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VOL. XXIV **MARCH, 1949** **No. 9**

THE 21 Mc/s BAND

Members who have expressed surprise that the 21 Mc/s. band was not released last January appear to have forgotten the existence and purpose of the International Frequency Registration Board (I.F.R.B.) which was set up during the Atlantic City Conference. For the past 18 months the Board has been attempting to produce a properly engineered table covering the use of frequencies below 27·5 Mc/s. for submission to a world Conference in Geneva during 1949.

Originally it was planned to hold the Geneva Conference during the current month, but the date has now been put back to October, 1949.

Some time before October—probably in May—the Board can be expected to circulate its agreed list for consideration by the members of the I.T.U. If all goes well the list should be approved without too much argument in October or November at the latest. When that time arrives we can begin to look forward to the release of the 21 Mc/s. band, but we should do well to remember that some months must elapse before the new list can come into force. As amateurs we have no problem worth talking about—a new aerial plus a few new coils and hey presto! we shall be on the air. Not so the operating companies—their task will be much more formidable.

For that reason it is unlikely that the new table will take effect until October, 1950, at the earliest. Pessimists hint at January, 1951.

Incidentally when the 21 Mc/s. band is released to amateurs the width of the present 7 Mc/s. band will be reduced by one-half and that of the present 14 Mc/s. band by one-eighth.

There is, of course, the hard fact to be faced that the members of the I.F.R.B. may not be able to agree among themselves. In such a dire event world chaos in the field of radio engineering would no doubt result. Let us hope that wisdom and common sense will prevail between nations.

Wireless Telegraphy Bill

Speaking in the House of Lords debate during the Second Reading of the Wireless Telegraphy Bill, Lord Sandhurst made some interesting and knowledgable observations besides paying a tribute to radio amateurs.

Supporting the Bill, Lord Sandhurst said "I have had a good deal to do with wireless in this country during the past ten years and I realise how essential this Bill is; the Government are asking for no more than what I may describe as the minimum powers. I think I may claim to have had a good deal more to do with the Post Office interference investigation department, and to know more about the way it works, than possibly even the noble Earl (Lord Listowel) who introduced this Bill. Time and time again the safety of this country has been dependent upon the tact and skill of the Post Office engineers engaged in this work, to get something suppressed because they had no power to enforce it."

After commenting on the use of communal aerials Lord Sandhurst said: "There is another person—and a very important person—who is more affected by this Bill than the ordinary broadcast listener. The average person with the broadcast receiver does not suffer from severe interference, but we in this country have a person known as the wireless amateur, commonly known as a 'ham.' These amateurs work on short waves and are particularly liable and susceptible to interference. *They are a valuable asset to this country; they are the breeding ground for our operators of the future and they are the people who need protection far more than the ordinary household broadcast listener.*"

National Convention

For the first time since 1938 the Society is to hold a National Convention, but, unlike all those that have gone before, the 1949 event will take place out of London. Belle Vue, Manchester—"Showground of the World"—has been chosen as the venue.

Wisely the Council has decided that the Convention shall take place during the back end of the year, at a time when holidays are but memories and hotel accommodation is easier.

The organisation of this important event will be undertaken largely by a group of Manchester members possessing an intimate knowledge of local affairs. They will be assisted and guided by a small Executive Committee whose duty it will be to see that the programme covers a wide range of interests.

Reserve the dates *now*—October 22–23.

In this issue

A CRYSTAL-CONTROLLED EXCITER OR LOW-POWER TRANSMITTER FOR 420 Mc/s.

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

Introduction

THE chief object in mind in designing this transmitter was not the production of a highly-finished and expensive instrument but rather an investigation of the possibility of constructing a stable and reliable exciter or low-power transmitter for the 70 cm. band from inexpensive and easily-obtainable parts.

The choice of components, especially valves, has, therefore, been governed mainly by their availability as ex-Government surplus. All the same, the high performance of the ubiquitous DET 20 as a frequency - multiplier has amply justified its use and the DET 19 is, of course, a well-tried crystal oscillator and multiplier.

Before attempting work on 420 Mc/s., many amateurs are gaining experience on the 144 Mc/s. band and will have constructed crystal-controlled transmitters for that band. For this reason the present transmitter is made up in two separate units, the first of which provides a source of radio-frequency at 72 Mc/s. and can be used as a basis for transmissions on either 144 or 420 Mc/s. The second unit, specifically for 420 Mc/s., consists of a doubler stage, followed by a power-tripler.

Each unit is mounted on a chassis 10" × 6" × 2½".

The Driver Unit

There are countless ways of producing a crystal controlled signal on 72 Mc/s. from 6 and 8 Mc/s. crystals and most active experimenters have their favourite methods. The driver unit (Fig. 1) is described, therefore, for the benefit of those who wish to "start from scratch." It is entirely straightforward and needs but a little comment.

The first half of the DET 19 (RK34) is a straight crystal oscillator for 6 or 8 Mc/s. crystals. If crystals mounted in small two-pin holders are used, an ordinary octal-valve base will take two mounted side by side and a single-pole double-throw switch mounted on the chassis will enable either crystal to be used at will. The circuit diagram shows this arrangement.

The second half of the DET 19 acts as a tripler when 8 Mc/s. crystals are used or as a quadrupler with 6 Mc/s. crystals, the anode coil being tuned to 24 Mc/s.

The remainder of the unit comprises two DET 20 (CV6) valves in push-pull and trebles the frequency to 72 Mc/s. Link-coupling is used from the DET 19 output, a single turn of insulated wire at either end giving adequate coupling. Small split-stator condensers, available for a few pence from ex-Government surplus stores, are used in both grid and anode circuits and the anode coil, consisting of ten turns of No. 14 S.W.G. wire, is self-supporting. The output is taken to a co-axial plug *via* a single-turn loop closely coupled to the centre of the plate coil. Power leads are taken to a 5-pin *Belling Lee* socket at the rear of the chassis.

The Output Unit

DET 20 valves again feature in the second unit, a pair acting as a push-push doubler stage and

* 8 *Beckenham Grove, Shortlands, Kent.*

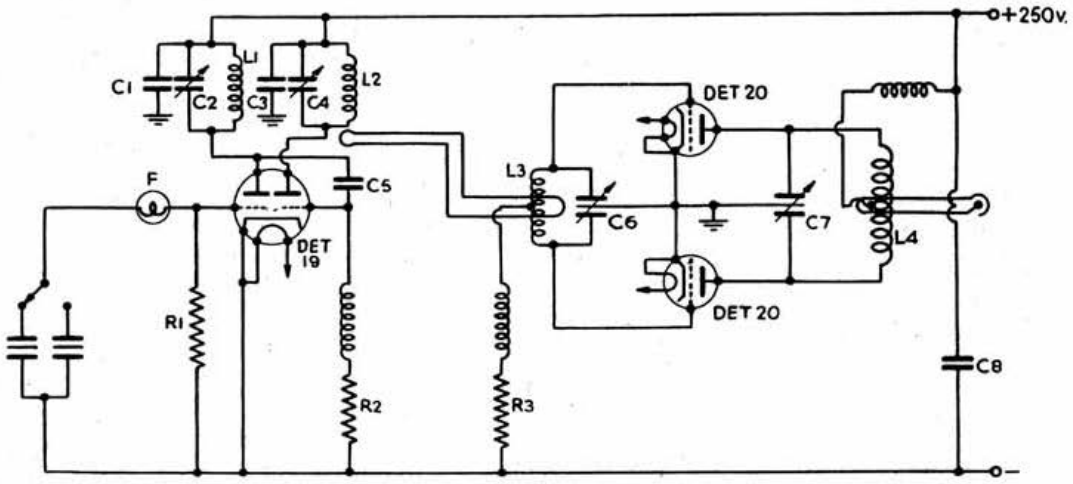


Fig. 1.
Circuit of the Driver Unit.

L1	40 turns No. 20 S.W.G. 5/16" dia. (approx.)		L3	24 turns No. 20 S.W.G. ¾" dia.	
L2	15 turns No. 20 S.W.G. 5/16" dia.		L4	10 turns No. 14 S.W.G. ¾" dia.	
C1, 3, 5, 8,	.001 μF.	C6	30 + 30 pF.	R2	100,000 ohms.
C2	60 pF.	C7	10 + 10 pF.	R3	33,000 ohms.
C4	30 pF.	R1	50,000 ohms.	F	60 mA fuse bulb.

giving a very satisfactory 144 Mc/s. output, which could, if desired, be coupled directly to an aerial for low-power transmission on that band, or to a power amplifier on the same frequency. The two units are coupled by a short length of 80 ohm co-axial cable and the link to the grid coil of the push-push stage is again by means of a single turn of insulated wire.

In constructing this stage, the DET 20 valve holders should be so orientated that the anode caps are only about an inch apart. The caps are then strapped by a short length of copper braid or ribbon. The anode coil, which is soldered directly to the centre point of the strap, consists of 3½ turns of No. 14 wire, one inch in diameter. The tuning condenser (C2) is a midget ex-Government component of about 12 pF. capacity, one side of which is bolted directly to the metal chassis.

The output valve, an 832 (or 832A), is one of the very few valves readily obtainable that is capable of use above 400 Mc/s. Although its efficiency as a tripler at this frequency is admittedly low, the R.F. output obtained, with careful construction, will be found adequate for experimental work on the 70 cm. band and a straight power amplifier may easily be added if suitable valves are obtainable.

The circuit of the unit is given in Fig. 3. The 832 valve-holder is supported by two aluminium angle brackets with the suppressor grid pin at the bottom. This brings the two control grid pins level and well-placed for making the shortest possible connections to the *Phillips* trimmer (C3) and single-turn coil (L3). Coupling and tuning of this coil is fairly critical and the single turn of insulated wire is pushed inside the anode coil of the push-push stage to give as close coupling as possible. Care will be necessary in making the centre tap to the single turn for connection *via* a small R.F. choke to the grid resistor (R3) and battery bias lead. Final adjustment of the coil position may be left until later.

The design of the output circuit L4/C5, explained in Fig. 4, should be carefully followed. The close-up photograph, Fig. 5, also shows the construction.

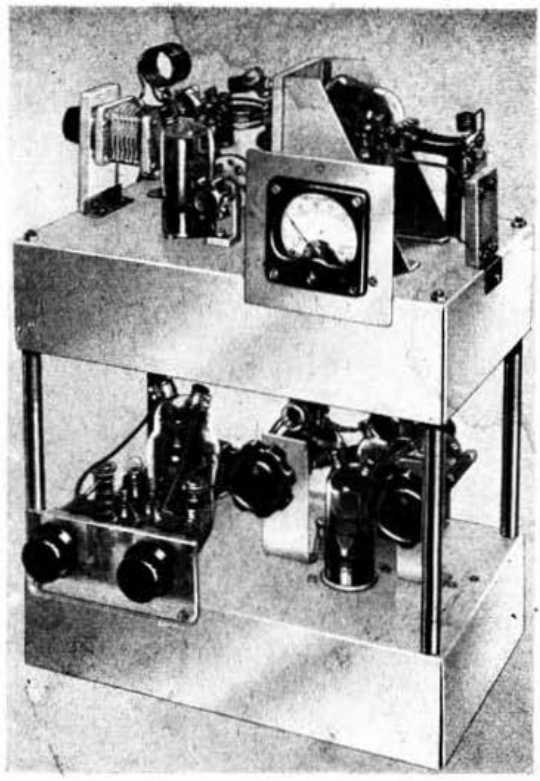


Fig. 2.
View of complete transmitter. The output unit is on the top deck.

The inductance is made from a short length of ¼ inch diameter copper tubing, which, after bending to shape, is tapped near its ends, as shown, for the

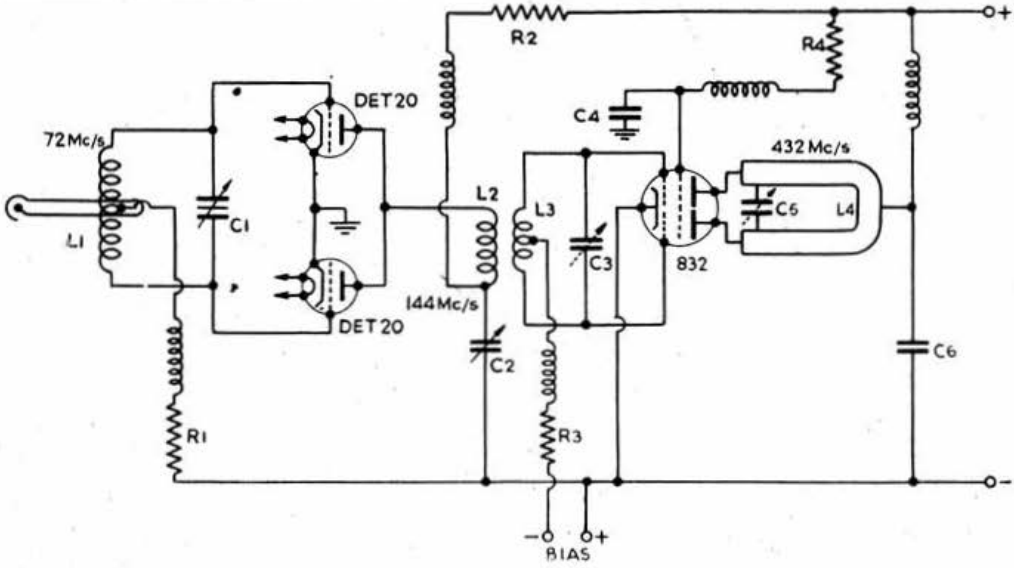


Fig. 3.
Circuit of the Output Unit.

L1	6 turns. No. 14 S.W.G. ⅜" dia.		L3	1 turn No 18 S.W.G. 1" dia.	
L2	3½ turns. No. 14 S.W.G. 1" dia.		L4	See Fig. 5.	
C1	18 + 18 pF. (or less)	C4, 6	100 pF.	R2	3,900 ohms.
C2	12 pF.	C5	See text.	R3	40,000 ohms.
C3	1–3 pF Trimmer (Philips).	R1	30,000 ohms.	R4	24,000 ohms.

insertion of 6 B.A. screws which grip the anode pins of the valve. The tubing *must* be shaped in such a way as to bring the two anode pins close against and parallel to the inner walls of the tube. If this is not done, the tightening of the screws will squeeze the two anode pins nearer together and the valve envelope may fracture at the seals.

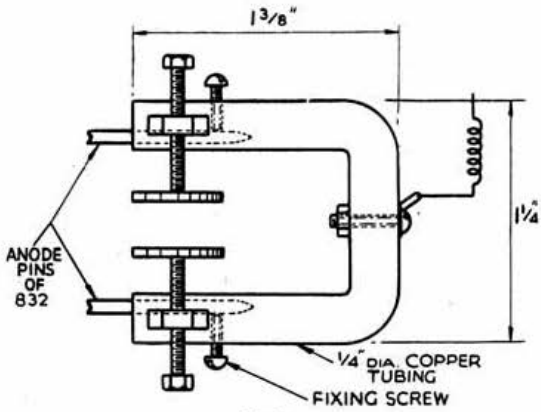


Fig. 4.
Output Tank Circuit Construction for 420 Mc/s. Transmitter.

