The SHORT WAVE Magazine

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THE *SHORT WAVE LISTENER* ASSOCIATED WITH THIS MAGAZINE IS SPECIALLY FOR THE RECEIVING ENTHUSIAST

FOR THE EXPERIMENTER AND THE RADIO ENGINEER

The SHORT WAVE Magazine

Christmas

Every year at this time it is our pleasure to spare those who may glance over this space any discussion of the burning controversies of the moment — and instead to send them greetings and good wishes for the Christmas season.

We now number our readers in all corners of the world, from Russia to Alaska and from Greenland to the Antartic. Many will not in fact be seeing these lines until well on in the New Year. In the realm of Amateur Radio, however, time and space are hardly ever factors of any great significance — for radio amateurs girdle the earth and are in constant communication. And it is in this realm of Amateur Radio that the true spirit of Christmas still lives.

So once again we are happy to have the opportunity of offering our good wishes for their happiness and our thanks for their support to all our readers at home and abroad

from the Editor, Management and Staff of

SHORT WAVE MAGAZINE

An All-807 Transmitter for the HF Bands

DESIGN, CONSTRUCTION AND SETTING UP

J. N. WALKER (G5JU)

The design presented here was commissioned by SHORT WAVE MAGAZINE, *the main objective being an HF transmitter of adequate power rating using the readily available 807 and capable of giving good results on the new 21 mc band—for which it is primarily intended. The transmitter is described in detail in this article and will be of interest to all who are contemplating new construction for the communication bands, since it covers the range 14-28 mc. It can either be an exact copy, or built on a plain chassis in those cases where TVI is not a problem, or the circuit can be adapted to meet individual requirements for similar apparatus.—Editor.*

AS the title suggests, all the valves handling RF energy in this particular transmitter design are of the 807 type and a number of advantages are thereby secured. For one thing, the 807 is cheap and easily obtainable; secondly, the number of spare valves required is reduced; and, thirdly, the 807 is a very efficient valve and is capable of good service in a number of different ways at quite high frequencies. For reliability and long life, it is always well to keep within the manufacturers' ratings and normally this applies in the present instance. The power input depends largely on the HT voltage applied to the PA stage, and some may wish to run up the power level, on the argument that the cost of replacement valves is not high. Analogous to the recommended system of changing car tyres round, the valves in this transmitter can be similarly interchanged at intervals to "even out wear."

There are two valves other than the 807's. One is a neon stabiliser type VR150/30, used to regulate the voltage on the screens of the first two valves: the other is a 6V6 (or any of its variants) used as a "clamp" on the screen grids of the PA valves to prevent excessive dissipation under non-driven conditions. In fact, another 807 could have been used for the latter purpose but a 6V6 is preferred as it is large enough and the total heater current is kept within the rating of the heater transformer.

Purpose of the Design

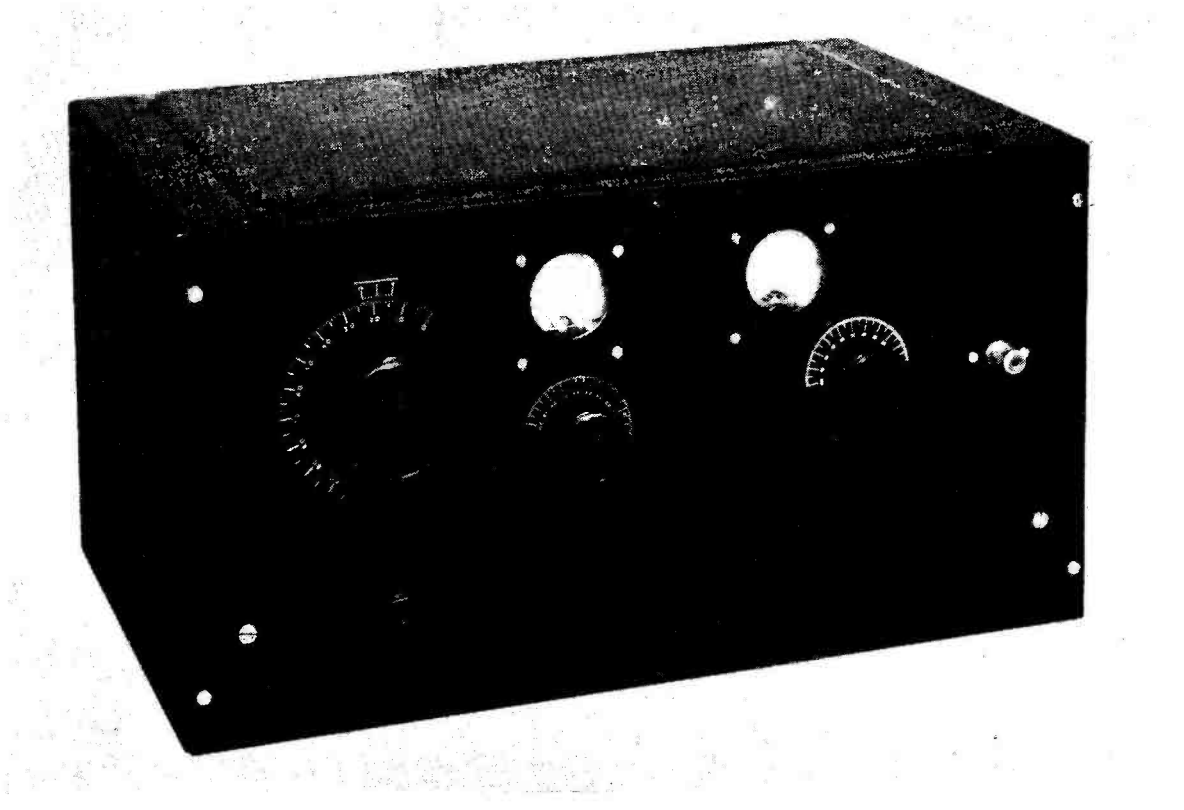
A large number of transmitting amateurs spend their operating time mainly on the HF communications bands and a transmitter of the table-top pattern and giving optimum performance on the 14, 21 and 28 mc bands will prove of interest. It is better to use a transmitter designed essentially for these bands anyway, since greater complexity and some degree of compromise—which mean loss of efficiency—are unavoidable if lower frequencies must also be covered. And, of course, transmitters for the VHF bands and for the Top Band should be separate equipments.

The present design is intended primarily for the comparatively new 21 mc band and many readers will probably consider building it to get going on that band—the writer's own first QSO's have been made using this transmitter. A rapid change can be made to 14 or 28 mc should this be desired.

The transmitter can be built either in open chassis form or enclosed in a metal cabinet finished black wrinkle. The latter is strongly advisable when the greatest possible protection against television interference is necessary. The cabinet is one supplied by Webbs Radio and comes complete with panel and chassis, but it is understood that the panel and chassis are available separately.

Brief Outline of the Circuit

The first 807 is a VFO in a circuit built in a way and having constants such that frequency drift is reduced to a very low figure, this factor being important because of the fairly high final operating frequency. The actual circuit is one which has been used in other instruments for several years and it can be guaranteed to give satisfaction providing the components incorporated are of high quality branded types, this applying particularly to the silvered mica condensers C3 and C4 shown in the circuit diagram Fig. 1.



