April 1949

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R.S.G.B. BULLETIN

OFFICIAL JOURNAL OF THE INCORPORATED RADIO SOCIETY OF GREAT BRITAIN

Published on or about the 15th of each month. Issued free to members.

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Honorary Editor: ARTHUR O. MILNE

VOL. XXIV **APRIL 1949** **No. 10**

BAND-PLANNING

SINCE licences were restored after the war the most debatable subject for discussion among radio amateurs has been that of band planning. But while the controversy has raged the number of licensed amateurs has continued to increase until, today, we have, in the U.K. alone, nearly 7000 amateur stations. With such activity, some form of planned frequency division has become ever more essential.

The chief critics of band planning have been those "die-hards" who object to the imposition of new and possibly irksome restrictions. In an age where our lives are so regimented by dockets, forms and coupons, there is much to be said for the preservation of the maximum degree of freedom on the amateur bands. Nevertheless the rights of all licence holders to enjoy effective communication must be ensured.

Originally it had been envisaged that a Band Plan would fail unless it was made mandatory and written into the terms of the licence. Experience during the past few months, however, serves to show that amateur opinion has become alive to its communal responsibilities in this matter and that, today, a *voluntary* plan has every chance of succeeding. Indeed the state of the bands already corresponds closely to the proposals made herein. It is, therefore, a voluntary plan that is now put forward by the Council on the recommendation of its Codes of Practice Committee.

In giving publicity to the plan it is only right that the steps which have led to its introduction should be briefly reviewed and placed on record.

Experience has shown beyond any doubt that the average telegraphy signal stands little chance of survival at a distance if it has to compete with the much broader signals emitted by telephony stations. The Society recognises the value of both modes of transmission. It also recognises that the future well-being of Amateur Radio depends upon encouraging the newcomer. Unless there is a constant flow of new blood into the ranks, the amateur movement would soon cease to flourish.

After the war, the newly-licensed amateur, limited to an input of 25 watts and telegraphy only, found himself unable, on many of the bands, to enjoy effective contacts during normal leisure hours. Particularly was this the case at weekends. Other amateurs who, for a variety of reasons, wished to continue low power transmissions on the key were equally handicapped.

The Council, noting these trends, and believing that the solution was to be found in a Band Plan based on the wishes of the members, called for a national poll of amateur opinion in the February 1947 BULLETIN. Unfortunately at that time only a small percentage of amateurs took the trouble to record their votes with the result that no clear opinion could be deduced. Perhaps the great mass of amateurs had yet to realise the full importance of the question.

(*Continued overleaf*)

THE PLAN

NOW		LATER	
3500– 3600 kc/s.	Telegraphy only	3500– 3600 kc/s.	Telegraphy only
3600– 3635 kc/s.	Telephony only		
3685– 3800 kc/s.	Telephony only	3600– 3800 kc/s.	Telephony only
7000– 7050 kc/s.	Telegraphy only	7000– 7050 kc/s.	Telegraphy only
7050– 7300 kc/s.	Telegraphy and Telephony	7050– 7150 kc/s.	Telegraphy and Telephony
14000–14150 kc/s.	Telegraphy only	14000–14100 kc/s.	Telegraphy only
14150–14400 kc/s.	Telegraphy and Telephony	14100–14350 kc/s.	Telegraphy and Telephony
		21000–21150 kc/s.	Telegraphy only
		21150–21450 kc/s.	Telegraphy and Telephony
28000–28200 kc/s.	Telegraphy only	28000–28200 kc/s.	Telegraphy only
28200–30000 kc/s.	Telegraphy and Telephony	28200–29700 kc/s.	Telegraphy and Telephony

ADOPT IT TODAY!

The next step, taken 12 months later, certainly had the effects of arousing the membership to the many aspects of band-planning. (A tentative plan was put forward coupled with the statement that measures would be taken to give publicity to the scheme throughout Europe. While on reflection it can be seen that the suggestions then made suffered from over-complexity and represented only a compromise solution, they were to prove a basis for future action.) No longer was there need for Council to be concerned at lack of interest! Criticisms, suggestions—some constructive, others less so—poured into Headquarters.

Having digested the views expressed it was decided to make another attempt to canvass the membership. Accordingly a questionnaire was circularised to all Town Groups to ensure that a complete cross-section of *active* amateurs was given an opportunity of expressing their opinions. On the results of this "Gallup Poll" the final Band Plan has been formulated.

This plan is now put forward with the recommendation that it should be adopted voluntarily by every U.K. amateur immediately. It will also be sent to other I.A.R.U. Societies in the hope that it will ultimately form a basis for all amateur stations located in Region 1 as defined by the Atlantic City Convention. As a matter of pride, all amateurs, even if they do not completely agree with the proposals, should ensure that a fair trial is given to this plan which represents the wishes of the majority.

A few words about the plan itself. Every endeavour has been made to keep it as simple as possible with full regard both to existing conditions and to future developments. Attention has also been paid to harmonic relationship, ease of frequency measurement, and the frequency divisions already in force in various parts of the world. Sometimes, perhaps, we tend to forget that U.K. amateurs form less than 10 per cent. of the world total. It will also be noted that two sets of divisions are shown; one for the bands at present authorised, the other based on the Atlantic City Conference allocations. No proposals are made in regard to the 1·7 Mc/s. band or to bands above 30 Mc/s.

With the exception of the 3·5 Mc/s. band, the well-tried American principle of reserving sections of each band for the exclusive use of telegraphy, but without similar cast-iron restrictions on the remaining frequencies, has been adopted. At first sight, this might seem a little unfair to telephony stations but, in practice, it does not appear to be the case. The telephony station has not the same fundamental need for protection and, except during C.W. contest periods, few—if any—telegraphy stations will venture into the "telephony" portions of the bands. By adopting this principle, the valuable elasticity of the bands is retained.

The one recommendation which may seem a little at variance with current practice is the fixing of the telegraphy limit on 28 Mc/s. at 28, 200 kc/s. Some may be inclined to argue that present telegraphy activity does not justify this width for exclusively C.W. operation. This, however, is really an argument in favour of the decision. Two hundred kilocycles from a band two megacycles wide is not large, but the allocation should encourage the newcomer to gain practical experience of the higher frequencies on a band in which power is of comparatively slight importance.

To be effective, the plan requires the active co-operation of every amateur. It is YOUR plan, and it is up to YOU to ensure that it comes into effect at the earliest possible moment. Study the plan and adopt it in your own station. Bring it to the notice of other amateurs who may not read these pages. If necessary, boycott persistent offenders—politely but firmly. With goodwill all round, the R.S.G.B. Band Plan will encourage the newcomer, safeguard the low-power operator, permit full experimental work, and above all, help YOU to enjoy Amateur Radio at its best.

PER AMATEUR AD TELEVISION

Vale

THE five metre band, lost to the Amateur Service in the United Kingdom at midnight on March 31, 1949, went down with colours flying. Activity had been building-up for a week or more prior to close down, and culminated in a grand finale with so many stations taking part that it sounded like a well-supported contest. Although conditions were apparently not favourable for G–DX, calls unheard on five for months or even years suddenly appeared for a final fling, and many "first and last" contacts were made during the closing hours.

Post Mortem

Very few poor notes were in evidence, although it was noticeable, as always, that the possession of a crystal controlled transmitter is no guarantee that the signal will not creep in frequency; in some cases to quite an alarming extent. Our thoughts went back to the early days of five when hearing a signal on the band at all was an event, and little notice was taken of "notes" for the very good reason that the average receiver was not capable of making such an assessment, being in most cases a super-regen., and therefore unsuitable for C.W. reception. This type of receiver had an important influence on the design of V.H.F. equipment at that time, for its unsuitability for C.W. led to the inevitable use of transmitters modulated either by speech or tone, with a consequent reduction in the range obtainable, and the broad band-width and an ability to receive transmissions in which frequency modulation played a large part offered no encouragement to the design of stable transmitters.

Broadly speaking this state of affairs continued until only a short time before the war, when some of the more serious workers on the band turned their attention to the super-het. circuit, while others developed the reacting detector receiver, with or without a tuned R.F. stage, for satisfactory performance on these high frequencies. Neither of these receivers was able to utilise their qualities of weak C.W. reception to the full on unstable transmissions, but as valves and circuit technique changed for the better, and it was found possible to build a crystal controlled transmitter, suitable for either C.W. or modulated service, without too many stages and with fair efficiency, the range of consistent communication went up considerably as weaker and weaker signals became capable of resolution by the receiver.

During the war valve development proceeded apace and at the conclusion of hostilities the fruits of this research became available to the amateur. The terms "signal to noise ratio" and "noise factor" took on a practical meaning for the receiver designer, and it was appreciated at last that sheer gain from aerial to first I.F. stage meant next to nothing unless it could be accomplished with the minimum of noise contributed by the valves and circuits of the receiver itself. Here the use of triode valves in the hitherto unfamiliar earthed-grid circuit and of pentodes where particular attention to internal geometry had led to a reduction in partition noise, were powerful aids, and the boosting of the signal at the input of the

(*Continued on page* 244).

VOLTAGE REGULATION

By J. N. WALKER (G5JU)*

IN the ordinary domestic receiver, the load applied to the power supply is practically constant and the question of voltage regulation is unimportant. On the other hand, in laboratory instruments used for accurate quantitative measurements, it is essential to arrange for voltage supplies constant to within extremely narrow limits and the expense of doing it is justifiable.

Amateur requirements are different in several ways. In the majority of cases, it is to be expected that the voltages in various pieces of equipment will be varying during operation, and sometimes varying between wide limits. Under some circumstances such variations may not matter much—under others, they can be very undesirable, and steps should be taken to prevent or materially reduce the variations. The question of economy comes into the picture but fortunately the laboratory standard—regulation to within one volt—is by no means necessary. The gaseous type of voltage stabiliser, either singly or in combination, can usually be made to fulfil most amateur requirements.

Regulation of Power Supply

It is always well to design a power unit, for any given purpose, with adequate inherent regulation. Where the load is constant, or varies only over a small range, as in receivers and Class A audio amplifiers, a condenser input filter is suitable. Where the load current is subject to wide variations (*e.g.* Class B modulators and keyed transmitters), then invariably a choke input filter should be used. Care should be exercised to see that the input choke is of the correct type (no air gap in the core, and with suitable current carrying and inductance ratings). Such points as low resistance transformer primary and secondary windings, low resistance chokes, low voltage drop in the rectifier(s), all help to improve the inherent regulation.

Receiver Considerations

In a communications receiver it is desirable, if not essential, to avoid fluctuations of voltage at points liable to affect the operating frequency. The variations may arise either from fluctuations in the mains supply or by the change in H.T. voltage which is liable to occur when the gain of the variable-*mu* valves is varied, so causing a change of total current drawn from the power supply. It must, however, be noted that it is the variations of current consequent upon change of voltage which cause frequency shift. A pentode is a constant current device—small changes of anode voltage affect the anode current hardly at all but changes of screen voltage may have quite a considerable effect on the anode current. In a self-running oscillator, a change of anode current affects the slope as well as the input and output impedances of the valve and hence is liable to vary the frequency directly. Furthermore, the fact that the internal dissipation changes one way or the other gives rise to a change of inter-electrode capacity and this again affects the frequency.

Where a pentode, or tetrode, valve is used as a primary source of frequency control in a self-running circuit, it is important at least to stabilise the screen voltage and better if the anode voltage also is stabilised. The only difficulty with the latter procedure is that the voltage may be somewhat low for satisfactory operation.

Usually, the oscillator output will be fed into another valve—a frequency changer, or perhaps a buffer amplifier—which will invariably be a pentode (or tetrode). Stabilisation of the screen voltage of the latter will confer constant operating conditions, without which reflex action, due to variation of input impedance and capacity, would affect the oscillator frequency.

Unlike a pentode, a triode is not a constant current device. Change of anode voltage results in an instantaneous change of anode current, and the more constant the anode voltage is maintained the better.

It should be appreciated that the addition of a stabiliser will not correct slow frequency drift, other than that consequent upon varying dissipation, mentioned above. A steady oscillator frequency is achieved by attention to the design of the oscillator circuit and constants.

Similar considerations apply to a variable frequency oscillator, used as the primary drive for a transmitter, to a frequency meter and to a signal generator, each of which is based on a self-running, high stability oscillator.

Transmitter Refinements

It is desirable to stabilise the voltage applied to a crystal oscillator valve (anode or screen), not only to improve frequency stability but also to prevent H.T. surges causing high R.F. voltages and crystal current.

Most pentode and tetrode transmitting valves are given very definite screen grid voltage ratings, based on a figure for screen dissipation, an increase in which is likely to cause harm to the valve. This statement applies particularly to the larger valves (807, 813, etc.) and to the family of double beam tetrodes. When C.W. is employed, the voltage on the screen grid is liable to rise to the full H.T. line value. Possibly, this is not harmful in itself, but the transition from full line voltage to working voltage,

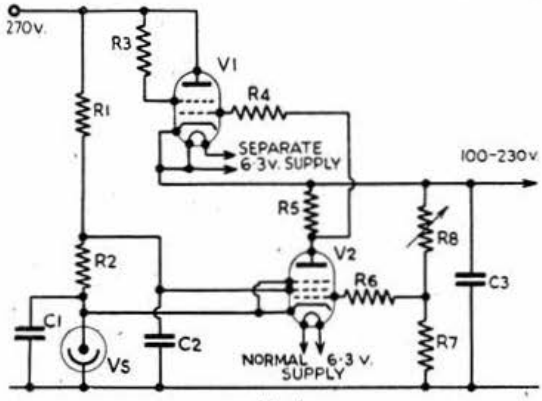

Fig. 1.

Constant voltage power supply unit. With 270 volts in from standard power unit, a sensibly constant voltage, variable at will between limits of approximately 100 and 230 volts, at any current up to 70 mA., is obtainable.

R1, 2	25,000 ohms 1 watt.	C1	·01 μF Mica.
R3	100 ohms 1 watt.	C2	4 or 8 μF.
R4, 6, 7	30,000 ohms (R7 1 watt).	C3	1 μF or more.
		Vs	7475 or 85A1 Mullard.
R5	·25 megohm ½ watt.	V1	6L6 or EL37.
R8	50,000 ohms wire-wound.	V2	EF50.

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when the key is pressed, takes a fraction of a second and makes it difficult, if not impossible, to obtain a clean signal on "make." This rise and fall of screen voltage may, of course, apply to a chain of valves, following the keyed stage, which only makes matters worse. Stabilisation of the screen voltages throughout is the ideal, although not always realisable economically. A separate, small, valve-stabilised power unit is one good method but a combination of stabiliser valves will prove almost equally satisfactory.

Although not so important as regulated screen voltage, it is good practice to stabilise also the fixed control grid bias, particularly in the case of the final valve(s).

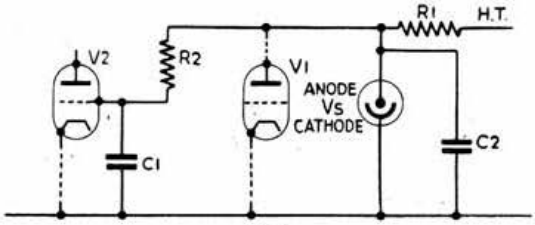

Fig. 2.

V1 is a triode oscillator, with tuned circuits omitted for simplicity. V2 is a pentode frequency changer. (Only the screen grid is shown.) The anode of V1 and screen of V2 are connected to the stabilised H.T. line.

C1	Usual bypass.	R1	See appendix.
C2	·01 μF Mica.	R2	470 ohms decoupling.

Modulator Applications

The importance of regulating the screen voltage of audio amplifiers (modulators) running in other than a Class A mode, has previously been pointed out (1) and alternative methods of achieving this object are suggested later. In the article referred to, grid bias was derived from batteries, this being a simple and reliable method. Where it is desired to dispense with batteries, stabilisation of the grid bias voltage becomes necessary and means of doing so are given.

The Gas-Filled Stabiliser Valve

When a potential is applied between two electrodes in a low pressure gas, the free electrons present attain a high velocity and ionise gas molecules by collision. The new free electrons thus liberated are in turn accelerated and more ionisation by collision occurs. This action is cumulative and rapid, consequently the conductivity of the gas between the electrodes increases quickly with increasing current. A very small increase of voltage at the electrodes results in a considerable increase in the current flow through the gap.

By suitable design, the voltage across the gap can be made practically independent of the current passing so that the voltage across a varying load will remain substantially constant. Fluctuations in the supply voltage appear across the series resistance but not across the stabiliser gap.

Since the voltage remains practically constant with comparatively large changes of current, the gap has no resistance in the usual sense of the word. Nevertheless, the gap has an A.C. impedance, which varies with frequency.

A certain minimum voltage is required to cause the gap to ionise—generally of a value about one-third greater than the maintaining (stabilising) voltage. This voltage must be applied through a series resistance, to limit the current flow to a safe value. The method of ascertaining the correct value of this series resistance is given later.

The permissible maximum current varies between different types of valve and details are given in a separate panel. There is also a minimum current below which ionisation, and therefore the control characteristic, tends to be erratic. With some types, a third current value is mentioned, this being the figure at which the stabiliser should be operated for close control. This latter current is usually somewhat low and is most useful when the valve is used for voltage reference purposes.

It should be made clear that the specified stabilising voltage for any given type is only an average value—the actual voltage will vary over small limits between one valve and another of similar type.

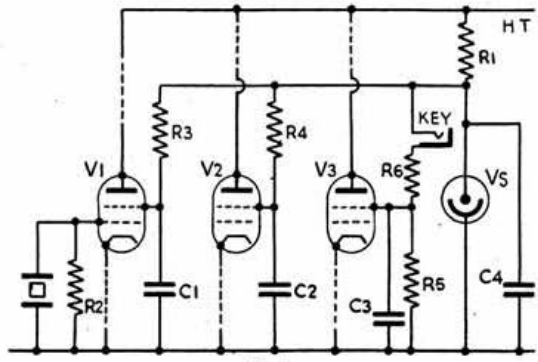

Fig. 3.

Stabilisation of exciter stages. All screens are connected to stabilised line.

R2	Usual grid leak.	R1	See appendix.
R3, 4, 6	Low value (470 ohms) decoupling.	C1, 2, 3	Usual decoupling Condenser.
R5	47,000—100,000 ohms. VS VR 150/30.	C4	·01 μF Mica.

Valve Stabilisation

Fig. 1 is a circuit of a valve stabilised power supply to follow after the normal smoothing components. Regulation is brought about by feedback action through V2 to the control grid of V1, the internal voltage-drop of which varies accordingly and in a manner which maintains a remarkably constant output voltage.

A unit of this type possesses several advantages. The voltage is maintained constant despite variations of load current or mains supply voltage, the output impedance is very low and the hum content is reduced. Admittedly additional valves and components are required, compared to an ordinary power supply, but the advantages outweigh the disadvantages. The writer has in use, with a V.H.F. converter, a unit built exactly as in Fig. 1, and it has made an appreciable difference—to a degree which makes it practicably indispensable. As shown, the unit is suitable for an output of up to 70 mA., at a voltage which can be varied between 100 and 230 volts, by adjustment of the potentiometer R8. The transformer in the power supply is an ordinary 300–0–300 volt receiving type—one with a smaller or larger output can be used, according to the desired output voltage.