Before the inductance is finally positioned, the small variable capacitor must be added. Originally, the writer was fortunate enough to find just the thing for this in the junk box in the form of a tiny dual-disc trimmer condenser from an ex-Government set. This is seen in the photographs. It is easy enough to build a similar component by soldering nuts and washers (the latter about ⅜ inch diameter for preference) to the ends of short lengths of 6 B.A. rod. Deep 6 B.A. nuts are then soldered to the ends of the inductance as shown and tuning is effected by screwing the rods in and out. It is assumed that most work on the band will be carried out between 430 and 440 Mc/s., thus enabling the same crystals to be used as for the 144–146 Mc/s. band. With this in mind the circuit was designed to work between these limits. If on test, the range is not quite correct, the copper tubing may be removed and the ends filed down slightly.

As the copper is sure to expand a little when the valve warms up, it is advisable not to clamp the tubing elsewhere and the R.F. choke, consisting of about seven inches of No. 16 enamelled wire is, therefore, made self-supporting and the inductance is held in position by the valve pins, with some additional support from the choke.

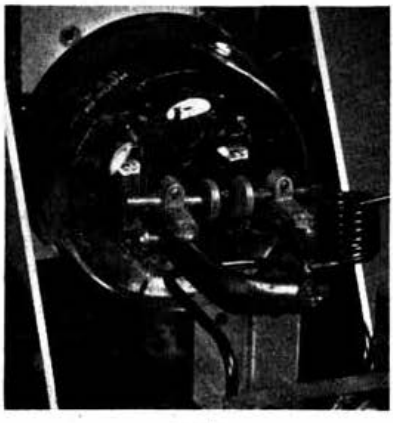


Fig. 5.
Photograph showing construction of Tank Circuit.

A rectangular loop of wire immediately below the inductance is used for coupling to the aerial or power amplifier and is soldered to a suitable plug or a pair of sockets. The degree of coupling is important and must be finally adjusted during tests.

Operation

No difficulty will be experienced in tuning-up the driver unit for which a voltage of between 200 and 250 is required. A separate source of high voltage for the second unit is desirable and this should be capable of supplying approximately 80 mA. at 300 volts.

Coupling between the two units should be adjusted to give maximum grid current in the push-push doubler before high-tension voltage is applied to the final stages.

About 72 volts of battery bias should be applied to the 832 during test. This will probably need to be reduced somewhat to give correct anode current at the measured plate voltage. The tuning of both grid and anode circuits of the valve is fairly critical and to avoid detuning, caused by body-capacity, a home-made tuning wand, conveniently made from a length of paxolin tubing, may be used for the final adjustment of C3 and C5.

It is recommended that arrangements for M.C.W. be incorporated in any modulator built to accompany the transmitter. This type of transmission is invaluable for station identification on the 420 Mc/s. band and the importance of including a short call with M.C.W. in any telephony transmission cannot be over-stressed.

Model Control Frequency

It is understood that frequencies in the bands 26·96–27·28 Mc/s., 464–465 Mc/s. are available in the U.K. for Model Control purposes. Power input 5 watts.

Faraday Lecture in Sheffield

On March 23 at 7 p.m. in the City Hall, Sir Noel Ashbridge, chief engineer of the B.B.C., will deliver one of the I.E.E. Faraday Lectures. His subject will be Television.

FREQUENCY MODULATION DISCRIMINATOR for the R.1147B

By B. W. St. Leger Montague (G2ANR)*

THE conversion of the R.1147B into an amateur band receiver particularly suited to 144 Mc/s. operation was described by the present author in an article in the May, 1948, issue of the BULLETIN. Provision was made for the addition of a frequency modulation discriminator, and the following description outlines the design of the additional section. In operation it is quite satisfactory, in spite of the fact that, due to the restricted space available, economy of design was essential.

Circuit Design

The phase discriminator was chosen in preference to other circuits because of its somewhat higher sensitivity and its comparatively easy alignment procedure. The theory of operation is described fully in several textbooks and the reader is referred to the Bibliography for details. On the practical side, the heart of the discriminator is the I.F. transformer, and details of a suitable component are given in the Appendix. The ideal transformer is one with a curve as shown in Fig. 1; the optimum conditions

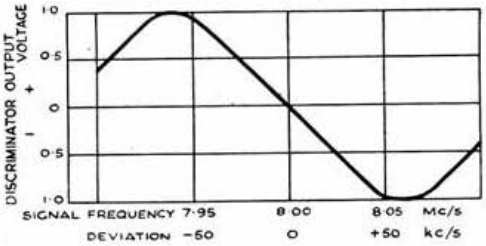


Fig. 1.

The ideal response curve of a discriminator transformer, connected as T4 in Fig. 2.

for linearity and frequency deviation are obtained by making the Q of the primary and secondary windings approximately equal, the ratio of the inductances of primary and secondary equal to $1/1{\cdot}8$ and the product of Q and k equal to $1{\cdot}5$, where k is the coupling coefficient of the windings.

The writer was fortunate in having a spare I.F. transformer from an R.1147, which was rewound in accordance with the data given in Appendix 1. The permeability trimming was retained, but in addition capacitance trimmers were fitted to enable a measure of control of the L/C ratio to be obtained. With a mean I.F. of 8 Mc/s., it was found that a deviation of $\pm$ 40 kc/s. could be accommodated with low distortion, and the B.B.C. F.M. station on 90 Mc/s. could be received intelligibly although it uses a deviation of $\pm$ 75 kc/s. For high quality broadcast reception it would be necessary to add extra damping resistors across the primary and secondary windings, and to increase the coupling, by means of a link, for example.

Construction

The discriminator transformer (T4) was mounted on the side of the case in the lower left front compartment, and in order to prevent the trimmer screws from projecting outside, it was supported on $\frac{1}{2}$" distance pieces. Clearance holes $\frac{1}{4}$" in diameter were drilled in the case for access to the trimmer screws, and it was found necessary to alter the position of the lid retaining clip on this side.

The circuit of the limiter and discriminator is given in Fig. 2, the EB34 double diode (V6) being accommodated in the valve socket which was left spare after the original modifications. The capacitance trimmers, which are of the *Philips* 30 pF concentric type, are mounted in the wiring, preferably with one end of each soldered to a component tag for rigidity. They should be fixed so that, with the lid open, they are accessible for adjustment with an insulated trimming tool.

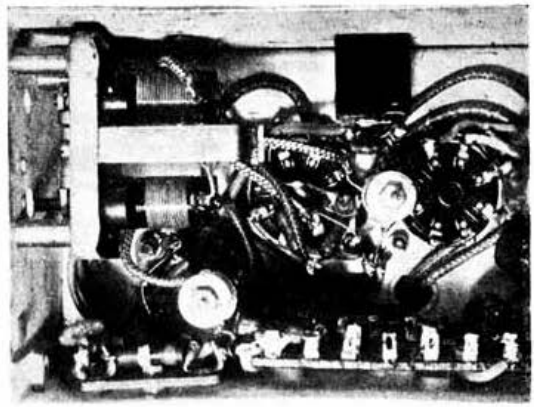
While the transformer was dismantled for rewinding, the brass wires forming the Faraday screen were snipped off; they are not required in the modified component, and their removal enables the coupling condenser between primary and secondary to be mounted inside the shield can. The photograph of the arrangement, which was taken with the can removed, shows the layout quite clearly.

For those who intend to make up their own discriminator transformer, it should be possible to mount it in a rather more elegant fashion than that described above, since, with the primary and secondary in line, less chassis space is required, and the unit can be mounted on the chassis in the corner of the compartment.

The limiter anode voltage is made adjustable by means of the 10,000 ohms potentiometer (mounted on the front panel in the top left-hand corner) to give control of the limiting level.

Alignment and Operation

The first three I.F. transformers should be aligned to give a bandwidth of approximately $\pm$ 50 kc/s. If a calibrated signal-generator is available, this is done quite easily as follows: The gain control is turned to maximum, and the signal-generator output is fed to the grid of the mixer valve, V1. Then, with a 0–100 μA meter connected to the limiter grid leak socket J, the I.F. trimmers should all be peaked to one frequency for maximum reading on the meter. If the



View of underside of R1147 showing disposition of component parts for F.M. discriminator.

* "*Onega*", *Chipstead Valley Road, Chipstead, Surrey.*

transformers have been wound in accordance with the data in the original conversion, the frequency will be around 8 Mc/s., and it should be determined exactly. The signal-generator should first be set 50 kc/s. on one side of this frequency, and the *primary* trimmers retuned for maximum output. It should then be set 50 kc/s. on the other side and the *secondary* trimmers peaked similarly. If no signal-generator is available, all trimmers should first be tuned for maximum noise output, and the primary trimmers each given half a turn one way and the secondary trimmers half a turn the other way.

For aligning the discriminator transformer, a valve voltmeter of some sort is very desirable, though it need be only of the simplest kind. This device should be connected across the lower diode load, with a good R.F. choke in the non-earthy lead. The receiver gain control should be set at maximum, the limiter control set to maximum limiting (minimum anode voltage) consistent with sufficient output, and the input amplitude adjusted to give about 50 μA grid current in the limiter circuit. The frequency of the injected signal must be adjusted to give maximum limiter current during the whole of the alignment procedure. With the primary capacitance trimmer about half-way in and the secondary circuit well off resonance, the primary dust core tuning slug should be tuned to resonance, as shown by maximum D.C. voltage across the one diode load.

The valve voltmeter is then connected across the *whole* diode load (*i.e.* the discriminator output) and, with the secondary capacitance almost at minimum, the secondary inductance is adjusted for minimum output. With the secondary very slightly mis-tuned from this point, the primary is tuned again for maximum, and the secondary finally tuned for minimum output.

The alignment is now complete, and if the signal generator is set in turn to, say, 20 kc/s. above and below the mid-band frequency, the outputs from the discriminator should be equal in amplitude and opposite in polarity.

If neither a signal-generator nor a valve voltmeter is available, the unit may be set up fairly satisfactorily by ear alone. The gain control should be at maximum, and, with the secondary mis-tuned, the primary should be tuned for maximum noise output. The secondary is then brought into tune, keeping the primary adjusted for maximum noise output until the exact secondary resonant point is reached, when the noise will disappear almost completely. This secondary tuning point is quite sharply defined.

Although the alignment procedure seems rather complicated, it is quite straightforward in practice, and takes less time to do than to describe. The most important point is to ensure that the input signal is at the frequency of the I.F. peak response as shown by maximum limiter grid current. When tuning on noise this condition, of course, follows automatically.

The operation of the receiver on F.M. transmissions is quite easy, the operator merely tuning for maximum intelligibility, which will correspond to the point of minimum intelligibility when the set is switched to A.M. reception of an F.M. signal. When the receiver is in use on F.M. signals, the gain control should be at maximum and the limiter control at the point of maximum limiting which will give sufficient output. On A.M. reception, the gain control is used in the usual way, the limiter control being inoperative.

Appendix I

Modification of a Spare 1147 I.F. Transformer for use in the Discriminator

The old windings and padding condensers should be removed and the formers rewound as follows :—

Primary—24½ turns, 34 S.W.G. D.S.C.

Secondary—35 turns, 34 S.W.G. D.S.C., centre-tapped.

The primary should be wound in the original grooves and will occupy about three-quarters of the former, but some of the secondary turns will need to be wound between the grooves in order that they may all be accommodated in the available space. Trimming capacitances are 30 pF across each winding.

Appendix II

Suggested Design for an Air-cored Discriminator Transformer

The following data has been calculated on the basis of a maximum deviation of ± 60 kc/s. with good linearity :—

(*Continued on Page* 221).

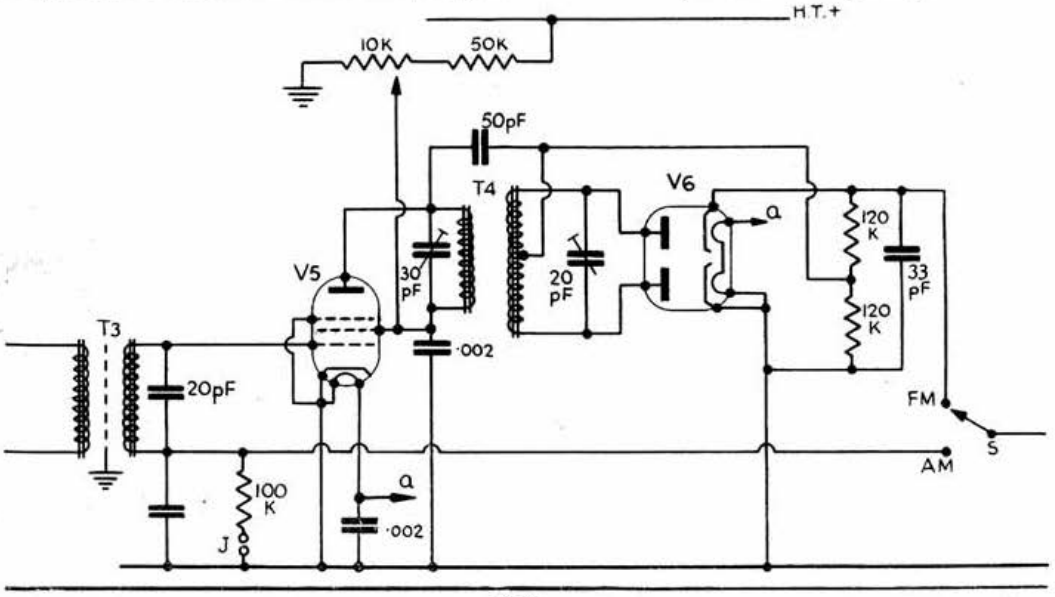


Fig. 2.

Circuit of the limiter and discriminator stages. A 0–100 μA. meter is connected to the points marked J when the stages are being aligned. When the meter is removed the two points should be bridged by a shorting plug. A suitable jack and plug arrangement is recommended.

R.F. PENTODE VALVES

By H. N. GANT, Grad. Brit. I.R.E. (B.R.S. 3759)*

BECAUSE of the very large number of valve types now available, it is sometimes difficult to decide which is the most suitable kind of R.F. Pentode for any particular application. The following description of uses and types may, therefore, be found helpful, but it should be appreciated that the list is by no means exhaustive.

