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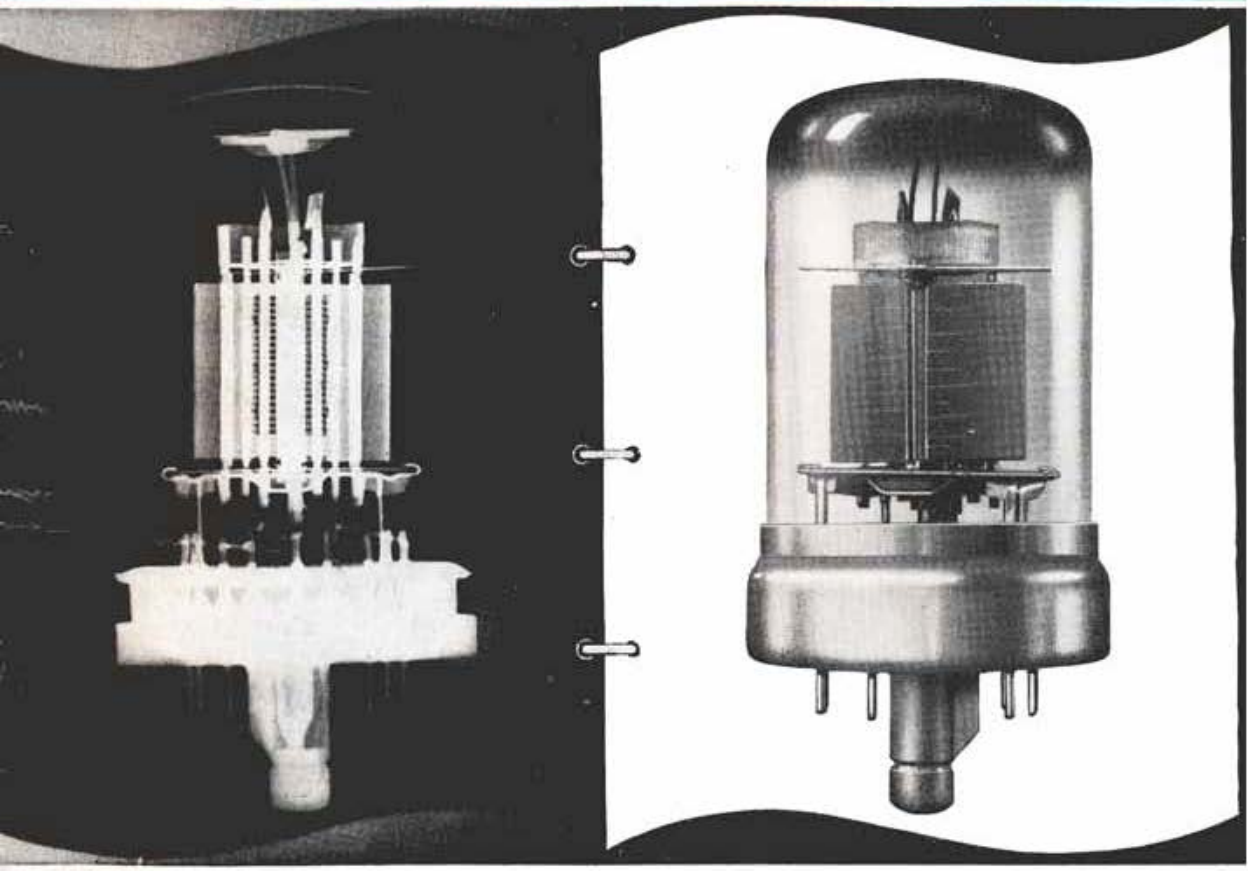
BULLETIN

JOURNAL OF THE RADIO SOCIETY OF GREAT BRITAIN



Mullard QV04-7 R.F. AMPLIFIER TETRODE

- ANODE FOLLOWER
- AN R.-C. AUDIO FREQUENCY FILTER
- MIDGET UTILITY TRANSMITTER
- 1946 TOP BAND CONTEST
- DIRECTION FINDING CONTEST

R.S.G.B. BULLETIN

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CONTENTS for MARCH, 1947

VOL. XXII — No. 9

CONTEST TIME

IN pre-war days this period of the year was unkindly described as the "silly season" by all who had set their faces against contests. "Playing numbers," some said. Well, call it what you will, it's contest time again for the first time since 1939—and what a time to be sure. The season proper opened last month with the first section of the 13th A.R.R.L. International DX Contest, followed a week later by the first section of the 'phone contest. March will see those contests completed and then will begin the grand clean-up for our own B.E.R.U. Contest. Newcomers, who have yet to enjoy fully the chase for DX, will find a new and exciting experience awaiting them, whilst the old hands will be on the lookout for those "Elusive Pimpernels" in the "rare" places on the earth's surface that have the happy knack of bobbing up during B.E.R.U. and then fading away for another 12 months—or so it seems.

This year will find some of the doughty fighters of 1939 in the novel position of having to chase the DX, instead of themselves being chased. Eric Cole for instance—the last winner of the Senior Trophy—is now just another of the 4,500 odd G's. When he last competed he was one of that small, but exclusive, band of SU's who really knew how to operate in a contest and did they set a pace !

The last Junior Trophy winner was Jack Drudge-Coates—then a VU. To-day, he is in far-off Japan but we have little doubt he will be there when the time comes to have a crack at holding the cup for another year. In like manner Australian enthusiast Eric Trebilcock will be defending his title in the B.E.R.U. Receiving Contest.

Contests call for patience, perseverance and above all, honesty. In past years there have sometimes been unpleasant happenings which have left a nasty taste in the mouth of many a competitor.

During a contest, when the competitor is under no supervision, it is an easy matter to step-up the volts, or pull out some smoothing. We can take care of the latter eventuality by disqualifying anyone who receives consistently poor tone reports, but it is not so easy to check the use of power in excess of licence. It is there that honesty comes into the picture. Unless every competitor is prepared to operate his station strictly in accordance with the rules and the *spirit* of the Contest, the whole event loses much of its interest and pleasure.

Contests bring out the best in all who claim to be good operators. By making slick calls, by choosing the right band at the right time and by selecting suitable frequencies in the chosen band, a contest can become a real pleasure. By ignoring such considerations patience is lost and disappointment results.

This year should see at least *four* of the DX bands in full use during the A.R.R.L. and B.E.R.U. Contests. We say four because we believe many good DX men tend to forget the possibilities of trans-Atlantic and trans-World contacts on 3·5 Mc/s. Clearly this band will not produce outstanding results during the hours of daylight but in March it should still be open for long distance work in the "wee sma' hours."

Empire DX Certificate Coming Shortly

The Council has approved the issue of an Empire DX Certificate which will be comparable with the A.R.R.L. DX Century Club Certificate. The rules have been approved and a further announcement will be made shortly.

In the meantime we recommend the DX fraternity to get busy and work as many parts of the Empire during the forthcoming B.E.R.U. Contest *on as many different bands* as conditions will permit.

It is perhaps too much to hope that "five" will enable any G competitor in the A.R.R.L. Contest to add a fifth band to his log sheet, but who can tell ? One thing is certain, there will be plenty of U.S. stations on "six" looking for contacts with Europe.

Although everything we have so far written relates to the DX Contests we must not forget that the Society has already staged two, more or less, inter-G, events this year and judging by the support given to them it would seem that many members are interested in these local contests.

The summer months, which seem so far away as we write, will bring with them further opportunities to try out our skill—not as individuals but as members of a team. The D/F contests are an experiment but we believe that they will justify themselves in no uncertain measure. National Field Day is already assured of a tremendous following. This year town will compete against town and as a result many more members will be taking part in the event than was ever the case before the war.

Already most town groups have laid plans for this greatest of all R.S.G.B. local events and we hear rumours that the scores attained this year will reach unheard of proportions.

N.F.D. and the D/F Contests will call for careful planning and more than careful selection of sites. With Easter only a few weeks ahead we suspect that many a T.R. has already decided to spend part of the holiday prospecting the land in his neighbourhood.

May we remind all those who compete in Society events that the Contests Committee is always willing to make innovations provided they are for the common good. If, therefore, you—Mr. Competitor—think that an event could be improved, do not hesitate to write to Headquarters.

Good luck to you all and may the best men and the best teams win. J.C.

THE ANODE FOLLOWER

A circuit in which negative feedback is applied to a single valve amplifier.

By B. H. BRIGGS, B.A. (G2FJD)*

(Norman Keith Adams Prize Winner, 1945)

Introduction

THE advantages of negative feedback are very well known (1). It may be applied to a single valve amplifier for any of the following reasons :—

(1) To improve the frequency response.

(2) To reduce harmonic distortion (especially when the valve is handling a waveform of large amplitude).

(3) To change the output impedance.

(4) To stabilize the voltage gain to a known value, independent of changes in supply voltages, valve replacement, etc.

(5) To reduce the gain to exactly unity, so that a "paraphasing" or "phase-splitting" circuit is obtained.

A well-known method of obtaining negative feedback in a single valve amplifier is by the use of an unbypassed resistance in the cathode (2). This represents *current feedback*, and although it provides some advantages, it raises the output impedance, and the frequency response may be worse with the feedback than without it. The well-known paraphasing circuit which has equal resistances in anode and cathode is an extreme form of this kind of feedback, in which the gain is reduced to unity by the feedback. When a valve is being used as a *voltage* amplifier, it is fundamental that *voltage* feedback should be applied and not current feedback, if all the advantages of negative feedback are to be obtained. The anode follower (3) (also known as a "see-saw" circuit (4), and in the special case in which the gain is reduced to unity, as a "floating paraphase" circuit), represents a simple method of applying such negative feedback to a single valve amplifier.

In this article an account of the properties of this circuit is given, together with practical details of design and several applications. All the mathematics is collected in an Appendix, and is not necessary for an understanding of the rest of the article. Practical circuits are given for the following :—

(1) A paraphasing circuit, suitable for driving an ordinary push-pull audio stage, but having a performance which makes it suitable for more stringent applications as well, *e.g.* paraphasing a fast time-base waveform.

(2) A high precision amplifier for oscilloscope work.

(3) A flexible tone-control circuit.

The formal type of circuit analysis is reduced to a minimum in this article, because it does not assist in understanding the operation. By making reasonable approximations *first*, it is possible to make the small amount of mathematics which *is* necessary almost self-evident, and entirely adequate for practical applications.

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Voltage Feedback in a Single Valve Amplifier

In order to apply voltage feedback, a known fraction of the output voltage may be taken and applied in series with the input voltage. The circuit of Fig. 1 (*a*) suggests itself, in which V_i represents the input voltage source. The feedback voltage V_f is obtained from the output voltage V_o by means of the potential divider formed by R_1 and R_2, so that :—

$$V_f = \frac{R_1}{R_1 + R_2} V_o \quad .. \quad .. \quad .. \quad (1)$$

The actual input to the grid is $V_f + V_i$, and it is obvious that the feedback is negative, because of the phase reversal in the valve. The disadvantage of this circuit is that the source of input voltage is "floating," *i.e.*, neither side is at earth potential. A transformer would have to be used in practice, as shown in Fig. 1 (*b*), and for this reason the circuit is seldom used in this form. It is quite a common arrangement for a push-pull circuit, however, where a transformer is used to supply paraphased voltages to the push-pull grids. Fig. 1 (*c*) shows the arrangement, and it will be noted that a transformer with a split secondary is necessary.

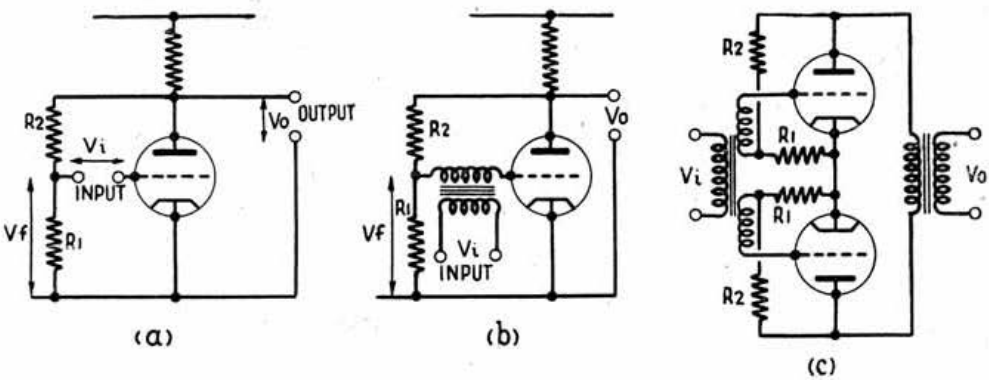


Fig. 1.

Voltage feedback applied to an amplifier. These are skeleton circuits only (no grid-bias arrangements or blocking condensers are shown)

The anode follower circuit avoids the use of a transformer. It is only a small step removed from Fig. 1 (*a*).

The Anode Follower Circuit

The circuit is shown in Fig. 2 (*a*). This is a simplified circuit, which takes no account of D.C. conditions, or grid bias for the valve. A practical circuit is given in Fig. 2 (*c*). Here the following changes have been made :—

(1). Blocking condensers C_1 and C_2 have been inserted to remove H.T. potential from the grid. (C_1 will be necessary because the input will usually be taken from the anode of a preceding valve).

(2). Normal cathode bias has been introduced. This is arranged to bias the valve to the middle of the straight part of its characteristic in the usual way.

(3). A pentode valve, of the H.F. receiving type, is shown. This is nearly always used in practice, in order to get sufficient gain to make the feedback worth while.

(4). A grid leak R_g is now necessary.

Of course, the performance of Fig. 2 (*c*) will not be identical with that of Fig. 2 (*a*), because of the changes which have been made to get the circuit into a practically usable form. Fig 2 (*c*) can be regarded as practical approximation to Fig. 2 (*a*), and by suitable design (to be explained later) the approximation can be made very close over the range of frequencies which are of interest. For the moment we return to the basic circuit of Fig. 2 (*a*) to describe the operation, remembering not to worry about D.C. conditions in the valve, but only to consider *changes* in grid and anode potentials.

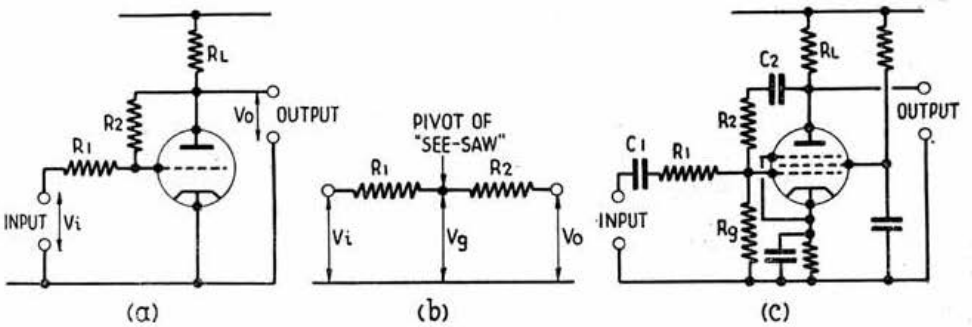


Fig. 2.
The anode follower circuit.
(*a*) Skeleton circuit. (*b*) The " see-saw." (*c*) Practical circuit.

