The SHORT WAVE Magazine

2/-

VOL. XII FEBRUARY, 1955 NUMBER 12

WORLD WIDE COMMUNICATION

LYONS RADIO

LIMITED

3, Goldhawk Rd., Shepherds Bush, London, W.12

Dept. MS. Telephone : SHEPHERDS BUSH 1729

METAL MINE DETECTOR UNITS, No. 3. We have once again been able to secure another small supply of these units which give warning of the presence of metal objects in water, timber, underground, etc. There are probably many applications for which this equipment can be used in addition to its original one. Electricity, Water and Gas Co's., Timber Merchants and Post Office departments are amongst those we have so far supplied. The equipment is complete (less batteries, which if desired we can supply as an extra) in strong wood transit case. The principal items are : an A.F. amplifier employing 3-ARP12 (VR23) valves mounted with battery space in metal case 11 x 11 x 4½ins., search coils, control box pole front and rear sections, high resistance headphones and carrying satchel. Power requirements are : 60 or 90v. H.T. battery and 4-1.5v. cells "S" type or similar. In good condition and instruction data included. PRICE **£3/12/6.** carriage 10/6.

RECEIVERS TYPE R.1155. One of the best known and most popular of ex-Government communications receivers. Frequency range includes the 20, 40 and 80 metre "Ham" bands, medium and long wave transmissions. Valve line-up VR100-Sig. freq. amp., VR99-Freq. changer, VR100-1st I.F. amp., VR100-2nd I.F. amp., VR101-Det. A.F. amp., VR101-A.V.C. B F.O., VR103-Tuning indicator. In condition as new and unused, supplied in maker's original transit cases. PRICE **£10/17/6,** carriage 7/6.

A.C. MAINS POWER PACK/OUTPUT-STAGE UNITS. Specially designed to operate the R.1155 direct from A.C. mains and to provide for a speaker output. Fitted with 5Z4 rectifier and 6V6 output valves and connector which plugs straight into receiver for immediate use. PRICE **£3/19/6,** carriage 3/6.

SLYDLOK FUSE HOLDERS. 5 amp size, 3 for **6/6.** 6 for **11/9.** Trade enquiries invited for large quantities.

"PYE" 45 Mc. I.F. STRIPS. Using 6-VR91's (EF50) and 1-VR92 (EA50) valves, these units form a complete vision receiver having 4-R.F. stages ; detector, Video amplifier and phase splitter. In good condition. PRICE, with valves, **62/–**, less valves **35/–**, post 2/6.

AMERICAN MADE 807's. As brand new in maker's original cartons. Buy some now whilst stocks last. PRICE ONLY **7/6** each.

Prices slashed at Clydesdale

ELECTRONIC IGNITION TESTER
Type VED. patt. 563562 by English Electric. In Original Wood Case. A Cathode Ray tester for checking ignition of internal combustion engine while engine is operating, will operate from 6, 12 or 24 volts D.C. or 230 volts A.C. Built into black crackle case with hinged front and carrying handle. Dim. : 15in. x 8½in. x 11½in. No leads or instruction book available.
ASK FOR SM/H535. **£15** CARRIAGE 10/- EXTRA

INDICATOR UNIT TYPE 6
With VCR-97 tube and valves 4-VR91 (EF50), VR54 (EB34), 3-VR92 (EA50), VR78 (D1), etc. Dim. : 18in. x 8½in. x 7½in. Weight 21 lbs. In original Wood Case.
ASK FOR SM/H524. **45/-** Each. CARRIAGE 5/- EXTRA

INDICATOR UNIT TYPE 6H.
With VCR-97 tube and valves 4-VR91 (EF50), 3-VR54 (EB34). Dim. : 18in. x 8½in. x 7½in. Weight 22 lbs. In Original Case.
ASK FOR SM/E777. **59/6** Each. CARRIAGE 5/- EXTRA.

R.F. UNIT TYPE 24. In Original Carton.
With valves 3-VR65 (SP61), etc. Range 20-30 Mc/s., switched tuning. Dimensions : 9½in. x 7½in. x 4¾in. Weight 7 lbs.
ASK FOR SM/H850. **10/-** Each. Circuit 1/3. POST 1/6 EXTRA

R.F. UNIT 25. In Original Carton.
Range 40-50 Mc/s. Otherwise as R.F.24.
ASK FOR SM/H874. **12/6** Each Circuit 1/3. POST 1/6 EXTRA

8 core Screened Cable. PVC outer sheath. Any length supplied, price **9d.** per yard.
ASK FOR SM/H539. Minimum 8 yards, at **6/-** POST 1/- EXTRA

6 core Rubber covered Cable. Any length supplied, price **6d.** per yard.
ASK FOR SM/H540A. Minimum 12 yards, at **6/-** POST 1/- EXTRA

PLEASE NOTE : Carriage and postal charges refer to the U.K. only. Overseas freight, etc., extra.

Order direct from Tel. : South 4451/7

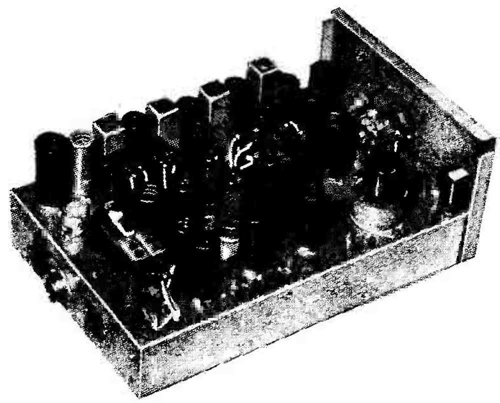
CLYDESDALE SUPPLY CO., LTD.

2 BRIDGE STREET, GLASGOW, C.5

P.C.A

Hamobile

Mobile
Transmitter / Receiver
For 2 Metres



Specially designed for amateurs for mobile use or in the shack. Mains and Car Batteries.

●

We are proud to announce that after many months of research and testing we have produced a highly sensitive double conversion superhet using the latest miniature valves and modern technique. An efficient 14 watt plate and screen modulated transmitter for phone and c.w.

●

This is the set for which all VHF enthusiasts have been waiting.

Send post-card for full particulars of this amazing set to:

P.C.A. RADIO

BEAVOR LANE, HAMMERSMITH, London, W.6.

Telephone : RIVerside 8006/7

SHORT WAVE MAGAZINE

VOL. XII FEBRUARY 1955 No. 138

CONTENTS

Managing Editor: AUSTIN FORSYTH, O.B.E., (G6FO)

Advertisement Manager: P. H. FALKNER

Assistant Editor: L. H. THOMAS, M.B.E. (G6QB)

Published the Friday following the first Wednesday each month at 55 Victoria Street, London, S.W.1. • Telephone: Abbey 5341/2

Annual Subscription: Home and Overseas 24s. post paid.

AUTHORS' MSS

Articles submitted for Editorial consideration must be typed double-spaced with wide margins on one side only of quarto or foolscap sheets, with diagrams shown separately. Photographs should be clearly identified on the back. Payment is made for all material used, and it is a condition of acceptance that full copyright passes to the Short Wave Magazine, Ltd. on publication.

FOR THE EXPERIMENTER FOR THE RADIO ENGINEER

The SHORT-WAVE Magazine

EDITORIAL

Coverage *The remarks in this space in our last issue may be said to gain point from the general contents of this issue of* SHORT WAVE MAGAZINE. *They will be found to range from the practicalities of a superhet receiver and transmitter for the Top Band using transistors throughout, to an entirely new approach—in the amateur sense—to UHF circuitry. The latter is a particularly important contribution to the problems of opening up on a band which is at present very little used but which, nevertheless, has extremely interesting possibilities for the keen experimenter.*

Thus we see the immense scope there is in the Amateur Radio field purely for experimental work—quite apart from the interesting things always happening on the communication bands, on which the great majority of amateurs spend most of their time and expend the greater part of their energies.

What it comes to is that, as ever, the field of activity for the keen radio amateur—considering only the comparatively narrow range of possibilities expressed by the term Amateur Radio—is in fact so wide that very few amateurs are able to cover all the ground. We are developing more and more as specialists in different branches of the art. This in turn means that, collectively, amateurs have a great deal of scientific experience and know-how, mainly practical.

For this reason they comprise an increasingly important section of a community for which science is finding more and more of the answers to the problems of daily life.

Austin Forsyth
G6FO.

Starting on 25 Centimetres

VALVE AND CIRCUITRY PROBLEMS—COAXIAL LINE TUNING SYSTEM—A PRACTICAL OSCILLATOR DESIGN FOR 1215 MC

A. G. WOOD (G5RZ)

PART I

From time to time we have drawn attention to the vast areas open to us in the UHF regions, still uncharted territory where Amateur Radio is concerned. It behoves us to get on to these frequencies and make use of them, not only to keep them, but also because there is so much useful and interesting exploration still open to amateurs on the UHF bands. The difficulty, of course, has been the equipment—what to use, and how to make it work. On our 1215-1300 mc band, the next above 430 mc, we are in the "twilight zone," in which normal circuit techniques can no longer be used, and we have to begin to think more in terms of radar circuitry. The author of this article—a well-known contributor to SHORT WAVE MAGAZINE*—is devoting a great deal of time and experimental effort to finding the practical answer, in the amateur sense, to the problems of our unoccupied 25-centimetre band. The first results of his researches are presented herewith. In case it should be imagined that G5RZ is a "professional amateur," with vast technical resources beyond the reach of the average radio experimenter, let it be said that he is strictly an amateur and only started on VHF himself about three years ago. His approach to the thousand-megacycle band is therefore essentially that of the practical man.—Editor.*

IT is an interesting reflection that within the lifetime of many amateurs a kindly G.P.O. granted us the freedom of the air on all wavelengths below 200 metres — secure in the knowledge, perhaps, that few even knew how to get down to 100 metres and still fewer knew whether there was any point in so doing, anyway.

What immense distances we have travelled since those days ! And what of the future ? There are some, doubtless, who feel that with the commencement of activity on Seventycems the end of the road has already been reached. In spite, however, of the apparently complete lack of activity on any of our frequencies higher than 430 mc, the writer is one who does not share this view and feels (with some others) that there is a wide field for development, using equipment within the reach of nearly all, just waiting for the enthusiast, at least in respect of the next frequency allocation of 1215-1300 mc and possibly also on 2300-2450 mc.

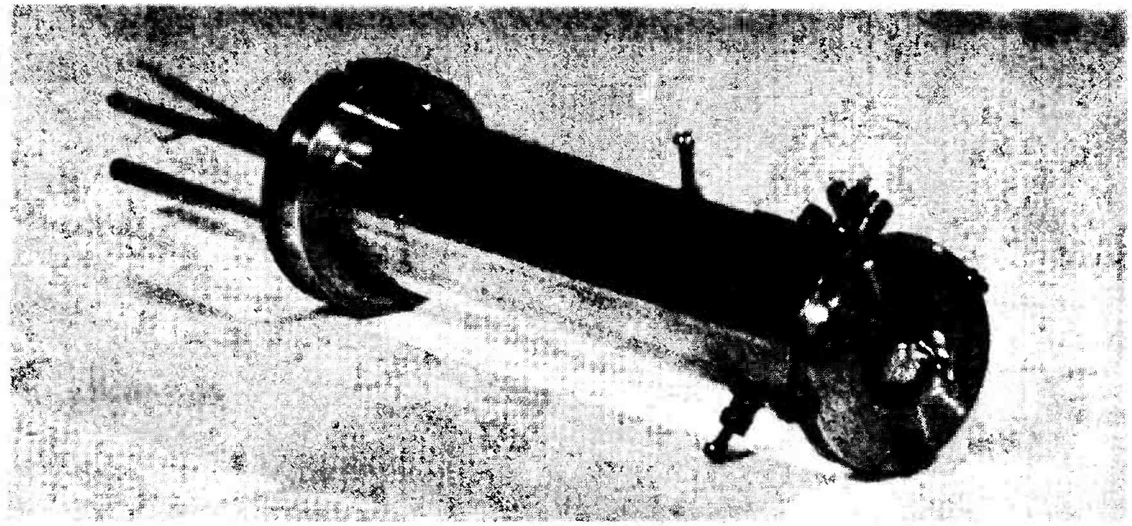
Very little appears to be published with regard to operation at these ultra-high frequencies, and it is therefore the object of these comments to attempt to explain the kind of difficulties which will be encountered and to suggest ways in which they may be overcome.

The General Problem

With increase in frequency three main problems raise their ugly heads ! (1) Transit time ; (2) Inter-electrode and stray capacities ; and (3) Lead inductance.

Transit time can best be explained as the actual time taken by the electron to travel from the heated cathode to the anode of the valve. At conventional frequencies this period of time is so small in relation to the time cycle that it has no effect on the working of the circuit and may be ignored. As the frequency increases this happy state of affairs begins to deteriorate, the transit time occupying an appreciable part of the cycle time. Eventually, a point is reached where a *complete reversal* of cycle takes place before the electron has had time to complete its journey, and the valve ceases to function. This condition is beyond the control of the user, but fortunately valve manufacturers have been fully alive to the problem and have done all they possibly can to improve matters in valves intended for very high and ultra-high frequencies, by reducing the distance between electrodes to very narrow limits. One other way in which transit time can be reduced is by an increase in anode voltage, but unfortunately the reduction in electrode spacing calls for a reduction also in anode volts — so the two methods become conflicting.

Inter-electrode capacities also can only be dealt with by the manufacturers, and these have



The 1215 mc oscillator complete, seven inches in length, as designed and constructed by G5RZ and described in the article. The coaxial line tuning technique is what makes the dimensions manageable at this (relatively) very high frequency. The unit can be operated either as oscillator or amplifier and will give about two watts of measurable and controllable RF output, with reasonable stability.

been cut down by reducing the physical size of the electrodes. This, in turn, also brings about a reduction in anode dissipation unless steps are taken to provide forced air cooling. Stray capacities can be kept to the lowest possible levels by careful circuit design, as will be shown later. At this stage it is as well to realise *why* it is so necessary to keep these capacities down to the absolute minimum. A tiny capacity of only 1 $\mu\mu$F has a reactance at 1 megacycle of about 160,000 ohms. At 10 mc this has been reduced to 16,000 ohms; at 100 mc it is down to 1,600 ohms; at 1,000 mc it becomes 160 ohms and at 3,000 mc it is as near 53 ohms as makes no odds! The grid-filament capacity of a UHF triode can be anything from around 2 to 8 $\mu\mu$F . . . !

The reduction in lead inductance is partly in the hands of the valve manufacturers and partly under our own control. The manufacturer tackles the problem by reducing the physical size of the glass envelope so that the distance between the point of attachment to the electrode and the external pin or other contact is as small as possible; by providing, in some instances, two external contacts to the same electrode and (for ultra-high frequencies) by making the outside contacts an integral part of the actual electrode in the form of a copper ring fused into the glass, such as in the " lighthouse " type of valve. Least improvement in this respect applies to the heater/cathode leads. Owing to the fact that the cathode is heated, a minimum distance between the heated area and the glass seal is required to prevent seal cracking and this limits any great improvement in lead inductance in this case.

Although all these factors are beyond the user's control it was felt necessary to explain them at some length in order that their importance should be realised and to show why it is quite useless to hope to obtain results at these frequencies with the aid of the conventional type of valve which line the shelves of almost any amateur station!

Circuit Considerations

It is time now to turn attention to details of circuitry. Consider first Fig. 1A which is the conventional tuned-plate tuned-grid circuit as it appears at normal frequencies. The internal capacity between plate and grid is almost always sufficient to sustain oscillation when both circuits are in resonance. Turn now to Fig. 1B which is the same circuit as it would appear at much higher frequencies. Notice, particularly, that the cathode is no longer at ground potential as the lead inductance is introduced and that this inductance (which, remember, is the worst of the three) is common to both circuits. No wonder that TPTG circuits become somewhat unmanageable at times!

The writer feels that it is not sufficiently widely appreciated that the cathode need not be the only common element. In a triode any one of the three electrodes can be selected for

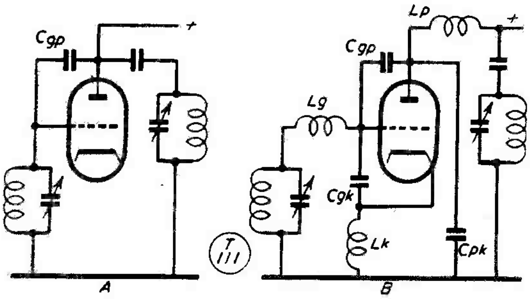


Fig. 1. (A) shows the basic circuit of the conventional TPTG oscillator. At (B) is the TPTG as it appears at VHF, showing the effect of lead inductance, inter-electrode and stray capacities.

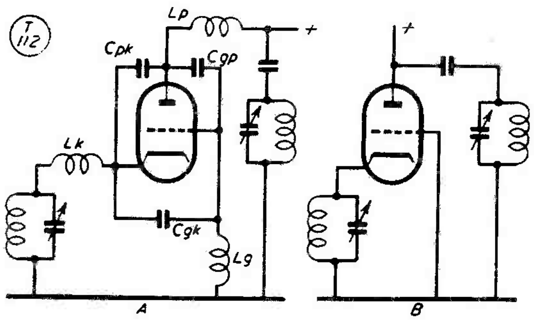


Fig. 2. (A) The common-grid circuit drawn to conform with Fig. 1 (B). (B above) The common-grid with the unwanted L and C components absorbed into their respective circuits. This is now the familiar grounded-grid arrangement.

this function and the reader is now referred to Fig. 2A, where the grid has been selected for this purpose. Now the somewhat unwieldy cathode lead inductance is in series with the tuned grid-cathode circuit and, in fact, can form part of the total inductance. Likewise, the same thing applies in the tuned plate-cathode circuit and the only lead inductance common to both circuits is now the very small one connected to the grid. In valves of the disc-seal type this is reduced to a very low figure indeed. In like manner the rather high grid-cathode and grid-plate capacitances are placed across their respective tuned circuits whilst the lowest of the three — the plate-cathode capacity—provides the feed-back in a greatly-reduced form ; so much so, that in a properly designed circuit this is insufficient to sustain oscillation and external feed-back has to be applied for this purpose, with the great advantage that it is under the control of the circuit designer. In other words, this circuit can be used both as an oscillator or as an amplifier up to very much higher frequencies than would have been possible with the former arrangement. The circuit is re-drawn in Fig. 2B with the various L and C components absorbed into their respective tuned circuits. and it is now easily recognisable as the well-known grounded-grid amplifier.

Hence, by a simple re-shuffle of the circuitry a very much more stable and efficient stage has been achieved capable of giving results at frequencies beyond the reach of the TPTG circuit.

Admittedly, ordinary lead inductance still exists even if the coils and condensers are wired up with great care and forethought so that additional means must be provided to remove these or to make them form part of the tuned circuits.

This can be achieved by substituting tuned lines for the normal coil and condenser combination. These consist of parallel rods approximately one quarter-wavelength long at the required operating frequency, short-circuited at the ends remote from the valve by adjustable shorting bars. These rods will be less than a physical quarter-wave long since they are tuned by the interelectrode capacity of the respective elements to which they are attached. Tuning is accomplishd by varying the physical length of each pair of lines with the aid of the adjustable shorting bars. Fig. 3 shows just such a circuit from which it will be seen that negative high tension is applied to the common grid line at any convenient point and positive high tension at the end of the plate line. In this circuit the plate-grid shorting bar must consist of a condenser to isolate HT+ from the remainder of the circuit.

Circuits of the type as shown in Fig. 3 have been made to oscillate at frequencies as high as 1215 mc, but the efficiency falls off very greatly from about 300 mc and is very low indeed at 1215 mc. This is largely because as the frequency is increased the spacing between the two lines becomes an appreciable part of a wavelength and radiation takes place, thereby reducing the Q of the circuit. Physical difficulties arise if attempts are made to bring

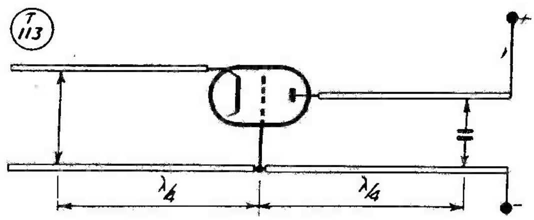
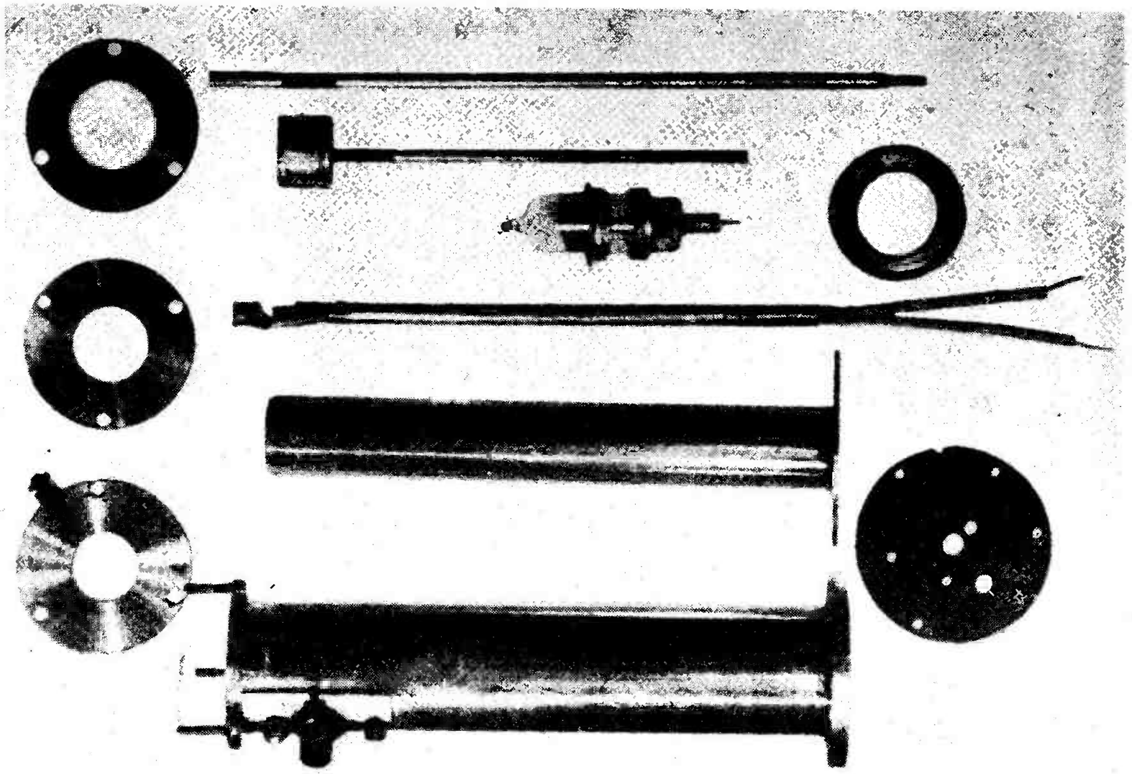


Fig. 3. The next step is the substitution of tuned quarter-wave lines for the conventional coil-condenser combination, as a means of reducing unwanted L and C components.



All the parts for the 25-centimetre oscillator, which make up to the assembly shown in the accompanying photograph. The valve is a Mullard TD03-10 (ME-1000) and a detail drawing of the oscillator appears in Fig. 5A.

the lines closer together and also another form of loss is introduced, known as the promixity effect; this is due to eddy currents set up in the adjacent fields. The circuit is described only because it is the next logical development in the chain leading to the evolution of the co-axial line circuit.

Co-axial Line Technique

In order to prevent unwanted radiation, steps must be taken to confine the field, and this is achieved with a *very great* improvement in efficiency by the use of co-axial lines in conjunction with the disc-seal or "lighthouse" type of valve for which kind of circuit these valves are specially designed. For those who are not familiar with these special types Fig. 4 shows sketches of a number. Basically they are all similar in that they are intended to be built into co-axial or concentric line circuits. Most valves of this type follow the plate-grid-cathode sequence of external connections and therefore are admirably suited to the grounded-grid or grid-separation type of circuit. The CV178 shown is an exception to this rule.

Fig. 5 shows the logical evolution of the grounded-grid circuit of Fig. 3 into co-axial form. Such a layout is particularly suited to a valve of the CV16 type where the largest external connection is the centrally situated

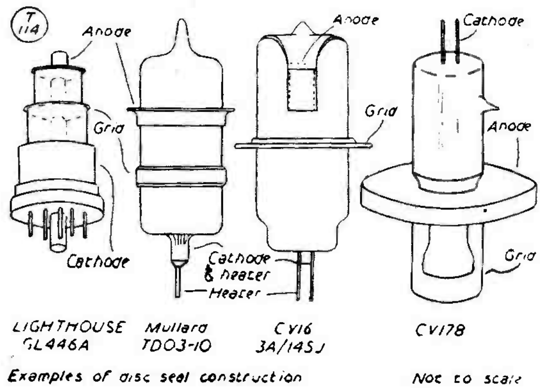


Fig. 4. Outline drawings (not to scale) of valve types designed for concentric line circuits at UHF.

grid-disc. (The valve drawn into Fig. 5 is of no particular type.) This double-ended form of construction has both drawbacks and advantages. As an oscillator some form of external feed-back will be required, usually by co-axial cable and probes linking the two live cavities. As an amplifier no feed-back is needed, of course, and moreover, it becomes an easy matter mechanically to arrange for input drive into the grid-cathode cavity, and output coupling from the grid-anode cavity.

In either case tuning arrangements have to be handled from each end which may become a disadvantage. The supply connections to a circuit of this type are interesting if a trifle unorthodox to conventional ideas. The whole of the plumbing is at the same DC potential and since positive HT must be applied to the plate this would constitute a real danger to the operator! Consequently, HT+ is earthed; negative HT is applied to the isolated grid and *via* the cathode bias resistor R to the cathode lead; the cathode de-coupling condenser is built-in at the junction of the cathode prong and the cathode tube termination. The negative HT is held at ground potential to RF by the 0·1 μF condenser shown. As explained previously, tuning of each circuit is accomplished by altering the physical length of the live cavity and this is achieved by means of the tuning plungers or pistons which are arranged to make a positive sliding contact with the walls of the tubes, being operated by means of push-rods as shown.