The whole of the H.T. current flows through V1, which must be capable of handling it. The internal dissipation will, however, be less than in other applications, because the anode/cathode voltage drop will be less. For good control V1 should possess a high mutual conductance, as is the case with the 6L6 suggested. Several other types of valve (807, EL37, PX4) are equally suitable. Where a current greater than 60/70 mA. is called for, two valves in parallel will be required in the V1 position.

This circuit is recommended where extreme overall stability is desired, such as in a V.F.O., a frequency meter or signal generator. It is also excellent for providing an independent screen voltage for pentodes or tetrodes, particularly in a transmitter. In the latter case it should be noted that provision is

necessary for switching off and on the screen H.T. supply, simultaneously with the anode supply.

The stabiliser valve used in Fig. 1 acts as a voltage reference source. The *Mullard* types 85A1 and 7475 (as specified) are the most suitable for the purpose.

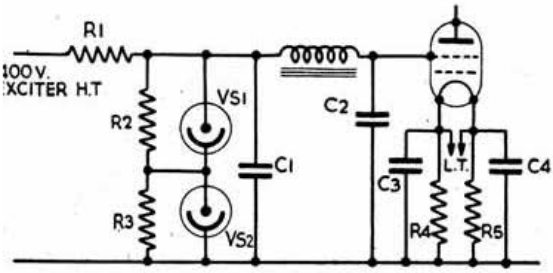

Fig. 4.

Screen grid stabilisation of 813, PT15 and similar high anode voltage valves. VS1 and VS2 can be Brimar VR150/30, giving 300 volts. R1 will be about 3,000 ohms, 5 watts.

R2, 3	·25 megohm.	C1	·01 μF Mica.
R4, 5	100 ohms or more.	C2, 3, 4	Usual by-pass condenser.
R1	See appendix.		
Choke	20H 50 mA.		

Separate Stabilisation of a Low Power Oscillator

The circuit given in Fig. 2 shows probably the simplest application of the stabiliser valve. It is assumed that a triode valve, such as a 6J5, EC52, etc., is being used with a more or less steady load current end with an H.T. supply liable to vary between small limits. There are quite a number of stabiliser valves which can be employed in such a circuit, depending on the regulated voltage required and on the current consumption allowable. The *Mullard* 7475 and the *Osram* ST11 are economical types and give close regulation. The output voltage is on the low side but adequate for an oscillator in a receiver. The accompanying table provides comprehensive figures for various British-made stabiliser valves, from which a type can be selected for higher voltages and currents.

Where the load current is liable to vary, the selected stabiliser valve must possess a range of current flow equal to the expected variations. Also indicated in Fig. 2 is a pentode valve (V2) associated with the oscillator in one way or another, with its screen fed from the stabilised supply. The condenser in parallel with the stabiliser should be noted. Its purpose is to short-circuit any high frequency currents which may tend to develop. The value of R1 calls for special consideration and is dealt with in the appendix.

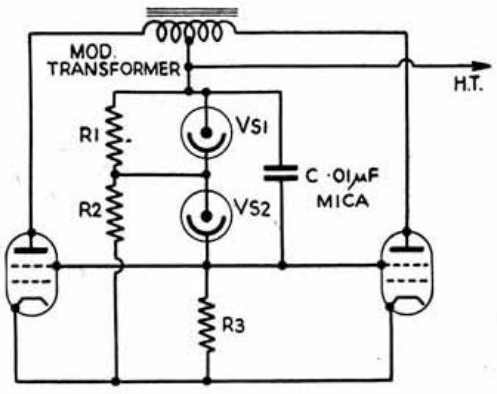

Fig. 5.

Two stabiliser valves used in series to provide a constant voltage drop to screens of modulator output valves. Also applicable to R.F. valves. Assuming 807 valves with 600 volts H.T., VS1 and VS2 can be Brimar VR150/30. The resistors R1, R2 and R3 (each ·25 megohm) ensure proper ionisation.

Exciter Stages

Fig. 3 shows how improvements can be effected in the exciter stages of a transmitter, using tetrode valves throughout. A good average value for the screen voltage in valves such as the 6V6, 6L6, 807, KT8, QV04/7 used in this class of service is 150 volts and the circuit is arranged to provide this value (or near). A jack is included in the feed to the screen of V3 for keying purposes. Since the voltage is held constant, with the key up or down, a clean characteristic is obtained. The current broken is small and, in many cases, a key click filter will be unnecessary.

P.A. Stage

As mentioned earlier, one of the most important points in a transmitter calling for stabilisation is the screen grid of the P.A. stage, to prevent large variations of voltage.

Where high anode voltages (1,000 or more) are employed, it is not desirable to feed the stabiliser from the P.A. high tension supply, as a large series dropping resistor, of considerable wattage, will be necessary. It is better to use the exciter high tension line and Fig. 4 shows how this may be accomplished.

In a transmitter used for C.W. only, the screen of the P.A. valve may be taken directly to the stabiliser anode. If, however, telephony is also employed, this connection will prevent proper modulation, as the relatively low impedance of the stabiliser will by-pass audio frequency currents. In Fig. 4, therefore, a choke is included in the lead to the screen grid—the latter can then follow the modulation but is held at a constant D.C. potential. Two stabiliser valves in series are necessary and the types will vary according to the screen voltage recommended by the makers for the P.A. valve. To assist readers in selecting a combination of adequate current-carrying capacity and regulating voltage, a panel has been prepared giving information regarding a number of popular P.A. valves. In cases where the final anode voltage is comparatively low (400/500 volts), an alternative method of stabilising the screen supply is the series connection of one or more stabiliser valves. This is discussed in a later paragraph.

Modulator Service

In a Class AB1 or AB2 modulator, using tetrode output valves, the screen current is liable to swing between wide limits. This is not detrimental in itself—the trouble is that, when the screens are fed from the anode supply *via* a series resistance, the screen voltage *drops* when a driving voltage is applied to the control grid. This means that just when more power output is required, the valve is operating under a condition which results in less power output—a fact which obviously affects both total power output and quality. A circuit for overcoming this difficulty is given on page 109 of the November, 1948, BULLETIN (Fig. 4). There a Stabilovolt is employed, but two VR 150/30 valves in series will also serve.

An alternative method is shown in Fig. 5. This circuit anticipates some remarks about the use of stabiliser valves in a series connection, instead of in the more usual shunt connection employed in the earlier circuits.

The stabiliser valves in Fig. 5 ensure a constant *voltage drop* between the anodes—or rather the H.T. line—and screens of the output valves, so that, providing the main H.T. voltage is reasonably steady (a matter of the power supply design), the screen voltage also remains steady irrespective of the screen current. The correct stabiliser valve combination

will depend on the anode voltage. For example, if the latter is 600 volts (assuming 807 valves), two VR 150/30 valves in series are suitable.

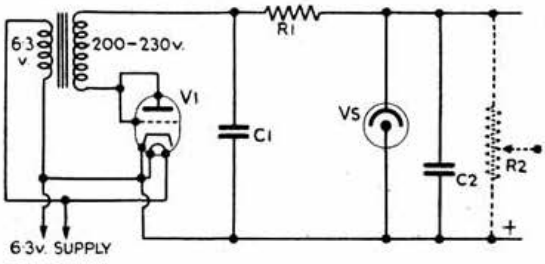

Fig. 6a.

Simple method of obtaining stabilised bias supply. Maximum (negative) voltage will depend on type of VS employed.

C1 8 μF.
C2 ·01 uF.
R2 10,000 ohms wire-wound.
R1 See appendix (6,000 ohms with a small current stabiliser, less with S130, etc.).
V1 Any small power valve (10mA.).
Transformer—filament type in reverse.

Stabilised Negative Grid Voltage

It is not a difficult matter, by suitable choice of valves, to secure a stabilised fixed negative bias voltage between 100 and 150 volts, as required by many power amplifier transmitting valves. Provided the grid current is moderately low, the circuit can be quite simple—a typical example is given in Fig. 6a. The power supply—hardly a proper title in this instance—is, in fact, only necessary to ensure that the stabiliser valve "strikes," so that it functions whether or not grid current is flowing. Consequently, the power unit can be elementary and as shown, a small filament transformer (in reverse) and almost any small power valve can be pressed into service. If a variable bias is required, the lead to the control grid of the P.A. valve(s) can be taken from the moving arm of a 10,000 ohm potentiometer connected in parallel with VS. The latter may be a *Brimar* VR 150/30 or a *Cossor* S 130, or equivalent types.

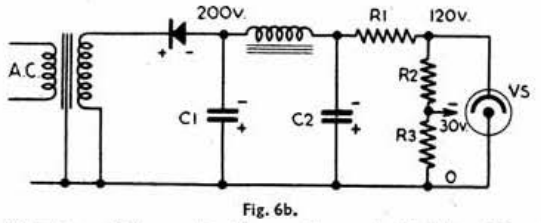

Fig. 6b.

Modulator grid bias supply. The transformer should deliver 200 to 230 volts, 70 to 80 mA. Adequate ventilation should be arranged for rectifier and resistors.

C1, 2 8 μF.
Choke 10–20H 70/80 mA.
R2 1,500 ohms 10 watt.
R3 500 ohms 3 watt.
VS Type S130.
Rectifier Selenium 250v. 80 mA.
R1 (+ Choke) 1,000 ohms 10 watt.

A ·01 μF Mica condenser should be connected in parallel with VS

It is not so easy when a low stabilised voltage is called for, particularly when the resistance in circuit must be kept low, as is a requirement in the grid circuit of a Class AB1 or AB2 audio amplifier. A common value of grid bias in such amplifiers is 30 volts, and no stabiliser is available which will regulate at less than 55 volts. Even this one (the *S. T. C.* G 120/1B) requires 100 volts to ensure striking. It therefore becomes necessary to maintain a high rectified current, so that the 30 volts required can be developed across a low resistance. A suitable circuit, using a *Cossor* S 130 valve, is shown in Fig. 6b. A combination of resistors gives a fixed output voltage of 30 volts—variation can be effected by altering the ratio of the specified values.

Series Connection

With one exception, all previous information has referred to the shunt method of connecting a stabiliser valve. The series connection mentioned under "Modulator Service" has other applications also. It may be used in a receiver, to ensure that the potential of screen grids is always so much less (according to the type of stabiliser) than the H.T. line voltage. Similarly, in a transmitter, the series connection is a simple means of obtaining the correct potential on the screens of 807, 815, 829 and similar valves. The power dissipated in the stabiliser valve is equal to that which would be lost in a series resistor but, due to the lower A.C. impedance of the former, modulation is maintained at a higher level. A typical circuit for use with 815, 829 and similar valves is shown in Fig. 7. A resistance shown connected from the cathode of the stabiliser to earth is necessary to ensure that ionisation of the stabiliser is independent of the valve operating conditions.

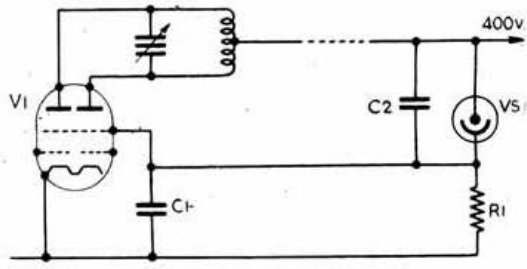

Fig. 7.

Series connection of stabiliser for good regulation of screen grid voltage with twin tetrode R.F. valve. Also applicable to single valves (807, etc.).

C1 Normal by-pass.
C2 ·01 μF Mica.
R1 100,000 ohms 1 watt.
V1 815, 829, 832, etc.
VS VR150/30 or equivalent.

The Stabilovolt

The *Marconi* Stabilovolt is of more than ordinary interest because it permits simultaneous stabilisation at different levels. It can be used to provide positive voltages of 280, 210, 140 and 70 volts or alternatively positive voltages of 210, 140 and 70, and a stabilised negative voltage of 70. The maximum permissible current through the Stabilovolt varies between 30 and 100 mA.—the higher current at the lower voltages and *vice versa*.

The number of possible applications are too numerous to give in detail. In almost any circuit—receiver, transmitter, modulator, etc.—there are points, the stabilisation of which will tend to improve the performance.

The basic circuit used with a Stabilovolt is given in Fig. 8. The various resistors from each electrode

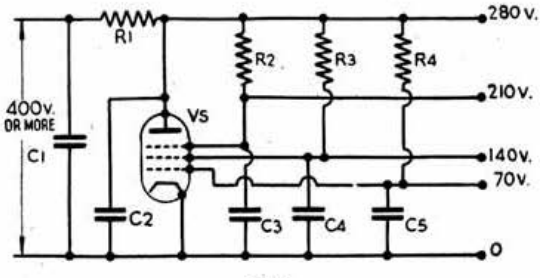

Fig. 8.

Connections of Stabilovolt to give four regulated positive voltages.

C1 In power pack.
C2, 3, 4, 5, ·1 to 1 μF.
R1 See appendix.
R2, 3, 4 ·25 or ·47 megohm.
VS Marconi Stabilovolt.

to the main H.T. line ensure that each gap strikes, irrespective of the nature of the load. The values stated in the caption are average ones, based on a 400 volt line.

To obtain a negative voltage, the circuit in Fig. 9 is used. A potentiometer across the lower gap enables the bias to be varied, the potentiometer resistance being no higher than is necessary to maintain ionisation of the gap.

APPENDIX

Derivation of value of series resistor

Three conditions have to be borne in mind. They are (*a*) maximum and minimum values of input (H.T. line) voltage (*Vin*); (*b*) maximum and minimum values of the current (*Il*) through the load; and (*c*) maximum variation of current (*Is*) permissible in stabiliser valve.

Vout will, for practical purposes, be constant and any variation of *Vin* will appear across R1. The ohmic value and wattage of R1 must therefore be suitable for operation with *Vin* at maximum.

The current flowing through R1 is the sum of *Il* maximum and *Is* minimum, but an allowance may be necessary for the additional current which flows when *Vin* is at maximum. This, in effect, will raise the permissible minimum of *Is*.

The variation between *Il* maximum and *Il* minimum must not be greater than that between the new minimum value of *Is* and the maximum current the stabiliser valve can handle.

The foregoing sounds somewhat involved and some practical examples based on Fig. 10 will probably make matters clearer.

Example 1

Consider the case where the input voltage and load current variations are small—as with the oscillator in a receiver. The calculation is a straightforward one, based on average values. The formula to use in this case is:

$$R1 = \frac{Vin - Vout}{Is + Il} \ ohms$$

Assume the average oscillator current is 6 mA. and the screen current of an associated valve is 1 mA. The stabiliser valve is a *Mullard* 7475, controlling at approximately 100 volts. The 7475 is allowed to draw 4 mA. Line voltage is 200 volts.

Substituting figures in the above formula:

$$R1 = \frac{200 - 100}{\cdot 004 + \cdot 007} = \frac{100}{\cdot 011} = 9091 \ ohms$$

A 10 per cent. tolerance is permissible and the actual resistor used may be between 8,000 and 10,000 ohms. A one watt resistor will run hot and one having a dissipation of 2 watts or more is recommended.

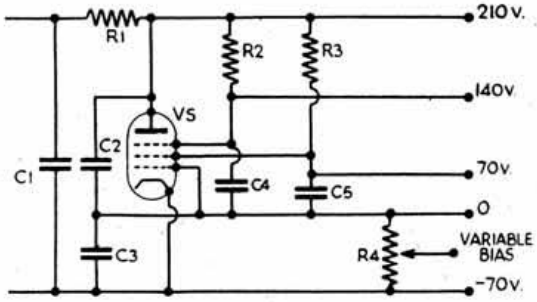

Fig. 9.

Connections of a Stabilovolt, to provide a number of regulated positive voltages plus one fixed and one variable negative bias voltages.

C1	In power pack.	R4	10,000 ohms or more.
C2, 3, 4, 5	·1 to 1 μF.	R1	See appendix.
R2, 3	·25 or ·47 megohm.	VS	Marconi Stabilovolt.

Example 2

Consider the case where the operating conditions are more severe. The stabiliser valve is a *Brimar* VR150/30, having maximum and minimum current ratings of 5 and 40 mA. respectively. Let the load current be 30 mA. maximum and 10 mA. minimum. The line H.T. voltage is nominally 250 volts but is liable to vary over limits of 230 and 270 volts.

Normal H.T. voltage.

$$R1 = \frac{Vin - Vout}{Is + Il}$$

British Gas-Filled Stabiliser Valves

Type No.	Make	Regulating Voltage	Striking Voltage	Min. Current	Max. Current	Current as Voltage Reference	Base	Impedance
7475 ..	Mullard	90–110	140	1	8	4	B4	300
4687 ..	Mullard	90–110	130	10	40	20	SC8	250
13201A..	Mullard	90–110	135	15	200	—	B4	80
85A1 ..	Mullard	83– 87	125	1	8	4·5	B8G	290
VR150/30	Brimar	150	180	5	40	10	Octal	—
S130 ..	Cossor Osram	120	160/180	5	75	10	B4	—
ST11 ..	Osram	100	140	1	8	4	B4	—
G120/1B	S.T.C.	55	100	2	30	—	B4	—
G180/2M*	S.T.C.	150	180	5	40	10	B8B	—
STV280/40†	Marconi	280 : 210 : 140 : 70 :	400	5	35/60	—	B5	60 per gap
STV280/80†	Marconi	as 280/40	400	10	70/100	—	B5	40 per gap
QS70/20	Marconi	70	95	2	20	—	B7G	—
QS95/10*	Marconi	95	110	2	10	—	B7G	—
QS150/15*	Marconi	150	180	2	15	—	B7G	—

Notes.—All values of current are given in milliamperes and impedances in ohms.
*Fitted with auxiliary starting electrode—to be connected to H.T. through a high resistance (*e.g.* ·25 megohm).
†Permissible maximum current varies from gap to gap. Maximum figure applies to lowest voltage electrode and *vice-versa*. Last three types are miniatures and therefore useful where space is restricted.
Type 85A1 is intended mainly for voltage reference purposes.

$$\left.\begin{array}{l} Is\ (Min) + Il\ (Max) \\ (5) \qquad\quad (30) \\ Is\ (Max) + Il\ (Min) \\ (25) \qquad\quad (10) \end{array}\right\} = 35\ mA.$$

$$R1 = \frac{250 - 150}{\cdot 035} = 2860\ ohms \quad (3 \cdot 5\ watts)$$

H.T. Volts 270.

Volts dropped across R1 = 120 volts.
Current through R1 (2,860 ohms) = 42 mA.
Wattage rises to 5 watts.
Additional current through valve = 7 mA.
Is (*Min*) becomes 12, *Is* (*Max*) 32, which is permissible.

H.T. Volts 230.

