employing spring pressure to ensure a uniform contact, and avoids any spurious air gap arising, as when the top electrode is laid on the crystal. When an air

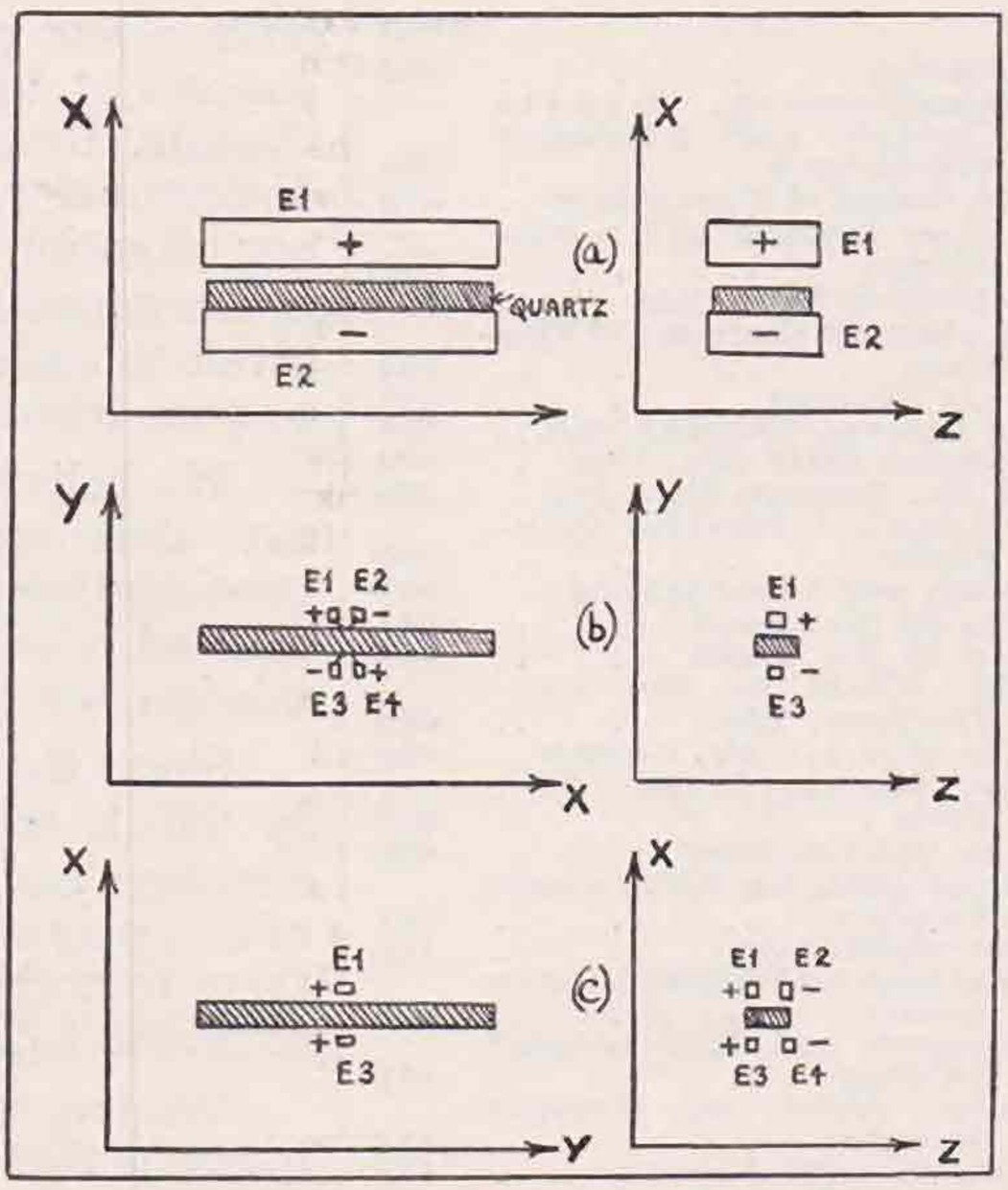

Fig. 1.
Arrangements of electrodes used by Giebe & Scheibe for the excitation of (a) longitudinal, (b) flexural, and (c) torsional vibrations.

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gap is required the top electrode can be made adjustable by supporting it on a micrometer thread arrangement. The crystal is sometimes clamped sideways between a small number of tiny pointed rods fitting in a groove cut centrally round the edge of the crystal, and one or both electrodes may be made adjustable. Whatever type of mounting is used, a quartz crystal holder is generally completely enclosed for protective purposes.

Vibrations of Quartz Crystals.

The piezo-electric constant K in the formula Q=K.P. has different values in different directions in a crystal, but along the most " active " directions its values are 6.5, 11 and $1{,}000 \times 10^{-2}$ E.S. units of electricity per kg. for quartz, Tourmaline and Rochelle salts, respectively.

Consider a quartz plate or disc of area 4 sq. cms. to which a pressure of 10 kg. per sq. cm. is applied, and let the capacity C between two metal coatings applied as electrodes to the " quartz crystal " be 10 cm. The quantity of piezo-electricity developed by this static pressure is

$$Q = 6.5 \times 10^{-2} \times 10 \times 4 = 2.6 \text{ E.S. Units.}$$

Hence the voltage V produced between the electrodes is

$$V = Q/C = 2.6/10 = 0.26 \text{ E.S. Units} = 0.26 \times 300 = 78 \text{ Volts.}$$

Consider now a quartz crystal mounted between two electrodes to which an alternating voltage of variable frequency may be applied. The first application of a voltage to the electrodes will cause either a compression or a dilatation of the crystal, which will not return immediately to its original shape, but will tend to execute a series of mechanical vibrations of decreasing amplitude, at a frequency determined by the elastic properties of quartz, the dimensions of the crystal and its orientation with respect to the axes, and the temperature. These natural vibrations of the crystal will be accompanied by the development on the electrodes of a potential difference alternating at the same frequency. The importance of quartz crystals in wireless is indirectly due to the fact that they can be made of such a size that their natural frequencies are of the same order as the frequencies used in wireless.

The mechanical vibrations of a quartz crystal die away like the current in an oscillatory circuit to which a momentary voltage has been applied. Also, owing to the low internal friction of quartz, the rate of decay of the mechanical vibrations is very small; it is much smaller than the rate of decay of electrical oscillations in a low resistance oscillatory circuit, i.e., a quartz crystal has a very low decrement.

If, now, an alternating voltage V is applied to our quartz crystal the latter will be forced to vibrate at the frequency of the applied voltage, but the amplitude of the vibrations will be very small unless this frequency is near that at which the natural mechanical vibrations can take place. When the two frequencies are nearly the same the amplitude of the vibrations will build up to a large value. The quartz crystal behaves like an oscillatory circuit.

A quartz crystal is capable, in general, of vibrating in different modes at different resonant frequencies. These vibrations depend on the shape and orientation of the quartz axes in the crystal, and on the arrangement of the electrodes and the manner in which the crystal is excited into vibration, i.e., the circuit used. Three general types or modes of vibration are possible. These are longitudinal (i.e., dilatation or compression in the direction of either the thickness or the width of the crystal, the latter being sometimes called transverse), flexural (i.e., bending), and torsional (i.e., twisting) vibrations.

For the simplest case of an X-cut crystal, deformations of the crystal take place in the directions of the X- and Y-axes, the total volume of the quartz remaining unaltered. The deformation D_x in the direction of the X-axis (the longitudinal effect) is

$$D_x = 0.34 \times 10^{-9} \times V \text{ in mm. per volt}$$

and that in the direction of the Y-axis (sometimes called transverse effect) is

$$D_y = 2.15 \times 10^{-9} \times V.y/x \text{ in mm. per volt}$$

x and y being the dimensions of the quartz crystal in directions parallel to the Y- and X-axes.

For the frequency of the vibrations of an X-cut quartz crystal we have the formula

$$f = \frac{1}{2x} \sqrt{\frac{E_x}{d}} \text{ c/s}$$

where E_x is the modulus of elasticity of the quartz in the direction of the X-axis, equal to 7.87×10^{11} dynes per sq. c.m, and d is the density of quartz, equal to 2.65 grs. per cc. Hence

$$f = \frac{2.705.\ 10^6}{x} \text{ c/s}$$

x being the thickness of the quartz crystal in mms.; or, expressed in wavelengths:

$$\lambda = 110.\ x \text{ metres}$$

i.e., an X-cut quartz crystal of 1 mm. thickness has a natural wavelength of 110 metres.

The type of vibration just considered above is sometimes called a thickness vibration because the vibrations take place in the direction of the thickness of the crystal, and the thickness determines the natural wavelength. Quartz crystals may also, especially when in the form of rods, be excited into longitudinal vibrations, in which the latter take place in the direction of the length of the rod, which is the factor determining frequency, in this case.

The multiplicity of the modes of vibration of quartz rods has been studied in detail by Giebe and Scheibe. Figs. 1a, b and c show the arrangements of electrodes used by them for the excitation of longitudinal, flexural and torsional vibrations, respectively. Fig. 1a shows how longitudinal vibrations may be excited along the direction of the Y-axis of a quartz rod. Since the longest rods which can be cut from quartz are about 10 cms. in length, the greatest wavelength which can be so produced is about 11,000 metres, corresponding to a frequency of about 27 kc/s. Lower frequencies, down to about 1,000 c/s., can be excited by means of flexural vibrations, in which the particles of the quartz rod vibrate in a direction perpendicular to that of the applied electric field, as shown in Fig. 1b.

X- and Y-Cut Quartz Crystals.

Crystal-controlled valve oscillators used in practice nearly always employ longitudinal vibrations of X- or Y-cut quartz crystals, having the form of rectangular plates or circular discs.

The X-cut quartz crystal has two principal resonant frequencies, one due to vibration of the

crystal in the direction of its thickness, and the other due to vibration in the transverse direction, i.e., in the direction of the width of the crystal. The former, the thickness frequency, is given approximately by the formula

$$f=2.7/t$$

where f is the frequency in Mc/s. and t is the thickness in mms. The other frequency is determined by

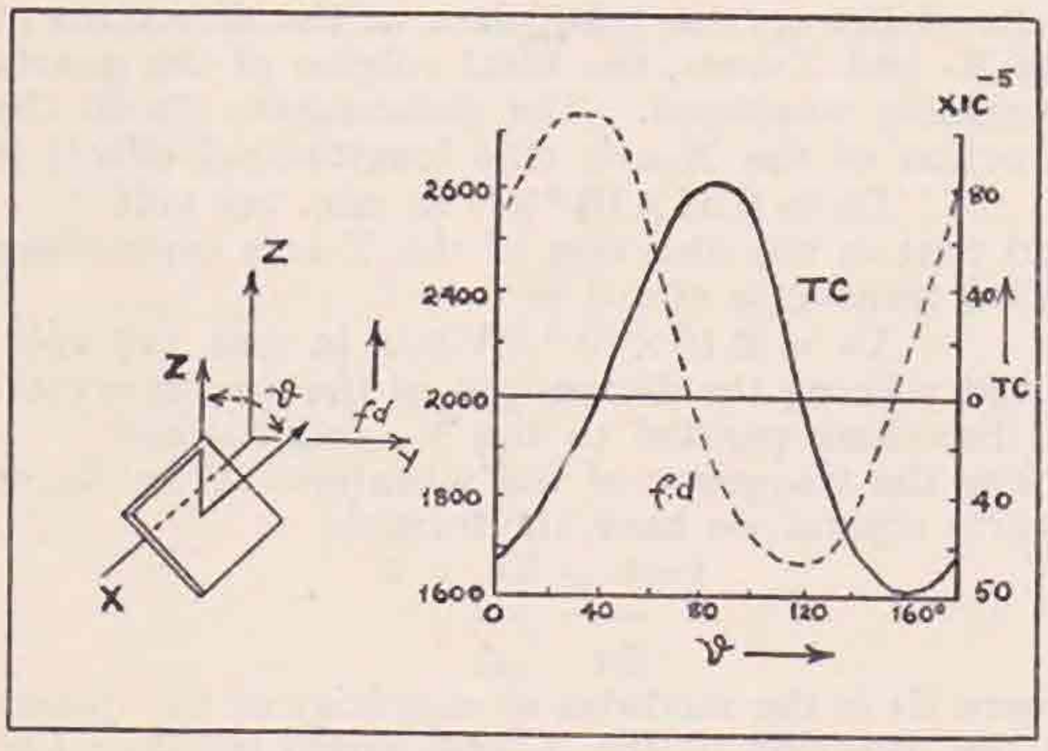


Fig. 2.
Effect of angle of cut on temperature coefficient.

the width of the crystal in the direction of the Y-axis, and is given by the same formula with t replaced by w the width of the crystal in mms. The width and thickness vibrations in X-cut quartz crystals are produced by the aid of the same circuits, the vibration obtained in a particular case depending on the circuit adjustments.

A Y-cut quartz crystal also possesses two principal resonant frequencies corresponding to those of the X-cut crystal, and the width frequency is given by the same formula. The thickness frequency in this case, however, depends on the ratio of the thickness to the width of the crystal, and has other peculiar properties. For very small values of the ratio mentioned, the thickness frequency depends substantially on the thickness t, measured in the direction of the Y-axis, and the formula is that, approximately,

$$f=2/t$$

This frequency, however, often appears as a double-t consisting of two frequencies differing by a small amount. Also, at certain thicknesses no resonant frequency is to be found, and a variation of the thickness causes the resonant frequency to vary discontinuously. In particular, this resonant frequency is affected by the width of the crystal, for certain values of which it disappears. This phenomenon is most pronounced when the thickness and width of the crystal are of the same order of magnitude. The explanation of this behaviour is that the two vibrations involved are coupled together, and at certain values of the width and thickness the ratio between the two latter is such that the frequency of the width vibration, or of a narmonic thereof, is the same as that of the thickness vibration. A single response frequency can usually be obtained by grinding the edge of the crystal to give a slightly different width.

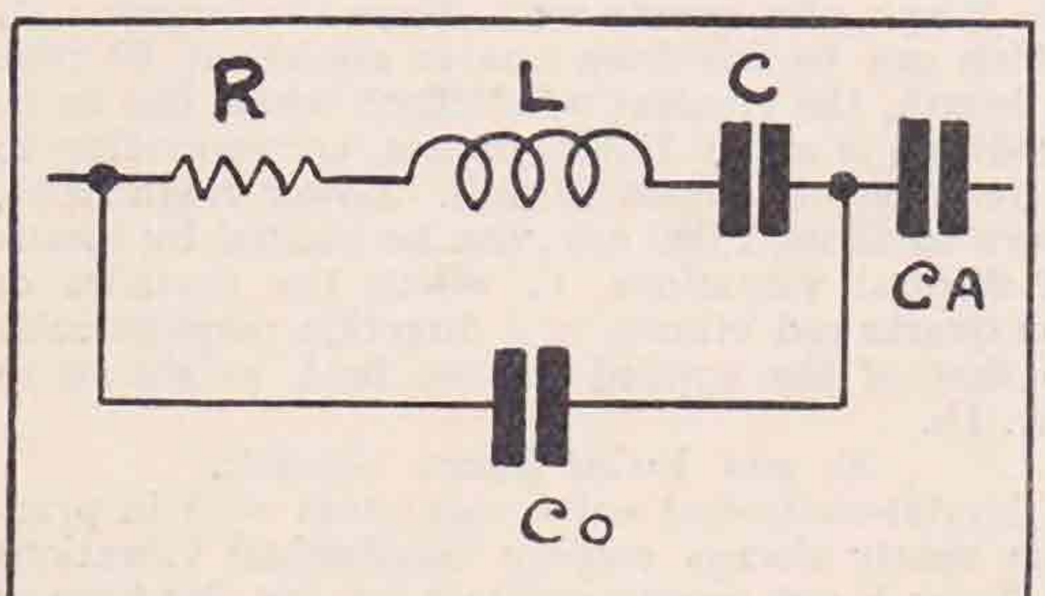


Fig. 3.
Equivalent electrical network of vibra ting quartz crystal.

The Temperature Coefficient of Quartz Crystals.

Temperature fluctuation is the chief factor causing frequency variation in a crystal-controlled valve oscillator employing an accurately made quartz crystal correctly mounted. Hence, where high frequency stability is required the quartz crystal mounted in its holder is enclosed in a small electrically heated oven that is maintained at a suitable constant temperature by means of a thermostat, in order to prevent the frequency of vibration from changing with the atmospheric temperature, or to maintain the crystal at an optimum temperature for single response operation. The use of a thermostatically controlled oven with a quartz crystal is nowadays almost universal. (In commercial practice.—Ed.)

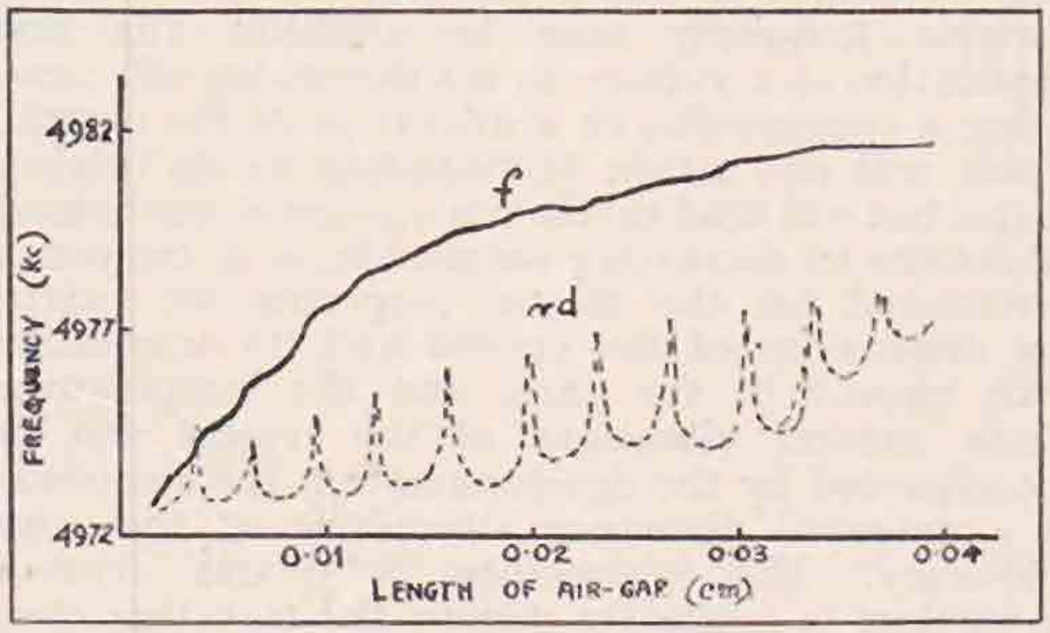


Fig. 4.
Curve showing how frequency varies with change of air gap.

Depending on the dimensions of the crystal and on the direction of cut, the magnitude of the temperature coefficient of frequency variation may vary from a few times 10^{-5} to less than 10^{-6}, and it may be either positive or negative. As the temperature coefficient is different along the three principal axes of quartz, the effect of temperature in a quartz crystal is very complex, and only recently have the conditions governing the temperature coefficient become clarified.

For Y-cut quartz crystals the temperature coefficient varies with the shape and size of the crystal, having a wide range of possible values whose limits are approximately $+100$ and -20×10^{-6} per ° C., with all intermediate values including zero. The temperature coefficient of the thickness vibration of a Y-cut quartz crystal, however, is positive for a small ratio of thickness to width, and is about 40×10^{-6} per ° C.; if the ratio of thickness to width is not small the above-mentioned

range of values is possible for the temperature coefficient. The behaviour of a Y-cut quartz crystal vibrating in the direction of its thickness often changes violently with small changes in temperature. This result is due to the coupling effect, mentioned earlier, between the thickness vibration, which has a positive temperature coefficient, and the width vibration, which has a negative temperature coefficient, the resultant

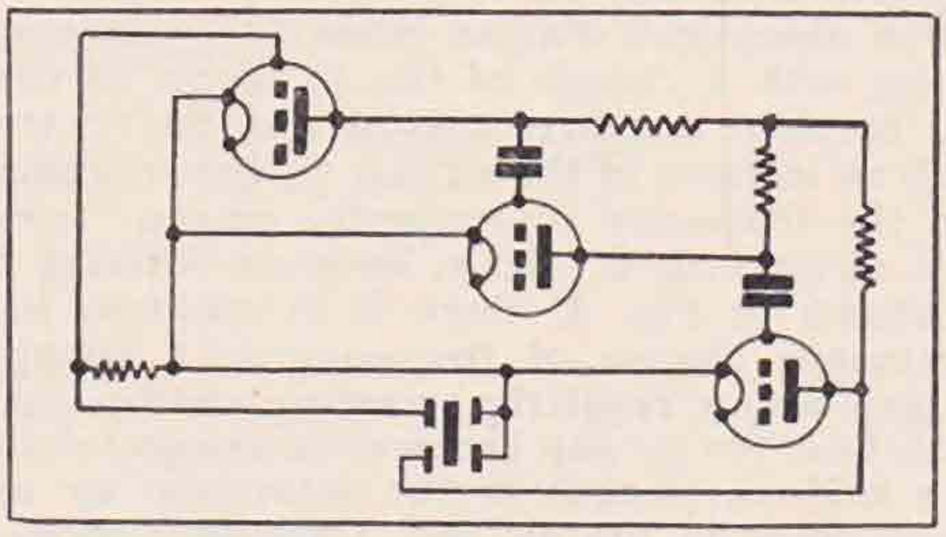


Fig. 5.
The original frequency stabilising circuit developed by Cady.

effect depending largely on the degree of coupling between the two vibrations. A consequence of this is that in Y-cut quartz crystals the frequency often changes discontinuously with temperature.

For X-cut quartz crystals the temperature coefficient varies little with the size of the crystal, and lies between 15 and 25×10^{-6} per ° C., being always negative, but the peculiar variation of the temperature coefficient of a Y-cut quartz crystal indicates that a crystal might be cut so as to have a negligible temperature coefficient.

A ring-shaped quartz crystal can be cut having a zero temperature coefficient over a small temperature range. The ring is cut in the plane of the optic and electric axes of quartz, with the difference between the radii equal to the thickness. Such an annular shaped crystal attains a zero temperature coefficient because its dimensions are proportioned so that the positive and negative temperature coefficients of different modes of vibration of a Y-cut crystal are made to compensate for each other. It is suitable only for relatively low frequencies.

Recently, what are known as A-cut quartz crystals have been produced by the Bell Telephone Laboratories. These crystals have characteristics that give them a temperature coefficient of practically zero. Starting from the Y-cut, with orientation of the cut about the X-axis, crystals are obtained at certain angles that have a simplified frequency spectrum, i.e., practically single-frequency response, while at certain other angles the temperature coefficient becomes zero.

With the angle of rotation about the X-axis measured with reference to the Z-axis, the single-response cuts occur at +31° and —60°, while the zero temperature coefficient cuts occur at +35° and —49°. The +31° cut which gives the single-frequency response is known as the AC-cut, and the +35° zero temperature coefficient cut is known as the AT-cut. The AT-cut is an important and useful cut, since it has a zero temperature coefficient and also is very near to the 31° cut, which gives a single-frequency response. An AT-cut crystal is somewhat thinner than the Y-cut from which it is derived, but the AT-cut is practically free from the coupled vibrations that not only give the Y-cut its notorious double-humps, but also make it liable to fracture in operation.

Bechmann, in Germany, has also found that the temperature coefficients of a quartz crystal cut at a particular angle is zero. Fig. 2 shows the effect of the angle of cut on the temperature coefficient, according to Bechmann. The angle of cut is measured as the angle between the normal to the crystal and the Z-axis. The dotted curve in Fig. 2 shows the variation of the product f.d., where d is the thickness of the quartz crystal in mms. and f its natural frequency in kc/s., with the angle of cut v ; the full line curve shows that the temperature coefficient varies between $+80 \times 10^{-5}$ and has zero value at two particular angles.

Equivalent Electrical Circuit of a Quartz Crystal.

According to the works of van Dyke and the late Dr. Dye, a vibrating quartz crystal is equivalent to an electrical network consisting of a series combination, as shown in Fig. 3 of an inductance L, a capacity C and a resistance R. If the quartz crystal is contained between two electrodes, the static electrode capacity is represented by the addition of a capacity C_o in parallel with R, L and C, and if there is an air gap between the quartz crystal and its electrodes a further capacity C_A must be inserted in series with the network (see Fig. 3). The series combination is the electrical equivalent of the vibrational characteristics of the quartz crystal. L is the equivalent of the mass of the crystal that is effective in the vibrations, C is the equivalent of the mechanical resilience of the crystal, and R is the equivalent of the friction that takes place during vibration. The frequency at which L and C are in series resonance is equal to the frequency of mechanical resonance of the crystal.

All electrical circuits employing quartz crystals can be analysed by replacing the crystal by its equivalent electrical network and then determining the behaviour of the resulting circuit. Conversely, if a quartz crystal is to replace a given network of electrical elements, as, for example, in a filter, the dimensions of the crystal required may be determined from the equations and constants, which have been derived by mathematical analysis, governing the equivalent electrical circuit. The values of L, C, R, C_o and C_A in any particular case

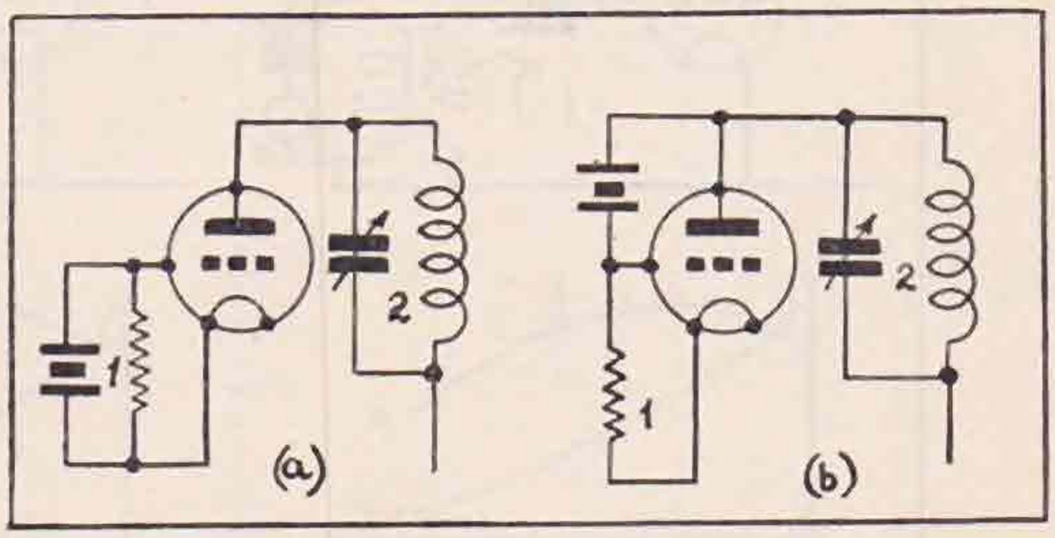


Fig. 6.
At left the Pierce Circuit with crystal between grid and filament. At right a modified arrangement with crystal between grid and plate.

depend on the orientation of the crystal with respect to its axes, the size of the crystal, and the type of mechanical vibration (mode of vibration) involved.

The constants of the equivalent electrical circuit of a quartz crystal may be determined either theoretically or experimentally. Straubel gives the following set of values for L, C and C_o for a few different wavelengths :—

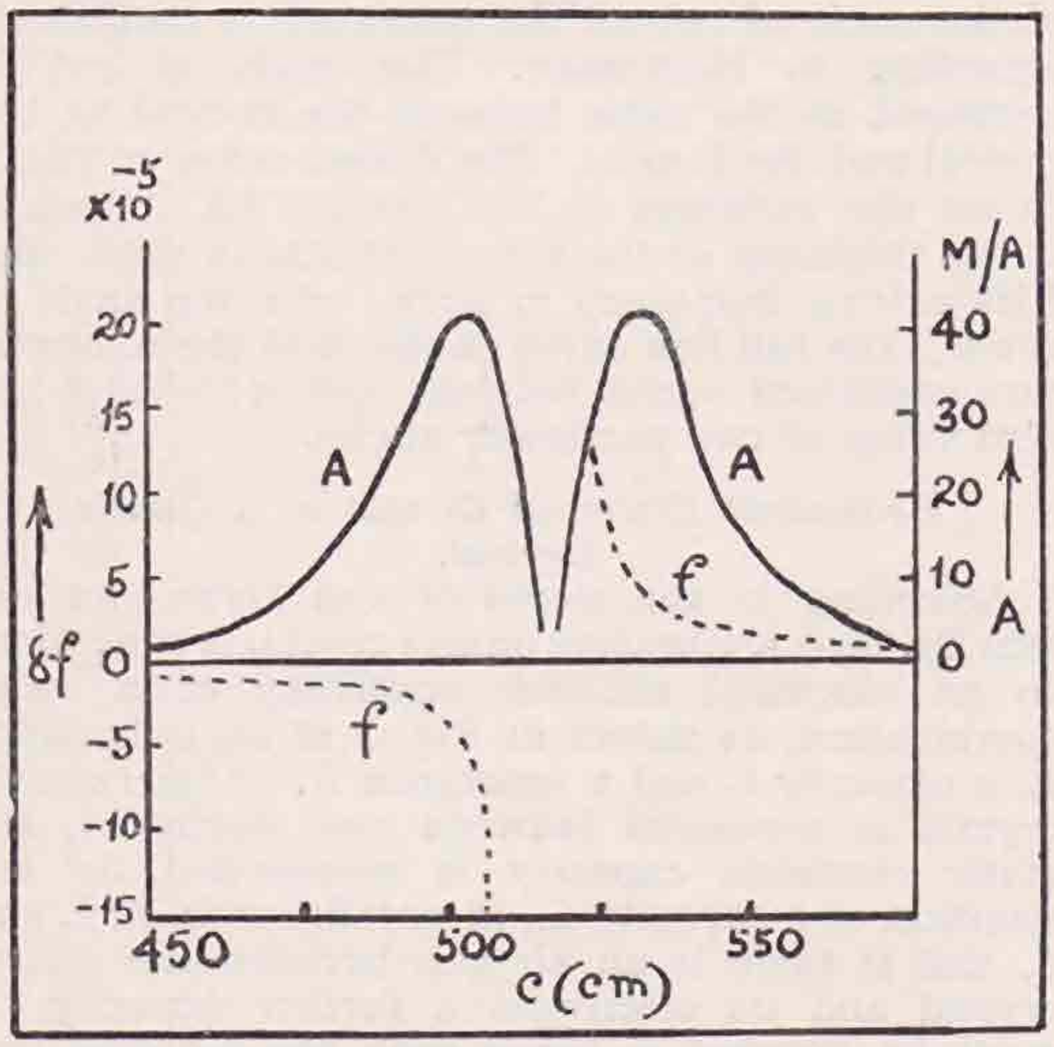


Fig. 7.
Effect of output circuit (2 in Fig. 6) on frequency of oscillation.