Valves of the TD03-10 type, whilst still intended for the grid separation form, lend themselves more readily to a more compact and convenient design. This is shown in Fig. 5A in which it will be seen that three concentric tubes are employed, the cavity formed by the outer and middle tube constituting the grid-plate circuit and that between the middle and inner the grid-cathode circuit; the DC cathode and heater connections are led through the middle of the innermost tube. It is still necessary to incorporate a cathode decoupling condenser, either at the junction point of the cathode and its tube, or by incorporating it in the cathode-grid tuning plunger arrangement. The plate blocking condenser is built in at the plate ring and consequently the HT supply is earthed in the more normal manner. Tuning is accomplished by plunger adjustment as before, but from one end only. In either form of design isolation between plate and cathode is very complete and feed-back will be required for oscillation purposes. Because of the mechanical difficulties of providing for input drive this form of layout is perhaps more suitable when an oscillator and not an amplifier is under consideration.

Standards of Design

Before turning to more specific details of design it would be as well to pause and consider what, at this present stage, is really required for 1215 mc operation. Activity is *nil*, or almost so, so that QRM is certainly not yet a force to be reckoned with! Consequently, it hardly seems necessary to consider provision for a *high* degree of stability such as could be obtained from a complicated crystal oscillator-multiplier chain. By the same token the receiver requirements can be kept at the same simple level, and it is suggested that perhaps the easiest approach to the problem would be by the use of a co-axial line quenched oscillator. The super-regenerative receiver is known to be a very sensitive piece of apparatus and its inherent lack of selectivity would positively be an advantage in this case. After all, these were not unknown in the earlier days on five metres and as activity increased so did the technique of improving both stability and signal-to-noise ratios.

It has already been implied that part of the price of obtaining RF at these advanced frequencies has to be paid in the form of reduced output. As an example, the Mullard TD03-10, a drawing of which appears in Fig. 4, is rated at 10 watts, and it is stated by the makers to be capable of producing $2\frac{1}{2}$ watts output at a frequency of around 1200 mc, or 25 cm. It will, moreover, still produce something right down to 8 centimetres or 3,750 mc! All this without forced-air cooling which only tends further to complicate the issue. Now, at first sight a single watt or so of RF does not seem very much, but let it not be overlooked that at these frequencies, where a dipole does not exceed about 5 inches in length, complex arrays of *enormous* gain can be built at very little cost and taking up very little space—so that the QRP aspect of the matter can perhaps be reviewed with greater satisfaction.

Mechanical Side

It has been said by many, and doubtless it is being said by some reading this discourse at the moment—"This is all very well, but this plumbing business is not up my street, and in any case I do not possess a lathe." It is true that a lathe *is* an advantage, but the writer is no plumber and what could not be done by the determined enthusiast could be done at little cost by the "chap next door" or the local garage in exchange for a pint at the local or a

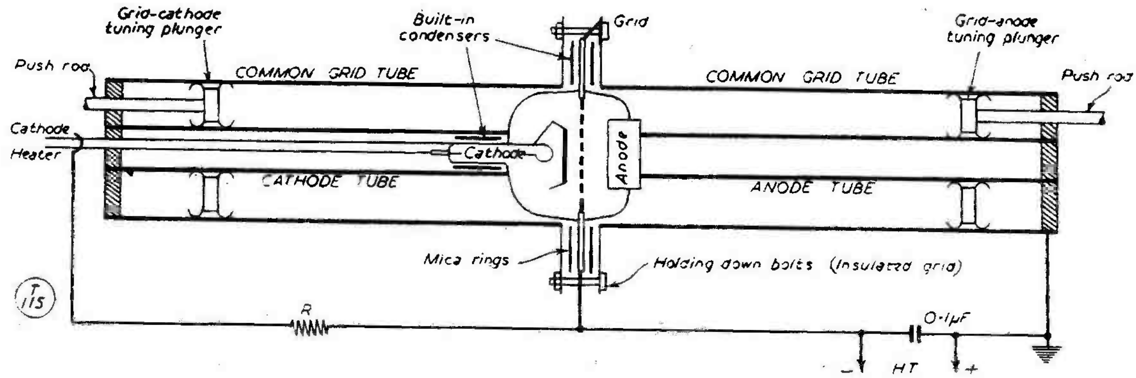


Fig. 5. The basic coaxial or concentric-line oscillator circuit as a logical development of Fig. 3. This is a sketch of the electro-mechanical arrangement, in section, the actual construction being cylindrical.

KEY TO FIG. 5A

(1) 2 oz. Brass valve retaining ring*
(2) Plate blocking condenser
(3) Insulated bushed holding down bolts
(4) Plate tube 1-7/16" o/d x 7½" long, brass
(5) Grid tube ¾" o/d x 6⅞" long, copper
(6) Cathode tube ¼" o/d x 6¼" long, copper
(7) ¼-wave mode feed-back probe
(8) ¾-wave mode feed-back probe
(9) Inductive coupling loop
(10) Output capacity probe into 72 ohm co-axial line
(11) Cathode decoupling condenser (at least 100 μμF)
(12) Grid-plate tuning plunger
(13) Grid-cathode tuning, plunger
(14) Plunger push rods
(15) Bakelite (or metal) end plate

Valve Mullard TD03-10 UHF triode (ME 1000 : ME 1001)

Zo *g-p* approx. 40 ohms	C *g-p* 1.10 μμF
Zo *g-k* approx. 65 ohms	C *g-k* 2.20 μμF
$\frac{\text{Zo C } g\text{-}k}{\text{Zo C } g\text{-}p}$ = 3.2 approx.	C *p-k* 0.02 μμF

*N.B. At least 2 oz. of brass or its thermal equivalent must be in contact with the anode to limit anode seal temperature and rate of change of temperature.

few shillings, whichever is more appropriate. Lest it be thought that the tubing presents difficulties let us hasten to add that the prototype oscillator constructed by the writer and described in greater detail later in this article utilised a disused garden spray: a piece of scrap copper water pipe; a short length of discarded copper petrol pipe unearthed in the garage: and the remains of a copper reflector from an old electric bowl fire, together with a few odds and ends from the inevitable junk box. In passing it might be worth adding that at one time contemplative eyes were even turned in the direction of the G5RZ front-door bell chimes as possibly useful for the required tubing!

The choice of cylinder diameters depends

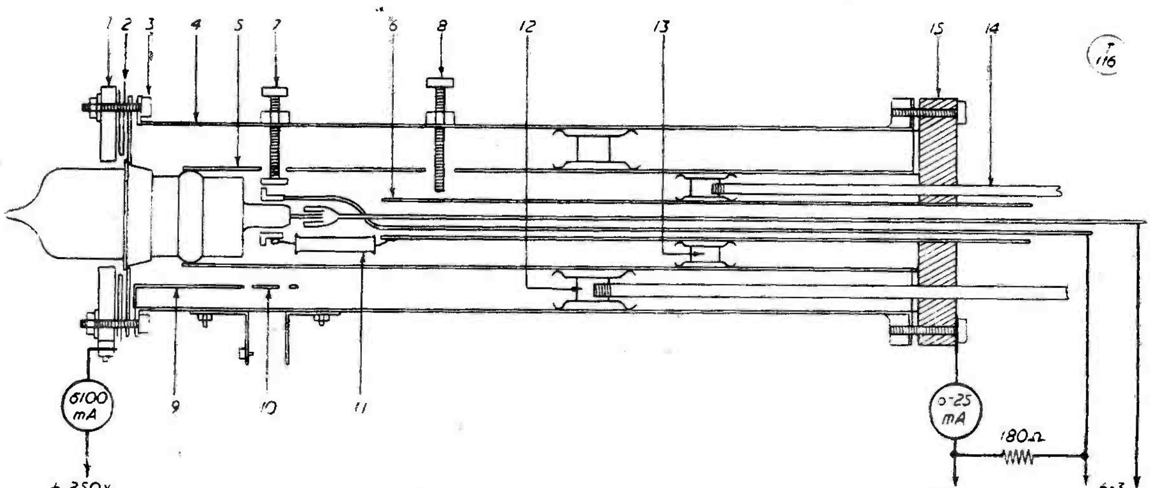


Fig. 5A. Detail of the 25-centimetre oscillator designed by G5RZ and illustrated in the photographs. This is a sectional view ("cut in half down the centre") showing both the mechanical arrangement and the electrical layout and connections — see key for details, and refer exploded view photograph.

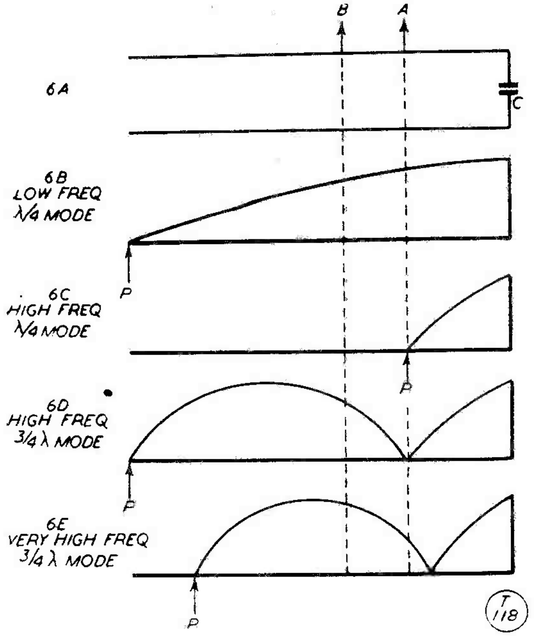


Fig. 6. Showing how quarter-wave and three-quarter wave modes of oscillation can be obtained over the same pair of lines. As explained in the text, this is one of the most important attributes of the concentric line principle.

upon a number of factors, both mechanical and electrical, and, within reasonable limits, will be governed to a great extent by the type of valve selected for the purpose. The cathode tube must be sufficiently large to accept the cathode terminal of the valve and to carry internally the heater leads. Likewise the grid tube diameter, will to some extent, be governed by the diameter of the grid ring on the valve. The spacing between them must accommodate a tuning plunger, perhaps with a cathode de-coupling condenser built in, and provision must be made for the tuning push-rod. Similar mechanical considerations apply to the outside tube. The relative diameters of a pair of tubes will determine the characteristic impedance of the line which will affect tank circuit Q and will also bear a direct relationship to the physical length of the line.

Since, in practice, the tube diameters will probably depend primarily upon what is available in relation to the size of the valve selected, it is unfortunate but true that tank circuit Q is likely to be left very largely to look after itself !

The physical length should be determined, based upon the minimum frequency at which it is desired to operate and for the 1215-1300 mc band it is suggested that 400 mc should be chosen, and for reasons which will later be explained.

Having then selected three tubes of differing diameters which appear to satisfy the mechanical requirements, proceed first to determine the characteristic impedance of each pair. Next work out the reactances of the interelectrode capacitances at the minimum chosen frequency (from the capacity figures provided by the manufacturers of the valve) and then calculate the electrical length of the lines in degrees. Finally, the physical length can be determined from this information, and this final result increased by about 10% as a safety factor. This length will probably work out differently for each pair of lines, so select, of course, the longer length in your design.

The upper frequency limit can be calculated with somewhat less accuracy owing to the increasing impact of end effects at this very short physical length. The mathematical formulæ for making these calculations appear as an appendix for the benefit of those who are interested.

The forward travel of the plungers will be limited by the positioning of the feed-back and/or output probes and their recommended positions will be referred to later.

Tuned Circuit Frequency Range

Mention was made earlier of the minimum frequency requirement and this was given as about 400 mc. Apart from the desirability of having a wide-band oscillator available as a prototype for experimental purposes, there is another and more important aspect.

So far, all that has gone before has referred to quarter-wave lines in which the electrical distance between the plunger short-circuit and the valve element represents a quarter wavelength. It is found, however, that if, at a certain frequency, the plunger is withdrawn an electrical half-wavelength back and feed-back and output coupling are suitably adjusted, the circuit will again oscillate, but this time in three-quarter wave mode. In fact, five-quarter and even seven-quarter mode is technically possible, but perhaps not so easy of attainment.

This means that over the same physical length of line the device can be made to function over two entirely different ranges of frequency. This is the most important characteristic of these circuits, which makes much possible—in particular, tuning cavities of reasonable physical dimensions even at these very high frequencies ! This technique bears no relation to normal circuit design at lower frequencies, so do not be surprised if the dimensions look large when compared with usual inductance values on, say, 430 mc.

To make matters clear, let us assume that in the quarter-wave mode the oscillator will tune from a minimum of 400 mc to 1200 mc. At the latter frequency the active cavity is very small and a considerable portion of the available RF field is actually confined within the glass envelope of the valve, thus making feed-back and output coupling inefficient. If now the plunger is withdrawn to the LF end of the tube leaving the plunger in the grid-cathode line unchanged, a position will be found where the valve once more starts to oscillate at 1200 mc, but this time in *three-quarter* wave mode. Moving the plunger inwards will then have the effect of increasing the frequency above 1200 mc, perhaps up to 2000 mc or even higher ! In selecting 400 mc as a minimum frequency requirement, therefore, the writer wished to ensure (in this early development work) that sufficient length of line would be available to enable oscillation to be obtained over a wide range of experimental frequencies in both quarter and three-quarter wave mode, with the possibility of exploring frequencies still higher than those attainable in the quarter-wave mode.

Selection of Mode

It may be questioned how multi-mode operation is possible in either or both cavities at similar plunger settings, and what determines which mode is selected. The answer depends upon (*a*) Good mode separation being provided for in the original design, and (*b*) The type and positioning of feed-back and output coupling arrangements. As regards (*a*) this is dependent upon the Zo/C ratio of the two circuits and is at its worst when $\frac{Zo \cdot Cgk}{Zo \cdot Cgp}$ is unity. In selecting initial tube dimensions, therefore, it is desirable, as far as possible, to make this ratio as large as practicable, commensurate with mechanical considerations.

With regard to (*b*), let us examine what goes on inside a co-axial resonant line at different resonant frequencies and in alternative modes. Fig. 6A shows the outline circuit of a pair of concentric tubes tuned by their terminating capacity (generally the inter-electrode capacity of the valve). In order to obtain the maximum forward position of the plunger, feed-back and output probes will be positioned as close as is practicable to the valve elements, corresponding to the arrow marked A in the diagram. Fig. 6B shows the approximate voltage distribution along the line when operating in quarter-wave mode at the lowest frequency, *i.e.*, with the plunger remote from the valve. It will be seen that nearly maximum volts are available at the probe position and consequently capacity-type probes are best suited under these conditions. When the shorting bar P is moved to the highest frequency position as shown in Fig. 6C it will be seen that the probe position now corresponds to a voltage node and consequently inductive-type probes would be necessary to effect energy transfer. Moreover, towards the high frequency end, transfer becomes very frequency-sensitive, whereas at the low frequency end quite large changes are possible without greatly affecting the transfer efficiency. If the plunger is once again withdrawn to the low frequency end and the feed-back probe position is altered to point B, voltage is again available for capacitative coupling and with a good mode separation ratio three-quarter mode operation becomes possible *at the same frequency* as in Fig. 6C. This is shown in Fig. 6D. Note that output pick-up could still operate in position A providing it is inductive.

Finally, in Fig. 6E the plunger is commencing to move again towards the termination with a corresponding increase in frequency over and above that attainable at quarter-wave mode maximum and that a voltage loop is once more developing at position A, thereby once again permitting capacitative feed-back to operate. If the mode separation is poor the circuit is likely to become unstable and to revert to quarter-wave mode operation once more at the lower frequencies.

(To Be Concluded)

XTAL XCHANGE

Readers are reminded that those wishing to *exchange* crystals (only) can send in a notice, set out in the form shown under this heading in any recent issue of the *Magazine*, for free insertion. Buy-or-sell offers for crystals cannot, however, be accepted for "Xtal Xchange."

NEW TVI SUPPRESSION LAW COMING

At last, it is announced that steps are to be taken to suppress the interference caused by such domestic appliances as vacuum cleaners and hair dryers, as well as commercial equipment driven by electric motors. A draft regulation will shortly be laid before Parliament by the PMG making it possible to compel owners of interfering appliances and machinery (except refrigerators) to suppress them. This means that amateurs blamed for local TVI will be able to point quietly to the complainant's vacuum cleaner and ask if anything has yet been done . . . . !

HF Band Table-Topper

MATCHING THE EDDYSTONE RECEIVER RANGE

A. H. CAIN (VQ2AH)

In these days, the mode is to go table-top with the "permanent" communications equipment, the idea being tidiness, space saving and a self-contained band-switching transmitter for the favourite DX channels, ready for instant operation. This article suggests an ingenious approach to the constructional problem involved, the author having produced a transmitter matching in appearance his Eddystone receiver. It is a neat arrangement, resulting in a transmitter assembly which would look well with several of the receivers in this popular and well-known range.—Editor.

RECENTLY on leave in the U.K., the writer purchased an Eddystone S.740. When it was discovered that a cabinet of similar dimensions and appearance could be obtained separately, a transmitter to match the receiver became a requirement at VQ2AH.

As CW is used quite a lot at the writer's station, it was decided to design for the maximum input allowed in Northern Rhodesia, 100 watts. As far as he is concerned, for inputs of about this figure and frequencies up to the 21 mc band the 807 is first choice, and a pair of 807's was decided upon for the PA.

However, due to space restrictions within the cabinet, it was found impossible to provide for high-level amplitude modulation, so the next decision was that screen control should be used. To obtain good modulation with this method it is necessary to decrease the PA screen voltage to about half the normal (full CW output) rating, which in turn of course reduces DC input and RF output; it was this consideration that mainly determined the choice of paralleled 807's, since such a PA would ensure reasonable RF output being obtained.

The RF Section

A Z77 oscillator on 3·5 mc is followed by a second Z77 as buffer, V1 and V2 in the main circuit diagram Fig. 1. The voltage on the screen of both these stages is stabilised by V8. Output from V2 is taken to V3, a 6AQ5, in the plate circuit of which is a slug-tuned coil resonating in the 7 mc band. Output at 7 mc drives V4, a 6L6, its plate circuit consisting of VC3 and coils L3, L4, L5, giving respectively 7, 14 and 21 mc (the bands are identified in terms of metres in the diagram, as around S1a). The 6L6 in turn drives the 807 PA, of which the tank circuit is a pi-section network VC4, L6-L7, VC5, switched by means of S5 for the 7, 14, 21 and 28 mc bands. While separate equipment, or more drive, is probably desirable on Ten, this band is only used for local 'cross-town talking, and it was found that the 807 PA would double to 28 mc from the 14 mc output given by V4.

It should also be mentioned at this stage that the PA tank coils L6, L7, while being connected in series for the 7 mc band, are in fact two separate coils and must be mounted at right angles to each other. The reasoning is as follows: On 7 mc, they form one complete coil; for 14, 21 and 28 mc L7 is shorted out, but being at right angles to L6 it does not form an RF loop to reduce the overall-Q of the tank circuit to anything like the extent it could if L6, L7, were made one long, tapped inductance; L6 is tapped in the usual way for 14, 21 and 28 mc, with unused sections shorted out. L6 is wound with very small diameter soft-drawn copper tubing as used in automobile work and makes a first-class RF coil. (It could be argued that tapping L6 in this way is not conducive to efficiency, but if a band-switching facility is to be provided at all, in any simple mechanical design tapped tank coils are almost unavoidable.)

The PA band switch S5 is an important item. In the writer's case it was taken from a TU5 unit and is ideal for the service; it has heavy contacts, designed for RF, and very positive action. The plate on which the output bands are marked is merely a piece of dural, cut to the same size as the meter face (see front-panel view) and is intended to balance the panel in appearance. RF output is taken *via* a short length of coax from the "hot" side of VC5, the output socket being mounted on a dural bracket at the back of the cabinet.

It was thought that neutralising of the PA might be necessary, so neutralising links were at first wound close to, and on the same formers as, coils L3, L4, L5. However, due to the constructional layout adopted (as suggested by the photographs), careful screening and short RF leads, it was found that the transmitter was completely stable on all frequencies, and no neutralising was required. At the same time, anyone attempting a similar job would

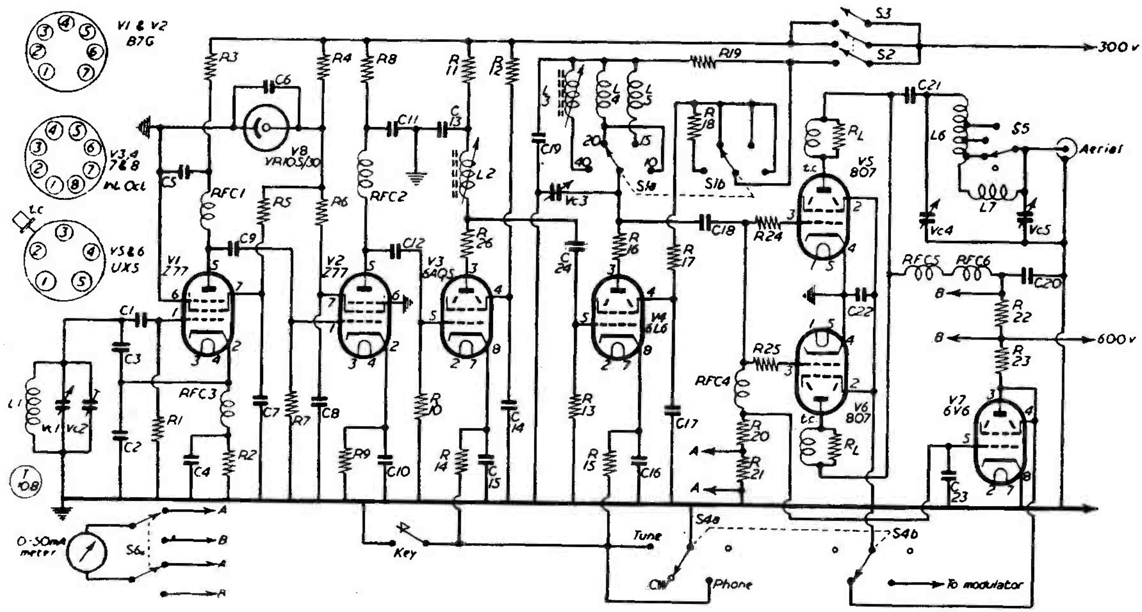


Fig. 1. Circuit of the RF section of the VQ2AH transmitter as described. The driver section V1, V2, V3 can be built and tested as a separate unit before fitting to the main chassis. The switched coils in the plate of V4 give output on three HF bands, operation of the PA on 10 metres being obtained by doubling from the 20-metre drive at L4. The 807's in the PA are in parallel and modulation is by screen control.

be well advised to build in some method of neutralising the PA, just in case it might be necessary.

V7 in the circuit of Fig. 1 is a 6V6 used as a protective device ("clamper") for the 807's under key-up (no drive) conditions when operating CW; with the values given, plate dissipation is kept within the 807 ratings.

The Modulator Section

The built-in modulator gives series screen control, resulting in quality much better than with the usual parallel arrangement. The circuit is simple and the modulator is easy to set up, but the modulation transformer T1 (Fig. 2) must have ample inductance and a ratio of not less than 3 : 1.

In the modulator circuit, Fig. 2, a 6SJ7 V1 is RC-coupled to a 6J5 driving a 6V6 strapped as a triode. The earthy end of T1 secondary is taken to the potential divider VR2, R8 and VR2 is adjusted to give about 150 volts *plus* on the cathode of the 6V6, this being in effect the screen voltage of the modulated 807's in the PA, as per switching. C1, R2, C3 in the modulator section, Fig. 2, is an effective RF stopper network, as it is essential to prevent RF reaching the grid of V1, especially at the higher frequencies.

If the RF section of the transmitter as dis-

Table of Values

Fig. 1. Circuit of the RF Section complete.

C1, C9	= 100 µµF, silver mica
C2, C3	= .001 µF, silver mica
C4, C5, C6, C7, C8, C10, C11, C13, C14, C15, C16, C17, C19	= .005 µF, mica, 350v.
C12, C18, C24	= 100 µµF, mica
C20	= .01 µF, 1,000v.
C21	= .001 µF, 1,000v.
C22	= .0005 µF
C23	= .01 µF
VC1	= 50 µµF, variable
VC2	= 100 µµF, variable
VC3	= 40 µµF, variable
VC4	= 150 µµF, variable
VC5	= 300 µµF, variable
R1, R10	= 47,000 ohms
R2, R9, R14, R15	= 250 ohms
R3, R8, R11, R19	= 1,000 ohms
R4	= 10,000 ohms, w/wound
R5, R6	= 470 ohms
R7	= 100,000 ohms
R12, R17, R20	= 10,000 ohms
R13	= 25,000 ohms
R16, R21, R24, R25, R26	= 100 ohms
R18	= 50,000 ohms
R22	= Meter shunt (*See text*)
R23	= 25,000 ohms, w/wound
RL	= 1-watt resistor (100 ohms or any low value) wound full of No. 26 SWG enam. wire
RFC1, RFC2, RFC3, RFC4	= Receiving type RF chokes
RFC5, RFC6	= Transmitting type RF chokes
S1a-S1b	= 1-pole, 4-way on common shaft, ceramic
S2	= DPST toggle, on-off
S3	= SPST toggle, VFO tune
S4a-S4b	= 1-pole, 4-way on common shaft
S5	= 1-pole, 4-way ceramic, heavy RF duty (*see text*)
S6	= Meter selector (*see text*)

COIL DATA

L1 = About 14 turns 18g. enam. on ¾-in. dia. former
L2 = 40 turns 30g. enam. on ½-in. dia. former, slug tuned (*see text*)
L3 = 18 turns 18g. enam., to tune 7 mc.
L4 = 7 turns as above, 14 mc.
L5 = 4 turns as above, 21 mc.
L6 = 8 turns ⅛-in. copper tube, s/d, wound to 1¼-in. dia.
L7 = 14 turns 14g. enam. wire, 1¼-in. dia.

cussed here is to be used with a separate modulator capable of anode control at full input, the PA ratings are such that 50 watts of audio could be applied with safety.

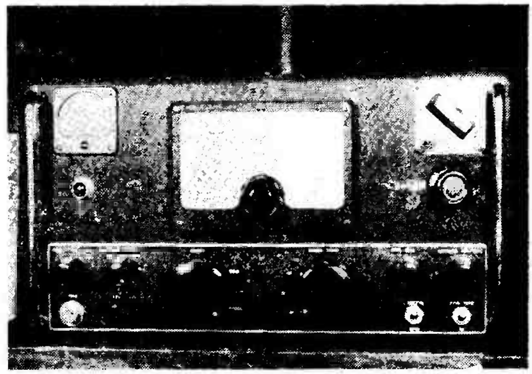
Construction

The photographs suggest the disposition of the various components and some idea of the general layout, so it is not thought necessary to give exact measurements, which in any case will probably vary in individual cases. Space *is* limited (for a job of this kind) in these standard Eddystone cabinets, but nothing is so cramped that it cannot be moved a half-inch or so either way. A fair amount of metal work is involved, but nothing that cannot be carried out "on the edge of the kitchen table," since all that is called for is ordinary cutting, drilling and bending.