The assembly complete, showing the neat construction and appearance of the All-807 HF Transmitter.

Originally it was intended to arrange the first valve to act as either crystal oscillator or VFO, but the need for a VFO is so great—and it was not desired to use an external VFO although this can well be done where suitable gear exists—that it was decided to simplify things by making V1 act as a variable oscillator only. It is a fairly simple matter to change it over to a crystal oscillator if desired and a note on this modification is given towards the end of the article.

It has been found possible to dispense with a buffer valve, and no frequency pulling occurs for two reasons. One is that a wide-band coupler is employed in the anode circuit of V1 and a sensibly constant impedance is presented over the working frequency range. The other reason is the wide frequency separation between the grid/cathode and the anode circuits. The fundamental oscillator works over the range 2333 kc to 2400 kc (or thereabouts), the third harmonic in the 7 mc band being extracted in the anode circuit. Appreciable power is developed (a small neon lamp lights when held against the top cap of V1) and adequate drive is applied to the grid of V2.

It is desirable to stabilise the screen-grid voltage of V1, hence the presence of the VR150/30. Advantage is taken of it to stabilise the screen of V2 also.

The second 807 acts as doubler, tripler or quadrupler, according to the final frequency. The outputs are practically equal on 14 and 21 mc. and, although naturally less on 28 mc. it is still adequate for running the PA at fair power. The unbalanced output from V2 has to be changed to a balanced drive for the push-pull output valves and this is accomplished with plug-in coils having a single primary and two secondary windings. It is agreed that to use plug-in coils in a modern transmitter design is something of an inconvenience, but there is really no alternative. To add switching would "clutter-up" the under-chassis space between V2 and the output valves and undesirable losses would be introduced.

The first two valves are intended to run off a 300-volt supply capable of giving 60-70 mA

and possessing moderately good regulation.

The two 807 valves in the PA operate at all times as a straight push-pull amplifier. The use of a push-pull stage permits a fairly high input without the normal valve ratings being exceeded. The balanced circuit is of benefit in bringing about a lower level of even order harmonic output which is of some importance when TVI problems are present.

Generally the writer's preference is for a semi-fixed grid bias supply which obviates any problems of excessive dissipation when no drive is present. In the present case, the object was to produce a compact transmitter of not too complex a type and bias is therefore derived from the grid current which produces a voltage drop across R11. The clamper valve V5 reduces the screen voltage on the final valves when the key is up and can also be pressed into service for clamp modulation.

The use of a balanced pi-network in the output stage had been considered, but for various reasons this idea had to be abandoned. For one thing, mounting coils of adequate size in positions where they could be changed or adjusted easily presented difficulties, whilst a variable condenser suitable for the loading position does not seem to be readily available —a split-stator of at least 250 $\mu\mu$F per section is called for, it must withstand the DC and RF voltage and it must not occupy much space. It would be possible to make do with a smaller variable and switch a number of small fixed condensers, but that would mean introducing the complexity of switching and adding another panel control. Standard Labgear plug-in coils are therefore employed and the output taken off at a low impedance, either direct to the aerial system or to a separate aerial tuning unit. Harmonic output can be attenuated conveniently by the insertion of a low-pass filter in the coaxial lead.

Keying

Following the writer's normal practice, the keying jack was first connected in the screen-grid of the second valve but difficulties were encountered. With the key up, there was not complete cut-off—in fact one or two milli-amperes of grid current continued to be registered and there was plenty of output from the PA ! Providing some negative bias for the screen through the volts dropped across a resistor in the cathode, using the method outlined in an earlier article (*Short Wave Magazine*, February, 1951), was successful as regards clean keying but the output fell off to a degree which could not be tolerated—it has to be remembered that V2 is driven directly from the VFO valve and there is not a lot of drive to spare. So recourse was made to keying the cathode of V2 and this proved quite satisfactory. A key filter is necessary to prevent clicks—one is not included in the transmitter, the filter being near the key itself.

Table of Values

Fig. 1. Circuit of the All-807 Transmitter.

C3, C4 = 800$\mu\mu$F ± 2% Silvered Mica
C5, C16 = 100 $\mu\mu$F S.M. or Ceramic
C6, C10, C12 = .002 μF Moulded Mica
C7, C8, C9, C13 = .01 μF Moulded Mica
C11, C15, C17, C18, C25 = .001 μF Moulded Mica
C20, C21, C22, C23, C24, C26 = .001 μF Moulded Mica (750v.wkg)

R1, R5 = 100,000 ohm, 1 watt
R2 = 470 ohm, 1 watt
R3, R8, R15 = 200 ohm, ½ watt
R4 = 7,500 ohm, 5 to 10 watt (Welwyn)
R6, R12, R13 = 22 ohm, ½ watt
R7 = 11 ohm, 1 watt (2 x 22 ohm ½ watt)
R9 = 330 ohm, 1 watt
R10 = 20,000 ohm, ½ watt
R11 = 20,000 ohm, 1 watt
R14 = 10,000 ohm, ½ watt
R16 = 15,000 ohm, 10 watt, Varley (*see* text)

LIST OF PARTS

Cabinet, with chassis and panel, ripple black	Webbs Radio
1 Variable Condenser 140$\mu\mu$F (C1) Cat. No. 586	Eddystone
2 ,, ,, 60$\mu\mu$F (C2) ,, ,, 582	,,
1 Transmitting Condenser 50/50$\mu\mu$F (C19) Cat. No. 612	,,
1 Slow Motion Dial (for C2) ,, ,, 594	,,
2 Direct Drive dials (for C14, C19) ,, ,, 595	,,
2 RF Chokes (RFC1, RFC 7) ,, ,, 1022	,,
6 RF Chokes (RFC2, 3, 4, 6, 8, 9) ,, ,, 1011	,,
1 6 pin Coil Base ,, ,, 964	,,
3 6 pin Plain Coil Formers ,, ,, 537	,,
1 Flexible Coupler (for C2) ,, ,, 529	,,
1 Flexible Coupler (for C19) ,, ,, 50	,,
1 Insulator ,, ,, 1019	,,
1 Filament Transformer 6.3 v. 4 amps. PTF15	Woden
1 Wide-band Coupler 7 mc type E5018C	Labgear
1 Transmitting Coil with link type T2OA 14 mc	,,
1 ,, ,, ,, ,, type BCL 21 mc	,,
1 ,, ,, ,, ,, type FCL 28 mc	,,
1 Base for Coils 5 pin	,,
1 5 pin Socket and Plug	Belling-Lee
1 Coaxial Socket and Plug	,,
1 Meter 0-10 mA 2½ inch diameter or less (M1)	
1 Meter 0-50/100 or 150 mA 2½ inch diameter (M2)	
4 Valveholders American medium 5 pin	
2 ,, International Octal	
4 Valves 807 or QVO5/25 (V1, V2, V3, V4)	
1 Valve 6V6, 6V6G etc (V5)	
1 Valve VR150/30 (V6)	
1 Jack (insulated or otherwise)	
Top caps, spacing pillars, wire, sleeving etc.	

