



THE T & R

# BULLETIN

A JOURNAL FOR  
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Vol. 15 No. 11

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## AFTER THE WAR—WHAT THEN?

If an Old Timer was asked to name the one development of the last war which affected experimental radio work more than all others, it is a safe bet the answer would be, "The triode valve."

The addition of the grid electrode to the early diode was not, as some may think, a war-time development (the Lee de Forest patent dates back to 1905), but due to war requirements the three Services were quick to apply the improved technique to their problems. Even then some time elapsed after the war before radio experimenters fully appreciated the importance of the triode as an oscillator, amplifier and detector.

Those members who attended a North London meeting last month spent an enjoyable evening speculating as to what developments are likely to occur during the present war which will affect experimental radio to the same extent as did the development of the triode, two decades ago.

Possible improvements in aerial design, particularly in regard to feeder methods, were fully discussed and reference made to one of the difficulties of present-day radio communication—namely, the lack of secrecy due to the use of omni-directional aerial systems.

In the u.h.f. field it was thought that the method, described in the current issue, of substituting short lengths of concentric pipe-line for conventional coils would rank as an important advance. Improved valve designs for u.h.f. operation were also foreshadowed.

An interesting opinion was expressed that at the end of the war the radio amateur would be better served with portable high tension equipment. Improvements in the design of vibrators were mentioned, and reference made to the compactness and lightness of such units.

It was thought that the Cathode and Frequency systems of modulation held great promise for amateurs, especially on the score of economy of modulation equipment. The Cathode system, for example, is reputed to give excellent results with a modulation power of only 10 per cent. that of the final amplifier.

Improvements in crystal manufacture were visualised, especially in the direction of increased efficiency at ultra-high frequencies. The possibility was considered of a substitute being found for quartz which would permit the fabrication of fundamental plates down to the metre wavelengths, thereby obviating the need for numerous multiplier stages.

When all had been said, the unanimous conclusion was reached that no fundamental changes of great magnitude are likely, in view of the large industries which would be affected. In support

(Continued on page 456.)

# THE TRACKING OF U.H.F. CONCENTRIC LINE RECEIVERS†

By E. H. CONKLIN (W9BNX), Associate Editor, RADIO.

*It is hoped that the information contained in this article will serve to encourage the construction of equipment making use of short sections of transmission lines as tuned circuits.*

ONE of the greatest pleasures in amateur radio is derived from a satisfaction of the desire for something better than the apparatus we were contented with a few years ago. Yet it often takes a long time for most of us to digest a "new" idea and incorporate it in our equipment. The superheterodyne circuit, for instance, had been known for years before many amateurs abandoned regenerative detectors.

There is room for improvement on the ultra-high frequencies, a fact that has attracted many who derive more fun out of solving a problem than out of repetitious contacts over the air. The ultra-highs have both advantages and disadvantages compared with lower frequencies; an advantage is the ease of constructing high-gain beam aerials capable of emitting a signal several hundred miles with reasonable regularity, while a disadvantage is the loss of stage gain in amplifier circuits due to the unsatisfactorily low impedances developed by the usual coil and condenser circuits. This loss of stage gain makes it more difficult to bring a weak signal through above the noise level generated in the first stage unless an efficient aerial and transmission line will deliver a good signal initially to the receiver.

## More Receiver Gain?

Many readers may say that they could not use more receiver gain because of the high noise level at their location but such statements usually come from those with receivers where there is considerable gain *after* the first stage, thus amplifying the set noise created by the first stage. Something can be done about this, for if the first stage gain is improved substantially, the signal and outside noise will predominate over set noise (which then needs less amplification *after* the first stage) in the receiver-output, and a noise silencer will then become effective. The silencer would have been of no great value when sharp outside noise peaks are of a strength comparable with the more even set hiss.

In addition to improving the aerial and transmission line, what else can be done to increase the signal-to-set-noise ratio? This question can be answered by examining the r.f. stage of the receiver. First, the signal should be coupled into the grid circuit with as much step-up as possible. Second, the grid circuit itself should be designed for reasonably high impedance. Third, the valve should be one that has a high input impedance so that it will not ruin the good tuned circuit called for above. Fourth, the valve should have a high transconductance if this can be obtained in conjunction with the third

requirement. Fifth, the output tuned circuit should have a high impedance in which may be built up a signal voltage that is sufficient to operate the relatively inefficient mixer valve well above the noise in this circuit.

The first requirement demands matching the transmission line as carefully in the receiver as in the transmitter, with none of the coupling-condenser-to-grid business so frequently used in the past! The second and fifth requirements can be met by dispensing with coils and substituting short lengths of transmission lines (especially concentric lines), a policy which is becoming widespread in commercial and laboratory practice. The third and fourth requirements will be satisfied by the use of acorn valves which are now widely reported to be giving satisfactory life when operated within their ratings.

Of these requirements, only the use of *concentric lines as tuned circuits* represents any substantial departure from practices that are familiar to most readers. It is hard, however, for some amateurs to understand that better tuned circuits can be built with the aid of a hacksaw or tin shears than with a length of wire and a coil former! Many favourable comments have been made by satisfied experimenters who have taken the plunge into "plumbing" circuits, in fact the author has yet to hear from anyone who has tried concentric lines and then returned to coils.

Various phases of the design and application of transmission lines to ultra-high frequency equipment have been treated in past issues of *Radio*, particularly those for January, 1938; January, April, May and June, 1939. Neither those articles nor the present one should prove too technical for anyone who did not fail in his grammar-school arithmetic.

## Short Concentric Lines

Single-ended circuits are best made (so far as we know to-day) from sections of concentric lines. These may develop a  $Q$  of several thousands whereas a coil and condenser will be doing well if they measure up at 200.

For two good reasons *it is not necessary* to use pipes a yard long. First, a reasonably good circuit results from the use of a line considerably less than a quarter wave-length long (the Civil Aeronautics Authority Radio Section was well satisfied with a 60-142 Mc. receiver using lines 2 in. in diameter and only 8½ in. long). Second, a higher  $Q$  results from the use of a line half as long and twice as thick. Therefore, it is quite practical to build short lines into the bottom of a receiver chassis, using either round or square outer conductors, the latter bent up from sheet metal and bolted to the chassis. In fact, satisfactory tuned circuits for 2½ and 1½ metres will probably result from the use of a coil-can or valve shield as an outer conductor.

† Published by kind permission of the Editor of "Radio," 1300 Kenwood Road, Santa Barbara, California, and with the agreement of the author. Original title "Super-het Tracking at Ultra-High Frequencies."

Before leaving the subject of  $Q$ , it is desirable to clear up a point which is easily overlooked.  $Q$  provides selectivity. The sending-end impedance ( $Z_s$ ) of the tuned circuit produces the gain. Optimum design for  $Q$  and  $Z_s$  are not necessarily the same. A ratio of outer conductor-inner diameter, to inner conductor-outer diameter, of about 3.6 gives the best  $Q$  and is preferred for oscillator stability or for transmission line efficiency, but a much higher ratio (smaller inner conductor) will produce a higher  $Z_s$ . When a shortened line, loaded with a variable condenser, is used it appears possible that an even higher ratio will be preferred in an r.f. stage in order to sacrifice less impedance ( $Z_s$ ). The short, higher ratio line can be tuned to resonance with a smaller condenser than can another short line with a lower ratio of conductor sizes.

Another point worth mentioning at this juncture is that the damaging effect of placing the input (grid) circuit of a valve across the open end of the line will be less in the case of a short than a long line, because effectively the valve is tapped down on the line.

The use of these pipes is not confined to superheterodynes nor, for that matter, to receivers. A plain regenerative or a super regenerative receiver is improved just as much by the substitution of lines for the coils.

### Tuning Charts

In order to assist users of transmission lines of any type to find the value of capacity necessary to resonate them at various frequencies near to the amateur bands, Figs. 1 and 2 have been prepared. These show "curves" for several frequencies.

Fig. 1 is for a characteristic impedance of 81.04 ohms which, in the case of a concentric line, results from the use of a  $\frac{1}{8}$ -in. inner conductor and a 2-in. outer conductor with 0.035 in. walls, giving an inside diameter of 1.93 in. Fig. 2 is for a  $Z_0$  of 139.9 ohms which results from a reduction of the inner conductor size to  $\frac{1}{16}$ -in. This higher impedance line will usually be more satisfactory for receiving, because very short lines do not require as much capacity across the open end to resonate them.

By selecting a line length along the scale at the left of the charts, the corresponding capacity to resonate will be found on the scale at the bottom. The "curves" have been made "straight" by plotting the lengths in terms of the co-tangent of the electrical length (in degrees) of the lowest frequency shown in the figures; the equations appeared in *Radio* for April and May, 1939.

One set of curves holds good for one characteristic impedance ( $Z_0$ ), either for concentric or open wire lines. The accuracy is such, that these lines are now being used to measure inductance and capacity at very high frequencies. The inductance of the shorting disc or bar has been neglected, but this is generally of small importance in amateur work, in fact, when a tuning condenser or valve is placed across the open end of a line, it might be well to consider the conductor length as including the lead to the condenser shaft or valve elements.

The data for characteristic impedances ( $Z_0$ ) other than those shown in the charts can be determined easily because the tuning capacity is inversely proportional to the characteristic impedance for a given line length. That is, a line of twice the impedance will tune to a given frequency with half the capacity.

The charts can also be used with simplicity on other bands. For 112 Mc., employ the 56 Mc. curve but divide the capacity and line length scales by two. For example, if an 81.04 ohm line 30 in. long will tune to 56 Mc. with 28.20  $\mu\text{F}$  capacity, a 71.04 ohm line 15 in. long will tune to 112 Mc. with a 14.10  $\mu\text{F}$  condenser. Likewise, a 60 in. line of the same impedance will tune to 28 Mc. with 56.40  $\mu\text{F}$ . On the face of it, this appears to be a large capacity—which can be reduced to 28.20  $\mu\text{F}$  by using a 162.08 ohm. line—but the circuit will outperform a coil both in regard to gain and selectivity. The capacities mentioned include circuit capacity which in the case of a mixer, preceded by an r.f. stage, will amount to about 10  $\mu\text{F}$  with acorn types of valve.

To facilitate converting Fig. 1 for other characteristic impedances, Table I has been prepared to show the capacities necessary to resonate an 81.04 ohm, 30 in. line to various frequencies. The exact lengths of a quarter wave are also given.

TABLE I.

Megacycles	$\frac{1}{4}$ -wave (in.)	C ( $\mu\text{F}$ )
49	60.260	40.36
50	59.055	38.31
51	57.895	36.37
52	56.784	34.55
53	55.712	32.82
54	54.682	31.21
55	53.688	29.65
56	52.727	28.20
57	51.804	26.81
58	50.910	25.49
59	50.048	24.23
60	49.213	23.03
61	48.405	21.90
62	47.652	20.82
63	46.870	19.78
64	46.137	18.79
65	45.428	17.85
66	44.739	16.94
67	44.072	16.07

### Tracking Methods

On ultra-high frequencies, most amateurs pad the oscillator, mixer and r.f. circuits with capacity until the receiver is lined-up at mid-band. Seldom is it even necessary to rebuild the oscillator coil, because the tuned circuits are so broad that accurate tracking is unnecessary. With concentric line circuits, this method—or lack of method—can still be used whether the oscillator circuit is a coil or pipe, but it will probably be necessary to touch up the tuning with a trimmer condenser between ends of a band because the r.f. and mixer circuits have become more selective.

If an identical "pipe" is employed on the oscillator, it is found that around 56-60 Mc., using relatively long (30 in.) lines with a 3.86 ratio of conductor diameters and a 2 Mc. intermediate frequency, the r.f. and mixer circuits will be out of tune by 213 kc. at 56 Mc. if lined up at mid-band (58 Mc.). A higher i.f. would result in a greater

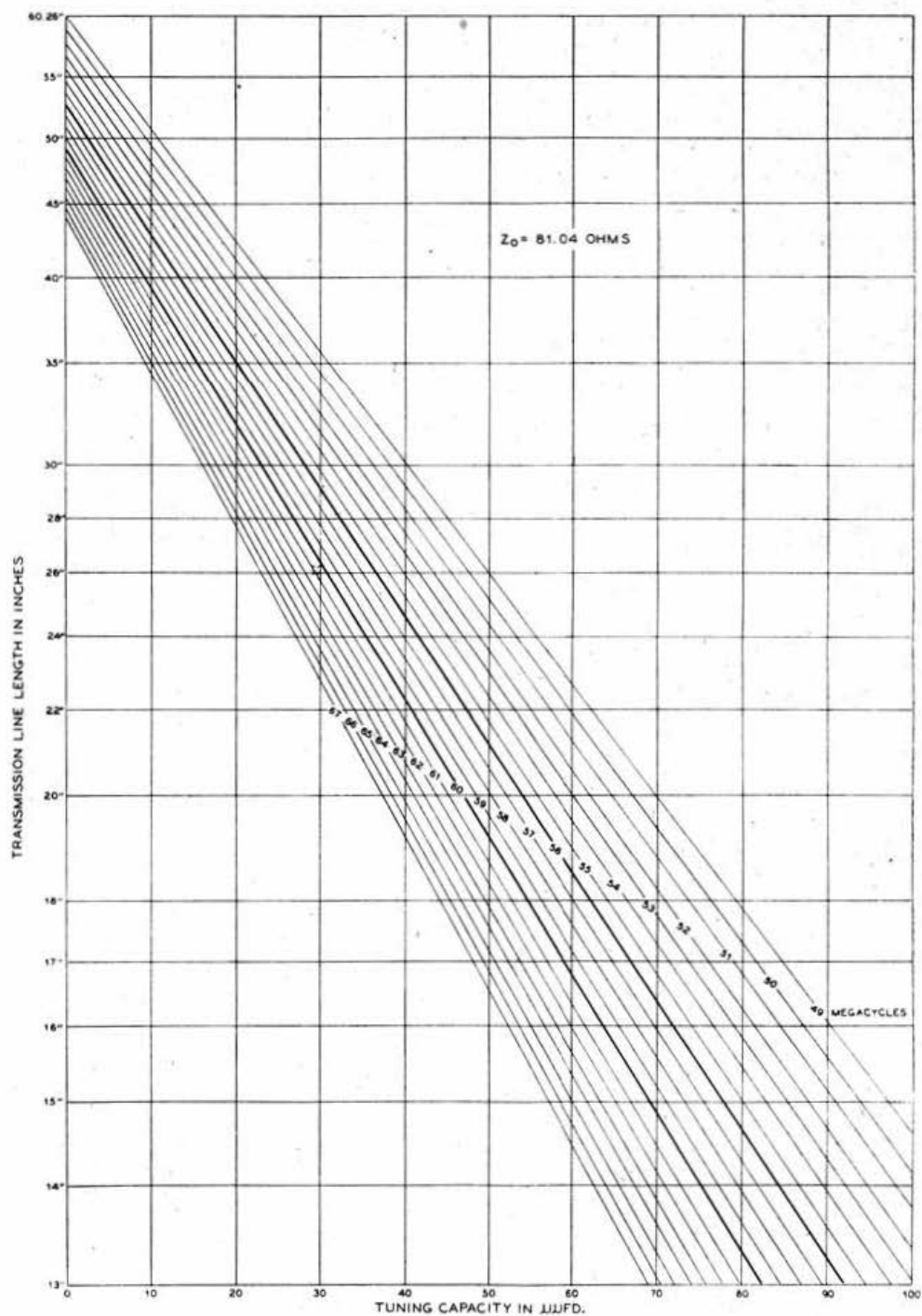


Fig. 1.