Volts dropped across R1 = 80 volts.
Current through R1 (2,860 ohms) = 28 mA.
Which is insufficient to provide maximum current through load and valve is liable to extinguish.

Consider 230 volts as normal.

$$R1 = \frac{230 - 150}{\cdot 035} = 2{,}280\ ohms$$

Voltages rise to 270.

Volts dropped across R1 = 120 volts.
Current through R1 (2,280 ohms) = 53 mA. (wattage over 6 watts).
Additional current through valve = 18 mA.
Is (*Min*) becomes 23, max 48 mA., which latter exceeds the limit.

On the face of it, the stabiliser valve will not cope with the operating conditions. However, intermediate values of R1 can be tried. If calculations are made on the basis of R1 being 2,500 ohms, it will be found that the current flow is 32, 40 and 48 mA. respectively at 230, 250 and 270 line volts. Although, at the minimum value, the stabiliser valve will be passing only 2 mA., the conditions are just met. Had this not been so, steps would have to be taken (*a*) to improve the line voltage regulation, possibly to the extent of using a circuit such as Fig. 10, or (*b*) to alter the operating conditions to give less variation of load current, or (*c*) to employ a valve capable of passing a higher maximum current.

Example 3

The calculation for the value of R1 with a Stabilovolt is carried out in the same way as with single gap valves. The load current in this case will be the sum of the currents drawn from each electrode and there will be the standing ionisation current.

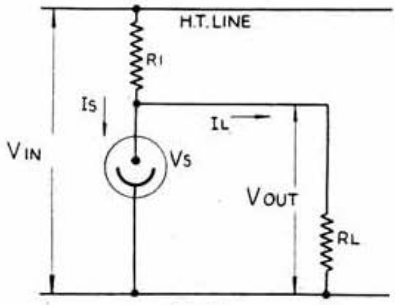

Fig. 10.

Basic circuit for deriving value of series resistor.

Assume the following conditions.

Valve Stabilovolt 280/40.
H.T. voltage = 450.
Current from A4 electrode at 280 v. = 20 mA.
,, ,, A3 ,, ,, 210 v. = 10 mA.
,, ,, A2 ,, ,, 140 v. = 5 mA.
,, ,, A1 ,, ,, 70 v. = negligible.

Popular Pentode or Tetrode Transmitter Valves.

Type	Screen Voltage	Screen Current	Grid Current	Bias Voltage
PT15	300	25	6/7	—90
KT8	250	4–10	2	—40
807	250	6	3	—50
QQVO4/20 (815)	150	16	4	—45
QQVO7/40 (829)	200	30	12	—50
QVO4/7 ...	150	6	2·5	—45
813	300–400	15	10	—90
832	200–250	12/20	3	—60
Modulators. Per pair.				
KT66	250/300	5–12	—	—25
807	300	2–20	—	—30
815	125	5–32	—	—15
EL37	400	10–72	—	—32
EL38	400	5–56	—	—25

Total load current *Il* is 35 mA. Current *Is* is say 10 mA. *Vout* is the maximum stabilising voltage available — 280 volts.

$$R1 = \frac{Vin - Vout}{Is + Il} = \frac{450 - 280}{\cdot 010 + \cdot 035} = \frac{170}{\cdot 045} = 3777\ ohms$$

Wattage = 170 × ·045 = 7·65. (A 10 watt resistor is necessary.)

Obtaining Correct Resistor Values.

It will be found that the value of resistor required is nearly always some odd value. The nearest possible standard value may usually be used, erring on the low side if anything. Often, a near approximation is possible by making up a series-parallel combination of standard values.

Attention should always be given to the wattage dissipated and resistors used must have a total wattage for the purpose.

Reference

(1) "A Modern Modulator with Pre-Amplifier." Part I—R.S.G.B. BULLETIN, November, 1948.

PER AMATEUR AD TELEVISION—(*continued from page* 238).

receiver by high gain beam aerials and carefully designed tuned circuits went far in the production of the results which have become commonplace at the present time.

Survival

All this passed through our mind as we sat listening to "five," and the hands of the clock drew nearer to midnight and its passing. But a great deal of experience has been derived from this band and this will not be lost to us, as is already apparent from our yet small experience of its successor, two metres. So we can say farewell, after an association of many years, satisfied that our time has not been wasted, and hopeful that the many friendships that have grown up among V.H.F. workers on five metres will continue to flourish as we climb higher and yet higher in the radio spectrum. W.H.A.

A TUNEABLE OSCILLATOR OF HIGH-STABILITY

By "Spenny"

A TUNEABLE oscillator with a high degree of stability is a fundamental requirement for many amateur radio purposes—for transmitter control, as a heterodyne oscillator for a receiver, for use in a frequency meter, and so on.

It is of first importance that the advice, repeatedly given but often ignored, regarding mechanical rigidity, careful construction and a well-regulated power supply should be followed if any benefit from circuitry is to be realised. By "careful construction" is meant principally the accuracy with which all the parts are made *and fitted together*.

The Ideal Oscillator

Consider now an oscillator in which the valve-maintaining circuit has no effect whatsoever upon the frequency, in other words, where the frequency is determined solely by the coil and condenser, irrespective of changes made in other parts of the circuit. Any variation must now be due to a displacement of the turns comprising the coil and/or the condenser plates. Displacement due to vibration can be satisfactorily reduced by anti-shock mounting and rigid construction, and that due to a shift of the controlling element can be made negligible by the use of a suitable dial or lock. The only other displacement is that due to the expansion and contraction of the materials making up the inductance and capacitance.

The Coil

Assuming the coil to be of self-supporting copper construction of the usual proportions, thermal expansion will theoretically alter the frequency by 8·5 parts in a million per degree Centigrade rise in temperature. The writer has measured consistent changes of 9 parts in a million in this type of coil. If a former is used in such a way that the axial expansion of the coil is different from its radial expansion, then by selecting a suitable proportion of length to diameter, the coil can be made so that variations due to temperature changes cancel out.

The Condenser

The magnitude of the effect of temperature changes in condensers is often greater than that in coils. An air-dielectric condenser can alter the frequency by increasing it as much as 100 parts or by decreasing it as much as 50 parts in a million per degree Centigrade, depending on the mechanical design. Variable condensers which have widely spaced vanes, mounted on ceramic insulation usually cause a change of between 10 and 15 parts in a million, provided that they are physically small. Closely spaced variable condensers of the broadcast receiver variety do not usually have good characteristics in this respect. Silvered mica condensers will be responsible for frequency changes of the order of 10 or 15 parts, but ordinary clamped mica-and-foil fixed condensers are notoriously bad, being responsible for changes which will often be non-cyclic, of several hundreds of parts. Thus it will be seen that, if a good condenser and coil are used, and if a good mechanical job is made of the assembly, a frequency change due to temperature of between 19 and 24 parts in a million per degree Centigrade can be expected. This figure may be compared with that of an "X"-cut crystal, which has a coefficient of 20 to 25 parts in a million, but it should be clearly appreciated that the figure of 19 to 24 parts applies only to an oscillator where the coil and condensers are the *sole* frequency-determining elements.

The Valve

Before dealing with circuits, it will be worth while to consider the broad principles involved in the maintenance of oscillations. First of all, there must be available an amplifier with an output sufficient to make good all the losses in the system, as well as to provide the required output. A small part of the "tank" energy is fed into the amplifier, part of whose output is fed back into the "tank" again, at the right voltage and in phase with the "tank" energy. The gain of the amplifier is thus seen to be fixed, and, what is very important, the phase shift through the amplifier must be either nil or a multiple of 360°. Moreover, the phase shift must not vary under normal operating conditions, otherwise the frequency of oscillation will change until a new frequency is reached where the phase is correct. The frequency of oscillation will depart from the natural frequency of the "tank" by the amount required to bring the "tank" energy into phase with the amplified energy, provided that the amplifier has sufficient gain to maintain the output. The higher the Q of the "tank," the smaller will be the frequency shift required for a given phase shift.

In the first place, therefore, it is necessary to make the "tank" circuit as loss-free (high Q) as possible. Secondly, the phasing should be correct but if this cannot be achieved then every precaution must be taken to see that it will remain constant at least under the likely operating conditions. If all these things can be done, then a very good oscillator indeed will result.

Summing up these requirements we require a high-Q tank circuit, large enough physically to dissipate its losses without appreciable rise in temperature, and a maintaining amplifier coupled in such a manner that its effects upon frequency are negligible. There are many circuit arrangements which provide for these requirements. Some of them are unsuitable for amateur use for such reasons as being stable only over a very small frequency range. The Franklin oscillator, for example, is very good at low frequencies, especially if high-gain pentodes are used and if "Miller effect" is watched closely. But, in the writer's opinion, it suffers from the disadvantage (when a simple transmitter is required) of low output. It is also difficult to operate at high frequencies.

The Oscillator Circuit

Fig. 1 shows the circuit of a complete transmitter, but for the moment it is proposed to consider only the oscillator stage. Basically this is a Colpitts circuit, with the valve working into a capacitive load at harmonic frequencies, thus minimising the danger of added frequency shift due to harmonic production. The valve works across C1 and C2, as in the normal Colpitts arrangement. These condensers are made as large in value as possible, consistent with reasonable operation, so that any variation of

capacity due to the valve will have only a small effect on the total capacity, and hence on the frequency. The function of C3 is to "tap down" the valve, and this condenser is therefore made as small as possible, lessening even further the capacity effects across C1 and C2. The result of connecting the valve grid to the junction of C2 and L1 is much the same as that of "tapping down" the coil with a turns ratio equal to the reciprocal of the capacity ratio of C3 to C1 and C2 in series.

In order to arrive at suitable starting values for C1, C2 and C3, it is necessary to have an estimate of the Q of the coil. By allotting a tentative value to C3 to make its reactance in the region of 500 to 1,000 ohms, and by bearing in mind that this will be of the same order as the reactance of C1 and C2 in series, a value for C1 can be deduced which will give a resistance just sufficient to enable the valve to develop reasonable gain; this resistance is given approximately by the Q of the coil multiplied by its reactance, divided by the product of the square of the capacity ratio C1 to C2 and C3 in series. This very rough outline will give the data for an oscillator capable of useful performance which can be improved upon by experiment. If the oscillator appears to be "lively," then C3 should be made smaller. This will entail the use of a larger coil to keep the same frequency, or, conversely C1 and C2 can be made larger, which will improve the isolation of the valve circuit. If the valve appears to have too much drive, which may be the case with valves of high mutual conductance, then C2 needs to be made larger. Battery valves, of comparatively low mutual conductance, may require a circuit with this condenser smaller than C1.

Provided that the value of C1 is not critical as far as the action of the oscillator is concerned, decreasing it will reduce the output, due to degeneration, so that, as a last operation in the adjustment of capacities, it is advisable to adjust C1 to the largest value possible, in order to obtain the best anode efficiency. Bandspreading is best obtained by shunting a small variable condenser across C3. The rotor can be earthed if the coil and C3 are interchanged.

The output circuit is preferably tuned to a harmonic of the frequency of the grid circuit, as in the conventional Dow oscillator. The output is roughly proportional to the order of the harmonic. Valves which have a high value of mutual conductance and a small value of anode-to-grid capacitance are the most suitable for this application. The amount of screen current should be small compared with the anode current if the overall efficiency is to be high. The writer has used the following valves successfully:—Z62, VR65, EF50, EF55, 807, PT15, 6F12, 813 and RK23/25. Anode efficiencies up to 35% have been obtained, although 25% is a more usual figure.

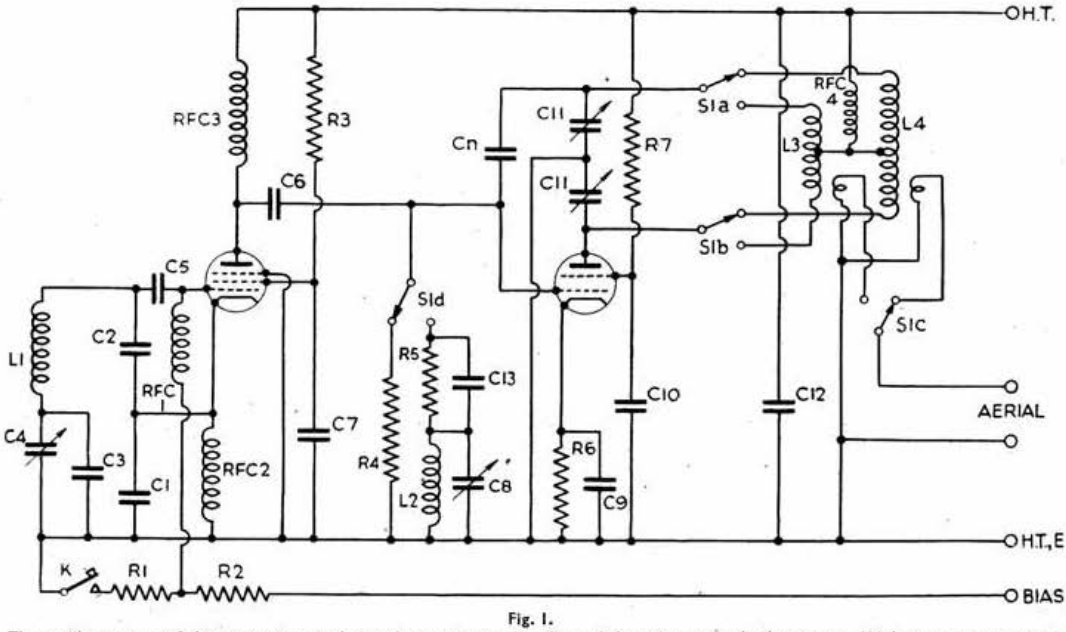

Fig. 1.

The oscillator stage of this transmitter is designed to minimise the effect of the valve upon the frequency. With great attention paid to mechanical rigidity and screening, and with L1 constructed carefully and C1, C2, C3 and C4 chosen wisely, stability comparable with that of a crystal oscillator can be achieved. Component values are as follows:

C1	3,000 $\mu\mu$F.	C10	·01 μF, mica.	R4, 5	100,000 ohms (adjust for optimum drive).
C2	2,000 $\mu\mu$F.	C11	400–400 $\mu\mu$F, split stator.	R6	200 ohms.
C3	300 $\mu\mu$F.	C12	·01 μF, mica.	R7	1,000 ohms.
C4	100 $\mu\mu$F, microdenser.	C13	500 $\mu\mu$F, mica.	RFC1, 2, 3 and 4	2·5 mH choke.
C5	50 $\mu\mu$F, silvered mica.	Cn	Neutralising Condenser	S1	*a*, *b* and *c* on two biscuits, *d* on separate screened biscuit.
C6	500 $\mu\mu$F, silvered mica.	R1	27,000 ohms.	K	Key.
C7	·01 μF, mica.	R2	1 megohm.		
C8	50 $\mu\mu$F, air trimmer.	R3	68,000 ohms.		
C9	·01 μF, mica.				

A Practical Version

The layout of the transmitter whose circuit is shown above, is arranged to ensure a minimum of feedback from the amplifier output into the oscillator, particular care being taken to reduce the number of earth connections to the chassis, and to keep these as far apart as possible; as the power or the frequency is raised this factor becomes increasingly important.

A 6F12 is used to drive a 6V6, giving some ten watts of output. The fundamental oscillator frequency is in the 1·7 Mc/s. band, and the amount of "frequency pulling" which is experienced is negligible, although if a valve with a higher anode-to-grid

capacitance than the 6F12 were used, the "pulling" might be more serious. When the transmitter is used on 1·7 Mc/s., the oscillator anode circuit consists of a 2 mH choke.

Construction of the Coil

For this particular transmitter, the construction of the oscillator coil was undertaken by G3AVZ, and the following is the method which was used. A "Mycalex" former was made from a piece of tube of that material, by turning a shallow groove in it to support the wire, which is ·024 in. in diameter. After the various holes had been drilled, the wire was wound on the former "piping hot." To do this the wire was kept hot by passing through it a current of several amperes. Upon cooling, the wire shrinks on to the former and remains under tension, so that any change in its length due to temperature variation is taken up by the tension, and the overall change is approximately the same as that of the former. As Mycalex has a temperature coefficient of 8 parts in a million per degree Centigrade rise in temperature, the coil will be roughly twice as good as it would have been had the more usual method of winding been used. Ceramic formers are available which have expansions of only about 3 parts, and these can be used to advantage if they are of the right size and shape.

The variable condenser was an *Eddystone* microdenser. All fixed condensers were of the silvered mica variety and of good make. The frequency range was 1,700 kc/s. to 2,000 kc/s., and the dial was calibrated directly on its harmonic. The 6F12 delivered approximately a quarter of a watt to the grid of the 6V6.

The Transmitter in Use

This transmitter has been used during the last two N.F.D.'s as well as by G5NF in between times. Actually, the "in between times" use was far more arduous than that of the N.F.D. operations, as the apparatus often seemed to be soaked in moisture from condensation, due to the nearly-outdoors location. After a period of over a year of this sort of operation, the calibration was found to have shifted by only a hundred cycles on 3·5 Mc/s. During the first N.F.D., the whole transmitter was run from a hand generator, but although the H.T. varied from 30 to 300 volts, the note remained T9 throughout—impressive proof that the valve circuit has little effect on the frequency of oscillation.

Alternative Versions

Experiments have been conducted at much higher frequencies, and satisfactory performance has been obtained up to 80 Mc/s., which is probably the limit of the usefulness of this arrangement. In this case, a triode was used, and the best values were more difficult to obtain. The optimum value of the "tapping condenser," C3, seemed to be about 3 $\mu\mu$F, and with careful experimentation it was found possible to produce an oscillator which was sufficiently stable at V.H.F. to be used with a receiver of comparatively narrow bandwidth.

Another version consisted of a VR65, working on a fundamental frequency of 7 Mc/s. and doubling to 14 Mc/s. in the anode circuit. The output from this was coupled to an aerial, and on several occasions T9X reports were received. The arrangement can be keyed either by interrupting the screen supply or by blocking the grid; the writer favours the latter method.

It is bad practice to key the oscillator stage, but sometimes there is no alternative. In cases where it is impracticable to screen the oscillator sufficiently to prevent it from interfering with reception, facilities for "break-in" operation can be provided only if the oscillator is rendered completely inoperative when the receiver is in use. To do this satisfactorily, all the by-pass condensers must be made as small as possible, and in addition to the oscillator stage, the subsequent stage should also be keyed, with the necessary shaping circuits to "clean off" the transient nature of the oscillator waveform envelope. In this way, the output of the transmitter behaves as if post-oscillator keying were used, for the oscillator is started up before and shut off after the rest of the transmitter, so that the first and last few cycles of the oscillator output are not radiated.

Conclusion

It cannot be too often repeated, or too strongly emphasised that good workmanship is a pre-requisite of the stable functioning of any oscillator. With care the circuit described is capable of reducing to negligible proportions the ill-effects of the oscillator-maintaining system.