Let the gain of the amplifier *without* feedback be A. By this is simply meant that if the grid potential changes by 1 volt, the anode potential changes by A volts. (The value of A depends, of course, on the anode load. It is not to be confused with the amplification factor of the valve). For a pentode, A will normally be of the order of 100, so that whatever waveform exists at the anode also exists at the grid, phase inverted, and of about 1/100th of the amplitude. Suppose in the first place that R_1 and R_2 are *equal*, and let the input voltage be the sine wave of Fig. 3 (*a*). The problem is to find what the amplitude of the output will be. A little thought will show that the output must be of very nearly the same amplitude as the input (but phase inverted) in order that the two may very nearly cancel out in their effect at the grid. For it has been shown that the waveform at the grid must be very small, and this waveform is the resultant of the input and output waveforms, fed to the grid through two equal resistances (Fig. 2 (*b*)). Thus the only possible output waveform is a phase-inverted version of the input waveform, only differing from it in amplitude by about 1 per cent. (Fig. 3 (*b*)), the difference being just sufficient to produce the grid waveform, Fig. 3 (*c*).

This argument shows what is the only possible output satisfying all the conditions imposed by the circuit, but it is not quite convincing, because it does not indicate the *mechanism* by which the valve maintains this state of affairs. The following remarks may help in this connection. Suppose that the output waveform were to decrease in amplitude and become appreciably less than the input waveform. Then the feedback of out-of-phase waveform from the output would decrease and would be less than the waveform fed to the grid from the input. There would therefore be a large waveform produced at the grid, and the output amplitude would immediately increase. Similarly, if the output amplitude were to increase, the negative feedback would increase, and the output would therefore decrease. The only possible equilibrium condition is with the input and output very nearly equal. Obviously they will be more nearly equal the higher the value of A.

It follows that Fig. 2 (*b*) may be pictured as a " see-saw," pivoted at the centre (grid) and having arms R_1 and R_2 of equal length. The up and down motion of the left-hand end of the " see-saw " represents the input waveform, and the motion of the right-hand end represents the output waveform.

A second explanation of the operation will now be given which brings out further points of importance. It is advisable to consider feedback circuits from several different points of view, if they are to be thoroughly understood. Their explanation is always rather difficult, because it is inevitable that, to a certain extent, the argument is circular. (The output is fed back to the input, so that the input cannot be found until the output is found, and *vice-versa*. One way to overcome this is to make an intelligent guess at the output, as was done above, and then confirm that it satisfies all the conditions).

The second explanation runs as follows. In Fig. 2 (*a*), the input voltage will set up a certain alternating current in R_1. In a properly biased amplifier there is no grid current, and so this current must all flow into R_2—in other words, the currents in R_1 and R_2 are equal. Therefore, if R_1 and R_2 are equal resistances, the amplitudes of the waveforms developed across them must be equal. If, further, it can be assumed that the grid waveform is negligibly small, it must follow that the input and output waveforms are equal in amplitude. This explanation, which at first sight seems deceptively simple, is really quite sound, and is one of the most useful ways of looking at the circuit. It indicates the two conditions which are essential for proper operation :—

(1). No current must flow from the junction of R_1 and R_2 (either into the grid, or through a grid leak resistance).

(2). The value of A must be sufficiently high to make the amplitude of the grid waveform negligibly small compared to the input and output waveforms.

The effect of *unequal* values of R_1 and R_2 can now be seen. The currents in R_1 and R_2 must still be equal, but the amplitudes of the waveforms developed across them will be proportional to their resistance values. Thus, if R_2 is greater than R_1, the output will be greater than the input (this is obvious because the feedback to the grid is less). In fact, the amplification *with feedback* is equal to R_2/R_1. The amplification depends only on the ratio of the two resistances, and is to a very large extent independent of everything

else (*e.g.* H.T. potential, valve replacement, etc.). This is a very useful feature in accurate work, *e.g.* oscilloscope amplifiers, electronic calculators. It is more nearly true the higher the value of A, since the only factor which makes it not strictly true is that the grid waveform, though small, is not zero.

The "see-saw" (Fig. 2 (*b*)) can now be pictured as having "arms" of lengths proportional to R_1 and R_2. The motion of the right-hand end is now R_2/R_1 times the motion of the left-hand end, but still exactly 180° out of phase.

Harmonic Distortion and Frequency Response

The distortion of the amplifier is reduced, and the frequency response improved, by the use of the feedback. As far as harmonic distortion is concerned, it is well known that the reduction is the same as the factor by which the gain is reduced—if the gain is reduced m times by the feedback, there will be $1/m$ of the distortion. This feature is of most use, of course, when the valve is operating at high amplitude near its distortion limit, *e.g.* in the later stages of speech amplifiers.

It is not possible to make any such exact statement about the frequency response, but the following rule will prove useful in practice. As the frequency is raised, the gain without feedback (A) will fall due to the usual causes, *e.g.* stray capacity on the anode. Let n be the gain which it is desired to obtain (*i.e.* R_2/R_1 has been made equal to n). The feedback will try to hold the gain constant, but it will eventually fail to do so when A becomes too small. At the frequency at which A has fallen to $3n$, the response will have fallen by less than 4·6 db., which for many purposes is negligible. In other words the frequency response will be flat over the range which is of interest, provided that the gain is always being reduced at least three times by the feedback. At *low* frequencies, the gain often falls due, for example, to inadequate by-passing of the cathode or screen grid. The feedback will compensate for this in a similar manner, down to the frequency at which A has again fallen to $3n$.

The above rule is justified in the Appendix, where an exact method of calculating the frequency response is given.

Output Impedance

It is well known that the output impedance of an amplifier is reduced by the use of voltage feedback. It is shown in the Appendix that the output impedance R_o of the circuit of Fig. 2 (*a*) is given by the formula

$$R_o = \frac{n+1}{g} \text{ ohms} \qquad \ldots \quad \ldots \quad \ldots \quad (2)$$

where n, as before, is the gain with feedback (*i.e.* $n = R_2/R_1$), and g is the slope of the valve. If n is small, this may be quite low. In the particular case of a paraphasing circuit ($n = 1$) the value of R_o is $2/g$, and for a valve with $g = 5mA$ per volt, this would be 400 ohms. The *cathode follower* has an output impedance of $1/g$, *i.e.* in the above case, 200 ohms. It follows that the anode follower paraphase is very nearly as good as a cathode follower from the point of view of output impedance. It may therefore replace the cathode follower with advantage whenever the additional feature of phase-inversion is required, often permitting a valve to be saved. Also a larger output amplitude can be obtained than from a cathode follower, for the same H.T. supply voltage. Even with a gain of 10, which is about the maximum which can be obtained with a single stage, if a reasonable amount of feedback is desired, the output impedance is still quite low (2,200 ohms in the above case). It is clear that this is another very useful feature of the circuit.

To summarize: the anode follower circuit has been shown to possess the following useful properties:—

(1) Accurately known and very stable voltage gain, depending only on the ratio of two resistances.
(2) Improved frequency response.
(3) Large output obtainable without distortion.
(4) Low output impedance.
(5) All these features available with a gain of from unity (paraphasing circuit) up to a practical limit of about 10 or 20, for a single stage.

Practical Points of Design

It will now be clear why the circuit is suitable for the applications which were suggested in the Introduction. Before considering these, however, it is necessary to go back to the practical circuit of Fig. 2 (*c*). It has still to be shown that it is possible to design this circuit in such a way that none of the essential properties of Fig. 2 (*a*) are lost. The various points of design can be dealt with separately:—

(1) Choice of Valve

As in all negative feedback circuits, gain is sacrificed in order to obtain other advantages. For this reason a pentode is nearly always used in order that the initial gain may be as high as possible, for the more the gain is reduced by the feedback, the better the performance will be. It is true that if a paraphase circuit is required (gain of unity), an initial gain of 20 or 30 may be ample, so that a triode may be used. There is, however, often another reason for using a pentode. With a pentode a larger output amplitude is obtainable because the anode can swing very nearly down to cathode potential without cutting off the current in the valve. With the use of feedback this full swing can be obtained with very little distortion.

(2) Choice of R_1 and R_2

If a paraphase circuit is required, make $R_2 = R_1$. If a gain of n is required, make $R_2 = nR_1$. The actual values of the resistances must be high enough not to shunt the anode load R_L too much. The following is a typical case. R_L = 50,000 ohms. Gain of 10 required. In order not to shunt R_L make R_2 = 500,000 ohms. R_1 must then be 50,000 ohms. This gives an *input impedance* (*i.e.* load on preceding circuit) of 50,000 ohms. If a higher input impedance is required, R_2 and R_1 may both be increased in value by the same factor, *e.g.* R_2 = 2M Ω, R_1 = 200,000 ohms, giving an input impedance of 200,000

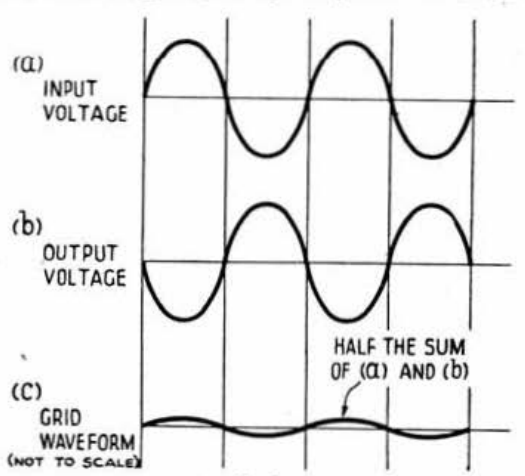


Fig. 3.
The anode follower—sinusoidal input.

ohms. Values above a few megohms should be avoided, as trouble may be experienced due to stray capacities.

(3) Choice of C_1 and C_2

At first sight it would appear that C_1 and C_2 should be very large; so large, in fact, that their reactance at the lowest frequency of interest, would be negligible compared to R_1 and R_2. It is shown in the Appendix that this is not necessary, and that the frequency response will be flat provided that C_1 and C_2 are chosen so that

$$R_1 C_1 = R_2 C_2 \quad .. \quad .. \quad .. \quad .. \quad (3)$$

(for example, in the special case of a paraphasing circuit the two condensers should be equal). The series impedance of each arm increases at low frequencies, but the *ratio* remains constant, provided the above condition is satisfied. This is fortunate, because it is important that C_1 and C_2 should have low leakage, so that very large values are not practicable. Mica condensers should be used whenever

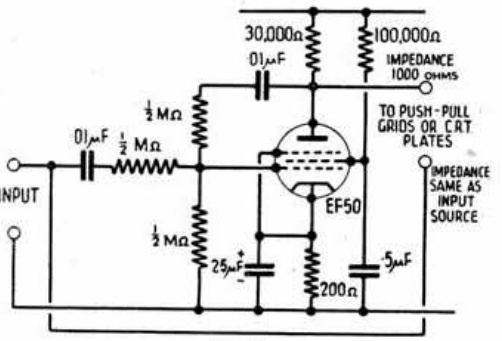


Fig. 4.
A general purpose paraphasing circuit.

possible. Note that this provides a method of interstage coupling free from the usual low frequency loss associated with R.C.-coupled amplifiers. It permits a good low frequency response without the use of large coupling condensers, with which trouble is often experienced due to leakage. The arrangement fails eventually at very low frequencies, of course, as it must do, because there is no D.C. connection. The impedance of the condensers becomes so high that the shunting effect of R_g is important (see 4 later).

It is interesting to observe what happens if C_2 is made *smaller* than the value necessary to satisfy equation (3). The impedance of the R_2 C_2 arm then rises more rapidly at low frequencies, than that of the R_1 C_1 arm, so that the amplification *increases* at low frequencies. This is often useful as a tone control, or to compensate for a low-frequency loss somewhere else in the circuit. It must be used with care, however, because the feedback is being reduced at low frequencies, so that some of the advantages may be lost. It is often useful, however, if applied as a small correction. Of course, if the valve is being used primarily as a tone control stage, a large bass boost can safely be obtained by this method, and C_2 can be made variable to control the amount.

(4) Choice of the Grid Leak R_g.

For proper operation, no current should flow from the junction of R_1 and R_2. There will be such a current if R_g is present. It is easy to see how large R_g must be made in order that its effect may be negligible. Suppose R_g is made equal to R_2. The current in R_g will then be about 1/100th of the current in R_2 if the anode waveform is 100 times the grid waveform. It follows that this value is adequately large, the current which is diverted from R_1 and R_2 to flow down R_g being negligible. Thus R_g can be made about equal to R_2 with safety, but its exact value is of no importance. (The impedance of the R_2 C_2 arm increases at low frequencies so it should be verified that R_g is adequately large at the lowest frequency of interest).

This completes the consideration of the circuit of Fig. 2 (*c*). There are other variants of the circuit. It is possible to use a single blocking condenser between the junction of R_1 and R_2 and the grid of the valve, omitting C_1 and C_2. If the input has D.C. continuity to earth, the blocking condenser C_1 can be omitted, and no grid leak will be necessary. There is no reason why the circuit should not be used with an amplifier which has a transformer in its anode circuit, instead of the resistance R_L of Fig. 2 (*c*). In this case twice the output amplitude can be obtained, because the anode can swing above H.T. potential. There is also a form of the circuit which can be used as a D.C. amplifier, no blocking condensers being used [3].

Practical Circuits

A number of practical circuits will now be given. Valves other than those specified may be used, but this may necessitate some changes in component values. Where the best possible performance is desired, valves of the high-slope type should be used (*e.g.* EF50, 6AC7, SP41), but lower slope valves (*e.g.* 6J7, EF6), may often be adequate.

(1) A General Purpose Paraphase Circuit

The valve (Fig. 4) is arranged to draw about 5 mA of anode current, at which current the slope is about 3 mA/volt; the gain *without* feedback is therefore 90 with the anode load shown. The output impedance

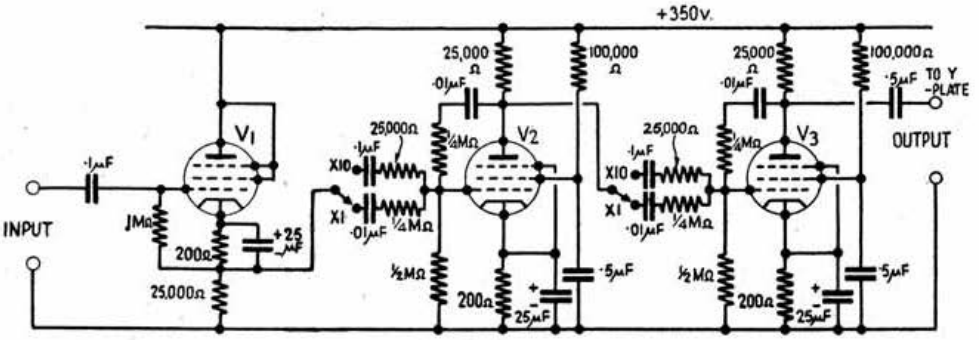


Fig. 5.
An oscilloscope amplifier. The valves used are the 6AC7 type.

is about 1,000 ohms. If it is desired to save a condenser, the cathode resistance may be left un-by-passed, though this will approximately double the output impedance. If possible, accurate high stability resistances should be used for R_1 and R_2, though if necessary a small variable resistance may be placed in series with one of them and adjusted for exact paraphasing. It should be noted that if it is required that *both* outputs should have a low impedance the input source must be a low impedance one. In such a case, it may be necessary to drive the anode follower from a preceding anode follower, cathode follower, or other low impedance source.

