THE T. & R.

BULLETIN

THE INC. RADIO SOCIETY OF GT. BRITAIN

AND THE BRITISH EMPIRE RADIO UNION

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THE INCORPORATED

RADIO SOCIETY OF GREAT BRITAIN

AND THE

BRITISH EMPIRE RADIO UNION

53, *VICTORIA STREET, LONDON, S.W.I.* (*'PHONE: VICTORIA* 4412)

PATRON: H.R.H. THE PRINCE OF WALES, K.G.

R.S.G.B. CALENDAR.

Unless otherwise announced, all meetings are held at the Institution of Electrical Engineers, Savoy Place, W.C.2. commencing at 6.15 p.m. Tea is served at 5.30 p.m.

April 26. Lecture "Talking Films," by Mr. J. Paddon, A.R.I.E.

April 30. District 17 Conventionette
Grosvenor Hotel, Hull. 12.30 p.m.

May 7. District 5 Conventionette
Grand Hotel, Bristol. 12 noon.

May 21. District 16 Conventionette
Maidstone. 12 noon.

May 28. District 10 Conventionette
Swansea. 12 noon.

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THE T. & R. BULLETIN

Hon. Editor :—
G. W. Thomas (G5YK)

Advertising Manager :—
H. Freeman

Vol. 8 No. 10

CONTENTS.

INTELLIGENT REPORTING.

HARDLY a week passes without complaints being received from new members to the effect that they are being tardily treated in the matter of QSL cards.

It is not our intention to criticise or condone the individual actions of members in connection with the sending of cards, but we feel that the time is opportune for expressing some views which may assist those who are interested in this side of Amateur Radio.

First, then, we recommend that our BRS members should only send reports to *DX stations* heard on the 7 and 14 mc. bands, unless the station heard is known to be newly licenced, or is specifically requesting reports. We recently had occasion to point out to an over enthusiastic BRS that no useful purpose was served in sending to one G station fourteen separate QSL's confirming the reception of his 7 mc. signals ! This same BRS in one week delivered to Headquarters just on 300 QSL cards for delivery to stations he had heard during one week-end on 7 mc., and not one was addressed to a station outside Europe and North Africa ! And then, again, we had a letter from a Scottish member in which he mentioned that out of 400 cards sent to Great Britain by a European listening station, only 86 replies had been received. We attempted to analyse the reason for this complaint, and discovered that in general the information given by the receiving station was practically useless to the recipients. Surely it is of little value to the average G working on the DX bands to know that his signals are QSA5, R7 in Berlin or Prague ? It *would*, however, be of interest if the reception had been effected on 1.7 or 3.5 mc. We feel, therefore, that more care should be exercised before cards are sent to comparatively local stations.

Although at the beginning of the previous paragraph we suggested sending reports to *DX Stations* operating on the 7 and 14 mc. bands, even this requires further consideration. We submit that if ZL4AA is working G5ML on 7 mc., it is not headline news to ZL4AA to know that his signals were also being received in Birmingham. If the strength reported from Birmingham was greater than that reported by G5ML—probably the listener was particularly anxious to receive a QSL card ; if less, he may have had a poor receiver. Very little thought appears to be used in this, apparently, indiscriminate sending of QSL cards to every station heard. We are not mincing matters when we say that many amateurs are so overwhelmed with comparatively useless reports that they make a rule of not replying to *any* of them. The effectiveness of one's 'phone on Sunday morning could be judged by weighing the post on

(*Continued on page* 322.)

CHOKE CONTROL MODULATION.

By A. E. Wood (G5AW), B.Sc. (Hons.), A.C.G.I., D.I.C.

IN this article an attempt has been made to show how underlying principles can be used to clear up modulation problems. The mathematical significance of modulation is first shown and from this a basic rule derived from determining a suitable valve as a modulator.

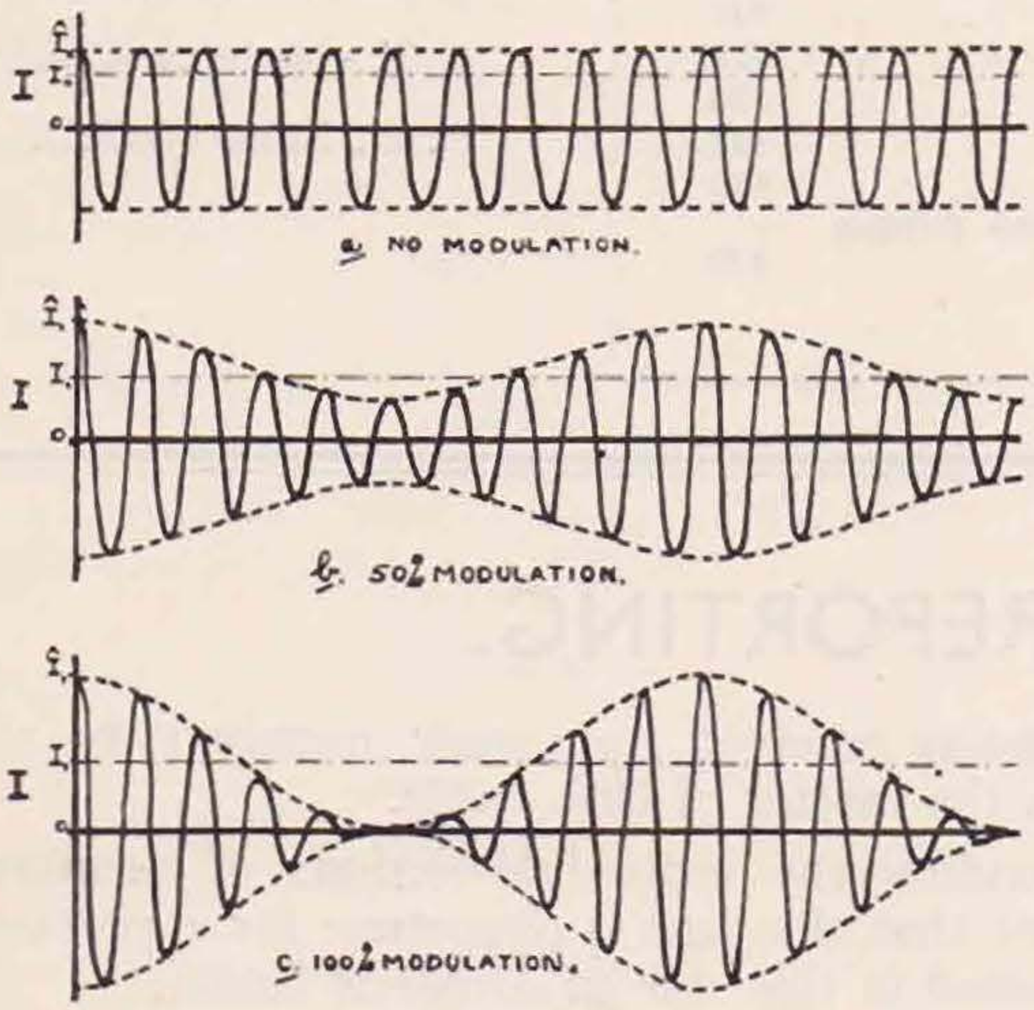


FIG. I. TIME SCALE FOR L.F. = 1000 × SCALE FOR H.F.

Methods of modulation other than choke control are shown to fail as they cannot give a high percentage distortionless modulation unless one is prepared to sacrifice efficiency at high frequencies.

Choke Modulation is dealt with fully, and by applying principles familiar in broadcast work, a modification is obtained which allows of 100 per cent. modulation without dropping the oscillator volts in a resistance and also reduces the cost of the choke. Finally, the relative merits of various types of valves as modulators are considered.

Modulation is obtained by superimposing a low-frequency wave (*i.e.*, the speech) on the high-frequency carrier wave. It is shown in the appendix that for good modulation the aerial current rises and Fig. 1 shows the aerial current *a* for no modulation, *b* with 50 per cent. modulation and *c* with 100 per cent. modulation. For 100 per cent. modulation the aerial current increases from that indicated without modulation by 23 per cent., assuming negligible distortion.

Our aim should be minimum distortion, hence the plate current to the valve, being modulated, must remain sensibly constant. If 100 per cent. modulation is needed, however, the radiated watts must increase by 50 per cent., it is interesting to consider from where this extra power is derived. In the case of absorption modulation, it comes from an increase of efficiency with modulation due to variations in damping; modulation by using a valve as a grid leak, as in Fig. 2, functions in a similar manner, since the efficiency varies with change in value of the grid leak. With these methods, however, serious distortion is introduced due to non-linear relations if anything beyond a low percentage of modulation is attempted and they have become obsolete. With plate modulation, *i.e.*, of the high tension supply to the oscillator or neutralised power amplifier, it comes from the A.C. watts output of the modulator valve, the modulated valve acting as the external load to the modulator valve, just as a moving-coil speaker acts as the load to the output valve of a broadcast amplifier. With grid modulation, as in Fig. 3, the valve may be looked upon as being its own modulator—it has to deal with both high and low-frequency swings on its grid. This makes a compromise necessary between percentage modulation and efficiency, for with both neutralised power amplifiers and also oscillators, high efficiency is

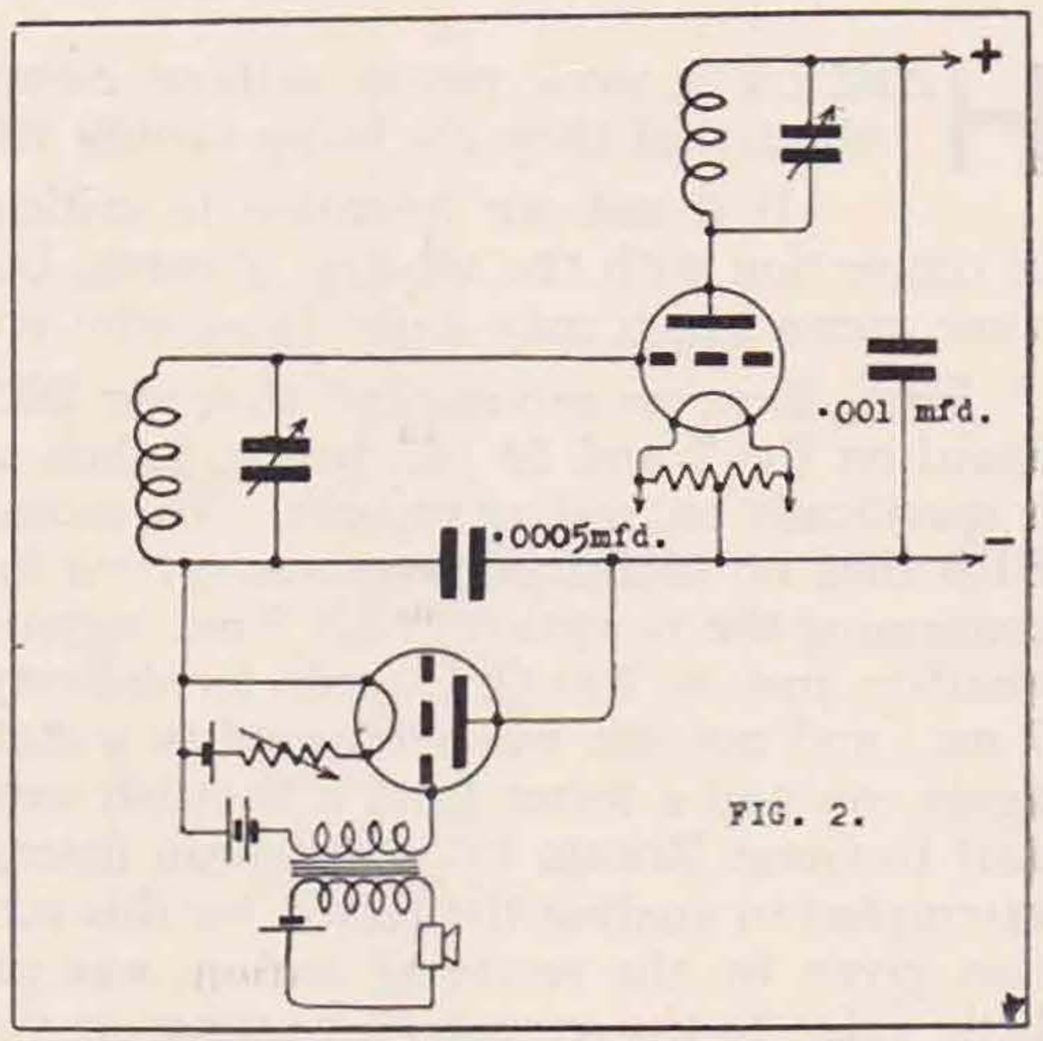


FIG. 2.

obtained by large grid excitation (in the neutralised power amplifier from the preceding frequency doubler and in the oscillator by the anode grid capacity), and it is necessary to drive well into grid current and then back to beyond cut-off of anode current, which will, in consequence, flow in pulses as in Fig. 4; the oscillatory current in the tuned circuit will, however, be a practically pure sine wave, as this tuned circuit is of very low impedance to the harmonics, but of high impedance to the fundamental.

The effect of the high frequency is to paralyse the valve with respect to the low frequency applied to the grid, if the efficiency at high frequency is 75 per cent., then if more than 20 per cent. modulation is attempted, serious distortion is inevitable. A heavy modulation, say, 85 per cent., can only

be obtained if the high-frequency efficiency is about 40 per cent., *i.e.*, 60 per cent. of the plate power would be used to heat up the plate. Since the average amateur cannot afford to sacrifice either efficiency or percentage modulation, the writer considers plate modulation to be the only method of achieving useful telephony work.

The normal plate modulation arrangement is shown in Fig. 5, where a tuned plate tuned grid oscillator V_1 (preferably Goyder locked) and the modulator valve V_2 have the choke L common to both in their high-tension supplies. To prevent loss of low notes, L must have a high inductance,

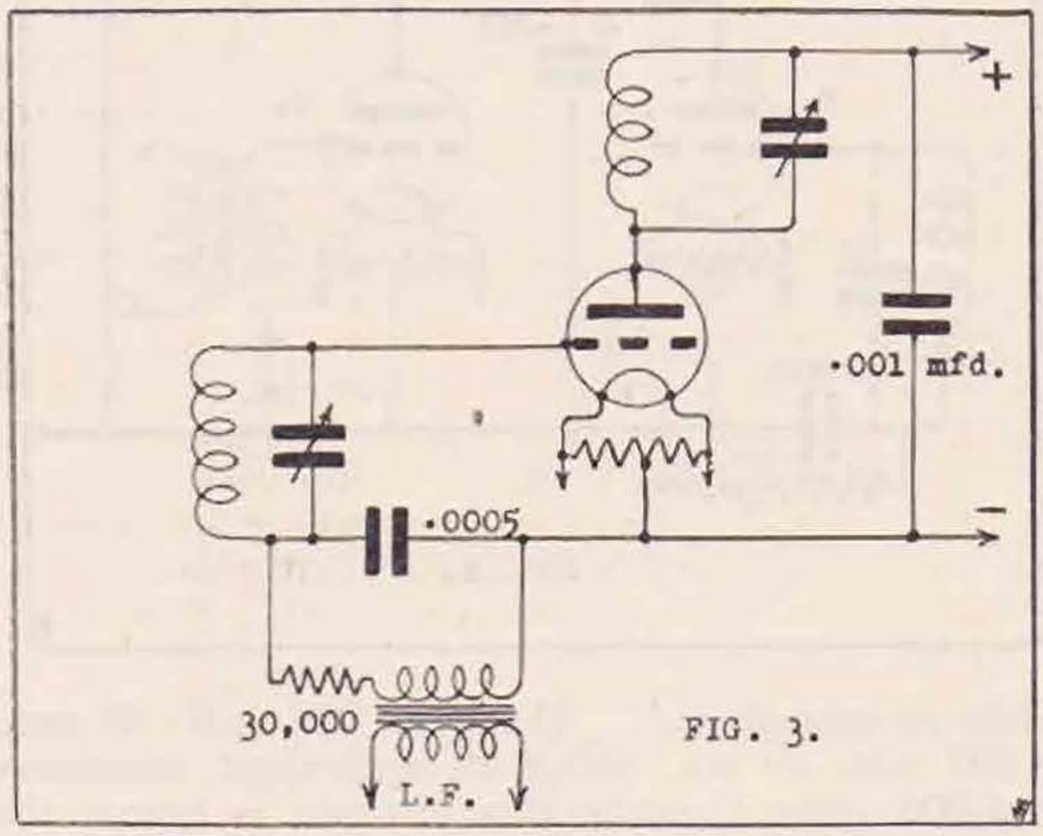


FIG. 3.

and assuming for the time being that L is very high, it can be neglected and the oscillator stage may be looked upon as the load for the modulator valve V_2. V_1 may be an LS5 valve run at 400 volts 25 ma.; with all but very badly designed oscillators, it would be found that if 200 volts H.T. was used, 12½ ma. would flow, and for 600 volts H.T., 37½ ma. If a curve of I_a to V_a was plotted for the oscillator, it would be a straight line of slope of 16 volts/ma; hence the oscillator is equivalent to a pure resistance of 16,000 ohms.

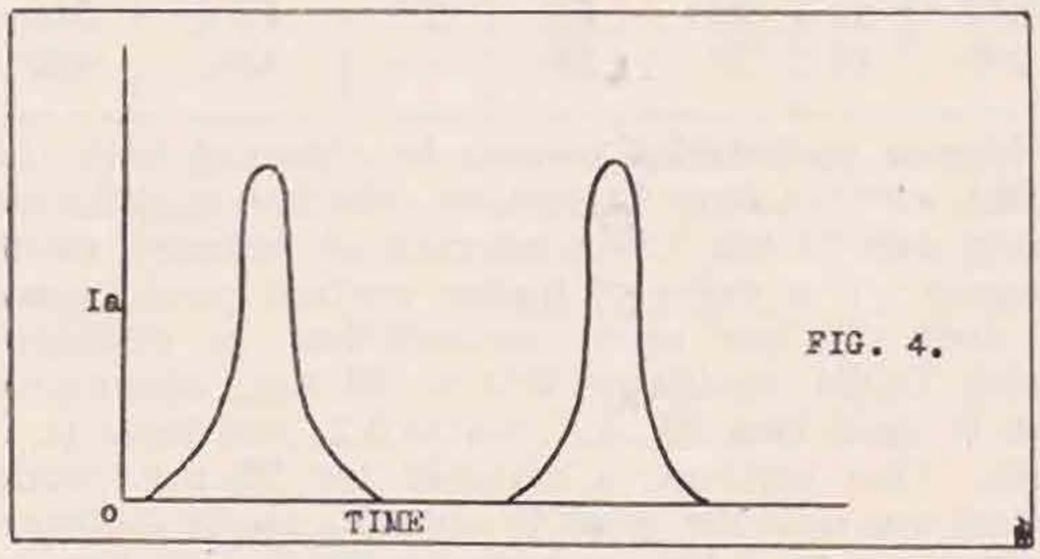


FIG. 4.

It has been shown earlier that for complete modulation of a 10-watt carrier, 5 watts of audio-frequency power are required. A valve of the LS6A class will give this when run at 400 volts 63 ma., but output valves are designed to work into relatively low impedances and the LS6A will give 5 A.C. watts *only* into its optimum load of 3,700 ohms; worked into 16,000 ohms, as above, it will only give 2.2 A.C. watts and the percentage modulation cannot exceed $\sqrt{\frac{2 \times 2.2}{10}} = 66$ per cent. without running the modulator valve into grid current. In order to obtain heavier modulation a larger modulator valve and increased H.T. to the modulator would have to be used.

Principles learnt from broadcast work can be applied. A moving-coil speaker is always matched into the output valve by means of an output transformer; this can be copied and the choke L changed to a transformer. The circuit will be as in Fig. 6, where *ab* and *cd* are the two windings of the transformer. The optimum load for an LS6A is 3,700 ohms, and turns ratio of transformer $= \frac{cd}{ab} = \sqrt{\frac{16,000}{3,700}} = 2.08$. One hundred per cent. modulation is now possible without having to use more volts on the modulator than on the modulated stage. The LS6A is giving 5 A.C. watts into 3,700 ohms; since $W = V.I$ and $R = \frac{V}{I}$ $\therefore W = \frac{V^2}{R}$.

$\therefore V = \sqrt{W.R} = \sqrt{5 \times 3,700} = 136$ volts R.M.S. across *ab*,
$\therefore$ across *cd* = 136 × 2.08 = 283 volts R.M.S., assuming a sine wave (the 5 per cent. second harmonic can be neglected),
$\therefore$ peak volts across *cd* = $283.\sqrt{2} = 400$,
$\therefore$ the plate voltage of the oscillator V_1 varies from 800 to zero volts, *i.e.*, 100 per cent. modulation.

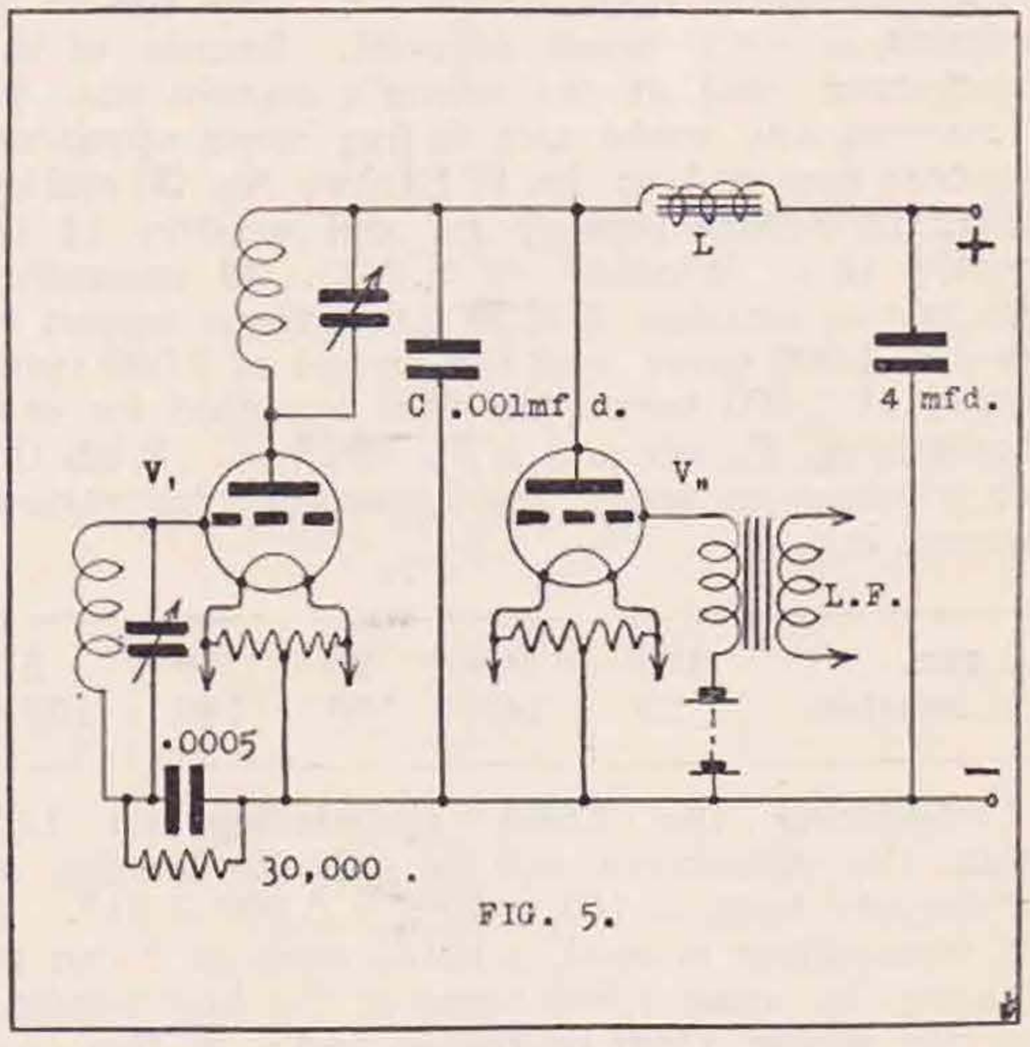


FIG. 5.

In practice several points have to be considered. These will now be dealt with. If the oscillator is of high efficiency—above 75 per cent., then without modulation the volts developed across the anode-tuned circuit will approach a peak value equal to the high tension volts; hence the actual voltage of the plate of the valve with respect to earth will vary from zero to twice the high-tension voltage at a high frequency of, perhaps, 14 million times a second; if 100 per cent. modulation is now applied, this voltage will reach a peak of *four* times the high-tension volts, and may be sufficient to cause flash-over. Even with more usual efficiencies of 65 per cent. and modulation of 85 per cent., the peak is 3.3 times the high-tension voltage. Wherever a high percentage of modulation is to be used, the valve in the oscillator (or neutralised power amplifier) must have a total emission of

at least five times the steady anode current to prevent any possibility of saturation on modulation peaks with consequent distortion; also, during the millisecond or so that the plate voltage to the oscillator is nearly doubled, the anode current is nearly doubled and the input power is three to four times normal, the lock from the preceding stage (when using this system) must be sufficiently strong to prevent any unwanted radiations on these peaks; similarly, with a neutralised power amplifier the drive must be very strong to prevent any falling off in efficiency on peaks.

