R.S.G.B Bulletin

JOURNAL OF THE RADIO SOCIETY OF GREAT BRITAIN

Vol. 31 No. 12 | JUNE, 1956 | Price 2/6 Monthly

PIRANI HIGH VACUUM TEST EQUIPMENT

Manufactured by ' Pye Radio Ltd.' for Atomic Research Station. Comprising : Pirani Control Unit, Pirani Bridge Unit, Gauge head with calibrator and Pye scale lampgalvanometer. All items brand new in original packing.

£33.10.0 COMPLETE

Spare Pirani Heads (Edwards M6) **15/-.**

TRANSMITTER RECEIVERS

Special offer of above set, complete with 5 valves, 4-ARP12 and ATP4, with circuit. Range 7.4 to 9 mc/s. These sets are not guaranteed but are serviceable. Junction box **2/6** extra.

" 38 " WALKIE-TALKIE SETS **25/-.**

FERRANTI TESTVAC

High Speed Vacuum Tester, 200/250 A.C. **£10/10/0**

62A INDICATOR UNIT

Containing VCR97 with Mu-Metal Screen, 21 valves: 12-EF50, 4-SP61, 3-EA50, 2-EB34, Plus Pots, Switches, H.V. Cond., Resistors, Muirhead S/M Dial, Double Deck Chassis and Crystal. BRAND NEW ORIGINAL CASES, **67/6.** Carr. 7/6.

PYE 45 Mc/s STRIP TYPE 3583 UNITS

Size 15in. x 8in. x 2in. Complete with 45 Mc/s. Pye Strip, 12 valves, 10 EF50, EB34 and EA50, volume controls, and hosts of Resistors and Condensers. New condition. Modification data supplied.

Price **69/6.** Carriage paid.

QUARTZ CRYSTALS

Type FT243. Fundamental frequencies, 2-pin, ½in. spacing.

120 types. 5,675 Kc/s to 8,650 Kc/s (in steps of 25 Kc/s).

80 types. 5,706 Kc/s to 8,340 (in steps of 33.333 Kc/s).

All Brand New 10/- each

Special price for complete sets of 80 or 120

Type FT241A. 54th Harmonic 2-pin ½in. spacing.

80 Types : 20 mc/s to 27.9 mc/s.

(In steps of 100 kc/s)

Brand New and Guaranteed. 7/6 each.

(Complete sets of 80 available)

FT241A 200 Kc/s., **10/-**, 2-pin holders for all types, **1/3.**

NEON INDICATOR

Striking at 80 volts, bayonet fitting... ... ... **2/-**

TRANSISTORS

(JUNCTION TYPE P.N.P.)

This Junction Transistor is designed for audio-frequency amplification although its frequency response makes it suitable for intermediate frequency and switching applications, together with many other uses, e.g. Local Station receiver, Transistor Voltmeter, Signal Tracer, Oscillators and Experimental work, Radio Control, etc.

Due to a large purchase we can offer these Transistors (a product of a well-known Manufacturer) at the very low price of

Complete with data **10/-** EACH

MINIATURE TRANSMITTING STRIP " TYPE 81 "

Size 7½in. x 6in. x 3in. Complete with Valves Type CV415, CV309, 2-6AM6, 2-7D9 and Quartz Crystal 4,860 Kc/s. **£4/10/-** complete.

MINIATURE I.F. STRIP TYPE " 373 " 9-72 MEG.

Brand new miniature I.F. Strip size 10½in. x 2½in. x 3in. high. Valve line-up: 2-EF92; 3-EF91 and EB91. With circuit.

Price (less valves) **7/6** p. & p. 1/6.

This I.F. Strip is part of above equipment.

WE HAVE OVER 50,000 B.V.A. AND AMERICAN VALVES IN STOCK AT VERY LOW PRICES. SEND FOR LISTS.

LATEST TYPES NOW IN STOCK

EBC41	10/-	UCH42	12/6	PL82	10/-	12AT7	9/-	EF86	10/-	DAF96	9/-
EY51	12/-	UBC41	10/-	PY81	10/-	12AU6	9/-	EF89	10/-	DF96	9/-
EF41	11/-	DK40	10/-	EM80	10/-	12BA6	9/-	ECF82	15/-	ECC84	12/6
EL41	11/-	EZ80	10/-	6X4	8/-	12BE6	10/-	PABC80	15/-	6AQ5	10/-
EZ40	10/-	EABC80	10/-	PY82	10/-	12AH8	12/6	6AU6	9/6	EF86	12/6
EM34	10/-	ECC85	10/-	PCC84	12/6	35W4	8/6	1I7Z3	8/6	PCL82	12/6
UL41	11/-	EF80	10/-	PCF82	12/6	PCF80	15/-	12AX7	10/-	832	35/-
UY41	11/-	ECL80	12/6	12AU7	9/-	EBF80	11/6	DK96	9/-	884	12/6
UF41	11/-	PL81	12/6	12AT6	8/-	EF85	10/6	DL96	9/-	3A5	12/6

CRYSTAL MICROPHONE INSERTS

POST FREE	POST FREE
5/-	**8/6**
Ex-Units	Brand New & Boxed

Ideal for tape recording and amplifiers. No matching transformer required.

SPECIAL REDUCTION FOR SETS OF VALVES

1A7GT, 1N5GT, 1H5GT, 1A5GT (or 1Q5GT or 3Q5GT) ..... **37/6** Set

10 EF50 (Ex-Brand New Units) **5/-** each **45/-** ..

10 EF50 (Red Sylvania ex-new units) **6/-** each **55/-** ..

6K8G, 6K7G, 6Q7G, 5Z4G, 6V6G **35/-** Set

1R5, 1S5, 1T4, 1S4, or (3S4 or 3V4) **27/6** ..

DK96, DF96, DAF96, DL96 ... **32/6** ..

6K8G, 6K7G, 6Q7G, 25A6G, 25Z5 (or 25Z6G) ..... **37/6** ..

12K8GT, 12K7GT, 12Q7GT, 35Z4GT, 35L6GT (or 50L6GT) **37/6** ..

12SA7GT, 12SK7GT, 12SQ7GT 35Z4GT, 35L6GT or 50L6GT **35/-** ..

T/R 1196 RECEIVER

Complete with 6 valves 2 EF36, 2 EF39, 1 EK32, 1 EBC23, 465 I.F.T. ideal for conversion. In absolute new condition. **27/6** pp. 2/6, with circuit.

TR 1196 TRANSMITTER

Transmitter section comprising EL32, EF50, VT501, Relay, etc., **12/6** p.p. 2/6.

COMPLETE TRANSMITTER RECEIVER with 24v. power-pack in original transit case, **57/6** p.p. 5/-.

CATHODE RAY TUBES

VCR138A (with screen) **35/-**

VCR139A. 2½in. C/R Tube. Brand new in original cartons (carr. free) **£1.15.0**

VCR97. Guaranteed full T/V picture (carr. 2/-) **£2.0.0**

VCR517C. Guaranteed full T/V picture **£1.15.0**

MU-METAL SCREENS for VCR97 or 517. P.P. 1/6 ..... **10.0**

6in. ENLARGER for VCR97 or 517. P.P. 1/6 ..... **17.6**

VCR97. Slight cut-off. Carr. 2/-... **15.0**

3BPI Brand new **£1.10.0**

AN/APA-1 CATHODE RAY INDICATOR AMPLIFIER UNIT. Complete, comprising 3BPI C.R.T., 7-6SN7gts, 1-6H6, 1-6G6, 1-2X2, 1-6X5 valves. Brand new **£4.19.6** plus carr. 7/6.

INDICATOR UNIT TYPE 182A

Unit contains VCR517 Cathode Ray 6in. tube, complete with Mu-Metal screen, 3 EF50 4SP61 and 1 5U4G valves, 9 wire-wound volume controls and quantity of resistors and condensers. Offered BRAND NEW (less relay) at **67/6.** Plus 7/6 carr. "Radio-Constructor" scope circuit included.

U.S.A. INDICATOR UNIT BC929A

Complete with 3BPI C/R tube and screen, 7 valves—2-6SN7GT, 2-6H6GT, 6G6, 2X2, 6X5G, volume controls, condensers, etc. Ideal for portable scope. In black crackle case, size 15½in. x 9in. x 9in. BRAND NEW. **65/-** carr. FREE.

SEND 3d. FOR 28-PAGE CATALOGUE

HENRY'S RADIO Ltd.

5 HARROW ROAD, PADDINGTON, W.2

PADdington 1008/9 & 0401

R.S.G.B. BULLETIN

Devoted to the Science and Advancement of Amateur Radio

Vol. 31, No. 12 **June, 1956**

EDITOR: JOHN CLARRICOATS, O.B.E., G6CL
ASSISTANT EDITOR: JOHN A. ROUSE, G2AHL
EDITORIAL OFFICE: RADIO SOCIETY OF GREAT BRITAIN
28 LITTLE RUSSELL STREET, LONDON, W.C.1
Telephone: HOLborn 7373

ADVERTISEMENT MANAGER: HORACE FREEMAN
ADVERTISING OFFICE: THE NATIONAL PUBLICITY CO., LTD.,
36-37 UPPER THAMES STREET, LONDON, E.C.4
Telephone: CENtral 0473-6

Published on or about the 15th of each month as its official journal by the Radio Society of Great Britain and issued free to members.

CONTENTS

Current Comment

Too Many Contests ?

JUST to get discussion started on a subject of major importance to quite a large proportion of the membership, here is a pertinent and provocative question: *Are there too many Contests?*

Hardly a month of the Amateur Radio calendar year is devoid of one contest or another, with the result that barely any aspect of the transmitting art is neglected, from direction finding through to the " ultra-highs." Plenty of opportunities for sustained and concentrated Morse operation are offered in such events as the Top Band and National Field Day marathons, and still going strong—one of the oldest competitions of all—is B.E.R.U., representing " red on the map " the world over.

The effort expended upon contests is not confined to the participants alone; the Society's Contests Committee devotes a large number of man-hours to the preliminary organising and subsequent checking. A certain proportion of these man-hours could be saved if the Committee were spared the distasteful duty of stopping up all possible loopholes for unfair scoring—which, put bluntly, means stopping people from cheating. Some lack of the true spirit of Amateur Radio seems to be evident when there is always a minority who are prepared to " get to the top, come what may."

That by the way; what might well be more widely known is that the personal enjoyment of the individual participant depends largely on the amalgam of skill, psychology and prescience which is to be found in the members of the Contests Committee. To them come some of the most arduous duties of *any* member of *any* Committee of the Council.

But this is not in any way a plea for fewer contests or less work for the Committee; contests can be regarded as one of the Society services for its members. What might be borne in mind, though, is that the more contests there are the more work falls on the Committee and therefore the longer will it take to judge the results; remember, the work is done voluntarily!

What does the customer say—you, the individual contestant?—J. H.

QWU ?

THE above mention of contests will turn the minds of many members to that first week-end in June, with happy recollections of what is perhaps the biggest competitive event in all Amateur Radio: National Field Day. A British inspiration dating back to as long ago as 1933, it now enjoys many emulators in other countries.

What is particularly pleasant to note is an increasing tendency for other national societies to hold their field days on the same week-end as the British one—a custom which might be further encouraged in the future via I.A.R.U. channels. It will all add to the QRM!

It may be expected in any event that as each year passes interference levels during N.F.D. will increase. On the three lower frequency bands Field Day stations crowd into little more than 75 kc/s of c.w. space. Because there is so much to work under such rigorous conditions of interference, economical operating is a must. This means, in a phrase, working as many as possible in the brief 24 hours available. It is not economical for a subsequent operator to call a station which a previous operator has worked!

A good check-log system should obviate such minor disasters: even so, from what could be overheard, it did seem this year that rather more inadvertent "repeat contacts " were made than is usual. The waste of time entailed is not confined to initiating the needless contact; more valuable minutes are lost trying to get clear again. So that such contingencies may be disposed of with minimum delay future National Field Days could well use some such self-evident code as " QWU " (meaning " Have Worked You "). It would be a valuable and practical Q-signal to add to the numerous amateur-inspired codes already in use, of which Mr. Piggott reminded us of a few last month in his masterly and unique article about Morse, and of which Mr. McIntosh has contributed a useful collection to the *R.S.G.B. Callbook*.

Give " QWU " a try-out in the next Top Band Contest five months hence—though we hope you won't find it necessary!—J.H.

Diagnosis of TVI

A System of Locating the Cause of Interference

By R. H. HAMMANS (G2IG)*

This article will not tell you how to cure television interference but it does describe a deductive system of investigation which will help to find the cause of TVI in any particular case. Once that has been done, well-known principles which have been described in these pages many times in the past may be applied.

BEFORE TVI can be cured, an intelligent system of tracing and diagnosis by means of available evidence is highly desirable. In this article it is intended to systematize the complex business of ascertaining the cause rather than to offer means of effecting a cure.

This conception of tracking down interference to its final elimination is based on a series of " go " or " no go " trials, leading, according to the results, down a chain of observations and tests which will provide an answer which should be conclusive. A chart or " tree " is given for rapid reference and to show more clearly than the text the logical sequence of the method.

Types of Interference

There are three categories of television interference caused by amateur transmitters:

(a) Harmonic or spurious radiation from the transmitter and/or its aerial system.

(b) Response by the television receiver to signals outside its design pass-band.

(c) The generation of harmonics in non-linear elements in the vicinity of the transmitter which re-radiate and enter the receiver in the same manner as if they were radiated from the transmitting aerial.

Cases in category (a) must obviously be treated at the transmitter and the amateur cannot escape responsibility. Those in category (b) can only be cured at the receiver and in general the G.P.O. is sympathetic towards the principle that the amateur is not to blame. In category (c) neither the transmitting amateur nor the receiver owner is to blame except in so far that either the amateur or the receiver owner may have somewhere about his property metalwork which, due to corrosion or other form of bad contact, is producing the trouble. A corroded receiving aerial of course comes into category (c) and the owner has the cure in his own province.

Category (a) Causes which must be dealt with at the Amateur Transmitting Station

The system to be adopted in this case is as follows:

1. Connect the transmitter to a dummy load. Operate the transmitter in all other respects in the same manner as that used when interference is known to be caused.

Possible Results:

(i) Interference no longer caused.

(ii) No change in interference.

(iii) Appreciable reduction of interference.

If the results are as in (i) then it is clear that all the trouble is brought about by the signal radiated from the transmitting aerial. It may, therefore, be due to harmonic radiation, to receiver defects in category (b) or to effects in category (c).

If the results are as in (ii) there is strong evidence of harmonic radiation from the early or final stages of the transmitter and well-known methods of cure, such as screening, filtering of leads, etc., should be applied. It is unlikely that the receiver is to blame or that non-linear elements are involved since there should be no swamping signal, as would be the case if the transmitting aerial, instead of the dummy, were in use.

If the results are as in (iii) there is every likelihood of a combination of harmonic radiation from the transmitter itself as in (ii) plus further interference falling into categories (a), (b) and (c). The procedure, therefore, is to work on the transmitter screening and filtering, etc., until interference is eliminated on dummy load.

2. When all interference on dummy load has been cured, the following test should be carried out. Reconnect the aerial to the transmitter through a low-pass filter of good or known performance.

Possible Results:

(i) Interference no longer caused.

(ii) No change in interference.

(iii) Appreciable reduction of interference.

If the results are as in (i) this is the end of this particular branch of investigation and the case is closed. However, if the results are as in (ii) there is strong evidence that the transmitter was blameless even without the low-pass filter and that the case falls into either category (b) or category (c) or both.

If the results are as in (iii) the transmitting station with the low-pass filter in circuit is probably now blameless and the remaining interference is due to causes in categories (b) or (c) or both. It is, of course, necessary to make sure the low-pass filter is really effective before these assumptions can be true.

At this stage of the investigation the transmitting station and, therefore, category (a) have been eliminated and only categories (b) and (c) remain.

Category (b). Causes which must be dealt with at the Receiving Station

3. The system to be adopted in this case is as follows:

Disconnect the receiver aerial and turn up the brilliance control until the raster is just visible. Modulate the transmitter by speech or keying and check whether interference persists.

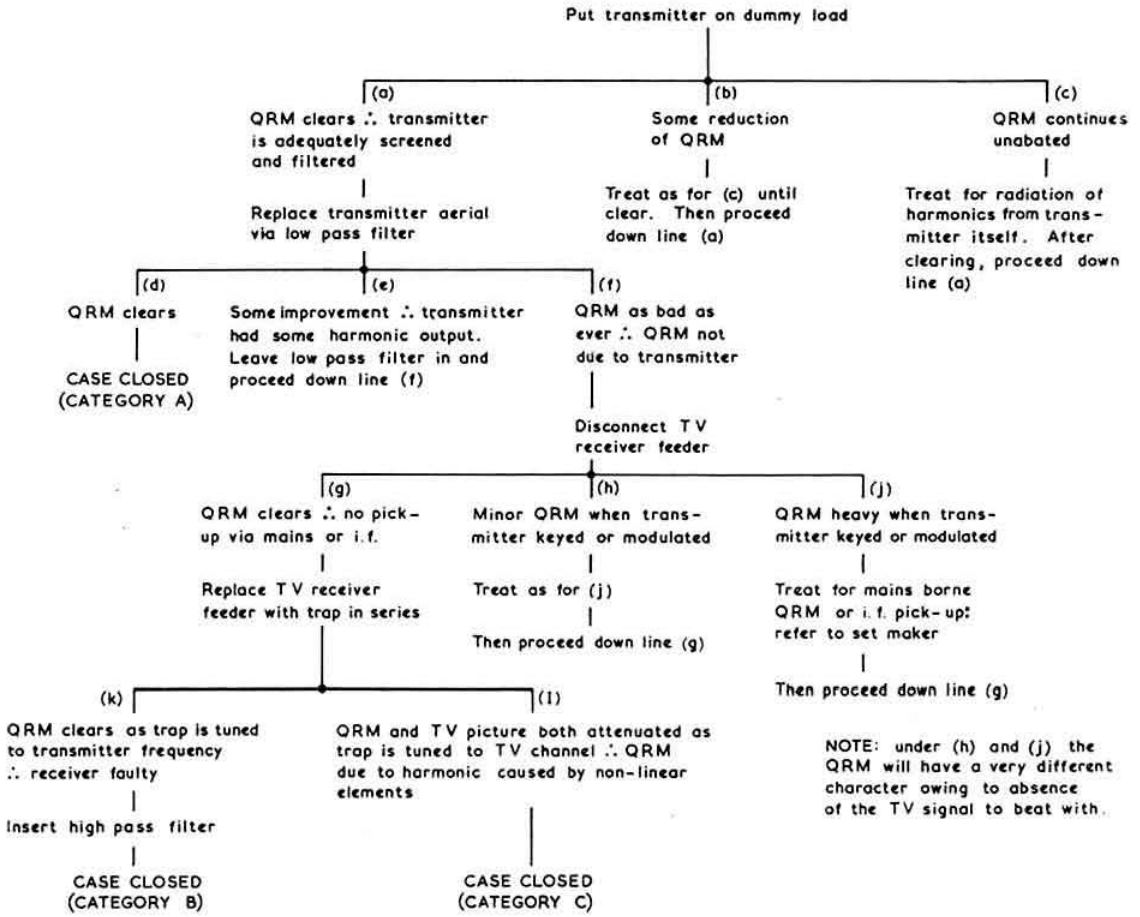
Possible Results:

(i) No interference visible.

(ii) Significant interference still present.

If the results are as in (i) then the interference is coming in via the aerial and the frequency of the interfering signal should be checked. This is best done by means of a tuned trap or traps which will cover the fundamental and appropriate harmonic frequencies of the amateur signal (see section 4 following). If the results are as in (ii), then at least some interference is entering the receiver via the mains connection or is being picked up on the i.f.

*President, 1956, 34 Crofton Lane, Orpington, Kent.



The chart devised by the author for the rapid diagnosis of television interference.

wiring in the receiver. Apart from putting r.f. chokes in the mains lead and trying elementary screening around obviously vulnerable i.f. circuitry there is not much that can be done by anyone but the set manufacturer.

4. Reverting to section 3 (i)—the case where on removal of the receiver aerial no trace of interference is to be seen when the transmitter is keyed—the following tests should be carried out.

Insert a parallel tuned circuit, resonant at the transmitter output frequency, in series with the inner conductor of the receiver co-axial feeder. For 14 Mc/s the tuned circuit should preferably cover at least a 3:1 frequency band so that at one sweep of the tuning condenser both transmitter fundamental and third harmonic can be rejected. For lower frequency bands the tuned circuit need only resonate at the transmitter output frequency but a second tuned circuit should be available to cover the television band.

With the transmitter keyed or modulated, and the television transmission on the air (preferably with test card C), rotate the trap condenser in the vicinity of the known resonance point for the transmitter frequency as determined with a grid dip meter.

(i) If a substantial reduction in interference is observed, then the trouble is either swamping (cross modulation) or i.f. break-through or image response. Which it is can usually be deduced from a knowledge of the receiver circuit but it is of academic interest only since the receiver is at fault anyway.

When it is found that a trap resonant at the transmitter output frequency is effective in reducing interference, a properly designed high-pass filter of known performance should be inserted in the receiver feeder. Any remaining interference is probably due to causes in Category (c).

(ii) If no appreciable reduction is observed on tuning the trap to the transmitter output frequency, the evidence is that the receiver is not at fault. Retune the trap—or insert a second trap—to the television channel. Clearly, if the trap is operating effectively, it will seriously attenuate the picture. If the interference is due to a transmitter emission (such as a harmonic or spurious signal) or to a Category (c) source, then the trap will attenuate the interference to the same extent as the picture. In earlier tests it has already been established that there is no transmitter output in the television band. Therefore, we have the case of a harmonic free transmitter and a faultless receiver, yet harmonics are being received. From this it may be deduced that the cause is in Category (c) and sheer dogged searching or inspired deduction are needed to find it and attempt a cure.

Category (c). Harmonics caused by Non-linear Elements

The process by which non-linear elements cause harmonic radiation is akin to that on which metal rectifiers and semi-conductor rectifiers rely for their operation. Generally, any substantial lengths or areas of metal which make partial contact with one another will, by virtue of the existence of oxides and other substances due to tarnishing, behave like an aerial system having a detector at the centre or somewhere along its length. The metal will pick up large currents due to the strong r.f. field in the locality of the transmitter and these currents flowing through the rectifier will be of greater magnitude in one half-cycle than in the other. Thus a sine wave containing no harmonics will be converted into a wave of the same frequency but having an unpredictable and sometimes serious harmonic content. The metalwork, by the theory of reciprocity, re-radiates the original signal plus the harmonics it has itself generated.

The commonest causes are rusty joints in domestic plumbing such as gutters, drain pipes, gas pipes and electrical wiring conduit. Indeed, the phenomenon has been called for many years the "drain pipe effect" or "rusty bolt effect"—the latter, particularly in sea-going installations where an earth bolt has rusted, giving rise to the conditions described. More often than not the efficiency of the rectifier in the corroded joint is very poor and the proportion of harmonic re-radiated to the amount of the fundamental re-radiated is very low, but it must be realized that a field strength of many volts per metre at the fundamental is common in the immediate vicinity of the transmitting station, and a re-radiated harmonic field of 1/1,000,000 compared with the fundamental may be sufficient to cause TVI. Occasionally, however, the nature and condition of a rusty joint may be such as to rectify quite efficiently, with the result that any modulation of the transmitter may become audible at the joint! At the writer's station, for example, a gutter pipe 20ft high and having a loose-fitting joint about 5ft from the ground was found to be emitting an audible tone when the transmitter was being modulated for test purposes. On disturbing the joint by vigorously shaking the pipe, the sound output vanished but there was still a varying degree of harmonic radiation (as detected on a harmonic indicator) as the pipe was moved about.

Some of the most obscure causes, which are at the same time most difficult to cure, are rusty conduit pipes embedded in the plaster of walls. The only hope of tracing these is by means of a sensitive harmonic indicator, preferably in the form of a portable two r.f. stage battery-operated receiver working at the harmonic frequency and having a tuned loop aerial. The transmitter should be modulated and operated at full power while the portable receiver is taken around the neighbourhood exploring for the points of origin and maximum harmonic indication. The tuned loop aerial will be found quite directional enough to pin-point even hidden conductors in walls and under floors.

After the source has been located it may be an altogether more difficult problem to eliminate the generation of harmonics. In the writer's house there are probably a dozen different instances of this effect, all of which are embedded in the plaster or underneath tongued-and-grooved flooring boards. One of the most disheartening things about this particular trouble is that houses immediately either side may also contain rusty connections which in most cases cannot be dealt with.

Further Aids to Diagnosis

One of the commonest forms of TVI is the diagonal "cross hatch" pattern formed on the picture. By observing and measuring the *horizontal* spacing of the light and dark bars it is possible to deduce the interfering frequency. For example, suppose the horizontal pitch of the pattern so formed is 0.25in. on a screen 10in. wide; then there will obviously be 40 complete cycles of the interference "beat" (or heterodyne) occurring in the 80 microseconds of active line duration of the television picture. If 40 cycles take 80 microseconds, then 1 cycle takes 2 microseconds and the frequency is 0.5 Mc/s. Similarly, a heterodyne of 2 Mc/s would be represented by a horizontal pitch of one-quarter of 0.25in., i.e., 1/16in.

If the transmitter is on a frequency of, say, 14.333 Mc/s its third harmonic will be exactly 43 Mc/s, and this harmonic will beat with the vision carrier of the London B.B.C. station on 45 Mc/s to produce a heterodyne of 2 Mc/s. Thus, if the interference is due to the third harmonic, a 1/16in. horizontal pitch pattern will be produced on a 10in. wide screen (or, of course, 3/32in. on a 15in. screen).

Changing the transmitter frequency to exactly 14 Mc/s will produce a 3 Mc/s heterodyne and the pitch should reduce in width to two-thirds of the previous measurement.

The pattern will not usually be stationary because the television waveform is locked to the a.c. mains which are not highly stable in r.f. terms. However, a quick inspection along one line of the raster will enable a fairly accurate pitch measurement to be made even if the pattern is moving quite rapidly. Any pattern having a pitch detectably larger than 1/16in. on a 10in. wide picture (in the case of 14 Mc/s and Channel 1 for example) is indicative of a lower frequency heterodyne than 2 Mc/s. Such should be impossible if the trouble is really third harmonic since the transmitter would have to operate outside the high frequency end of the 14 Mc/s band to produce any heterodyne appreciably lower than 2 Mc/s.

On the other hand, if the trouble is due to i.f. breakthrough or image response in the receiver, heterodynes of this order can be caused. Furthermore, due to "inversion" produced by the mixing process in the receiver, it is possible to increase the pattern pitch instead of reducing it when the transmitter is changed from 14.333 Mc/s to 14 Mc/s.

Television Channels

THE following table shows the frequencies for each television channel in Bands I and III. All channels in Band I are assigned to, and are in use by, the B.B.C. The I.T.A. is so far using Channel 8 (Birmingham) and Channel 9 (London and Manchester) only.

Channel 1:	Sound 41.5 Mc/s;	Vision 45 Mc/s.
Channel 2:	Sound 48.25 Mc/s;	Vision 51.75 Mc/s.
Channel 3:	Sound 53.25 Mc/s;	Vision 56.75 Mc/s.
Channel 4:	Sound 58.25 Mc/s;	Vision 61.75 Mc/s.
Channel 5:	Sound 63.25 Mc/s;	Vision 66.75 Mc/s.
Channel 6:	Sound 176.25 Mc/s;	Vision 179.75 Mc/s.
Channel 7:	Sound 181.25 Mc/s;	Vision 184.75 Mc/s.
Channel 8:	Sound 186.25 Mc/s;	Vision 189.75 Mc/s.
Channel 9:	Sound 191.25 Mc/s;	Vision 194.75 Mc/s.
Channel 10:	Sound 196.25 Mc/s;	Vision 199.75 Mc/s.
Channel 11:	Sound 201.25 Mc/s;	Vision 204.75 Mc/s.
Channel 12:	Sound 206.25 Mc/s;	Vision 209.75 Mc/s.
Channel 13:	Sound 211.25 Mc/s;	Vision 214.75 Mc/s.

The Cup Winner

A Five Band Transmitter of Contemporary Design

By GERALD GIBBS (G3AAZ)*

The Welwyn Garden City Group of the R.S.G.B. of which the writer has the privilege of being Town Representative, holds an annual exhibition of personally constructed radio equipment. To the member who submits the most outstanding exhibit, as judged by an independent panel of assessors, goes the "Stanley Harrison Trophy" which has been donated to the group by Stanley Harrison, J.P. (G3EPK) of Hertford.