This circuit is specially useful where a large output amplitude is desired or where the frequency response must be very good. For example, it may be used to paraphase a time-base waveform, or a signal under observation, so that symmetrical deflection of the C.R.T. may be used (push-pull voltages applied to the two deflector plates). It is well known that this improves the focus by eliminating what is termed "deflection defocussing." [5]

gain, as this gives the lower output impedance. Further stages of amplification may be added if a greater gain than 100 is required. No trouble should be experienced due to self oscillation, owing to the fact that feedback is only applied over one stage at a time.

(3) A Flexible Tone Control Circuit

This circuit illustrates the use of the anode follower as a *linear mixer*. If several different inputs are fed to the grid of the valve through separate input resistances, each will produce its own output independently of the others; thus the output is the sum of the various inputs. The grid end of the input resistances can be regarded as being very nearly at earth potential, because the grid waveform is so small. In the circuit of Fig. 6 this mixing feature is used as a tone control. High and low frequency components of the input are first separated out by C_1 R_1 and C_2 R_2 respectively. Varying amounts are obtained by the potentiometers R_1 and R_3 and fed into the

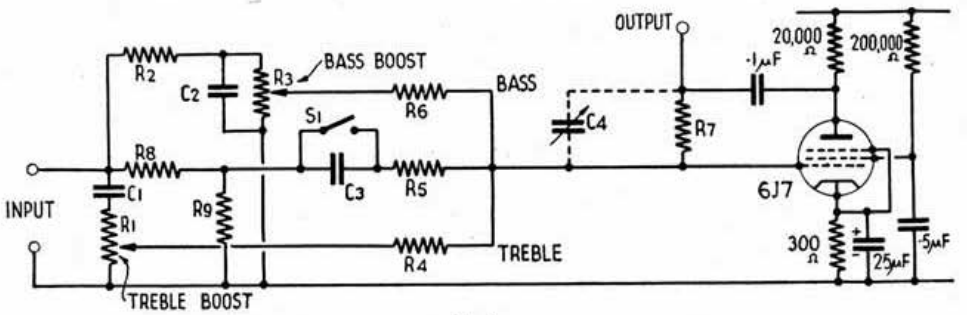


Fig. 6.
Tone control circuit.

R_1	500,000 ohms.	R_8	1 megohm.	C_1	40 μμF.	C_3	.003 μF.
$R_{2,3,4,5,6,7}$	200,000 ohms.	R_9	20,000 ohms.	C_2	.1 μF.	C_4	.0005 μF.

The valve is a 6J7 or equivalent type.

(2) An Oscilloscope Amplifier

This circuit (Fig. 5) consists essentially of two anode followers in cascade (the second two valves V_2 and V_3) each of which can be switched to have a gain of x 1 or x 10. Thus the overall amplification is x 1, x 10, or x 100. As the gain is accurately known, small waveforms may be observed and measured.

In order to avoid trouble due to stray capacities at high frequencies, the resistors in the feedback networks are kept fairly low in value; this means that when the first anode follower is giving a gain of 10, its input impedance is only 25,000 ohms. The two stages are, therefore, preceded by a cathode follower V_1, giving a very high input impedance, with very nearly unity gain. This cathode follower may, if desired, be built into a "probe" of the type familiar in connection with valve voltmeters, so that a very short lead is obtained from its grid to the point under test.

Owing to the low output impedance of the amplifier, the capacity of the oscilloscope leads and of the deflector plates will not cause trouble. In a practical case the output was connected to an oscilloscope through about four feet of wire, and the frequency response measured for a gain of x 100. (Under these conditions there would be at least 100 μμF of stray capacity across the output.) The response was flat up to 200 kc/s., and 6 db down at 500 kc/s. At the low frequency end, the response was flat down to 5 c/s., and the measurement could not be taken any lower.

When a gain of 10 is desired, it is best to work with V_2 giving the gain, and V_3 switched for unity

anode follower through input resistances R_4 and R_6 respectively. At the same time, 1/50th of the input is fed straight in, without modification of frequency response, through R_5. Thus, bass or treble boost up to 50 times the normal response is obtainable, controllable in amount by R_1 and R_3. Bass-cut and treble-cut can also be obtained if desired. For bass-cut the condenser C_3 is inserted. For treble-cut, a variable condenser C_4 (this may be of the solid dielectric type) may be placed across R_7. The type of characteristics obtained for various settings of the controls are shown in Fig. 7. As far as the middle

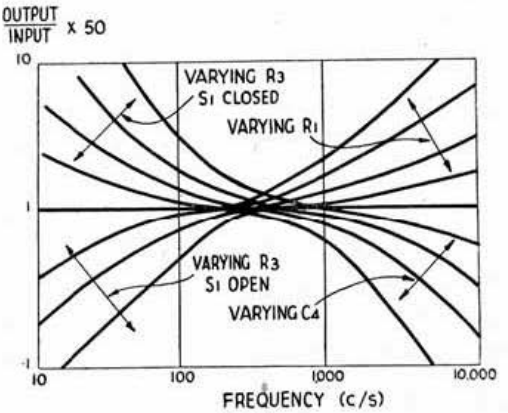


Fig. 7.
Response curves of the circuit of Fig. 6.

register is concerned there is a loss of 50 times in passing through the circuit, and this will have to be made up elsewhere. The tone control stage should be placed as late in the amplifier as possible, owing to the possibility of hum pick-up, especially on the wiring to C_4, which has neither side earthed.

References

(1). H. A. M. Clark, *Negative Feedback in Transmitters and Receivers, Part I*, R.S.G.B. BULLETIN, July, 1944.

(2). *Ibid.* Part II, August, 1944.

(3). F. C. Williams, *Introduction to Circuit Techniques for Radiolocation*. J.I.E.E. Part IIIA, No. 1, 1946, p. 289.

(4). M. G. Scroggie, *See-Saw Circuit*, "Wireless World," 51, 1945.

(5). O. S. Puckle "*Time Bases.*" Chapman & Hall, 1943. p. 109.

APPENDIX

Exact Formula for Voltage Gain

The notation of Fig. 2 (*a*) will be used. Equating the currents on R_1 & R_2, we have

$$\frac{V_i - V_g}{R_1} = \frac{V_g - V_o}{R_2}$$

But $V_o = -AV_g$ (the negative sign being included because of the phase reversal), and so V_g can be eliminated from this equation, giving finally

$$R_2 V_i = -V_o \left[R_1 + \frac{(R_1 + R_2)}{A} \right]$$

Thus

$$Gain = -\frac{R_2}{R_1 + \frac{(R_1 + R_2)}{A}} \quad .. \quad .. \quad (4)$$

(where again the negative sign indicates the phase reversal). If A is of the order of 100, the term $(R_1 + R_2)/A$ will be negligible in comparison with R_1, and so the formula reduces to R_2/R_1, as shown previously.

Frequency Response

If it is desired to find the frequency response, the exact formula (4) must be used, in which A varies with frequency, and cannot be assumed to be very large at the limits of the frequency range. As before, let the gain which it is desired to obtain be n (i.e. $n = R_2/R_1$), and let $m = A/n$. (m is the factor by which the gain is reduced by the feedback). Then equation (4) may be written :—

$$Gain = -\frac{n}{\left(1 + \frac{1}{mn} + \frac{1}{m}\right)}$$

If $n = 1$ and $m = 3$ the actual gain is $3n/5$ instead of n, representing a fall of 4·6 db. If n is greater than unity, the gain differs from n by an even smaller amount. This justifies the "factor of three" rule.

More General Case

If R_1 and R_2 are replaced by general impedances Z_1 and Z_2, then, by exactly the same mathematics, the gain will be Z_2/Z_1. There is now amplification and phase shift. Let Z_1 consist of R_1 in series with C_1, and Z_2 of R_2 in series with C_2. Then

$$\text{Gain} = \frac{Z_2}{Z_1} = \frac{R_2 - \frac{j}{\omega C_2}}{R_1 - \frac{j}{\omega C_1}} = \left(\frac{\omega C_1 R_2 - j}{\omega C_1 R_1 - j}\right) \frac{C_1}{C_2}.$$

Provided that $R_1C_1 = R_2C_2$, this is independent of frequency and equal to C_1/C_2 (or R_2/R_1).

Similarly it can be shown that if Z_1 consists of R_1 in *parallel* with a condenser C_1, and Z_2 of R_2 in parallel with C_2, the gain will be independent of frequency if $R_1C_1 = R_2C_2$. This result is sometimes useful, because the presence of *stray* capacities across R_1 and R_2 may spoil the response at high frequencies. It is then advantageous to place a small trimmer across either R_1 or R_2 and adjust for level frequency response. Small condensers are also sometimes placed across R_1 and R_2 to nullify the effect of grid to cathode capacity of the valve.

Output Impedance

Let a small change of voltage e be impressed on the anode by external means. This will cause a voltage $eR_1/(R_1 + R_2)$ to appear at the grid, and so a current equal to $eR_1g/(R_1 + R_2)$ will flow in the valve. Thus, to an external source, the valve appears as an impedance R_o of $(R_1 + R_2)/R_1g$ ohms. Since $n = R_2/R_1$ we have :

$$R_o = \frac{n + 1}{g} \text{ ohms.} \quad .. \quad .. \quad .. \quad .. \quad (2)$$

In parallel with this resistance there is the usual anode load, so the actual output impedance consists of R_o in parallel with R_L. Usually, R_L is much larger than R_o and so can be neglected. No account has been taken of R_g (Fig. 2 (*c*).). If $R_g = R_a$, the formula becomes $R_o = (n + 2)/g$.

List of Countries

Included with this issue is a leaflet containing a comprehensive list of countries. The list has been drawn up by representatives of the R.S.G.B., the A.R.R.L. and "CQ" (the U.S. West Coast magazine,) and will be used by the A.R.R.L. as a basis for the award of their DX Century Club Certificate. Additionally it will be the official reference for their Annual DX Contest.

Considerable thought and care have been expended in its compilation, and those who possess copies of pre-war lists will see that certain anomalies have been removed. For example, the Isle of Man, Baluchistan and Tasmania no longer count as separate countries, whilst the Malayan Peninsula now ranks as one country and Sikkim (AC3) becomes a separate Country. Numerous other modifications and clarifications will be apparent from a careful study of the list.

As far as the Society is concerned, we are grateful to the A.R.R.L. and "CQ" for consulting us in the matter. We feel that there cannot be too much co-operation of this kind.

As a matter of interest, the new Council is to be asked at the suggestion of the A.R.R.L. to appoint a "DX Committee" to keep such matters under constant review and to further collaborate with "CQ," the League, and other National Societies. A.O.M.

* * *

Additional copies of the leaflet are available (price 3d. each) from Headquarters.

Generous Gesture

The Hutt Valley Branch of the New Zealand Amateur Radio Transmitters Association are sending to the Society a number of tins of fat for distribution to certain members of the Society who it is hoped will benefit from such gifts. This generous gesture is warmly appreciated by the Council.

Headquarters' Station

Messrs. Stratton & Co., Ltd., of Birmingham, have very kindly offered to present to the Society a Model 640 Receiver. The offer has been accepted with thanks.

* * *

Good progress is being made in connection with the bringing into operation of Headquarters' station. Due to the recent severe weather the aerial system has not yet been erected, but it is hoped that this work will be completed at an early date.

It is anticipated that the station will begin operations within the next two months.

Incredible - but true

They have come at last! Six completely blank envelopes. We knew someone would come up to scratch! The only clue is O.A.S. at the top. Six blank unstamped envelopes for the collection of someone's QSL cards!—Yes that is what we said. There was nothing else enclosed.

AN R.-C. AUDIO FREQUENCY FILTER

By P. NEWTON NIELD (G8SH)*

THE audio frequency filter has been used by amateurs for telegraphy reception over a number of years with both straight and superhet receivers, enabling a very useful increase in selectivity and signal/noise ratio to be achieved by relatively simple means.

Audio frequency selectivity is usually obtained through the use of tuned circuits involving iron-cored chokes or transformers. These are bulky, expensive and not particularly efficient, and have a number of disadvantages, such as hum pick-up, etc.

This article attempts to describe an AF filter, composed entirely of resistances and condensers, which was originally investigated and incorporated in a communications superhet designed about a year ago, in which receiver the filter has since given a most satisfactory performance. Its few components and lack of additional front panel controls render it particularly suitable for adding to an existing straight or superhet receiver.

Facilities Provided by the Filter

(*a*) A simple circuit which, when added to the AF amplifier section of a receiver, will allow the amplification of a certain band of frequencies (usually centred about 1000 cycles/sec.) and attenuate all others outside that band.

(*b*) Frequencies within the pass band are not attenuated, and the circuit can be arranged to give a gain if required.

(*c*) Provision is made for varying the width of the pass band, and/or the attenuation of frequencies outside that band.

(*d*) The filter can be switched in or out at will.

Circuit

The basis of the circuit is the well known ladder network oscillator shown in Fig. 1. Positive feedback will occur when the overall phase shift of the network is 180°, *i.e.* at a frequency *fo* depending upon the values of *C* and *R*. For oscillation the gain of V1 must be not less than the attenuation in the network.

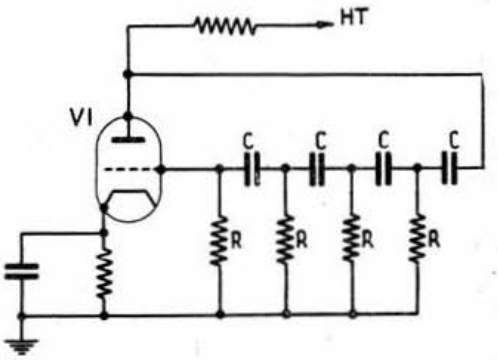


Fig. 1.
Ladder Network Oscillator.

Now if the gain is reduced just below that required for oscillation, there will still be positive feedback at *fo*, and any signals at that frequency injected into V1 grid will be amplified much more than signals of any other frequency, and by providing a feedback control the "resonant gain," *i.e.* the gain at *fo*, can be made greater or less as required. In addition, negative feedback occurs at frequencies above *fo*, reducing the gain of V1 below that without feedback, still further increasing the effectiveness of the filter. An example of the overall response curve with moderate feedback is shown in Fig. 2.