The Eddystone Semi-Automatic Key

NOT so long ago the semi-automatic—or "bug"—key was regarded in the United Kingdom with something akin to suspicion, both by amateurs and by commercial telegraphists. But during the war, operators at busy traffic-handling stations proved—often in the face of official disapproval—that where continuous hand-sending was necessary over long periods, this type of key permitted a high average speed of transmission to be maintained almost without fatigue. On many a night shift the heavy thump of traditional brass-pounding gave way to the soft swish and clatter of the "bug." Contrary to the then popular belief, the standard of sending by an experienced operator was found to be as good, and as easy to copy, as with an orthodox key, providing that the ratio between the length of the automatic dots and the hand-formed dashes was correctly adjusted.

Until recently, mass-produced "bugs"—originally used on the U.S. railway telegraph networks—were of exclusively foreign manufacture. In 1947, however, *Stratton and Co. Ltd.*, introduced the now well-known Eddystone model. No mere copy of overseas designs, this key was noteworthy for its high standard of mechanical finish, its new style of "paddle" or handle suitable for either right- or left-hand operation, and its heavy die-cast housing which totally encloses the movement, provides sufficient weight to prevent the rubber feet of the key from slipping on a smooth table, and adds considerably to the attractive streamlined appearance. The dot contact of this model is also sufficiently "heavy" to avoid the spluttering effect experienced with some "bug" keys. For the amateur who wishes to operate for long periods at a time, either in contests or during those pleasant ragchews which are such a feature of high-speed C.W. working, a semi-automatic key soon becomes an essential part of station equipment.

SCIENTIFIC OBSERVATIONS

D. W. HEIGHTMAN, M. Brit. I.R.E. (G6DH)*†

AN editorial in the April, 1948 *Bulletin* announced a scheme by which Amateur Radio observers could assist in the study of ionospheric and tropospheric propagation, and solar, meteor and auroral effects. During the past few months the scheme has had a trial run and some useful results have already been obtained although it must be admitted that a great many more observers will be required if future observations are to be made both complete and accurate.

Undoubtedly many active radio amateurs, receiving as well as transmitting, possess logs which contain a wealth of useful information if this can only be presented in a form suitable for collation and correlation. If therefore, time is available for Amateur Radio it should *also* be available for these observations!

Why Scientific Observations?

What advantages are likely to be gained by making these observations? The answers might well be :—

(1). There will be the knowledge that they are adding to the prestige and cause of Amateur Radio.

(2) That, in enjoying their hobby, participants are also doing something useful in providing information of considerable scientific value, and

(3) That the work, in itself, will provide new interest which will steadily increase as observations proceed.

The work of the S.O. Groups is at present confined to three main categories namely (1) Ionospheric, (2) Tropospheric, (3) Solar and Auroral effects.

In order to simplify the task of preparing a practical and usable digest from the logs of many participants, standard reporting forms have been prepared and observations are restricted so far as is possible to certain definite subjects. These are as follows :—

Ionospheric

(1) Maximum usable frequency observations of the F2 layer and sporadic E propagation.
(2) Reception records of fixed stations.
(3) Skip distance observations.

Auroral, Meteor and Solar effects

(4) Observations of Auroras.
(5) Observations of Meteor effects.
(6) Observations of Solar Noise (or Solar Radio Radiation).

Tropospheric

(7) Reception records of fixed stations.

Ionospheric

(8) Wave Interaction (Luxembourg effect).

Observers may undertake work under more than one of these headings. For example while checking M.U.F.'s (1) it will often also be convenient to record reception of certain regularly operating stations (2). Similarly, in checking (1), (2) or (3), observers may also note the irregular effects of (4), (5) and (6). Much of course will depend upon the amount of time observers can devote to the work. Obviously, consistent operation is desirable but actual time taken in making individual observations need not necessarily be more than, say, 5 or 10 minutes, *i.e.* a total of one half to one hour per day for as many as 10 or 12 observations per day. Some operators may only be able to carry out such work at week-ends but this should not deter them from participating in the scheme. In order that the collated reports may be as complete as possible observations will be required at all hours of the day and night. As some difficulty may be found in finding sufficient observers for normal day-time observations, offers of assistance during the hours of 0900–1230 and 1400–1700 will be particularly welcome.

It will be apparent that most of the observations can be made by members possessing good receivers (preferably in good receiving locations), *i.e.* the use of transmitters is not generally necessary. There are however instances when the co-operation of transmitting members to provide suitable signals is requested. Some previous experience of Amateur Radio will, however, normally be preferable.

Those interested should in the first instance write to R.S.G.B. Headquarters', giving details of equipment available, operating times, subjects in which interested, qualifications—past experience etc.

Detailed information on the observations required is sent to prospective observers by the Group Managers.

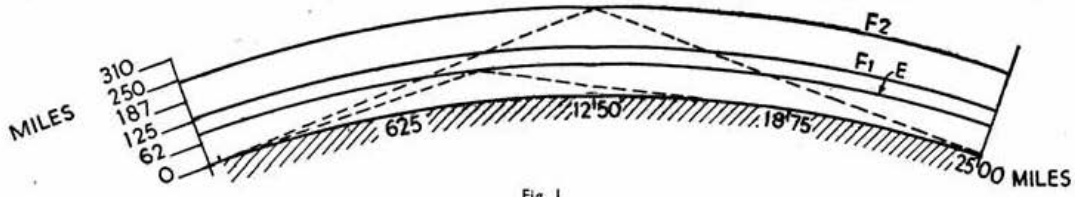

Fig. 1
Relative heights of ionised layers above the earth, summer day-time condition, showing single hop transmissions by F2 and Sporadic E propagation.

Ionospheric Observations

There is still a great deal to learn about the ionosphere, particularly as to the causes of the continuous and geographical variations which take place. Most of our knowledge of the ionosphere has been gained by frequency-sweep vertical-pulse transmission from ionosphere sounding stations in various parts of the world. But these stations are far too few in number to provide all the answers and the results obtained apply only to the ionosphere immediately above them. Again, it is not practicable to have such stations covering the wide expanses of ocean whilst they are almost non-existent in the equatorial zones.

This is where amateur observations of propagation over various paths can provide a valuable supplement to the results obtained by the professional research organisations.

From simple observations on the strength of signals from stations located in a given direction and at a known distance from the receiving point, a composite picture can be built up as to the state of the reflecting agency at a point mid-way between the receiver and transmitter. Such observations, multiplied many times over, can disclose valuable information on the efficiency of reflection, the degree of absorption and the intensity of ionization.

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† *Joint Manager, Ionospheric Group.*

In general, these factors are dependent upon the position of the part of the world being considered in relation to the sun's radiation and to the earth's magnetic field but in addition considerable variations occur in the ionosphere over places a comparatively short distance apart. These are believed to be due to variations in the incident solar radiation and also to a certain extent by secondary variations in the earth's upper atmosphere, magnetic field, charge, etc.

For obvious reasons, ionosphere variations become more apparent on the higher frequencies. Consequently much of the work of the S.O. Groups is concerned with the frequencies of the order of 28 Mc/s. and higher. Workers on the 28 Mc/s. band cannot fail to have noticed how, for instance, one day it "opens," perhaps an hour earlier than normal, or how U.S.A. signals may one evening remain "in" for as much as two hours longer than on other days of the same week. Again, on ionosphere storm days they will probably have observed how southerly signals are quite good whilst signals from N. America and Russia are non-existent. It has been noticed by the writer on a number of occasions that when ionosphere storm conditions are in force along the polar routes the trans-equator or southerly working frequencies are relatively high. Such an observation might easily throw further light on the mysteries of the ionosphere storm. Amateur observations under disturbed conditions are particularly useful, for a study of abnormalities does, of course, teach us much about normalities!

The writer's observations show that so far as F2 M.U.F. was concerned the winter of 1948 was considerably below that of 1947 (the peak year), and in Europe a M.U.F. of 50 Mc/s. was barely touched. There were the usual "peaks" in November, 1948 and February, 1949 when M.U.F.'s of about 48 Mc/s. occurred and these were mostly in southerly directions. By contrast with the *summer* of 1947, however, there were more frequent European E_s (sporadic E) "openings" over 50 Mc/s. during 1948.

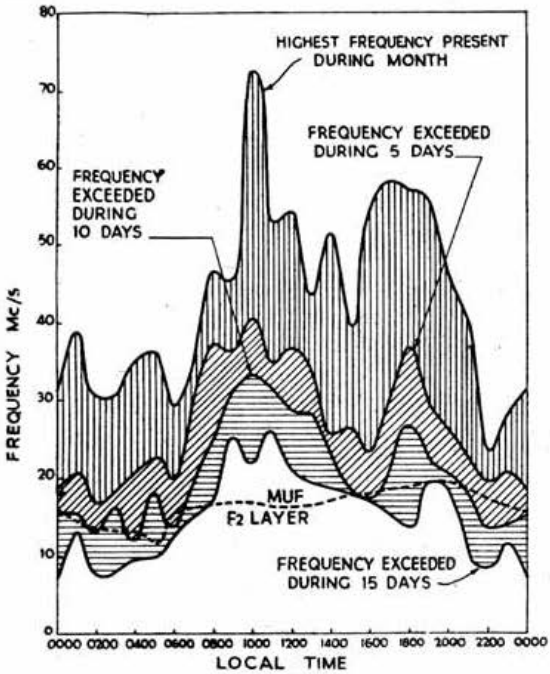


Fig. 2
Typical summer Sporadic E, M.U.F.'s for 1450 miles transmission paths recorded at Slough, June, 1946.

As much information as possible is required on E_s openings, particularly above 30 Mc/s. and it is hoped that many members even if they are unable to make regular observations will co-operate by forwarding reports covering the coming Summer.

Not only is there uncertainty as to the radiations responsible for sporadic ionisation at the E region height (around 100 km.) but it is not at all clear as to whether or not such conditions tend to follow the sun-spot cycle in the same way as F2 critical frequencies. It is hoped therefore that S.O. Group members will be able to cover the period of the next sun-spot cycle (minimum expected in 1952) with fairly complete observations.

There seems little doubt that more than one form of radiation causes E_s. In latitudes below 60° and especially in the tropics, E_s tends to peak during daylight hours, pointing to photo-ionisation (*i.e.* ultra-violet radiation from the sun) as being the cause. In polar regions, however, the opposite is the case, *i.e.* E_s is more frequent around midnight and during the early hours, suggesting some form of ionising agent other than direct sunlight, unless, perhaps, this ionisation is a secondary effect of some occurrence on the daylit part of the globe. There is some evidence that this "Northern E_s" is closely connected with the aurora and may, in fact, be one and the same thing. It is also considered possible that meteors or meteoric dust streams are responsible for a degree of sporadic E propagation.

Signals over 30 Mc/s. reflected by E_s normally arrive from distances of the order of 500–1200 miles. There are a number of European stations operating between 30 and 60 Mc/s., both fundamental and harmonic, amateur and commercial, which are useful for checking purposes. Reports on these stations should, if possible, give time of appearance and/or disappearance and reception of signals, frequency, strength, and location.

When considering ionospheric observations made to date (some of which are still being analysed), mention must be made of the good work done by the joint Group Manager, Mr. L. Blagborough (BRS15012), Messrs. Eaton (BRS14882), Haylock (G2DHV), Hine (G4RA), Jamieson (BRS12730) Proctor (BRS 13709) and Sharpe (BRS7961). But many more helpers for checking M.U.F.'s are required.

Auroral, Meteor and Solar Observations

The Auroral, Meteor and Solar effects Group under the management of Mr. H. R. Hatch, G2CBB, have provided useful information, particularly relating to meteors. Nearly one hundred observations have been made and details given of the Doppler effect, its duration, an estimate of the audio limits and the hourly rate, as well as the directional properties of the aerials used.

Tropospheric Group

Unfortunately, due to pressure of other work, Mr. E. J. Williams, B.Sc., G2XC, had to give up the managership of the Tropospheric Group, consequently very little has yet been achieved in this direction by members of the Scientific Observation Groups.

A considerable amount of research was of course done in this field during the war, particularly in connection with radar, but our knowledge requires consolidation before it can be considered to be anything like complete—especially insofar as communication channels and low angle radiation are concerned.

The effect of *frequency* needs clarification. In this respect the new 144 Mc/s. and higher amateur bands offer important fields for experimental observation. Here transmitting amateurs can be very useful in

providing regular transmissions for observation purposes. Comparison between 28 and 144 Mc/s. by tropospheric propagation would provide information of considerable interest. Members who can co-operate in tests by making regular (say 5 or 10 minutes) transmissions on 28 and/or 144 Mc/s. at suitable times, are asked to advise H.Q. In order to avoid ionospheric effects, night time is generally the only suitable time for such tests on 28 Mc/s.

European Co-operation

Co-operation has already been obtained from F8OL (15 km. south of Paris) who transmits daily at 1930/40 on 145 Mc/s. Comparison of his signal with those from the Paris television station on 46 and 42 Mc/s. provides a useful series of observations. ON4FG (Bornhem, Belgium), transmits at 1840/45 on 144·7 Mc/s. almost every day, and tests are also made with this station by changing from a 3·5 Mc/s. schedule at 0730 GMT to one on 145 Mc/s.

At times, skip effects, pointing to reflection at atmospheric discontinuities (as opposed to refraction around the earth's surface) are noticed. By having several receiving stations in line at suitable distances from a transmitting station, checks on this effect should be obtained. Distances of the order of 50–250 miles are normally involved.

News has been received from Mr. B. Van Dijl, of Noordwijk, who is organising a project similar to S.O. in Holland. Initially the Dutch observations will be confined to M.U.F. and skip distance, combining both subjects, with distances limited to *less* than 3000 km. Mr. Van Dijl wishes to arrange a number of fixed station schedules with U.K. amateurs. Frequency predictions for the stations concerned, where the M.U.F. is plotted against time, would be given. Observations would then be made during the appearance or disappearance periods (*i.e.* when the frequencies of the stations should come within or just exceed the M.U.F.—such as at dawn or in the evening). Where different stations appear or disappear at different times, due to their respective distances, the *exact* time of these happenings would be noted. Owing to the comparatively short distances involved it is presumed that stations will be required in the lower frequency bands, 3·5, 7 and possibly 14 Mc/s. Offers from those who can undertake fairly regular transmitting schedules of this nature would be appreciated and may, in the first instance, be forwarded to H.Q.

In conclusion it might be mentioned that the writer is always pleased to discuss S.O. during his rather limited operating time "on-the-air." In particular a receiver is left tuned to 3575 kc/s. each day from 0730 –0800 GMT (or BST) to receive calls from any station wishing to pass information relating to this work.

Victor Desmond Trophy

The Council has been pleased to accept from the President (Mr. V. M. Desmond, G5VM), a new Trophy, to be competed for annually by members resident within the United Kingdom.

The Rules governing the award of the Trophy are as follows :—

(1) The Victor Desmond Trophy will, at the discretion of the Council, be awarded each year to a fully paid-up member of the Society resident within the United Kingdom.
(2) Initially the Trophy will be awarded in connection with 1·7 Mc/s. (Top Band) Contests organised by the Society.
(3) The Trophy will be held for one year and will be awarded at the Annual General Meeting, or such other function as the Council may decide.
(4) The Council reserves the right to award the Trophy for any purpose other than that mentioned in Rule 2.

Arthur Watts Trophy

The Council has been pleased to accept from Mr. Arthur E. Watts, G6UN, a new trophy to be competed for annually by members resident within the United Kingdom.

The Rules governing the award of the Trophy are as follows :—

(1) The Arthur Watts Trophy will, at the discretion of the Council, be awarded each year to a fully paid-up licenced member of the Society resident within the United Kingdom.
(2) Initially the Trophy will be awarded to the winner of the annual 420 Mc/s. Transmitting Contest organised by the Society.
(3) The Trophy will be held for one year and will be awarded at the Annual General Meeting, or such other function as the Council may decide.
(4) The Council reserves the right to award the Trophy for any purpose other than that mentioned in Rule 2, provided that the purpose is related to amateur operation on frequencies in the U.H.F. range (*i.e.* above 300 Mc/s.)

R.S.G.B. Certificates

During the three years which have passed since the first post-war transmitting licences were issued, an unprecedented number of amateur stations have been active within the British Commonwealth and Colonial Empire. In view of this fact the Council has decided that the rules and conditions governing the issue of R.S.G.B. Certificates shall be modified and brought up-to-date.

A new leaflet containing the Rules and listing the British Commonwealth and Colonial Empire call sign areas, is now available from Headquarters free of charge on receipt of a stamped and addressed envelope.

The modified Rules and Conditions take effect from September 1, 1949.

Side Slips

The circuit diagram (Fig. 1) which accompanied the article "A Communications Superhet from the T.R.1196" published in the November, 1948, issue of the BULLETIN, contained several mistakes. The local oscillator grid-leak (R.6) should be connected between grid and earth, and not to C.3c as shown. The cathode bias resistor of V5 should also be connected to earth and not to the A.V.C. line. The resistance R9d should be connected to the grid and not to the screen-grid of V6. The author (Mr. M. Baerlejn) regrets any inconvenience which may have been caused by these errors.

— LONDON MEETING —

FRIDAY, MAY 27th, 1949

AT THE INSTITUTION OF ELECTRICAL ENGINEERS, SAVOY PLACE, VICTORIA EMBANKMENT

LECTURE

"THE DESIGN OF COMMUNICATION RECEIVERS"

by

DENIS W. HEIGHTMAN M. BRIT. I.R.E. (G6DH)

Tea 5.30 p.m. Lecture 6.30 p.m.

RADIO EQUIPMENT INSURANCE

A special radio equipment insurance policy arranged by *France, Fenwick (Insurance), Ltd.*, Bank Buildings, Castle Square, Swansea, and issued by the *Edinburgh Assurance Co. Ltd.*, is now available to members.

The Policy Covers

(1) Damage to, or loss of, Transmitters, Receivers, Aerial Equipment, Test Gear and any Components forming part of the Installation or in stock (including Valves); whilst on the Insured's premises or whilst temporarily removed to any occupied private dwelling-house in the United Kingdom. This includes damage by Fire or Lightning, and loss by Burglary, Housebreaking or Theft.

(2) Damage to the Insured's own property (including house, outbuildings, etc.) caused by breakage or collapse of Aerials, Aerial Fittings or Masts, forming part of the Installation, including whilst such Aerials, Aerial Fittings or Masts are being erected, repaired or dismantled, up to a sum of £500.

(3) The Insured's liability at Law for death of or injury to any person (except persons in the Insured's service or members of his household) or for damage to property of any such person, caused by the Installation, or arising out of the operation, erection, repairing, dismantling or maintenance of any part thereof, or by the breakage or collapse of Aerials, Aerial Fittings or Masts forming part thereof, (including whilst such Aerials, Aerial Fittings or Masts are being erected, repaired or dismantled) but limited to an amount of £5,000 any one claim or number of claims arising out of one accident.

(4) All Legal Expenses incurred with the Company's consent in the settlement or defence of any claim and all Law costs recoverable in any such claim by any Claimant.