As nowhere is the chassis allowed to act as an RF return earth, it was decided to retain the black enamelled chassis supplied with the Eddystone cabinet. This gave a useful increase in area available for component mounting. An Eddystone S.740 Receiver finger-plate was obtained and used as a front-panel control template. With a little juggling it was found possible to arrange the transmitter controls to follow the same pattern as the receiver panel drilling, the Rx markings on the finger-plate being painted out.

While the transmitter panel was being cut, holes for the 0-50 mA meter, PA tuning condenser, PA band-switch and the pilot light were made at the same time. For the modulator, octal-base holes were cut in the chassis, also fittings for the voltage stabiliser V8 and the clamper V7, with openings on the rear apron of the chassis to line up with the apertures in the back of the Eddystone cabinet, for the power inlet and coax RF output sockets.

The first three valves in the transmitter RF section are mounted on a separate sub-chassis measuring roughly 6 x 4 x 2 inches, a quarter-inch flange being left for direct mounting of this sub-chassis to the main chassis by means of self-tapping screws. It is possible, actually, to wire up the V1-V3 stages and test out before fitting to the main chassis. The spindle of VC2 comes out through the top of the sub-chassis and is fitted with a small knob; the dial on VC1, the VFO control, can then be calibrated as desired. All the parts associated with the Z77's and 6AQ5 are easily accommodated on a sub-chassis of the size given; if the four connecting leads (excluding V8 and R4) are left fairly long any future servicing of the sub-chassis as a unit can easily be carried out merely by removing the self-tapping screws and pulling the unit out, having disconnected the lead connecting the 6AQ5 output to 6L6 grid. (A miniature plug-socket would be the thing here, for anyone repeating the design in detail.)



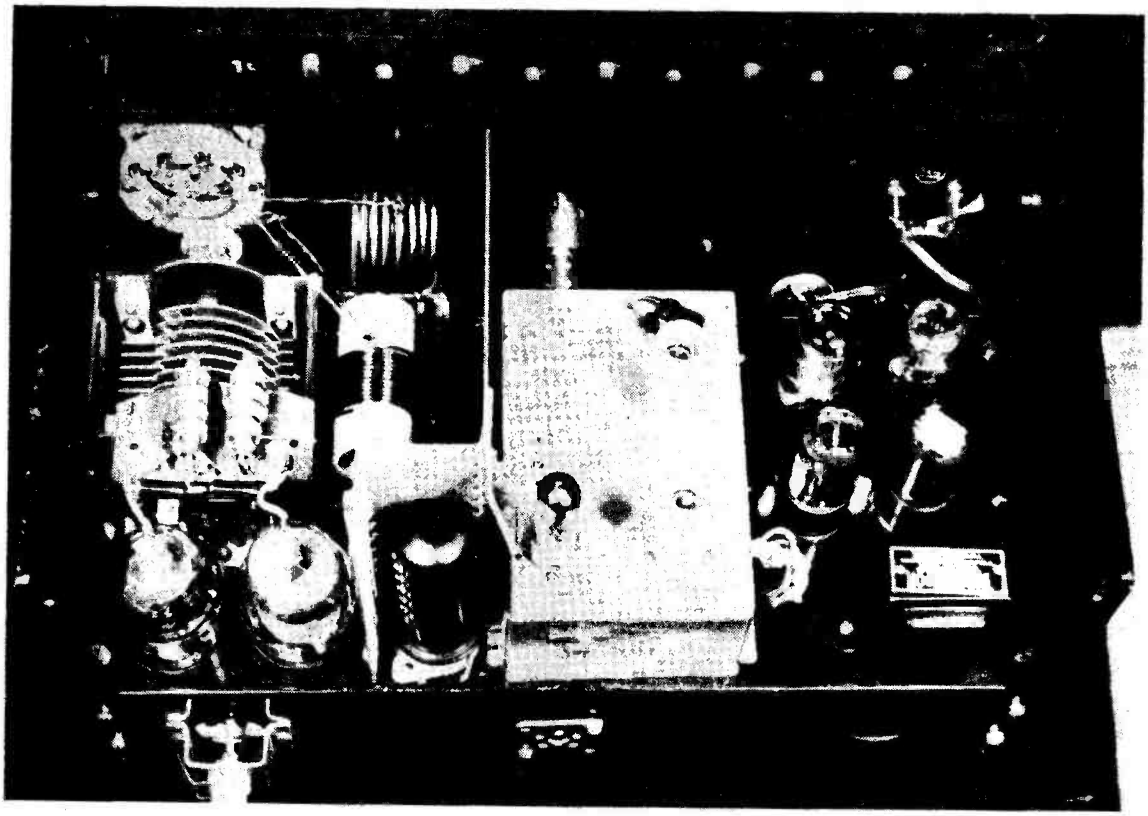
Front view of VQ2AH's transmitter, showing how the controls follow the Eddystone receiver panel layout. The centre dial is for the VFO, controls along the lower panel being, left to right: Modulation gain, with microphone input below; meter selector switch, with key jack below; first large knob selects "Tune-CW-Phone"; right hand large knob selects driver band, either 10, 14, 20 or 40 metres; upper small knob is PA grid, with send-receive toggle below; the knob at the extreme right is for aerial coupling, with the VFO on-off below.

The slug-tuned coil L2 was an IF transformer from a BC-455 with the untuned winding removed, all condensers taken off and any metal work discarded. It is mounted horizontally in the sub-chassis and an iron-dust slug, with a threaded screw extension, has the threaded portion brought out through the rear apron of the sub-chassis to permit adjustment after everything has been connected up. It should be noted that the coupling condenser C24 and the 6L6 grid leak R13 are mounted within the sub-chassis.

Coils L3, L4, L5 are mounted on a narrow strip of dural, as shown in the under-view photograph. The three coils can be fitted on the strip and then the whole thing bolted into place on the underside of the chassis.

To preserve front-panel symmetry it was necessary to contrive a drive system between the amplifier grid control and VC3 itself; this was done with a piece of quarter-inch brass rod, panel bushed, with its rear end held by an L-shaped bracket; VC3 has an extension shaft fitted with a small pulley wheel; a V-groove was filed in the brass rod and a length of cord fitted in the same manner as for the dial drives in many broadcast receivers.

The driver stage band-switch is a three-wafer single-pole 4-way "surplus" item. One wafer switches plate coils L3, L4, L5, and No. 2 wafer was intended to switch neutralising links,



Inside the cabinet of the transmitter described in the article, showing the general layout above the chassis. It works on the four bands 40-10 metres inclusive and with 600 volts HT will take an input of 100 watts on CW. Construction is in an Eddystone cabinet, with the panel laid out to match the author's S.740 receiver. The PA valves are lower left, with the clamp valve V7 (see Fig. 1) alongside; the arrangement of the PA coils, tuning control and switching can be seen in this compartment. The VFO-exciter section V1, V2, V3 is the aluminium box in the centre, with the modulator and stabiliser valves to the right.

as previously mentioned. The third wafer is used to bring in an additional screen resistor for the 6L6 when operating on 7 mc; this prevents excessive drive to the 807's. Detuning V4 tank would have had the same effect, but reducing screen voltage to decrease output is the preferable method. Incidentally, a ceramic valve-holder must be used for the 6L6 stage.

RF End. The PA section is screened off both above and below the chassis and it is that contributes so much to the stability of the transmitter. The tuning and loading condensers VC4, VC5, are firmly bolted, one above and one below chassis level, with their spindles in line and insulator bushed on the front panel. The 807 valve-holders are mounted on a U-shaped piece of dural, and all items associated with the 807 input side are grouped round the bases; separate earth returns, of copper braid, are taken from the frames of VC4 and VC5 to the cathodes of the 807's. RFC5, RFC6, C20 and C21 are placed on an L-shaped dural mount between VC4 and the 807 mounting; holes about 2½ ins. diameter are cut in the main chassis to allow the 807's to drop through about two inches.

Wiring of the modulator (Fig. 2) is straightforward, but leads should be kept as short as possible; note that the connection from the modulator 6V6 cathode, V3, to the 807 screens (*via* switch S4b) is run in screened wire.

Finally, as regards construction, screens are fitted to isolate the RF driver, modulator and RF power amplifier sections.

Setting Up and Operation

With HT and LT applied to VFO-BA-Dblr. (which should previously have been tested as a separate unit) the VFO frequency is located on the station receiver and VC1 adjusted to bring the beat into the 80-metre band; this is done in conjunction with VC2, which, once set, can be left. At this stage in the proceedings, there should be no connection between the 6AQ5 and the 6L6.

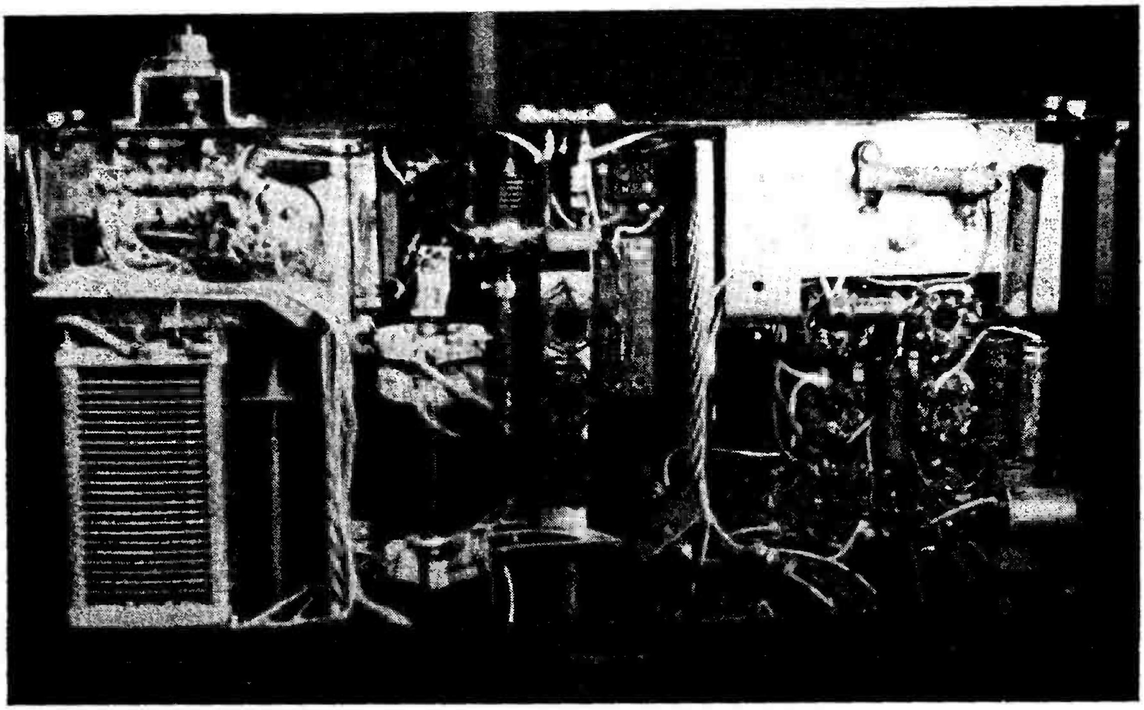
Next, a meter reading 0-50 mA is temporarily connected into the 6AQ5 plate (or cathode) and L2 slug adjusted for a well-defined dip; check with an absorption wave-meter or a GDO that this dip occurs in the 7 mc band. Disconnect the meter, connect the drive into the 6L6, and screw down the sub-chassis. With a voltmeter set to read about 0-60 volts, positive side earthed and the negative lead to the 6L6 grid through a temporary RF choke (to protect the meter) adjust L2 slug for maximum voltage across R13 with the VFO set for some frequency in the 40-metre band, say 7100 kc. Take away the voltmeter, apply HT to the 6L6, and tune VC3, L3, for maximum grid current into the 807's, with *no HT* on the PA. Note that if the transmitter is completely wired up, it will be necessary to make a temporary disconnection somewhere to get plate and screen HT off the 807's; this could be done by providing a dead position on the selector switch.

Having obtained a grid current reading in the PA, touch up L2, L3, VC3 to make sure that it is at a maximum; L2 can then be left as set, as band changing will not affect it. Tuning on VC3, with adjustment of L4 and L5, is then carried out for the 14 and 21 mc bands in the same way as for 7 mc, the adjustments on L3 being left as set.

On the author's model as pictured here, grid current to the paralleled 807's is in the region of 9-10 mA on 7 and 14 mc, and about 7 mA on 21 mc; this drops off when HT is applied to the PA and it is tuned up for maximum RF output, it being found that 5-6 mA gave optimum results. It should be possible to get around 5 mA on all bands under full-output conditions, and this is quite enough drive, even for paralleled 807's.

An important point is that aerial coupling must be tight for good modulation; an RF meter in the aerial itself is extremely useful here (if the aerial is of such a length that a reasonable deflection is given), the adjustment being to go on increasing coupling (VC4, VC5) until the RF reading on the meter *just begins* to drop off. If not set up in this way, quality will be poor and downward modulation may be evident. With slight over-coupling, the depth of control is excellent and the quality is always reported as very good.

As regards maximum output loading, with



General view underneath the chassis of the HF Band Table-Topper described by VQ2AH. The big condenser on the left is VC5 (see Fig. 1), with coax RF output connection above, on the rear apron. The grid side of the PA section is immediately below this and the coil assembly L3, L4, L5 can be seen at centre, with the switching S1a-S1b alongside at left. The wiring associated with the modulator is over to the right.

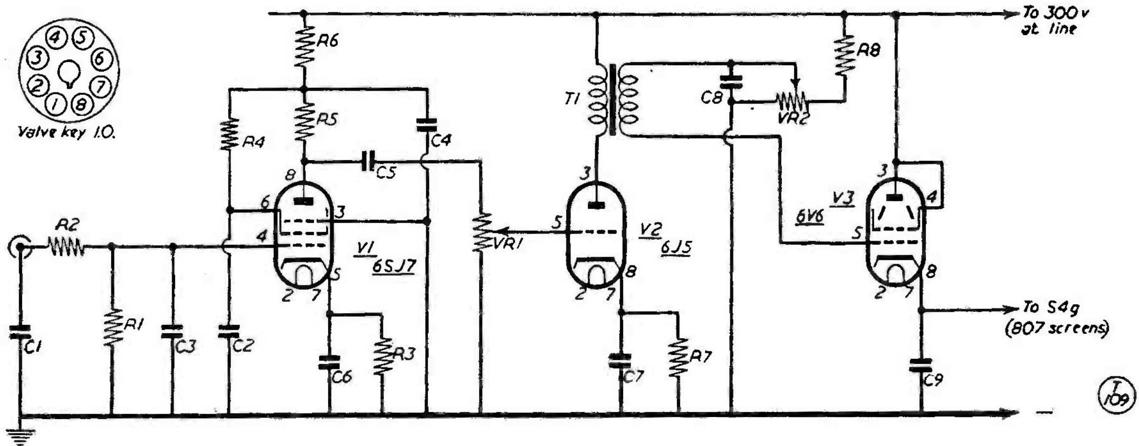


Fig. 2. Screen-control modulator unit for the VQ2AH transmitter. This arrangement will give full modulation of a 70-watt carrier, with good quality speech and easy adjustment, provided the screen voltage of the 807 PA, controlled by VR2, is correctly set.

the 600-volt supply available, it has been found possible to run the PA up to 120 mA (70 watts) quite easily on phone with full modulation, and to about 170 mA (100 watts) on CW for full RF output.

On the aerial side, the pi-section coupler has been found to load up several different aerial systems quite satisfactorily, and the transmitter has given very gratifying results on all bands—though it is fair to say that at the time of writing nothing had been worked on Ten.

Some General Notes

The resistances R21, R22 are meter shunts and their actual values will depend, of course, on the instrument used. Switch S2 is the main "Tx on" and S3 is a by-pass for "VFO on only." S6 is the meter switch, and a point to watch is that the contacts break before making; the writer could not find a suitable one, so adapted a 3-way Yaxley with the centre contacts left unused, to give greater spacing between HT (B-B) and grid lead (A-A) contacts.

Finally, the power supply requirement (the power unit as well could not quite be got into the Eddystone cabinet!) is a 300-350v. HT line for the intermediate stages, with 600 or 750 volts for the PA, and a 6·3 volt supply giving adequate current for the heaters.

Fig. 2. Modulator Section of the Table-Topper.

C1, C3	= 50 $\mu\mu$F	R7	= 1,500 ohms
C2, C8	= 0.1 μF	R8	= 25,000 ohms
C4	= 0.25 μF	VR1	= 0.5 megohm gain control
C5	= .001 μF	VR2	= 25,000 ohms, wire/wound, pre-set to give 150v. at pin 8, V3.
C6, C7	= 2 μF	T1	= 3.1 audio transformer (any good intervalve type)
C9	= .0005 μF		
R1	= 2 megohms		
R2	= 10,000 ohms		
R3	= 1,000 ohms		
R4	= 1.5 megohms		
R5	= 470,000 ohms		
R6	= 20,000 ohms		

BBC FM STATION FREQUENCIES

The BBC's frequency allocation for the projected new FM network in Band II VHF has recently been announced. There will be ten stations, each with three transmitters radiating the Home, Light and Third sound programmes, with an effective radiated power of 60 or 120 kW, depending on station and location. Frequencies are in the range 88.1 to 94.5 mc, with the Aberdeen and West Wales stations as the only sharing pair. Wrotham (Kent) will be the first station in regular operation, on 93.5 mc (Home), 89.1 mc (Light) and 91.3 mc (Third). Wrotham is already on a regular test schedule and can be well heard over a wide area of southern England.

DX COMMENTARY

HB9NL

CALLS HEARD, WORKED and QSL'd

L. H. THOMAS, M.B.E. (G6QB)

FIRST of all, we should like to thank the numerous correspondents who sent their congratulations and good wishes on reading the "Century" notice in last month's Commentary. We heartily reciprocate, in the case of those who claim to have read all of our hundred effusions—anyone who can read one hundred such, and still remain an avid reader, must be Pretty Tough! And so we congratulate all our Centenarian readers, and hope that the next hundred will contain more optimism and less dismal news about conditions not being good.

This month the formula is very much as usual. Conditions have not been nearly as bad as some people seem to think, but they certainly haven't been brilliant. The interesting thing has been that the North Atlantic path remained open nearly all the time, and in a very good state, on all bands from 160 to 20—and, on occasions, even down to Fourteen. Whenever we have heard WWV (and that's quite a few times) he seems to have been sending N7. Reference to last year's WWV log shows that during the same period we had W4, W3, U5, U4 in profusion, but very few N7's; in fact, very seldom did he go above a 5. So the North Atlantic path must be a whole lot better than it was a year ago.

But this does not mean that general conditions have been too good. In fact, very few of our regulars seem to have worked any DX to speak of. We have heard plenty of activity from VK and ZL in the earlyish mornings; around lunch-time, when the W's have been coming in, we have often noticed 4S7, VS6, HS, FI8 and VS1 in the background; and most evenings the South Africans and South Americans have been pretty strong. So there's your WAC in twelve hours—which is more than one could have hoped for a year ago.

Once more the Top Band has kept most people busy, and activity up there continues at a very high level. A surprising number of erstwhile DX-chasers seem to have settled down for the winter with 10 watts and a map of the British Isles. What's more, they enjoy it!

Before dealing with Top Band, however, we will examine the DX band reports and see what has been going on. And this month, for a change, we will start at the LF end.

DX on Eighty

G3IAD (Wakefield) remarks that he has worked UA1, VP8 and KL7, all on Eighty CW, but gives no further details. GW3INO (Neath) has raised a lot of W's since Christmas, in districts 1, 2, 3, 4, 9 and Ø. His best was W2LMH/4, 579 both ways at 0845 GMT and still audible as late as 0930. Other stuff worked on the band included CN8MI, EL2X, FA3HH, ZB1BF, I1BLF/T and a lot of more usual Europeans. OY5S was heard but not worked.

A very interesting letter from VS6CQ (Hong Kong) gives a list of Europeans logged on 80 metres between December 22 and January 9. All were in the region of 3500-3510 kc. The U.K. stations were as follows: G2LA, 2FT, 2FWS, 3BDI, 3FGX/A, 3GLW, 3HWF, 3IMX, 4CP, 5BJ, 5CR, 5RS, 5VB, 6UF, 6YQ, 8QZ, GD3UB, GM3JDR. In addition to these, there are sundry DL's, EA's, SM's, an LA, two OZ's and two YU's, also quite a batch of PA's.

VS6CZ worked five Europeans—SM5AQW and 5AHU, OH2MQ, OZ7BG and SP3AN. Naturally, both VS6CQ and 6CZ want to work G's, and they will be QRX at week-ends from 2300-2330 GMT; VS6CQ is rockbound on 3510, 6CZ VFO between 3500 and 3510 kc. Both say that

European signals are heard from 2200 until 2330 GMT. and at strengths up to S7.

In the early mornings the W6's and W7's have been getting through, and an SWL friend in Beckenham reports hearing W6VBY, 6ZAT, 6GAL/7 and 7PQE with "monotonous regularity" around 0800 GMT.

G3IGW (Halifax) worked CT2BO, FA8BG, SU1SW, VE1GU and some W's, apart from several new Europeans. He was heard by W6ZAT, and he has himself heard such interesting ones as EA6, EK, OY and SV. Being called were KH6AFS, VP9AL and some VS6's.

Forty Metres

Despite all its occupational hazards, *Forty* springs a nice line in DX for those who look between the slabs of QRM. Down in the cracks are all sorts of interesting things, but you almost need a microscope to see them. G3IAD raised a KH6 at 2300 GMT, also OD5 and 3V8.

G8KP has settled into a new QTH (still in Wakefield) and finds that Twenty is dead when he has time to go on the air. So Forty has been the band, and he managed to raise a WAC in twenty-four hours. Contacts have included CR6AI, EA9, LU, PY, VS2CR, VK6, lots of W's, ZC4, ZS and 3V8. So, as he says, things could be worse.

G2HKU (Sheerness) worked LU3ZO some time back, and had his card returned marked "unknown." Now, however, he has received a card from LU3ZO and confirming his QTH as Deception Island, Antarctic.

DL2RO (Hamburg) found Forty the only band to produce anything worth mentioning. There were several good openings for W's in the late evenings, and on December 29 a single CQ call, made at 2100 GMT, produced a "chain reaction"—ten QSO's straight off, and all with W2's, no other W district being heard. Other DX on the band was quite varied and included KR6KS (1900), VS6CT (1700), EL2X, XZ1AA (2200-2300), KZ5MN, ZS's in the evenings, and ZL's in the early mornings.

G3JKO (Nottingham) did some listening over the Christmas period and heard HP1PH, HR1AD, KZ5CR, OQ5GU, VP2GJ, VP6RL, VP7NG, VP9BL and lots of ZL's. Stations being called, but not heard, were FR7ZA, VP8BE and

SHORT WAVE MAGAZINE

Certificate of Merit

HAROLD MERRIMAN, G6GM

It is with great pleasure that we announce the award of the *Short Wave Magazine* Certificate of Merit to Harold Merriman, G6GM, in recognition of his exceptional achievements in making two-way contact on the Top Band with New Zealand. On October 16, 1953, he obtained his first QSO by working ZL1AH, and on October 21 of that year he followed this by raising ZL3RB. Again in 1954, on October 13, he was in contact with ZL3RB. When considered in the light of all the circumstances, this work is of more than usual merit, representing as it does about the ultimate in terms of amateur long-distance communication on low power.

Harold Merriman, G6GM, now in his 71st year, is ex-Royal Navy, and is one of the very few naval men left who received their early training in sail. His interest in Amateur Radio, however, was not aroused until the early 1930's and was largely inspired by his younger brother George, then VS6AH and now ZL2AL. About 1935, G6GM started up on the 160-metre band, the urge here being applied by G6FO, who at that time lived at Appledore, North Devon — G6GM is, of course, near Holsworthy.

G6GM quickly proved himself to be a keen and successful Top Band man, aided by patience, ample aerial space and a very quiet DX location. He made and erected his own masts, mostly single-handed ; these are moved about his fields to align the aerial for the particular DX being sought. A half-wave wire about 50 feet high is almost invariably used on Top Band.

At one time, power was supplied entirely by a wind-driven generator, but nowadays a 50-volt D.C. house lighting set is used to drive a rotary converter for HT, although the wind-generator is still in use for LT and for charging batteries. The HRO receiver has been modified to run from 6v. batteries and the 50v. D.C. line ; the transmitter is necessarily always QRP and has never been connected to a mains supply. Indeed, this is one of the aids to G6GM's success, for the nearest power line is some miles away, the nearest neighbour out of sight, and the local noise-level is extremely low.

G6GM, Old Timer in his 71st year, has been an inspiration to many a younger operator. The results that he has achieved with low power and the simplest of gear are a tribute to his success in making full and proper use of the advantages he does possess, and as such are an example to all amateurs.

Editor.

TOP BAND COUNTIES LADDER

(Starting Jan. 1, 1952)

Station	Confirmed	Worked
G5JM	94	94
GM3OM	93	95
G8KP	92	92
G2NJ	91	91
GI6YW	91	91
G3HIS	90	91
GM3EFS	89	91
G5LH	87	87
G6VC	87	87
G3JEQ	86	87
G3HDQ	85	85
G3HIW	83	88
G3CO	83	84
G3JML	80	81
G3IVH	79	83
G3EUK	77	83
G3BRL	76	76
G2AYG	73	74
G3HYJ	71	77
G3JHH	71	72
G3FTV	69	79
G3IGW	66	81
G3HQX	66	73
G3GYR	66	67
G3JKO	65	73
G3DO	64	67
G3GZB	62	62
G3GSZ	62	62
G5AO	61	64
G3IND	60	60
G3HZM	58	60
G3ITY	55	70
G2HKU	53	55
OH7OH	53	55
G3JJZ	51	59
G2CZU	44	45
GM3JNW	43	46
G3JBK	41	50
G3JBU	41	45
G3DGN	34	53
G3IAD	31	56
G3FAS	31	45
G3JJG	20	48
G3JYV	20	45
EI8J	20	45
G3JVK	17	33
G3JZG	15	33
G3FTV/A	13	60

ZC7AM. Altogether a pretty good selection.

An SWL correspondent rounds off the Forty report by telling us that he heard KR6KS calling K6DV at 1400 GMT! Since then he has heard him every Saturday and Sunday afternoon without the slightest difficulty, always around 7014 kc between 1400 and 1500. Other nice ones noted were KR6OY, KC6CG, HKØAI, KL7BNU, KH6TA/KL7, W7KBM/KL7, and ZD6BX.