It is obvious that the relative importance of the various characteristics of a valve will depend largely on the application, and it is necessary, therefore, to consider separately the uses to which R.F. pentodes are normally put. The present article, however, will be limited to voltage amplifiers, and these may be broadly classified as follows :—

(1) Resistance-capacity coupled (R.C.C.) amplifiers for audio frequencies.
(2) Inductance-corrected R.C.C. amplifiers for wide-band A.F. and V.F. amplifiers, oscilloscope input and deflection amplifiers, etc.
(3) Tuned amplifiers, with pass-band narrow compared with the central radio frequency, such as in receiver I.F. amplifiers.
(4) Wide-band tuned amplifiers, such as the I.F. stages of television and wide-band F.M. receivers.
(5) R.F. amplifiers for the higher frequencies, where the valve input resistance and the circuit dynamic resistance are both low enough to limit the gain.
(6) First stage amplifiers in large receivers and pre-selectors, where signal-to-noise ratio is the important factor.

The R.C.C. Amplifier

When correctly designed, an amplifier of this type will yield an output voltage of about one-third of the H.T. supply voltage and, provided that the anode load resistance is not excessively high, the response will be fairly level over the entire audio-frequency range. It is necessary for the grid characteristic to be straight over the portion required to give the full output, and this necessitates the use of non-variable-mu types. The treble response is given by ([1]).

$$A_t = \frac{A}{\sqrt{1 + \left(\frac{R}{X}\right)^2}}$$

where A_t is the treble gain, A is the gain at middle frequencies, R is the parallel value of the anode impedance, anode load and the following grid resistors, and X is the reactance of the stray capacities (Cs). These stray capacities include the output capacity of the valve, strays due to wiring, and the input capacity (including the Miller Effect) of the succeeding valve. In most cases the output capacity is only a small portion of the total stray capacity, with the result that variations between valves of different type will have little effect on the treble response.

The gain at middle frequencies is given by

$$A = g_m.R$$

where g_m is the mutual conductance and A and R are as above. Since the following grid leak is generally of much higher resistance than the other components of R, the gain will be proportional to

$$\frac{r_a \cdot R_L}{r_a + R_L},$$

where r_a is the anode impedance of the valve and R_L is the resistance of the anode load.

From this formula, it will be seen that R_L should be as high as possible; but it cannot be increased indefinitely or the available anode voltage will be too low to give the required output voltage. In the case of high-slope valves, the anode current is larger, so R_L must be smaller, thus limiting the gain obtainable, and making the stage gain much the same for all valve types. Thus the choice of valve may sometimes be made from the point of view of current economy, freedom from microphony, physical size, etc.

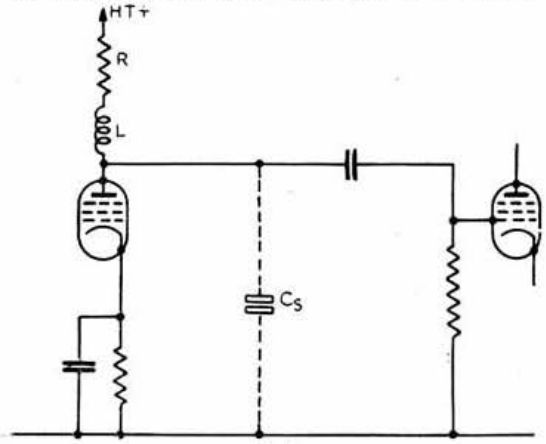


Fig. 1.
Typical circuit of aperiodic wide-band amplifier.

Inductance-Corrected R.C.C. Amplifiers

Valves for use in this category need to be more carefully chosen, as the requirements are more rigorous. A typical circuit for such an amplifier is shown in Fig. 1. The gain ([2]),

$$A = g_m.R\sqrt{\frac{1 + k^2.\Omega^2}{(1 - k.\Omega^2)^2 + \Omega^2}}$$

where $k = L/C_s.R^2$ and $\Omega = \omega.C_s.R.$ L is the inductance in series with the anode load. Factor k is fixed by the permissible variation of gain over the pass-band, and is generally of the order of 0·5 to 2·0. Factor Ω is fixed by the maximum frequency it is required to amplify with a given drop in response. R is thus limited by the pass-band requirements, and for a given pass-band is inversely proportional to C_s. For maximum gain, therefore, C_s must be as small as possible, and in the ideal case it will be due to the valves only, *i.e.* the output capacity of one and the input capacity of the next. Assuming the next stage employs a similar valve, this sum of input and output capacities, C_v, is the absolute minimum, and the maximum gain available from a given valve will then be proportional to g_m/C_v. The figures for this ratio, which is a figure of merit for valves used in such a circuit, are shown in column 8 of the Table. Here again it is essential to use non-variable-mu valves to avoid distortion due to the curvature of the characteristic.

Tuned Amplifiers

Amplifiers of the tuned type represent the commonest use of R.F. pentodes, as in the I.F. amplifier stages of receivers. The input and output

* 15 Lancaster Road, Southall, Middlesex.

capacities can be considered as part of the tuned circuits, and may, therefore, be neglected. The most important factors for this use are a reasonably high mutual conductance and a small value of grid-to-anode capacity, to prevent instability due to feedback of energy from output to input. The use of valves with too high a mutual conductance will give an unmanageably high gain, as such valves generally have rather a large value of grid-to-anode capacity, which encourages instability. Variable-*mu* valves, with a slope of 1·5 to 2·5 mA./V are generally used.

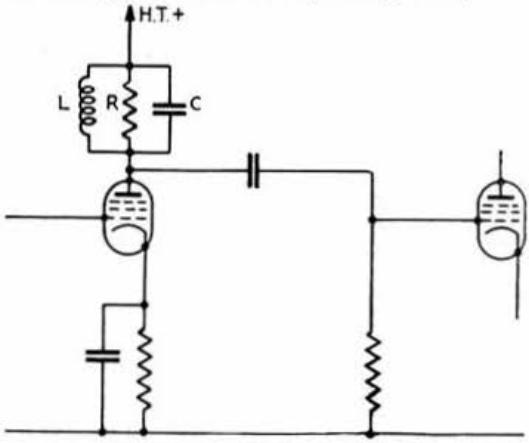


Fig. 2.
Typical circuit of tuned wide-band amplifier.

Wide-Band Tuned Amplifiers

The next type of amplifier to be considered is the wide-band amplifier using tuned circuits as coupling, such as the I.F. amplifiers of television, F.M. and pulse receivers. In order to provide the wide pass-band, it is necessary to damp the tuned circuit artificially, a typical circuit being that shown in Fig. 2. The dynamic resistance of the tuned circuit will be

$$Q^1/\omega C$$

where Q^1 is the effective Q of the circuit when damped. The stage gain will then be

$$A = g_m \frac{Q^1}{\omega C}$$

Since Q^1 is fixed by pass-band considerations, it is evident that the gain is proportional to $g_m/\omega C$, and C must, therefore, be as small as possible. In the limit, C will consist of only the output capacity of the valve and the input capacity of the next, so that a convenient factor of merit for this application will be g_m/C_v, where C_v is the sum of the input and output capacities of the valve, and this ratio is shown in column 8 of the Table as in the case of the second class of amplifier described. If A.G.C. is to be applied to such an amplifier, variable-*mu* valves must be used; some of the types mentioned in the Table have a variable-*mu* suppressor-grid, and in these cases the A.G.C. voltage is applied to the suppressor.

High Frequency Tuned Amplifier

This category includes amplifiers for use at H.F. or V.H.F., in which the gain per stage is limited by the low dynamic resistance of normal tuned circuits, and by the low input resistance of the valves.

Taking as a typical example an amplifier for 50 Mc/s., the probable Q of the tuned circuits would be about 150, and, assuming a total tuning capacity of 25 pF, the dynamic resistance would be about 6,000 ohms, which is comparable with the input resistance of the valve at that frequency. It will be evident, then, that the ideal valve will have a high value of mutual conductance, together with a high value of input resistance, and, as a guide, the product of these two figures is given in column 9 of the Table.

First Stage Amplifiers

The limit to useful amplification in the first stage of a high-gain receiver or preselector tends to be set by the amount of noise introduced rather than the actual gain in that stage. Noise introduced after the first stage is normally small enough to be neglected in comparison with the signal.

It can be shown (3) by a mathematical analysis of the equivalent circuit of a first-stage amplifier that, to achieve a minimum of noise voltage, the ratio R_n/R_e must be as small as possible, where R_n is the "valve noise equivalent resistance," and R_e represents the effective dynamic resistance of the tuned circuit and the transit-time loss in the valve, but any attempt to go more fully into the nature of these terms would be outside the scope of this article.

1 Valve Type	2 g_m (mA./V)	3 C_v (pF)	4 $C_{a\text{-}g}$ (pF)	5 R_n (ohms) (4)	6 R_{ip} (50 Mc/s.)	7 Cut-off	8 $\frac{g_m}{C_v}$	9 $\frac{g_m \times R_{ip}}{10^3}$	10 $\frac{R_{ip}}{R_n}$
6AB7	5·0	13	·015	2,500	5,400	Remote	0·39	27·0	2·16
6AC7	9·0	16	·015	1,140	5,400	Sharp	0·56	48·6	4·74
6J7	1·2	19	·005	6,940	7,000	Sharp	0·06	8·4	1·01
6K7	1·65	19	·005	16,400	7,000	Remote	0·09	11·6	0·44
6SJ7	1·65	13	·005	5,820	7,000	Sharp	0·13	11·6	1·20
6SK7	2·00	13	·003	10,500	7,000	Remote	0·15	14·0	0·66
954	1·4	6·4	·007	6,600	80,000	Sharp	0·28	112·0	12·1
EF42	9·5	14	·005	750	5,000	Sharp	0·68	47·5	6·7
EF50	6·5	15·3	·003	1,400	4,000	Sharp*	0·43	26·0	2·9
EF54	7·7	11·1	·02	700	10,000	Sharp	0·7	77·0	14·3
EF91	7·65	9·0	·008	1,200	3,200	Sharp*	0·85	24·5	2·7
KTW61	2·9	15	·0025	5,000	4,320	Remote	0·19	12·5	0·86
SP41	8·5	15	·003	850	2,000	Sharp*	0·56	17·0	2·35

*Valves marked * have a sharp cut-off characteristic of the control grid, but gain may be controlled by application of negative voltage to the suppressor grid. The value of R_{ip} used in column 10 is the input resistance of the valve at 50 Mc/s.*

As far as the valve itself is concerned, the noise equivalent resistance (R_n) and the transit-time equivalent resistance (R_{tp}) are the components of the ratio R_n/R_c which may be employed in the assessment of its usefulness. In column 10 of the Table, the reciprocal of this ratio is shown as a figure of merit, the higher figures indicating greater usefulness. At frequencies below 25 Mc/s., however, this is of less significance, as the dynamic resistance of the tuned circuit is generally greater than the equivalent noise resistance, and the input resistance of the valve is negligible.

References

(1) Terman, *Radio Engineering*.
(2) Terman, *Radio Engineer's Handbook*.
(3) Moxon, *Wireless World*, Dec., 1946.
(4) Where the equivalent noise resistance of a valve type is not available from manufacturer's literature it is calculated from

$$Rn = \frac{I_a}{I_a + I_s}\left[\frac{2{\cdot}5}{g_m} + \frac{20\,I_s}{g_m{}^2}\right]$$

F.M. DISCRIMINATOR (*Continued from page 218*).

Primary—30 turns, 34 S.W.G. D.S.C. Inductance 6·7 μH.

Secondary—41 turns, 34 S.W.G. D.S.C., centre-tapped. Inductance 12 μH.

Both windings are close wound on a ½" dia. former with 0·4" spacing between adjacent ends.

Trimming capacitances are 20 pF fixed, plus 30 pF trimmer for the primary, and 30 pF trimmer only for the secondary. No damping other than normal circuit losses is specified, although in some cases it may be found to be necessary.

In the original article, the identification of L1 and L2 in the coil winding data was omitted; this refers to the mixer and oscillator coils respectively.

* * *

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COMPONENTS EXHIBITION, 1949

THE sixth private exhibition, organised by the *Radio Component Manufacturers' Federation*, of components, valves and electronic test gear was held in London early in March. A total of 106 exhibitors gave further proof of the British manufacturers' ability to provide the home and overseas markets with a wide range of products remarkable both for efficiency and dependability. In fact the rigorous production tests carried out at every stage of manufacture often account for as much as 20 per cent. of the finished cost. Recognition of the high standards of our components and valves is reflected in the 1948 export figure of £5,600,000, an increase of more than £1,600,000 on the 1947 total.

At this year's exhibition, the growing influence of television on radio design in general was particularly noticable. The desire to reduce the physical dimensions of video equipment has brought about still further miniaturisation of valves and components. If full use is made of this feature by receiver manufacturers, we may expect to see some extremely compact sets at this year's Radiolympia. In particular, capacitors and resistors appear to have been singled out for space-saving improvements. The first miniature paper capacitors using only one metallised paper and measuring $\frac{3}{16}$ in. diameter by $\frac{7}{16}$ in. length were exhibited by *A. H. Hunt*, and there were a number of electrolytic capacitors of much reduced size.

More advanced types of television aerials, including 3-element beams, were shown by *Antiference*; though the amateur will view these attempts to extend the television "service area" with more than a little misgiving. Other interesting developments include a *Ferranti* 12 in. flat-face cathode ray tube and an exhibit of the *Mullard* projection tube unit, which, it is anticipated, will go into restricted production shortly. Many of the new television servicing instruments have been designed to cover the higher frequencies of the Sutton Coldfield station. Resistors which may be screwed together to form a chain suitable for high voltage applications were shown by *Welwyn Electrical Laboratories*.

The manufacturers of interference suppression equipment—stirred no doubt by the Wireless Telegraphy Bill now before Parliament—have considerably extended the range of their products. Almost all types of industrial, medical and domestic appliances are covered by one or the other of the specialist firms such as *Erie*, *Dubilier*, and *Belling-Lee*.

The research work carried out by Ministry of Supply establishments (including T.R.E., R.A.E., R.R.D.E. and S.R.D.E.) to help Services and civilian radio development formed the subject of one of the outstanding exhibits. A unique machine, shown for the first time, can plot error and law curves for all types of potentiometers in the period of half an hour instead of the six days normally required. Important new applications of the recently developed insulating material P.T.F.E. (polytetrafluoroethylene) include its use, instead of ceramics, for valve holders. The slightly resilient properties of this material prevent damage to miniature valves although at present it costs £5 a pound. A high-speed 400 cycle vibrator, the work of S.R.D.E., will permit the design of a miniature power pack intended to replace primary batteries.

For the first time the exhibition included members of the *British Valve Manufacturers' Association*. Medium and low power communications type valves were featured by several leading companies. The *G.E.C.* range included the TT15, a double tetrode rated to give 20 watts output at 100 Mc/s. and 10 watts at 250 Mc/s. Amateurs who intend to operate on the newly released microwave bands should note the new *Mullard* disc seal triodes which include the ME1001 giving ¼ watt output on 10 cm. *Standard Telephones* also have an interesting list of types intended for amateur purposes.