In Fig. 5 it is obvious that both the by-pass condenser C and the choke L shunt the external load of the modulator—the oscillator V_1 of equivalent resistance of 16,000 ohms. If only speech is to be transmitted, loss of bass due to L being too small is not important, but for music an ambition of only losing 10 per cent. of a 50-cycle note should be aimed at; then L must be 105 henries while carrying the combined plate current of the two valves—in this case 40+63=103 ma., and such a choke would be very costly to buy. In Fig. 6 the windings *cd* and *ab* must have very high inductances whilst carrying the respective anode currents, but if the direction of winding from *a* to *b* is the same as from *c* to *d*, then, since the currents circulate in opposite directions round the core, the ampere-turns upon which the choke has to be designed is very much reduced. Details of the transformer used at the writer's station may be of interest and make this saving more apparent. The core area is 1 sq. in. of Sankey No. 30 stalloy (width of centre pole $\frac{15}{16}$ in. and window $1\frac{1}{8}$ in. long $\times \frac{7}{8}$ in.). Winding of S.W.G. 36 enamelled wire in two sections, first of 2,000 turns tapped at 500 and 1,000 turns, and the second of 3,000 turns tapped at 1,500 turns, the taps are used for ease of matching, the air gap is $2 \times .0025$ in. With the two windings in series, the inductance for various currents is :—

I ma.	100	50	25	10	5
L henries	25	90	130	140	130

Considering the LS6A modulating an LS5 again, the inductance will be only 25 henries, as the ampere turns $= 103 \times 10^{-3} \times 5{,}000 = 515$. If the transformer is used, a turns ratio of 2 can be obtained by using 1,500 turns of the first winding and the whole 3,000 of the second; in this case the ampere turns $= 40 \times 10^{-3} \times 3{,}000 - 63 \times 10^{-3} \times 1{,}500 = 120 - 95 = 25$, compared to 515 previously. Twenty-five ampere turns is equivalent to 5 ma. through the 5,000 turns, and the inductance of the whole winding would be 130 henries. Since for a given flux in the core, the inductance varies as the square of the turns—inductance of

$$cd = \left(\frac{3{,}000}{5{,}000}\right)^2 \times 130 = 47 \text{ henries, which will allow}$$

70 per cent. of a 50-cycle note to be transmitted. This is ample for an ordinary transmitter to put out high-quality music. The volt drop is only one-quarter of its previous value, so a higher inductance could be obtained by using a smaller wire. The condenser C must not be overlooked, as if it exceeds .001 mfd. it will cause a suppression of the higher frequencies, and since a .001 mfd. condenser offers an impedance of only 20 ohms to a frequency of 7 mc., this is a suitable value.

Series Modulation.—When a push-pull transmitter is being used (as for 5-metre work), series m dulation * as in Fig. 7, obviates the necessity of either

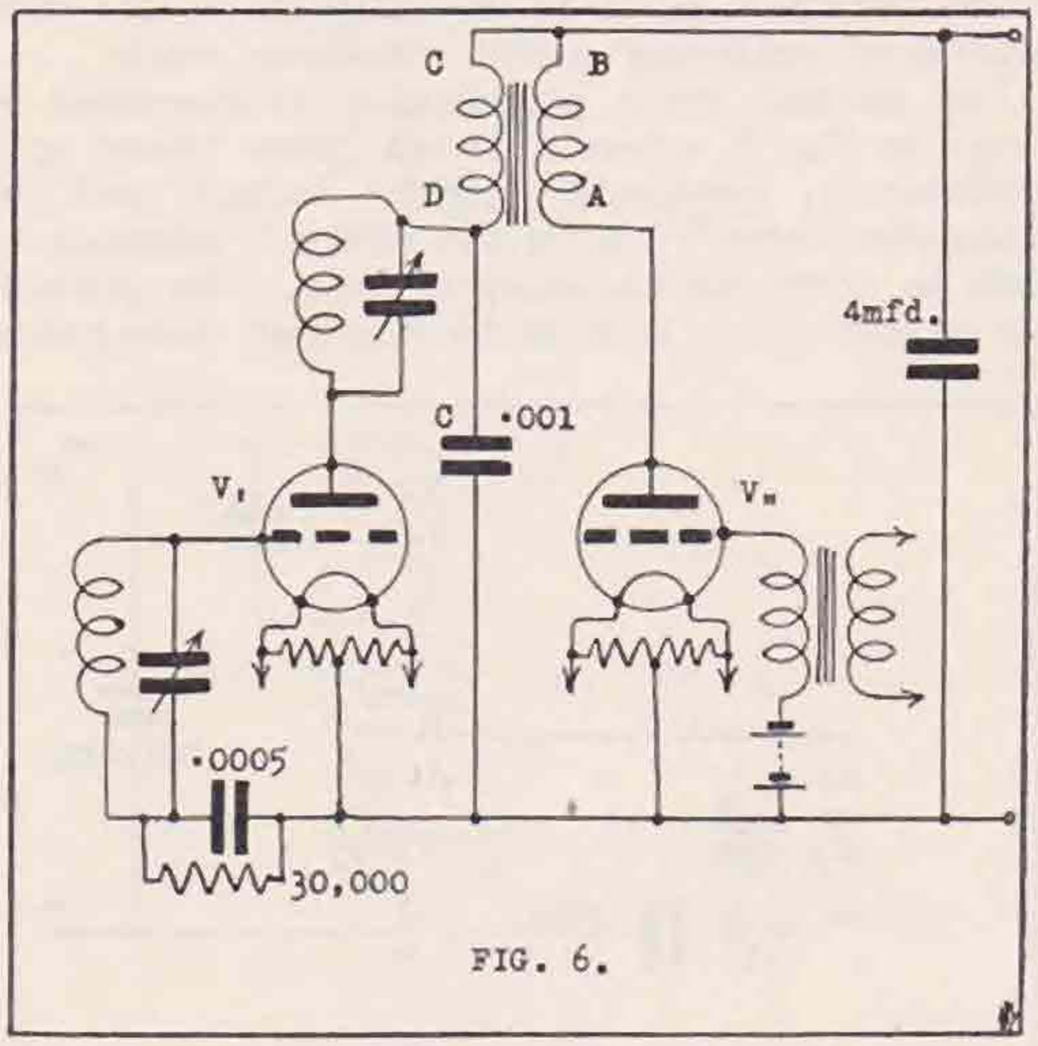


FIG. 6.

choke or transformer. If run at 250 volts 50 ma., or 200 volts 40 ma., this is an equivalent resistance of 5,000 ohms; since this current is below the normal of 63 ma. for a valve of the LS6A class, bottom bending will occur first if the normal 400 volts is used. The high-tension volts to the modulator can be reduced and by plotting load lines on curves of an LS6A the following results were obtained :—

Oscillator Volts.	Ma.	Mod. volts.	Grid Bias.	A.C. Watts.	Modulation.	Total H.T.
300	60	400	90	4.0	45%	700
250	50	300	65	2.6	41%	550
200	40	280	50	1.3	33%	480

Higher modulation cannot be obtained with the LS6A without some distortion—the low modulation being due to the LS6A running at reduced anode current; if a valve of higher mutual conductance is used, 90 per cent. modulation is possible: valve DO24, oscillator 200 v. 40 ma., modulator 300 v., grid bias 20, A.C. watts 3.2, and total H.T. 500. This method is suitable for 56 mc. work, where one does not wish to obtain a choke or transformer or to build a heavy-current high-tension unit; in practice the modulator filament is connected to H.T.$^{-ve}$ to prevent the grid circuit of the modulator from being at, perhaps, 200 volts above earth potential.

Valves for Use as Modulators.—In all the above the LS6A valve has been considered, as it is familiar to most amateurs and is suitable for modulating a 10-watt oscillator; other valves of this class, such as the DO25, DO24 and PP5/400, are equally suitable and the more modern valves will give the

* Series modulation was dealt with very fully by G5IS, Mr. P. Johnson, in the December 1932, issue.

same watts output for smaller grid swings which means less amplification after the microphone. The LS6A needs a grid peak swing of 90 volts, compared to only 22 volts with the DO24; this latter is easily obtained by a single valve between the modulator and the microphone. Another admirably suited valve as a modulator, in the writer's opinion, is the Mullard PM24D; this is a 500 volt 50 ma. pentode and gives 8.5 A.C. watts for a grid peak swing of 25 volts, *i.e.*, its sensitivity is much higher than the 25-watt plate dissipation triode; with this valve 85 per cent. modulation of a $\frac{2 \times 8.5}{.85^2} = 23.5$ watt carrier is possible, or two of these valves in parallel would modulate 50 watts amply. The optimum load of a PM24D is 8,000 ohms, so that if the oscillator takes 47 ma. at 500 volts, *i.e.*, 23.5 watts and equivalent resistance of 10,650 ohms, the transformer ratio is 1.15, the difference in the ampere-turns of its two windings is very small and a high inductance transformer can be made at little cost. In fact, except for the higher inductance possible, the transformer is not essential; a choke could be used, as this pentode will give 8.0 watts in a 10,000-ohm load with negligible second and third harmonics.

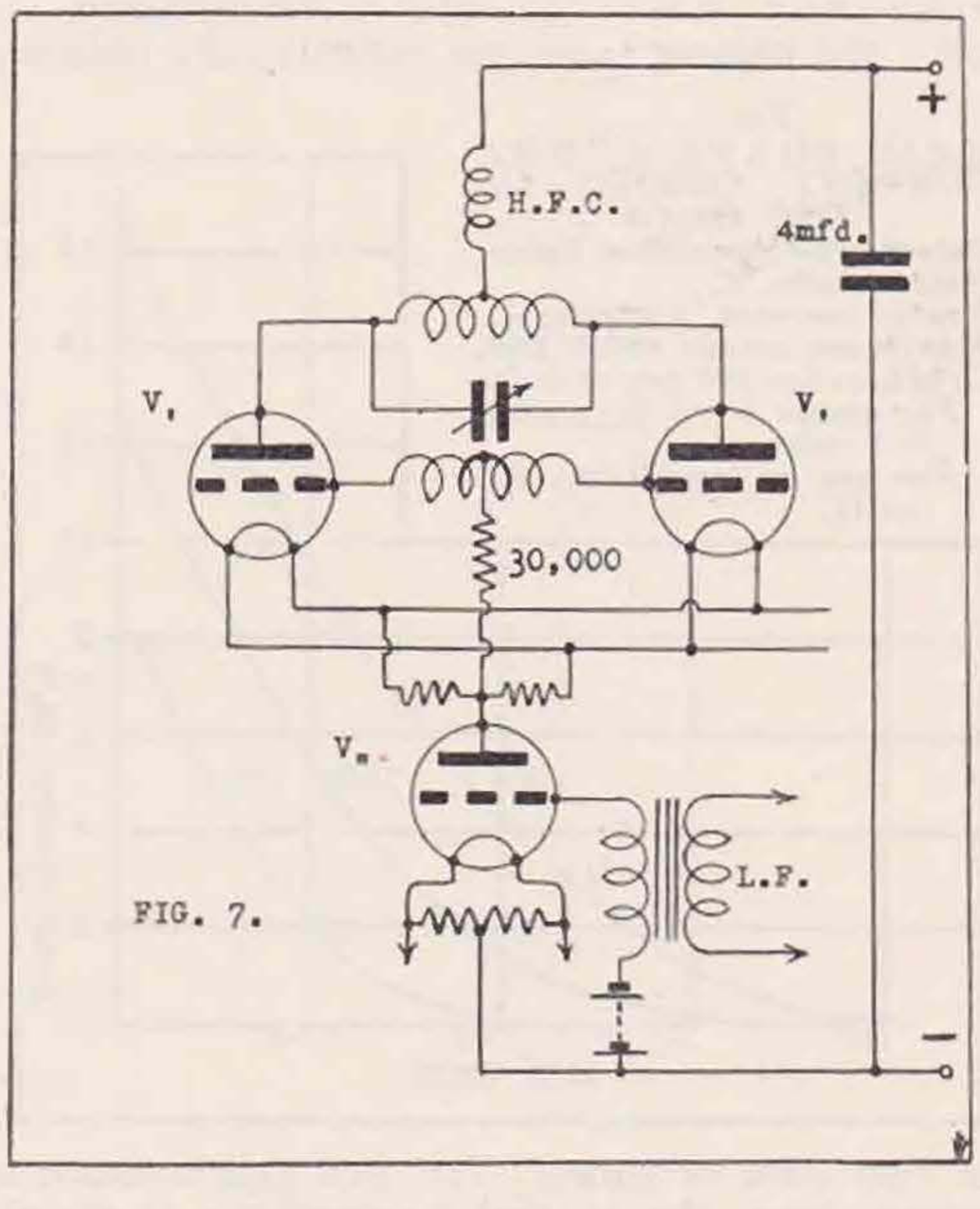


FIG. 7.

By following definite rules as set out above, one knows what it is reasonable to expect from the transmitter; all hit and miss work is obviated with the result that the telephony transmitter can be relied upon to give satisfaction whenever used.

A recent development in broadcast receivers is the use of pentodes in quiescent push-pull, and there seems to be no reason why this should not be applied to modulators with a great increase in overall efficiency. The writer has not yet had the opportunity to try out this scheme, but it appears that two PM24D valves operated in this manner would modulate 60 watts at 85 per cent. and the mean anode current to the modulator valves would be of the order of only 30 to 40 ma., instead of the 100 ma. in the case of two PM24D valves in parallel. This would be achieved by giving the valves a bias of about 60 volts, so that the anode current to each valve was 4 ma. when no signal was applied to the grid. The circuit arrangement shown in the *Wireless World* of January 6 would have to be used, and as that article explains the scheme, no attempt will be made to explain it further in this article. The following points would have to be studied, however, as each valve only works on alternate half-cycles: the output transformer must be designed differently from the normal push-pull output transformer, and if the primary had two windings, each of 1,500 turns, then the plate-to-plate load is 32,000 ohms, and therefore the secondary, which would be in series with the valve being modulated, would have 1,500 turns if this valve had an equivalent resistance of 8,000 ohms and the airgap in the output transformer would be designed to give a high inductance for a D.C. current equal to the feed to the valve being modulated as the anode currents of the two modulators cancel out in their magnetising effects. For the impedance-limiting device the writer would suggest .01 mf. in series with 10,000 ohms from plate to plate; when using one PM24D it is advisable to connect a .002 condenser between plate and earth to prevent any tendency to oscillate, and if the pentodes in Q.P.P. were unstable, a cure might be effected in this manner. Finally, since the anode current varies with the signal input, then to prevent the carrier power from varying, the regulation of the H.T. supply would have to be exceptionally good; to be sure of this separate supplies would be best, 500 volts at a mean of 40 ma. for the modulators, and with a very large filter to keep the volts steady, and another for the output valve giving, perhaps, 750 volts at 75ma. (the use of a matching transformer makes it possible to use less volts on the modulator than on the output valve) and with this method of Q.P.P. a mean power of 20 watts to the modulators would modulate 60 watts.

Appendix.

If the high frequency is f_1 and a low-frequency sine wave input of frequency f_2 is applied, then the high-frequency current in the aerial should, if no distortion (with consequent introduction of harmonics) takes place, be $\hat{I}_o (1 + m \cos \omega_2 t).\cos \omega_1 t$; where $\omega_1 = 2\pi f_1$ and $\omega_2 = 2\pi f_2$; $m \equiv$ modulation factor $= 1.00$ for 100 per cent. modulation, also when there is no modulation; $\hat{I}_o \equiv$ peak value of aerial current $= \sqrt{2}.I_o$, where I_o = aerial current as measured on a hot-wire ammeter, when there is no modulation.

In the above, cos ωt is used instead of sin ωt for simplifying later working and indicates that initially the aerial current has its peak value $\hat{I}_1$ with modulation, then $m = \frac{\hat{I}_1 - \hat{I}_o}{\hat{I}_o}$.

Fig. 1 shows the aerial current *a* for no modulation, *b* with 50 per cent. modulation and *c* with 100 per cent. modulation. To a different scale

(*Continued on page* 319.)

THE MODERN HIGH EFFICIENCY INDIRECTLY-HEATED VALVE.

(*Lecture delivered before the Society on January* 17, *by W. T. Gibson, Chief Engineer, Valve Department, Standard Telephone & Cables, Ltd.*).

SHORTLY after the development of the three electrode filamented valve, designers of receiving valves turned their attention to the complete operation of such apparatus from either A.C. or D.C. mains. It was proved unsatisfactory to use a rectified power supply for the filaments of the valves and A.C. heating is generally only possible in the output stage. Their interest, therefore, was focussed on the idea of using an equipotential cathode heated by means of a heater in thermal contact with the cathode and electrically insulated from it ; freedom from hum being ensured by the thermal inertia of the cathode.

As a matter of interest it may be mentioned that the first attempt on record on the manufacture of such a device appears to be that of the Nicholson Patent filed in America in 1915. Apparently little was done in the matter until about 1923-4, because of the difficulty experienced from grid emission and other causes. The first valves of this type were marketed in this country about 1926-7, and the process of development has proceeded fairly steadily since that date.

Recent developments have shown the advantages of indirectly-heated valves as small power transmitters giving many important technical advantages. The low power transmitting valves were developed in order to meet the requirements of short wave aircraft radio equipments, the "Micromesh" form of construction being applied with remarkable success. Generally, the modern developments of the indirectly-heated valve have been :—

(1) Improved mutual conductance ;
(2) Decreased anode/grid capacitance ;
(3) Improved mechanical construction.

In order that the relative importance of each of the above developments may be properly estimated, it is now proposed to analyse the requirements of the various functions of the valves. A comprehensive treatment is impossible, and, therefore, the analysis will be limited to three-electrode valves.

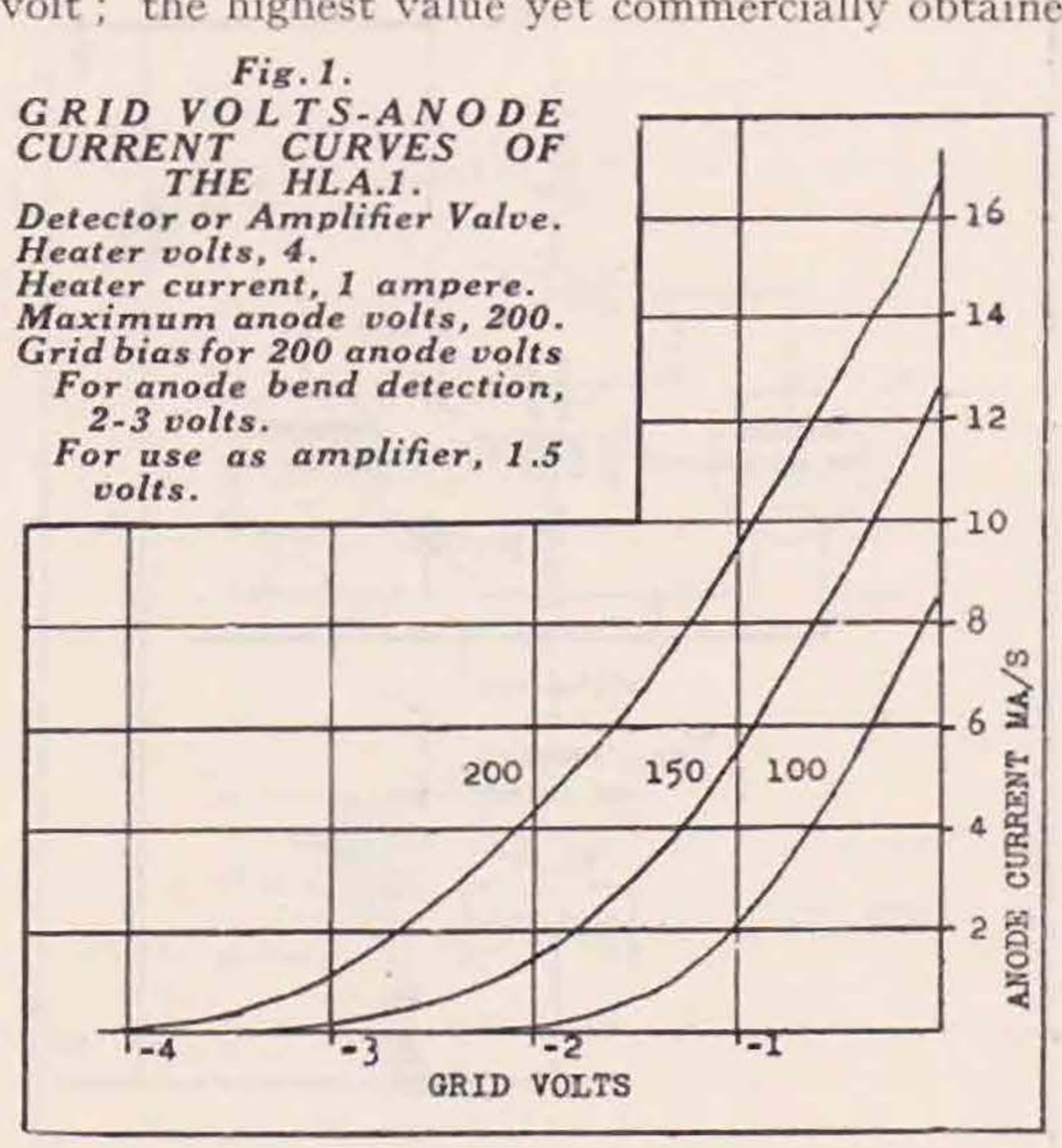
The functions of three-electode valves in modern radio receiving sets may be roughly classified as that of detection and low frequency amplification ; high frequency amplification being performed almost exclusively by screen-grid valves. The detector valve has normally to perform the function of both rectification and amplification. We may state that the rectification takes place in the grid circuit of the detector stage when power-grid detectors are used, and is effected as follows :—

The valve is biassed so that a low value of grid current flows when no signal is applied ; when a signal is applied to the grid circuit, the grid current increases during the positive half-cycles and decreases to zero during the negative half-cycles. In other words, we have half-wave rectification. A grid condenser is necessary to isolate the D.C. grid current from the A.C. input and to prevent the tuning coil short circuiting the grid leak. The grid condenser performs another function, in that the rectified current charges up this condenser so that we may assume that the low frequency component of voltage developed across the grid leak represents that which gives the A.C. audio frequency output. The condenser charge leaks away through the grid leak, and the time constant of the grid circuit must be so arranged that there is no appreciable delay acion which would mar the reproduction of transients.

The low frequency component of voltage developed across the grid leak should be as large as possible. Therefore, we require a large change of grid current for a small change of grid voltage, that is, the grid conductance should be large. In the Micromesh type of valve it is of the order of 0.8 milliamps per volt ; the highest value yet commercially obtained for this class of valve. The grid conductance as distinct from the mutual conductance is mainly governed by the total emission of the cathode, the grid to cathode clearance, and the μ of the valve, and optimum conditions are obtained when the total emission is high, the cathode to grid clearance small, and μ of the valve high.

A small curvature at the foot of the grid volts/grid current characteristic is unavoidable in any type of valve, and the improvement effected by "power grid" detection over the normal type of "leaky grid" rectification is that with the value of grid leak selected, together with the larger value of signal input used, the curved portion at the foot of the characteristic forms a small proportion of

Fig. 1.
GRID VOLTS-ANODE CURRENT CURVES OF THE HLA.1.
Detector or Amplifier Valve.
Heater volts, 4.
Heater current, 1 ampere.
Maximum anode volts, 200.
Grid bias for 200 anode volts
For anode bend detection, 2-3 volts.
For use as amplifier, 1.5 volts.



the part of the characteristic used. Hence the value of the audio frequency harmonics introduced is correspondingly decreased; in other words, it means that the rectification is more nearly perfect. A high grid conductance, however, usually means that the input voltage to be applied may be small and still satisfy the requirement of input previously mentioned, that is, a high grid conductance implies sensitivity even when used under power grid conditions.