Chart showing capacity necessary to resonate shortened lines of 81.04 ohm surge impedance. See text for method of converting this chart to other frequencies and surge impedances.



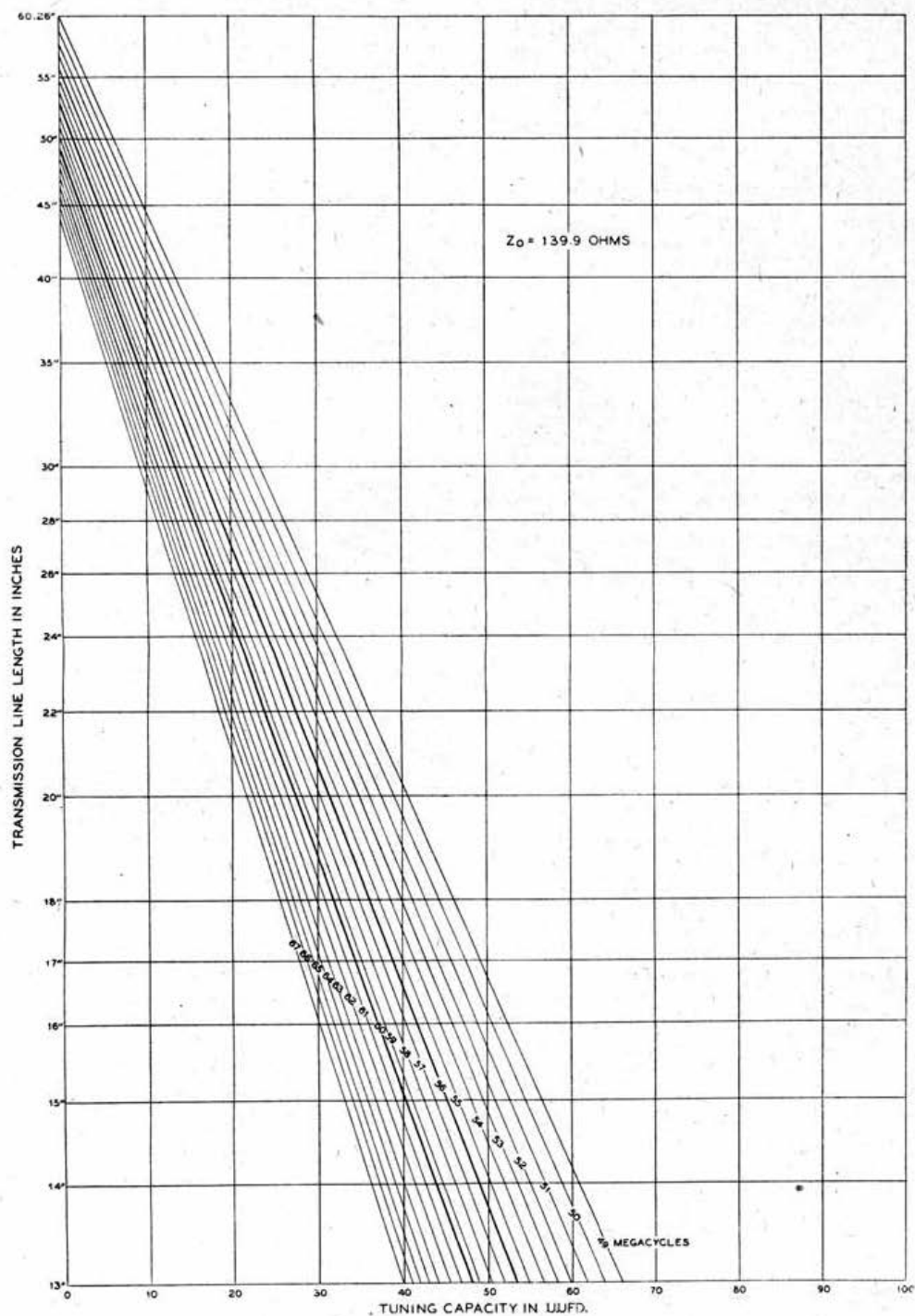


Fig. 2.

Chart showing capacity necessary to resonate shortened lines of 139.9 ohm surge impedance.

mis-alignment. Conversely, a lower i.f. will track more closely, and may be practical in view of the excellent selectivity of the lines, which provide a good image ratio. Shorter, more convenient lines will be broader and will require less careful tracking. High ratio lines (with a small inner conductor) will also be somewhat more broad. However, excellent tracking within a band can be obtained by any of the several methods which are reviewed below.

It would be possible to obtain better tracking if a smaller or larger condenser were used to tune the oscillator than on the mixer. With the lines described in the above paragraph, the oscillator can be tuned with a condenser 10 per cent. smaller on the high frequency side or 11 per cent. larger on the low frequency side of the signal frequency.

In present broadcast practice, special condensers are avoided by the use of a condenser in series with the tuning condenser, together with a parallel padder. Using this system for the scheme above mentioned and adjusting for perfect tracking at 57 and 59 Mc. (selected as crossover points of the tuning curves), it is found that the maximum error in tracking would be 6.2 kc., which is well within both the i.f. band-width and the r.f. band-width. It would be "perfect" in any u.h.f. receiver. One possible objection to this standard method is the need for three condensers, another is that a little cut and try on the series and parallel adjustments will be necessary in order to achieve the best theoretical tracking. The series condenser, of course, should reduce the tuning condenser capacity 10 per cent. in the above example.

### Automatic Tracking

With concentric lines as tuned circuits, there are additional possibilities of obtaining satisfactory tracking by "hacksaw" methods. One of these is to make the oscillator line longer or shorter than the r.f. and mixer lines. The longer line is impractical because one naturally wants to use the maximum possible length in the r.f. circuits for high gain, and a shorter oscillator line provides satisfactory oscillator stability anyway.

Fig. 3 will help to demonstrate, by exaggeration, the method by which the oscillator line length for good tracking, using the same size condenser as in the signal frequency stages, can be determined. Here again the object is to track at 57 and 59 Mc., hoping that the circuits will not be badly out of tune at 56, 58 and 60 Mc.

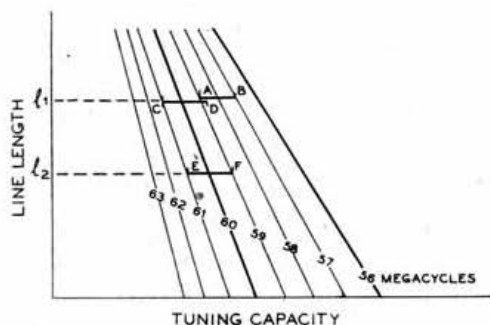


Fig. 3.

Exaggerated chart similar to Fig. 1, to illustrate method of tracking oscillator by shortening line, as described in text.

A horizontal pencil line, AB on Fig. 3, can be drawn at the line length,  $L_1$ , selected for the mixer, and the separation between the 57 and 59 Mc. curves measured with dividers. In the case of a 2 Mc. higher heterodyne oscillator frequency, the dividers are next moved to the left until the 61 Mc. line is encountered at CD, then moved to the lower right until the horizontal distance, EF, between the 59 and 61 Mc. lines, is equal to the comparable separation between the original points, AB. Inasmuch as horizontal separation represents a given change in tuning capacity, an oscillator line of length  $L_2$  can be tuned in track with a mixer line of length  $L_1$ , using similar tuning condensers.

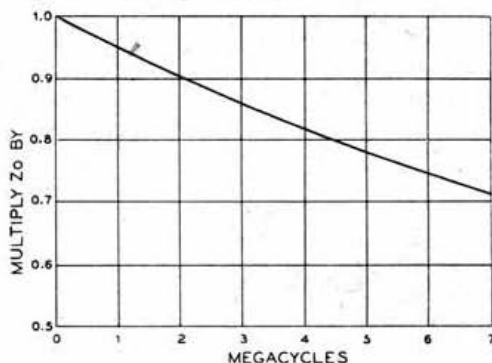


Fig. 4.

Chart showing constants by which mixer line surge impedance can be multiplied in order to obtain oscillator line surge impedance for tracking with lines of the same length.

The only requirement is the adjustment of a parallel condenser on the circuit requiring the higher capacity, or a change in the relative position of the ganged condenser sections, to give alignment on 57 or 59 Mc. This will result in tracking within a few kilocycles throughout the band. Using a 3.86 ratio of diameters as in Fig. 1 or a 10.3 ratio as in Fig. 2, suitable tracking will result from the approximate selection of oscillator line lengths, for a 30 in. line on the mixer as shown in Table II.

TABLE II.

Intermediate Frequency	$Z_0$ 81.04 ohms.	$Z_0$ 139.9 ohms
2 Mc.	26.0"	26.5"
4 Mc.	23.8"	24.2"
7 Mc.	18.5"	19.3"

### Tracking by Choosing Pipe Ratio

The remaining variable that can be used to obtain tracking is the ratio of outer to inner conductor diameters, which determines the surge or characteristic impedance ( $Z_0$ ) of the line. In this case the tuning condenser, and line length as well, can be the same for the oscillator as for the other circuits. For the reason that the oscillator is most stable with a high  $Q$  line (around a 3.6 ratio), whereas the i.f. and mixer gain will be highest with a higher ratio line, it appears better to use a heterodyne oscillator frequency above the signal frequency, requiring a larger inner conductor diameter on the oscillator.

Fairly good tracking with only a one point cross-over of the curves results from selecting an oscillator inner conductor of such size that the tuning capacities are equal. This is not difficult to do, inasmuch as the capacity necessary to resonate short lines is inversely proportional to their characteristic impedance ( $Z_0$ ).

As shown in Fig. 1, the mixer will tune to 58 Mc. with an 81.04 ohm, 30 in. line and 25.49  $\mu\text{F}$  of capacity. If we assume a 4 Mc. i.f., the oscillator will have to be on 62 Mc., calling for only 20.82  $\mu\text{F}$  capacity with an identical line. Substituting in the equation  $Z_{02} = Z_{01} C_2 / C_1$ , it is found that  $Z_{02} = (20.82 \times 81.04) / 25.49$  or 66.2 ohms as the necessary characteristic impedance for the oscillator line to tune to 62 Mc. with the same capacity as tunes an 81.04 ohm line to 58 Mc. Substituting in the characteristic impedance formula  $Z_0 = 138.15 \log (b/a)$ , where  $b$  and  $a$  are outer and inner conductor sizes, it follows that  $66.2 = 138.15 \log (b/a)$ , giving a ratio of 3.015. This ratio would be satisfied with an outer conductor-inside diameter of 1.93 in. and an inner conductor of 0.64 in.; it is approximated by  $1\frac{1}{2}$  in. and  $\frac{1}{2}$  in. or 3 in. and 1 in. sizes. To align, it is necessary only to trim to resonance at the mid-band frequency.

For a 30 in. line, the tracking will be within 10 kilocycles throughout the 56 Mc. Band, and closer for shorter, less selective lines or for a lower i.f.

### Two-point Crossover

Two-point tracking is also rather easy. This requires that the change in capacity between two frequencies be the same for the mixer and oscillator. Returning again to Fig. 1, it takes a change of 2.58  $\mu\text{F}$  to tune the mixer from 59 to 57 Mc., whereas the oscillator requires only 2.12  $\mu\text{F}$  to go from 63 to 61 Mc., assuming a 4 Mc. i.f. and identical

30 in. lines. Substituting again in the "inversely proportional" equation of the above paragraph  $Z_{02}$  is equal to  $(81.04 \times 2.12) / 2.58$  or 66.59 ohms as the proper impedance for the oscillator line for good tracking. The conductor size ratio again can be determined from the formula  $Z_0 = 138.15 \log (b/a)$  which gives a ratio of 3.034. This will be satisfied by a 1.93 in. outer conductor-inside diameter and 0.637 in. inner conductor, and is again close, but not exactly a 3 to 1 ratio as in the above example.

Inasmuch as this procedure gives the proportionate  $Z_0$  for any selected i.f., the first step can often be eliminated by reference to Fig. 4 or to Table III, for the proper  $Z_0$  for the oscillator line if on the high frequency side of the signal.

TABLE III

Intermediate Frequency	Multiply $Z_0$ by
1 Mc.	0.9535
2 Mc.	0.9031
4 Mc.	0.8217
7 Mc.	0.7093

To line up the receiver with this tracking method, it is only necessary to set the mixer on either 57 or 59 Mc. (the cross-over points), and adjust the padding condenser until the oscillator is on the correct frequency as indicated by noise or signal at the output of the receiver.