The DX on Twenty

You would no longer think Twenty was supposed to be our main DX band. It is still there, it is often open, but the attraction seems to have disappeared. Nevertheless, we have a few worth-while reports covering the band.

G3HCV (Lympne) is restricted to an indoor aerial, which he describes as "an apology for a dipole," since the ends hang down for four or five feet and there is a 90-degree bend in the middle! With 150 watts pumped into this strange creature, 'HCV has raised 87 countries on Twenty, the only real difficulty being the Far East. To those with poor aerials, G3HCV gives some advice; he says the only thing is to rely on *technique*. And, to use a station with a weak signal to the best effect, the first thing to do is to listen *and listen*. There's no future in calling "CQ DX," but you have a chance of hearing a DX station that is missed by others, and a snappy return to him on the right frequency may steal a march on the Big Boys.

And just to show how much attention is paid to the receiving side, G3HCV says that only 450 QSO's have been made in the course of four years of operating.

G8KP and G6VC (Northfleet) both mention that they have now received cards from VQ6LQ, who has been in England on holiday.

VE3BWY (Toronto), who was, of course, our predecessor in the conducting of this column when he was G6WY, sends an interesting letter mostly about Twenty. He got on the air in November and is now nearing his second DXCC, with 97 confirmed to date. Ham uses 350 watts and a dipole, but says that even then it is hard going in competition with North American QRO—something that a 150-watt G doesn't understand until he experiences it. City QRM is also terrific, what with street cars, neon signs, floor polishers, refrigerators, cake mixers, fans, elevators and even the odd electric typewriter (100 per cent. wipe-out!) Notwithstanding all this, he has recently worked six new ones, in the guise of HR2AD, FM7WP, CR7LU, VQ2GW, CR6CJ and VP7MI.

African DX has been the best ever, according to VE3BWY, with VQ4's giving him S9 reports, and nice ones such as VQ6, ZS3 and ZS9 attracting queues of W5's and W6's, lined up with beams and kW's. So picture the ex-op. of G6WY, who used to think the South London QRM was *terrible*, sitting in the middle of a forest of beamed kilowatts, electric razors, TV aerials, the entire mobile output of Detroit, and all the hazards previously mentioned (not forgetting the electric typewriter), and you will have a picture of Life in Canada!

G2BW (Walton-on-Thames) raised ZA1FA *and* got a QSL from him! ZD3BFC was a new one, and sundry VK's and ZL's make up the total. G3IAD collected M1L, UA1BE, UF6KAB and ET3GB. (Incidentally, we heard UB5KAB stating that he

Short Wave Magazine
DX CERTIFICATES

The following have been awarded since the publication of our last list, in the November issue:

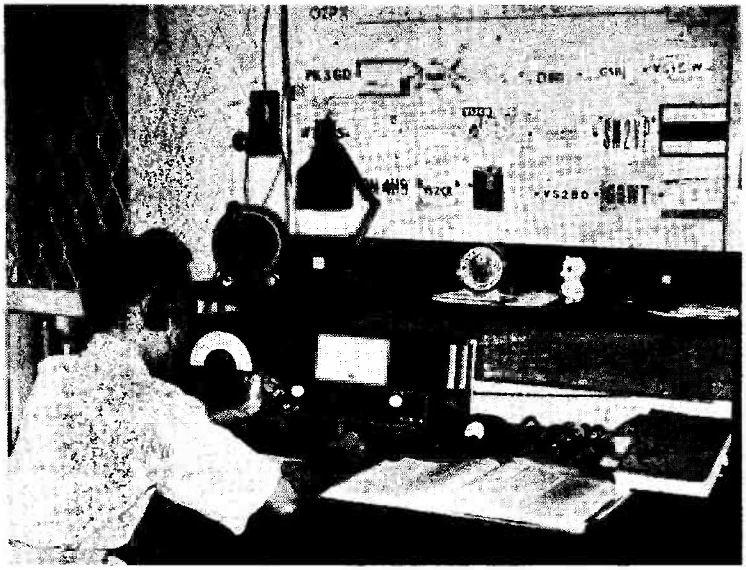
WFE
No. 19. W6NTR (Van Nuys)

WNACA
No. 76 CT1PK (Cartaxo)

FBA
No. 42 EA4CR (Madrid)
43 G3ESY (Hereford)
44 YU1AG (Belgrade)
45 IS1FIC (Cagliari)

WABC
No. 78 G3HQX (Mitcham)
79 GW2CPU (Aberystwyth)
80 G5AO (Hove)

Details of MAGAZINE DX AWARDS and CERTIFICATES, and the claims required for them, appeared in full on p. 323 of the August, 1954 issue.



This photograph, of a well-known SWL station, is of exceptional interest because its owner, who describes himself as a "brownskin," has been chasing difficult DX for years; his most treasured cards are a set of four from G5JO (Cambridge) confirming phone reception on 10, 20, 40 and 80 metres. Tan Bin Hussain is an interpreter in the Supreme Court, Malaya, and suffered badly during the Japanese occupation. Tan Bin says his "shack is devoid of junks and soldering iron became cold long time ago" because of the heavy duty on radio parts out there. All the QSL's visible are for 80-metre phone "just to convince doubting Thomas that 80 is vy FB hunting ground"!

would be allowed to work "all the world" from January 1 onwards, but this doesn't seem to apply to all the Russian stations by any means. Presumably they have to be Politically Pure before that privilege is bestowed—or what is the answer?)

DL2RO has found the band very patchy, with little real DX worth mentioning except the West Coast W's, who have been good between 1600 and 1800 GMT.

Not having had very much time to spend on the band ourselves, we must admit that our impression is that it has not been quite so bad as the above remarks imply. We have seldom failed to find activity from Oceania in the mornings, the Far East after lunch, and America for several hours from about 1130 onwards. Still, it has been nothing to write home about — which is doubtless why so few have written to us about 14 mc this month!

Activity on 21 mc

After some promising openings last month, 21 mc has remained pretty dull for the first weeks of 1955. DL2RO says that even the old regulars have not been heard much, and he hasn't even an interesting "Gotaway" to report this time.

G3TR (Southampton) returns to the fold and takes a place on the Ladder again, with 90 worked on 'phone. Recent new ones have been CR7, CO, FC, HC, VP5, YO, ZL and 4S7. He hopes to be pretty active around the band during the next two months.

G2BW reports recent contacts with CO, KG4, VQ5, VS6, XE, ZD2 and ZP, making up his century at last. He found Sunday, January 9, the best for some time, and made WAC in four hours with VK, 5A, VU, YO, ZP and W. In the International DX Contest he worked on 21 mc only, and raised a score of 9352 points by working 40 countries in 16 Zones.

G3CMH (Yeovil) is back on the air after building a new modulator, tackling TVI, and having an aerial blown down in a gale. The band has been patchy down there, but they have worked AP2K on CW, while phone has raised EA9AR, HB1MX/HE, HK3FV, KP4WI, PY, TA, VK, W's and 4S7YL.

G3HCU (Chiddingfold) had very bad luck in the 100 m.p.h. "tornado" that swept up through the Home Counties. His mast just split and crumpled up, although the guy-wires were unbroken; an 80-ft. pine tree crashed (this was four feet thick at the base); other trees were "torn out of the ground," and chicken sheds were lifted up and deposited twenty-five feet away. However, the house is still standing, and 'HCU thinks he is lucky on that score! Repairs took a complete week, and the new beam was put on the air on December 15. Since then one new one has been worked on 'phone (CO1AF), and other QSO's have included HP, VE, VU, VQ4, VK2, 5 and 6, W, ZE, ZL, ZS, 4S7 and 5A2.

News from Overseas

Ex-DL2VM is now in Korea, and sends an interesting letter. Amateur operation is not allowed there, but he says that the HL1 station reported a little while back was genuine, though unlicensed. There is a station in the U.S. MARS Network which operates on 14 and 7 mc, with the call AD4ER, the man behind the key being WØDAQ. 'VM hopes to be posted to VQ6 for three years, and will, of course, get on the air then. Listening on 14 mc has not produced anything startling, but SM and OH stations put in good signals, and three G's have been heard — G2HQ, G2HFO and G3JGY. No amateur signals have been heard on Top Band, although a continuous check was kept during the Trans-Atlantics. All that is audible on 7 and 3.5 mc seems to be JA stations.

G2YS (Scarborough) passes on two items from I1BEY, who runs the technical reviews in *Radio Rivista*. First, he made WAS in 78 days, and wonders if this is a record for a European station. Secondly, he very much wants details of Wireless Set No. 21 (ZA-1829), an Army set covering 4.2-7.8 and 19-31 mc, for publication in his column. Any reader with this gen. is asked to get in touch with G2YS, or I1BEY direct.

News from Kenya comes from VQ4FB, giving his address as "Meru Cop Shop." VQ4EV is

21 mc MARATHON

(Starting July 1, 1952)

STATION	COUNTRIES
G4ZU	112
GW3AHN	112
G5BZ	108
G4ZU (Phone)	108
VQ4RF	108
G2BW	100
DL2RO	99
G2WW	98
G3HCU (Phone)	95
G3TR (Phone)	90
GW3AHN (Phone)	85
G6QB	82
G2BJY	81
G2VD	80
G2YS	78
G3DO	74
G3CMH	71
ZS2AT	70
G3CMH (Phone)	68
GM2DBX	67
G3FXB	65
ZB1KQ	64
ZB1KQ (Phone)	63
5A2CA (Phone)	60
GM2DBX (Phone)	58

active from Nanyuki and expects a move to Nairobi; VQ4AA is operating from the caboose of a railway train! He supplies the rig with batteries, and puts out a good signal on the Sunday morning net at 0930 local time. It would be interesting to know if this has ever been heard in G-land —around 7050 kc.

VQ4FB himself bought a No. 48 set and strung up 50 feet of wire; with this outfit on 7 mc and an input of one watt, he worked VQ3DQ, three VQ4's and VQ5EK. He hopes to have a 50-mile two-metre link going before long.

VP8AQ (Base H, South Orkneys) reports that the call-signs allotted to the various bases are being withdrawn, and new calls will be allocated to the individual wireless operators at the bases. 'AQ has already contacted many G's on 14 mc and is still looking for more. He is ex-G3ISL (Graham B. Davis).

ZS1RG hopes to be back as G6UT by next April, at the old QTH in Bishops Stortford. He has done well out in South Africa, as our heading photograph last month suggested.

Top-Band DX

As usual, we will not comment in any detail on the Trans-Atlantics, which will have their own write-up in due course. Things have been going quite well —but more so for the W's than for us! Numerous contacts take place every Sunday between North and Central America, with quite a lot of new countries taking part —but these luxuries are not for us in Europe.

DX stations, other than W's and VE's, which have been logged in this country, now include OD5LX, ZC4GF, 4JA and 4RX, KP4CC, 4DV and 4KD, TI2BX, VP7NO, KV4AA and 4BB, VE4TM (?), VO3X, and many lesser lights in the European area, including ZB1.

Best conditions of the season, so far, seemed to be around December 29. On the whole, though, nothing unusual has happened except that DX activity has reached a higher level than before. The difficulty of raising any of it with 10 watts remains about the same, and frustration is the order of the day for all those who are not blessed with colossal aerials.

Concerning the "Novice Night" on January 30, the following cryptic "cablegram" reached us from G6LB (Chelmsford) soon after that paragraph appeared in the last issue:—"Novice weekend idea FB *Stop* Grateful any crumbs rich man's table *Stop* Suggest present situation due W's seem always tune QLH so solid wall Big Brother sigs 1825 nearly always heard first *Stop* If W's tune QHL more often Little Brother sigs driven higher up stand better chance *Stop* Probable small fry across more often than QSO's indicate *Stop* Good luck fellow little 'uns 30th *Stop*."

G6LB lost his mast and aerial in the November gales, but is now airborne again with a 360-ft. wire and 360-ft. counterpoise. That lot ought to take him out of the Little Brother class!

VS6CQ says he has nothing to report on the VS6/W skeds, except very weak unreadable signals on the test frequencies. Skeds are now at 1200 GMT, so of no interest whatever to Europeans.

Top-Band Locals

The County-chasers continue with unabated zeal. Several

". . . . Said I'm getting Q-R-Morocco from the Charlie-Oboe-Peter-Sugar . . . ."

opinions have come to hand concerning the suggestion, published last month, which mooted the idea of including all the County Boroughs and making a total of over 200 to go for. In general, the reactions are decidedly "anti"; one correspondent suggests that it puts the thing on a par with going outside and collecting registration numbers of cars as they pass. Others, less derisive, think it might be worth giving the thing a try as a separate ladder, but they will brook no interference with the present Counties Worked ladder and the WABC scheme as it stands. Several take the trouble to point out all sorts of confusions which might arise, as in the numerous cases where rates are paid in one area, postal district says something different, and Parliamentary constituency tells yet another story. And so on . . . . (It *was* only a suggestion!—*Ed.*).

Last summer, an amateur expedition to Scroby Island (off the Norfolk coast) was undertaken by some of the locals. They were only there long enough to work a few stations, as the Island is tidal! In this photograph are, left to right: G3IOR, G3HKD, G3HUL and G3JBU. Aerial photographs were also taken for the press, so the word "Scroby" was dug in the sand for identification.

G3JYV (Mitcham) reports for the first time, and joins the ladder. He says the consistency of OH2YV and OH7OH is worthy of mention, but he can't raise them. G3FAS (High Wycombe) has climbed a bit, thanks to GW3GCZ (Flint), GM3IGY (Fife), GM3DOD (Renfrew) and others. He asks us to state that GW2FDF recently moved from Monmouth to Staines (address unknown) and that G3FAS is holding three packets of QSL cards for him.

G3GYR (Stoke-on-Trent) has now worked 19 GM's, all verified. Argyll and "Clacks" have recently given him two new ones. OK1KTI and '1HI have also been worked.

G3HQX (Mitcham) laments the number of types who have not QSL'd, even when sent a 2d. stamp. But he wishes to thank an unknown amateur who helped him through a bit of a contretemps involving a car, a puncture, and lots of snow, near Greenford, Middx. After the "Good Samaritan" act had taken place, he noticed a Two-Metre stack in the garden of the chap concerned, but he still doesn't know who it could have been. He wants to say "Thank you" through this column.

G3JZG (Willenhall) is another recruit to the ladder, and he has just put up a half-wave, so he is hoping for better things, including, perhaps, even a Trans-Atlantic on Novice Night. G3JVK (Worthing) is a 16-year-old (licensed at 15) who reports for the first time. He has worked three OK's, an HB, sundry GM's and GW's, and climbs on the ladder with 17/33. He heard and called OD5LX at 0430 on December 19, but had no luck (nor did anyone else!) The original 33-ft. aerial having now been replaced by 100 feet, 'JVK has hopes of some DX on Sunday mornings.

G3JHH (Hounslow) is still chasing Oxford, but has collected Argyll and Renfrew (GM3KBU, 3DOD and 3HZA). He also mentions GM's, 3JNW, 3HRZ and 3EFS as consistent. GI's were also good, and the Old Year finished up quite nicely. G3JJG (London, S.W.16) reports for the first time; he came on the air in mid-October and has already worked 48 counties, including many GM's, GI and EI, but he finds GW's scarce. G2NJ (Peterborough) mentions that G3GFI is in Banbury, Oxon. He has also heard MB9BJ on the band, working OK1SX.

G3JJZ (London, S.E.6) put up a half-wave which brought in terrific reports for a while and then seemed to fail. He thinks somebody must have put a curse on him . . . . However, all is well again now, with GM's, GI's and OK's all giving good reports. He passes on the news that OH2YV says the OH's have now lost their special tickets—but he hopes to get another one for the next DX season.

G8KP climbs on the ladder again, with a score of 92/92; however, he is beaten for the top place in G by G5JM (Buckhurst Hill), who is now 94/94 and not only the top G but the top U.K. station!

G2HKU raised new ones in Argyll, Fife, Renfrew, Lanark, Co. Down; also five OK's and a real QSO with PAØPN, who was on during a flood emergency on December 23. G6VC received his QSL from ZC4JA and, more recently, heard and called ZC4RX but did not QSO. Regarding G6VC's remarks about Anglesey last month—GW2BMN (Menai Bridge) says that whenever he comes on he is snowed under with SWL reports. Also he complains that people who work him start making it a long-winded QSO, complete with exchange of names and all the rest of it, even with a queue waiting. Then there is a pile-up, and he closes down without answering anyone. Snappy QSO's without all the trimmings, if you want a contact with, or a card from, Anglesey. (*Late Flash:* G6VC has now worked Anglesey!)

General Patter

YU1GM has applied for a ZA licence, but has not yet had a reply (*via* YU1AD and G3JJZ). G3TR has received his WAB Certificate, the first issued to a G and the 54th outside Brazil. The contacts were all on phone, and 'TR recommends it to anyone who wants a really difficult job.

G3KDK (Plymouth) was an operator with the British Greenland Expedition, G3AAT/OX, and is now home with his own call . . . G5HB (Swindon) asks if anyone has details of VK1PN, who was on Heard Island in 1952. No card yet! We are in the same boat ourselves, and would like his QTH if anyone knows his present whereabouts. 'HB adds that he would probably have packed up DX long ago if it hadn't been for this Commentary; we didn't realise that it had been as cheerful as *that* in the last few years!

G3KAK (Waddington) read that G2YS had recently worked MD5FH. As 'KAK himself used to be MD5FH, but closed down last May, he would be interested to hear from the present user, or, for that matter, any of the boys out there. His own home QTH is Carlisle, but he is stationed at RAF Waddington.

ARRL DX Contest

This event takes place again in February and March. The *Phone* Contest runs over February 11-13 and March 11-13; the *CW* section is timed for February 25-27 and March 25-27. (Midnight GMT for start and finish in all cases).

The rules are practically the same as usual, with one exception, which will make it more interesting for all of us. The W/VE stations, instead of sending a three-figure group denoting their power, will send an abbreviated form of their State or Province. Thus you will receive groups like "579NJ" or "459Sask" instead of the former six-figure groups on CW. The same applies to phone—two figures and some letters. The States and Provinces are not used as a multiplier, but will serve as a guide to those hoping to make a rapid WAS. The multiplier, as always, will be the sum of the W/VE *districts* worked on each band.

DX Strays

ZS2MI (Marion Island) is on again, usually on 14150 kc phone . . . . JZØDN, on Biak Island, is ex-PAØDN—7 mc only, and QRP . . . . There is a station on Jan Mayen, signing LB1LF . . . . If you hear ZM6AS/A, he is probably on Tokelau Island. The ZM7 prefix used for this island on previous occasions is not official . . . . Still no news of W1JRA and his possible stay in Afghanistan.

FE8AE should be heard on Twenty CW by the time you read this . . . . VS1GH (ex-GM3AVO) visits Labuan and the Nicobar Is. once a month, but no report of activity as yet . . . . G2RO's travels put him on Cocos as ZC2RO; a possible future stop is Nauru, from where he will sign VLØRO!

Known to be on 3.5 mc CW: KM6AX, KH6AFS, YV5BJ, ZS3K, EL2X. Reported on 7 mc CW: VR1RO, VP8BD, FG7XB. VQ4HJP packed up, but John, now living on Mafia Is., might come back with the call VQ3HJP—and might even count as a new one.

(Acknowledgments to KV4AA and W5ALA for several of the above items of news.)

And that concludes this month's offerings. Please note that next month's deadline is unavoidably early (blame the calendar!) All contributions are wanted by **first post on Friday, February 11.** Get down to it and write as soon as you have finished your week-end DX. Address everything to "DX Commentary," *Short Wave Magazine*, 55 Victoria Street, S.W.1. Until then, 73, Good Hunting, and BCNU.

XYL VIEWPOINT!

Why I do *not* like my husband to be a radio amateur: It is an expensive hobby, and if it is a question of a "perm" for me or a pair of 813's for him, which do we have? An amateur station is like a locust—it eats up all the spare cash. And where's the companionship, with the old man on the air and me left alone with my knitting? Visitors sit in bored silence or are made to feel like eaves-droppers. And the meals, and meal-times! I get a nice dinner ready for the table just as his lordship starts an important QSO with a new station; he "won't be a minute," he says. When he does appear, the meal is ruined, and the children disappointed because they have been waiting all the afternoon to tell him their news. So he finds the atmosphere rather frigid—and goes back to the shack for the evening! As for getting anything done about the house, there's never any time for *that;* he is always too busy re-tuning, re-building or re-organising the wretched Rig. (Of course, all hobbies are boring to those who cannot share them).

Next Month (*perhaps*): "Why I am glad my husband is a radio amateur."

HONOURS AND PROMOTIONS

In Her Majesty's New Year Honours List, published on January 1st, the distinction of ***O.B.E.*** was conferred upon Alderman J. C. Clarricoats (G6CL), of the Southgate Borough Council, a governor of Enfield Technical College and of Southgate Technical Institute, and for 25 years secretary of the Radio Society of Great Britain. Among the recipients of the ***M.B.E.*** were: S. W. Brown, chief radio officer, s.s. *Scythia*; D. Fairweather, in charge of crystal production, Marconi's; and H. L. Peddle, signals officer, telecommunications dept., Ministry of Civil Aviation.

The half-yearly promotion list issued by the Air Ministry included W/Cdr. S. G. Morgan, O.B.E. (G6SM), promoted to Group-Captain in the Technical Branch of the Royal Air Force.

Miniature Oscilloscope

DESIGN & CONSTRUCTION OF WIDE-RANGE GENERAL-PURPOSE INSTRUMENT

A. K. BROOKMAN, B.Sc., A.R.C.S. (G3FLP)

This article deals more fully with design considerations than the details of construction—though sufficient information is given for the intending constructor—and will be of particular interest to the experimenter with a knowledge of oscilloscope technique. The author explains how conflicting performance requirements were reconciled and gives reasons for the choice of circuit and values.—Editor.

AN oscilloscope is now rightly regarded as an essential part of the equipment of the radio amateur, or, for that matter, of any experimenter in the field of communications or electronics. Its flexibility of operation and application to a wide variety of measurements at all frequencies from zero upwards are too well-known to require elaboration here; and, whilst for many purposes neither amplifier nor time base are essential, both these facilities are necessary to realise its full potentialities.

The process of design, in common with many others, consists of drawing up a specification of the performance desired, and making a series of compromises between conflicting practical factors with this in mind. The design of a miniature general - purpose oscilloscope is, perhaps, unusually difficult, since no definite specification can be laid down; one can only aim at providing the best possible performance within the limitations of space and power dissipation imposed. Although the design described here was made principally with amateur uses in mind, it has been kept as flexible as possible to permit more specialised applications when required.

The necessity of keeping the physical size of the oscilloscope as small as possible was imposed simply by acute lack of space at this station (a condition from which many amateurs seem to suffer!). This sets a definite limit to the amount of power which can be dissipated, assuming a reasonable temperature rise and normal ventilation.

Choice of CRT

The first choice to be made is, of course, the cathode ray tube itself; a screen diameter of $2\frac{3}{4}$ ins. was decided on as the smallest which would be acceptable, since it is very difficult to distinguish detail in a complex trace on a smaller screen. Of the three tubes readily available with this screen diameter, the VCR138 and EMI 4/1 were rejected because of their length (the use of either would nearly double the bulk of the finished oscilloscope), leaving only the VCR139A. This tube has poorer focus and lower sensitivity than either of the others, but it is easier to screen magnetically (an important point when a mains transformer is in close proximity) and its much smaller length was a deciding factor. The CVX279 is an improved version of the VCR139A and should be used if available; the focus is much better and it also appears to suffer less from astigmatism.

The Amplifier

With an EHT supply of 1,000 volts an input of about 400 volts peak-to-peak is required for full screen deflection; to obtain this from a single-ended amplifier, an HT supply of between 500 and 600 volts would be required. A paraphase amplifier was therefore used; with an HT supply of 400 volts, a peak-to-peak output of about 700 volts is available, which provides a fair margin for the expansion of details of a trace. Symmetrical deflection has the further advantages of reduced astigmatism, smaller HT decoupling condensers (since no signal currents flow in the common HT line) and better HF response (since the load resistors per anode can be considerably smaller than for a single-ended amplifier).

Miniature B7G valves were used for both amplifier and time base, principally to conserve space; of the valves generally available in this range, only the EF91 (or equivalent), with a maximum anode dissipation of 2·5 watts, is suitable. By drawing load lines on the static anode characteristics published for this valve, and hence obtaining the dynamic Va/Vg curves for various loads, the most suitable anode load resistor was found to be roughly 22000 ohms. The operating point is at $Va=225$ volts, $Ia=9$ mA, $Vg2=250$ volts, $Vg1= -2{\cdot}5$ volts, $Rk=220$ ohms. Under these conditions, full screen deflection is obtained for an input of about 1·5 volts RMS (sensitivity 12 mms/volt), which is adequate for most purposes.