The award for 1955 went to Gerald Gibbs (G3AAZ) for a five band 150 watt transmitter of modern design. Both electrically and mechanically this exhibit was quite outstanding, and the more so in view of the fact that Mr. Gibbs has no connections whatever with professional radio engineering. His approach to the job has been to provide not only a design of transmitter that would be completely up-to-date, but to ensure that layout and general accessibility were such that eventual trouble shooting—if any—would be facilitated.

The "Cup Winner," as his transmitter may well be called, can be easily reproduced by members who have nothing more than average workshop facilities and skill. While the design as presented in the following article visualizes this r.f. assembly as part of a rack and panel layout, there is no reason at all why it should not be included in a completely screened table-top cabinet by constructors who prefer it that way. It is "TVI-proof" in either mode! An orthodox modulator and power supply are all that remain to be added to put it on the air with the greatest of ease.

Jack Hum (G5UM)

IN visualizing the design which G5UM has called "The Cup Winner" the writer had three main requirements in mind so far as its electrical characteristics were concerned. The first was that the final amplifier should be capable of the full permitted input of 150 watts. Secondly, "split second bandswitching" and netting should be furnished by means of wide-band couplers that would eliminate the time-wasting tuning up of each stage when frequency is changed. Thirdly, the finished article should be blameless from the point of view of the numerous televiewers in the district.

It might be added that these were *basic* requirements. Such things as rugged construction and ease of accessibility were—like TVI-proofing—taken for granted, and considered to be quite indispensable in spite of the compact and fairly crowded finished design.

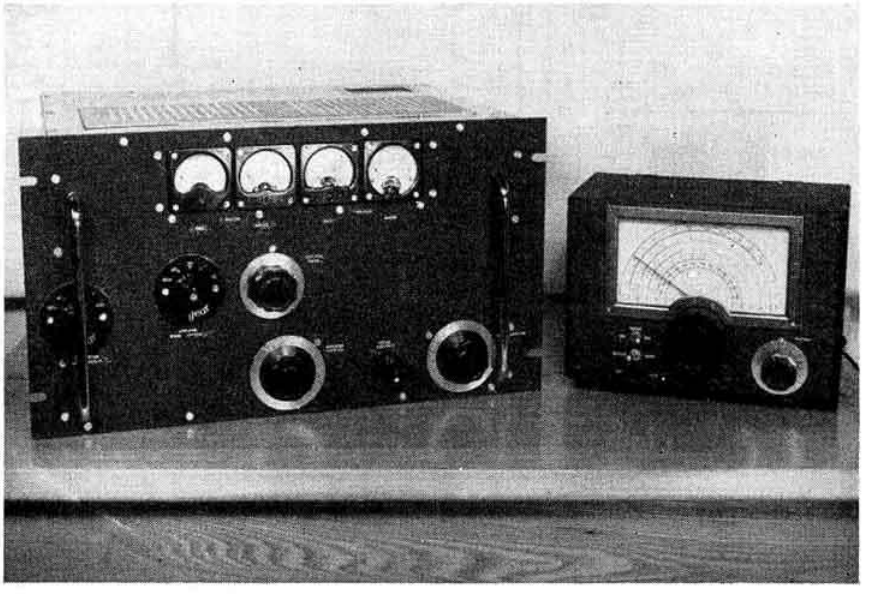
Circuit Diagram

The valve chain (Fig. 1) comprises four low-level multipliers, followed by a driver stage which operates "straight through" on all bands, and finally the power amplifier connected into a conventional pi-network output circuit.

The Exciter

A Labgear wide-band multiplier is used in the low-level stages in conjunction with four 6F12 r.f. pentodes connected as triodes. The triode connection of these valves simplifies the wiring considerably, avoiding the use of a stabilized screen rail with its associated by-pass capacitors; moreover, drive to the 807 is more than adequate on all bands.

*Chesilbank, Digswell, Welwyn, Herts.



Front view of the transmitter and associated v.f.o. The controls from left to right are exciter bandswitch, p.a. bandswitch, p.a. tuning, aerial loading, drive control and driver tuning. The meters read driver grid current, driver anode current, p.a. grid current and p.a. anode current.

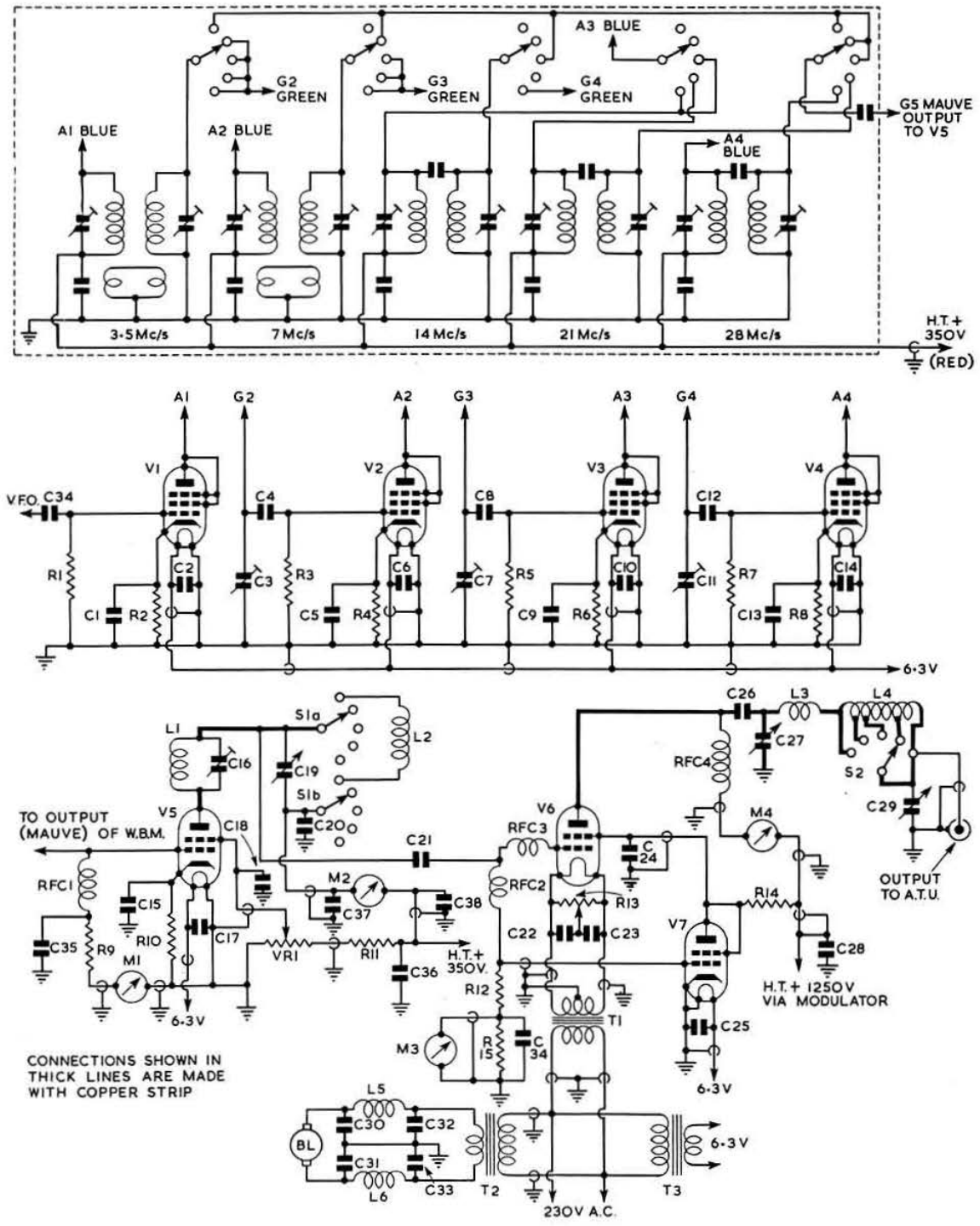


Fig. 1. Circuit diagram of the transmitter. The components within the dotted line are part of the Labgear wideband multiplier unit.

Triodes also have the added advantage of producing a more even response, maintaining an adequate output at the band edges. The only exception is on the 28 Mc/s band, where there is a marked falling off above 29 Mc/s. However, as most of the activity occurs below this frequency, it is not a serious handicap.

The first stage of this chain is a straight amplifier with an output frequency of 3.5 Mc/s. The second doubles to 7 Mc/s and the third, according to the switch position, will either double to 14 Mc/s or triple to 21 Mc/s. The fourth and final stage doubles from 14 Mc/s to 28 Mc/s.

The 807 driver stage is perfectly conventional and its output is capacity coupled to the final amplifier. It must be admitted that the method of coupling originally raised some doubts concerning the generation of unwanted harmonics, and these doubts did in fact prove to be justified; the inclusion in the anode lead of a parallel trap circuit set to the TV band reduced the harmonic content to a negligible proportion.

While this method of harmonic suppression is very effective, the relatively high "Q" of the trap circuit necessitates its readjustment if maximum attenuation is to be achieved when the v.f.o. output frequency changes by more than about 50 kc/s.

The output of the driver stage is controlled by potentiometer VR1 and provides a convenient method of adjusting the grid current of the p.a.

Components List for Fig. 1

BL, Blower (see text).
C1, 2, 5, 6, 9, 10, 13, 14, 17, 18, 25, 35, 0.01μF disc ceramic.
C3, 7, 11, 16, 30$\mu\mu$F air trimmer (Polar).
C4, 8, 12, 34, 100$\mu\mu$F tubular ceramic.
C15, 22, 23, 36, 37, 38, 0.001μF, disc ceramic.
C19, 120$\mu\mu$F variable (Raymart).
C20, 32, 33, 0.01μF mica.
C21, 100$\mu\mu$F.
C24, 0.001μF mica 2 kV wkg.
C26, 28, 0.001μF tubular ceramic 5 kV wkg.
C27, 200$\mu\mu$F Eddystone type 833, sections in parallel.
C29, 1500$\mu\mu$F (receiver type 3 gang, 500$\mu\mu$F sections in parallel).
C30, 31, 470$\mu\mu$F disc ceramic.
L1, 6 turns 18 s.w.g. $\frac{1}{4}$in. o.d. spaced one turn (TVI trap).
L2, Labgear turret type E.5023B.
L3, 4 turns $\frac{3}{16}$in. diam. copper tube spaced one turn o.d. $1\frac{1}{4}$in. (28 Mc/s).
L4, 20 turns 14 s.w.g. enam. $2\frac{1}{2}$in. diam. (Eddystone former type 1090) tapped from junction with L3 at 10 turns (7 Mc/s), 17 turns (14 Mc/s) and 19 turns (21 Mc/s).
L5, 6, TV chokes 1 amp. type (Radiospares).
M1, 0–5 mA m.c. meter.
M2, 0–50 mA m.c. meter.
M3, 0–15 mA m.c. meter.
M4, 0–200 mA m.c. meter.
R1, 3, 5, 7, 27,000 ohms $\frac{1}{2}$ watt.
R2, 4, 470 ohms $\frac{1}{2}$ watt.
R6, 8, 1000 ohms $\frac{1}{2}$ watt.
R9, 15,000 ohms $\frac{1}{2}$ watt.
R10, 350 ohms 1 watt.
R11, 15,000 ohms 5 watts.
R12, 18,000 ohms 10 watts.
R13, 40 ohms wire wound centre tapped.
R14, 75,000 ohms 50 watt wire wound.
R15, 200 ohms 1 watt.
RFC1, 2, 1.25 mH Eddystone type 1010.
RFC3, 8 turns 18 s.w.g. $\frac{1}{4}$in. diam. (anti-parasitic choke).
RFC4, See text and Fig. 3.
S1 a, b, Part of Labgear turret type E.5023B.
S2, 5-way single pole heavy duty ceramic p.a. bandswitch (ex-TU5B unit).
T1, 10 volts 5 amps (Woden type DTF22).
T2, 12 volts 1 amp (to suit blower).
T3, 6.3 volts 4 amps (Partridge).
V1, 2, 3, 4, 6F12.
V5, 807.
V6, 813.
V7, 6L6.
VR1, 25,000 ohms 5 watt potentiometer.
Wideband multiplier—Labgear type E.5026.
The bevel gears are $\frac{1}{4}$in. diam., $\frac{1}{4}$in. bush.

The Power Amplifier

The power amplifier, an 813, is connected in a pi-network circuit, and requires little explanation. The choice of the input and output capacitors and tank inductance can be calculated quite simply by reference to Whalley's excellent article on the subject[1].

The output impedance of the 813 was calculated to be 3500 ohms, and the network operates into a load of 72 ohms. From these factors the reactance of C27, L4 and C29 can be determined; the ideal values for each band are shown in Table I.

On 28 Mc/s it is practically impossible to reduce the capacity in the input circuit to 17$\mu\mu$F (the output capacity of the 813 is 14$\mu\mu$F) and therefore the value of the inductor for this band must be reduced slightly to compensate, resulting in a small reduction of Q.

Table I—Ideal Values

Component	Reactance Ohms	Frequencies in Mc/s				
		3.65	7.2	14.15	21.15	28.5
C27	330	132$\mu\mu$F	68$\mu\mu$F	34$\mu\mu$F	23$\mu\mu$F	17$\mu\mu$F
L4	375	16.4μH	8.4μH	4.2μH	2.8μH	2.1μH
C29	45	1000$\mu\mu$F	500$\mu\mu$F	250$\mu\mu$F	167$\mu\mu$F	125$\mu\mu$F

From these figures it can be seen that the input capacitor should have a maximum value of 200$\mu\mu$F and a very low minimum capacity, while the output capacity should be a maximum of say 1500$\mu\mu$F. The Eddystone capacitor type 833 with both sections connected in parallel fills the first need very well (C27), while any good quality 3-gang (500$\mu\mu$F per section) tuning condenser suffices for C29.

On 28 Mc/s the point of resonance is obtained with C27 very nearly disengaged, the capacity being provided by (1) the output capacity of the 813; (2) the stray capacity, and (3) the almost minimum value of the tuning condenser. On 3.5 Mc/s the point of resonance occurs with C27 almost two-thirds engaged. In order to keep the stray inductance to a minimum, copper strap is used to connect the tapping points of the coil to the switch, and the anode to the live end of the blocking condenser.

A separate coil of heavy-gauge copper tube is used for 28 Mc/s and consequently the efficiency of the p.a. stage has been found to be quite high on this band.

The clamp valve, a 6L6, is connected in the normal way. With a h.t. supply voltage of 1250 and a grid resistor of 15,000 ohms the standing anode current of the amplifier with no input is maintained at about 30 mA.

It might be emphasised that the method of by-passing and decoupling at the 813 base is of paramount importance if complete stability is to be achieved.

In order to avoid r.f. radiation from exposed heater leads, both filament transformers are mounted within the cabinet. This in itself is a good insurance against TVI, while the short heater leads ensure minimum voltage drop at the valve pins.

Layout and Construction

(1) *The Main Cabinet*

The basis of the transmitter is a chassis 17in. x 13in. x 3in. deep, and all the external screening is constructed on this. The intention was to construct the unit in such a way that not only would the transmitter be enclosed, but that the joints and corners should be virtually "leak proof."[2] For this r.f. weather-stripping it was decided to use $\frac{3}{4}$in. drawn brass angle, of which about 24ft is required. This amount allows only a very small percentage for waste.

First of all the angle is laid around the inside rim of the chassis and down each corner, with mitred joints silver soldered for strength. The angle is drilled and tapped and fastened to the chassis with ¼in. countersunk 4BA bolts ready to receive the bottom cover. The sides of the cabinet can then be bolted into place, and the angle mounted around the edges; this will then form the basis for the panel support. It is recommended that the bolts be placed, at the most, four inches from each other in order that the sealing be really effective.

The whole cabinet was built up in this manner, with the angle joints mitred and silver soldered. A set of steel fish plates must be made up to hold the corners together at the correct angle, and then the blow-lamp can be applied and the silver solder run into each joint. Ordinary soft solder would be quite adequate electrically but silver soldered joints are much stronger, and have a better appearance.

The screen separating the exciter and power amplifier stages is mounted on brass angle laid along the top of the chassis and the side panels.

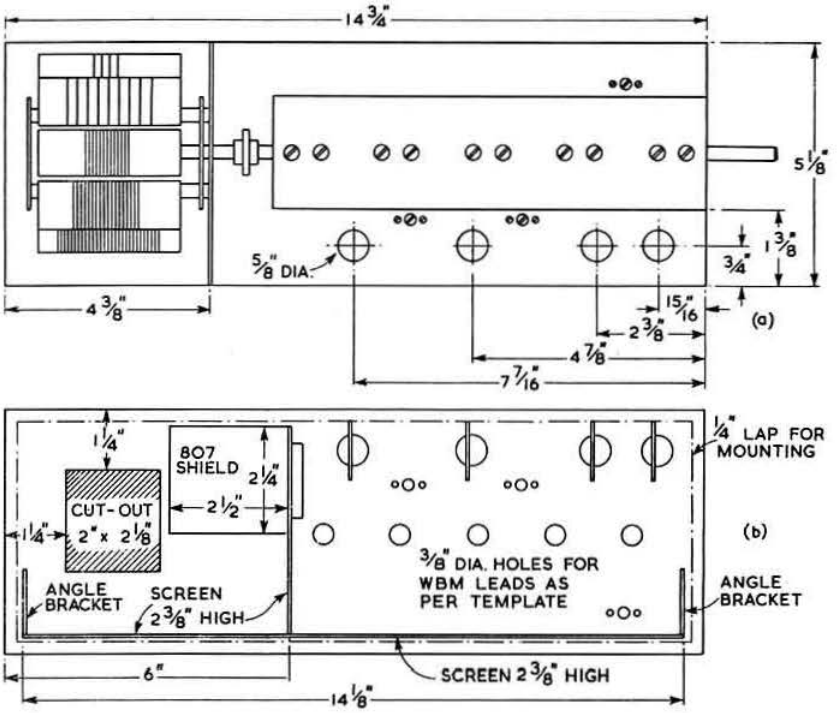


Fig. 2. Layout of components in the exciter section. (a) View from above. (b) Underside view.

The top cover of the cabinet must be drilled to provide an air escape, and the holes covered on the underside with copper gauze to maintain the r.f. weather-stripping.

When the cabinet has been completed the sub-assembly for the exciter can be tackled.

(2) *The Exciter Sub-Assembly*

The sub-assembly was designed for easy removal from the main chassis, first for ease of construction, and secondly to facilitate subsequent modification (if any) and servicing. The sketches (Figs. 2a and 2b) give all the necessary dimensions.

The unit is made from 20 s.w.g. copper sheet, and after the holes have been drilled the five main pieces are sweated together ensuring good electrical bonding and mechanical strength. Finally, the small copper screens are soldered across the apertures for the B7G valve-holders. These screens, while not strictly necessary, were used to achieve a slight increase in gain. This copper unit should then be cleaned and polished and given a coat of clear copal varnish to prevent tarnishing. Where the components have to make either a pressure or soldered contact with the copper it is important to clean away the varnish coating first.

The components should then be mounted in the following order: B7G valveholders, 807 holder, 30$\mu\mu$F air trimmers, wide-band multiplier and turret, and driver anode tuning capacitor.

The wide-band multiplier unit is secured to the sub-chassis by four 6BA bolts inserted into the tapped holes. A chassis drilling template is provided for this purpose with each unit by the makers.

The turret and w.b.c. are joined with a flexible coupling unit, but even so great care should be taken to ensure that the spindles are properly aligned, otherwise considerable strain is imposed on the switch wafers, besides increasing the already high torque required to turn them.

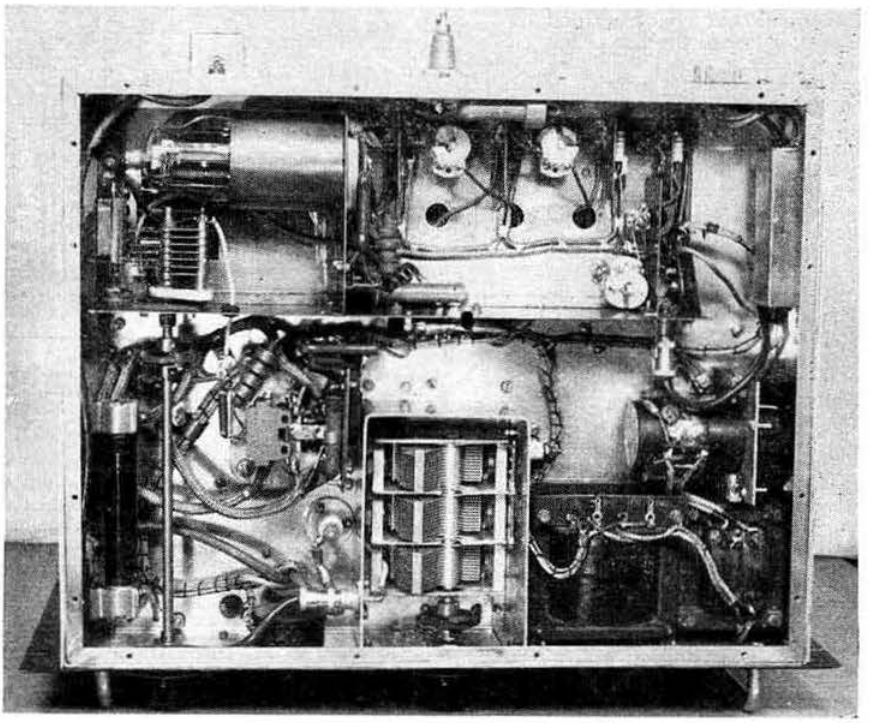
All wiring other than r.f. leads must be made with shielded rubber-covered cable, the shielding being soldered in at least two places per lead to the copper base. P.v.c. shielded lead is not recommended as it is thermoplastic and the inner core will break down to the outer sheathing under the sustained heat necessary to bond the latter to the chassis.

If the 807 stage is to be completely stable without neutralizing, special attention must be paid to the decoupling methods. It was found that heater and screen by-pass capacitors must be mounted right on the valve-holder tags, and earthed by direct soldering to the copper chassis, at a common point. The anode by-pass condenser (0.01μF) is large enough to provide efficient decoupling at the lowest frequency and is soldered directly between the base of the tuned circuit and the chassis. These methods, coupled with the adequate screening, are completely effective and there is no trace of feed-back on any of the five bands.

When the wiring is complete the h.t. rail should be checked for continuity and no short circuits; the unit can then be tested with a power supply and v.f.o. according to the details given later on.

(3) *General*

When the large cut-out to contain the exciter assembly has been made on the main chassis the remainder of



View from below chassis showing the placing of the sub-chassis components. The blower motor and its transformer (T2) are at the extreme right of the picture.

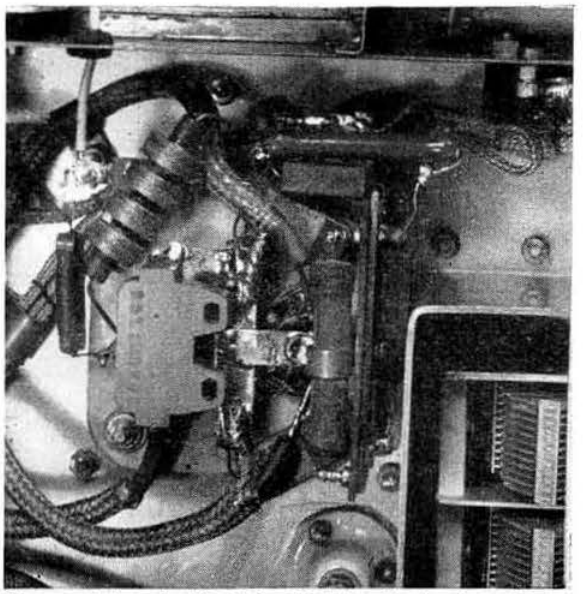
the components can be mounted. The position of these is clearly shown in one of the photographs. Looking along the lower edge (next to the panel) the components are as follows: drive control, output condenser, filament transformer (for all valves except 813) and blower motor transformer, and then just above on the right, the motor itself. As the whole transmitter is enclosed in a screening cabinet forced air cooling is essential, especially under sustained operation at full power, and the blower motor ensures adequate circulation of cold air throughout the unit. The air is drawn through a one-inch hole in the side of the chassis which is covered with copper gauze to avoid r.f. leakage. The motor must be mounted on sponge rubber and this feature, coupled with its total enclosure, reduces the mechanical noise to a negligible level. The blower is an item of American surplus designed to work on 27 volts d.c. It performs very adequately however with the 12 volts a.c. provided by the transformer!

The P.a. Stage

And now for the power amplifier. The 813 base is constructed as a sub-assembly, the ceramic valveholder of course forming the main component. This valveholder is set below the chassis on distance pieces so that the top of the metal base shell of the valve is level with the chassis; on the chassis itself is a flange plate to which is sweated a piece of drawn copper tube 3in. in diameter and 1in. high. The top of this tube is just level with the base of the anode assembly, and serves first to direct the air stream uniformly over the valve envelope, and secondly to provide additional screening of the grid input section from the anode tank components.

The close-up photograph of the 813 base shows how the various components are supported on a copper framework mounted on the base itself in order to achieve low resistance, rigidity, and a short earth path for the capacitors. Two strips of springy brass are mounted in the base so as to earth the metal base shell of the valve.

Referring to the photograph of the top view, the 813 heater transformer can be seen to the right and the



Close-up of the underside of the 813 holder showing the position of the by-pass capacitors and other components.

Eddystone tank condenser and the r.f. choke to the left of the valveholder.

The r.f. choke is worthy of special mention as it is in almost every way a reproduction of a similar National Company component (No. R175)[3] with the exception that the material used is p.t.f.e. This is an ideal substance, as it possesses excellent electrical characteristics, is not thermoplastic, and can easily be turned into shape on a lathe from a billet 6in. long and 1¼in. in diameter. However, if it is not possible to obtain this material, a perfectly satisfactory component can be made from Tufnol[4]. In any case the winding should be cemented into place with polystyrene solution, once it has been determined that the choke is efficient on all bands, and does not develop any unwanted resonances. It should be mounted on a small stand-off insulator, by means of a 4BA screw in its base. All the necessary dimensions for the construction of this choke are given in Fig. 3.

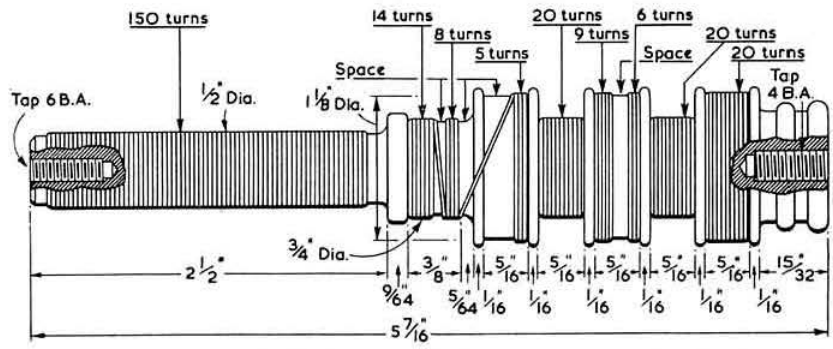


Fig. 3. Construction of RFC4. The dimensions of the former are as described by G8SC in the November, 1953, issue of the R.S.G.B. BULLETIN. The wire used is 30 s.w.g. d.s.c.