### Oscillator Circuits

Considerable comment has been made about using a concentric line as the tuned circuit in an oscillator, without any suggestion as to the circuit. The "Radio" Handbook shows a concentric line tuned

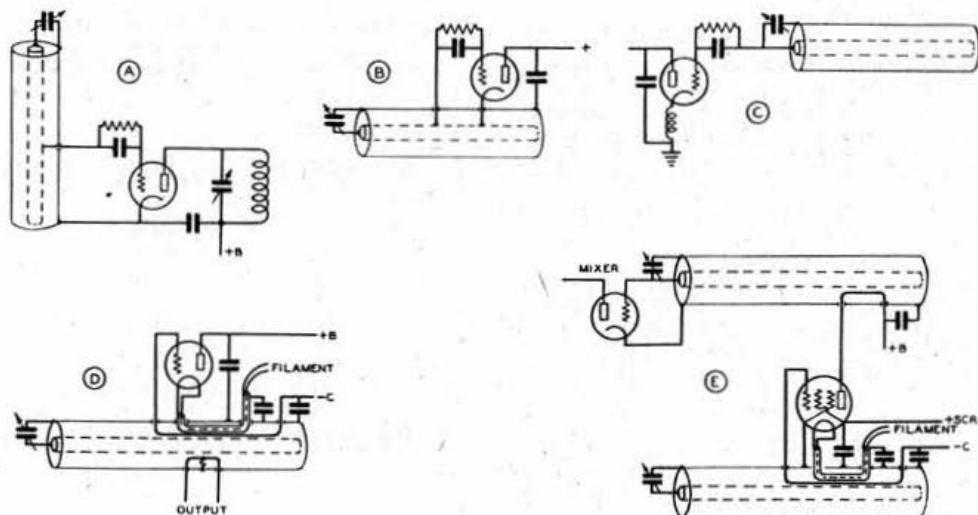


Fig. 5.

(a) Concentric line tuned-grid, coil-tuned plate oscillator. (b) Cathode-above-earth type oscillator circuit with concentric line. (c) Single control oscillator circuit without tap on line, although stability can be increased by tapping the grid down. (d) The oscillator circuit used by R.C.A. in a broad band transmitter having good stability, requiring only one tuned circuit. (e) Similar to (d) but showing pentode valve and balanced loop coupling to mixer stage.

grid and coil tuned plate oscillator, as in Fig. 5a, but this possesses two disadvantages. First, it has two controls, although the plate circuit is so broad that retuning it may not be necessary over large parts of the band. Second, the plate circuit tuning reacts on the frequency to some extent. A single circuit oscillator of the "cathode above earth" type is possible, as in Fig. 5b, but this requires that the valve shall be placed somewhere along the line, with the cathode and grid leads brought into the line at different points, which may make long leads necessary except with large valves or very high frequencies.

Another easy approach to the "two terminal" or single tuned circuit oscillator appears in Fig. 5c. The cathode coil is cut so that the oscillator output peaks at mid-band. The disadvantages are that

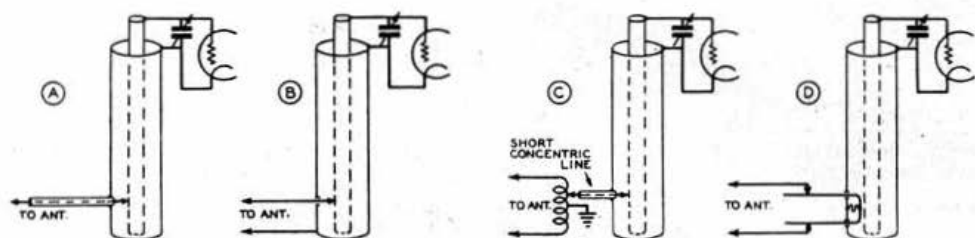


Fig. 6.

(a) Coupling a concentric line feeder to a concentric line resonant circuit. (b) Unbalanced method of coupling two wire line into a concentric line circuit. (c) Balanced-to-unbalanced method of coupling a two wire line to a concentric line resonant circuit. (d) Balanced loop method of obtaining good coupling from two wire line to a concentric line circuit.

oscillator output varies a little with frequency, and frequency stability may be reduced somewhat by the presence of the coil. The circuit places the valve at the open end of the line (although it can be tapped down for better stability) as in the r.f. and mixer stages, which facilitates construction. A condenser shunted by a choke coil has been tried in one case in place of the cathode coil, but the oscillator output was not as good.

An oscillator that is purely single control is shown in Fig. 5d. This circuit has been found suitable for a 1 kW test transmitter covering a wide frequency range, used by R.C.A. with a large triode. It can be adapted to pentode valves, as in Fig. 5e, providing electron coupling if desired, or the output can be taken out of the oscillator tank with a balanced loop inserted in the line or from a tap on the inner conductor for unbalanced output. In this circuit, loop coupling into the mixer can be used to avoid difficulties which might otherwise result from having the mixer and oscillator valves at opposite ends of their lines. The coupling of one of these half-turn loops can be increased by making the loop wider, or by bringing it closer to the centre conductor. In the oscillator circuit where there are two loops, the grid loop must be larger and closer to the inner conductor than the cathode loop in order to accomplish the same effect as "tapping down" the cathode on the coil of an e.c. oscillator.

The circuit of Fig. 5d should not be overlooked for transmitting on 112 and 224 Mc.

### Aerial Coupling

Methods of coupling an aerial into a concentric line have given some amateurs trouble except when a concentric line feeder is available. Some have hooked on a two-wire feeder in the same way as a concentric line, as illustrated by Fig. 6b, causing a slight feeder unbalance.

Another method of shifting from balanced to unbalanced feed, and of coupling a balanced feeder directly into a concentric line resonant circuit, are shown in Figs. 6c and 6d. In the latter, coupling can be increased by placing the loop nearer to the inner conductor, and by increasing the width of the loop. There is no information at hand as to the size of the loops, but one amateur found that a U-shaped aerial loop gave excellent results on a 600 ohm line, when it was about 8 in. wide (using 28 in. line). This

method increased signals more than 2S points over the arrangement of Fig. 6b. In any event, proper coupling is very important on ultra-high frequencies. After all, who would hook a feeder on to a transmitter in any fashion without checking its effectiveness?

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# THE MEASUREMENT OF RADIO FREQUENCIES

By S. O'HAGAN (G2CR)

## PART II

*In this, the concluding section of Mr. O'Hagan's article, the practical design of a Frequency meter and Sub-standard are described. A very comprehensive Bibliography is also included as an Appendix.*

IN presenting practical design details for a Frequency meter and Sub-standard, the writer has kept in mind the fact that the average amateur will not require an accuracy greater than 0.02 per cent., except for marking the edges of the amateur bands when transmitting work recommences. The equipment to be described provides an accuracy of about 0.002 per cent. for band-edge marking, and 0.02 per cent. for intermediate frequencies. Such an arrangement, which is simple and rapid in operation, should cover most requirements. It is proposed to consider first the theoretical problems of such a design before proceeding with practical details of construction and use.

### The Sub-standard

This is required to be readily synchronised with a primary frequency standard, such as the WWV transmissions mentioned in Part I. When set to the desired frequency, it must stay there and produce harmonics at convenient intervals throughout the spectrum.

These requirements can be met most easily and simply by a 100 kc. crystal oscillator. An e.c.o., or Franklin oscillator could, undoubtedly, be made to give the required stability, but would require more skill, facilities and patience than it is likely to receive from amateurs. As there would be little, if any, saving in cost when the necessary refinements were incorporated one may therefore regard the crystal as the most suitable oscillator.\*

The most readily available type of low-frequency crystal is usually termed the "100 kc. bar," which has the relatively low temperature-coefficient of 6 p.p.m./°C. If mounted at room temperature, a swing of from 10° to about 22°C. may be expected, representing a drift of 72 cycles per megacycle, or about one kilocycle at 14 Mc. The change in temperature of the holder may add another similar amount to the drift, so that it might at first sight seem that temperature-control would be essential. Second thoughts, however, will show that the room temperature is not likely to vary over such wide limits in the course of a day. The widest changes in temperature will be met where the gear has to be located in a wooden shed exposed to the mid-summer sun or in mid-winter, when a powerful gas or electric fire is used in the shack. In other cases the temperature swing will seldom be more than 5°C., equivalent to about 0.8 kc. at 14 Mc. This degree of drift is still greater than was specified at the outset and, unless one is prepared to check the sub-standard frequency shortly before use, it will actually be necessary to use temperature control of the oscillator.

Three forms of thermostat device are commonly available, (1) the simple bending-strip of two dissimilar metals, (2) the mercury-toluene type, (3) the resistance thermometer. The bending-strip is by far the simplest to set up (although it tends to alter with age), and it will hold temperature to a maximum accuracy of about  $\frac{1}{2}^{\circ}$ , which is quite sufficient for present purposes. It must be erected with great care in close thermal association with a metal box, totally enclosing the crystal and holder. The heater wires must be wound, with a minimum of insulation round the box, and the box surrounded with about 3 in. of Celotex, or other heat-insulating material, such as dry Balsa wood, the whole being enclosed in a thin aluminium box.

Inside the metal box upon which the heater is wound is fitted another layer of Balsa or Celotex, about  $\frac{1}{2}$ -in. thick on all sides; inside the cavity thus formed are kept the crystal holder and any other parts which it is desired to maintain at constant temperature. The contacts of the thermostat strip should not carry the whole heater current, but only serve to operate a relay which controls the main supply.

A more fragile, but more sensitive device, is the mercury-toluene thermometer, which will hold the temperature to better than a fiftieth of a degree, if every precaution is taken. Whether or not the additional complexity of this type of thermostat is justified depends upon the individual user. Information on such matters is rather scarce, so that the author believes that this brief mention may be worth while.

### Circuit of Sub-standard

The circuit of the frequency sub-standard requires careful consideration and three designs are possible: (1) the Franklin, (2) the Colpitts e.c.o. with the crystal as series-resonant filter in the cathode tuned-circuit, (3) the capacity-stabilised triode. Of these the second arrangement is the most widely accepted and is recommended.

The plate and screen supply should be stable to within fairly close limits and either a neon stabilised power pack† or HT accumulators are desirable. Failing this, three neon lamps (5-watt regulator type) without base resistors should be connected in series across the 250 volts power pack, with a 10,000 ohm, 10-watt resistor between the top neon and H.T.-. The power to the oscillator is taken from the junction of this resistor and the neon lamp. This will give excellent regulation of up to 20 mA. with a minimum of cost and complication.

To ensure adequate strength of harmonics in the higher-frequency bands, a harmonic amplifier is desirable. If this is of the mixer-heptode type, such as the 6L7, then it will be convenient to use it also as a mixer to introduce the output of the multi-vibrator.

\* "Wireless Engineer," June, 1937. "Frequency Measurement 1-70 Mc/s" by H. A. Thomas.

† The Radio Amateur Handbook, 1938 Edition, pp. 343-344.

For the multi-vibrator, a double-triode, such as the '53, is excellent, and the metal edition (6N7) will be found convenient.

The circuit suggested is given below.

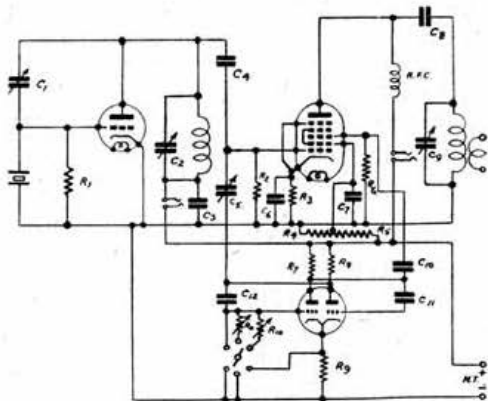
### The Heterodyne Frequency Meter

The essentials of this apparatus are that it should have very good frequency stability for short periods and that it should cover the range 1700-2000 kc. over as wide an arc of the dial as possible. If a 4 in. dial is used with calibration in degrees to 180 and a vernier reading to tenths of a degree, the band should cover 150° or 170°.

An electron coupled oscillator or Franklin oscillator is suitable, the latter having better stability over long periods.

The coil and condensers are, naturally, the most important components, and the utmost care should be taken to obtain the very best available. The condenser must have a substantial frame with two good bearings, the "short-wave" type with a single bearing is not satisfactory as there is always some slackness at the bearing. A National PW-1 unit is good since the dial reads directly to 500 divisions, each of which can be mentally sub-divided into four parts. An excellent British combination is the *Cyldon* standard type of condenser used in conjunction with a *Muirhead* 4 in. dial with 0-180° calibration and vernier.

The coil should be wound with silk or cotton-covered wire heavily doped into position with polystyrene varnish on a solidly made former,



The Author's Circuit for Frequency Sub-standard.

C1 = 3-30 $\mu$ F.	R1 = 100,000 ohms.
C2 = 25-500 $\mu$ F.	R2 = 1 meg.
C3 = 1 $\mu$ F.	R3 = 500 ohms.
C4 = 50 $\mu$ F.	R4 = 50,000 ohms.
C5 = 1-6 $\mu$ F.	R5 = 50,000 ohms.
C6 = 0.1 $\mu$ F.	R6 = 50,000 ohms.
C7 = 0.1 $\mu$ F.	R7 = 5,000 ohms.
C8 = 0.01 $\mu$ F.	R8 = 15,000 ohms.
C9 = 10-150 $\mu$ F.	R9 = 400 ohms.
C10 = 0.002 $\mu$ F.	R10 = 30,000 Variable.
C11 = 0.0007 $\mu$ F.	R11 = 80,000 Variable.
C12 = 0.0006 $\mu$ F.	

The crystal oscillator circuit was designed by Messrs. Hight and Willard of the Bell System Laboratories (see Bibliography).

preferably of ceramic, with a low coefficient of expansion.

The band-setting condenser may consist of a fixed air-condenser or of a combination of ceramic types selected to give a low capacity-coefficient of temperature. In parallel with it must be placed a small rigidly made neutralising condenser to take up small changes due to ageing.