It is desirable that the amplifier should have

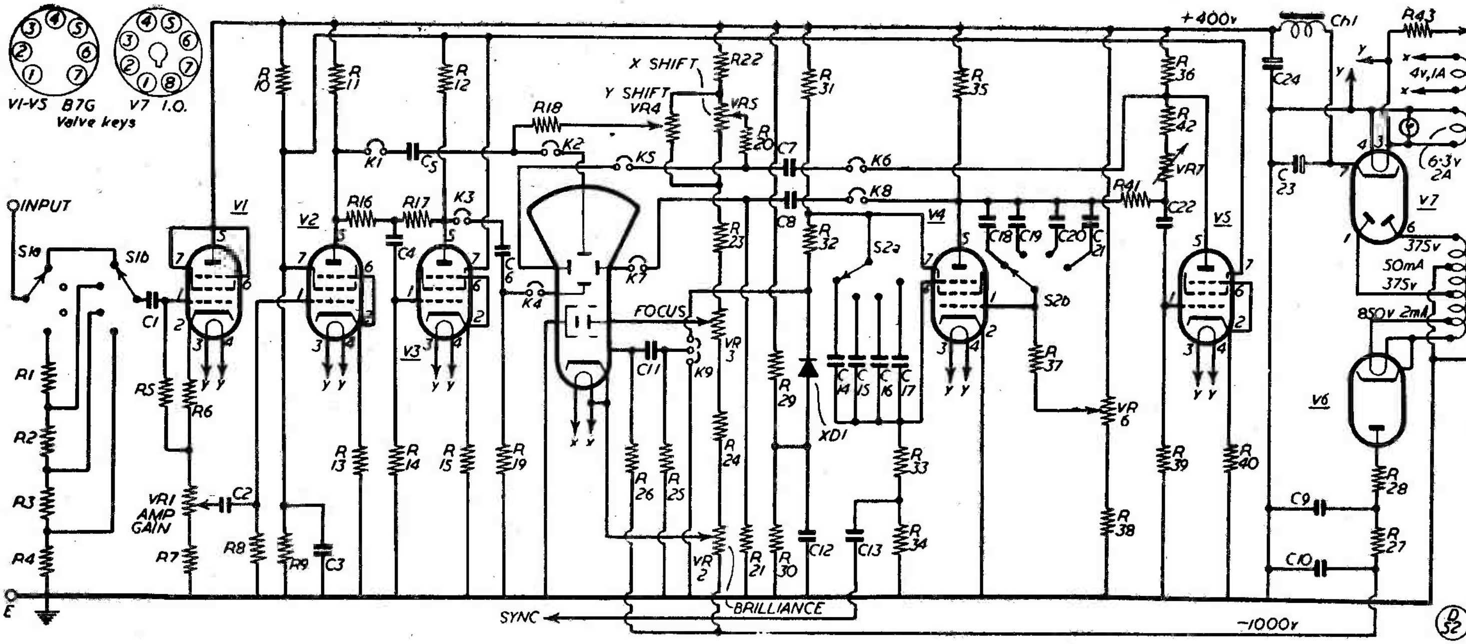


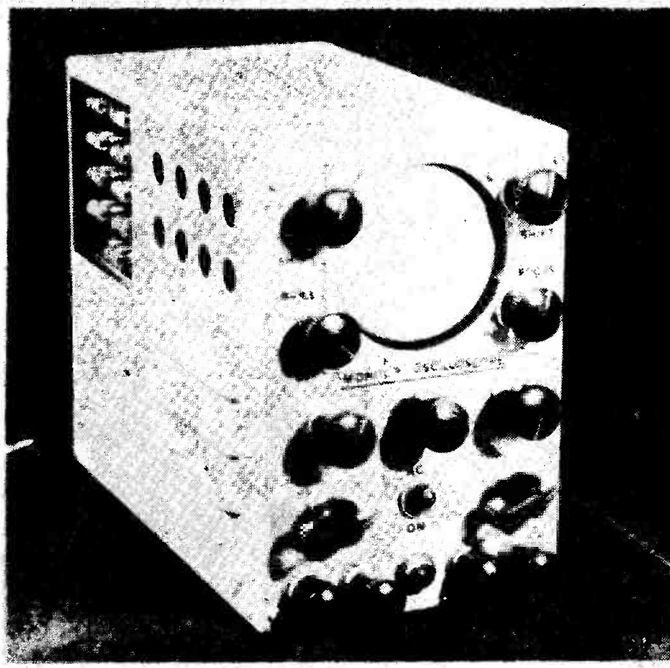
Fig. 1. Complete circuit diagram of the Miniature Oscilloscope; the various sections are discussed in the text, and all values in the accompanying table.

Table of Values

Fig. 1. Circuit of the Miniature Oscilloscope

C1	= .02 μF, 500v. (TCC CP34S)
C2	= 0.25 μF, 150v. (Dubilier)
C3	= 4 μF, 350v., elect.
C4, C22	= 0.1 μF, 350v. (TCC CP37N)
C5, C6, C7, C8	= 0.1 μF, 500v. (TCC CP46S)
C9	= 0.25 μF, 1,500v.
C10	= 0.5 μF, 1,000v.
C11	= 0.1 μF, 1,000v. (TCC CP47W)
C12	= 1.0 μF, 275v. elect. (TCC CE3ON)
C13	= .01 μF, 350v. (TCC CP113N)
C14	= .001 μF, 500v.
C15	= 220 μμF, mica
C16	= 82 μμF, mica
C17	= 15 μμF
C18	= .02 μF, 500v.
C19	= .005 μF, 500v.
C20	= .001 μF, 500v.
C21	= 220 μμF, mica
C23	= 8 μF, 500v. elect., (ripple current rating 100 mA)
C24	= 16 μF, 450v. elect.
R1, R32	= 1 megohm, ½-w.
R2	= 470,000 ohms, ¼-w.
R3, R4	= 220,000 ohms, ½-w.
R5, R8, R14, R39	= 2.2 megohms, ¼-w.
R6, R7	= 1,000 ohms, ¼-w.
R9	= 82,000 ohms, 1w.
R10	= 27,000 ohms, 1w.
R11, R12, R35, R36	= 22,000 ohms, 3w, w/wound
R13, R15, R40	= 220 ohms, ½-w.
R16, R17	= 100,000 ohms, ½-w.
R18, R19, R20, R21, R25	= 10 megohms, 1w.
R22, R29, R33	= 820,000 ohms, ½-w.
R23	= 2.2 megohms, 1w.
R24	= 220,000 ohms, ¼-w.
R26	= 22 megohms, ½-w.
R27, R31	= 100,000 ohms, 1w.
R28	= 100,000 ohms, 2w.
R30	= 82,000 ohms, ¼-w.
R34	= 100,000 ohms, ¼-w.
R37	= 680,000 ohms, ½-w.
R38	= 47,000 ohms, ¼-w.
R41	= 330,000 ohms, ½-w.
R42	= 68,000 ohms, ¼-w.
R43	= 10,000 ohms, ¼-w.
VR1	= 50,000 ohms, Amp Gain
VR2	= 100,000 ohms, Brilliance
VR3	= 250,000 ohms, Focus
VR4	= 2.5 megohms, Y-shift
VR5	= 2.5 megohms, X-shift
VR6	= 1 megohm, Speed
VR7	= 500,000 ohms, X Amp.
V1-V5	= EF91, 6F12, 6AM6
V6	= R10
V7	= 6X4
XD1	= B.T.H. CG4C, or equiv.
K1-K9	= Links on Group Board
T1	= Mains xformer
Ch1	= LF Choke, 10H, 60mA
S1A-S1B	= Input attenuator
S2A-S2B	= Time Base range
S3	= Mains on-off

NOTE: All variable resistors VR1-VR7 are 1-inch diameter type, rated ½-watt.



General view of the completed Oscilloscope, designed and constructed by G3FLP. The circuit is given in Fig. 1 and will be seen to include all desirable facilities in a test instrument of this sort.

the highest possible input impedance, certainly not less than 10 megohms, and preferably much higher. The input capacity should also be as low as possible, with 25 $\mu\mu$F as a maximum. This is essential if observation of voltages at high impedance points is to be made without seriously loading the circuit under test. For example, a pentode used as an audio amplifier with an anode load of 470,000 ohms has an output impedance only slightly less than that figure, and an oscilloscope with an input impedance of 0·5 megohm connected to the anode would show about half the voltage actually present. And in some amplifiers (notably deaf-aids) impedances as high as 10 megohms may be encountered.

To provide this high input impedance, the first valve in the amplifier is connected as a cathode follower; with the component values used, the resistive component of the input impedance is about 100 megohms and the capacitive component about 22 $\mu\mu$F. This arrangement has two further advantages, namely, input signals up to about 200 volts peak-to-peak can be handled without overloading, and the gain control (located in the cathode circuit) can be of comparatively low resistance.

In order to handle very large voltages, such as occur at the anode of a modulator valve, a switched input attenuator was provided in addition to a gain control. Although the input resistance is only 2·2 megohms when the attenuator is in circuit, it has proved most useful, and if slightly elaborated might make the gain control redundant. With the maximum attenuation of 8 : 1, inputs up to 1500 volts peak-to-peak can be accommodated—which is rather more than the maximum voltage rating of the miniature Yaxley switch used !

Frequency Response of Amplifier

Although a DC-coupled Y-amplifier is occasionally useful, and for some purposes essential, it leads to considerable complications. If the useful facility of making external connections directly to the Y-plates is to be retained, the mean potential at the output terminals of a DC-coupled Y-amplifier must be zero to avoid introducing astigmatism. This makes both a positive and a negative HT supply rail necessary, and considerably increases the power consumption, unless a second negative supply is provided for the inter-stage coupling potentiometers. An AC-coupled amplifier was therefore used, the low frequency response being extended by the use of the largest permissible resistances and largest practicable condensers in the coupling networks. The low frequency 3 dB point occurs at about 2 c.p.s., the phase shift being approximately 90°.

A disadvantage of the large coupling components is that the shifts have correspondingly long time-constants (actually one second), but this is unavoidable: a more serious effect is caused by the DC component of voltage across the gain control potentiometer. If the gain is varied suddenly, the trace momentarily disappears off the top or bottom of the screen; this is due to the time constant C2, R8. The effect can be avoided by making R8 the gain control potentiometer, but it must not be larger than about 100,000 ohms if the high

WINDING TABLE

In Order of Winding

WINDING	NOMINAL OPEN-CIRCUIT VOLTAGE	CURRENT RATING AMPS.	WIRE SIZE SWG	NUMBER OF TURNS	INSULATION
Primary	240 225 210 0 (common)	— — — —	30 enam.	0 83 (tap) 166 („) 1320	1 layer of 2 mil. Kraft paper between layers.
	—	—	—	—	5 layers 2 mil. Kraft paper.
Screen	—	—	—	—	———
		then			7 layers 2 mil. Kraft paper.
HT	375 —0 (CT) 375	50mA	38 enam.	0 2060 (tap) 4120 („)	1 layer 1 mil. Kraft paper between layers.
EHT	850	2mA	44 enam.	6735	1 layer 1 mil. Kraft paper between layers.
(Heater)	4.2	0.5	26 enam.	24	
		then			15 layers 2 mil. Kraft paper.
Heater	6.6	2.5	19 enam.	37	
					10 layers 2 mil. Kraft paper.
Heater	4.2	1.1	22 enam.	24	
		Finish off with			10 layers 2 mil. Kraft paper.
					2 layers Empire cloth.

MAINS TRANSFORMER WINDING DATA

The core is a 1½ in. stack of M.E.A. Pattern 24A laminations, wound at 5.5 turns per volt.

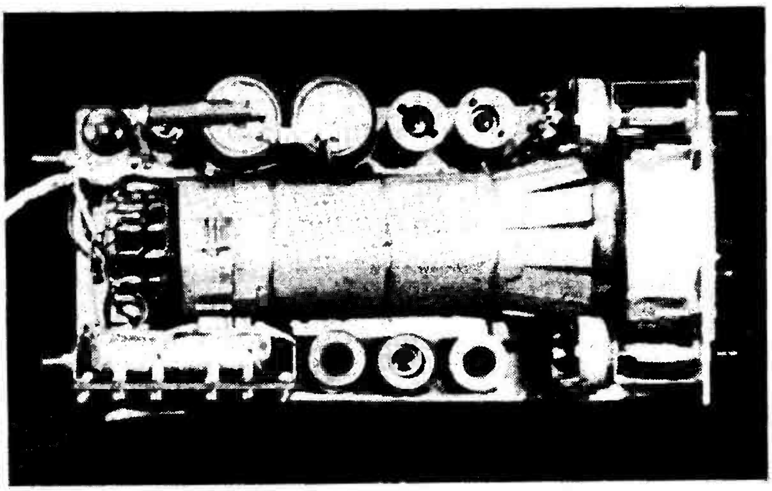
The primary, of 30 SWG enamelled wire, is wound on first, followed by 5 layers of 2 mil. Kraft paper; the copper foil screen, which should occupy slightly more than one complete turn, is then wound in, the paper providing the insulation between the overlapping ends of the foil. A further 7 layers of 2 mil. paper are wound on, followed by the HT winding, of 38 SWG enamelled wire. The EHT winding is of 44 SWG enamelled wire, and follows on from the end of the HT winding; the EHT rectifier heater winding, if required, is then wound on, the end of the EHT winding being internally connected to it. (This requires some care—44 SWG wire is very easily broken by the much heavier heater winding). The 6.3 volt heater winding, of 19 SWG enamelled wire, is next wound on, preceded by 15 layers, and followed by 10 layers, of 2 mil. Kraft paper. The CRT heater winding is put on last, followed by 10 layers of paper and two layers of Empire cloth. The completed winding is then baked for at least 3 hours at a temperature of 110-120°C. (a "slow" oven is near enough), and immediately put in a bath containing equal parts of paraffin-wax and bees-wax. The wax is allowed to cool slowly until a skin forms on the surface, when the winding is removed and surplus wax drained off. When cool, surplus wax is scraped out of the inside of the bobbin, and the core assembled.

---

frequency response is to be maintained, due to the shunting effect of the input capacity of V2. Consequently, a very large value of C2 is required to maintain the low frequency response; a 10 μF paper condenser would be needed if R8 were 100,000 ohms (an impossibly bulky component). In practice, however, the effect does not cause appreciable inconvenience, and the system shown has been retained.

It is, perhaps, worth noting in passing that since C4, R14 and C22, R39 are inside the feedback loops of V3 and V5 respectively, their actual time-constants should be multiplied by the loop gain to obtain the effective values of their time-constants (which are about 5 seconds). Similar remarks apply to C1, R5.

The high frequency 3dB point occurs at the frequency at which the reactance of the total output stray capacity of the amplifier equals the anode load resistor; for the 22,000 ohm



Plan view of the Oscilloscope, showing that space is not wasted. The drawings to follow should be consulted for the mechanical details.

loads used, this frequency is about 700 kc, and, by using inductive compensation, may be extended to about one megacycle. Compensation was not used because it was considered that the slight extension of HF response (which would in any case be inadequate for the examination of television waveforms) would not justify the use of extra components. If it is desired to use inductive compensation of the 22,000 ohm loads, however, inductances of between 500 and 1000 microhenries are suitable. By reducing the loads to 4000 ohms and using inductive compensation, the high frequency response can be extended to about 3 mc; the price paid for this increased bandwidth is that the maximum output is reduced to about half a screen diameter, which television enthusiasts may consider acceptable. For those interested principally in audio frequencies, however, a limit of 700 kc is more than adequate, even for the resolution of transient parasitics.

Signals of sufficient amplitude at any frequency may, of course, be observed by feeding them directly into the Y-plates. (The upper frequency limit for this procedure is set by a variety of factors, notably the transit time of the electron beam and the resonant frequency of CRT electrode system—for the construction used, results are unreliable above about 200 mc). To facilitate this, all four deflecting plates are brought out to a group board mounted at the back of the chassis, the leads to the CRT being kept as short as possible; the amplifier and time base outputs and their coupling condensers are also brought out, and the appropriate connections made with small U-links. Thus direct connection, with DC or AC coupling, is available for external use, which is occasionally required, *e.g.*, in displaying valve dynamic characteristics.

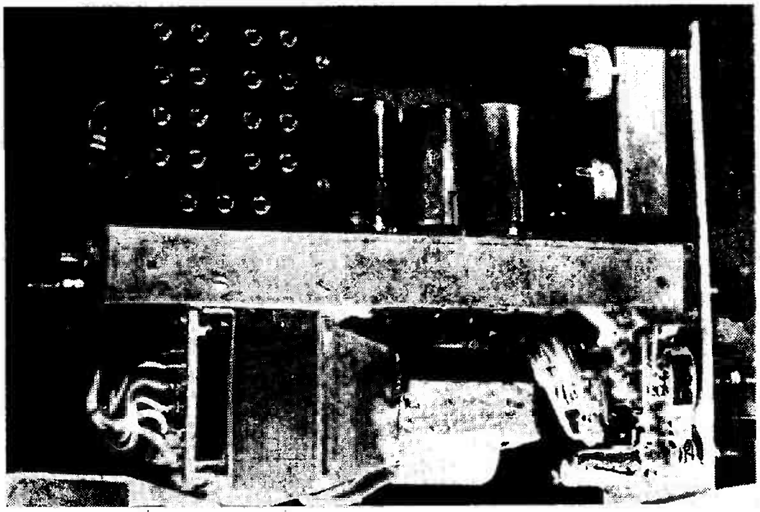
The Time Base

A Miller Integrator time base is used, followed by a phase inverter with variable feedback, which serves as a scan amplitude control. The negative pulse which occurs on the screen grid of the Miller-connected valve is applied, after clipping, to the modulator of the cathode ray tube, and effectively "blacks-out" the flyback. The frequency coverage is approximately 10 c.p.s. to 25 kc; it may be extended upwards or downwards by the provision of additional condensers, but this range has proved adequate so far.

The possibility of using a "constant time scale" time base, in which the frequency is varied by means of a diode clipper at the anode of a Miller-connected valve, was carefully investigated; the system enables time intervals to be read directly from the trace, the time base range switch being used as a time scale multiplier. The disadvantage (apart from the extra complication) is that on each range, the amplitude of the time base is inversely proportional to its frequency (which is simply another way of saying that the time scale is constant); thus, if the coverage per range were as little as 3:1, only one-third of the screen width would be used at the high frequency end of the range. With a screen diameter of only 2¾ ins. this limitation was not considered acceptable; work is proceeding, however, on a modified form of this system, and has so far given encouraging results.

Some further comment is required on the fly-back blanking circuit. Although the screen-grid potential has the general form of a negative-going pulse, the "top" is far from flat. Clipping of the positive peak is therefore necessary to provide uniform brightness throughout the sweep; this is achieved by means of the crystal diode XD1, the clipping level being set by the potentiometer R29, R30.

On each time base range, the flyback time is constant, hence the ratio of sweep time to flyback time varies from about 50: 1 to 5: 1 as the frequency is increased ; since the blanking pulse is AC-coupled into the CRT grid, without DC restoration, the average brilliance of the sweep increases with frequency. This effect is minimised by using the smallest amplitude of pulse which gives satisfactory blanking; it may be eliminated by using DC restoration at the CRT grid, but the complication seems hardly justified. The blanking pulse and the CRT grid are brought out on to the group board, which enables external modulation to be applied if desired.



Left-hand side elevation, showing a portion of the power pack sub-assembly and the link panel fitting.

Power Supplies

At this point in the process of design, the power supply requirements can be calculated. They are: HT, 400 volts at 50 mA ; LT, 6·3 volts at 2·5 amps.; EHT, 1 kV at 500 microamps. A CRT heater supply of 4 volts at 1·1 amps. is also required, insulated for 1,000 v. DC.

The HT supply can conveniently be obtained from a 6X4 rectifier in a full-wave circuit; this valve has the advantage of not requiring a separate heater supply. The screen feed of 250 volts is obtained from the HT line by the potentiometer R9, R10, decoupled by C3 (which was originally 2 μF, but later increased to 4 μF). EHT may be obtained either by voltage doubling from the HT transformer winding, or by half-wave rectification from a separate EHT winding. A valve rectifier was used in this case, requiring a separate heater winding, but this is unnecessary if a "pencil" type metal rectifier is used. For the arrangement shown in the circuit diagram, a mains transformer with the following rating is required :

HT: 375–0–375 volts at 50 mA.
EHT: 850 volts at one mA.
EHT Rectifier Heater: 4 volts at 0.5 amps.
LT: 6.3 volts at 2.5 amps.
CRT Heater: 4 volts at 1.1 amps., insulated to 1 kV.

A transformer with this specification was wound by the author, and the winding data are given in the table herewith.

Choice of Components

Although as much ventilation as possible is provided, the temperature rise of the "hot spots" is considerable and components must be chosen which will operate satisfactorily in high ambient temperatures. The choice of condensers is particularly critical, since they are associated with very high resistances ; oil-filled metal cased tubular condensers are suitable—waxed cardboard cased condensers should *not* be used. Wherever possible, type numbers and ratings have been quoted in the table of values for Fig. 1.

(To Be Concluded)

* * *

THE NEW "CALL BOOK"

The Winter edition of the *Radio Amateur Call Book* (No. 4 of Vol. 32) is now available from stock, with the usual large G-section, which this time includes all U.K. QTH's and changes of address as published in "New QTH's" in *Short Wave Magazine* up to our issue for November 1954. As always, the *Call Book* can be obtained either complete, at 27s. post free, or in the abridged edition, which covers the whole world less *only* the Americans ; this costs but 10s. and is really amazing value for money. An average issue of the *Radio Amateur Call Book* complete now runs to nearly 500 pages in the full edition, and more than 150 pages in the abridged version. Orders, with remittance, to: Publications Dept., Short Wave Magazine, Ltd., 55 Victoria Street, London, S.W.1.

Reducing Break-Through on TV IF's

SUPPRESSING LF BAND HARMONICS

A. D. TAYLOR (G8PG)

This is a very useful practical article for the operator who, while accepting some restrictions on the HF bands in the presence of TV receivers with IF channels in the 14 mc region, wants to be free to work on Top Band and Eighty during TV hours. The filter unit suggested, for which full constructional details are given, should go far to eliminating harmonic break-through in the 14 mc area.—Editor.

UNDER the revised GPO regulations the amateur can no longer be held to blame if his 14 mc fundamental or 3·5 mc harmonic cause break-through on the 14 mc IF circuits of a television receiver in the vicinity. This is an important step forward in gaining justice for the amateur but, in many cases, it may lead to practical difficulties when applied, especially where a number of receivers are concerned. The point is that legal rights are not necessarily the final answer when their rigid application leads to constant social unpleasantness locally. The writer was recently faced with this problem and these notes outline the solution adopted.

In the writer's case it was mostly a question of harmonics, as 90% of the available operating time was spent on the 1.7 and 3.5 mc amateur bands, *plus* Service reserve schedules on non-amateur LF channels. In truly British style, therefore, it was decided to compromise. An attempt would be made to reduce harmonics from the range 1.8 to 4 mc to negligible proportions at the transmitter, while during the occasional periods of operation on 7 and 14 mc the viewer must either accept the interference or else take his complaint to the set manufacturer. This implied some restrictions (the writer has too much conscience to come on 14 mc during a Wolves *v*. Spartak telecast, for instance !), but experience shows that it works well and that on two bands at least even the deficiencies of the television receiver have been overcome.

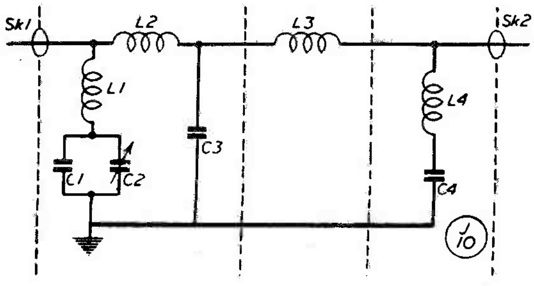


Fig. 1. Circuit of the filter suggested by G8PG. Values are: C1, 100 μμF silver mica ; C2, 50 μμF air trimmer ; C3, 440 μμF, silver mica ; C4, 120 μμF, silver mica ; L1, L4, 13 turns spaced 1-¾ ins. ; L2, L3, 20 turns spaced 2 ins. ; all coils are ½-in. diameter. Sk1, Sk2, are coax sockets.

The Solution

Having sorted out the ethics, the problem was next examined on a practical basis. Briefly, a 50-watt transmitter and a 10-watt transmitter operating over the range of frequencies 2 to 4 mc had to have all harmonic radiation reduced by some 50 dB in the range 13 to 16 mc without affecting their performance at the fundamental frequencies. Both sets incorporated normal VHF harmonic suppression and were used in conjunction with a low-pass filter giving some 60 dB of attenuation at TV signal frequencies.

Considerable thought was given to the problem and suddenly the solution became clear. To stop TVI from harmonics at the actual TV signal frequencies we use a low-pass filter with a 30 mc cut-off and maximum attenuation at these frequencies. To stop IF break-through from harmonics in the 13 to 16 mc region, therefore, it should only be necessary to introduce a second filter having a cut-off around 8 to 9 mc and providing maximum attenuation over the 13 to 16 mc band. This seemed a reasonable conclusion, so work was started on such a filter at once.

Construction and Adjustment of the Filter

The circuit of the filter chosen is shown in Fig. 1 and the physical arrangement in Fig. 2. An aluminium box 10 x 5 x 3 inches was available and this was divided into three compartments by means of two aluminium screens, as indicated in Fig 2. The centre compartment takes up 3 inches in the lengthwise direction and the two outer compartments 3½ inches. To ensure full efficiency the screens must be a close fit against the four faces of the box and must be firmly secured in place. This is best done by putting flanges on the bottom and sides of the screens and securing each flange to the box by means of 3 self-tapping screws. The lid must also be a close fit and is secured in place by means of 12 self-tapping screws. Wiring access between the various compartments is by means of small lead-through insulators.

The silver-mica condensers used must be of high quality, preferably 1% tolerance types. They are suspended in the wiring, earth returns being made to solder tags bolted to the box. The air-dielectric trimmer should have a spindle suitable for screwdriver adjustment and this should protrude through a small hole in the box so that it can be adjusted from the outside.

The coils are wound with 16 SWG enamelled copper wire and are self-supporting. Winding details are given with Fig. 1, the method of winding being as follows:

Cut off a suitable length of wire and draw it out taut to remove kinks. With one end held in the vice, wind the coil on a suitable former, such as a length of ½-inch diameter rod (the diameter must be ½-inch), keeping plenty of tension on the wire to provide a firm, well formed winding. When the coil is finished, leave 1½ inches of wire at each end to provide leads to the coil support points, remove the tension and slide the coil off the

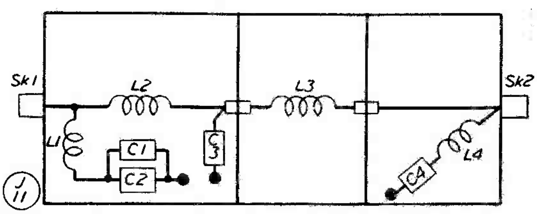


Fig. 2. Sketch showing layout for the filter, as adopted by G8PG. Good screening is essential for really useful results.

former. When the wire is removed from the former it will spring a little, thus slightly increasing the diameter of the coil, but this has been allowed for in the winding data given. Each completed coil should have the turns evenly opened out until it occupies the specified winding length.

When the filter is completed it should be inserted in the aerial circuit as shown in Fig. 3. From this diagram it will be noticed that both the input and output impedances are 75 ohms. With the filter in circuit, tune up the transmitter in the 3.5 mc band and locate the 14 mc harmonic with the aid of the station receiver. Adjust the air-dielectric trimmer until the strength of this harmonic is reduced to a minimum. The filter is then ready for service and should provide some 50 dB of

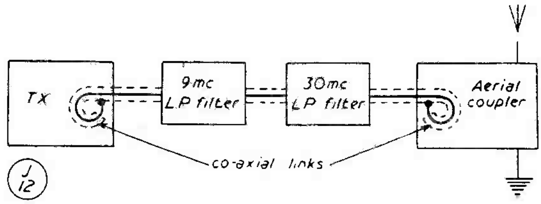


Fig. 3. Incorporating the filters in the transmitter output, as described in the article. If the filters are working properly, operation should be possible on both LF bands without risk of TVI by 14 mc break through.

attenuation in the 14 mc region.