Wavelength (*m.*)	*L* (*cm.*)	*C* (*cm.*)	C_o (*cm.*)
2	801	1.390	208
10	100,175	0.278	42
40	6,411,170	0.069	10

The ratio of C_o/C is about 140. It is seen that the ratio L/C has an extremely high value, not otherwise obtainable with an ordinary electrical oscillator circuit. The decrement (πR. C/L) of a quartz crystal is thus very small, being about 10^{-3} to 0.5×10^{-4}; this is 100 times smaller than the decrement of a good low resistance oscillatory circuit. Herein lies the cause of the excellent frequency stabilising action of a quartz crystal used in conjunction with a valve oscillator. It may be mentioned here that the equivalent electrical circuit of a quartz crystal may also be represented as a parallel oscillatory circuit. Since C_o is much greater than C, the latter almost exclusively determines the resonant frequency. Small changes of C_o, e.g., due to change of valve, have consequently only a relatively small effect on the frequency of a quartz-controlled valve oscillator.

Dye discovered that an interesting phenomenon occurs with a change of the thickness of the air gap between a quartz crystal and its electrodes. With an increase of the air gap, C_A becomes smaller, and the frequency consequently greater, since C_A is in series with C. It is, however, striking that, as shown in Fig. 4, there is in addition to the continuous change of frequency with change of air gap also a regularly occurring sudden change. Each time the air gap becomes an integral multiple of a half wavelength of the supersonic air waves which occur in the air gap, stationary waves are formed ; these affect the frequency and also increase the decrement of the quartz vibrations due to damping. The variation of the decrement with the length of the air gap is shown as a dotted curve below the frequency curve in Fig. 4.

Quartz Crystal Oscillators and Resonators.

Since a vibrating quartz crystal is equivalent to an oscillatory circuit, a quartz crystal of appropriate dimensions can be used to control a valve oscillator, instead of the usual tuned circuit, by utilising the reciprocal action between the direct and inverse piezo-electric effects to provide a link between the mechanical and electrical oscillations. The outstanding feature of such a valve oscillator is that the frequency generated is, when all causes of variation of the frequency generated by the quartz crystal have been compensated, remarkably constant and independent of minor variations in the circuits associated with the valve. The chief reason for the latter result is that, owing to the high equivalent L/C ratio of the quartz crystal, the coupling between the latter and the electrical circuits is very low.

In 1922, just at the time when the question of the frequency constancy of wireless transmitters was becoming important owing to the higher power

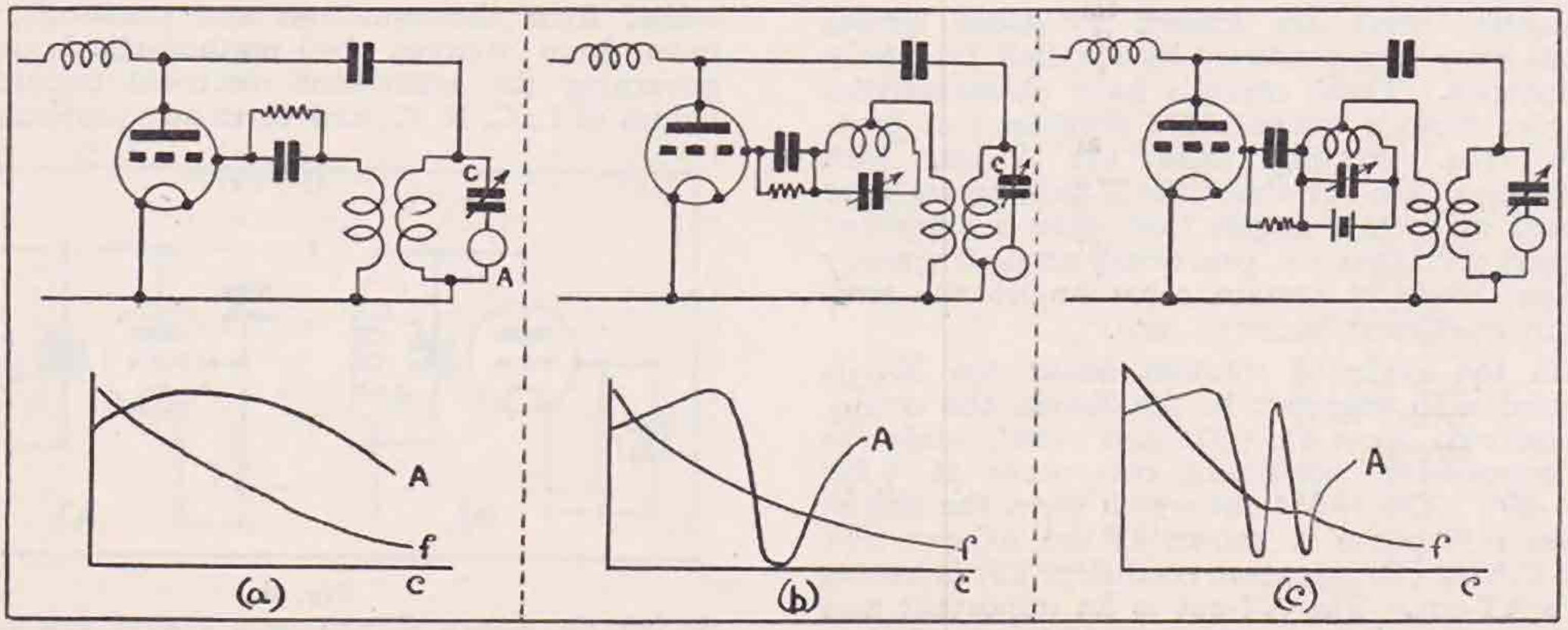


Fig. 8.
Circuits evolved by Kusunose and Ishikawa for obtaining increased power from a crystal oscillator without overloading the crystal.

of stations and the increase in their number, Cady discovered the possibility of securing extremely high frequency constancy by the aid of piezo-electric control. The circuit used by him is shown in Fig. 5. This circuit delivers only very small high-frequency power, but it is interesting to note that it has no electrical oscillatory circuit. The most widely used circuit nowadays is the Pierce circuit, shown in Fig. 6a, of which most other circuits are modifications.

It is to be noted that with this circuit self-excitation of oscillations can only occur if circuits 1 and 2 are inductive, since the back-coupling via the internal grid-anode valve capacity is always capacitive. If, on the other hand, the back-coupling is inductive, circuits 1 and 2 must be capacitive. It thus follows that, since in the Pierce circuit the resulting quartz crystal impedance must have an inductive component, the frequency f generated by the circuit must be greater than the natural frequency f_q of the quartz crystal (series circuit). On the other hand f is smaller than the natural frequency f_A of the anode oscillatory circuit, so that also its impedance is inductive (parallel circuit).

If we consider the behaviour at different frequencies we see that it is as follows: The circuit does not oscillate except near the resonant frequency of the quartz crystal. At or near this resonance, however, sufficiently large voltages are produced for permanent oscillation to become possible. Away from resonance the impedance of circuit 1 is capacitive since the relatively large capacity between the quartz crystal electrodes then determines the phase. Exactly at resonance the phase difference is zero, but at a frequency slightly above the natural frequency the phase is inductive and oscillations are maintained. The frequency of oscillation is determined almost exclusively by the quartz and is only little dependent on circuit 2. This must, however, always be inductive. If, by increasing the capacity of the oscillatory circuit, the frequency of the latter approaches the frequency f, the amplitude of oscillation increases; since the amplification increases, the frequency control also increases. Just before reaching the frequency f, oscillations cease (see Fig. 7, left).

Sometimes the quartz crystal is placed between the grid and anode as shown in Fig. 6b. In this case circuit 1 is capacitive, and therefore circuit 2 must likewise be capacitive, and the quartz crystal impedance inductive. In contrast with the Pierce circuit a frequency is excited which is greater than the natural frequency f_A, of the anode oscillatory circuit. If this frequency approaches that of the quartz crystal there is again an effect similar to that described above for the Pierce circuit, but opposite in direction, on the frequency of the oscillations generated (see Fig. 7, right). Fig. 7 shows for both circuits described the variation in the amplitude and frequency of the oscillations produced, with variation of the tuning of the oscillatory circuit.

On the longer waves it is sometimes difficult to get the quartz crystal to oscillate. In such a case a small additional back-coupling is introduced of such magnitude that, without the crystal, it would be insufficient to maintain oscillations. If the Pierce circuit is used for very short waves, below, say, 5 metres, a small condenser must be placed in parallel with the grid-anode capacity of the valve. For very short waves C_o becomes quite large (about 200 cms.). Since the impedance of the crystal during vibration is still smaller than $1/wC_o$, but $1/wC_{ga}$ is relatively larger (C_{ga} is about 5 cms.), the back-coupling is very small, and so must be artificially increased as mentioned. The shortest wavelength which can be directly controlled by a quartz crystal is about 3 metres. Using Tourmaline instead of quartz, Straubel has been able to get down to 1.2 metres. The limit is due to the difficulty of cutting thin crystals accurately and uniformly.

Many circuits have been devised for obtaining increased power from a quartz-controlled valve oscillator, without overloading the quartz crystal and consequently causing it to fracture. Crossley proposed the use of a choke and grid battery instead of a leak-resistance in the grid circuit, and was thereby able to control stages of 100 watts power. Another interesting and useful circuit for this purpose is that due to Kusunose and Ishikawa, and shown in Fig. 8. If a parallel oscillatory circuit is connected to the grid of an ordinary self-excited oscillator (Fig. 8a), as shown in Fig. 8b, oscillations cease when the frequency is equal to that of this circuit. If, however, as shown in Fig. 8c, a quartz crystal of the same frequency is connected across the grid oscillatory circuit, the quartz crystal has a low impedance over a small region near its series resonance, and it therefore compensates the suppressing action of the oscillatory circuit. Using this circuit, it has been found possible to obtain directly-controlled stages of 100 watts power. Recently, quartz crystal control has been applied to electron-coupled oscillators, and advantages obtained with respect to power output and constancy.

It is nowadays possible, without great difficulty, to obtain a frequency constancy of 10^{-6} to 10^{-7} with quartz-controlled oscillators over a long period of time. Scheibe and Adelsberger have constructed quartz-controlled oscillators whose constancy has been found to be as good as 10^{-9} over periods of hours. After several stages of frequency division they are able to use these oscillators to drive electric clocks, whose accuracy of time-keeping even surpasses that of astronomical time measurement.

As resonators, quartz crystals find their greatest use in the form of the luminous resonators created by Giebe and Scheibe. They use quartz crystals in the form of rods with electrode arrangements as shown in Fig. 1. Such a quartz crystal resonator is mounted in an evacuated glass bulb at a pressure of 10-15 mm. H_g, since the excitation of the glow requires a much smaller voltage therein than at atmospheric pressure. The glow occurs at the places of maximum vibration amplitude at resonance, the necessary voltage being of the order of 20 to 30 volts. The optimum frequency band of these luminous quartz resonators is about 1 to 5×10^{-6}, and, with loose coupling, a deviation of half this amount from the resonant frequency is sufficient to extinguish the glow. Luminous quartz resonators are very constant, and useful as simple frequency standards for frequencies from about 1,000 c/s. up to the frequencies of short waves. By using harmonics a few quartz rods can provide a large number of standard frequencies.

THE DESIGN OF WAVE FILTERS

By E. C. Bayldon (G5NP).

THERE are several books which discuss the design of wave filters at great length, but even if these are available it is not easy to extract the formulæ required for the design of any particular filter.

This article is based on notes made when working out some filters and the formulæ are derived from "Electrical Wave Filters," a paper by M. Reed, M.Sc., published in *The Wireless Engineer* of March to August, 1930, and from "High Frequency Alternating Currents," by McIlwain and Brainerd. (*McGraw-Hill.*)

A wave filter may be defined as a network of inductances and capacitances connected in a circuit to offer a bar to the passage of some particular band of frequencies.

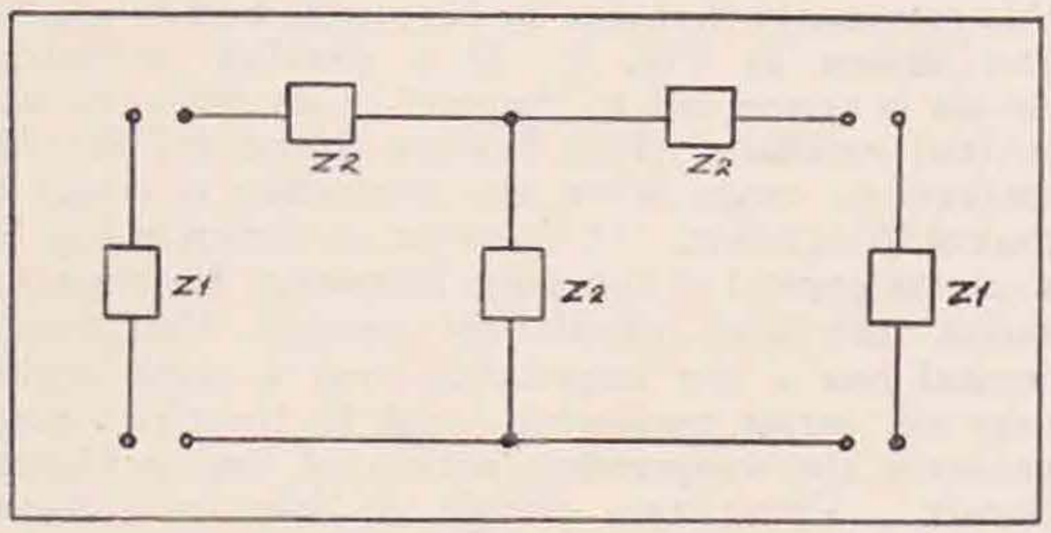
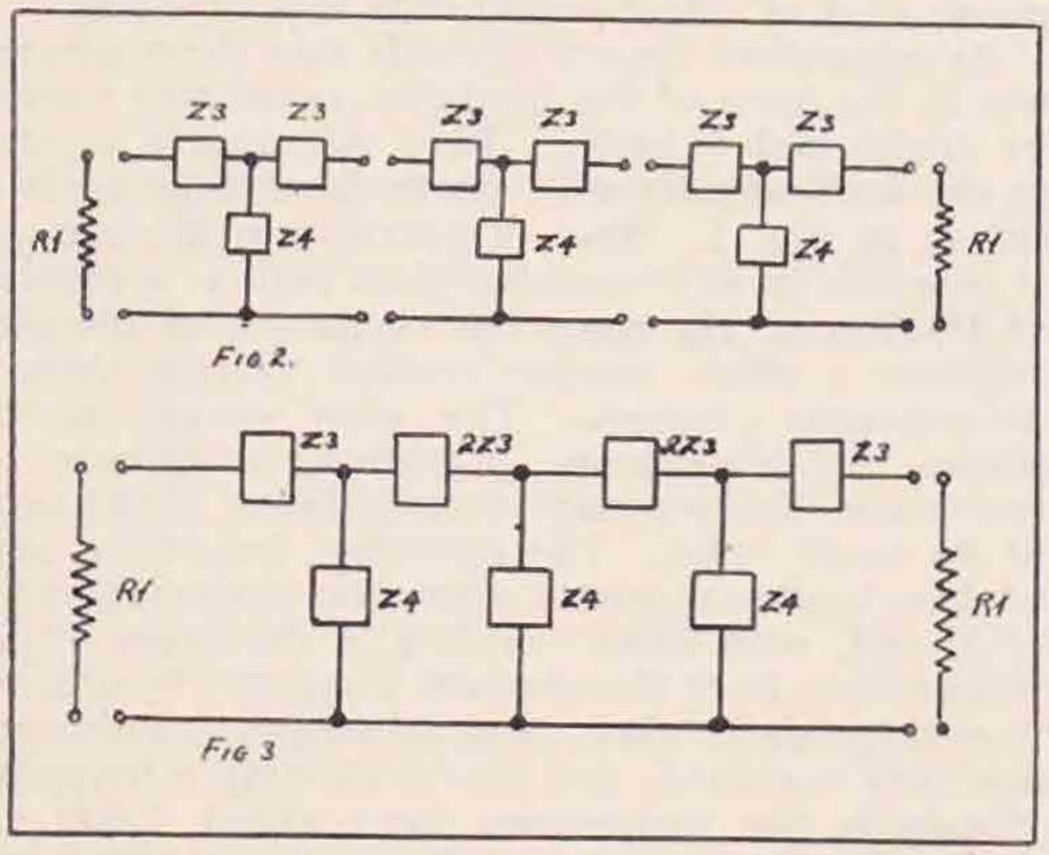


Fig. 1.
"T" Section wave filter.

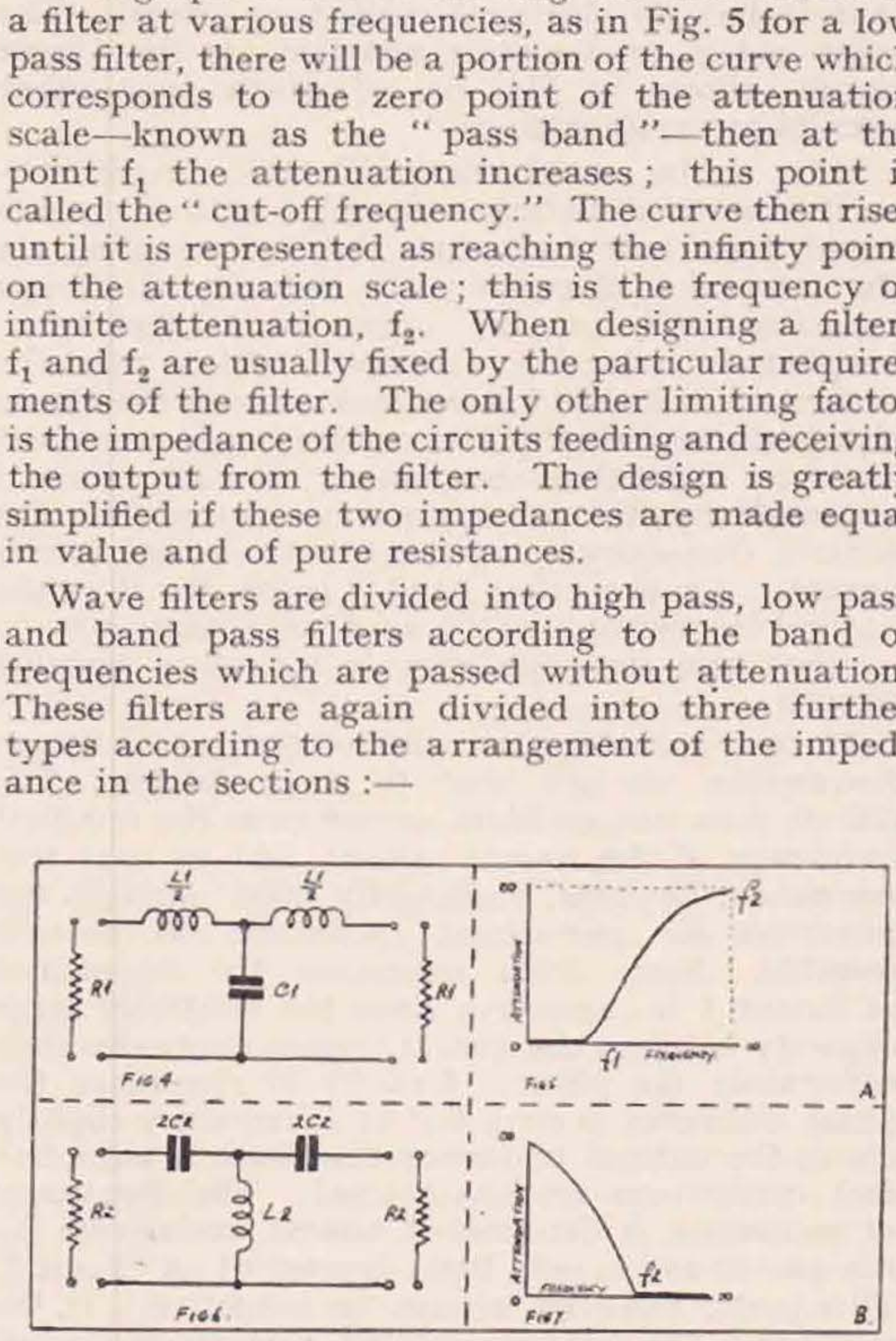
The most common method of arranging the impedances in a filter section is the "T section" as shown in Fig. 1. Several sections may be connected in series as in Fig. 2, which, when adjacent components are combined, become as shown in Fig. 3. The greater the number of sections connected in this manner the greater will be the attenuation of the filter, or in other words, the greater will be the bar offered to the particular band of frequencies the filter is designed to suppress.



Figs. 2 and 3.
Fig. 2. Filter composed of three "T" Sections.
Fig. 3. The actual circuit of Fig. 2.

If a graph is drawn showing the attenuation of a filter at various frequencies, as in Fig. 5 for a low pass filter, there will be a portion of the curve which corresponds to the zero point of the attenuation scale—known as the "pass band"—then at the point f_1 the attenuation increases; this point is called the "cut-off frequency." The curve then rises until it is represented as reaching the infinity point on the attenuation scale; this is the frequency of infinite attenuation, f_2. When designing a filter, f_1 and f_2 are usually fixed by the particular requirements of the filter. The only other limiting factor is the impedance of the circuits feeding and receiving the output from the filter. The design is greatly simplified if these two impedances are made equal in value and of pure resistances.

Wave filters are divided into high pass, low pass and band pass filters according to the band of frequencies which are passed without attenuation. These filters are again divided into three further types according to the arrangement of the impedance in the sections :—



Figs. 4, 5, 6 and 7.
Constant K Filters.
Fig. 4. Circuit. Fig. 5. Attentuation characteristic.
Fig. 6. Circuit. Fig. 7. Attenuation characteristic.
Figs 4 and 5. Low Pass Section.
Figs. 6 and 7. High Pass Section.

1. *"Constant k" Type Filters.*

These are composed of one or more symmetrical "ladder" sections in which the series impedance multiplied by the shunt impedance equals a constant (k^2) at all frequencies. They have the advantage of simplicity, but for high attenuation they require a large number of sections.

2. *"M-derived" Type Filters.*

So called because they are derived from "constant k" prototypes. They are slightly more complicated than the "constant k" type, but have the advantage that it is possible to fix the frequency at which the attenuation is infinite as well as the frequency of cut off, thus a sharper attenuation characteristic is obtainable with a single section "m-derived" filter than is possible with several "constant k" sections. In this type of filter the attenuation reaches a peak value of f_2, then falls, approaching a constant value.

3. *Composite Wave Filters.*

The composite filter consists of a number of different sections of " constant k " and " m-derived filters " joined in series. This type offers the most economical method of obtaining any but the simplest attenuation characteristics, but the design is involved and is normally not worth undertaking unless a number of the filters are to be produced.

To Design a Filter.

Having decided that a high or low pass filter is required for the particular purpose in view, it is necessary to determine the cut-off frequency required and possibly the frequency at which attenuation is to be infinite. Then consider the circuit in which the filter is to work and calculate the values of the terminal impedances; if possible these should be pure resistances.

If the filter is to have a gradually sloping attenuation characteristic a " constant k " type filter will be suitable, although it may be necessary to use more than one section connected in series. If the attenuation characteristic is required to fall off rapidly, an " m-derived " type will be necessary; one section will usually be sufficient.

Having decided these points, select the particular group of formulæ and from them calculate the values of the components. It is always more convenient to use standard values of components; if, therefore, after having completed the original calculation, it is found that several of the components required are not of standard value, the nearest standard value should be taken and the formulæ solved to find the change this makes in the cut-off frequency, etc.

Low Pass Constant K Filter.

The circuit arrangement of this type of filter is shown in Fig. 4, and the attenuation characteristic in Fig. 5.

In Fig. 4 if f_1 = cut-off frequency.
L_1 = total series impedance of a section.
C_1 = total shunt impedance of a section.
R_1 = pure resistance terminating the section at either end and adjusted to give best operating conditions.

$$\left.\begin{aligned} \text{then } f_1 &= \frac{1}{\pi\sqrt{L_1C_1}} \\ \text{and } R_1 &= \sqrt{\frac{L_1}{C_1}} \end{aligned}\right\} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (1)$$

$$\left.\begin{aligned} L_1 &= \frac{R_1}{\pi f_1} \\ C_1 &= \frac{1}{\pi f_1 R_1} \end{aligned}\right\} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (2)$$

If more than one section is used the attenuation will be increased. When two sections are connected together the inner inductance will become $L_1\left(\text{i.e., } \frac{L_1}{2}+\frac{L_1}{2}\right)$.

In these and all following formulæ the resistances, inductances and capacities are in ohms, henries and farads respectively.

High Pass " Constant K " Filter.

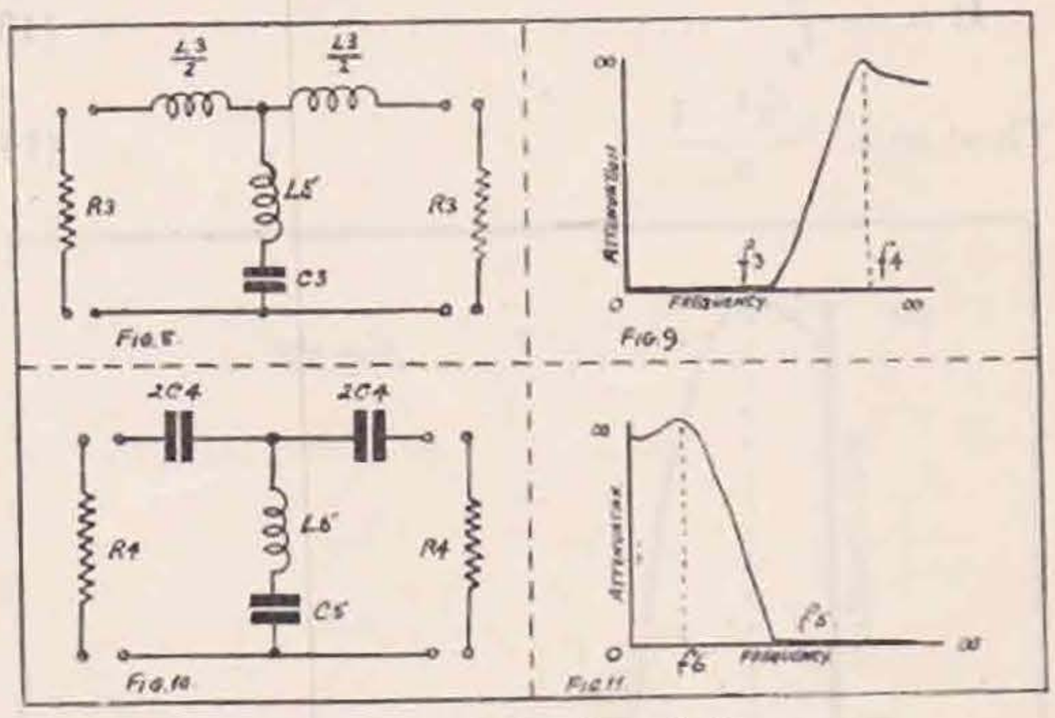
The circuit and attenuation characteristic are shown in Figs 6 and 7.

In Fig. 6 if f_2 = cut-off frequency.
C_2 = total series impedance of a section.
L_2 = total shunt impedance of a section.
R_2 = pure terminal resistance for best operating conditions.

$$\left.\begin{aligned} \text{then } f_2 &= \frac{1}{4\pi\sqrt{L_2C_2}} \\ \text{and } R_2 &= \sqrt{\frac{L_2}{C_2}} \end{aligned}\right\} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (3)$$

$$\left.\begin{aligned} L_2 &= \frac{R_2}{4\pi f_2} \\ C_2 &= \frac{1}{4\pi f_2 R_2} \end{aligned}\right\} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (4)$$

As with the low pass filter, if more than one section is used the attenuation will be increased. When two sections are connected together the inner condenser will become C_2.



Figs. 8, 9, 10 and 11.
" M "—Derived Filters.
Fig. 8. Circuit. Fig. 9. Attenuation characteristic.
Fig. 10. Circuit. Fig. 11. Attenuation characteristic.
Figs. 8 and 9. Low Pass Section.
Figs. 10 and 11. High Pass Section.

Low Pass M-Derived Filter.

The circuit and attenuation characteristic of an " m-derived " low pass filter are shown in Figs. 8 and 9.

In Fig. 8 if L_3 = total series inductance of a section.
L_4 = total shunt inductance of a section.
C_3 = total shunt capacity of a section.
R_3 = pure terminal resistance for maximum efficiency.
f_3 = cut-off frequency.
f_4 = frequency at which attenuation is infinite.

$$\text{Then } L_3 = \frac{mR_3}{\pi f_3} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (5)$$

$$L_4 = \left(\frac{1-m^2}{4m}\right)\frac{R_3}{\pi f_3} \quad \ldots \quad \ldots \quad \ldots \quad (6)$$

$$C_3 = \frac{m}{\pi f_3 R_3} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (7)$$

$$\text{If } a = \frac{f_4}{f_3} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (8)$$

$$\text{Then } m = \frac{\sqrt{a^2-1}}{a} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (9)$$

One is usually given R_3, f_3 and f_4, so the values of the components can be found.

High Pass M-Derived Filter.

Figs. 10 and 11 give the circuit and attenuation characteristic of this type of filter.