The Policy does not Cover

(*a*) Damage by War, Riot, Civil Commotion, and similar risks.

(*b*) Damage by Earthquake.

(*c*) Depreciation or wearing out of any part of the Equipment.

(*d*) Loss or damage caused by Rain, Mist or normal Atmospheric Conditions, other than by Storm and Tempest.

(*e*) Damage caused to any particular item of the Equipment caused by short-circuiting, overrunning or excessive pressure originating in that particular item.

(*f*) Liability at Law for damage caused by Fire to any building in which the Installation or any part thereof is contained.

The annual premium is 10/- per cent on the total value of the installation.

Members interested in this proposition should write direct to *France, Fenwick, Ltd.*, marking their letters for the attention of Mr. R. F. Armstrong.

Crystal-Controlled Exciter for 420 Mc/s.

A useful hint to members building the 420 Mc/s. transmitter described in the March issue of the BULLETIN has been contributed by Mr. C. H. L. Edwards, G8TL, who points out that the use of 6BA screws to secure the ¼" dia. copper tank coil to the anode pins of the 832 P.A. valve (as suggested in the original article) may lead to the fracture of the valve envelope close to the anode pins. A similar system tried by both G8TL and G2BRH resulted in the loss of four valves despite the fact that the copper tubing was in alignment with the pins and the pressure of the screws was not excessive. The cause was eventually found to be the strain set up by the unequal rate of cooling of the glass and the copper.

To overcome this defect the screws were replaced by small spring bronze clips to which were soldered short lengths—about ¼"—of copper braid. The braid was then sweated to the ends of the inductance from which corresponding lengths had been removed so as to leave the frequency coverage unchanged. This arrangement was found to give sufficient flexibility to allow for the different coefficients of expansion and rates of cooling between the glass envelope of the valve and the coil. Since making these alterations no further difficulties have been experienced.

Paper Control

Although paper was mentioned when on March 22nd last the President of the Board of Trade announced further relaxation of material controls no new change in the paper situation is involved. The inclusion of paper in the list was merely a confirmation of the relaxations previously announced affecting books, stationery and similar uses.

At the subsequent Press Conference it was also made clear that paper for newspapers and periodicals will still be controlled by statutory order.

Members who jumped to the conclusion after reading certain Press announcements that the paper restrictions, which at present limit the size of the Bulletin, had been swept away must remain patient for a little longer.

More Good Work

When an American aircraft was forced down, recently, on an ice cap in Greenland, the lives of the crew of 9 depended largely upon the speed of the rescue work. With the co-operation of VO6AN and K4USA of the Military Amateur Radio System, telephony communication was established between Goose Bay, Labrador and Washington, D.C., within an hour of the request being made by the Air Rescue Service. These facilities afforded valuable assistance to those in charge of rescue operations.

* * *

Amateurs, working under difficult conditions, also played an important role when U.S. Mid-West states were struck by severe icing conditions which left many cities without power or outside communications. No wonder a recent statement from the American Chief of Naval Operations paid the following tribute: "Both in peace and war, amateurs have repeatedly demonstrated their value and importance to National Security."

THE MONTH ON THE AIR

By A. O. MILNE (G2MI) *

FORTHCOMING R.S.G.B. CONTESTS

June	11–12	National Field Day.
July	3	144 Mc/s. Field Day.
August	20–21	420 Mc/s.
September	25	Direction Finding.
October	1– 2	Low Power (3·5 Mc/s.).
November	26–27	" Top Band " (1·8 Mc/s.).

Date to be announced. Affiliated Societies.

QSL Cards

ABOUT two years ago we incurred the wrath of several members when in an Editorial we mentioned the matter of inter-G QSL cards and asked " are they necessary ? " It was made quite plain then that if an amateur wanted a card, he had only to say " Pse QSL." Our point was that there must be many amateurs who do not want cards for local contacts and it is therefore a waste of a card to send them one. We now possess hundreds of U.S. cards for which we have no wall space and little storage space. Of course there are some cards that we do want, but surely the time has come when some discrimination should be used. Naturally the newly-licensed station is keen to get all the cards he can but the longer one is on the air the less interest in merely duplicating many times over those cards already held.

May we suggest therefore the following simple rules :—

(1) If the station you work says " please QSL," then wherever he may be, send him a card. He wants one.

(2) If the station you work does not say " please QSL," then you may assume that he does not want a card.

(3) If you want a card, say " please QSL." If you do not, then say nothing, unless you care to say you don't want a card.

If these simple rules are followed (and it is regarded as a point of honour always to send a card if one is requested), then everyone, including you, dear reader, who wants a QSL card will get one. People who do not want a card will not clutter up the Bureau with hundreds of unwanted and unclaimed cards and everyone will be happy.

Now don't go dipping your pens in vitriol to tell us that we are snooty high-handed Old Timers trying to do the newcomer out of his QSL cards. If you feel like that, just read this paragraph again a little more carefully.

Notes and News

DL4EX asks us to correct the statement on page 204 of the February issue regarding DL4 calls. He is a British subject but is licensed by the U.S. authorities in Germany and has had some difficulty in convincing people that he is not a pirate because of his English accent. He is in fact G3TG.

Will AP2D, AP2H and D2GO please send envelopes to the QSL manager to collect a vast accumulation of cards awaiting them ?

TA3GVU, so prominent a call on 28 Mc/s., is none other than our old friend Lt.-Col. Elser, W6GVU, whom many London members will remember meeting during the war. Cards have arrived from him and also TA3AA. VS2CH is shortly returning home and has recently contributed a nice fat wad of cards to the QSL manager's troubles ! G4KY is now active as ZL2AIQ and was in contact with G2IG on 28 Mc/s. recently. BRS17335 with a 640 receiver has been pulling them in. DU1AK in the Philippines is one of his latest but as these stations may only contact American citizens, the interest is rather lessened.

G5DQ has the usual amazing assortment of DX to offer : UM8KAA, 14035, T7 with bad drift ; MD7RCS, 14080, T9 ; C4RK, 14100, T9 ; HP2X, 14040, T8 ; VK9NR, 14007, T9 ; W0MCF/C3, 14045, T9 ; KC6EA who listens QLM and KC6WA not yet worked. It surprises us that G5DQ has not applied for the Empire DX Certificate. He must surely have the necessary cards several times over. Who will be the first three-letter G3 to qualify ? We suggest G3AAM as a possible bet.

G3ABZ hooked a good 'un on March 11 with VR2AQ on 28200 'phone at 0815 S6/7. He also worked VE7CN at 0814 on March 12 the long way round. Input 75 watts to a two wavelength Zepp.

The ZD9AA/G2MI sked has now been re-established and cards for contacts which have taken place since the mail left Tristan have now been despatched through the Bureau.

MP4BAD on 7014 is ex-YI1X and QSL's. YI1FC is active on 7 Mc/s. HZ1JE is B.M.M., Saudi Arabia, c/o T.A.I.F., M.E.L.F. ST2AE is Box 25, Malakal. All this comes from G3DCQ. G3BCK has worked LZ3SD on 7035, who asks for QSL via Box 49 Sofia . . . we wonder !

From the G6RH log come ZD8B (Andy Boa) on 14020, W8QOH/HS on 14075 and EZ4H on 14060.

BRS11494 suggests keeping an ear open on 27 Mc/s. for W's who call " CQ 11 tuning the 10 metre band."

Here are a few to look for on 28 Mc/s. VQ2DC, 0830 ; JA2AB, 0830 ; W6WVJ/KW6, 0845 ; VP5EM, 1400 ; HL1CQ, 0900 ; KR6BL, 0930 ; OA4AO, 1830 ; CP4DG, 2100. And on 14 Mc/s. KR6AZ, 1615 ; KL7EW, 0715 ; TA1BS, 2045 ; and lots of VE8's around 0730. (All times G.M.T.)

From HR1MB comes the news of the death on March 19 of HR1CE. 1MB is returning to the States in two months time. There will then be only one HR station active, HR1KV, who operates on 28 Mc/s. with 100 watts, but has a poor location.

ZC6JG is now in Mogadishu, Somalia, with the call-sign MD4GC. Once again we appeal to all ex-ZC6 calls to send envelopes to the Bureau.

BRS16304 seems to specialise in rare DX. CP1AM, 2BA, 4DG, 4DN, 5FB and 6PB, PZ1WK, VK9GW, YN1RO and HP2RO are the pick of his bunch. He is now trying to get cards from the various States and provinces of South America ! Rather more difficult than a W.A.S.

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

29 KECHILL GARDENS, HAYES

BROMLEY, KENT

AND NOT R.S.G.B. HEADQUARTERS

More Interlopers

VS2CQ complains of the large number of odd Commercial, Service and Broadcasting stations which are using our bands in the Far East. Pity the poor amateur who strays out of *his* band even to an unoccupied kilocycle, yet these people seem to dump their squeals anywhere they think fit, and no one does anything about it. Here are a few of them : Radio Bangkok on 7025, Bandoeng YDB on 7100, Kung Chun X6AF on 7100, to say nothing of the welter of short-wave broadcasters in the 7150–7200 section where, of course, they will be by right when Atlantic City comes into action, but by what right are they there now ? Who listens to their blatherings ?

Broadcast interests will no doubt produce formidable listener figures if asked to do so, after all they *must* to justify their jobs, but personally we have never yet found anyone who listens consistently to short-wave broadcasting. We still stick to our original conservative estimate—one listener per kilowatt ! Short-wave broadcasting is probably the greatest waste of time and energy in the world to-day, and most likely to cause international ill-will.

Tibet

Some 500 nice new QSL cards are on their way to AC4RF, so be patient. He works from storage batteries and has been coming through quite well on 28 Mc/s. both C.W. and 'phone. The transmitter in use is an EL32 crystal oscillator driving a 6L6 with screen modulation by means of a 6SN7. He says Lhasa is a pleasant place in which to live and is inhabited by some of the most charming and hospitable people on earth.

B.R.S. QSL's

Will B.R.S. stations in all parts of the British Isles please note that envelopes for the collection of their incoming cards should be sent to Mr. W. F. Thomson, " Ross," The Gardens, Brookmans Park, Herts. Their outgoing cards should be sent to G2MI.

EXPERIMENTAL STANDARD FREQUENCY TRANSMISSIONS

GB1RS

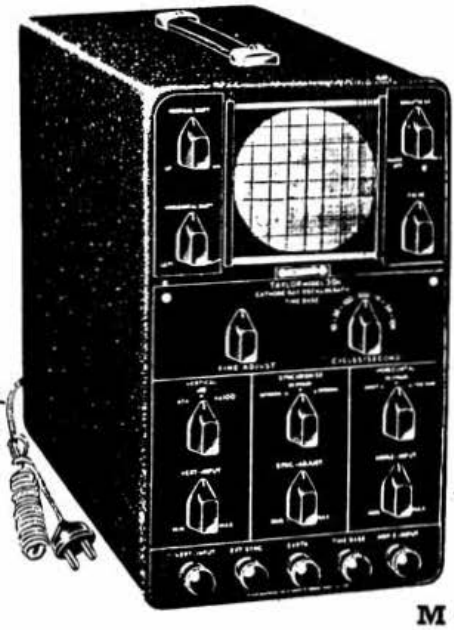
The Headquarters' Station, GB1RS, transmits daily for two minutes at each hour from 1800 G.M.T. to 0900 G.M.T. on a frequency of

3500.25 kc/s

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

WINDSOR

CATHODE RAY OSCILLOGRAPH



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

Six Metres

FROM 1240 GMT until some time after 1600 GMT on March 30th Denis Heightman, G6DH, maintained satisfactory two-way telephony contact on 50 Mc/s. with ZS1P and ZS1AP of Capetown. Initial contact was made cross-band from 28 Mc/s.

It was appropriate that G6DH, who has contributed so greatly to our knowledge of V.H.F. Propagation technique, should have had the honour of affecting what were probably the last 50 Mc/s. DX contacts from England before the band was lost to U.K. amateurs.

Five Metres

That faithful devotee of the band, G2AOL (Otford, Kent), made a praiseworthy attempt to put Leicestershire on the map before the close-down, by operating under the call G2AOL/A from Loughborough during the period March 20/28. No report had been received from him up to the time of going to press, but G6SM heard him RST339–559 in Sanderstead, Surrey, at 22.45 GMT on March 23. Since July, 1948, G6SM has worked 123 stations in 22 counties on this band, and all with an indoor dipole hung immediately above the operating position. Well, there seems little doubt but that *he's* got a pretty good site for V.H.F. anyway.

Firsts on Two

GM3OL (Dumfries), and G5BM (Cheltenham), made the first 2 metre contact between Scotland and England at 2205 G.M.T. on March 28. Signals were RST 569 in both directions, and the distance 230 miles.

The first G/DL4 contact was made between G2FMF (Hillingdon, Middlesex) and DL4OK operating portable in the Zugspitze mountains (7000 ft. above sea level) in Bavaria not far from the Austrian frontier. The distance of approximately 570 miles compares favourably with the present world amateur record of 660 miles.

Two Metres

Conditions were generally poor during the first three weeks of March, but the warmer weather on the 23rd caused the band to open up somewhat, and on that evening G2ADZ (Oswestry), worked G3AEX (Dorking) and 3BLP (Selsdon) 165 miles, 3BY (Ashton-under-Lyne) 50 miles and 3EHY (Banwell, Som.) 120 miles, and heard 2MR, 5MI and 6NB, thus showing the value of regular operation in enabling one to take advantage of a sudden change for the better in propagational conditions.

G2XS and 5UD (Kings Lynn), are now exclusively on this band and are active every evening at 19.30 and again between 22.30 and 23.15. 2XS, using a 4 element beam and an 829 in the final, had three contacts in one week with G5MA (Ashtead), but has heard no one else.

Activity in the West Country is not particularly high, and we are therefore pleased to welcome G3EHY (Banwell, Som.), who, in the first three days on the band, worked G2ADZ as above mentioned. He employs two frequencies, 145·0 and 145·2 Mc/s. and has his six element stacked array trained on London every evening between 19.30 and 20.30 and again after 22.30, and would appreciate reports. G3YH and 5YK (Bristol), are also looking for contacts with the London area. The former finds that his location is even poorer on 2 metres than was the case on 5, and can only work G5BM (Cheltenham), 40 miles away, under peak conditions.

We understand that GW5SA (Neath), is on the band, and if this should catch his eye, we feel that details of his frequency and times of operation would be welcome to those looking for Wales to add to their two metre list of prefixes worked.

Seventy-centimetres

A further portable sortie by G2WS and G6HD (this time to Woldingham, Surrey, 800 ft. above sea level) carried out on the afternoon of Saturday, March 19, produced some interesting contacts. G3AHB/A, situated on the roof of the *E.M.I.* Building at Hayes, Middlesex, was S8 on M.C.W. and S7 on 'phone both ways at a distance of 22 miles, while G2FKZ (Dulwich), 11 miles, was worked on both M.C.W. and 'phone at S9. In addition an S7 contact was made with 3CU, also at Dulwich. G5PY was heard at S7 but no QSO materialised. The transmitter employed by G2WS was of rather higher power than that previously in use, and consisted of a pair of CV82's in push-pull with an input of 5½ watts. A two valve super-regen. receiver and a 16 element broadside array made up the remainder of the equipment. A comparative test between the beam and a single dipole was made while working G2FKZ, and the latter's signals fell from S9 to S5 with the unassisted aerial. It was unfortunate that the portable tests could not be continued after 5 p.m., but the complete failure of the car accumulators forming the power supply terminated operations at that time.

G2FKZ has been carrying out polarisation tests with 3AHB/A, but no definite conclusions have yet been reached beyond the necessity for both stations to have their aerials in the same plane. Referring to the above mentioned tests with G2WS/P, 3AHB states that it was the first occasion he had been on the band in daylight, and he is of the opinion that, if anything, signals were stronger than at night.

* *32 Earl's Road, Tunbridge Wells, Kent.*

Top-Band Contest

IT is the rule, and not contrary to the facts, to say of "top band" contests that "a good time was had by all"; the event held during the first weekend in February qualified fully for the comment.

The weather being rather raw-cold it is not surprising that activity was slightly less than during the previous contest but of the vigour there is no doubt.

In an excess of zeal a number of competitors, unwittingly no doubt, exceeded the maximum speed of 20 w.p.m. stipulated in their licence when sending call signs and in so doing nullified the declaration they had signed. The point must not be overlooked in future.

Viewed from London it was pleasant to note that rules designed to encourage more general activity did in fact produce entries from further afield than usual, including Northern Ireland.

That faithful Danish supporter of earlier "top band" contests —OZ1W—was not active on this occasion because advice as to the date of the event had not been received by him; he should be active next time as the omission has been rectified.

It is interesting to record that one of the DL2 stations was operated by a German which, of course, placed it outside the Contest in accordance with the rules, yet the action says a lot for the sportsmanship of the British operator who so arranged to give the German amateur the pleasure of participating in a contest and U.K. competitors the chance to make another European contact.

There is some feeling that the "T9 note" rule tended to produce a more-or-less standard report which may, or may not have accorded with the facts, yet it is recorded in several instances that reports lower than T9 had the effect of causing the operator to rectify matters so that subsequent reports were satisfactory. There was one outstanding T8 note.

Presumably competitors will always congregate around the middle of the band which seems a pity, because QRM-free spaces are left at both ends. It is good policy these days to use every kilocycle available to us. It must, however, be admitted that the leading competitors appear to achieve their success when working between 1800 and 1900 kc/s.

The times assigned for this event appear to have suited most entrants but the early start may have added some difficulties to those living in television range-fringe areas.

Results

Pos.	Call Sign	Reg.	Pts.	Pos.	Call Sign	Reg.	Pts.
1	G2DU	6	477	45	GM2HIK	12	301
2	G6BQ	7	472	46	G5YN	9	296
3	G2YY	13	461	47	G4BI	4	295
4	G4AU	7	458	48	G3LZ	1	290
5	G2DTD	6	446	49	G3CAG	6	289
6	G5MY	4	445	50	G5HS	3	288
7	G8VR	7	441	51	G8BM	1	281
8	G6VC	7	430	52	G3APV/A	2	280
9	G3BYF	7	426	53	GM8MJ	14	278
10	G2VD	7	417	54	G2BCX	7	273
10	G6HD	7	417	55	GI2HML	15	266
12	G2JF	8	416	56	G6UT	5	264
13	G5ZX	3	414	56	G5JL	7	264
14	G3FAB	3	412	58	G3AZ	7	262
14	G8TR	1	412	59	G2IC	8	260
16	G3BVJ	3	408	60	G3EKX	4	257
16	GW2HH	10	408	61	G3AEX	7	255
18	DL2GC	DL2	403	62	G2MJ	1	248
19	G8WF	2	400	63	G8FW	4	236
20	G3AOG	6	399	64	G3CCN	1	220
21	G6ZN	2	396	64	G8KU	2	220
22	G3DYQ	8	393	66	G3DDM	8	219
23	G6NB	7	390	67	G2BOU	7	210
24	G2LC	7	388	68	G2HOX	7	207
25	G8JM	7	385	69	G6MH	5	202
26	G2HPF	5	384	70	G2SF	5	199
27	G3EDW	5	380	71	G2DZF	8	190
28	G2NJ/A	4	365	72	G3NT	2	184
29	G3AEX	7	364	73	G2NH	7	178
30	G3AH	1	351	74	GW3CBY	10	175
31	G3AIG	7	348	75	G5IV	2	160
32	G2DAN	3	344	76	G3AOK	7	157
33	G4DC	7	343	77	G6GN	9	152
34	G3BOC	1	340	78	G6CL	7	151
35	G2AOL	7	339	79	G2CWY	7	139
36	G3AMF	7	335	80	G2AJU	5	138
37	G2AMV	1	333	81	G2FJD	5	132
38	G3CBU	7	327	82	G3CKX	7	117
38	GI3BKG	15	327	83	G3CU	7	112
40	G6OM	1	317	84	G8LN	7	109
41	G4AR	7	315	85	G3CPI	2	92
42	G3ECC	2	314	86	G3CO	7	84
43	G2RD	7	311	87	G6WN	7	69
44	G3YF	7	304				

Received Late - G3GDM (points claimed 204).