The exhibition certainly showed that the British radio industry is preparing to meet the changed economic conditions brought about as production slowly overtakes demand. An increased awareness of the necessity of "selling" the equipment was evident. Attractive advertising material, sales services and support for technical publications which spread information on British goods throughout the world underline the determination of the industry to meet all competition. The designers have done well; now the yoke passes to the shoulders of the salesmen.

J. P. H.

INTERPOLATION MADE EASY

By A. G. Dunn (G3PL) *

MANY amateurs now possess crystal-controlled frequency sub-standards, the construction of which have been the subject of numerous articles in the BULLETIN and other publications, but few appear to possess means for the accurate measurement of frequencies between the check points given by the sub-standard. This article is an attempt to describe a simple method of interpolation between 10 kc/s. points provided by a crystal-multivibrator type of frequency sub-standard. The accuracy of the method is higher than that required by the G.P.O., and an elaboration of the method could be made to give accuracy of the order of 0·001 per cent. if desired.

Interpolation Methods

The obvious method of interpolation is to use a calibrated variable oscillator working at the frequency to be measured, or at a sub-multiple of it, but this demands an extremely well-constructed and well-designed oscillator with a dial which can be read to very fine limits. Another system and probably the most accurate one is to compare the audio frequency beat note between the signal and the nearest standard harmonic with an accurately calibrated audio frequency oscillator. Other variations of the method exist, but it is proposed to discuss only one of them here.

The superheterodyne receiver translates any signal falling within its input pass-band to a corresponding signal in its I.F. range. As the frequency change is made by simple addition or subtraction, the frequency separation of two signals is unchanged in terms of kilocycles per second although the actual frequencies may be very different. It is therefore possible to carry out the interpolation mentioned above at the I.F. of a superheterodyne receiver. All that is required is a variable oscillator, with a calibrated dial, capable of tuning-through the receiver I.F.

Calibrated B.F.O.

Every normal communications type receiver employs such an oscillator in the shape of the C.W. oscillator or B.F.O. However very few B.F.O.'s are fitted with an accurately calibrated scale; in fact the writer does not know of a single commercial receiver with this feature.

The measuring procedure consists of tuning the receiver (with B.F.O. operating) to zero beat with the signal and then using the B.F.O. to measure the difference between the frequency of the signal and that of the nearest standard harmonic, without altering the receiver tuning.

The advantages of the scheme are that :—

(1) No additional apparatus is needed apart from the station receiver and the frequency sub-standard.
(2) No calculations are required, thus mathematical errors are eliminated.
(3) It is very rapid in operation.
(4) Errors, through confusion of harmonic beats (prevalent in the audio frequency method), are impossible.

A disadvantage is that the degree of accuracy is less than that of the audio frequency method. Furthermore the frequency stability of the B.F.O. and the frequency stability of the receiver H.F. oscillator must be good. (This has no effect on the audio frequency comparison method.) When the required accuracy is only of the order of 0·01 per cent., the advantages greatly outweigh the disadvantages. Where greater accuracy is desired, a separate B.F.O. with temperature compensation could be constructed. This would permit readings to probably 0·001 per cent., unless the receiver H.F. oscillator is very prone to drift. Even using the ordinary receiver B.F.O. the chief source of error in the writer's case is the accuracy to which the B.F.O. dial can be read. A visual method of determining zero beat is desirable but not essential.

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Calibration

The most convenient scale for the B.F.O. is one with a centre zero exactly on the I.F. calibrated to ±5 kc/s. Calibration may be effected by tuning the receiver to a steady signal such as one of the sub-standard harmonics, and comparing the audio beats, as the B.F.O. dial is turned, with the output from an accurately calibrated audio frequency oscillator. If the latter is not available, the following calibration procedure employed by the author may be used.

The equipment consists of a crystal oscillator on 100 kc/s., controlling a 10 kc/s. multivibrator, followed by a tuned output amplifier. The receiver is a pre-war *National* NC–101X. The 100 kc/s. oscillator is normally checked against the B.B.C. Droitwich station on 200 kc/s., (which is stated to have a frequency accuracy of 1 part in 10^6,) or against WWV.

After allowing the receiver and crystal standard to warm-up, the 100 kc/s. oscillator is adjusted until its second harmonic is in zero beat with Droitwich (within 1 c/s.). The receiver is then switched to the 1·8 Mc/s. band and the output of the standard fed directly into the receiver aerial terminal.

The receiver crystal filter is then brought into circuit and the B.F.O. switched on. The receiver tuning is now adjusted until one of the standard harmonics is received on the crystal peak, after which the B.F.O. is adjusted to zero beat and the point marked " 0 " on a cardboard scale fixed behind the B.F.O. knob. The crystal filter is then switched out. (This procedure is merely to assure that the zero on the B.F.O. scale is on the crystal peak frequency, and is not essential.)

With the B.F.O. still at the point " 0," the receiver is tuned to a point approximately midway between two of the standard 10 kc/s. points. The receiver audio gain is turned well up so that a beat between the audio tones formed by the B.F.O. beating with the two adjacent 10 kc/s. signals can be heard.

To make the foregoing clearer, suppose the receiver, with B.F.O. at " 0," is at zero beat with the 1,800 kc/s. standard signal. There will be a 10 kc/s. beat note in the output due to the 1,810 kc/s. signal. As the receiver is tuned towards 1,805 kc/s., the beat with the 1,800 kc/s. signal will rise from zero and that from the 1,810 kc/s. signal will fall. When the receiver is tuned exactly to 1,805 kc/s., both beats will have a frequency of exactly 5 kc/s. If the receiver is retuned slightly away from 1,805 kc/s., the two audio tones will be slightly different. The beat between the two will be audible as a very much lower and fainter tone. (Overloading in the receiver audio amplifier helps the formation of this beat.) The receiver tuning must be adjusted until the faint

beat falls exactly to zero. The receiver is then tuned to 1,805 kc/s.

The B.F.O. dial is now turned until zero beat is obtained with the 1,800 kc/s. signal. The setting so obtained is marked " +5 kc/s." on the dial. The latter is now turned to the other side of " 0 " until zero beat is obtained with the 1,810 kc/s. signal. This setting is recorded as " —5 kc/s."

This process gives three calibration points on the B.F.O. dial. The intermediate points are obtained by a similar process which is somewhat more difficult owing to the weakness of the beats. Assuming the receiver to be still set-up as above, the B.F.O. is adjusted to one of the 5 kc/s. marks and then tuned slowly towards " 0." When the audio beat has risen to nearly 1 kc/s., the beat caused by the other 10 kc/s. sub-standard signal is a little more than 9 kc/s. Their difference is rather more than 8 kc/s. This beat and others combine to make the 1 kc/s. note, which is the strongest, sound a little rough, but when this note reaches a frequency of 1 kc/s. exactly, the other beats come suddenly into harmonic relationship with it, and the 1 kc/s. note becomes pure. It is helpful if one is already familiar with the sound of a 1 kc/s. tone as the approximate setting can then be found quickly. The point at which the note clears up is marked on the B.F.O. scale as " 4."

The other points, " 3," " 2," and " 1 " are found in the same way, at places where the audio beat with the first 10 kc/s. signal is 2, 3, and 4 kc/s. These can be found approximately by remembering that 2 kc/s. is one musical octave above 1 kc/s., 3 kc/s. is the " soh " above that, and 4 kc/s. is one octave above 2 kc/s. The points on the other side of " 0 " are found in the same way, starting with the B.F.O. set on the other 5 kc/s. mark.

Frequency Measurements

The procedure for measuring the frequency of a signal is simple. The B.F.O. is set to " 0," and the receiver tuned to zero beat with the signal. The frequency standard is switched on and the B.F.O. dial turned until zero beat is obtained with one of the 10 kc/s. points. Only one zero beat will fall on the calibrated part of the dial, unless the frequency is exactly on the 5 kc/s. mark between the two nearest 10 kc/s. harmonics, when one zero beat will be at +5 kc/s. and the other at —5 kc/s.

If the zero beat setting is on the positive side of " 0," the dial reading should be added to the frequency of the lower 10 kc/s. point. If it falls on the negative side it should be subtracted from the higher of the two 10 kc/s. points. If zero beat falls precisely at " 0," the frequency is a multiple of 10. It will be necessary to have a rough calibration of the receiver to enable easy identification of the 10 kc/s. harmonics.

Accuracy

The maximum likely error, using the receiver B.F.O., has been calculated as ±0·02 per cent., assigning large values to all possible sources of error, and assuming them to be additive. In practice, the error will be less since all causes of error do not act in the same direction, and conditions will generally not be as bad as those assumed. Details are given below for the measurement of a frequency of 2 Mc/s. It will be seen that over half of the error is due to the B.F.O. dial reading, which has no vernier scale. The percentage accuracy improves slightly at higher frequencies, since the dial reading error stays constant whilst the signal frequency increases. This may be offset by more drift in the receiver H.F. oscillator.

Source of Error.	*Error in c/s.*	*Per Cent.*
Inaccuracy of comparison standard (Droitwich)	0·2	0·0001
100 kc/s. oscillator zero setting ..	2·0	0·002
Receiver zero setting	5·0	0·00025
B.F.O. zero setting	5·0	0·00025
B.F.O. drift between readings ..	5·0	0·00025
Receiver H.F. oscillator drift ..	50·0	0·0025
Dial reading error	200·0	0·01
Total ..		0·01535

It has been assumed that the various zero beats can be obtained to an accuracy of 5 c/s., which should not be difficult. The 100 kc/s. oscillator is set to zero by means of its second harmonic, so that the percentage accuracy is twice as good. In practice it has been found easy to obtain zero beat to less than 1 c/s. at 200 kc/s. Provided that the time interval between the two zero-beat readings is very short, the B.F.O. drift is negligible and the H.F. oscillator drift very small.

The calibrated B.F.O. can also be used to measure the frequency separation of two signals without using a frequency standard. Other arrangements of the dial calibrations could be used if found more convenient. It will also be found useful when audio filters are used for C.W. reception. In some cases the possible variation of the B.F.O. may not be as great as ±5 kc/s. and it may be necessary to increase the tuning range of the B.F.O. by replacing the " pitch control " condenser with one of higher maximum capacity. In the case of the receiver mentioned above the B.F.O. tuning range was about ±6 kc/s. In other cases the B.F.O. may need re-trimming if the I.F. does not fall approximately in the middle of the range of the pitch control.

DX CERTIFICATES

AS the number of proficiency certificates and diplomas issued by overseas societies and organisations has increased considerably during recent months, it is thought that a few notes on some of the better-known certificates now available may be of interest to transmitting members. The conditions governing the issue of all R.S.G.B. awards (W.B.E., H.B.E., B.E.R.T.A., and E.DX.C.) have recently been reviewed and an announcement regarding these certificates will appear shortly in the BULLETIN.

Worked All Continents (WAC)

The International Amateur Radio Union issues the WAC award to licensed amateurs submitting confirmations of satisfactory two-way communication with amateur stations in each of the six continental areas of the world: Europe, Asia, Africa, North America, South America and Oceania. Applicants must be members of the national amateur society of the country in which they are normally resident. Two types of certificates are available; the regular award, and a special one for telephony operation. Claims may be sent to the R.S.G.B. for checking.

DX Century Club (DXCC)

The DX Century Club Certificate is issued by the A.R.R.L. to amateurs submitting proof of postwar (since November, 1945) contact with 100 or more different countries as defined in the A.R.R.L. Countries List printed periodically in *QST*. Further endorsement stickers are issued in steps of 10 to certify countries confirmed above 100. Claims must be sent direct to: Communications Department, A.R.R.L., 38 La Salle Road, West Hartford 7, Conn., U.S.A., and should be accompanied by a list of claimed countries and stations to aid in checking and for future reference. Sufficient postage for the return of the confirmations must be forwarded with the application. The DXCC award is also available to any amateur who has worked 100 countries " all-time " provided that the claim is based on the pre-war DXCC rules and countries-list, and that the contacts were made from the same location. These " all-time " awards are not listed in *QST*.

Worked All States (WAS)

A certificate is issued by the A.R.R.L. to any amateur who submits proof of contact with each of the 48 continental United States. Pre-war cards may be combined with those resulting from post-war operation but all contacts must be made from the same location. This is defined as from places no two of which are more than 25 miles apart. Only one certificate is issued but, if requested, endorsements can be made in recognition of operation on a particular band or by a particular mode provided that the original certificate is returned. All claims must be sent direct to the A.R.R.L. at the address given above and sufficient postage sent to cover the return of the confirmations.

Worked All Pacific (WAP)

The New Zealand Association of Radio Transmitters has instituted a new award to be known as WAP (Worked All Pacific). Applications for the award should be sent *via* registered mail to N.Z.A.R.T., P.O. Box 489, Wellington, New Zealand, and must be accompanied by confirmations of two-way contacts with amateur stations in 30 or more countries in the Pacific area and a list of such confirmations to facilitate checking. Each confirmation must show a readability report of 3 or better, and a minimum tone report of T8. Contacts must have been made from the same call area (or country, if not subdivided) with the exception that if the applicant's station is moved from one country to another all contacts must have been made from within a radius of 150 miles from the original location.

For purposes of this award, the Pacific area, known also as the " continent " of Oceania, includes the following prefixes:

CR10, FK8, FO8, FU8, J9, YJ1,
KA, KB6, KG6, KH6, KJ6, KM6, KP6, KW6, KX6,
PK1, 2, 3, PK4, PK5, PK6, PK7,
VK2, VK3, VK4, VK5, VK6, VK7, VK8, VK9,
VR1, VR2, VR3, VR4, VR5, VR6,
VS1, 2, VS4, VS5, ZC2, ZC3, ZK1, ZK2, ZL, ZM.

Worked All VE (WAVE)

The Canadian Amateur Radio Operators' Association will award a certificate to any amateur who submits proof of contact with two different stations, on two different amateur bands, in each of the 9 Canadian Provinces. All contacts must have been made after January 1, 1939. The sum of 25 cents (or equivalent) should be forwarded with each application. A total of 18 confirmations are required from the following 9 Provinces: Prince Edward Island, New Brunswick, Nova Scotia, Quebec, Ontario, Manitoba, Saskatchewan, Alberta, and British Columbia. For the purposes of this award, Yukon Territory and the North-West Territories shall be considered as part of British Columbia. Claims must be sent direct to C.A.R.O.A. Headquarters, 46 St. George Street, Toronto 5, Canada.

Worked All Zones (WAZ)

Devised in 1936 by the Editors of *Radio* magazine (of which *CQ* is the successor), the WAZ system of DX classification is based on the division of the globe into 40 different geographical zones. The number of zones on each continent is roughly proportional to its area. To claim the WAZ certificate proof of contact with each of the 40 zones should be submitted to: CQ Editorial Offices, 342 Madison Avenue, New York, 17, N.Y., U.S.A., from whom a zone and country-list may be obtained on request (addressed envelope and reply coupon should be attached). Certificates are issued for either post-war or " all-time " operation but only post-war claims are listed in the monthly *CQ* " Honour Roll."