Possibilities of TVI

This of course loomed large, and it is now generally appreciated that the design of a modern transmitter must take into account the possibility of TVI being caused. The higher the frequency range, on the lower side of the television bands, the more necessary does it become to take anti-TVI precautions. For those who are not much concerned with TVI—meaning those who are either in a region of high field strength, or else in an area completely out of range of a television station—the transmitter can be built in chassis form. For others, enclosure of the transmitter in a metal cabinet is practically essential and it is

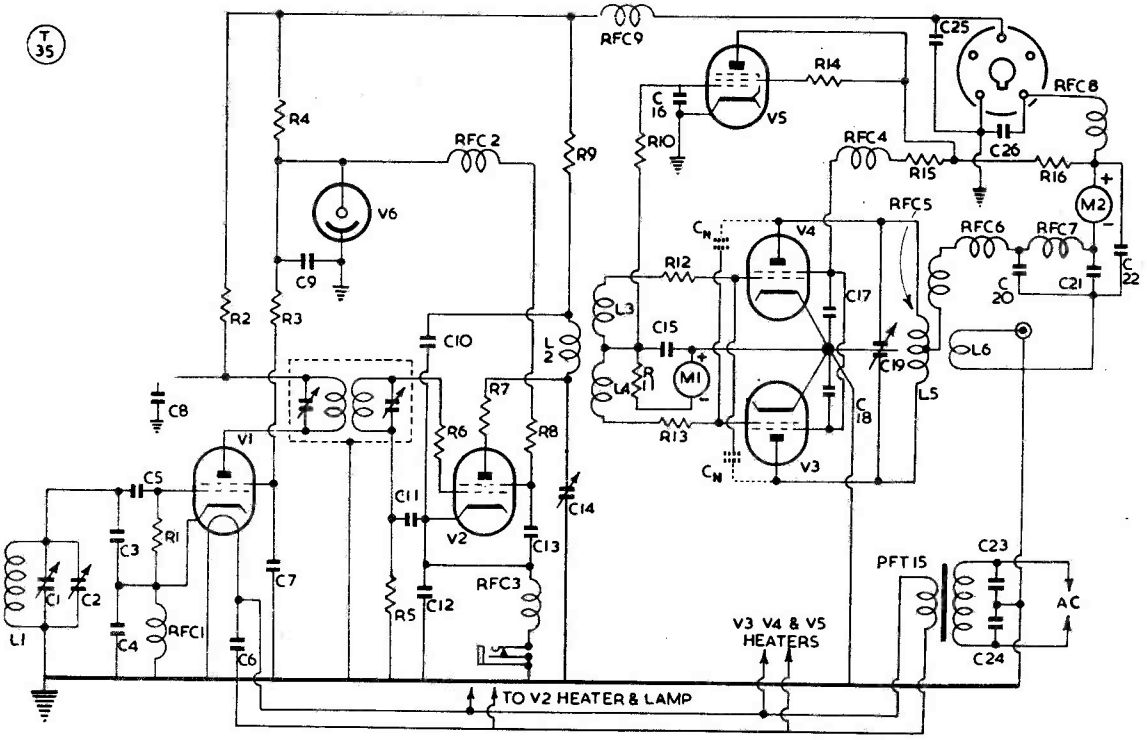


Fig. 1. Circuit diagram complete of the three-band HF transmitter, designed for operation on 14, 21 and 28 mc. Four of the valves are type 807 for economy of spares and interchangeability.

assumed that this will be done in the majority of cases—the instrument presents a much tidier appearance anyway.

The amount of harmonic radiation is low and this is accounted for by a number of factors, as follows : The use of wide-band couplers ; the avoidance of excessive grid drive ; the inclusion of VHF chokes at various points ; adequate decoupling of power leads ; moderately low L/C ratios ; and final filtering of the RF output, of which more later. Those who reside in fringe areas, where the absolute minimum of harmonic radiation is the aim, may have to take a few extra precautions, such as using screened wiring for some of the internal and external leads and the fitting of wire mesh over the meter openings in the panel and the louvres in the cabinet.

Practical Construction

The chassis dimensions are 15¼ inches by 8½ inches with a depth of 3 inches. Whilst this latter is convenient as regards finding space for components inside the chassis, it does not permit the 807 valve bases being fitted flush with the chassis deck and they must be sunk at least one inch and preferably a little more. This is no bad thing as it gives greater isolation between input and output circuits. With the addition of screening rings around the envelopes of V3 and V4, to match up with the screening plates inside the valves, it was hoped neutral-

COILS

Intermediate Stage (6 Pin)

BAND MC	PRIMARY WINDING	EACH SECONDARY WINDING	END-TO-END SPACING (between windings)	APPROX. DIAL READING
14	8 Turns 18g enam. closewound	10 Turns 22g enam. closewound	7/16"	60
21	4 Turns 18g enam. closewound	5 Turns 20g enam. closewound	½"	40/45
28	3 Turns 18g enam. Slightly spaced	4 Turns 20g enam. closewound	7/16"	20/25

The secondary windings follow on in the same direction to ensure proper phasing.

isation would not be required. However, as is well known, 807 valves are lively customers, the more so as straight amplifiers, and, whilst the instability was but slight on 14 mc, it was serious on the other bands. Neutralisation *was* therefore very necessary.

To get back to the construction, the drawings in Fig. 2 give details of the various holes required in the chassis deck and in the panel. One of the holes in the panel takes the keying jack and a hole to match is required in the front wall of the chassis. Only three holes are made in the rear wall—one for an earth terminal at the PA end, one for the mains lead and one for the Belling-Lee socket. The two latter are on the VFO side and it is only necessary to ensure that all are made to coincide with the openings provided in the rear of the cabinet. How the various holes are made —with punch, tank-cutter, metal saw, or a multiplicity of small drillings—will of course depend on the resources of the individual constructor.

Two metal screens are fitted to the top deck, in positions indicated in Fig. 2(a), and in the plan view photograph, to isolate the stages from each other. Both have a height of $4\frac{3}{8}$ inches, with a flange $\frac{3}{8}$ inches wide for mounting. The length of the one near the output stage is 8 inches, whilst the other is $5\frac{3}{4}$ inches, the screening being completed by fitting the heater transformer close up against it.

The VFO Stage

The oscillator coil is wound on a low-loss former $1\frac{1}{8}$ inches in diameter, this former being bolted to the chassis near to the front panel where it is least likely to be affected by radiated heat. Grouped near it are the bandspread condenser C2 (on a metal bracket) and the bandset condenser C1, which is below deck and adjusted with a screw-driver. The bandspread condenser is controlled by a large slow-motion dial. The various small components are grouped around the valveholder below deck and can be seen in the under-chassis view. Those forming part of the oscillator circuit proper should be well clear of other components and of the wiring.

The Labgear 7 mc wide-band coupler is plugged into a five-pin valve base mounted near V1. A slight modification should be made to it—the anode lead is disconnected internally from the base pin (this pin is the one which would be the anode of a triode valve) and an insulated lead brought out through a suitably placed hole for connection to the valve top cap.