The following are thanked for forwarding check logs:— DL2IY, G2CIL, MI QI, QX, G3AFZ, AKY, BTP, CSC, DTK, G6WH, ZT, G8IG, GI3ALT, 5SJ.

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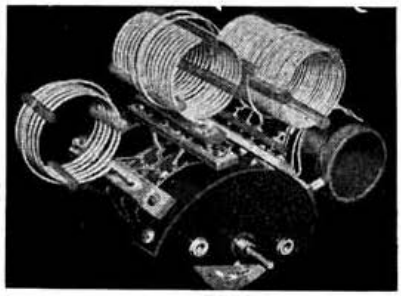

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LETTERS TO THE EDITOR

Signal Strength Reporting Standards

DEAR SIR,—I heartily agree with the first paragraph of the letter of Mr. K. E. Marcus published in the February, 1949, BULLETIN. It is high time both national and international agreement was obtained on standards for "S" reporting. I cannot, however, agree with Mr. Marcus's proposal to use the noise level as the basis, for obviously the noise level depends on such local factors as bandwidth, site noise, frequency, receiver performance, etc.

There appears to be some confusion of readability and receiver sensitivity (which are, of course, defined on a signal/noise basis) with pure signal strength recording. If we are to use the amateur "RST" code to its full advantage obviously the "R" will take care of the Readability considerations while the "S" should give the station at the other end as accurate a report on the received field strength as is reasonably possible.

We have, briefly, to set two standards: (1) the reference level for "S1" in microvolts input to the receiver input terminals; (2) the increment in db or μV per "S" point.

Reference to some of the specifications of the internationally well-known communications receivers shows fair agreement on "S1" as being about 0·5 μV. If we remember the original amateur definition of "S1" as a barely perceptible signal, experience shows that 0·5 μV *would* be of the order of "S1" for a telephony signal, although with low site noise and very high selectivity a signal of this order will often provide an easily read c.w. signal. We must start somewhere, however, and this 0·5 μV value is quite convenient as a general rule.

There is rather less general agreement on db per S point but undoubtedly the most convenient figure is 6 db and I propose that this be used. Compared with Mr. Marcus's proposal of 10 db, which, in voltage, is an awkward ratio of 3·16 : 1, 6 db is, of course, conveniently a ratio of approximately 2 : 1, and is quite a perceptible increase in level to the ear. Hence we would have:—

	μV.	db.		μV.	db.
S1	0·5	0	S6	16·0	30
S2	1·0	6	S7	32·0	36
S3	2·0	12	S8	63·0	42
S4	4·0	18	S9	125·0	48
S5	8·0	24			

(Note.—These proposals apply to unmodulated carriers.)

We are seldom concerned, in amateur circles, with levels higher than 125 μV and experience shows that this is a very suitable figure. Levels over this can, of course, be taken care of by "db over S9" where necessary.

It is interesting to note that the American Army in determining experimentally the receiver input voltage required to override the internal receiver noise, in typical receivers, found a value of 1 μV as necessary for 90 per cent. intelligibility of 100 per cent. modulated telephony on frequencies of the order of 1·5 to 20 Mc/s. In the above table 1 μV is S2, which conforms quite nicely with these findings.

I do not propose to go into questions of actual measurement in receivers apart from pointing out the fairly obvious facts that the reading of a meter, whether indicating on A.G.C. controlled circuits or in some special arrangement as described by Mr. Marcus, will be dependent on the frequency-gain characteristics of the aerial, R.F. and mixer circuits. Unless constant gain is obtained over the complete frequency range of the receiver, correction factors will have to be applied to the meter readings according to the received frequency or some sort of calibrated gain setting control will have to be arranged in "front" of the receiver. Correct matching of the aerial into the first circuit will also be necessary.

Having provided for these variables we are left with the gain (or loss!) factors of the receiving aerial (which at some later date calls for a "G" code—say db in reference to a standard doublet) but at least we shall be considerably closer to our target of accurate signal strength reporting.

It now requires some bright person to devise a simple, easily duplicated, signal generator giving 1 μV upwards in suitable steps. Diode noise generators suffer from the disadvantage that bandwidth and other considerations must be taken into account.

Yours faithfully,

D. W. HEIGHTMAN (G6DH).

DEAR SIR,—The article on "S-metering" by Mr. Marcus provided in part practical realisation of an idea with which I have been toying for some time. The circuit as shown, however, does seem to suffer a disadvantage in that it depends upon a comparatively inefficient A.V.C. circuit for successful operation.

In an ideal A.V.C. system with a delay of say 5 volts, the input to the detector will increase linearly up to 5 volts and then remain constant at that figure as a steadily increasing R.F. input is fed into the receiver. Consequently the S-meter would read linearly up to say S3 and then remain at that figure for any higher input, assuming S3 is equivalent to 5 volts input to the detector.

Since A.V.C. is a form of feedback, it is clear that the ideal curve cannot be obtained in practice, but the more efficient the A.V.C. is made the less will be the change in output for a given input. In consequence, with efficient A.V.C. the S-meter scale will be open from S0 to S3 and progressively more cramped from S4 to S9. This might be overcome by taking readings with the A.V.C. off, but the range would then be limited by overloading in the I.F. amplifier chain.

It means that if, what is in effect a positive feed-back path is provided for the S-meter valve, then the flattening effect of the A.V.C. might be overcome and the scale made more nearly linear. If the triode is replaced by a pentode with a long suppressor grid base, such as the EF50, and the A.V.C. bias applied to this suppressor as well as the normally controlled valves, then the meter will operate as described up to the point where the A.V.C. delay is exceeded. At signal levels greater than this it will be operated by the combined effect of the rectified signal on the grid and the A.V.C. voltage on the suppressor, thus giving a greater change of anode current for a given change in receiver input. By suitably proportioning the relative amounts of the two voltages applied to the valve it should be possible to achieve a comparatively linear scale or even open out the scale towards S9.

Although I agree that it is essential for the meter to operate on weak signals, before the A.V.C. operates, it is much easier aurally to estimate signal strengths in this region because the noise provides a convenient datum level. When the signal is well above the noise or the noise level is reduced by A.V.C., the estimation is much more difficult and likely to be less consistent. The visual counterpart of this was found in Radar, where operators were quite consistent on 2 : 1 echoes but much less so when asked to estimate 10 or 15 : 1. It seems desirable, therefore, that the scale should be opened out in the middle rather than at the lower end and I think the proposed alteration would achieve this.

Yours faithfully,

JOHN R. CARTWRIGHT (BRS5807).

146 Icknield Way, Letchworth, Herts.

DEAR SIR,—The last sentence of the letter by Mr. Marcus in the February issue calls for some qualification. It is true that, where delayed A.G.C. is employed in a receiver, the S-meter will not commence to show readings until the delay voltage is overcome, but nowhere in my article (June, 1948, issue) do I mention the use of delayed A.G.C. and, from an amateur point of view, there is no benefit in using such a system.

Maybe I should have made it clear that, in receivers incorporating delayed A.G.C., steps should be taken to cut out the delay, and for this omission I apologise—it was probably due to the fact that I am used to handling modern communications receivers which do not incorporate delayed A.G.C.

The circuit given by Mr. Marcus in his article in the same issue is interesting but, its incorporation would in many cases, involve considerable modifications and additions—the 25 volt battery is particularly inconvenient. Where great reliance is placed on S-meter readings, the circuit obviously has applications, but, considering that the average depth of modulation controls, to a major degree, the actual intelligibility, the additional complication is hardly worth while.

Yours faithfully,

J. N. WALKER (G5JU.)

West Heath, Birmingham 31.

Mains Voltage Regulation

DEAR SIR,—In reply to Mr. Bridgman's letter published in the February issue, I should like to make clear the following points:

(1) The system described by Mr. Bridgman is basically the same as the system described by me in the October, 1948, issue; both are auto-transformers, and both are of the same rating, *i.e.* (maximum boost volts) × (load current) = 50 volts × 5 amps = 250VA.

(2) Mr. Bridgman's system must of necessity be employed where a core with an existing primary winding is used. The method described by me (with tapping switch on the input side of the transformer), gives a more economical use of copper and iron, and hence a smaller transformer. However, in this case an existing primary winding cannot be used.

(3) The tapping switch used by Mr. Bridgman must fall into one of two categories:

(*a*) make-before-break: in this case part of the transformer is short-circuited whenever the tapping switch is moved. This is undesirable as it causes heavy currents to be broken by the switch, and should the switch be left inadvertently between two positions, destruction of the transformer will follow in a short time.

(*b*) break-before-make: in this case the load is switched off and on again every time the switch is moved. This will cause rapid wear of the switch contacts, and may cause trouble in equipment fed from the transformer.

A switch of the type described by me in the October issue, using a transition resistor, avoids these troubles. The switching duty is very small and contact-life is determined almost entirely by mechanical wear. This switch could, of course, be used with Mr. Bridgman's booster, giving the same advantages.

Yours faithfully,

Heaton, Newcastle-on-Tyne, 6. L. BERGNA.

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800	400	2 × 30	2 × 3·1	2 × 107	2 × 28·5	36	120	5·0
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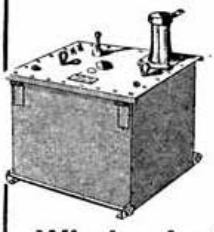

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The "Windsor" Model 30A Oscillograph, a product of *Taylor Electrical Instruments Ltd.*, is a general purposes instrument employing a 3½" electrostatic tube. It is self-contained for A.C. mains operation (110 to 250 volts, 40/100 c/s.) and includes a variable time-base oscillator and push-pull Y-plate amplifier. The twelve controls include horizontal and vertical shifts, focus, brightness, time-base range switch and fine control, vertical amplifier gain switch and control, synchronisation selector and control, horizontal selector switch and gain control.

Probably the most important use to which an oscillograph is put in the average amateur station is the measurement of modulation percentages by the trapezium method. This requires the use of audio voltage deflection from the modulator applied to the horizontal plates of the oscilloscope, and an R.F. voltage, up to the highest communication frequency, applied directly to the vertical plates. Both of these connections are easily made on the Model 30A, as the horizontal plates can be switched alternatively to the internal time-base, to a 50 c/s voltage from the mains or to terminals on the front panel, when the gain control remains in operation. All deflector plates are brought directly from the tube holder to linked terminals located behind a cover plate at the rear of the instrument, thus a low capacity connection direct to the vertical plates can be made at radio-frequency with ease.

Another use to which an oscilloscope is likely to be put is that of measuring the performance of modulation equipment. For this work the coverage provided by the internal time-base of the Model 30 (10 to more than 10,000 c/s), is adequate, and the linearity, whilst not quite up to the standard expected from more costly apparatus employing hard-valve time-base circuits,

is sufficient for all normal amateur requirements. The long *Mullard* ECR35 tube, used at moderate anode potential, gives excellent deflectional sensitivity, good focus, and ample brilliance for use throughout the audio range. At most frequencies the time-base can be extended to approximately three times the width of the screen, giving good resolution of wave-forms. The green screen is intended for visual, rather than photographic, work. An alternative model is however available with a persistent trace tube.

An outstanding feature of the instrument is the high gain and linearity of the vertical amplifier which, in addition to balanced deflection, incorporates negative feedback, and is decidedly superior to that generally associated in the past with the more moderately-priced oscilloscopes employing the smaller sizes of tube. The amplifier includes a decade switch providing ratios of x1, x10 and x100, and delivers more than sufficient voltage to fill the screen without evident distortion at frequencies from 50 to 10,000 c/s. The performance is thus very satisfactory for audio work, whilst the amplifier remains useful up to about 100 kc/s., permitting fair resolution of individual wave-forms up to about 200 kc/s. In other respects the 30A follows established practice. The design is flexible, and can be applied without difficulty to such diverse uses as panoramic reception, and the tracing of response curves with the aid of a frequency-modulated oscillator.

E. L. G.

B.I. Callenders' All-Wave Anti-Interference Aerial

Ever since short wave reception became generally popular 25 years ago attempts have been made to market special aerials designed to minimise the effects of man-made interference. Most of these devices have fallen far short of expectations, for the one very good reason that they have not been theoretically sound. Electrical interference, whether it be caused by cars, trains or trolley buses or by domestic machinery, is nearly all introduced into the receiver *via* the down lead. It should, therefore, be a first principle of design that a highly efficient and properly screened down-lead is employed. The ill-effects of interference can be considerably reduced by efficient matching between the aeria and the input to the receiver. Balanced transformers are the answer.

The All-Wave Anti-Interference Aerial marketed by *B. I. Callenders Ltd.*, Norfolk House, Norfolk Street, London, W.C.2, is designed to give uniformly good signals on all wavelengths normally covered by domestic receivers, including the long, medium and short-wave bands.

The standard kit consists of :

(1) A 60ft. dipole-type polyethylene insulated aerial complete with suspension insulators and a matching transformer.
(2) 80ft. of coaxial screened down-lead cable with polyethylene plugs moulded to each end.
(3) A receiver transformer, complete with rubber suction mounting, a socket to receive the down-lead plug and leads 6in. long for connection to the receiver.
(4) Ten weather-resisting clips and screws for installation of the feeder cable and a tube of sealing compound for use with the suction mounting.

The whole is packed in a strong carton.

The patented combination of aerial and transformers represents a marked advance in design. Without any switching it acts as a "T" type aerial on medium and long waves and as a dipole on short waves thus avoiding the common need for compromise in choice of aerial length on an all-wave receiver.

The enthusiastic short-wave listener situated in an area of high noise-level will find the aerial of great help in bringing in weak signals. When properly installed it gives virtual elimination of interference.

The standard kit, as described, sells at £6 18s. 0d.

Radio Amateurs' Examination—Course of Instruction at Ilford Literary Institute

As the current course of instruction in preparation for the 1949 Radio Amateurs' Examination is due to terminate shortly, the Ilford Education Committee is anxious to learn whether there will be sufficient support to warrant a new course of instruction being arranged in preparation for the 1950 examination. Members interested in this matter are requested to communicate with Mr. C. H. L. Edwards, G8TL, by not later than May 31st, 1949. Applications will be considered from districts additional to East London.

Approximately 50 members are attending the current course of instruction.

New Book

RADIO, TELEVISION & ELECTRICAL REPAIRS. By Roy C. Norris. 448 pp. Odhams Press. Price 10s. 6d.

This comprehensive, well illustrated volume is presented in a style which will appeal to the service engineer and the newcomer to radio alike. It should also help the layman to cope safely with general household repairs.

The 27 chapters, which cover an immense range of subjects are intended to make readers more familiar with radio, television and electrical apparatus. In that respect the author has succeeded but perhaps even more important is the fact that he has, perhaps unconsciously, helped popularise still further the use of electricity in the home.

Slow Morse Transmissions

B.S.T.	*Call*	*kc/s.*	*Town*
Daily			
22.00	G6NA	1840	Guildford
Sundays			
11.00	G2LC	1800	South Ruislip
20.30	G2DLJ	1802	Derby
Mondays			
13.00	G3AXN	1870	Southend-on-Sea
20.00	G2AJU	1900	Stutton, Ipswich
20.00	G2DJS	1800	Bradford
20.00	G3BHS	1820	Eastleigh, Hants.
20,00	G3DSR	1750	Derby
21.00	G2BLN	1900	Bournemouth
21.00	G8VR	1850	London, S.E.2
Tuesdays			
13.00	G3AXN	1870	Southend-on-Sea
22.00	G8TL	1896	Ilford
22.30	G4GA	1896	Chingford
22.30	G6JB	1820	Salcombe, Devon
23.00	GM4AN	1820	Kirkcaldy
Wednesdays			
20.00	PA0AA	3625	Hilversum
20.00	G3AFD	1783	Southampton
21.00	GM2HIK	1800	Forfar, Angus
22.00	G3DLC	1800	Grays, Essex
Thursdays			
13.00	G3AXN	1870	Southend-on-Sea
22.00	G2BCX	1873	South Woodford
22.30	G3ARU	1873	South Woodford
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Fridays			
13.00	G3AXN	1870	Southend-on-Sea
19.00	G3BLN	1900	Bournemouth
20.00	G2AJU	1900	Stutton, Ipswich
20.00	G3AKW	1860	Wirral
20.00	G3BHS	1820	Eastleigh, Hants.
20.30	G8LZ	1868	Gravesend
22.30	G6JB	1820	Salcombe, Devon
23.00	GM4AN	1820	Kirkcaldy
Saturdays			
23.00	G3CHY	1800	Ashton-u-Lyne

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

CARBON DESK MICROPHONES

On "candlestick" stand. Screened lead, jack plug. **7/6** (1/6).

METER PANELS (I.F.F Control Unit type 17). Containing one 0–5 mA. and one 0–20 v. 2" square Moving Coil Meters, Switches, Shunts, Sockets, etc. **7/11** (1/1).

CARBON HAND MICROPHONES, press-to-talk switch in handle, lead. **4/6** (1/-).

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THROAT MICROPHONES, British. Two low-impedance electro-magnetic units, leads, jack plug, as used BOAC, etc. **3/6** (9d.). Special small flat 2-pin flex plug and socket, as used on Yorks and Lancasters, add **1/2.**

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RECEIVER TYPE R1132A

These are high grade receivers covering a frequency range of 100 to 125 Mc/s. (2·4–3 metres). The circuit is an 11 valve superhet with the following stages: R.F. Ampl., Freq. Chngr., Osc., Stblsr., 3 I.F. Amplfrs., B.F.O., Det., 1st Audio and A.V.C. output. Fitted with tuning meter, precision slow motion drive, R.F. and L.F. gain controls, etc. Circuit diagram fitted inside dust cover. Really first-class job. Size 19 in. x 11 in. x 18 in. Requires 200 v. H.T. and 6 v. L.T. for power supply. Condition as brand new and unused. Supplied in original transit cases. *PRICE* **£4 . 19 . 6** (Carriage 10/–).