Feedback Control

One way to control feedback would be to make the last network resistor a potentiometer, and to connect V1 grid to the slider; however, interaction between this control and normal AF gain control

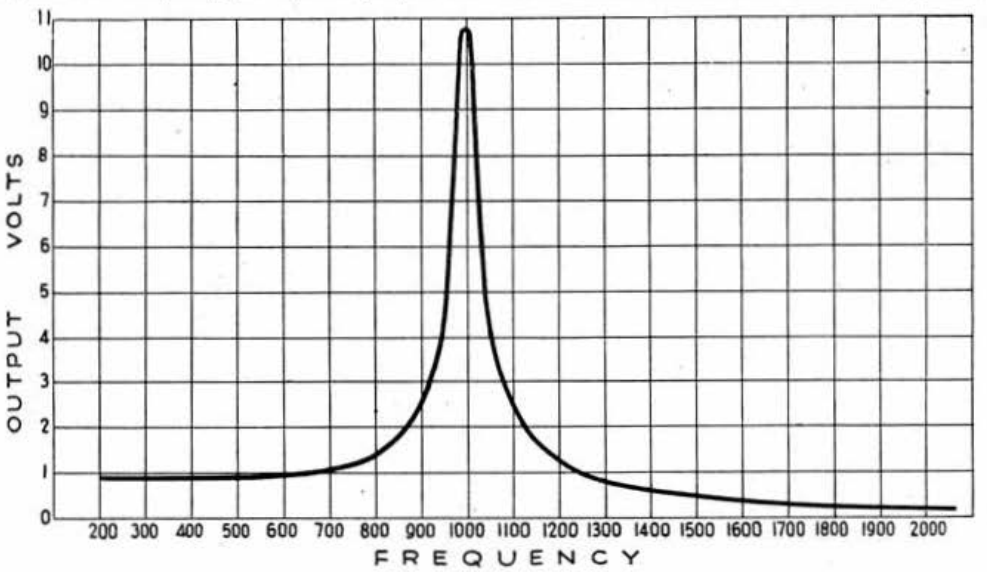


Fig. 2.
Response curve of R.-C. audio filter with constant input.

usually connected to V1 grid would occur, and make operation difficult. Figs. 3 and 4 show how the normal AF gain control was made to serve the dual purpose of AF gain and feedback control. Fig. 3 shows a double-diode-triode in a conventional second detector–first LF circuit of a superhet; R1 is the AF gain control and of course the gain is a maximum when the slider is at point "A." Fig. 4 gives the modified circuit. Four resistances and condensers and S1 have been added and the connection to point "B" on R1 has been modified.

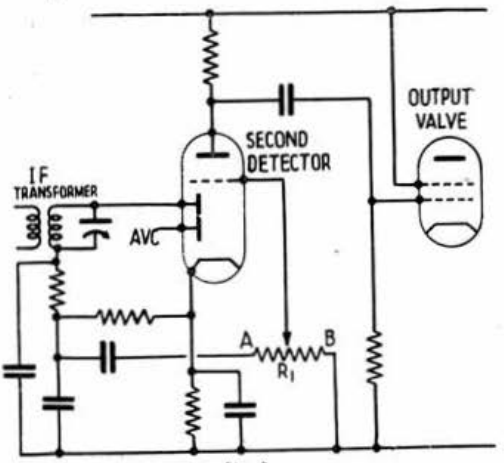


Fig. 3.
Typical second detector-first AF amplifier circuit before modification.

Consider the action of R1 with respect to feedback; when the slider is at point "B" feedback will be maximum, at point "A" it will be minimum (although not zero because of R2), *i.e.* movement of R1 slider towards "B" will reduce "signal" gain and increase feedback (and therefore "resonant" gain), while movement towards "A" will have the opposite effect; thus by suitable choice of circuit values the overall gain to a signal at a frequency *fo* can be made to appear roughly constant, and the "gain" control then acts merely as a control of selectivity, the receiver RF gain control being used to set a suitable signal level. By closing S1 the feedback is short-circuited and R1 returns to its normal function; S1 can conveniently be combined with say the tone control.

In practice, the effect of adjusting R1 is quite impressive; when receiving a faint CW signal with

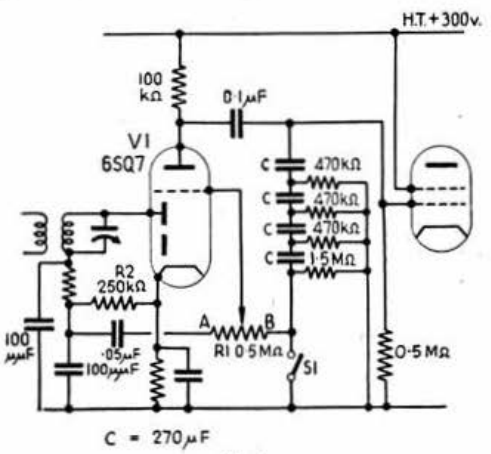


Fig. 4.
Modified circuit to include audio filter.

Table 1

Type of Network	3 section	4 section
Resonant Frequency *fo*	$\frac{1}{2\pi RC\sqrt{6}}$	$\frac{1}{2\pi RC\sqrt{\frac{10}{7}}}$
Attenuation	29	5·5
Suggested values for *fo* approx. 1000 cyles /sec. R..	470,000	470,000
Suggested values for *fo* approx. 1000 cyles /sec. C..	150μμF.	270μμF.

R1 at "A" in the presence of background noise and slightly off-frequency QRM, adjustment of R1 towards "B" causes the background noise apparently to fall away and gives an improvement in readability often approaching two "R" points.

Either a three or four section network may be used, as will be seen from Table 1. While the three section network has the advantage of requiring less components, the attenuation is greater; it is therefore only suitable when V1 gain is large. The gain of V1 should be rather larger than the network attenuation, to allow for the effect of network unbalance due to component tolerance. In the filter constructed, a high-μ triode (6SQ7) and a four section network were used, as the particular values of resistances and condensers to give a suitable resonant frequency were to hand. It will be noted that the last network resistor has to be greater in value than the others, as it is shunted by R1 and R2 in series.

* 5 Park Street, Loughborough, Leicestershire.

Loss in A.F. Transformers

By H. N. GANT (BRS 3759)*

MANY transformers handling appreciable power at audio frequencies, such as the output transformers used in speech and modulation amplifiers, or those which match output valves to a loud speaker, are wound on laminations with holes punched in the stampings. This is done for ease of mounting, screws being passed through the holes and clamps or the chassis. This method of mounting is commonly used on transformers somewhat larger than the usual commercial loudspeaker output transformer, which is generally far too small to handle anything more than a watt or so without appreciable distortion.

As the manufacturer of laminations carefully insulates one or both sides of his product, it seemed to the writer to be technically wrong that they should be short-circuited by the usual 4BA screw passing through the mounting holes. Measurements were accordingly taken on several transformers when it was found that the maximum available undistorted output was considerably greater when the securing screws were removed. In one case the improvement measured was from 6 to 8 watts, and in all cases the improvement was between 10 and 20 per cent. It was found that by using thinner screws (such as 6BA) with two turns of sticky paper tape, wrapped round the shanks before inserting them into the laminations, no measurable loss occurred.

* 92 Elspeth Rd., Clapham Common, London, S.W.11.

A MIDGET UTILITY TRANSMITTER

By D. J. G. LEGGE (G3MP)*

WHEN the writer's transmitter was recovered from the G.P.O. after its six years rest, one look was sufficient to show that in the light of modern development it was definitely not the thing. It had been modified so many times after its initial construction that the under-side of the chassis looked as though mice had been nesting there, so it was pulled down and work commenced on a new rig. Consequently, when 7 and 14 Mc/s. opened up we were caught with the soldering iron red hot and in the midst of reconstruction. Something had to be done and the little rig to be described was the result.

Circuit

As most of our financial resources were being poured into the transmitter proper the standby was of necessity an effort at economy and because the power supply is no mean item it was decided to test the possibilities of the simple AC/DC circuit as applied to the commercial domestic receiver. In this circuit the mains are applied direct to a diode rectifier whilst a resistance is used to drop the mains voltage to the correct value for the heaters which are wired in series.

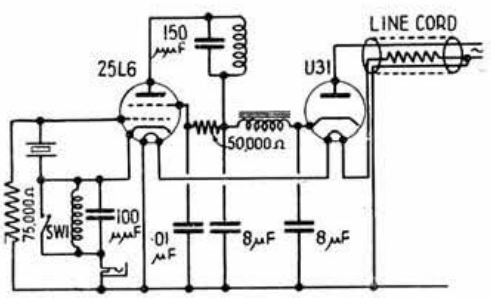


Fig. 1.
Circuit of Midget Utility Transmitter.

The valves used by the writer—both of the 25-volt type—are an Osram U31 as diode rectifier and an American 25L6 as a tritet crystal oscillator. The filament dropping resistance is a three way line cord, but a suitable resistance could be used instead; in which case it should be mounted on the rear drop of the chassis.

Apart from the power supply requirements the circuit (Fig. 1) is fairly straightforward. Smoothing is taken care of by means of a 60mA choke—such as is sold for small receiver power supplies—and two 8μF Drilitics which fit neatly under the small chassis. The 50,000 ohms resistance in the screen can be reduced in value if desired, but this is not recommended as no great increase in output results and the valve life will be considerably shortened.

As the transmitter was designed primarily for operation on 7 and 14 Mc/s. a fixed coil and condenser arrangement was employed in the cathode for use when working on the crystal harmonic, this being short circuited by means of a minature switch when working on the fundamental. Keying is also affected in the cathode, a jack being wired in series with the cathode coil and earth for this purpose.

* 19 William Road, Stapleford, Nottingham.

Construction

The aluminium chassis was cut, drilled and bent as shown in Fig. 2, and given a coat of grey paint enamel on its upper surface. Mounted on the front edge of the chassis from left to right are the switch, (for shorting the cathode coil) the two-pin socket (for the crystal) and the key-jack. These are shown in Fig. 3 which also depicts the positioning of the filter choke and tuning condenser.

Components List

- 1 150 μμF variable condenser.
- 1 100 μμF fixed condenser.
- 1 .01 μF fixed condenser.
- 2 8 μF electrolytic condenser (Dubilier).
- 1 50,000 ohms resistor.
- 1 75,000 ohms resistor.
- 1 L.F. choke (60mA receiving type).
- 1 Closed circuit jack. (Bulgin).
- 1 3-way line cord (600 ohms).
- 2 Octal type valve bases.
- 1 Valve type 25L6.
- 1 Valve type U31 (Osram).
- 1 Crystal, holder and socket (Hamrad).
- 1 Single-pole, single throw switch.

The valve sockets are mounted with their keys towards the rear of the chassis; this is an aid to obtaining short leads thereby simplifying the wiring.

It is desirable to commence wiring the series connected heaters first, as these must be as close to the chassis and as short as possible in order that no hum can be picked up from them. The line cord should not be connected to the set until the last, otherwise difficulty will be experienced in manœuvring the chassis whilst carrying out the rest of the wiring.

The cathode coil, mounted under the chassis by means of a small bracket, is located just to the rear of the key-jack. This coil is wound on a 1 in. former and consists of 6 turns of No. 22 s.w.g. spaced to occupy $\frac{5}{8}$ in. If any trouble is encountered from

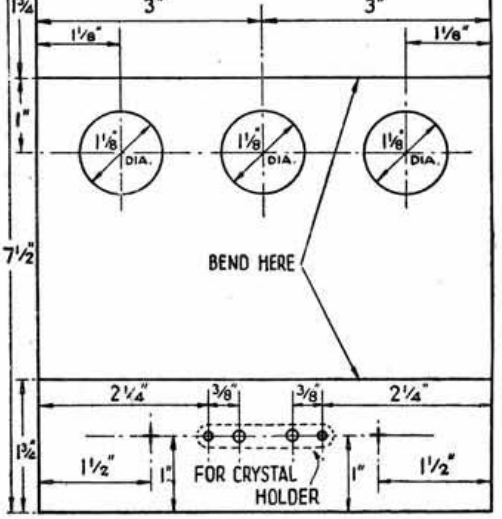


Fig. 2.
Chassis Dimensions.

spurious harmonics, an extra turn should be added to effect a cure. The above data is for use with a 7 Mc/s. crystal; if the transmitter is to be used on

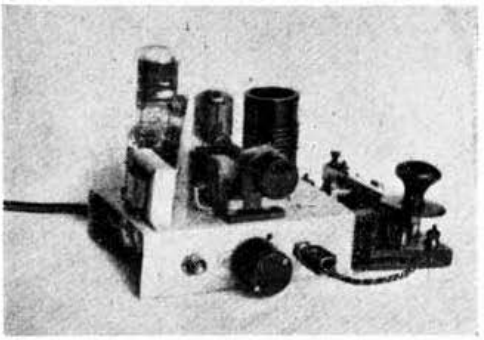


Fig. 3.
View of complete Midget Transmitter.

any other band then the coil must be altered accordingly.

The anode coils are wound on receiving type coil formers 1½ in. in diameter. For 7 Mc/s. operation, 15 turns of No. 22 s.w.g. are wound to a length of 1½ in.; for 14 Mc/s. 8 turns of No. 18 s.w.g. are wound over the same length.

Operation

Before switching on, make sure that the wiring to the heaters is correct; any mistake here will cost the price of two new valves. It will be found that the heaters take a considerable time to warm up, but this is usual with valves of the type specified. With the anode circuit tuned off resonance a meter in the cathode circuit should read approximately 60mA; this will drop to about 15mA at resonance when operating on the fundamental and to about 30mA. on the harmonic. These figures may differ somewhat in other localities, due to variations in mains voltages.

If a four turn coupling loop to the aerial is wound round the anode coil the transmitter can be loaded until the anode current is about 45mA. representing an input of 10·3 watts. It is not wise to go beyond this figure as the quality of the signal falls off rapidly. The efficiency of this transmitter may not be all that is desired, but it serves admirably the purpose for which it was built: it is compact, cheap and effective.

Side Slip

Several members have pointed out that the State of Maine was omitted from the W.A.S. list published in our last issue. Attention has also been drawn to the fact that the District of Columbia is not a State and should not have been included in the list.

Our apologies to the "Hams of Maine."

"Radio News"

The Society is now in a position to accept subscriptions from members for the American monthly journal "Radio News."

Subscriptions rates are as follows:—

One year	.. ..	£1 5 0
Two years	.. ..	£2 5 0
Three years	.. ..	£3 0 0

Copies will be posted direct to subscribers from Chicago.

A New Venture!

LONDON REGION MEETINGS

will be held at the

ROYAL HOTEL, WOBURN PLACE, HOLBORN, W.C.1

on Wednesdays April 23 and May 21

7 p.m. to 10.30 p.m.