In Fig. 10 if C_4 = total series capacity of a section.
L_5 = total shunt inductance of a section.
C_5 = total shunt capacity of a section.
R_4 = pure resistance terminal impedance for best operation.
f_5 = cut-off frequency.
f_6 = frequency at which attenuation is infinite.

$$\text{then } C_4 = \frac{m}{4\pi f_5 R_4} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (10)$$

$$L_5 = \frac{mR_4}{4\pi f_5} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (11)$$

$$C_5 = \left(\frac{4m}{1-m^2}\right)\frac{1}{4\pi f_5 R_4} \quad \ldots \quad \ldots \quad \ldots \quad (12)$$

$$\text{If } a = \frac{f_5}{f_6} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (13)$$

$$\text{Then } m = \frac{\sqrt{a^2-1}}{a} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (14)$$

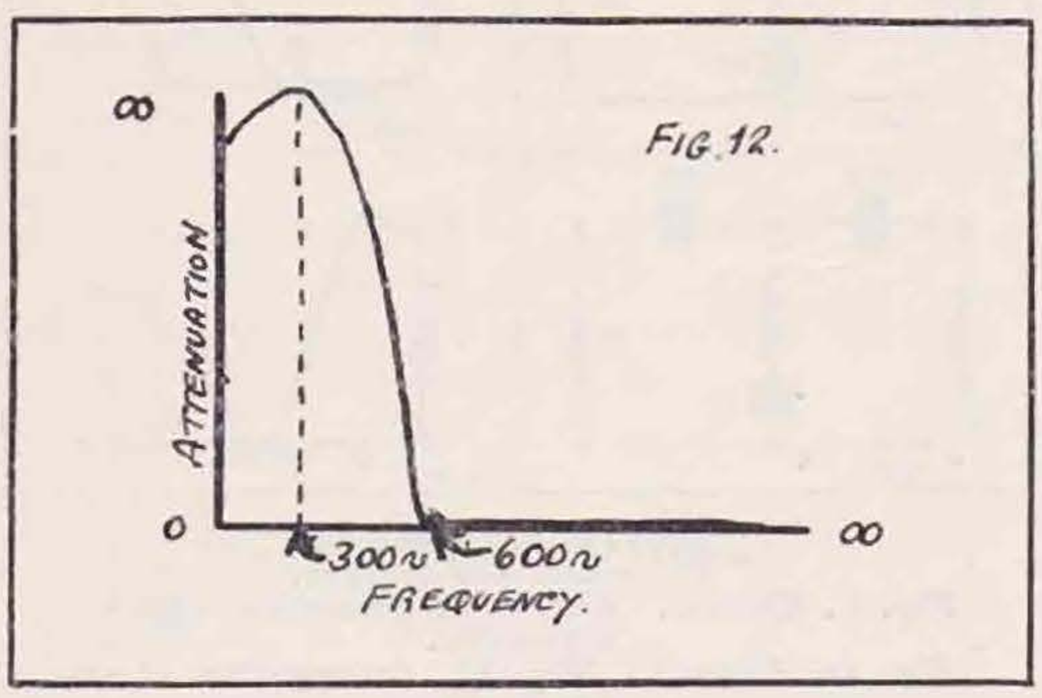


FIG. 12.

Fig. 12.
Attenuation characteristics required in the example.

One is usually given R_4, f_5 and f_6.

In the above formulæ the effect of resistance in the circuits has been neglected. In practice the effect of resistance in the inductances and condensers is to round off the sharp points of the attenuation characteristics and so it does slightly alter the effective frequency of cut-off.

Further, at high audio frequencies the distributed capacity of any inductance used may be sufficient to form a parallel tuned circuit resonant within the frequency band which will be applied to the filter. As this resonant frequency is approached, the effective reactance of the coil will rise and, after dropping suddenly to zero at the resonant frequency, will become a high capacitive reactance which will decrease as the frequency increases further. When designing filters it is important that this resonant frequency of each coil shall not fall within the frequency band being applied to the filter, unless due allowance is made for its effect on the attenuation characteristic.

Example Showing Use of the Above Formulæ.

Required to design a high pass filter to cut off at 600 cycles and to give infinite attenuation at 300 cycles. The filter will work between terminal impedances of 25,000 ohms.

The required attenuation characteristic is approximately as shown in Fig. 12, and the circuit will be as in Fig. 10.

We know that $R_4 = 25{,}000$ ohms; $f_5 = 600$ cycles, and $f_6 = 300$ cycles.

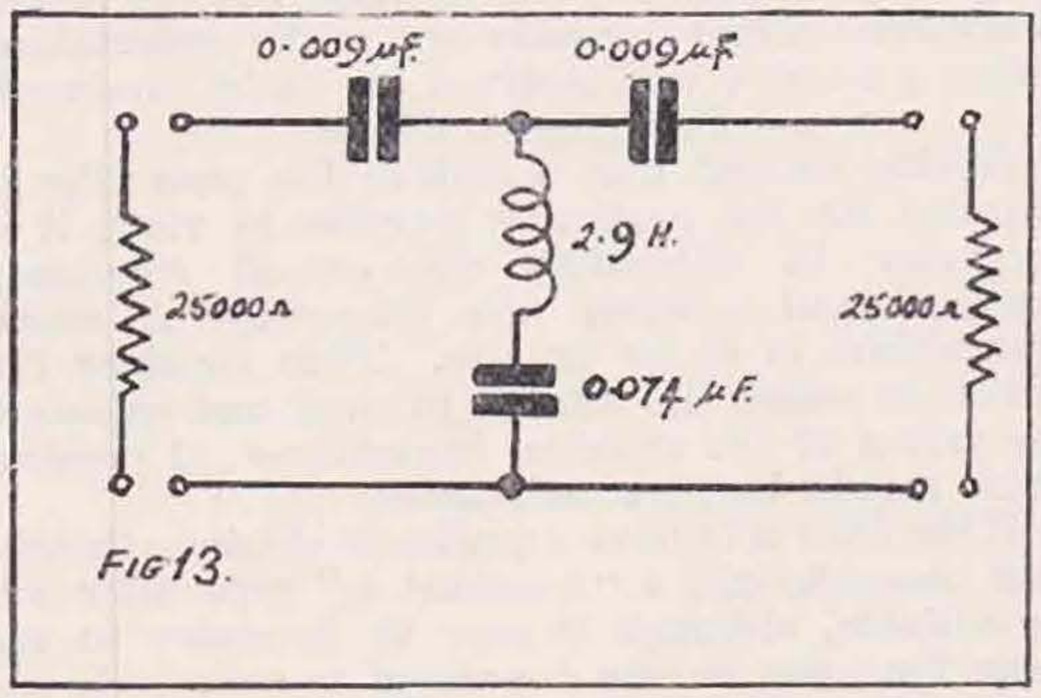


FIG 13.

Fig. 13.
Practical circuit to give the attenuation characteristic of Fig. 12.

Therefore from equation (13) $a = \frac{600\sim}{300\sim} = 2$

and from equation (14) $m = \frac{\sqrt{3}}{2} = 0.87$

,, (10) $C_4 = \frac{0.87 \times 10^6}{4\pi \times 600 \times 25{,}000}\ \mu F = 0.0046 \mu F$

,, (11) $L_5 = \frac{0.87 \times 25{,}000}{4\pi \times 600}\ H = 2.9$ Henries.

and from equation

(12) $C_5 = \left(\frac{4 \times 0.87}{1-0.87^2}\right)\frac{10^6}{4\pi \times 600 \times 25{,}000}\mu F = 0.074\ \mu F$

Therefore the required filter will be as shown in Fig. 13.

Cranwell Amateur Radio Transmitting Society

The above society, which was formed at Cranwell some six months ago, has now well established itself. With a view to assisting and encouraging amateur radio as a hobby among the R.A.F. at home and abroad, it has been decided to provide an associate membership which will be open to all interested who are or have been associated with the Royal Air Force.

The society transmitter is on the air on 14 Mc. every evening from 18.00 to 20.00 G.M.T. for the purpose of maintaining schedules with R.A.F. units abroad, and it is hoped will shortly be active on 3.5 Mc. for home stations.

The society exists for the furtherance of amateur radio in the Service, and will always endeavour to give assistance or advice to anyone experiencing difficulty in becoming active. A small bulletin is being prepared, and will be available periodically for associate members. Would all interested parties please communicate with the Hon. Secretary, Mr. N. Davis, G6TV, Wireless Operator Mechanics' School, Electrical and Wireless School, Cranwell, Lincs., or G8FC or G6AC, as soon as possible, giving any ideas or views on the subject they may care to. The yearly subscription has been fixed at 2s. 6d.

A NEW FEATURE AND A NEW SERVICE

ASK a new member or even one who has displayed his membership certificate for a year or two, what feature he would like included in the BULLETIN, and his invariable reply will be " A Beginner's Section."

We on the editorial staff have for long appreciated the need for such a section, but like many other things in life it has not been an easy matter to find a person willing to undertake the task. By good fortune one of our senior members and a frequent contributor to these columns, Mr. Austin Forsyth (G6FO) has offered us his services. Mr. Forsyth has had considerable journalistic experience which, coupled with his extensive knowledge of the difficulties which worry the newcomer to our ranks, should enable us at last to fill a long-felt want.

The new feature, to be known as " The Helping Hand," will appear monthly, commencing with the April issue. As the name implies, it will be our contributor's endeavour to provide up-to-date information on all phases of our work, and this will be presented in such a manner as to enable the newest member to obtain a clear insight into the problems which beset him.

Mr. Forsyth, in his introductory article, which appears elsewhere in this issue, stresses the fact that flexibility is to be the keynote of his articles, in other words, he will change his method of approaching a specific subject if experience indicates that it is necessary or desirable.

In addition to undertaking the preparation of " The Helping Hand " feature, Mr. Forsyth has offered to conduct a *Questions and Answers Bureau* along the lines suggested in our January issue. The service will be given free to members, except that in order to prevent frivolous questions being asked, a nominal fee of 6d. per question will be charged, to cover clerical and postage expenses. Members wishing to avail themselves of this service will be required to abide by the simple rules which are published below.

1.—Questions must be written legibly and concisely on one side of the paper.

2.—They must be accompanied by a sixpenny postal order for each question. The postal order must be made payable to the R.S.G.B. and the letter addressed to :—Technical Enquiry Bureau. R.S.G.B., 53, Victoria Street, S.W.1.

3.—The service is available only to members in good financial standing.

Mr. Forsyth wishes to make it clear that protracted correspondence cannot be undertaken in connection with any matter arising from a particular query. In other words, further enquiries will mean more sixpences!

The service will be operated as expeditiously as possible, but certain questions may require a good deal of " digging into," with consequent delay. We shall however, endeavour to maintain a seven days' service, improving as time goes on.

Selected questions and answers will be published in " The Helping Hand " feature each month.

The ultimate success of the new feature and the new service will depend upon how they are received by the membership. If you like them, tell us if you do not, send us your constructive criticisms.

Television Exhibition

The first public exhibition devoted solely to the development and modern attainments of television is to be opened at the Science Museum at South Kensington early in June. It is expected that the exhibition will remain open for three months.

All the principal British manufacturers interested in the development of television are co-operating with the Radio Manufacturers' Association and the B.B.C. to make the exhibition truly representative, and it is expected that it will do much towards spreading a wider appreciation and understanding of modern television.

The history of television may be said to date from the year 1873, when a telegraph operator named May discovered that the electrical resistance of the metal selenium was altered by light, and ever since 1880 experimenters have attempted to send pictures and scenes, first by wire, and then by wireless. It is only now, however, that the development of apparatus and technique have made possible the inauguration of an official television broadcasting service on a high definition standard.

The exhibition at the Science Museum will illustrate the development of the subject, and will show the simple principles of modern television. In addition, demonstrations will be given of the B.B.C. programmes on modern receivers, and a local transmitter will be shown in operation so that the receivers can operate when no B.B.C. transmission is available.

The Science Museum is open free on weekdays from 10 a.m. to 6 p.m. and on Sundays from 2.30 to 6 p.m.; closed on Good Friday and Christmas Day. Free public lectures are given twice daily by the guide lecturers, at 12 noon and 3 p.m. (on Saturdays and Bank Holidays at 2.15 and 4.15 p.m.—no lectures on Sundays). Arrangements can also be made for free special lectures to school and other organised parties. Particulars can be obtained on application.

Reports Wanted

VQ8AB (Mauritius) would appreciate reports on his 14,288 and 7,144 kc. signals.

G5OH (Bournemouth) on his 14,036 kc. phone transmissions.

VS1AA

Mr. J. MacIntosh, VS1AA, our Malayan Representative, tells us that his call has been misused recently by a station located in Europe or Asia. Mr. MacIntosh was off the air from November, 1936, until February 7, 1937, therefore contacts with a station signing VS1AA during that period were bogus.

THERMIONIC EMISSION OF ELECTRONS

By P. G. Day, B.Sc. (G6PD).

THERMIONIC emission is the name given to the emission of charged particles from any substance under the action of heat. Thermionic emitters are often used when a stream of electrons is required, but we are chiefly concerned in the present article with the application of thermionic emission to radio valves.

During the latter part of the 17th century, physicists observed that the air became electrically conductive near the surface of a heated body, but it was not until the close of the 19th century that Elster and Geitel found that heavy metals gave off positive and negative electricity at low and high temperatures respectively. In 1883 Edison discovered that an electric current could flow through a tube containing an incandescent filament of carbon, and a cold metal electrode which was maintained at a positive potential with respect to the filament. When the latter was made negative with respect to the filament no current flowed. Somewhat later the arrangement was modified by Fleming, who thus produced the first thermionic rectifier. The nature of the emission from hot filaments was not definitely established until 1899, when J. J. Thomson was able to prove that it was a stream of electrons (fundamental units of negative electricity) by measuring the ratio e/m, "e" being the charge on a single particle and "m" its mass.

Between 1901 and 1903 Richardson developed a theory of emission and tested it experimentally. The experimental arrangement consisted of a hot filament and a cold concentric metal cylinder to which could be applied any desired potential with respect to the filament. As the potential was increased to a high positive value the current increased up to a certain "saturation" value above which it was impossible to go, however high the potential was raised. Further, it was found that the saturation value of the current increased as the temperature of the filament increased, so Richardson supposed that saturation occurred when *all* the electrons emitted by the filament were collected by the anode, and he assumed that the electrons were those responsible for the ordinary electrical conductivity of the filament. Whilst still in the filament some of the electrons receive a sufficient increase in their kinetic energy (due to high temperature and consequent thermal agitation) to enable them to overcome the surface forces and to escape into the surrounding space (which, of course, is a very high vacuum). From this theory an emission equation was derived mathematically and verified experimentally for the metals platinum and sodium and for carbon.

An important discovery was made by Wehnelt in 1904, when he found that filaments coated with the oxides of calcium, strontium and barium gave much higher emission currents than the pure metal, and at a later date it was found that all substances which can be heated to a sufficiently high temperature without disintegrating are capable of emitting electrons.

Richardson's theory of emission was based on the classical electron theory, which assumes that free electrons exist in the interior of metals; this theory was later abandoned by physicists, so it was necessary to look for a fresh explanation of the phenomenon of emission. This was supplied by Sommerfeld in 1928 by the application of quantum mechanics, and the consideration of the wave properties of electrons as well as their particle properties. Although the new theoretical treatment is different, the present-day view as to what actually happens when thermionic emission takes place is the same as that originally put forward by Richardson in the pre-quantum days.

It was discovered by Langmuir and Rogers in 1914 that tungsten filaments containing up to 2 per cent. of thoria showed an electron emission far greater than that from pure tungsten after they had been subjected to special heat treatment. Very high emission currents were obtained with filament temperatures below 2,000 degrees Absolute. (Degrees Abs. equal degrees Centigrade plus 273.) The following treatment is employed for producing thoriated-tungsten filaments :—

First, the filament is prepared so that it contains about 2 per cent. of thoria (ThO_2). The electrodes (filament, plate, grids, etc.) are then assembled in the glass envelope and the whole thoroughly de-gassed with the filament operating at about 2,000° Abs. A film of some "getter" is then deposited on the glass walls to remove all traces of oxygen and the whole sealed off from the high-speed vacuum pumps. The temperature of the filament is then raised to about 2,800° Abs. for two minutes, and then maintained at some temperature, called the "activating temperature" (between 1,800 and 2,200° Abs.) for a comparatively long time.

When the filament is first "flashed" at 2,800° Abs., the thoria is dissociated into free thorium and oxygen, the former being distributed throughout the metal. During the activation process thorium atoms diffuse to the surface and form a layer, thereby increasing the emission. Throughout the normal life of the filament more thorium continually diffuses towards the surface so that the initial high emission is maintained. Immediately the filament is formed the emission is about the same as that from pure tungsten, but it very rapidly increases to about 1,000 times this value. It is common practice to give thoriated tungsten filaments a hydrocarbon treatment, so that some of the tungsten on the surface is converted into tungsten carbide, and the layer so formed decreases the rate of thorium evaporation, and thus improves the performance of the filament.

It is interesting to note that the emission from pure tungsten is 10^{-3} amp. per cm.^{2}, whilst for a fully activated thorium-coated filament it is of the order 2.8 amps. per cm.^{2}.

Thorium is not the only element which can be used to produce an atomic film emitter, and caesium, potassium, rubidium and sodium have been successfully used; in fact, the rule that any of the alkali or alkaline earth metals adsorbed

on the surface of any of the metals tungsten, molybdenum, nickel or platinum reduce the work function of the metal and improve the emission appears to be obeyed.

We now come to the topic of oxide-coated emitters. As was mentioned earlier the presence of a visible layer of oxide of calcium, strontium or barium greatly improves the emission from a filament of pure metal.

The method of preparing oxide-coated filaments is as follows: The material of the metal carrying the oxide (core) may be one of many alloys such as platinum and rhodium or iridium, nickel, iron, cobalt and titanium (Konel), and the coating mixture may be a suspension of barium carbonate and strontium carbonate in amyl acetate. The mixture is sprayed on to the core, which is then heated for a few seconds to a temperature of about 700° C. in an atmosphere of carbon dioxide. This treatment firmly bakes the coating on to the core. A very thin layer of collodion is then applied. The oxide-coated filament is now complete, and it is only necessary to activate it by suitable means, and it will be ready for use. The method employed varies according to the nature of the core, but for Konel cores the method is to strongly heat the filament to a high temperature for several minutes and then reduce the temperature until it is only a little greater than the normal operating value. During this process the carbonates have been dissociated into the corresponding oxides, and the gases evolved completely pumped away until the residual pressure is less than 10^{-5} mm. of mercury. The temperature of the filament is then reduced to the normal operating value of about 800° C. The presence of any trace of oxygen in the residual gases is highly undesirable, so some "getter" is always employed to extract the last traces of gas. Normally the emission from an oxide-coated filament is between 0.1 and 1.0 amp. per cm.^{2}, but under special circumstances emissions up to 5 amp. per cm.^{2} have been recorded.

One theory of the operation of oxide-coated filaments is as follows:—Free barium (and/or strontium) is produced during the activating process, and good electrical contact is established between the oxide layer and the core. It is possible for the barium to diffuse through the oxide to the surface and back again to the core, so that eventually a state of equilibrium is reached between the rate of diffusion to the surface and the rates of evaporation and diffusion from the surface. Consequently, a definite equilibrium concentration of barium is set up in the surface which effectively reduces the work function. In addition to depending on the work function, the activity of the filament depends upon the number of electrons available in the oxide beneath the surface; in other words, it is dependent on the electrical conductivity of the oxide. This, again, increases as the amount of free barium in the oxide increases. The manner in which the barium is liberated in the oxide is uncertain, but it is definitely not due to simple thermal dissociation of the barium oxide; probably it is due to electrolysis of the oxide and to thermo-chemical reactions which occur between the oxide, the core metal and any impurities such as hydrogen and carbon which happen to be present in the oxide. Positive ion bombardment probably also produces free barium in the oxide.

BOOK REVIEWS

Radio Field Service Data. By Alfred A. Ghirardi. Second revised edition. 436 pages, 81 diagrams, 26 charts, and many tables. Published by Radio & Technical Publishing Co., 45, Astor Place, New York City. Price $2.50. (Foreign $3).

This book is intended for radio service men dealing with American receivers, and though prepared as a companion book to the author's "Modern Radio Servicing," it will undoubtedly be welcomed on its own merits by the practical man. It is "loose-leaf" in an attractive but serviceable stiff black cover, and two sets of supplement sheets will be issued during 1937.

The intermediate frequencies employed in 5,200 models, old and new, of 154 American and Canadian manufacturers, are tabulated alphabetically according to trade names and numerically according to model numbers.

A very comprehensive section deals with the "case histories" of over 1,500 receivers, including all-wave types. An experienced service man can sometimes clear up a fault quickly because he knows that a certain trouble often arises in that type of receiver. The author has been able to tabulate case histories from service records representing more experience than any one man could possess, and they offer *possible* short-cuts to the remedy.

Remedies for stubborn cases of ignition interference in some 80 different models of American cars are fully described. Then follow 62 wiring diagrams of the electrical equipment of various models.

It is not possible to mention in a short review all the data supplied, but the following items are representative: glass and metal valve charts, socket connections, rectifier valve characteristics, grid-bias resistor chart, colour codes, wire tables, transformer turns-per-volt chart, drill and tap sizes, etc.

There is no doubt that this book will be a great boon to anyone who has to service American receivers; it is utterly practical, and the price is very reasonable.

T. P. A.

LONDON MEETING,

Wednesday, March 31, 1937

at

I.E.E., SAVOY PLACE.

Tea 6 p.m. Commence 6.45. p.m.

Technical Discussion Groups.

AN AERIAL COUPLING UNIT

By J. Butcher (G5XG).

ALTHOUGH much has been written in the past on various systems of matching units for aerial networks, the success achieved by the writer, with the aid of the unit described below, is instrumental in the writing of this article.

Mention should, however, be made that the coupler has only been operated on the 7, 14, and 28 Mc. bands, and would, therefore, be worthy of trial on both 1.7 and 3.5 Mc.

No difficulty is experienced in changing from one band to another and the tuning of the unit is simplicity itself.

As the coupling of the final stage of the transmitter to the aerial is inductive, it allows elasticity in operation and no neutralisation troubles are experienced as are at times to be found with direct or capacity coupling.

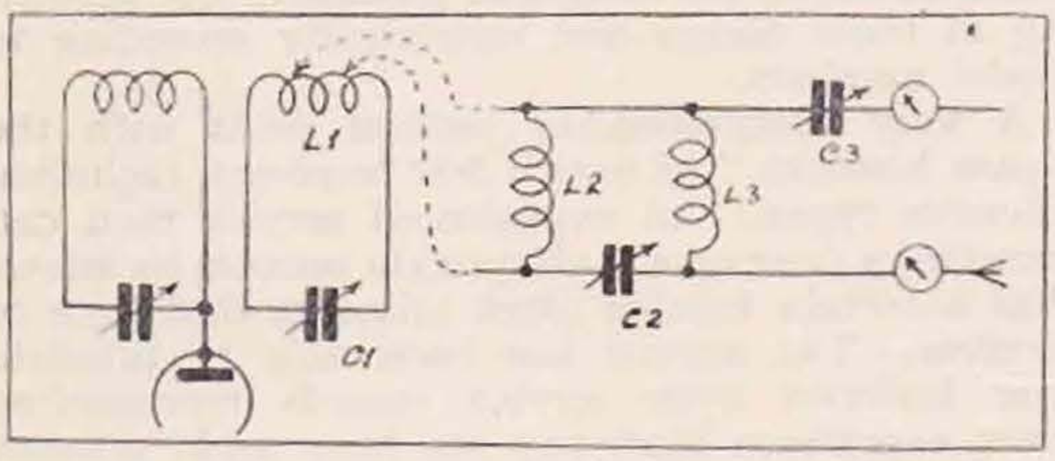


Fig. 1.

A schematic diagram of the coupler described.
C1—.00025 μF.
C2, C3—.0003 μF.

It will readily be understood that the unit is actually a step-down transformer and takes the form of a low pass filter or harmonic suppressor, whilst the condenser C_3 enables the current in the feeders to be balanced.

Tuning the Unit.

The operation of tuning is effected in the following manner.

Firstly the PA is tuned to resonance or minimum dip, with the condensers C_2, C_3 at about half capacity, L_1 is now tuned to draw maximum plate current in the PA. Unequal current reading will now be observed in the feeders, but this can be equalised by tuning condensers C_2, C_3 one against the other, with slight adjustment of C_1 until equal current is established in the feeders.

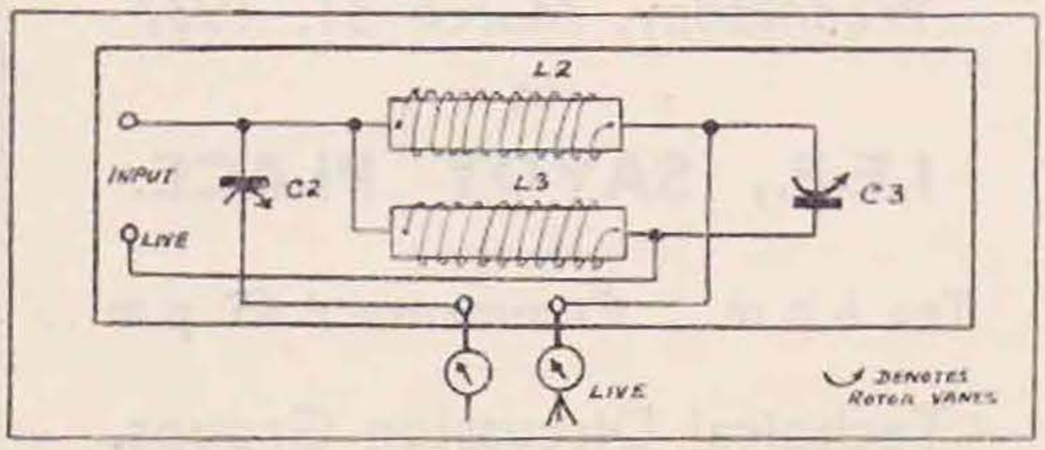


Fig. 2.

Layout of components used in the coupler.

On 28 Mc. the capacity of the unit condensers will be practically at minimum.

Constructional Details.

The inductances L_2, L_3 are wound on ebonite tubes of $1\frac{1}{2}''$ outside diameter and $3\frac{1}{4}''$ long with 24 turns of 16 gauge enamelled copper wire. The tubes are lathe cut 10 turns to the inch, which spaces the turns the diameter of the wire.

The variable condensers C_2, C_3 are .0003 μF, and of the receiving type. All component parts are mounted on an ebonite panel $13'' \times 5''$. Wiring is completed with 16 gauge enamelled copper wire and will be found strong enough to support the inductances. The inductance L_1 is six turns, $2\frac{1}{2}''$ diameter, copper tubing and the variable condenser C_1 is .00025 μF.

The aerial systems used in conjunction with the coupling unit have been a 66′ end fed Zepp and also $2\text{–}\frac{1}{2}\ \lambda$ in phase (14 Mc.) with $49\frac{1}{2}'$ feeders in both cases. The phased antenna for 14 Mc. is unsuitable for operation on 7 Mc.

The aerials, 34′ high, are badly screened by large trees, less than $\frac{1}{4}\ \lambda$ away, but that the coupling unit effects an excellent impedance match between the transmitter and the aerial is proved by the results obtained on 14 Mc. telephony, since May 21, 1936, from which date WAC phone has now been effected four times and over 200 W and VE telephony stations contacted.

QRK reports of R7-8 are in the majority. In addition 100 phone QSO's have, to date, been made with SU1KG on schedule.

The transmitter and audio equipment were described in the October issue of the Bulletin, p. 153.

In conclusion, the writer would add, that although the carrier was well modulated, the input to the final stage when operating on 14 Mc. 'phone never exceeded 20 watts.

Coil Data.

Band.	L1.	L2.	L3.	L4.
3.5 Mc.	12 turns 18 S.W.G. $2\frac{1}{2}''$ diam.	—	—	—
7 Mc.	6 turns. 16 S.W.G. $2\frac{1}{2}''$ diam.	16 turns 18 S.W.G. $1\frac{1}{2}''$ diam.	16 turns 18 S.W.G. $1\frac{1}{2}''$ diam.	12 turns 12 S.W.G. 3″ diam.
14 Mc.	—	8 turns. 18 S.W.G. $1\frac{1}{2}''$ diam.	8 turns. 18 S.W.G. $1\frac{1}{2}''$ diam.	7 turns. $\frac{3}{16}''$ tubing. 3″ diam.
28 Mc.	—	—	—	4 turns. $\frac{3}{16}''$ tubing $2\frac{1}{2}''$ diam.

Coils L2 and L3 wound on celluloid strips.
All close wound except L4.

NATIONAL FIELD DAY, 1937

IN presenting the rules for this, our Fifth Annual National Field Day, the Tests and Awards Committee desire to thank all those who offered suggestions for their improvements.

It will be seen that in order to meet the wishes of many groups of members, it has been decided to allow each district to operate four separate stations. It should, however, be emphasised that where reference is made in Rule 4 to "different sites," the intention is that two stations may be operated from the *same locality*, so long as different aerial systems and different call signs are used.

For example, District 12 may, if they so wish, decide to operate their A1 and B2 stations from a field in Welwyn Garden City; providing station A1 is housed at one point in the field and station B2 is housed at a different point in the same field the intention of the rule has been met.

It will be noted that in accordance with the practice adapted in other contests, the hours of operation have been reduced to 24. We believe this change will be appreciated.

Rule 5 has been introduced to prevent a repetition of the confusion which arose last year when harmonics of stations were heard on other bands.

A slight modification in the method of scoring has been introduced as a result of experience gained in past years. It will also be noted that the word "building" has been substituted for "dwelling house" in Rule 11.

To encourage competition between stations operating on the same frequency band, replicas of the N.F.D. trophy will be awarded to the leading stations in each group.

D.R.s are requested to note that their application for permission to operate stations during N.F.D. must reach headquarters not later than April 17. This will enable us to publish in the May issue of the T. & R. BULLETIN details of all portable calls. In forwarding this information, the call sign to be used, the location of each station, and the name of the operator in charge must be stated.

Overseas amateurs are invited to co-operate with the R.S.G.B. in this event, and providing details are given us prior to April 30, a list of the portable calls to be used by such stations will be published in this journal.

Attention is drawn to the following points:—

(*a*) Every endeavour must be made to ascertain that stations worked (particularly continentals) are licensed.

(*b*) Particular care must be taken to see that public or private power supplies are not used.

(*c*) Crystal control or some other method of frequency stabilising is essential in order to conform to licence conditions.

(*d*) After contact has been effected, both stations are required to acknowledge receipt of the report given. There has in the past been a tendency amongst certain operators to commence another call before the sending station has completely finished his transmission.

RULES.