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ARMY RECEPTION SETS TYPE BP413

These are 4 valve superhets in wooden cases, size 10½ in. x 8 in. x 8 in. with fitted frame aerial. A built-in loud speaker is provided. Operation is from batteries approx. 100 v. for H.T. and 2 v. for L.T. A triode-pentode frequency changer stage, followed by an I.F. amplifier, double diode triode and pentode output provides the valve line-up. Frequency coverage 1·4–4 Mc/s. (75–125 metres approx.). Easily converted for broadcast or other short wave bands. Price includes all valves and receivers in good working order. An unrepeatable bargain.

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HIC ET UBIQUE

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General Secretary: John Clarricoats, G6CL

G.P.O. Liaison Officer: Arthur E. Watts, G6UN.

February Council Meeting

*Resume of the Minutes of a Meeting of the Council of the Inc. Radio Society of Great Britain, held at New Ruskin House, Little Russell Street, London, W.C.*1, *on Tuesday, February* 15, 1949, *at* 6 *p.m.*

Present.—The President (Mr. V. M. Desmond, in the Chair), Messrs. W. H. Allen, A.P.G. Amos, I. D. Auchterlonie, F. Charman, D. N. Corfield, S. K. Lewer, J. W. Mathews, A. O. Milne, W. A. Scarr, P. A. Thorogood, A. J. H. Watson, A. E. Watts, and John Clarricoats (General Secretary).

Apology.—An apology was presented for the absence of Mr. D. A. G. Edwards.

New Trophies.
Rules governing the award of the Arthur Watts and Victor Desmond Trophies were approved.

Membership.
Resolved—
(*a*) to elect 97 Corporate Members, 31 Associates, and 9 Junior Associates (total elected 137).
(*b*) to grant Corporate Membership to 10 Associates who had applied for transfer.
(*c*) subject to the receipt of satisfactory reports from the appropriate Regional or County Representatives, to grant affiliation to the Brighton & Hove Amateur Radio Society, the Hayle (Cornwall) Radio Society and the Redditch & District Amateur Radio Club.

N.F.D., 1949.
Seven members resident in South West London wrote to protest against the rule which limits the power to be used by N.F.D. stations to 5 watts. They considered that the figure should be changed to 25 watts.

After caretul consideration of the views expressed it was decided to inform the signatories that as the rules are now in print, the Council cannot agree to amend the rule relating to input power. It was reported that only a very small number of complaints concerning the power limitation to 5 watts were received after the 1948 event.

Marine Mobile Operation.
Mr. Watts reported that he is continning to accumulate evidence in support of the Society's contention that Marine Mobile operation should be permitted by the G.P.O. Mr. Watts was hopeful that the G.P.O. would agree eventually to allow qualified persons to operate amateur transmitting equipment on British ships.

Committees of the Council.
Terms of reference of the Committees of the Council were approved and the Committees constituted for the current year. (A list of the Committees was published last month.—Ed.)

National Convention, 1949.
After considering the views put forward by the Regional Representatives, it was

Resolved to proceed with plans for the holding of a National Convention at Belle Vue, Manchester, during October, 1949.

The meeting terminated at 10.10 p.m.

British Sound Recording Association

A meeting of the Association will be held on Saturday, May 7 at 3 p.m. in the Grand Hotel, Birmingham, at which event any member of the Society will be most welcome.

The Annual Conference and Dinner will be held on May 21 at the Clarendon Restaurant, Hammersmith, London, W.6.

Representation

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

Region 7.
London South—
Plumstead, Woolwich and Abbey Wood — R. Halls, G3EIW, 48 Raglan Road, S.E.18.
Kent—
Gravesend... ... — P. F. Jobson, BRS9195, 13 Brandon Street.
London West—
Ealing ... ... — R. E. G. Caws, G3BRL, 34 Greystoke Lodge, Hanger Lane, W.5.

Region 8.
Kent—
Ashford ... ... — J. C. Foster, G2JF, Wye College, Nr. Ashford.
Sussex—
Brighton and Hove — F. W. How, G3DEU, 25 Brunswick Place, Hove.

Region 12.
Banffshire—
Banff and District — A. Johnstone, BRS14743, 16 Whinhill Terrace.

Region 14.
Ayrshire—
Androssan and Saltcoats ... — J. F. McCreight, GM3DJS, 1 Knox Place, Saltcoats.

Vacancies

Mr. G. E. Ferrars, BRS15045 has resigned as Representative for the County of Yorkshire West.

Messrs. R. G. Nash, BRS4573 and P. J. H. Matthews, G3BPM have resigned as Town Representatives for Reading and Southgate (London N.) respectively. Nominations for their successors must be made in the prescribed form and should reach the General Secretary by April 30th, 1949.

Coventry Amateur Radio Society

Mr. Austin Forsyth, O.B.E., G6FO (Editor of *The Short Wave Magazine*) and Mr. John Clarricoats, G6CL (General Secretary of the R.S.G.B.) were among the guests at the annual dinner of the Coventry Amateur Radio Society held at the Wine Lodge, The Burges, Coventry, on Friday, March 25.

Mr. Councillor W. H. Malcolm, J.P., G6WX (Mayor of Coventry), who is President of the Society, was in the Chair supported by the Mayoress (Mrs. Malcolm), Douglas Edwards, G3DO (Council Member and Region 3 Representative), and Mrs. Edwards, Fred Miles, G5ML (Vice-President) and Mrs. Miles, George Brown, G5BJ (Vice-President), Leslie Gardner, G5GR, and K. G. Lines (Chairman and Hon. Secretary respectively of C.A.R.S.), H. J. Chater, G2LU (Coventry T.R.), T. Martin, G2LB (Warkwickshire C.R.), C. Young, G2AK, and A. Rhodes (President and Hon. Secretary respectively of M.A.R.S.).

Other prominent visitors included W. J. Butler, G5LJ, J. Bazley, G2BOZ, and W. Vincent, G4OI, all of M.A.R.S.

The toasts were in the hands of Mr. L. W. Gardner (Radio Press), response by Mr. Austin Forsyth; Mr. F. J. Chater (R.S.G.B.), response by Mr. John Clarricoats; Mr. Douglas

(*Continued on page 262.*)

The Candler System of Morse Code Training !

The Candler System of Morse Code Training was devised for all wishing to become proficient W/T Operators, and for those Operators who desire to increase their present sending and receiving speeds and to improve their technique.

We feel that we can give you no greater proof of the efficiency of the Candler System of Morse Code training than by reproducing a selection from the numerous letters which we have received from Candler Students.

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The JUNIOR Scientific Code Course is **for beginners.** Teaches all the necessary code fundamentals scientifically.

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From ADVANCED Course Students

Ref. 3207. "I can now read five words behind, can take commercial stations at 35 w.p.m. and send code at 35 w.p.m. without tiring. I have passed the G.P.O. Morse Test.
The G.P.O. Telegraph (op) who passed me out gave me an excellent report. I will be pleased to recommend your Course to all interested in Morse training." *T. T.*

Ref. 6160. "Many thanks for your letter regarding my son. I will pass your letter on to him, and ask him to reply to you. He told me quite definitely that he had derived great help from your course. You will be pleased to know that he was successful in passing his First Class P.M.G. He had to leave home at short notice to take up a position under Marconi Co., and is now at sea." *J. R. S.*

Ref. 8192. "I thought I would drop you a few lines to let you know how I have been getting on these last five years. Well, first of all here are my speeds: Reading at 65 w.p.m.; Copying (pen) 35/40 w.p.m., sending handkey 35 w.p.m. 'Bug' Key 35/40 w.p.m. While I was in the Army, I was told I was the fastest operator in all the 'links'." *D. B.*

SPECIAL NOTE.—The above Student (Ref. 8192) enrolled in April, 1942. Completed his Course in July, 1943. Joined the Army in 1945 as Radio Mechanic. Was demobilised in July, 1948. His age is now 20 years and 10 months. Secured position as Civilian Radio Operator with War Office on August 16th, 1948.

From JUNIOR Course Students

Ref. 5529. "I could not read a word of Morse Code before I started your Junior Code course. . . . I took the G.P.O. test for an Amateur Transmitting Licence and passed very comfortably. I sent a faultless eighteen words per minute without effort and received at fourteen words per minute with no errors; my numerals were also on the right side, sending twelve and receiving fourteen in the allotted one and a half minutes. I am now full of confidence as a result of this success and delighted with the progress I have made. . . . I have done all my practising alone. I feel I have really achieved something and would like to thank you for a very fine course." *P. J. P.*

Ref. 2709. "I would like to say how pleased I am with the course; I can send a comfortable 16 w.p.m., and receive 12 to 14 w.p.m. (*After completing only first five lessons*) which I think you will agree is fairly good as I was a beginner at the start of the course." *E. A.*

Ref. 5848. "I have passed my G.P.O. Test for the Amateur Licence after only three months learning under your instructions. I passed the Test quite easily receiving solid at 15 w.p.m. sending without error at 18 w.p.m. *R. M.*

Ref. 2245. "I am glad to announce that I recently passed the P.M.G. Special Exam. My speeds are far ahead of the speeds needed. I therefore walked through the telegraphy part." *A. R. L.*

All original letters may be seen at London office.

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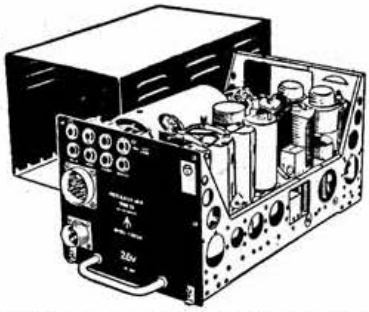

MODULATOR TYPE 76

9-valve equipment comprising 2 stages I.F. amplification (560 kc/s.) Detector, A.V.C., separate B.F.O. and 1-stage audio output (Phone). Also 4 valve push-pull modulation amplifier (1 valve used as A.F. oscillator on M.C.W.).

Complete with valves and power unit (24v. D.C. input with 2 outputs of 250v. D.C.).

Valve line-up: 2 KT33C; 2 EF36; 3 EF 39; 1 EBC33 and 1 EF50.

Brand new and complete in transit case, 50/–; or less valves 30/–.
Carriage and Packing 7/6.

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The portable power unit for the renowned "19" set. Comprises a powerful rotary transformer with associated smoothing circuits, including electrolytic condensers. On-off control switch on front panel with fuses and signal lamp. Input 12v. D.C. Outputs (*a*) 275v. at 110 m/a D.C. (*b*) 500v. at 50 m/a D.C. Housed in a portable steel carrying case with handle. A useful supply for RX and TX. Only 25/– carriage paid.

OSCILLATORS TYPE 37

A complete V.F.O. manufactured by R.G.D., inclusive of built-in 230v. A.C. power pack. Frequency coverage 22–70 Mc/s. Complete with 6 valves: P61, SP42, EL32, DD41, 807 and VU39A. 10 m/a meter mounted on front panel. Circuits and calibration chart supplied. 10 watts. Price £10 (carriage paid).

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A 10 valve receiver for use on 100–124 Mc/s. and adaptable for 144 Mc/s. Excellent A.G.C. and frequency stability. A local osc. gives audible beat when receiving unmodulated carrier wave. Receiver consists of a signal frequency R.F. amp. followed by a frequency changer with osc. valve, 3 I.F. amp. stages, double diode det. and A.G.C. rectifier and 2 stages A.F. amp. B.F.O. included to switch into detector circuit. Functions from A.C. mains (200–250v.) in conjunction with a separate power pack. Valves: 1 each P41, 7475, EB34, EF32, 6J5G, 2 of SP41 and 3 of EF39. Output impedance 600 ohms, but satisfactory 200–2,000 ohms. Supplied with circuits and calibration chart. Dimensions 19" x 10½" x 10½". Slightly soiled Receivers in transit cases, £3-9-6; Brand new, £4-19-6. (Carriage and Packing 10/–).

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Edwards (C.A.R.S.), response by the President; Mr. K. Lines (the Visitors), response by Mr. C. A. Young.

During the evening the President presented, on behalf of members, an electric clock to Mr. John Swinnerton, G2YS, who, until recently was Hon. Secretary of C.A.R.S. Mr. Swinnerton after returning thanks asked the President to accept a wooden gavel mounted on stand which he had made himself. The gift was received with acclamation.

Numerous Society trophies were presented, after which G6CL conducted a Dutch auction for a Pitcairn Island envelope. The sum of £4 15s. 0d. was realised for Society Funds.

The success of the Dinner was due largely to the energies of the C.A.R.S. Committee who received the thanks of all present.

Derby and District Amateur Radio Society

Forthcoming activities of the Derby Society include: April 20 Visit to the Burton Amateur Radio Society (Derby Bus Station, 6.15 p.m.); April 21 Social Evening at the P.O. Telephones Social Club, 50A Sadler Gate (Ladies invited); April 27 Lecture demonstration on loudspeakers; May 11 "Television Series" by Mr. J. Goodwin (M.U.O.F., Green Lane, 7.30 p.m.).

Gloucestershire County Social

A supper and social is to be held at the Prince of Wales Hotel, Berkeley, Glos., on May 6th when it is hoped that members throughout the county will attend. Further details may be obtained from P. Smith (G3DIB), Bristol 44212, A. Barber (G5WA), Brimscombe 2199, E. Perkins (G3MA), 40 Calton Road, Gloucester, N. O'Brien (G3LP), 3 Olio Cottages, Cheltenham, or from the County Representative, R. M. Sharp, Bristol 25963.

Liverpool Exhibition

An Exhibition of Amateur Radio equipment will be held in the Crane Building, Hanover Street, Liverpool, from May 2nd to 7th inclusive. The exhibition is being organised jointly by the Wirral Amateur Radio Society, the Mersey Radio Society, the Liverpool and District Short-wave Club, and the Ellesmere Port Amateur Radio Club.

Apart from the organising clubs, the local Territorial Army Signals Unit, and the City Police Radio Department will be among the Exhibitors.

The exhibition will be open from 9 a.m. to 7 p.m. each day except Saturdays when the closing hour will be 9 p.m.

Isle of Man Amateur Radio Society

With a membership that now exceeds 30, the Society has been fortunate in securing the use of a pavilion as its new headquarters at the Quarter Bridge, Douglas. There is plenty of space for aerials and plans for the installation of a club transmitter are already well under way. With interest growing throughout the island there should soon be no shortage of active GD amateurs. Prospective new members should contact the Hon. Secretary, Mr. H. Grist, Broadway House, Broadway, Douglas.

Lincolnshire Hamfest

Lincolnshire members are cordially invited to attend a hamfest at the George Hotel, Spilsby, on Sunday May 1 next at 1.30 p.m. It is hoped to include in the programme a technical talk, film show, and junk sale. High tea will follow. Inclusive charge 5s. 6d. Reservations to G2ABK, 3, Council House, Hundleby, Spilsby, by April 23 latest.

Stourbridge & District Amateur Radio Society

There was a good attendance at the Annual General Meeting of the above Society held at King Edward's School, Stourbridge, on March 1st.

Following the Officers' reports the President, G6OI, offered some suggestions for the coming year and stressed the desirability of better publicity.

The following were elected for 1949:—

President, J. Timbrell (G6OI), *Chairman*, H. Littley (G2NV), *V. Chairman*, N. Harper (G4MI), *Secretary*, W. A. Higgins (G8GF), *Treasurer*, C. E. D. Mclean (G2CLS), *Committee*, B. Whitehouse (G6WF), F. Bills (G3CLG), N. C. Heathcock (BRS6319), F. Meredith, D. Weaver (Juniors).

After the meeting Mr. H. Porter (G2YM) Secretary, Wolverhampton A.R.S., and Secretary of the Association of Midland Radio Committees, outlined the purposes of the Association. This was followed by presentations to the winners of the January Top Band Contest:—

Telegraphy Section: 1, G8GF; 2, G3DIQ. Telephony Section: 1, G3CLG; 2, G4MI.

London Members' Ladies Night

ROYAL HOTEL,

WOBURN PLACE, LONDON, W.C.1

FRIDAY MAY 13th, 1949

DANCING, COMPETITIONS
SPOT PRIZES, BUFFET

Tickets 4/6 from London Regional, District, Town and Area Representatives or from Headquarters. Dress Optional

You'll be sorry if you miss it!

Totteridge and Whetstone

Members living in the above districts of North London are invited to contact Mr. M. R. Jenkins (G3EIM), 1193a High Road, N.20 with a view to forming a local group.

Wanstead and Woodford Meetings

Members from the outlying districts of Chigwell, Epping, Harlow, Loughton and Theydon Bois will be particularly welcome at the meetings held on the first Monday of each month. For further details see "Forthcoming Events."

V.H.F. Gear

Members interested in VHF. work are cordially invited to submit for consideration by the Editor, photographs of their equipment and aerial systems. Much of the gear at present in use is novel and in years to come will be considered of historic importance. The BULLETIN is anxious to record all current developments pictorially as well as by means of the printed word.

American Army Equipment

Mr. H. Harris, BRS12959, Strouds, Pangbourne, Berks., has in his possession manuals covering more than 200 types of U.S. Signal Corps equipment. He offers to answer briefly technical queries on such apparatus. Where more extensive information, or complete circuit diagrams, are required members are invited to call and examine the manuals providing that a prior appointment has been made.

German Nationals Licensed at Last

After countless delays qualified German nationals living in the Western Zone have at last been licensed to operate on amateur frequencies. It is understood that the system of granting licences is similar to that adopted by the G.P.O. Call signs are in the series DL1AA–DL1ZZ and DL3AA–DL3ZZ. The first 748 licences were issued on March 24th last.

WEST MIDLANDS REGIONAL — MEETING —

SUNDAY, APRIL 24th, 1949

CIVIC RESTAURANT, COVENTRY

Assemble	12 noon
Lunch...	1 p.m.
Business Meeting	2.30 p.m.
Light Tea	5 p.m.

Tickets (price 8/6) from T.R.'s, C.R.'s, or the R.R. (Mr. D. A. G. Edwards, G3DO), 25 Pilkington Avenue, Sutton Coldfield, Warwickshire.

SOUTH WALES & MONMOUTHSHIRE — REGIONAL MEETING —

SUNDAY, MAY 22nd, 1949

ESPLANADE HOTEL, PORTHCAWL.

Assemble...	2 p.m.
Business Meeting	2·30 p.m.
Tea & Ragchew	4·45 p.m.
Concert	6·30 p.m.

Inclusive charge 7/6. Reservations to T.R.'s or Mr. D. A. Dyer, 29, Ladysmith Road, Penylan, Cardiff, not later than May 2nd. Lunch can be arranged at 5/– extra.