The VR150/30 stabiliser is conveniently placed in the VFO compartment, but the series resistor R4 is mounted at the other end of the chassis, where the heat developed will not affect oscillator stability.

Multiplier Stage

The valve, coil and tuning condenser are all in line, the condenser being on the panel and having the rotor earthed. Leads from the condenser stator (and also the rotor as mentioned later under "Wiring"), and from the valve anode are taken down through holes in the chassis to the coil base socket. Anti-parasitic resistors are fitted to both the anode and grid of the valve. Anode, screen and grid decoupling condensers are returned to the cathode and not to the chassis.

This stage is compact and, when boxed in, it is not easy to see what one is doing when changing coils. So a rather unusual refinement has been added—the inclusion of a small bulb near the coil base. It is a 12 volt lamp running off the 6.3 volt heater supply and gives sufficient light to illuminate the darker recesses.

PA Stage

As can be seen in the plan view photograph the PA stage occupies roughly half of the chassis space and is symmetrically arranged. The tuning condenser is set back from the panel and is controlled through a flexible coupler and a short length of brass rod. The coil holder must be so placed as to give clearance to the largest coil—the one for 14 mc—both from touching the variable condenser and from the top of the cabinet. The holder is fixed $1\frac{1}{4}$ inches above chassis level and it is an easy matter to change coils with the cabinet lid lifted. The two RF feed chokes are held in the wiring between the centre contact on the coil base and a small ceramic insulator. The coaxial socket mounts conveniently on the front panel.

The rings which are placed around the 807 envelopes are made up to a diameter of $1\frac{1}{2}$ inches from lengths of brass measuring $6\frac{1}{2}$ inches by $1\frac{1}{2}$ inches. Flanges are made at each end and bolted together. A small angle piece fixes the screens to the chassis. With the valve inserted, clearance should be adequate without leaving too much of a gap.

The valveholder for the clamp valve is mounted in the PA compartment—in this case it is fitted flush with the chassis deck.

The Panel

One or two points about the panel fittings call for comment. The slow motion dial con-

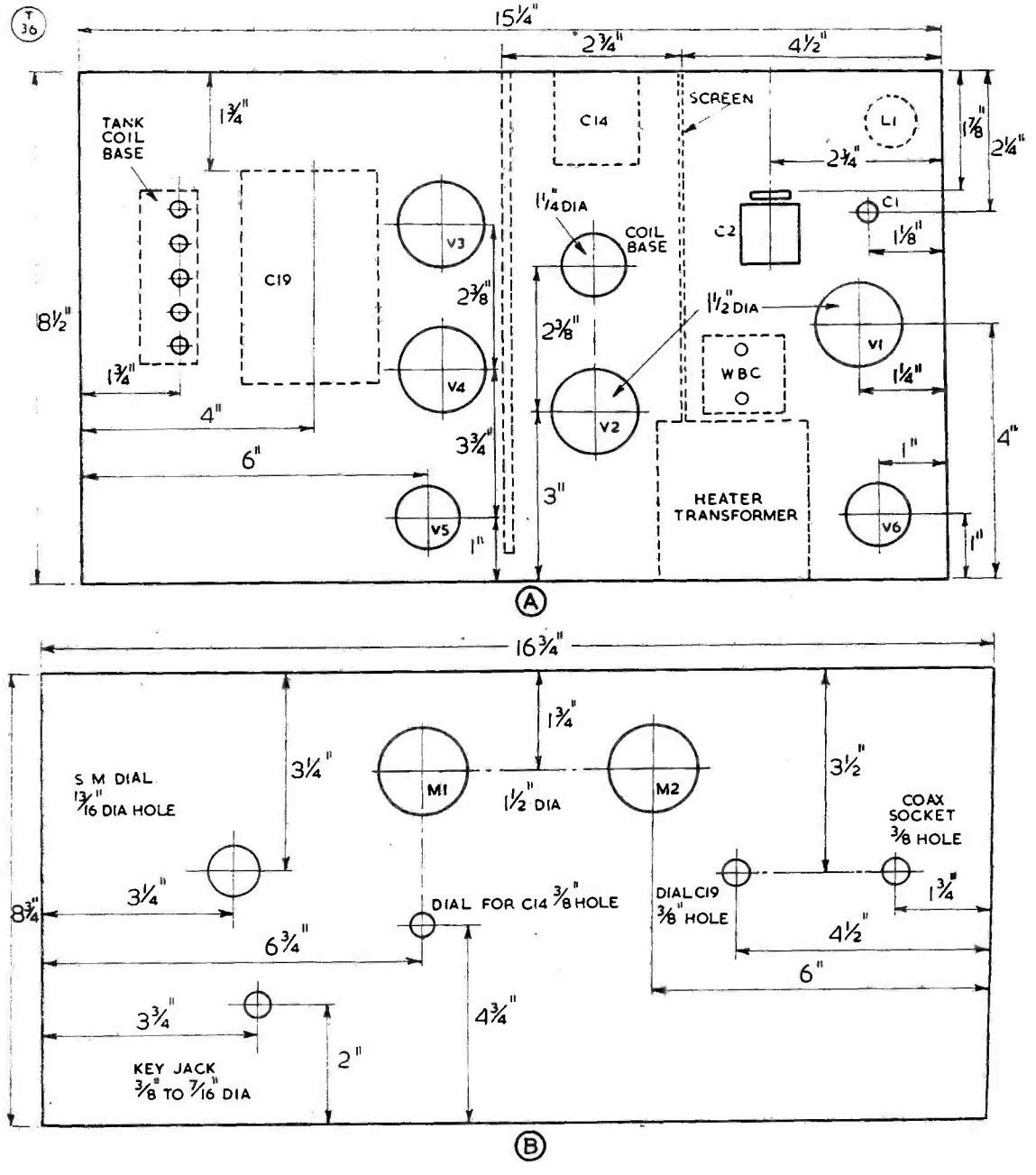


Fig. 2. Layout and drilling details for the chassis (section A) and the panel (section B). The design and placement of parts have been carefully worked out.

trolling C2 comes perhaps under the heading of " VFO Stage," but it is easier to fit the dial first and then make the condenser match up to the spindle, rather than adopt the reverse procedure. The slotted bracket which holds C2 allows vertical alignment, but care is necessary, when fixing the bracket, to ensure correct horizontal alignment.

The same thing applies to the PA tuning condenser—the bush in the panel is fitted first

and the condenser mounted to come into exact alignment.

It will be noticed the meter holes are specified as $1\frac{1}{2}$ inches diameter whereas the meter cases are $2\frac{1}{4}$ inches diameter. The smaller size is adopted in the interests of reducing harmonic leakage and entails mounting the meters *behind* the panel instead of through it. Since the actual scales are $1\frac{1}{2}$ inches across, there is little loss of visibility. The meter reading PA anode current comes fairly close to the nearer PA valve and the terminals have been cut off short. According to the full scale deflection of the meter chosen, a shunt will be required to bring up the actual reading to 150 mA or more. In the photograph, the meter is one of the commonly available 0/50 mA and the shunt across it triples the full scale reading.