Results

As soon as the filter was installed at the writer's station careful tests were carried out with the aid of a communication receiver located within two feet of the transmitter. As was to be expected, harmonics from the 10-watt transmitter were now negligible, while those from the 50-watt set were a couple of S-points down on the 19-metre signals of the Canadian Broadcasting Corporation! This indicated a very satisfactory degree of attenuation which has proved to be the case in practice, as no complaints of break-through from signals in the range 1.8 to 4 mc have been received since. Transmitter performance is not affected on these frequencies, but 7 mc operation with the filter in circuit is not possible, apparently due to the "skirt" of the stop-band overlapping this frequency. All tests were made at a distance of 50 miles from the Holme Moss transmitter.

Conclusion

While not represented as a "cure-all," it is felt that the method outlined here may be of considerable practical interest to the LF band enthusiast or to those who, like the writer, wish to feel completely TVI-proof on as many bands as possible.

"VHF BANDS"—A. J. Devon

It is very much regretted that, because of a sudden indisposition, our contributor was unable to produce his usual offering in time for this issue. He asks, with humble apologies, to be forgiven by those readers and correspondents who may be disappointed, and hopes to be back in the line in time for the March issue. All "VHF Bands" reports are being held for that issue, and correspondents are asked to write in, as usual, by February 14, addressed A. J. Devon, "VHF Bands," SHORT WAVE MAGAZINE, **55 Victoria Street, London, S.W.1.**

TRANSISTOR TOPICS

More History
Transistor Superhet
VFO-PA Transmitter
Transistor Notes and News

FOLLOWING on last month's description and explanation of the crystal-diode oscillator, it is very interesting to learn of a connection between the original experiments of Dr. W. H. Eccles in this country and the results subsequently claimed by the Russians. It seems that about 1910 one Eisenstein, head of a Russian wireless firm in St. Petersburg, asked for details of his LF "oscillating detector" experiments from Dr. Eccles, who sent full particulars. The Russians are believed to have succeeded in obtaining heterodyne (CW) reception of arc signals during the 1914-'18 War; they were compelled to try Dr. Eccles' method because they could not obtain the triode valves then in use by the Allies, and had found a local arc oscillator inconvenient for reception! It is believed that the Russian O. Lossev—to whom much of the early practical work on oscillating crystals has been attributed—was an employee of the St. Petersburg firm.

So it all ties up nicely, and once again we find that it was a British experimenter who pioneered these developments. Dr. Eccles, who happily is still with us and living in Putney, has himself given these details to your contributor.

A Transistor Superhet

In the near future we hope to discuss fully the all-transistor communications receiver designed by G3CCA. In the meantime, the subject of the transistorized superhet is introduced here with a simple receiver using only three transistors. This is probably the minium number for a useful receiver—and about the maximum most people can lay their hands on, unless successfully rolling their own!

The circuit, shown in Fig. 1, is not very sensitive, and would benefit by more IF gain and the addition of an LF stage. However, it works well on strong stations and, apart from Top Band, can give an excellent account of itself on the MF broadcast band, where selectivity is more important than sensitivity. With a good aerial, local broadcasters produce overloading at full sensitivity.

Greatest scope for design and experimental work lies in the frequency changer stage. As with valve equipment, it is probably best to use a separate oscillator and either a diode or triode mixer, unless a special double-emitter transistor is available (or can be made). However, the highest gain that can be obtained with a single transistor in this stage is when it is used as the mixer. This means that it must perform as the local oscillator as well. The circuit adopted is that suggested by Bettridge in his book, *Transistors and Crystal Diodes*, reviewed here last month. The signal is injected into the emitter of a base-tuned oscillator giving IF output in the collector. This circuit is simple and sensitive, but is not without gremlins. It is difficult to control the amount of injection, and bad wave-form can cause strong harmonics which beat with unwanted signals. Generally, injection is too great, though attempts to reduce it may result in oscillation suddenly ceasing. Two adjustments are available here: The oscillator coil is tapped one-third of the way up; by reversing the coil the tap appears two-thirds of the way up; there are thus three possible positions at which to tap in the base. The bias resistor in the emitter provides

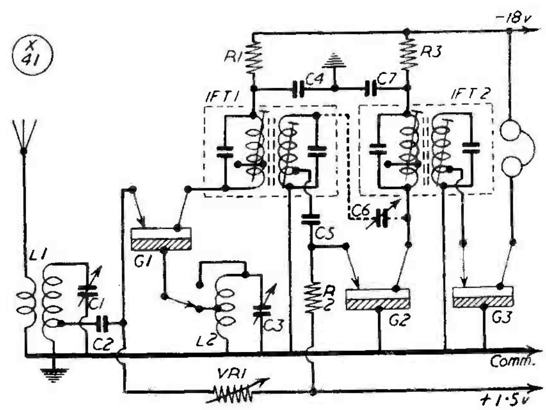


Fig. 1. This simple superhet circuit employs only three transistors. The signal is injected into the emitter of a base-tuned oscillator and the resulting IF taken from the collector. Feedback in the IF stage increases sensitivity and makes CW reception possible. The last transistor detects and amplifies, the output being taken on phones. This is an experimental circuit, which has been tried on the 160-metre band with very encouraging results.

Table of Values

Fig. 1. Superhet Receiver using Transistors.

C1, C3	= 500 $\mu\mu$F, tuning
C2, C4, C5, C7	= .002 μF, mica
C6	= 50 $\mu\mu$F, BFO trimmer (*see text*)
L1, L2	= Aerial/Oscillator coils, Amos Electronics (*see text*)
IFT1, IFT2	= 465 kc IF transformers, Amos Electronics (*see text*)
VR1	= 25,000 ohms
R1	= 15,000 ohms
R2	= 10,000 ohms
R3	= 5,000 ohms
G1	= Point-contact Transistor (GET-2)
G2, G3	= Point or Junction Transistors. (GET-2 or OC70)

the other adjustment and is best set for minimum oscillator amplitude.

The intermediate frequency chosen was the standard 465 kc. A lower frequency would be advantageous, especially if one uses a junction transistor in the IF stage, but this means that the oscillator and signal frequencies would be closer, with a risk of oscillator pulling. The oscillator is intended to work on the LF side of the signal only because this gives the transistor (which may be "feeling the frequency" at 2 mc plus 465 kc) the best chance. In the broadcast band this does not apply, and, as the tuning is not ganged in the experimental hook-up, one can tune the oscillator 465 kc above or below the signal. The oscillator sweep is approximately 500 kc to 1.6 mc, and the aerial tuning from about 800 kc to 2 mc. The emitter is tapped (through a blocking condenser to isolate the bias supply) one-fifth of the way up the aerial coil.

The IF stage is quite straightforward. The IF transformers are tapped in the secondaries one-fifth turns up from the "cold" end for the emitter, and also have an optional collector tap one-third from the "hot" end. Coils and IF transformers are slugged throughout and are of orthodox construction.

All these inductances were wound, with the special taps necessary for transistor work, by Amos (Electronics), Ltd., 47-49 High Street, Bletchley, Bucks. The coils and IF transformers specified here are for design and experimental work with transistor equipment. Amos (Electronics), Ltd., specialise in coil winding and can repeat these inductances for those who may require them.

To increase sensitivity and to make CW reception possible, a trimmer across the IF stage enables it to be brought to a state of oscillation. Although a point-contact transistor is shown in the circuit for the frequency-changer position, either point- or junction-type transistors can be used for the other stages. Junction transistors are to be preferred if they can cope with the IF, as they require less power. Total battery consumption for the circuit as shown here is only 1.5 mA at 18 volts, anyway!

It must be emphasised that performance of this receiver will depend entirely on the types of transistor used and their individual merit. Even with transistors of adequate performance up to 2 mc best results may only be achieved after considerable experiment and variation of tapping points from those given in Fig. 1.

The circuit as it stands is purely experimental, and though satisfactory results are being obtained on Top Band phone and CW stations, a good deal more can be done with it by the earnest and enthusiastic worker, to whom it is commended as a practical design around which much experiment is possible. And we shall, of course, be very interested to hear from those who try it.

The Base-Tuned Oscillator—Another Explanation

Sometimes a new approach to a problem from a different angle leads to an easier and better understanding of it. The base-tuned oscillator may be explained without reference to the negative characteristic of the base by treating it as a feedback amplifier. Fig. 2 (a) shows how the emitter may be directly coupled to the collector load by putting the collector supply before the load instead of after it. If it was inserted at point Y in the circuit instead, then a blocking condenser would be needed at point X. The feedback in this circuit, being direct, involves no step up or down of the feedback current. Therefore, the circuit will only oscillate if the transistor gives a current amplification of more than one. Hence, we are limited to point-contact transistors, junction types being eliminated by having an *alpha* of just under one. By tapping the emitter down the coil and thus getting a current step-up, readier oscillation might be obtained, but we should no longer have a normal "base-tuned oscillator." That Fig. 2(a) is the usual circuit can be seen by comparing it with (b), which is the same circuit drawn in the conventional way. A transmitter using this arrangement was given on p.166 of the May 1954 *Short Wave Magazine*.

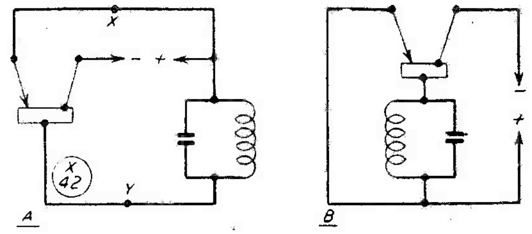


Fig. 2. An explanation of the base-tuned transistor oscillator in terms of the amplifying properties of a transistor rather than negative resistance. Circuit (A) shows direct feed-back from collector to emitter. Circuit (B) is the same as (A) but is the more conventional layout of a base-tuned oscillator.

VFO-PA TTX Rig

G3CSZ, who is using home-made transistors only, gives details of his rig. He is trying the Clapp oscillator as adopted by G3CCA, but with some modification in values. In the original form (p.281 of the July 1954 *Short Wave Magazine*) G3CSZ found it would not work on home-made transistors. With this transmitter as modified, reports of RST-558 have been given over 7 miles; G3CSZ has not attempted DX, as his aerial (only 75 feet long and badly screened) is hardly good enough for such to be possible with QRPP. (*See* Fig. 3).

Setting-Up Procedure. Put main switch to central position, *i.e.* VFO only on. Press key and swing VR1 from maximum resistance towards minimum and watch current rise. Two flicks should be seen. The first indicates that oscillation has commenced and the second, about 0.25 milliamp higher, shows that the VFO is squegging. Set VR1 half-way between the two. Make a note of the current, which should be about 2 mA. Roughly adjust tank C4 and bandspread C5 tuning controls. Set VR2 towards maximum resistance.

Put main switch in "down" position, *i.e.* VFO and PA on. Adjust VR2 until total current drawn is

Table of Values

Fig. 3. G3CSZ VFO-PA Transmitter using Transistors.

C1, C9	= 0.1 μF	R2	= 250,000 ohms
C2	= 200 μμF, mica	R5	= 500 ohms
C3, C8	= 100 μμF, mica	VR1	= 50,000 ohms
C4	= 100 μμF, tuning	VR2	= 5,000 ohms
C5	= 50 μμF	G1, G2	= Home-made transistors
C6	= 300 μμF	Sw.	= 2-pole, 3-way, wired as shown
C7	= 500 μμF		
R1, R3, R4	= 15,000 ohms		
L1, L2	= Eddystone standard plug-in (pink spot L1, white spot L2), or as wound for 160 metres.		

about 4.5 mA. A peak FSM or S-meter setting can be found for VR2. It will be necessary to re-tune while doing this. The PA will pull the VFO tuning when using the HF winding of the Eddystone coil as a coupling inductance.

Operating Conditions. Switch on VFO and allow 3 minutes or so for it to "warm up" (!). This really means stabilising. Ensure that current is at correct setting as ascertained in setting-up procedure. Let VFO run for whole of operating period and just switch PA on and off as required.

With PA switched on, check that total current is at established value. Press key. Net bandspread C5 tuning to required frequency on receiver. Tune C5, C6 and C7 for maximum on receiver S-meter with BFO off, or equivalent device.

Comments. Under these conditions the PA delivers a fraction more power into the aerial than with the same transistor and coil used in the CO TTX (*Short Wave Magazine*, March '54).

Originally, both VFO and PA were fitted with miniature air-cored coils, but both were replaced by standard 1½in. diameter Eddystone coils owing to poor results. This means that only three coils are required to cover two bands.

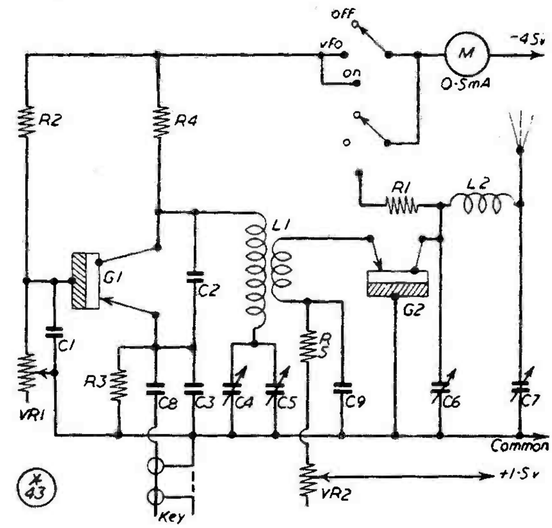


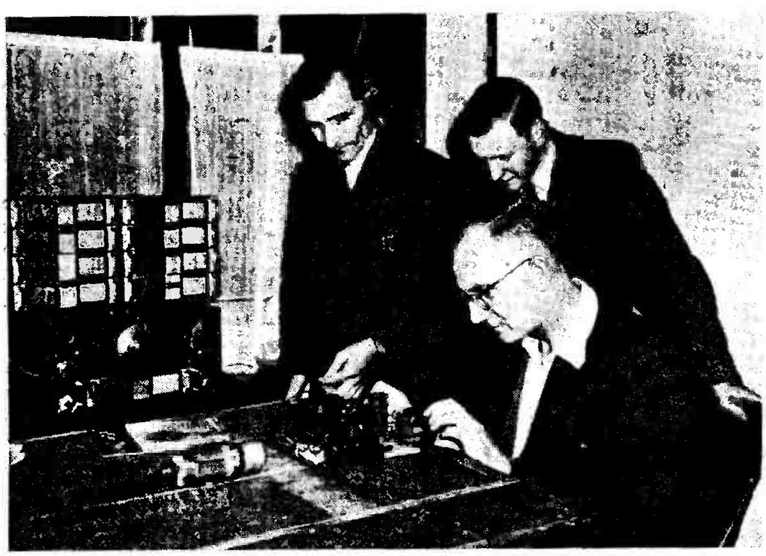
Fig. 3. VFO-PA transistor transmitter now in use at G3CSZ, of which details are given in the text. He uses the VFO circuit suggested by G3CCA, while the PA arrangement is that devised by G3HMO. The result is a handy, stable TTX for 160-metre working; in G3CSZ's case, the transistors are home-made but GET-2's could very well be used.

Keying is by frequency shift which, like netting with the PA on, causes no inconvenience at such low power. In the key-up position, the VFO oscillates about 40 kc on the high side of the operating frequency. This method of keying has advantages in that it does not produce chirp as when keying the VFO, and the frequency is not blocked as when the VFO is run continuously and the PA keyed.

There is no reason why the power drawn by the PA should not be varied independently of the VFO by adjustment of R1.

Since R1 is large for reasons of simplicity and not for protection, the theoretical power input of 112.5 milliwatts is correspondingly out of proportion. Perhaps R1 could be split into 10,000 and 5,000 ohms and input calculated at the junction from the voltage, which would be a truer measure. This gives a nominal figure in the region of 80 milliwatts, which is the input usually quoted for this TTX.

Finally, the TTX was accidentally left fully switched on—without aerial — drawing 4½ milliamps for seven hours without coming to any harm—which



G2AUA demonstrating his transistor transmitter, running about 85 milliwatts input, at Wellingborough recently. The valve in the foreground (which has nothing to do with it!) is an 813, which can handle 250 watts quite comfortably. G2AUA is one of those experimenting with home-made transistors.

is more than can be said for the battery!

Transistor Communication Test

A Test took place on the night December 17/18, but was not an outstanding success, as the condition of the band was not very propitious. However, several interesting contacts were made, and it appears that a new centre of transistor activity and interest is growing round Wirral and Merseyside. On TTX for all or part of the evening were G3CCA, G3HMO, G3IYX and G6FO, with G3FOO and G6FO acting as linking stations with their valve transmitters. G3CSZ was standing by with his TTX, but conditions were not good enough to make it worth while coming on. G3CCA (Leicester), who, as reported last month, was using the junction TTX with only 8 mW to the collector, was heard in the Liverpool area by G3CSZ, G3FOO and G3IQO with reports from RST-548 to 238. G3FOO also reported G3IYX (North Bucks.) at RST-469 and G6FO at 439 on their transistor transmitters. G3CCA and G3IYX both heard each other, G3IYX being reported at 339 while G3CCA was being received at 568 in the Buckingham area. However, his signals disappeared after midnight. An intermediate station, G2HDK (Northampton) came up to report that G3CCA was still on but was now on transistor phone (using a carbon microphone into an OC70 modulator).

Other Activity. G3CCA has also worked G2NJ (Peterborough) at RST-569 and G3JEL (North London) at 569 with the 8 mW TTX. G3CSZ has been lecturing to local clubs on making transistors at home. G3JRV is reported as having started construction and hopes to be in action with transistor equipment before the spring. G8PG (Greasby, Ches.) is building a superhet receiver, using mainly the Brimar TP2 transistor.

Reports and results for discussion in this column will be welcomed. Please address to: "Transistor Topics," c/o The Editor, *Short Wave Magazine*, 55 Victoria Street, London, S.W.1.

STORY OF G3AAT/OX

THE BRITISH NORTH GREENLAND EXPEDITION

R. BRETT-KNOWLES (G3AAT)
Instr.-Lieut.-Cdr., R.N.

WHEN the writer joined the British North Greenland Expedition in May 1952, his first question was "Have we got an amateur licence?" The answer was in the negative, as the Danish authorities had forbidden foreign stations in Greenland because on a previous occasion the privilege had been abused. However, our G.P.O. arranged that we be granted amateur facilities, using call-sign G3AAT/OX, and a very wide range of frequencies was authorised.

As the Expedition was due to sail early in July, there was much work to be done in Stockholm and The Hague and no time at all to collect any suitable gear for Amateur Radio working—so the Expedition equipment had to be used on the amateur bands as well as for general communication.

On arrival in Greenland, time was found for amateur contacts in between spells of unloading the ship and flying up to out-Base at Britannia Lake. The R.A.F. lent us R.1155/T.1154 equipment for some of these contacts, but otherwise the Army Type WS52 was used, battery state permitting. Most amateurs who worked us about this time were apparently under the impression that G3AAT/OX was a new manifestation of piracy, and some discontinued the QSO when told who we were. These latter types do *not* get QSL cards!

During the first year at Base there was not very much time for Amateur Radio, nor indeed did our power-supply position permit it. While unloading a Sunderland F/B, the pontoon with one of our diesel generators and an Army WS53 capsized and we lost the lot, which made our power supply position rather precarious. Shortly afterwards, the one remaining diesel gave trouble and could only be run for schedule-keeping with the Admiralty on a WS53. Our power came from 12- and 24-volt batteries, and a Naval Type 612 and Army WS52 were available for amateur working whenever charged batteries could be produced.

Ice-Cap Station

Meanwhile, an ice-cap station at 78°N, 38°W had been set up and called "Northice." The wireless operator there soon found the VE8's in the Canadian Arctic, and before long was having regular contacts with them and the MARS station at Thule (West Greenland) on the 80-metre band. Base and Northice worked every evening on 3800 kc, signing XPN and XPN1 respectively. Europeans were heard on occasions, but never actually worked on this frequency.

In the spring, the writer travelled round the ice-cap in a "Weasel," a tracked snow vehicle, with an Army WS19-HP and an R.209 for communication. Several amateurs in Greenland and Norway were raised with this outfit, and a particularly interesting QSO was obtained with G2DZ (Daventry), under very difficult conditions, on the 7 mc band.

It was the winter of 1953-'54 that saw most of our amateur activity; a new diesel generator had arrived at Base, and Northice were more settled. Both stations had been equipped with rhombics aimed on the U.K., as well as dipoles and long wires. The WS52 type of gear was in use at Northice and at Base, where also the Army WS53 could now be employed for amateur work. Regular contacts between Northice and GM3DHD, of Edinburgh, were made on 14 mc phone, giving the three members who wintered up there an opportunity to talk to somebody else. Besides this schedule on Twenty, Northice was able to raise the VE8's in the 75- and 80-metre bands, as well as many American phone stations.

The Base Set-Up

At Base, during the nightly fire-watch periods, the WS52 was made available for 75-metre working, with an HRO to receive, and this helped to while away the night hours. Nearly all members of the Expedition took an interest in these activities and many learnt Morse and amateur jargon. We got to know the various stations and their operators intimately, and they similarly got to know us. During week-ends, the writer would try to put in an appearance on 14 mc. Unfortunately, pressure of general work prevented us from getting on the air as much as we would have liked—and then in the spring, when we went our various ways on the Expedition's business, amateur activity dropped almost to zero.

After that, it was time for us to pack up and go home. This put Amateur Radio right out of the picture, save for a few days in July 1954 while waiting for the R.A.F. Sunderlands to fly us out. For those who may be interested, the very last contact made before finally closing down G3AAT/OX was with G3IEW on July 29—any QSO's claimed after that date are not genuine.

QSL Position

Cards verifying contact with the Expedition have already been despatched to all stations worked, and shortly the QSL's for SWL reports will be sent out. It is an astonishing thing that some of the letters we got (by air-drop, incidentally) expressed concern that although cards had been sent to the Expedition, none had been received! Since we were a completely isolated party living in tents, it is difficult to see how we could have sent cards from Greenland, even if we had had any up there to send. All our contact with the outside world was by radio. However, having cleared up any little misunderstanding there might have been on this point, it is hoped that all amateur operators who gave us the pleasure of a contact have by now had their cards.

The Expedition returned home on August 11, 1954—by Sunderland F/B to Pembroke Dock—mostly with feelings of regret at leaving the Arctic. As a result of their experiences on the air, several members are now applying for their own amateur licences (G3KDK has recently been licensed—*Editor*), so you may meet them again from their home stations.

Your contributor himself is hoping to go on further Polar expeditions, and you can be sure that he will try to get himself licensed to operate on the amateur bands.

"VHF BANDS"—A. J. Devon

See p. 678 for an explanation!

SOLDERLESS WIRING — PLESSEY CRIMPING TECHNIQUES

To overcome the disadvantages inherent in the normal soldering of joints, The Plessey Co., Ltd., have pioneered and developed the principle of a solderless wiring connection. This ensures a reliable joint regardless of the skill of the operator, and eliminates all troubles due to heat and the corrosive action of fluxes.

Defective electrical circuits can immobilise the most vital and costly plant, and are frequently caused by faulty soldered connections which may be impossible to detect visually. Once the soldered joint is sealed, there is no way of knowing how many cable strands are oxidised, crystallised by heat or burned. In addition, the heat applied during soldering makes the conductor brittle just at the point where the greatest flexibility is needed, with the result that manipulation or vibration eventually fractures the wire.

The Plessey system which overcomes these difficulties was evolved primarily for use in the aircraft industry, but is now being extended to a much wider field of industrial application, being especially useful, for instance, in coal mines and oil refineries, where naked flames might be hazardous.

There are two types of solderless crimp—indentation and hexagon. In the first, the indentation type, the solderless wiring connection is made by manually crimping opposite sides of the connection tag so that the wire connector is gripped immovably. The second type, the hexagon, is a later development, and was designed to take any size of wire for crimping and is also suitable for use with aluminium cables, which cannot be soldered.

A cable terminal joint made by these methods possesses good electrical continuity, has the ability to withstand heavy vibration and abnormal handling, retains its natural flexibility right up to the point of entry into the terminal, and is much less susceptible to corrosion than is a soldered joint.

To prepare these connections, the cable end is bared and inserted into the metal sleeve. In the case of the indentation crimp, a special hand-operated tool is then used to perform the crimping operation by producing uniform indentations which swage but do not crush the connector sleeves.

For the hexagon type of crimp, either a hand-operated crimping tool (for light cables) or foot-operated hydraulic tool (for heavier cables) is used. This latter tool is sufficiently powerful to make joints with copper cables carrying up to 280 amps. and aluminium cables carrying up to 200 amps. To make these latter connections, the aluminium cable is treated with an oxide inhibitor before crimping.

A.W.R.S REPORTING AGAIN

A FORTNIGHT IN CAMP

D. MacLEAN, *Lieut., R.Sigs.*

THE Army's own Amateur unit—the Army Wireless Reserve Squadron — recently assembled at Chester for annual training, for the second time since its formation. There were many new faces. Thanks to the generous publicity accorded its activities by periodicals like *Short Wave Magazine* and some national newspapers, word seems to be getting around that this new Royal Signals Squadron is "different."

There are now three self-contained troops in addition to the HQ staff. Number 3 Troop, commanded by G8PG, was formed especially to cater for the many members who wanted promotion to a higher trade rating. They spent the first of the two weeks in intensive training and practice before joining the operational units, who were then "on location" over a wide area of N.E. England and Wales.

Number 2 Troop, under G3FDU and G3EJF, consists of a variety of mobile wireless stations forming a command network which connects with the line circuits of other reserve units. Most of these stations are manned by three operators and a radio-mechanic, who work in comfortable, electrically-heated and air-conditioned compartments in a 3-ton truck. They have R.107 and R.109 receivers, a 300w. transmitter covering 2 to 20 mc, and a selection of aerial arrays. Their sets and test equipment are powered by 230v. AC from a petrol generator in another compartment which is remotely-controlled by push-buttons. Each station can operate over long distances *while on the move*, and the members of the team, including the driver, are in touch through an ingenious R/T intercom. system.

Number 1 Troop, with G3DNQ in charge, provides long-range radio-teleprinter communication. Its signal centre contains teleprinters, equipment for automatic (tape) transmission, and a small exchange for "patching" the gear to external telegraph lines in various ways. The four receivers are served by separate tuned aerials. The transmitter tunes from 80 to 15 metres, and has an input to the final amplifier of 5 kW. The whole station, including a rhombic with 97ft. masts, a 30 KVA diesel generator (and such mundane items as two petrol cooking ranges) is mobile! During the second week it was, in fact, moved during darkness between closing-down on one link at 6 p.m. and opening on another (Trans-Atlantic) at 5 a.m. from a new site.