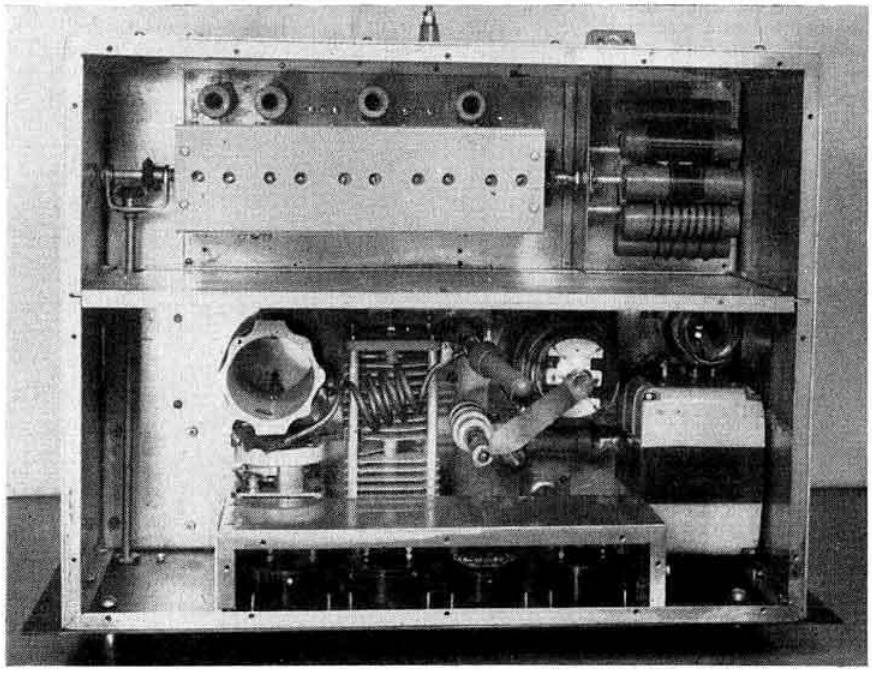
Initially there were some doubts as to the positioning of the clamp valve, which being so close to the 813 might introduce feed-back into the grid circuit of this valve. A screen could easily have been introduced to obviate this but it was decided to exclude it until testing was carried out. As it happened, and rather surprisingly, there was no trace of feed-back whatsoever.

In order to reduce the stray inductance the anode circuit is wired as far as possible with copper strap and this together with the position of the 28 Mc/s coil and main inductor can be clearly seen in one of the photographs. The p.a. bandswitch S2 (from a TU5B unit) is just visible beneath the meter compartment, which is constructed of brass angle with mitred and silver soldered corners, and aluminium plates on four sides. The meter leads are in shielded cable, decoupled at the meter end, and passed through a copper conduit to the underside of the chassis.

The shielded cable for the anode meter is ¼in. diameter and this size should be regarded as the very minimum that can be used in conjunction with the 1250 volt supply.

The right-angle drive for the exciter switching is formed from ⅝in. x ⅛in. brass strip bent into the "U" form seen in the photographs. This must be done hot, otherwise a fracture will almost certainly result. The bearings are ¼in. bushes sweated into place, the bevel gears being 1:1 ratio, ⅝in. diameter to accept ¼in. shafting.

The band switch for the p.a. circuit is mounted on a copper bracket so that it is positioned just in front of



In this view from above with the top cover removed, the 813 heater transformer and the clamp valve can be seen at the lower right.

the p.a. coil. Two stops were installed for this switch to prevent turning too far in either direction.

Finally a word about the wiring. All the wiring, with the exception of that carrying r.f., is, of course, carried out with shielded cable and where possible laid in clips at convenient points to prevent movement. The harness is formed by binding the cables with waxed thread and tying off at each end.

The braid at the end of each, if it cannot be connected to the chassis, should be bound with a little wire and tinned to prevent fraying.

Adjustment of the Exciter Stages

The exciter unit should be checked first, and for this purpose it is convenient to separate it from the main chassis.

The grid and anode meters and drive control can be temporarily connected to the terminal block at the rear from where the permanent connections will eventually be made.

The tuning of the wide-band multiplier unit must be done with an insulated trimming tool and is carried out as follows:

The pairs of trimmers, which can be seen through the top, run from right to left, covering 3.5, 7, 14, 21 and 28 Mc/s respectively. The right-hand trimmer in each pair is for the grid tuning and the left for the anode. Tuning up is accomplished by first switching the v.f.o. on and turning the wave-change switch to the 3.5 Mc/s position. Peak the grid drive to the 807 on the l.f. end of the band with the grid trimmer and on the h.f. end with the anode trimmer; this will have to be repeated several times to obtain a reasonably even drive over the whole band. Having correctly tuned the 3.5 Mc/s band, repeat the same process with the next pair of trimmers with the switch in the 7 Mc/s position and so on throughout all the bands. Having set up one pair, do not adjust them again when aligning the trimmers on other bands. The trimmer condensers C3, C7 and C11 are adjusted to compensate for the extra capacity which is present when the stage in use is switched to the 807 grid. Extra capacity is added to the next multiplier grid as it must be appreciated that to obtain flat response from any stage into the 807 grid, the drive into the multiplier grid must also be flat.

Do not attempt to cover a greater band than necessary as this will only result in a general reduction of drive and minimize the harmonic attenuation of the wide-band circuits.

H.t. can now be applied to the 807 and a dummy load consisting of a loop of wire and a 10-watt lamp can be slipped over the earthy end of the anode coils for checking the output on each band.

It should be possible to light the latter to full brilliance while maintaining a minimum of 2.5 mA drive over each band. If these conditions are not achieved then the adjustment of the w.b.c. is not correct and should be checked again.

Initial Tuning of the P.a. Stage

When the exciter is working correctly, it can be replaced in the main chassis, preparatory to setting up the p.a. stage.

The wiring of this stage should be checked, and tested for short circuits to earth before the h.t. is applied for the first time. It is preferable to carry out the initial adjustments with the voltage on the p.a. stage reduced to about 600. A dummy load consisting of a 100 watt 75 ohm resistor is connected across the output terminals.

After allowing a little time for heaters to warm up the power can be switched on and the grid and anode condensers completely rotated on each band. The standing anode current of approximately 15 mA (under this low voltage condition) should not fluctuate at all when this test is carried out. The drive to the p.a. should now be checked on each band, bringing the tank condenser quickly to resonance in each case. The output capacitor will have already been set to full mesh, and it should be opened progressively, keeping the tank input capacitor at resonance, until the amplifier is properly loaded.

It should be possible to get at least 12 mA drive to the 813 on all bands (even when, later, operating it at full input). The positions of the tank and loading condenser should be noted in tabular form for reference when tuning up on full power later on. If desired the band-switches and tuning controls can be colour coded for rapid band changing.

Conclusion

This transmitter, while it could easily be adapted to a table-top design, forms part of an enclosed rack assembly, with the modulator immediately below and the all-band aerial matching unit above. The latter incorporates the aerial change-over relay (operated from an independent d.c. source), the low-pass filter, and the harmonic check point.

The v.f.o. seen to the right of the photograph at the beginning of this article contains its own power supply and is situated next to the station receiver about 7ft away from the transmitter. When changing frequency within a band, it has only been found necessary to adjust the transmitter tuning if the change exceeds 100 kc/s.

The author's station is situated about thirty miles north of Crystal Palace, in a valley which causes quite a fair degree of attenuation to the TV signal. The viewer density is quite high for a rural area, with approximately thirty or forty receivers within a hundred-yard radius circle. The nearest of these (the author's) is a t.r.f. (*Electronic Engineering*) design and its aerial is a close spaced "H" array pointing directly away from the transmitting aerial about ten yards distant. Under these conditions, c.w. operation is possible on all bands with a very slight degree of cross batching on 21 Mc/s. On phone there is slight break-through in the form of splatter on 14 Mc/s and 21 Mc/s, the other bands being clear. These conditions also obtain to a lesser degree with the next nearest receiver (Pye t.r.f.) about thirty yards distant. Work is now being carried out with an improved low-pass filter and a series tuned by-pass circuit attached to the output socket of the transmitter. It is hoped by these and other means to get rid of the last traces of interference.

It is not intended to describe the adjustments and precautions necessary to minimize TVI as these have all been dealt with at length in previous issues of the BULLETIN. Suffice it to say that if the transmitter is reproduced as described, televiewers local to it will have little cause for complaint.

Bibliography

[1] "The Design of Pi-Network Tank Circuits," Whalley, R.S.G.B. BULLETIN, April, 1952.

[2] "TVI *Can* be Cured," Whalley, R.S.G.B. BULLETIN, April, 1954.

[3] *Radio Amateur's Handbook*, 30th Edition, 1953. Page 204.

[4] "R.F. Chokes for Parallel Feed," G8SC, R.S.G.B. BULLETIN, November, 1953.

London V.H.F.-U.H.F. Convention

New Techniques Dominate Discussions

THIS event, organized by the R.S.G.B. with the valuable co-operation of the London U.H.F. Group, was held at the Bonnington Hotel, Southampton Row, on Saturday, May 26, and attended by more than 100 enthusiasts including a party of four from France and representatives from Ireland, Holland and the United States.

After an informal lunch there was an opportunity to inspect and discuss the many interesting pieces of v.h.f. and u.h.f. gear on display and to indulge in that favourite pastime of the radio amateur, ragchewing.

Forward Scatter

The high spot of the afternoon's lectures was that given by Lt. Philip Jeter, United States Air Force (by kind permission of Col. George M. Higginson, Officer Commanding A.A.C.S., Ruislip) on "Some Aspects of Forward Scatter." Lt. Jeter traced the development of this method of v.h.f. communication from the first experimental transmissions in the United States in 1950 through the various stages of development to the present permanent links which provide the U.S.A.F. with direct communication between the States and this country via Iceland.

No satisfactory theory of propagation has so far been advanced to account for the persistence of signals so far beyond their normal horizon, but proof has been amply provided that given sufficient power at the transmitter combined with really high gain aerial systems at both ends of the link, frequencies between 25 and several thousands of megacycles may be transmitted throughout the 24 hours over distances far exceeding what has hitherto been thought possible and with a reliability approaching 100 per cent.

The frequencies at present in everyday use lie in the lower portion of the range mentioned and are transmitted and received on 60° corner reflector aerial systems used in diversity and having gains of the order of 20db over a dipole. Unfortunately many of the details of the apparatus in use are "classified" and it was therefore not possible for the lecturer to satisfy the more searching questions of the v.h.f. DX fraternity in this respect.

V.H.F. Work in U.S.A. and the U.K.

The name of Ed. Tilton (W1HDQ), V.H.F. Editor of *QST*, has been well known on this side of the Atlantic for many years, and it was much appreciated that he had recorded on tape a short talk for delivery at the Convention. Mr. Tilton contrasted the somewhat different approach in the States and in this country in regard to developments on 420 and 1215 Mc/s and gave his view that there is little to choose between the best American and British practice on the lower of these two bands although we have developed the crystal mixer to a greater state of efficiency than has been the case in the States, where suitable valve mixers have been more readily available. The proportion of amateurs operating on 420 Mc/s is far greater in this country.

So far as 1250 Mc/s is concerned, however, it appears fairly certain that we have the edge on our friends across the Atlantic as is definitely the case with amateur television. In the latter field tribute was paid to *CQ TV* which has no counterpart in the U.S.A.

U.H.F. Valves

D. N. Corfield (G5CD) then reviewed the current valves available for operation at the ultra high frequencies, paying special attention to the 6AF4A, a conventional triode capable of oscillating up to more than 900 Mc/s, and showed a type of tuned cavity suitable for that class of service. Other interesting receiving valves included the DET23, with 15db gain and a noise factor of around 10db at 1000 Mc/s, and the 6BY4, a new ceramic triode, with a slightly better noise factor in the same frequency range.

For transmitting applications the DET24 will give an output of 10 watts at 1200 Mc/s while the ceramic UL10 in the Ferranti range will give half as much again at the same frequency. In the higher power class the 2C39A, available in the U.S.A., France, Germany and in this country, is rated at 100 watts anode dissipation and an output of 12 watts at 2500 Mc/s.

Equipment for 1250 Mc/s

Dennis Furby (G3EOH) and A. L. Mynett (G3HBW) discussed current receiver practice for 1215 Mc/s illustrated by examples of their own designs, and raised the question of the sub-band to be employed in that allocation as harmonic operation from 144 and 430 Mc/s is not possible with the band as at present laid down for use in the U.K.

Pierre Millot (F3SK), who had with him his beautifully made 72 and 1260 Mc/s converter, described its circuit and took part in the general discussion.

Convention Dinner

After an excellent dinner the Chairman, Fred Lambeth (G2AIW) introduced the Guest of Honour, Dr. Smith Rose, who stressed the importance of work which could be carried out by amateurs to enlarge our present scanty knowledge of the propagation of and the effects of screening by buildings and terrain on radio frequencies between 350 and 1250 Mc/s.

Greetings from Ireland were conveyed by Harry Wilson, P.C. (EI2W), who also announced that the Irish V.H.F. Group were arranging tests on 144.14 Mc/s with Finland from September 8 to 16. Operation will be for six hours nightly commencing at 8 p.m. and co-operation is requested in listening for the Finnish stations.

Marcel Compaignon de Marcheville (F8NH), ex-President of R.E.F., F3SK, the Montagne brothers F8MX and F9CQ, well known on the v.h.f.'s for their summertime operation from St. Valery-en-Caux, and J. Adama (PA0FB) all spoke of the international friendship engendered by Amateur Radio and stressed the importance of co-operation in v.h.f. work. Greetings from F8GH were conveyed by Mrs. Margaret Mills (G3ACC), and Phil Thorogood (G4KD), Chairman of the London U.H.F. Group, paid tribute to G2AIW for his part in the organization of the Convention and to F8MX, F9CQ and other French amateurs for their kindness to him during a recent visit to Paris. Thanks to the members of the Convention Sub-committee, and to all others connected with the successful running of the event were suitably expressed by Council Member W. A. Scarr (G2WS). It was a disappointment to all that the President of R.S.G.B., Mr. R. H. Hammans (G2IG) was unable to be present owing to illness.

Mr. Lambeth then announced the winners of the competition for the most meritorious pieces of apparatus on

(*Continued on page 526*)

Systems of Amplitude Modulation

A Review of the Many Methods Possible

By G. L. BENBOW, M.Sc., A.M.I.E.E. (ex-G3HB)*

AS already defined, amplitude modulation requires the variation of the envelope of the r.f. carrier wave in accordance with the intelligence it is desired to transmit. There are several possible ways of doing this and they are classified according to the manner in which the modulating voltage is applied to the stage to be modulated. Thus the following broad classification is arrived at:—

1. Anode modulation.
2. Control grid modulation.
3. Suppressor grid modulation.
4. Screen grid modulation.
5. Cathode modulation.

Modulation should be applied only to an r.f. stage which is driven from a source of constant frequency, *e.g.*, a crystal oscillator or a stable variable frequency oscillator followed by at least one isolating stage. This is to prevent the production of spurious frequency modulation such as would result from the direct modulation of a self-excited oscillator. In the case of a triode p.a. stage, neutralization must be perfect, and there must be no parasitic oscillation in a high-gain tetrode or pentode stage.

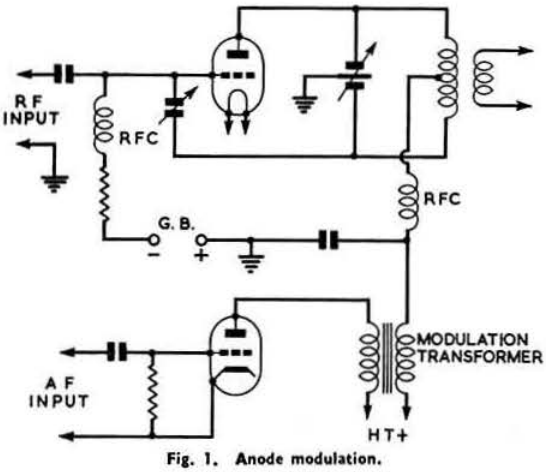


Fig. 1. Anode modulation.

Anode Modulation

Anode modulation of a class C r.f. stage means that the modulating voltage is superimposed on the d.c. anode voltage; thus, for full modulation the normal anode voltage of the p.a. is swung from zero to twice its normal value, causing a corresponding variation in the amplitude of the r.f. output.

The ways of achieving anode modulation may be sub-divided into the following headings:—

1. Transformer modulation.
2. Choke modulation.
3. Series modulation.
4. Anode modulation of pentodes and tetrodes.

*81 Anglesmede Crescent, Pinner, Middlesex.

1. Transformer Modulation

The most straightforward means of anode modulation is by the use of a transformer, known as a modulation transformer, to couple the modulator to the p.a. stage. This is shown in Fig. 1. The ratio of the transformer should be such that it will match the modulating impedance of the r.f. stage to the load required by the modulator valve(s). Although in Fig. 1 a single triode is shown as the modulator, it should be realized that triodes, tetrodes or pentodes, either in push-pull or single-ended operation, may be used.

For 100 per cent. modulation, an audio output equal to half the r.f. input is required, *i.e.*, 75 watts of a.f. power are required to modulate fully an input of 150 watts.

The adjustment of a modulated r.f. amplifier, no matter what system of modulation is used, is best carried out with the data published by the valve manufacturer for the valves concerned as a general guide. The chief points which require attention are the amount of grid drive, which must be two to three times that required for c.w. operation, and the aerial loading, which must be carefully adjusted to provide the necessary modulating impedance (*i.e.*, ratio of anode voltage to anode current) of the modulated stage.

Although the effective power input is varied in anode modulation, the average power input remains constant because each positive excursion of the anode voltage is immediately followed by a corresponding negative one. This means that the d.c. anode current of an anode-modulated stage does not vary during modulation.

Anode modulation is the most common form of modulation used. It is also the simplest system to adjust and apply. Moreover it is a system which enables the r.f. amplifier to operate with the highest efficiency and is capable of full modulation with the least amount of distortion. The ratings of a given value in anode modulation are of the order of two-thirds of the c.w. ratings.

2. Choke Modulation

An alternative method of anode modulation is the use of a choke as the coupling impedance between the modulator and r.f. stages. This is known as "choke" or "choke control" modulation and is shown in Fig. 2. This system was commonly used under pre-war conditions as it lent itself particularly to low-power operation. The modulation choke must have an impedance at audio frequencies which is fairly high compared with the modulating impedance.

Obviously, if both valves operate at the same h.t. voltage, then the output of V2 (Fig. 2) cannot fully modulate V1, as the modulating voltage produced across the choke must of necessity be less than the h.t. voltage, while the voltage required for 100 per cent. modulation must equal the h.t. voltage. For this reason the p.a. stage is always run at a lower h.t. voltage than the modulator, the excess voltage being dropped across the resistor R which is bypassed at audio frequency by the condenser C. The h.t. voltage on the p.a. valve should be about 60-70 per cent of the modulator h.t. voltage. The modulator valves in this arrangement must operate under class A conditions, and only a single valve or two valves in parallel are possible.

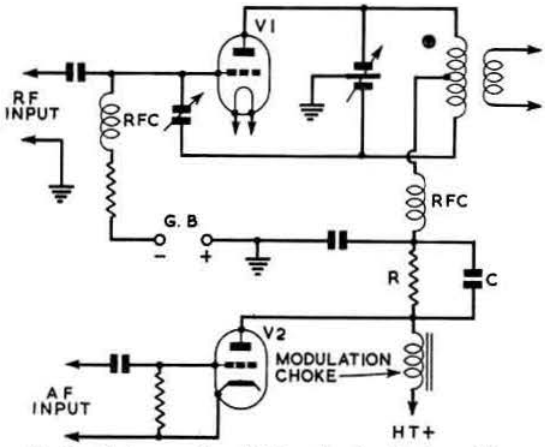


Fig. 2. Choke control modulation of a class C r.f. amplifier.

For high power use the large amount of audio power needed cannot be economically obtained by class A operation and the design of the modulation choke is difficult. For this reason choke modulation is most suitable for low-power operation, *i.e.*, up to about 15 watts input to the r.f. amplifier.

3. Series Modulation

Another form of anode modulation is "series modulation." In this case, the modulator and the p.a. are connected in series, as shown in Fig. 3. Both will therefore pass the same current, the method of adjustment being to vary the operating conditions (*i.e.*, grid drive, aerial loading and grid bias of the p.a. stage) so that it is operating at a lower voltage than the modulator. As with choke modulation, once the correct operating conditions are obtained, it is a very convenient way of achieving modulation. It also has the advantage that one power unit feeds both p.a. and modulator and that no modulation transformer or choke is required. Valves such as the 807 are suitable for use in a series modulation system, and may be operated from a 1000V supply. There should be 500-600V across the modulator and 400-500V across the p.a. For higher power, two such valves may be used in parallel as the modulator, and two in push-pull or parallel as the p.a.

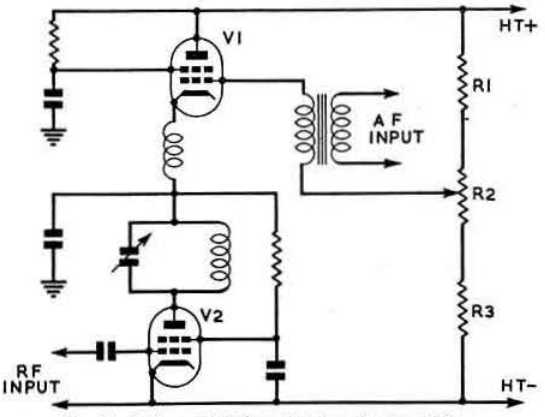


Fig. 3. Series modulation of a class C r.f amplifier. Note the biasing arrangement of V1. R1, R2 and R3 must be such that the cathode of V1 is positive with respect to its grid.

Although in Fig. 3 the modulator is shown "up in the air," this is not the only arrangement. The modulator and p.a. may be reversed so that the p.a. is at the higher potential with respect to earth. It is immaterial which arrangement is used so long as appropriate precautions are taken. In the example quoted, an isolating transformer of adequate insulation is recommended at some point in the audio chain. It must also be remembered that the valve which is "up in the air" requires a separate heater transformer, otherwise the cathode/heater insulation is likely to break down.

4. Anode Modulation of Tetrodes and Pentodes

True anode modulation can be applied only to triodes. Due to the characteristics of tetrodes and pentodes, both the screen and anode voltage affecting the anode current, it is necessary to apply modulation to both screen and anode to obtain a linear modulation characteristic. This may be done as shown in Fig. 4 where it is seen that the screen is fed by a series resistance from its modulation transformer. A potentiometer must not be used for this purpose. The screen by-pass condenser C must have a reasonably high reactance at audio frequencies. In this case, the modulating impedance is the ratio of the anode voltage to the sum of the anode and screen currents, the audio power required being one-half of the product of the anode voltage and the sum of the anode and screen currents.

Efficiency Modulation Systems

The remaining systems of amplitude modulation are usually grouped together under the general heading of "efficiency modulation systems" because modulation is achieved by varying the efficiency of the p.a., as opposed to the various forms of anode control where the input is varied at constant efficiency. The term "efficiency modulation" is a generally accepted expression, but tends to cause confusion because the overall efficiency of such a system is low, generally in the range of 25-30 per cent. In other words, the average r.f. output for a given d.c. input to the p.a. is appreciably less than for anode modulation. It should also be emphasized that in anode modulation, the audio power at the positive peaks of modulation, is added to the d.c. input to the p.a. This does not occur in "efficiency" modulation systems.

Grid Modulation

This is probably the most common form of efficiency modulation and it may be applied to practically any type

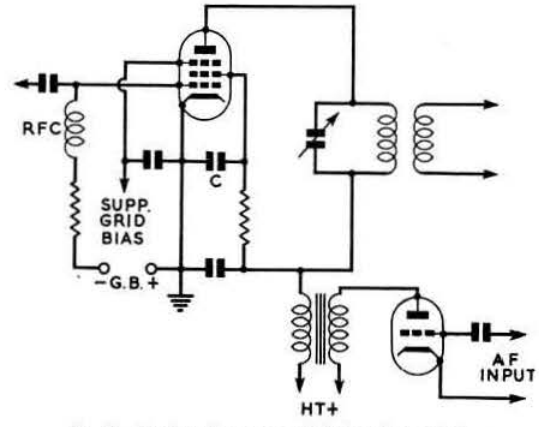


Fig. 4. Anode and screen modulation of a pentode.

of valve, whether triode, tetrode or pentode. It is rather difficult to adjust for optimum results, and has several stringent requirements. These are:—

1. The r.f. grid drive must have good regulation. This may be arranged by providing much more drive than is really necessary and dissipating the excess in a lamp or resistance.
2. The modulator must have a low impedance output. A triode in class A is preferable, but if a pentode or tetrode is used it is advisable to connect a swamping resistance across the secondary of the modulation transformer.
3. The grid bias supply must have good voltage regulation. Either battery bias or a voltage stabilized supply is required.

These requirements are necessitated by the fact that during the modulation cycle, there is appreciable variation in the impedance of the grid circuit of a grid modulated amplifier. The circuit arrangement is shown in Fig. 5.

The maximum permissible input for a given valve (assuming an efficiency of 35 per cent) must be calculated in order that the anode dissipation is not exceeded. The adjustment then consists of setting the grid drive (which is about 20-25 per cent of that obtained under c.w. conditions), grid bias, and aerial loading, until upward modulation and no variation of p.a. anode current is obtained at the required input. The a.f. gain may then be increased until approximately 90 per cent modulation is obtained.

Screen-grid Modulation

With the greatly increased use today of beam tetrodes such as the 807 and 813 as r.f. amplifiers, modulation of the screen-grid has recently received a great deal of attention in amateur circles.

The main limitation in screen modulation is that the screen-grid voltage must be reduced to a fairly low value (100-130V in the case of the 807) in order that the positive excursions of the screen voltage on peaks of modulation shall not be limited, otherwise asymmetrical modulation will occur.

The positive peaks will be flattened and the negative peaks will be unaffected. The general arrangement is shown in Fig. 6.

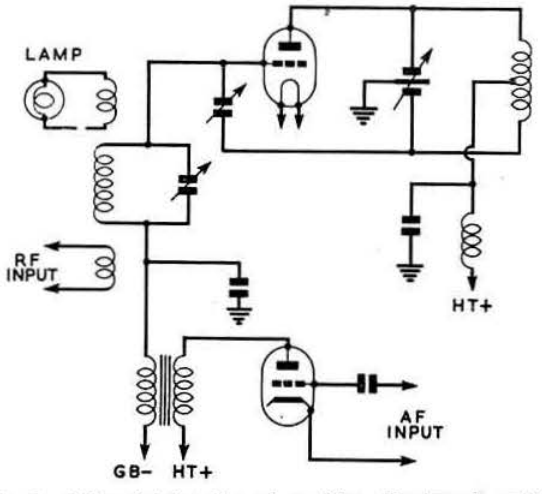


Fig. 5. Grid modulation of a r.f. amplifier. The lamp is used to absorb a fairly large proportion of the grid drive and so improve the regulation.

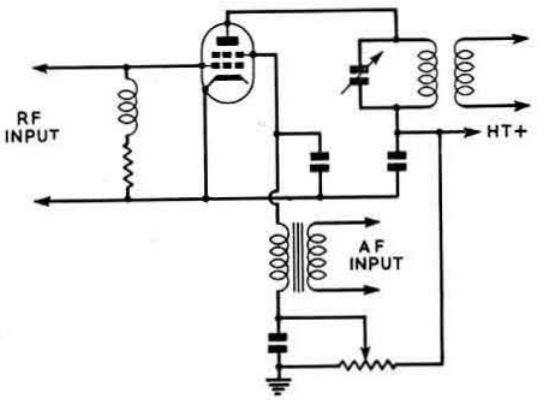


Fig. 6. Screen modulation of a r.f. tetrode. The screen voltage must be obtained from a variable resistance to enable close adjustments to be made.

In the case of the smaller tetrodes, screen modulation is more conveniently applied to two valves in push-pull to compensate for the rather low r.f. output resulting from the low screen voltage. Screen modulation does not call for critical adjustment of grid drive to the modulated stage, but for optimum results the screen voltage must be adjusted carefully to allow the greatest possible modulation depth without distortion. This maximum is generally of the order of 75 to 80 per cent. The audio power required, as in other efficiency modulation systems, is quite low, 4 to 6 watts being sufficient to modulate a 100 watt carrier.

Clamp Modulation

The so-called clamp modulation is an interesting variation of screen-grid modulation. The purpose of a "clamp" valve is to reduce the screen voltage of a tetrode r.f. amplifier to a low value in the absence of excitation, so that it acts as a protective device and allows the exciter to be keyed without using fixed bias on the p.a. stage. The circuit is shown in Fig. 7. In normal operation, the clamp valve V2, which may be of the KT66 or 6L6 class, is cut off by the operating bias of the r.f. stage V1 which is developed across R1. When the excitation is removed, there is no bias on V2 and hence it passes a large current which causes a high voltage drop across the

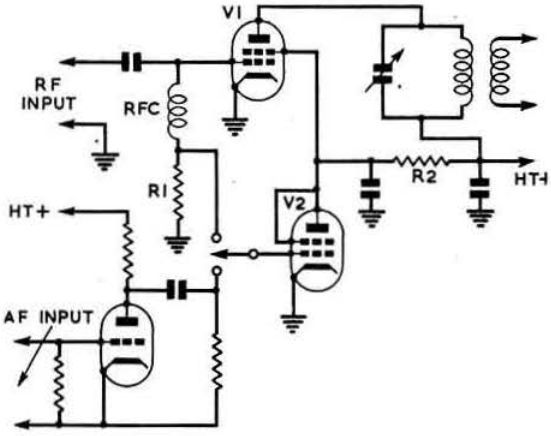


Fig. 7. Clamp modulation. Series resistance control of the screen voltage is necessary.