Index markers have not been provided for the two small tuning dials as a rough indication is sufficient. If desired a marker can easily be fitted to the PA dial, but it may be found difficult with the other dial to avoid fouling the grid current meter.

PA COIL TABLE

BAND MC	LABGEAR TYPE	COIL		TURNS	WIRE GAUGE	LINK TURNS	APPROX. DIAL READING
		OUTSIDE DIAM.	WINDING LENGTH				
14	T2OA	$2\frac{1}{8}$"	$1\frac{1}{2}$"	10	14	2	50
21	BCL	$1\frac{5}{8}$"	$1\frac{1}{2}$"	8	14	1	50
28	FCL	$1\frac{3}{4}$"	$2\frac{1}{4}$"	6	16	1	20/25

Below the Chassis

Probably the most striking feature inside the chassis, as seen in the under-chassis view photograph, is the rather large number of by-pass condensers ! It is of greater importance in a transmitter of this type to position the condensers so that the leads are very short, as distinct from making the layout and wiring tidy to the eye. The by-pass condensers for the screen-grids are all mounted directly across the valveholder tags—it should be noted that two condensers are used with V3 and V4 and not a single one, as might have been expected, as leads otherwise would have been longer. Returns from other parts of the PA stage are taken to *a common earth point* formed by soldering tags bolted beneath the inner screws securing the valveholders.

The condensers which decouple the power leads can be seen connected directly from the socket pins to a copper earthing strip. The mains supply is also provided with by-pass condensers taken to the same strip. Condensers connected to the 300 volt supply should be rated for 500 volts DC working and others should be 750, or more, work rating.

Wiring

The heater wiring is twisted and made to lie close to the chassis. One side of each heater is earthed at the valveholder and no earth connection is made at the transformer tags. C6 prevents modulation hum in the oscillator—again, it is directly across the tags.

The chassis is *nowhere* relied on for return paths, either DC, AC or RF. To the earthing tag on each variable condenser is soldered a length of copper strip which (where necessary) is taken down through a hole in the chassis to give the shortest possible path to the earth point of the valve concerned. Circulating currents are thereby prevented. Where practicable all leads carrying RF currents are of copper strip, to minimise inductance effects.

All the RF chokes are held by their own wires and are secured near critical points. The HT lead to the centre tap of the tank coil is well provided with VHF chokes, RF choke and by-pass condensers.

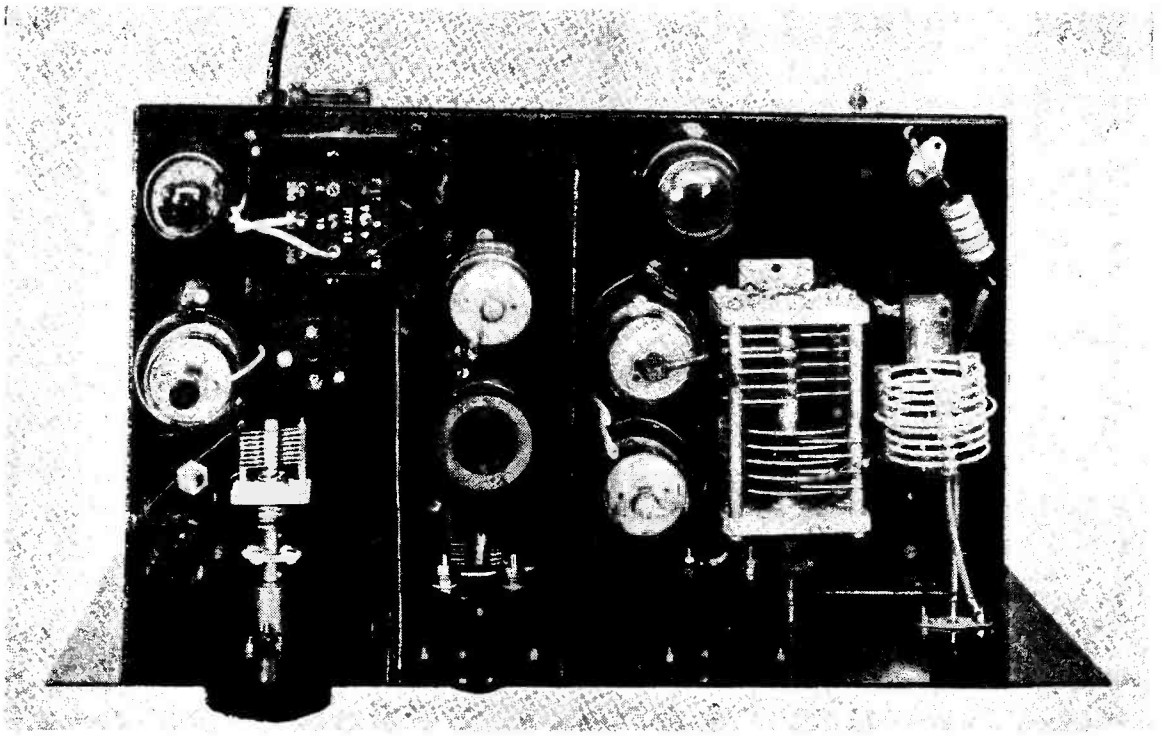
Coils

Information on the coil windings is given in the appropriate panel. Although the PA coils are standard manufactured types, details are included so that those who wish to roll their own can do so.

The formers for the plug-in intermediate coils should be plain, not threaded, so permitting slight movement of the secondary windings. Tests should be made to secure optimum grid drive by moving the secondary windings away from or closer to the primary, after which the windings can be firmly secured by an applicatin of " Denco " or similar polystyrene varnish.

Neutralising

As mentioned earlier, it was found necessary to neutralise the PA stage, but not much room is available for mounting built-up neutralising condensers. Recourse was therefore made to



View of the transmitter in plan. The 807 valve-holders are sunk an inch or more below the deck, those for the other two valves being mounted flush.

sleeved wires placed near the valve envelopes —a system which, whilst perhaps not particularly tidy, is very effective. The wires are 16 gauge tinned copper, each seven inches long (*total* length, not length above chassis) and they cross over to the opposing valve grids below the chassis. Holes are made in the chassis ($\frac{1}{4}$-inch diameter) and the wires positioned between the metal screen and the valve so that they touch neither.

(To be concluded in the next issue.)

AMATEUR RADIO IN HOSPITAL

G2AHB is well remembered as the very active honorary secretary of the successful Grafton Radio Society and, at one time, a hard-working official of the BSWL. He has recently had to go into a London hospital for a long treatment, and when the "occupational therapy wizard" came round, G2AHB firmly declined a pressing suggestion that he should make rag dolls and/or lamp-shades, saying that *his* hobby was Amateur Radio. After a certain amount of this'ing-and-that'ing, permission was given for the installation of a station ; the Grafton chaps got busy, and the result is that G2AHB/A is now on the air with a B2 transmitter, an 1155 receiver, and a length of DCC wire strung across the ward, banging it out on 3.5, 7 and 14 mc, CW only. Already, all G and much of Europe has been worked on this simple rig, and of course, it is the best sort of occupational therapy that could have been devised. We wish G2AHB rapid recovery, and G2AHB/A lots of luck on the air in the meantime. QSL to : W. H. C. Jennings, G2AHB, Ward C1, St. Ann's General Hospital, St. Ann's Road, Tottenham, London, N.15.