NATIONAL FIELD DAY, 1949

MAXIMUM POWER AGAIN FIVE WATTS

AS announced in the January BULLETIN, the rules for the 1949 National Field Day event are similar to those used last year. It is hoped that the combined ingenuity of Town or Area Groups will be used to produce efficient stations, which—complete with all auxiliary gear—are easily portable when the day arrives.

As an inducement to co-operation from portable stations within the Empire and overseas, an award is again offered to the British Empire or foreign station giving the most points to British Isles entrants.

Rules

1. The event will commence at 5 p.m., Saturday, June 11, 1949, and conclude at 5 p.m., Sunday, June 12, 1949.

2. The event will be confined to properly constituted R.S.G.B. Town or Area Groups within the British Isles, which, for the purpose of the event, constitute the prefix zones G, GC, GD, GI, GM and GW.

3. Each Town or Area Group taking part will be permitted to place two stations (" A " and " B ") into operation. Station " A " will operate on the 1·75 Mc/s. and 3·5 Mc/s. bands and Station " B " will operate on the 7 Mc/s. and 14 Mc/s. bands. Both stations may operate from the same site or from different sites, provided they are located within the agreed limits of the area covered by their County Representative. It will be permissible for two or more towns or areas within a single county to amalgamate for the purpose of this event.

4. Equipment at any " A " or " B " station must not exceed one transmitter and two receivers. (If desired one receiver may be used for searching one wave-band while the transmitter is operating on the other band.)

5. All transmissions must be signed off with the band in use; the numerals, 1, 3, 7 and 14 signifying the four bands (e.g. " .....AR 7 K ").

6. Each station must be licensed to use a different call sign. T.R.'s are responsible for forwarding to Headquarters applications for N.F.D. permits. Such applications should be set out as follows :—

National Field Day, 1949

On behalf of the members in.....(Town or Area)
I submit this application for permission to operate portable stations for the duration of the above event, as follows :—

" A " Station Call sign...../P Licensee.....
Site .....
" B " Station Call sign...../P Licensee.....
Site .....
(If applicable). I desire to combine with.....
(Town or Area) for the purpose of scoring.
Signed.....(T.R. or A.R.)
Call Sign..... Address.....

The above application, which is necessary to obtain the permission of the G.P.O., will also be regarded as an entry for the event. Permission is normally sent to the licensee direct by the G.P.O.

Applications, duly signed, must be in the hands of the Hon. Secretary, R.S.G.B. Contests Committee, New Ruskin House, Little Russell Street, W.C.1, **not later than April 11, 1949.** A list of portable stations and their locations will be published in the May issue of the BULLETIN.

7. The total D.C. power input to the anode circuit of the valve or valves energising the aerial or to any preceding stage of the transmitter shall not exceed 5 watts. Power shall not be derived from supply mains.

8. The height of the aerial at any point must not exceed 45 feet above ground level, nor may the point of suspension exceed 45 feet from ground level.

9. Stations must be operated from tents.

10. No apparatus may be erected on the site prior to 12 noon on June 11, 1949. This rule includes aerial and aerial fittings as well as tented accommodation.

11. The event is restricted to the use of C.W. only. Any station receiving consistent tone reports lower than T8 will automatically be disqualified.

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

A.—Between all Town or Area Portable Stations and Fixed Stations :—

(*a*)	Outside the Town or Area (or Town or Area Group), but within the British Isles ...	1 point
(*b*)	In the rest of Europe (including Eire) ...	2 points
(*c*)	Outside Europe	3 points
(*d*)	In the British Empire	6 points

B.—Between G, GC, GD and GW portable stations on the one hand, and :

(*a*)	Portable stations outside their Town or Area (or Town or Area Group), but within the prefix zones G, GC, GD and GW	3 points
(*b*)	Portable stations in the prefix zones GI and GM	4 points
(*c*)	Portable stations in Europe (including Eire)	4 points
(*d*)	Portable stations outside Europe	6 points
(*e*)	Portable stations in the British Empire ...	12 points

C.—Between GI and GM portable stations on the one hand, and :

(*a*)	Portable stations outside their Town or Area (or Town or Area Group), but within the prefix zones GI and GM	3 points
(*b*)	Portable stations outside the prefix zones GI and GM, but within the British Isles and Eire	4 points
(*c*)	Portable stations in Europe	5 points
(*d*)	Portable stations outside Europe	6 points
(*e*)	Portable stations in the British Empire ...	12 points

13. Only one contact with a specific station may be made on each band during the contest.

14. In addition to the National Field Day Trophy and miniature replica which will be awarded to the Town or Area Group obtaining the highest combined score, miniature replicas will be awarded to the Town or Area Groups with the leading " A " and " B " station scores. Should the winning Town or Area Group also lead with the highest " A " or " B " station score, it will only be eligible for one replica, the other would not then be awarded. A certificate will be awarded to the chief operator of the British Empire or foreign portable station contributing the largest number of points to stations taking part in the event.

15. An exchange of reports (RST) must be made before points can be claimed; proof of contact may be required.

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

17. All entries must be submitted and signed by the T.R. or A.R. who will be solely responsible for the conduct of the event in his town or area.

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

19. Entries must be made on the approved log sheets which will be issued to all competitors by Headquarters. Log sheets must reach the Hon. Secretary, R.S.G.B. Contests Committee, New Ruskin House, Little Russell Street, W.C.1, postmarked **not later than Monday, June 27, 1949.**

20. The N.F.D. Trophy will be held by the winning Town or Area Group for one year and will be handed to the T.R. or A.R. who will be held responsible for its custody during the year.

21. Operators of portable stations competing in the event must be holders of a G.P.O. Amateur Transmitting Licence and must be fully paid-up members of the Society.

22. The Contests Committee reserves the right to amend or alter these rules at any time prior to the commencement of the event. The decision of the President of the R.S.G.B. will be final in all cases of dispute.

That Avo Advert!

Observant eyes—and it is surprising how many there were—spotted an obvious error in the description of the Avo front cover advertisement published last month. The meter featured in the photograph was being used to measure the anode voltage of the oscillator stage of an AR88 receiver which had been adjusted to work at 105 volts. The photographer mixed his captions!

* * *

Old Timers were quick to notice a mistake in the Quiz published last month. The first broadcasting station in Great Britain was of course Two Emma Tock—Writtle. In those days *Emma* stood for the letter M. Our contributor (R. Sigs. 1941–46) was brought up on a new phonetic alphabet which is *Easy* to follow.

Withdrawal of Amateur Frequency Band

The Postmaster General announces that holders of Amateur Wireless Station licences will not be permitted to use frequencies within the band 58·5 to 60 Mc/s. after March 31st, 1949. Licences will be formally amended by a notice to be published in the London Gazette on April 1, 1949.

* * *

Notwithstanding the apparent finality contained in the above official notice the Society is still trying to persuade the G.P.O. to allow U.K. amateurs to use frequencies around 50 Mc/s. If permission is granted prior to the April issue appearing, a notice will be sent to R.R.'s.

THE MONTH ON THE AIR

By A. O. MILNE (G2MI)*

B.E.R.U. 1949

The 1949 Contest—for the first time a single week-end affair—attracted the support of most of the regulars and a pleasing number of newcomers. Three-letter G3's were heard going it "hammer and tongs" and several should have finished with most creditable scores. Slick operating and clean signals characterised this popular event.

Doughty warriors of past contests, such as G2EC, G5WP, G6CJ, VK2EO and VE1BV, were all giving high serial numbers during the last few hours. It will be a surprise if one of them is not declared the winner.

DX Phone Contacts on Ten

AS the use of the V.F.O. becomes general practice, more and more British 'phone stations are moving up into the so-called American 10 metre 'phone band (28·5–29·7 Mc/s.) and finding to their surprise that they are making 100 per cent. contacts with American 'phone stations on what, in the U.S.A., is a comparatively empty portion of the band.

Band Planning

It is interesting to see how the division of the bands is sorting itself out by common consent. In particular is it gratifying to note that 'phone in the first 100 kc/s. of the 3·5 Mc/s. band is now a commendable rarity.

However the best example of "mutual-consent" band planning is to be found on 14 Mc/s. where 14,000–14,150 kc/s. is now practically 100 per cent. C.W. There are still one or two odd men out but the position is as good as one could wish to see when it is realised that no form of compulsion has been necessary.

Notes and News

VP9G advises that KV4AB is leaving the Virgin Is., and will shortly be active with an HH call. He learns from CN8MU that FF8AA does not QSL but responds to a request for a "signed picture postcard bearing his call-sign!" VP9G very much wants to QSO VS and VU.

PX1A is a pirate. Why do we have to keep on telling you this? There are no PX stations active on any band.

BERS740 in Ipoh asks 7 Mc/s. stations to announce their call-signs slowly and clearly. He hears many South African and European signals on the band but is seldom able to identify their calls. PK5AA in Balik Papan is on 14 Mc/s. and has been heard working VQ4ERR at 1345 G.M.T.

VS2CQ says the following are active on 14 Mc/s.—2CB, 2CL, 2CN, 2CQ. VS2CC and 2CH are on spasmodically.

G2AVP claims the first "four band in one day" contact with VK5KO. This took place on January 31, 1948 (? 1949), as follows: 1205 G.M.T. on 28 Mc/s., 1210 G.M.T. on 14 Mc/s., 2005 G.M.T. on 3·5 Mc/s., and 2024 G.M.T. on 7 Mc/s. We have an idea G6ZO performed this feat some time ago with another VK station. Incidentally VK5KO heard GB1RS at S6 on March 4 at 2000 G.M.T.

We hear that our old pre-war "phoney" friend TA1CC, is on the warpath again and on 3556 Mc/s!

G5RQ tells us that his son, VP4TO, is now operating in South Africa as ZS4TO. They still maintain their daily sked.

W2RA hands a bouquet to G stations. He has sent out 93 QSL's and received 91 in return. He wants to publicly thank British Amateurs for their splendid response. Talking of QSL's, 3·5 Mc/s. confirmations are in from VK5KO and ZC8PM.

BRS.15822 says the address of C1CH is now c/o Y. C. Hsu, Box 443, Shanghai. VP9E will soon be active again, but with a ZB1 call. VP9Q confirms the rapidly growing amateur activity in Bermuda. The following are on fairly regularly: VP9AA, BB, CC, DD, D, F, G, L, Q, WW, and Z. Says propagation seems to be excellent from the island. VP9Q's home, by the way, is at Mottingham, London, S.E.9.

From G2YL we learn that MD4JG has left Mogadishu and is now VQ4CJG and active on 28,300 and 14,150 kc/s. Those still waiting for a MD4JG QSL are asked to have patience as he had to leave in a hurry and his logs and cards have only just caught up with him.

The Heard Island station, VK1VU on 14,123 kc/s., has been worked by G3AKU and G3ATU, and heard by G3SU. VK1 counts as a new country.

Anyone waiting for a QSL from W5AFU is asked to send a repeat as some of his outgoing cards have gone astray.

ZE2JI says that although radio conditions have not been too good recently, the Southern Rhodesia Amateur Radio Society is going strong and has already succeeded in obtaining for its members and others an increase of maximum licensed power from 50 to 100 watts. Permission to use the 144 Mc/s. band has also been secured.

G3BCK suggests two new ways of calling CQ: CQ RS—"I want a rubber stamp QSO." CQ RC—"I would like to rag-chew." He draws attention to the activities of two pirates. GO2HA who claims to be in the Orkney Is. saying it is a separate country and TAF4. Both the operators sound like Latins. We have quite enough trouble on our hands from Italian and Spanish stations using R.A.C. and T1 spitch without them turning up with "phoney" calls as well. It is surely time that the amateur organisations in these two countries put their house in order and got off the air those people who fill a hundred kc/s. and more with the most disgusting noises imaginable. The Spaniards are the worst offenders. Some of their signals sound like a microphone in the field windings of a 2kW vacuum cleaner.

BRS.11494 sends in the usual log of "extra specials" including KR6BA, W7LZJ/C6, SV5UN, VP3MCB, and ET3AE on 28 Mc/s., W6WVJ/KW6, KR6AG (APO239), VK5AE (Darwin), and VK5KM on 14 Mc/s. YN1RO on 28 Mc/s. at 1630 G.M.T., is a useful one to look for.

BRS.16857 has just received a confirmation from VQ4FCA on 28 Mc/s. C.W.—input 3 watts. Other cards include ZS1ER (20 watts), UB5AG (20 watts), PY5QG (30 watts), and VK3TX (24 watts).

G6RH offers the following: ZK2AA 14130, VK9NR 14009, FD8RG 14045, FI8ZZ 14015, EA6AZ 14065 (Balearic Is.), FE8AB 14030, EA8CO 14185 'phone (QSL's).

21 Mc/s.

BRS.15050 has heard CN8EI working on 21 Mc/s. with W2LHQ on 14 Mc/s. CN8EI was heard to state that the 21 Mc/s. band would be released on April 1. (Significant date!) *This is not so.* Nor so far as we know has CN8EI any right to use the band. It may have been a pirate, of course, but don't be misled. Members will receive ample notice when the band is to be released and this will not be for many months to come.

Another Hoax

HB9GP, the Swiss QSL Manager, has advised us through G2PL that the station using the callsign CZ2AC was a pirate in Switzerland, that he has been apprehended by the authorities, and that the Miss Monsinio who sent the cards is an Italian living in Switzerland. In short, no amateur station has operated in the State of Monaco and the whole thing was just a rotten hoax. G8PL who has handled the cards was taken in with the rest and is in no way implicated. Amateur Radio is coming to a pretty pass when even a QSL card is suspect!

Tibet

A letter from AC4RF clears up the position in that part of the globe. Only AC4RF and AC4YN are genuine, AC4YN has not been on 3·5 Mc/s. Several G's have worked AC4RF, including G5RF, G5YU and G6RH. G2MI is sending him a supply of QSL's. He is ex AC3SS. AC3NC is also genuine.