In addition to the detection effect described above, there is also a second function of the valve, that of audio frequency voltage amplification, the requirements of which may be classified as :—

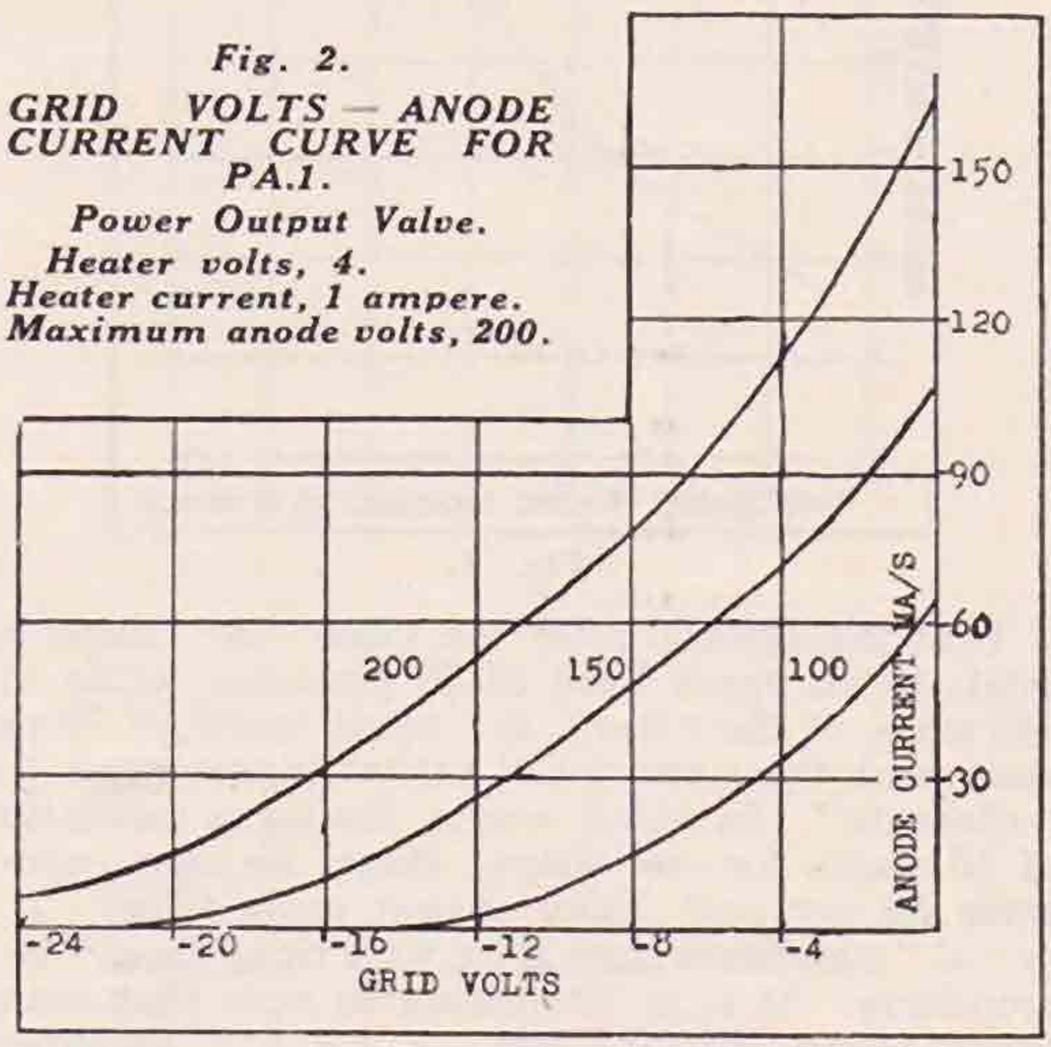
(1) That the anode volts/anode current dynamic characteristics be straight in order that no rectification takes place in the anode circuit. This condition implies a fairly high anode voltage.

(2) That the impedance of the valve be fairly low, since the effective amplification factor is given by :—

$$\mu \frac{R}{R + R^1}$$

where R^1 = valve impedance and R = coupling resistance.

Fig. 2.
GRID VOLTS — ANODE CURRENT CURVE FOR PA.1.
Power Output Valve.
Heater volts, 4.
Heater current, 1 ampere.
Maximum anode volts, 200.



With a normal value of H.T. supply available, say 250-300 volts, a suitable value of anode slope impedance for the valve is about 10,000 ohms. The amplification factor of the valve should be as high as possible, and since the impedance is fixed, this means that the mutual conductance of the valve should be as high as possible.

In order to fulfil the above conditions, the Micromesh HLA1 was designed to have an impedance of 10,000 ohms and a mutual conductance of 8 milliamps per volt, which is the highest value obtained commercially for this class of valve. (Fig. 1.)

Usually the detector valve is placed immediately after a tuned circuit, and the damping impressed on that tuned circuit by the input impedance of the valve is worth a little study. The equivalent circuit for a valve has been derived by Miller and others, and from whose work it may be shown that generally we may represent the input impedance of a valve by an equivalent circuit consisting of a pure capacitance in series with a resistance, and is dependent in all cases on the nature of the anode load, e.g., whether capacitative or inductive.

This damping, sometimes called " Miller Effect," is transferred to the grid circuit by the anode/grid capacitance of the valve. The input resistance and capacitance are both nearly proportional to the anode/grid capacity of the valve multiplied by the amplification factor, and since the amplification factor should be high we must reduce the anode/grid capacitance to as low a value as practicable. Careful design of the HLA1, has resulted in an anode to grid capacitance of about 6 m.mfds. With a normal detecting circuit as previously described, the input impedance without reaction would be, in common with other valves of this class, of the order of several thousand ohms. The effect of reaction is to increase the input impedance considerably, as well as to enhance the sensitivity in the well-known manner.

Amplification.

If an intermediate low frequency voltage amplifier be used, the same condition holds as for the second function of the " power grid " detector, that of voltage amplification.

Where, however, the low frequency amplifying valve is the output stage we may show the variation of output with mutual conductance in the following manner :—

$$\text{Mo (dynamic mutual conductance)} = \frac{\mu}{Rp + R^1}$$

where R^1 is the anode slope impedance, and Rp the anode load impedance.

The ideal power output = (Vg^2 Mo^2 Rp) watts, where Vg is the grid volts rms. (assumed sinusoidal), from which it can be shown that for maximum output $Rp = R^1$.

In this stage it will be observed that the amplification factor only alters the optimum impedance to be placed in the anode circuit, but that the power output varies as the square of the mutual conductance and of the input grid voltage. Here we have to examine the Micromesh PA1, which has a mutual conductance of 12 milliamps per volt and whose power sensitivity is the equal of a modern mains pentode. (Fig. 2.)

In the power stage, the pentode is the chief competitor of the three-electrode valve, and so a very rough comparison of their characteristics should prove profitable. For about 5 per cent. of either second or third harmonic introduced, the output level of the PA1, and a modern pentode is about the same. However, the triode mainly introduces second harmonic while the pentode introduces both second and third and under certain conditions third harmonic only. Since the harmonic distortion of pentodes is mainly third, there is no object to be gained in using pentodes in push-pull from this standpoint. In general there is not a great deal to choose between a pentode and a high efficiency triode such as the PA1, except that the triode is to be preferred, since it is less sensitive to anode load impedance and will not give a poor frequency response if the anode load varies greatly with frequency.

Transmitting Circuits.

Here triodes are used as oscillators, modulators and high frequency amplifiers, and the following

remarks are intended to apply to small transmitting equipments up to say 20 watts output power, for which a Micromesh valve, known as the 4024-C has been specially designed and another valve capable of dissipating 40 watts has nearly reached the commercial stage.

Modulation is essentially a low frequency operation, so that the remarks referring to low frequency power amplification apply fairly well.

High frequency voltage amplification is usually performed by screen-grid valves in receiving circuits, and sometimes in transmitting circuits. The output amplifier is usually a triode system, which must be neutralised if used on short wavelenths. Screen-grid valves have an optimum output impedance which is too high for efficient coupling between the output valve and the aerial system.

The requirements of the output stage of most amateur transmitting equipments is that the efficiency shall be high. There are three methods

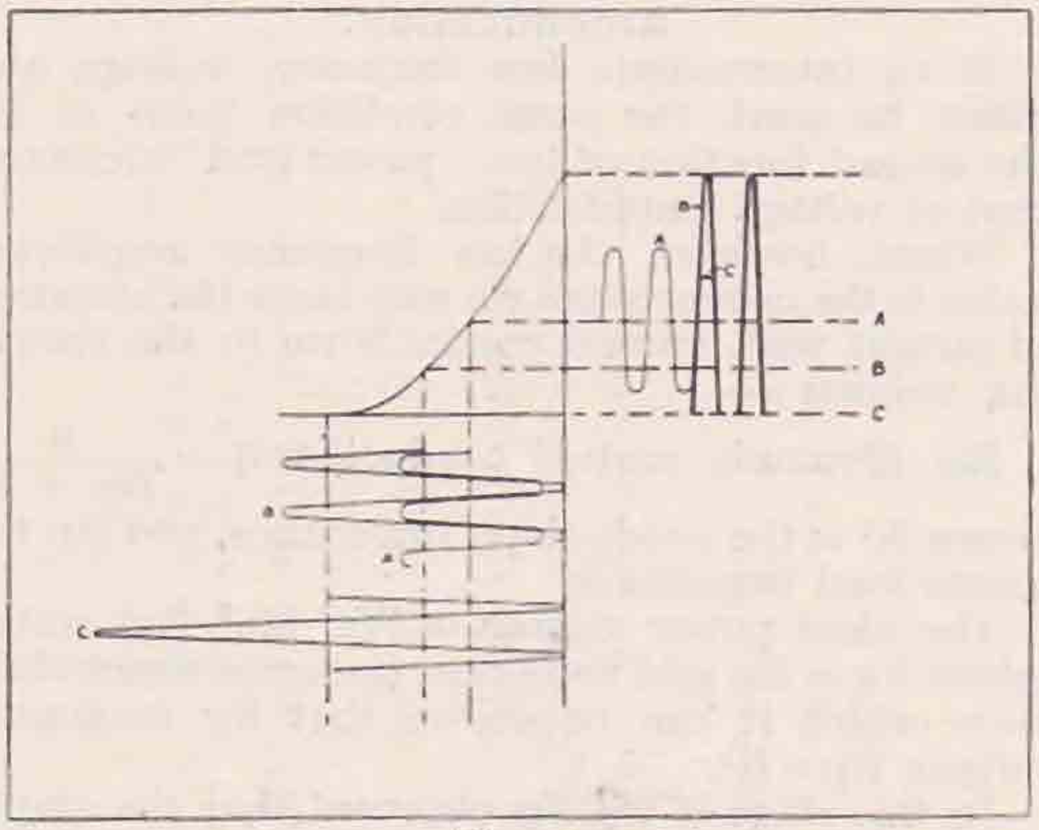


Fig. 3.

Showing the relation between grid volts input and anode milliamps in Class A, B, and C. Amplifiers. Only in Class A amplifiers is the output a true copy of the input.

of using valves as amplifiers, Class " A," " B," and " C," the differences being evident from Fig. 3.

Class " A " amplification is the normal triode or pentode amplifier. Classes " B " and " C " differ in the amount of negative bias applied to the valve, in both cases the output wave shape is not a copy of input wave shape, i.e., distortion is present in the anode current of the valves. The negative bias must be, however, independent of the value of anode current, so that the normal type of self-bias is not satisfactory. The input applied to the valve may or may not be sufficient to cause grid current when used as either Class " B " or " C " amplifiers, but grid current must not be present in Class " A " amplifiers. The 4024-C is usually operated under Class " C " conditions with D.C. inputs of about 30 watts at 500 v.

Provided that we allow for the fact that the effective dynamic mutual conductance is less with Class " B " and " C " systems than with Class " A," and that allowance is made for the harmonics produced in valves; the power output of Class " B " and " C " systems varies in the same way as the Class " A " system, i.e., very nearly the square of the mutual conductance, the input being assumed fixed.

When triodes are used for the Class " B " method of amplification, the second harmonic is largest in magnitude in the anode circuits of the valves, and is, therefore, eliminated in push-pull circuits. When the Class " B " or " C " amplifier is used as a radio frequency amplifier, the harmonics are suppressed by the tuned output circuits, audio-frequency amplifiers must, however, be aperiodic.

The advantages of Class " B " and " C " amplifiers over the Class " A " amplifiers are :—

That the power output of the Class " B " and " C " is some two or three times that of the Class " A " type when the same valves are used in each case.

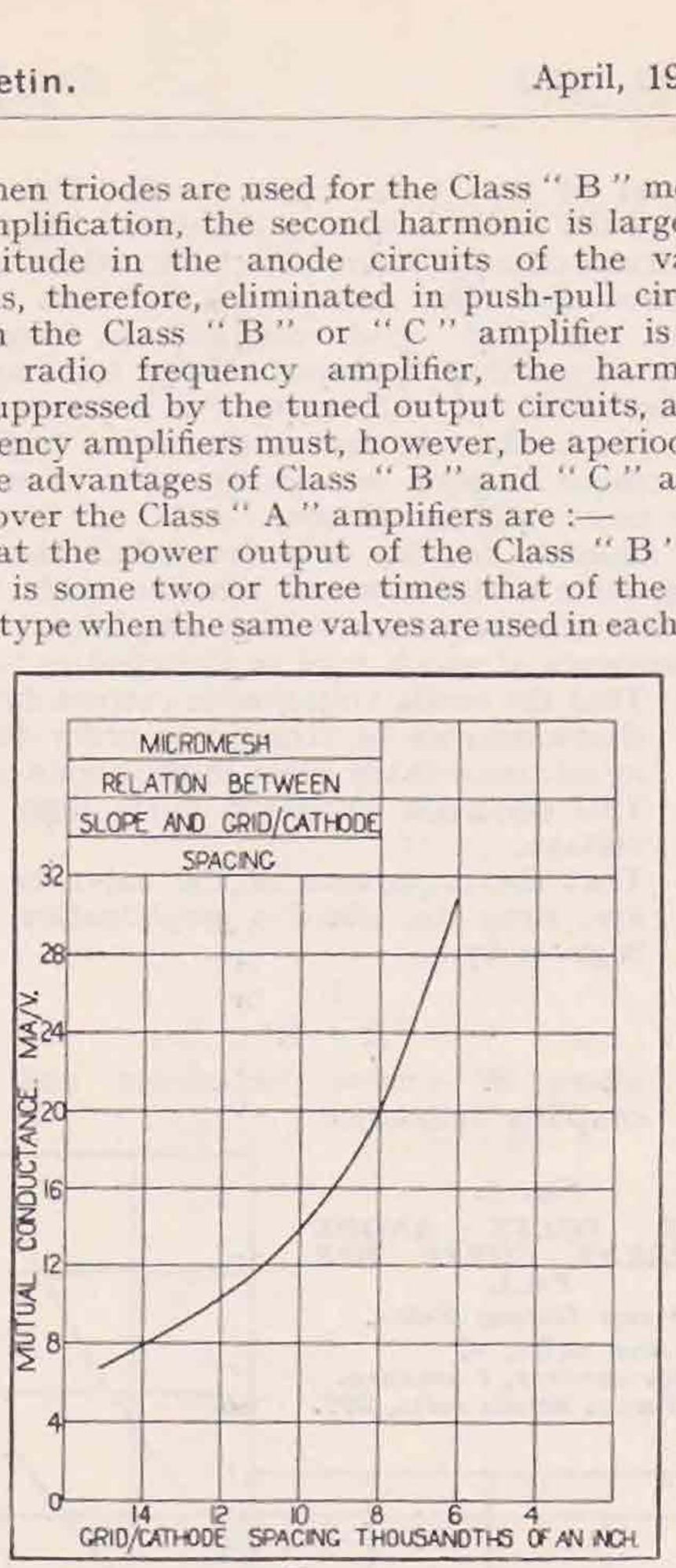


Fig. 4.

That the efficiency for the Class " A " amplifier tends to an upper limit of 50 per cent., while the efficiency of the Class " B " tends to about 75 per cent. and the Class " C " rather higher than the " Class B." In other words, having a limitation of 10 watts for our output stage, we may expect some 50 per cent. more output using Class " B " or " C " amplifiers than if we were using Class " A " amplifiers. It is is interesting to note that many broadcasting stations use " Class C " amplifiers in the final stages.

The 4024-C has been developed for low power radio transmitting stations, and is especially suitable for operation in highly efficient circuits. Where, however, 10 watts is the maximum power permitted, two 4024-C. valves in push-pull, neutralised, will give a surprisingly large output even down to say 20 metres. The efficiency at these low wavelengths varies so much with the exact components, and the wavelength used that it is, however, difficult to estimate the output unless full details of the equipment are known. Efficiencies of the order 40-60 per cent. are comparatively easily obtained at 20 metres wavelengths, without expensive or elaborate arrangements when Class " B " systems are used in conjunction with 4024-C. valves. These valves will oscillate satisfactory at 6 metres.

Referring now to this exceedingly short and inadequate analysis of the functions of triodes,

the requirements may be summed up as follows :—

(1) High mutual conductance is required ;
(2) low inter-electrode capacity is required ;
(3) the mechanical construction shall be sound.

In order to obtain the high mutual conductance which has been shown to be desirable, we require a cathode which shall have a very high total emission and that both the anode-to-grid and grid-to-cathode clearances be small, in fact, up to a certain point, the smaller the better. The cathode must be run at red heat in order that its total emission be high, but as soon as we bring the grid near to the cathode the grid becomes heated by radiation, and unless special precautions are taken the grid emits electrons in a similar manner to the cathode.

Fig. 4 shows, for the Micromesh type of construction the relation between mutual conductance and cathode/grid clearance, the advantages of small clearances being evident. The tendency to grid emission varies very rapidly with the grid/cathode clearance. The disadvantages of grid emission are extremely serious and very few arrangements exist where the operation of the circuit would not be very seriously affected if grid emission were to take place.

This fault has been the most serious stumbling block in the design of indirectly heated valves with high mutual conductance. We shall now proceed to analyse the cause of it and see what steps should be taken to be absolutely sure that no grid emission can take place. In order that the cathode shall have a high total emission at a low operating temperature it is coated with the oxides of barium and strontium, but after pumping, the coating most probably consists of barium metal and the oxides in some complex molecular form. During the whole of the time the valve is running this active material very slowly evaporates and is partly deposited on the cooler grid and anode of the valve. The immediate effect is, therefore, that if the grid be heated very slightly, by radiation from either cathode or anode or grid current bombardment it will readily emit electrons and that the tendency for the grid to emit electrons will become greater during the life of the valve. This effect, therefore, explains the reason why some valves exhibit the phenomenon of grid emission only after they have been running for some long time. If the valve is to have a high mutual conductance and at the same time be free from grid emission, it is necessary to take special precautions to keep the grid absolutely cool. Efforts have been made in the past to keep the grid cool by oxidising and carbonising, but none of these methods are really satisfactory. In Micromesh valves the grid laterals are welded to a large radiating fin which absolutely ensures that under no normal conditions can the grid become hot and so emit electrons. This method is of fundamental importance to the future of the triode valve especially, and as an indication of its efficiency it may be stated that laboratory models have been made having a mutual conductance of 25 milliamps per volt, having the very close clearances required by this abnormally high mutual conductance ; no evidence of grid emission being present.

Rectifiers.

Following the experience gained on the triode valves, it has been found practicable to design and manufacture a range of diodes, rectifiers and detectors, having indirectly heated cathodes and extremely small clearance between the anode and cathode. These are made up to 500 v., 120 milliamps, and with an internal volt drop not much in excess of a mercury vapour rectifier. They offer many desirable operating features such as protection of condensers from surges and freedom from the tendency to self-oscillation experienced with mercury vapour rectifiers ; without the high internal volt drop associated with many directly-heated rectifiers.

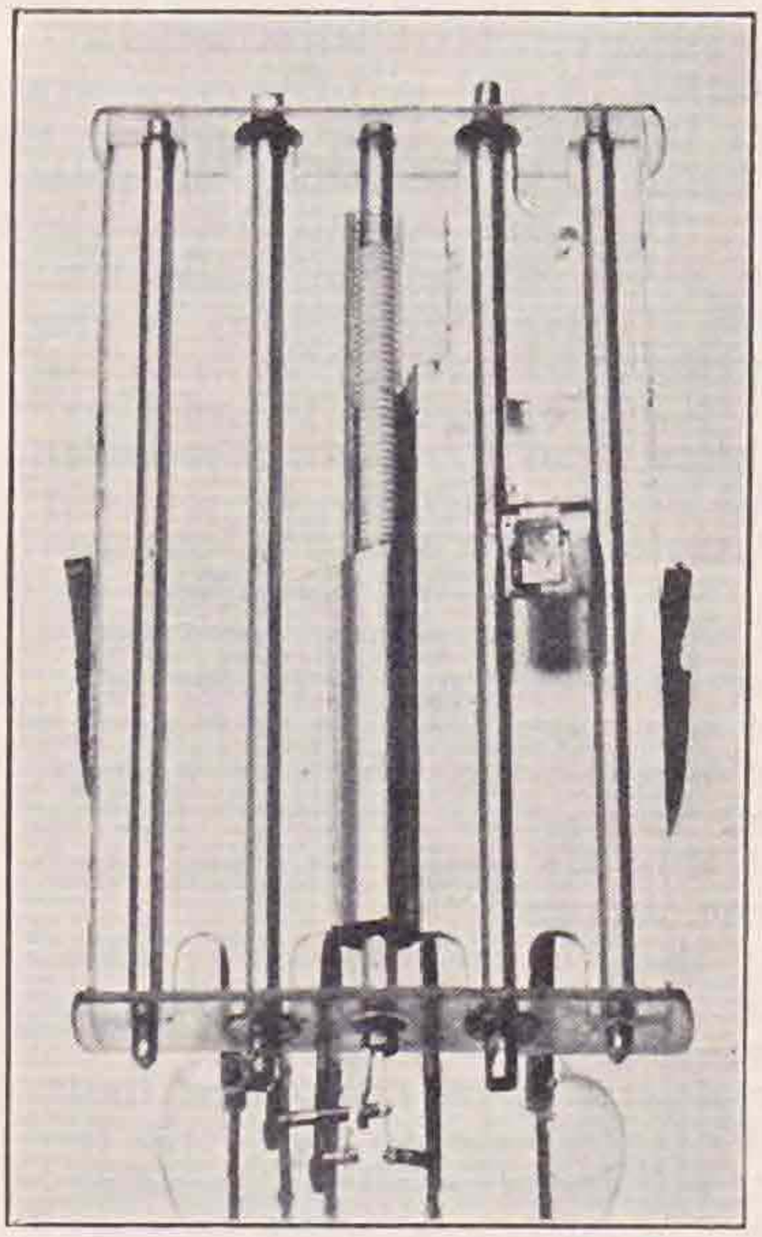


Fig. 5.

Showing the general construction of the Micromesh electrode assembly. In the cut-away portion can be seen the fine grid turns. The large fins are employed for cooling the grid and anode.

Interelectrode Capacity.

In this type of valve the effective portion of the grid electrode is extremely small in size, and only this part is encompassed by the plate. The large grid radiating fin is substantially out of the field of the anode. Hence, we should expect to find that the anode/grid capacitance low, and this is confirmed by measurement. The actual electrode (cold) capacitance being of the order 6 mmfds.

The other point of interest in connection with the Micromesh is the mechanical construction.

It is obviously necessary to have the mechanical arrangement more nearly perfect when such close clearances are used between the electrodes than where the clearances are more generous. The fundamental advance in this aspect is the idea of using a unitary structure in which the location of the respective parts is made by means of accurately-punched mica insulators used on both the top and bottom of the assembly, no dependence

(*Continued on page* 319).

STATION DESCRIPTION No. 31.

G5ZX

Winner of the 1933 *QRP Contest.*

By "Scrutator."

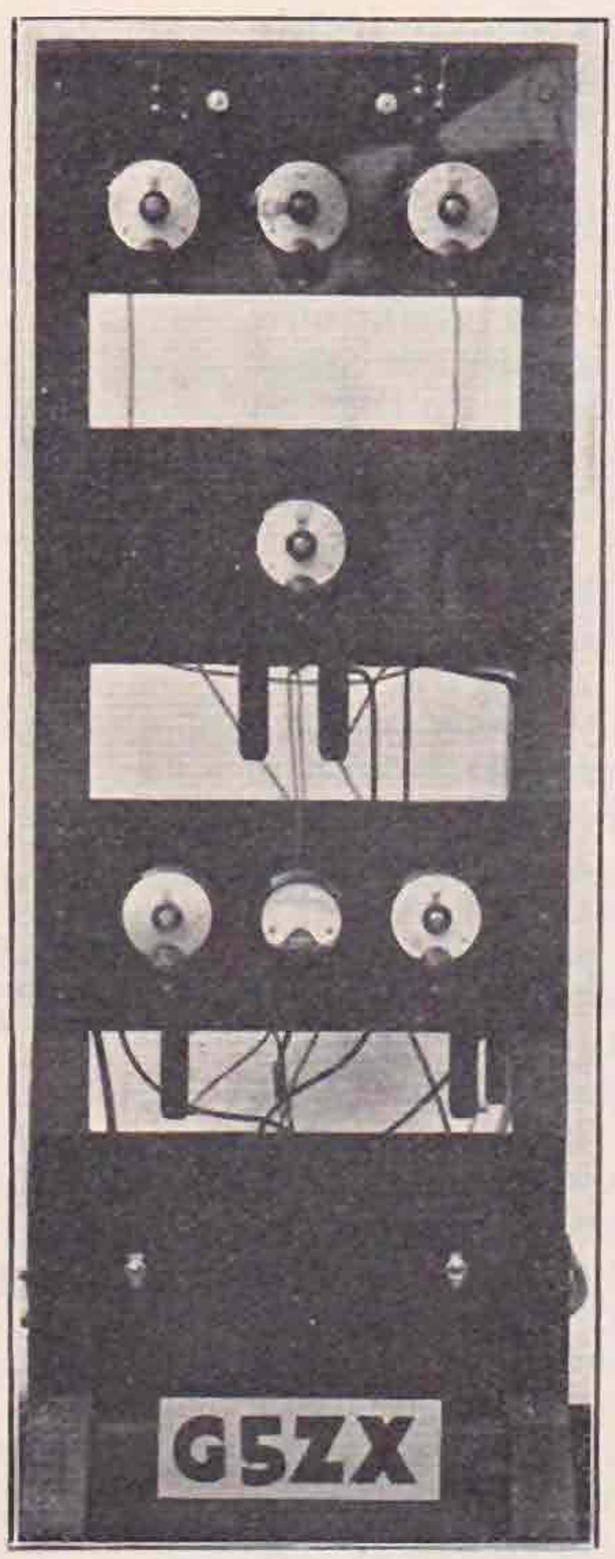
WITH some transmitting amateurs, QRP is a matter of preference; with others, a necessity. G5ZX, our QRP Contest winner, falls into the latter category, and as an example of what may be achieved in adverse circumstances, his transmitter can teach many lessons.