XTAL XCHANGE

Notices for this space are free, but can be accepted in respect of exchanges of crystals *only*. Offers should be set out in the form shown here, on a separate slip headed "Xtal Xchange—Free Insertion," and all negotiations conducted direct.

G2BAM, 4 Church Path, Iwerne Minster, Dorset.
Has 3510, 7040 and 2390 (x3, 7170), 2415 (x3, 7245) kc crystals, all 3/4-in. mounting, no certificates. Wants frequencies near 3505, 3550 and 7010 kc, or what-have-you, in 3/4-in. pin spacing.

G3HKO, 42 Prospect Road, Scarborough, Yorks.
Has 7220, 7230 and 7235 kc crystals, 3/4-in. mounting, no certificates. Wants 100 kc bar.

SWL, 152 Avon Street, Coventry, Warks.
Has 7075, 7085, 8000 kc crystals, FT-243 mounting. Wants frequencies 7224, 7225, 7446, 7447 kc, and near 8021 kc.

The Cure of TVI

DESIGN OF RF STAGES

PART III

R. L. GLAISHER (G6LX)

The first two parts of this useful and important article appeared in our October and November issues. This section discusses the design of RF stages generally, with the object of avoiding the generation and radiation of unwanted harmonics. The use of proper by-pass arrangements in the PA stage is also treated in detail.—Editor.

VALVE amplifiers are usually classified according to their intended method of operation—such as Class A, AB, B, or C. These classifications are related to driving conditions, bias voltage, whether grid current flows during the drive cycle, and so on, and are fully explained in text books dealing with the basic theory of valve amplifiers.

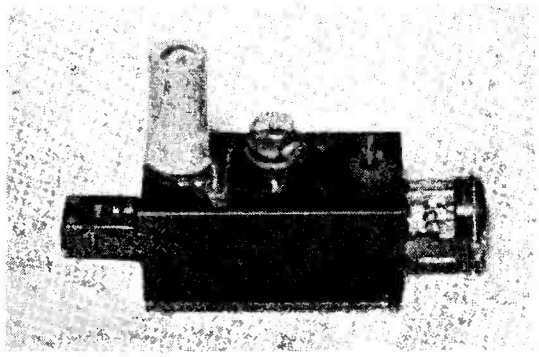
RF power amplifiers can be operated under any of the usual conditions, but Class-C is more often selected because of its high efficiency and because of the difficulties in providing amplitude modulation with other modes of operation.

Let us first examine the case of a Class-A amplifier whose grid voltage/anode-current relationship is linear : The output waveform will be exactly similar to the waveform of the input signal but increased in amplitude by the stage gain of the valve. This means that if the signal fed into the grid circuit contains harmonics, then the output will have the amplitude of the fundamental and each harmonic increased proportionately. If a clean harmonic-free signal is fed to the grid, the output circuit should contain only fundamental energy. These statements only hold true for *linear operation* ; if the stage is non-linear, the individual amplitudes of the fundamental and harmonics are altered, some harmonics being accentuated and others attenuated.

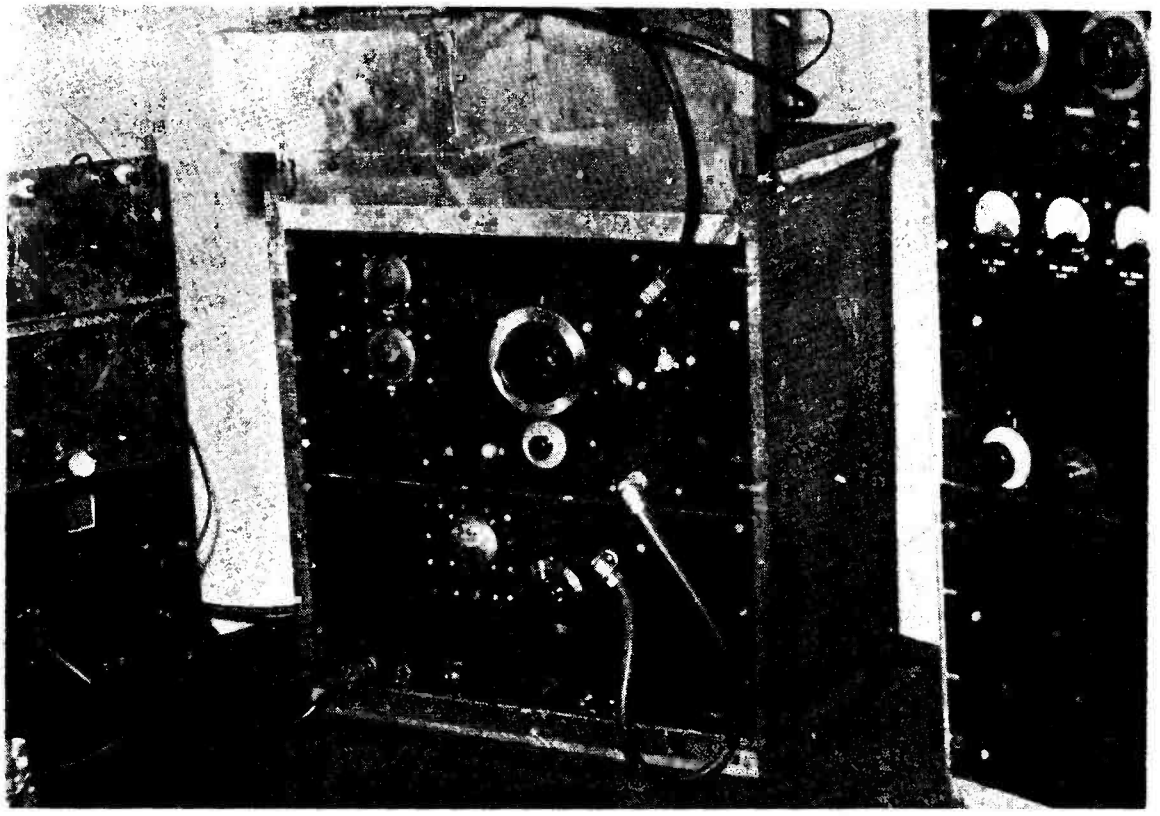
Under Class-C conditions, however, the input signal impressed on the grid of a valve must of necessity have sufficient amplitude to cause the valve to operate over the non-linear portion of the grid-voltage/anode-current characteristic. Under these conditions the anode current will contain both fundamental and harmonic components of the input signal, even if this consists only of fundamental energy. If the drive voltage contains harmonics, it is almost certain that some of them will be amplified and fed to the anode circuit, along with those generated by the valve itself. It is therefore essential to try to eliminate the harmonic output of the lower-power driver stages, so that only the *cleanest possible signal* is fed to the final amplifier grid circuit.