1. The event will commence at 18.00 G.M.T. (19.00 B.S.T.), June 5, and conclude at 18.00 G.M.T. (19.00 B.S.T.), June 6, 1937.

2. The event is confined to the English, Welsh, and Scottish Districts, and to Northern Ireland and the Irish Free State (Northern Ireland and I.F.S. count one district each).

3. Each District taking part will be permitted to place into operation four stations, A1, A2, B1, and B2, which must be located at points within the District. An exception to this rule will be permitted in the case of the four London Districts and Scottish Districts A and E who may erect their stations in counties adjacent to their District. Station A1 will operate on 1.7 Mc., Station A2 on 3.5 Mc., Station B1 on 7 Mc., and Station B2 on 14 Mc.

Optionally a District may put into operation *three* stations in which case Station A will operate on 1.7 and 3.5 Mc., and Stations B1 and B2 on 7 and 14 Mc. respectively.

Optionally a District may put into operation *two* stations, in which case Station A will operate on 1.7 and 3.5 Mc. and Station B on 7 and 14 Mc.

4. In the case of a District operating four stations on four different sites only one transmitter may be installed at each station.

In the case of a District operating three stations, Station A may employ one transmitter for each of the two bands (1.7 and 3.5 Mc.). In the case of a District operating two stations, both stations may employ a pair of transmitters (1.7 and 3.5 Mc. at A; 7 and 14 Mc. at B).

5. All transmissions must be signed off with the band in use. The following numerals must be used to identify the four bands:—

1.7. Mc.	...1	7 Mc. ...	7
3.5 Mc. ...	3	14 Mc. ...	14

As an example, Station G2MI when calling test on 14 Mc. will sign at the end of the transmission "Test de G2MIP 14."

6. No station may be operated on more than one band at any one time.

7. Each station must be licensed to use a different call sign; the D.R. is responsible for forwarding to Headquarters an application for such permission, together with the exact location of each station, not later than April 17, 1937.

8. The input to the valve or valves delivering power to the aerial must not exceed 10 watts on 1.7 Mc. and 25 watts on the other three bands.

9. The power supply must not be derived from either public or private supply mains.

10. The height of the aerial at any point must not exceed 45 feet above ground level.

11. Stations must not be operated from a normally occupied building.

12. No apparatus may be erected on site prior to 10.00 G.M.T. (11.00 B.S.T.), June 5, 1937. This rule includes aerial and aerial fittings.

13. Points will be scored for established contacts on the following basis:—

With fixed stations outside the district but within the British Isles	1
With portable stations outside the district but within the British Isles	3
With fixed stations in Europe	2
With portable stations in Europe	4
With fixed stations outside Europe ...	6
With fixed B.E.R.U. stations	8
With B.E.R.U. or Foreign portable stations outside Europe	10

14. In addition to the National Field Day Trophy, which will be awarded to the District obtaining the highest combined score, a miniature replica will be awarded to the leading stations in each of the four groups (viz., A1, A2, B1, and B2). Districts operating with less than four stations will not be eligible to compete for the replicas.

15. An exchange of reports (readability, strength and tone) shall be made before points can be claimed; proof of contact may be required.

16. Contacts with ships or unlicensed stations located in countries where licences are obtainable will not be permitted to count for points. The decision as to whether a station is to be classed as unlicensed will rest with the Awards Committee.

17. The British Isles for the purpose of this event shall include England, Scotland, Wales, Northern Ireland, the Irish Free State and the Channel Isles.

18. All entries must be submitted and signed by the D.R., who will be solely responsible for the conduct of the event in his District.

19. The official entry form must be signed in full by the station operator *at the time of each contact*.

20. Entries must be made on the approved form issued by Headquarters, and must reach that address not later than June 19, 1937.

21. The N.F.D. Trophy will be held by the winning District for one year, and will be handed to the D.R. concerned at Convention. The D. R. will be solely responsible for its custody during the year.

22. Persons operating a portable station, which is competing, shall be members of the R.S.G.B.

23. Council reserve the right to amend or alter these rules at any time prior to the commencement of the event, and their decision will be final in all cases of dispute.

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56 Mc. National Field Day

To meet the wishes of many members the Council have decided to organise a 56 Mc. Field Day event on National lines. The event will take place on Sunday, July 4, between the hours of 10 a.m. and 8 p.m. (1000 to 2000 B.S.T.).

The following rules must be adhered to :—

1. Members or groups of members will be permitted to install portable 56 Mc. apparatus at any *fixed* point in the open air.

2. In the case of transmitting stations the input to the valve or valves delivering power to the aerial must not exceed 10 watts.

3. Transmitting stations must be equipped with frequency measuring apparatus or the transmissions must be frequency stabilised by means of a crystal.

4. The site of each transmitting station must be given in an application to Headquarters for permission to be granted a special portable permit..

5. Applications for these permits must reach Headquarters not later than May 23, 1937.

6. Only members holding a G.P.O. licence to use the 56 Mc. band may apply for the special portable transmitting permits.

7. The station call will be suffixed by the letter P.

8. The event will be open only to fully paid up members of the R.S.G.B. and a declaration must be signed by the licensed operator in charge of each transmitting station, stating that the terms of the licence have been strictly adhered to.

9. Official entry forms will be sent to all contestants prior to the event.

10. Certificates of merit will be awarded to the licensed operators in charge of the three transmitting stations who submit the best logs and technical descriptions of the gear used and observations recorded.

11. Certificates of merit will also be awarded to the operators in charge of portable receiving stations submitting the best entries judged on the basis of Rule 10.

12. Council reserve the right to amend or alter these rules at any time prior to the commencement of the event, and their decision will be final in all matters connected with its operation.

13. Entries must reach Headquarters by July 19, 1937.

Members will appreciate that the arrangements for this event are of an experimental nature, therefore suggestions for future improvements will be welcomed after its conclusion.

A full list of call-signs and sites will appear in the June issue of this Journal.

Bulletin Features Competition

The response to this competition was small but the views expressed leave no doubt in our mind that articles of a practical nature find considerable favour. As anticipated, Mr. Wilford's excellent series of articles dealing with Transmitter Design headed the list with Mr. Buckingham's DX Two second. The fact that Uncle Tom's "Soliloquies" were placed third shows that this feature is still very popular, as are the notes contributed by Mr. Hunter under the title "The Month on the Air."

Mr. Samson's article on Single Signal Superhets, and Mr. Wilford's Olympia transmitter were placed 5th and 6th.

The final ballot was as follows :—

1. *Transmitter Design*, by Mr. G. McL. Wilford, G2WD.
2. *The DX Two*, by Messrs. S. Buckingham, G5QF, and J. Clarricoats, G6CL.
3. *Soliloquies from the Shack*, by Mr. L. H. Thomas, G6QB.
4. *The Month on the Air*, by Mr. J. Hunter, G2ZQ.
5. *A Study of Receiver Requirements*, by Mr. G. G. Samson, G5ZZ.
6. *The* 1936 *Olympia Transmitter*, by Mr. G. McL. Wilford, G2WD.
7. *Experimental Work with Aerials*, by Mr. J. MacIntosh, VS1AA.
8. *A Crystal Gate Receiver*, by Messrs. R. H. Hammans, G2IG, and A. O. Milne, G2MI.
9. *A* 56 *Mc C.C. Transmitter*, by Mr. H. C. Page G6PA.
10. *Inter-stage Couplings*, by Mr. J. K. Hankinson, G2JH.
11. *A Half-wave Rotating Beam Aerial*, by Mr G. W. Slack, G5KG.
12. *A* 56 *Mc Receiver for C.W. and Telephony* by Mr. J. N. Walker, G5JU

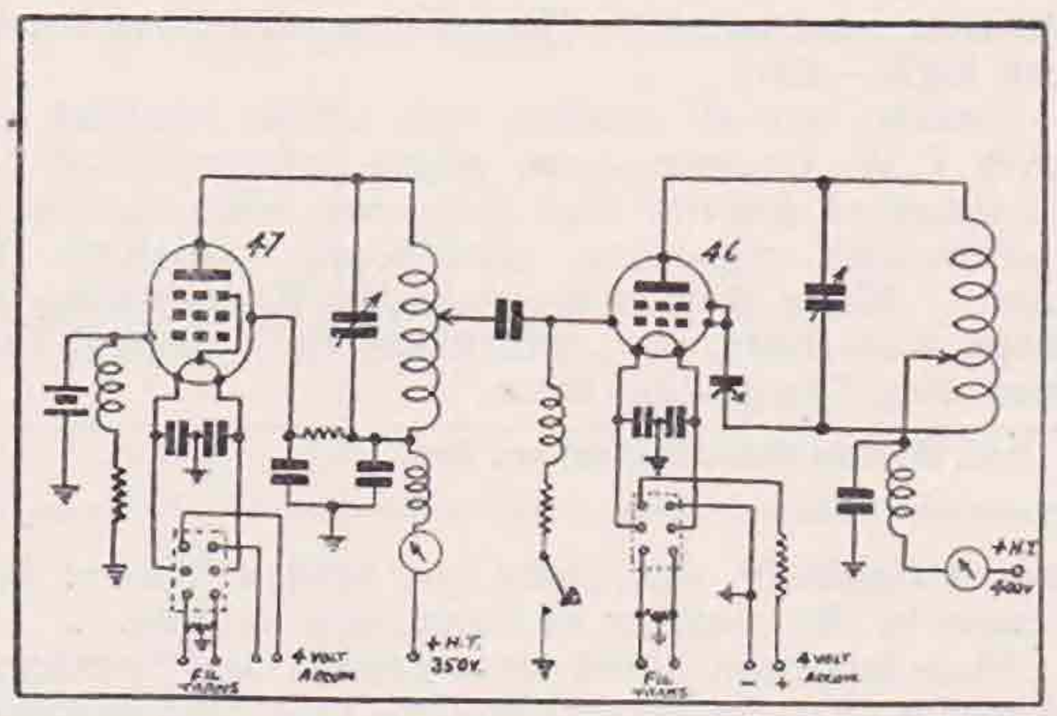
No member placed all 12 articles and features in their correct order, but the winner of the copy of Ladner and Stoner, Mr. L. Metcalfe, 2AVY, of Birningham, included no less than 10 out of the 12 in his list.

We wish to thank all those who submitted entries

RADIO AND FIRE-FIGHTING

FIRE! The dreaded spectre raises its ugly head at the most inopportune times and in the most inaccessible spots. Yet within a short time a not altogether unmusical clanging of bells announces the arrival of the nearest body of worthy firemen, hurrying to check the progress of the hungry flames. Speed in assessing the extent of the outbreak is perhaps the first essential, but unless this assessment can quickly be translated into adequate equipment to stem the destruction, much can be lost in little time.

The Cape Town Fire Brigade is therefore fortunate in having the services of Capt. Stanley W. Thorpe (ZS1AH), who has added yet another instance to the creditable list of public service by amateur radio. Capt. Thorpe, after much thought and experiment, has evolved a mobile transmitter which can be taken in a van at high speed to the scene of a fire in order that full details as to the assistance required may be immediately communicated to headquarters by radio. As the van approaches, a preliminary account is given of the extent of the fire, and while the actual work of fighting the blaze is being carried out, continuous contact is maintained between the mobile transmitter and that situated at headquarters.



Circuit of Transmitter used by ZS1AH for Fire Brigade work.

As will be seen from the circuit and layout diagrams, the transmitter may be operated either from accumulators and a generator or from a mains supply through a power pack and filament transformer. For mobile or short-duration work, H.T. is obtained from a 500-volt 150 mA. generator driven by a 12-volt accumulator, the output being steadied by reducing it to 400 volts by means of a bleeder resistance. The filaments of the valves are heated by 4-volt accumulators. In the case of a serious fire which shows promise of being a lengthy job, however, a cable may be connected to the nearest mains supply, and by simply putting over the switches the transmitter may be operated for any length of time without the use of the accumulators.

The circuit of the transmitter itself calls for little comment; its design follows conventional practice for the reasons that simplicity and low cost were desirable, and that better all-round results have been obtained with this circuit than with any other tried. A type 47 valve is used as C.O., and this is followed by a type 46 as neutralised P.A. Both valves have 2.5-volt filaments, and to run these valves from accumulators it is necessary to use 4-volt accumulators with resistances in series to reduce the voltage to 2.5. As the 47 filament passes 1.25 amps and the 46 1.75 amps these resistances should be as near as possible to 1.2 and 0.86 ohms respectively. Keying is effected in the grid circuit of the P.A.

All the apparatus is housed behind the switchboard, and the switching, with the exception of the valve filament leads, which must be kept short, is controlled from the front switch panel. It is thus only a matter of seconds to change from one form of power supply to the other, and it can be achieved without interrupting the continuity of communication, a matter of no little importance in the original purpose of the transmitter.

An aerial switch is provided on the switchboard to connect the aerial either to the transmitter or receiver.

The receiver in use is a four-valve battery-operated *Eddystone* set, which is found to be extremely satisfactory.

At the fire brigade headquarters the transmitter consists of a 47 type crystal oscillator, followed by a 46 buffer, and two 46 valves in the final. Input to the last stage is 50 watts.

Results

Signals sent out to headquarters from the van while travelling along the road have been picked up in Johannesburg, 1,000 miles away, which demonstrates the efficiency of the transmitter. The amateur who received the signals was able to follow the progress of the van during the whole QSO, and he sent a telegram to Capt. Thorpe while the test was in progress with correct details of the route travelled by the van.

With the van standing stationary in the fire station yard, Rhodesia and Angola have been worked.

The Cape Town General Post Office Wireless Inspector has been at headquarters and also out with the van, and he stated that he was satisfied that the system was a success. Tests were carried out on the 40 and 80-metre amateur bands, but final arrangements with the local Council and the Postmaster-General as to wavelength, etc., are now awaited.

It will readily be realised how much these facilities for speedy action really mean to the safety of life and property, and ZS1AH is to be congratulated on his excellent work.

S. P.

Bournemouth Crystal Register

Mr. D. Sherley-Price, 2ACA, 39, Nelson Road, Bournemouth, informs us that he is willing to compile a register of crystal frequencies used by members living within 20 miles or so of Bournemouth. Those interested are asked to include a stamp for reply, so that a copy of the register can be circulated.

THE 56 Mc. BAND

By L. G. Blundell (G5LB).*

THERE have been no DX signals heard since the end of January—when G2HG heard CN8MQ, and attention this month is centred round the number of new stations regularly active with C.W. transmissions.

G2YL passes on the information that OH2NB, 2NM, and 7NF are starting up on this band, and are hoping to contact G stations. As this news was received at the beginning of February it is presumed that these stations are now active.

HB9J reports that he is now regularly active with modulated tone signals at 11.00, 13.00 and 16.00 G.M.T. every day. He is using an FBXA receiver plus a converter for 56 Mc. work, and reports hearing several commercial harmonics.

G6RS is now putting out tone signals every Saturday and Sunday as follows : 15.00-5, 15.15-20 and 15.30-35 G.M.T. This station is located at Sunbury-on-Thames, and reports should preferably be sent direct.

Another newcomer is F8JG, and this station is now regularly active with crystal-controlled gear on 56.57 Mc. at 13.00-10 and 18.00-10 G.M.T. every day. In addition, if conditions on the slightly lower frequencies indicate possibility of DX contacts, F8JG will be active from 09.00 to 20.00 G.M.T. for ten-minute periods, starting at the hour and half-hour throughout the schedule.

G2KI in East Twickenham, Middlesex, adds his call to the C.W. list, and states that he is now testing C.C. gear on the following frequencies :— 56.12, 56.7 and 57.24 Mc. This station is not yet in a position to put out regular transmissions, but states that usual test times are Saturday evenings and Sunday mornings and occasionally on week-days after 22.30 G.M.T.

G6GO reports UHF interest in YT7, and states that YT7KP is listening for five-metre C.W. from G stations. 6GO also reports that he will be active with C.C. gear in the near future.

Whilst listening round the 28 Mc. band on February 20, G2HG heard at 15.30 G.M.T. an R2/3 signal calling "CQ 56 Mc. de W6DOB." As other W6 stations were quite strong at this time, 6DOB must have been on the higher frequency, but G2HG could find no sign of him on 56 Mc. However, 2HG had a 28 Mc. QSO with W6DOB later on, and it appears that the signal heard on 56 Mc. was due to similar effect as when W3AIR heard a 56 Mc. call from 6DOB on 28 Mc. (See last issue.) 2HG adds that he has fixed a schedule with W6DOB and 6IOJ for every Saturday and Sunday at 15.00 and 16.00 G.M.T.

G6FO whilst listening on 28 Mc. on February 14, heard W3AUC asking for co-operation in some 56 Mc. tests with W3HI, who was then QRX on "five" for C.W. calls. Unable to effect contact with W3AUC, G6FO kindly wrote and advised him of C.W. activity in this country, and at the same time suggesting a mass 56 Mc. test for February 28. So in spite of the very short notice, about nine stations in this country agreed to take part. However, as these notes are being written no news is yet available as to whether any station was successful in getting across as either "worked" or "heard," but it is hoped to give something definite next month. (Results negative, but hopes run high.—Ed.)

Finally, will all stations who intend starting up with C.W. transmissions, please advise G5LB as to times of activity and frequency used, and any information regarding directional radiators (if used). These details are valuable for purposes of large scale tests, etc., which are (it is hoped) the next step "in getting there."

* 45, Monivea Road, Beckenham, Kent.

THE 28 Mc. BAND

By Nelly Corry (G2YL).

CONDITIONS in February showed a definite improvement, and signals from at least 45 countries in all continents came through. "Test B.E.R.U." calls were rarely heard, but, judging by the huge number of North American stations now active, those who neglect the band during this month's A.R.R.L. Contests will be missing a good thing.

East Coast W's were audible daily from 12.00 G.M.T.; W6's could sometimes be heard as early as 14.30 G.M.T., but usually peaked about three hours later; and towards the end of the month the band was frequently open till about 22.00 G.M.T. G6LK had 54 'phone contacts with W6, 7, VE4, 5, during the month; 21 of these were on February 25 and 26. W6ITH got an R7 report from G6LK when his transmitting aerial was lying on the ground—so much for "Californian kilowatts" and HRO receivers! G6FO, who returned to the band at the beginning of January after six years' absence, found W's were consistently louder and steadier than on 14 Mc., especially from 15.30 to 17.00 G.M.T. G6DH worked all districts, including VE5, and six different W7 stations. VO3X was heard regularly, and there has been a distinct increase in the number of Canadians audible.

More has been heard from Central and Southern America than for several months past, and stations active included FM8AA, FM8AD, HK1JB, K5AC, K5AY, LU7AZ, LU9AX, PY1BR, PY2AC, PY3BP, and PY5QD. G6GO worked HK1JB on 'phone on February 23 for the first HK/G 'phone QSO. The first K6/G contact took place on February 27, when G5ML worked K6MVV on 'phone. G6LK reports he has heard the latter R7/8 recently on about 28,600 kc., from about 19.00 to 20.00 G.M.T. K6MVV has heard G6LK four times at about 16.30 G.M.T., but his own signals are usually weak then. K6MVX and two other stations are active on c.w., and looking for European contacts.

Oceanic signals in the mornings have again become the rule, rather than the exception, and those heard included VK2EH, 2GU, 2JH, 3BQ, 3CP 3XP, 3YP, 4UL, 5KL, 5LJ, ZL1CD, 2CI, 2KK, 3AS, and 3DJ. VK2GU uses beam aerials for Europe and the U.S.A., and is the most outstanding station. His signals frequently come through with a heavy echo, and are invariably two or three R strengths louder than other VK's. He reports that Europeans were FB in February from 09.00 to 14.00

(*Continued on page* 432.)

THE MONTH ON THE AIR—FEBRUARY, 1937

By John Hunter (G2ZQ).*

THIS month being the one month in the year when many of our experimental stations actually try and work DX, it seems appropriate to devote a little space to certain aspects of BERU 1937.

The majority of bad operators are still to be found in this country and the worst form this takes during BERU appears to be the needless calling of Test BERU, in circumstances when calling the other station would be far more effective. After all there are more Gs in for the contest than amateurs from any other country, so it stands to reason that correct procedure is for the other man to do the CQ-ing and for us to answer him. Many stations still call test for over a minute without signing, few use QRZ?, and the use of QHM, etc., is confined to very few.

Who was VK8SS? He seems very doubtful. VP8B 14395 (Falkland Is.) had little chance of working Gs in the Junior, with all the Californian kilowatts on his tail. EI4J and EI8B showed real sporting spirit, for although they were not in the contest, they were always ready to sked Gs on any band. Many missed VS6AH in the unexpected frequency of 7,100 (thanks for telling me, Clarry !), clipping along at 25 per. ST2LR (ex-G2LR) emerged for a short time to reassure the CARTS boys of his safety. ZS3F was a new country for many.

Who were the Gs heard calling J8CF and XE1CM? Couldn't they resist the temptation? And who was the well-known "HAM" who thought that VP6MR and VP6QE were two different stations? And why did a W start calling "CQ test BERU G VK ZL"? How did VP1AA manage that really magnificent creep?

G6CJ by clever use of ECO managed to do a lot of highly successful "queue-jumping." G2PL after the first week-end had a 66-foot doublet erected by his next-door neighbour just 10 feet from his aerial—effectively shorting PL's signals at source. One Londoner couldn't be bothered to go in for Senior, but condescended to collect 130 points in less than half an hour! (That's his story.)

The GM calls puzzled many the first week-end, and GM5YG considers that he lost about 70 points in explaining to every station worked that it was the new prefix for Scotland. One extraordinary feature this year was the VEs from all districts who piled in on 14 Mc. all through the night, accompanied by an S8 signal from ZT2Q.

The queue after ZB's continued all through the 24 hours, and at least one G fell to sleep while calling a station and couldn't remember the call when, a few seconds later, he woke up.

* * *

Many requests have been received for frequencies of all rare stations heard, so please give these, if at all possible, and also state if they are self-excited. If you cannot estimate 14 Mc. frequencies, accurately, just state which side of the 'phone band they are.

3.5 Mc. produces a QSO between G2PL and W6CXW, and EI4J and EI8B both get S8 from VK3MR. N8NTF heard by BRS2178 is a U.S. Navy Amateur net station.

On 7 Mc., G8FF works T4TWO, a British ship in the Atlantic. The call seems well in the tradition set by W4UX for bogus ship calls. G2LC and 2BDO hear EARR on this band, on 'phone calling "CQ 20 metre phone USA," and stating that the station is located in the front line trenches of Madrid. EA9AH puts 100 per cent 'phone over to BERS185 in South Australia and to BERS386 in Rajputana, India. EAN starts up on 7,026 kc., and G6CJ hears "ABC de GIJ 6985 kc" on 7,050 kc. Sounds as if the commercials are just getting a bit of their own back. BRS1535 hears LZ1B. The continual dots or dashes often heard all day on 7 Mc. are believed to be deliberate QRM for Spanish War stations. GM8HJ works CDA, another Spanish station.

World-known Doug. Borden, W1BUX with his wife and second operator, and also the two junior operators. Contact Doug. if you want a good ragchew.

On 14 Mc., BRS1535 reports CR7GB, CR7GF, MX2A, YV5AZ, J8CF all at the H.F. end, and TA4B at the L.F. end. He says that ZL2MM, an ex-Notting-Ham, will be glad of QSOs and reports from the Old Country. BERS386 in India, hears HS1PJ's 14,200 kc. 'phone well, and from HZ1AA's 350-watt class B 'phone he gathered that he was in El Khobar, and that he was an ex-W6. HZ1AA never QSO's, and also operates as HZA, testing with Jeddah above 14,400 and on 3,000 kc. Conditions for DX are excellent in Jodhpur, and 386 regularly hears all continents on 'phone. BERS185 air mails his report from South Australia, but unfortunately just misses the last Bulletin. Using a portable battery receiver with 45 volts on the plates, he hears more DX than many SSS users. G2PU is the most consistent G signal with him, and GI5NJ the loudest. He reports that VQ8AH is not in Mauritius, but in the Lagos Archipelago, 800 miles south of Ceylon. CR9AA's QRA is Carlos Soumia, Macao. FK8AA is regularly heard and his shack looks like a power station. G2LC hears FC1AC giving QRA as Loumer. Where is this? He asks

(*Continued on page* 431.)

* 63, Hervey Road, London, S.E.3.

THE 1937 1.7 Mc. CONTEST

By A. O. Milne (G2MI).

"I MUST say how much I enjoyed this event." In these words is to be found the keynote of this year's 1.7 Mc. Contest; for, without exception, every competitor who wrote to us concerning the event used some similar phrase.

The shorter operating hours were to a large extent responsible, but it would be unfair not to take into account good conditions, good operating and signal quality and also the splendid support which was given. If is certain that the shorter hours are popular, and it is more than likely that next year they will be further reduced to 12 midnight on Saturday till midday on Sunday.

More than one hundred stations are known to have been active, and all previous records have been broken by the excellent entry of no less than 57 stations.

For the first time the leading position is shared by two stations, both of whom returned a score of 70. They are:

Mr. H. J. M. Box (G6BQ) of Gravesend, Kent, and Mr. H. Jones (G5ZT) of Preston, Lancs.

Third place is taken by Mr. Greenaway (G2LC) of Leigh-on-Sea, Essex (who, by the way, is a member of the Awards Committee) with 65 points. Mr. Hum (G5UM) being fourth with 63 points.

A full list of the remaining scores in order of merit is given in the table.

A comparison between the two winning stations is rather interesting, for not only are they about 250 miles apart, but their apparatus is quite different; their only point in common being that they both have aerials pointing north and south and fed from the southern end.

G6BQ uses a CO-PA and a home-made SG-V-2 battery receiver, whilst G5ZT has CO-BA-PA and a Hammalund Comet Pro receiver.

G2LC uses ECO-BA-PA and 1-V-1 receiver operated from an A.C. supply. He also has a North-South aerial.

General.

The two most noteworthy points which emerge from the reports are, first, the general absence of fading and atmospherics, and secondly, the almost complete absence of trawler interference.

Conditions were such that, as long as a signal was audible it was readable. This, combined with the general excellence of both the signals themselves and the operators, was largely responsible for the element of enjoyment, which, as has already been mentioned, characterises so many of the logs. Why, we wonder, does the 1.7 band attract the good telegraphists?

A temporary migration from some of the other amateur bands, would, we feel, do a lot of good. To a great extent it is a band which is patronised by the Old Timers. Are the newcomers not so careful about their proficiency in the Morse code? We wonder!

Order of Merit.

No.	Call.	Location.	Score.	No.	Call.	Location.	Score.
1	G5ZT	Preston	70	30	G6KP	Welling	43
1	G6BQ	Gravesend	70	31	G5TO	Sheffield	42
3	G2LC	Leigh-on-Sea	65	32	G2QN	Blackburn	41
4	G5UM	Welwyn	63	32	G6GR	Northwood	41
5	G6VC	Northfleet	61	34	G2WS	Ilkeston	40
6	G6WY	Beckenham	60	35	G2UJ	Tunbridge Wells	39
6	G5BM	Cheltenham	60	36	G2TH	London, S.W.	37
8	G5CH	Manchester	58	36	G6GM	Holsworthy	37
9	G5JO	Cambridge	57	36	G6LG	Aberdeen	37
10	G2MI	Hayes, Kent	56	39	G2NJ	Heacham	36
10	G5WW	East Finchley	56	39	G2XP	Ilford	36
12	G5OD	Old Colwyn	55	41	G2CD	Seven Kings	35
13	G2IN	Southport	52	42	G6UT	Chingford	34
13	G5RI	Hexham	52	43	G5PX	Ashton-under-Lyne	31
15	G2XC	Portsmouth	51	44	G6CS	East Greenwich	30
15	G6UJ	Driffield	51	45	G6LQ	Weston-super-Mare	29
17	G2DU	Oxford	50	46	G5PR	Horam	28
17	G5FI	Cefn Coed	50	47	G6QM	Hornsey, N.8	26
19	G8BD	Portsmouth	49	48	G2GZ	London, S.E.1	25
20	G6GL	West Kirby	48	48	G6FO	Appledore	25
20	G6FL	Longstanton	48	48	G2GG	Newbury	25
20	G6YR	Southport	48	50	G2KC	Winchester	21
23	G8AB	Loughton	47	51	G5KT	Bristol	20
24	G6RB	Bristol	46	52	G6VD	Leicester	19
24	G2JL	Newport, Mon.	46	53	G5JU	Bristol	18
26	G2HW	Darwen	45	54	G5HS	Thame	17
26	G2PL	Cambridge	45	54	G8CS	Bexleyheath	17
28	G6AC	Cranwell	44	56	G6HD	Cambridge	16
28	G6CT	Westcliff	44	57	G5SF	Liverpool	11

Nearly all the stations active during the contest seem to have been located in either England or Wales. Scotland was represented by only one station, and Ireland not at all.

The only foreign stations heard were OZ2H and SM6UA.

The R.S.T. system has obviously come to stay; observation during the test made it clear that the last stronghold of the conservative-minded amateur, the 1.7 Mc. band, had fallen for it without a single dissentient. Another pleasing feature was the quite large proportion of stations who were either working break-in, or who had some very rapid means of change-over from send to receive. Several were actually signing BK. This is most encouraging.

Once again we have to thank the telephony stations for their sporting co-operation in keeping the band clear of 'phone. This excellent spirit is much appreciated, and contributed very markedly to the success of the event.

Technical Notes.

Several points which may well repay further investigation have arisen from a perusal of the entry forms.

It will be remembered that the weather was cold and frosty with a clear, moonless sky. This type of weather usually spells good conditions, with freedom from " Static " ; this in itself is interesting and would repay further investigation.

Several reports mention a pronounced echo noticeable on distant signals around 04.00 G.M.T. This disappeared quite suddenly at 04.30.

At daybreak the North of England stations were received at very great strength in the South the reverse also being the case, but evidently not to such a marked extent. The effect is not noticeable at sundown, and would seem to offer a problem to the propagation group in R.E.S.

A very interesting log has been received from G6WQ who was listening during the test on board ship, 1,200 miles south-west of Land's End. It is thought to be of sufficient importance to warrant reproduction in full.

The following stations were heard at an average of RST 579 : G2IN and G5OD. The following at an average of RST 569 : G2KT, G2XC, G5BM, G5JO, G5US, G5ZT, G6AC, G6FL, G6FO, G6GL, G6GM, G6LQ, G6RB, G6RH, G6UJ, G6YR and G8BD.

Conclusion.