The chassis, panel and cabinet should be made of metal not less than 1/16th in. thick and the connections carried out with wire not thinner than 16 S.W.G. No wire should be allowed to run for more than 2½ in. without support and no components should be suspended in the wiring.

### Tap Adjustments

When built, a process of trial and error must be carried out to discover the correct points for the cathode and band-spread taps for the e.c.o. coil, or for the band-spread and capacity-feed-back arrangements if the Franklin circuit is used. The Franklin will then be ready for calibration, but the e.c.o. requires one further adjustment, that of plate-to-screen voltage ratio. For this adjustment, the H.T. should temporarily be obtained from a potentiometer capable of rapid variation. The frequency meter is set to zero-beat with one of the harmonics of the sub-standard and the H.T. varied  $\pm 20$  per cent., whilst the resultant frequency change is noted. The setting of the tap on the screen potential divider is then shifted and the process repeated until a point is found where the changing H.T. supply has little or no effect upon frequency. Adjustment is then complete.

### Calibration of Heterodyne Frequency Meter and Sub-standard

Assuming that the modified Colpitts circuit has been used for the frequency Sub-standard, it will be found that varying the cathode tuning capacity will vary the crystal frequency slightly. This can be used for fine adjustment, to zero-beat with the standard frequency transmission in the TRF receiver with the reaction slacked back.

When set to simple zero-beat by ear, the reaction can be increased to oscillation and the receiver detuned to give a beat note of about 500 cycles, when the beat note will be heard to throb like a *vox humana* or *celeste* organ stop. By slight further adjustment of the Sub-standard, the number of beats can be reduced almost to zero, although one or two per second is good enough if the 5 Mc. transmission of WWV is being used.

When satisfied with the adjustment of the 100 kc. oscillator, switch on the multi-vibrator to the 20 kc. position, leaving the oscillating receiver tuned to one of the 100 kc. harmonics. Then slowly tune towards the next 100 kc. point, counting the weaker chirps passed on the way. There should be four of them between each 100 kc. point and the next. Then switch the multi-vibrator to the 10 kc. position and repeat the procedure. In this case there should be nine chirps between each pair of 100 kc. points. In either case, if there are more than the correct number of chirps the adjustable resistor of the appropriate grid-circuit should be reduced. The chirps should suddenly change from four to three or five as the resistance is varied. If this does not occur, increase the size of the locking coupling condenser slightly or shift the tap on the potentiometer a little higher.



Should there be three or two chirps only when the switch is turned to the 20 kc. position and the resistance is set at maximum, try reducing the coupling to the 100 kc. source by shifting the potentiometer tap further down towards the earthed end. If this is unsuccessful, switch off the 100 kc. source and roughly estimate the frequency separation of adjacent chirps of the uncontrolled multi-vibrator and adjust it until they seem to be about 20 kc. apart and again switch on the 100 kc. It should then lock-in quite satisfactorily. If necessary a similar procedure may be used on the 10 kc. position.

When the multi-vibrator is satisfactorily locked, switch on the heterodyne frequency meter and allow it to warm up for half an hour. Find the band† by trial and error, by listening for the chirp in the receiver on the 1.7 Mc. range. When the 17th or 20th harmonics of the 100 kc. source can be located on the heterodyne dial, be careful to centre them at the appropriate ends of the scale, then identify the 18th and 19th harmonics. When band setting and spreading are satisfactory, switch on the 10 kc. multi-vibrator, set the heterodyne to 1700 kc., and slowly tune up the band, logging each 10 kc. chirp passed. This will give thirty points in the band and probably one or two just outside each end.

### The Chart

This should be a better affair than the majority of temporary charts, drawn by amateurs, which remain temporary ones throughout the life of the frequency meter. Really good graph paper, with ten squares to the inch, is best, and the graph should be drawn on such a scale that there is one square to each tenth of a degree (if the *Muirhead* dial is used), or four squares per dial division (if the *National PW-1* is used). This would require a sheet about 200 in. square and, apart from the cost, it would displace too many QSL's from the wall, so it will be found better to use a number of smaller sheets, each covering part of the scale! Such sheets are easily soiled, lost or torn, so mount them on sheets of good white card, varnish them with clear, waterproof varnish (celluloid in amyl acetate), and punch one edge and file them into a ring-type loose-leaf book. The edge of the cards should be cut away and indexed to facilitate the easy consultation of any dial reading or frequency required.

Remember, the first cost of frequency checking gear is almost the last, and that it will not become out-of-date in a year or two. Therefore if it is worth producing, it is worth producing well.

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† It is assumed that checking is to be carried out in one of the recognised amateur bands.—Editor.

## KHAKI AND BLUE

*A topical feature in which we publish information concerning our members serving in H.M. Forces. Items for inclusion in future issues should reach the Secretary-Editor not later than the first day of the month preceding date of publication.*

F./O. C. H. Parsons, GW8NP, who is living at 68 Salisbury Road, Andover, Hants, will be glad to meet members located in the neighbourhood.

L./Sgt. Waddington, one of the operators of ZB2B, will be pleased to meet any amateur who calls at Gibraltar. His private address is 33 Naval Hospital Road.

Writing from France, Les Gunnell, G8HB, tells us that in the course of his duties with the R.A.F. he had the luck to examine some of the new portable

members. Letters may be sent via G6CL. Brian is serving in France with the R.A.F.

Congratulations to Ft./Lt. Douglas Johnson, G6DW, whose engagement to Assistant Section Officer Evelyn Lang, W.A.A.F., was announced on April 22.

Sig. Tom Arnold, VU2AN, writing from Baluchistan, tells us that VU2FO is now a Staff Sgt.-Major and located at Karachi. Tom himself has been doing some interesting work on 56 Mc.



The first War-time gathering of R.A.F. Amateurs. A photograph taken at Sleaford, Lincs. G6NZ is at extreme left, and ZB10 at extreme right.

V.H.F. gear being used by the French Army. Unfortunately we cannot ask him to send us a technical description for publication!

Alan Mears, G8SM, who has been transferred to the Signals Platoon of the 7th Gloucester Regt., is acting as an instructor to the Signals Class. He will be pleased to hear from old friends of the T.V.A.R.T.S. Letters should be sent c/o home address, 34 Vine Road, East Molesey, Surrey.

Raymond Loveland, 2ARU, who is stationed at an R.A.F. station in Suffolk would be pleased to hear from old friends via his home address, "Waverley," Crockford Park Road, Addlestone, Surrey.

Cpl. Brian Lagden, G3GX, of Whetstone, will be glad to hear from G5NA and other District 12

transceivers. Lt. Farr, VU2JG, has also been engaged on 56 Mc. problems.

### Service Members

Members in H.M. Forces are urged to arrange for THE T. & R. BULLETIN and other Society correspondence to be sent to their home address. Providing re-direction is made without delay no extra stamp is required on the wrapper or envelope.

### Civil Defence

Members engaged on A.R.P., A.F.S., or other Local Government work of a civil defence character, are invited to send brief details to Headquarters, for record purposes only.

The following particulars are required: Name, Branch of Civil Defence, Call Sign or B.R.S.

## ON ACTIVE SERVICE

## EIGHTH LIST

WE publish below our eighth list of radio amateurs on active service. Additional details and corrections should be advised to Headquarters as early as possible. The present list contains information received up to May 2, 1940.

Rank and Name	Regiment or Branch	Pre-war Call or B.R.S.
L.A.C. C. C. Algar ...	R.A.F. ...	G6AU
L.A.C. D. Alimundo ...	" ...	G4HK
A.C.2 D. H. Allerston*	" ...	G5PQ
L.A.C. F. B. Athersych ...	" ...	2896
A.C.1 R. Bowes*	" ...	2DTA
L.A.C. C. S. Burnham ...	" ...	G4PC
Lt. R. Banks ...	R.N.V.R. ...	G5BN
O./Tel. N. T. J. Bevan ...	R.N. ...	G8IH
L.A.C. N. Brandon ...	R.A.F. ...	2BZN
Sig. E. Brooks ...	R.C. of S. ...	3775
A.C.2 J. H. Cant ...	R.A.F. ...	G6FU
2nd Lt. W. J. Chalk ...	R.C. of S. ...	G3IC
Lt. S. H. Chapple ...	R.A.O.C. ...	G6SC
R.O. H. Clegg ...	R.N. ...	G3FX
A.C.2 W. A. Clemenson*	R.A.F. ...	G6KQ
A.C.2 H. G. Collard*	" ...	2CVA
Maj. E. S. Cole ...	R.C. of S. ...	G5IW
A.C.2 G. Constable ...	R.A.F. ...	3522
F./O. S. Conway*	" ...	VS6AQ
L.A.C. W. T. J. Cox ...	" ...	GW8QI
L.A.C. R. Cretney ...	" ...	2BKO
P./O. B. Davis ...	" ...	G2BZ
L.A.C. C. R. Davis ...	" ...	2FVG
A.C.2 K. W. Drummond*	" ...	2CRD
Sig. W. S. Eadie ...	R.C. of S. ...	2627
Cpl. C. W. Farrell ...	R.A.F. ...	G8GS
A.C.1 D. A. Furzey ...	" ...	3783
L.A.C. R. J. Gilbert ...	" ...	2CQB
L.A.C. H. W. Gillam ...	" ...	G6GI
P./O. C. A. H. Goudie ...	" ...	G8VC
Sig. K. N. Greenaway ...	R.C. of S. ...	G4CN
2nd Lt. J. H. Gurr ...	" ...	G4JG
L.A.C. W. G. Havell ...	R.A.F. ...	2959
L.A.C. A. H. Hillman*	" ...	2DLL

Rank and Name	Regiment or Branch	Pre-war Call or B.R.S.
A.C.2 J. Hodge ...	R.A.F. ...	2766
Gnr. K. W. Holyland ...	R.A. ...	3616
P./O. N. A. W. How, B.Sc.	R.A.F. ...	2829
L.A.C. H. G. Hughes ...	" ...	G4CG
Pte. S. B. Jagger ...	Seaforth Hrs.	3777
A.C.2 J. Johnson*	R.A.F. ...	G3KB
A.C.2 J. W. Kyle ...	" ...	G6WL
Gnr. W. D. Manson ...	R.A. ...	G8PW
L.A.C. C. G. Middle ...	R.A.F. ...	G4CM
L.A.C. N. Nash*	" ...	G4DA
Cpl. R. A. Norrington ...	R.C. of S. ...	3526
P./O. S. Pollard ...	R.A.F. ...	G2GB
2nd Lt. M. L. Quartermaine	R.C. of S. ...	G3FZ
O./Tel. F. Rabone ...	R.N. ...	2AFA
O./Cdt. L. J. Ralli ...	O.C.T.U. ...	G4AJ
L.A.C. W. Ripley ...	R.A.F. ...	G4AD
A.C.2 J. G. Ross ...	" ...	GM6ZP
A.C.2 T. Rutherford ...	" ...	3611
L.A.C. F. T. S. Smith...	" ...	G6FK
L.A.C. R. G. Taylor ...	" ...	3619
Cpl. A. H. Tilse ...	Australian Signals.	VK4WO
L.A.C. R. S. Uren*	R.A.F. ...	2HLS
L./Sgt. H. Waddington	R.A. ...	BERS
A.C. E. F. Wadsworth	R.A.C.F. ...	VE5AAD
F./Sgt. D. A. Weale ...	R.A.F. ...	G6DZ
W./Tel. J. E. Wetherill*	R.N.V.(W.)R.	G5UB
Lt. Com. D. Grove-White	R.N. ...	G5GW
A.C.2 E. R. Whittaker	R.A.F. ...	3738
Capt. G. McLean Wilford	R.C. of S. ...	G2WD
2nd Lt. T. A. Wilson ...	" ...	GM2WL
A.C.2 W. S. M. Wilson	R.A.F. ...	2FFC
L.A.C. D. L. Wood ...	" ...	2FKC
Tel. J. H. Wood ...	R.N. ...	2925

In List No. 7 L. F. Hoskins, G3VN, was inadvertently recorded as F. E. Hoskins, G8DF.

\* Non-Members.

## "Electrical Timekeeping"

Mr. Frank Hope-Jones, for many years Chairman of the Wireless Society of London and the Radio Society of Great Britain, is the author of an important new standard work entitled "Electrical Timekeeping."

This book is published to coincide with, and to mark the centenary of the first electric clock. In it the author reviews every invention and idea of value in the field of electrical timekeeping giving a precise and graphic description of each device.

"Electrical Timekeeping" is obtainable (price 10s.) from the author at 80 Queens Road, Richmond, Surrey, or from N.A.G. Press Ltd., 26-28 Old Street, London, E.C.1.

## Returned Bulletins

Readers are asked to assist us in tracing the present whereabouts of the following members who have moved from the address given below without advising Headquarters:—

N. T. Bevan (G8IH), 51a Manor Court Road, Hanwell, W.7.

A. R. Drake (2ARA), Cranmere, Maple Avenue, Braintree, Essex.

W. J. Kirkland (G8FP), 26 Rufford Drive, Yeadon, nr. Leeds.

R. E. Simms (BRS3404), 58 Stoke Green, Coventry.

W. B. Stirling (GM6RV), Moss Grove, Bridge of Allan, Scotland.

### City of Belfast Y.M.C.A. Radio Club

From Mr. Frank Robb (GI6TK) we learn that the above club is still flourishing well despite the war. Many visiting amateurs have been made welcome at recent meetings, including G4LZ, 6KS, GW3XY, GM3TR, 2AJV, 2CKQ and 2DBO.

Mr. S. H. Pattison (GI5UW) delivered a lecture on April 24 to an audience of over 50. He chose as his subject "Cathode Ray Tubes and their Uses."

A 1940 Sky Champion has just been installed at the Club-room, and Morse practises continue to be popular.

The lecturer in May will be Dr. J. Parke (GI8PA).

All service members located in Northern Ireland are cordially invited to visit the Club. Meeting times are Wednesday evenings, 8 p.m., and Saturday afternoons, 3 p.m.

Mr. Robb will be glad to give further details to any member writing to him, c/o Y.M.C.A., Wellington Place, Belfast. His home address is 60 Victoria Avenue, Sydenham, Belfast.