Personalities

G3AMO, who is responsible for this monster transportable station, has to endure some merciless banter from his assisting hams each time he asks for help in lifting a PA coil into place. Having to watch a row of air pressure gauges and thermometers is also an unusual experience—there can't be many shacks where even the driver valve has to be cooled by compressed air!

G3JBU runs the receiving organisation of Number 1 Troop. One noticed him on the last day of training casting a wistful eye over his racks of AR88's and the 72ft. aerial masts, which he had to leave till another Camp comes round.

The Top Band bug infected the Squadron this year. Private QRP rigs appeared everywhere in off-duty times, and the rare counties of North Wales sprouted a sudden crop of /P stations.

G3FDU found many willing helpers for longer-range tests of the 3 cm equipment he has built from surplus units. Unfortunately, his many duties as second-in-command prevented an attempt on the 3 cm record.

Personnel of No. 1 Troop, Army Wireless Reserve Squadron, taken during a convoy stop when training at their last Camp; the photograph shows the operators and radio-mechanics of the radio-teleprinter station, accommodated in the seven heavy vehicles in the background. The group includes G3AMO, G3DNQ and G3JBU, and some account of their activities is given in the accompanying notes.

The Commanding Officer, G3ADZ, only once managed to escape from his office with a Top-Band rig in the back of his car. But he returned later with a log book well filled with call-signs, the operators of which had been delighted to find their QRP Contest scores perked at the eleventh hour by a station in the wilds of Merioneth.

And now members of the A.W.R.S. are back in their home shacks until their QSY to khaki next summer. And more and more are handling traffic in their spare time on the Squadron's voluntary nets. More and more newcomers to Amateur Radio are finding an easy way to a licence of their own through A.W.R.S. correspondence courses, Morse records and the Equipment Pool run by G3IFM.

More and more licensed amateurs are staking a personal claim to a place in this Squadron with a real sense of purpose. Information regarding the Army Wireless Reserve Squadron can be obtained from any of the operators mentioned in these notes (QTH's as in *Call Book*) or from the C.O., Major D. W. J. Haylock (G3ADZ), 230 Devonshire Avenue, Southsea, Hants. All members of the A.W.R.S. receive the full pay and allowances of their rank while at training camp, and there are other benefits.

BOOK REVIEW

"TRANSISTORS, THEORY AND PRACTICE"

It is not surprising that the author of an American book on Transistors should be R. P. Turner. He is almost certainly the most popular writer on that side of the Atlantic on the subject, and most American radio magazines have carried articles by him. "Transistor Test Circuits," which was reprinted in the December 1953 *Short Wave Magazine*, is a typical example of his style.

He has been interested in the subject from its inception in 1948 (and crystal detectors since 1922!). He feels, quite rightly, that most of the vast quantity of technical, physical and mathematical literature on transistors, which has appeared since then, has been beyond the average radio experimenter, while much of the practical application is well within his ken. To right matters, Mr. Turner has contained, in one small volume, a simplified but comprehensive summary of the whole subject.

The theory of semi-conductors and the physical action of the transistor has been kept very brief. The descriptions and illustrations of the various types of transistors are most informative and will help the beginner to understand what is, in fact, inside that little hermetically-sealed capsule. The action of the transistor and its electrical characteristics—far more important to those who want to use rather than make transistors—is dealt with admirably. The more advanced equivalent circuit methods are kept to a separate chapter so that those not interested in the mathematics of the circuitry may omit it.

The most valuable chapters in the book are those on the amplifier, the oscillator and practical transistor circuits. The three amplifier circuits—grounded-emitter, -base and -collector—are dealt with and details of bias methods, cascading stages and various push-pull circuits are given. Tuned RF amplifiers are also described. All the basic oscillator methods are discussed, RF and LF, base-tuned and feed-back, series-tuned and transformer-coupled, R-C and crystal stabilised. The chapter on practical transistor circuits gives a very wide variety of applications and includes RF and LF stages, a phone monitor, a crystal oscillator for 100 kc, a field strength meter and a DC microammeter. Except for LF amplifiers, no multi-stage circuits are given.

The chapter on switches and triggers is a good introduction to what might otherwise be a difficult subject. Similarly, the measurement of characteristics, both the taking of curves and their interpretation, are well explained, although the author makes use of that not always-available instrument, the valve voltmeter, even when not strictly necessary. The interpretation of the transfer and possibly feedback resistances from the circuits given on p.116 are open to doubt, as the conditions under which the measurements are made differ from those in practice.

Some other minor criticisms are: pp.27-28, explanations of *alpha* in point-contact transistors rather confused; p.38, transit time of the carrier varies approximately as the cube of the point spacing (not inversely as the square); p.40, the cell using moistened paper and coins requires, not a pair, but two *different* coins; p.42, equation (3-3) the slope is $\frac{dv}{di}$ (not the reciprocal). These criticisms are mostly of an unimportant nature to the text as a whole, and the subject is presented in an easily assimilable form, Mr. Turner's style doing much to smooth over the difficult passages.

Transistors, Theory and Practice, pp.144, illustrated line, by R. P. Turner, published by Gernsback Publications, Inc., New York. To be obtained in U.K. of Publications Dept., Short Wave Magazine, Ltd., 55 Victoria Street, London, S.W.1, price 16s. 6d. post free (from stock). *J.M.O.*

OBITUARY NOTICES

We much regret to have to announce the recent death of Harold John Eaves, G6UQ, of Cheadle, Staffs., at the age of 58. Although of late years not himself active on the air, he was chairman of Stockport Radio Society and took a great interest in the doings of the younger members. G6UQ was employed in the G.P.O. Radio Branch.

* * *

The death was announced, on November 22 last, of Henry Rieder, ZS1P, of Cape Town, a well-known experimenter, model engineer and radio amateur, who served in the Royal Corps of Signals in the 1914-'18 War. In 1948, ZS1P startled the world by receiving television pictures direct from Alexandra Palace, a distance of some 6,000 miles, a feat he was able to repeat on many subsequent occasions. He will also be remembered as a keen and active operator on the 28 and 50 mc bands; he worked many G's on six metres during the short period U.K. operators were licensed for that band.

* * *

Another South African who passed over early in November was Jack Twine, ZS1A, of Pinelands, Cape Province, who had also held an active amateur licence for many years.

Overseas journals please copy

Random Jottings by the Old Timer

A CORRESPONDENT takes us to task for "insinuating that amateurs are poor operators," and suggests that on the whole they are better than their commercial counterparts, if a little slower. Harking back to the story of the commercial op. who received several columns of press and acknowledged with "R," he says that you will always find a more long-winded receipt being given if you listen on the commercial or shipping bands — and we admit that he is perfectly right. One can hear really bad operating on all sides if one looks for it, and we do *not* think that the average amateur disgraces himself. The trouble—as, indeed, in all other walks of life—is that it is the abnormal that sticks in the memory, and usually the abnormally bad, at that. We can all of us remember bits of amateur behaviour that were so bad as to be laughable, but we tend to overlook the many pleasant contacts, whether on key or microphone, with operators whose performance was above reproach in every way.

THE LID DOWN UNDER

While thinking of "lids," we cannot resist quoting from a letter in our New Zealand contemporary *Break In*. The chap concerned was trying to qualify for the Rag Chewers' Club, and thought a contest would be a nice occasion for it . . . . Having raised another ZL—"Well, Mr. Editor, believe it or not, back he comes with a string of numbers, never even said Good Evening. Then he says What's Your Number? Now seeing I'd done my time with a bit off for good conduct, I thought he was a bit personal but being a friendly sort of guy I goes back and tells him I hadn't got a number now but didn't know how long it would be before I was back in again." Eventually (the tragedy of it!) the other station came back with "73, Lid," and our hero gave up his attempt at the RCC Certificate with only three minutes to go. So he went back to 21 mc. "where you can send hundreds of CQ's without signing, whistle in the mike and use any old lingo, because nobody listens there anyway."

THE BIG JAM

It took a long time for some of the implications of "1984" to sink in, but, after due reflection, we are convinced that some major discovery must have been made between 1954 and 1984. We refer to the ease with which thousands of TV transmitters are operated at very close quarters, without any mutual QRM at all. Remember that not only does Big Brother leer at all and sundry *via* their telescreens, but that he and his vast staff of inner-party spies can see what all the others are doing in their offices, in their homes and, presumably, whenever they go shopping or just taking the dog for a walk. Imagine the spying headquarters, with thousands of TV receivers all in action at once, not to mention sundry transmitters doing their stuff simultaneously. It is nice to know that all QRM and VHF problems are apparently to be solved in the next thirty years, considering that nowadays one can't even operate a TV receiver and a medium-wave broadcast receiver in the same house without producing strange and undesirable noises.

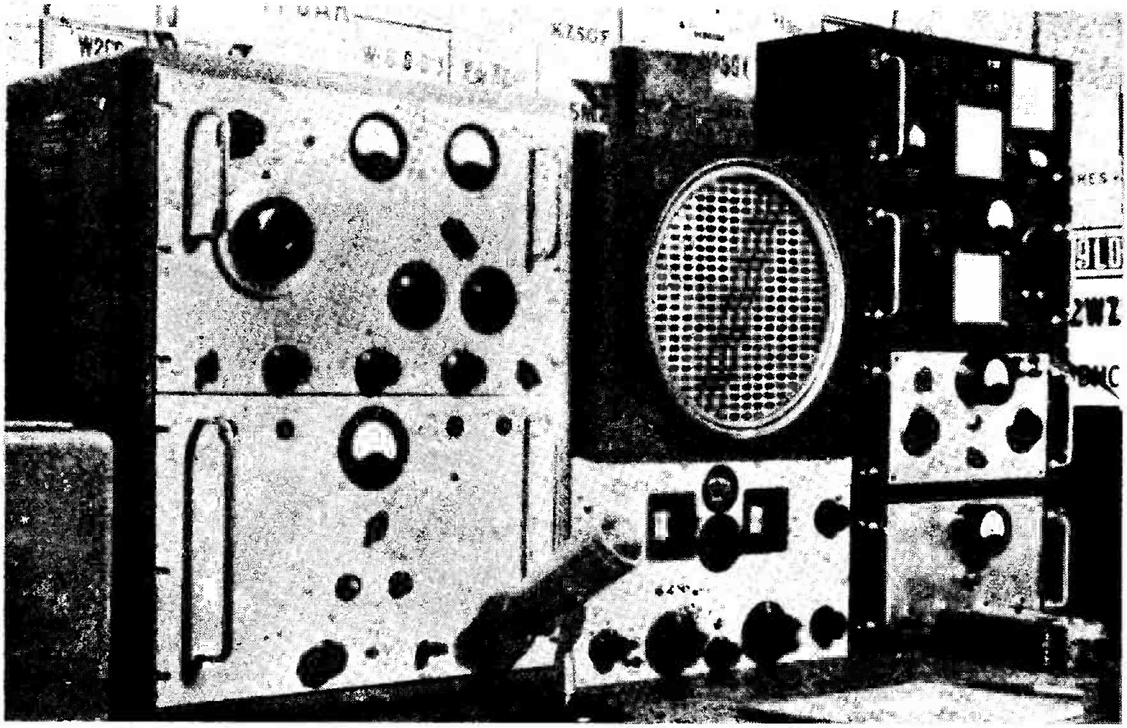
POWER OR SPACE?

One wonders whether possible restrictions imposed on us might not, in future, take the line of reduced power instead of narrower bands. For most amateurs this would surely be preferable, although it would not be popular among the kilowatts and beams in the U.S.A. Our own Top Band is a good example of peaceful co-existence, thanks entirely to the 10-watt limit imposed on us. What would it be like if we amateurs were allowed to use 150 watts up there? Well, one answer is that we should probably be restricted to a band about 25 kc wide, as are the W's in any given district. On Forty, of course, we are already restricted rather by power than by a narrowed band. In theory, we have 300 kc there, but with all the broadcasting that is let loose on the same band, we might as well be confined to transistors ourselves. Our own power has not been cut down, but 150 watts has been transformed into QRP by the opposition that has been let loose. Maybe the position will improve one day, but not until someone has decided that short-wave broadcasting is a farce.

PORTABILITY

One of the most intriguing possibilities opened up by the development of transistors is the construction of *really* portable gear. Many of the so-called "portables" that have been used up to the present day have really been "transportables" and little more. We should like to see how a field day would come off if one of the rules stated that the chief operator was to proceed to the site on foot with the receiver in one jacket pocket and the transmitter in the other, no abnormal bulge being visible to outside observers! True, he would need an assistant with a sizeable coil of wire to complete the picture, but at least the true meaning of the word "portable" might be realised at last. Yes, the day of the wrist-watch transmitter and receiver has been brought a lot nearer, but the aerial problems have not yet been solved, for a "bit of wire" running up one sleeve, across the shoulders, and down the other still has limited DX possibilities!

The Other Man's Station G3IRE



A POINT of particular interest about the neat installation shown here—owned and operated by R. E. Ireland, 4 Carlton Terrace, Portslade, Sussex—is that the mains transformers are home-constructed. The larger of the two in regular use gives 450 mA at 800 volts, with four GU50's in a bridge circuit; G3IRE says it took nearly three months to wind (by hand), working in the evenings and with no special facilities—it was simply a matter of "putting on the turns, layer after layer"! This remarkable tribute to his patience and ingenuity not only gives its full rated output, but runs quite cool, even after long sessions on the air.

The building of his station occupied G3IRE for nearly six months and, as he puts it, "fortunately it all worked first go." Licensed in July 1951, the general arrangement is now a four-band-switched transmitter running a pair of 807's in the PA, with a VFO (6SH7) tuning over two separate channels and incorporating VFO frequency-shift keying for BK, with wide-band couplers into four 6V6's. The first VFO channel covers 3.50-3.65 mc, and the second 3.65-3.80 mc. A high-speed keying relay is mounted close to the VFO oscillator coil and changes over when going from "stand-by" to "transmit," throwing the VFO output from the unused into the operating channel; thus, if working over 3.65-3.80 mc, the VFO is held in the 3.50-3.65 mc channel during "stand-by," so that there can be no interference in the receiver while listening. The relay is adjusted to shift the VFO output back to the working frequency just before HT is applied to the PA.

G3IRE has used this system of keying for some 18 months, with very good results; the next step is a control unit using a valve to operate the relay fast enough to follow CW keying, thus allowing "listening through" as well as full break-in.

As illustrated, the whole station is home-constructed (except for the Super-Pro receiver) and is relay-controlled throughout, with a single change-over switch. Auxiliary equipment includes a BC-221 frequency meter, a grid dip oscillator, field strength meter, tape recorder and a converter for the 21 mc band. High-level modulation, with a pair of 807's in push-pull AB2, is used, the speech amplifier being 6SJ7-ECC33-ECC32, with a Clamp modulator built into the main transmitter as a stand-by.

Aerials at present available at G3IRE are a 132-ft. Zepp, a dipole for 14 mc, and a 3-element beam for 28 mc. Main interest is DX chasing, and several certificates are held, with 88 countries booked in towards DXCC.

THE MONTH WITH THE CLUBS

By "Club Secretary"

(Dead-line for March Issue: FEBRUARY 11)

HAPPY are those Clubs with comfortable premises of their own, particularly if they have a goodly supply of heat laid on. As we write this the temperature is well below freezing, the snow is swirling past the window, and we have, for some curious reason, a very vivid recollection of a Five-Metre Field Day on the top of a hill !

Winter holds no terrors for the well-organised Club, though, except for occasional transport difficulties. The smaller the Headquarters, the better the chance of getting up one of those real " fugs " which seem to bring forth the best talks and the most amusing anecdotes concerning our common hobby.

The lectures of the winter season are now well under way, Club transmitters well and truly warmed up, and summer activities might well belong to another planet.

Diversity of Subjects

There are not many aspects of radio that do not receive some attention in any particular month. We have perused all the Club letters received in time for this issue, and noted the subjects of the talks that will be going on, up and down the country. Here are a few of them.

The inevitable Transistors come in for discussion at ***Bradford*** on February 22, when Dr. G. N. Patchett covers the subject. This lecture will be at the Bradford Technical College, not at Club HQ. ***Clifton*** have "An Introduction to VHF" by G3FZL on February 4, and ***Leeds*** will hear about the Bradmatic Tape Deck (C. Varley) on February 16, and Simple Tx Construction (G4AD) on the 23rd.

Leicester's subjects are Power Supplies (G3GXZ) on February 14, and the Grid Dip Oscillator (G3DVP) on February 28.

Transistors figure again at ***Newark*** on February 6, when G3CCA, from Leicester, gives a talk on the circuitry aspect. This is at the Northern Hotel, where there is a meeting on the first Sunday of each month.

At the newly-formed ***St. Eval*** Amateur Radio Club, the weekly Tuesday meetings will be taken up with such subjects as Amplifier Technique, Valves, and Radio Control systems. ***Slade*** are to hear about Equipment for 70 cm (G3HAZ) on February 18, February 11 being a special D-F meeting.

Spen Valley have a lecture on Audio Reproduction on February 9 ; on February 22 they join the ***Bradford*** club for the Transistor talk previously mentioned.

Other Club Events

Bradford have a Film Show on March 8, and their A.G.M. a fortnight later. ***Clifton*** have constructional evenings on February 11 and 25, and a Quiz on February 18. Their Christmas Party is reported as a great success, attended by over 40 members and friends. G3IXL won the Constructional Contest with an SSB Exciter. On Christmas morning a Top Band net was organised by G3DIC ; proceedings were recorded on tape by a member, and the tape was played through at the meeting on December 31.

On March 4 ***Slade*** have a special meeting to consider amendments to the rules, followed by a display of members' apparatus. ***Southend*** visited the Plastic Division of the Ekco works, and had a thrilling conducted tour. At a later meeting they had a demonstration by the Ekco Research Department of a very advanced 12-valve receiver of remarkable performance.

Chester held their A.G.M. in January, and the future programme includes an auction, work on a new aerial for headquarters, and NFD planning. Their Annual Dinner will be held on March 19, and many useful prizes will be offered at the traditional " draw." Visitors from other North-Western Clubs will be welcomed — full particulars from the Hon. Sec.

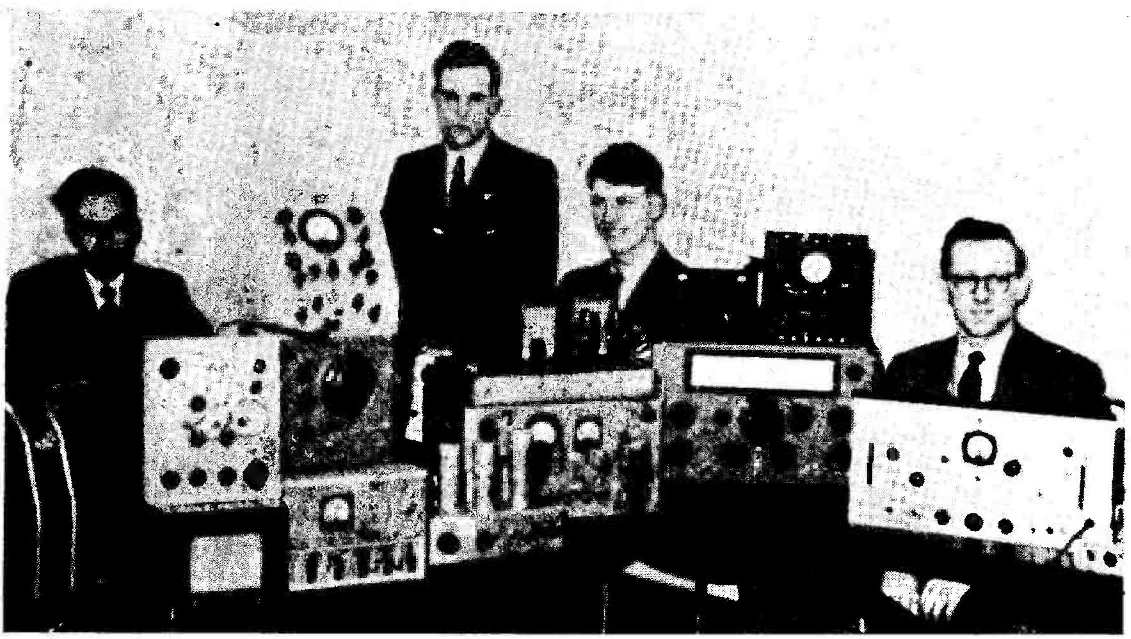
Birmingham have acquired new headquarters, and now meet at the Y.M.C.A., 20 Soho Road, Hockley, Birmingham 19. At this site it is proposed to erect and operate the Club transmitter. Meetings will still be held on the second Monday at 7.45 p.m. At the February meeting, on the 14th, W. Neal will talk on " Listening and DX'ing ": the subject for March will be Power Supplies.

Surrey heard a talk from G2KU (more recently VS5KU) on his experiences as a DX station, and, later in January, held their Annual Dinner.

The death of Mr. H. J. Eaves, G6UQ, left a gap in the ranks at ***Stockport*** which will be very difficult to

PROPOSED CLUB AT MITCHAM, SURREY

It is hoped that it will be possible to found a new Club in the Mitcham (Surrey) area. All interested readers in that neighbourhood are asked to get in touch, either by letter or in person, with G3GYV (16 Taffey's-How, Mitcham) or G3HQX at 6 Cambridge Road, Mitcham.



Apparatus constructed by members of the Leeds Amateur Radio Society and a very fine show, too. Exhibited at a recent meeting, the display includes amplifiers, signal generator, short wave converter, communications receiver, valve tester and an oscilloscope. The members in this photograph are, standing, G3JMG ; seated, left to right, SWL's Brown, Boyd and Roberts.

fill. The election of a new Chairman is left over until the A.G.M. on March 16.

East Kent meet fortnightly at The Two Brothers, North Gate Street, Canterbury, next meeting after publication being February 15. The Club has varied interests which include television, transmitting, tape recording, VHF, radio control and short wave listening. Lectures, junk sales, raffles and all the rest have been arranged for the coming season, and new members will be welcomed.

Harrow provided a fully operational station at the Harrow and Wembley Model Engineers' Exhibition, together with a large number of exhibits of home-built gear. These included a band-switched transmitter, two-metre receiving equipment, a 70-cm transmitter and two Braille-calibrated test meters made by blind member G3HAO.

A Hamfest is to be held at ***Worthing*** on February 25, at the Thomas a'Becket Hotel ; there is no definite programme, the object being to provide a room where local amateurs can meet and talk. If successful, this type of meeting will be repeated quarterly or half-yearly. The time is 7.30 p.m., the tickets 2s. each, and the Secretary's QTH is in the panel.

Newcomers

We have already mentioned ***St. Eval.*** This is a newly-formed Club at the well-known Coastal Command R.A.F. station, which already has 31 members. The Secretary would like to hear from local Clubs with a view to mutual social events.

Hawick also boasts a newly-formed Radio Society — at least, one which has revived after lying dormant for some years. There are now 20 members, and they have a clubroom and a workshop. Meetings will be held on the first and third Thursdays, in Hawick Public Library until the clubroom is completely ready in March.

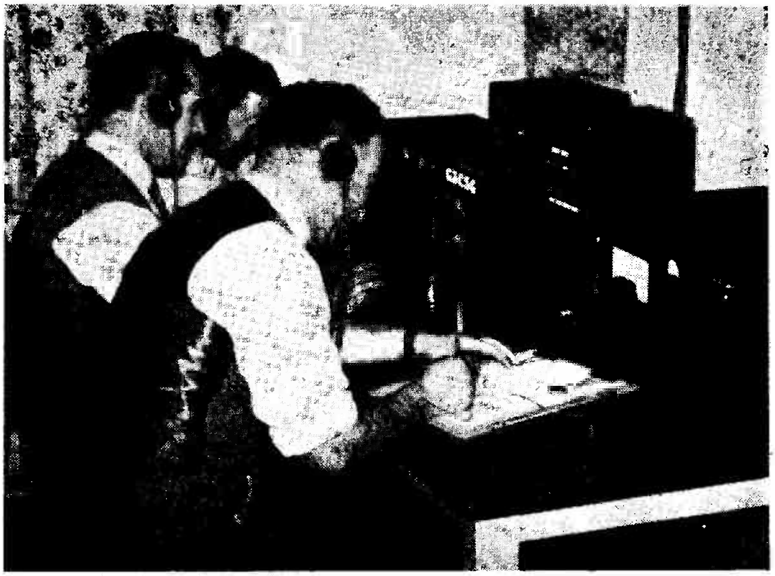
The ***East Berks College*** Radio Society was formed

ADDRESSES OF CLUB SECRETARIES REPORTING IN THIS ISSUE :

BIRMINGHAM : R. Yates, 28 Daimler Road, Yardley Wood, Birmingham 14.
BRADFORD : F. J. Davies, 39 Pullam Avenue, Bradford 2.
CHESTER : N. Richardson, 23 St. Mary's Road, Dodleston, Chester.
CLIFTON : C. H. Bullivant, G3DIC, 25 St. Fillans Road, London, S.E.6.
COVENTRY : J. H. Whitby, 11 St. Patrick's Road, Coventry.
EAST BERKSHIRE COLLEGE : F. H. Rickards, East Berks College, Royal Albert Institute, Windsor.
EAST KENT : D. Williams, Llandogo, Bridge, near Canterbury
EDINBURGH : D. B. R. Black, 16 Edina Place, Edinburgh.
HARROW : S. C. J. Phillips, 131 Belmont Road, Harrow Weald, Middx.
HAWICK : G. Shankie, 17 Ettrick Terrace, Hawick, Roxburghshire.
LEEDS : B. A. Payne, 454 Kirkstall Road, Leeds 4.
LEICESTER : W. N. Wibberley, 21 Pauline Avenue Belgrave, Leicester.
NEWARK : J. R. Clayton, 160 Wolsey Road, Newark.
RADIO AMATEUR INVALID AND BEDFAST CLUB : W. Harris, 25 Playford Lane, Rushmore, Ipswich.
SCARBOROUGH : P. Briscombe, G8KU, 31 St. John's Avenue, Scarborough.
SLADE : C. N. Smart, 110 Woolmore Road, Birmingham 23.
ST. EVAL : A. E. White, R.A.F., St. Eval, Wadebridge, Cornwall.
SOUTHEND : J. H. Barrance, M.B.E., G3BUJ, 49 Swanage Road, Southend.
SPEN VALLEY : N. Pride, 100 Raikes Lane, Birstall, nr. Leeds.
STOCKPORT : G. R. Phillips, 7 Germans Buildings, Buxton Road, Stockport.
SURREY : S. A. Morley, G3FWR, 22 Old Farleigh Road, Selsdon, South Croydon.
WORTHING : J. F. Wells, Atickwa, 37 Salvington Gardens, Worthing.

last September, in response to many requests from past and present students. Members are offered the use of an extensive array of equipment, visits to places of interest, film shows, lectures, a club Tx (G3KAL), and a congenial clubroom (with licensed bar!). Meetings are held every Thursday at the Royal Albert Institute, Windsor.