One good thing has resulted from the test, namely, the increased activity on the band. Numbers of stations went on for the Contest and decided to stay a bit longer. It is clear that much of the present QRM on the 7 Mc. band could be obviated if some of the stations concerned would transfer their activities to 1.7 Mc. It is a pity that the Americans were unable to use the band during the Contest week-end, but this could not be helped, as the band was strictly reserved for flood emergency traffic.

We offer our congratulations to the winners and our thanks to all who took part and helped to make the event an unqualified success. We can only hope that it will serve to popularise this very useful band, so that more stations will make use of it, to the benefit both of themselves and amateur radio generally.

THE JANUARY 56 Mc. C.W. TESTS

By J. N. Walker (G5JU). *

AS only a few reports have been received, following the above tests, it must be assumed that, in the majority of cases, results were completely negative. That quite a lot of interest was taken in them was shown by the number of letters received asking for further advice on matters connected with the alterations necessary to gear to make it suitable for C.W. use. It must be admitted that conditions during the first part of the month were not good but they improved considerably towards the later part. Probably by then the interest of the majority had flagged, due to lack of results earlier on.

One point was evident and this was remarked upon by several, and that is that the majority of those who, as a general rule, use telephony exclusively, made no attempt to give C.W. a chance to show what could be done over long distances.

The chief fact that emerges from the tests is that *horizontal aerials do definitely give better results over long distances than vertical ones.* G6GR at Northwood has, since horizontal aerials and stabilised transmitters became popular in London, heard several new stations and worked more. What may have been a French station was heard once but could not be definitely identified. G6GR experienced difficulties in getting a good note from his long lines transmitter and expresses the opinion that C.C. or MOPA is essential for C.W. work.

G2HG was very active and sent in a good log of fundamental signals and harmonics heard, the latter coming from within a radius of 20 miles or so. He was successful in hearing and nearly working CN8MQ, as was reported in the February Bulletin. Of the eleven stations worked during the month, only four used plain unmodulated C.C. C.W. CN8MQ is also using C.C. C.W.

G5LB did not hear any new stations on the band but is expecting to hear of DX contacts taking place at any time now.

G6DH reports receiving television signals from the R.C.A. building in New York on a wavelength of 7 metres, whilst he has also heard the third harmonics of RIS (Tiflis, South Russia) and EAK (Madrid) on about the same wavelength. He finds that the band shows signs of opening up after 0930 G.M.T., and this is confirmed by CN8MQ.

CN8MQ must have a wonderful location as he heard many harmonics, whilst static on 56 Mc. apparently does not trouble him—it is probably non-existent. He heard G6OB RST 539 at 1000 on January 29, when G6OB was operating on 14 Mc. with an input of 10 watts. Other harmonics

(*Continued on page* 432)

*R.E.S. Transmitter and Receiver Design Group.

THE HELPING HAND

By Austin Forsyth (G6FO).

PART. 1. STARTING AMATEUR RADIO.

IN this section it is intended month by month to try and cover the needs of the BRS, the AA man, and the newly licensed transmitter with a full permit. We appreciate that in general The Bulletin has been unable to deal adequately with their exclusive interests owing to the fact that it has been necessary in the past to treat Amateur Radio as a comprehensive subject, and in the nature of things contributions on what might be called the more advanced aspects of the game have been forthcoming with greater readiness. For those who do not know it, we might add that writing for The Bulletin is a labour of love in that a contributor gains nothing by it, except perhaps the criticisms of his friends!

With the idea, therefore, of trying to fill this gap, we propose dealing in a strictly practical manner with the progress of the newcomer to Amateur Radio from the time he becomes a BRS till he takes out his G8 call. Though the mathematical side of the subject can be very interesting if looked at in the right way, we shall involve ourselves in it as little as possible, nor shall we talk in formulæ. The articles have been planned with these objects in view, but that does not mean that those who really want to know exactly what makes it all tick can dispense with their textbooks. A little fundamental theory—which becomes more interesting as the need for it arises—helps a great deal, and as most of the essentials of the various sides of Amateur Radio are covered in the "Guide," we think that our efforts will best be directed to the assistance of the new member who may, perhaps, feel that he is groping in the dark, a little out of it all.

As we now have such a large and varied non-transmitting membership, at different stages of knowledge and experience, it has been decided for the sake of completeness to start at the beginning, with the hope that even those who know quite a lot more about it will yet be able to find something to interest them till their own particular standard is reached.

Furthermore, to make the series really useful to the body of members for whom it is intended, BRS and AA men are invited to offer contributions, and correspondence, either of criticism or suggestion, is welcomed. If we can put over the idea, here and now, that this section exists to help them, we shall be well pleased. *Your* co-operation as an individual reader will go far to ensure success. Remember, however, that we do not pretend to know everything, nor do we pose as experts in any particular subject; our sole object is to try and give readers the benefit of a lot of practical experience, in the hope that it will be of some assistance in getting started.

As the series of articles has already been roughly planned, headings are given hereunder. The point of this is that if we get snowed under with correspondence indicating that something different is wanted, we can alter course accordingly. The articles we have in mind as likely to be most useful are as follows:—

(1) Receiving and frequency-measuring equipment for the amateur station. Some advice on QSL'ing.

(2) Station lay-out, power supply and aerial arrangement.

(3) The scope for the BRS member.

(4) Getting the AA permit. Gear necessary for making a start.

(5) A simple CO-PA transmitter and artificial aerial.

(6) Modulation.

(7) The scope for the AA man.

(8) Getting a full licence. Aerial design for various bands.

(9) Going on the air. Good operating. Using the bands, etc.

(10) The scope for the fully-licensed transmitter.

This programme covers a period of at least ten months from the commencement of the series, not allowing for possible additions and the probable necessity of running some articles in two parts. During that period we anticipate—and hope—that many BRS and AA men will have indicated their existence to us. From it all our further hope is that something really useful will emerge.

* * *

Having thus pushed the boat out, it may be worth while in this first article if we try and define the term Amateur Radio. To some of our senior members, Amateur Radio means something very difficult, if not impossible, to define; something, in fact, which is almost sacred, though it is unfortunately true that the real "ham spirit" has shown some signs of deterioration in recent years. Yet it is still very evident, and to the new member falls the job of carrying on the torch. The best description which occurs to us is that Amateur Radio means the science, hobby or art of non-professional short-wave communication, with which is involved a code of conduct and a standard of behaviour probably not approached in connection with any other human activity. This sounds a tall order—and a somewhat priggish one at that—but in its best sense it is true. The practitioners in Amateur Radio are called "hams"—no one knows why—and we have all heard of the aforementioned ham spirit. This means, briefly, that to a ham any other ham is as a blood-brother,

while all those who aspire to becoming hams can count on the ready assistance of their fellow R.S.G.B. members. At the same time, hams are not so foolish as to think there is nothing else in the world but Amateur Radio, nor to regard people who are not very interested in it as beneath their notice. It has been said somewhere that a good ham is a well-balanced individual; the writer of that line knew how easy it is to become completely absorbed in Amateur Radio to the exclusion of all else, very often with disastrous results.

With this ham spirit is bound up a feeling of good fellowship and camaraderie which draws together men and women of every creed and nationality in a way that no other hobby or interest that we know of can do. The bond which seems to cement hams together is their common interest in a pursuit which demands not only skill, but also other qualities such as patience, ingenuity and concentration, and in which wealth and position count for very little. Therefore, as can be observed at any R.S.G.B. meeting, hams meet on common ground—their interest in Amateur Radio. Nothing else matters outside this. Money, on which most of us base our hopes and fears in everyday life, is of secondary importance in Amateur Radio because a ham is not judged by the cash he spends or the power he uses, but by the signal he radiates. A good ham is the man who gets the best out of Amateur Radio within his own particular circumstances and the means at his disposal. There is just as much useful work to be done by the low-power as by the high-power man, and the latter—who is often unjustly deried because he uses a large number of watts—is yet a worthy ham, for he is making the best use of his opportunities, apart from the fact that handling high-power apparatus is an art in itself.

Taking it all in all, therefore, we may say that Amateur Radio is a fascinating hobby open to anyone, which develops qualities of resource and initiative, and brings friendships of a type and character which could never be made otherwise, while hams who become proficient equip themselves with specialised knowledge and experience which is often very useful in unexpected ways.

NEUTRALISING THE R.F. PENTODE AMPLIFIER

By E. G. Ingram (GM6IZ)

NO doubt many readers are now using one of the new R.F. Pentodes, mainly due to the fact that these valves require small driving power, are easily modulated by the suppressor grid method, and best of all, do not require neutralising.

Now about this neutralising. In many experimental rigs proper shielding of the grid circuit from the plate circuit is not accomplished. Consequently the effective G.-P. capacity, instead of being that delightfully small figure which is given by the makers, and which we are usually content to disregard altogether, becomes in most cases beyond the threshold value for absolute stability.

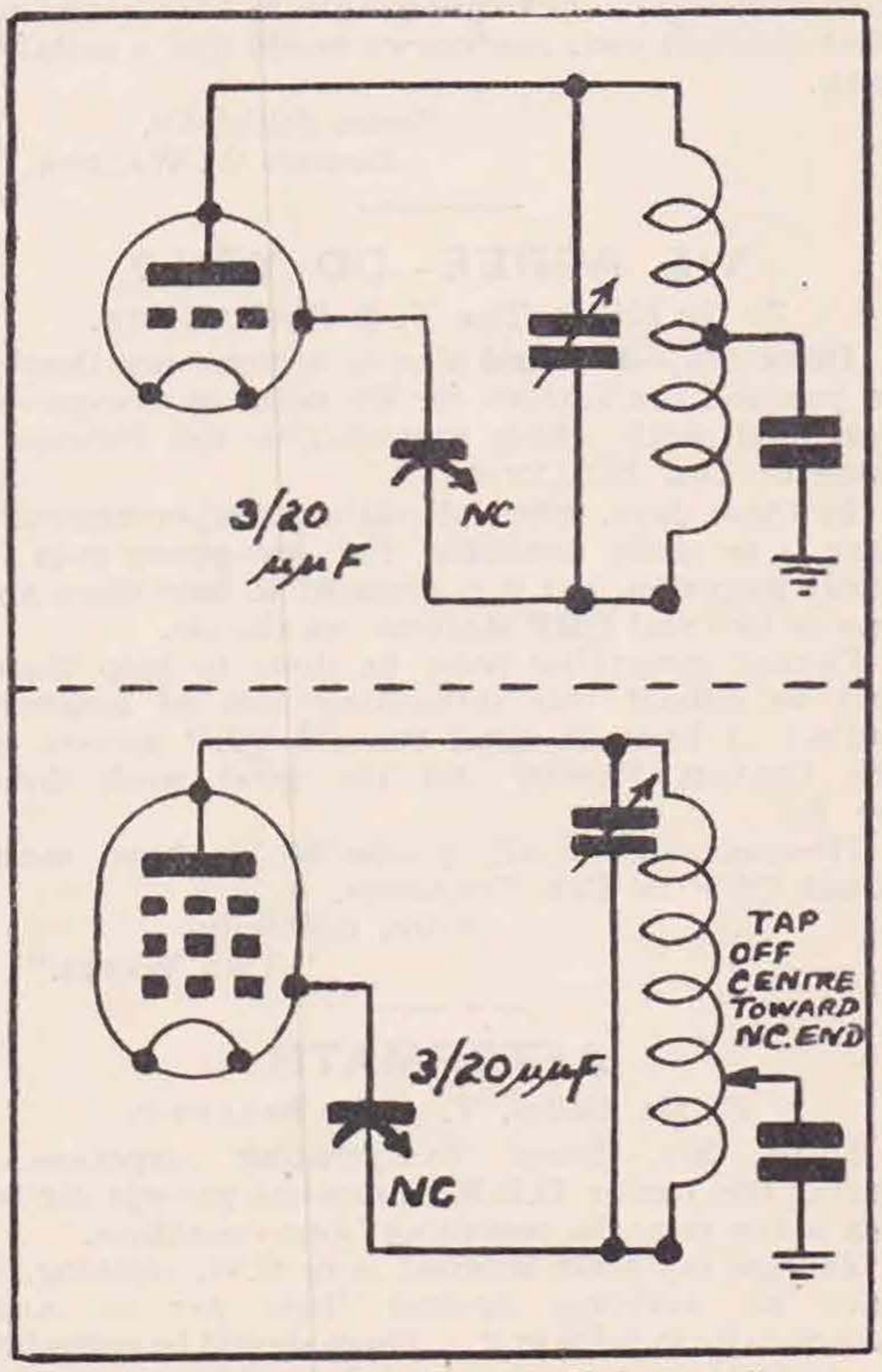
If neutralising is attempted in the usual way we are faced with the difficulty of obtaining a neutralising condenser with a maximum capacity of something like .5 μμF and a minimum of 0.01 μμF. Getting over the difficulty can be accomplished by reference to the following diagrams where a standard condenser of 3/20 μμF is used.

Keeping in mind that the voltage impressed on the grid depends not only on the value of the neutralising condenser, but is also a function of the ratio of the turns on the anode coil each side of the earth tap, the idea becomes obvious.

Practical tests show that excess feedback is certainly present when non-shielded or even partially shielded rigs are used, and bearing in mind that due to the extreme sensitivity of these R.F. pentodes very little feedback is necessary to give most erratic operation, neutralising is to be recommended where the slightest effect of excess G.-P. capacity is noticed or suspected.

It will be realised that as the neutralising capacity required is a function of the turns ratio, the tapping points on coils for different bands must be determined experimentally if the capacity is to remain fixed. Otherwise the turns ratio can be fixed approximately the same on each coil and minute adjustment of the capacity made to compensate for error.

The writer hopes that the above may prove useful particularly when telephony is being used, as instability on modulation peaks, which very often goes on unnoticed, can cause a great deal of unnecessary interference and which, for many, appears to be a difficult trouble to diagnose correctly.



At the top a conventional method of neutralising a triode. Below a suggested method of neutralising an R.F. pentode when complete shielding is not affected.

To The Editor

THE BRITISH ANTARCTIC EXPEDITION, 1937.

To the Editor, THE T. & R. BULLETIN.

DEAR SIR,—Very shortly the above expedition is to leave for the Antarctic, where it is hoped to carry out both geological and coastal surveys.

The expedition ship and the shore bases will be equipped with radio, and we will require the services of a well-trained radio operator to handle the equipment.

The qualifications necessary are that the operator be between the age of 21 and 33 years; be in sound health; have had a good radio training, preferably university or to I.E.E. standard; experience with crystal-controlled commercial radio telephone equipment, and have had at least three years' sea-going experience as an operator. Preference will be given to a man who has also had some experience in amateur radio transmission and reception.

I would be extremely grateful to you if you could give publicity to our requirements, as I feel confident that amongst your readers we would find a suitable man.

Yours faithfully,
ERNEST W. WALKER.

WE AGREE—DO YOU?

To the Editor, THE T. & R. BULLETIN.

DEAR SIR,—I should like to express my thanks to you and the authors for the notes on low-power gear and work which appeared in the February issue of THE BULLETIN.

In these days, when all mains, semi-commercial gear is so easily available, the low-power man is easily forgotten, but it is pleasant to hear there are one or two real QRP stations on the air.

Cannot something more be done to help them and to extend this interesting side of amateur radio? I have in mind the old QRP section of the Contact Bureau and the good work done by it.

However, above all, please let us have more about QRP in THE BULLETIN.

Yours faithfully,
"TWO WATTS."

AFTERMATH

To the Editor, T. & R. BULLETIN.

DEAR SIR,—Some exasperating experiences during the Junior B.E.R.U. Contest prompt me to pen a few remarks regarding 'fone operation.

Though my main interest is in C.W. working, I have no umbrage against 'fone *per se* and occasionally indulge in it. There should be restraint in everything, however, and I would suggest the main contest of the year is not the time, nor is the 14 Mc. band the place, for inter-G QSO's. During the week-ends of the contest the QRM from G 'fone, particularly at the high frequency end of the band, was colossal and effectively blotted out many B.E.R.U. signals. The DX was there but, at most times, was practically unreadable. It is usually possible to make something of a signal jammed by C.W., but it is a vastly different story when the interference is caused by telephony.

Of course, C.W. is not the be all and end all of amateur radio. Neither is 'fone. Because of the much greater amount of interference caused by 'fone, however, a little consideration by its devotees in the choice of the correct band to use for specific contacts, and, if one *must* use the 14 Mc. band, the choice of a frequency within the limits of, say, the American 'fone band would relieve matters to an enormous extent.

Our meagre bands are becoming more congested every week and, since it is extremely unlikely that more frequencies will be granted, it is up to all amateurs to make the best use of what we have. This can only be done by planned and considerate operation.

I would ask some of our confirmed 'fone addicts to dig out the key again—if it can be found—and try a few week-ends at DX contacts. Realisation of the hopeless position in which the C.W. operator often finds himself might bring about the consideration for others which I urge.

Yours faithfully,
D. MAXWELL TYRE
(GM5TY).

71, Waverley Street,
Glasgow, S.1.
February 25, 1937.

Southend and District Radio Society

The Committee of this very active Society are again arranging a Radio Exhibition which will be held at the Boys' High School, Southend, on April 2 and 3. The principal object of the exhibition, apart from the publicity gained, is to raise funds for local charitable activities which include the maintenance of the huge radio installation in the Southend General Hospital; the equipment and maintenance of receivers in the homes of over 50 necessitous blind persons; and various other radio sets in Cripples' Homes and the like.

The large hall of the school will be chiefly devoted to displays by local dealers who have obtained the co-operation of leading manufacturers. There will be a special display of receivers, transmitters, etc., constructed by members of the Southend Society, and entered in a competition for the best workmanship in various classes. Ultra-short wave and television demonstrations may also be arranged.

The Society are anxious to receive offers of prizes for the Amateur Section, and for the Prize Draw. Such offers should be addressed to the Organising Secretary, Mr. F. S. Adams, "Chippenham," Eastern Avenue, Southend-on-Sea.

On April 17 the Society will hold its annual dinner and dance at the London Hotel, Southend. Tickets 5/6 each. Members and their ladies will be most cordially welcomed at this function, which will be attended by executive officers of the R.S.G.B. and prominent local officials.

Book the date—Saturday, April 17.

RESEARCH AND EXPERIMENTAL SECTIONS

MANAGER :

H. C. PAGE (G6PA), "Warren House," Warren Road, Bexleyheath, Kent.

ASSISTANT MANAGER :

J. C. ELMER (G2GD), "Aethelmar," Seabrook Road, Hythe, Kent.

SECTIONS :

No. 1 : TRANSMITTER DESIGN
S.M. : (To be appointed)

G.M. : 7 and 14 Mc.
S. BUCKINGHAM (G5QF), 41, Brunswick Park Road, New Southgate, N.11.

G.M. : 28 Mc.
(To be appointed)

G.M. : 56 Mc.
J. N. WALKER (G5JU), 4, Frenchay Road, Downend, Bristol, Glos.

G.M. : Artificial Aerials
A. W. LISTER (G5LG), Royal Military Academy, Woolwich, S.E.

No. 2 : RECEIVER DESIGN
S.M. : J. MAWBEY (BRS. 1300), 109, Clare Road, Tankerton, Kent.

G.M. : General
J. MAWBEY (BRS. 1300)

G.M. : 56 Mc.
J. N. WALKER (G5JU)

No. 3 : AERIAL DESIGN
S.M. : F. CHARMAN (G6CJ), Orchard Cottage, Stoke Poges, Bucks.

G.M. : General
F. WILSON (G2XX), 85, Risca Road, Newport, Mon.

G.M. : 28 Mc.
L. O. ROGERS (G2HX), "Audwen," Estcourt Road, Gloucester.

G.M. : Joint Group with Propagation
G. A. H. ECKLES (G5GC), 57, Sutton Road, Beverley High Road, Hull.

No. 4 : PROPAGATION
S.M. : J. C. ELMER (G2GD), "Aethelmar," Seabrook Road, Hythe, Kent.

G.M. : 56 Mc.
D. W. HEIGHTMAN (G6DH), 59, Burrs Road, Gt. Clacton, Essex.

G.M. : 28 Mc.
MISS N. CORRY (G2YL), "Redholm," Walton-on-the-Hill, Tadworth, Surrey.

G.M. : Conditions
J. HAIGH (G6HA), 2, Greenock Terrace, Leeds, 12.

G.M. : Joint Group with Aerial Design
G. A. H. ECKLES (G5GC).

No. 5 : VALVES AND INSTRUMENTS
S.M. : D. N. CORFIELD (G5CD), 10, Holders Hill Gardens, Hendon, N.W.4.

No. 6 : AUXILIARY APPARATUS
S.M. : A. O. MILNE (G2MI), "Twemigh" Kechill, Gardens, Hayes, Kent.

G.M. :
F. W. BENSON (2BWF), 53, Corona Drive, Thorne, Doncaster.

No. 7 : MICRO-WAVES (112 Mc. and above)
S.M. : DR. C. G. LEMON (G2GL), 19, Lena Gardens, Hammersmith, W.6.

No. 8 : CONTEMPORARY LITERATURE
S.M. : L. FRYER (GM2FR) 2, Murray Villas, Heugh Road, Portpatrick, Wigtownshire.

No. 9 : TELEVISION
S.M. : E. L. GARDINER (G6GR), The Nyth, Norwich Road, Northwood, Middlesex.

G.M. : Contemporary Literature
E. J. SCUDDER (BRS. 981), 32, Queen Street, Folkestone, Kent.

NEWS OF THE MONTH

Straight Receiver Design.

At the January I.E.E. meeting the writer had the privilege of opening a discussion on the above subject. Members who are unable to attend these meetings have often asked that the proceedings of all such meetings should be published, and whenever possible this has been done. In the present instance, however, the writer was aware beforehand that Mr. Allen (G2UJ) was preparing an article on the subject—in fact, he had very generously offered his material for use at the discussion. It is with pleasure, therefore, that we publish this month Mr. Allen's contribution. His remarks cover the matter in a full and able manner.

Radio and Medicine.

In our next issue we shall publish details of some interesting experiments carried out by Mr. E. de Cottignies, in connection with the radio-transmission of heart sounds through a well-known London station. Reception reports of these heart recordings should be sent direct to Mr. de Cottignies, at King's College Hospital, Denmark Hill, S.E.5.

Contemporary Literature.

The recent decision to strengthen the Contemporary Literature Section is already bearing fruit, and next month we shall publish the first of a series of contributions on the subject.

As mentioned on another page, most of the foreign journals received at Headquarters are now being distributed to competent members, who have promised to send in a *précis* of all important technical information.

The new Section Manager (Mr. L. Fryer, G2FR) is preparing a comprehensive card index, from which it will be possible to obtain an immediate reference to all subjects of radio interest.

Articles for Publication.

We must again stress the point that all R.E.S. contributions should be sent in the first place to the appropriate G.M. and not to the R.E.S. Manager. In preparing articles members should bear in mind that, in order to preserve a balance between print and illustrations, not more than one diagram or photograph should accompany each 500 words of manuscript.

G6PA.

Special 56 Mc. Permits

Members holding 56 Mc. permits are reminded that they may apply for permission to operate portable 56 Mc. stations from Good Friday until the end of September without additional fee.

An assurance must however be given that frequency stabilised apparatus will be used.

Applications must reach Headquarters not later than March 20.

SOME NOTES ON STRAIGHT RECEIVERS

By W. H. Allen, (G2UJ).

IN these days of multi-wave superheterodyne receivers of almost unbelievable selectivity and sensitivity, the "straight" receiver has come to be regarded by many people as a back number.

These notes are not intended to decry the amazing strides made in the performance of the modern single-signal superheterodyne, nor are they in the nature of a constructional article, but rather an attempt to summarise the developments made in straight receiver practice, and to suggest lines of experiment for those interested in making the straight receiver as efficient for its job as possible.

Opinions may differ as to the precise form which the receiver should take, but few who have tried tuned high-frequency amplification are willing to go back to the detector-LF arrangement, so that we will assume that a modern straight receiver consists of an RF amplifier, a grid-leak detector, and an LF stage or stages. From this bare circuit the various alterations and additions mentioned later will be discussed.

Ganging.

With a worth-while RF stage the tuning will be fairly sharp, and this control, together with the detector tuning condenser and reaction will make three controls to be operated simultaneously when tuning over a given band, so that the first thing to be done is to consider ganging the two tuning condensers. This, if attention is paid to the coupling between the aerial and the RF stage, and the RF stage and the detector, will not present much difficulty.

With a receiver which has to cover a range of frequencies from, say 28 Mc. to 1.7 Mc. with plug-coils, capacity coupling is unsatisfactory, as a value giving adequate transfer of RF on 1.7 Mc. will be hopelessly large for 28 Mc., so we are left with inductive coupling giving us an RF transformer in the two positions mentioned. The primary and secondary windings will be on one former, and each coil can be separately adjusted for optimum results on its particular range.

Bandspread.

The next important consideration for ease of handling is bandspread. There are several systems, and they will be reviewed briefly.

(1) Use of small tuning condenser, with or without parallel bandsetter.

The disadvantage here is that *complete* bandspread cannot be obtained on all frequencies from 28 to 1.7 Mc. with one value of tuning condenser.

(2) Use of a small capacity in series with the tuning condenser, which in this circuit can be of almost any capacity. This enables a high L/C ratio to be used with consequent gain in both selectivity and sensitivity, but the very fact that there is so little capacity across the tuned circuit makes the valve and other stray capacities important, and it will be found that no matter how rigidly the coil and condenser are mounted, slight alterations in frequency will take place as the valve warms up, whilst a change in valve will probably mean that the coil will have to be altered to find the band!

(3) Use of a condenser connected across a few turns of the coil, such that the band is spread over as many degrees of the dial as desired. This condenser may be of any reasonable value, say .00015 μF, and another condenser of .00005 μF in parallel with the whole coil is suitable for bandsetting.

There are several advantages of this system. The condenser can be mounted at some little distance from the coil it has to tune, as being across only a portion of the coil, a fraction only of the stray capacity in the leads will be thrown in parallel with the coil. Losses in the condenser itself will also be less important for the same reason. With this system it would be perfectly practicable to construct a tuner with suitable coils to give bandspread on all high-frequency bands and to cover the medium and long broadcast bands as well.

The Detector.

The next circuit for our consideration is that of the detector, and here there is a choice of triode, screen-grid or pentode valves.

There is little to choose between the SG and pentode types, both having the advantage over the triode that regeneration may be controlled by alteration of screen voltage with little effect on frequency. The anode impedance of a pentode is high, and the coupling to the LF stage must be by either a high-inductance choke or a high resistance. For simplicity and smoothness of reaction control, it will be difficult to improve on the electron coupled oscillator circuit which has the advantage of requiring only one coil. The potentiometer supplying voltage to the screen grid of the detector should be of fairly low total resistance, say 20,000 ohms, and it is an advantage to shunt the variable part of the potentiometer which can be of 50,000 ohms, with a fixed resistance of 5,000 ohms or so. This ensures that the current through the variable portion of the potentiometer is low, enabling a carbon-track type to be used with little or no noise in operation.

With the average RF pentode or screen-grid valve, a grid condenser of .0001 μF. and a grid-leak of 3 megohms will be found to give both good sensitivity and smooth reaction.

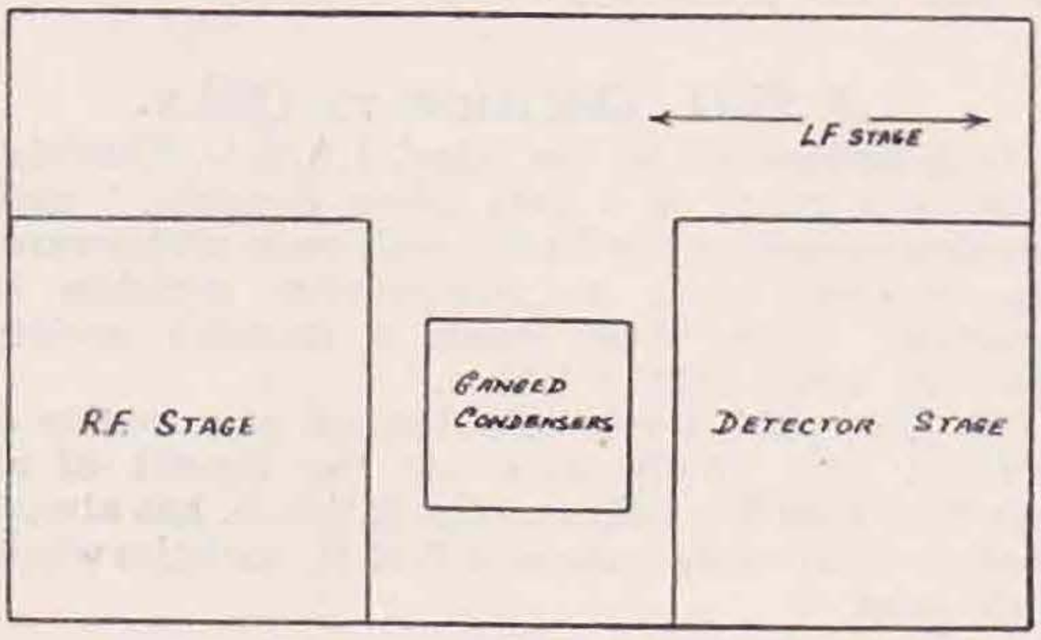
It would be interesting to compare a grid-leak detector with an anode-bend type, still using the ECO circuit, and the writer would be pleased to hear from anyone who has done so.

Selectivity and Screening.

We now have to consider means of increasing the selectivity of the receiver.

Thorough screening is most important, not only of the RF from the detector stage, but of all parts of the detector wiring carrying RF. There is a change of phase between the voltages on the RF and detector grids, and if the detector gets part of its input from the RF stage and part direct through inadequate screening of its input circuit it is possible that signals may actually be weaker than if no RF stage were employed.

A practical method of construction giving good screening is that shown in the diagram. The ganged condensers are situated in a separate screening box between the two boxes containing the RF and detector stages, and if method No. 3 is used for bandspreading, the long leads between the tuning condensers and their respective coils will be of no consequence. The problem of screening the lead carrying the RF from the left to the right-hand box can be solved by using a tube made from copper foil, with a thin wire inside on spacers, the whole being of low capacity and easily accommodated under the baseboard.