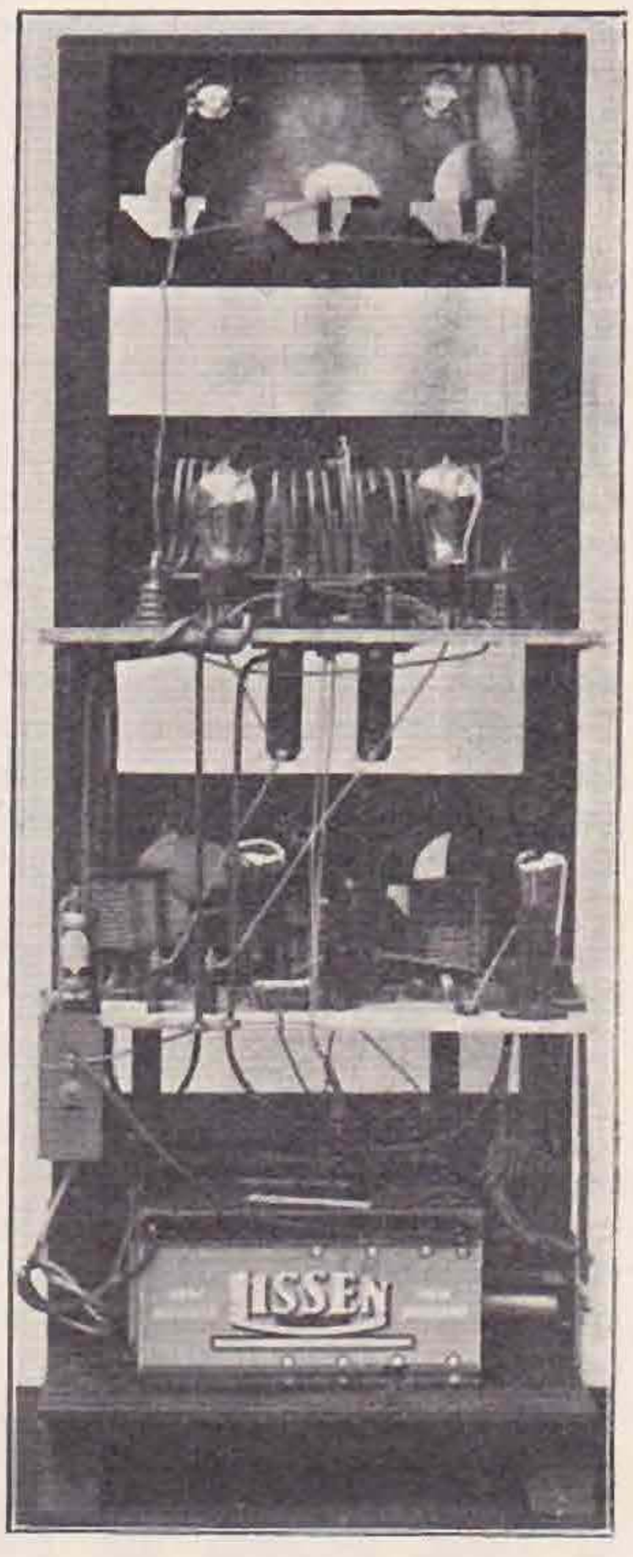
His station, located in Glasgow, is situated one storey up in a block of flats, and is screened by similar buildings at practically all points of the compass. The aerial system, during the Contest, consisted of a conventional half-wave "Zepp" suspended between two chimney heads, and the effective height of the radiating portion with respect to the roof could not be more than five feet. The feeder lines had, of necessity, to be brought off the roof in close proximity to large iron gutters, and thereafter descended the front of the building parallel to and not more than 12 ins. from a large iron pipe. Attempt was made by close spacing the lines to minimise the effects of absorption and extraneous capacity, but in spite of this the losses sustained must have been serious.

What, then, of the transmitter which produced 278 points under these adverse conditions?

Before describing the transmitter itself, the writer would like to deal for a few moments with its immediate surroundings, and the circumstances which rendered careful design necessary. First of all, the house mains rate their supply in therms, and to date have not be found particularly helpful in the matter of facilitating the passage of electrons from the filaments!!! Dry batteries had, therefore, to be resorted to. The transmitter is located in a living-room, and consequently has to possess qualities of self-effacement when not in use. "ZX" has more or less accomplished this by adopting the "rack" type of construction much favoured by our American friends, with the result that the transmitter only occupies a small section of floor space, approximating 18 ins. by 10 ins., which enables a window curtain to mask the whole outfit.

Remote control by relays is resorted to and the transmitter is operated from the receiver desk at the other end of the room. Keying is carried out either by one of G2MA's autoplex keys or an R.A.F. "pump handle." The keys are permanently wired in parallel and either, consequently, can be used at will. Crystal control is used and all transmissions are, in addition, monitored by a monitor of orthodox type. The transmitter is designed for work on 7 and 14 mc., but is actually capable of QSY to any frequency from 28 mc. downwards. During the QRP Contest, the 7 mc. band only was used. The transmitter used in the Contest consisted of CO—Buffer—PA, and the valves were CO—PX240 (Lissen), Buffer—PM22, PA two SP55R in Push Pull. As the anode supply was limited by the Contest conditions to 100 volts, at no time during the tests did the input to the PA exceed 3½ watts, and, indeed, frequently was considerably less than that.





G5ZX is probably one of the youngest amateur transmitters in the country, and consequently much praise is due for the outstanding performance.

In conclusion, he has asked me to express his best thanks to those amateurs with whom he made contact, and who consequently helped him to amass his very satisfactory score.

THE MONTH ON THE AIR.

By Uncle Tom.

(Our avuncular friend, still stepping in where angels fear to tread, fills his Onoto with vinegar and lets fly once more.)

ONE would have thought that February produced enough "test" for the average ham. But no! throughout the middle of March the hard-boiled ones have been occupied with "Hr nr 333,777," and the like, until they can't look a column of figures in the face again. And *what* a mess! Through most of the A.R.R.L. Tests conditions were quite exceptionally good, with the result that our normally quiet and well-behaved 14 mc. band has been cram full, from top to bottom (and then some) with Tests, CQ's, Nr's, and 73's.

I have always regarded the U.S.A. as a nation, as a most peculiar mixture of good and bad things, and hasn't this been borne out by the hams? I think U.S.A. undoubtedly houses the world's best *and* the world's worst operators. There is the beautiful C.C. sig. with that super-quality note that sends a thrill down your spine, marvellously handled, on 59 degrees, while on 58 there is that circular-saw, spluttery noise, combined with the strange combination of "dats and doshes" that only the most hopeless of all lids can produce.

And when an American ham is a lid, he *sure is* a lid. Oh, boy! Five figures instead of six, call-signs read wrongly and uncorrected after ten "O.K.'s", long callings and short signings, wobbles, sputters and chirps, all rolled into that glorious mixture of complacent inability that we know so well.

Far be me from it (as Mr. Brown would say) to say that the Yanks don't know their job, though. When a country possesses about 30,000 *active* hams and produces as small a proportion of real lids as they do, one can't grumble.

Several British stations were heard piling up good scores, including G5YH, G6QB, G2NH, G5ML, G6GZ, and others.

Question Nr. 1: Are all these tests really worth while? Do they further the cause of amateur radio? They promote QSO's, but they are business QSO's rather than friendly ones. Even in the B.E.R.U. Tests the object was rather to get rid of a station as quickly as possible than to chat. I wonder whether we could evolve a form of test in which credit was given just as much for a long QSO with one DX station as for several short ones with all the hams on the map?

What do the B.E.R.U. stations think of this? Will they please write to Uncle Tom and tell him? I think amateur radio is in danger of turning into one huge competition unless some of us get down to it.

G6HP has a pet theory that conditions don't vary as much as we think they do. Witness, he says, the fact that they seem to be good whenever there is a big test on. Can it be possible that the ether is worked into a receptive (or "transmittive") state by use? It hardly seems out of the realms of Heath Robinson to make such a suggestion, but, after all, we none of us know anything about radio, do we? Are the summer months "dud" because nobody is using the ether at the particular frequencies that are allotted to hams? Of course, 7 mc. is always good—French fone sees to that! Incidentally, my own pet word for French fone is "spitch," ordinary fone being "speech" in the best circles, that is.

I will now mount upon my tub, deliver a resounding whack with a hammer, and make a Provocative Statement (and, by heck, they have to be provocative to make anyone take notice of them). I say, here and now, with all solemnity, that the worst piece of gear in the average ham's shack is the *receiver*. Yes, Mr. Pillworthy, I know you'll say you're in a bad location. My reply to that is one word—— (No, no!—Ed.)

I have carted my own RX (which I am not quoting as anything extra-special) round to several of these "bad locations," and it has always performed in exactly the same way as it does at home. "Bad location" is merely the ham translation of "punk receiver," and I don't care who says it isn't. Now let fly at me for that one.

Once or twice I have told hams to try a single valve as a cure for a noisy locality. "But we can't hear anything on a single valve," they say. Exactly! They don't know how to make a detector work unless it has a string of note-mags. after it. If some of these O-V-2 people took their note-mags. off, they wouldn't hear anything at all. On the other hand, if some of the single-valve enthusiasts added two note-mags. they would blow their heads off. I know, because I've tried. *One* note-mag. on the end of a decent detector needs considerable use of the volume control to give headphone comfort.

One hardly needs a good receiver nowadays during the bouts of good conditions, but when things go off a bit, it is the man with a decent one that shows the others up. I am willing to bet that, for us in Great Britain, a good receiver is a greater help during bad conditions than an extra good transmitter. Most G's I know seem to be able to get a signal across the pond so long as there's a solitary Yank audible at R2; but that's not much help unless one can hear the said Yank!

An outstanding bit of DX during the month has been the consistent way in which AUICD of Vladivostok has been coming over. Look him up on the map and you will see that he is no distance from Japan; yet he has been a steady R6 at all times of day—quite like an FM or a CT2 station.

No one ever seems to send me news about the 3.5 mc. band. Will someone please oblige? I suppose it is the best band on which to work other G's, and crowds of them may be heard every Sunday morning. Unfortunately Sunday morning is a time when I can't usually be on the air.

From Scotland comes the news that G6LG has received permission to take a portable up the Rubislaw quarries, where he intends to do the Blondin act 300 feet up for three hours or so. "B"

(*Continued on page* 319).

MEASUREMENT OF RADIO FREQUENCY

A Paper read before the Society by E. H. Rayner, Sc.D.

(Continued from previous issue.)

Physikalisch Technische Reichsanstalt Scheme.

The Dye rings so far constructed of 20,000 cycles weigh about 140 grams, and the Marrison ring still more. The German National Laboratory has developed a quartz clock mechanism with an oscillator of a weight of about 0.4 gram, of 60,000 cycles, $91 \times 3 \times 1.5$ mm. Frequency dividing circuits and phonic motor are used for transmitting to a chronograph.

Measurements over some months have indicated a steadiness of 0.002 second per day. I am informed that having proved the method it is to be rebuilt, in order to make it give signals more nearly the nominal value of 1 second than does the present experimental equipment.

Bureau of Standards—Carrier Frequency Standard.

The Bureau of Standards in Washington, U.S.A., provides a weekly service for calibrating purposes of 5,000,000 cycles, 60 metres, which is sent out on Tuesdays. The power is only 2 kilowatts at present, and is only receivable here with any facility during the winter months. They endeavour to keep the frequency correct to 1 cycle in 5 million, and the observations of my colleague, Mr. Essen, show that this may well be attained. Fading and other effects render long-time comparisons impracticable.

One method of measurement which Mr. Essen has found to be effective is to use the quartz oscillator of 20,000 cycles and to generate from it the 250th harmonic. This has the same nominal frequency as the American wave, and beats between the two give a measure of the difference of their frequencies.

Broadcasting—Maintenance of Frequency.

The "policing" of broadcasting operations from an international point of view is carried out at the checking station, "Centre de Controle de l'Union Internationale de Radiodiffusion at Brussels." There are national control stations in Berlin, Madrid, Finland, Tatsfield, Sesto Calende (Italy), Warsaw, Lisbon, Stockholm, Prague, and Russia, which keep in touch with Brussels.

The chief work of the Brussels station is measuring the frequency of the European broadcasting stations and also of telegraph stations which may interfere with broadcasting. Not only are regular measurements of frequency made, but also observations on the constancy of the frequency. The general procedure is to take daily measurements; and to send a telegram if the frequency is seriously defective. Regular graphic reports are made of the results. Seven years ago an accuracy of 1 in 10,000 was regarded as adequate for measurements of this kind. At the present day 1 in 100,000 is aimed at. The method of operation is to use a valve maintained tuning fork of 1,000 cycles, operating a multivibrator which produces integral multiples of 1,000 cycles. The 1,000 cycle frequency drives a synchronous motor which operates a contact and gives a "tuning fork" second. A clock at the National Observatory of Belgium sends a signal every siderial second. The two are registered on a siphon recorder. The signal from the Observatory is sent by a special low power radio transmitter. The comparison is made by the method of coincidences, and experience shows that in 15 minutes an accuracy of 2 or 3 in 10^6 can be obtained. This accuracy has also been attained by comparisons with the tuning fork of 1,000 cycles at Teddington, the comparison being made by radio. In 15 minutes there are 900 seconds, and in this time not less than two coincidences take place between mean solar seconds and siderial seconds. The function of the multivibrator is to calibrate a number of heterodyne wavemeters. These are of special mechanical construction, each having four ranges, each of which covers about 100 k.c. The position of the moving part is read to 1/20 degree, and the accuracy is about 2 to 8 in 100,000. The wavemeters are installed in thermostat boxes. The condensers are of the cylindrical type, and the inductances are wound in grooves cut in tubes of pyrex glass.

International Comparisons of Frequency Standards.

I now come to the final and, I think, not the least interesting part of my subject.

Not long ago portable wavemeters were commonly used for comparing standards of frequency in different places. They are still used for the purpose, but instruments of this type are not sensitive enough for use as primary standards. Comparisons of an international character must be made direct between the standard apparatus of different countries, without moving them from their permanent situation. The only method of doing this is to distribute a standardising frequency; and if this can be made use of by a large number of stations simultaneously, exactly the same result ought to be obtained by each. A radio frequency of great steadiness can be used, but there are great advantages in using a much lower frequency, and a value of 1,000 cycles is the obvious one to choose. This could be sent by wire; but it would be very expensive and the obvious course is to send it as a modulation of a powerful radio transmitter. The 1,000 cycles can be generated where convenient and sent to the station by wire. This has the advantage that it can be produced under the best conditions where great stability and knowledge of its value are available. In June last an emission of 1,000 cycles generated by the National Physical Laboratory fork was sent out from Daventry for 1½ hours and reports of successful measurements were received from places as far as Warsaw. This was repeated at 2 a.m. on December 21, 1932. You have published in this journal, page 153, an announcement of a local emission from Teddington for similar purposes, the duration being periods of 8 minutes. Some organisations have automatic integrating apparatus, controlled by the local standard oscillator equip-

ment. This converts the apparatus into a clock, and by using some sort of chronograph, direct comparison can be made with a standard clock or the international time signals. In such cases the time signals act as a calibrating frequency having a period of 24 hours, so that from a standardising point of view, a broadcast frequency of 1,000 cycles is not of so much value as it is to those organisations, considerably larger in number, which have only an oscillator, such as a tuning fork or crystal, to rely upon, and which require the provision of a standardising frequency in order to determine its value. There is, however, one aspect of the subject which is rapidly becoming important. The day-to-day variations in the steadiness of clocks, small though they are, can no longer be neglected when verifying stiffness oscillators such as forks and quartz. There is no doubt, I think, that oscillators can be made the better time dividers; they are, therefore, becoming too good to have their unsteadiness measured by pendulum clocks. International comparisons carried out by radio, between the best oscillators in different countries, afford a means of comparison more precise than relying on the intermediary of clocks. Comparisons of frequency can be made to about 1 part in 10 million or more; but this demands a steadiness of the same order to be of any value. One part in 10 millions corresponds to about 0.01 second per day.

Though comparisons to such an accuracy are of growing interest from a national laboratory point of view, it is unnecessary for the general verification of standards from a radio point of view. The standardising emission is maintained for a little more than 5 million cycles, taking 1½ hours at 1,000 cycles. If beats with a local oscillator are counted during all this time comparison to 1 part in about 5 million is practicable. Using harmonics, a higher accuracy of comparison is available. In order to determine whether the local oscillator has a higher or lower frequency than the emission, a definite small change is made at prearranged moments which will alter the beat frequency.

It is interesting to note that the modulation frequency at a receiving station can be caused to run a synchronous motor directly and register itself on a chronograph. This may not be altogether a trustworthy method, as an atmospheric might record itself by putting the system out of action for a cycle or two, and a slip of the synchronous motor of one or two pole pitches might take place without being detected. Still the method is a very pretty one, and has been used at Teddington taking the power from the emission of the Eiffel Tower.

(*Continued from page* 317.)

district are also going up to Balmoral during May with the same call-sign, chiefly to get some practice for Field Day.

G6QB, likewise, will have a 56-mc. transmitter going on the top of the Crystal Palace tower for a whole Sunday during May. The actual date should be found elsewhere in this issue, but has not been fixed at the time of writing. The C.P. tower commands an unobstructed view of eight counties, including, I believe, the Isle of Wight! With the help of G6NF and G5IS it should be possible to put a 56-mc. sig. into parts of the country that have not yet heard one.

QB also has the offer of an aeroplane, but, knowing the pilot and his past record, doesn't feel like accepting it just yet. After all, a few hams don't matter, but the risk of busting two DFA 8's is a serious business.

(*Continued from page* 315.)

being placed upon the glass press for the electrode alignment. (Fig. 5.) It is this advance in valve technique which makes the micromesh commercially practicable. For this assembly special tools had to be devised to enable mica to be punched with the extreme accuracy necessary.

The manufacture of Micromesh valves was then described, illustrated by lantern slides.

(*Continued from page* 311.)

these curves show the voltage across the anode coil and condenser.

The expression $I = \hat{I}_o (1 + m \cos \omega_2 t). \cos \omega_1 t$ when expanded gives $I = \hat{I}_o (\cos \omega_1 t + m \cos \omega_2 t. \cos \omega_2 t)$.

$$\therefore I = \hat{I}_o \left\{ \cos \omega_1 t + \frac{m}{2} \cos (\omega_1 + \omega_2) t + \frac{m}{2} \cos (\omega_1 - \omega_2) t \right\}.$$

This shows that the effect of modulation is to produce two sidebands of frequency f_2 above and below the carrier frequency.

With modulation the mean power in the aerial is increased, if R_o = effective radiation resistance at the point of maximum current, then watts radiated = $I^2.R_o$.

Ratio of watts radiated $\frac{\text{when modulated}}{\text{when not modulated}} = \frac{W_m}{W_c} = (1 + m \cos \omega_2 t)^2 = 1 + 2m \cos \omega_2 t + \frac{m^2}{2} (1 + \cos 2 \omega_2 t)$. The mean value of $\cos \omega_2 t$ and $\cos 2\omega_2 t$ over any number of cycles is zero; hence with modulation the watts radiated must increase by $\frac{m^2}{2}$. For $m = 1.00$, $\frac{W_m}{W_c} = 1.50 = \frac{I_1^2.R_o}{I_o^2.R_o}$,

$\therefore I_1 = \sqrt{1.50}.I_o = 1.23\ I_o$ *i.e.*, for 100 per cent. modulation, the aerial current increases from that indicated without modulation by 23 per cent., assuming negligible distortion. An indication of the amount of modulation can be obtained by reading the aerial current with and without modulation since $m = \sqrt{2\left(\frac{I_1^2}{I_o^2} - 1\right)}$.

STRAYS.

Mr. M. W. Pilpel (G6PP) offers to translate German, French, or Polish into English and English into German.

* * *

Mr. R. H. Jackson advises us that his call was recently listed as G5ZU instead of G6ZU. Mr. Jackson also mentions that at Hazel Grove, near Stockport, a house in the village is named "Beru." The owner is not a "Ham!"

CALIBRATION SECTION.

Choice of Condensers for Frequency Meters.

WE have made a number of tests on different types of variable and fixed condensers with a view to making recommendations for suitable components for amateur frequency meters and monitors. It is obviously useless to construct a frequency meter incorporating variable condensers with poor insulation and poor bearings or cheap bundles of mica and copper foil enclosed in "muckite" cases. With fixed condensers of cheap foreign make, the alteration of capacity due to a rise in temperature of 10° C. has been found to affect the calibration of a frequency meter by 0.1 per cent.

The chief fault with condensers is change in capacity due to temperature variation, and this fault seems to be completely neglected both in this country and abroad in all current literature on frequency meter construction. In the numerous tests which we have conducted, we have not found any detectable temperature co-efficient with variable condensers of good design such as the new Gambrell type or the Cyldon, but in some instances, due to bad alignment of bearings, condensers designed for broadcast receiver work will not return to the same reading always for a given frequency.

The question of H.F. resistance and power factor losses need not be considered on a fundamental basis. What we require to know is: what extent of frequency drift will be caused by the temperature co-efficient of certain fixed capacities which are necessary in the construction of frequency meters? The H.T. by-pass condenser will not enter very substantially into the discussion; the most important capacities in the triode frequency meter being those used across the grid and anode coils, or in the case of the Dynatron frequency meter, the condenser which is placed across the tuning condenser.

Although neither space nor time will permit of full instructions on how these determinations of temperature co-efficient may be made, it is sufficient to indicate that these effects may be most successfully demonstrated in an extremely simple manner by anyone possessing any form of monitor or frequency meter.

The only requirement is a large tin about the size of a biscuit tin or, shall we say, 12 ins. square with a source of heating. The tin is fitted with an ordinary 60-watt lamp in one corner, and this will be sufficient to raise the internal temperature to 25° C. in 30 mins. (even a 5-watt neon lamp will raise the interior of a tin to 25° C. in 30 mins.), dependent to some extent on the ambient temperature, so that if mains voltages are not available, a motor-car headlamp bulb with 6 volts at 1 amp should be adequate. A 0-110° C. enclosed paper scale laboratory thermometer is not absolutely necessary, although they may be purchased for 2s. 6d. from Messrs. Baird & Tatlock, Ltd.

The *modus operandi* is to place the condenser to be tested across the tuning condenser of the monitor reducing the capacity of this to nearly zero and at the same time locating the carrier on the receiver and tuning it to heterodyne either a crystal harmonic or some commercial station. The fixed condenser will be connected across the monitor by means of two rigid leads which are run through holes spaced about two inches in the side of the tin. The temperature of the interior of the tin is then raised about 10 degrees, allowing time for the heat thoroughly to penetrate to the interior of the condenser, and any change in beat note between the monitor and crystal oscillator will obviously be due to change in the capacity of the condenser brought about by its increase in temperature.

This experiment will be found a most striking demonstration of a condenser's suitability for use in a frequency meter and will convey more information than actual figures for temperature co-efficient. Condensers will be found to have either positive or negative co-efficient according to type, and by chance two may be employed in a frequency meter which have opposite signs and cancel out; such instances are, however, rare, and obviously the best line to adopt is to use capacities with negligible co-efficients.

Out of some several different makes of condenser of approximately 0.0003 m.f. capacity, some air spaced, but mostly of mica dielectric, the worst produced a change of 2 kilocyles on 2 mc. over 10° C., several produced a change of 500 cycles, while the only condenser that produced no measurable change, apart from standard condensers, was the Dubilier type 577.

Two of these condensers taken at random from the laboratory were tested with identical results, and the secret of their stability obviously lies in their unique construction.

FREQUENCIES MEASURED BETWEEN FEBRUARY 26, 1933, AND MARCH 18, 1933, INCLUSIVE.

YI2DS	...	14209	G5IS	...	14352
FM8IH	...	14310	G5IS	...	14154
G2DZ	...	14316	G5LA	...	14053
G2GF	...	14193	G5OJ	...	14188
G2NH	...	14024	G5YH	...	14251
G2LZ	...	14350	G6CW	...	14056
G2ZQ	...	14224 *	G6NF	...	14080
3 mins. later		14229	G6QB	...	14209
G5DP	...	14234	G6QB	...	14093
G5GQ	...	14150	G6WQ	...	14206
G6WY	...	14178	G6VP	...	14341
G6XN	...	14108	G5LC	...	7124

* These two figures represent a marked instance of frequency drift while a station is transmitting, and one of the worst we have observed.

A. D. G.

STRAY.