Technical and topical talks—Questions and answers on Society affairs

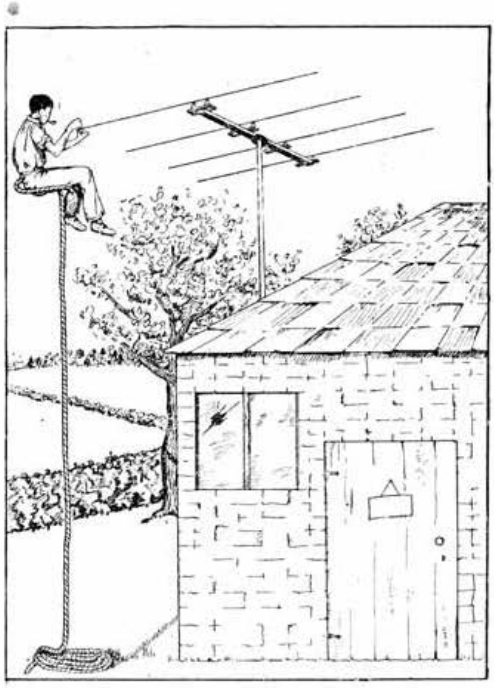
Light Refreshments at popular prices — *Ladies Invited*

A cordial invitation to attend is extended to all members resident in the London Region

New Regional Representative

The Council has been pleased to appoint Mr. H. J. Sherry, G6JK, 17 New Drive, Totteridge, High Wycombe, Bucks., Acting Representative for Region 6 (Home Counties).

The new R.R. is well-known to local members, and it is anticipated that under his leadership the Region will make good progress.



THE INDIAN INFLUENCE.

G4AJ who is shortly returning to India releases the secret of the successful pruning of his multi-element rotary beams.

World Telecommunications Conference

THE March 1945 issue of the BULLETIN carried an announcement dealing with the Post-War Licence Policy of the Society. Contained therein were many proposals designed to improve the conditions under which Amateur Licences were to be issued. With minor exceptions those proposals have been put into force, and we believe that members generally will agree that our post-war licences show many improvements and compare favourably with those issued anywhere else in the World.

The allocation of amateur frequencies at the forthcoming World Telecommunications Conference, is naturally engaging the attention of every amateur at the present time, and whilst the situation looks serious, a similar situation confronted us at Cairo. Newer members may not know that the Society sent a representative to Cairo in 1938 and to Madrid in 1932. The authorities have themselves paid tribute to the Society for the fight we put up for Amateurs on both occasions. It must not however be assumed that all the work is done at the Conferences. In point of fact a great deal of the work is done in the preparatory stages, and those handling these matters for the Society have devoted an enormous amount of time to frequency allocation problems.

The recent Moscow Conference was of an exploratory nature only and committed no one, although undoubtedly the exchange of ideas has been of great help to the countries taking part.

Since our statement of policy was published in March, 1945, the Society has revised its claims regarding frequencies and has recently submitted to the G.P.O. as the minimum requirements to accommodate amateurs, the following proposals :—

1,715– 2,000 kc/s.	shared (as now)		166– 170 Mc/s	exclusive	
3,500– 3,800 ,,	exclusive		220– 225 ,,	,,	
7,000– 7,200 ,,	,,		400– 430 ,,	,,	
7,200– 7,300 ,,	shared (as now)		1,200– 1,300 ,,	,,	
14,000–14,400 ,,	exclusive		2,300– 2,450 ,,	,,	
21,000–21,500 ,,	,,		5,600– 6,000 ,,	,,	
28,000–30,000 ,,	,,		10,000–10,500 ,,	,,	
			20,500–22,000 ,,	,,	
either 50 – 54 Mc/s.					
or 58·5 – 60 ,,		} exclusive.			
or 66 – 67·5 ,,					

Although our authorities have a greater appreciation of the value of Amateurs than was the case before the War it must be borne in mind that the number of services requiring space in the spectrum is now far greater than was the case when the Cairo Conference took place, *and all of them have to be fitted in.* The position is far more complex in Europe than in America, and we sense that the general attitude of the U.S.A. may not react to our advantage.

It was not known by the G.P.O. at the time of writing where the Conference will be held, but this information should be available very shortly, as the Conference is expected to start in May. Incidentally it is the intention of the Society to send two delegates, if possible, to the Conference.

It is easy for those who bear no responsibility to criticise and make statements which do not stand up to inspection. We have never exaggerated in the statements we have made either to the authorities or to our members.

In the past we have fought the battle for Amateurs with success and members can rest assured that we are doing and shall continue to do our utmost to protect their interests. A. E. W.

Late News.—It is understood that the U.S.A. have issued invitations for a world telecommunications conference to commence on May 15 next, in Atlantic City, New Jersey.

Radio Amateurs' Examination

THE following table lists the results of the Radio Amateurs' Examination held on November 15 last, and compares them with those recorded at the previous examination.

Date	No. of Candidates	No. of Passes	No. of Failures	Percentage of Failures
May, 1946	182	145	37	22.2
Nov. 1946	216	150	66	30.5

The falling off in the proportion of passes, as compared with the May, 1946, examination, appears to be due to the fact that a number of persons sat for the examination without adequate preparation. There was a tendency, noticeable also in the first examination, for answers to be worded so briefly or vaguely that it was difficult, or impossible, for the examiner to assess correctly the entrant's knowledge of the subject. A typical example of this occurred in the question on over-modulation, in which a number of candidates wrote that this could be prevented " by the use of a cathode-ray oscilloscope," without giving any evidence that they know what such an apparatus is, or stating how it should be used, or what results would be strived for. The advantages gained from the use of diagrams in answering questions still seems not to be appreciated by many students. For example, even the question on fading was answered by many without the aid of a diagram ! A few candidates used no diagrams at all in their answer papers. Comments on the individual questions are :—

Question 1. *Frequency-multipliers.*—Fairly well answered, though a number of candidates were under the misapprehension that the harmonics are produced by a piezo-electric crystal. Many failed to grasp that the harmonics are produced as a result of the conditions under which the valve in a frequency-multiplier operates, and failed to describe these conditions, *i.e.* the portion of the characteristic on which the valve is biased to work.

Question 2. *Fading.*—Many candidates, while describing fading along a single path, omitted to describe fading caused by two or more signals arriving by differing paths with varying phase relationships. The majority gave good diagrams, but a number submitted very poor diagrams and in a few cases no diagram at all was given. These latter were perhaps candidates having insufficient knowledge of the subject to do so.

Question 3. *Super-heterodyne Receiver.*—Fairly well done. Most candidates drew the block schematic diagram correctly, but many gave an inadequate description of the functioning of the receiver.

Question 4. *The calculation.*—Generally well done.

Question 5. *Directional aerials.*—Only fairly well done.

Question 6. *Heterodyne frequency-meter.*—Not very well done. Answers generally were somewhat confused, or lacking in essential detail. This question appeared to catch a number of candidates by surprise.

Question 7. (*a*) *Key-clicks.*—Only fairly well done. The use of filters for primary keying was rarely mentioned. Very few candidates sketched the waveforms with and without the filters.

continued on page 149

Service Transmitter Surplus

FOLLOWING protracted negotiations between the Society and representatives of the Ministry of Supply, an arrangement has now been approved whereby members of the Society who hold a transmitting licence, or whose application for a licence has been approved by the G.P.O., may purchase certain items of ex-Government transmitting equipment at attractive prices. It is, however, not possible for the Ministry to deal direct with individual members. All sales will, therefore, be negotiated by the Society's County Representatives who will be required to enter into contracts with the Ministry. No order can be accepted of a total value less than £25, but there seems little doubt that most orders will be well in excess of this figure.

Sales must be effected promptly as the depôts in which the gear is located are required urgently for other purposes. Every C.R. holds a complete list of the equipment which is for sale, together with a list of prices. Quantities are small in some cases, large in others. Certain items are available from several depôts, others from only one.

As C.R.'s will be responsible for the collection of the equipment from the depôts, the scope of the scheme is somewhat limited by virtue of transport difficulties, nevertheless the material available locally should prove useful to members.

Those who wish to participate in this scheme should communicate with their C.R. enclosing a stamped addressed envelope.

It is a condition that no gear purchased in connection with this scheme may be offered for resale. Abuses of the conditions of sale may lead to serious consequences.

Council members C. H. L. Lambourn Edwards, G8TL, and George Bloomfield, G2NR, were responsible for bringing the negotiations to a successful issue.

Interference with R.A.F. Distress Frequency

At the request of the G.P.O. the following urgent official R.S.G.B. announcement was transmitted during the week-end February 8–9, 1947.

> "The R.A.F. distress frequency of 3805 kc/s. is being interfered with by amateurs. In view of the threat to the safety of aircraft, amateurs are urgently requested to operate at least 20 kc/s. from this frequency until a further announcement is made."

Although the above message was cancelled one week later at the request of the G.P.O., members who use the high-frequency end of the 3·5 Mc/s. band are advised to take every precaution to ensure that no portion of their radiation falls outside the authorised limit, *viz.* 3800 kc/s.

Commercial Interference in the 7 and 14 Mc/s. Bands

Some months ago the Society requested the G.P.O. to investigate the commercial interference being encountered in the 7 and 14 Mc/s. amateur bands.

The G.P.O. have now reported that the interference is largely caused by automatic transmissions on two or three Russian and American circuits. As however certain Service and B.B.C. stations are using frequencies in these two bands, the G.P.O. are not at present in a position to make effective representations to the U.S.S.R. and U.S.A. authorities in this matter.

The Council deplores this state of affairs and will continue to press the G.P.O. to remove the Service and B.B.C. stations now operating on frequencies within our bands. If this is done, possibly the demise of the U.S.S.R. and U.S.A. stations will not long be delayed.

Service Valve Equivalents Booklet

We are indebted to Messrs. Palmer, BRS14295 Densham, BRS9909, and others for drawing attention to the following errors, and omissions, in the Service Valve Equivalents Booklet.

Page	4	—	..	Add NR64 CV1100
,,	4	—	..	Add NR65 CV1282
,,	8	ARP10	..	Should read CV1329
,,	8	ARP11	..	Should read CV1330
,,	8	ARP20	..	Delete NR79
,,	8	ARP21	..	Add NR79
,,	9	CV173	..	Add EF55 (Mul)
,,	13	CV1035	..	QP21 (MOV) not (Maz)
,,	13	CV1040	..	Add PX 25 (MOV)
,,	13	CV1051	..	Pen 220A not Pen 22A
,,	13	CV1057	..	EK 32 not EF32
,,	13	CV1065	..	SP61 not SP41
,,	13	CV1066	..	P61 not P41
,,	13	CV1099	..	X66 not Z66
,,	14	CV1119	..	DDL4 (Cos) not (MOV)
,,	14	CV1127	..	Pen 46 (Maz) not (Mul)
,,	14	CV1136	..	Add EF54 (Mul)
,,	14	CV1137	..	Add EC52 (Mul)
,,	15	CV1282	..	Should read AC/S2/Pen.
,,	15	CV1332	..	Should read VP21 Maz.)
,,	15	CV1333	..	Should read 220IPT(Cos.)
,,	17	CV1576	..	KT44T (MOV) not KT44
,,	21	VT51	..	841 not 481
,,	23	VT235	..	Delete 705A and 8021
,,	23	VT266	..	Delete 866JR

* * *

Since the publication of the Booklet, a number of members have inquired why Cathode Ray tubes were omitted. The reason is that, except in a few instances, there are no commercial type numbers for Service tubes and a list of Service numbers without such commercial equivalents would serve little purpose. It is hoped at some later date to publish a short list of those tubes which are available commercially.

RADIO AMATEURS' EXAMINATION—

Continued from page 148.

(*b*) *Interference to television reception.*—Not well done. Few could mention all the standard methods of suppressing the third harmonic.

Question 8. (*a*) *Use of call-signs.*—Fairly well done. Practically all candidates had a general, if not precisely correct, idea of the procedure.

(*b*) *Over-modulation.*—The objections to over-modulation were well brought out. Descriptions of the methods of presenting it were often only partially correct, or in terms which were too general or too vague to score highly.

* * *

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THE MONTH ON THE AIR

By A. O. MILNE (G2MI)*

Contests

MANY of us have welcomed the return of the various Amateur Radio contests, several of which have taken place recently, with more to come. Most of the activity during February was centred around the A.R.R.L. DX contest and several British stations made very substantial scores in the first half of the event. Conditions during the C.W. section were excellent up to the Sunday morning. 14 Mc/s. was wide open and the whole of the States and Canada came in all night with no difference in signal characteristic between W1 and W6. Those who decided to spend Saturday night in bed and make up their scores on Sunday, however, were unlucky, because there was an almost complete fade-out for North America all day on all bands.

The telephony section of the contest can only be described as Bedlam ! We do not think that many G's stood the strain for long. Conditions were excellent and the bands wide open, but what a din ! We feel that it would be a good idea for the amateur delegates to the forthcoming International Conference to have some records made of week-ends on the amateur bands and play them over at the Conference assembly! That ought to convince them of the need for more space !

Notes and News

G2WW has now heard from OP2C who turns out to be a Czech recently returned from Rumania. He promises to QSL. 'WW succeeded in working Ken Ellis in all eight of the countries he visited. G2AXG recently contacted W6FMO who was using two watts. Yes *Watts*. 2AXG was much more QRO with no less than three whole watts. The QSO was on 'phone on the 28 Mc/s. band. Reports 58 and 56 respectively. He confirms HZ1AB's address as APO816 and cards have arrived. G8VR says CN8ED is W41JW. QSL via A.R.R.L. CR4AA is a phoney, definitely not known in Cape Verde so don't waste your QSL cards.

G8ON has had a good bag with W6AFU/5 in New Mexico, PK4KS, J2UVW, VQ5JTW, KH6FX, VK7DW, VP4TR, PK6HA, J3AAD and J4AAK. He suggests a new procedure signal, CQ5, meaning, I don't want replies inside 5,000 miles radius. Looks as if he has been using it too ! If you work LJ2H, he says, you need great patience and a bottle of aspirin. They speak " book " English, know no ham or other abbreviations and are ignorant of the international prefix list. Favourite signal is AS which seems to mean QRX 10 mins. The station is evidently run by a Norwegian Army outfit.

G2TG worked TG5K on 3.5 at 21.45 GMT, January 14, with 20 watts. TG5K used 15 watts. Talking of QRP, G2QY mentions W0JJY of Bethel, Kans., who runs 10 watts to a 6V6–6V6 and an 8 wave aerial.

Cards are through from YR5X. QSL via R.S.G.B. G6RC gives H18X as Box 1043, Trujillo City, Dominican Republic, and W7QI/KL7 as Box 307, Anchorage, Alaska. Cards are through from KL7GG within three weeks of the QSO complete with apology for delay ! D2TG informs us that D2UF is a phoney so again, save your cards. G6RH produces the usual plums, amongst which are the following, HK3DW, 28300 'phone, HK3DD, 28290 'phone, HC2HP, 14360 'phone. YN1LB 14370 cw, LA4LA 14060 (Spitzbergen), ZP5AA, 14250 'phone, CP1AP 14020 cw. T6. He recently heard a G calling FK8VB on 28 Mc/s. 'phone. G8TK has also done well with KL7FF on 7188. Solid from 09.00 to 10.15 GMT. He mentions W2QHH who has worked 94 countries with a single 6L6 running at 18 watts input; he needs a GC and operates on 3545, 3697, 3720 and 3730 from 07.00 GMT. G5MR offers PK6EE. Box 76, Macasser Celebes, D.E.I. 14110 19.00 G.M.T.