Another way would be to place the RF valve in a metal tube joining the two boxes, so that its grid connection was in one box and its anode connection in the other. This would be unsuitable, however, if the valve concerned had its grid brought out to a top cap, as in the interests of stability all " earth " returns should be made to their respective valve's cathode by the shortest possible route.

To get the utmost selectivity in the RF amplifier, regeneration should be applied, and the best method that the writer has so far tried is to use an ECO type of circuit ; that is, tap the RF valve cathode up the coil, so that with full screen voltage the stage is just *not* oscillating. Control of selectivity and sensitivity is then possible by means of a potentiometer to vary the screen potential.

With regard to RF transformers, the coupling between primary and secondary should be really loose, looser, that is, than that giving maximum signal strength, but whether this is best accomplished by a reduction in the number of turns in the primary winding, or a greater spacing between the two coils, is a moot point. The thing to avoid here is a primary coil of such a size that, in conjunction with stray capacities, it can resonate in the band being used. Very loose coupling in the aerial circuit is desirable, and little loss of signal strength will be experienced, while selectivity will be greatly increased. For maximum selectivity, it would be advantageous to use a Faraday shield between primary and secondary of both transformers so as to ensure that coupling is purely inductive, and any information on how this works out in practice would be appreciated by the writer.

Signal to Noise Ratio.

The actual sound output from a receiver on any given signal is no criterion as to its useful sensitivity ; the ratio of signal to noise is the crux of the question, and suggestions for the improvement of this ratio will next be put forward.

The use of a harmonic aerial is a definite advantage, and a doublet, with two arms each 33 feet long with feeders of ordinary flex taken from the centre, will be found to work well on either 7 or 14 Mc. The flex can be of any length, and should be connected across a few turns loosely coupled to the grid coil of the RF stage. The writer has made careful comparison between an outdoor aerial 50 feet high and a doublet such as has been described, but situated under the roof, and found that signals beard on the large aerial could always be heard on the doublet at a very slightly reduced strength, but in all cases with a better signal to noise ratio. Both aerials ran in the same direction.

If headphones are to be used for reception, there is no point in providing a large output valve, and one consuming 5 or 6 mA. of anode current will give satisfactory signals with less valve noise.

Ability to vary the grid-bias to cut-off or beyond is an advantage in reading strong CW signals through QRM, as the working conditions of the LF valve can be so arranged that only the strongest signals can overcome the excessive bias and operate the valve.

Another useful addition to the LF side of the receiver for CW reception is an audio filter arranged to respond sharply to a narrow band of frequencies and to suppress all others. This filter consists of an air-cored inductance tuned by a condenser so that it resonates at about 500 or 800 cycles, and is connected in parallel with the grid and cathode of the LF valve. The reduction in noise when this is in circuit is remarkable, but the wanted signal is only slightly reduced in strength.

This filter can be further elaborated by providing a switch which puts various fixed condensers in parallel with the inductance so that a peak may be produced at any desired point in the audio range, and if this is done a cut in either high or low frequencies may be made according to the nature of the interference or background being experienced.

Another aid to reading signals under difficult conditions is the simple one of a gain control in the grid circuit of the LF amplifier, for as this is turned towards zero gain, much of the noise is lost, leaving the desired signal much reduced in strength, but definitely easier to read.

It is hoped that the foregoing may encourage further experiments with simple receivers, and the writer will be pleased to have others' opinions or criticisms on this subject.

Thanks are expressed to the many amateurs with whom the writer has discussed the straight receiver question, and particularly to Mr. D. G. Bagg, ex-G6BD, who kindly read through and commented upon the draft of this article.

EMPIRE CALLS HEARD

*BERS*195, 40*a*, *Nelson Street*, *St. Peters*, *South Australia*. *December* 28, 1936, *to January* 12, 1937 :

14 Mc. (C.W.) : G2fz 559, pu 559, xn 559, zp 559, 5jo 559, md 559, my 559, sr 558, ss 449, 6dt 558, jw 569, lc 549, qx 339, xf 449, 8iw 348, gi5nj 569, su1ch 569, ve1hk 559, 3aex 559, 3qs 559, vq4crh 568, 8aa 567, af 557, ah 558, vs6ab 569, 7ra 569, rf 579, vu2au 459, ba 558, bn 569, fh 568, 7fy 569, ze1jv 549, jz 559, zl1ak 569, ap 559, fe 569, ft 569, gx 589, hh 568, jf 589, kv 559, 2bg 569, go 569, hb 449, hr 557, ju 469, kv 589, mm 549, mn 578, ou 589, oq 569, sm 559, sx 578, 3aj 589, am 569, cc 579, ja 458, 4bq 589, ck 569, fk 569, fs 579, zs6ay 559, zt5p 559, 5z 559, 6ak 559, 6al 569, 6n 559, 6z 559, zu1t 569, 5af 559, 6l 559, 6p 559.

BETWEEN  OURSELVES

I.E.E. Meeting

An entirely new idea is to be tried out at the I.E.E. meeting fixed for Wednesday, March 31.

Instead of a formal lecture or set discussion, arrangements are being made for well-known members to conduct small technical discussion groups. The meeting will commence at 6.45 p.m., and members may move from one group to the other at will.

A tentative list of Group Leaders follows :—

Mr. H. A. M. Clark ... Low-frequency problems and mathematics.
Mr. F. Charman ... Aerial design.
Mr. A. D. Gay ... ... Frequency measuring.
Mr. H. A. M. Whyte and Mr. A. O. Milne ... Super-het receivers.
Mr. H. C. Page and Mr. W. H. Allen ... Straight receivers.
Mr. S. Buckingham ... Transmitter design.
Mr. D. N. Corfield ... Valve problems.
Mr. L. Blundell ... 56 Mc. problems.

It has been arranged for the meeting to start at 6.45 p.m., tea will be served from 6 p.m., and the I.E.E. will be open from 5 p.m.

Licence Fees

For the benefit of transmitting members, we give the following information concerning licence fees.

In the case of a 10-watt licence the annual fee is £1 per annum, plus an initial licensing fee of 10s. When a 25-watt permit is granted a further licensing fee of 10s. is charged and the annual fee becomes £1 10s.

When a permit for power in excess of 25 watts is granted the annual fee becomes £2, but no additional licensing fee is charged, if a 25-watt permit has previously been held. If on the other hand a person holding a 10-watt licence is granted a high power permit, e.g., 50 watts or greater, the additional licensing fee of 10s. is charged.

We tabulate the above information for future reference.

Fees	10 watts	25 watts	25 watts increased to 50w or more	10 watts increased to 50w or more
Licensing ...	10/-	10/-	—	10/-
Morse Test ...	5/-	—	—	—
Annual ...	20/-	30/-	40/-	40/-

New Prefix for Scottish Amateurs

We are pleased to inform our members that favourable consideration has been given to the Society's application for Scottish amateurs to use a special prefix. The authorities have agreed that the prefix GM may be used instead of G.

We have been asked by the G.P.O. to inform members of this arrangement, and all new licences issued to experimental stations in Scotland will include this prefix.

I.A.R.U. Decision re QSLs.

It is announced in the latest I.A.R.U. Calendar that, as a result of a vote taken recently, "each member society in the Union shall cease all forwarding of QSL cards to non-member societies in countries where there exists a member society officially voted by the Union."

We give publicity to this decision as a matter of interest, but would state for the benefit of all members that the policy of the R.S.G.B. has always been to send cards only to I.A.R.U. societies where such exist.

Technical Articles Wanted

Our stock of technical articles is running low. We mention this because we can only maintain a 52-page BULLETIN if the material to fill those pages is available.

We are in urgent need of at least a dozen full-length articles, constructional, practical or theoretical.

Members willing to assist are invited to communicate with Headquarters intimating the subject or subjects they are willing to prepare. If typed, double spacing should be used. Rough sketches should be drawn on separate sheets of paper.

The following subjects are suggested as being particularly suited to our present requirements :—

(*a*) A description of a 56 Mc. superhet employing modern valves.
(*b*) A description of practical experimental work conducted on 56, 112 or 224 Mc.
(*c*) A description of a modern transmitter using suppressed carrier.
(*d*) Practical results obtained with beam aerials.
(*e*) A constructional article for a low-power crystal-controlled transmitter and straight receiver.
(*f*) Field strength observations.
(*g*) A summary (with graphs) of conditions on any amateur band noted during the past year or more.
(*h*) Useful measuring gear.

Bright ideas and short articles are also needed, together with interesting general articles of the type published last month under the title "Meet a Ham."

We shall also be glad to receive suggestions for future articles.

Where are those promised District contributions ?

North-Eastern P.D.M.

In view of the fact that many members from Northern Districts may have attended the Midland

P.D.M. on March 14, it has been decided to rearrange the date for the North-Eastern P.D.M. This will take place on Sunday, May 2, at York. See District Notes for further details.

1.7 Mc. Transmitting Contest

Council are pleased to announce that Messrs. Box (G6BQ) and Jones (G5ZT) were judged to be the leading stations in the 1.7 Mc. Contest. They will hold the trophy for six months each as from Convention.

Mr. C. Greenaway (G2LC) was placed third.

A full report of the Contest appears elsewhere in this issue.

Copying Contest

Mr. A. Tomlinson (G2QN) has suggested that we arrange a 1.7 Mc. copying contest, but before taking any definite steps we should like to hear whether the event would be supported. A postcard to Headquarters not later than March 31 will help us to form an opinion.

Foreign Journals

With reference to the paragraph published in the January issue, it is of interest to record that some two dozen members signified their willingness to read through foreign radio journals, with a view to passing a précis of interesting articles to R.E.S., but, unfortunately, many applied for the same group of journals. Arrangements have been made for the following members to receive the journals listed :—

Name.	*Call.*	*Journals.*
C. F. Haberer ...	BRS1225	Helios
B. W. Mainprise	G5MP	Old Man.
M. Buckwell ...	G5UK	Intercine.
		Radio (Colombia).
		Club Paulisa.
G. E. Smith ...	BRS402	U.R.E.
J. J. Taylor ...	G6XD	CQ.
I. B. Clark ...	2BIB	Funk.
B. de Figueirdro	FRS37	QSL
A. G. Brightmore	G6TY	FAR.
		Onda Corta.
G. H. Shorten ...	G2SQ	LA.
L. K. Lewer ...	G6LJ	QTC.
B. J. Hill ...	BRS2494	QEM.
T. L. Herdman...	G6HD	QSO.
A. P. De Boer...	BRS1852	QH.

We take this opportunity of thanking all those who responded so promptly to our request.

Q.S.L. Matters

We wish to again remind non-transmitting members resident in the British Isles that we **cannot** accept reports addressed to European transmitting stations unless they refer to the reception of 1.7, 28 and 56 Mc. signals. Recently a number of cards reporting the reception of European signals heard on 3.5, 7 and 14 Mc. have been received from B.R.S. and A.A. members.

We have also to draw the attention of overseas members to the fact that we cannot accept from them cards addressed to amateurs resident outside the British Isles. On examining a batch of 200 cards received from one overseas member we found that only a very small percentage were addressed to British Isles stations, the remainder being for European, American, African or Asian amateurs.

Overseas members are requested to send all such cards to their own QSL Bureau for despatch to the appropriate Bureaux.

It is of interest to record that coincidental with the R.S.G.B. taking steps to prevent its QSL Bureau becoming a general clearing house for QSLs, the A.R.R.L. took similar action. For some while both organisations have been receiving from overseas QSL Bureaux very large quantities of cards addressed to amateurs outside their own immediate territory.

CALIBRATION SERVICE

Crystals should be sent direct to the Calibration Manager enclosed in a small tin, and securely packed to avoid loss in transit. The Society cannot be responsible for any loss that might occur in sending crystals through the post.

Return postage must be enclosed as postage stamps, and not attached to the Postal Order.

Calibration fees : 1.7, 3.5 and 7 Mc. crystals, 1s. 6d. ; 100 kc. crystals, 2s. 6d.

All communications should be addressed to :—

Mr. A. D. Gay (G6NF),
"Oak Dene,"
156, Devonshire Way,
Shirley,
Croydon,
Surrey.

See page 117 *A Guide to Amateur Radio* for particulars of frequency meters, etc.

As from March 1 last the A.R.R.L. decided to accept only those cards which are addressed to W, VE, K and N call signs. From the same date the R.S.G.B. had to decline to handle incoming cards from abroad addressed to amateurs resident outside the British Isles.

Members will, we feel sure, agree that time and money has been wasted in sorting, filing and posting huge batches of cards received from abroad, and intended for non-British Isles amateurs. By continuing this practice our own service would eventually suffer.

NEW MEMBERS.

HOME CORPORATES.

H. Manning (G2GI), Ewtor House, Heath End, Nr. Farnham, Surrey.
J. Balderston (G2OB), 6, Clough Terrace, Barnoldswick, Yorks.
N. Gill (G5GL), 13, Petrie Road, Bradford, Yorks.
B. A. Evans (G6VR), 46, Woodfield Terrace, New Malden, Surrey.
C. A. McDonald (G8FZ), "Torilla," Nast Hyde, Hatfield, Herts.
G. Rawling (G8GM), 15, Abbey Walk, Halifax, Yorks.
J. L. Simmons (G8HD), Newland, St. Giles Avenue, Scarthoe, Grimsby.
F. J. Magarry (G8HR), 38, Spinney Rise, Birstall, Leicester.
W. T. Pickard (G8KP), 125 Oakwood Avenue, Flanshaw Park, Wakefield.
S. Allen (2AUQ), 57, Ripley Street, Warrington, Lancs.
H. F. Nell (2ABB), 15, Montague Road, Edgbaston, Birmingham, 16.
A. W. Birt (2BTV), 6, Hempstead Road, Kings Langley, Herts.
R. H. Drew (2BVV), 22, Benton Road, Ilford, Essex.

R. C. Baskett (2CBW), 51, Geneva Road, Ipswich, Suffolk.
E. R. Simpson (2CIG), 52, Douglas Street, Largs, Ayrshire.
S. A. Morley (BRS2780), 22, Old Farleigh Road, Selsdon, Croydon, Surrey.
R. D. Morrison (BRS2781), 20, Stanhope Road, Highgate, N.6.
A. R. J. Young (BRS2782), Othery Vicarage, Bridgwater, Som.
F. T. Hopkins (BRS2783), Apple Tree House, Horley, Surrey.
A. I. C. Murfitt (BRS2784), Sutherland House, London Road, Deal, Kent.
L. G. Mays (BRS2785), 185, Windsor Road, Torquay, Devon.
C. W. Plimmer (BRS2786), 36, Cambridge Road, Shoeburyness, Essex.
R. Cartwright (BRS2787), 14, Beresford Street, St. Helier, Jersey, C.I.
E. T. Roach (BRS2788), 112, Tokington Avenue, Wembley, Middlesex.
W. McMahon (BRS2789), 34, Waverley Place, Galashiels.
D Appleby (BRS2790), 20, Station Road, Edgware, Middlesex.
J. Manning (BRS2791), 16, Riversdale Road, West Cross, Swansea, Glam.
L. Phillips (BRS2792), Rosewarren, Graham Avenue, St. Austell, Cornwall.
T. Bentley (BRS2793), 158, Sylvan Avenue, Timperley, Cheshire.
C. W. Storm Clark (BRS2794), 68a, Shinfield Road, Reading, Berks.
J. Korndorffer (BRS2795), Christ Church, Oxford.
R. H. C. Carr-Gregg (BRS2796), 38, Maids Causeway, Cambridge.
H. G. Cawdron (BRS2797), Meadow House, Fakenham, Norfolk.
J. Patterson (BRS2798), 23, Nursery Street, Forfar, Angus.
J. K. McDowall (BRS2799), 15, Ruthven Avenue, Giffnock, Scotland.
N. S. Cindery (BRS2800), 200, Reddings Lane, Hall Green, Birmingham.
T. G. Warburton (BRS2801), Fair Holme, Helmshore, Nr. Manchester, Lancs.
G. A. T. Smith (BRS2802), 110, Prospect Road, Cove, Farnborough, Hants.
W. Norris (BRS2803), 1, Stanley Street, Ilkeston, Derbyshire.
C. C. White (BRS2804), Heathfield House, Ipswich Road, Norwich.
A. S. Rawcliffe (BRS2805), 27, Bedford Street (N.), Liverpool, Lancs.
R. D. Jack (BRS2806), 31, George Street, Markinch, Fife.

DOMINION AND FOREIGN.

K. G. Montgomery (VQ4KGM), c/o The K.A. Rifles, Kitale, Kenya Colony.
C. J. Peach (ZB1P), Headquarters, R.A.F., Mediterranean, Valletta, Malta.
J. M. Davidson (ZE1JR), P.O. Box 870, Salisbury, S. Rhodesia.
W. R. H. Sheward (ZS1AN), P.O. Box 119, Cape Town, South Africa.
E. W. Ormerod (ZU6AD), 36, Biccard Street, Torfontein, Johannesburg, South Africa.
C. F. L. Turner (BERS388), No. 47 (B) Squadron, R.A.F., Khartoum, Sudan.
A. Mauchan (BERS389), P.O. Box 74, Vereeniging, South Africa.
C. J. Berry (BERS390), 29, Bompas Road, Deenheld West, Johannesburg, South Africa.
J. F. Barraclough (BERS391), 7, Institution Hill, Singapore, S.S.
A. G. Smith (BERS392), National Lime & Stone Corporation, Natalspruit, Transvaal, South Africa.

R.S.G.B. Slow Morse Practices.

Details will be found below of the slow Morse practices organised by the Society for those members wishing to learn or improve their code. As usual, test matter will be taken from recent issues of The T. & R. Bulletin. The page number and month of issue will be given at the end of each test—by telephony. A telephony announcement will also be given at the commencement of each test to assist those interested in tuning in the sending station. It is emphasised that reports will be appreciated and are desired, in order to ascertain useful range of transmission and numbers utilising the service. If, however, a reply is desired, a stamp should be sent. Will stations in areas at present not served offer their services to Mr. T. A. St. Johnston (G6UT), 28, Douglas Road, Chingford, E.4 (Telephone: Silverthorn 2285). G6QI, of New Barnet, will be unable to continue owing to pressure of business. A new station in the following schedule is Mr. G. Bloomfield (G6UA), 147, Cowgate, Norwich, until such time as his speech amplifier is again running. G6UA will commence his transmissions by sending a long series of dots.

Schedule of Slow Morse Transmissions.

			G.M.T.	k.c.	Stations
Mar.	21	Sunday	0915	1775	G6ZQ
,,	21	Sunday	0945	7155	GI5UR
,,	21	Sunday	1000	7260	G5JL
,,	21	Sunday	1015	1825	G5SU
,,	21	Sunday	1330	7180	G2YV
,,	22	Monday	2300	1741	GI6XS
,,	23	Tuesday	2200	7184	G6UA
,,	24	Wednesday	2300	1775	G6ZQ
,,	24	Wednesday	2315	1741	GI6XS
,,	25	Thursday	2200	7184	G6UA
,,	26	Friday	2315	1852	G5DY
,,	27	Saturday	2300	7145	GI5QX
,,	28	Sunday	0915	1775	G6ZQ
,,	28	Sunday	0945	7155	GI5UR
,,	28	Sunday	1000	7260	G5JL
,,	28	Sunday	1015	1825	G5SU
,,	28	Sunday	1330	7180	G2YV
,,	29	Monday	2300	1741	GI6XS
,,	30	Tuesday	2200	7184	G6UA
,,	31	Wednesday	2300	1775	G6ZQ
,,	31	Wednesday	2315	1741	GI6XS
Apr.	1	Thursday	2200	7184	G6UA
,,	2	Friday	2315	1852	G5DY
,,	3	Saturday	2300	7145	GI5QX
,,	4	Sunday	0915	1775	G6ZQ
,,	4	Sunday	0945	7155	GI5UR
,,	4	Sunday	1000	7260	G5JL
,,	4	Sunday	1015	1825	G5SU
,,	4	Sunday	1330	7180	G2YV
,,	5	Monday	2300	1741	GI6XS
,,	6	Tuesday	2200	7184	G6UA
,,	7	Wednesday	2300	1775	G6ZQ
,,	7	Wednesday	2315	1741	GI6XS
,,	8	Thursday	2200	7184	G6UA
,,	9	Friday	2315	1852	G5DY
,,	10	Saturday	2300	7145	GI5QX
,,	11	Sunday	0915	1775	G6ZQ
,,	11	Sunday	0945	7155	GI5UR
,,	11	Sunday	1000	7260	G5JL
,,	11	Sunday	1015	1825	G5SU
,,	11	Sunday	1330	7180	G2YV
,,	12	Monday	2300	1741	GI6XS
,,	13	Tuesday	2200	7184	G6UA
,,	14	Wednesday	2300	1775	G6ZQ
,,	14	Wednesday	2315	1741	GI6XS
,,	15	Thursday	2200	7184	G6UA
,,	16	Friday	2315	1852	G5DY
,,	17	Saturday	2300	7145	GI5QX
,,	18	Sunday	0915	1775	G6ZQ
,,	18	Sunday	0945	7155	GI5UR
,,	18	Sunday	1000	7260	G5JL
,,	18	Sunday	1015	1825	G5SU
,,	18	Sunday	1330	7180	G2YV
,,	19	Monday	2300	1741	GI6XS
,,	20	Tuesday	2200	7184	G6UA

New QRA's

Owing to pressure on space the list of new QRA's has unavoidably been held over until next month.

NOTES and NEWS from the BRITISH ISLES

DISTRICT REPRESENTATIVES.

DISTRICT 1 (North-Western).
(Cumberland, Westmorland, Cheshire, Lancashire.)
MR. J. NODEN (G6TW), Fern Villa, Coppice Road, Willaston, near Nantwich, Cheshire.

DISTRICT 2 (North-Eastern).
Yorkshire (West Riding, and part of North Riding).
MR. L. W. PARRY (G6PY), 13, Huddersfield Road, Barnsley, Yorks.

DISTRICT 3 (West Midlands).
(Warwick, Worcester, Staffordshire, Shropshire.)
MR. V. M. DESMOND (G5VM), 199, Russell Road, Moseley, Birmingham.

DISTRICT 4 (East Midlands).
(Derby, Leicester, Northants, Notts.)
Mr. J. J. CURNOW (G6CW), "St. Anns," Bramcote Lane, Wollaton Notts.

DISTRICT 5 (Western).
(Hereford, Oxford, Wiltshire, Gloucester.)
Mr. J. N. WALKER (G5JU), 4, Frenchay Road, Downend, Bristol.

DISTRICT 6 (South-Western).
(Cornwall, Devon, Dorset, Somerset.)
MR. W. B. SYDENHAM (G5SY), "Sherrington," Cleveland Road, Torquay.

DISTRICT 7 (Southern).
(Berkshire, Hampshire, Surrey.)
Mr. E. A. DEDMAN (G2NH), 75, Woodlands Avenue, Coombe, New Malden, Surrey.

DISTRICT 8 (Home Counties).
(Beds., Cambs., Hunts., Rutland and the town of Peterborough.)
Mr. G. JEAPES (G2XV), 89, Perne Road, Cambridge.

DISTRICT 9 (East Anglia).
(Norfolk and Suffolk.)
MR. H. W. SADLER (G2XS), "The Warren Farm," South Wootton, King's Lynn, Norfolk.

DISTRICT 10 (South Wales and Monmouth).
Capt. G. C. PRICE (G2OP), The Mount, Pembroke Dock.

DISTRICT 11 (North Wales).
(Anglesey, Carnarvon, Denbighshire, Flintshire, Merioneth, Montgomery, Radnorshire.)
MR. D. S. MITCHELL (G6AA), "The Flagstaff," Colwyn Bay, Denbighshire.

DISTRICT 12 (London North and Hertford).
(North London Postal Districts and Hertford, together with the area known as North Middlesex.)
Mr. S. BUCKINGHAM (G5QF), 41, Brunswick Park Road, New Southgate, N.11.

DISTRICT 13 (London South).
MR. J. B. KERSHAW (G2WV), 13, Montpelier Row, Blackheath S.E.3.

DISTRICT 14 (Eas ern)
(East London and Essex.)
MR. T. A. ST. JOHNSTON (G6UT), 28, Douglas Road, Chingford, E.4.

DISTRICT 15 (London West).
(West London Postal Districts, Bucks, and that part of Middlesex not included in District 12.)
MR. H. V. WILKINS (G6WN), 81, Studland Road, Hanwell, W.7.

DISTRICT 16 (South Eastern).
(Kent and Sussex).
Mr. W. H. ALLEN (G2UJ), 32, Earls Road, Tunbridge Wells.

DISTRI.T 17 (Mid East).
(Lincolnshire and Rutland.)
REV. L. C. HODGE (G6LH), The Bungalow, Skirbeck Road, Boston, Lincs.

DISTRICT 18 (East Yorkshire).
(East Riding and part of North Riding.)
Mr. W. A. CLARK (G5FV), "Lynton," Hull Road, Keyingham, E. Yorks.

DISTRICT 19 (Northern).
(Northumberland, Durham, and North Yorks.)
Mr. H. C. D. HORNSBY (G5QY), "Newlands," 105, Kenton Lane Newcastle-on-Tyne, 3.

SCOTLAND.
MR. JAMES HUNTER (G6ZV), Records Office, 51, Camphill Avenue, Langside, Glasgow.

NORTHERN IRELAND.
MR. W. GRAHAM (GI5GV), 5 Ratcliffe Street, Donegal Pass, Belfast.

NEW MEMBERS ARE CORDIALLY INVITED TO WRITE TO THEIR LOCAL DISTRICT REPRESENTATIVE.

DISTRICT 1 (North-Western).

LIVERPOOL. — Twenty-one members were present at the February meeting at which details of the income and expenditure were given by the T.R., who explained that it was intended that the financial position of the local group should be announced at each monthly meeting. Mr. Davies reported that 45 members took advantage of the arrangement to visit the Liverpool Airport, and that the radio equipment had been inspected with considerable interest. A further visit will be arranged when the remainder of the wireless equipment has been installed.

Members are asked to report any matters of particular interest so that these can be published in the BULLETIN. Volunteers are required for band occupancy work.

The talk on Rediffusion which had been arranged for this meeting had to be cancelled, owing to the absence of the proposed lecturer on other duties, but this will take place at a later date and will be followed by a visit to the Broadcast Rediffusion Station in Wallasey.

In view of the cancellation of this talk emergency measures had to be adopted, and the solution of the difficulty may be of interest to other groups. G2OA produced a paper published by one of the manufacturers on the subject of "Cathode Ray Tubes," and with the help of 2JT, a blackboard and some chalk, he succeeded in reading the paper to the members and elucidating some of the facts relating to these tubes, 2JT drawing numerous diagrams on the blackboard as the talk proceeded. This scheme worked out very successfully, but it was a condition that questions should be reserved until such time as a full lecture can be arranged on the subject by a representative of the manufacturers.

There are no individual reports of outstanding interest, but the usual stations are active in this area.

Birkenhead and District.—The monthly meeting of the Wirral Amateur Transmitting and Short Wave Club was held on January 27, in Birkenhead, when G6HQ exhibited his new transmitter, which was much admired by all. Reports are few and the T.R. would be glad to receive more.

G6HQ has been working numerous W stations on 7 Mc. 6DO is believed to have CC going on 56 Mc. 2BXO awaits Morse test. Good luck, O.M.! 2BDT is active. 2BON is stated to have given up radio, but it is hoped that this report is incorrect. 2AHG, 2FZ and 6GL have spent much time trying to trace and cure very bad electrical interference on the 1.7 Mc. band.

In spite of numerous warnings local pirates are still at work in this district and will be reported if their activities continue.

Rochdale.—Reports are scarce, but G6QA states that he is now installed at 13, Haslam Street, and will be pleased to meet members there.

BRS1152 is away from home a great deal and, therefore, unable to spend much time on radio, and as 8DJ has had to move from his excellent QRA he is temporarily inactive. The T.R. will be glad to receive reports from other members in the district.

Blackpool.—The local Society has started a series of readings and talks on radio beginning with elementary electrical facts, and it is intended to progress through receivers to transmission, etc.

By the time this appears in print the second annual meeting will have been held and officers elected for the coming year.

G5MS entered for B.E.R.U., but found conditions very poor. 6MI has almost finished his 56 Mc. MO-PA phone rig, using 6L6's throughout. 6VQ and 8GG are operating on 7 Mc. and testing grid-leak modulation—6VQ very successfully, but 8GG has not been quite so fortunate. 6YV and 8AK are active on 7 Mc. CW. 2ARL has applied for full ticket, and Mr. Duckworth, a prospective new member, has applied for A.A. licence.

Two new licenses are 2CJP and 2CKD.

DISTRICT 2 (North-Eastern)

Will members please note that the Northern Provincial meeting at York has been postponed until Sunday, May 2. It is important that all members who intend being present should send a card as early as possible to G6PY, 13, Huddersfield Road, Barnsley, so that accommodation can be reserved and overcrowding avoided.

Barnsley.—An interesting talk on transmitting and receiving problems was given at a recent meeting by G2BH, and this was much appreciated. 6LZ is rebuilding for break-in and frequency shift operation; 6AJ is off the air at present; 2CGD and 2NHM are busy with superhets; 2AHT is on 28 Mc.; 2BNN has made a transverse current mike. Active stations include G6PY, 6LZ, 5KM, 5UA, 5IV, 2BH, 8IJ, 2BNN, 2CGD, 2AHT, and 2BHM. Best wishes are extended to a new member G8KP, who is active on 7 Mc.