We regret to announce the death of Mr. Ronald Croucher, BRS594, of 4, Victoria Road, Sittingbourne, which took place on March 15, after a long illness. Mr. Croucher was a keen and enthusiastic BRS member, and during his illness derived great pleasure from the BULLETIN.

RADIATION.

By J. A. Farrer (G5FA).

"RADIATION is not measured in Amps." One has frequently seen this very true statement made, and, indeed, most amateurs seem agreed that an increase in aerial current does not necessarily denote either greater range or greater signal-strength. Yet there seems to linger an impression that an aerial in which the current obtainable is high (when due regard is paid to the transmitter input power and wavelength in use) is of necessity a more efficient radiator than one in which the maximum aerial current obtainable falls short of this. Actually the reverse is often the case. When one considers that in the circuit that radiates least of all, the closed "Coil and Condenser" circuit, the highest possible currents are obtained, this apparently rather anomalous statement begins to explain itself.

If it were possible to build a condenser and coil so perfect that they had no losses whatever, one might expect that a circuit composed of them would also be loss-less, and that a current once set up in oscillation in it would go on for ever since the decrement of the circuit would apparently be zero. We should, however, still have a source of loss, viz., energy lost by radiation. We might, then, introduce into this circuit an imaginary resistance, the power lost in which (I^2R) would exactly equal the power lost by radiation from the circuit when an oscillatory current was flowing therein. This resistance is known by the name of "Radiation Resistance" and is not to be confused with an "ohmic" resistance but is of the nature of a loss-resistance. Such "resistances" are commonly met with in Alternating Current theory, where sources of power-loss other than that due to the ohmic resistance of a conductor are invariably present.

Now we see that the value of this resistance is a direct measure of the radiating efficiency of the aerial. Its value in a closed circuit is generally very small, though increases with an increase in frequency, as does the H.F. copper-loss resistance with which it is not to be confused. Thus an aerial in which high current readings are obtained may be a very poor radiator. Its copper-loss and hysteresis-loss may be low, but if its radiation resistance is small too, then a high aerial current will be obtained without very efficient radiation. What decides the radiating efficiency of an aerial is the ratio between the actual loss resistance and the "radiation" resistance. The total aerial power will be the square of the aerial current multiplied by the total effective resistance of the aerial, and the useful or radiated power will be the square of the aerial current times the radiation resistance of the aerial.

Consider two numerical examples:—

(*a*) An aerial having a total resistance of 14.4 ohms, a radiation resistance of 10 ohms, and an aerial current of 1 amp.

(*b*) An aerial with a total resistance of 10 ohms, a radiation resistance of 6 ohms and an aerial current of 1.2 amp.

In both the total aerial power is 14.4 watts, but the *radiated* power in (*a*) where the aerial current is only 1 amp., is 10 watts, whilst that in (*b*) with its 1.2 amps., is only 8.64 watts. Since the *total* aerial power is the same in both cases, it might well be that both transmitters had identical inputs, yet (*b*) would probably impress its owner with a sense of superiority when he could point with pride to his 20 per cent. greater aerial ammeter reading. This illustrates the fallacy of taking aerial ammeter readings as an index of radiation.

As has been mentioned previously, the radiation resistance varies with the frequency. Actually, it varies as the square of the frequency, so we begin to see why long-wave commercials get such inspiring aerial-ammeter figures, apart, of course, from the fact that it is generally possible to get much greater D.C. input to H.F. output efficiency all round on the longer waves. Thus 10 amps. aerial-current on, say, 400 metres does not represent anything like the radiated power it would on, say, 40 metres. He'd be lucky if he got over 3 amps. with the same input on that wave!

If we went up to "The land of a thousand inductance turns" we might expect to get something like 3 amps. in the aerial (provided we could rent half the village for the aerial site) for our modest ten-watt inputs. Wouldn't that be nice?

Yes, and one might hear a London ham saying: "Wonderful conditions last night, OB; I worked BRIGHTON!"

APPARATUS REVIEWED.

We have had two transformers submitted to us for test by K-P Instruments, of Blackheath.

The first is known as their HT100 and is designed to give a secondary output of 50 m/a at 1000-750-0-750-1000 volts. The primary is provided with tappings for mains voltages from 200 to 240 volts. Upon test a current of .05 ampere was drawn from the outer tappings when the input current was .6 amp. The voltage between the centre tap and each outer was measured by electrostatic voltmeter, and found to be approximately 970 volts, a total of 1,940 volts, at an output of 97 watts. The input being 120 watts, the transformer showed only a loss of 23 watts combined copper and iron, which in such a small transformer is an excellent result.

The second transformer is designed for heater circuits of mains valves and gave an output of 6 amps at 4 volts, or 24 watts while the input was .14 amp. at 200 volts, a ratio of 24 to 28 watts.

The transformers were next submitted to a flash test of 4,000 volts between the windings, and finally to a disruptive kick-discharge test when the insulation stood up perfectly.

Both transformers are well made and designed. The clamping frames are substantial, and are provided with webs to resist the pull of the bolts. There is not the slightest suspicion of hum while working, and the terminals are well spaced and very accessible.

H. B. S.

HIC ET UBIQUE.

Society Notices—National Field Day—Reception Tests—Correspondence—Empire Calls Heard—QRA and QSL Sections—New Members.

Intelligent Operating—*continued from p.* 307.

Monday and dividing by the nnmber of hours spent on the air: the cards need never be looked at!

Second, we suggest that those who forward us long lists of Empire Calls heard should use more thought in their preparation. In editing this issue, for instance, we noticed that several of the lists sent in by British members included such calls as SU1EC, SU6HL, YI6HT, YI6WG, YI2DS and YI6BZ. We consider that by publishing these and similar well-known calls we should be guilty of wasting valuable space in this Journal.

These facts have lead us to again question the value of Calls Heard lists. We realise that many a low power G has been given encouragement in his early "ham" life by seeing himself included in a list of calls heard in ZL or VK, and we believe, too, that many of our colleagues overseas have been pleased to note that their signals have been heard at DX. It is for this reason *only* that we are inclined to agree to continue publication, but we believe that we shall have the support of most members at home and abroad, if we publish only such calls as are of real value.

May we ask, then, that all BRS members use discretion when reporting European signals heard on the DX bands, and may we request those who send in lists of Calls Heard to confine them to those calls which from their experience they know are of unusual interest?

HEADQUARTERS.

For the benefit of provincial members desiring to visit Headquarters, the following directions will be found useful. By Tube to St. James's Park (District), along Broadway into Victoria Street, three minutes walk. By 'bus; routes 11, 24, 29, 39, 76, 176, 284, 285, 299, 629 pass the door. Book to Army and Navy Stores.

The office is open from 9.30 to 5.30 p.m. daily and from 9.30 to mid-day on Saturdays.

Provincial members wishing to meet the Secretary are advised to telephone Victoria 4412 beforehand. During the summer Mr. Clarricoats will be in the Provinces most week-ends attending District Conventionettes.

The home telephone numbers of London Council members are as follows:—

Mr. H. Bevan Swift. Pollards 1639.
Mr. A. E. Watts. Tudor 3970.
Mr. E. Dawson Ostermeyer. Buckhurst 1942.
Mr. G. W. Thomas. Mountview 7818.
Mr. A. D. Gay. Streatham 2154.
Mr. J. W. Mathews. Clissold 9380.
Mr. E. H. Dedman. Malden 0671.
Mr. J. C. Watts. Tudor 2466.
Mr. J. Clarricoats. Finchley 3512.

Headquarters Correspondence,

We again draw attention to the fact that letters intended for the Secretary or other officials must *not* be included in batches of QSL Cards.

We cannot be responsible for delays which may occur if this practice is continued by certain members.

We also continue to receive numerous letters and postcards from members which have been insufficiently stamped. In the past it has been our practice to accept these at the Society's expense, but in future delivery will be refused.

Convention and Exhibition

IMPORTANT NOTICE.

Advice has just been received that the R.M.A. Exhibition will take place between Tuesday, August 15, and Thursday, August 24. It will thus be seen that for the first time only one weekend will be available for those wishing to visit the Exhibition.

In past years Convention has coincided with the second weekend of the Exhibition, but before deciding on the actual dates for this year's event, we are anxious to obtain the views of provincial members.

There are three alternatives: (*a*) Convention during the Exhibition, viz., August 18-20; (*b*) Convention immediately after the Exhibition, viz., August 25-27; (*c*) Convention during the latter part of September, as arranged from 1926 to 1931.

Council are anxious to meet the wishes of the majority of the provincial membership in this matter, but as considerable advance bookings must be made, it is essential that views be given *at once*.

If you contemplate attending the Eighth Convention, please advise Headquarters which dates are most suitable. An attendance of over 200 was recorded last year, and we are anxious to exceed this figure in 1933.

W.B.E. Certificates.

We regret that Mr. G. B. Ragless (VK5GR) was omitted from the list of W.B.E. awards published last September.

The following have qualified for the award recently:—

B. Wickham (G2DW).
W. B. Weber (G6QW).
R. O. Davidson (VQ4CRL).
F. J. Finn (G6UF).
H. Biltcliffe (G5HB).
A. Brown (G2WQ).
J. Lees (G2IO).
A. M. Ralli (G2II).
R. W. Kidner (G6KI).

The Leicester Experimental Short-Wave Society.

The first meeting of the above Society was held at the Turkey Café, Leicester, on March 3 last.

The Society has been formed by several well-known Leicester amateurs to bring together regularly those interested in amateur radio.

The following officers were elected at the first

meeting. President F. H. Tyler (G6GF), Vice-President; W. E. G. Brigden (G6WU), Secretary and Treasurer; S. H. Whitley (2ADC); Messrs. P. R. Chapman (G5VH) and W. W. Storer (G6JQ) were elected to serve on the Committee.

Meetings are to be held on the first and third Fridays of each month at the Turkey Café from 7.30 p.m. to 10.30 p.m. The period from 7.30 to 8 p.m. is to be devoted to morse practice for beginners.

Morse practices will be transmitted by G6WU at 9 p.m., Mondays; by G5VH at 7 p.m., Thursdays; and by G6JQ at 10 p.m., Fridays. Each transmission will commence with test "L.E.S.S." All these transmissions will be on 7 mc. Reports will be welcome from those receiving these practice exercises.

The second meeting was held on March 17, when several new members were present.

Listening competitions are being arranged for the members, and if successful, prizes will be given. Also trips to places of interest and field days are being arranged. The Society is fortunate in having the full support of the *Leicester Evening Mail*, who are giving very valuable publicity.

The subscription has been fixed at 6d. per meeting, until such time as the committee decide upon an annual fee. The membership to date is 20, and it is hoped that all members will eventually also join R.S.G.B.

All communications should be addressed to the Hon. Secretary, 69, Wilberforce Road, Leicester.

The Long-Distance Flight to South Africa.

Further to our comments in the last issue of the T. & R. Bulletin, we have pleasure in reproducing a full report of the work carried out by the S.A.R.R.L.

We are indebted to Mr. N. H. Auret (ZU6W), for the report and take this opportunity of congratulating both him and his colleagues on the successful manner in which they carried out their work.

Report on the Reception by Amateur Radio Stations of the South African Radio Relay League of Messages Transmitted from the R.A.F. Monoplane during period 6th-8th February, 1933.

At 12.30 G.M.T. on February 6, advice was received from the Government Wireless Department, Pretoria, that the flight had started. Johannesburg and Pretoria amateur radio stations had been organised for months past for keeping a continuous watch and stations were advised by telephone to start listening. Durban and Capetown also instituted a continuous watch.

A message was also sent at 16.15 G.M.T. *via* E.C.S. (S.A. Amateur Emergency Communication Scheme) to Capetown asking Port Elizabeth and Durban to stand-by in case they had not already received advice.

At 19.00 G.M.T. a confirming message was also received by Amateur Radio from G5ML (Mr. F. Miles, of Warwickshire, England) that the flight had started.

From the receipt of the initial advice a continuous watch in two-hour shifts was maintained from Monday evening until the end of the flight by the following S.A.R.R.L. amateur stations: ZT6G, ZT6K, ZT6X, ZT6D, ZT6U, ZS6M, ZU6W, ZS6AH, ZU6E, SARS6EG, ZS1AA, ZS1B, ZS1A, ZU1E, ZT6Q, ZS5L, ZU5B, ZT5E, ZT5S, ZS5A, ZU5J.

It is regretted that messages were not sent QSZ and well spaced instead of three times singly, as, owing to atmospherics (very prevalent in South Africa), messages were difficult to copy and three sets of isolated figures and letters were at times difficult to correlate.

Air Ministry,
London.
March 15, 1933.

The Secretary,
Sir,

"I am directed to acknowledge receipt of your letter AEW/REA, dated March 10, 1933, forwarding reports by the South African Relay League relating to signals received from the long distance monoplane, and to thank you and the South African amateurs for co-operating in the communications organisation of the flight.

The information will be extremely useful in compiling the analysis of signal strengths over the whole route."

(Signed) C. B. Brown,
For Head of Signals.

On the 7th, at 21.30 G.M.T., the message received at 20.12 G.M.T. was passed back to G5ML and on the 8th, at 19.00 G.M.T., a further message was given advising him that the machine had landed at Walvis Bay at 16.30 G.M.T. It is understood these messages were telephoned by G5ML to the Air Ministry. The former was advised on Saturday evening, the 11th, that the machine had landed safely at Capetown.

The first batch of messages were valuable in that they indicated that the machine was still flying, while the latter messages from 20.00 G.M.T. February 7 were sufficiently accurate in most cases to locate the machine's position.

The signals were pure and steady throughout with the exception of the evening of the 7th, when they were logged as T7. The morse was, however, very difficult to copy.

Attached to this report was the text of all messages received, but in accordance with our agreement with the G.P.O., these are not being published. They have, however, been forwarded to the Air Ministry.

* * *

Mr. W. J. Thompson, in response to our request last month, advises us that he intercepted messages from GEZAA at 22.00 and 24.00 G.M.T. on February 6, when signals were QSA 4/5 R5/6, and again at 18.00, 20.00, 22.00 G.M.T. February 7. The last transmissions were QSA 2/3 R2/4. Mr. Thompson's station is at Kingston-on-Thames.

The Egyptian W.D. Motor Convoy and the Almassey-Penderel Expedition.

An E.L.S. message from SU1EC reached HQS via G2MI on March 21, advising us that an official experimental Convoy was leaving Cairo on April 3. The Convoy is equipped with short-wave gear in charge of SU1AA, and will work schedules with SUAA, Cairo and Q3P Khartoum. The Convoy station will operate daily from 1600 G.M.T. under the call PMAA, on 7,100 and 14,100 k.c.'s. After schedules have been completed the Convoy station will work on the amateur bands, under the call SU1AA.

The route during April will be as follows :— April 11, Delfa ; April 23, El Fasher ; May 8, Khartoum ; May 14, Kassala ; May 19, Sudan ; May 19 to 31, along Red Sea Coast to Cairo.

Members are asked to co-operate in this important pioneer work. All reports of interest should be sent direct to HQ's.

* * *

News of another Egyptian Expedition reached us on March 12 from SU6HL via G5YV. From March 15 the former station transmitted a telephony broadcast on 7130 kc. to the Almassy-Penderel Expedition on Mondays, Wednesdays and Saturdays at 0600 and 1400 G.M.T.

This expedition is surveying routes in the Libyan Desert and will probably be away until the end of April. Members who received Mr. Hill's transmissions are asked to report to him direct.

Rules for National Field Day.

The following revised rules for the above event cancel those given on pages 89 and 90 of the September, 1932, T. & R. Bulletin.

1. The event will commence at 16.00 G.M.T. (17.00 B.S.T.), June 10, and conclude at 19.00 G.M.T. (20.00 B.S.T.), June 11, 1933.

2. The event is confined to the 17 English and Welsh Districts, the four Scottish Districts, and to Northern Ireland, the latter ranking as one district.

3. Each District taking part will be permitted to place into operation two portable stations, A and B, which may be located at any point or points within the District (an exception to this rule will be permitted in the case of the four London Districts, who may erect their stations in counties adjacent to their District).

4. Station A will be permitted to operate on the 1.7 and 3.5 mc. bands ; Station B will be permitted to operate on the 7 and 14 mc. bands.

5. In the event of a District being unable to erect two stations, the District station will be permitted to use any of the four bands mentioned in Rule 4.

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

7. Stations A and B must be licensed to use different call signs.

8. The power input must not exceed 10 watts on 1.7 mc. and 50 watts * on the other three bands.

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

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

With fixed stations outside the District, but within the British Isles	1
With portable stations outside the District, but within the British Isles	4
With fixed stations in Europe	2
With portable stations in Europe	8
With fixed stations outside Europe	4
With portable stations outside Europe ...	16
With B.E.R.U. stations outside Europe ...	32

11. The points scored by the Stations A and B shall be added together to give the District's score.

12. An exchange of reports QSA, QRK and T shall be made before points can be claimed. Proof of contact may be required.

13. The British Isles, for the purpose of the event, shall include England, Scotland, Wales, Northern Ireland, I.F.S. and the Channel Islands.

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

15. The official entry sheet must be signed in full by the station operator at the time of contact.

16. Entries must be made on the approved form issued by Headquarters, and must reach that address not later than June 26, 1933.

17. Council's decision will be final in all cases of dispute.

18. Council reserve the right to amend and alter these rules at any time prior to the commencement of the event.

19. The District securing the highest total number of points, will hold the " National Field Day Award " for one year, which award will be handed to the District Representative at Convention. The D.R. will be solely responsible for its custody during the year.

* Subject to G.P.O. permission being obtained for all District portable stations.

Reception Tests.

The following are the dates and times fixed for the next series of Reception Tests. These tests are open to all grades of members.

Logs in connection with previous Contests have been received from all parts of Europe ; members who are not acquainted with the details of this scheme, are invited to refer to the February issue of the Bulletin. All logs in connection with this series of tests should be forwarded to Mr. T. A. St. Johnston (G6UT), 28, Douglas Road, Chingford, London, E.4, not later than May 23, when they will be circulated in Budget form to all participants.

Reception Tests, Series 17.

Test Letter.	Date, 1933.	Period G.M.T.	Band. Mc.
A	Sunday, April 23	0830-0930	14
B	,, ,, 23	1000-1100	28
C	,, ,, 23	0830-1930	3.5
D	,, ,, 23	2230-2330	7
E	,, ,, 30	0000-0100	1.7
F	,, ,, 30	0900-1000	56
G	,, ,, 30	1130-1230	56
H	,, ,, 30	1830-1930	14
I	,, ,, 30	2230-2330	3.5

J	Sunday,	May	7	1000-1100	1.7
K	,,	,,	7	1130-1230	7
L	,,	,,	7	1830-1930	28
M	,,	,,	7	2230-2330	1.7
N	,,	,,	14	0900-1000	3.5
O	,,	,,	14	1130-1230	56
P	,,	,,	14	1800-1900	28
Q	,,	,,	14	1900-2000	14
R	,,	,,	14	2230-2330	7

CORRESPONDENCE.

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

Do We Want QRO?

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

DEAR SIR,—I wish to concur heartily with Uncle Tom's sentiments concerning the use of input powers of 25 watts and, like him, I draw the obvious moral from the Junior B.E.R.U. Tests.

It has long been a contention of mine that input powers of over 50 watts are entirely unnecessary and a cause of much QRM. Not only this, but there is a definite tendency of high power stations to annex DX stations when they are operating, tending to exclude low power stations, with the consequent diminution of serious work done by such stations.

Now this is a most unfair state of affairs.

The aim of the amateur transmitter, as I interpret it, is to advance the ease and certainty of moderately long distance communication. Nothing much remains to be done to the transmitter, but the radiating aerial presents a very extensive field for research and more attention should be paid to this. I have been attempting to gain an idea of the behaviour of my aerial during the last eight months with an input of 10 watts on 7 mc., but I find it nearly impossible to make consistent medium DX contacts which are essential in order to form an estimation of the angle and optimum directions of radiation of an aerial system. A lot of blame for this state of affairs is attributable to the use of QRO by other stations.

I agree that high power is essential to stations investigating the behaviour of frequencies such as 28 and 56 mc. and to one or two link stations, but I fail to see the justification for use of high power on 3.5, 7 and 14 mc. Perhaps some of the QRO men would be kind enough to enlighten me.

In conclusion, I would suggest that only two ratings of power should be available to the amateur, say, an input of 25 watts for the first licence, with a maximum power of 50 watts to those who can provide reasons for its use.

I am, Sir,

Yours sincerely,

RONALD J. KEIR (G6JX).

EMPIRE CALLS HEARD.

We must again remind members that we cannot publish detailed lists of calls heard, and that all lists must be arranged in alphabetical order. Repetition of the International prefix is not necessary when several stations are reported from the same country.

*BERS*134 (*Malta*) *sends a detailed list of about* 100 *G stations heard recently. As his list is too extensive to publish, we have selected a few stations to whom we believe his report will be of interest.*

G2fu, 2kt, 2oc, 2oi, 2tk, 2ux, 5fk, 5lh, 5mu, 5nv, 5sa, 5vn, 5xh, 5xv, 5yv, 5zc, 5zy, 6ct, 6dl, 6ds, 6lf, 6lk, 6rl, 6uf, 6us, 6xm, 6yh, 6zs.

Full details of reception can be obtained from BERS134, or from H.Q.

* * *

*BRS*822 (63, *Tennyson Road, Small Heath, Birmingham*), *January* 1 *to March* 12.

3.5 mc.: ve1er.

7 mc.: su5cu, 6sw, 8ma, ve1ep, zt2b.

14 mc.: su1aa, ve1ak, bv, dc, dp, dq, 2bb, 2bg (fone), 2ch, 2ex, 2fs, 3wa, 3xc, vk2jz, 2xg, 3bw, vp2mr, vu2ah, 2lt, xx2ae, xzn2b, zs1aa, 1b, 1h, 2j, 4u.

* * *

*BERS*120 (*Calcutta*), *between November* 10, 1932, *and February* 25.

g5la, su1ec, vk2nr, 2ns, 2oc, 2sr, 2xu, 2zw, 3bj, 3bq, 3dt, 3jj, 3ml, 3rw, 3uk, 3wl, 3xf, 3zb, 4gk, 5fm, 5gr, 5gw, 5hg, 5mu, 5wb, 5yk, 6ag, 6fl, 6fo, 6gf, 6hf, 6nj, 6rl, vq4crl, vs6ab, 6ae, 6af, 6ag, 6ah, 7ce, 7gt, vu2ah, 2jp, 2jt, 2kh, 2lt, 2lz, yi2ds, zl2ci, 4ai, 4bp, zs1h, zs2j, zt6k, zu6w, 6z.

* * *

2BYO, J. F. Renouf (1, *Rockhampton Villa, St. Aubin's Road, Jersey*), *between January* 20 *and March* 13, *inclusive.*

7 mc.: vk2bq, 2bx, 2fq, 2hw, 2je, 2jz, 2lh, 2od, 2ou, 2qt, 2rq, 2sa, 2tx, 2wd, 2wp, 2wu, 2xy, 2zh, 2zw, 3aj, 3bx, 3dt, 3es, 3gj, 3gu, 3jw, 3ml, 3ou, 3rj, 3wk, 3wl, 3wo, 3xf, 4bs, 4wt, 5fm, 5wb, 7ch, zl1ab, 1ar, 1ba, 1ce, 1ck, 1cn, 1cp, 1fq, 1gq, 1gx, 1hd, 2ab, 2ac, 2aw, 2ax, 2bh, 2bi, 2bm, 2bs, 2bu, 2bw, 2bx, 2bz, 2ci, 2cp, 2cw, 2ds, 2fi, 2fp, 2fq, 2gn, 2gq, 2hr, 2ja, 2je, 2kd, 2ki, 2kk, 2ks, 2lx, 3ab, 3aj, 3aq, 3aw, 3ax, 3az, 3bd, 3bh, 3bs, 3bv, 3by, 3cc, 3da, 3dg, 3dh, 3di, 3dj, 3dk, 3dn, 3dt, 3dw, 3fg, 3fx, 3fz, 3gn, 4ai, 4al, 4ao, 4bj, 4bp, 4bq, 4bt, 4cj, 4ck, 4cl, 4co, 4db.

14 mc.: ve2ex, 3cf, 3dd, 3de, zs1h, zl4kl, vp2mr, vp4cf.

* * *

ZT6X (*Johannesburg, South Africa*), *during B.E.R.U. Contests.*

7 mc.: vk2oc, 2zw, 2xu, 3zb, 3wl, 3jw, 3kr, 3zb, 3zl, 3bq, 3uk, 3cx, 5mu, 5my, 5xk, 5gr, 5wp, 6fl, 6gf, 5ml, g5fv, 5bj, vu2jp, 2ah, 2lz, vs6ag, 7gt, 7ah, 6ae, vq4crh.

14 mc.: vk4gk, 5hg, 5gr, vu2lt, 1aa, vs7gt.

* * *

Miss B. Dunn, G6YL (*Felton, Northumberland*), *February.*

7 mc.: zl2bt.