Slow Morse Tranmissions

Day	*G.M.T.*	*kc/s.*	*Call*	*Town*
Daily	22.00	1840	G6NA	Guildford
Sundays	11.00	1800	G2LC	South Ruislip
Sundays	20.30	1802	G2DLJ	Derby
Mondays	13.00	1870	G3AXN	Southend-on-Sea
Mondays	20.00	1900	G2AJU	Stutton, Ipswich
Mondays	20.00	1800	G2DJS	Bradford
Mondays	20.00	1750	G3DSR	Derby
Mondays	20.00	1900	G3DDM	Petersfield
Mondays	21.00	1900	G2BLN	Bournemouth
Mondays	21.00	1850	G8VR	London, S.E.2
Tuesdays	13.00	1870	G3AXN	Southend-on-Sea
Tuesdays	22.00	1896	G8TL	Ilford
Tuesdays	22.30	1896	G4GA	Chingford
Tuesdays	22.30	1820	G6JB	Salcombe, Devon
Tuesdays	23.00	1820	GM4AN	Kirkcaldy
Wednesdays	19.00	3625	PA0AA	Hilversum
Wednesdays	20.00	1783	G3AFD	Southampton
Wednesdays	21.00	1800	GM2HIK	Forfar, Angus
Wednesdays	22.00	1800	G3DLC	Grays
Thursdays	13.00	1870	G3AXN	Southend-on-Sea
Thursdays	22.00	1873	G2BCX	South Woodford
Thursdays	22.30	1873	G3ARU	South Woodford
Thursdays	22.30	1803	G3OB	Manchester
Fridays	13.00	1870	G3AXN	Southend-on-Sea
Fridays	19.00	1900	G3BLN	Bournemouth
Fridays	20.00	1900	G2AJU	Stutton, Ipswich
Fridays	20.00	1860	G3AKW	Wirral
Fridays	20.00	1900	G3DDM	Petersfield
Fridays	20.30	1868	G8LZ	Gravesend
Fridays	22.30	1820	G6JB	Salcombe, Devon
Fridays	23.00	1820	GM4AN	Kirkcaldy
Saturdays	23.00	1800	G3CHY	Ashton-u-Lyne

Volunteers in districts still not covered by these services are invited to write to Mr. C. H. L. Edwards, G8TL, 10 Chepstow Crescent, Newbury Park, Ilford, Essex.

* *29 Kechill Gardens, Hayes, Bromley, Kent.*

AROUND THE V.H.F.'s

By W. H. ALLEN, M.B.E. (G2UJ)*

THIS feature depends to a very large extent upon reports and comments supplied by readers, and the brevity and lack of news in the present article reflects the fact that only three such letters have arrived during the past month. In order to give a balanced account of V.H.F. work on all bands, we would request readers to send their news in time for the next issue, the closing date for which is March 24.

Five Metres

There are no signs of a further reprieve for this band and we must, therefore, be resigned to its passing on March 31. Several of its former habitues have announced their intention of returning during this month to help give a worthy send-off to our first V.H.F. allocation which, over a period of years, has provided not only a source of interest to many operators, but has been the proving-ground for technical development and theories of propagation connected with the higher frequencies. Looking back over the years the Story of Five Metres has followed closely that of other bands lower in the spectrum. At first considered of little practical importance, it was given over to amateurs to "waste their time on." Not satisfied with the results of self-excited oscillators, super-regen. receivers and simple aerials, apparatus which proved adequate for cross-town contacts at visual range, the amateur progressed to crystal controlled transmitters feeding multi-element rotary beams and, most important of all, led the way to reliable semi-DX working by his development of sensitive, low noise-level receivers, of which some outstanding examples have been produced, and which have contributed much to the general fund of knowledge regarding R.F. amplification and receiver technique generally. This work having reached the stage where the band has been proved of practical worth we now have the not unmixed pleasure of seeing it taken from us and handed over to commercial interests for television. May the viewers get as much pleasure from its use as its development has given us.

G2ADZ (Oswestry), will be active until close-down, and will be calling G2AOL (Otford, Kent), every evening except week-ends at 1930 G.M.T. G2AOL and 3AVF (Torquay), have been rewarded with a QSO after two months of unsuccessful effort, thanks to an aurora opening which produced S9 plus signals in both directions.

Two Metres

G2ADZ has been active most evenings during the past month, and reports that conditions have been almost continuously good for 150 mile working since January 22, with openings up to 180 miles on January 23 and February 16. He is uncertain whether to regard his inability to raise London stations, which he can hear making short-haul QSO's, as evidence of one-way traffic, or to a general lack of sensitive receivers among the said London stations. We would remark that we too have experienced this one-way effect over much shorter distances, and are curious to know its explanation. 2ADZ suggest that as, in nearly all cases, conditions have deteriorated by 2200 G.M.T. this is a good argument for earlier operation on the band by those interested in DX working.

Reference was made last month to the extraordinary differences in signal strength experienced by G2ADZ and G4LU, who lives 5 miles south of him and is apparently better situated, when working the Cheltenham stations. On one evening recently G5BM (Cheltenham), was receiving 4LU S5 fading to S2, while 2ADZ remained a steady S8. The Cheltenham signal varied from S8 down to zero at 4LU, but was S9 plus at 2ADZ.

The following have been reported as reliable signals by 2ADZ over the past month:—G2HDY, MR, 3BLP, 4AU, 5MA, MI, RP (rather weak), 6NB, VA, VX, YP and 8DM.

Two Metre Contest

We take this opportunity of reminding readers of the contest to be held on April 2–3, and hope that as many stations as possible will be taking part. The rules governing this event will be found elsewhere in this issue. Please remember that the band now covers the whole of the range 144–146 Mc/s. and that some stations may be transmitting on frequencies towards the upper and lower limits of this range in order to avoid interference in the "popular area" 145 Mc/s. ± 100 kc/s.

Seventy Centimetres

Some observations have been made by G2FKZ (Dulwich), on reception of those harmonics of the Alexandra Palace sound and vision transmissions which fall in or near the 70 cm. band, and while sufficient data is not yet available to enable the ruling propagational conditions to be assessed accurately by this means some interesting facts have already come to light. The tenth harmonic of the vision signal on 450 Mc/s. is normally unreliable, while the strength of the tenth and eleventh harmonics of the sound—transmitted on 41·5 Mc/s.—vary from day to day. During one period of thick fog the vision harmonic was received at a strength generally expected from the sound, but the latter was practically unreadable. Some variation in the readability of the sound transmission takes place, but whether this is due to varying transmission path conditions or to adjustments at the transmitter, is not yet known. It is worthy of note that evidence of differences in signal strength amounting to 3 or 4 to 1, or possibly greater, have been noticed by G2WS and 6HD when operating over a very short but non-visual path of less than 2 miles.

We understand that some tentative suggestions have been put forward for tests between the Midlands and South London on this band, during which all available southern stations will transmit CQ calls in a northerly direction for a period, immediately followed by a similar procedure on the part of the northerly stations beaming south. By this means it is hoped that, even if no two-way contacts are accomplished right away, some signals may survive the distance. We shall be pleased to receive further news on this subject as soon as arrangements have reached a more advanced stage.

Several instances have been reported of better results being obtained between two stations situated out of visual range when their beams have been pointed not at one another, but in such directions as enables the signals to be "bounced off" a building or natural feature at some distance from the direct route. This seems to presage the erection by interested parties on inconvenient obstructions of a tuned aerial to relay signals by re-radiation as was used with advantage, so we understand, in some V.H.F. connections during the war!

BRS13111, (Herne Hill), using a converted R.1294 receiver, has heard 2FKZ and 3CU, on an indoor aerial.

South London U.H.F. Group Meeting

This group invites the attendance of members interested in U.H.F. operation at a meeting to be held at G4CG, 57 Kingswood Road, South Wimbledon, on Sunday, March 27, when, among other things it is hoped to arrive at a general agreement upon the employment of either vertical or horizontal polarisation for 70 cm. signals. It would be appreciated by 4CG if those intending to be present would let him know by post card at the above address before the date of the meeting.

Television Tests in the Netherlands

We are indebted to S/Ldr. C. Keith Street, G3DKS, for the following information regarding commercial and amateur television transmissions in Holland. *Philips*, of Eindhoven, are transmitting sound (call sign PAGE) on 67·75 and vision on 63·25 Mc/s., with powers of 3 and 9 kW respectively, on Mondays and Saturdays low power tests are carried out between 0900 and 1100, with normal radiation on Monday from 1300 to 1600 and programmes from 1915 to 2100 on Tuesdays, Thursdays and Saturdays. The service was resumed on February 10, and the system employs 567 lines and 25 frames per second.

The Groningen amateur group, PAOBE, GN, USA, WL and ZX, transmit vision on 145 and sound on 144 Mc/s. with a power of 250 watts in each case. 202 lines, 25 frames, are used on the vision transmission. Tests are made for irregular periods from Monday to Friday and a programme is radiated on Saturdays from 1900 to 2130, and on Sundays from 0900 to 1100. All times are G.M.T., and the call is PAOZX. The vision transmitter at PAOZX consists of an oscillator on 145 Mc/s. using a cavity tuned circuit, a buffer stage, a 50 watt push-pull driver, and two *Philips* QB 2·5/200's capable of handling 500 watts in the P.A. On a previous 50 watt transmitter a range of 30 miles was obtained with a converted British Gee indicator unit modified for use as a receiver, but the new transmitter is expected to do much better. Listeners are reminded, however, that Groningen is nearly 400 miles from London.

Scientific Survey

Mr. T. Kellett, G3EGF, "Aysgarth," Lyndhurst Crescent, Gateshead 9, representing the Durham University Exploration Society would be glad to hear from any member who has information on the subject of short range radio working in mountainous country. He also needs details of simple D/F devices that can be used in such circumstances.

The D.U.E.S. is making, in July, a scientific survey of part of the Cairngorm region and the party, which will be split into two groups, hope to keep in touch through the medium of transceivers operating on 7100 kc/s. Permission to operate short-wave equipment is being sought from the G.P.O.

Region 8

Members resident in Bexhill, Hastings and St. Leonards, are asked to consider promptly the question of the appointment of an Area Representative. Nominations should be forwarded in prescribed form to the General Secretary.

The Regional Representative (Dr. W. P. Cargill) is anxious that this part of his Region should be adequately represented.

TWO METRE CONTEST

THE first Two Metre Contest organised by the Society will be held during the first week-end in April.

Intending entrants are referred to the General Rules for 1949 Contests as published in the January issue of the BULLETIN.

Additional Rules

1. The Contest is open to all fully paid-up members of the R.S.G.B. resident within the British Isles.
2. The Contest will extend from 12 noon, Saturday, April 2, to 12 midnight, Sunday, April 3, 1949.
3. Entries must be submitted in the form set out below :—

Two Metre Contest, April 2–3, 1949.

Name..... Call Sign.....

Address .....

Transmitter..... Receiver .....

Aerial System.....

Time	Station Worked	Serial Number		Location	Estimated Distance	Points Claimed
		Sent	Rec'd.			
					TOTAL	

Declaration.—I declare that my station was operated strictly in accordance with the rules and spirit of the Contest, and I agree that the decision of the President of the R.S.G.B. shall be final in all cases of dispute.

Signed.....

4. The input power to the final stage of the transmitter must not exceed 25 watts.
5. Points will be scored for two-way telegraphy or telephony contacts in accordance with the following scale :—

Distance from Station Worked	Points
Up to 25 miles	1
Over 25 and up to 50 miles	3
Over 50 and up to 100 miles	5
Over 100 and up to 200 miles	7
Over 200 miles	10

(NOTE.—The map used by the Contests Committee for checking distances will be the Ordnance Survey Base Map (10 miles per inch), Sheets 1 and 2.)

6. An exchange of a six-figure group (comprising RST and the serial number of the contact), and the location (*viz.* Town and County or Town and Country), will be required before points for a contact can be claimed.
7. Only one contact with an individual station will be permitted to count for points.
8. The Mitchell-Milling Trophy and a Miniature Cup will be awarded to the winning entrant. Certificates of Merit will be awarded to the entrants placed second and third.

"Top Band" to open in U.S.

We learn from the American Radio Relay League that the amateurs of the United States are expecting shortly to regain some of their operating rights in the 1·8 Mc/s. band. Broadly speaking 50 kc/s. of the band (in two 25 kc/s. segments) will be available to amateurs in any one section of the U.S. under certain power restrictions. No night-time operation will be permitted in the States bordering the Gulf of Mexico. Maximum input power permitted in most areas will be 500 watts during daylight and 200 watts at night.

The proposal to allow U.S. amateurs to share the 1·8 Mc/s. band with other Services—and in particular with Loran—is to be discussed at the forthcoming Inter-American Regional Conference due to open in Washington on April 1 next.

S.C.U.3 Royal Signals

It is proposed to hold a Northern Re-union in Birmingham on Saturday, April 23, 1949, for personnel who served in the above unit. All members who are interested in attending should write to Mr. Gilbert Moss, 24 Stanway Road, Shirley, Birmingham.

The address of the R.S.G.B. QSL BUREAU IS :

29 KECHILL GARDENS, HAYES

BROMLEY, KENT

AND NOT R.S.G.B. HEADQUARTERS

New Books

RADIO VALVE DATA. Compiled by the staff of *Wireless World*. Published by Iliffe & Sons, Ltd. Copies available from Headquarters price 3/6 (postage 3d.).

Before the war, the annual *Wireless World* Valve Data Supplement was recognised as the standard source of reference for information on British valves. Unfortunately since 1940, paper restrictions have prevented the publication of this supplement. Now, however, a post-war edition has been prepared in the form of a separate booklet, containing 80 large 10" × 7" pages.

"Radio Valve Data" gives the main electrical characteristics of 1,600 British and American receiving valves, the information comprising figures for normal operating conditions arranged in tabular form. Valves are classified according to type under the headings frequency changers, screened tetrodes and pentodes, output valves, diodes, triodes, rectifiers (valve and metal), tuning indicators, barretters and voltage stabilizers. The British valves are further grouped under manufacturers' names and then sub-divided into obsolete, replacement and current types, according to the makers' categories.

Additional tables and diagrams give the base connections for all valves, and an index enables any valve to be easily found by type designation. A separate list of those American-type valves which are made in this country is included : data is also given on crystal valves and signal-frequency metal rectifiers.

Amateurs will regret the omission of low power transmitting types but, nevertheless, will welcome the re-appearance of this invaluable source of reference, especially in view of the many new valves which have been introduced since 1940.

OUR FRONT COVER

THE performance and reliability of transmitting valves in the field depends to a large extent upon a series of rigorous tests which are conducted during various stages of manufacture.

Our front cover picture shows dynamic characteristic tests being carried out on a QY2–100 R.F. Power Tetrode at one of the Mullard Valve Factories. Above the cabinet housing the valve, will be seen one of a series of lamps which constitutes the load for these tests. This test board provides for a large combination of tests under various conditions, thus ensuring that all valves leaving the factory will give the highest standard of performance.

Visit to Holland and Denmark

For the benefit of members of the Society, Mr. H. Andrews, G5DV, 175 Moorland Road, Weston-super-Mare, is organising a visit to Holland (2 days) and Copenhagen (11 days) between July 23 and August 6. The inclusive charge for rail and boat fares and hotel accommodation (bed and breakfast) is expected to be about £21. There are a few vacancies for the trip and any member interested is requested to communicate with Mr. Andrews immediately as early reservation is essential.

Silent Keys

It is with deep regret that we record the death at the early age of 21 of Mr. John Caley, BRS.14556, of Swindon, Wiltshire. John was a staunch supporter of the local Society, and an enthusiastic listener. His passing will be mourned by his many friends.

* * *

We also record with sorrow the passing at the age of 30 of Mr. Lawrence ("Lofty") G. Hayns, G3BBM, a prominent member of the Burton-on-Trent Radio Society. He leaves a widow and two children to whom we offer sincere condolences.