Leeds.—The Leeds Radio Society has acquired more central and comfortable headquarters at the

FORTHCOMING EVENTS

Mar. 17.—District 6 (Exeter Section), 8 p.m., at Y.W.C.A., Exeter.
,, 18.—District 6 (Torquay Section), 7 p.m., at G5SY, "Sherrington," Cleveland Road, Torquay.
,, 18. *—District 13, 7.30 p.m., at Brotherhood Hall, West Norwood.
,, 18.—District 12 (Watford Section), 7.30 p.m., at 11, Nightingale Road, Bushey.
,, 21. *—District 4, 4 p.m., at the Trent Bridge Hotel, Nottingham.
,, 23. *—District 14 (East London Section), 8 p.m., at 2BPY, 16, Hatley Avenue, Barkingside.
,, 24. *—District 14, 7.30 p.m., at G8KZ, 348, Portobello Road, North Kensington, W.10. Discussion on keying systems.
,, 24.—Scotland "D" District, 7.30 p.m., in the R.S.A. Rooms, 16, Royal Terrace, Edinburgh.
,, 25.—District 14 (East Essex Section), 8 p.m., at G2SO, 44, Lindisfarne Avenue, Leigh-on-Sea.
,, 31.—Scotland "A" and "E" Districts, 7.30 p.m., in Room "A," Institution of Engineers and Shipbuilders, 39, Elmbank Crescent, Glasgow.
Mar. 31.—London Meeting at I.E.E. Tea at 6 p.m., Technical Group Discussions at 6.45 p.m.
Apr. 2 & 3.—Southend Radio Society. Exhibition at Technical High School, Victoria Circus, Southend-on-Sea.
,, 4.—District 7, 2.30 p.m., at "Tumble Down Dick" Hotel, Farnborough, Hants.
,, 7.—S.L.D.R.T.S., 8 p.m., at Brotherhood Hall, West Norwood.
,, 7.—District 6 (Exeter Section), 8 p.m., at Y.W.C.A., Exeter.
,, 7.—Scotland "D" District, 7.30 p.m., in the R.S.A. Rooms, 16, Royal Terrace, Edinburgh.
,, 8.—District 14 (Chelmsford Section), 7.30 p.m., at G5RV, 19, Springfield Park Avenue, Chelmsford.
,, 11.—District 6 (Bridgwater Section), 3 p.m., at Bristol Arms, Bridgwater.
,, 17.—Southend Radio Society Dinner and Dance. London Hotel, High Street, Southend-on-Sea.
,, 18.—District 9, 3 p.m., at the "Marchesi," Prince of Wales Road, Norwich.
,, 20.—District 12 (N. London), 7.30 p.m., at "The Café," Landers Corner, Waterfall Lane, N.11.

*Sale of disused apparatus at these meetings.

Y.W.C.A., Cookridge Street, Leeds. Meetings, as usual, on Mondays, at 7 p.m. Congratulations to G5PW on the occasion of his marriage. 5CX is active on 7, 14 and 56 Mc., and would like more local co-operation, particularly on the latter band. 5DD is on 56 Mc.; 5GL rebuilding; 5PW active on 3.5 and 14 Mc.; 6QS rebuilding; 6HA on 3.5 and 7 Mc.; 6XL, who has been active on the higher frequency bands, has worked VE on 3.5, 7 and 14 Mc. 2BLA is building a transmitter. BRS2317 has heard G6NZ on the 28 Mc. band (QRB 200 miles) at night, which is unusual. 2439 reports the latter band up to standard.

Sheffield.—The attendance at meetings has been satisfactory despite an influenza epidemic. G8JP deputised for the T.R. at the last few meetings, owing to the latter being ill. The next N.F.D. is receiving consideration. Members are asked to report monthly to the T.R. at 57, Tillotson Road, Sheffield. The next meeting is at The Angel Hotel on March 18. Active stations include G6LF, 6PJ and 5TO on 7 and 14 Mc.; 5HK rebuilding; 2JY on 1.75 Mc.; 2AS and 2MF on 14 Mc. 'phone. 2ASF is now 8JP; 8IW is on 7 and 14 Mc. 2CBQ, 2AWQ, 2OJ, 2BXA, 2CHA, 2CFA, 8IO and BRS2282, 2293, 2688, are also active.

NORTH EASTERN PROVINCIAL DISTRICT MEETING

SUNDAY, MAY 2, 1937

at

WINDMILL HOTEL, GLOSSOP STREET, YORK

Assemble	1 p.m.
Lunch	1.30 p.m.
Business Meeting	2.30 p.m.
Tea	4.30 p.m.

Inclusive Charge 5/-

Reservations to Mr. L. W. Parry, G6PY, 13, Huddersfield Road, Barnsley, not later than Wednesday, April 28.

Bradford.—Most stations are active, and those heard on the air include G6BX, 6KU, 5TQ, 2UY, 5AZ, 8CB and 8JD. The scribe hopes to meet you all at York at the meeting on May 2, and *please don't forget to send that card to 6PY.*

DISTRICT 4 (East Midlands)

A lapse of two months between District meetings seems a long time, and one is inclined to think that, on the surface, activity is slack, but according to notes at hand, local contacts have fallen off due mainly to B.E.R.U. Contest, everyone taking part endeavouring to obtain the best from the gear at his disposal, and using their spare time as a means to that end. Sympathy is extended to 2IO in contracting "flu" on the first Saturday of B.E.R.U. The District is to be complimented on the number of entries in both junior and senior sections, and it is sincerely hoped that G5KG, 5VU, 6PD and All are in at the kill. 6HL has left the district, but only for a few months. 2CDF claims hearing 16 countries (five continents) in 40 minutes on February 15. He does not quote this as a record, but it proves that his RX is in good order. Activity in the West Bridgford area continues. BRS2578 applying for A.A. and taking particular interest in 28 and 56 Mc., and has been standing by for VK's on an RX designed by 8DZ. 8JV is unfortunate regarding choice of suitable antenna, but still, that gives him plenty of scope for experiment.

Worksop.—Activity continues, 2CAJ concentrating on 14 Mc. and preparing phone equipment. 8CR is active, but appears to have antenna trouble. 6MN does not report. Meetings at Worksop are held on the third Sunday of each month at 2BIC's QRA.

The next District meeting will be held at 4 p.m., March 21, 1937, at Trent Bridge Hotel, Nottingham.

DISTRICT 5 (Western).

Bristol.—A good attendance was recorded at the February meeting, the new T.R. BRS686, being in the chair. An interesting discussion was held on the desirability or otherwise of having a committee to assist the T.R. in his duties. It was decided to form one, and seven members, representing full licence, A.A. and B.R.S., were appointed to serve on it. At the conclusion of the business meeting, several technical questions were asked by members and suitably answered. It is hoped that this innovation will prove of much interest and help to members.

G6VF and 6RB are maintaining their good results on 28 Mc., whilst the latter is also busy testing aerial systems. 5WI is recovering from his illness and has been heard on the air again on 14 Mc. G5KT and 2BHV are co-operating on 28 and 56 Mc. tests, 2BSU has an RFP15, and 6OZ is also conducting aerial tests. Other active stations include 6DJ, 6VK, 5JU and 2GQ.

The D.R., in company with 2BMT, paid a visit to Bridgwater on February 13, and much enjoyed the all too brief stay.

Cheltenham.—The K480 valve mentioned in last month's notes is made by Triotron and not Tungsram. G8DT has acquired a T55 and finds results much better, even with only 320 volts on the plate. G5BM awaits a super Skyrider and

WESTERN PROVINCIAL DISTRICT MEETING

SUNDAY, APRIL 11, 1937

at

GRAND HOTEL, BRISTOL.

Assemble	12 noon
Lunch	1 p.m.
Business Meeting	2.15 p.m.
Tea	4.30 p.m.
Visit to Automatic Telephone Exchange	6 p.m.
Inclusive charge	5s. 6d.

Reservations to Mr. J. N. Walker (G5JU), 4, Frenchay Road, Downend, Bristol, not later than April 8.

6QZ has a Comet RO, so that quite a lot of new gear is being put into use locally.

Congratulations to 2BNM, who is now G8LB, and doing well on 7 Mc. The Swindon S.W. Club paid a visit with D.F. gear but unfortunately the local pirate was not on the air. Other active stations include 5BK, 8DA and 2AKR.

Gloucester.—G2HX's ground wave has been audible on 14 Mc. during the Contest, but no news of activity in this district has been received.

DISTRICT 6 (South-Western)

The membership in this district is evidently at the peak of its winter activities, furthermore there have been a considerable number of enquiries from non-members in regard to joining. It is also clear that the attendances at meeting has improved, and we are glad to learn that Plymouth has got over its difficulties in that respect. Members are now beginning to discuss Conventionette and N.F.D. We hope that everyone in the district will keep these two very important events in mind. The former will soon be upon us.

Exeter.—No report has been received from Exeter, which is the first occasion this has happened since the introduction of the T.R. system. It is understood, however, that the meetings are being very well attended.

Taunton.—Here the usual meeting was held at Bridgwater on Sunday, February 14 at the Bristol Arms. There was a good attendance, and many subjects of interest were discussed. Most of the members round here are very interested in 56 Mc. work, and the D.R. and others hope to enjoy many field days in collaboration with them during the coming summer (if any).

Plymouth.—The T.R. reports that at last they have been able to find a suitable date for a monthly meeting. Members present at the February meeting held on the 12th, were: 6RF (T.R.), 8HF, 6NL, 2AHX, 2ANX, BRS1751, and one new member. It is hoped to hold another meeting in March, but the date cannot yet be fixed. G8HF reports that his call is being pirated, as he has received many QSL's regarding contacts of which he has no knowledge. The T.R. also heard another G station working G8HF at a time when the genuine station was not on the air.

Torquay.—The usual monthly meeting at the D.R.'s QRA was held on Thursday, February 18. There was an attendance of twelve, including two prospective members. Subjects for discussion were the modern straight receiver and the progress of 56 Mc. work. Preparations for N.F.D. were also discussed.

G5GD, 2CI, 6WT and 5SY continue their experiments on 56 Mc. A series of comparative tests at 5SY produced the conclusion that a single half-wave reflector behind a half-wave vertical radiator is more effective in stopping radiation to the rear than in boosting it in the forward direction!

Bideford.—G6FO reports that G6GM has now got WAC and WBE, having at long last hooked a PY. G6FO has been busy with 14 and 28 Mc. He has worked all W on 28 Mc. except the 7th. He would like to know whether he now possesses the first G/W five band QSO. (G2PL is another.—Ed.)

Penryn.—Most members report active. G6LV is now delving into the mysteries of plate modulation. He is also experimenting with preselectors. G6BC and G8AW have been rebuilding, and are now on the air again.

DISTRICT 7 (Southern).

The April District Meeting will be held at 2.30 p.m. Sunday, April 4, at the Tumble Down Dick Hotel, Farnborough, Hants.

Guildford.—G8IX, although a new station, has already worked VK4 on 14 Mc. He is also on 7 Mc. 'phone and is contemplating building a long lines TX for 56 Mc. He also wants reports from BRS. 5CM has been doing his usual good work on 28 Mc. His latest capture is ZU6P. Also on 14 Mc. his bag includes VE4, several W4 and 9, and VK3. 6LK is wrecking crystal mikes, which is a very expensive pastime to say the least. He is working on all bands except 1.7 and 56 Mc, it appears. Judging by the reports, he believes in keeping Surrey on the map, and means to give a good account of himself in the U.S. DX Contest. 5WP is occasionally heard on 7 and 14 Mc. 5RS seems to be having a spot of bother in either feed-back or too much drive to the final P.A., as his signals are heard all over the band at times. 6GS is still trying for that elusive W6 'phone contact, for although he hears them he cannot contact them. He has also been down with influenza but is O.K. again now. In between times he is after a better station RX and is thinking of a rack and panel job to hold four separate receivers and two power packs—that is, if funds will allow the 18 or 19 valves required!

Bournemouth.—Meetings are to be held every Tuesday evening at 8 p.m. at the T.R.'s address. A notice has been sent to all local members. We welcome 5MB to Bournemouth and hope he will be on the air again soon, and also BRS 2719 and 2553. 5PB finds his new Super Pro FB and wants a VK-ZL contact for 14 Mc. 'phone WAC. 2NS is using break-in for 7 Mc. and has moved shack. 2AKJ is now 8KX. Congratulations, OM. BRS Brook is on 56 Mc. and listening for the numerous local pirates on that band. He does not find amateur radio easy, as he lives right underneath the 1 kw. aerial of the B.B.C. Station 6BM. 2ACA is building a 5-watt speech amplifier/modulator in readiness for his ticket, which he hopes to get when his morse is up to test standard shortly.

Croydon.—There is an increasing amount of activity in the Croydon area with G6NF, 2CX, 5XH, 5XW, 2KU, 2MV, 5RR, and 5AN all active. 2AQG and 2BIV have passed their morse test and will soon be on the air. 2BHL is very keen, but television takes up a lot of his time. 2CHQ finds building a 12-valve S.S. Super an interesting but long job. 5BT is reconstructing at his new QRA. An old-timer in 5RZ has turned up in the district and contemplates opening up again. The T.R. would appreciate a line from all members in the Croydon area.

Reading.—Some 15 amateurs were present at the last meeting of the R.T. & R.S. The general knowledge questionnaire idea "cribbed" from the district meeting was introduced by G2GG and the questions asked made a lively debate. The prize

for the correct answers was won by G5JI. Congratulations are given to 2AIW, now G8KJ, on obtaining his full licence. Welcome is extended to G8JL, a new member to the district. G5HH is trying out a Windom and has worked a lot of ZS. G2YB has WBE. G5AO also trying 14 Mc. Windom, having worked VS6; he awaits his card to claim WBE. The local morse class is proving a success and the newcomers are coming along fine. G2IT, 6GT, 5TP and 8BK heard active, the latter on 7 Mc. 'phone. The next radio meeting will be on Wednesday, March 17. Please send District notes by the 20th, OMs.

Kingston.—G2GK, of Walton, reports working good DX in Senior BERU. He intends to modify his gear, using a T55, and is awaiting 50 W permit on 28 and 56 Mc. 5ZK, of Camberley, has moved to Stroud, Glos., due to business changes, and will be installing his gear there in a few weeks. 2HI, of Tolworth, is very active on 7 and 14 Mc.; he is experimenting with various feeder points on Windom aerials. BRS2326, of Morden, writes of his television experiments, and would like to hear of others interested. G6BI, after a very short spell on 28 Mc., is now active on 56 Mc. and is putting out a very fine signal, using only 7 watts. His signals are R6 on the loudspeaker in Sunbury. 8IX (ex-2BKK) has been getting some remarkably fine 'phone signals out on 7 Mc. He has only worked good DX on 14 Mc. and is well on the way for W.A.C. after only a month on the air. He is getting going on 56 Mc. 2CFW, a new member, hopes soon to be active on 56 Mc. and is building E.C. receiver. G8HN (ex-G2NQ of the old days) has staged a "come back" to amateur radio, and we all wish him the best of luck. He is at present active on 7 and 14 Mc. with temporary aerials. He will very soon be radiating on 56 Mc. 6RS is active on 56 Mc. practically exclusively. His 5-watt signals have been heard in Woking, Egham, and Wimbledon. He would appreciate reports on his regular evening transmissions which commence at 21.00 G.M.T. and consist of CW and telephony.

The Kingston and District A.R.S. are having a very successful season; a special 5-metre group has been formed and holds fortnightly meetings, which are always well supported. A 56 Mc. link, Egham - Woking - Wimbledon - Sunbury - Twickenham, is practically completed. Particulars of scheduled transmissions from G6RS.

Southampton.—The first meeting of local members was held on February 16 and was attended by seven Southampton members. BRS2432, of Salisbury, was welcomed, having cycled 25 miles to attend. Meetings will be held regularly in future at the College on the second Tuesday in the month at 7.30 p.m.

Local activity remains at the usual level, 14 Mc. being the most popular band. Aerial experiments are being carried out, and despite 5OB's lack of success with the Windom, 5PT is now testing with this type. 56 Mc. activity is almost at a standstill owing to lack of co-operation by BRS stations in the vicinity. 5PT and 8DM are the only stations working this band at present and are rather tired of the sound of each other's voices and a complete lack of reports.

Portsmouth.—A discussion, chiefly on 28 Mc. Receivers, took place at the February meeting of the South Hants. R.T.S., many interesting points being raised. For April, it is hoped to have a lecture on "Output Measurement of H.F. Transmitters."

28 Mc. seems to be the chief local interest at present: G2XC, 6NZ, 2BCM, 2CBL, 2AZX are compiling comparison propagation data on 28 and 14 Mc. Others interested please note. 2ZR and 2105 are surmounting more transmitter troubles. 5OT is at sea. 6WS is changing radio room. BRS 2727, 1319, 1907, 2VH, 8BD all active.

Farnham.—G8LY reports that she will not be working any G stations on 7 Mc. CW during the period March 15-31. Someone is pirating her call.

DISTRICT 8 (Home Counties)

At a meeting held at "The Bird in Hand Hotel," Peterborough, on February 12, there were only ten members present, which tends to show that meetings held at a distance from the centre of District activity are not a success; there was only one member from Cambridge in attendance. It may be necessary in the near future to make different plans for further meetings in Cambridge.

A vote of thanks was passed to Mr. Frost, 2CDW, for valuable help in collecting data for the district frequency register, which is now nearing completion. Arrangements for the forthcoming Conventionette were also discussed at length.

Preliminary arrangements regarding N. F. D. were also discussed.

It is pleasing to note that the number of stations reporting to the D.R. is on the increase. G5JO has been active on 14 Mc. phone, 5DR still does good work on 14 Mc. CW, and is preparing to test phone on this band. 6HD continues with consistent work on 1.7 Mc. and his SS receiver is nearing completion. 6FL is mostly active on phone and by the time these notes appear he will be transmitting both phone and CW on 56 Mc. Reports will be welcomed. 5OV is mainly active on 14 Mc. phone and CW, but is also doing good work on 28 Mc. 6WA is building a SS receiver. 2XV continues good work on 14 Mc. phone and is considering a SS in the near future. 2679 now becomes 2ABR but is QRT for the present. 2PL is doing excellent work on most bands, particularly 28 Mc.

Peterborough.—G6PD is now operating at Beeston, Notts, and putting a good CW signal into his home town on 7 Mc. 2NJ is on 7 Mc. phone from Peterborough, and is erecting a new aerial for 1.7 Mc. at Heacham. 5NX has rebuilt on the all-metal plan. 2UQ has been heard recently in U.S.A. on 7 Mc. 1540 becomes 2BQC. 2075 has built a 56 Mc. receiver.

Regarding the conventionette to be held in Cambridge on April 25, will members who intend to attend this function kindly note that this is a social affair in addition to being an opportunity to discuss society matters, and therefore your YL and/or Ex-YL, together with all the little "electrons" (if any) are welcome, and no effort will be spared to make this function a big success. Visits to the Cambridge Observatory Stratosphere Research transmitting and receiving stations are being arranged, together with a visit if possible to the P.O. transatlantic telephone station at Baldock. Luncheon and tea will be served in the spacious Winter Garden of the University Arms Hotel, overlooking the renowned "Parker's Piece," and with good support this should be a Convention-

ette which will go down in R.S.G.B. history as a fine effort. For your part all you have to do is to let the D.R. know in good time that you intend to be present, and how many will be with your party. *Please do that now, before you forget it.*

DISTRICT 9 (East Anglia).

Members in general throughout the District are known to be active but, as usual, first-hand information is limited.

It is proposed to hold a District meeting in Norwich at Marchesi's, Prince of Wales Road, commencing at 3 p.m. on Sunday, April 18, at which it is hoped all will be present.

Experiments with Windom aerials have been engaging the attention of 2MN during the last few weeks.

Sickness has taken its toll in the District lately. 2UT has been down with pneumonia, but we note he is now on the air again. 5QO and 6UA are both on 14 Mc., working DX. 8DD, the only member sending in a report this month (other members please note), is experimenting with tri-tets. 6QZ continues to work DX on 28 Mc. and gives many fruitless test calls on 56 Mc. Other stations active include 5IX, 5UD and 5UF.

DISTRICT 12 (London North and Hertford)

N. London.—The February meeting of District 12 was held at the Parade Café, New Southgate, on February 16. In the unavoidable absence of the speaker G5TD, Mr. Corfield (G5CD) gave an informal chat on television. G6GC is building a SS superhet. G5WW is devoting considerable time to the 56 Mc. band. He is also experimenting with 72-ohm transmission lines, and reports working 30 miles on 5 metres, and is making tests on the efficiency of Class C amplifiers.

2BXL is G8KW and BRS2490 is 2ACN. 2BIW is G8KO, and expects to be working on 14 Mc. He is particularly interested in the ultra-short wave-lengths, and is willing to assist or co-operate with anyone interested in these frequencies.

G2AI reports verification of receipt of his 7 Mc. phone from New York (R7-8), using 8-9 watts. He is using a CO-BA-PA with a 33-ft. doublet-aerial system fed with 72-ohm low-impedance cable. 2AIX, of Highgate, reports active, and is building a tritet osciliator using an 89.

Watford.—The second meeting of this group was held at Bushey on February 12, but there was a disappointing attendance. Discussion was on receiver design, and special interest was centred on the 56 Mc. band.

The March meeting will be at 11, Nightingale Road, Bushey, on March 18, and it is hoped that a better attendance will be recorded.

2ANS has become G6MH, and is on the air with 7 Mc. CW and phone. He is using a 59 CO and 210 PA, but is at present only able to modulate to some 20 per cent. G5RD has a 56 Mc. crystal-controlled rig working, and finds it as good as his self-excited oscillator. The power is about the same and the transmission is horizontally polarised.

BRS2196 is building a television receiver. BRS1224 is carrying out experiments with a regenerative RF stage on 56 Mc.

The 14 Mc. phone activities of a certain station living not a thousand miles from Wood Green were not appreciated by the District 12 members taking part in the B.E.R.U. Junior Contest. He may like to note that his transmissions completely ruined the reception of DX telegraphy stations working at the LF end.

DISTRICT 13 (London South).

Elsewhere in these pages appear details of alterations which have been made in the rules for N.F.D., and we would earnestly request everyone to peruse them carefully. So far the D.R. has received only three offers of help for N.F.D., and as the time left for making arrangements is strictly limited, it is hoped that more offers will be speedily forthcoming. It has been decided to hold a general district meeting on Thursday, March 18, at the Brotherhood Hall, West Norwood, and there will, therefore, be no area meetings this month. The two most important items on the agenda for the meeting are N.F.D., 1937, and a Junk Sale. We sincerely hope that everyone will make an effort to be present, and that many will bring along "junk" for disposal.

Blackheath Area.—G2YG reports no activity at his own station, but says he has been assisting 8JX and 2APQ to get their gear in working order. A hearty welcome is extended to ex-VU2EB, who is a newcomer to the area; we look forward to seeing him at the next meeting. G2ZQ has had his time occupied with B.E.R.U. Senior and scored 997. 2WV has spent some considerable time endeavouring to erect a really efficient aerial on the roof. This has at last been done, but results so far have been most discouraging!

Wandsworth Area.—An excellent meeting took place at the "Collingwood" on February 17, and the D.R. was very pleased to meet some of the local amateurs. There were interesting discussions on topics ranging from the modulating system at G5SH to Television. 2RC has now decided that his W3EDP aerial is not a success, and is continuing his efforts to find the "perfect aerial." He is building a portable rig for use on the River Thames. 5SH has finished building his high-power modulator, which is now working satisfactorily. 2TH has now rebuilt and after numerous difficulties is back on the air. 2AFC is using a 6L6 in a tritet with some success. He reports that his iron core coils in the I.F. of his receiver are a great improvement. 2AFA continues his transmitter experiments. The March area meeting has been cancelled in view of the forthcoming district meeting.

Anerley, Tooting, Kennington, Brixton and New Cross Areas.—The D.R. was glad to be able to attend the local meeting at the Brotherhood Hall on February 25. G5PY made some interesting suggestions for N.F.D., which we hope he will carry through. He has obtained his 25 watt licence and is now using a QRP 'phone transmitter with a class "B" valve. Reports on his 7, 28 and 56 Mc. transmissions would be appreciated. 2UX was active in B.E.R.U. Junior, as also was 2JB. 2ADY went in for the receiving contest and has a good score. 2BFH made a gallant effort to get a receiver working about five hours before the start, and was last seen tearing about with several bits and pieces! G2LW, 2GZ and 2AZP all report active. 5OX has moved to West Wickham, but still remains attached to District 13.

Wimbledon Area.—No meeting will take place in this area during March, owing to the district

meeting. 2BMH is still hoping for further reports from local members.

It will be appreciated that some time must elapse before the South London Trophy can be presented, but an announcement on this point will be made at the next District Meeting.

Mr. H. L. Gibson, BRS1224, has asked us to include in these notes a statement to the effect that he is desirous of obtaining "digs" in the Barnes or Putney area. He would welcome assistance in obtaining the accommodation, and letters should be addressed to him at 50, Oundle Avenue, Bushey, Hertfordshire.

DISTRICT 14 (Eastern).

Chelmsford.—At the February meeting, held at the Bell Hotel, arranged and provided for by the T.R., there was an attendance of 16, including G8AB, G6LL and the D.R. Break-in was discussed with a view to solving band congestion. More use of the 1.7 Mc. band for telephony was advocated. The group will run the 1.7 Mc. station on N.F.D., using the call-sign G6LBP. Offers of help will be appreciated by the T.R., Mr. L. J. Fuller, G6LB, 85, High Street, Chelmsford. At the meeting G2GN, late of Sheffield, was made welcome to the district.

Brentwood.—2BJV is moving to 49, Rose Valley, Brentwood, and offers his QRA for a meeting. He is building and preparing transmitters. The T.R., with other members of this area, supported the Chelmsford meeting.

East Essex.—At the February meeting held at 2BNR, of Southend, an attendance of 21 was recorded. Suggestions were put forward in connection with N.F.D. and it was decided to run a 7 Mc. station in this area.

News of activity is as follows: G2SO and 5UK rebuilding; 2UK has received his 56 Mc. permit; G6CT research on RX's; G6IF raising funds to be link-coupled to a YL. The Chairman of the S.R.S. having completed his TX has had a house built around it! 2CLN building his A.A. TX; 2BNR building a signal generator; BRS1626 applying for his A.A. licence.

Congratulations to BRS2562, now 2AWD.

East London.—At the meeting held at 2BZK it was announced that the 14 Mc. station will be G6UTP, G8AB will assist and offers of help in the form of operators, apparatus, etc., will be appreciated. It is hoped that the QRA will be once more at Rookwood Hall, Abbess Roothing. G8JM of Chingford, has now made contacts on 7 Mc., and will welcome reports. 2BVV of Ilford, will be meeting local members, and is anxious to obtain a full permit. District 14 have still to find a group to run a 3.5 Mc. N.F.D. station, BRS2450, of Loughton, will shortly apply for A.A. permit.

DISTRICT 15 (London West, Middlesex and Buckinghamshire)

The twenty-one members who braved the weather to attend the meeting at G6VP, had the pleasure of again meeting his daughter, Mrs. Rita Price. Thanks to them all for the hospitality.

It is still necessary to plead for venues and speakers for these meetings. The junk sales are well supported and last month the total for the area funds was the best ever.

Congratulations to 2BAZ, now G8KZ, and a welcome to both G8IL and BRS2697, who are new members. All three send their first reports.

West London.—G6CO on 7 and 14 Mc. phone, 6WN on 28 and 14 Mc., worked FM8 on the latter and ZA on the former. 8KZ on 7 and 14 Mc. telephony worked F, GI, GM, ON, HAF, PA and EI with an RK23. 2AUB got 572 points the first week-end of B.E.R.U., and had a visit from W2JAJ. BRS2239 heard usual 7, 14 and 28 Mc. stations. G8IL got permission to erect aerial across the road, but it took four months. Intends to use two thirty-three-foot dipoles at a height of 60 feet.

Middlesex South.—G2KI, 2LA, 2ZY, 8IP, 8HN, 8FV, 6GB, 5VB and 2NN all active. G2KI is on 56 Mc., while 2LA and 2ZY are on 28 Mc. 2NN, using semi-vertical aerial, worked W6, ZL, VK, PKI, ZT, ZE and VU9, the latter also on telephony QSA5, R6. 2AIB applied for morse test, BRS2697 built 30-foot mast and listening on 56 Mc.

G6LJ suggests a list of pirates be published. G2KI will be on 56 Mc. with crystal control almost exclusively with only occasional trips to 28 Mc. 2BXC has been ill, but listened during B.E.R.U.

West Middlesex.—G5JL on 1.7, 3.5 and 7 Mc. G6VP active as usual. 8FA appears inactive. 2CGS building new receiver. 2BLX moving to Hayes. G2BY recovering from influenza, and getting good reports on his telephony.

Bucks.—G6JK bought rotary converter, only to hear of proposed change of mains. 2BVX has new receiver going and hopes for new aerial.

The Southall Radio Society offers a welcome to all R.S.G.B. members. G5JL will supply details.

T.V.A.R.T.S. have started group meetings and G6PK, the 56 Mc. group manager, arranged for Mr. E. H. Swain (G2HG) to give a talk on February 18. This was much appreciated, and others are to be arranged.

DISTRICT 16 (South-Eastern).

Brighton and Hove.—The last meeting of the Brighton and Hove Radio Society was on February 4, when G6CY gave a talk on "Aerial Feeders." BRS2594, of Haywards Heath, reports activity.

Folkestone have not reported, but 5MR, of Dover, is active on 28 Mc., and is getting out well after rebuilding.

Whitstable.—On Saturday, February 6, D. Slawyk (D4BUF) was entertained by the W.R.A. and gave an interesting talk on "German Amateur Radio and the D.A.S.D." There was a good attendance at the meeting, and a quantity of interesting gear was exhibited by members. 2AA reports hearing W8FH on January 31 on 56 Mc., a R.S.T.458, using a O-V-1 quench receiver. The feat has not yet been confirmed by W8FH, but details are awaited of gear, etc. if such confirmation is forthcoming. 2BIB is working on frequency dividing circuits for C C on 56 Mc. from h 114 Mc. tourmaline crystal. The following also report activity: 2BUC, 2AMY, and BRS2453.

Gravesend.—A meeting of the Gravesend group was held on February 22, when G2UJ have a talk on "Improvements in the Straight Receiver." We are pleased to welcome five new members who have joined this month. G6BQ entered for B.E.R.U. and seems to have done well. Interest in t

56 Mc. band is evident, and some field work is being planned for the summer. 2IZ is busy crystal-grinding.

Heathfield.—We are pleased to know that 5AQ, an old Heathfield member, is again in the town, after a long absence in Plymouth. Congratulations to BRS2511, who is now 2CJZ. The following are active : 5JZ, 5PR, 5PN, and BRS1173.

Ashford.—The Ashford group now numbers ten, the majority of whom are active, and meetings are held every fortnight. The B.B.C. television signals are received regularly in the town.

Tunbridge Wells.—G5OQ has returned to 7 Mc. after a long stay on 14 Mc. and, despite the QRM, contrives to work DX. 5KV is now using an RK23 as PA on 7 and 14 Mc., and if the size of the RF arc that can be drawn from the anode cap is any criterion, he should get out remarkably well ! 6OB seems to be settled on 14 Mc. and is working regular DX with the aid of a Windom and the excellent site of his new QRA. 2UJ has been busy building a new mains-driven receiver for 56 Mc., of which more later, if the design, which is a little unorthodox, proves successful.