14 mc.: Ve1ab, 1bv, 1ci, 1dc, 1dd, 1dr, 1dt, 1dw, 1st, 2bb, 2ca, 2ch, 2cq, 2cs, 2dl, 2dm, 2dq, 2ex, 2fs, 3bf, 3de, 3gt, 3ig, 3jm, 3kc, 3oo, 3wa, 3xc, 4lc, VK2hc, 2oc, 2tx, 2xu, 2zw, 3bj, 3bq, 3cw, 3dt, 3ml, 3or, 3wl, 4gk, 5gr, 5hg, 5wb, Vo8aw, 8z, vq2mx, vs6ae, 6ah, 7al, 7gt, vu2ah, 2lt, 2lz,

zc6cn, 6kr, zd2a, zl2ci, 4ai, zs1b, 1h, 1s, 2f, gfsb, xx1aa, xx2ae, xzn2b, xzn2c.

* * *

*BRS*536, *G. P. Anderson* (24, *Millway, Mill Hill, London, N.W.*7), *during B.E.R.U. Contest.*

7 mc.: vk2bw, 2je, 2px, 2tx, 3cw, 3em, 3es, 3gu, 3kr, 3ml, 3ng, 3wl, 7ch, 7cw, vq4crh, vs6az, vs7gt, vu1aa, 2ah, zd2a, z1lar, 2ab, 2ai, 2bs, 2bx, 2bz, 2ci, 2fi, 2fp, 2gq, 2je, 3az, 3cm, 3cx, 3cz, 3dj, 4ai, 4ao, 4bp, 4bq, 4bt, 4cl, 4db.

14 mc.: ve1bv, 1ci, 1ea, 2be, 2cx, 3wa, vk2oc, 2xu, 4gk, vs7gt, vu1aa, 2ah, 2ai, 2lt, zd2a, zl4ai.

* * *

G2HJ (*K. E. Brian Jay, The Quinta, Elm Close, Amersham, Bucks.*), *during B.E.R.U. Contest.*

7 mc.: ve1et, 2ay, 2ci, vk2ba, 2dw, 2hw, 2je, 2oc, 2tx, 2wu, 2xj, 2xu, 2zf, 3cw, 3ei, 3fm, 3mx, 3uk, 3wl, 5pk, 5wb, 5xk, 7ch, vp5is, yi2ds, zc1esa, 1ex, zt2b, zl1fq, 1ga, 2bz, 2ci, 2fi, 2fp, 2gn, 2je, 2kd, 3aw, 3az, 3dj, 3dn, 3fg, 4ai, 4ao, 4bp, 4bq, 4bt.

14 mc.: ve1as, 1bv, 1dd, 1dr, 1dw, 1ed, 1en, 1ev, 2ah, 2bc, 2ch, 2dm, 2dq, 3ee, 3jm, 3jz, 3ox, 3wa, vk2oc, 4gk, vq3msn, zs1h, 2f, 2j.

* * *

*BERS*161, *H. G. Cunningham* (*Malta*), *February.*

7 mc.: gi5qx, 2bh, 2jh, 2ux, 2wx, 5dp, 5hb, 5pj, 5sa, 5yv, 6ds, 6nj, 6pz, 6qx, 6rl, 6rs, 6to, 6us, yi6bz.

14 mc.: g2ux, 5ml, 5oj, 5sy, 6cl, 6nj, yi6bz.

* * *

*BRS*865 (71, *Tintern Avenue, Westcliff-on-Sea, Essex*), *February* 5 *to* 19.

7 mc.: vk2je, 2ns, 2oc, 2tx, 2xu, 2zw, 3bj, 3bq, 3bx, 3cw, 3dt, 3gp, 3hq, 3kr, 3lq, 3ml, 3mx, 3nj, 3pr, 3tx, 3wl, 3zb, 4gk, 5dx, 5mu, 5pk, 5wb, 6fo, 7ch, vq4crh, 4crl, vs6ad, 6ae, 6ag, 6ah, vs7gt, vu1aa, vu2ah, xu1u, zl2am, 2bw, 2bz, 2ci, 2fi, 2je, 2lx, zl3aj, 3dg, 3dj, 3fg, 4ai, 4al, 4ao, 4bq, 4bt.

* * *

G6HP, H. D. Price (12, *Hillcrest Road, Sydenham, London*), *Senior B.E.R.U. Contest.*

zl1ar, 1fe, 1je, 1cn, 2ci, 2gn, 3af, 3aj, 3az, 3dn, 4ai, 4cl, 4bp, 4bt, vk2nr, 2ns, 2oc, 2xu, 3zw, 3bj, 3jj, 3ml, 3tx, 3uk, 3wd, 3wl, 4ck, 4gk, 4ov, 5dq, 5gr, 5hg, 5mu, 6fo, 7ch, yi5gl, ve5gs, vp9z.

Junior B.E.R.U. Contest.

zl2bz, 2ef, 2gq, 3fg, 4ao, 4aw, 4bp, 4bt, vk2ns, 3dt, 3fm, 3wl, 5gr, 5wb, 7ch, 7cw, ve1cv, 3gt, 3nd, 3wa, 3xa.

* * *

*BERS*83, *J. S. H. Youldon, off the Azores, February* 12.

7 mc.: g2cx, 2gf, 2oa, 2op, 2xs, 5bj, 5jl, 5la, 5ml, 5np, 5qq, 5tz, 5vb, 5xv, 5yk, 6ds, 6hp, 6li, 6qx, 6rb, 6uf, 6vp.

1,500 *miles east of St. Kitts, February* 19 *to* 21.

14 mc.: ve1dr, 1dt, 2ah, 2ee, 2ex, 3de, 3ib, 4gt, vp2yb.

March 5 *to* 7.

14 mc.: g2dh, 2io, 5cv, 5la, 5pl, 5qa, 5rv, 6cl, 6tm, 6vp, 6wy, ve2cl, ve3wv, 4js, vp2mr.

7 mc.: 5np, 5ml, 5pk, 6ac.

Off the Azores, March 10, 11 *and* 12.

14 mc.: g2dh, 2gf, 2ii, 2tj, 2zq, 5ch, 5fv, 5ma, 5ml, 5rv, 6ac, 6bx, 6ma, 6mn, 6vp, 6wy, gi6yw, ei8b, ve2bg, 2ee.

7 mc.: g5du, 5ml, 5np, 5pk.

* * *

By B. Pashley (2*AJW*), 124, *Nicholson Road, Sheffield* 8, *March* 14 *to* 23, *on* 7 *mc.*:—

vk2nr, 2zh, 3dm, 3cw, 3es, 3ml, 7ch, zl2ci, 3fg, 3aj, 4cm, 4ao, 4bi.

QRA Section.

Manager: M. W. Pilpel (G6PP).

NEW QRA's.

G2AS—H. V. Booth, 17, Cemetery Avenue, Sheffield, Yorks.

G2CS—E. J. Martin, Eden Villas, Burham, near Rochester, Kent.

G2CV—T. B. Cocking, 509, Finchley Road, London, N.W.3.

G2DU—P. G. Tandy, 17, Osberton Road, Oxford.

G2FF—L. Robins, "Avondale," St. Margaret's Drive, Rhyl, North Wales.

G2VO—A. C. Holmes, 40, Aireview, Cononley, near Keighley, Yorks.

G5BR—G. L. Brownson, 20, Eastside Road, London, N.W.11.

G5HB—H. Biltcliffe, 74, Beldon Lane, Great Horton, Bradford, Yorks.

G5QC—G. Colley, 18, Crossways, Gidea Park, Essex.

G5ZT—H. Jones, 251, Manchester Road, Frenchwood, Preston, Lancs.

G5ZZ—R. Emery, 386, Goldhawk Road, London, W.6.

G6HY—T. Dyer, 20, Mount Pleasant, Cheshunt, Herts.

G6KU—C. A. Sharp, 316, Poplar Grove, Great Horton, Bradford, Yorks.

G6KX—A. Carrington, Tag Hill, Heanor, Derbyshire.

G6NQ—L. B. Parkes, 102, Lichfield Street, Walsall, Staffs.

G6SO—J. Soten, 7, Potters Lane, Polesworth, Tamworth, Staffs.

GI6VG—J. Rainey, 9, Hartington Street, Belfast, Northern Ireland.

G6VY—W. T. Shannon, "Sandymount," Castledon Road, Wickford, Essex.

G6ZX—A. C. Brown, "Amulree," Clarkston, Glasgow.

2AAA—P. Pennell, 3, Pepys Way, Girton Road, Cambridge.

2AAH—W. F. Miller, 60, Spitalfield Lane, Chichester, Sussex.

2AAU—K. T. Harvey, 33, Howard Road, Westbury Park, Bristol 6.

2ABS—A. B. May, 177, Claremont Road, Pendleton, Salford 6, Lancs.

2AKT—C. D. Whaley, "Danum," Ramsey Road, St. Ives, Huntingdonshire.

2ASF—A. R. Land, 10, Kimberley Street, Bradford, Yorks.

2AUB—J. H. P. Bell, 22, Front Street, Winlaton, Blaydon-on-Tyne.

2BIR—J. C. Wicks, 83, Crombie Road, Sidcup, Kent.

2BPK—A. J. Mathews, 57, Hawthorn Road, Hornsey, London, N.8.

2BQF—R. Miles, 35a, Nightingale Lane, Bromley, Kent.

The following are cancelled: 2AOI, 2AUZ, 2BDW, 2BHT.

QRA Wanted: KI2CT.

Mr. Cole (SU1EC) advises us that the following SU calls are known to him: 1AA, 1AQ, 1CH, ICW, 1EC, 1MM, 1MN, 1SG, 1SK, 6HL, 8MA. SU1CX is active, but his whereabouts are unknown. Members working SU stations not in the above list are asked to obtain full addresses and advise SU1EC or G6PP.

QSL Section.

We have recently had complaints that cards in some instances have been sent to the wrong person by the Section staff. We present our apologies to those who have suffered and ask their indulgence in view of the enormous number of cards that pass through the Section annually. Mistakes are bound to occur in the best regulated departments, and when one realises that the majority of cards received at Headquarters for distribution are written by continental amateurs whose method of forming letters is entirely different from English practice—Germans and Russians are notable in this respect—it will be easier, we hope, to forgive lapses.

With reference to the A.R.R.L. and BRS cards: We understand that a definite announcement will be made shortly which will enable us to accept once more all listening reports for A.R.R.L. stations (see last Bulletin), but until that times comes we must regretfully refuse such cards for distribution.

J. D. C.

Our New Members

Amongst the list of new members published below will be found the names of Messrs. Sainio, Kairenius, and Eckstein. These gentlemen are, perhaps, better known to us as OH2NM, 2ND and 2PP, under which call signs they conceal their identities as President, Secretary and Communications Manager of S.R.A.L. We in Great Britain have always held a high regard for the Finnish stations, whose operating methods and first-class signals have been for many years, an outstanding feature in European amateur radio. We trust that by the election of these well-known Finnish amateurs, a closer link than hitherto will be established between our two organisations.

The election of Messrs. Moore, VO8AW and Wade, VR1MA, will, it is hoped, enable us to appoint them in the near future B.E.R.U. Representatives for Newfoundland and Mauritius respectively.

It is pleasing to record that G6IY has again found himself able to take an active part in Society work, and to him and all other new members a cordial welcome is extended.

Home Corporates.

A. S. Binks (G2DM), Glencoe, Shelf, nr. Halifax, Yorks.
H. P. Townhill (G5XL), 27, North Parade, Lincoln.
A. Pacy (G6IY), 36, Beverley Road, Barnehurst, Kent.
J. L. Wraight (G6OC), 59, Bramley Road, South Ealing, W.5.
G. Kingsbury (G6SS), Brading House, Brading Avenue, Southsea.
H. Turner (G6ZT), Oakleigh, Station Road, Billingham, Stockton-on-Tees.
C. W. Horrell (2ADR), 38, Greaves Street, Little Horton, Bradford.
G. O. Ravenscroft (2AFY), 2, Edward Street, Cleethorpes, Lincs.
I. J. P. James (2AMS), 1, West Terrace, Newlyn, Penzance, Cornwall.
W. Carter (2APT), 1, Gladstone Street, Peterborough, Northants.
J. W. B. Baker (2AUR), c/o Halliday, 19, Brisbane Street, Greenock.
J. M. Adams (2AYA), 24, Northfield, Donaghadee, Co. Down.
R. Palmer (2BIU), 44, Kingsland Avenue, Coventry.
G. H. Salter (2BUT), 35, Val Plaisant, St. Heliers, Jersey.
R. H. Stevens (BRS1094), 37, Albert Avenue, Newport, Mon.
P. F. Soper, B.Sc. (BRS1095), Clovelly, 22, Teville Road, Worthing.
D. M. J. Tyre (BRS1096), 9, St. Andrew's Drive, Glasgow, S.1.
T. H. Nisbet (BRS1097), 32, Bryston Road, Edinburgh.
C. N. Blatherwick (BRS1098), 20, The Drive, Roundhay, Leeds.
R. T. H. Gelston (BRS1099), Drill Hall, Park Street, Cardiff.
G. E. Adkins (BRS1100), Hoyvanine, Exmouth, Devon.
A. W. G. English (BRS1101), 3, Nascot Street, Watford, Herts.
S. H. G. Green (BRS1102), 40, Sherbourne Street, St. George, Bristol 5.
H. D. Grattan (BRS1103), The College, Wye, Kent.
W. Johnson (BRS1104), 28, Denmark Road, Southport, Lancs.
J. H. Owen (BRS1105), 45, Elmwood, Welwyn Garden City, Herts.
J. Telford (BRS1106), 54, Castle Street, Carlisle, Cumberland.
R. Vout (BRS1107), 18, Brydon Crescent, South Hetton, Co. Durham.
J. W. T. Wise (BRS1108), 162, Bedford Road, Kempston, Bedford.
F. Wiseman (BRS1109), 38, Louvain Place, Newcastle-on-Tyne.
E. J. Williams (BRS1110), Rochdale, London Road, Widley, Portsmouth.
H. Wood (BRS1111), 33, Bridge Street, Rochdale, Lancs.
J. F. James (BRS1112), 1,343, London Road, Leigh-on-Sea, Essex.
O. H. Adamson (BRS1113), Nadencroft, Norden, Rochdale, Lancs.
B. W. Webster (BRS1114), 45, Cambrai Crescent, Westwood Park, Eccles, Manchester.
T. Vickery (BRS1115), 7, Broadfield Road, Folkestone, Kent.
C. F. C. Neate (BRS1116), Ivydene, Leewood Road, Dunblane, Perthshire.
L. G. Knight (BRS1117), Ourome, Madeira Walk, Reigate, Surrey.
R. S. Hodgson (BRS1118), 254, Westbourne Avenue W., Hull, Yorks.
G. Curran (BRS1119), 4, Freckleton Avenue, Chorlton-cum-Hardy, Manchester.
A. M. B. Cooke (BRS1120), St. Mary's Rectory, Hamilton, Scotland.
R. W. Corse (BRS1121), Cliff Cottage, Stromness, Orkney.

Dominion and Foreign.

Werner Uthoff (DE1455), Berlin-Haselhorst, Gartenfelderst 122h.
E. E. Kairenius (OH2ND), Laivurinkatu 21 C.7, Helsinki, Finland.
K. S. Saino (OH2NM), Merikatu 3, Helsinki, Finland.
A. H. Eckstein (OH2PP), Engelaukio 2, Helsinki, Finland.
R. Weiland (UO6WR), Goesting bei Graz, Weidweg 92, Austria.
R. H. O. Prissick (VE2CX), 27, Bellevue Avenue, Westmount, P.Q., Canada.
A. E. Howard (VE4CJ), 2401, 25th Street West, Calgary, Alta, Canada.
J. Moore, Jnr. (VO8AW), Carbonear, Newfoundland.
N. H. Wiles (VP5NY), c/o Jamaica Telephone Co., Kingston, Jamaica, B.W.I.
R. C. Wade (VR1MA), O/C. Radio Station, Rose Belle, Mauritius.
C. C. Newman (ZC6CN), Meteorological Officer, R.A.F. Station, Ramleh, Palestine.
H. A. Shoyer (ZS1H), Oakvale, Oakhurst Avenue, Rondebosch, Cape Town.
M. G. Puckle (ZS5P), P.O. Nkwalini, Zululand, South Africa.
M. B. Money (BERS167), H.M.S. *Shropshire*, c/o G.P.O., London.
R. L. Wroughton (BERS168), H.M. Customs, Lagos, Nigeria.

(*Continued from page* 329.)

times. G2UV also kept the schedule when business permitted.

Special Note.—Several more members are required to participate in the activities of all three 2 mc. Groups. Groups 10A and 10B are devoting their time mainly to DX working on C.W., and on investigation of the numerous phenomena affecting such working. Group 10C is more concerned with telephony experiments. Amateurs willing to pull their weight as members of any of these Groups should get in touch without delay with G5UM at 17, Eastwood Road, London, N.10.

CONTACT BUREAU NOTES.

By H. C. Page (G6PA).

THERE seems to be a rather serious falling off in the activities of some sections of Contact Bureau this month. Despite the fact that I have delayed several days, there is still no report from the 56 mc. group, and I have had advice from the television and aerial groups that their activities are at a standstill owing to lack of support. To balance this, however, I am able to report the formation of a group under BRS981 to study receiver design, with special regard to the recently-produced "Ferrocart" coils, and Quiescent Push Pull. A new group to study the effect of the atmosphere on radio conditions is also in the process of formation under G2GD, who, by the way, will be very glad to hear from anyone interested in this question. I think this particular subject is one in which the BRS men should be interested, and I hope that G2GD will have their support. His address is: J. C. Elmer, Aethelmar, Seabrook Road, Hythe, Kent.

I shall watch with great interest the progress of these two new sections of Contact Bureau, for in both cases there are excellent openings for the BRS men, and if they pull their weight in them I shall be very pleased indeed to have to retract some of the harsh remarks I have made in the past!

G6OM, the new G.M. of the 3.5 mc. groups, writes to say that both groups are active, but that there appears to be little of interest to comment upon.

G6FY informs me that there is nothing of particular interest to English amateurs in the foreign magazines this month, but remarks that the French station, F8DS, is continuing the R.E.F. calibration as usual, and is not working to French Summer Time. For the benefit of those interested, F8DS transmits calibration waves on 14,000 kc. at 09.00 G.M.T. for ten minutes and on 14,400 kc. at 09.15 G.M.T. also for ten minutes. A service is also transmitted on 7,000 kc. at 10.00 G.M.T. and on 7,300 kc. at 10.15 G.M.T.

28 M.C. Group.

G6VP, Manager.

It seems a pity that we are experiencing such hard lines on 28 mc., and even the "die-hards" are getting discouraged. One wonders whether it is worth while running the section.

It is true that we have had a period of intensive activity on other bands, and it is little wonder that all spare time has been utilised on the frequencies that showed some return in results for the trouble.

As to 28 mc., it evidently behaves very much like 56 mc. normally—ground-wave reliability—and only in isolated cases do we get sufficient reflection to enable us to cover any distances.

We must also remember that, granted the Sunspot Cycle, we are at about the worst period.

There are very few reports to hand. These are all nil. Experimental work, however, is still proceeding.

Group 1*B*.—G5SY (Centre) has been trying various sizes of reaction windings in his receiver, and he finds the best critical in value; he is also rather surprised to find this latter sharply timed. He has also been trying different combinations in his transmitter, with a view to obtaining more output. He finds that much more drive is required to obtain output than on 14 mc. He favours 7 mc. CO 14FD, 28FD, 28A, 28PA where one can use a high-power value as 28A. Otherwise 7 mc. CO 14FD, 14A, 28FD, 28PA seems the best. Both G5RP and 5QA are experimenting with SG valves as detectors. Seemingly, there is only one made (a 2-volt battery valve) that seems to be of any use. They wonder whether this has been discovered by others also. YI6HT and VU2AH are on every Sunday morning. G2FN calls them at 12.00 G.M.T. and listens for them 12.10—12.20 G.M.T. It might be useful to be on also at those times, and perhaps the HAF and FM stations would co-operate.

Group 1*C*.—G6VP (Centre) has been QRL tests, but nevertheless has got a power FD (genuine this time, not harmonic, hi) going. He has also found that the hum in his receiver has disappeared. He attributes this to the use of a horizontal doublet for reception. He finds this type 100 per cent. more QSA than a vertical aerial on all frequencies. G6WN have also been occupied with the tests, but now intend to resume their normal activities.

Group 1*F*.—BRS25 (Centre) has nothing to report, although he still "pegs away with the receiver." 2BHK, who holds the receiving prize, finds it impossible to work on 28 mc. at present, and sooner than be a passenger in the group, drops out, at least for the time.

Fading, Blindspotting and Skip Group.

G6MB, Manager.

It has now been found possible to start a new group to take the place of the old 2B. Two new members are required. Will anyone interested and prepared to carry out intensive listening schedules, not only on amateur bands but on certain other frequencies as well, please let me have his name and address, at the same time giving roughly the times he would be available. This is a good chance for BRS members who would like to do some serious work and are prepared to stick it for a considerable period of time.

Group 2*A*.—In view of recent experience, it is now intended to carry out tests on distant signals, and arrangements have been made to that end. The results obtained by systematic observation on 7 mc. are encouraging, and it is hoped now to extend the investigations to cover the lower frequencies, as it is thought that meteorological effects will be greater as the lower frequencies are reached.

Group 2*C*.—This group is discussing the Heaviside Layer and two theories in connection with it. They submit a chart showing the connection between earthquakes and variations in barometric pressure, together with information of solar phenomena and remark on the marked fall in pressure after a 'quake.

Group 2*D* is returning to 14 mc. observation work and to W2XAD, and predict that this waveband should return to activity with the approach of spring and summer. Theoretically, the northern

and southern hemispheres should receive equal ultra-violet radiation about March 21, and they propose observing results about this date on both strength and direction of signals. The moon theory is still under discussion and a question on 'quakes and their effect has been raised.

Theory Group.

BRS865, Manager.

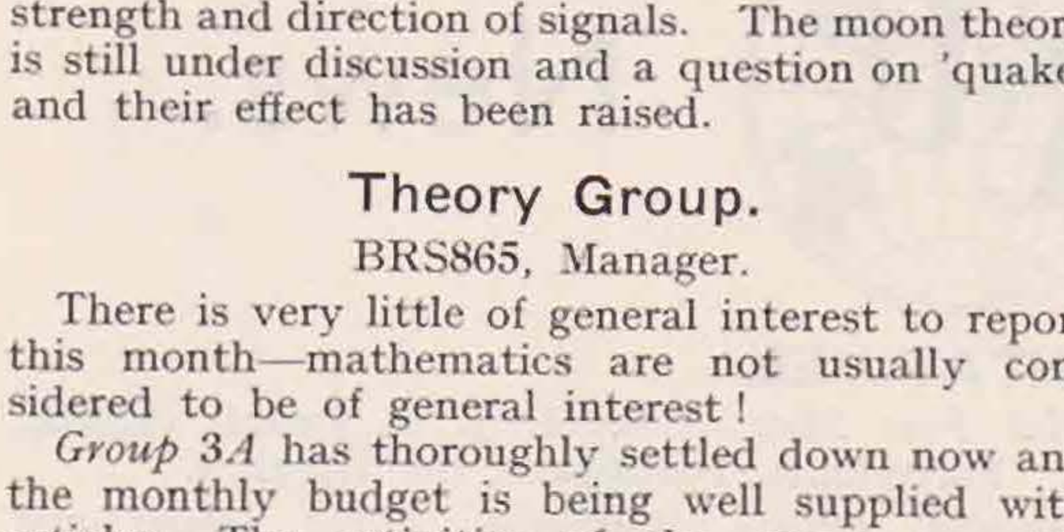
There is very little of general interest to report this month—mathematics are not usually considered to be of general interest!