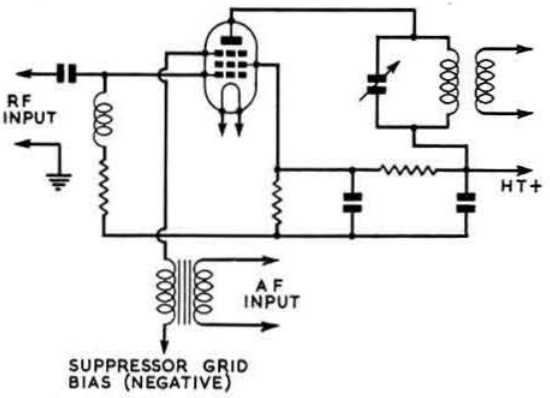


Fig. 8. Suppressor grid modulation of a r.f. pentode.

screen resistor R2. The screen voltage of V1 is therefore reduced to a low value and the anode current is cut off.

The grid of the clamp valve may be switched from the r.f. bias to the output of a speech amplifier and so the screen voltage may be varied in sympathy with the speech input. On switching to telephony operation, after tuning up with r.f. bias on the clamp valve, the screen voltage and hence the anode current drops. When modulating the audio gain may be increased until the anode current on modulation peaks is two-thirds to three-quarters of the normal c.w. value.

Suppressor-grid Modulation

So long as the other voltages remain constant, the gain of a pentode may be controlled by varying the voltage applied to the suppressor grid. This is the basis of suppressor-grid modulation, the a.f. input being applied in series with the suppressor-grid voltage as shown in Fig. 8.

This form of modulation is the simplest to adjust but it is capable of up to 95 per cent modulation without distortion, using only a small amount of a.f. power.

Adjustment is carried out by applying sufficient negative bias to the suppressor grid to reduce the anode current to one-half of the c.w. value. The bias required is about 40-60V for the PT15. A.f. input to the suppressor may then be increased to give up to 95 per cent modulation.

Grid-leak Modulation

A form of grid modulation which is occasionally used is grid-leak modulation. If, in an r.f. amplifier which obtains its operating bias solely by the grid leak method, the value of the grid leak is varied, the grid bias and hence the output will also be varied. In practice this may be accomplished by using a valve as a grid leak (Fig. 9).

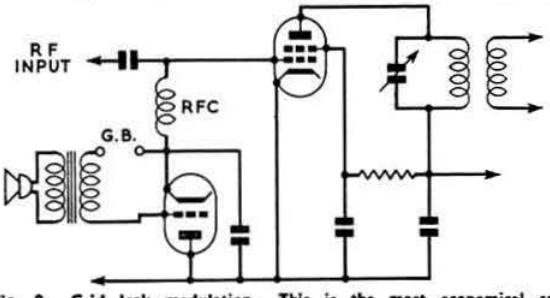


Fig. 9. Grid leak modulation. This is the most economical so far as audio equipment is concerned but the efficiency is low.

The usual adjustments of grid drive and aerial loading at approximately half of the c.w. ratings to give upward modulation are required.

The efficiency of this system is very low, being about 25 to 30 per cent, but on the other hand it is probably the most economical system as it needs only a carbon microphone and transformer, and one small triode.

Cathode Modulation

Modulation may also be applied to the cathode circuit of the p.a. as illustrated in Fig. 10. This is known as cathode modulation and in effect both anode and grid voltages are varied simultaneously. Cathode modulation is, therefore, a compromise between high-efficiency anode modulation and low-efficiency grid modulation. By suitable adjustment, any desired proportion of each form may be achieved. The ratio of anode to grid modulation is controlled by

1. The amount of a.f. power applied.
2. The value of the grid bias on the p.a.

The former obviously determines the amount of anode modulation, while the latter determines the amount of control a given value of modulating voltage will have.

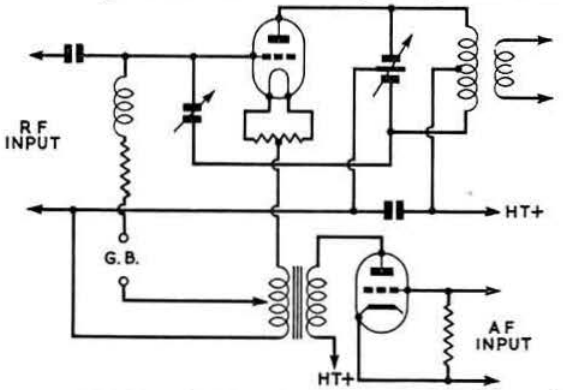


Fig. 10. Cathode modulation. A greater degree of adjustment is possible if the grid return is taken to a tap on the secondary of the modulation transformer.

The grid bias is, of course, controlled by the value of the grid and applied voltage. A greater range of adjustment in the grid circuit may be obtained if the grid return can be made a variable tap on the secondary winding of the modulation transformer, but this is only possible if a multi-ratio transformer is available.

Setting up can be fairly complicated, because in addition to the usual adjustments, the proportion of grid and anode modulation must be adjusted to give full modulation. However, once set up it is capable of very good results.

Low-level Modulation

The modulation systems so far considered are known as "high level" systems because the modulation is applied to the stage working at the highest power level. There is no reason, however, why the modulation should not be applied to a low power stage, the modulated output of which is then amplified. This is called "low level" modulation and is occasionally used in amateur practice. The modulated r.f. voltage is amplified by a linear amplifier or an amplifier operating in class B whose output power is proportional to the square of the input voltage.

The chief practical difficulty in operating such a system is the maintenance of the operating conditions. The impe-

(Continued on page 519)

A Utility Reversible 14 Mc/s Three-Element Beam

An Easily Built Directional Array

By D. J. GRIFFEN (G3EGQ)*

THE aerial system to be described was evolved after a careful consideration of various types of directional arrays. It would appear that the three element Yagi is superior to many other types in respect of its comparatively small size, its useful forward gain and its good front-to-back ratio.

Ideally, such a beam should be rotatable. This necessitates the use of a tower and self-supporting tubing elements, requiring a financial outlay outside the meaning of the word "utility". Accordingly, it was decided to compromise and accept a fixed beam with reversible directivity so that it could be made to radiate in one of two principal directions and which could be suspended between two masts. At the author's location the beam was erected so that maximum radiation took place on bearings of 280 or 100 degrees, giving reasonable coverage of the West Indies, Central and North America in one direction and Europe, Asia, Oceania, Australasia and North and East Africa in the opposite direction.

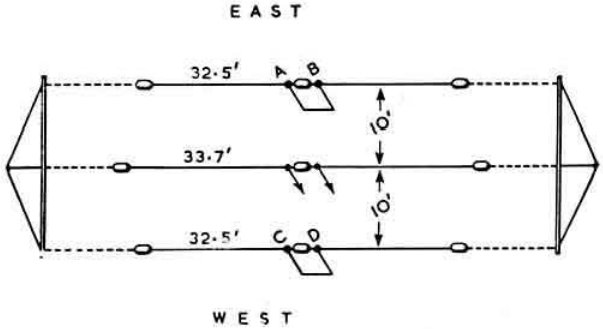


Fig. 1. Dimensions of the utility beam for a design frequency of 14100 kc/s.

Construction

From Fig. 1 it can be seen that the elements are close spaced, with 0.15 wavelength spacing between the radiator and either parasitic element. Reduced spacing of 0.1 wavelength could be employed, but with reduced gain and bandwidth, and a considerable reduction in radiation resistance. The elements are composed of 16 s.w.g. copper wire but in the interests of slightly increased efficiency by the reduction of copper losses they may be lengths of a heavier wire gauge. No. 16 s.w.g. was used by the author to reduce the weight of the beam and, especially, to reduce the strain on the spreaders, two of which are required, each 20 ft long. They may be garden canes strapped together or lengths of light timber. 10 ft garden canes are available from seedsmen and a number of these may be joined together to form a lightweight spreader. Stout timber spreaders are necessary if 12 s.w.g. wire elements are used, but the bamboo spreaders are adequate for the lighter elements. A length of light, portable 80 ohm twin transmission line is used to connect the beam, via a matching device, to the aerial changeover relay in the transmitter.

Performance

Electrically, the beam is quite orthodox, with an estimated forward gain—with reference to a half-wave dipole—of about 7 db and a front-to-back ratio of about 25 db. It has proved most satisfactory for DX working and its good front-to-back ratio has helped to minimize the QRM problem. The radiation resistance at the centre of the driven element is estimated to be about 10 ohms[1].

Reversibility

The beam was originally constructed using parasitic elements of the conventional type with a 35 ft reflector and a 32.5 ft director, but to reverse directivity the feeder had to be disconnected and the entire beam turned over. At the author's location the beam is suspended over sideland complete with blackberry bushes and shrubs, and turning over the beam on a wet, dark and windy night became a rather hazardous task. Accordingly, means were sought whereby the direction of maximum radiation could be reversed, preferably without lowering the beam and certainly without turning it over physically. The easiest solution to this problem would appear to be the use of stub-tuned parasitic elements, and the approach to this solution may best be illustrated by means of numerical examples.

A half-wave element of the correct length to resonate at some given frequency will, at a point of current maximum, possess a purely resistive impedance of approximately 80 ohms. If the element is shortened by a few per cent it may be said to possess capacitive reactance as well as resistance and its impedance may be represented by, say

$$Z = 80 - j10 \text{ ohms.}$$

The shortened element behaves as a director.

An element which is a few per cent longer than an electrical half wavelength may be represented by an inductive reactance in series with resistance, and its impedance may be expressed thus:—

$$Z = 80 + j30 \text{ ohms.}$$

Reconsidering the numerical examples given, it can be seen that a director of

$$Z = 80 - j10 \text{ ohms}$$

will, with the addition of $+ j40$ ohms in series, become a reflector of

$$Z = 80 + j30 \text{ ohms.}$$

Thus, we have only to add an inductive reactance of $+ j40$ ohms in series with a director to convert it into a reflector; by arranging to short-circuit this inductive reactance the reflector may be re-converted into a director.

Now consider how this inductive reactance may best be obtained. A coil may be used but requires protection from the weather. Instead, a length of short-circuited transmission line may be used. This possesses inductive reactance, its magnitude being given by

$$X_1 = j Z_0 \tan \frac{360l}{\lambda}$$

*Eagle Farm, Batheaston, Bath, Somerset.

where l is the length of the line in wavelengths, and Z_o the characteristic impedance of the transmission line.

In the prototype tested, Z_o was approximately 600 ohms but this value is not critical.

It is thus easy to calculate the length of a stub so that it exhibits the desired inductance. There are, however, many variables in Yagi design—the optimum capacitive and inductive reactances are usually unknown —so that in practice it is best to resort to cut and try tactics. The stubs are therefore made longer than the optimum length and the beam adjusted by variation of stub length for either maximum forward gain or maximum front-to-back ratio with the aid of a field strength meter.

Each parasitic element is cut to a length of 32.5 ft, the optimum length with AB or CD shorted. The stub length is 4 ft, each stub made of 18 s.w.g. wire spaced 3in. The radiator is cut to a length of 33.7 ft. By shorting points AB and open-circuiting points CD the beam fires eastwards; shorting CD and open-circuiting AB gives radiation westwards.

Matching System

The importance of a correct match between the feeder and the beam cannot be over-emphasized and in this instance the problem was solved by the use of an uncommon matching device in amateur circles—the reactance transformer. It is shown in Fig. 2. (As a starting point, the radiation resistance was taken to be 10 ohms.) The matching system is versatile and readily adjusted, an important feature when the precise value of radiation resistance is unknown and when there may be some reactance present as well. The inductors consist of five turns of 12 s.w.g. wire, $\frac{1}{2}$in. internal diameter and $\frac{5}{8}$in. winding length, mounted mutually perpendicular. The capacitor is 500 pF variable initially.

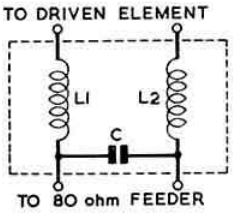


Fig. 2. The matching unit. C is 400pF and L1 = L2 = 0.15μH. During initial adjustments C should be a 500pF variable condenser (see text).

Adjustment

An approximate match between the driven element and the feeder should first be obtained. It will be necessary to check this match after adjustment to the stub lengths, but the first task is to get a certain amount of power into the beam so that this parasitic element tuning may be adjusted.

Suspend the beam about 6 ft above ground. Connect the feeder to a receiver, preferably one possessing an "S" meter. Tune the receiver to a steady signal in the 14 Mc/s band and rotate C to obtain maximum input to the receiver. Now expand or compress the turns on both coils and readjust C to improve the match. It will be found that optimum capacitance is moderately critical but that inductance changes have a relatively small effect.

The beam is now adjusted for optimum match to the receiver. Next check its performance with low power fed from the transmitter. No S.W.R. meter need be used as a check on the accuracy of the match if the following checks are taken and provided the feeder length is not an exact multiple of an electrical half wavelength. Place an r.f. ammeter in series with one leg of the feeder and check that a reasonable reading is obtained; for example 0.5A for 25 watts input to the power amplifier. Now increase the power amplifier coupling and check to see if the tank circuit requires retuning. If the beam is correctly matched and a purely resistive load on the transmitter no retuning should be necessary. If a partially reactive load is thrown on the transmitter, then the inductance and capacitance in the reactance transformer should be adjusted to obtain a reasonable match. This adjustment with power applied to the beam is important, since it is unwise to allow a high S.W.R. with this type of feeder. Now adjust the stub lengths using a field strength meter and give the matching system a final check. It may be necessary to modify the reactance transformer component values slightly. The variable capacitor should be replaced by a high quality fixed capacitor of equivalent value.

It is recommended that the reactance transformer components be mounted in a small weatherproof wooden box, with two stand-off insulators at the top for the radiator connections and a small hole in the base for the feeder. The principle of the reactance transformer may be applied to effect a match between any transmission line and most aerial systems. The relevant formulæ are given in the Appendix.

Insulator and Spreader Losses

Since the ends of the radiator and the parasitic elements are points of voltage maxima, great care should be taken with insulation. Pyrex transmitting type insulators of the smallest possible self-capacitance should be used. Furthermore, there will be dielectric losses in the bamboo spreaders and to minimize these it is recommended that the spreaders be 40 to 50 ft apart.

Remote Control

Ideally, the points AB and CD could be shorted by relay contacts, with the relays suspended at the centres of the parasitic elements, permitting remote control reversibility from the operating position. So far the author has been unable to obtain suitable relays and, instead, removable straps have been used. The use of tilting mercury switches might be worth investigation. Alternatively, stubs which are a half wavelength plus 4 ft may be used, adjustment at ground level then being possible. (This assumes the beam to be a half wavelength above ground.) The problems associated with this idea of reversible directivity are mechanical rather than electrical and their solution is left to the ingenuity of those sufficiently interested to investigate the possibilities.

With remote control one may switch over instantaneously from say North America to South Africa and obtain an immediate comparison of the front-to-back ratio of the beam. The beam has been in use at G3EGQ for several months and has come up to all expectations.

References

[1] *Radio Amateur's Handbook, 1955.*
[2] *A.R.R.L. Antenna Book.*

Appendix

The values of inductance and capacitance used in the reactance transformer may be obtained from the formulæ given below.

Inductance

$$(1)\quad X_1 = R\sqrt{\frac{Z_0}{R} - 1} \text{ ohms}$$

where Z_0 is the characteristic impedance of the feeder, and R is the radiation resistance of the driven element.

Substitute the value of inductive reactance in the next expression to obtain the actual inductance.

$$(2)\quad L = \frac{X_1}{2\pi f}\ \mu\text{H}$$

where L is the inductance,
X_1 is the inductive reactance given by the previous formula and
f is the frequency in Mc/s.

Capacitance

$$(3)\quad X_C = \frac{Z_0}{\sqrt{\frac{Z_0}{R} - 1}} \text{ ohms}$$

where Z_0 is the characteristic impedance of the feeder and R is the radiation resistance.

Substitute the value of capacitive reactance obtained in the next expression to find the actual capacitance.

$$(4)\quad C = \frac{10^6}{2\pi f X_C}\ \text{pF}$$

Note Each coil in the reactance transformer should have half the total inductance given by formula (2).

Alternatively, stub matching may be used. An open-circuited stub may be attached to the main transmission line; the length of the stub and its point of attachment to the line may be determined from data given in reference 2.

This type of matching is recommended should a modified version of the beam be constructed for use on the 21 or 28 Mc/s bands. At these higher frequencies, the reactance transformer method requires extremely small values of inductance and it becomes impracticable to construct suitable coils.

If stub matching is used, the velocity factor of the 80 ohm line (0.67) should be taken into account when calculating the length of the stub and the distance between its point of attachment and the centre of the driven element.

Solid-state Battery

AN American company has recently announced a new battery which constitutes a water-free primary energy source. In contrast to conventional dry batteries which contain some water solution and a depolarizer, the new voltage battery has no water in its make-up. It is a true solid-state energy source. Voltage is generated by the differential in contact potential between two conductors in contact with a solid electrolyte.

The battery undergoes negligible chemical reaction when idle. On the basis of current tests, shelf life of ten years or more is expected. This characteristic indicates particular usefulness in military and civilian applications which require extremely long shelf life. Small size per volt of output is made possible by the inherent nature of the battery; 200 volts can be obtained from a unit one cubic inch in volume. As a result of its completely dry construction, the battery holds stable output voltage over a temperature range from −65° to 165° F. Efficiency does not drop at the low limit of this range. (From *Electronics*, quoted by the *I.T.U. Journal*.)

Systems of Amplitude Modulation

Continued from page 516

dance of the grid circuit varies appreciably, and so a low impedance source of grid drive is required. As in grid modulation, the regulation of the exciter may be improved by providing excess drive and dissipating a fairly large proportion of it in a lamp or resistor. A linear stage should always be operated as a straight amplifier and not as a frequency multiplier, otherwise the depth of modulation is increased accordingly.

Summary

There is no doubt whatever that anode modulation is the most effective system of amplitude modulation from all points of view and as such it should be the aim of every serious telephony worker. It has, however, the disadvantage that the a.f. power requirements are the highest, thus the modulator and associated power supply are expensive and often complicated pieces of equipment.

Other systems are appreciably less effective as means of modulation, although it may be argued that the overall efficiency of a transmitter employing any of the efficiency systems is much higher on account of the smaller amount of audio equipment required. This may well be a powerful argument in the case of portable, mobile or battery-operated equipment, but it should be kept in its proper perspective in fixed station work.

Not the least important aspect of Amateur Radio is making do with apparatus which is available or easily obtainable and in such cases choke and series modulation have a lot to recommend them. Choke modulation is a very useful method of utilising a single r.f. triode as a modulator valve, while series modulation enables a single high voltage power supply to be used with small valves.

There is not a great deal of difference between any of the variable efficiency methods. They are all capable of excellent results but in general they are harder to set up than anode modulation. With very great care in adjustment and operation, they may be safely operated at somewhat higher than the published ratings for a given valve. The published ratings usually refer to maximum conditions but due to the "peaky" nature of the speech waveform the average conditions are appreciably less. This is a course which obviously needs to be followed with great discretion.

The various efficiency systems do, however, present to the amateur whose main interest lies in c.w. operation a convenient method of telephony operation.

Bibliography

"Modulating the Carrier," Thomas, L. H., *Short Wave Magazine*, July, 1946, August, 1946.

"Efficiency Systems of A.M.", Gunnell, L. M., R.S.G.B. BULLETIN, January, 1949.

"Clamp Modulation," Wood, A. G., *Short Wave Magazine*, March, 1951.

"More About Clamp Modulation," Spittle, J. D., *Short Wave Magazine*, September, 1951.

"Parallel Cathode Modulation," R.S.G.B. BULLETIN, January, 1950.

"Design Limits for 'High Output' Grid Modulation," *QST*, February, 1951.

"Series Modulation," Vass, A. G., R.S.G.B. BULLETIN, July, 1938.

"Direct-coupled Screen Modulator," Dunn, A. G., R.S.G.B. BULLETIN, July, 1952.

"Screen Modulation," Russell, O. J., R.S.G.B. BULLETIN, January, 1955.

Winding Coils on Standard Formers

By J. GREENWELL (G3AEZ)*

COIL formers of the Aladdin type are widely used in modern radio equipment, not least in amateur gear. The home constructor however is always faced with the problem of "how many turns" for any particular application. For this reason the two charts which form part of this article have been prepared to enable the amateur to calculate quickly and easily the necessary winding data.

Use of Chart I

The use of Chart I is best illustrated by describing a typical calculation.

Example: It is required to wind a coil on an Aladdin type F804 former which will resonate at 7 Mc/s with a 50μμF condenser.

The method is as follows:—

1. Draw a straight line through 50μμF (axis A) and 7 Mc/s (axis B).

2. Project the line to cut axis C and read off the required inductance, which in this case is 10.3μH.

3. Draw a horizontal line through 10.3μH on axis D and a vertical line through a reasonable winding length (say 0.5in.) and determine the most suitable wire gauge to use, i.e., 32 s.w.g.

4. From the 32 s.w.g. curve determine the exact winding length to give an inductance of 10.3μH, i.e., 0.48in.

The coil required will therefore be close wound with 32 s.w.g. enamelled copper wire and 0.48in. long.

If desired, the number of turns may be calculated using wire tables (such as Table I) from which it will be found that the turns per inch for 32 s.w.g. enamelled copper wire is 83. Hence, a winding 0.48in. long will consist of [83 x 0.48] = 40 turns.

Table I

The following table, prepared from information provided by the London Electric Wire Company, shows the minimum turns per inch for enamelled copper wire of the gauges most commonly used by amateurs.

Gauge	Turns	Gauge	Turns
20 s.w.g.	26 t.p.i.	32 s.w.g.	82.6 t.p.i.
22 s.w.g.	33 t.p.i.	34 s.w.g.	96.2 t.p.i.
24 s.w.g.	41.5 t.p.i.	36 s.w.g.	116.3 t.p.i.
26 s.w.g.	50.3 t.p.i.	38 s.w.g.	144.9 t.p.i.
28 s.w.g.	61 t.p.i.	40 s.w.g.	178.6 t.p.i.
30 s.w.g.	72.5 t.p.i.	42 s.w.g.	212 t.p.i.

For coils of low inductance, i.e., less than 1μH, it is advisable to space wind rather than close wind with a heavy gauge wire. Curves are, therefore, given in Chart I for pitches of 10, 15 and 20 turns per inch using 26 s.w.g. enamelled copper wire. Other gauges may be used, however, without introducing significant errors.

The values shown in Chart I for Aladdin F804 formers have been calculated for formers without cores. The variation in inductance obtainable with dust-iron or brass cores depends on the winding length and composition of the core material and no simple correction factor may be quoted. However, experiments show that for coils between 0.3 and 0.8in. long a dust-iron core will give a maximum possible inductance of about twice the "core-less" inductance and a brass core a minimum possible inductance of about 0.8 times the "core-less" inductance. These factors should be borne in mind when designing variable inductances from the charts.

Wigmore Lodge, Beare Green, near Dorking, Surrey.

Chart for 0.3 Inch Diameter Formers

The inductance required is found from Chart I in the same way as for Aladdin F804 formers and the winding details determined from Chart II.

Measurements show that the effect of a screening can on the average coil wound on 0.3in. diameter formers is to reduce the inductance by about 5 per cent.

When designing very low inductance coils, an allowance of approximately 0.15μH should be made for the leads.

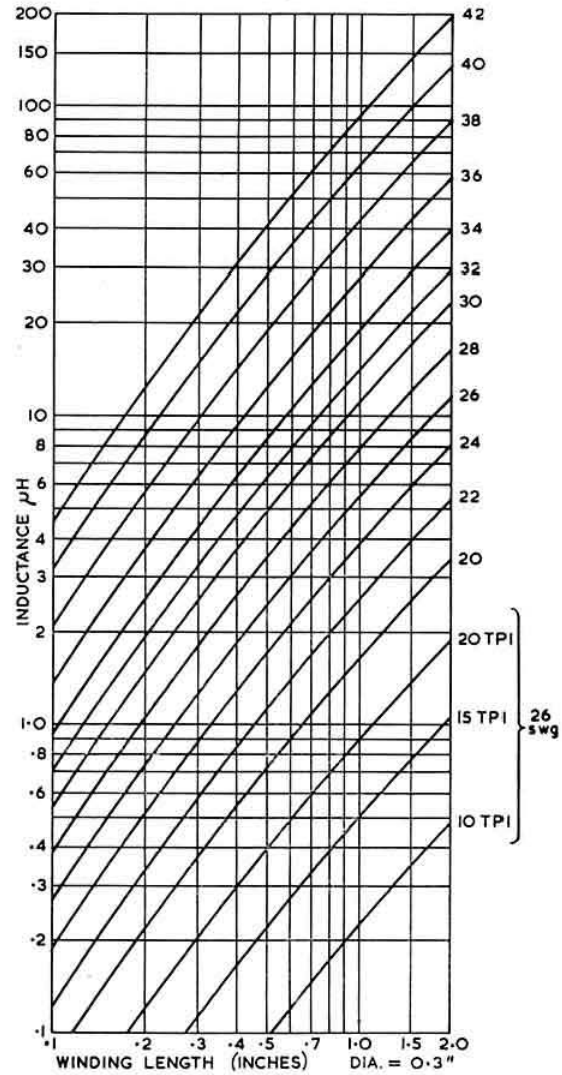


Chart II. Winding data for 0.3in. diameter coil formers.

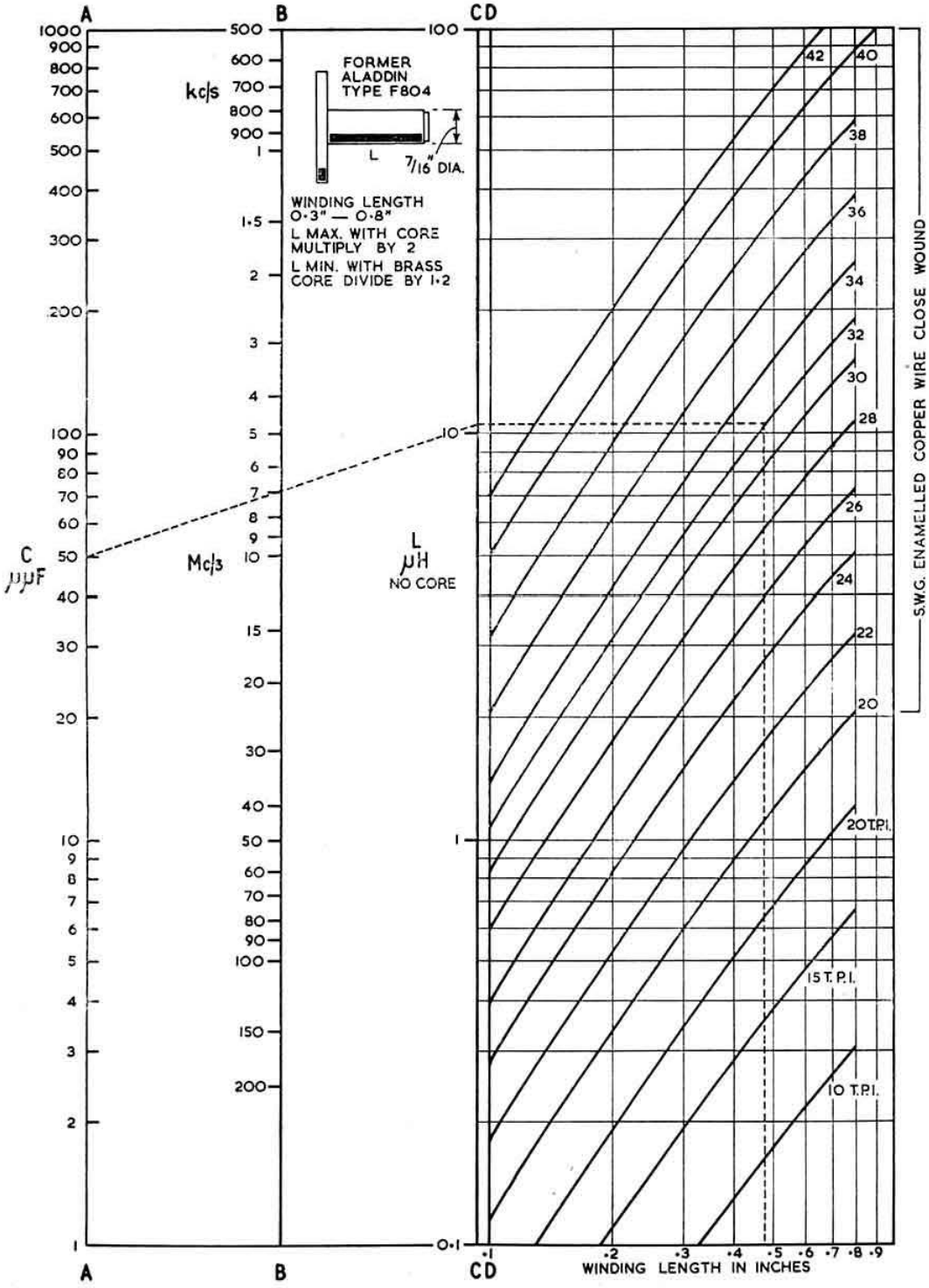


Chart 1. The calculation of inductance required and winding data for Aladdin type F804 coil formers. The dashed lines refer to the worked example.