* * *

Those amateurs who regularly work Australians on 14 Mc/s., will be grieved to hear of the sudden death of Alex Robinson, VK2GR. One of the outstanding phone stations from "down under," he was well-known to many British operators for his unfailing cheerfulness and his willingness to help in tests.

He died from a heart attack only a few hours after making his last contacts with several British stations on 14 Mc/s. Our heartfelt condolences go to his wife and family in their sad loss.

HIC ET UBIQUE

January Council Meeting

Resume of the Minutes of a Meeting of the Council of the Incorporated Radio Society of Great Britain, held at New Ruskin House, Little Russell Street, London, W.C.1, on Tuesday, January 18, 1949, at 6 p.m.

Present.—The President (Mr. V. M. Desmond, in the Chair), Messrs. Auchterlonie, Corfield, Edwards, Evans, Hammans, Lewer, Milne, Scarr, Watson and John Clarricoats (General Secretary).

Apologies for Absence.—Apologies were presented for the absence of Messrs. Charman, Mathews and Watts.

New Trophies.

The President offered to present a trophy to the Society for annual competition.

Resolved (*a*) to accept with thanks the offer made by the President, (*b*) that the trophy shall be known as the Victor Desmond Trophy, (*c*) that initially the trophy shall be awarded to the winner of the second 1949 1·7 Mc/s. Contest.

The trophies presented by Messrs. A. O. Milne and A. E. Watts were displayed at the meeting.

Resolved that the trophies be known respectively as the Arthur Watts and Arthur Milne Trophies.

Rules governing the award of the Arthur Milne Trophy and revised rules governing the award of the Braaten Trophy were submitted and adopted. (The two sets of Rules were published in the February issue of the BULLETIN.—ED.).

I.A.R.U. Calendar.

It was reported that the Radio Club Argentino had offered to present to the I.A.R.U. a trophy which would be awarded in 1959 to the Member-Society of ten years standing and upwards which is then adjudged to have contributed most to the advance of the amateur communication art and to international understanding among amateurs.

Resolved to endorse the acceptance of the trophy by the President of the I.A.R.U.

It was reported that Liga Panamena de Radio Aficiondos (Republic of Panama), L.P.R.A., had applied for membership in the I.A.R.U.

Resolved to vote in favour of the proposal submitted by I.A.R.U. Headquarters that L.P.R.A. be accepted into membership.

It was reported that the Club de Radio Aficionados de Guatemala, the Hong Kong Amateur Radio Transmitting Society, the Phillipine Amateur Radio Association, and the Radio Club Peruano had been elected to membership in the Union.

It was reported that the following new operating awards had been instituted:

Worked all Pacific (WAP)	...	N.Z.A.R.T. (New Zealand)
Worked all CE (WACE)	...	R.C. de C. (Chile)
Helvetia 22	...	U.S.K.A. (Switzerland)

Membership.

Resolved (*a*) to elect 87 Corporate Members, 41 Associates and 8 Junior Associates. Total elected 136. (*b*) to grant Life Membership to Messrs. I. J. Wood, G3CHP, and O. J. F. Davidson, GM3CFX. (*c*) to grant Corporate Membership to 11 Associates.

Finance.

Resolved to accept and adopt the Cash Account for the month of December, 1948.

The Secretary reported that the Bank of England Foreign Exchange Branch now require separate Mail Transfer applications to be prepared to cover all transactions relating to orders for U.S. technical publications received from members and others resident outside the U.K. This requirement had created a great deal of extra work in the office.

The Secretary also reported that he had submitted to the Board of Trade a statement in support of his application for the Society to be granted an extension of the Board of Trade authorisation to accept orders for U.S. publications. The statement had been certified by the Society's accountants.

Contest Committee Report.

Resolved (*a*) to award miniature trophies to Messrs. Hunt, G2FSR, and Shears, DL2KW, the leading stations in the 1948 Top Band Contest; (*b*) to award certificates of merit to Messrs. Railton, G8AB, and Wormer, OZ1W.

Resolved to award a miniature trophy to Mr. Banner, GW3ZV, the leading U.K. entrant in the 1947 V.E.R.O.N. DX Contest.

Resolved to publish in loose leaf form revised rules governing the award of R.S.G.B. certificates.

Vote of Thanks.

The President moved and it was

Resolved that a vote of thanks be recorded to the retiring members of Council, Messrs. Edwards, Morton Evans and Hammans.

The Meeting terminated at 8.20 p.m.

Committees of the Council

The Committees of the Council for the year 1949 have been constituted as follows:

Codes of Practice.—Messrs. G. P. Anderson, G2QY; I. D. Auchterlonie, G6OM; W. E. Russell, G5WP; P. A. Thorogood, G4KD.

Contests.—Messrs. F. Charman, G6CJ; C. J. Greenaway, G2LC; T. L. Herdman, G6HD; W. H. Matthews, G2CD; P. A. Thorogood, G4KD.

Finance and Staff.—The President (Mr. V. M. Desmond, G5VM); Messrs. D. A. G. Edwards, G3DO; J. W. Mathews, G6LL; A. J. H. Watson, G2YD.

G.P.O. Liaison.—The President (Mr. V. M. Desmond, G5VM); Messrs. J. Clarricoats, G6CL; S. K. Lewer, G6LJ; W. A. Scarr, G2WS; A. E. Watts, G6UN.

Membership.—Messrs. A. P. G. Amos, G3AGM; I. D. Auchterlonie, G6OM; D. A. G. Edwards, G3DO; S. K. Lewer, G6LJ.

Scientific Observations.—Messrs. W. H. Allen, G2UJ; L. Blagbrough, BRS.15012; H. R. Hatch, G2CBB; D. W. Heightman, G6DH; W. A. Scarr, G2WS.

Technical.—Messrs. W. H. Allen, G2UJ; F. Charman, G6CJ; D. N. Corfield, G5CD; H. A. M. Clark, G6OT; E. L. Gardiner, G6GR; R. H. Hammans, G2IG; S. K. Lewer, G6LJ; J. W. Mathews, G6LL; A. O. Milne, G2MI; R. H. Newham, G3SU.

Representation

The Council has been pleased to re-appoint Mr. S. J. Granfield, G5BQ, 47 Warren Road, Cambridge, as Region 5 Representative. Mr. Granfield recently resigned owing to pressure of private business.

* * *

The following are additions or alterations to the list of Representatives published in the February, 1948, and subsequent issues:—

Town and Area Representatives

Region 7.

London South—Bromley and Beckenham ... G. M. Ward, G3BOB, 5 Abbotsbury Road, Hayes.

Region 8.

Sussex—Area of Bognor Regis, Littlehampton, Rustington, Chichester, Bosham, Emsworth, East and West Horsham. R. Allen, G2DSP, "Farndell," Upper Bognor Road, Bognor Regis.

Vacancies

Messrs. D. E. Davy, G3RW, T. Sharp, BRS10363, and W. Hervey Banks, G2ARX, have resigned as Town Representatives for Great Yarmouth, Ardrossan and Stockport respectively. Nominations for their successors must be made in the prescribed form and should reach the General Secretary by March 31, 1949.

Official Regional Meetings

The following programme of Official Regional Meetings has been approved by the Council:

Date.	Region.	Venue.	Council Representation.
April 10	6	Luton ...	Messrs. Corfield and Thorogood
,, 24	3	Coventry ...	Messrs. Auchterlonie, Mathews and Milne
May 22	10	Portheawl ...	Messrs. Allen and Scarr
Sept. 17	14	Glasgow	Messrs. Thorogood and Watson
,, 18	12	Aberdeen	
,, 25	4	Nottingham	Messrs. Amos, Charman and Edwards
Oct. 9	8	Brighton ...	Messrs. Allen and Amos

The President expects to attend several of the meetings including those in Scotland, whilst the General Secretary hopes to attend all meetings.

J.T.L.

FORTHCOMING EVENTS

REGION 1

Accrington.—April 13, 7.30 p.m., Cambridge Street Schools.
Ashton-under-Lyne.—April 3, 3 p.m., New Jerusalem Schools, Katherine Street.
Blackpool.—March 15, 7.30 p.m., Chamber of Trade Office, Queen Street.
Bolton.—April 5, 8 p.m., Y.M.C.A.
Burnley.—April 6, 7.30 p.m., Mechanics Institute, Manchester Road.
Bury.—April 14, 7.30 p.m., Atheneum, Market Street.
Darwen and Blackburn.—April 1, 15, 7.30 p.m., Weavers Institute, Darwen.
Manchester.—April 4, 7.30 p.m., Reynolds Hall, College of Technology, Sackville Street.
Oldham.—March 23, April 13, 7.30 p.m., Civic Centre.
Preston.—March 18, April 1, 7.30 p.m., Three Tons Hotel, North Road.
Rochdale.—April 3, 3 p.m., Drill Hall, Baron Street.
Wirral Radio Society.—March 23, April 6, 7 p.m., Y.M.C.A., Birkenhead.

REGION 2

Barnsley.—March 25, April 8, 7.30 p.m., King George Hotel, Peel Street.
Bradford.—March 22, April 5, 7.30 p.m., Cambridge House, 66 Little Horton Lane.
Catterick.—Tuesdays, 7 p.m., Loos Lines, Catterick Camp.
Darlington.—Thursdays, 7.30 p.m., Club Room, British School Yard, Skinnergate.
Doncaster.—Wednesdays, 7.30 p.m., 73 Hexthorpe Road.
Harrogate.—Wednesdays, 7.30 p.m., rear of 31 Park Parade.
Hull.—March 30, 7.30 p.m., Ye Olde White Harte, Mytongate.
Middlesbrough.—March 28, April 1, 7.30 p.m., 400 Linthorpe Road.
Newcastle-upon-Tyne.—March 21, 8 p.m., British Legion Rooms, 1 Jesmond Road.
Pontefract.—Alternate Thursdays, 7.30 p.m., Travellers Arms, Featherstone.
Sheffield.—March 23, Faraday Lecture (see separate notice). April 13, 8 p.m., Albreda Works, Lydgate Lane.
South Shields.—Thursdays, 7.30 p.m., Trinity House, Laygate.
Spenborough.—March 30, April 13, 7.30 p.m., Temperance Hall, Cleckheaton.
York.—Wednesdays, 8 p.m., 29 Victor Street.

REGION 5

Cambridge.—March 18, 7.30 p.m., Jolly Waterman. (The display of home-built gear will take place at the April meeting.)
Southend Radio Society.—March 18, April 1, 7.15 p.m. Morse Classes, 7.45 p.m. Lectures, Room 1, Municipal College.

REGION 6

High Wycombe.—April 27, 7.30 p.m., G3BZM, 7 The Quadrant, Totteridge.
Luton.—Every Monday, 7.30 p.m., at Surrey Street Schools.
Stotfold.—Every Monday, 8 p.m., the A.C.F. Hut.

REGION 7

London.—March 25, 6.30 p.m., Institution of Electrical Engineers. Tea, 5.30 p.m. "Technical Publishing," G. Parr, A.M.I.E.E.
Barnes and Putney.—April 5, 7.30 p.m., 28 Nassau Road, S.W.13.
Barnet.—April 16, 7.30 p.m., Bunny's Restaurant, 15 Station Road, New Barnet.
Chingford.—March 17, 8 p.m., 1 Essex Road, N. Chingford. March 31, 8 p.m., 21 Mornington Road, Chingford. April 14, 8 p.m., 23 Moreland Way, Chingford.
Croydon, Surrey, R.C.C.—April 12, 7.30 p.m., Blacksmiths Arms, South End.
East London.—April 10, 2.30 p.m., Lambourne Room, Ilford Town Hall.
Edgware and District R.S.—March 16, 23, 30, St. Michael's School, Flower Lane, Mill Hill.
Enfield.—March 20, 3 p.m., George Spicer School, Southbury Road.
Hayes.—April 8, 7.30 p.m., "The Vine," Uxbridge Road, Hillingdon.
Hoddesdon.—April 1, 8 p.m., Salisbury Arms Hotel.
Holloway (Grafton R.S.).—7.30 p.m., Grafton School, Eburne Road, N.7. (Mondays, Wednesdays, and Fridays).
Peckham.—April 4, 7.30 p.m., The Kentish Drover, Rye Lane.
St. Albans.—April 13, 8 p.m., The Beehive, London Road.
Slough.—March 17, 7.30 p.m., Labour Memorial Hall, Chandos Street.
Southgate.—April 1, 7.30 p.m., The Merry Hills Hotel (Oakwood Station).
Watford.—March 15, April 5, 7.30 p.m., Carlton Tearooms, Queen's Road.
Welwyn Garden City.—April 5, 8 p.m., Council Offices.

REGION 8

Brighton.—March 24, 31, 7.30 p.m., St. Mary Magdalene Hall, Bread Street, North Road.
Guildford.—March 27, 3 p.m., Cinema Cafe, Woodbridge Road. P.c. to T.R. if attending.
Southampton.—April 2, 7.30 p.m., 22 Anglesea Road, Shirley.

REGION 9

Bristol.—March 25, 7 p.m., Keen's University Cafe, Park Row.
Cheltenham.—March 18, April 1, 8 p.m., Committee Centre, Brooklyn Road.
Exeter.—April 1, 7 p.m., Y.M.C.A., 41 St. Davids Hill.
Gloucester.—March 13, 31, 7.30 p.m., Spread-Eagle Hotel.
Plymouth.—March 19, 7 p.m., Tothill Community Centre, Tothill Park, Knighton Road, St. Jude's.
Stroud.—Wednesdays, 7.30 p.m., Subscription Room.
Torquay.—March 19, 7.30 p.m., Y.M.C.A., Castle Road.

REGION 14

Ayr.—March 30, 7.30 p.m., Royal Hotel, Prestwick.
Glasgow.—March 30, 7 p.m., 39 Elmbank Crescent.

London Meeting

About 100 members were present at the meeting held on February 25, 1949, at the Institution of Electrical Engineers, when Mr. H. A. M. Clark, B.Sc.(Eng.), A.M.I.E.E., G6OT, read a paper entitled "Impedance Matching." A number of demonstrations contributed considerably to the enjoyment of the evening.

Mr. D. N. Corfield, D.L.C. (Hons.), G5CD, on behalf of the members present thanked Mr. Clark for his paper which will be published in the next issue of the *Proceedings of the R.S.G.B.*

Mr. E. L. Gardiner, B.Sc., G6GR (Past President) officiated as Chairman.

Coventry Amateur Radio Society

Consequent upon taking up a new appointment outside the town, Mr. J. W. Swinnerton (G2YS), who has been Hon. Secretary of the Society for a number of years, recently announced his resignation. The new Secretary is Mr. K. Lines, 70 Stepping Stones Road, Coventry. Meetings are held on alternate Monday evenings at the B.T.H. Social Club, Holyhead Road.