The FD Stages

Frequency multipliers are operated so that the harmonic output at a particular frequency is deliberately accentuated. The conditions for efficient multiplier service are such that prolific high-order harmonics are usually generated. It is in general better to operate frequency multipliers at low level and build up the final drive power by means of a buffer stage. Receiving-type valves with low anode and screen voltages should be used wherever possible. High-slope pentodes, such as the 6AK5, 6AG5, 6AC7, 6SG7, EF42, EF50, EF80, EF91, EF95, and similar types make very efficient triplers and quadruplers, for multiplier service, and will easily drive an 807, QV04-7, 5763 (or 6L6) buffer stage operating under Class A, B, or C conditions. Receiving-type triodes can also be used and sometimes offer advantages in the shape of reduced odd-harmonic output, where frequency-doublers are operated in a multi-band switched exciter. The 6SL7, 6SN7, 6J6, 12AU7, 12AT7, ECC91, ECC81, are useful valves for this purpose. It was thought that the 6SL7 and 6SN7 should be slightly better than the miniature types from the standpoint of TVI, because of their lowered efficiency at the TV harmonic frequencies, but early tests have not proved this point. Power doublers directly driving a power amplifier stage should be avoided, as they nearly always cause a high



To carry out his TVI-proofing thoroughly, G3BFP provided himself with a harmonic checker unit, as described by G6LX in the October issue.



Half-front view of the G6LX experimental 14 mc transmitter. Note aluminium bonding strips at top and bottom of panel ; copper mesh sides ; shrouded meters ; half-wave filter mounted on top panel.

level of harmonic signal to be passed to the grid of the amplifier stage.

The buffer-stage operating conditions will depend on the amount of drive required by the power amplifier valve. In the case of tetrode and pentode final amplifiers, Class-A operation will usually provide sufficient drive for full excitation, especially if the power amplifier valve is operated as described later. If a triode final amplifier stage is used, it is often necessary to operate the buffer stage under Class AB, B, or C, conditions to obtain adequate drive. In these circumstances the buffer stage should be adjusted for the lowest possible bias and grid current, consistent with the safe static ratings and the output required.

Most valve manuals list operating conditions for Class A, AB, and B modes for audio use, and these data can be followed as a basis for selecting the most suitable method of operation for RF applications. An example of a typical Class-A buffer stage, suitable for exciting a single-ended 813 Class-C power-amplifier stage, is shown in Fig. 1.

The PA Stage

The choice of a power amplifier often depends on the types available from surplus sources, or already in the store cupboard. The low drive requirement of pentode and tetrode types makes them particularly attractive for use in TVI-proof rigs ; in general, however, these types tend *to produce more odd-harmonic output than triodes*, and it is sometimes better to use a triode where trouble is experienced from third-harmonic interference. For example, G3BFP has a well-screened and filtered band-switched transmitter using a pair of parallel 807's in the final amplifier. This transmitter has a very low order of second-harmonic output (under 10 microvolts per metre), while the third harmonic is well above 200 microvolts per metre. A 100-watt triode transmitter also constructed by G3BFP last year, using a single-

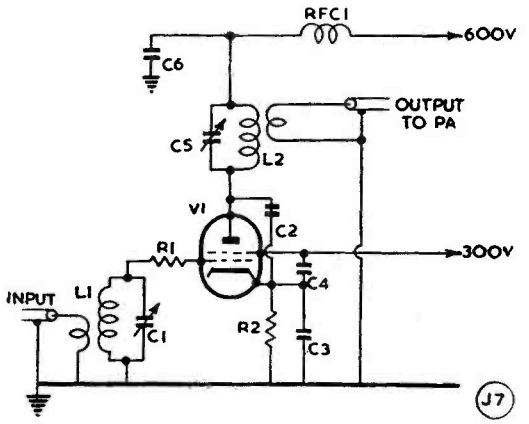


Fig. 1. Circuit for a Class-A buffer stage, the details of which are discussed in the text.

Table of Values

Fig. 1. A Class-A Buffer Stage in a QRO Transmitter.

C1, C5 = 150$\mu\mu$F Variable

C2 = Special low inductance coaxial capacitor, made up of 6in. Uniradio 4, 50 ohm coaxial cable, anode connected to inner, cathode connected to braid (*See* Sketches)

C3, C4 = 0.005 μF ceramic or low inductance mica

C6 = 0.001 μF transmitting type Micadisc, or other low inductance mica condenser

R1 = 100 ohms, ½ watt

R2 = 680 ohms, 5 watt

RFC1 = 2.5 mH RF choke

V1 = 807 or 1625

Coil Table Fig. 1

L1-14 mc : 2.5 μH 10 Turns ¾in. long. Link 3 Turns spaced $\frac{1}{16}$in. from cold end.

21 mc : 1.44 μH 8 Turns ⅝in. long. Link 2 Turns spaced $\frac{1}{16}$in. from cold end.

28 mc : 1.19 μH 7 Turns ⅝in. long. Link 2 Turns spaced $\frac{1}{16}$in. from cold end.

L2-14 mc : 2.55 μH 11 Turns ¾in. long. Link 3 Turns spaced ⅛in. from cold end.

21 mc : 1.5 μH 8 Turns ⅝in. long. Link 2 Turns spaced ⅛in. from cold end.

28 mc : 1.2 μH 7 Turns ½in. long. Link 2 Turns spaced ⅛in. from cold end.

All coils wound with 20 SWG enamel wire on 1in. diameter formers.

ended 812 PA with simple screening and filtering, had a third harmonic output of under 50 microvolts per metre. At this time the 21 mc band had not been allocated, so no measurements were made of the second-harmonic output.

Another similar case was reported recently by G3HLS, who has two separate power-amplifier stages, the first incorporating an HK257B pentode, and the other a 100TH triode. No details are available of the relative harmonic outputs of the two amplifier stages, but it is sufficient to say that the 100TH stage can be operated on 14 mc without producing

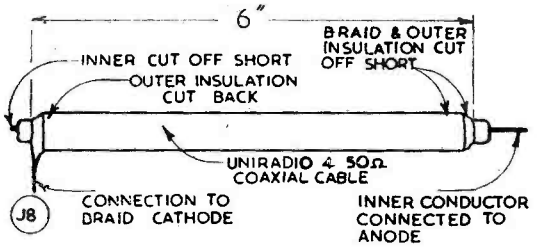


Fig. 2. A coaxial capacitor of the type described by G6LX.

any harmonic interference, while the HK257B unit does produce some interference of this type. G3HLS is located in Farnborough, Kent, about 22 miles SSE of the London television station.

Single-ended circuits for power-amplifier stages are usually to be preferred because, contrary to accepted belief, push-pull amplifiers frequently generate quite high levels of even-harmonic output. When a higher power level than can be generated by a single valve is required, two similar valves can be paralleled.

High values of grid bias and grid current increase the harmonic content of the RF circulating currents in both the grid and the plate circuits. Except for amplitude-modulated telephony service, the power valve can be operated under Class-B conditions with only a small loss of efficiency. This small reduction in output power (about 10%) will not be noticeable on the air, but the benefit of lowered drive requirements and harmonic output will be quite considerable.