DISTRICT 17 (Mid-East).

The Crystal Register has taken longer to revise than had been anticipated. Some members have not replied yet to the D.R.'s requests for their frequencies, and unless these are promptly forthcoming they will be omitted. The most onerous task, that of typing the Register, will have been begun by the time these notes appear, and it is hoped that copies will soon be in the hands of members.

It is time we had another district meeting. The next will be held either in Wragby, as suggested at the Louth meeting, or somewhere more South, possibly in Boston. Notice of this meeting will be given by post.

Brigg.—Using the W3EDP aerial, 8AP has worked several more W's, and now only needs Asia for WAC and WBE.

Cranwell.—The great event this month has been the completing and satisfactory testing of the Society transmitter on 14 Mc. This consists of a 6A6 push-pull C.O. and a push-push 6A6 doubler ink, coupled to a pair of DET 1 valves in push pull. No difficulty has been experienced in driving these to 85 watts, which is the present input. Conditions on 14 Mc. have been rather patchy, and as the aerial system is still experimental and very low in height, consistent results have not been obtained, although S, VQ8, VU, PY, and a goodly number of W tations have nearly always reported QSA 5, nd good T9. Permission is still awaited for rection of the 70 foot masts, which are all ready, nd with the lower angle radiation that a 2-element oomans Bi-directional array gives, a good signal ould result. Numerous tests have been made ith matched feeder systems that have afforded uch useful information, and shown the difficulty getting rid of standing waves. The lectures this onth have been by Mr. Davis, 6TV, and Mr. legg, B.Sc., both on feeder and aerial systems.

Boston.—6GH has added K7, VS1, VQ8, and S8 to his list of DX, bringing his total to 75 untries. It seems that he was the only district trant for the Senior B.E.R.U., and did very well. H has been active on 28 Mc., and has worked K2, 3, and 5 and W5. 8BQ is adding a doubler age to his QRP CO-PA.

Lincoln.—5XL has now obtained his 50 watt licence, and is very busy trying to get his transmitter functioning more effectively on 14 Mc. 2CFT has been experimenting with a TPTG.

Sleaford.—Congratulations to 2BOS (ex BRS 2461), who is building his first transmitter.

DISTRICT 19 (Northern).

The D.R. regrets he was unable to be present at the joint Stockton and Darlington Hamfest, due to business. Fifteen members attended and plans for another in the near future are in hand. It is rumoured that Sunderland is soon to have a T.R. We are glad to extend a welcome to G8DY, who has arrived from District 17.

Stockton and Darlington.—G8HQ is on 14 Mc., testing series modulation, and is having trouble with crystal frequency instability. 2CKN is building a CC rig and learning morse. G2FO has been busy in B.E.R.U., and says the best way to raise W is to send test B.E.R.U. ! G8GL is testing suppressor grid modulation. 2AKH and 2CBA are also active with new rigs.

Sunderland.—G6HV is using directional antennas and preparing for 14 Mc. phone DX. He is also arranging spot frequency phone schedules with GM6RG, GM5FT, GM6WD and G5CJ. G6UD is doing U.H.F. work and getting ready for 14 Mc. phone. 6TR is having trouble with aerials. 5NS is working DX on 7 Mc. on QRP. G8AR has had rectifier trouble but now OK. Where is G5AC these days ?

Tyneside and District.—G5RI is active at week-ends on 28, 14 and 1.7 Mc. G6YL has now worked W5 on 28 Mc. QRP, and contemplates some 56 Mc. work. G6IR has been rebuilding, and reports better efficiency. BRS2770 is active when he can find the time. G2OT had an interesting trip to Spitzbergen and Greenland as Radio op. He is on 14 Mc. 2APJ will be active again soon. 2PN worked all W districts on 28 Mc. in two hours, and is now using mains bias on final. 8AY is on 7 and 14 Mc. Congrats to 2ADU, who is now G8KK. 5WZ is on 7, 14 and 28 Mc. 5YO and 6XO are tackling 14 Mc. DX. 5QY is mostly on 28 Mc., and still maintaining daily sked with W5DRF. He is also on 1.7 Mc. each week-end and would like to see more activity on that band. 2GC is on 28 and 14 Mc. and is getting ready for 1.7 Mc.

Scotland

Everyone has received with great pleasure the news that permission has been granted for radiating permit holders in Scotland to employ the special prefix " GM." This restores a privilege to Scottish stations which was withdrawn a few years ago. Most stations have had a busy time working all the foreign stations who are anxious to contact the new prefix. Our thanks go to all concerned, and in particular to Mr. J. Wyllie, Mr. A. E. Watts and Mr. J. Clarricoats, who negotiated for the privilege.

" A " District.—The District discussed preliminary arrangements for N.F.D. at the monthly meeting, but little could be definitely settled until the regulations governing the event are issued. GM6VH has recently completed a superheterodyne receiver employing a regenerative 1st detector, and is pleased with results. 56 Mc. is receiving

attention from GM8AH. A good score was compiled by GM5YG in the Senior B.E.R.U. Contest (883 points), and it is reported that this will possibly occupy second place in Britain. Changes this month are artificial aerial licenses for Mr. J. I. M. Sinclair, BRS2620, 2CJY, and Mr. J. K. McDowall, 2CLO. Mr. J. A. Sey, 2BIJ, has passed morse test and awaits full call.

"B" District.—Last month we recorded the re-election of Mr. H. R. Taggart, GM5TA, as D.O. However, owing to business reasons, he has been forced to resign. At the monthly meeting Mr. D. W. Milne, Jr., GM6BM, was elected to fill the office as D.O., and we hope that all members will support him. "B" district did well in Senior B.E.R.U., four stations taking part, the scores made being GM5YN 155, GM6IZ 117, GM6BM 102, and GM8AT 12. Several stations have made a good start in Junior B.E.R.U., but details are of necessity lacking of the complete scores, as at the time of writing the contest was still in progress. Most of the stations in the district are active, and Mr. Milne will appreciate reports. Preliminary details for N.F.D. have been completed. GM2OX will take charge of the 160/80 station and GM6BM of the 40/20. The site for the 40/20 meter station will probably be in the Aboyne district. GM5YN has made W.B.E. GM6IZ is settling down at his new QRA and has built a new transmitter. GM2JF is using American D.C. valves and putting out a nice phone signal. 2CHK entered for B.E.R.U. Receiving Contest.

"C" District.—Activity continues at a very high level, and most stations are active. GM5WT is now W.B.E. Several B.R.S. members are active with 56 Mc. receivers.

"D" District.—GM2TM has received a S.W.L. report of RST359 from Chicago on his 1.7 Mc. transmissions. He is also reported in *QST* as the only DX station heard on that band. GM6XI has rebuilt to 6L6/RK20. GM2BD is carrying out comparative tests with 59 and 6L6 valves as tritets, and has raised most W districts and VU. GM5YX has worked VE5GI on QRP. N.F.D. matters are now beginning to receive attention from the district. Mr. Borthwick (2AZB) has received the radiating call GM8LA, and Mr. J. J. E. Black (BRS2713) is now licensed as 2CIJ.

"F" District.—Mr. J. Laing (BRS1653) has been licensed as GM8JG. It is believed that one or two stations took part in B.E.R.U. and put up good scores.

"G" District.—Mr. Rix, of Messrs. Edison Swan Electric Co., Ltd., will deliver a lecture to the members at the Maxwell Hotel, Galashiels, on March 18, 1937. GM6RG is rebuilding fast after the serious fire at his station. 2CGY has new receiver for 28 and 56 Mc., and will be pleased to stand by for tests almost any time.

"H" District.—Our sympathy goes to Mr. Lawson (2ANL) on his sad loss.

The district dinner was a great success, and everybody enjoyed themselves immensely, some 20 persons being present. Small parties of members have paid visits to the stations of GM6SR and GM5YX. The district has acquired a district shack in Kirkcaldy. Mr. Clackson (2ACK) has now received the call GM8KR. The district is hoping, if at all possible, to be able to take part in N.F.D.

Northern Ireland

Congratulations to Mr. E. O. Byrne on his new call, which is GI8LF. His frequencies are 1,800, 7,180 and 14,360 kc.

Belfast.—GI5SJ only received one monthly report, but he sends the following news:—GI6TK W.A.C. in forty minutes with PY, U9, D4, UK5, CN8, W8. He has also made a considerable number of contracts on 28 Mc. GI5QX, 2UO, 2SP, 8GK, 2KR and 5SJ are active on 28 Mc. GI5MZ and 8PA are on 7 Mc. phone, the latter using a type 6L6 to drive a 59. GI5WD is doing good work on the 28 Mc. band using an RK 20.

We hope that GI5SJ will receive the practical support in his endeavour to supply notes each month. These should reach him by the 24th of each month and be sent to 10, Cyprus Avenue, Belfast.

This report is in the nature of a farewell one, as the writer finds that he cannot give as much time to the duties of his office as he would like. He has, therefore, decided to retire in favour of one who will be able to further the interests of the R.S.G.B. in Northern Ireland. GI5GV would like to thank those who made his work a pleasure, and to express the hope that his successor will receive the unstinted support of the Northern Ireland members.

GI5GV.

Snaps from the States No. 2

Our photograph shows the well-known American telephony station W2IXY, operated by Miss Dorothy Hall at Long Island, New York. "Dot," as she is familiarly called on both sides of the Atlantic, is the first lady member to qualify for a W.B.E. telephony award.

The gear displayed speaks for itself!

Stray

Asian stations are asked to look out for G8A who only requires a British Empire contact wi that continent to give him W.B.E. and W.A. His frequency is 14,060 kc. and times of workii are 0715-0830, 1345-1415, and 1745-1900 G.M.T.

Empire B.E.R.U. News.

B.E.R.U. SECTION REPRESENTATIVES.

Australia : I. V. Miller (VK3EG), P.O. Box 41, Tallangatta, Victoria ; Sub Representatives : J. B. Corbin (VK2YC), 39, Mitchell Street, McMahon's Point, Sydney, N.S.W. ; R. Ohrbom (VK3OC), 22, Gordon Street, Coburg, N.13, Victoria ; A. H. Mackenzie (VK4GK), Fire Station, Wynnum, Brisbane ; G. Ragless (VK5GR), South Road P.O., St. Mary's, S.A. ; J. C. Batchler (VK7JB), 21, Quarry Street, North Hobart, Tasmania.

Bahamas, Bermuda and the Eastern Part of the West Indies :

Burma : W. G. F. Wedderspoon (VU2JB), Government High School, Maymyo, Burma.

Canada : Earle H. Turner (VE2CA), 267, Notre Dame Street, St. Lambert, P.Q. ; W. P. Andrew (VE3WA), 1337, Dougall Avenue, Windsor, Ont. ; F. Taylor (VE5GI), 4374, Locarno Crescent, Vancouver, B.C.;

Channel Islands : J. le Cornu (G2UR), 1, Les Vaux Villas, Valley Road, St. Helier, Jersey.

Egypt, Sudan and Transjordania : F. H. Pettitt (SU1SG), Catholic Club, Mustapha Barracks, Alexandria.

Hong Kong : G. Merriman, (VS6AH), Box 414, Hong Kong.

Irish Free State : Captain G. Noblett, M.C. (EI9D), Barley Hill House, Westport, Co. Mayo.

Kenya, Uganda and Tanganyika : W. E. Lane (VQ4CRH), P.O. Box 570, Nairobi.

Malaya and Borneo : J. MacIntosh (VS1AA), Posts and Telegraphs, Penang, S.S.

Malta : L. Grech (ZB1C), 18, Constitution Street, Zeitun, Malta.

Newfoundland : E. S. Holden (VO1H), Box 650, St. John's, Newfoundland.

New Zealand : R. T. Stanton (ZL3AZ), 17, Martin Avenue, Beckenham, Christchurch.

North and South Rhodesia : R. A. Hill (ZE1JB), P.O. Box 612, Salisbury, S. Rhodesia.

North India : J. G. McIntosh (VU2LJ), Bukhia Tea Estate, Letekujan P.O., Assam.

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

South India : J. S. Nicholson (VU2JP), c/o Kanan Devan Hills Produce Co., Ltd., Munnar P.O., Travancore.

Malaya and Borneo

By VS1AA.

There is a complete absence of reports these days. VS1AA was off the air from November 9, 1936, to February 7, 1937, but despite this, he has received cards from 2BXO, G5TH, VE2HG, W2EMI, and W9EZT, reporting reception of his signals on 14 Mc. on January 6 and 8, 1937.

The Director-General of Posts and Telegraphs, Malaya, announces that " Malayan amateurs may continue indefinitely the use of the 3500-4000 kc. frequency band, with the exception that use of the and 3810-3860 kc. is forbidden, as this is reserved for the Services. I shall be obliged if you will draw the attention of your members to the necessity for avoiding interference within this frequency band." Malayan amateurs please note.

Rhodesia

By ZE1JB.

Notes this month are rather scarce, but those received are interesting. Another Rhodesian station has succeeded in working New Zealand on 14 Mc., namely, ZE1JE, who received reports of ST569 and 559 respectively from ZL1BC and ZL1HY on February 7. The transmitter used is a 3 stage affair with a 47 CO, 46 FD and RK 20 in the final with 50 watts input, link-coupled from the crystal oscillator right up to the aerial.

ZE1JB has not been very active recently and did not enter for the B.E.R.U. contest. He has now acquired a Super Skyrider, 1936 vintage. 1JF has at last made WAC on 'phone, having had some very good reports from all Continents. He has also worked a number of stations on CW, including FT, ZB and SV. He reports Canadians R7, but has been unable to make contact. The receiver used is also a Super Skyrider SX9, while the transmitter is the same as that at ZE1JE. All Umtali stations report conditions erratic and QRM very bad on 14 Mc. 1JG has obtained his WAC and WBE after having been on the air for eight months. 1JN has completed his transmitter, and is waiting for a pair of RK 25's. ZE1JO is back on the air and entered the B.E.R.U. contest. A pair of RK 25's is being used in the final with inputs which never exceed 45 watts. For the second time ZE1JO blew all the valves in his receiver as a result of an internal short. 1JP has given up his licence and to date it has not been re-issued. 1JS worked all Continents in 2 hours 10 minutes, and QSO'd not less than three stations in each Continent, getting a total of 27 contacts with an average report of R6 or 7. The power input was 41 watts to a pair of RK 23's.

ZE1JU who has worked the South American required to give him WAC on 14 Mc., has acquired a Lafayette communications receiver. 1JV participated in the S.A.R.R.L. Jubilee contest. He took part in the Senior B.E.R.U. contest, but like the other Umtali men, reports conditions very erratic. During February he worked numerous stations, including CE VS1, VS8 and HS. He will be proceeding on leave in March.

ZE1JY is being relied on by the Bulawayo group to hold up their end in the B.E.R.U. contest,

and we understand that he scored rapidly. He reports conditions almost the opposite from last year, when Australia was easy to work on 7 Mc., whereas they are unobtainable this year. We are told that ZE1JY has ordered a National NC 100, so he should be well equipped when this arrives. 1JZ has obtained his WAC but he requires the elusive Canadian for his WBE. Canadians are very much easier to work nowadays than they were several years ago and the writer and several others waited something like seven years before being able to get the desired contact. The Bulawayo group has a complaint against U.S.A. and other stations. ZE1JS heard a New Zealand station calling, but due to QRM was unable to get the call. Since he wanted to work a New Zealander, JS made a "CQ ZL" call, to which numerous W6 stations replied. He then tried "test ZL" with the same result. Eventually he used the call "CQ New Zealand only," but still the W6's replied. Surely stations realise that it is not playing the game to answer a directional CQ, because it means that the country desired may be missed as a result of waiting for the call sign of the station wrongly answering the CQ. To show that this complaint is not directed only against W6 stations, we would add that one of the "CQ ZL" calls resulted in a reply from a VQ4 station only a thousand or so miles away.

Surely something can be done to have the Italian station IUB or IUP removed from the Amateur band, where it is causing very considerable interference in a congested area.

[The G.P.O. have again protested to the Italian Government.—Ed.]

South Africa

Division One.—ZS1AN is welcomed as a new B.E.R.U. member. ZS1H having piled up a huge score in the 28 Mc Contest is now turning his attention to 56 Mc, after completely rebuilding his station.

A great many S.A. stations took part in the B.E.R.U. Contests, but details are at the moment lacking.

Attention is directed to the use of the Q signals, for indicating the point in the band from which listening is to commence. Much time would be saved if this code became general.

Transmissions between a plane and a traffic control van were conducted with great success during the recent Cape Town Grand Prix Motor Race. The wavelength used was 7½ metres (Bulletin article, please.—Ed.). ZS1B

Division Five.—Congratulations to ZS5Z, ZT5V, and ZU5D on working ZL. This is a real achievement, as South Africa-New Zealand contacts are very rare. ZS5AK and ZU5AC are welcomed as new B.E.R.U. members. ZS5U has had further bad luck, his main transformer having blown up. He took part in the B.E.R.U. tests using low power.

ZU5AC has been conducting slow Morse practices, and has gathered together a large class of beginners.

ZS5Z, ZT5V, ZU5AF, 5D and 5Q have all been active.

Duplex phone on 7 Mc has been conspicuous by its absence, for which relief we breathe again. We do, however, commend the use of 3.5 Mc for this work, which has a definite experimental value.

ZU5Q.

Division Six.—The period under review has been notable for the interest taken in the B.E.R.U. Contests. Many local amateurs, after spending considerable time rebuilding their outfits, devoted the week-ends to Contest contacts. Prominent among them was ZS6AM, who is very proud of his score. ZT6AQ entered the Contest wholeheartedly, and his total points were well earned.

A pleasing feature of the Contest was the numerous new prefixes heard in Division Six for the first time. Perhaps this was due to the participant listening-in more attentively; or was it because many Empire amateurs became enthusiastic and got their rigs "on the air"?

ZU6C has not worked any DX since last October, and local contacts are few; due to being troubled with QRM from a neighbouring station. He is constructing a new receiver incorporating four stages of I.F. His new transmitter tube line-up is a 53 oscillator, 865 buffer, 825 amplifier.

ZS6T is rebuilding again. The tube line-up of his new outfit will be a 6L6 oscillator, RK23 buffer, Eimac 35T amplifier. He has also just acquired a senior model H.R.O. receiver.

ZT6X is contemplating a new transmitter, but is not yet certain of the tubes he will utilise, but probably the last stage will be either an Eimac 50T or a Taylor 55T.

Three stages are in commission in ZT6M's new 28 Mc. transmitter: 53 oscillator, DET1 buffer, DET1 amplifier.

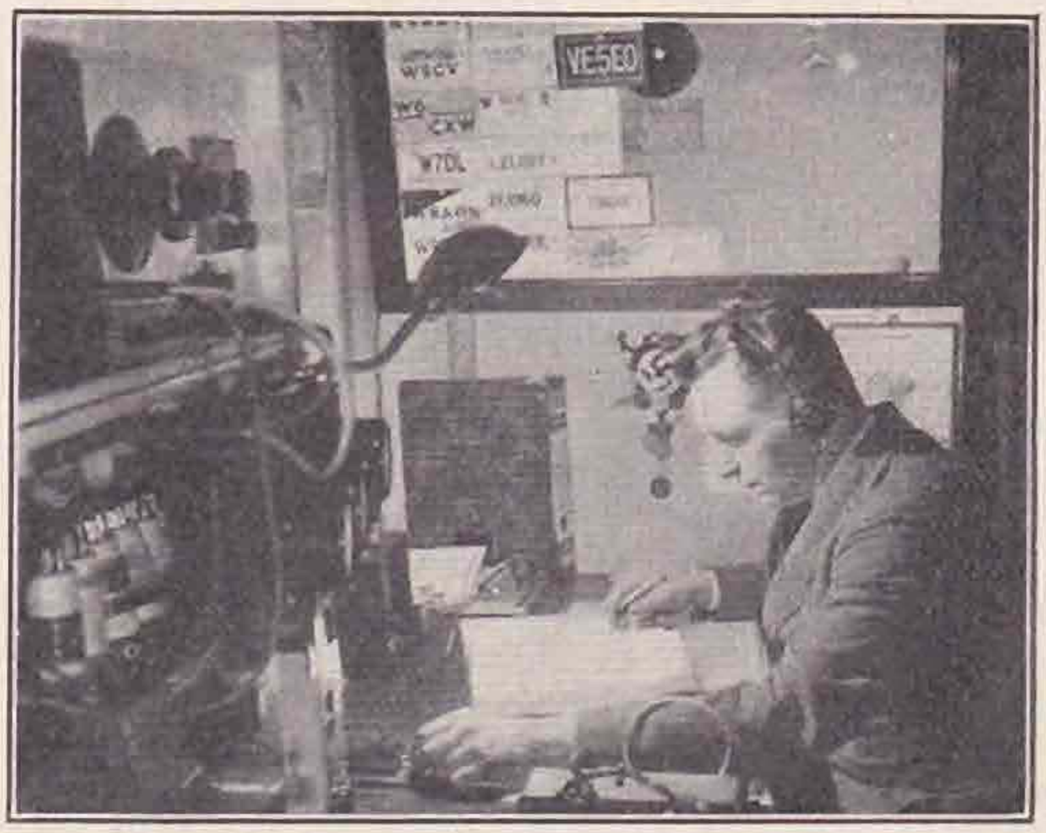
ZT6AD is temporarily inactive, as he will be moving to a new QRA soon.

ZU6V is active on 14,276 Kc., using a 14 Mc. Johnson Q antenna.

ZS6C is active on 56 Mc. ZU6V.

Visitors to Headquarters.

Mr. H. A. M. Clark (G6OT) and our Secretary recently had the pleasure of entertaining Herr Slawyk (D4BUF) (Foreign Secretary of the German amateur organisation, D.A.S.D.) and Mr. Phil Moores (ex-ZD8A and VQ8A), late of Ascension Island. Mr. Moores has just been appointed Engineer-in-Charge of the Beam Station at Salisbury, Southern Rhodesia, and leaves England or March 25 to take up his new duties. He hopes to be operating under a ZE call within a few weeks



Our photograph shows D4BUF at his receiving position.

THE MONTH ON THE AIR—(*Continued from page* 403.)

for QSLs via an F8. G2PL reports XZ2BU a DX signal. BRS1679 hears VO6L, VO1J and VO1I working triplex 'phone; the latter remote controls his transmitter over a mile and a half of landline. Other 'phones are HP1A, VP9G, and SV1NK. G6YR hears ZN4ZN in the Mediterranean, and DX includes CE3AR, HC1JW, HK4D, K6BNF. SU2TW puts up a W3EDP aerial and W3EDP answers the first CQ. I suppose that must prove its efficiency. He heard W3EXB on January 28 sending "QST by order FCC clear all bands for emergency work." Reports FHO sending Meteo on 14,300 and EAN inside the L.F. end. SU2AX is bogus. G6LJ deprecates the amount of piracy and names HS4T and W6ABF as examples. BRS2178 hears K7EVM and FY8C of French Guiana, while G8AP snags a good one in J9CA. G2ZR hears HZ1AA sending fast in German, wonders whether he is the same as HJ1JD heard in December, 1935, giving QRA as c/o Cable Co., Aden. G6CJ hears VP1WB 14,420 T6, VP4TJ 14,420 T6, VS8AA 14,375. G2SO hears NX1AP working an LA: says he is local.

G6YL worked ZA6F on 28 Mc., who gave his QRA as Janina. G6YL told him that Janina was in Greece and that he should be using an SV call, but he was insistent that the place was in Albania. 2BDO reports that U.S. police transmitters QSL; he has heard Car 63 of the Boston police S5 on the LS. G6FO has worked U.S.A. on all bands except 56 Mc.

Finally, G2ZQ will be glad to send Coronation covers with all British denominations to any amateur stamp collector who will do the same for him. (We are not sure whether this is a free advert. but will let it go in. G6CL also collects stamps!—Ed.) The best of DX to you all and thanks for the help of your reports.

The Leonard Trophy Contest

The contest is open to all transmitting stations in Ireland (EI and GI) and the rest of the world.

Dates of Contest.

May 7, 1937. At 24.00 GMT to May 9 at 24.00 G.M.T.

May 14, 1937. At 24.00 GMT to May 16 at 24.00 GMT.

May 21, 1937. At 24.00 GMT to May 23 at 24.00 GMT.

May 19, 1937. At 24.00 GMT to May 30 at 24.00 GMT.

Rules.

The contest is open to all licensed transmitting tations. Licensed power must be used.

Only one operator allowed at each station; if nore than one operator, each operator's score ounts separately.

All stations must exchange R.S.T. reports to ount for points.

Stations may be worked once only during contest.

All licensed frequencies may be used.

Iethod of Scoring.

1 (One) point for European contacts.

2 (Two) Points for African contacts (above quator).

3 (Three) Points for African contacts (below quator).

3 (Three) Points for North American contacts.

4 (Four) Points for South American contacts.

4 (Four) Points for Oceania contacts.

Irish Stations.

Score to be multiplied by the number of countries worked.

Districts of America W1 to 9, and Canada VE1 to 5 count as separate countries.

Awards.

For the leading Irish station the Leonard Trophy will be awarded for one year (replica also presented).

For the leading station outside Ireland, a Gold Medal.

For the second station outside Ireland, a Silver Medal.

All entries must reach the Hon. Secretary, Radio Society of Northern Ireland, F. A. Robb (GI6TK), 46, Victoria Avenue, Sydenham, Belfast, North Ireland, not later than July 31, 1937.

Knock Answered

Mr. H. E. Sutton, 2AAS, informs us that 0, 2 and 4 B.A. brass wing nuts, bolts, washers, round and square brass rod can be obtained from *Messrs. Lumers Electric Co.*, Scarisbrick Avenue, Liverpool 21.

Mr. H. Chorley, G5YH, tells us that excellent clips which will grip anything from 22 S.W.G. wire up to ¼-in. tube are obtainable from Woolworths at 1d. each. Mr. Chorley also mentions that aluminium and other metals can be bought from *Z. Dessar & Co.*, 5, Museum Street, W.C.1. Panels will be cut and bent very accurately to any size.

Our second list of components and oddments wanted is supplied by Mr. C. E. Beyts, 2BYJ.

Item 1. Silver-plated copper wire in various S.W. gauges from No. 14 to No. 20.

Item 2. 4 and 6-pin *British*-made low loss coil formers, 1 in. diameter.

We shall be pleased to publish further lists submitted by members.

Break-in Operation

GM5TY operates on 7,115, 7,156, 7,184, 14,230, 14,312 and 14,368 kc. E.C.O. is occasionally used.

Mr. P. Nicoll (G5ZN) uses "break-in" on 3,579, 7,158 and 14,316 kc. His transmitter is remote-controlled and employs a Tritet C.O. link coupled to an RFP15. The aerial is of the W3EDP type, and keying is affected in the C.O. cathode.

First G-K6 Phone Contact?

Mr. F. W. Miles (G5ML) contacted K6MVV on telephony at 1930 G.M.T., February 27, on 28 Mc. His signals were reported QSA 5 R6. It is believed that this was the first G-K6 phone contact. Any challengers?

What Would You Have Said?

The following is true:—

An instructor was lecturing on Ohm's law and cells in series and parallel. A member of the class—one of those who know very little, but ask awkward questions, said: "I understand about cells in parallel. You get the 'voltage of one' because it's like having one big positive and one big negative plate. Now will you give me a simple technical explanation of why you get the total voltage when cells are joined in series?"

THE 28 Mc. BAND—(*Continued from page* 402.)

G.M.T., and on 'phone he often worked as many as 50 W's in a day!

Asia is still the most elusive continent, but several U9's are active, and G6DH had nine contacts with VU2AU, VU2LJ, J2CB, J2CF, and J2IN. VU2DA is apparently also active, as W. stations have been heard calling him around 17.00 G.M.T. Apart from CN, FA, FT, and SU stations, Africans have been weak and unreliable. Those heard during the month included FB8AB, ZE1JJ, ZS1C, ZT1R, ZU1T, and ZS6AJ. New countries are represented by VQ4KSL and FQ3AA (Senegal), worked by G6DH on February 7 and 27 respectively.

Signals from OH, YL, YR, YT, and U stations have been roaring through as usual, and nearly every other European country has been heard at some time during the month. ZA6F, said to be in Albania, is a new station on the band. OH2NB reports that in Finland conditions are very similar to ours. He says W6CXW is often R8 for several hours, and is the outstanding West Coast W. G6DH is the best G 'phone station—"R9 every day, and making terrible QRM!" OH2NB was W.A.C. in one hour and fifty-five minutes from 13.30 G.M.T. on February 24, his contacts being with VK2GU, U9ML, VE3DU, SU1RJ, HK1JB, and G5ZN. G6DH caps this by W.A.C. in *one hour* from 11.25 on February 28! His contacts were with VU2LJ, VK2GU, FB8AB, W8JFC, PY2AC, and YT7KP.

Returning to distances of a mere 200 miles or so, G6NZ, of Portsmouth, optimistically called "Test Ten" at 23.13 G.M.T. on January 31, when the band had been dead for several hours, and was heard by BRS2317 of Leeds! Query: which layer reflected that one?

JANUARY 56Mc. TESTS.—(*Continued from page* 405.)

heard include GI2KZ (539) at 1010, PA0OK (569) 1100 and GI2KZ again at 1200, when he had improved to RST 559. These were all heard in the 56 Mc. band. On frequencies between 60 and 40 Mc. CN8MQ has heard harmonics of such distant stations as INB, WTS and WQF, besides many from European and African commercial stations.

2AAN reports hearing W8FH on January 31 at RST 458, when the latter was using telephony, and announced that he was using 100 watts crystal controlled. Confirmation of this fine feat is awaited.

G5JU heard three weak C.W. stations, two on January 24 and one on January 31, but was unable to identify them. Harmonics from local transmitters working on 28 and 14 Mc. were heard from stations up to 10 miles away, whilst both the sound and vision signals from the Alexandra Palace were receivable whenever the transmitters were working. Reception was better in daylight, averaging R4 to 5, falling away to R3 at night.

All this goes to show (*a*) that the 56 Mc. band is definitely open for C.W. contacts, (*b*) that it appears necessary for a daylight path to exist with conditions improving as noon approaches and probably peaking between noon and 1600 G.M.T. This again shows that reflection is taking place from ionised layers and this is confirmed by the recently announced discovery of layers between 5 and 40 miles high.