Modifying the B2 Transmitter for V.F.O. Operation

Simple Modifications to the Oscillator Section

By L. CRITCHLEY (G3EEL)* and N. CARTER (G2NJ)**

There have been many requests for information on modifying the Type III Mark II transmitter (popularly known as the B2) for v.f.o. operation. The writers here describe how this can be effectively carried out without the need for constructing a separate unit.

AFTER trying various portable v.f.o. units, it was decided to provide an internal v.f.o. which would operate from the B2 power pack without increasing the current drain on the batteries. It was considered that, with the minimum of alteration to the existing crystal oscillator unit, the EL32 valve could be made to function as quite an efficient electron coupled oscillator and it was with this in mind that a B2 transmitter unit was modified and tested.

The front panel and controls were first removed and then the crystal selector switch, together with the

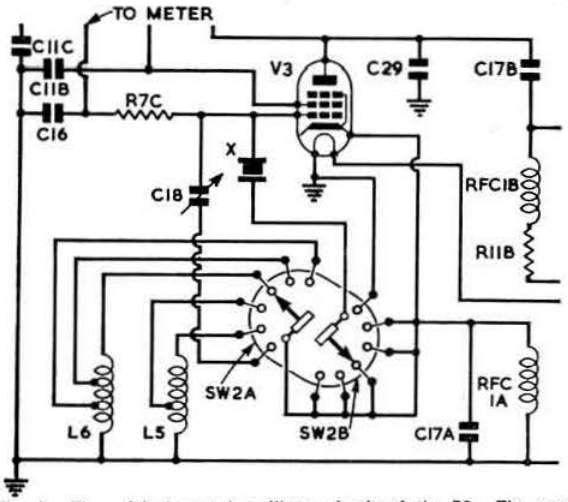


Fig. 1. The original crystal oscillator circuit of the B2. The component numbering is the same as in the circuit printed in the R.S.G.B. Members' Circular issued in October, 1947.

cathode coil units. As it was intended to modify the transmitter for use on 1.8 Mc/s and 3.5 Mc/s, the former of the larger cathode coil was retained, stripped of its windings, and re-wound with 54 turns of closely wound No. 30 s.w.g. enamel wire, tapped at 14 turns from the earthy end. This coil was re-mounted in its original position.

The remainder of the original wiring above the chassis associated with the 40$\mu\mu$F trimmer, which is fixed to the side of the chassis, was taken out, care being taken not to remove the connection to the cathode of the EL32, which passes through the chassis via a rubber grommet located near the 40$\mu\mu$F trimmer. This wire serves as a convenient connection to the cathode tap on the coil.

*36 Waterloo Road, Peterborough.
**34 West Parade, Peterborough.

Components Required

Additional components required are a small panel mounting air spaced trimming condenser of about 75$\mu\mu$F, this being the largest which could be accommodated, and two 316$\mu\mu$F silver mica condensers. The air spaced trimmer should be mounted on the panel in the position previously occupied by the crystal switch with one of the 316$\mu\mu$F silver mica condensers wired in parallel with it.

The remainder of the wiring is straight forward. The "hot" end of the coil should be connected to the fixed vanes of the tuning condenser. The earthy end of the coil can be earthed to the chassis by a solder tag on the metal cover holding the 40$\mu\mu$F trimmer. To this point it is necessary to connect one of the leads to this condenser which, as will be seen later, serves to set the band edge. The cathode tap from the coil is soldered to the lead from the cathode of the EL32 valveholder which was previously left poking through the chassis. The other side of the 40$\mu\mu$F trimmer is wired to the fixed vanes of the tuning condenser. As a precaution against faulty contact between the spindle of the tuning condenser and the chassis, the solder

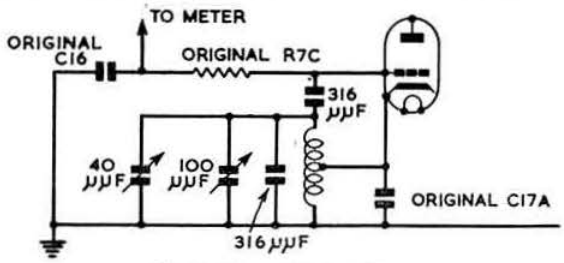


Fig. 2. The modified oscillator.

tag on the moving vanes of the tuning condenser was earthed to the chassis.

All that remains is to connect a grid condenser from the "hot" end of the tuning coil to the leg of the crystal socket which carries the connection to the cap of the EL32.

The grid leak to the EL32 is left undisturbed, thus permitting metering of the oscillator grid current.

1.8 Mc/s Operation

It was found necessary when the unit was used on 1.8 Mc/s, to arrange for a capacity of 130-140$\mu\mu$F to be placed in parallel with the grid tuning condenser of the 6L6 valve. This can be done by connecting the condenser in series with a switch mounted on the front of the panel near the top right-hand corner of the meter, thus enabling the capacitance to be switched in and out of circuit at will.

The unit was then re-assembled, a scale of cardboard or similar material being pasted over the calibrations of the crystal selector switch and the v.f.o. tuning condenser fitted with a suitable knob. (A slow-motion dial would be an asset here.)

The C17A 100 $\mu\mu$F silver mica condenser, which is shown in Fig. 1 wired between the cathode of the valve holder and earth, and situated under the chassis, was left

in position as a result of an over-sight. As the unit worked well, this was not altered. It has been noted however, that this capacitance is effectively in parallel with the portion of the coil between cathode tap and earth.

V.F.O. Coverage

Drive to the 6L6 is the same when working from either the fundamental or second harmonic of the v.f.o. By judicious adjustment of the 40$\mu\mu$F trimmer, it is possible to make the v.f.o. cover from 1800 to 1915 kc/s. This adequately covers those portions of the band consistently used by the operators and also permitted full coverage of the 3.5 Mc/s band. If full coverage of 1.8 Mc/s is required, it can be obtained by adjusting the 40$\mu\mu$F trimmer at the expense of coverage on 3.5 Mc/s.

In a second unit which was similarly converted, a 100$\mu\mu$F air-spaced trimmer of smaller dimensions was accom-

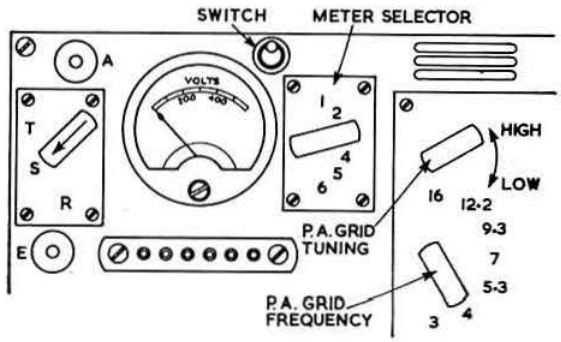


Fig. 3. Front panel arrangement of the B2.

modated in the space previously occupied by the crystal selector switch. With this condenser as tuning control for the v.f.o., rather better coverage of the 1.8 Mc/s band was secured, it being possible to tune to 1940 kc/s with only 49 turns on the coil, tapped at 13 turns from the earthy end. Full coverage of 3.5 Mc/s was still obtained.

Results Achieved

Both units work well. Adequate drive is obtained on both 1.8 Mc/s and 3.5 Mc/s and the output from the 6L6 was the same as with crystal operation. The v.f.o. is very stable and does not appear to suffer from drift due to warming up. Both transmitters were left on and monitored by station receivers for approximately an hour when no change in the pitch of the beat oscillator was noticed. A slight disadvantage is that the v.f.o. tends to pull somewhat when the p.a. stage is tuned but this effect is not as pronounced on 3.5 Mc/s when working on the second harmonic.

The transmitter keys well in the p.a. as previously and is remarkably free from chirp, except when the aerial circuit is particularly heavily loaded. (It has been found in the operator's judgment that judicious adjustment of aerial loading and grid drive will eliminate chirp to the ears of all but the hyper-critical.) No reports of chirp have been received when the units are mains operated.

A B2 unit, converted as above but with suitably reduced power, was used on 1.8 Mc/s and 3.5 Mc/s during National Field Day, 1955, and only one T8 report and three T9c reports received out of 400 otherwise T9 contacts! It might be mentioned that both units have been modified for screen modulation by the gating system and that details of this modification, which is equally as simple as that just described, are in course of preparation.

Television in the Service of Science

THE Seventh Memorial Lecture of the Television Society commemorating the life and work of Sir Ambrose Fleming, the inventor of the radio valve, was given this year by Professor J. D. McGee of Imperial College. Professor McGee, who is well-known for his pioneer work in the development of the Iconoscope, chose for his subject "Television in the Service of Science" and considered in detail the possible extension of television techniques for scientific purposes into the infra-red, ultra-violet and X-ray ranges of the spectrum.

Considering the infra-red radiation, two types of television microscope were described. The first used a conventional light source and television camera tube, while the second microscope used a flying spot scanner, photo-multiplier and a display cathode ray tube.

Conventional ultra-violet microscopes covering the range 2,000 Angstrom units to 4,000 Angstrom units have been designed and used, but they have the limitation that the operator cannot observe what is happening to the specimen. Television techniques using an ultra-violet sensitive photo-cathode together with a quartz window can overcome this defect. This technique has great possibilities in the biological field and in particular for cancer research.

Radiologists employ X-ray techniques in their investigations and diagnoses in the medical field. However, with present practice, observations can only be made under dark adapted eye conditions, and it is known that under such conditions the eye loses acuity. This loss of acuity can be overcome by using an X-ray sensitive camera tube, operating on the photo-conductive principle. Existing image intensifier fluoroscope techniques could be extended by replacing the small viewing screen with a storage surface and scanning this in the normal manner to produce a television signal. For the observation of any rapid movement, the lag normally associated with photo-conductive surfaces would have to be overcome.

The detection of gamma-rays which are of even shorter wavelength than X-rays is at present being achieved by a phosphor/photo-multiplier combination. The quantum efficiency is, however, exceedingly low and the storage principle could be of great use.

A further application of television camera tubes is in the detection of faint optical images, for example as are encountered in astronomy and astro-physics. The main difficulties associated with existing optical telescopes are the long exposures required to record a satisfactory image of the distant stars, together with the general fogging due to sky glow.

The greater quantum efficiency of the photo-electric effect, which can reach 20 per cent., would help considerably in astronomy. In addition, it is known that the reciprocity law holds down to very low light levels; a wide range of wavelengths can be covered; electronic presentation is possible; the signal to noise ratio is improved; and that the sky background can be removed electronically. All these factors of the photo-electric effect could be useful in extending the range of the existing 200in. Hale telescope such that it would be possible to record stars whose brightnesses are three magnitudes smaller than those observed at present. This would mean that light would be observed from stars which had taken 5,000 million years to reach the earth.

In conclusion, Professor McGee outlined the requirement of a television camera tube which could effect this improvement in astronomy. The main properties of this tube would be good quantum efficiency, good linear integration, the target surface to be highly insulating, good reproducibility of pictures, and the rejection of the background signal.

Society News

Licence Examinations

THE G.P.O. is again arranging to conduct technical examinations and Morse tests for the Amateur (Sound) Licence in the autumn, provided sufficient applications are forthcoming.

The technical examination will be held on Saturday, October 6, 1956, from 2.30 to 5.30 p.m. at the following centres:—

Armour House, St. Martin's-le-Grand, London, E.C.1.

Radio Surveyor's Office, Ministry of Transport and Civil Aviation, 2 Bute Place, Cardiff.

Radio Surveyor's Office, Customs House, Dock Place, Leith, Edinburgh, 6.

Applications to sit the examination, accompanied by a remittance for the entrance fee of 25s., must reach The Wireless Telegraphy Section, Radio & Accommodation Dept., Union House, St. Martin's-le-Grand, London, E.C.1, *not later than Saturday, September 1, 1956.*

* * *

Morse Tests will be held at the Head Post Offices in Birmingham, Cambridge, Derby, Leeds and Manchester during the first week in September, 1956, provided there are sufficient candidates. Application forms may be obtained from the Radio Branch, Radio & Accommodation Dept., Post Office Headquarters Building, St. Martin's-le-Grand, London, E.C.1. Completed application forms, to which the entrance fee of 10s. must be affixed in stamps, must be posted to the Wireless Telegraphy Section, Radio & Accommodation Dept., Union House, St. Martin's-le-Grand, London, E.C.1, *to arrive not later than August 20, 1956.*

Publicity for Instruction Courses

ORGANIZERS of courses of instruction for those intending to take the Radio Amateurs' Examination in May, 1957, are asked to send full details as soon as possible for publication in the BULLETIN. By securing such publicity, prospective students and organizers will be able to make their plans well in advance.

G3IGV in Birthday Honours List

CONGRATULATIONS are offered to Mr. J. W. Birkbeck (G3IGV) of St. Austell, Cornwall, who was awarded the B.E.M. in the recent Honours List. Mr. Birkbeck, a blind telephonist, operates the switchboard at the St. Austell Employment Exchange.

National Radio Show

HEADQUARTERS will be pleased to hear from members willing to do stand duty at the National Radio Show at Earls Court from August 21, to September 1.

The theme of the Society's stand—No. 305—will be "An Introduction to Amateur Radio."

Society Blazer Badge

IT is regretted that the motto used on the first batch of Society blazer badges was incorrect. The new motto is "Per Artem Amicitia" which means "Through our Art to Friendship."

Members who purchased original badges are invited to return them to Headquarters for replacement, free of charge.

To meet a popular demand, the badges will be available on a dark blue as well as on a black background cloth. The price for either type is 7s. post free from Headquarters. New supplies are expected in mid-July.

Correction

IT is regretted that Mr. F. Hicks-Arnold's name was omitted from the list of Council Members present at the Council Meeting held on March 20, 1956, and published in the résumé on page 481 of the May BULLETIN.

R.S.G.B. News Bulletin Service

GB2RS		**3600 kc/s**
10.00 B.S.T.	**Sundays**	**12.00 B.S.T.**

Technical Articles

THIS issue contains many more technical articles than usual. In order that this standard may be maintained far more material will be required for publication.

Offers of articles on all aspects of Amateur Radio are invited. Practical information on transmitters, receivers, gadgets, "gimmicks," aerials, v.h.f. and u.h.f. equipment, single sideband and mobile gear will be particularly welcome. All articles accepted for publication will be paid for at the Society's usual rates.

A helpful leaflet—*Hints to Contributors*—will be gladly sent by Headquarters on request.

Contests Diary

1956

June 24	-	D/F Qualifying Event (South Manchester)[4]
July 7–8	-	144 Mc/s Contest[5]
July 8	-	D/F Qualifying Event (High Wycombe)[4]
July 14–15	-	*Short Wave Magazine* All-European V.H.F. Contest[6]
July 21–22	-	*Short Wave Magazine* All-European V.H.F. Contest[6]
August 18–19		Region 1 V.H.F. Contests[8] (organized by individual national societies)
August 19	-	144 Mc/s Field Day No. 2
September 2	-	Low Power Field Day[7]
September 2	-	1250 Mc/s Tests[7]
September 8–9	-	European V.H.F. Contest[2] (organized by D.A.R.C.)
September 9	-	D/F National Final
September 9	-	420 Mc/s Contest No. 2
October 6–7	-	Low Power Contest
October 6–7	-	VK/ZL DX Contest (organized by N.Z.A.R.T.)[5]
October 13–14	-	VK/ZL DX Contest (organized by N.Z.A.R.T.)[5]
November 10–11		Top Band Contest No. 2
November 24–25		21–28 Mc/s Phone Contest[2]

Unless otherwise indicated all contests are arranged by the R.S.G.B.

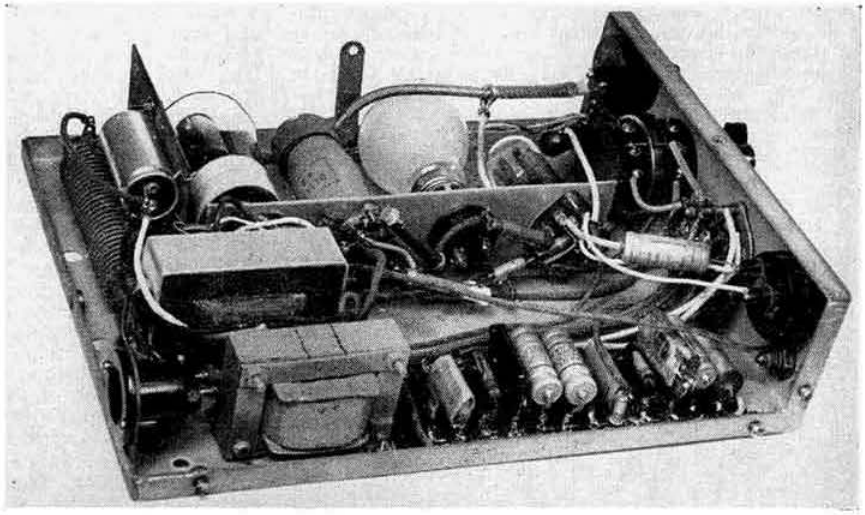
[1] For rules, see page 532.
[2] For rules, see page 480, R.S.G.B. Bulletin, May, 1956.
[3] See page 285, December, 1955, and page 386, March, 1956.
[4] For details, see page 478, R.S.G.B. Bulletin, May 1956.
[5] For rules, see page 431, R.S.G.B. Bulletin, April, 1956.
[6] For rules, see *Short Wave Magazine*, May, 1956.
[7] For rules, see page 532.
[8] For details, see page 538.

A Simple Audio Oscillator

By

A. H. KOSTER,

Dr. Ing. (G3ECA)*



V1 is at the top right, with the lamp between it and the cathode follower V2. The power supply is at the left of the picture.

AN audio oscillator is a useful piece of test gear all too frequently missing from the average amateur workshop. It need not be very complicated and in fact the essential part of the circuit to be described consists merely of two equal RC time constants, one in parallel and one in series, which are connected to a regenerative system such that the gain and phase relationship will sustain oscillation at a frequency which depends solely on the RC value.

This type of oscillator has been described in several forms with a varying number of valves and accessories to achieve certain results[1]. A particularly simple circuit[2] employs one twin triode. It fulfills the requirements which the radio amateur needs for testing modulators and a.f. amplifiers or for oscilloscope work. The range is wide, the harmonic content low, the output large and of reasonably constant amplitude over the ranges.

*195 Woodford Avenue, Ilford, Essex.

The Circuit

Fig. 1 shows the oscillator feeding a cathode follower so that it remains unaffected by the load into which it may have to work. The switch S1, S2, provides six ranges covering 32 c/s to 33 kc/s. This could be covered in three ranges, i.e., ranges 1, 3 and 5, but if this were done the scale would become rather cramped at the high frequency end of each range.

The frequency can be readily calculated from $f = 1/2\pi RC$ where R is the value to which one section of the twin potentiometer VR1, VR2, has been adjusted, and C is the capacity of the respective range condenser. For this relationship to hold, the R and C values in each section should be within $\pm$ 1 per cent of each

C1, 7, 0.05μF; C2, 8, 14, 0.02μF; C3, 9, 0.005μF; C4, 10, 0.002μF; C5, 11, 0.0005μF; C6, 12, 0.0002μF; C13, 0.1μF; C15, 16μF; C16, 8μF; CH1 5H 50mA; Lamp, see text; MR, 250V 50mA metal rectifier; R1, 500,000 ohms ½ watt; R2, 750 ohms ½ watt; R3, 1000 ohms ½ watt; R4, 30,000 ohms ½ watt; R5, 10,000 ohms ½ watt; R6, 1 Megohm ½ watt; R7, 5,000 ohms 2 watt; R8, 150 ohms ½ watt; R9, 6,800 ohms 1 watt; S1, S2, 2-pole 6-way Yaxley type switch; S3, single pole 2-way switch; T1, 200V 50mA, 6.3V 1A; V1, 6SN7; V2, VR65; V3, VR150/30; VR1 + VR2, twin potentiometer 100,000 ohms each section, 3 watts; VR3, 50,000 ohm potentiometer; VR4, 500,000 ohm potentiometer; VR5, 10,000 ohm potentiometer.

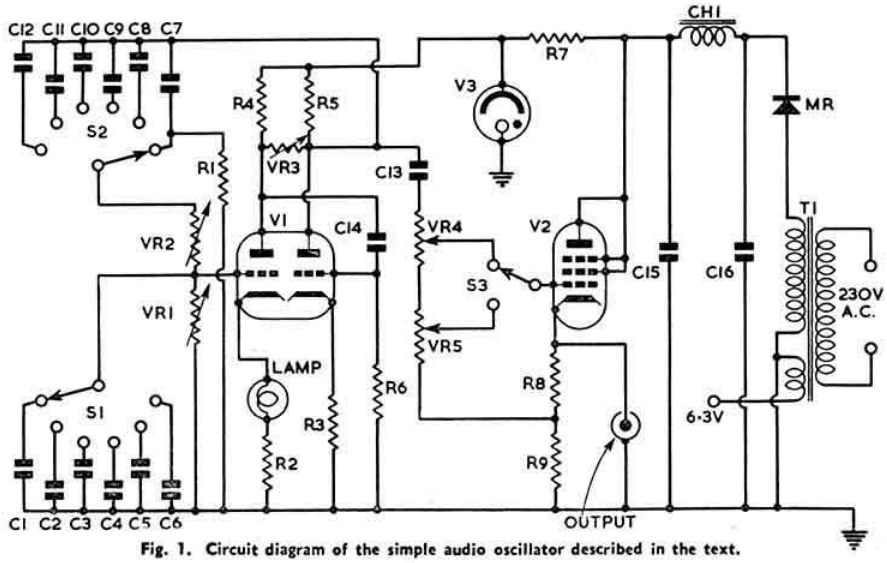


Fig. 1. Circuit diagram of the simple audio oscillator described in the text.

other. Greater discrepancy makes calculation more difficult and calibration is recommended if better accuracy is required. However, the circuit will oscillate without trouble if the components vary by as much as ± 10 per cent.

Each section of the potentiometer VR1, VR2, is 100,000 ohms. Other values can be used, e.g., 50,000 ohms, in which case all the associated capacity values should

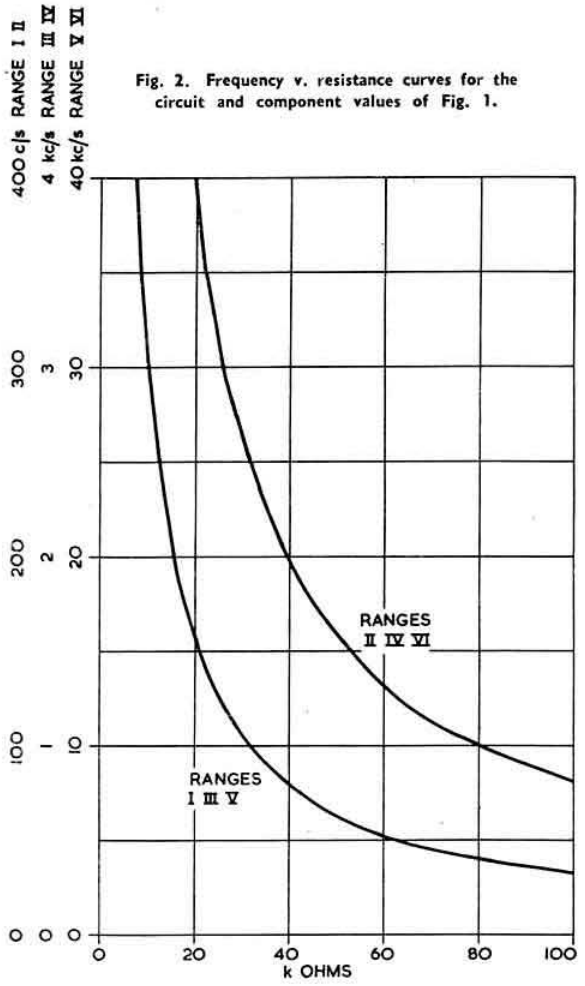


Fig. 2. Frequency v. resistance curves for the circuit and component values of Fig. 1.

be doubled, or 200,000 ohms with all the capacity values halved. Beyond these extremes, the R/C ratios become rather big in one case and rather small in the other, and oscillation is erratic at the ends of each range. For some applications it may be desirable to cover only 1 octave per range and it is quite easy to select capacity values and a twin potentiometer with fixed series resistors to cover the audio spectrum from 32 c/s to 33 kc/s in ten octaves.

Fig 2 shows the frequency v. resistance curves of the circuit described: on ranges 1, 3 and 5, and on ranges 2, 4 and 6. It is clear that the 10 octaves can be covered without the cramped part of each range by working from 100,000 ohms to 20,000 ohms.

The lamp in the cathode circuit of V1 is a 230 volt type of 5 to 15 watts consumption. The bulb used took 8 watts when connected to the 230 volt mains supply and there was nothing to choose between it and others of similar value, provided VR3 was adjusted as described later. The resistance of the lamp varies with the thermal effect of the current flowing through it and keeps the amplitude of oscillation reasonably constant independent of the frequency. Of course, the bulb does not show a light. Its operation can be verified by watching the a.f. voltage across it on an oscilloscope. The thermal lag of a few seconds can be observed and the bulb therefore requires to accommodate itself after a frequency change has been made.

The variable resistor VR3 is a regeneration control and has a marked effect on the distortion present. If VR3 is at its maximum value the output is more or less distorted at all frequencies. Its resistance should be reduced until the circuit just oscillates satisfactorily on all ranges. Oscilloscope traces of the output look clean with the exception of those on the lowest range which still have a slightly flattened crest. This can be remedied by shunting C7 to earth with a 500,000 ohm resistor R1.

The cathode follower stage (V2) and the power supply are quite orthodox. The maximum audio voltage available is about 7 volts R.M.S. For many purposes, smaller voltages are required and VR5 in conjunction with S3 permits the output to be adjusted from 0 to 150 mV.

References

(1) "Audio Signal Generator," M. G. Scroggie *Wireless World*, August and September, 1949.

(2) "A Simple Wide Range Sine Wave Generator," A. D. Booth, *Electronic Engineering*, March, 1953.

London V.H.F./U.H.F. Convention

Continued from page 512

display. First prize went to G3HBW for his 1250 Mc/s converter, second to F3SK for the 72 and 1260 Mc/s converter previously mentioned, and third prize to G3HRH for a table-top two-metre ten-watt transmitter, receiver, modulator and power supply. It was announced that Dr. Smith Rose who, together with Mr. Corfield, had kindly judged the competition, had decided to offer two further prizes and these were awarded to G3EOH for his "Poor Man's" 70 cm Signal Generator and to G3HT for a very compact 70 cm field strength meter consisting of a crystal diode followed by a transistor amplifier. The event concluded with a free raffle for the many valuable prizes kindly donated by various manufacturers, among which were those mentioned on page 424 of the April BULLETIN.

Altogether a most enjoyable event.—W.H.A.