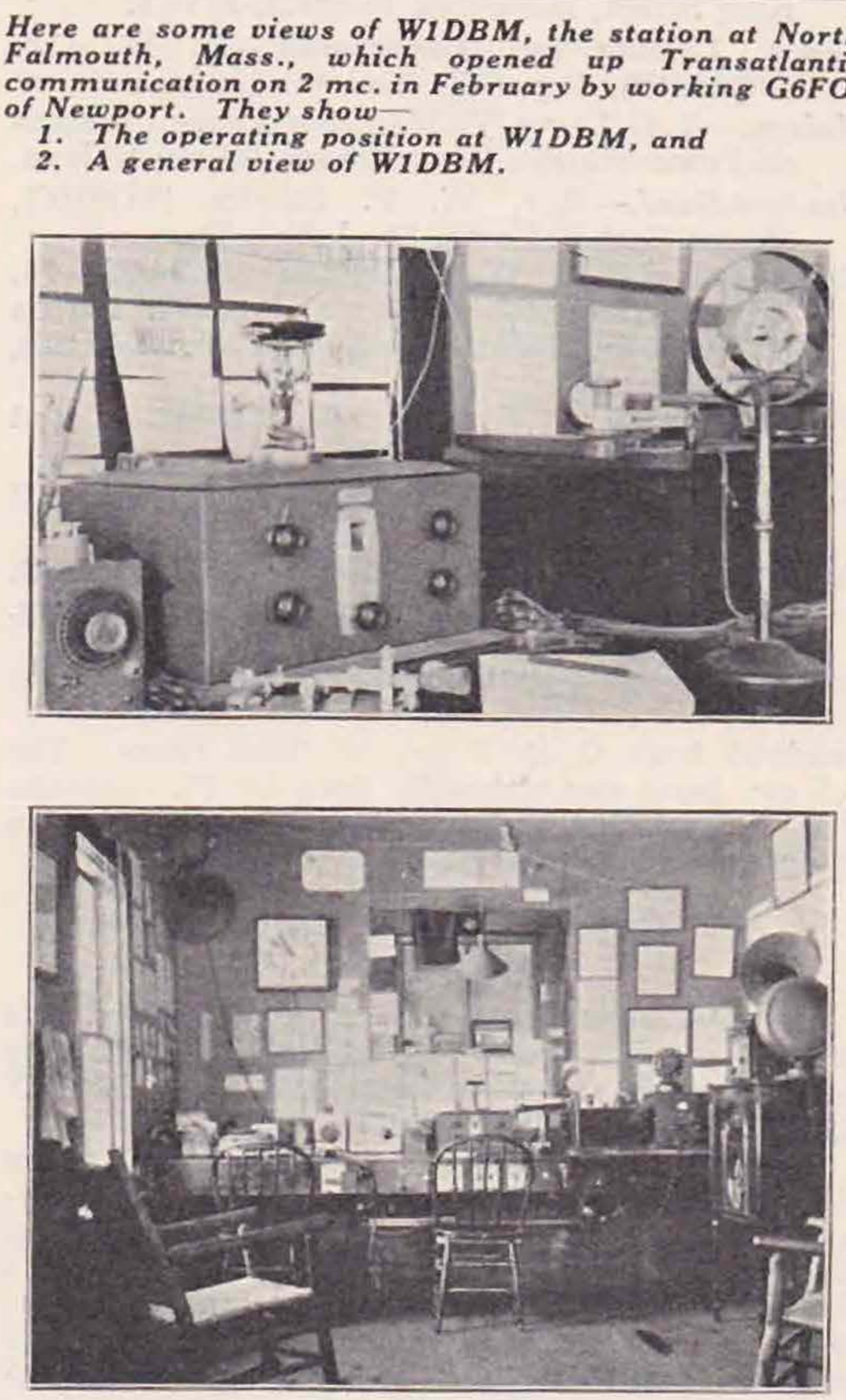
Group 3A has thoroughly settled down now and the monthly budget is being well supplied with articles. The activities of the group are still centred on reading existing theory, and interesting accounts are provided by members on important mathematical theorems and processes, such as the use of complex E.M.F.'s and the use of $\omega\sqrt{-1}$ in solving differential equations. G6FJ has summarised the work of Appleton and Taylor on the super-heterodyne and brings forward the interesting point that there exists an optimum value of the strength of local oscillations for any given signal input. He quotes several cases in which broadcast set owners find reception of weak signals very poor, due to this fact. It is hoped that some practical work on this subject will be carried out shortly.

Here are some views of W1DBM, the station at North Falmouth, Mass., which opened up Transatlantic communication on 2 mc. in February by working G6FO, of Newport. They show—

1. The operating position at W1DBM, and

2. A general view of W1DBM.





Group 3B.—I have no detailed information to hand from G6ND, but I understand that investigations are being carried out on the accuracy of the various formulæ proposed for the length of antenna tops. The vacancy mentioned in last month's "BULL." has been filled by a new member, BRS1095.

2 M.C. Group.

G5UM, Manager.

Group 10A still awaits news from U.S.A. regarding the highly successful 2 mc. Transatlantic test that was held in February, when G6FO worked W1DBM with only 9.7 watts input. However, some very interesting material circulated in the letter-budget provides valuable food for thought.

It appears from the logs submitted that conditions were quite good on 2 mc. at the beginning of the tests (February 18-19), but gradually deteriorated towards the end of the series. G5UM attributes this fact, in part, to the gradually lengthening period of daylight each morning as February progressed. Another important fact to note, however, is that the advent of exceptionally severe blizzards during the last few days of February brought heavy QRN which, with the additional trial of "small boat" interference, made 2 mc. working very difficult. Suffice it to say, then, that W1DBM was logged in this country most mornings that he was on, but apart from W1APK and W2ASH on February 19, no other Americans were heard.

Apart from G6FO's contact of February 19, it is believed that he has been heard several times on the other side. On February 21 he was received by WICHV, and on February 22 by W1BMW, W1CHV and W1DBM.

G6FO submits an interesting theory on the matter. He says:—

"During the December test, conditions were particularly good from West to East. We did not get over at all, but W1DBM was received by me at fully four times the strength at which I got him at his best this time. He was QSA5 R7 on the indoor aerial in early December. During the February test, however, conditions have been good from East to West. We have been getting across on what amounts to extreme QRP, and only on the morning of February 19 did I personally hear any other W stations. Results here have shown that the peak period is about 06.30 G.M.T. From this it seems to me that next season we shall find it comparatively easy to work the States about the beginning of January from 05.30 to 07.30, with a peak probably at 06.30."

G2IP, of Bristol, reports the reception at very weak strength of W1AQF on February 26. G2YI had no luck at all. G5RX was in the throes of rebuilding when the circular announcing the tests was received. This was particularly unfortunate, as he is one of the most consistent 2 mc. stations.

Group 10B.—G.C. G6OO reports apathy on the part of his members. Only he and G6UJ continue to do any serious work on the band. Both have had considerable success with telephony experiments.

Group 10C has now been re-formed under the leadership of G2CT. During the February Transatlantic tests, G5WU maintained regular watch for the Americans, and logged W1DBM several

(*Continued on page* 327.)

Empire B.E.R.U. News.

B.E.R.U. REPRESENTATIVES.

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

Bahamas, Bermuda and the Eastern Part of the West Indies.—H. B. Trasler, No. 2 Mess, Pointe à Pierre, Trinidad, B.W.I.

Burma.—W. G. F. Wedderspoon (VU2JB), Government High School, Akyab, Burma.

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

Ceylon and South India.—G. Todd (VS7GT), District Engineers Bungalow, Nuwara Eliya, Ceylon.

Channel Islands.—H. J. Ahier (G5OU), Lansdowne House, 45a, Colomberie, St. Helier, Jersey, C.I.

Egypt and Sudan.—E. S. Cole (SU1EC), Haking House, Abbassia, Cairo, Egypt.

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

Iraq.—S. A. Rance (YI2DS), A Bungalow, 203 Squadron, R.A.F., Basra.

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

Jamaica, British Honduras, Turks Island and Cayman Island.—C. M. Lyons, (VP5MK), 68½, King Street, Kingston, Jamaica, B.W.I.

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

Malaya.—T. G. Laver (VS3AC), Government Electrical Power Station, Johore Bharu, Johore, Malaya.

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

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

Nigeria.—Capt. G. C. Wilmot (ZD2A), Depot Nigeria Regt., Zaria, Nigeria.

North India.—T. C. Pratley (VU2AH), Aircraft Depot, Drigh Road, Sind.

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

On the opposite page we publish a few words about BERS74. There must be many others who could say a little about themselves, without writing a long station description. (The latter, by the way, are usually requested by the Editor after having done some outstanding piece of work in, say, a recent contest.) We welcome further information from at home and abroad and will publish, each month, not more than one such short description in each of the sections "Notes and News from the British Isles" and "Empire News." One photograph only and not more than 250 words, please.

Australia.

By VK2HC.

The A.R.A. (N.S.W.) arranged a 28 mc. test during February and March, and reports from Empire stations are awaited with interest. During the Senior B.E.R.U. Contest some of the VK stations put up good scores, ; these included 2OC, 3UK, 3ML, 3WL, 3BQ, 4GK, 5HG, 5GR. On 14 mc. conditions were fair, but the 7 mc. band brightened up well, mainly from 18.00-20.30 G.M.T., although VS6, VU and a few South African stations were heard earlier. Excellent signals have been received from G on 7 mc. at these times. The 3.5 mc. band was unusually dead for ZL contacts. The Annual W.I.A. Convention is to be held in Melbourne on February 28.

Ceylon and S. India.

By VS7GT.

February.—No reports have been received this month, and it is believed that VS7GT is the only active station at the moment as VS7AL is QRT again owing to battery trouble.

The period set aside for the Senior Trophy Contest has now passed. This long and eagerly-awaited event has proved most disappointing. Terrific QRN and QRM have made this year's Trophy Contest more a test of endurance than of skill. A notable feature of the Senior Test was the absence of G stations on 14 mc., VK6 on both 7 and 14 mc. and the difficulty encountered in raising SU and ZU. No VE's have so far been heard. Conditions generally during the Senior Contest were at their worst for many months, and it is unlikely that VS7 or VU will occupy the same happy positions in the final list as were achieved last year!

Channel Islands.

By G5OU.

After a quiet period activity seems to be increasing. G2ZC, 5OU, 2BYO, 2BDP, 2BCS and BRS1042 are active, the latter being the first R.S.G.B. member in Sark. 2BCS is expected to receive his full licence shortly.

Egypt.

By SU1EC (*via* G5ML).

Conditions on 7 mc. were good during March, as was Western DX on 14 mc. between 04.00 and 06.00 G.M.T. SU1EC was off the air during the month owing to service calls. SU1AA was preparing for the W.D. Desert Expedition (details appear in a separate page), whilst SU6HL was keeping 'phone schedules with another desert motor expedition. SU1MM and SU1SG are new amateurs in Alexandria, and both have been active. SU1CX has been heard, but his whereabouts are unknown. SU1CH is still inactive. SU1SK has started up in Heliopolis.

Iraq.

By YI2DS.

In contributing these, my first B.E.R.U. notes, I wish to take the opportunity of conveying my thanks to the H.Q. Council for the honour accorded me in appointing me B.E.R.U. representative for Iraq. I also desire through this medium to wish ex YI6BZ, on behalf of all YI stations, every success and the best of good luck during his stay in India.

YI2FU and others have recently been restricted in their operations for service reasons, but I hope shortly to report that all Baghdad stations are fully active again. Conditions on 7 and 14 mc. during March have been very much below those noticed during February. QRN has been increasing on 14 mc. during the day and decreasing to zero two hours after darkness.

On 7 mc. static has been encountered from early evening until after midnight, when it has ceased until two hours after dawn.

Jamaica.

By VP5MK.

During February several of our stations had the pleasure of contacts on 3.5 mc. with VP5PZ via W2AC. We had the pleasure of meeting recently the father of Mr. J. Lees, G2IO, Mr. Ralli, G2II, and Mr. Wright, G2YD.

VP5CC was again heard on the air when he visited VP5MR for the Tattoo. VP5NH is using a low power Hartley transmitter on 14 mcs. and is making many good contacts. VP5GM is also active on 14 mc., as is also VP5DD.

Nigeria.

By ZD2A (via G5YV).

Conditions here on 14 mc. were erratic during March. On 7 mc. static level rose with the approach of the tornado season, with the result that little work has been possible. The Empire Broadcast Station GSF continues to be well received in the mornings and afternoons.

South Africa.

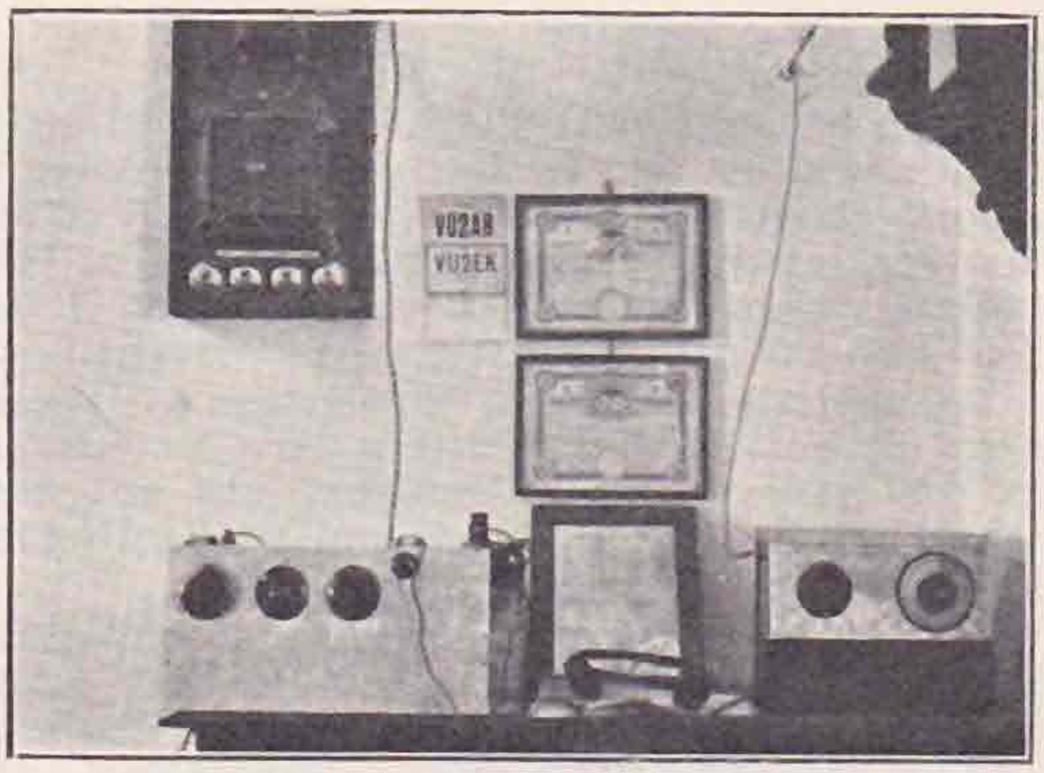
From ZT6X (via SU6W and G5ML).

There was a marked falling off of DX conditions during March on 7 mc., whilst a pronounced skip has been noticeable locally, which is very unusual for this time of year.

We were sorry to hear of the bad luck of the LMZ Expedition, and, although several stations were standing by, as far as we know, no signals were picked up in South Africa from the Expedition.

BERS74.

L. A. C. HORTON (BERS74) is stationed with No. 31 (AC) Squadron, R.A.F., Quetta, Baluchistan, India, a QRA which seems ideal for the reception of amateur signals.



Quetta is about 5,400 ft. above mean sea level, and has mountains 7,000 ft. high on three sides, North, East and West. As might be expected at such a QRA the temperature range is considerable, varying from 100° F. in the summer to about minus 10° F. in the winter.

QRN is particularly bad during the summer, as it is in most hill districts of India, becoming so bad at its worst as to make listening hardly possible. The winter period is a different matter, the limit to the stations received being the patience of the listener.

The receiver at present in use is a straightforward O-V-2 with capacity reaction, all circuits being well decoupled. The receiver is contained in an aluminium cabinet which was made for BERS74 by VU2DR when BERS74 was touring Central India. VU2DR's good effort was followed by an equally good effort on the part of BERS74, for the efficiency of the receiver was thoroughly proved during the 1932 B.E.R.U. Contest. The components used are all of good repute—Polar type C variable condensers, coils wound on Eddystone formers, with Cossor and Osram 2-volt valves.

The opening of the Empire Broadcasting Station has started yearnings for a more ambitious receiver, and an A.C. SG-V-Pen. is now under test. Results up to the present have been good but variable. This receiver is on the left of the bench in the photo, the O-V-2 being on the right.

BERS74 has one bad grouse—no amateur transmitters are allowed in Baluchistan. Perhaps the brass hats will change their minds one day. Who knows ?

Stray.

Mr. S. A. Rance (YI2DS) of Basrah, has been appointed B.E.R.U. Representative in Iraq, in succession to Mr. Hamblin (YI6HT), who has asked to be relieved of this office owing to service demands on his time.

NOTES and NEWS from the BRITISH ISLES

DISTRICT REPRESENTATIVES.

DISTRICT 1 (North-Western).
(Cumberland, Westmorland, Cheshire, Lancashire.)
MR. S. HIGSON (G2RV), "Hebblecroft," Egremont Promenade, Wallasey, Cheshire.

DISTRICT 2 (North-Eastern).
West Riding, Durham, Northumberland).
MR. L. W. PARRY, G6PY), 13, Huddersfield Road, Barnsley, Yorks.

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

DISTRICT 4 (East Midlands).
(Derby, Leicester, Northants, Notts.)
MR. H. B. OLD (G2VQ), 3, St. Jude's Avenue, Mapperley, Nottingham.

DISTRICT 5 (Western).
(Hereford, Oxford, Wiltshire, Gloucester.)
CAPT. G. C. PRICE (G2OP), 2, St. Anne's Villas, Hewlett Road, Cheltenham, Glos.

DISTRICT 6 (South-Western).
(Cornwall, Devon, Dorset, Somerset.)
MR. H. A. BARTLETT (G5QA), "Donbar," Birchy Barton Road, Exeter, Devon.

DISTRICT 7 (Southern).
(Berkshire, Hampshire, Surrey.)
Mr. E. A. DEDMAN (G2NH), 63a, Kingston Rd., New Malden, Surrey.

DISTRICT 8 (Eastern).
(Cambridge, Huntingdon, Norfolk, Suffolk.)
MR. S. TOWNSEND (G2CJ), 115, Earlham Road, Norwich.

DISTRICT 9 (Home Counties).
(Bedfordshire, Hertfordshire, Essex, Buckinghamshire.
MR. F. L. STOLLERY (G5QV), "Kingsmead," Lancaster Gardens East, Clacton-on-Sea, Essex.

DISTRICT 10 (South Wales and Monmouth).
(Monmouth, Glamorgan, Breconshire, Carmarthen, Cardigan, Pembroke.)
MR. A. J. E. FORSYTH (G6FO), "St. Aubyns," Gold Tops, Newport Mon.

DISTRICT 11 (North Wales).
(Anglesey, Carnarvon, Denbighshire, Flintshire, Merioneth, Montgomery, Radnorshire.)
Mr. T. Vaughan Williams (G6IW), "Malincourt," Grosvenor Ave., Rhyl, Flintshire.

DISTRICT 12 (London North).
Mr. S. BUCKINGHAM (G5QF), 19, Oakleigh Road, Whetstone, N.20.

DISTRICT 13 (London South).
MR. A. D. GAY (G6NF), 49, Thornlaw Road, West Norwood, S.E.27.

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

DISTRICT 15 (London West and Middlesex).
MR. H. V. WILKINS (G6WN), 81, Studland Road, Hanwell, W.7.

DISTRICT 16 (South-Eastern).
(Kent and Sussex).
MR. H. A. M. WHYTE (G6WY), Killiney, Worsley Bridge Road Beckenham, Kent.

DISTRICT 17 (Mid East).
(Rutland, Lincoln and E. Riding.)
MR. A. E. LIVESEY (G6LI), Stourton Hall, Horncastle, Lincs.

SCOTLAND.
MR. J. WYLLIE (G5YG), 31, Lubnaig Road, Newlands, Glasgow.

NORTHERN IRELAND.
Mr. C. MORTON, (GI5MO), 27, Bristol Avenue, Belfast.

District Notes for publication should be written as concisely as possible and should be in the Editor's hands by the 25th of the month preceding publication. They should be of a general rather than personal nature. Individual reports from County Representatives will not be accepted for publication.

DISTRICT 1 (North-Western).

It is pleasing to record for the first time for many months some activity in the two Northern counties of Westmorland and Cumberland. G6JZ is active on 14 mc., and with an input of four watts, recently worked YI6BZ. BRS1043 has heard all continents on 7 and 14 mc., and G2YN, after an absence of six months, is rebuilding his station, and hopes to be active very shortly. We are pleased to welcome a new BRS in Carlisle, and we understand that G5ZT, of Preston, will also make his debut in the course of the next few weeks.

It is interesting to report that a station in this district, G2OI, was able to assist the Pan-American Polar Expedition NX1XL, recently, when an important experimental message was relayed to the States.

The Manchester area is still active, and is represented on the air by the following stations: G2BK, 2DF, 2DH, 2OI, 2WP, 5KD, 5MB, 5OZ, 5PX, 5WR, 5YD, 6AX, 6GV, 6JN, 6ZU, and 2BMX.

A revival of interest in 56 mc. work is taking place in West Cheshire. G5CN, 2AGT, and 2ADG are busily preparing for future tests. G2OA made use of the 3.5 mc. band during the ARRL contest, by coupling his antenna to the 3.5 mc. stage of his 14 mc. transmitter, and by this method succeeded in scoring about 460 points. G5FC and G6OM are also working on this band. G5GY is using the Telefunken system of Modulation on 1.7 and 7 mc. 2AOO is at present busily engaged on patent work.

The invitation extended to members to forward particulars of the crystals they possess, for inclusion in the District Crystal Register, has not been accepted. To date no member in the District has forwarded the particulars required.

Nine members of No. 1 District attended the Birmingham Conventionette, and on their behalf I wish to convey our best thanks to Mr. Desmond and his colleagues, for a most enjoyable day. The station visits made late in the evening were extremely interesting, and although the weather was as bad as it could possibly be, the two car parties arrived safely home in the small hours of the following morning.

DISTRICT 2 (North-Eastern).

Activities in the Middlesbrough area have brightened up considerably. G5XT has been testing various modulation methods and is active

on 3 bands; he would welcome reports on his telephony transmissions and seeks information regarding aerials. [Suggest writing to G2OP.—Ed.] G5QU is concentrating on the 3.5 mc. band, and is experimenting with harmonic crystal control, in the M.O. stage. G5CV has been testing aerial systems for use on 3.5 mc. G5CU is using telephony on 7 mc., but as he is shortly leaving the district, no serious experimental work is being undertaken on the other bands. BRS1016, 2AVM, and BRS922 are all active. A start has been made on the Area Headquarters transmitter, and it is hoped to have this on the air shortly. From Yorkshire G5CT is reported active on 1.7, 7 and 14 mc., but owing to a difficult location, results are rather discouraging. G6VR is still confined to a sick bed, but hopes to be active shortly.

DISTRICT 3 (West Midlands).

The Annual Conventionette held on March 19 was attended by 59 members. We were honoured by the presence of our President, Mr. H. Bevan Swift, who was making his first official visit to the West Midlands District. No less than nine District Representatives and members from 12 districts were in attendance, together with our Secretary and four members of Council. This representative attendance is, we believe, a record for the Provinces.

Mr. Bevan Swift presided at the luncheon, following which the usual toasts were given. After lunch, Mr. Clarricoats gave a most interesting report of Society progress, which was followed by a general discussion. Station visits were organised after tea, when parties were shown over G2PD, 5BJ, 5ML, 5NI, 6DL, 6KI, and 6XQ.

Thanks are extended to all who made the event an outstanding success.

District reports are as usual sparse. BRS427 sends a list of American amateur fone stations heard, which includes stations in all districts except W5.

We are pleased to welcome Mr. Cecil Runeckles (ex-SU8RS) into this district, and hope his stay will prove happy and successful.

DISTRICT 4 (East-Midlands).

[In the absence of notes from the DR, Mr. Lees (G2IO) and Mr. Storer (G6JQ) have furnished reports covering the activities in their counties. We are advised by Mr. Lees that the No. 4 District Conventionette has been fixed for July 9 in Nottingham.—Ed.]

The B.E.R.U. Contest helped several Nottingham members to contact distant Empire Stations. G6DS and G6KQ await cards to claim WBE. We welcome G5YP back to the district from No. 3. G6PZ and G6KX are busy with aerial tests. The following are heard to be active: G2HD, 2OC, 2IO, 5DM, 5VU, 6CD, 6DS, 6KQ, 6KX, 6MN, 6VB, also 2AWC, 2BMR, BRS595, BRS726, BRS784.

Most of the Leicester members are either on the air or are busy rebuilding.

G5VH has rebuilt his 7 and 14 mc. Tx for choke control fone and has constructed a condenser microphone. G6GF is rebuilding his transmitters, and has been active on 56 mc. G6WU is active on 7 and 14 mc. G6JQ is active on 3.5, 7, 14 and 56 mc., and is testing out the "2BI aerial" with good results.

BRS1028 has received his AA permit and is now 2ADC. 2BHA has been rebuilding, as has 2BVN. BRS884, as usual, sent in a very good report.

DISTRICT 5 (Western).

Arrangements have been made for the Annual Conventionette to take place on Sunday, May 7, at the Grand Hotel, Bristol. Members will assemble at mid-day and lunch will be served at 1 p.m. The usual business meeting will take place during the afternoon, and following this, it is hoped that Dr. Marston, G2PD, will show his film of G5ML winning the B.E.R.U. Contest last year. Tea will be taken at 4.30 p.m., and following this, visits will be made to local stations. The inclusive charge will be 5s., and in order that the necessary catering arrangements may be made, all members who propose attending are asked to advise Mr. W. B. Weber, G6QW, at 2, Balmoral Road, St. Andrews, Bristol, immediately. Visitors from other Districts are asked to notify the D.R. It will be remembered that this District holds the record for Provincial Conventionette attendances, and it is hoped that this year our previous figures will be broken.

There is little of general interest to report this month, except that four Gloucestershire stations are now operating on naval wavelengths in connection with the R.N.W.A.R. The Gloucester Radio Club are arranging a number of field days, for the summer, and full particulars may be obtained from the Hon. Secretary, J. W. Hamilton, 2ASX, Sandhurst, Upper Parting.