Scarborough have appointed G3GBH Chairman, G3KS Vice-Chairman and G2YS p.r.o. Regular reports are promised in future! G8KU continues his long stretch as Hon. Sec. Monthly "Beginners' Lectures" are among the new season's plans.



Wirral entered G3CSG for the recent MCC, in which they gained 9th place, a creditable performance. Here we see G3EGX (nearest camera), G3CSG and G3FOO at the back. In previous years Wirral have been placed 18th or 19th, so the 1954 result represents a considerable improvement.

News in Brief

EDINBURGH: Every Wednesday, 7.30 p.m. at 16 Bothwell Street (off Easter Road). Morse classes and lectures every meeting.
LEICESTER: Alternate Mondays, 7.30 p.m. at the Holly Bush Hotel, Belgrave Gate, Leicester.
SLADE: Fridays, 7.45 p.m. at the Church House, High Street, Erdington, Birmingham.
COVENTRY: February 14 and 28, Lectures at 9 Queen's Road; February 25, Annual Dinner at Barras House Hotel.

We have received a copy of *Radial*, the official journal of the Radio Amateur Invalid and Bedfast Club. This contains much interesting news of the club, and gives a good idea of its very praise-worthy objectives. A year's subscription costs 4s., which should be sent to the treasurer, J. Comben (EI5L), Oldbawn, Gordon Avenue, Foxrock, Co. Dublin.

Club Secretaries and Scribes are asked to note that the dead-line for next issue is **Friday, February 11.** All Club News should be addressed to "Club Secretary," *Short Wave Magazine*, 55 Victoria Street, London, S.W.1.

BROADCAST RECEIVING LICENCES

The GPO announces that during the month of November 1954 the number of TV licences increased by 157,956. Broadcast receiving licences totalled nearly 14 million, which includes the 4 million for TV. The number of sets licensed in cars was 250,256 as at the end of last November.

THE PYE "SWORDFISH"

The new "Swordfish" by Pye Marine, Ltd., is a transmitter/receiver installation for Class III ships (500 - 1,600 tons) which, under the new regulations, must now be fitted with radio-telephone equipment. The specification to which the "Swordfish" is designed and built is the most rigid ever laid down for apparatus of this sort—it is the first such equipment on the market to have been granted the official certificate of approval. The "Swordfish" is CC on eight channels, for spot-frequency working, the transmitter using 807's and giving 50 watts RF output; the set is adapted for CW, MCW, Phone or Loudhailer operation. The frequency range over which channels can be selected is 1600-3900 kc, and the PA will load into any ship's aerial down to about 30 feet in length. The receiver is a 7-valve superhet, also intended for spot frequency working over the same range as the transmitter, with a crystal-controlled local oscillator. The "Swordfish" is designed to work direct from a 24v. or 32v. ship's DC supply, rotary converters being used to obtain the necessary AC power.

AUDIO FREQUENCY POWER MEASUREMENT

The series "Notes on Applied Science" is produced by the National Physical Laboratory to provide those interested in various scientific and technical subjects with information not readily available elsewhere. No. 8 in this series deals with power measurements by means of electrostatic, thermal and electro-dynamic wattmeters, over the range 25 c.p.s. to 30,000 c.p.s., which is approximately full audio frequency coverage. "Notes on Applied Science, No. 8" *Audio Frequency Power Measurement*, is obtainable from the Stationery Office, Kingsway, London, W.C.2 (or branches) at 1s. 1½d. post free.

SMALL ADVERTISEMENTS

9d. per word, minimum charge 12/-. No series discount ; all charges payable with order. Insertions of radio interest only accepted. Add 25% for Bold Face (Heavy Type). No responsibility accepted for errors. Replies to Box Numbers should be addressed to The Short Wave Magazine, 55 Victoria Street, S.W.1

APPOINTMENTS

TECHNICAL INSTRUCTOR (HF & VHF RADIO) required for POSTS & TELEGRAPHS DEPT., NIGERIAN FEDERAL GOVT., for one tour of 12 to 24 months in the first instance. Appointment either (*a*) On contract with salary scale (including expatriation pay) £807, rising to £1,269 a year with gratuity at rate of £100/£150 a year; or (*b*) With prospect of permanency with salary scale (including expatriation pay) £750, rising to £1,175 a year. Outfit allowance £60. Free passages for officer and wife. Assistance towards cost of children's passages or grant up to £150 annually for maintenance in U.K. Liberal leave on full salary. Candidates must have extensive experience in G.P.O. or with firm of electrical manufacturers in installation and maintenance of HF and VHF radio telephone links. — Write to the Crown Agents, 4 Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience, and quote M2C/40324/SQ. Candidates at present employed by the General Post Office should submit their applications through their Establishment Division.

WIRELESS STATION SUPERINTENDENTS required by the NIGERIA Posts & Telegraphs Department for one tour of 18 to 24 months in the first instance. Option of appointment (*a*) On temporary terms with salary scale (including expatriation pay) £864, rising to £1,392 a year. Gratuity at the rate of £100/£150 a year; or (*b*) With prospect of pensionable employment with salary scale (including expatriation pay) £750, rising to £1,175 a year. Outfit allowance £60. Free passages for officer and wife. Assistance towards cost of children's passages or grant up to £150 annually for maintenance in U.K. Liberal leave on full salary. Candidates must have had wide practical experience of modern radio technique and equipment, in particular VHF Equipment, and preferably also VHF multi-channel equipment. — Write to the Crown Agents, 4 Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience and quote M2C/30086/SQ.

TRADE

LEARN IT AS YOU DO IT.—We provide practical equipment combined with instruction in Radio, Television, Electricity, Mechanics, Chemistry, Photography, etc.—Write for full details to E.M.I. Institutes. Dept. SW.47, London, W.4.

WANTED: TUNING UNITS TN17, TN18, TN19, and R54/APR4; £50 each offered.—Box 1383, Short Wave Magazine, Ltd., 55 Victoria Street, London, S.W.1.

WANTED: BC-610 Hallicrafters, ET-4336 Transmitters. AR88D's and LF's; receivers and spare parts for above. Also BC-221 Frequency Meters. Best prices.—P.C.A. Radio, Beavor Lane, Hammersmith, W.6.

SMALL ADVERTISEMENTS, TRADE—*continued*

QSL's and LOGS by MINERVA. The best there are.—Samples from Minerva Press, 48 Queen's Road, Brentwood, Essex.

BRAND-NEW, original cartons: RF Units, Types 26, 27/6; 25, 15/-; 24, 11/-; postage 2/6.—E.W.S. Co., 69 Church Road, Moseley, Birmingham.

G3CGD for first-class QSL's at QRP prices; 5% **Discount** for Club Stations.—30 St. Luke's Road, Cheltenham, Glos.

QSL CARDS AND LOG BOOKS. APPROVED G.P.O. SAMPLES FREE. — ATKINSON BROS., PRINTERS, ELLAND, YORKS.

READERS' ADVERTISEMENTS

3d. per word, min. charge 5/-, payable with order. Box Numbers 1/6 extra. Replies to Box Numbers should be addressed to The Short Wave Magazine, 55 Victoria Street, S.W.1.

G3DQ has the following for sale: Hallicrafter S22R Rx, covers Broadcast 1.7 to 17 mc band-spread; 1155 with internal P/Pack, Top Band, S-meter, muting (both completely re-aligned). Sender 33 Tx, 200w., 1.7 to 17 mc, complete with P/Pack, Line megger, Labgear turret, 4 bands, 150w. Several large Tx Condensers, stand 4000v., ex-1190 Tx. TU5B (new). Several mikes, Turner Dynamic, etc. BC-221 (as new) with own P/Pack. 800-800 6.3 5v. Shielded Transformer (new), Thordarson. Also Wire Recorder (USA); Admiralty-type 3" 'scope; own P/Pack. German Tx/Rx and P/Pack, covers 3.5 mc Phone and CW. REQUIRED: New or nearly-new Eddystone 750, also Rx with 1.7 to 3 mc enclosed P/Pack and speaker; also Table-Top, 144 mc, Tx.—Cliffe Metcalf, Carr Farm, Flamborough, E. Yorks. (*Tel.: 346*, most evenings).

FOR SALE: Hallicrafters S20R, £16; delivered free within 40 miles. Also other components; send s.a.e. for list.—8 Mattocke Road, Hitchin, Herts.

CR100: Very good performer, £20, plus carriage; AR88D, AR77 manuals, 15/- each.—Box 1535, Short Wave Magazine, Ltd., 55 Victoria Street, London, S.W.1.

WANTED: Pre-war Eddystone 9m. twin "blue spot"; 160m. "white spot," four-pin SW coils; good condition; state price.—A. W. Mann, 62 Costa Street, Middlesbrough.

FOR SALE: BC342, in very good condition, £12 10s.; buyer must collect.—Batey, 95 Kenilworth Cres., Enfield, Middx.

EDDYSTONE S640 Receiver with Eddystone S-meter; alignment just checked and sensitivity up to makers' specification on all bands; specially good on 21 mc; appearance as new; £17.—Parsons, 90 Maesycoed Rd., Heath, Cardiff.

SALE: 145 VFO, £2; Calibrated Audio One, £3 10s.; VHF Rx, R3A/ARR/2X, £3 10s.; 'Scope, £5; six 35T's, 10/- each; two 100TH, £1 each; Wilcox-Gay VFO and Stab P/Pack, £8 10s.; RSA ribbon mike, £3 10s. Carriage extra. — 38 Wyresdale Avenue, St. Helens, Lancs.

This is Candler calling —

ALL ENTHUSIASTS

wishing to learn or to improve their speed and accuracy in Morse Code.

The Candler System of *home study* and practice embodies exclusive methods for quickly learning to read and send Morse Code. The Practice Equipment costs only a *few shillings*.

30 minutes of guided practice a day, the Candler way, is more beneficial than hours spent in hit and miss methods. This System is recognised throughout the World as the most efficient, simple, and scientific method of Morse Code Training.

These are three Courses available:

(1) THE SPECIAL SHORT COURSE
For G.P.O. Morse Code Test for securing the Amateur Transmitting Licence, and for S.W.L's.

(2) THE JUNIOR COURSE.
A Complete Course for the *Beginner*.

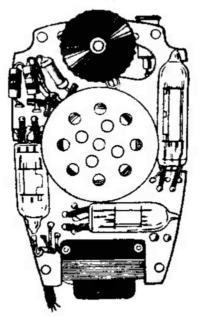
(3) THE ADVANCED COURSE.
For all who desire to increase their accuracy and speeds to 20 or more w.p.m.

For Terms and Full Details, write for the "BOOK OF FACTS" which is sent post free without any obligation.

CANDLER SYSTEM COMPANY

(Dept. 55S.W.) 52b ABINGDON ROAD, LONDON, W.8.
Candler System Company, Denver, Colorado, U.S.A.

The Walk-around Shop



EVERY RADIO-MINDED AMATEUR will find many valuable conversions possible with a "MEDRESCO" DEAF AID.

We have developed two interesting conversions :— 1. A Crystal Receiver incorporating a Germanium Diode. Circuit requires no alteration to present wiring. 2. An O-V-2 (detector with two stages of amplification) receiver. (Circuits for these two supplied free).

Other conversions include: **Miniature Radio Receiver — Model Control Equipment — Pre-Amplifier — Inter-com Telephone, etc.,** in addition to its original application.

WE OFFER the "Medresco" unit in perfect working order (every one checked by experts) complete with Crystal Microphone and incorporating three Miniature Valves at the remarkable low price of 27/6. Post 1/-. Price without crystal microphone, 23/6. Post 1/-.

ACCESSORIES

Miniature crystal earpiece, complete with lead and plug, 6/6; Ever-Ready Batteries: 1.5 v. L.T. (Type D 18), 8d. 30v. H.T. (Type B119), 4/3; 45v. H.T. (Type B106), for greater gain and output, 7/6.

CONVERSION ACCESSORIES: Set of parts for Crystal Receiver 5/-. Set of parts for O-V-2 Receiver 6/-. *Circuits for either Free.*

WIND FINDING ATTACHMENT for Air Speed Indicator. Comprising two small counters. Two Desyn type follower motors. (Ideal for an antenna direction indicator) Size of motors 1½in. long, 1in. diam., 6-way terminal block. Yaxley type switch. Housed in metal outer case, fitted with plastic 360 degree dial. PRICE 8/6. Post paid.

Come along and inspect our wide range of RADIO EQUIPMENT, COMPONENTS AND ELECTRICAL ACCESSORIES.

Note: Orders and Enquiries to Dept. "S"

PROOPS BROS., LTD. 52 Tottenham Court Road, London, W.1. **LANgham: 0141**

SMALL ADVERTISEMENTS, READERS—*continued*

FOR SALE: National NC57, had very little use. £30.—Box 1538, Short Wave Magazine, Ltd., 55 Victoria Street, London, S.W.1.

BC342, many mods. and improvements, separate P/Pack, metered; BC453 (Q5'er) with P/Pack, mint; Test Set 210; RF26, P/Pack, converted 21 mc; Model 90A Taylormeter. Large number *Wireless Worlds*; 4ft. Cabin Cruiser, suitable radio control.—Details, offers, exchanges: GW3HJR, The Shack, St. Cenydd Rd., Caerphilly, Glam.

EDDYSTONE 640: little used since complete overhaul by Webb's; offers invited.—Finlay, 41 Langley Park Road, Iver, Bucks. (*Iver 1075*).

WANTED: *CQ*, January, March, April, June, November, December 1945, May 1946; *Radio* before 1936; *R/9* before April 1935; *QST* before 1924. Many *Amateur Radio, Break-In, Radio ZS, Calling CQ* (de Soto).—G3IDG, 95 Ramsden Road, London, S.W.12.

BC221, in exceptional condition, with spare valves and crystal; original calibration charts; fitted stabilised 230 AC power unit.—Enquiries to Box 1537, Short Wave Magazine, Ltd., 55 Victoria Street, London, S.W.1.

OFFERS INVITED: Eddystone 740, excellent condition; Eddystone S-meter; Top Band Tx in TU case with built-in Power Pack; new OC51 Transistor; QCC Xtals 160, 80, 40, 20, with certs.; Ronette Xtal Mic. T-17; Misc. 807's. Parcel of radio periodicals free to radio enthusiast in hospital. —J. Woodward, G3GYR, 6 Council Houses, Rode Heath, Stoke-on-Trent, Staffs.

CR100 with phones, speaker, manual, £22; KT66 4, £1; 88D manual, 15/-.—Box 1540, Short Wave Magazine, Ltd., 55 Victoria Street, London, S.W.1.

R107 with manual, £9; Sky Champion, perfect, £20; matched pair RK-28, £5; 100 kc sub-standard, £1 10s.; head-sets, 2/6 pair; T20, 25/- pair; Xtal mike, 5/-; bags assorted resistors, 1-25 watts, usual values, 5/-.—Lawson, 23 Alington Grove, Wallington, Surrey.

HRO 50 kc - 30 mc (4 bandspread coils), no Power Pack, £27 10s. or offer; Broadcast HRO coils, 35/- each; Labgear multiplier, built EF50's, £4 10s.; Standard TV tuner, 12-channel, £10; Electro-Voice ribbon microphone, £15; 829, £1; 832, 10/-; RK-715B, 35/-; 931A, 30/-; Manuals AR88D, Collins 32V-1, SP400, HRO-50, 30/- each.—Box 1539, Short Wave Magazine, Ltd., 55 Victoria Street, London, S.W.1.

URGENT DISPOSAL: BPL Signal Generator, CV57, PT15, offers? VCR139, 15/-; geared motor, 10/-; Acos GP20, 30/-; 78 turntable, 45/-; Solar Capacitor Analyser, 50/-; 832, 15/- each; Avominor, £5; Beam motor, £1; 48 *Bulletins*, 12 *Practical Wireless*, 20 *Practical Television*, 30/-; Mod. Transformer, 10/-; pair magslips and transformer, 50/-; R1155 D/F meters, 15/- each; superhet coils and dial, 10/-; Eddystone variables, 50 x 50 mmF and 25 x 25 mmF, 10/- each. Buyer pays carriage.—40 Seafield Road, Arnos Grove, London, N.11.

SMALL ADVERTISEMENTS, READERS—*continued*

FOR SALE: NEW Rx 1132A, £3; five 36v. and one 6v. miniature accumulators with hypodermic syringe; all unused; 25/-.—Box 1536, Short Wave Magazine, Ltd., 55 Victoria Street, London, S.W.1.

TWO-METER Receiver, modified RL85, mains, Cascode RF, nice cabinet, perfect, £10; Xtal Converter, two 6AK5 RF, £5; 1224, £2.—G3HVO, Highwood Road, Parkstone, Dorset.

WANTED: SX28.—Details of condition and price, etc., GM3JQL, 24 Hammerman Bdg., 35 Dunkeld Road, Perth. (All letters will be answered).

FOR SALE: Hallicrafter's S20R, S38B, National 1-10, 58 Transmitter-Receiver, R1155, R1132, Canadian ship's radio, R103, Beam Motor, Radio Compass, Wire Recorder. WANTED: S27, SX28; s.a.e.—17 Kent Road, Atherton, Manchester.

QRT: Exchange AR88D, complete with speaker and manual, for Rolleiflex Camera; must be modern and perfect. Many Transmitter and Receiver components in £2, £1 and 10s. parcels. You can't go wrong!—Box 1541, Short Wave Magazine, Ltd., 55 Victoria Street, London, S.W.1.

BC-458 urgently required. State condition and price.—Mortimer, 51 Townhead Rd., Dore, Sheffield.

CLASS-D FREQMETER; two audio stages, speaker, power pack, mounted one panel and chassis, £9; Modulator 6J7, 6J5, 6L6, p/pull 807's, UM2, SCR522 and RCA 460-volt power, Eddystone panel and chassis, £5; Pre-Selector 2-stage 4-figure band, Power Pack, £5; VFO 40/80 TU5B, with power pack, £4; postage, packing, extra.—R. Mitchell, Croft House, Horbury, Wakefield.

FOR SALE: Valves. At 7/6: CV52. At 5/-: 12SA7, 12SJ7, 12J5. At 4/-: ECC31 (four), ACP4, CV73, KTW62 (two), 6K7GT, 6G6G. At 2/6: CV63 (two), BL63. At 1/6: 12H6, 7193 (two), VR18, VR19, KT2, AR8 (two), P61, VT61A (two); also two Magslips, 2" MK2, 10/- each.—Box 1542, Short Wave Magazine, Ltd., 55 Victoria Street, London, S.W.1.

FOR SALE: RCA AR77E, RCA Speaker, RCA Manual; excellent condition; £28 10s. Buyer collects.—Fletcher, 80 Naunton Lane, Cheltenham, Glos.

EDDYSTONE S640 Rx; perfect; £16.—4 Boardman Road, Manchester, 8.

WANTED: Communications Receiver, 30 to 0.6 mc.—Price, details, please, to 67 Sheephouse Way, New Malden, Surrey. (*Phone Derwent 4330*).

RECEIVERS for sale, CR100; Hallicrafters SX24; German spy S/W; Eddystone late model. Callers, please.—Fawkes, St.-Chloe Green, Amberley, Stroud, Gloucestershire.

HRO SENIOR for sale; three band-spread coils, Tx power pack, 500v., 340 mA.—*Phone HAR 6945.*

FOR SALE or exchange Hallicrafters: S.20R for an SX28, with cash adjustment.—Apply Goldstein, 106 Oxford Gardens, London, W.10, or *Ring LAD, 0241.*

SMALL ADVERTISEMENTS, READERS—*continued*

WANTED: AR88 Spares and Handbook. What have you? Have DST100 Handbook, 50/-.—Partics. to G3GCO, 31 The Crescent, Donnington, Shropshire.

1154F as 1154M, 2-18 mc, brand-new, ex-B.O.A.C, £4 10s.; mains Power Pack and accessories, £3 10s.—V. Cedar, 9 North Drive, London, S.W.16.

B2 Tx Rx, P/Pack, 3.5 and 7 mc, Xtals, key, all coils, in original watertight cases, £12. Components, Valves; s.a.e. for list.—15 Normoss Avenue, Normoss, Blackpool.

Southern Radio's Wireless Bargains

TRANSRECEIVERS. Type "38" Mark II (Walkie-Talkie). With 5 valves and ready for use. Metal carrying case. Less external attachments .... 30/- per set

TRANSRECEIVERS. Type "18" Mark III. Comprising Superhet Receiver and Transmitter. Two units contained in metal carrying case. Complete with 6 valves .... £4/10/- per complete set

RECEIVERS. Type "109." Built-in speaker. 8 Valves with VIBRATOR PACK for 6 volts. Contained in metal case. Perfect .... £5 each to clear

TELESONIC 4-valve Battery Portable. Complete with Hivac valves in metal carrying case. Simply converted to Personal Portable .... £2 per set including Conversion Sheet

BOMBSIGHT COMPUTERS. BRAND NEW ex-R.A.F. Contains gyro, motors, rev. counters, gear wheels, etc., etc. Ideal for model makers, experimeters, etc. ...... £3/5/- each plus 10/- carr.

CRYSTAL MONITORS. Type 2. New in transit case. Less crystals .... 7/6 each

LUFBRA HOLE CUTTERS. Adjustable ¾ to 3½in. For metal, wood, plastic, etc 6/6

RESISTANCES. 100 Assorted, all useful values, etc. Wire end .... 12/6 per 100

CONDENSERS. 100 Assorted. Mica, Metal, Tub., etc. 15/- per 100

PLASTIC CASES. 14in. by 10¾in. Transparent. Ideal for maps display, etc. 5/6

STAR IDENTIFIERS. Type I A-N. Covers both Hemispheres, in case 5/6

CONTACTOR TIME SWITCHES. In soundproof case, 2 impulses per second. Thermostatic control. Clockwork movement .... 11/6 each

REMOTE CONTACTORS for use with above .... 7/6 each

DIMMERS. Wire wound in bakelite case .. 1/3 each ; 12/- doz.

TRANSMITTERS. Type 1154. Brand new. Complete with meters and valves in transit case .... 37/6 each

CONVERSION KITS for 1154 Transmitters. New . 10/- each

METERS. 12 Instruments. May need adjustment or with broken cases .... 35/- for 12

Postage or carriage extra.

Full List of Radio Books, 2½d.

SOUTHERN RADIO SUPPLY LTD.

11, LITTLE NEWPORT STREET, LONDON, W.C.2.

GERrard 6653

Wanted for Cash

All types of American Equipment. Communication Rxs. A.R.88s S.X.28s. Hallicrafters, B.C.221s, B.C.348s. Test Gear. Sig. Gens. Oscilloscopes. Valve Testers, Tape Recorders. Portable radiograms. 3-speed players, etc., etc. Highest price in the trade paid, call, send or write, every letter or enquiry answered, all goods forwarded will receive personal attention, cash forwarded by Telegraphed money order as soon as offer is accepted. Send to Dept. "S"

Miller's Radio

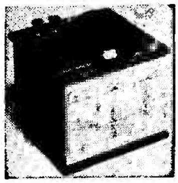
38a Newport Court, Charing Cross Road.

Close Leicester Square Tube Station, London W.C.2. Established 20 years

Phone Ger 4638. Ham 0713.

UNIVERSAL ELECTRONICS

Offers Amazing Value in :—



SULLIVAN

Standard Variable Air Condensers

Individually calibrated.

50μμF to 610μμF.

NEW in original packing.

PRICE 19/6 Post Paid U.K.

This is a fraction of original cost.

22 LISLE STREET, LONDON, W.C.2.

Shop hours : 9.30—6 p.m. Thursday : Close at 1 p.m. Open All Day Saturday.

Telephones : GERrard 4447 and 8410 (Day) : MEAdway 3145 (Night).

Solder with LITESOLD

REGD TRADE MARK

THE LIGHTWEIGHT CHAMPION

Rapid Heating — Extreme Lightness — Eight different models — Bit sizes, ⅛", $\frac{3}{16}$", ¼", ⅜" — Prices from 19/6. A precision instrument for discerning craftsmen.

- **NO TRANSFORMER NECESSARY**
- **FOR MAINS OR LOW VOLTAGES**

Details of full range in folder No. S9 sent on request.

Sole Manufacturers and Distributors :

LIGHT SOLDERING DEVELOPMENTS Ltd.

106, GEORGE STREET, CROYDON, SURREY :

Telephone CROydon 8589

RADIOCENTRE

12, SHIRLEY ROAD, SOUTHAMPTON

RECEIVERS. AR88Lf, £45. SX28, £42/10/-. HRO 4 coils and power pack, £25. Super Pro. and power pack, £32/10/-. Scott Laboraties Communication Receiver, £30. HRO coils all ranges. Details as requested.

TRANSMITTERS. Army 12 set, £14. 68T, £3/10/-. TBY Walkie Talkies, complete in case. £12.

VALVES. 813 at 45/-. TZ40. 811, 805, 35T, 803 at 17/6. 5U4G, 6SG7, VR150, 6SA7, 6K6GT, 6V6GT, 5Z4G at 5/6. L63, KTW61 at 3/-.

FEW ONLY LEFT. AR88 Cabinets, 45/- each.

WANTED URGENTLY Clean Valves. TX and RX.

COMMUNICATION RECEIVERS especially required. S27, HRO, AR88, S36, SX28.

Carriage Paid on all Orders over £2.

BRASS, COPPER, BRONZE, ALUMINIUM, LIGHT ALLOYS

IN ROD, BAR, SHEET, TUBE, STRIP, WIRE

3000 STANDARD STOCK SIZES

H. ROLLET & CO., LTD.

6, CHESHAM PLACE, LONDON S.W.1.

SLOane 3463

Works : 36 ROSEBERY AVENUE, LONDON, E.C.1.

Branches at LIVERPOOL, MANCHESTER, BIRMINGHAM, LEEDS

"No Quantity too Small"

Printed by The Courier Printing Co., Ltd., Tunbridge Wells, for the Proprietors and Publishers, The Short Wave Magazine, Ltd., 55 Victoria Street, London, S.W.1. The *Short Wave Magazine* is obtainable abroad through the following: Continental Publishers & Distributors, Ltd., William Dawson & Son, Ltd., ; AUSTRALIA AND NEW ZEALAND—Gordon & Gotch, Ltd. ; AMERICA—International News Company, 131 Varick Street, NEW YORK. Registered for transmission to Canada by Magazine Post. *February* 1955.