Swiss DX Programme

ON the first Thursday in each month at 19.05 G.M.T. the Overseas Service of the Swiss Broadcasting Corporation transmits a DX Programme for amateurs and short-wave listeners. Presented by Russell Henderson, the programme features interviews, the Broadcast Bands Review prepared by Otto Berner (HB9GI), Radio Amateur DX and Overseas News by Etienne Héritier (HE9RDX) and news about amateur activities in Switzerland by Max de Henseler (HB9RS). The programme is beamed to Great Britain and Ireland on 9665 and 11865 kc/s. Comments, suggestions and reception reports are most welcome and should be addressed to Swiss Shortwave Service, Neuengasse 23, Berne.

THE MONTH ON THE AIR

By S. A. HERBERT (G3ATU)*

THIS edition of *M.O.T.A.* cou'd truthfully be called *T.W.O.T.A.* as only two weeks have passed since writing the May screed! However, things are now back to normal once more, editorially at least. On the bands, two weeks have failed to produce anything of a major change in conditions, which remain unexciting for most of the time. However, fifteen and twenty have a habit of producing the goods just at the point when people are beginning to despair of ever hearing DX again. Then down drops the curtain once more and back we are where we started. Increasing sunspot numbers are bound to have their effect, though, and the present blank periods must be a prelude to bigger and better DX openings. In the meantime, to see what is already going on, we make a start with our highest frequency band.

Ten Metres

Although approaching summer is doing no good at all to DX conditions, it is surprising to note the variety of calls still available during times when the band *is* open. **B.R.S.18017** (Warwick) covered four bands in the last month and he says that 28 Mc/s is almost his favourite now. Phone gave him two new ones—YN1HF and ZD8SC, to make his total 39Z-208C on all bands since 1946. What might the missing Zone be? **B.R.S.20135** (Newport, I.o.W.) has been busy preparing for the annual "invasion" of the island and so his list is a joint one—a co-operative father helped to sort out DX from noises made by hair-dryers, milking-machines, diathermy equipment and other aids to concentration, with the result that CR6BH, '7AG, '9AH, FB8BC, XE1GE, YN4CD, VU2EJ, 4S7WA, W0PQR/VE8 (Resolution Is.), MP4BBW, SM8CSH/MM (Indian Ocean), VK6RU, '6FL, '6NF, VE4RO, ET2FM, TI2LA, ZP5JE, ZS, CX, ZC4, KZ5 and VQs 2, 4 and 5 feature in their phone log.

G3JFF (Kingswear) found the band wide open one day, with Ws fighting it out with Radio Italia, whose harmonic, or whatever it was, boomed out loud and clear on 28450 kc/s. (At any rate, it makes a change from Moscow Radio, which usually has two harmonics thereabouts!)

Fifteen Metres

Very much the same sort of situation exists as on ten metres, with various non-amateur noises drowning the rare stuff from time to time, but the phone man can still depend on a goodly assortment of DX for at least some of the time. The c.w. end remains somewhat sparsely populated, apart from W and VE, although the odd XE, VK and VS is sometimes to be found. **B.R.S.20135** happened on KR6QV (100 watts), 4S7GE, ZD8SC, VS1DU, VU2RC, VE7ZM, YI2DK, MP4KAC, ET2FM, VP4TM, '5RR (Turks Is.), '6GT, ZD2JHP, VQ5GC and some VKs on A3, while **B.R.S.18017** unearthed FF8AK, FQ8AK, MP4BBO, VU2JP, ST2DB and ZS9G. One or two ELs are also around, on both A1 and A3.

*Roker House, St. George's Terrace, Roker, Sunderland.

Twenty Metres

Twenty seems to have come into its own again this month, with a little more DX workable in the early morning, evening and late night periods, but during the day there has been little except European skip, with even the Ws weak. Early mornings, however, have often seen the band wide open to the rarer American States. Wyoming, Utah, Nevada, Montana and New Mexico have been represented and CE0AD (Easter Is.) has been heard strongly around 06.00 G.M.T., apparently passing traffic to South America, *circa* 14090 kc/s. Pacific openings are still disappointing on the whole, with VK and ZL weak or absent altogether. W stations have been calling KX6BU, KJ6BN and KC6s shortly after mid-day and the KC6s should be workable around mid-day from Europe by now, judging from the pattern of past years, with KJ, KM, KX6, etc., coming through in the mornings and early evenings.

3W8AA has burst into renewed activity and may be heard most days from 17.00-19.00 G.M.T. in the middle of what our American friends would describe as a "king-size pile-up" around 14050 kc/s. No attempt is made to control the mob centred on the frequency, except for an occasional remark to the effect that he is not interested in working "so and so," who is causing QRM. The result quite often is that "so and so," hearing his call through the racket, thinks he's in QSO and incenses the irascible 3W8 still further by repetitious requests for a QSL! A ludicrous touch is lent to the situation by the fact that the F.C.C. forbid U.S. amateurs to work 3W8 and therefore, the A.R.R.L. do not recognise that country for DXCC. So even if you work him now, you'll have to do it again, should the ban be lifted in the future.

The U.S.S.R. situation remains inscrutable, with certain Us apparently free to take on all comers and the majority still talking only to their *tows*, but **G2ZR** (Bath) found the "curtain" pulled aside a little when UA9DT came back to him with a report, name and request for a card via Box 9, Sverdlovsk. The next day, UA1KBB was worked and gave his QTH, rig, name—the lot—but others either use "QRZ" or don't reply at all. Russians apart, '2ZR found morning conditions superb and his 65 watts and bent long wire gave excellent QSOs with W6, 9 and YV between 05.00-06.00 G.M.T.

B.R.S.20249 (Sutton) returned to the fray after three months inactivity and heard phone from the newly active YI2DK (QSL via G3HKP), and a certain ZA1AA, whose "CQs" at 22.45 went unanswered. Malcolm heard a VP3 and an HC1, but was unable to get the full calls through severe QRM, but he *did* hear strong signals from KT1AA and HH3DL while listening on the domestic receiver with 12ft of wire round the picture rail! Friend **G3IRU** has been rebuilding and he had the galling experience of calling a ZS on the almost completed rig, only to have the v.f.o. break down. Too bad! **G3JFF** has been indulging in a house-decorating session and having finished, spent a little time on c.w., with the result

that CE3RE, VK5DK, PZ1AP (20 watts and long wire), VO6AB, W5FTP (New Mexico), W6 and W7 went in his log, making him 103C, all worked with 25 watts and a dipole.

G6CJ (Stoke Poges) passes on the news that old-timer VK2DA will shortly be in London and will stay at the Cumberland Hotel. **B.R.S.18017** heard CP4DM and ZP5CF on A3 and LU4ZS on A1, while the **B.R.S.20135** phone log shows 4S7YL, YI2DK, HZ1TA, SU1AS, ZS2MI (Marion Is.) and ZS6AIY (s.s.b.). **G6YQ** (Liverpool) made a "CQ" at 20.30 G.M.T. around 14075 kc/s and was far from disappointed when back came CR10AA. Add to that, QSLs received from FS7AA and VR1B and you have a happy '6YQ! Incidentally, George passes the news that Danny of VR1B was due to set sail for Nauru on June 1 and will eventually operate from that island as VK9TW. Your commentator happened on AC5PN giving forth quite strongly one evening and telling the world he was getting so many calls that he could read none of them. '3ATU decided to add to the QRM and back came "G3ATU de AC5PN k k." '3ATU "k'd," but that was the last heard from Bhutan. Almost frustrating! FE8AE is active and was heard weakly (RST447c) working Ws at 23.30.

Overseas News

John Knight **(W6YY)** sends what he modestly calls "another bit of DX dope"—ZD9AE got going from Gough Is. on May 18. He is v.f.o.—phone and c.w.—with 100 watts and a rhombic on South Africa. The four-man expedition replaces the ZD9AD gang and will be on the island for a year. QSL via the S.A.R.L. After putting good phone signals into W6, TA3US has departed, leaving the station without an operator—and lots of guys without a TA! BV1US has started up again from Formosa with some new operators. Mondays, Wednesdays and Fridays at 13.00-15.00 G.M.T., they are on 14165, 21200 or 28100 kc/s and will operate on occasional weekends. W6OYD worked AC3SQ on c.w. W7PHO handles QSLs for JZ0PS, who has now left for Indonesia. East Coast Ws were heard calling UQ2AN and YK1AK on phone. A station signing SV1SM is actually /MM.W5ZZR sent VR1B a new bug key. (Judging by the number of QSOs he's had already, the old one must be worn right down to the paddle. And to think he's got to start all over again from VK9TW!)

G3TA's son is now **VS9AH** and is operating on 7025 and 14050 kc/s with 40 watts input. The aerial is a folded dipole and the receiver an AR88. Two other VS9 stations —VS9AS and VS9AN—are also active.

Flash: W0AIW and some of the Kansas City DX gang were to operate from Socorro Is. in the Reville Gigedo group, starting June 4 or 5 for four or five days. The call-sign was **XE4A** and it should count as a new country, as should YV0AA, which should commence operations on June 17 for eight days. (XE4A will be past history by now, but we hope the R.S.G.B. News Service on GB2RS alerted most people in time to raise him.) QSL XE4A via W0AIW. QSL YV0AA via The Radio Club Venezolano, P.O. Box 2285, Caracas, Venezuela. GM3DHD is reported to be one of those lucky enough to work XE4A.

G3IDC says that VS2DQ holds QSL cards for the former operators of VS2EM and VS2ES. If they will write to VS2DQ he will send the cards to them.

VK1 Calls. **G3GQ** was told by VK1AIL (Box 59, Kingston) that as from June 1, 1956, stations in the Capital Territory of Australia have been allocated call-signs in the VK1 series.

G2MI passes on first-hand news from Norway, where there have recently been numerous changes in amateur licensing procedure. Of particular interest to overseas amateurs is the new means of identifying stations operating temporarily away from their usual QTH. Such stations—which may be either mobile or fixed—use their normal call-sign followed by an oblique stroke and final letter and this letter determines their actual location. The various Norwegian counties (*fylke*) are distinguished by the use of the letters A, B, C, D, E, F, H, I, K, L, O, R, S, T, U, V, W, X, Y and Z. Stations in Antarctic possessions use /G and those in Arctic possessions sign /P, while /M is used on board ships which have no other radio transmitting equipment.

Ryukyu Is. A letter from **KR6QC** to G2MI summarises KR6 activity thus. On April 1, there were seventy-two licences issued, twelve of which belonged to stations awaiting equipment. A "break-down" of the power used by the sixty active stations shows that twelve use less than 100 watts, with KR6QN's little 18-watter taking QRP pride of place. The most popular input is between 300 and 500 watts, accounting for twenty-six stations and it is interesting to note that there are but four "kilowatts," KRs '6AF, '6KS, '6NU and '6RX. The booming signal from KR6PI on 21 Mc/s is the result of 450 watts and doubtless, some help from a QTH on Tomari Heights.

The U.S.S.R.

At last it's happened. As from June 1, Russian amateurs are once again on speaking terms with the outside world and Box 88 is back in business! Many of us now have our first opportunity of adding a number of previously unattainable countries to the total and for all of us intriguing possibilities exist on one band or another. Top Band enthusiasts, especially, may benefit considerably in coming winters. Perhaps, too, we can hope that the enthusiastic hordes of "U" S.W.L.s will concentrate their attentions there, rather than waste paper with S9 reports on 14 Mc/s. Or are we asking too much!

Copelands, Co. Down

GI3HXV says that GI3KYP/P will be operating from a site on the Copelands, a group of three small islands off Donaghadee on the coast of Co. Down, from 17.00 G.M.T. on July 14 to 17.00 G.M.T. on July 15, on 3.5, 7 and 14 Mc/s c.w. with an input of 5 watts. GI2HML/P will operate on 144.138 Mc/s from the same site with an input of 20 watts. The operators will include GI3GSB, GI3HXV and GI5UR. Contacts and reports from listeners will be appreciated.

Home News

G3DDI, the station of the South Shields and District Amateur Radio Club, is now sending Slow Morse transmissions every Sunday at 11.00 B.S.T. on 7021 kc/s. Reports and copy may be sent to G3ELP, the operator concerned. The South Shields club is very active and has once again arranged to operate during the Corporation's Flower Show on August 24, using the specially allocated call-sign **GB3SFS.** **G3IKR** (Solihull) has been getting QSLs confirming contacts with **G3IUB** (Birmingham University Radio Society), despite the fact that the Society has been off the air for the past two years. If there is sufficient interest, the station may be in use again in some six months.

* * *

And that ends *T.W.O.T.A.* Your contributions to next month's *M.O.T.A.* will be welcome as usual and should be posted to arrive if possible by June 21. Good hunting again and 73.

TWO METRES AND DOWN

By F. G. LAMBETH (G2AIW)*

APART from the morning and midday skeds which PE1PL is working with several British amateurs (notably in the Home Counties, Lancashire, Yorkshire and Lincolnshire) little has been heard lately of other regular skeds. This is of course partly due to the apparent propagation conditions, of which no more need be said, but the fact that the PE1PL skeds continue so well, leads to the thought that others would have similar success. Some time age G5MA and G5CP carried on for months, almost without a break, although sometimes conditions were little or no better than they have been recently. From listening, it is apparent that a few such arrangements are being operated by stations near London, but it is hoped that if others are in existence or are proposed, we shall in due course hear about them. Much has been learned in the past by such regular activity especially as regards the effect of barometric and vapour pressure on v.h.f./u.h.f. signals, and it is by no means a certainty that the fund of knowledge on this subject is yet completed (it never is!) Accordingly, all those who can be available at fixed times are exhorted to try keeping regular skeds. There is always a great deal of pleasure involved, with the added attraction of helping in a very desirable cause—the betterment of radio knowledge. Amateurs have nearly always been at the forefront of the battle in the past, and there is no reason why this should not continue. The v.h.f./u.h.f. season now opening is an excellent time to commence, and the friendships which can thus be built up are even more lasting than the skeds! One never quite forgets the fellow with whom one has been *en rapport* for months on end.

Two Metre Reports

Nothing outstanding has happened lately, although several Continentals have been heard and worked. The northern stations come through to the south spasmodically, those from the west being perhaps more consistent. French stations have been a little better with GC3EBK (Guernsey) an excellent signal from time to time. A real opening is still awaited however. At the end of May conditions appeared to be improving slowly.

B.R.S.6327 (Earlsfield) was listening during the 144 Mc/s Field Day, but heard nothing in the way of DX. **B.R.S.16075** (Southampton) has been more busy preparing field day gear and listening and found southern paths good, although listening was restricted by TV local oscillators. Southampton appears to have had a goodly number of operators (out of proportion to its size) at the various field day stations. At G2DSW/P there were four with two B.R.S. members, at G3ION/P three operators with two B.R.S. whilst G3HKT/P had four. G3GOP/P was at Ludlow.

B.R.S.19162 (Dewsbury) expects to be more active from now on. G3IWJ (Liverpool) was heard for a rare direction, but otherwise nothing special has been logged. Some extensive convertor research is in prospect. The evening of May 13 was good; G5MA was heard (569), the first London area station this year. G3GHO and '6NB were also heard. **B.R.S.20133** (Melton Mowbray), one-time second operator at DL2LC, uses a modified RF27 unit into an R107 receiver, and three-element and four-element aerials. The four-element array (a Yagi) is at present indoors, but it is hoped soon to erect it outside the house. '20133 met G8SB/P (nr. Oakham) on field day and spent a very enjoyable time there. GW3GWA (Denbigh) was later heard. The courtesy of 2m operators is very marked, says '20133 who has been "inundated" with it since starting on the band, although this does not mean that other bands do not contain courteous operators.

G6XM (late of York) who is at present living at Melton Mowbray, is still out of action but it is hoped he will soon be able to recommence operations. **G3GRA** (Plymouth) reports that he is on 144.14 Mc/s and '3JYB on 144.2. '3KFN and '3KDK are also active. '3GRA suggests some alterations in the county code letters but unless others feel the same, it would be better to give them a trial first. Apropos these letters Hereford was somehow missed, points out G3ESY (Hereford City). It is suggested HF is used. **G3FKO** (Bristol, 6) was out portable during the 144 Mc/s Field Day on the Quantocks, working as far as London, the Midlands and Wales. Weather was excellent, activity high, and conditions were good for a change. G3FIH is joint operator. G3GMN and '3FKO are going /P into Radnorshire and possibly also to Montgomeryshire during July 7-8 for the contest. As operations will be on 145.8 Mc/s in the Welsh Zone, this should make people tune the whole band!

G5MR (Hythe, Kent) found the best period was on May 5-6 when the R.E.F. Contest took place. 22 French stations were worked, two being over 200 miles from Hythe, and eight more than 150 miles away. All these contacts were made on c.w. both ways. While the R.S.G.B. Field Day was on, much time was spent listening in the hope of QSOs with /P operators but little was heard except a few weak phone carriers. All this strongly bears out G5MR's view (January BULLETIN) that the ratio of c.w. to phone is much higher in France than in England and probably many DX contacts are missed by Gs because they use phone exclusively. HB1RD and HE9REP have written to '5MR stating that they worked 81 stations in various countries on May 5-6, but heard no Gs. HB1RD will be active again from Chasseral (1600m a.s.l., Latitude 47° 8′ N, Longitude 7° 3′ 30″ E) on the following dates: June 16-17, July 14-15, July 21-22, August 10-20 and September 8-9, HB1RD is most anxious to make contacts with U.K. stations. For the regional contests their frequency is governed by regulations and must be above 145 Mc/s. Thus for the contests in June, August and September it will be 145.01 Mc/s. For the July dates, however, they may choose any frequency and have asked advice on the best part of the band to avoid interference. The l.f. end has been suggested, but the h.f. end should be quite suitable, because surely everyone now searches the whole band!

*21 Bridge Way, Whitton, Twickenham, Middlesex.

G3ILI (Forest Hill, S.E.23), after two years of trial and much error, has produced a workable s.s.b. rig for 2m and is now hoping for a little more patience from 2m operators than was shown to him on the l.f. bands when he started s.s.b. operations. We are sure he will get it!

G8DA (Exeter) informs us that the Exeter net operates at 11 o'clock every Sunday morning. **G3EMU** (Canterbury) says that this year so far has been poor, but May has evened things up a bit. G3EMU's 100 watts have not yet bored a hole through the local hills, but in the other direction PE1PL and other PA0s, several French and Belgian stations have been worked. The only G worked was '3BPF/A. '3EMU wonders whether any stations are operative at around 06.30 B.S.T. as he could sometimes get an hour's operating then. On May 23, '3EMU had his own special opening when he was working ON4s nonstop between 22.00-23.30 B.S.T. ON4HN, 'OZ, 'ZK and 'DW were all worked at 58/9 on phone and '3EMU appeared to be the only G station audible to them.

The Midland Amateur Radio Society took part in the R.S.G.B. 144 Mc/s Field Day for the first time on May 6 using the call-sign G2AK/P at Lickey Beacon, nine miles south west of Birmingham. Left to right, G3HMG (President), G3HAZ and G3BA.

G3JGJ (Plympton) says the following new stations are active in the Plymouth area: G3GRA, '3KFN, '3JYB, '3KDK. G3BLO and '3HPC are starting on the receiving side. G3FDV is well on the way to full operation on 2m and there are quite a few other prospective 2m enthusiasts about. '3JGJ has had a sked with GC2FZC every evening (Sunday included) at 18.30 to 19.00 B.S.T., since April 26. Signals have varied between S2-3 to S8, with 100 per cent QSOs so far. The aerial at '3JGJ is a 16 element stack at 35ft facing the Channel Islands and France. **G5MA** (Great Bookham) has been shaking the local ether to some advantage and has an impressive list of G-DX contacts with some Continentals as well. '5MA seems to work them quite comfortably, so the new QTH is no worse than the old and possibly somewhat better.

G3WW (Wimblington) has to confine himself largely to local working due to lack of activity on the band but had a good innings on May 5-6 with 24 contacts spread well over England in addition to PE1PL.

On May 23, ON4BZ reported working PA stations in any direction of the beam. Rotating made no appreciable difference. This seems to connote an auroral effect, and is in line with the 27-day cycle resulting from the intense solar activity reported in February.

May 26, and May 27 to a lesser degree, produced European openings. On the night of the Convention G5KW, G6NB and some other stations had a very good time with PA0s, DLs and ON4s. LX1SI was heard on the Saturday but it is not yet known whether he worked any British stations. Probably the outstanding signals heard were DL1SE and DL3YBA.

News from Scotland

GM6WL (Glasgow) reports a steady increase of 2m activity among Scottish stations. This seemed to begin on the evening preceding the Edinburgh V.H.F. Dinner and has continued ever since. On May 6 many were heard from the site of GM3INK/P at Tomtain, Stirlingshire. Conditions were poor and the weather atrocious. Other GM stations on 2m are '2CHM, '3DDE, '3IBV, '2CQI, '5VG, '3ENJ and a comparatively new one, '3FMD (Maybole, Ayrshire). GM2BVD and '4PW (Ayrshire) expect to be on the band shortly. '6WL wants to know how many Gs turn their beams on Scotland, when there is an opening, rather than on to the Continent. He thinks there are many who have worked several Continentals and no GMs (which he admits is more difficult!)

Many GMs, including '3IBV, '3EGW, '2FHH, '3BDA and '6KH (to mention only a few) have worked G stations as far south as the Isle of Wight as well as the Continent and are always ready for further contacts.

Another cross band 23cm/2m QSO has been made between GM6WL and '6ZV. The distance—7 miles—is over a very good path but not exactly visible. The 23cm signals have been RS59+. The equipment was set up as for previous contacts. From the strength of the signals GM6WL is encouraged to hope for more distant QSOs shortly.

News from Wales

GW3GWA (Wrexham) was on the Vron Hills for the 144 Mc/s Field Day and was nearly blown off by the wind, although the weather was fine otherwise. Conditions were better than previously but only to the southern districts. To the East they were very bad, G2FJR (very weak) being the only contact. 61 stations in 25 counties were worked, 25 over 100 miles and five over 150 miles distant. Nothing was heard from Scotland, Ireland or the Channel Islands. The strongest fixed stations heard were G5KW, '8IL, '3FZL and '5DW.

Transatlantic and Other Long-distance Tests

F8ZT (Tourrettes sur Loup, Alpes Maritimes) refers to the question of Transatlantic contacts on 2m and thinks they are possible but not quite in the way envisaged in the December BULLETIN. It is known that high pressure systems can spread from the Azores to the West Indies and sometimes beyond. A favourable temperature inversion is obviously possible in this area and satisfactory contacts between stations in Madeira or the Azores and the West Indies may, therefore, be expected. Such an inversion might, exceptionally, extend to Florida and contrariwise to Spain, Portugal and possibly even the West Coast of France. The path may be cut by some West Indian Islands and this should be borne in mind. The Balearics seem to act as such a barrier in the Mediterranean cutting signals between Oran and Marseilles.

At Toulon (not affected by the Balearics) outstanding signals are received from FA8IH. Indeed, F9BG (Toulon, near the sea) can get a good signal from FA8IH's grid dip oscillator! '8ZF with an extra 70 miles to go cannot hear the grid dip oscillator but can receive '8IH's exciter only at S6. 3V8AB has just started operations in Tunis and a sked is kept daily except Thursdays at 20.00 G.M.T. Frequency in both cases is nominally 144.450 Mc/s.

3V8AB (Jean Marcille, 19, Rue Junon, Carthage, Tunisia) is anxious to learn about 2m activity in Malta, Tripoli and Benghazi. V.h.f. operators in these places are asked to write to him. As many weak carriers are heard and cannot be identified, stations in the Mediterranean area are asked to sign on c.w. *always*.

EI2W has arranged a series of tests between Ireland and Finland to take place between 20.00 and 02.00 B.S.T. from September 8 to 16, 1956. The frequencies to be used are 144.14 and 145.2 Mc/s. The co-operation of other transmitting amateurs and listeners in these tests is invited.

The Czecho-Slovak Central Radio Club, P.O. Box 69, Prague, is arranging for its International V.H.F./U.H.F. Contests to coincide with other Region I contests taking place on July 7-8 and September 9.

Seventy Centimetre News

G8PX (Oxford) hoped to go /P for the 70 cm contest. **G3KPT** (Kingswood, Bristol) has made contact with G3KHA. When the slot aerial is outside, better results are expected.

G2XV (Cambridge) found May 6 very good for 70cm and worked Worcestershire and Somerset for new counties (total now 25). The "easy" ones, like Suffolk, Huntingdonshire and Lincolnshire are still unobtainable and seem to represent "barren ground" as far as '2XV is concerned. If these notes reach the eye of HB9IV, a sked would be welcomed by '2XV when '9IV is next on his mountain top for an attack on the world record.

G5UM (Knebworth) is one of the 70 cm operators stung into action by the note requesting details of active stations. His frequency is 434.37 Mc/s, the aerial a 16-element stack and the receiver a G2DD-type converter into BC348 on 14 Mc/s. Any operator in London or the Home Counties who wants a 70cm check should make contact with the Mid-Hertfordshire 2m net any Monday evening from 8 p.m. onwards. Of the members of the Mid-Herts Group G5UM is regularly active on the band, and G2BMJ and '3JMS are actively preparing.

Seventy Centimetre Chain

Numerous ideas are suggested for promoting regular occupancy of 2m and 70cm but none of them seems to come to much. All too many operators do not bother to come on unless conditions are going to be obviously good. So in proposing yet another idea for promoting activity G5UM has no illusions that it will fare any better than earlier ones! However, here it is: Why not start a chain of 70cm stations extending through London as far north and as far south as possible, every station to come on at an agreed time (say, at 8 p.m. on every Monday or Friday)? From north to south, such a chain might well include G3WW, then G2XV, then a hop of 30 miles to G5UM, then a series of north and south London stations through to G2MV or G2WS. An east-west chain could start at Chelmsford where there is an active 70cm contingent, work through G8AL at Chingford then via London stations to G3MI, '6NB, perhaps ending up at Oxford with G8PX, or with one of the Bristol stations.

Two chains of this description where all stations were pretty well in line with one another would avoid the need for frequent tuning of beam aerials. It seems that a lot of time is spent tinkering with equipment for 70cm but the ultimate surely should be for this gear to do some communicating during the course of regular activity periods such as have been outlined. Let's have some operating as well as building!

London U.H.F. Group

At the June meeting of the London U.H.F. Group G3ILI gave an excellent lecture on his 144 Mc/s single sideband transmitter and described how the various problems encountered had been overcome. The Group will meet again at the Bedford Corner Hotel, Bayley Street, Tottenham Court Road, W.C.1, at 7.30 p.m. on July 5. All v.h.f. and u.h.f. enthusiasts will be welcome.

* * *

Reports for July would be appreciated as soon as possible. Meanwhile, it is hoped conditions will continue to improve.

Worked and Heard on Two

B.R.S.16075 (Shirley, Southampton) April 21–May 20.
Heard: G2YB, 2AIW, 2BMZ, 2HCG, 3XC, 3AUS, 3GHO, 3HHY, 3GOP/P, 3GVF/M, 5MA, 5NF, 5KW, 6AG, 6NB, 6OX, GC2FZC, 3EBK.

B.R.S.20133 (Melton Mowbray).
Heard: G2AK/P, 2BVW, 2FNW, 2HA/P, 3APY, 3BAC, 3EGE, 3FDF, 3FUW, 3IVF, 3JWQ, 3JWQ/P, 3KQF, 4JJ/A, 5JU, 5ML, 5ML/P, 6CW, 8CZ, 8SB/P, GW3GWA.

G3WW (Wimblington, Cambs) May 5–6.
Worked: G2AK/P, 2RD, 2XV, 2CIW, 2HDZ, 2HIF/P, 3FD/P, 3MA/P, 3YZ/P, 3GGQ/P, 3DOV, 3FZL, 3GGJ, 3GOP/P, 3GOZ, 3HBW, 3IIT, 3ION/P, 3JZW/P, 3KHC, 4GR, 5BM/P, 5DW, 5ML/P, 5UM, 5YV, 6NB, 8QV/P, 8SB/M, 8SB/P, 8UQ/P, GW3GWA/P, PE1PL.

G3EMU (Canterbury, Kent).
Worked: F8AA, 8GH, 9DI, 9LD, 9EA/P, ON4BZ, 4HN, PA0FB, BL, DSW, PE1PL.

G3FKO/P (Taunton) May 6.
Worked: G2AK/P, 2JM, 2AIW, 2ATT, 2CVD/P, 2CVD/M, 2DDD, 2DSW/P, 2HIF/P, 3FD/P, 3MA/P, 3MU, 3NL/P, 3XC/P, 3YH, 3YZ/P, 3BJQ, 3FFN/P, 3GNJ/P, 3GOP/P, 3HKT/P, 3HHY, 3HSD/P, 3IER, 3ION/P, 3IRA/P, 3KEQ/P, 4GR, 5BM/P, 5DW, 5ML/P, 6JK/P, 8DA, 8QY/P, 8SB/P, GW2ACW, 3FXR, 3GWA/P, 8SU, 8UH/P.