No. 17 District Conventionette

GROSVENOR HOTEL, Carr Lane, HULL

SUNDAY, 30th APRIL, 1933

Lunch 1.30 p.m. (3s. per head)

Afternoon Tea 5.0 p.m. (1s.)

Business Meeting during the afternoon to be addressed by Mr. J. Clarricoats, Mr. H. B. Old, District and County Representatives.

"A Cordial welcome to visitors—and please bring a Party."

Arrangements have been made for two separate stations to be in operation during National Field Day. One station will work on the 1.7 and 3.5 mc. band, whilst the other will operate on 7 and 14 mc. Members who are willing to assist are asked to communicate with the D.R. immediately. He will welcome the loan of generators and receivers for this event, and in order to make it an assured success, each station will require a string of good operators, a supply of cars, tents, cooks, grub, beer, beds, and what-not!! Further details regarding the venue of the two stations will be published in the next notes.

DISTRICT 6 (South-Western).

Conditions during March deteriorated considerably as compared with those noted during the previous two months. G2FN is maintaining a schedule with YI6HT and VU2AH on 28 mc. from 12.00 to 12.20 G.M.T. each Sunday. It is hoped later to include some of the SU stations in this schedule. G5SY is also working on this band,

but has no contacts to report. A cordial welcome is extended to G2BL, of Winscombe; BRS1088, of St. Ives; and BRS1089, of Penryn. It is hoped that these gentlemen will report by the 20th of each month, and that all of them will contribute to the monthly Letter Budget. Several members took part in the A.R.R.L. Tests, when reasonably good conditions prevailed. It is hoped to organise a 28 and 56 mc. Field Day during the Easter week-end; reports on signals heard from G5QA during that period will be welcomed. The following stations report active: G2FN, 2ZP, 5QA, 5QS, 5SY, 5VL, 5WY, 5YB, 5YR, 6QH, 6RP, BRS836, 958, and 1100.

DISTRICT 7 (Southern).

There have been several enquiries as to the date and venue of our Conventionette, and to settle any doubts that there may be about this matter, No. 7 District Conventionette will be held at Southsea on Sunday, June 25, 1933. The exact venue has yet to be fixed, but will be duly announced in the BULLETIN.

The March meeting, held at G6GS, was well attended, all the usual stalwarts and two new members being present. The question of our own field days and our support of the National Field Day was discussed at some length, and was finally adjourned for discussion at the next meeting. G5LC is now operating from his new QRA, and will welcome visits from any members who happen to be in his district. 2BWG has taken his morse test and will probably be licenced by the time this appears. VU2FP, an old member of No. 7 District, sends a long letter for the Letter Budget, containing much useful information on amateur activity and radio conditions in India. G6GZ had the misfortune to lose his 70-ft. mast during the ARRL tests, but signals were soon going out again on a temporary Windom.

The May meeting will be held at G2YL, "Redholm," Walton-on-the-Hill, near Tadworth, Surrey, on Sunday, April 30, at 14.30 B.S.T.

G2YL's station is well worth a visit and we hope all will turn up who possibly can.

DISTRICT 8 (Eastern).

The District Conventionette took place at Cambridge on March 5, and I think we can claim that it was a success.

This was the District's first attempt at the organisation of a show of this kind, but, thanks to the efforts of G6BS, who did most of the work, an attendance of 71 was obtained. This number includes, of course, many members from outside the District and also members of the Pye Short-wave Club, who were good enough to support us.

In the space of these notes it is impossible to thank everyone individually, but our special thanks are due to the contingents from London, Kettering and Bishop's Stortford.

We met, in the morning, in the Market Place at Cambridge and here, unfortunately before we had attained our full strength, a Press photograph was taken. The party then divided, some going to the University Science Laboratory, where various demonstrations of interest were given by Mr. Campbell, while the remainder were conducted over the works of the Pye Radio Co., Ltd., by Mr. Jones (G5JO), the Assistant Works Manager. Several members of the company's staff attended, specially, at the works, and despite the fact that it was Sunday, we saw many of the machines in operation.

Following this came station-visits, and then lunch at The Lion Hotel. After reports by the County Representatives, the meeting was addressed by our Secretary (G6CL). He dealt, in particular, with the result of the Madrid Conference. We were urged to make better use of our two lower-frequency bands, for it is here that our privileges may be curtailed in future, unless we make full use of them. G6CL also dealt with the working of the QSL Section, and most of us were astonished to hear that this Section deals with over 180,000 cards each year. This was the first occasion on which G6CL had addressed such a meeting as Secretary of the Society, as distinct from Honorary Secretary, and at the conclusion of his speech, a resolution was unanimously passed, supporting the action of Council in appointing a full-time Secretary and, particularly, in choosing G6CL.

There was now fifteen minutes to spare, before tea, and, how I don't know, the vexed topic of Goyder-Lock cropped up. Doubtless the whole subject had been fully discussed on many previous occasions, but that made no difference. The meeting divided itself into sides, Goyder-Lock *versus* Neutralised P.A., and war was at once declared. The "P.A." gang said their brothers, the "Lock" gang, were incapable of neutralising a power-amplifier to which they received the heated retort that, anyhow, the "Lock" gang had done most DX in the B.E.R.U. Tests! It need not be mentioned, that no agreement was reached, and in fact a free fight would probably have occurred had it not been for the announcement of tea.

After tea, Mr. Britton, of the Pye Technical Staff, gave a lecture on Quiescent Push-pull, and demonstrated an all A.C. amplifier built on these lines. It certainly gave immense volume and excellent quality.

So ended our first Conventionette, but we hope to have another next year.

There are few items of general news this month. We welcome to this District Mr. Van Perlstein ex-D4HEL (also formerly known as BERS95), who is now at Ipswich. He will soon be heard with a "G" call.

Cambridgeshire is running an excellent Letter Budget, to which a few members from other counties are contributing. In fact, the demand seems so great that a second Budget will soon have to be started.

DISTRICT 9 (Home Counties).

Arrangements for the forthcoming District Conventionette are now well in hand; this event will take place at Southend-on-Sea on Sunday, June 18, and full details will appear in the next notes. We welcome G6LB into this District, he having settled down at 85, High Street, Chelmsford. G2LZ was active during the A.R.R.L. Tests and still maintains almost daily contact with ZL4AO. Interesting county reports have been received from G2HJ and G5FB, who, between them, report the following stations active: G2DQ, 2KT, 2YI, 5FB, 5LY, 5UK, 5VS, 5VT, 5QV, and 6KV; whilst BRS191, 490, 949,1047, and 1011 have reported either direct or to their C.R.s. G2WG, who met with an accident recently, is

now fully recovered and active on the 1.7 mc. band. It is considered that much improvement could be obtained in connection with work on this band, if stations would strictly carry out the terms of their licence by standing by at frequent intervals, for the purpose of receiving observations and reports on their signals.

DISTRICT 10 (South Wales and Monmouth).

The District Report for this month reveals a very healthy state of affairs, with increased activity and more co-operation all through the area.

A very full report from 2AHN, the sub-area representative, gives details of the Swansea members' activities and the doings of the Short-Wave Club, for which permanent and more suitable accommodation has been found. All members are contributing in apparatus and effort to the construction of the Club's S/W Receiver. G5PH, who is still chasing the Antipodes for WAC, works VE, W and PY on QRP, and is now trying a Windom on 14 mc. When G5TW pressed the key, giving his new CO.PA TX its first test, his aerial mast collapsed. 2AWN and 2BJH are re-building their gear, and 2AHN, besides having his hands full with Club work, has been assisting again with the Band Occupancy Checks. G5WU is putting out an excellent CC 'phone transmission on 170 m., and was very unlucky to miss the chance of a complete QSO with W1DBM on February 25, when the American called him. Conditions on 1.75 mc. at the time made a contact impossible. G5FI, using choke-control modulation, is putting good speech into Newport. BRS727 is troubled with bad motor QRM from an unsympathetic and unscrupulous neighbour, who "may do something about it in a month's time." Capt. Gelston, our new member in Cardiff, has been responsible for the emergency W/T Link between Swansea and Fishguard, between which places all communication was cut off during the recent heavy snowfalls.

In Monmouthshire, a meeting was held at G6FO on March 8, at which the following were present: G2PA, G5WU, G6YJ, BRS727, and BRS1094, the latter being the new member in Newport, Mr. Stevens.

G2PA has recommenced working DX on 14 mc. with QRP, but his MO.PA is not satisfactory. G5BI has been QSO France on 1.75 mc., which is excellent work, as he is using low power from batteries. G6YJ, emulating the "stars," has put up two aerial systems at right angles, one a Windom and the other a Zepp., with the idea of getting directional effects as required. He is covering Europe well with QRP, and has also been busy with Band Occupancy Checks. G5NS, who holds a first-class PMG certificate, has gone to sea and he takes with him our very best wishes. 2BVB has applied for a Full Licence and is getting rigged up with crystal control. BRS570 is still interested but not very active, while BRS1094 is working up his Morse and preparing to let loose an avalanche of cards. His RX is a two-valve SG det. and Pen. G6FO is struggling with a Windom like that of 2PA's. In other words, it is not a Windom, though resonance adjustable to any part of the band can be obtained by using a tapped loading coil in series with the feeder. It is actually working G2BI fashion as a full-wave 7 mc. wire, and gives quite good middle-distance DX on 7 mc. 2PA, with a shorter aerial and feeder, is of the opinion that his is also a "2BI," full-wave on 14 mc. G6YJ, the other Windom disciple, finds that his appears to be working as it should.

Four Newport members, G2PA, G6YJ, BRS1094 and the DR, are to co-operate with the local branch of the Social Service Council in running a Radio Club for the unemployed. I suggest that members in other centres offer their services to the same cause in an advisory capacity.

And now for a most important announcement. I wish to draw the attention of all members to the fact that the District Conventionette is to be held at Swansea on Sunday, May 28. About a fortnight before this date, every member in No. 10 will receive a notice giving full details of the arrangements, which will also be published in the BULLETIN. I will attempt to arrange transport by car for members from this end of the District, and I hope that everyone will make a special effort to attend, as this affair is the outstanding event of the year, and our only chance of meeting each other personally. Please book the date now, and assist your CR's by replying promptly to any notices they may send you on the subject.

DISTRICT 11 (North Wales).

In thanking Council for appointing me Acting D.R. for North Wales, I wish to express the hope that the present members in this District will use their best endeavours to keep me posted with their progress. All items for inclusion in these notes should reach the C.Rs. or myself by the 25th of each month. Mr. E. G. Foulkes, G5FU, 27, High Street, Rhyl, has agreed to act as C.R. for Flintshire, whilst Mr. D. S. Mitchell, 2BAQ, The Flagstaff, Colwyn Bay, will act as C.R. for Denbighshire. From the latter C.R. it is reported that G2II and 2BAQ are active on 56 mcs. (suggest you make definite schedules with G6QB during his Crystal Palace tests on May 21.—ED.) They are using a 7 mc. crystal with two frequency "triplers," and have all stages arranged in push pull. Power pentodes are in the first stage. It is hoped that Mr. Ralli will prepare an article for the BULLETIN shortly on this work. G2BJ is at sea, and G2FF expects to be on the air shortly. G5FU reports that his call is being "pirated."

A cordial welcome is extended to G6OK and BRS1073.

Members in the District are requested to write to me with a view to arranging a district meeting during May.

DISTRICT 12 (London North).

The March District Meeting was held at 2AQW, when 10 members were present. The question of holding future meetings on weekday evenings was discussed, but the majority of those present were in favour of Saturday evening meetings being continued. The views of other members will be appreciated.

Arrangements were made to discuss N.F.D. at G6CL on April 6. An informal discussion took place on methods of driving power amplifiers from different types of frequency-doubler valves.

Several ex-A.A. are now fully licensed, and in all cases good results have attended their early efforts. G2CV (ex-2BHT) worked "W" with an input of 3 to 4 watts, a few days after receiving

his licence, whilst G2CT (ex-2ARV) and G6YS (ex 2BKH) are both putting out good signals with low power.

BRS497 again rendered valuable service during the March Band Occupancy Checks, and made a good score, it its believed, in the B.E.R.U. Contest.

The following stations are also active: G2IM, 5CD, 5MG, 5QF, 5SA, 5UM, 5VY, 6CL, 6PP, 6UN, 6YH, BRS536, 910, 935, 956, 2AQW.

The letter budget grows larger each month. North London members who are not contributing are asked to advise the D.R. if they wish to have their names included in future distribution lists.

DISTRICT 13 (London South).

G5AW has not forwarded District notes this month, and as the D.R. was away several times during the past month, information is somewhat scarce.

Many of the higher powered stations in South London were QRT during the Junior BERU contest, but whether this was out of consideration for the QRP people, or the result of exhaustion due to the first two week-ends, is a matter for conjecture!

G5YH, who was unable to participate in the BERU contest, made up for lost time in the A.R.R.L. contest. He put up the remarkably good score of 7,898 points!

The annual general meeting of the S.L.D.R.T.S. took place on March 2, 1933, when the following officers were elected for the year. Chairman, G6NF, Vice-Chairman, G5IS, Treasurer, G2CX, Secretary 2AUG. Committee G2NH, G5AW, G5XH, G6WY. The meeting was entertained by a most instructive lecture on "Aerials" by G5IS.

DISTRICT 14 (London, East).

At the March District meeting held at G6UT, it was decided that the District should enter for the National Field Day event. Further details will be discussed at the next meeting, which has been arranged for Tuesday evening, April 25, at G6UT.

A very successful District Field Day was held at Rookwood Hall, Abbess Roothing, on March 26.

Two crystal-controlled transmitters were installed and contacts established on 1.7, 3.5, 7, and 14 mc. Many European stations were worked and the best DX obtained was with Iraq. Several interesting telephony contacts were established with Europe which gave our District linguist, Dr. Fereday (G6FY), an opportunity of putting to good use his extensive knowledge of the French and Dutch languages. On one occasion he was successful in working a Belgian and two Dutch stations simultaneously. The power supply was derived from motor generators very kindly loaned for the occasion by Messrs. Rotax, Ltd. (M.L. Converters).

The station used the call G6UT, and on several occasions emitted the well-known Abbess Roothing time signal! (which was not synchronised).

Cars for the occasion were kindly loaned by G6CW, 6HY, 6LL, 6TX, and BRS1086. At suitable intervals G6LL made good use of his film camera, and several interesting "shots" were obtained for inclusion in the District Fllm which it is intended to show at the London District Hamfest. It is with regret that we have to mention that several members were reported missing for a matter of two hours! Under severe cross-examination, it transpired that a local dance had drawn them from the path of duty. Their deadly sins were forgiven them when a large bottle of —— (which had been won in a raffle) was presented to the D.R. on their return.

It is reported that some promiscuous shooting was sponsored by G6CW, who acted as instructor. The latter, it is understood, is qualifying for Bisley, having shot a bat! (not in a belfry).

All members who participated in this enjoyable weekend take the opportunity of thanking the Misses Rowe, of Rookwood Hall, for their many kindnesses, and for their offer to accommodate one of the District stations in the precincts of the Hall during National Field Day.

DISTRICT 15 (London West and Middlesex).

Fourteen members attended the March District Meeting when National Field Day arrangements were the main topic for discussion. Arrangements have been made for two stations to participate in this event, G6YK will be in charge at one location, whilst G6WN (L. Wilkins) will take charge of the other station. Members are requested to advise either of these two gentlemen if they are in a position to render help. The next District Meeting will be held at G6OC, 59, Bramley Road, Ealing (nearest station, Northfields), on Thursday, April 20, at the usual time. It is hoped to be able to give a little further news of the arrangements in hand for the field day at this meeting. The D.R. was very sorry to find that so little interest was shown in the B.E.R.U. tests in this District, but hopes the BRS members will be able to put the area back on the map with their reports. Reports this month are a little better, but still far from being good. G5CV received an R9 report when working VK3WL on 7 mcs. during the B.E.R.U. tests; and has a very fine score in the A.R.R.L. tests. G6RS has worked W1 and VE3 with five watts and has been heard in VE4. He complains of bad quality signals emanating from some of the G stations on the 7 mc. band. BRS957 is now 2ABL, BRS642 found conditions on 3.5 not so good this month; he is reported to be the first London man to send a report to WDSU, New Orleans, on their 248 metre transmission. G6WN took part in both B.E.R.U. tests and the A.R.R.L. tests.

The D.R. and other District 15 members wish to take this opportunity of expressing their thanks for the fine time they had at both the Cambridge and Birmingham Conventionettes.

DISTRICT 16 (South-Eastern).

Arrangements have now been made for the District Conventionette to be held on Sunday, May 21, in Maidstone. The full programme will appear in the next notes.

From G2IG (C.R. for Kent), it is learnt that a 56 mcs. Field Day will take place on Sunday, May 7, when a 60-watt station will be automatically keyed, using his call sign. A 1,000-cycle note will be modulated. Members are invited to foregather at G2IG as early as possible on the morning of the 7th.

Sussex appears to be more active, thanks to the energy shown by the C.R., G5JZ. He and G2AO

are devoting much time to 56 mc. work, but to date no two-way contacts have been made between them. The latter station is transmitting television on the 1.75 mc. band, and excellent pictures are received at G5JZ. G2CF is newly licenced, whilst 2ABR and 2BKR expect to receive their full calls shortly. G2PF is doing useful DX work, and G5YA hopes to be active as soon as a change of address takes place.

DISTRICT 17 (Mid.-Eastern).

Full arrangements have now been made for our first district conventionette: this will take place at the Grosvenor Hotel, Carr Lane, Hull, on Sunday, April 30. The full programme is set out below. A cordial invitation is extended to all members in neighbouring districts.

Several members in the district were making preparations during March for the 3.5 mc. contest, and I hope that the results obtained have compensated them for the trouble taken in improving the efficiency of their stations.

On behalf of the district, I extend a warm welcome to the following newcomers to the eyes and ears of the East Coast :—G5XL, 2AFY, BRS194, 618, 1021, 1044, 1077 and 1118.

I am very sorry to record that Mr. Harker (G6HK), late C.R. for Lincoln, has been obliged to retire from the Society in the face of heavy demands of work on his spare time. It is pleasing to record, however, that his call sign is heard on the air from time to time.

Finally, will all members in the district notify me immediately if they intend attending the conventionette.

SCOTLAND.

Whether as an aftermath of the B.E.R.U. Contest or not, it is impossible to say, but taken all in all, things have been very quiet in March.

Generally speaking, conditions have not been too bad, if we exclude the 48 hours of March 18 and 19, when unusually violent displays of Aurora Borealis practically wiped all the bands clear of signals Certain freak results evidenced themselves during this period, and as an example, the writer, in putting a hopeless "test" call out on the 7 mc. desert, raised an R9 report from CT2AA.

At the end of these notes you will find several new crystals. I am indebted for data regarding these, not to the purchasers, as should be, but to Mr. Dedman. In one of the instances the purchaser has landed himself right in the midst of local QRM, a circumstance which could have been easily avoided if he had consulted the register of crystals at Scottish Headquarters. My sympathies are with the station interfered with, particularly as he has been doing some very useful low power DX, and further, he DID record his frequency. Now, please discontinue this neglect of the register, as it is simply rendering futile an exceedingly useful record, and in addition is not showing much consideration for your fellow-members.

There was, so far as can be discovered, only one Scottish entry for the A.R.R.L. Contest, that of G5XQ, who made 32 contacts in five American and two Canadian districts, thus scoring 672 points.

The outstanding achievement of the month is undoubtedly G6UK's contact with CE1AC on 7 mc. with an input of slightly under 4 watts. This report was R5. Miss Burns (G2IA), after a long spell of inactivity, is on the air, and can be heard on the 7 mc. band. The 3.5 mc. Contest will be complete ere these notes reach print, and the Scottish entry should be composed of G6FN, 6IZ, 6ND, 5XQ and 5YG. I understand that G6FN has a new "comic aerial" with rickets, which puts R8 signals everywhere. BRS964 and BRS939 will have entered for the receiving side.

We have pleasure in welcoming another new licence to "A" District. This has been issued to Mr. J. W. Jeffrey, Stanley, New Mains, Wishaw, Lanarkshire, formerly BRS825. The new call is G2DI, and I am sure we wish Mr. Jeffrey the best of luck.

Here are the new crystals :—Mr. Burton (G2UG), 7,106 kc.; Mr. Thomson (G6RT), 3,515 kc.; Mr. Kyle (G6WL), 7,178 kc.; Mr. Wyllie (G5YG), 7,254 kc.; Mr. Miller (2AHZ), 7,142 kc.

Around Europe.

The U.S.K.A. (Switzerland) have now 30 active transmitters on their roll of members, most of whom took part in their National Relay Tests on 3.5 mc. each Sunday from 07.00 to 11.00 G.M.T.

Weekly broadcasts to U.S.K.A. members are given at 18.00 G.M.T. Fridays, on 84 metres. HB9H transmits the broadcasts in German and HB9V in French.

Their Annual Convention takes place in Basle on April 29 and 30, when amateurs from all countries will be weclomed. All correspondence in this connection should be addressed to Mr. R. Stuber (HB9T) Kannenfeldstrasse 27 Basle.

STRAYS.

Look for G6QB !

On Sunday, May 21, G6QB, assisted by several local transmitters, will be operating a 56 mc. transmitter on the top of the Crystal Palace North Tower. It is proposed to work with an aerial directed northwards from 10.00 B.S.T. till 13.00 B.S.T., and from 14.00 B.S.T. onwards, with an aerial directed South or South-West. It is possible to see eight counties from the top of the Crystal Palace Tower, and a range of over 100 miles may easily be possible.

Will everyone who possibly can do so, be on watch for G6QB's signals on May 21 ?

G2GD states that there have been replies to his tests calls on 1,788 kc. during Sunday evenings at 18.30 G.M.T. which he has not heard. His address is "Æthelmar, Seabrook Road, Hythe, Kent," and owing to excessive screening to the immediate north of the station these calls have not been heard by him. Further, the QRM from foreign phones is terrible. What do others in the South-East of England think of the 1.7 mc. band ?

We are advised by Msr. Juniet that he has been ssued with the call F3AD. This, we believe, is the first occasion that a new series of numerical prefixes have been granted officially to stations located in France. It has in the past been a general practice to issue F3 calls to French Colonial stations.

Strays.

Mr. C. Greenaway (BRS1011) recently heard W8CNC on 3.5 mc. In acknowledging his report, W8CNC (Mr. J. R. Magree, 847, Prospect Avenue, N.W. Warren, Ohio) mentions that he will be pleased to arrange schedules on that band with G stations. He finds difficulty in receiving our stations, although he is in regular contact with U.S.A. stations on the western seaboard, and has consistently heard FM81H QRA 5 R6. W8CNC transmits regularly between 0500 G.M.T. and 0700 G.M.T. Sundays on 3,600 kcs.

* * *

Mr. G. Brunyee (ZS1AA) states that he has received for distribution a large number of QSL cards for a station signing ZU1C. As this station is unlicensed, members are warned against working him in future.

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The Advertising Manager,
T. & R. BULLETIN.

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Enclosed please find matter for our advertisement in next month's issue of the "Bull" in the miscellaneous columns.

I may state that the last issue of the advertisement in your magazine has proved exceptionally valuable. We have had orders not only from dozens of local "hams," but have received export orders which alone have more than paid the cost of the ad. I feel sure that if manufacturers realised the value of advertising to such a discriminating and enthusiastic public, your magazine would be more in the nature of a catalogue.

Yours faithfully,
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G6VP. — 'Phones, Transformers Rewound; Brown's "A" a speciality; any resistance; 24-hour service. Lowest terms in the trade.

H.T. GENERATORS, Newton: 2,000 V. at 500 mils. Speed 2,500 r.p.m., perfect order, £4. One double output 1,200 V. at 100 mil. and 8 V. at 6 amps., compound wound, also perfect, £4. Carriage forward.—CENTRAL RADIO, Mossgrove, Bridge-of-Allan.

QSL'S AND LOG BOOKS (2 rulings). Have your next batch of cards printed in NEW type by ordering from G6MN—the original English Ham Printer.

SALE.—Trans. for H.T. 10 230 v. prim., 10s.; Trans. 500-0-500 v. 120 ma. 4 v. 2½ a. 230 v. prim., 12s. 6d.; Mod. Choke 75 h. 250 ma., 25s.; H.T. 10 rect., new, 15s.; Marconi U14, new, 14s.; 3 T.C.C. wet electrolytics, 440 v. 8 mfd., 3s. each; Xtal, 7055 k.c., 10s.; Xtal, 1875 k.c., 10s.; Ferranti AF5C, 10s. (or near offers, carriage paid).—G5JM, 22, Bisterne Avenue, Walthamstow, London.

A SNIP.—Autoplex Bug Keys reduced to 10s. 6d., C.W.O. Money returned if not satisfied.—MARSHALL (G2MA), 41, Kelvinside Gardens, Glasgow.

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W.T.C. RADIO.
2 and 16, Station Road, Walthamstow, London, E.17.

Fee 2s. 6d. per list. All American replies sent on to you as soon as received. Fee includes all postage for replies, etc. We are opening English exchange department shortly.

MORSE INSTRUCTION—Day or Evening. Easy terms. Special course for beginners: faulty formation; and Advanced Students.—TELEGRAPH SCHOOL, 29, Talfourd Road, Peckham, S.E.

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