FORTHCOMING EVENTS

REGION 1

Accrington.—May 11, 7.30 p.m., Cambridge Street Schools.
Ashton-under-Lyne.—May 1, 3 p.m., New Jerusalem Schools, Katherine Street.
Blackpool.—April 19, 7.30 p.m., Chamber of Trade Offices, Queen Street.
Bolton.—May 3, 8 p.m., Y.M.C.A.
Burnley.—May 4, 7.30 p.m., Mechanics Institute, Manchester Road.
Bury.—May 12, 7.30 p.m., Atheneum, Market Street.
Darwen and Blackburn.—April 29, May 13, 7.30 p.m., Weavers Institute, Darwen.
Manchester.—May 2, 7.30 p.m., Reynolds Hall, College of Technology, Sackville Street.
Oldham.—April 27, May 11, 7.30 p.m., Civic Centre, Clegg Street.
Preston.—April 29, 7.30 p.m., Three Tuns Hotel, North Road.
Rochdale.—May 1, 3 p.m., Drill Hall, Baron Street.
Wirral.—May 11, 25, 8 p.m., Y.M.C.A., Birkenhead.

REGION 2

Barnsley.—April 22, May 13, 7.30 p.m., King George Hotel, Peel Street.
Bradford.—April 26, May 3, 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.—April 27, 7.30 p.m., Ye Olde White Harte, Mytongate.
Middlesbrough.—April 25, May 9, 7.30 p.m., 400 Linthorpe Road.
Newcastle.—April 18, 8 p.m., British Legion Rooms, 1 Jesmond Road.
Sheffield.—April 27, 8 p.m., Dog and Partridge, Trippet Lane. May 11, 8 p.m., Albreda Works, Lydgate Lane.
South Shields.—Thursdays, 7.30 p.m., Trinity House, Laygate.
Spenborough.—April 27, May 11, 7.30 p.m., Temperance Hall, Cleckheaton.
York.—Wednesdays, 8 p.m., 29 Victor Street.

REGION 3

Stourbridge (S. and D.A.R.S.).—April 22, 8 p.m., Corn Exchange Vaults. May 3, 8 p.m., King Edward's School.

REGION 5

Cambridge.—April 29, 7.30 p.m., Jolly Waterman. Competition for home-built gear.
Southend.—April 20, 7.45 p.m., at G5VQ. 168 Westbourne Grove, Westcliff on Sea.

REGION 6

High Wycombe.—April 27, 7.30 p.m., at BRS.17415, 66 Havenfield Road, Booker. May 25, 7.30 p.m., at G6JK, 17 New Drive, Totteridge.

REGION 7

London.—April 29, 6.30 p.m., Institution of Electrical Engineers. Tea, 5.30 p.m. "Some Aspects of High Quality Sound Recording and Reproduction," R. W. Lowden, M.B.K.S.
Barnes and Putney.—May 10, 7.30 p.m., 28 Nassau Road, S.W.13.
Barnet.—May 14, 7.30 p.m., Bunny's Restaurant, 15 Station Road, New Barnet.
Chingford.—April 28, 8 p.m., 7 Cranworth Crescent, E.4. May 11, 8 p.m., 1 Essex Road, E.4.
Croydon (Surrey R.C.C.).—May 10, 7.30 p.m., Blacksmiths Arms, South End.
Edgware (E. and D.R.S.).—April 27, May 4, 11, 18, St. Michaels School, Flower Lane, Mill Hill.
Enfield.—April 24, 3 p.m., George Spicer School, Southbury Road.
Hayes.—May 2, 7.30 p.m., The Vine, Uxbridge Road, Hillingdon.
Hoddesdon.—April 21, May 5, 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.—May 2, 7.30 p.m., The Kentish Drove, Rye Lane.
St. Albans.—May 11, 8 p.m., The Beehive, London Road.
Slough.—April 21, 7.30 p.m., Labour Memorial Hall, Chandos Street.
Southgate.—May 6, 7.30 p.m., The Merry Hills Hotel (Oakwood Station).
Sutton and Cheam.—April 19, May 3, 8 p.m., Red Lion, Cheam.
Wanstead and Woodford.—May 2, 8 p.m., G2FLG, 29 Lord Avenue, Ilford.
Welwyn Garden City.—May 3, 8 p.m., Council Offices.
East London.—May 15, 3 p.m., at Lambourne Room, Ilford Town Hall.

REGION 8

Guildford.—April 24, 3 p.m. Cinema Cafe (a p.c. to T.R. if attending).
Portsmouth.—Every Tuesday, 7.30 p.m., The Radio Club Room, Eastney Barracks.
Southampton.—May 7, 7.30 p.m., 22 Anglesea Road, Shirley.

REGION 9

Bristol.—April 22, 7 p.m., Keen's Cafe, Park Row.
Exeter.—May 7, 7 p.m., Y.M.C.A., 41 St. Davids Hill.
Plymouth.—April 16, 7 p.m., at Tothill Community Centre, Tothill Park, Knighton Road, St. Judes.
Torquay.—April 16, 7.30 p.m., Y.M.C.A., Castle Road.

REGION 12

Aberdeen.—April 28, 7.30 p.m., Round-Room, Music Hall, Union Street.

REGION 13

Edinburgh.—April 28, 7.30 p.m., Chamber of Commerce, 25 Charlotte Square.

West London Hamfest

The Hamfest which is to be held on Sunday, May 22, at the Regal Cinema Cafe, Uxbridge, will include two outstanding lectures: "Aerial Apertures" by F. ("Dud") Charman, G6CJ, and "T.V.I." by H. A. M. Clark, G6OT. Latest amateur equipment will be on view and a number of competitions and lucky draws will be included in the programme. Assembly is at 3 p.m. with admission by ticket only. Tickets (price 5s.) should be obtained as soon as possible from local T.R.'s, the A.R., or from Mr. A. W. Watkins, G3CRK, 2, Cranleigh Gardens, Southall, Middlesex. There will be a running buffet.

OUR FRONT COVER

THIS month we publish again the photograph which appeared in our February issue, and which was wrongly described, owing to an error on the part of the photographer. Actually, the picture depicts a Model 7 Universal AvoMeter being used to measure the anode voltage of the oscillator stage of an AR88 receiver which has been adjusted to work at 105 volts.

An announcement regarding this error appeared in our March issue.

TECHNICAL ARTICLES WANTED

Silent Keys

It is with sorrow that we record the passing of Philip Anderson, G3TQ of West Hartlepool. Phil had been interested in amateur radio for many years prior to 1938 when he took out his licence: since then his shack had always been open to receive visitors. His death will be mourned by a wide circle of friends, who offer to his widow and two sons their heartfelt sympathies. A.R.D.

* * *

With deep regret, we record the death, in tragic circumstances, of Thomas Bertram Wimbush, G6HP, of Burnley, Lancashire. Tom Wimbush joined the R.A.F. as a youth and quickly began to show an interest in Amateur Radio. For several years he operated from Cairo as SU2TW. Shortly after the outbreak of hostilities Sgt. Wimbush (as he then was) was granted a commission in the R.A.F. Signals Branch. He served with distinction during the war and on his return to civilian life he opened a radio business in Burnley under the name "Amateur Radio Service." At about the same time he was granted the call sign G6HP having previously held the calls G2TW and ZC6XX in addition to SU2TW.

Mr. Wimbush who was 35 had been married only six weeks when he became involved in a taxi cab accident from which he received fatal injuries.

The sympathies of his many friends at home and abroad are extended to his widow (who was also injured in the accident), his mother and other relatives.

Tom Wimbush is the second holder of the call G6HP to die in tragic circumstances. Old Timers will remember that Don Price, an earlier holder, was electrocuted whilst engaged on television experiments in the Baird Studios at the old Crystal Palace.

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.

ABSOLUTE bargains guaranteed.—BC221's complete less batteries £6 10s. ; 832's new boxed 17s. 6d. ; 3 B.P.I.'s 3" C.R.T. new boxed 10s. ; 8 to 8·1 Mc/s. crystals 5s. ; Large selection of American transmitters and receivers, valves, components, S.A.E. with requirements.— Box 651, PARRS, 121 Kingsway, London, W.C.2. [651

AMATEUR Built C.W. transmitter complete with power supply and small wooden rack. Single 807 adaptable to pair. Complete with 2 crystals and E.C.O. Also two spare 807's RK23 T20 little used and other transmitting spares. £20 the lot or will sell separately. Offers S.A.E. with enquiries. Also brand new Eddystone S.640 £25 or offer.—G3DW, Bangay, R.A.F., Shawbury, Shropshire. [670

AVO all-wave battery oscillator 95 kc/s.–80 Mc/s. £5.— PETTS, Telephone Esher 998. [671

AVOMETER Model 7 as new. £15 or offers to A. SHERGOLD, G3APS, 49 Beatrice Street, Swindon, Wilts. [666

BC.221, mains operated crystal wavemeter, switched audio modulation, calibration book, spare valves £9 10s. 0d. Meico carbon microphone £2. Signal tracer, including 8" speaker, valve voltmeter £2 5s. 0d.—67 Sussex Road, Harrow. [678

CHASSIS, panels, racks and metal cabinets stock sizes or made to specification in steel or aluminium : Wrinkle finishes available.—REOSOUND ENGINEERING & ELECTRICAL COMPANY, Coleshill Road, Sutton Coldfield. [661

CIRCUITS and full details, BC348 L–R 1s. 6d. ; Circuits TR1196, TA12D, T1154, BC348, J, Q, N, 9d. Post paid.— BRS11732, 38 Jennings Road, St. Albans. [684

CRYSTAL microphone inserts (Cosmocord) MIC-6. Bakelised diaphragm. Brand new. 15s. 6d. each. Post free.—RADIO-AID LTD., 29 Market Street, Watford. [657

FOR SALE.—BC221 frequency meter. Perfect working order. Spares included £15 ; or part exchange for AR77.—DAVIES, 143 Walthall Street, Crewe, Cheshire. [646

FOR SALE.—R1116A. Good condition. Surplus to requirements. £5 10s., carriage 10s.—EASTON, Hillside, Bickington, Barnstaple, N. Devon. [650

FOR SALE.—6 813's with bases and boxed new 35s. each ; 4 6L6's 12s. 6d. each ; all new. 2 5Z4's 5s. each ; 14 EF50's 5s. each ; 12 807's 7s. each ; R.107 £14, any trial, snip. — Box 664, PARRS, 121 Kingsway, London, W.C.2. [664

G3TW. Station for disposal. AR88, S. Meter, spare valves. Offers.—G5MY, 268 Victoria Road East, Leicester. [652

HRO's 5 coils loudspeaker, power pack, excellent condition, 100 per cent. efficiency, £31 each, and AR88D with loudspeaker, excellent condition, £42.—P.C.A. WIRELESS WORKSHOP, The Arches, Cambridge Grove, London, W.6.

LABGEAR Viewing Unit (3" Oscilloscope) £10. Brookes crystals, new, in standard holders, 3700, 7041, 15s. 100/1,000 30s. 1·6 Mc/s. filter 10s.—Box 680, PARRS, 121 Kingsway, London, W.C.2. [680

M.C.R.1. complete with four coil packs, frequency coverage 15 Mc/s.–150 kc/s. Mains and battery power supplies £6 10s. 0d.—HARVEY, Hillview, Curlieu Road, Aokdale, Poole, Dorset. [675

MODIFIED BC.342 and ex. Government 12 set, 25 watts phone. Offers.—G3BPL, 94 Mangrove Green, Nr. Luton, Beds. [656

NEW RCA 2000–1500–0–1500–2000 800 mA. transformer. 210 to 240 V. 50 cycles input £4 15s. 0d. Carriage paid.— 58 School Lane, Rochdale. [681

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.

PREMIER 5 valve communication, just overhauled and realigned, perfect condition with matching speaker ·15 to 25 Mc/s. £10 plus carriage ; New 813, 805, 35T, offers.— LEWORTHY, " Malvern," Cedars Avenue, Mitcham, Surrey. [685

Q.C.C. Crystal 7019 and certificate, as new 25s. ; Valves 25A7GT, 12B8GT, 5 hours operation, 25s. pair.—G3DXB, 183 Perne Road, Cambridge. [640

QSL Cards.—Distinctive and attractive designs. Samples and prices from G5KT, 35 Hillside Avenue, Kingswood, Bristol. [587

QSL's and log books (P.M.G. approved) ; samples free ; state whether G or BRS.—ATKINSON BROS., Printers, Elland. [483

RADIO/Electrical d/f corner shop. 20 years lease. Rent £39 p.a. Ham specialist. Turnover £3,000 audited. 12 h.p. Van, £1,000.—s.a.v. Box 683, PARRS, 121 Kingsway, London, W.C.2. [683

RESLO Dynamic mike, new £4 10s. 0d. B2 transmitter and receiver offers. New 832 and base 20s. 70 valves for sale. S.A.E. enquiries. Wanted National 1–10.—G3BRT, 20 Redland Park, Bristol, 6. [662

R109 Mains HT. £8 ; " Record " insulation tester 500V in leather case, £6 ; 4 valve TRF Receiver, plug-in coils £3 10s. ; Ferranti AF3 transformer 7s. 6d ; BPL 0–1MA meter 8s. ; Pair PX4's 7s. 6d.—G3CXI, Easton Grey, Malmesbury, Wilts. [642

SALE.—Both perfect. MCR1 receiver complete, coils, power pack, phones, batteries, and T1154B transmitter.—Offers G3BTT, Stifford Lodge Cottage, Stifford, Grays, Essex. [673

SALE.—HRO Senior with nine general coverage coils, 230V power pack, some spare valves, just been realigned. New condition £38, carriage paid.—Box 679, PARRS, 121 Kingsway, London, W.C.2. [679

SALE.—Modified R.208 10–60 Mc/s. S. Meter. 6H6 noise limiter. B.F.O. spare tubes £12 ; R107 1·2–17·5 Mc/s. Variable selectivity. Audio filter, Noise limiter. B.F.O. £41 ; Both 100 per cent. Power supply components. 200 pF QRO transmitter tank condensers, etc.—Box 658, PARRS, 121 Kingsway, London, W.C.2. [658

SALE or Exchange : 150 watt transmitter CW and phone ; black crackle ; rack mounted, relay operated, pp 35T's in P.A., 1250 volt power pack, price £50 plus carriage, or would exchange for good TV receiver.—G6GD, Green Mount, Stamford Road, Bowdon, Cheshire. Telephone Altrincham 0875. [674

SALE.—Professionally built 75 watt C.W. transmitter, beautiful job, with power pack, £15 ; Class D wavemeter, brand new and unused in wooden transit case £4.—Details, GARNER, " Barbon," Aigburth Hall Road, Liverpool, 19. [672

SALE.—Receiver type R.1224A ; headphones ; Piezo Quartz crystal 3557 kc/s. frequency ; one morse key ; six meters (various) ; twelve valves (various) ; two slow motion drives ; three L.F. transformers ; valve holders, etc.—Offers to MRS. BATES, 50 Malvina Place, Perth. [660

SALE.—RME69 noise limiter £22. Advance signal generator type E, Model 1, 100 kc/s. to 60 Mc/s. new £13, accept £32 for lot or offers.—Hazel Drive, Nottingham Drive, Wingerworth, Chesterfield. [653

SALE.—T1154B with valves, as new. Offers ? Vertical enlarger wanted.—GREENWOOD, Glencairn, Watkinson Road, Halifax. [686

SCHICK electric razor perfect condition 35s. ; Few crystals 5–7 Mc/s. guaranteed OK 2s. 6d. ; Wanted : AC/DC gramophone motor.—G3BZV, 29 Kingston Road, Leatherhead, Surrey. [663

TAYLORMETER 90A (40 ranges 1000 o.p.v.) in wooden carrying case £10 ; H.M.V. needle-armature pick-up with transformer, 35s. (as new) ; Wharfedale (10") Golden Unit 50s. (new) ; Near offer considered.—REED, 39 Burnley Road, Southport. [682

THE full range of Eddystone components can be seen on the Stand of W.B. Radio at the Liverpool Amateur Radio Exhibition 2nd–7th May (inc.), Cranes Building, Hanover Street. [676

VALVES.—Mostly new and boxed. 3s. each. 7193, VR135, EB34, EC52, 2C22, EF54, EF39, D1 ; 5s. each, 6AG5, 957, 6L7, 4074B ; 7s. 6d. each, 6AC7, RK34, 6SK7, VU111 ; 10s. each, 6BE6, 6AQ7, also 6J6 15s. ; 832 25s. ; 829B 50s.— G2XV, 89 Perne Road, Cambridge. [649

WANTED.—AR88 or HRO7 Panoramic SP44.—Box 654, PARRS, 121 Kingsway, London, W.C.2. [654

WANTED.—A T1154 transmitter. Also receiver R1082 for friend.—BRS16290, 6 Kingsway, East Sheen, S.W.14. [655

WANTED.—BC.221 frequency meter and Avo No. 7.— Particulars to G3TT, 56 Shelley Crescent, Heston, Middlesex.

WANTED.—Buy or borrow. Circuits for receivers ; Bendix RA–10 ; ASB4 ; Radio compass MN26 ; Indicator APN4. —STOBIE, 60 Dean Street, Edinburgh. [645

WANTED.—Good quality 15 ohm cutting head. To purchase or exchange transmitter gear.—FIRTH, G8JD, Folly Hall, Wibsey, Bradford, Yorks. [665

WANTED.—HRO bandspread coil for 28 Mc/s. Cash waiting. —G8UA, 406 Higher Brunshaw, Burnley, Lancs. [669

WANTED urgently instructions and data for Reception Set R.201.—BRS.12959, STROUDS, Pangbourne, Berks. [667

WANTED : Urgently. Premier Octal based S.W. coils. 04A, 04B, 04C, and 04D.—Price to H. MILLS, 55 Helredale Road, Whitby, Yorks. [663

WANTED urgently U.S. Army Technical Manuals data and instructions on any radio or electrical apparatus.—HARRIS, Strouds, Pangbourne, Berks. [668

188. 6d. each offered for 35T's. No C.O.D.—Write RAITHBY, G8GI, School House, Helpringham, Sleaford, Lincs. [677

8-WAY high voltage " Jones " type plugs and sockets, with crackle covers 1s. 6d. pair complete, 12s. dozen pairs, £3 10s. per 100 pairs, carriage paid.—JACK PORTER LTD., College Street, Worcester. [570

APPOINTMENTS SECTION

CROWN AGENTS FOR THE COLONIES

APPLICATIONS from qualified candidates are invited for the following posts :—

WIRELESS STATION SUPERINTENDENTS required by Nigeria Government Posts and Telegraphs Department (for aeronautical wireless stations) for 18/24 months with prospect of permanency. Outfit allowance £60. Free passages. Salary according to age and war service in scale £600/£850 a year (including expatriation pay). Candidates must hold first class radio-telegraph operator's certificate, have had recent experience in wireless operating and direction finding apparatus, have thorough knowledge of transmitters and receivers and be capable of maintaining (under an Engineer's instructions) diesel engine sets driving small generators. Apply at once by letter, stating age, whether married or single, and full particulars of qualifications and experience, and mentioning this paper, to the **CROWN AGENTS FOR THE COLONIES, 4, MILLBANK, LONDON, S.W.1,** quoting M/N/24044(3B) on both letter and envelope.