### R.A.F. MEETING

*A cordial invitation is extended to  
all members and friends located  
in the neighbourhood  
to attend a*

## MEETING

on

**Sunday, May 19th, 1940**

**At The Queen's Head, Kirkby  
Laythorpe, near Sleaford. Meet  
2.30 p.m. Tea 4.30 p.m.**

Tickets and full details from Mr. N. Davies,  
Hon. Secretary, R.A.F. Amateur Radio  
Society, No. 1 E. & W. School.

### Technical Publications for Members on Active Service

In our last issue we gave publicity to a generous offer made by Mr. J. W. Bevan Evans, GW3GL, of The Apiaries, Conway, N. Wales, to send back issues of technical publications to members on active service.

Mr. Evans informs us that the response to his offer has far exceeded expectations. In view of this fact Mr. Evans has expressed his willingness to organise the distribution of technical literature to Service members provided he can obtain the co-operation of sufficient local members who would be willing to assist him in their spare time.

Members in other parts of the British Isles who would like to help in a practical manner, should communicate direct with Mr. Evans.

### "Electrical and Wireless Equipment of Aircraft"

Members serving in the R.A.F., and others who contemplate entry at a later date, will find the new (1940) edition of "Electrical and Wireless Equipment of Aircraft" an invaluable compendium. This book, published by Pitman at 5s. is one of the "Aeronautical Engineering" series.



Lt. Pierre Ramond, CN8BA, brother of F8VC, who is serving with the French Army.

Chapter one deals extensively with Electrical Theory, chapters two and three are devoted to comprehensive descriptions of Electrical Units and Magnetism, whilst the remaining chapters deal with Electrical Equipment of Aircraft, Magnetos, Wireless Equipment and Directional Wireless.



With the B.E.F.

Paul Stein, G8NV, and Bert Allen, G2UJ. The latter is now in England recovering from a serious illness.



## EXPERIMENTAL SECTION

Manager: A. M. H. FERGUS (G2ZC)

THE publication in this issue of Mr. Conklin's article on the tracking of U.H.F. concentric line receivers, will rank as one of the most valuable of recent contributions. Precisely how much work has been done by British amateurs in connection with concentric line receivers, is beyond the writer's knowledge, but the hope is expressed that those members who are experimenting with this fascinating development, will give us reports at an early date. Details of the design of an all-British U.H.F. receiver incorporating concentric lines will be particularly welcome.

The opportunity is here taken of congratulating Mr. E. J. Williams, G2XC, upon presenting in this issue such a wealth of useful information regarding the magnetic storms of last March. In particular members will be quick to appreciate that he has succeeded in obtaining important data from Greenwich Observatory.

It is regretted that the Aerial and Transmitter Groups are still unable to make a contribution to these notes.

G2ZC.

### Propagation Group

The 28 Mc. sub-group continues to maintain a high standard in its letter budgets and in addition to the usual detailed reports on the 28 Mc. band (complete with Character Figures) the April budget contains many interesting observations on the effects of the recent magnetic storms on frequencies from 6 to 40 Mc.

No report has been received from the Aurora sub-group, but it is understood that a letter budget has been started by the G.C. of the newly formed 56 Mc. sub-group.

A review of the magnetic and inospheric disturbances of late March appears elsewhere in this journal, and mention is made of the tendency for magnetic storms to occur near the equinoxes. The tendency seems to be stronger in March than September. So far as the G.M. is aware no satisfactory explanation of the annual variation of both the frequency and intensity of magnetic disturbances has yet been given. During 1939 the average magnetic character for each of the 12 months was as follows:—Jan. 0.20, Feb. 0.47, Mar. 0.53, Apr. 0.61, May 0.52, Jun. 0.41, Jul. 0.44, Aug. 0.35, Sep. 0.33, Oct. 0.46, Nov. 0.17, Dec. 0.27. These figures show up the peak during the spring months extremely well and it is probable that 1940 will provide another example. In fact, the March disturbances have been prominent during each of the last four years. In 1937 there were major disturbances on March 15 and 31; in 1938 on March 23; in 1939 on March 28, the whole period from March 22 to 31 being disturbed; and in 1940 on March 24 and 29. The autumn equinox has provided storms on September 30, October 3 and 7 in 1937; on September 28 and October 8 in 1938 but nothing of importance in 1939, until October 13.

G2XC.

### Receiver Group

As there has been very little published information on the subject of Preselectors we include this month

a few notes from C. N. Blatherwick (G.C. of the Superhet Sub-group):—

Listeners who are disappointed in the sensitivity and noise level of their short-wave receivers, specially on the 28 Mc. band, may be interested to try the effect of adding a Preselector. Some of the cheaper types of communication receivers can thereby be improved beyond recognition and although it is possible to spend almost as much money on the Preselector as on the receiver itself, an inexpensive but useful unit may be built up from an old "straight" receiver.

Only the detector stage is required so the remaining stages can be removed. The grid leak and condenser of the detector must also be removed. Two turns of 18 S.W.G. must then be round the coil and the ends connected to the input of the communication receiver, the aerial itself being connected to the Preselector. The latter is now ready for testing and must be adjusted so that it will oscillate; this is done by switching on both receiver and Preselector and tuning them to the same frequency. Oscillation will be indicated by a very loud "plop" from the loudspeaker. Having obtained this condition the reaction on the Preselector should be gradually backed off until the set is just out of oscillation, in which position the Preselector is providing maximum amplification, assuming it is tuned to the same frequency as the receiver.

Should it fail to oscillate the aerial coupling should be loosened and/or adjustments made to the coupling between Preselector and receiver by moving the two turns up and down the coil. The resistances in the anode circuit of the Preselector may be reduced and the H.T. voltage raised to aid oscillation. Once it has been persuaded to oscillate, the couplings should be adjusted to give maximum amplification; i.e., they should be tightened until the Preselector just oscillates when the reaction control is at maximum. If the tuning is too selective a resistor of a few thousand ohms may be placed across the tuning circuit, but this will reduce the signal strength and make oscillation difficult.

Such a unit as the one described can give excellent results when correctly adjusted, and an actual example was checked by working the idea in conjunction with a Sky Champion which was normally quite "dead" on 28 Mc. With a simple Preselector in use Australian signals were audible all over the house.

The idea of converting an old "straight" receiver into a Preselector can be applied equally well to a mains or battery receiver, although the superior efficiency of mains valves will make them more popular for use on the higher frequencies. G5HF.

**IS YOUR SUBSCRIPTION DUE ?  
PROMPT PAYMENT  
SAVES TIME AT HEADQUARTERS**

## Cosmic Notes

By E. J. WILLIAMS, B.Sc. (G2XC)

**T**HE outstanding features of the period covered by these notes were the magnetic disturbances at the end of March and the accompanying auroral displays and interruptions to radio communication. A report on these is given later in these notes.

### Sunspots

Provisional mean daily sunspot numbers for January and February, 1940, are 50.9 and 58.4 respectively. The numbers for these two months in 1937 were 132.5 and 128.5; in 1938, 98.4 and 119.2; in 1939, 80.3 and 77.4. These figures give a clear indication of our present position in the sunspot cycle.

### Magnetic Elements

Data from U.S.A. has become available for the period March 3 to 23. This shows that disturbances occurred on March 8 starting at 19.30 G.M.T. and reaching greatest intensity in the early hours of March 9 (K-index 6). A further moderate storm was recorded on March 12 which continued during the following two days. The effects of these two storms on reception of North American signals was mentioned in last month's Notes. Magnetic conditions were also disturbed on March 19 and 20.

### Radio Conditions

Measurements at Washington U.S.A. show that the critical frequency at midday for the F2 layer has been as follows: Wednesdays, beginning March 6, 10,800 kc., 10,200 kc., 7,200 kc., on April 3, 6,400 kc., April 10, 10,600 kc., April 17, 8,800 kc. In March 1938 the average critical frequency for the F2 layer was 12,000 kc., and in March 1939, 11,200 kc. (Note: Data for March 27 not yet received.) All these measurements are for the extra-ordinary ray.

Conditions during the first few days of April were sub-normal, but by April 5 reception of the U.S. broadcasting stations on the 11, 15 and 18 Mc. bands showed complete recovery. During the next few days U.S. signals were heard on the 28 Mc. band in the early evening. On April 12 the high-fidelity stations in the U.S.A. on 26 Mc. were heard as late as 21.00 G.M.T. The signal strength of WGEA during the late evening had reached a very high level on many occasions, notably April 14. At 18.00 G.M.T. on April 25, WGEA was an enormous signal, but at 22.00 G.M.T. the same evening there was no sign of it and there were numerous other indications that an ionospheric storm was in progress.

G2ZC reports a partial fade-out on frequencies between 3.5 and 7 Mc. during April 16 and again on April 25. It is probable that there was a small magnetic disturbance around the former date as many stations on the higher frequencies were affected by band "flutter" fading during the evening hours of April 15, 16 and 17. Comments on April 25 are given above.

Further reports on the magnetic storms of late March have been received from G6DH, BRS3003

and 3964. The last named reports that VLQ and VLQ2 could not be heard on March 25, whereas on previous mornings they had been strong signals.

### Recent Magnetic Disturbances

Several reports of the effects of the disturbances during the last eight days of March were published in the April issue, but more details of solar and magnetic activity have now come to hand from Greenwich, Cheltenham (U.S.A.) and Tokyo. The report from Greenwich confirms the date of central meridian passage of the large sunspot mentioned last month. This spot crossed the central meridian of the solar disc on March 26 in latitude 12° north. Its area on March 27 was 1,300 millionths of the visible hemisphere. On March 23 a brilliant chromospheric eruption was observed to be in progress at 11.30 G.M.T. At the same time a complete fade-out of long distance short-wave transmissions over the sunlit hemisphere of the earth was prevailing. This had begun shortly after 11.00 G.M.T. and was of the short-period type. A magnetic storm of moderate intensity was recorded at both Greenwich and Cheltenham the same day, the time of commencement being 06.15 G.M.T. This storm reached its maximum severity later in the day, the K-index at Cheltenham being given as 6 for the last three hours of March 23. The storm prevented a complete recovery from the effects of the chromospheric eruption on radio conditions, but fair reception of U.S. broadcasting stations on the 15 and 17 Mc. bands was obtained during the afternoon. At 21.00 G.M.T. conditions were below normal but several of the U.S. broadcasts were audible on 9, 11 and 15 Mc.

About 27 hours after the solar eruption had originated, an intense disturbance of the earth's magnetic field occurred. This time-lag has been noticed before (see THE T. & R. BULLETIN, June 1938, page 683) and it has been suggested by Greenwich\* that it is due to the time taken by the stream of electrified particles, ejected in the eruption, in travelling from the sun to the earth. However, it must also be pointed out that observers at the U.S. National Bureau of Standards do not support this theory (Proc. I.R.E., Sept. and Oct. 1939). The great magnetic storm began suddenly at 13.45 G.M.T. on March 24. Details of its effect on short-wave conditions have already been published but the reception of Italian signals on frequencies as high as 32 Mc. during the evening of March 24 should be noted. Reception of European signals on high frequencies of this order during magnetic storms has been noticed on previous occasions. It is possible that this is due to scattered reflections from unstable clouds of electrons. (See last month's E.S. Notes.) Greenwich states that the storm was virtually over by 05.00 G.M.T. March 25 "but agitation continued." The effect on the ionosphere also continued and conditions for east and west transmissions on short-waves were below normal during the following days. This applied, in particular, to conditions after dark.

*Continued on page 456.*

\* It is hoped to give further details in next month's E.S. Notes.

# THE MONTH "OFF" THE AIR—April, 1940

By ARTHUR O. MILNE (G2MI)

## Will You Help ?

**M**EMBERS who read the tailpiece of our January contribution may be interested to know that we have already provided the Navy Comforts Depot with seven receivers and that three others have been sent to the Army.

Some of our Northern Ireland friends who have not sufficient spare time to undertake constructional work, have made a very generous gesture in forwarding the sum of 25s. to be used to provide parts or to start a fund to buy a complete receiver. GI5QX in his covering letter suggests that there may be many others who would like to associate themselves with the scheme, and we therefore have pleasure in presenting his idea for approval. You can send your pennies or your fivers to the writer at 29, Kechill Gardens, Hayes, Bromley, Kent. Possibly a few weeks from now there will be enough in the "kitty" to buy a new receiver which can be sent along with our 73.

## Here and There

VQ2GW offers to send a further card to anyone who has not yet had one from him. GM3TD tuned from 28 Mc. to 1.7 Mc. on March 24 at the height of the magnetic storm (18.30 G.M.T.) and did not hear a signal of any kind! GM5FT says that it was past 21.00 before anything began to come through again. 3TD produced a remarkable list of KA's and XU's heard on 14 Mc. and reports hearing W7, K4, PY, LU, HK and OA on 7 Mc.

Confucius he say "Wise guy TA1AL but wiser he who get QSL!"—G5XB.

2CDT gave W4GDH (located in Memphis, Tenn.), his first G report. W4GDH is only 16 years of age and is the son of W4FQT. He also reports a remarkable opening up of 14 Mc. on April 3 when in just over an hour he copied KA1DM, 7FS, 1LB, 1RV and 1YL.

G8UO logged some good DX with a new crop of "phoneys," including B9FB, PIRJ, OF2BX and ZX2Y. "HB9ZY" was heard calling "EI5H." 8UO would also like to know the identity of HA0FK. Probably a Boy Scout station similar to HA0DK (MI). The LZ1ID now active is a pirate and was heard to say "No QSL please not QSL!"

G4AB remarks on the strength of the broadcast stations at Chungking XGOY 25-21 metres and Hsingking 25-48 metres, both being S8-9 in the early evenings. 4AB has heard eight K6's on 7 Mc. besides many W5, 6 and 7's. His most interesting "catch" was, however, VQ8AG heard handling traffic on 7 Mc. with VRS, VPK and ZCQ. Is this a case of Ham co-operation with commercials?