G5OZ has had a report on his 7 Mc/s. 'phone from Hong Kong, during a QSO with F3JB at 21.40 G.M.T. Let's hope that this will help to remind some of us that 7 is a DX band. There was a time when such a report would have occasioned no great surprise. G5IV has worked LI2BO. QSL to Mr. John Osborne, Talbot House, Cairo. QRA is given as Tobruk. G3VA sends a short, but most interesting, list. W5BSY/MM, using 10 watts on the 7,000 ton S.S. *Crest of the Wave* was contacted when 400 miles off the Virginia Coast, bound for Antwerp. VQ5FCA is another nice one. Input 3 watts. c/o Radio Station, Entebbe, Uganda.

G2YS has worked VU2PB on 14020. R.A.F. Signal Section, Port Blair, Andaman Is. Yes it is a new country. Should be VU5PB. GM3RL provided VP8AD with his 1,000th contact. '8AD uses 10 watts and has an SX24. He is on the look-out for G's every evening from 19.00–21.00 G.M.T. on 14050. He QSL's.

Look out for VU7AA. Address : J. A. Faithful, c/o Cable and Wireless, Balmain Is. He should be active in May.

The reference last month to G2HOJ should have been G2HOS. ME5AA, 5AB and 5AC are all genuine. They are Army personnel in M.E.L.F. Canal Zone, Suez. Do not confuse the " ME " with " G ". QSL *via* R.S.G.B. ME5AA is G4KV.

Finnish Solar Eclipse Expedition

G5CR and G3SS both report having worked OI2KAL. This is the official test station of the Finnish Solar Eclipse Expedition. At the time of contact it was at Helsinki, operating on approximately 28100. The station is going to Africa with the Expedition in May. A second station OI2KAF will be going to Brazil. The operator of 2KAL is ex-ES1NG and at the other station, OH2QM is the operator. QSL *via* S.R.A.L., Helsinki or R.S.G.B.

The Saturday Effect

G5JL is one of the many amateurs who has recently started working a five day week and sometimes looks round the bands on Saturday mornings. He rather expected that 1.7 Mc/s. and 3.5 Mc/s. might become heavily populated but this is not the case. If he wants to contact a G he has to do it on one of the DX bands where there are dozens of them working each other. Moral—Use the best band for the job and don't clutter up the DX bands with local contacts.

QSL Matters

The QSL manager for Jamaica is Mr. T. Myers, 122, Tower Street, Kingston.

Amateurs in Malaya are asked to send envelopes for the collection of cards to J. MacIntosh, VS2AA, P. and T. Dept., Kuala Lumpur.

Once again we ask you to please sort your cards before sending them to the Bureau. It saves us a lot of time.

Will all XA stations please send S.A.E.'s to G2MI for their cards?

* 29 Kechill Gardens, Bromley, Kent.

THE MONTH ON FIVE

By W. A. SCARR, M.A. (G2WS)

SNOW-covered aerials, shacks at freezing point, electric power cuts—hardly the conditions which we are wont to associate with 5-metre work, let alone a 5-metre contest! That was what many of the enthusiasts had to face up to on February 8 and 9, and as anticipated, conditions on the air matched conditions on the ground. We will not anticipate results except to say that as far as can be ascertained, DX contacts were very few in number and it would seem that all scores are likely, unless things are very different for the second week-end, to be extremely low. Please send in your log if you were on the air during either week-end.

A letter from the "Réseau des Emetteurs Français" gives welcome news of activity in France. A 5-metre contest is to be organised through the journal *Haut Parleur* as a preliminary to an attempt to establish amateur links on the band between Paris, London, Brussels, Luxemburg and Berne. British amateurs are invited to take part and details of dates and conditions will be published shortly.

G6DH (Clacton) sends a full report of recent observations. Conditions have been generally unfavourable for tropospheric contacts and the link with 2XC has for the most part been broken. 2MV was contacted on February 16. 6DH complains of hearing many weak carriers from stations who refuse to identify themselves by using the key. He has kept almost constant watch on the M.U.F. in the hope of hearing reflected DX signals but the limit has been around 45 Mc/s. for several weeks. 6DH has found that the M.U.F. is—to quote his own words—"highest to the E.N.E. or W.N.W. down to E.S.E. and W.S.W. and that best F2 distance is 1,500–2,500 miles." He adds: "If those who speak airily about getting across the Atlantic on 60 Mc/s. would accompany me in my daily checks on the M.U.F. I think they would modify their views!"

We are sorry to learn that indisposition has kept 2XC (Portsmouth) off the air lately. He has, however, contacted 5IG (Cambridge) and proposes to aim signals at 5MP (Hythe) in the hope of keeping a sked with him. 5IG himself has been active recently and worked 4DN, 5BD, 8QM and 8SM for the first time.

G2WS heard 2IQ (Sheffield) during the contest from his QRA in Kent. Judging by the peculiar quality of the note and the fact that nearer stations were inaudible, he considers that this may have been a reflected signal. 2UJ (Tunbridge Wells) is puzzled by the inconsistence of results obtained under apparently identical conditions. He has recently used a CV66 grounded-grid triode R.F. stage in front of his receiver and obtained greatly increased signal-noise ratio. 5JU (Birmingham) worked a number of Southern stations in January, but has found conditions "hopeless" in recent weeks and activity at a very low ebb in the Midlands. 8JV (Nottingham) maintains his nightly contacts with 5BD (Mablethorpe). Though using an indoor beam and low power, "Jock" works across the Pennines to Manchester and Liverpool with surprising ease.

A station new to 5-metre work is G5MR (Felpham, Sussex). London stations will wish to look out for him on 59 Mc/s. and 2MV has already worked him. 5MR's station is only a few feet above sea-level and the Downs are but eight miles behind him.

London Region Meetings

To meet the wishes of a large number of members who find it difficult to attend the 6.30 p.m. meetings at the Institution of Electrical Engineers, arrangements are being made to hold additional meetings (from 7 p.m. onwards) at the Royal Hotel, Woburn Place, W.C.1 (5 minutes from Holborn and 2 minutes from Russell Square Tube Stations) on Wednesdays, April 23 and May 21. The meetings will be quite informal but it is planned to include technical and topical talks as well as providing opportunities for questions on Society affairs.

The meetings will be organised by the London Regional Representative and the London D.R's.

The meeting place will accommodate up to 250 members and no charge will be made for admission. Refreshments will be provided at reasonable prices.

If this new venture proves successful and is well supported, the Council will consider further bookings at the same venue.

* * *

There was an excellent attendance at the meeting held on February 14 at the Institution of Electrical Engineers, when Mr. R. H. Hammans, G2IG, delivered a lecture on the subject of "Noise Limiters." It is hoped to publish an abridged version of the lecture in an early issue. A vote of thanks to the lecturer was moved by Mr. E. L. Gardiner, G6GR (Immediate Past President).

The Chair was taken by the President (Mr. S. K. Lewer, G6LJ).

THE 1946 "TOP BAND" CONTEST

"A GOOD time was had by all." These, the concluding remarks of more than one competitor, sum up the general feeling of the numerous entrants who felt like dropping a line to the organisers.

The "Top Band" Contest was always popular before the war, and it is evident that the old enthusiasm has quickly returned. With a larger number of licensed members than ever before, it was expected there would be more competitors. That this would be so was apparent from the amount of activity on the band during Contest hours. The entries received—132—was a record for any strictly R.S.G.B. contest and it would be safe to say that during the 18 hours of the contest there were more British amateurs active on the 1·75 Mc/s. band than ever before during one such period. *A total of* 432 *British amateurs were logged during the event.*

Reading the Rules

In all Contests it is stressed that the declaration must be signed; even so, six entrants were disqualified for this omission. Three intending entrants overrated the G.P.O.'s capabilities. Competitors posting their logs on the closing date should not expect delivery on the same day. Careless listening or logging also cost many entrants badly-needed points. There were numerous complaints that reports were not acknowledged; others who were not sure of their report, vainly asked for a repetition, but the other station was in too much of a hurry to give a repeat. Lacking a suitable recording system a number of competitors wasted time and points working a station a second time.

Conditions

On the whole, conditions were moderate, but plenty of QRM of course—increase of noise level at times—interference from Loran, trawlers and shore stations in some areas—and a lack of good DX. G6MC, however, worked VO1NF, ss. *Empire Brent*, 400 miles east of Halifax, Nova Scotia (unfortunately not admissible for points) and D2CH, OZ1W and EI9D were worked by others. The standard of operating on the whole was exceptionally good. Use was made of QLM, etc. (although most stations ignored the middle of the band). The new signal "QMF" will facilitate speedier QSO's in future Contests. Some stations worked under difficulties, but nevertheless put in good scores. G2JN, 3ALC and 6ZN operated QRP from dry batteries. G2BFJ, 6FJ and 8LN each, by force of circumstances, used indoor aerials, 6FJ's being only 25 ft. long, whilst G4AU utilised a balloon-suspended vertical ¼-wave for part of the Contest. Going to the other extreme, G5ZT was fortunate in having the space to erect a 560 ft. horizontal 30/60 ft. high.

An effort was made at short notice to enable the "D2" stations to complete, but as most of the regular "top band" users were away at the time, the only competitor was D2CH.

Check Logs

Check logs were received from G2ZC, 3AHH, BFR, RV, UI, 4CF, 5AO, QU, 6NA, QM, GC8NO and BRS1066, 1535 and 11494. Entries received from the nine disqualified entrants were also utilised as check logs.

The Winners

Mr. G. R. Scott-Farnie, G5FI, of Maids Moreton, Buckingham, placed first with a score of 143 points, is to be congratulated on an excellent performance. His transmitter, a CO–PA, with 10 watts to a KT8c was off the air from 17.00 to 19.00 owing to power supply failure when he returned with 4 watts only! The aerial in use was a Marconi, 276 ft. long and 50 ft. high.

Mr. F. T. V. Ritson, G5RI, of Hexham, who was second, used a CO–BA–PA with a T25D in the final running off 50-volt D.C. house mains with convertor. His aerial, 165 ft. long and 35 ft. high, was series-tuned in conjunction with a 3-wire fan-shaped counterpoise, each wire being 100 ft. long.

Third place was shared by Mr. H. J. M. Box, G6BQ, of Gravesend, and Mr. R. W. Rogers, G6YR, of Southport.

G6BQ used a CO–PA and alternatively ECO–FD–PA with 10 watts input. Aerial: Centre-fed Marconi, 136 ft. top 40 ft. high with 100 ft. counterpoise. Tuning of all stages and aerial was ganged.

G6YR's transmitter consisted of a two-stage Franklin oscillator with BA–FD–807 PA. Aerial: 200 ft. folded and centre-fed.

A list of competitors in order of merit is appended.

Position	Call Sign	Points	Position	Call Sign	Points	Position	Call Sign	Points
1	G5FI	143	45	G2IX	74	88	G6YJ	42
2	G5RI	128	46	G3CC	73	90	G5YN	41
3	G6BQ	125	46	G4DC	73	90	G6GH	41
3	G6YR	125	46	G5TO	73	90	G6UT	41
5	G2FSR	124	49	G3AFZ	71	93	G8NM	40
6	G8WF	120	50	G8GG	69	94	G2KO	39
7	G5MY	119	51	GM4GK	68	94	GW8WJ	39
8	G5ZT	116	52	G6HU	67	96	G6NC	38
9	G2MI	115	53	G5MN	66	96	G8VN	38
10	G2JL	112	53	G6NV	66	98	G3IP	37
10	G2YY	112	55	GM3BL	65	98	G8JD	37
12	G6VC	111	55	G8JM	65	98	G8KU	37
13	G2DU	110	57	G2JK	64	101	G3ALC	36
14	G3GX	108	57	G6CT	64	101	G8HJ	36
14	G5BM	108	59	G6YP	63	103	D2CH	35
14	GM6JJ	108	59	G6ZN	63	104	G2BH	33
17	G2WQ	104	61	G8VR	62	104	G5HH	33
17	G5UM	104	62	G3LA	61	104	G5IV	33
17	G6GM	104	62	G4GA	61	104	G6IO	33
20	G8JR	103	64	G3HS	60	108	GW2HH	32
21	G6NM	102	64	G5DZ	60	108	G8JI	32
22	G8NF	101	66	G2LC	59	110	G3WP	28
23	GM6RI	100	66	G6OT	59	110	G5JL	28
23	G8TR	100	68	G3CO	58	110	G8BM	28
25	G2HW	99	68	G4KS	58	113	G8NL	27
26	G4AU	96	68	G6MC	58	114	G3AMT	26
26	G4GJ	96	71	G5FY	57	115	G2AAU	25
26	G6LD	96	72	G5MP	55	116	G6XM	24
29	G6US	92	73	G2CPF	54	117	G3HT	23
30	G5HB	90	74	G6OM	52	117	G4FB	23
31	G3RF	87	75	G2CPL	51	119	G5HS	22
32	G2AJ	86	75	G2FO	51	120	G8LN	20
32	G6HD	86	77	G4FN	50	121	G5PO	19
34	G5OH	85	77	G8BN	50	122	G2CLD	18
35	G3FN	83	77	G8DZ	50	123	G2JN	17
36	G2VZ	82	80	G2DOW	49	124	G6FJ	16
37	G5KT	81	80	G2RB	49	125	G6AS	14
37	G6WH/A	81	82	G8LG	47	126	G3ALO	13
39	G8DV	80	83	G3AWA	45	127	G2HR	12
40	G2HP	79	83	G3YF	45	127	G5JF	12
41	G6QS	78	85	G3YH	44	129	G2BFJ	10
42	G3LZ	77	86	G3OA	43	130	G3AHU	9
42	G8QZ	77	86	G4JB	43	130	GM3UU	9
44	G3ANY	76	88	G2SO	42	130	G8JP	9

The Contests Committee wish to thank those who took the trouble to forward check logs and low scoring entries, which, it should be pointed out, are in no way a reflection on the operators, as they were mainly due to restricted operating hours.

DIRECTION FINDING CONTEST

IT was recorded in the article entitled "Portable Direction Finding," published in the January, 1947, issue, that arrangements were being made to hold two R.S.G.B. Direction Finding contests in the London Region during the coming year. If these contests receive good support, the Contests Committee will consider organising further events next year, including, possibly, a National Final of winners of local events.

The appended rules which have been compiled from rules used in the past for similar events, should form a basis upon which town or area groups and Affiliated Societies may organise similar events throughout the country.

Suggestions for further Direction Finding Contests are welcomed and all will be carefully considered by the Committee.

Rules

1. The First Contest will take place in an area North of the River Thames and will commence at 1.30 p.m. **18th May, 1947.**

The Second Contest will take place in an area South of the River Thames and will commence at 1.30 p.m. **6th July, 1947.**

2. Competitors will be required to forward their name, call sign (if any), number in party and address to the Hon. Organiser, D F Contests, c/o R.S.G.B. New Ruskin House, Little Russell Street, London, W.C.1., at least two weeks prior to the commencement of each event. Earlier indication of support will be appreciated.

3. The contest will be open to fully paid-up members of the R.S.G.B. and its Affiliated Societies.

4. Competitors for the first contest will report at the official assembly point—The Station Yard, High Barnet Underground Station (Northern Line) at 1 p.m. (Arrangements for the second contest will be announced later.)