The Annual Dinner will be held at the Wine Lodge Hotel, The Burges, on Friday, March 25, at 7.30. The General Secretary of the R.S.G.B., who is a Vice-President of C.A.R.S., will be present.

Derby Dines

Mr. W. A. Mead, G5YY, Chairman of the Derby and District Amateur Radio Society, had the support of a large number of members and their ladies at the first Annual Dinner, held on February 9 last, at the Grandstand Hotel, Derby. A happy and enjoyable evening was spent.

A further social evening will be held at the Post Office Telephones Club, Sadler Gate on March 24. Club meetings will be held at 67b London Road on March 16, 30 and April 13.

Mr. A. G. G. Melville, F.R.C.S., has accepted the Society's invitation to become President.

Hull and History

On March 30 the Hull R.S.G.B. Group begins monthly meetings at "Ye Olde White Harte," Mytongate. The room to be used is the historic "Plotting Chamber," scene of the decision to resist King Charles I when, in April, 1642, he demanded the surrender of Hull.

Llandudno Supper Meetings

Llandudno members hold a supper meeting on the third Wednesday of each month at Cestrian Cafe, near the Railway Station. Price 2/3. Visitors from other parts will be warmly welcomed at these meetings by the C.R., Ivor Jones, GW3KY and the T.R., Arthur Evans, GW4MZ.

Plymouth Group

The end of another successful year of amateur activities by the Plymouth R.S.G.B. Group was marked recently by the Annual Dinner, held at the Lockyer Hotel. Twenty-five members and their guests were present to enjoy the programme of dancing and entertainments.

South Hants Radio Transmitters Society

Monthly meetings of the Society are now being held in new and more spacious premises. The Hon. Secretary is Mr. H. G. Martin, G3ACM, 184 Kirby Road, North End, Portsmouth, from whom details can be obtained.

Spen Valley Amateur Radio and Television Society

The Society is meeting regularly and activities will continue throughout the summer. The new secretary is Mr. Norman Pride, 100 Raikes Lane, Birstall (telephone Batley 923), who will be pleased to contact prospective members, particularly those willing to lecture or to take an active part in the affairs of the Society.

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/-. (*Write clearly. No responsibility accepted for errors*). 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.

AMATEUR selling up, offers AR88D as new, with S. Meter £55; R.107 with S. Meter £15; BC342 £12; HRO with 20, 40, 80, 160 coils, 5 in all £25; 33 sender with 2,000V P.U. 500 watt CW, 250 watts phone 20, 40, 80 meters. Built in V.F.O. £45; numerous other radio parts. Must sell.—IRISH, 144 Adelaide Road, N.W.3. [644

AMERICAN I. 56.J. Valve tester, circuit analyser complete with separate D.C. multimeter, A.C. output meter, adaptors in padded case, perfect condition, suitable auto-transformer. £20 or nearest secures.—BRS12365, Alcester Road, Wootton, Birmingham. [629

AR.88 LF excellent condition, complete with trimming tools and manual. £45 or offer. Also Electronics 60W. Multimatch modified transformer, unused £3. North London Area.—Box 604, PARRS, 121 Kingsway, London, W.C.2. [604

AVO Valve tester £9; Avo CR bridge £7 10s.; Cossor double-beam 3339 oscilloscope, bargain £15; BPL signal generator (30 Mc/s.–100 kc/s.) £14; BPL Wobbulator (F.M.) £12; Re-align your R.F.'s, I.F.'s visually. All good condition. Carriage paid.—Write BRS12497, 78 Wilton Road, Salisbury, Wilts. [612

BARGAINS: B.P.L. signal generator £10; Oscilloscope £8; 12 watt amplifier £9; BC348 (external power pack, loud-speaker) £22 10s.; AC/DC superhet M.W. & L.W. £10. Near offers accepted.—G. BERNER, 4 Arundel Avenue, Morden, Surrey. Liberty 6066. [615

BC–221–D with calibration books, less crystal and valves, case soiled £3; Wavemeter W1117 with valves, calibration charts, transit case £3; or offers. Carriage extra. 3X 866A/866 20s. each.—G3CUC, Thornbarrow Cottage, Windermere, Westmorland. [616

B.S.W.L. Join British Short Wave League—over 20 departments (Q.S.L. Bureau, DX Certificates, Technical, Translations, etc.). Members receive "Short Wave Review" each month. For details send S.A.E.—H.Q., 145 Uxendon Hill, Wembley Park, Middlesex. [542

BC221 A.C. power packs. 200–250V input, stabilised output. To fit into battery compartment. £2.—M. A. WESTON, Harman's Cross, Corfe Castle, Dorset. [632

B348 230V plus 10M converter. Also Trophy 6. Nearest £12 and £8 respectively.—34 Birch Avenue, Romiley, Cheshire.

CAN someone please help? G3DAV seeks accommodation, preferably unfurnished, in Ruislip, Hayes or Pinner Districts, for self and wife.—Please write Box 628, PARRS, 121 Kingsway, London, W.C.2. [628

CHASSIS, Panels, Racks and Metal Cabinets. Stock sizes or made to specification in steel or aluminium.—REOSOUND ENGINEERING & ELECTRICAL COMPANY, Coleshill Road, Sutton Coldfield. [631

ECHOPHONE communication receiver Model EC2; seldom used, ·55 to 30 Mc/s., noise limiter, BFO complete with external L/S £15. Valves 810, 803 £2 each.—STEWART, 4 Craiglockhart Place, Edinburgh. [620

EDDYSTONE 504 perfect order £40 or offers; Brand new Taylor model 30A oscillograph, Maker's guarantee, £22 or offers. Taylor model 60 signal generator. Recently overhauled Makers, £10; or offers. Loudhailer Parmeko 6L6PP complete, speaker, mike, 12V car battery.—Offers: A. C. BEVINGTON, 41 Moore Crescent, Langley, Birmingham. [637

FOR SALE: D.C. Avo Minor as new £3. 807's 12s. unused.—TOMLINSON, 42 Chestnut Avenue, Oulton Broad, Suffolk. [624

FOR SALE: Type 19 set transmitter receiver, complete, all accessories; Type 22X transmitter receiver, good condition. 103A receiver, new condition A.C. mains or 6V D.C.; Wanted 12V accumulator, offers to—L. GROUT, 68 The Drive, Worthing, Sussex. [621

FOR SALE.—28 only—3 corrugation metal flange top and bottom "Steatite" porcelain insulators for transmitting aerials. 30,000 volts working 15s. each.—Apply Box 598, PARRS, 121 Kingsway, London, W.C.2. [598

FOR SALE: 1155A, internal power pack and 6V6 output stage, new panel, perfect £9 10s.—NIBLOCK, 25 Milner Road, Thornton Heath, Surrey. Liv. 1090. [619

G3DFY requires urgently circuit details Hallicrafter SX.24. To buy or borrow. Assistance greatly appreciated.—D. G. ELLIS, 124 Heckmondwike Road, Dewsbury, Yorks. [622

G5KS, 41 Moore Crescent, Langley, Birmingham. For sale. Owner going QRT. 150 watt plus transmitter modified 1131 phone C.W. or MCW final 813's 1200V D.C. modulator, TZ40PP; 6L6PP; 6C5PP; 6C5; 6J7, 24V D.C. for relays, relay operated, V.F.O. or crystal controlled. 28 Mc/s. beam. Also CR100 receiver. No reasonable offer refused. [636

HALLICRAFTERS Ultra Skyrider including speaker £25 or offers.—Buyer collects from F. RABONE, G2AFA, 28 Croftdown Road, Harborne, Birmingham. [626

H.R.O. Senior for sale, complete with band spread coils 1·7 to 30 Mc/s. and power pack, in perfect condition. Price £35.—DESMOND, G5VM, The Chestnuts, Hanley Castle, Nr. Worcester.

HRO's 5 coils, loudspeaker, power pack, excellent condition, 100 per cent. efficiency £31 each and 60 W transceivers, 829 output, high class superhetrodine receiver, 2–8 or 4–16 Mc/s., phone/CW, very compact, weight 13 lbs. Supply from power pack or convertor. New.—Offers to: P.C.A. WIRELESS WORKSHOP, The Arches, Cambridge Grove, London, W.6. [641

H.R.O. Senior, new, nine coils 50 kc/s.–30 Mc/s. B.F.O. crystal-gate. Power pack (A.C.), instruction book. £25, bargain.—RAY, 17 Frogmore Gardens, North Cheam, Surrey. [599

LABGEAR LTD. have a few vacancies for Short Wave Agencies.—Applications invited to Willow Place, Cambridge.

NATIONAL FBYA receiver. Bandspread coils 10, 20, 40, 80. A bargain £8; BC348J mounted on Eddystone panel for rack mounting, S. Meter, modified for 6·3 filaments, no cover, hotted up, excellent condition, £12 10s.; New Avo test bridge £5 10s.; 500 volt transformer 140 mills £1.—W. STIRLING, 137 Glasgow Street, Ardrossan, Ayrshire. [647

NATIONAL NTX transmitter and NSM modulator, rack mounting, £50 the pair.—Write N. D. LEFTWICH, 17 Walpole Street, S.W.3. [607

NEW best quality heavy duty soldering irons 100 watts 210/230 volts 9s. 9d. carriage paid.—FRS109, 48 Tudor Close, Belsize Avenue, N.W.3. [605

NEW 813 50s.; 955's 10s.; MR88's (UHF Triode) 4s.; Ceramic PA coil formers and subase 5s.; ceramic 807 valve holders 8d.; D.C. Avominor 45s.; Add postage.—G8UD, 13 Chandos Street, Keighley. [613

NEW 1155 receiver, converted new panel, 6V6 output, less power pack and speaker £12. Heavy duty 6 ft. rack £3; Rotary converter, new, 12V. D.C. input, 230 A.C. 50 c.p.s. 150W. output £5; 87 ft. Adastra tubular steel aerial masts complete £5; Milliammeters 0–5, 0–100. 5s. each.—GILES, G3AEB, Hainford, Norwich. [526

PATENTS and Trade Marks. Handbooks and advice free.—KING'S PATENT AGENCY, LTD. (B. T. KING, G5TA, Mem. R.S.G.B. Reg. Pat. Agent), 146A Queen Victoria Street, London, E.C.4. Phone: City 6161. 50 years' refs.

QSL's and logs by Minerva. The very best obtainable. Samples free from Minerva Press, Elm Park, Romford, Essex.

RACK 36" x 14" x 11" 10s.; TU5B 10s.; OP38/600's 10s. pair; 2A3's 10s. pair; m.c. meters 0–100, 0–500 mA. 5s. each; 500 volt power pack £2.—G8UA, 406 Higher Brunshaw, Burnley, Lancs. [609

R103A considerably modified. BC453, power pack and 3½" speaker. Perfect condition; £12.—Details G3CUE, 2 Duncroft Avenue, Coventry. [610

R1116.A. 8 valve Battery double S/Het. Perfect £7 or offers.—G2FST, 180 Foxdenton Lane, Chadderton, Oldham. [625

R1132.—Exchange brand new R1132A for M.C.R.1 (complete) 100–124 Mc/s. Write stating condition, etc.—BERRY, 30 Princes Avenue, Surbiton, Surrey. [630

SALE.—Type 53 transmitter, fully valved, fully operational. Best offer above £70 secures. Can be seen by appointment. East London.—Box 648, PARRS, 121 Kingsway, London, W.C.2. [648

SALE: Hallicrafter SX.23 in excellent condition auto transformer 230/115 fitted; bargain £25.—BELL, 22 Orchard Road, Anlaby Park, Hull. [603

SALE: R107 receiver power pack, meters, valves. Send for Lists.—BRS16161, 31 Verdin Street, Northwich, Cheshire.

SALE.—150 watt transmitter. P/P 35T's final. Four power supplies 450, 600, 800, 1,200V. Modulator 6SJ7, 6J5, P/P 2A3's, P/P TZ20's. Built into six foot steel rack on castors. Fully metered, £35; Woden UM3, £3; R1132A modified with Acorns for 144 Mc/s., £4.—G3AH, 142 Woodsend Road, Flixton, Manchester. [633

SX28 £40 Buyer collects. Collins C.K.P. receiver £4 15s.; A.C. Avominor £4 15s.; Pifco Multimeter 15s. 6d.; QCC 100 kc/s. crystal 20s.; BC610 80m crystals 10s.; 6V dynamotor 300V 100 mA. 25s.; 6V Vibropack 300V 90 mA. spare vibrator 21s.; VCR139A 16s. 6d; New, boxed; 7C7, 7A8, 5s. 6d.; 6SG7, 6SJ7, 5s.—89, Hurstfield Crescent, Hayes, Middlesex. [635

TAYLOR Junior 120A universal testmeter, volts A.C./D.C. 10/1000, Milliamps 1/500, Ohms up to 200,000. Also 5,000 volts D.C. Ideal for Television experimenter. Little used; £7.—BRS16494, KNOWLES, Hairby Cottage, Hundleby, Spilsby, Lincs. [601

TEN WATT Loudhailer. Good condition. Converted for use A.C.—power pack components, all brand new £10 10s.—G3BNV/A, 3 Abbey Gate, Minster, Sheerness, Kent. [602

THREE TU9B.'s brand new 30s. plus carriage 7s.; TU5A £1; P.P.51 rectifier power unit case and chassis, aluminium, 5 ceramic octals, ½ watt resistor 6s. carriage paid. Condensers 4 μF 1,000 V, 2s. 6d.; 1 μF 1,500 V. 1s. 6d.; Valves 5R4GY 3s. Please include postage.—KNIGHT, 82 Fairfield Road, Widnes.

TRANSMITTER PP807's 80–100 watts complete power supplies £15 or offers. Send S.A.E. for complete details of Ham gear for disposal.—A. C. BEVINGTON, 41 Moore Crescent, Langley, Birmingham. [638

UNIVERSAL Avominor, as new, complete with accessories £7. —BRS12365, Alcester Road, Wootton Wawen, Birmingham. [629

WANTED.—Enlarger, preferably vertical. Swop or part exchange for T1154, as new.—GREENWOOD, Glencairn, Watkinson Road, Halifax. [634

WANTED.—G.E.C. Type 4603 electrostatic Cathode Ray tube. State price and condition.—G6HU, 63 Aintree Crescent, Barkingside, Essex. [639

WANTED: Rack built transmitter 100/150 watts phone/C.W. on 14/28 Mc/s. Good quality components and workmanship. Mains A.C. 230 volts.—Description and photo if possible to Advertiser, Heatherwood, Hordle, Hampshire. [617

WANTED: T1131 preferably unmodified, also case and bottom plate for CR100.—Full particulars to 257 Lamond Drive, St. Andrew, Fife. [608

WIND your own I.F. transformers, R.F. Chokes, etc. on a Kaynite Wave Wound coil winder. Standard 50s., De luxe 84s.—Stamp brings particulars from RICHARD SHEARGOLD & CO., Sunbury-on-Thames. [627