G8UN overheard a QSO, between LU9AF and J6DV, and has heard VP1ZR being called. BRS3553 heard XUOA working 'phone to KA1OZ on April 2 and BRS3607 says EA9AI is located in Melilla, Spanish Morocco. BRS3416 gives details of an interesting Broadcasting Station on 9693 kc. and 6,063 kc. "Radio Tananarive Madagascar," which comes in at 05.30, 09.00/10.00 and 15.30/16.30 during the week and 07.30/09.00 on Sundays

(all G.M.T.). TF3C and TF5L have been heard on 14 Mc. G4FN overheard "ZC6JM" working D4AWY. More funny stuff. The "ZC" said "please QSL direct" sez you!

## Who's Who

G4NB gives XUOA's address as Box 172 Chungking and KB6RWZ as Box 47 Guam. OK3DK says he is in Bratislava. ON4AU assures us that the TA1AA who QSL's is genuine as he has had a card direct from Ankara. Well, that seems to clinch it. Still, it is a great pity that this fellow can't reveal himself to the A.R.R.L. It's no use sending cards if the DX Century Club don't recognise them. If he is genuine, why choose a call so suspect as TA1AA. Incidentally, TA1AL is now active and also says he is in Ankara.

EA7BA very active on 14 Mc. 'phone gives his QRA as Dr. Jose Jie Guerra, Sagasta 33, Cadiz. BRS3766 had a letter recently from OQ5IM who managed to work only two G stations before the outbreak of war. He must be one of the first people in the world nearing DX C.C. who has no card from Great Britain. G4AS, however, has sent him one and it should be there by now. 3766 gives the following frequencies which may be useful. XUOA, phone, 14250. XU2S, phone, 14210. CR8AA, phone, 14290, 14250. His receiver is an "All World Two" using a V Beam.

## DX PERSONALITIES No. II



Alec Heathcote, G3JR, well known for his DX achievements and his contributions to this feature.

EAIR is another Spanish station which seems to be very active and gives his QRA as Zaragoza. BRS2098, who mentions K6NYD and K6PLZ as good signals on 14, says EK1AF is still very active. TG9BA is another good 'phone. On March 22 he heard W2IXY and W2KGB, both YL's at the former's station working a three-way with W9DBD and W5DEW, also YL operators; he gives the QRA of KA1RV as 8, Dona Bartola St. Canada, Cavite, P.I.

### Can You Beat It ?

From the April issue of QST comes the following:—

"This information has been received from D4BIU. There seems to be a widespread misunderstanding concerning the activities of German amateur stations to-day. According to a statement made by our Government, all sporting activities, etc., will be continued during the war to as large an extent as possible. Due to this, amateur stations D4ACF, ADF, BIU, BUF, RGF, TRV, WYF, HCF, and DKN, have been re-licensed recently. More licences will follow shortly. The stations are supposed to carry on strictly in the usual manner. Please notify all interested."

Very subtle propaganda this, calculated to impress the neutrals, especially the Americas. These stations appear to operate in a perfectly normal manner but obviously go out of their way to be pleasant to everyone they work.

With our own amateurs off the air and all sorts of German nonsense stories of starvation in Britain being broadcast far and wide, this apparently normal state of affairs in Germany is most impressive to the gullible neutral. 2CLD has been keeping an eye on these activities and reports D4TKP as saying "Our Government allows us our hobby." D4AWY was heard to state that he is in Danzig. Altogether, so far, we have heard 25 German amateurs active on either 7 or 14 Mc.

### American Commentary

W8OQF says that the "working W's" experiment during the DX Contest was not a great success as the enormous amount of QRM caused thereby, masked much of the DX. With a possible multiplier of 61 and an allowance of 100 points for each DX contact, some of the scores ran into astronomical figures. 8OQF, with 185 contacts finished up with 735,100 points; others ran into millions. He mentions that his offer to correspond with G's produced 8 replies and he now has to pass some of them on to other Detroit amateurs.

W1WV sends a monumental list of DX heard and worked during March. During the early part of that month K6's seem to have been very good on 28 Mc. Besides working the usual South Americans, he had a good selection from XU, HC, YV, KA, CO, CX and K4. Quite a number of Japanese have also been heard, including 2IX, 2LL, 2XA, 6DU, 8CG and 8CL, but TG9BA on phone, AC4YN and PJ5CE are the pick of the genuine rarities, whilst ON4A (QRA Nomansland), CV5A, ON4J, PX1B and VR2PJ are among the other sort. South America, excepting Paraguay, seems to be particularly active.

W8JIW who has 80 countries to his credit with the low input for U.S.A. of 20 watts would appreciate reports on his signals on 14,036, 14,364, 14,280 and 29,042 kc.

G3JR asks us to correct the details about him published last month. His record is 100 countries on 10 watts in a year.—114 countries and 45 states in 16 months.

### QSL Matters

Owing to the international situation, cards can no longer be accepted for France and Colonies, Denmark, Estonia, Finland, Latvia, Lithuania, Norway and Sweden, but it is hoped that this is only a temporary difficulty in several cases.

Cards have been returned "unknown" from the normal address of the Yugo-Slav QSL Bureau. Can anyone give us any information on their present address?

G4JZ would very much appreciate cards from SU1TM, SU1MW, ZS1AX, ZS1W, VE5SR and VK3WL if this happens to catch their eyes.

### Postscript

Just as we go to Press another generous donation of 12s. 6d. comes from Northern Ireland towards the Navy receiver. This time from GI6TK and some friends.



### Ham Coincidence No. 5

Whilst visiting G6YL recently, Cpl. Joe Rockall, G2ZV, was shown some of Miss Dunn's early QSL cards. She happened to mention that she made her first far-east contact many years ago with TJCRJ (Arabia) but had never received a QSL. Her surprise can be imagined when G2ZV told her that he was the original TJCRJ!

We understand that Joe has been able to find one of the historic cards issued by him 14 years ago and that G6YL has been the recipient.



## THE 28 Mc. BAND

By NELLY CORRY (G2YL)

A year ago we were bemoaning the fact that VK's and West Coast W's were inaudible during April and that VU's were finding conditions extremely erratic, though VU7BR had managed to effect 79 QSO's in 18 days. It would be interesting to know how this year's propagation conditions really compare with previous years, but with only two African stations audible from the Eastern Hemisphere and reduced activity in the Americas it is impossible to say with any degree of accuracy. It is, however, certain that there has been a considerable and steady deterioration in conditions during the past year, and we have now reached the stage where the irregular 28 Mc. listener is convinced that the band has gone completely dead. The chances of anything being heard here (except perhaps OQ5), during the summer are certainly remote, but by the end of September we should be hearing W's again, unless there is a sudden acceleration in the approach of sunspot minimum.

From the reports received it appears that conditions during April were fair in the second week, but very little was audible otherwise. From Africa, BRS3003 heard OQ5AB at 17.50 G.M.T. on April 2, and OQ5IM was heard on April 14 at 15.45 and 18.15 G.M.T. by BRS3003 and 2BVU.

South Americans were reported on April 7, 8, 10, 14, 18 and 29, and included some strong signals. LU1DA was logged on three days, CE2BX and PY2CK on two, and HC1JB, HC1FG, LU9AX and PY2GC on April 18, 7, 28 and 10 respectively. From Central America BRS3179 heard K4ERZ and TI2RC on April 7, and BRS3003 heard TI2FG and TI2RC on April 14. The latter also reported hearing W6BOY, Portable Mobile Marine, s.s. "Barbara Coats," off the coast of North Carolina at 18.27 G.M.T. on April 11.

W's were only reported on nine days and were never very numerous or consistently loud. On the afternoon of April 12 conditions were poor, but BRS3003 logged W6PCB and W6POD after 18.00 G.M.T., so in that respect we are two up on April 1939!

Reports from 2BVU, 2CDT, BRS3003 and BRS 3179 are acknowledged with many thanks. All reports will be much appreciated by the writer, if sent to arrive not later than the 28th of the month—even though the sender may not consider the small amount he has heard warrants the expenditure of twopence for a postcard stamp!

## The 56 Mc. Band

By CONSTANCE HALL (G8LY)

ALTHOUGH violent sunspot activity, with its accompanying magnetic disturbances, plays havoc with the normal high frequency bands it certainly seems to give new life to 56 Mc. On February 24, for example, considerable "aurora type" DX was reported in America, CW being the order of the day, as telephony signals broadened out and modulation became distorted; this was preceded by the now familiar "aurora flutter" on most signals. This effect was again very noticeable,

during the great disturbance on March 24, probably more so than ever before, and many surprise contacts took place. This state of affairs lasted until late on March 31, and for those who support the twenty-eight day cycle theory these two good days should prove of interest.

We were glad to read in Q.S.T. the remark that "there are still U.H.F. enthusiasts in Great Britain despite the fact that they have no signals of any description to listen to."

G3YY finding W5 and W6's "rolling in" on 28 Mc. on April 11, hastily looked for his 56 Mc. receiver. On April 13, with conditions still good on 28 Mc. he was rewarded by hearing French Telephony, duplex, R2 S8 just outside the L.F. end of the 56 Mc. band. The time was 15.50 G.M.T. At 16.16 an S8 commercial harmonic was heard and this signal was also audible on 28 Mc. At 17.00 a self-excited CW station, believed to be sending CQ de D4, was heard inside the band. On April 17 the same commercial harmonic was heard both on 56 Mc. and 28 Mc., and an unstable unmodulated constant carrier just outside the L.F. end of the band. Nothing has been heard since but 3YY is now living in hope of hearing a real DX station soon.

The following comment from our notes published last July may be worth recalling: "The band opened for Italian Commercials IBE and IBT (at G6YL), ten days earlier than in June 1938, both times coinciding with the June full moon." Full moon this year is June 20—so watch points all ye 56 Mc. enthusiasts!

G6DH reports that the audible limit is still no higher than 30 Mc. In future no details will be recorded until the limit increases. The following are thanked for their reports: W1HDQ, W9BNX, G6DH, G3YL, G3YY, BRS2817, and many others for their never failing enthusiasm at the mere mention of the words "Ultra-High."

### SILENT KEY

#### PETER SPENCER (G8MH)

By the death last month of Peter Spencer (G8MH) at the early age of twenty-five, the Society lost one of its keenest members. In addition to his duties as Town Representative for Watford, G8MH was largely responsible for the formation and organisation of the active Watford Amateur Radio Society. He will also be especially remembered for his consistently fine work on the R.S.G.B. stand at Olympia over a period of many years.

He operated a very active station on 28 Mc. and during recent months had worked on the design of a new superhet receiver which was due for description in this Journal. In business G8MH was associated with G6GR and G5LU, who, not least among his friends, mourn the passing of a first-rate ham.

To his parents, fiancée, and relatives, we extend our deepest sympathies. J. C.

# BRITISH ISLES NOTES AND NEWS

## District Representatives.

**DISTRICT 1 (North-Western).** (Cheshire, Cumberland, Lancashire, Westmorland.) 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).** (Shropshire, Staffordshire, Warwick, Worcester.) MR. V. M. DESMOND (G5VM), 199 Russell Road, Moseley, Birmingham.

**DISTRICT 4 (East Midlands).** (Derby, Leicester, Northants, Notts.) MR. L. RIDGWAY (G2RI), 90 Romway Road, Leicester.

**DISTRICT 5 (Western).** (Wiltshire, Gloucester, Hereford.) MR. R. A. BARTLETT (G6RB), 31 King's Drive, Bristol.

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

**DISTRICT 7 (Southern).** (Berkshire, Hampshire, Oxfordshire, Surrey.) MR. W. E. RUSSELL (G5WP), "Milestones," Westfield Road, Mayford, Woking, Surrey.

**DISTRICT 8 (Home Counties).** (Beds., Cambs., Hunts, and the towns of Peterborough and Newmarket.) MR. S. J. GRANFIELD (G5BQ), 47 Warren Road, Milton 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).** MR. G. R. SCOTT FARNIE (GW5FI), "The Grange," Cefn Coed, Breconshire. Scribe: MR. S. HOWELL (G5FN), 38 Africa Gardens, Cardiff.

**DISTRICT 11 (North Wales).** (Anglesey, Carnarvon, Denbighshire, Flintshire, Merioneth, Montgomery, Radnorshire.) MR. D. S. MITCHELL (GW6AA), "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. Deputy: MR. P. SOLDER (G5FA), 35 Torrington Gardens, New Southgate, N.11.

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

**DISTRICT 14 (Eastern).** (East London and Essex.) MR. T. A. ST. JOHNSTON (G6UT), "Normandale," New Barn Lane, Little Hallingbury, Bishops Stortford.

**DISTRICT 15 (London West).** (West London Postal Districts, Bucks., and that part of Middlesex not included in District 12.) MR. H. V. WILKINS (G6WN), 539 Oldfield Lane, Sudbury Hill, Greenford, Middlesex.

**DISTRICT 16 (South-Eastern).** (Kent and Sussex.) MR. W. H. ALLEN (G2UJ), 32 Earls Road, Tunbridge Wells. Deputy: MR. W. A. SCARR, M.A. (G2WS), 8 Beckenham Grove, Shortlands, Kent.

**DISTRICT 17 (Mid-East).** (Lincolnshire and Rutland.) MR. W. GRIEVE (G5GS), "Summerford," New Waltham, Lincs.

**DISTRICT 18 (East Yorkshire).** (East Riding and part of North Riding.) MR. E. MITCHELL (G5MV), 40 North Marine Road, Scarborough.

**DISTRICT 19 (Northern).** (Northumberland, Durham, and North Yorks.) MR. R. J. BRADLEY (G2FO), "High Crest," Yarm Road, Eaglescliffe, Co. Durham.

**SCOTLAND.** MR. JAMES HUNTER (GM6ZY), Records Office, 51 Camphill Avenue, Langside, Glasgow.

**NORTHERN IRELAND.** MR. J. A. SANG (G16TB), 22 Stranmillis Gardens, Belfast.

New Members are cordially invited to write to their local District Representative.

## DISTRICT 1 (North Western)

**Burnley.**—The T.R. has received a cheery letter from G31Y, who is in France. 3KT is holding weekly Morse classes for members and friends who are likely to be called to the colours in the near future. The local stations, known pre-war as the Burnley network, feel lost without their transmitters but they are making the best of things with friendly chats in person whenever possible. 8TD is longing to give a call to the two States required for his W.A.S. 3SJ is purchasing a new receiver in the hope of being able to transmit again soon.