5. Each competitor on arrival at the assembly point will receive from the organiser, or his assistant, a sealed envelope giving the exact location of the hidden transmitter. The time that the unopened envelope is handed by the competitor to the transmitter operator, will count as the official entry time. Lost competitors should not open their envelopes before 4.30 p.m.

6. Transmissions from the hidden transmitter will take place on a frequency of 1755 kc/s. The call sign G6CTP will be used.

7. The first transmission, "Testing de G6CTP" will be sent in Morse for two minutes, beginning at 1.25 p.m. Transmissions will then continue on telephony until 1.35 p.m. Competitors will be allowed to leave the assembly point at 1.30 p.m. Subsequent transmissions will be on telephony and will take place in accordance with a schedule handed to each competitor at the assembly point. The transmitter will close down at 5 p.m.

8. The hidden transmitter will not be located on private property and will be within 15 yards of a road accessible by car without passing through gate, gateway or ford. Ordnance Survey, New Popular Edition, one-inch map, Sheet 160 or 161 will be used for the first contest. Map details for the second contest will be announced later.

9. The hidden transmitter will be located within **Ten** miles of the original assembly point and will be at least 50 yards from any building.

10. Competitors will synchronise their watches before leaving the assembly point.

11. Any competitor who opens, or tampers with, his sealed envelope will be disqualified.

12. Only the competitor may locate the transmitter. The arrival of a member of his party, at the transmitter, prior to the arrival of the actual competitor, will lead to disqualification of the whole party.

13. Upon arrival at the site of the hidden transmitter the receiving apparatus must be shown to be in working order.

14. The winning competitor in each event will be awarded a Certificate of Merit. Trophies may be awarded at the discretion of the Council.

* * *

An informal gathering and tea, will be held after each event; the time and venue will be announced at the assembly point. There will be a small charge to cover the cost of the tea.

R.S.G.B. CERTIFICATES

PRIOR to the war the Society issued a series of Proficiency Certificates for Long Distance work. These Certificates were based on an Empire theme and all were keenly sought after by members and non-members alike.

Due to the unsettled state of Amateur Radio during 1946, the Council wisely decided to wait awhile before reviving these awards. That time has now arrived, and claims may again be submitted.

In the light of experience it has been decided to tighten up the requirements of the H.B.E. and to issue a set of General Rules for all Certificates with short Rules governing individual awards.

General Rules Governing the Issue of all R.S.G.B. Certificates.

The following general rules and conditions apply to all certificates issued by the Society, and should be read in conjunction with the conditions which govern the award of the individual certificates.

(1) R.S.G.B. certificates will be issued free to corporate Members of the Society, and on payment of a fee of 2/6 (or an equivalent amount in other currency) to non-members of the Society.

(2) In the case of transmitting awards, claimants must certify, in writing that their licenced power was not exceeded in effecting the contacts upon which their claim is based.

(3) All claims must be sent by registered post and addressed to the

General Secretary,
Inc. Radio Society of Great Britain,
New Ruskin House,
28 Little Russell Street, London, W.C.1.

and each such claim must be accompanied by documentary proof in the form of letters or cards showing

that two-way communication has taken place. A minimum Readability report of R3 and a Tone report of not less than T8 must be recorded on each card or letter submitted.

(4) Contacts with mobile stations (other than ships) located in the British Empire will be accepted providing that the exact location of each such station at the time of contact is clearly stated in the evidence submitted.

(5) British Mandated territories and Protectorates will be regarded as forming part of the British Empire.

(6) Holders of an R.S.G.B. award are authorised to use the initial letters of the award followed by (C.H.) in personal correspondence. The letters C.H. signify Certificate Holder.

(7) In the case of any dispute concerning a claim, the decision of the Council of the Society will be final.

British Empire Radio Transmission Award (B.E.R.T.A.).

(1) The British Empire Radio Transmission Award may be claimed by any fully-licenced radio amateur who can produce evidence of having effected two-way communication on amateur frequencies, with Amateur Radio stations in at least 25 of the British Dominion Call Areas listed in Appendix I, and with at least 15 of the British Colonial Call Areas listed in Appendix II. Contacts may be made either on Telegraphy or Telephony. If all the contacts are made on telephony, the award will be annotated accordingly.

Heard the British Empire Certificate (H.B.E.).

(1) The H.B.E. Certificate will be issued to any radio amateur who has received signals from Amateur Radio transmitting stations located in at least 25 of the British Dominion Call Areas listed in Appendix I and from at least 15 of the British Colonial Call Areas listed in Appendix II.

(2) In the case of licenced amateurs, confirmation of two-way contacts will be accepted as evidence of the reception claimed.

Worked the British Empire Certificate (W.B.E.)

(1) The Certificate will be issued to any fully licenced radio amateur who can produce evidence of having effected two-way communication on amateur frequencies with at least one British Empire Amateur Radio station located in each of the five recognised Continental Areas as defined by the International Amateur Radio Union (North and South America count as one Continental area).

(2) Separate Certificates will be issued for :—

(*a*) Two-way Telegraphy communication on any amateur frequency band.

(*b*) Two-way Telephony communication on any amateur frequency band.

(*c*) Two-way Telegraphy communication on the 28 Mc/s. band.

(*d*) Two-way Telephony communication on the 28 Mc/s. band.

W.B.E. Awards only.

The Council of the Incorporated Radio Society of Great Britain may, at their discretion, and on receipt of formal application, authorise the Secretary of a recognised Overseas Amateur Radio Society to approve claims from non-members of the Society. In such circumstances the Society in question will assume responsibility. All claims for the B.E.R.T.A. and H.B.E. Awards must be submitted to R.S.G.B. Headquarters.

Appendix I.

The following is a list of the British Dominion Call Areas upon which claims for the *British Empire Radio Transmission Award*, and the *Heard the British Empire* Certificate must be based.

Australia (VK 2, 3, 4, 5, 6, 7); British Isles (G, GC, GI, GM, GW, EI).

Canada (VE 1, 2, 3, 4, 5, 6, 7, 8); Newfoundland (VO 1, 2, 3, 4, 5, 6).

India (VU); New Zealand (ZL1, 2, 3, 4); South Africa (ZS1, 2, 4, 5, 6).

To qualify for the B.E.R.T.A. contacts must be confirmed with at least 25 of the Call Areas listed above.

To qualify for the H.B.E. the reception of signals must be confirmed from at least 25 of the Call Areas listed above.

FORTHCOMING CONTESTS

The following events have been organised by the Contests Committee and approved by the Council :—

*April 12/15 ..	B.E.R.U. Contest (Senior and Receiving Events).
*April 17/20 ..	B.E.R.U. Contest (Junior and Receiving Events).
May 18 ..	D/F Event (North of Thames).
†June 7/8 ..	National Field Day.
July 6 ..	D/F Event (South of Thames).
‡July	Five Metre Field Day.
‡Aug. or Sept.	Low Power Contest.
‡Sept.	Five Metre Field Day.
‡Oct.	Listener's Contest.
Nov. 29/30 ..	1·75 Mc/s. Contest (Second Section).

* *Rules and entry form were inserted in the November, 1946, issue of the* BULLETIN.

† *Rules were published in the February, 1947, issue of the* BULLETIN.

‡ *Dates to be fixed.*

Rules for other events will be published later.

Appendix II.

The following is a list of the British Colonial Call Areas upon which claims for the *British Empire Radio Transmission Award*, and the *Heard the British Empire* Certificate must be based.

Africa.—Ascension (ZD8), British Somaliland (VQ6), Chagos Archipeligo (VQ8), Gambia (ZD3), Gold Coast (ZD4), Kenya (VQ4), Mauritius (VQ8), Nigeria and the Cameroons (ZD2), Northern Rhodesia (VQ2), Nyasaland (ZD6), St. Helena (ZD7), Seychelles, including Amirantes (VQ9), Sierra Leone (ZD1), Southern Rhodesia (ZE), South West Africa (ZS3), Sudan (ST), Swaziland (....), Tanganyika (VQ3), Togoland (British Mandate) (ZD4), Tristan da Cunha (ZD9), Uganda (VQ5), Zanzibar, including Pemba (VQ1).

Asia.—Aden, including Kamarin, Perim and Socotra (VS9), Bahrein (VU7), Burma (XZ), Ceylon (VS7), Cyprus (ZC4), Hong Kong (VS6), Malaya (VS1 and 2), Maldives (VS9), Palestine (ZS6).

Europe.—Gibraltar (ZB2), Malta (ZB1).

North America.—Bahamas (VP7), Barbados (VP6), Bermuda (VP9), British Honduras (VP1), Caymans (VP5), Jamaica (VP5), Leewards (VP2), Turks and Caicos (VP5), Windwards (VP2).

Oceania.—British North Borneo and Labuan (VS4), Brunei (VS5), Christmas (off Java) (ZC3), Cocos (ZC2), Cook (ZK1), Fanning, including Christmas and Wellington (VR3), Fiji (VR2), Gilbert, Ellice and Ocean (VR1), Lord Howe (ZK1), New Guinea (VK9), Niue (ZK2), Papua (VK4), Pitcairn (VR6), Sarawak (VS5), Solomons (VR4), Tonga (VR5), Western Samoa (ZM).

South America.—British Guiana (VP3), Falklands (VP8), Grahamsland (VP8), Sandwich Group (VP8), South Georgia (VP8), South Orkneys (VP8), South Shetlands (VP8), Trinidad and Tobago (VP4).

To qualify for the B.E.R.T.A. contacts must be confirmed with at least 15 of the Call Areas listed above.

To qualify for the H.B.E. the reception of signals must be confirmed from at least 15 of the Call Areas listed above.

County, Town and Area Representatives

Further to the lists published in recent issues we give below the names and addresses of additional members who have been appointed to serve as County, Town or Area Representatives :—

C.R's.

Region	Name, Address and Call Sign
REGION 6 Buckinghamshire ..	J. REDRUP, G8VZ, Lyndale, Longwick Road, Princes Risborough, Bucks.
REGION 9 Dorset	W. J. C. TITTERINGTON, G5MU, 19 Culliford Road, Dorchester, Dorset.
REGION 11 North Wales ..	E. G. FOULKES, GW5FU, 27 High Street, Rhyl, Flintshire.
REGION 12 Northern Counties	A. S. MCNICOL, GM3UU, Inchstellie House, Alves, Morayshire.
Aberdeenshire, Kincardineshire and Banffshire.	D. LEYS, GM3ATV, 3 Walker Avenue, Banff.

T.R's. or A.R's.

Town	Name, Address and Call Sign
Brixton (S.W.4, 8, 9, 11, 18. S.E.11,17)	J. L. MONK, G3AHU, 14 Angel Road, Brixton, S.W.9.
Cheam	B. J. BLOUNT, BRS7605, 5 Priory Crescent.
Guildford	R. G. LANE, G2BYA, " Dagley Lodge," Shalford, Surrey.
Huddersfield ..	J. L. CHURCH, G2BMC, 10 The Lodge, Linthwaite. (vice J. Dale, G5VD, resigned.)
High Wycombe ..	R. CHADBONE, G8JK, Trees Avenue, Hughenden, Nr. High Wycombe, Bucks.
Hawick	W. VINICOMBE, GM8RV, 6 O'Connell Street, Hawick, Roxburghshire.
Norwood (S.E.19, 20, 25, 26, 27) ..	S. C. DUNN, BRS6348, 94 Beulah Hill, S.E.19. (vice W. D. Gilmour, G2VB, resigned.)
Rhyl and Prestatyn	F. G. SOUTHWORTH, 2CCU, " Salmesbury," Bagilt Road, Holywell, Flintshire.
Stoke-on-Trent ..	D. POOLE, G3AQW, 13 Oldfield Road, Norton-in-Moors, Stoke-on-Trent.
Weybridge and Woking	R. J. DENNY, G3NK, 32 Waverley Rd., Weybridge

Members resident in South London are asked to note that the following Postal Areas are now covered by Area appointments :—
Balham and Streatham (S.W.2, 12, 16, 17).
Barnes and Putney (S.W.13, 14, 15).
Dulwich (S.E.21, 22, 23, 24).
Eltham (S.E.6, 9, 12, 13).
New Cross (S.E.1, 4, 5, 8, 14, 15, 16).
Wimbledon (S.W.19, 20).
Woolwich and Plumstead (S.E.2, 3, 7, 10, 18).
The names and addresses of the respective A.R.'s have already been published.

Northern Ireland

In view of the questions which have been raised regarding the appointment of a Regional Representative in Northern Ireland a further statement by the Council will appear next month.

West London District

Nominations are invited for the office of West London District Representative. These should be submitted in the form prescribed in the January issue and should reach Headquarters by not later than 31*st March next*. Each nomination should be accompanied by a letter from the nominee signifying his willingness to serve if elected.

Experimenters' Contact Bureau

Apropos the invitation published in the February issue, the following members have expressed their willingness to act as Group Leaders :—

Group 2 (*Audio Equipment*).
T. W. Clements, BRS8407, 31 Sackville Road, Hailsham, Sussex.
Group 4 (*Construction Methods*).
L. B. Trueman, BRS12431, 141 Ince Avenue, Liverpool, 4.
Group 6 (*Measuring Equipment*).
J. B. Harris, G3ABT, 65 Gurney Court Road, St. Albans, Herts.
Group 10 (*Propagation*).
L. Blagbrough, BRS15012, 39 Fountain Street, Sowerby Bridge, Yorks.
Group 12 (*Sound Recording*).
R. C. Jennison, G2AJV, 28 Park Road, Grimsby.
Group 14 (*Television*).
G. G. Smith, BRS8193, 39 Verulam Road, Greenford, Middlesex.
Leaders are still required for the other Groups.

Publicity at Ipswich

Local members were recently afforded a first rate opportunity of obtaining some useful publicity when, through the courtesy of the Ipswich Model Engineering Society, they were allotted a stand at that Society's Annual Exhibition.

More than 6,000 members of the public paid for admission to the exhibition, which was held in the Public Hall, and the R.S.G.B. stand was at all times the centre of an interested crowd. G2AN supplied the whole of the gear on show, which comprised his own personally-constructed transmitter, receiver, monitor and microphone. The station was completely operational and was backed by a selection of QSL cards. R.S.G.B. publications were displayed and sold from the stand, which was under the charge of G2AN, SQ, 5FB, 6CQ, 8AN, MU, WN, and others.

German Valve Engineering Terms

Mr. J. Baer, FRS93, draws attention to two important German engineering terms which were omitted from the list published on page 93 of the December issue.

Aussenwiderstand (*Ra*) .. *Load impedance.*
Innenwiderstand (*Ri*) .. *Internal* (*valve*) *impedance.*

In the list the German term for Impedance (Internal Resistance) was given as AuBenwiderstand.

Licences Issued

Up to the end of January last, approximately 4,400 licences had been issued by the G.P.O. of which number it is estimated that at least 50 per cent. are " new."

EXCHANGE AND MART SECTION

Due to paper restrictions advertisements are only accepted "for insertion when space is available." No advertisement must exceed 50 words. RATES: Members Private Advertisements 2d. per word, minimum charge 3/-. Trade, 6d. per word, minimum charge 9/-. Use of Box number 1/6 extra. Send copy and payment to Parrs Advertising Ltd., 121 Kingsway, London, W.C.2.