G3JGj (Plympton) May 6.
Worked: GC2FZC. *Heard:* G2AUS, 6NB, 8UQ.

G3KHA (Bristol) April 1–April 30.
Worked: G2YB, 2DVD, 2BRR, 3XC, 3YH, 3FIH, 3FKO/A, 3GHO, 3GNJ, 3GVF, 3GYO, 3HBW, 3HHY, 3HSD, 3KEQ, 3IRA, 3KPT, 3KPT/A, 5DW, 5HN, 5KW, 5MA, 6OX, 6NB, 8AL, 8UQ/P, GW2ACW.

G3KPT (Bristol) April 1956.
Worked: G2BRR, 3YH, 3FAN, 3FIH, 3FKO/A, 3GNJ, 3GYQ, 3HHY, 3HSD, 3IRA, 3KHA, 4GR, 5DW, 5MA, 6OX.

G5MA (Gt. Bookham, Surrey) up to May 15.
Worked: F3CA, 8BB, G2OI, 2FJR, 3BW, 3ACZ, 3AGA, 3AUS, 3ENY, 3GNJ, 3GPT, 3HHY, 3IOO, 3IUD, 3JZN, 3KFD, 3KHA, 3KPT, 3KQF, 3KUH, 4GR, 4JJ/A, 5BD, 5DW, 5YV, 6CW, 8DA, 8SB/P, GC3EBK, GW3GWA/P, 8SU, ON4BZ.

GM6WL (Glasgow) May 6 heard at GM3INK (Tomtain, Stirling).
Heard: GM2FHH/P, 3DYC, 3EGW, 3DIQ, 3FGT, 3FOW, 3GAB, 3NG, 3UM, 6KH, 6SR, 6XW, 6ZV, 8MN. *Worked:* G2NY, 3BW, 3GPT.

NEXT MONTH . . .

"The Principles of Colour Television"

B.E.R.U. Contests Results

And many other Technical and Topical Features

. . . IN THE BULLETIN

Tests and Contests

The First R.S.G.B. 1250 Mc/s Tests

THE first R.S.G.B. 1250 Mc/s Tests, to be held on September 2, 1956, should prove of outstanding interest to all u.h.f. enthusiasts. Both before 1939 and also since 1946, the development of the v.h.f. and u.h.f. bands in this country has been closely connected with the regular provision of tests and contests to stimulate interest and to provide operators with an incentive to come on the bands. It was the inauguration of the 420 Mc/s Tests in 1949 that first brought an appreciable number of amateurs on to a then almost unknown band. Has the time now arrived when a similar series of tests on 1250 Mc/s can stir up simultaneous operation on the band throughout the country? September 2 will provide the answer.

Until more experience has been gained on this band, the Contests Committee feels that a contest organized on a point-scoring basis would penalise experimentally minded amateurs, on whom the exploitation of the u.h.f. bands directly depends. The plan which succeeded so well during the early years on 420 Mc/s, and which paved the way for the more orthodox contests now held on that band, has therefore been revived.

Notify Headquarters

All amateurs who intend to be active during the tests are invited to notify Headquarters not later than July 15 of their call-signs, home address, proposed location, approximate frequency, form of frequency control and polarisation of aerial: it is hoped to publish this information in the August issue of the BULLETIN.

The award of the *Arthur Watts Trophy* will not be directly dependent upon the number of contacts made or the mileage covered; such factors as original experimental work, ingenious equipment, the compilation of a detailed report, and the general amount of effort put into the tests will also be taken into account. Entries from receiving stations will be welcome and will be eligible for the award.

Rules

The event will have few fixed rules, other than the time limits of from 10.00 G.M.T. to 22.00 G.M.T. on September 2, 1956, and the provision that all entries must be from fully paid-up Corporate members and accompanied by the declaration set out below. To give all entrants an equal opportunity, entries can be accepted only on behalf of the activities of an individual station, though no limitation is placed on the number of operators or assistants. Any type of operation or mode of transmission may be used, provided that the entrant adheres to the terms of the licence.

The entries will be required to include details of stations heard or worked (with distances) and general observations on the band. A full description of all equipment used should be included and this information and any other evidence submitted of work carried out on the band will be taken into consideration when judging the event. The copyright of descriptive matter may be retained by the entrant, though the Contests Committee reserve the right to abstract information for the purpose of preparing a report on the tests. The contestant submitting the best entry in the opinion of the judges will be recommended to Council for the award of the *Arthur Watts Trophy*.

Entries must be addressed to the Hon. Secretary, R.S.G.B. Contests Committee, New Ruskin House, Little Russell Street, London, W.C.1, postmarked not later than September 17, 1956, and contain the following declaration:

I declare that my station was operated strictly in accordance with the rules and spirit of the Tests, and I agree that the ruling of the Council of the R.S.G.B. shall be final in all cases of dispute.

Date..... *Signature* .....

Low Power Field Day, 1956

EXCEPT for the inclusion of the serial number to be added to each exchange of reports, the rules for this contest remain the same as in previous years.

Rules

1. The event will commence at 10.00 G.M.T. and finish at 17.00 G.M.T. on Sunday, September 2, 1956.
2. The event will be confined to fully-paid-up Corporate Members of the Society in the prefix zones G, GC, GD, GI, GM and GW. Such members may enter individually, but multiple-operator entries will be accepted. The declaration must be signed by the holder of the call-sign used by the station, who will be regarded as the entrant.
3. Operation will be restricted to c.w. (A1) in the 3.5 and 7 Mc/s bands.
4. Only one contact with a specific station on each band whether fixed, portable or mobile, will count for points, but duplicate contacts should be logged.
5. Each contact shall include an exchange of RST, QTH and a serial number starting between 001 and 100 and increasing with each successive contact, e.g., RST559001 Oxford, etc.
6. Entrants receiving frequent tone reports lower than T8 may be disqualified.
7. Each transmission must include the letters LFD and the figure 3 or 7 according to the band in use, e.g., LFD 3 K.
8. Equipment shall be entirely independent of the electrical system of any vehicle, and of supply mains.
9. The total weight of all equipment must not exceed 20 lb. The following items, if provided, must be included in this weight: receiver, transmitter, power supply, batteries, headphones, key, frequency meter, aerial wire, insulators, earthing device and spares—in fact, all radio and electrical apparatus and accessories taken to the site.
10. Subject to the weight limit, there are no restrictions on the number, type or height of aerials that may be used.
11. Entrants must comply with the terms of their transmitting licences.
12. Scoring: FIVE points may be claimed for each contact with a portable or mobile station, and ONE point for each contact with a fixed station.
13. Proof of contact may be required, and competitors must be prepared to satisfy the Contests Committee that their equipment conformed to the rules.
14. Contacts with unlicensed stations will not be permitted to count for points.
15. Entries must be addressed to RSGB Contests Committee, Radio Society of Great Britain, New Ruskin House, 28-30 Little Russell Street, London, W.C.1, and must bear a postmark not later than Monday, September 10, 1956. Entries must be set out in the form shown below, and the declaration must be signed.
16. The Houston Fergus Trophy will be awarded to the winning station, at the discretion of the Council.

LOW POWER FIELD DAY, SEPTEMBER 2, 1956

Name..... Claimed score.....
Home address..... Call-sign.....
Site of Station.....
Transmitter..... Receiver.....
Aerials..... Power supplies.....
Other equipment..... Total weight.....lb.

Time G.M.T.	Call-sign of Stn. worked.	My report on his signals.	His report on my signals.	Location	Band Mc/s	Points claimed.
10.05	G3—/P	569001	449001	Bath	3.5	5
10.18	G2—/P	449002	449004	Slough	3.5	5
10.23	G5—/M	459003	559001	Oxford	3.5	5
10.29	G4—	579004	449	Bexley	7	1
				TOTAL :		

Declaration : I declare that my station was operated strictly in accordance with the rules and spirit of the contest. I also declare that the weight of my apparatus as defined in Rule 9 was ..... lb. I agree that the ruling of the Council of the R.S.G.B. will be final in all cases of dispute.

Date : ..... Signed : .....

Radio Amateur Emergency Network

By C. L. FENTON (G3ABB)*

CONSIDERABLE activity is reported this month from Yorkshire, Norfolk, Suffolk and Essex, in all of which exercises have been carried out. These are reported in more detail below.

A special sub-committee has been set up to consider plans for a second R.A.E.N. Rally later this year. The sub-committee will be prepared to consider any suggestions which members may care to make, and which may be sent to the Hon. Secretary. It is requested that this should be done without delay. Details of the Rally will be published in the BULLETIN as soon as possible.

The general opinion seems to be that R.A.E.N. members in the inland areas can be of little active use except as relay stations in any major emergency. For this reason, in such areas, construction of portable and mobile gear has not progressed too well. We would emphasize to members, and particularly to E.C.O.s, that this is not necessarily the case. Major disasters are not always linked with coastal areas, and can take other forms than coastal flooding. The arrangements with the British Red Cross Society, which are now being discussed, may well mean members of R.A.E.N. being called upon to provide communications facilities in the event of major accidents. If *you* were called upon to provide such facilities at this moment, could you do it? E.C.O.s are invited to think along these lines, and be certain that they are prepared, for they can never tell just when the call will come, or from where.

New Membership Cards

As a result of the reference to new permanent membership cards in the April BULLETIN, a number of applications have been received. At the time of writing, the proofs had only just been passed and the cards were not yet printed (The new membership cards are now available.—EDITOR.)

If there is an E.C.O. for your area, make application to him for your new card, but if you have no E.C.O., write direct to the Hon. Secretary, enclosing a stamped addressed envelope. E.C.O.s will be issued with cards in bulk for issue to their members. When making the request for bulk issue for groups, E.C.O.s should state the names and call-signs of the members for whom the cards are requested. This will enable the Hon. Secretary to check the members who have requested renewals.

E.C.O.s

More E.C.O.s are still required in all areas. Volunteers are invited to write to the Hon. Secretary without delay for details of qualifications required.

Reports From the Groups

Clacton-on-Sea. Portable and transportable equipment is being built for most bands. Information is required on suitable transmitting and receiving equipment for a motor-cycle. Information is also sought on modifications to the Pye walkie-talkies, which were distributed recently to some members.

Chelmsford Group recently carried out an exercise to check for possible blind spots in the area. G3GZW, accompanied by G3IFN, started from near Foulness Island, G3GNQ from Bradwell Waterside near the mouth of the River Blackwater, and G4VF from Mersea Island. The cars stopped at pre-arranged points at nine-minute intervals, to call Control and exchange reports and map references. The writer, as Control Station, was fully occupied from 15.00 to 16.45 G.M.T., working one station or another every three minutes. All three cars eventually arrived at Control for an exchange of views before dispersing. Details of this exercise were arranged by G3IFN. Thanks are due to those fixed stations who broke in from time to time with reports, but who generally left the channel clear and only broke in to call Control when Control was temporarily having a few seconds breather. Thanks are also due to those listeners who phoned the writer, or otherwise submitted reports later. *York* Group conducted an exercise on May 6 with a similar object to the Chelmsford one. Participating were G2ADR/M, G3HSZ/M, G3YP/M, G3JCT/M and G3GMQ/P, with G3ATI as Control Station. At the conclusion of the exercise, which was from 14.30 to 17.00, G2ACD arrived from Bridlington. The E.C.O. wishes to express his thanks to all who participated, including the B.R.S. members who did such yeoman service.

Norwich. A very successful exercise was conducted on May 13, with the object of providing two-way communication between a Control Station at Acle Police Station and fixed and portable stations situated along the coast from Hemsby to Lowestoft, and the Waveney Valley from Beccles to the coast. Communication with two mobile stations patrolling in the area was also maintained. Stations participating were G3ASQ, G3IOR, G2CMK, G3ETP, G2UK, G3IFI, G3JMO, G3KJU, G3KYH, G4PV, G4KO, G3HRK, G3GTI and two listeners, Messrs. Dobson and Howden, who did sterling work at Control, G3ASQ. Transmissions were on the R.A.E.N. Emergency frequency of 1980 kc/s, except for G4PV, who used 28.2 Mc/s. As a result of this exercise, it was established (a) that communication could be maintained from Acle Police Station with R.A.E.N. stations operating both within the Division and along the Suffolk border; (b) that the use of mobile and/or portable mobile stations would be most useful in an emergency; (c) successful contact has been established between Norfolk and Suffolk R.A.E.N. groups.

The police authorities are particularly concerned with the danger of flooding in N.W. Norfolk from King's Lynn to Hunstanton, and hope to see a R.A.E.N. exercise in this area on similar lines to the above and to those carried out in other Divisions. Will anyone in these areas interested in R.A.E.N. please contact the County Controller, G3ASQ, or break in on the County net on 1980 kc/s any Sunday morning 11.00-12.00 B.S.T.?

E.C.O. Resignation

Mr. S. Poole has resigned as E.C.O. for Romford.

* * *

For the next three months, as an experiment, this column will appear monthly instead of bi-monthly, but will be somewhat shorter. The Hon. Secretary appeals for regular reports from all E.C.O.s to reach him by the 20th of each month.

* "*Niarbyl*," *Gay Bowers, Danbury, Chelmsford, Essex.*

Council Proceedings

Résumé of the Minutes of the Proceedings at a Meeting of the Council of the Radio Society of Great Britain, held at New Ruskin House, Little Russell Street, London, W.C.1, on Monday, April 16, 1956, at 6 p.m.

Present.—The President (Mr. R. H. Hammans in the Chair), Messrs. W. H. Allen, H. A. Bartlett, C. H. L. Edwards, K. E. S. Ellis, D. A. Findlay, F. Hicks-Arnold, W. R. Metcalfe, A. O. Milne, L. E. Newnham, W. A. Scarr, J. Taylor and John Clarricoats (General Secretary).

Apology for Absence

An apology for absence was submitted from Mr. R. G. Lane.

* * *

Membership

(a) *Resolved* (i) to elect 52 Corporate Members and 2 Associates; (ii) to grant Corporate Membership to 4 Associates who had applied for transfer.

(b) The Secretary reported that of the 640 members whose subscriptions became due on January 1, 1956, 76 became 3 months overdue on March 31, 1956. Of this number 20 were London, 43 were Country, 7 were Overseas Corporate Members and 6 were Associates. Of those overdue 11 London, 20 Country and 4 Overseas members held call-signs.

(c) The Secretary reported that 14 members wrote to resign during the four weeks ended April 14, 1956. Of this number four gave domestic reasons and the remainder stated they had lost interest in Amateur Radio.

Regional and County Meetings

Resolved to authorize the Regional Representatives concerned to hold meetings in Liverpool, York, Cambridge, Torquay, South Wales, Llandudno and Aberdeen during the current year.

Amateur Radio Exhibition

It was reported that the Birmingham Group had declined the Council's invitation to organize an Amateur Radio Exhibition in that city. An invitation had then been extended to the Bristol Group who also declined on the ground that Bristol is not suited as a venue for a National Amateur Radio Exhibition. The Group expressed the view that the National Amateur Radio Exhibition should not take place outside London and that it should be held every two or three years.

Resolved (a) to adhere to an earlier decision not to hold an Amateur Radio Exhibition in London during 1956.

(b) to discuss in the autumn of 1956 the question of holding an Exhibition in London during 1957.

The 7 Mc/s Band

It was reported that Major Haylock, on behalf of members of the Army Wireless Reserve Squadron and the radio society associated with the Squadron, had accepted an invitation from the Council to monitor the band 7000—7100 kc/s for "intruders."

News Bulletin Service

It was agreed to ask the Regional Representatives for their views, and those of other representatives in their Region, regarding times and frequencies for the News Bulletin Service.

I.A.R.U. Calendar No. 51

It was reported that I.A.R.U. Calendar No. 51 (December, 1955) contained no proposals. Preliminary information was, however, given of the forthcoming I.A.R.U. Region I Conference to be held in Stresa, Italy.

Varney Cup

Resolved to accept with thanks an offer of Mr. Louis Varney to donate a silver cup to the Society.

It was agreed to request the Technical Committee to give consideration to suggestions put forward by Mr. Varney as a basis for the award of the cup.

Mr. E. Brown, G3CSP

It was reported that Mr. E. Brown (G3CSP), of Sheffield, had experienced difficulty with neighbours in the matter of TVI. A local resident had, it was believed, been invited by a National Sunday newspaper to write an article on Amateur Radio and Television Interference. The article, it was suggested, might do harm to the Amateur Radio movement.

Resolved to authorize, and appoint, Mr. Metcalfe to make a fact-finding visit to Sheffield with a view to resolving any difficulties that may still exist between Mr. Brown and his neighbours.

Mr. J. Swinnerton, G2YS

A letter was submitted from Mr. Swinnerton in which he suggested that the Society should ask the Russian leaders (Messrs. Bulganin and Kruschev) during their visit to England to take steps to lift the ban, which at present appears to prevent amateur stations, behind the so-called "Iron Curtain," making contact with other amateur stations.

A member of Council stated he had a useful business contact with the Soviet Ministry of Communications and would be glad to make enquiries on the lines suggested by Mr. Swinnerton. The Council accepted the offer with thanks.

Disabled Members

A letter was submitted from Mr. W. R. Metcalfe in which he enquired whether the Society is in a position to assist members who are disabled and find it difficult to pay a subscription.

The Secretary explained that the Society's Articles of Association only permit the Council to waive a subscription in the case of blind persons. An attempt was made when the new Articles were being drafted to include a provision to cover disability, but the Board of Trade would not accept the suggestion.

Slade Radio Society

The Secretary was authorized to accept an invitation extended to himself and Mrs. Clarricoats to attend the Annual Dinner of the Slade Radio Society on October 13, 1956.

Cash Account

Resolved to accept and adopt the Cash Account for March 1956 as submitted by the Secretary.

Reports of Committees

Finance and Staff

The President submitted the Minutes of a Meeting of the Committee held on April 5, 1956, and reported that the meeting had been convened to interview three candidates for the post of Deputy General Secretary. The Committee had resolved by a majority vote to offer the position to Mr. J. A. Rouse (G2AHL), the present Assistant Editor.

Resolved (a) to accept the recommendation of the Committee, (b) that matters relative to and arising from the decision of the Council to offer the position of Deputy General Secretary to Mr. Rouse be referred to the Finance and Staff Committee.

R.A.E.N.

Resolved to receive, as a Report, the Minutes of a Meeting of the R.A.E.N. Committee held on March 3, 1956.

It was agreed to inform the Committee that although the Council has no power to appoint R.A.E.N. Committee Delegates to the Stresa Conference, Dr. Gee and Mr. Ives (members of R.A.E.N.) will be made most welcome as observers and their expert advice will be greatly appreciated when the question of emergency communication systems is considered. (The Committee had reported that Dr. Gee and Mr. Ives would be on holiday in Stresa at the time of the Conference.—ED.)

V.H.F.

Resolved to receive, as a Report, the Minutes of a Meeting of the V.H.F. Committee held on April 12, 1956, and to accept the three recommendations contained therein. The recommendations dealt with a suggestion to sponsor a V.H.F. Convention in Manchester; a proposal to invite certain R.R.s to consider holding V.H.F. Conventions during 1956/7 in specified provincial towns and a suggestion that the Contests Committee should prepare model rules for International V.H.F. Contests for submission to the Stresa Conference.

It was reported that plans were practically complete for the London V.H.F. Convention on May 26, 1956.

Membership and Representation

Resolved to receive, as a Report, the Minutes of a Meeting of the Membership and Representation Committee held on March 20, 1956, and to accept the recommendation contained therein.

The recommendation proposed that in future ten instead of five Corporate Members shall be required to sponsor a nomination for a Regional, County or District Representative, and that in the event of a ballot being required, a total of 50 votes at least shall be cast for the candidates, failing which the Council shall reserve to themselves the right to nominate a representative of their own choice.

Contests

Resolved to receive, as a Report, the Minutes of a Meeting of the Contests Committee held on March 22, 1956, and to accept a recommendation concerning the award of the Edgware Trophy to the Stourbridge & District Radio Society, winners of the Affiliated Societies' Contest.

Consideration of three other recommendations dealing with the 1957 B.E.R.U. Contest; a new 21-28 Mc/s Contest, and the award of the Metcalfe Trophy to the winner of the low power section of the latter contest, was deferred until the next meeting to enable Members of the Council to study draft rules of the Contests.

Exhibition (Home Constructors' Section)

Resolved to receive, as a Report, the Minutes of a Meeting of the Exhibition (Home Constructors' Section) Committee held on April 13, 1956.

The Chairman (Mr. Edwards) reported briefly on the tentative plans that had been made for the National Radio Show.

On the recommendation of the Chairman it was resolved to invite Messrs. J. Royle (G2WJ/T) and G. M. C. Stone (G3FZL) to serve on the Committee.

Other Business

The President read to the meeting a lengthy Report prepared by Mr. Findlay dealing with ways and means of increasing the membership and revenue generally, the organization of Headquarters, technical publications, etc. It was agreed to refer the relevant aspects of the Report to the Finance and Staff and the Membership and Representation Committees respectively.

Mr. Newnham read to the meeting a Report which he had prepared of the meeting held in Birmingham on April 7, 1956. It was noted that the majority of members present at the meeting were against the use of telephony during the first year of a new licence and that the Society's representatives at the meeting had agreed that the question of sponsorship of applications for membership would be raised in Council.

The meeting terminated at 9.5 p.m.

Application Forms

MEMBERS are reminded that applications forms for the use of prospective Corporate and Associate members can be obtained on request from Headquarters.

T.R.s are invited to apply for a small supply of forms for distribution at local meetings or other functions.

Full details of membership and a complimentary copy of the current issue of the R.S.G.B. BULLETIN will be sent to any address on request to Headquarters.

Eastern Regional Meeting

to be held on

SUNDAY, JULY 1, 1956

at

THE DRILL HALL,

EAST ROAD, CAMBRIDGE

Programme

Assemble	11 a.m.
Lunch	1 p.m.
Business Meeting	2.15 p.m.
Lecture with film on "The Antennamatch" by F. Hicks-Arnold (G6MB)	3.15 p.m.
Tea, followed by draw for prizes	5 p.m.

Tickets, price 12/6 each, may be obtained from the R.R., T. A. T. Davies (G2ALL), Meadowside, Comberton, Cambridge, and from the T.R., H. Waton (G3GGJ), Arkengarthdale, New Road, Barton, Cambridge, not later than June 25, 1956.

There will be an organized tour of the colleges. Messrs. C. H. L. Edwards (G8TL) and W. H. Matthews (G2CD) will represent Council.

Control stations will be operating on Top Band and 144 Mc/s using the call-signs G3BK and G3IIT.

Letters to the Editor . . .

Marion and Gough Islands

DEAR SIR,—QSL cards confirming contacts with ZS2MI will in future be issued only when a QSL card from the other party in the QSO is received. The ZS2MI cards will be made out by the department of the South African Government under whose control the meteorological station on Marion Island falls. This department has had new QSL cards printed. These are of the folded type, printed in green and gold, and include a pictorial map of Marion Island.

The QSL Bureau of the South African Radio League will distribute all ZS2MI cards and will also handle all incoming cards for that station.

The South African Government has also established a meteorological station on Gough Island, having taken over the equipment of the recent expedition to the Island. The amateur call-sign allocated to the operator is ZS9AE. The operator is Barry Brokensha (ex-ZS6AJY).

Yours sincerely,

South African Radio League, Cape Town. KEN MITCHELL (ZS1IR). *President.*

Morse Probationary Period Advocated

DEAR SIR,—Surely your Editorial comment on the letter from G3JJA about the abolition of the Morse probationary period in the April BULLETIN quite misses the point. Pre-war amateurs may, indeed, have been allowed to use telephony as soon as they received a radiating permit but that was only after an unspecified period during which an " A.A." (non-radiating) licence was held. Operators were expected to use this period to familiarize themselves with their equipment; they could generally be relied upon to radiate a stable signal when the full licence was received.

Further, before the war there were perhaps a few hundred licensed stations, most of which were limited, in theory at least, to a maximum power of ten watts; today, in our present narrower bands, there are some *eight thousand* allowed to use up to 150 watts. The increase in the resultant mutual interference is only too apparent to anyone listening on, say, 7 Mc/s—telephony transmissions may be heard down to 7030 kc/s, emanating from stations which in all too many instances have obviously never troubled to obtain a T9x note from their gear.

Another factor which did not have to be reckoned with before the war is the easy availability of ex-Service transmitters such as the T.1154 which are not really suitable for amateur use without modification; many of these transmitters are, however, being used unmodified by newly-licensed operators, and their telephony signals are not of the high standard expected from British amateurs.

I do hope that the Society will realise the damage that is being done, and ask the G.P.O. to re-introduce a probationary period again at the end of the " trial " twelve months. I am supported in this view by many others, including, I am pleased to say, a number of operators who are still in the first year of their licence.

Yours faithfully,

WILLIAM H. BORLAND (GM3EFS).
Alexandria, Dunbartonshire.

Editorial Note.—Hundreds of pre-war licensed amateurs never held an A.A. Licence. Prior to the war a great many U.K. stations were licensed to use power well in excess of 150 watts. In fact a number were licensed to use up to 500 or even 1000 watts.

An N.F.D. Suggestion

DEAR SIR,—May I put forward the following suggestion on this the eve of another N.F.D.

All members taking part and attached to the winning station should be issued with a diploma suitably inscribed.

I believe this would hold a place of honour amongst the many DX awards.

Yours faithfully,

Bonnybridge, Stirlingshire, Scotland. J. SIMPSON (GM4QV).

Top Band Plan

DEAR SIR,—Whilst G2BB's " Top Band Plan " (May issue) seems logical on first reading there are a number of snags to any arbitrary division of the band.

During daylight hours at weekends there is virtually no c.w. activity (at least in this area) but there is a considerable number of telephony stations. At night the position is reversed so that if we are to make full use of our 200 kc/s the time factor would have to be brought in.

One of the delights of Top Band is that phone to c.w. contacts are quite common—how would the band plan cater for them?

A lot of local duplex is worked on 160m with one station at either end of the band; the plan would stop this.

These are snags but no doubt someone will produce perfect answers to them.

G2BB asks for member's views so without further ado let me say that I am " agin him." In this modern age we are beset by planners in one form or another. Let us keep one band where the refugee from the dog fights on the higher frequencies may pound his brass or modulate his final where he pleases.

In the absence of reliable information to the contrary the likelihood of serious interference to the coastal stations seems remote; from Wick to Land's End the strength of the coastal stations is so much greater than that of any but the most local amateur.

Let us by all means encourage phone stations to operate, in the Loran when working cross-town but otherwise let's leave 160 as it is—the only sane band of them all.

Yours faithfully,

Tottington, nr. Bury, Lancs. JOHN E. HODGKINS (G3EJF).

QSL Bureaux

DEAR SIR,—With reference to the remarks by your QSL manager on page 487 of the May issue, the reason why he gets only " small and infrequent " packets of cards from us is simply because they represent those few R.S.G.B. members—about a dozen in the last three years—who have specifically asked us to clear their cards via G2MI.

This in itself can be no indication whatever of the volume of cards now being handled by our Bureau, the present total throughput of which would probably astonish Mr. Milne.

The British Short Wave League was wound up in March, 1953, with nearly a thousand members on the register. Of course, we accept cards for those of them who like to retain their old B.S.W.L. numbers and also keep envelopes with our Bureau. We also accept cards one-way for any U.K. amateur and for those overseas who care to keep envelopes with us for postal delivery. Both-way use of BCM/QSL is, however, strictly reserved for direct subscribers to *Short Wave Magazine*.

No doubt you will be good enough to give this letter the same publicity as Mr. Milne's misleading conjectures.

Yours faithfully,

AUSTIN FORSYTH (G6FO),
Managing Editor, *Short Wave Magazine*.

Can You Help?

● A. Gill (B.R.S.16221), 30 Ashby Street, East Bowling, Bradford, who wishes to borrow a manual for the R.M.E. preselector covering 0.55 to 32 Mc/s?

● C. B. Raithby (G8GI), School House, Martin, Lincoln, who wishes to know of a supply of the old-fashioned large shell pot insulators?