**Blackburn.**—ZD2H was present at the last meeting and recounted his experiences at Lagos. A welcome was also extended to 2FUC who was home on leave. He is stationed on a Balloon Barrage "Somewhere in England."

The T.R. would like to hear of any amateur gathering likely to be held in District 1 during the next few months. Also will G4NC, who was stationed in Blackburn with his Battalion, please write.

The T.R. will answer all letters from any member of His Majesty's Forces. G6TW via G6CX.

## DISTRICT 2 (North Eastern)

The suggestion mooted last month to arrange a Services meeting in the District has produced one letter, from G5GJ, who states that the six amateurs stationed with him near York would support any gathering arranged in that area. Before following up the idea the D.R. must receive promises of support from other groups, so please drop a line if you and your friends would like to get together again at a P.D.M.

Only one report is to hand, and that from BRS2317, who has logged three more high-fidelity U.S.A. B.C. stations on 11 metres, including W2XWZ and W9XCD. In his last report W8XLA should have read W9XLA.

**Barnsley.**—A meeting was held on April 24 at the QRA of G2BH, but no details are to hand.

G6PY.

**DISTRICT 4 (East Midlands)**

Over 50 members were very grateful for the opportunity of visiting Nottingham University on March 31; the only trouble was that some of them became so interested in single items of instruments shown that they were unable to give proper time to the entire collection!

**Forthcoming Events**

- |        |   |
|--------|---|
| May 18 | District 15, 3 p.m. at G5LN, The Excelsior Hotel, 1 and 2 Ladbroke Gardens, Ladbroke Grove, W.11.                       |
| .. 19  | Scotland A District, 2.45 p.m. in the Y.M.C.A. Residential Club, 100 Bothwell Street, Glasgow.                          |
| .. 19  | R.A.F. Meeting at The Queen's Head, Kirby Laythorpe, near Sleaford. Meet 2.30 p.m. (See separate announcement).         |
| .. 21  | District 14 (Southend Section), 7.30 p.m. at G2KH, 26 Hampton Gardens, Prittlewell, Essex.                              |
| .. 25  | District 13 and S.L.D.R.T.S., 3 p.m. at Brotherhood Hall, West Norwood.   |
| .. 25  | District 15 (High Wycombe Section), 7 p.m. at G6JK, "Hartland," New Drive, Totteridge, High Wycombe.                    |
| .. 26  | Ham Gathering at Y.M.C.A., Lynchford Road, North Camp, Farnborough, Hants. 2 p.m.                                       |
| June 2 | District 14. Eastern Provincial District Meeting. 1 p.m. at "The Spotted Dog," Chelmsford. (See separate announcement). |
| .. 16  | District 12, "Garden-Party" at G6LL, "Woodlands," Tolmers Road, Cuffley, Herts.   |

Ten members from District 4 visited the Midlands P.D.M. at Birmingham on April 28, and here again the journey was very much more than worth while. In the impromptu "technical talks" which followed lunch G5BJ proved himself a great comedian. Our old "top band" friend G8FU turned up with a 4-valve receiver, complete with frame aerial and batteries, self-contained in his jacket pocket; an excellent piece of work.

Our latest addition to the Forces is G5MY, who made the grade to L.A.C./R.A.F. in one jump. We also hear that 4BJ is now a corporal. 8MW, after having a very good time in London, is now in Manchester on special work.

General conditions make it very difficult to arrange interesting monthly meetings for the District as a whole, although every effort is being made to

provide as good a programme as is possible under the circumstances. In this connection the D.R. would be glad to hear from members who are able to obtain permission for visits to places of interest. No fixture has been made for May, but please watch these Notes for an announcement next month. Attendances at meetings since the war have been greater than those prior to September, and we want to keep it that way, for the Society is ten times more important under present conditions than ever it was in peace-time.

All members are earnestly requested to keep in touch with the D.R., whether in or out of the Services. G2RI.

**DISTRICT 7 (Southern)**

*Aldershot and Farnborough.*—The April Ham Gathering, held at the North Camp Y.M.C.A., was another highly successful meeting, and fully up to the high standard of its predecessors. It was particularly pleasant to welcome some of the Canadian R.A.F. amateur contingent, and it is hoped they will all be able to make the journey to the next meeting.

Between 50 and 60 Canadian and Home members gathered to watch the R.S.G.B. films, which were accompanied by a running commentary given by "Clarry" for the benefit of the VE's. Thanks are again due to VE5ZM and G6ZO for making the arrangements, and to G5YA for the loan of the projector.

In view of the undoubted success of this series of meetings, they are to become a monthly feature and every effort will be made to ensure that they will continue even if the present organisers are moved elsewhere.

The next Ham Gathering will take place on May 26 at 2 p.m., at the Y.M.C.A., Lynchford Road, North Camp, when Bill Wadsworth will give a talk on "Amateur Radio in British Columbia." It is also hoped to provide a reciprocal talk for the VE's by a G, on "Amateur Radio in Britain." Once again may we say—everyone is welcome.

*Croydon.*—G4NG unfortunately had his leave cancelled and was unable to get to the local meeting. 2FWA complains about the lack of notes from Croydon in recent issues.

*Portsmouth and Southsea.*—The next meeting will be held on June 2, at the T.R.'s QRA—65 Ebery Grove, Copnor, at 2.30 p.m. Welcome to 8AA, who is now in the area. BRS3182 is experimenting with audio amplifiers.

It is noticed with regret that two members have allowed their subscriptions to lapse, and the T.R. would refer them to recent BULLETIN remarks on the need for a strong Society after hostilities.

All Service members are assured of a welcome at the T.R.'s QRA. Previous notice of proposed visits would be appreciated.

*Weybridge and Woking.*—The attendance of five at the last meeting at Weybridge was deemed sufficient indication of lack of interest, and it is not proposed to hold any more for the present. 8IX is now the possessor of a HQ120. 6NA has completed a new receiver with particularly fine selectivity and an ingenious coil turret. 4AP has installed a noise silencer and a preselector in his NC44.

G5WP.

**DISTRICT 8 (Home Counties)**

The District Reunion, held at the Waffle Café, Cambridge, on Sunday, April 21, was attended by 16 members who managed to get along in spite of transport difficulties. The absence of some of the "old regulars" brought home the fact that several are now serving elsewhere. We should like to send them greetings. The forthcoming P.D.M. at Chelmsford was discussed, and several members hope to attend. It was decided to pool petrol resources to help matters. A new member, 2HGC, of Luton, amused the company with his tales of the old lady who had been primed to ask for a drip-pan for her grid-leak and a "Droitwich" valve!

*Cambridge.*—G5PU was recently on leave from France, looking very fit. 8SY is constructing a "Wobulator." 2CAM has completed a super-gram with two power-packs and many refinements. Local members will be interested to hear of the marriage of Mr. A. Porter, Secretary of the Cambridge Short Wave Society.

*Luton.*—G3KG, now working "duplex" with apparent success, is willing to give advice to anyone interested. BRS3610 has a pre-selector working with his NC44, consisting of an EF8 and 6K7. BRS3376 is serving in the Army. BRS3617 is doing A.R.P. duties.

*Peterborough.*—G2NJ must have created something of a record to attend the Cambridge meeting. In order to cover the round trip of 70 miles he made use of bicycle, bus, car, taxi and train, but he said it was worth it to meet the boys again. 6LX, who is attached to an air defence station in the south, recently visited Cambridge. 3DY was present at the Reunion, but 3WW had "D4 measles."

*St. Ives.*—G4AZ is working overtime on his farm in support of the "Grow more food" campaign. He says, "What's a field-day, anyway?" 6FL is building a car radio. 5OV is still employed by the Air Ministry. 5RL expects to have word to join the R.A.F. shortly. BRS3259, of Swavesey, has joined the R.E.'s.

G5BQ.

**DISTRICT 9 (East Anglia)**

A District Meeting will be held on Sunday May 26 at Norwich. Rendezvous: General Post Office, 3 p.m. sharp. Will all members who intend coming please inform the D.R. by May 20 as arrangements will be made according to the number booking.

*Norwich.*—We are sorry to hear that G2UT has moved into District 4.

*Yarmouth.*—G3RW and 2FAO have registered and hope to join the R. C. of Signals. We regret that 2HFK has had a long period of illness. Weekly meetings are still being held.

*King's Lynn.*—2CFO has been seriously ill in an R.A.F. hospital but we understand he is now recovering. He was visited there by 3IP and 2HBZ. G2XS has been pleased to welcome 8IJ who is stationed near by.

G2XS.

**DISTRICT 10 (South Wales & Monmouthshire)**

It is regretted that no areas outside Cardiff have given the Scribe news of local activities.

At Cardiff regular meetings continue to be held, the last at the home of GW3UH attracting seven members including 3VL, 4KQ, 5BI, 5FN, 8NP and 8WU. A letter was read from 2GV who has left the

District to take up Government work elsewhere. An interesting discussion took place on radio matters of general interest. Thanks are again extended to Mr. and Mrs. 8UH for their hospitality.

The next meeting will be held at 14 Keynsham Road, the QRA of GW3VL. Date to be announced.

G5FN.

**DISTRICT 12 (London North and Hertford)**

The last district meeting held at the Orpheum cinema café on April 4, was attended by 18 members. We had hoped for a larger number but the meeting was successful, if only for the reason that for the first time since the war started it brought members together from parts of the district outside the area covered by the local meetings previously held at members' homes. After tea and a ragchew, a discussion took place on the subject "Will the war produce any fundamental changes in Amateur Radio Technique." Various suggestions were put forward, but the main trend of thought seemed to be along the lines that important developments might take place in ultra-high frequency aerial systems and gear, with little or no change in the lower frequencies.

At the meeting G2YD was elected to look after the financial side of the District's affairs. In this connection we wish to record our thanks to Bill Hartley for his past services as District treasurer.

Special attention is drawn to a change in date of the District "Garden Party" at G6LL's home at Cuffley. This was to have been held on May 26, but in order not to clash with the Services meeting at Farnborough, it has now been decided to hold it on June 16. The proposal is that we should lunch in the woods nearby and adjourn to G6LL's later for tea. Will those who can attend please advise either G6LL or 5FA in advance so that the necessary arrangements can be made? Ladies are specially invited. A suitable train leaves Finsbury Park Station L.N.E.R. at 10.40 a.m. (Palmer's Green, 10.56 a.m.), arriving at Cuffley at 11.17 a.m. Turn right on coming out of the station and proceed along Tolmers Road. Buses also leave Potters Bar at hourly intervals.

Activity reports are scarce, but various members are known to be busy one way or another. G8CK who is still stationed at Hertford is busy designing a new receiver, 3NR has passed as a naval telegraphist, 3KP has a new SX23, and is making a remote controlled aerial change-over switch and hopes to be able to put it in full use one of these days.

It is hoped that as many as possible will endeavour to form a party to attend the Eastern Counties P.D.M. at Chelmsford on June 2. Full details will be found elsewhere in this issue of the "BULL."

It is with deep regret that we have to record the death of Peter Spencer, G8MH, after a short illness. He had been T.R. for Watford for the past few years.

G5FA.

**DISTRICT 13 (London South)**

An interesting meeting was held on April 20 at West Norwood, when a discussion took place regarding future meetings. It has been felt for some time that, owing to the present circumstances, benefit would accrue if the District 13 and the S.L.D.R.T.S. meetings were amalgamated. Members of the latter society are aware that the subscription of 5s. per



annum has been waived for the present, and a small charge per person is necessary at their meetings to cover the cost of hiring the room. Many points were discussed (with G2JK representing the S.L.D.R.T.S.) and it was finally decided that a joint meeting should be held on the fourth Saturday of each month, at 3 p.m. The first of these meetings will take place on May 25. It will be appreciated that, owing to the cancelling of the yearly subscription to the S.L.D.R.T.S., it will no longer be possible to notify each member of forthcoming events. We make a special appeal to all concerned to be present at West Norwood on May 25.

## WAR OR NO WAR!

### you are cordially invited to attend the EASTERN COUNTIES Provincial District MEETING

at  
**THE OLD SPOTTED DOG INN**  
**Tindal Street - Chelmsford**  
on

**Sunday, June 2nd, 1940**

Assemble .. .. .	12 noon
Lunch (Olde English Fare) .. .	1 p.m.
Technical Talks .. .. .	2 p.m.
Morse Contest (with Prizes) .. .	3.30 p.m.
Brief Business Meeting .. .. .	4.30 p.m.
Tea .. .. .	5 p.m.

**Inclusive Charge 5/-**

All Reservations to:—Mr. R. L. Varney,  
G5RV, 184 Galleywood Road, Chelmsford, not  
later than May 27.  
Telephone, Chelmsford 3394.

No further items of news within the District are to hand, although many members are known to be actively engaged on the receiving side of radio.

G2WV.

#### DISTRICT 14 (Eastern)

*Chelmsford.*—The D.R. and all local members are looking forward keenly to the forthcoming P.D.M. on June 2, and hope to welcome many visitors, but don't forget the reservation date is Monday, May 27. Those intending to be present are urged to polish up their Morse code, as some very nice prizes are to be given in the Morse Competition. It is also hoped to stage a small exhibition of historic radio apparatus. The monthly meetings continue to be well attended, and the following are active: G5RV, 6LB, 5CA, 8GV, 2SA and BRS3650.

*Southend.*—Eight members attended the meeting at G2GU, when a general discussion took place. G3LA, 8PB and 2BRR, all of whom are serving with the R.A.F., send greetings to old friends.

G6UT.

#### DISTRICT 15 (London West, Middlesex and Buckinghamshire)

The 19 members who attended the April meeting listened to a very interesting talk by OK1VU which opened our eyes a good deal. We were very pleased to welcome him especially as he was wearing the uniform of the British Army and had travelled a considerable distance to attend.