ADVERTISER desires to purchase circuits of modern commercial receivers, either separately or in bulk. Your price. Any offer or information acknowledged. Price and particulars to: BRS13253, 23 Gladstone Avenue, Liverpool, 16. [69

AMERICAN-BUILT 9 + 1v Communication Receiver, modified for 230v A.C./D.C. mains; coverage 1·5–18·0 Mc/s. in six bands; new set tubes; complete and in excellent condition; bargain £25.—GRIFFITHS, 62 Lynn Road, Ilford, Essex. Phone VAL7593. [92

A1134 Amplifier, new and unused, standard speech amplifier for T.1154 transmitter, £4. *QST* perfect condition, January to December, 1946 and April, June, October, December, 1945, 32s. complete.—G3ABE, 4 Hawthorn Gardens, Low Fell, Gateshead, Co. Durham. [91

CRYSTALS.—Following power type crystals in plug-in dust-proof holders, standard pin spacing. 3576, 3581, 3585, 3596, 3616, 3624, 3633. Guaranteed perfect, £1 each.—G8UA, 406 Higher Brunshaw, Burnley, Lancs. [84

D.C. Avominor in case, £2 10s. Universal Avominor, £6. Both as new. Many other items and components at bargain prices. S.A.E. list.—PREVOST, 17 Perham Road, London, W.14. [119

DISPOSAL. Tobe communication receiver, ham bands 160 metres to 20 metres, £15. Avo-minor, £6 10s. Both instruments in excellent condition.—G3OR, 3 Chestnut Avenue, Whiteley Village, Walton-on-Thames, Surrey. [106

EX-R.A.F. transmitter-receivers, model TR9, complete with nine valves, new condition, ready for operation, or contains many useful items for your rig. relays, short-wave condensers, silver plated inductances, thermo coupled meter, milliameter, etc., £6 carriage paid.—STAMFORD RADIO CO., 199 Stamford St., Ashton-u-Lyne, Lancs. [85

EXCHANGE Zeiss Super Ikonta Camera, 16 on 120, compur, coupled rangefinder leather case, good condition, for good communication receiver. Cash adjustment.—BRS3526, c/o BOOTH, 70 Binswood Avenue, Leamington Spa. [118

FOR SALE.—Unused valves, 100 per cent. emission. 35T, 50s.; RK20A, 90s.; RK25, 30s.; HY25 equiv. T20, 15s. Transformer 1000–0–1000v 200mA, 20s. Two chokes 150mA, 10s.—G3RV, 278 Old Church Road, Chingford, E.4. [108

GOVERNMENT surplus receivers R.1124, 6 valve 30·5 to 40·5 Mc/s., Preset to six spot frequencies, complete with three 9D2's, one 15D2, one 8D2 and one 4D1 valves. Price £3 including carriage.—C. E. NICHOLS, 115 Mortimer Road, Filton, Bristol.

GW3BAZ of Cardiff (at present G3BAZ/A of Bristol) is shortly removing to Brentford, London area, and would appreciate any help from local hams in finding accommodation.—JACK EVANS, 9 Heol Dolwen, Whitchurch, Cardiff. [101

GW6JW selling.—HRO, as new. Power pack, speaker and coils Complete ¼ kw. TX in 6ft. rack; 3 power packs—1,500v., 800v., and 500v. 3 G.B. packs. Switch panel. 3 R. F. panels. P.A.–PP TZ40's. Recently overhauled. New tubes. Best offer over £110 secures, or, separate offers for RX and TX.—8 Bilton Road, Neath. [81

G6VS.—25 watt Transmitter, complete with valves, crystal, coils, meters, power pack. Ready for immediate operation, £30 2s. 6d., rotational delivery. Ten watt 'Top Band' Transmitter ready shortly; EF54, EF50, EC52 valves; large stocks of Eddystone, Labgear and Q-Max equipment; Q.C.C. Crystals, Pullin meters, etc.—G6VS, Carlton Music Salon, West Kirby, Cheshire. [113A

HALLICRAFTERS S-38 Receiver for sale, 1946 model, only used two months, cost £35; 32 Mc/s.–550 kc/s. Any offer over £30.—Box 111, PARRS, 121 Kingsway, London, W.C.2.

HAM-AID QSL's, well-known for quality and design. Samples from: TILLOTSON, G6XT, 47 Watson Street, Morley, Leeds.

HAM Library Disposal: CRO in Industry (Wilson), 11s.; SW Wireless Communication (Ladner and Stoner), 32s. 6d.; FM (Hund), 32s. 6d.; Measurements in Radio Engineering (Terman), 25s.; Fundamentals of Vacuum Tubes (Eastman), 25s.; Experimental Radio Engineering (Rapson), 7s.; Radio Engineering Handbook (Henney), 32s. 6d.; CRO's (Rayner), 6s. —G2HNJ, Ardmore, Tring, Herts. [79

HAMMARLUND SUPER-PRO. 100–200 kc/s., 200–400 kc/s., 2·5–5 Mc/s., 5–10 Mc/s., 10–20 Mc/s., complete with power supply. FB working order and appearance. No speaker. What offers?—G2FSJ, c/o County Police H.Q., Winchester, Hants. [82

HRO/M Senior, coils 100 kc/s to 30 Mc/s, 2 sets valves and power pack 200/250 v. A.C. Excellent condition, realigned, £55, or offers.—Box 71, PARRS, 121 Kingsway, London, W.C.2. [71

H.R.O. Senior or R.M.E. 69, also peak preselector wanted.—2 Cliff Road Gardens, Leeds, 6. [41

KEEP a permanent record of your circuits! Blue prints drawn from your sketches, 5s.; extra copies 1s. 3d.—Send to BCM/MANUSCRIPTS, London, W.1. [112

MARCONI miniature communications receivers, 100 kc/s to 15 Mc/s. Full details on request.—M. O. S., 24 New Road, London, E.1. [75

MODIFIED 1155 covers 10, 20, 40, 80 but not broadcast bands Hotted version with S.P.41 R.F. stage, internal power supply and 6V6 output. Bargain £22. ACT/6 tubes, 45s.—G21Q, 44 Tapton-hill Road, Sheffield. [103

NATIONAL HRO four-gang condenser for sale, less dial. What offers?—G6WB, Lyneal Lodge, Ellesmere, Salop. [73

NATIONAL H.R.O. receiver with full set of coils, near new and perfect, £65. Also complete 150w. station for sale. Enquiries invited. Meters, valves transmitter in rack and panel etc.—G3ADT, 52 Poulton Avenue, Sutton, Surrey. [127

NEW unused valves.—9001, 9002, 6AK5 series, quantity 29, 11s. each, £14 10s. the lot. Eight acorns, £1 10s. each. Also Simpson meter, £1 10s., new, 20,000 ohms per volt (100 microamps to 5,000 volts),ohms, D.B.'s, volts, amps, etc., £10.—Write D. V. BINGE, 3 Trevor Gardens, Ruislip, Middx. [124

NEW tubes.—813's, 829's, TZ40's, 35T's, PT15's, KT66's, offers. 1155 receiver, built-in power pack and audio stage; offers.—Box 94, PARRS, 121 Kingsway, London, W.C.2. [94

QSL's for the individual. Samples free. For all your printing requirements apply 75 St. Andrew's Avenue, Elm Park, Romford, Essex. [125

RECEIVER for £6. Gross Standby, 2 to 2000 metres, 110v to 250v A.C. or 12v and H.T. battery, complete with circuit. Thordarson T.6699 modulation transformer, PP parallel 46's or 59's to 500 ohms, 3500 ohms and 6250 ohms 215 mA., £2 10s. Unused T20 tube, 15s.—G6GO, Ashby Parva, Rugby. [120

R.C.A. type A.R. 88 receiver wanted. Also wire recorder. Please give full particulars and price.—HARRIS (BRS12959), Strouds, Bradfield, Berks. [77

ROTARY convertor for sale, 230v D.C. to 230v A.C., 250 watts. What offers?—Box 104, PARRS, 121 Kingsway, London, W.C.2. [104

SALE.—Two-valve C.W. transmitter (6L6 CO/5Y3G Rect.) complete with power supply, crystal and key, £9. S.A.E. for details.—Box 97, PARRS, 121 Kingsway, London, W.C.2. [97

SALE.—New 35T (2), £2; EL35 (2), 12s. 6d.; RK34, 15s.; KTZ63 (2), 7s. 6d. As new, 9001, 12s. 6d. Would exchange.—Box 98, PARRS, 121 Kingsway, London, W.C.2. [98

SALE.—Taylor resistance capacity bridge model 110A, only 4 hours use, £12 10s.—11A Welwyn Close, Sheffield. [95

SALE.—Service sheets, radio books, magazines, valves, components, etc. S.A.E. list.—11A, Welwyn Close, Intake, Sheffield. [86

SALE.—Hallicrafters SX25, one owner, best offer over £40, Parmeko 600–0–600 250 mA, £2. Lightweight headphones, new, 7s. 6d. Piles pre-war QST, Bulls, and S.W. Mags., approx. 100. Offers lot or separately.—G3HS, Coxwell Street, Faringdon. Berks. [80

SALE.—Battery communication receiver, 14–20,000 metres in 10 ranges. Turret coil unit, £8. 1155 receiver, power-pack, £23. 6in. speaker in black crackle cabinet, 30s. Morse key, 10s. 813, £3. T40, £2. TZ40, £2. 807 17s. 6d. Crystals in holders— 7007, 7053, 7063, 7082, 7139, 7180, 7194.—" Stonehaven," Horncastle Road, Boston, Lincolnshire. [70

SALE.—Superb 1946 100w., 5ft. rack 7, 14, 28 Mc. Phone—CW.TX.60W. Mod. with A.M.C., Bias Pack, Ant coup, all fully metered, remote control. Has W.A.C. 14, 28 Mc. Phone —CW., £130. S.A.E. for photo, data.—G3LB, Ripon, Yorks. [74

SALE surplus components. S.A.E. for lists. Wanted: gramophone induction motor.—BRS5271, 461 Footscray Road, New Eltham, London, S.E.9. [116

SALE.—Record 500v insulation tester in case, £6. 0–1 mA meter, 35s. 0–3500v electrostatic voltmeter, 55s. Valves 807 (4), 20s.; PP5/400, pair, 30s.; 5U4G (3), 10s.; ECR30, 35s.; EF50 (2) 955 (2), 12s. 6d.; 954, 15s.; 6X59 (2), 7s. 6d. All new boxed.—BM/ANLL, London, W.C.1. [121

SALE.—Modified R1155, internal power pack, output stage, bandspread, new crackle front panel, realigned, £20.—BRS13,644, 4 Windsor Place, Shotts, Lanarkshire. [126

SERVICE and Constructional Engineer wanted for radio firm in S.E. London. Age under 30, salary depending upon ability.—Apply giving full details of age and experience to Box 102, PARRS, 121 Kingsway, London, W.C.2. [102

SELL or swop for good communication receiver, Hohner Verdi 1V Accordion, 120 bass, black and white, with case Worth £40. —BRS3779, Clickemin, Ponteland, Northumberland. [117

SIX RK28A's (new) for sale. What offers over £3 each.?—Box 115, PARRS, 121 Kingsway, London, W.C.2. [115

SPECIAL offer to make room. Two moving coil meters, 50 ft. super co-axial and over 200 other articles, many being unused —the lot to any member for £5 5s., or separately. List from: G6CB, 7 Caxton Road, Wimbledon, S.W.19. [83

SUPREME combination valve tester/multimeter unused. 115/230v A.C. Fitted 8 types valve-holder plus acorn adaptor. Meter sensitivity 500 microamps. Current 0/10 amps., 7 ranges. Volts 0/2500 D.C., 7 ranges. 0/1000 A.C., 5 ranges. Ohms 0/20 megs., 5 ranges. Condensers 2–50 μf at 25–450v wkg. Wooden case c/w instruction book. Weight 15½ lb. Price £40 or near.—Box 122, PARRS, 121 Kingsway, London. [122

TRANSMITTER 10 watts, single 6L6, perfect, £8 10s. Brand new, boxed, 6V6 (5), 8s.; RL7 (3), 11s.; AT4 (2), 35s., unboxed, guaranteed, 807 (3), 10s.; TZ40 (2), £2; Z62 (2), 10s., KT66 (3), 12s.; DET19 (1), 12s.; G3BEO, 50 Belle Vue Road. Ramsgate. [88

TRANSMITTING valves (new) (2) 1625's (1) 832, will exchange for good 1-V.1 Ham Receiver or what offers.—BRS12,329, 9a Blantyre Road, Liverpool, 15. [110

TOBE communication receiver, amateur bands only, 20, 40, 80 and 160 metres. Full scale bandspread, B.F.O. A.V.C. on/off, send/receive, mottled aluminium panel, separate P.M. speaker. Just been re-aligned, a really nice job, ready for hard work. Valves equal to new. Offers.—MCEWING, 89 Armadale Street, Glasgow, E.1. [93

VALVES.—IS5's (Midget 1·4v. Diode-Pentodes), 15s 6L6's (metal), 13s. 5T4's (metal), 12s. All unused.—BRS5788, 8 Ditchling Road, Brighton, 7. [76

EXCHANGE AND MART—continued

VALVES, new, unused. EB34, 5s.; 8D2, 9D2, 15D2, 7s. each; VP23, QP21, 7s. 6d. each; KTZ63, 8s.; Y63, FC2, X66, EF32, 8s. 6d. each; 6K8G, 10s. 6d.; 12SH7, 12SJ7, 11s. 6d. each; 6SN7 G/T, 15s. Arrange exchange any for 6V6, 807.—BRS9754, 54 Chaddlewood Avenue, Lipson, Plymouth. [*109*

VOLUMES 1 to 9 of BULLETIN wanted.—HARRIS, BRS12,959, Strouds, Bradfield, Berks. [*107*

WANTED.—H.R.O. coils. All ranges. Write—Box 78, PARRS, 121 Kingsway, London, W.C.2. [*78*

WANTED.—*Wireless World*, issue dealing with modification of T.1154 transmitter, the 1154 booklet, and any other information concerning it. Your price.—BUNDLE, 48 Croyland Road, Edmonton, N.9. [*90*

WANTED to loan or purchase, circuit diagram for services set T.R.9.H.—SCOTT, High Street, Great Budworth, Cheshire. [*96*

WANTED urgently, H.R.O. Senior coils of all ranges; state price and condition.—BRS8851, 6 Norfolk Road, Tunbridge Wells, Kent. [*99*

WANTED.—8X42, R.M.E. 45, 8X28A or similar good receiver, must be perfect, as new.—6M1, 131 Bloomfield Road, Blackpool. [*100*

WANTED for H.R.O., up to four No. 58 valves.—G6WX, 52 Second Avenue, Coventry, Warwickshire. [*105*

WANTED.—Really first-class valve test meter. Good price. for F.B. job.—G2BXL, 33 Prince's Way, Fleetwood, Lancs.

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