Silent Keys

A. BARNETT (ZS1RO)

With deep regret we record the death, suddenly, of Mr. A. Barnett (ZS1RO), at the age of 61 years. " Barney," as he was known affectionately to all his friends, was a Lancastrian who settled in Cape Town after four years' service in the Royal Navy as a telegraphist during World War I. Later he became a wireless operator with an air-line flying between London and the Cape.

Deepest sympathies are extended to his wife and married daughter. A.S.T.

JAMES E. CATT (G5PS)

Members will be grieved to hear of the sudden death, on June 5, 1956, of James (" Hamish ") Catt, G5PS.

An appreciation will appear in the next issue of the BULLETIN.

Frequency Predictions for July, 1956

PREPARED BY J. DOUGLAS KAY (G3AAE)

BAND	NORTH AMERICA	CENTRAL AMERICA	SOUTH AMERICA	SOUTH AFRICA	NEAR EAST	MIDDLE EAST	FAR EAST	AUSTRALIA
28 Mc/s	2000	1800	1400—2030	0800—1800	0830—2100	1100	1000	0800
21 Mc/s	1330—0000	0930—0030	1100—0100	0700—1900	0600—2200	0600—2100	0800—1800	0600—0930 2100—0100
14 Mc/s	ALL DAY	ALL DAY	0900—0400	0630—2200	ALL DAY	ALL DAY	0700—0100	1400—2300
7 Mc/s	0700	0400	0600	0200	0100	0000	2200	2000
3.5 Mc/s	0700	0400	0600	0200	0100	0000	2200	2000

These predictions are based on information provided by the Engineer-in-Chief of the Post Office. All times are G.M.T.

Between approximately May and September Sporadic E reflection may result in short skip conditions on the higher frequency bands. The incidence of Sporadic E is unpredictable but is most pronounced around mid-day and dusk.

Forthcoming Events

REGION 1

Blackpool (B. & F.A.R.S.).—June 26, 7.30 p.m., 25 Abbey Road, Blackpool.
Bury (B.R.S.).—July 10, 8 p.m., George Hotel, Kay Gardens.
Chester (C. & D.A.R.S.)—Tuesdays, 7.30 p.m., Tarren Hut, Y.M.C.A.
Crosby. — Tuesdays, 8 p.m., over Gordon's Sweetshop, St. John's Road, Waterloo.
Isle of Man (I.o.M.A.R.S.).—June 21, July 4, 19, 7.30 p.m., Manor Guest House, 48 Victoria Road, Douglas
Lancaster (L. & D.A.R.S.).—July 4, 7.30 p.m., George Hotel, Torrisholme.
Liverpool (L. & D.A.R.S.).—Tuesdays, 8 p.m., Room "G," Wavertree Community Centre, Penny Lane, Liverpool, 18.
Manchester (M. & D.R.S.).—July 2, 7.30 p.m., Brunswick Hotel, Piccadilly. **(S.M.R.C.).**—Fridays, 7.45 p.m., Ladybarn House, Mauldeth Road, Manchester, 14.
Preston (P.A.R.S.).—Wednesdays, 7.45 p.m., 48 High Street, off Lancaster Road.
Rochdale (R.R.T.S.).—Fridays, 7.45 p.m., 1 Law Street, Sudden.
Southport.—Thursdays, 8 p.m., Sea Cadets' Camp, Esplanade.
Stockport (S.R.S.).—June 20, July 4, 18, 8 p.m., The Blossoms Hotel, Buxton Road.
Warrington (W. & D.R.S.).—June 21, July 5, 19, 7.30 p.m., King's Head Hotel, Winwick Street.
Wirral (W.A.R.S.).—June 20, July 4, 18, 7.45 p.m., Y.M.C.A., Whetstone Lane, Birkenhead.

REGION 2

Barnsley.—June 22 (visit), July 13, 7.30 p.m., King George Hotel, Peel Street.
Bradford.—June 26, July 10, 7.30 p.m., Cambridge House, 66 Little Horton Lane.
Doncaster.—July 10, 7.30 p.m., Y.W.C.A., Cleveland Street.
Gateshead.—Mondays, 7.30 p.m., Mechanics' Institute, 7 Whitehall Road.
Hull.—June 26, July 10, 7.30 p.m., Rampant Horse, Paisley Street.
Leeds.—Wednesdays, 7.30 p.m., 4 Woodhouse Square.
Middlesbrough. — Thursdays, 7.30 p.m., Joe Walton's Boys' Club, Feversham Street.
Newcastle.—July 3, 7.45 p.m., Liberal Club, Pilgrim Street
Pontefract.—June 21, July 5, 8 p.m., Queens Hotel, Tanshelf.
Rotherham.—Wednesdays, 7 p.m., "Cutler's Arms," Westgate.
Scarborough.—Thursdays, 7.30 p.m., B.R. Rifle Club, West Parade Road.
Sheffield (S.A.R.C.).—June 27, 8 p.m., "Dog and Partridge," Tripper Lane.
Slaithwaite.—Fridays, 7.30 p.m., 3 Dartmouth Street.
South Shields (S.S. & D.R.C.). — June 27, 7 p.m., Trinity House Social Centre.
York.—Thursdays, 7.30 p.m., Club Rooms, Y.A.R.S., Fetter Lane.

REGION 3

Birmingham (South).—July 6, 7.30 p.m., "A" Committee Room, Cadbury Bros., Bournville Lane. **(M.A.R.S.).**—June 19, 7 p.m., Midland Institute. **(Slade).**—June 22, July 6, 7.45 p.m., Church House, High Street, Erdington.
Coventry.—June 22, 7.30 p.m., Priory High School, Wheatley Street. **(C.A.R.S.).**—June 25, July 9, 7.30 p.m., 9 Queens Road. **(Courtaulds).** — Wednesdays, 5-8.30 p.m., Messrs. Courtaulds, Foley Road.
Malvern.—July 2, 8 p.m., "Foley Arms."
Redditch.—June 28, July 10, 8 p.m., "Scale and Compass," Birchfield Road.
Solihull.—June 18, 7.30 p.m., Defence H.Q., Sutton Lodge, Blossomfield Road. (No meeting in July.)
Stoke.—June 27, 8 p.m., "Lion's Head," John Street, Hanley.
Stourbridge (St.A.R.S.).—July 3, 8 p.m., King Edward VI School.
Walsall.—June 27, July 11, 8 p.m., Technical College, Bradford Place.
Wolverhampton.—June 18, July 2, 8 p.m., Nechell's Cottage, Stockwell End.

REGION 4

Alvaston. — Tuesdays, Thursdays, 7.30 p.m. Sundays, 10.30 a.m., Boulton Lane, Alvaston, Derbys.
Chesterfield.—Tuesdays, 7.30 p.m., Bradbury Hall, Chatsworth Road.
Derby (D. & D.A.R.S.).—Wednesdays, 7.30 p.m., Room No. 4, 119 Green Lane, Derby.
Ilkeston (I. & D.A.R.S.).—Thursdays, 7 p.m., Room 5, Ilkeston College of Further Education, Field Road.
Leicester (L.R.S.).—Mondays, 7.30 p.m., Holly Bush Hotel, Belgrave Gate.
Lincoln (L.S.W.C.).—July 4, 7.30 p.m., Technical College, Cathedral Street.
Mansfield (M. & D.A.R.S.).—No meetings in June, July or August.
Newark.—July 1, 7 p.m., Northgate House, Northgate, Newark.
Northampton (N.S.W.C.). — Fridays, 7 p.m., Clubroom, 8 Duke Street.
Nottingham.—June 15, 7.30 p.m., Staff Canteen, Cinderhill Colliery, Cinderhill.
Peterborough.—July 4, 7.30 p.m., 21 Hankey Street.
Retford & Worksop.—No meetings in July or August.

REGION 7

Guildford and Woking. — June 24, 3 p.m., Royal Arms Hotel, North Street, Guildford.
Southgate and Finchley. — July 12, 8 p.m., Arnos School, Wilmer Way, N.14 (no meeting in August).

REGION 9

Bristol.—June 15, July 20, 7.15 p.m., Carwardine's Restaurant, Bristol, 1.
Exeter.—July 6, 7 p.m., Y.M.C.A., St. David's Hill.
Falmouth (W.C.R.C.). — Alternate Tuesdays, 7 p.m., Technical Institute.
North Devon.—July 5, G2FKO, 38 Clovelly Road, Bideford.
Plymouth.—June 16, July 21, 7 p.m., Tothill Community Centre, Tothill Park, Knighton Road, St. Jude's.
Torquay. — June 16, July 21, 7.30 p.m., Y.M.C.A., Castle Road.
Western-super-Mare. — July 11, 7.30 p.m. R.A.F.A.R.S., R.A.F. Locking, Somerset.
Yeovil.—Wednesdays, 7.30 p.m., Grove House, Preston Road

REGION 10

Cardiff. — July 9, 7.30 p.m., "The British Volunteer," The Hayes, Cardiff.
Neath and Port Talbot.—July 3, 7.30 p.m., Royal Dock Hotel, Briton Ferry.

REGION 14

Falkirk and Stirling.—July 6, 7.30 p.m., The Temperance Café, High Street, Falkirk.

Regional & Club News

Bristol.—Recent lectures have included " Clamper Valve Protection for Tetrode Power Amplifiers " by D. V. Newport (G3CHW) at the May meeting while E. C. Halliday (G3JMY) was due to talk about " Oscilloscope Circuits and Applications " at the meeting on June 15. J. G. Downes of Pye Ltd. will give a lecture and demonstration of " Industrial Television " at the meeting on July 20. Slow Morse practice classes have been resumed by G3KPT (Kingswood) who will be pleased to hear from anyone interested in attending. *Hon. Secretary:* D. F. Davies (G3RQ), 51 Theresa Avenue, Bishopston, Bristol 7.

Crystal Palace & District Radio Club.—The annual contests for the " Ann " Cup and Trophy will in future take the form of transmitting and receiving contests on the high frequency amateur bands. Meetings are held regularly at Windermere House, Westow Street, S.E.19, in association with Norwood & District R.S.G.B. Group. *Hon. Secretary:* G. M. C. Stone (G3FZL), 10 Liphook Crescent, Forest Hill, London, S.E.23.

East Kent Radio Society.—Meetings are held on Tuesdays at 7 p.m. in the basement of the Technical College, Longhurst Street, Canterbury. Prospective members and visitors are always welcome. G3JES and G3KNR have completed D/F sets and it is hoped to have two more completed soon. *Hon. Secretary:* D. Williams, Llandogo, Bridge, near Canterbury.

Torbay Amateur Radio Society.—At the meeting on May 19, R.S.G.B. members discussed final arrangements for N.F.D. and a Junk Sale was held in aid of expenses. Preliminary details of the " hamfest " to be held at the Oswalds Hotel, Babbacombe, in October were also discussed. The next meeting will be held on June 16 at the Y.M.C.A., Torquay. *Hon. Secretary:* L. H. Webber (G3GDW), 43 Lime Tree Walk, Newton Abbot.

* * *

R.S.G.B. Representatives and Hon. Secretaries of Affiliated Societies are asked to submit reports for this feature not later than the 22nd of the month preceding publication.

Representation

THE following is an addition to the list of County Representatives published in the December, 1954, issue.

Region 10—
Pembrokeshire, Cardiganshire and Carmarthenshire
Capt. G. C. Price, T.D. (GW2OP), Bangeston Hall, Pembroke Dock, Pembs.

* * *

The following is an addition to the list of Town Representatives published in the December, 1955, issue.

Region 7—London North
Finsbury Park Area (comprising postal areas N.1, 4, 5, 7, 16 and 19)
A. J. Mourton (G8QU), 18 Baalbec Road, Highbury, N.5

Affiliated Societies

THE following are additions to the list of Affiliated Societies published in the October, 1955, issue of the R.S.G.B. BULLETIN.

Grammar School Radio Society, c/o E. T. Ward, B.A., The Grammar School, Burton-on-Trent, Staffs.

Newark & District Amateur Radio Society, c/o J. R. Clayton, 160 Wolsey Road, Newark, Notts.

Changes of Address

Mr. G. F. Lyon, Hon. Secretary of the **Sheffield Amateur Radio Club,** has changed his address to 125 Rokeby Road, Sheffield 5.

Mr. G. F. Nottingham, Hon. Secretary of the **York Amateur Radio Society,** has changed his address to 23 Abbotsway, Muncaster, York.

LONDON MEMBERS' LUNCHEON CLUB
will meet at the Bedford Corner Hotel, Bayley Street, Tottenham Court Road, at 12.30 p.m. on Fridays, July 20 and August 17, 1956.
Telephone table reservations to HOL 7373 prior to day of luncheon. Visiting amateurs especially welcome.

VK/ZL DX Contest, 1956

THE New Zealand Association of Radio Transmitters and the Wireless Institute of Australia invite all radio amateurs to take part in the VK/ZL DX Contest to be held in the autumn. The Phone Section will commence at 10.00 G.M.T. on October 6 and end at 10.00 G.M.T. on October 7. The Telegraphy Section will also last for 24 hours and will start at 10.00 G.M.T. on October 13 and finish at 10.00 G.M.T. on October 14.

One point will be scored for each contact on a specific band with any VK/ZL district. The final score will be derived by multiplying the total number of contacts on all bands by the total number of VK/ZL districts worked on all bands. The districts are VK1, 2, 3, 4, 5, 6, 7, 9 and ZL1, 2, 3, 4. Serial numbers consisting of the RST or RS report followed by three figures commencing with 001 and increasing by 1 for each contact must be exchanged. In the Listeners' Section, VK or ZL stations must be heard.

Attractive certificates will be awarded to the highest scorer in each country.

Logs, posted to arrive not later than January 21, 1957, should be addressed to N.Z.A.R.T., Box 489, Wellington, New Zealand, from whom full details may be obtained.

GB3AWR

THE Army Wireless Reserve Amateur Radio Society is operating GB3AWR near Chester on all bands from 1.8 to 28 Mc/s until June 30. In addition, members of A.W.R.A.R.S. are active on Top Band with portable stations in North Wales and Westmorland. These stations use their operators' own call-signs with GW and /P when necessary and include the name of the county in which they are temporarily located.

DX Listeners' Club

BRIAN C. Smith of 9 St. Margarets Road, Westgate-on-Sea, Kent, is acting as United Kingdom representative of the new Norwegian DX Listeners' Club, and will be pleased to send details on request.

North Eastern Regional Meeting

to be held on
SUNDAY, JULY 8, 1956
at
THE WINDMILL HOTEL,
BLOSSOM STREET, YORK

Programme

Assemble	1.0–1.30 p.m.
Meeting	2 p.m.
Lecture (To be announced)	3.30–4.30 p.m.
High Tea	5.30 p.m.
Draw for Prizes	6.15 p.m.
Group Photo	6.30 p.m.

Tickets, price 8/6 each, may be obtained from the T.R., G. Nottingham, (G3DTA), 23 Abbotsway, Muncaster, York.

An Official Guide will be provided to conduct those not attending the meeting on a sightseeing tour. Control stations will be operating on 1919-1925 kc/s and 3650 kc/s.

EXCHANGE AND MART SECTION

ADVERTISEMENT RATES. Members' Private Advertisements 2d. per word, minimum charge **3s.** (All capitals, **6d.** per word, minimum charge **9/-). Trade Advertisements 6d.** per word, minimum charge **9s.** (All capitals **1/-** per word, minimum charge **18/-).** Write clearly. No responsibility accepted for errors. Use of Box number **1s. 6d.** extra. Send copy and remittance to **National Publicity Co., Ltd., 36-37 Upper Thames Street, London, E.C.4,** by **22nd** of month preceding date of issue.

ALL valves 100 per cent. 829 and base, 40/-. 6C5gt (2), 2/6 lot. Q575/40, 4/-. 6SJ7m, 2/-. 6AC7m (3), 6/- lot. 6SK7gt (4), 7/6 lot. 6SH7gt, 2/-. 6SH7m (9), 10/- lot. 6J6 (2), 6/- lot. 6C8G, 2/-. U24, 2/6. VR105/30 (2), 5/- each. 12SK7m (2), 5/- lot. 6J7m (2), 5/- lot. Det 20 (10), 10/- lot. 955 (6), 10/- lot. 956 (2), 5/- lot. 125R7m, 3/-. STV/280/40, 7/6. Meters 10-0-10mA 2½ in. F., 5/-. 0-30 mA 2 in. P, 3/-. 0-50mA 2 in. F (4), 4/- each. 0-200mA 2 in. F (2), 5/- each. 0-40/120mA 2 in. F (2), 4/- each. Eddystone transmitter condensers Type 137 Split stator 60pF per section. 2,000 V R.M.S. (2), 12/- each. Buyers to collect below; Rack 6 ft 6 in. high on castors takes 7 standard panels and chassis, £2. VCR140 and mask, 12/-. Chokes 8H 250mA (2), 5/- each. 20H 250mA, 5/-. Sephton, 16 Bloemfontein Avenue, Shepherds Bush, London, W.12. (36

AMATEUR moving QTH has the following high class gear for disposal:—AR88LF, £45. HRO 9 coils untouched even with a screwdriver, £30. American all band transmitter made for the amateur, 150W phone/cw built in scope and aerial tuner, only £65. Webster wire recorder, £15. 348R receiver fitted S/meter, £15. American UHF signal generators 22/330 Mc/s with mod. and carrier level meters, £35. Another 15/230 Mc/s with one band TV wave lengths, £15. 82 Walsall Road, Aldredge, Staffs. (39

BARGAIN 20 metre transmitter v.f.o. 6C4 doubler 6AK5 buffer QV03/12 p.a. QVO6/20 50W input housed in a G4BI cabinet with a 19in. panel, £3. Modulator, line up 6SJ7, 6J5 12AU7 (clipper) 6K6 into pair 1625 in A.B.2. driver transformer is Woden DT1 mod. transformer UM2 housed in a TU5B cabinet, £6; no power supplies. Meters at 5/-; 5mA 2 in. sq. 50mA 2 in. sq. 15mA 2 in. round. 200mA 2½in. round. Valves at 7/6; 8012 (four) EM34 (one). 5/- 1625 (six). Labgear 5 band p.a. coil turret, £1. Eddystone full vision dial, 10/-. Labgear wide band coupler 3.5 Mc/s, 7/6. Labgear p.a. r.f. choke, 5/-. Post extra. P. Carter, 51 Sundew Avenue, Shepherds Bush, London, W.12. (34

COMMAND receiver medium wave .5–1.5 Mc/s, 12V, £3.15.0. 12V Dynamotor 15/- Ideal car radio. Rotary converter (19 set) 12V in 275V, 110mA, and 500V, 50mA out (British), £3. Goodmans m/c microphone Z33. Brand new original box, £3.10.0. QVO6/20 (2), 25/- each; 6AG7, 6V6M, 9/- each. All brand new boxes. G3AIZ, 157 Wanstead Park Road, Ilford. (31

EDDYSTONE S640 wanted for Bury Radio Society. Reasonable price paid. C/o G3EJF, 24 Beryl Avenue, Tottington, Bury, Lancs. (38

FOR SALE. Hallicrafters S27 AM/FM/CW 28-145 Mc/s. BRT 400E as new. AR88F. 1392D and 234 Power Unit. Panadaptor by Panoramic Radio Corporation New York Model SA1/T200. 5" Tube 230 V.A.C. 450–470 kc/s I.F. 150 W. Transmitter 4 Band 813 P.A. W.B. Couplers less V.F.O. and power supplies. Could arrange delivery. B.R.S.20878, 25 Russell Avenue, Sprowston, Norwich. (27

FOR SALE. Panda PR120 V microphone AR88LF. Both with spare valves, handbooks. 65 other valves excellent condition, £140 or nearest offer. John Bain, GM3KAI, Reston, Berwickshire. (28

FOR SALE. Avo No. 7 as new £12.10.0; also High Resistance Avo, £10. Brand new Wolf ¼ in. Electric Drill, £5 plus 2/6 carriage. O'Brien, 18 St. Helens Road, Dorchester, Dorset. (37

FOR SALE. BULLETIN Vols. 24-29, very reasonable, single vols. or the lot. P. Woollett, How Green Farm, Edenbridge, Kent, Four Elms 276. (43

(Continued on page 544)

EXCHANGE AND MART SECTION (Contd.)

HRO complete good condition, £22 ono. G3KCA, "Blackwell," Brook Lane, Sarisbury, Hants. Tel.: Locks Heath 2436. (41

METALWORK.—All types cabinets, chassis, racks, etc., to your own specifications. Philpott's Metal Works, Ltd. (G4BI), Chapman Street, Loughborough. (99

MORECAMBE holiday. Overlooking Bay and Lake district mountains, Ham Shack. Write brochure. G3AEP, "Ferncliffe," Drewton Avenue, Sandylands, Morecambe. (962

PATENTS and Trade Marks. Handbooks and advice free. Kings 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. (98

QSLs and log book (P.M.G. approved). Samples free. State whether G or B.R.S. Atkinson Bros., Printers, Elland. (400

RCA communication receiver. Mod AR88 and speaker. Best offer £60 or over. Phone Manchester RUS 3155 or write Box 46, National Publicity Co., Ltd., 36-37 Upper Thames Street, London, E.C.4. (46

SALE. ZC1 with vibrator pack, £8. Receiver MCR1, £4. Double superhet receiver 480 kc/s to 30 Mc/s, £17. Electric Hawaiian guitar with a.c./d.c. amplifier, £20. G2HDU, 140 High Street, Shoeburyness, Essex. (47

SIGNAL Generator All-wave, 120 kc/s–84 Mc/s. A.C. mains 200/250V. Unused, £3. Langdale, 18 Buckley Avenue, Leeds, 11. (32

TWO metre transmitter, SCR22, 2 crystals, handbook, 3 el. beam, power pack H.V./Bias, rack, 2 metre converter, £13. 10 metre converter, 30/-. G6BZ, 142 Woking Road, Guildford. (44

U.S.A. equipment for sale. MILLEN 90800 Transmitter/Exciter 50 watts, £7. TRIPLETT Signal Generator 100 kc/s to 120 Mc/s, £20. HRO Senior, 4 Bandspread coils no power supply, £15. PHILCO BC221AE stabilised power supply, £25. MICRO MATCH original Jones Type MM.1, £3. INDUSTRIAL ELECTRONICS Oscilloscope Type 1200B, £15. BC453, 10/-. METERS: 3½ in. 0-500 microamps, 15/-; 0-15V AC, 5/-; 0-300V MI, 5/-; 2 in. all at 5/-; 0-.5 amps RF, 0-2 amps RF, 0-3 amps RF, 0-5 Mills, 0-100 Mills, 0-150 Mills, 0-300 V. VALVES: all at 5/-, EF37, EF41, EL42, 5W4, 6J5, 6L6m, 6SK7, 6SQ7, SP61, Z62, 717A, 807. TRANSFORMERS: Thermidor 620V 225 Mills with 10H Choke to match, 30/-, Parmeko 620V 200 Mills-375V 250 Mills, etc. with 5V 3A Twice, £1. Elstone 6.3V or 4VGT 12 amps, £1. Woden 12H 150 Mills, 10/-. Line transformers 5000 ohms to 200/500 ohms, 5/-. Paper condensers all at 5/- each, 4μF 1000V, 6μF 500V, 8μF 350V. Aerial Prop Pitch Motor with two Selsyns and 30V transformer, £8 the lot. Buyer collects Walton-on-Thames or Brentford or carriage forward on heavy items. G3DOG, Greensleeves, Silverdale Avenue, Walton-on-Thames. (42

WANTED BC610 Hallicrafters, E.T.4336 transmitters, and spare parts for same. Best prices. P.C.A. Radio, Beavor Lane, Hammersmith, W.6. (626

WANTED: HRO coils, receivers, power packs, AR88Ds, AR88LFs, SX28s, BC348s, AR77s, and many other types, also laboratory test equipment and R54/APR4, TN17, TN18 and TN19 units. Details please to R. T. & I. Service, 254 Grove Green Road, Leytonstone, London, E.11 (LEY 4986).

WANTED one or more 813 valves, full particulars please to G8JO, 22 Pembroke Terrace, South Shields, Co. Durham. (29

WANTED. H.R.O. AR88 or SX28 receiver. Also H.R.O. Coils. Particulars to Howell, 40 Streatfield Road, Kenton, Harrow, Middlesex. (35

ZD9AD selling up, post-expedition, pre-national service, XYL pending. Also selling AR88s, CR100, BC348, BC221, VRL and over two tons of good gear. Lists published shortly send enquiries to GW3HEU, 97 Ruabon Road, Wrexham. (33

75 watt transmitter MkIII (Pi-output) (3.5–28 Mc/s), Companion 60 watt modulator, bandswitched A.T.U. with 2 meters, 2½" scope. All built by G5RV in separate B/crackle cabinets. 3 Power supplies excitor, modulators, p.a. and bias, all choke inputs, all in separate B/crackle cabinets. 7 units. £50. Box 30, National Publicity Co. Ltd., 36/37 Upper Thames Street, London, E.C.4. (30

314 Valve Tester with manual, mint condition, £6 carriage paid. Horrocks, G2FLP, Biddulph Road, Congleton, Cheshire. Tel.: 258. (45

APPOINTMENTS SECTION

Situations Vacant

ENGINEER-in-CHARGE, BROADCASTING SERVICE, NICOSIA, required by Government of CYPRUS, on contract for two years in first instance. Salary in scale (including overseas allowance and present temporary allowance of 11½ per cent of salary) £1,480 rising to £1,789 a year. Gratuity at rate of £150 a year. Free passages. Liberal leave on full salary. Candidates, preferably between 25 and 35 should have sound theoretical knowledge and practical experience of operation and maintenance of MF broadcast transmitters and aerial systems and be able to control and supervise junior staff. Write to the Crown Agents, 4 Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience and quote M2C/41601/RC.

SIERRA LEONE GOVERNMENT POSTS AND TELEGRAPHS DEPARTMENT requires SIGNALS STAFF for two tours of 18/24 months each either (a) with prospect of pensionable employment or (b) on temporary terms with gratuity at rate £100/£150 a year. Salary scales (including Expatriation Pay) as indicated. Commencing salary according to qualifications and experience. Outfit allowance, £60. Free passages for officer and wife. Free passages for two children under age 19 or grant up to £150 annually for maintenance in U.K. Liberal leave on full salary. Candidates should be experienced MF., HF., VHF., VHF/DF and ancillary equipment. Preference for C. & G. Cert. in Radio. SIGNALS OFFICER (AERADIO) M2C/41718/RC. Salary scale under terms (a) £1,272 rising to £1,442 a year or (b) £1,376 rising to £1,558 a year. Candidates should possess P.M.G. 1st Class Cert. or equiv. and should be able to control staff and organise traffic schedules.
ASSISTANT SIGNALS OFFICER (AERADIO) (M2C/41719/RC). Salary scale under terms (a) £797 rising to £1,257 a year or (b) £859 rising to £1,359 a year. Candidates should possess P.M.G. Cert. or equiv. Write to the Crown Agents, 4 Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience and quote the reference numbers shown against the post applied for. (40

WIRELESS STATION SUPERINTENDENT required for the POSTS AND TELECOMMUNICATIONS DEPARTMENT, GOLD COAST LOCAL CIVIL SERVICE, for two tours of 18 to 24 months in the first instance. Consolidated salary scale £990 rising to £1,230 a year. Gratuity at the rate of £100/£150 a year. Outfit allowance £60. Liberal leave on full salary. Free passages. Candidates should preferably have served an apprenticeship in electrical or radio engineering and have had five years subsequent experience in the manufacture, installation or maintenance of radio equipequipment. Candidates also eligible for consideration with at least eight years engineering experience including a minimum of five years spent on above duties. Experience in two or more of following fields desirable:—V.H.F. mobile and fixed link systems; H.F. communication system; Freqency shift keying and teleprinter maintenance; V.H.F. and H.F. Cathode Ray direction finding; manufacture of light engineering projects; Diesel Engine Generation. C. & G. Final Cert. in Telecommunications (Radio) an advantage. Write to the Crown Agents, 4 Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience and quote M2C/29100/RC.

Printed in Great Britain for the RADIO SOCIETY OF GREAT BRITAIN, New Ruskin House, Little Russell St., London, W.C.1, by The Haycock Press, Ltd., London, S.E.5

IF UNDELIVERED Return to:— R.S.G.B., NEW RUSKIN HOUSE, LITTLE RUSSELL STREET, W.C.1

IF UNDELIVERED Return to:— R.S.G.B., NEW RUSKIN HOUSE, LITTLE RUSSELL STREET, W.C.1