An excellent idea was evolved, mainly by G3HT and 3UQ, whereby each District member serving with H.M. Forces shall be asked to write a letter once a month to the D.R. or to one of his pals at home. These letters will be read at district meetings and will be handed to someone else for reply. It is thought that in this way members will get to know each other better. We should like to know how this idea appeals to those serving. The scheme will, as suggested by G3HT, be known as "Written Skeds."

The following "locals" are now known to be serving in H.M. Forces: G3YM, 4MT, 8IH, 8ZD, OK1VU and we believe 2BAJ. G4HT has again been away entertaining the B.E.F.

The cigarette fund is increasing but we still require addresses of Service members. For date of next meeting, see "Forthcoming Events."

*High Wycombe.*—The T.R. advises that a local meeting will be held at G6JK, "Hartland," New Drive, Totteridge, High Wycombe, at 7 p.m., May 25. All members in the area will be welcomed.

G6WN.

#### DISTRICT 16 (South Eastern)

We have all been sorry to hear of the illness of our regular D.R., Bert Allen (G2UJ), and a number of members have written expressing their sympathy and best wishes for his quick recovery. We send you our greetings, OM.

(G2UJ is now convalescing, and asks us to convey his 73 to all in District 16.—ED.)

There seems to be plenty of activity in the District and many members are finding the amateur bands full of interest just now. The D.R. would be glad to know if anyone in No. 16 is keeping watch on 56 Mc., for with the arrival of warmer weather there is a chance of signals being received from abroad.

G3SU sends an interesting report of a meeting held at the home of G3VB (Haslemere, Surrey). Two budding naval wireless operators were amongst those present. A 60 watt amplifier belonging to G3VB was the chief object of interest. 3SU hopes to hold other meetings in this area, and anyone interested should write to him at "Trofts," Byworth, Petworth, Sussex.

*Brighton and Hove.*—The T.R., G3WR, sends his usual interesting report (would there were more like him). At the April meeting a talk was given by G6CY on the subject of L.F. Amplifiers. G6OW followed with an account of his own experiments on the same subject. The following were present at the meeting: G2RU, 2UX, 3HP, 3JF, 3YY, 4DC, 4NY, 6CY, 6OW, 8DG, 2ACU, 2FLZ and 2FMK.

The May meeting will be addressed by Capt. E. A. Houghton (G2OJ), who will speak on "Refinements of Communication Receivers." For the June meeting Mr. A. Hudson, B.Sc., Area Engineer, Post Office Telephones, has consented to give a talk on "Interference and other matters." Both these meetings should be of special interest, and members are urged to make a special effort to attend.

2FLZ is welcomed to the area, whilst good wishes are extended to G8DG on his return to Acton.

*Gravesend.*—We are glad to hear again from the T.R., G2IZ. No meetings have been possible owing to domestic, A.R.P., and various other duties, but arrangements are being made for an early resumption when things get more settled. Congratulations are extended to G6VC and G2IZ on the arrival of junior op. and YL respectively. G2WS.

### Scotland

There is only one District report this month and that from "A" District who report an excellent attendance at their April meeting to hear Jim Emmerson (GM8HA) address an appreciative audience on "Ham Aerials." As is usual with these talks members are invited to interrupt the speaker, consequently some lively discussions take place. We were glad to welcome several members, who were present at a Society meeting for the first time since the outbreak of the war, and we look forward to seeing still more at future gatherings.

Congratulations to Harry Jefferies (GM8HJ) on obtaining a commission in the R.A.F. V.R. The next meeting will be held at the usual place and time on May 19 when a talk will be given on a subject still to be fixed at the time of writing.

Apologies to GM3GG who was inadvertently recorded in our February Notes as having joined up. Mr. Mortimer is at a G.P.O. radio station in Fife-shire. GM6ZV.

### The Birmingham P.D.M.

The first war-time P.D.M., held at the Hope and Anchor Hotel, Birmingham, on Sunday, April 28, proved a great success and the 60 members who supported it were given a great time, due in no small way to the splendid organisation of G5VM, G5BJ, G3DO and their helpers.

Dr. Naylor Strong, G2RQ, President of the Midland Amateur Radio Society, G2RI, D.R. for District 4 and "Jerry" Walker, ex-D.R. for No. 5, were among those present, whilst "Clarry" and Arthur Milne, G2MI, represented Headquarters.

A large contingent from No. 1 E. & W. School, R.A.F. (headed by G6NZ), the T.R. for Coventry (G5GR), G5ML, G6GL, G2MF and GM5LF were some of the other visitors from near and far.

After an excellent luncheon, and the inevitable photographs, George Brown, G5BJ (who later convulsed the entire assembly with his account of his impressions on a first flight in Vic Desmond's plane), was presented by Dr. Naylor Strong with a silver cup for the best M.A.R.S. lecture during the past year.

A series of very informal and impromptu "technical" talks followed, after which came an hour's chat from "Clarry," who, with the aid of his little black book, which always seems to be turned to an irrelevant page, and to which he seems never to refer, gave an outline of the war-time activities of R.S.G.B.

The theme of his address could be summed up in the name of the hotel: *Hope* in the future of Amateur Radio, and *Anchor* your confidence in the Society!

After a further ragchew at the tea-table, the meeting broke up about 6 p.m.

G6CL and G2MI returned to London taking with them lasting impressions of a memorable week-end spent in the warm-hearted Midlands of Britain, and in particular of the personal kindness of Mr. and Mrs. Edwards, G3DO, and Mr. and Mrs. Matthews, G6CC, who so generously looked after them during their short visit.

TWO MIDLAND INTRUDERS.

## Contemporary Literature

By L. FRYER (G2FR)

THE SCATTERING OF RADIO WAVES IN THE LOWER AND MIDDLE ATMOSPHERE. J. H. Piddington, A.M.I.R.E. Proc. I.R.E. December, 1939.

The evidence relating to the reflection of radio waves from levels below 80 kilometres is considered and apparatus to investigate the reflection coefficients of these regions is described. The new experimental results here presented are not in agreement with those of earlier workers, but indicate that reflections from the region B (below 10 kilometres) and region C (35 to 60 kilometres) are very weak and are due to scattering patches rather than reflecting strata.

It is shown that reflections from region B are probably due to water molecules and that echoes with time delays corresponding to semipaths of 10-25 kilometres probably originate at scattering centres within the troposphere.

The equivalent reflection coefficient of region C is discussed and the mechanism of formation of this region of ionization is briefly considered in connection with atmospheric temperature gradients.

\* \* \*

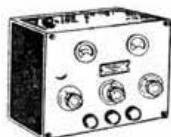
THE ELECTRONIC-WAVE THEORY OF VELOCITY-MODULATION TUBES. Simon Ramo, A.I.R.E. Proc. I.R.E. December, 1939.

Following a brief discussion of the Hahn theory of velocity modulation in which there is explained the basic velocity-modulation tube phenomena by means of space-charge waves propagating along the electron beam, the wave theory is reformulated by means of the retarded potentials for the most important case, that of a magnetically focused electron beam. The use of the potentials is believed to result in sufficient simplification to merit consideration in choosing the best attack on the theory.

The electron beam is seen to be a medium for space-charge wave propagation, the input signal serving to excite waves which propagate with beneficial change down the tube and induce output current in the output circuit. It is shown that important design constants for velocity-modulation tubes, such as optimum-drift tube length and the amount and phase of the transconductance, may be computed by use of the wave theory. Numerical values are given for a special case as an example.

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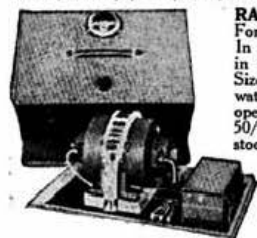
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# HEADQUARTERS CALLING

## Defence Regulations

With reference to the statement published on page 286 of the January 1940 issue of this Journal, and referred to again on page 354 of the February issue, we have now been advised by the G.P.O. that persons having in their possession a complete transmitter or set of components which can be assembled to form a complete transmitter must apply for a permit to hold the apparatus. Such applications should be made by letter to the Engineer-in-Chief, G.P.O. Radio Branch (W2/1), Harrogate, Yorks, to whom enquiries may also be addressed if a member is in doubt whether a permit is required for the apparatus he holds. Components ordinarily used for receivers are not intended to be covered by the Order and no permit is necessary for power supply equipment or purely audio frequency equipment such as modulation amplifiers.

## A.R.R.L. and Radio Ltd., Publications

Orders can now be accepted for the American publications listed below. On receipt of orders, the R.S.G.B. will advise the A.R.R.L. and Radio Ltd., who will in turn despatch the publications direct to members. It must be appreciated that a delay of several weeks will occur between the time an order is received by the Society, and the delivery of the goods in Great Britain.

The following are the current prices for those publications which the Society is prepared to handle:

A.R.R.L. (1940) Handbook ... 7s. 0d.

A.R.R.L. Antenna Handbook ... 3s. 0d.

Radio (1940) Handbook ... 8s. 6d.

Radio Ltd. advise that their Antenna Handbook is now out of stock.

## A.R.R.L. (QST) Subscriptions

Due to the alteration in sterling exchange, the annual A.R.R.L. subscription rate is now 15s. per annum. Members who have, in the past, subscribed direct to the A.R.R.L. or have purchased copies of QST from booksellers would be well advised to pass their renewal instructions through the Society in view of the present difficulty of sending money out of the country.

## "Radio" Subscriptions

Members who wish to obtain *Radio* the West Coast U.S.A. technical Journal may forward their subscriptions direct to Headquarters. The subscription at the present rate of exchange is 17s. 6d. for one year or 30s. for two years.

## Kilocycles-Metres Conversion Tables

Copies of this very useful 64-page publication, in vest pocket booklet format, are available from Headquarters, price 1s. 4d. each, post free.

## C.O.D.

Due to the fact that Headquarters is being operated by a greatly reduced staff, it is regretted that Society publications and Sales Dept. items can no longer be sent C.O.D.

## New Postal Rates

With the introduction of new postal rates it now becomes even more important than hitherto, that unnecessary correspondence with Headquarters should be avoided. Members will be assisting the Society in a practical manner by paying subscriptions promptly on receipt of their statement of account. This will obviate further applications being made, thereby preventing a waste of Society monies.

## Publicity

The Secretary-Editor will be pleased to hear from any member, but preferably one in the London area, who would be prepared to assist in following up inquiries received from prospective members.

During each month an average of 100 inquiries are received and literature sent out. Many of these inquiries result in applications being made for membership, but a further follow-up would probably result in a wider response.

It is essential that the member offering his services should possess a typewriter and be willing to devote a few hours each week to the work. Postage expenses will of course be paid by the Society.

## Back Issues of "The T. & R. Bulletin"

In past years members have allowed their subscriptions to lapse for several months and then asked to be brought up to date. This has generally been possible, but under present conditions, we cannot load Headquarters with big stocks of back issues on chance.

Members will greatly assist by renewing their subscription promptly thereby making sure that their copy of THE T. & R. BULLETIN arrives regularly each month.

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J. E. P. RAVEN (G3HG), 30 Old Devonshire Road, Balham, S.W.12.

J. THOMSON (G3RY), 16 Coniston Road, South Reddish, Stockport.

A. H. WOOLNER (G4BC), 35 New Road, Wood Green, N.22.

H. MILLINGTON (2BMN), 76 Roseway, Priory Estate, Wellington, Shropshire.

R. Q. MARRIS (2BZQ), c/o 10 Wyberton West Road, Boston, Lincs.

A. G. PRUDEN (2CZM), 25 Germain Street, Chesham, Bucks.

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## EDITORIAL

(Continued from page 427)

of this contention it was pointed out that gramophone manufacturers recognise the most efficient method of recording as being from the centre to the outer edge, but if such a method was adopted present-day gramophones would become obsolete. For a similar reason it was considered that, if new principles governing the generation and reception of radio frequencies are evolved, they will not pass beyond the laboratory stage for many years to come.

In recording these views it is hoped that other members will be induced to "pull a long bow" and tell us what *they* think the future holds for radio amateurs—but remember there is a war on; so no official secrets, please! J. C.

## COSMIC NOTES—(Continued from page 444)

Another chromospheric eruption occurred on March 27 co-incident with the fade-out recorded by the writer in last month's notes. The time of commencement is given officially as 16.19 G.M.T. and its effect was most marked on western signals (i.e. on those whose routes were in the most intense daylight). Recovery took about two hours.

A further severe storm followed on March 29 beginning soon after 16.00 G.M.T. The report from Greenwich states that this disturbance was active but not so intense as that of March 24. The second storm (probably two storms, the second beginning "remarkably suddenly" at 09.41 G.M.T. on March 31) continued until 22.00 G.M.T. April 1. A general fade-out of short-wave signals during this period was noticed and, in addition, Tokyo reports two short-period fades on March 30.

## Acknowledgments

The occurrence of great magnetic storms during March is not unusual, in fact, the tendency for such storms seems to be greatest during the months around the two equinoxes. The cause of this is not yet known.

The above recorded data from Greenwich is published by kind permission of the Astronomer Royal. In giving this permission attention was drawn to the fact that Greenwich do not consider it correct to describe the short-period fade-outs as being of the "Dellinger type." This type of ionospheric disturbance was first recognised by Mögel and "workers all over the world have contributed to the elucidation of these interesting phenomena." These last words are Professor Appleton's and he has suggested that the term "ionospheric irruption" be used. As this term has apparently been officially adopted it is proposed to use it in these notes in future in place of the term "Dellinger fade-out."

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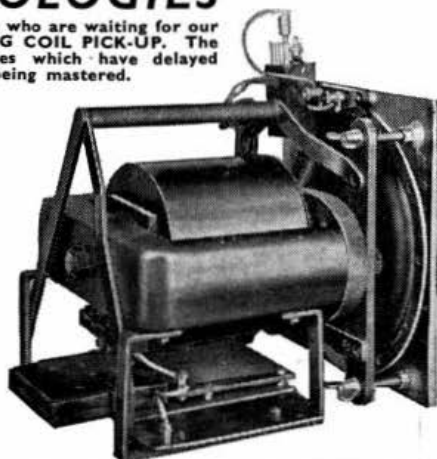
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