If Class-C operation is essential, where the final amplifier is being modulated for AM telephony service, the bias voltage can be reduced to a level just sufficient to ensure satisfactory linearity of the modulated stage for 100% modulation. This point is usually slightly beyond the value needed to cut off the valve

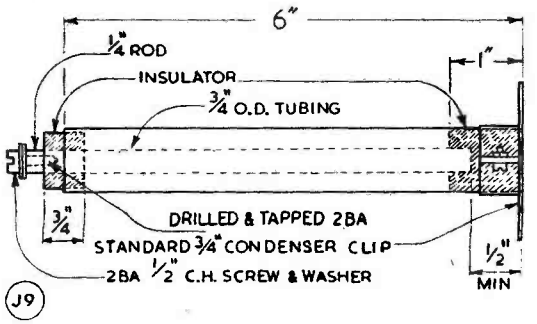


Fig. 3. A linear capacitor suitable for working voltages up to 1250 modulated DC. Metal can be copper, brass or dural, and the insulators should be of polythene or similar material, and made a tight push fit into the tubing and round the inner rod, as illustrated.

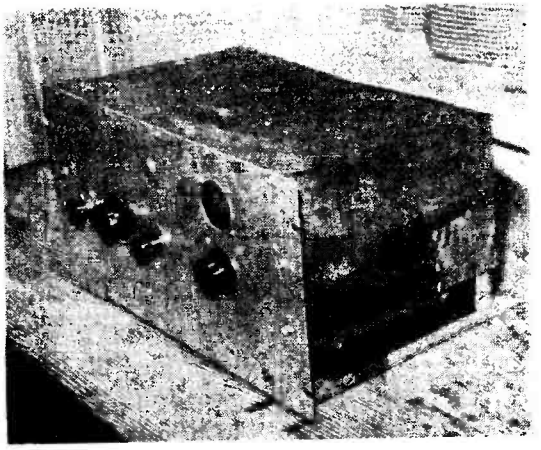
under static conditions. The grid current should be kept to the minimum that provides satisfactory operation, and this should be done by adjustment of the drive in an earlier stage, *e.g.*, by varying the screen voltage ; de-tuning the amplifier grid circuit, or under-coupling, may increase the harmonic output, and so should be avoided.

RF Power Amplifier Circuits

It has been pointed out that the anode circuit of a Class-C amplifier contains harmonic components despite the fact that the input signal may be completely harmonic-free, and that these spurious components are generated within the valve. The circuit arrangements of commonly used power amplifier stages are described in the various Amateur Radio handbooks. Fundamentally, all these circuits perform well in their intended role of amplifying RF drive and providing means of coupling to a load circuit, but unfortunately they do not all have the same degree of harmonic attenuation. In order to consider this point in detail, let us examine the closed-circuit path of the anode current flow through a typical amplifier stage. The anode current will flow from the anode of the valve along the internal connecting wire to the anode cap, and then *via* various routes to the external filament or cathode lead, and so back into the valve. The harmonic components of the anode current will always take the lowest impedance path back to the cathode: this is not necessarily the shortest or most direct route. The internal connecting wire running from the anode to the valve cap is usually of very low inductance. The connection from the anode terminal to the tank circuit depends on the individual stage layout: if this lead is long, it can offer appreciable impedance to the harmonic components of the anode-current flow, and if the reactance of the capacity to earth of the lead is less than the inductive reactance, the harmonic current will flow through the capacitance to earth. If, however, the lead is short and of low inductance, the harmonic current will flow to the tank circuit. The spurious components will always flow through the tank condenser in preference to the tank coil, since this presents a high impedance. If the tank condenser is of the low-inductance type, the harmonic will pass on through the blocking or by-pass condenser back into the cathode. If this tank condenser has inductive reactance as well as capacitative reactance, the condenser may offer a high impedance to the harmonic content, and a sizeable voltage may be developed.

The length of the leads forming the grid/cathode or anode/cathode paths is very important, since their inductance combined with the valve capacitances may resonate near a transmitter harmonic frequency, which will then be tremendously increased in amplitude. The VHF resonance points can be checked by coupling a grid-dip meter to the anode and grid leads ; if a resonance is found, the lead lengths should be modified to raise the resonant frequency. Flat copper strip can be used instead of wire connections to reduce the lead inductance, and quite often this change will be sufficient to move a resonance clear of a transmitter

The JAN specifications for some types of transmitting valve do not lay down tight limits for cathode lead inductance or output capacity,



A view of the G3BFP TVI-proofed transmitter for 21 and 28 mc working. At 130 watts input, there is less than 10 microvolts per metre of 2nd harmonic output from 21 mc. Copper mesh screening is used.

and these differences can have a considerable bearing on VHF circuit resonances. The 807 specification allows an output capacity of between 5.3 and 8.7 $\mu\mu$F, and the 813 specification between 10.5 and 17.5 $\mu\mu$F. No cathode-lead inductance figures are given for either type.

To quote a practical example of the damage that these changes can cause, the writer recently had occasion to replace the 807 Class-B buffer amplifier valve in an experimental 14 mc transmitter. Soon after the change was made, a TVI complaint was received, and on checking it, was soon obvious that the trouble was due to excessive third-harmonic output. Actual field-strength measurements showed that the 42 mc harmonic had increased from under 30 microvolts per metre to nearly 1 millivolt per metre (nearly 33 times). The anode circuit of

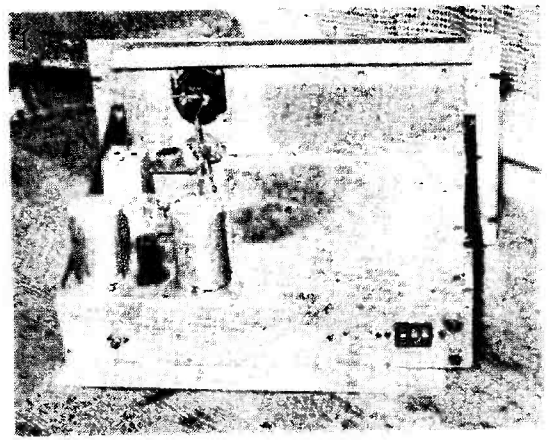
the buffer stage was checked with a grid-dip meter and a resonance was found at 43.5 mc. The discarded 807 was replaced and the VHF resonance was found to be around 55 mc. Several other 807 valves were then tested in the circuit, and the VHF resonances appeared to be within the range 40-69 mc. depending on the make of 807 !

This difference of output capacity and cathode-lead inductance may account for the occasional report of a harmonic-free transmitter causing trouble when a valve is changed.

Every effort should be made to provide a low-impedance path for the VHF harmonics from anode to the cathode of the valve. It is important to keep the impedance between the rotor of the tuning condenser and the cathode as low as possible, since harmonic currents flowing between these points cannot very well be kept out of other points of the circuit, where they may cause trouble. One method that can be used is to mount the condenser frame directly on the chassis as close as possible to the point where the valve cathode is earthed. The valve holder should be mounted on a sub-chassis above the main chassis so that a short low-inductance connection can be made from the cathode pin to the chassis. When the socket is mounted in this way the anode/cathode current does not follow a roundabout path.

In the case of low-frequency transmitters operating in the 3.5 or 7 mc bands, it is often difficult to provide short return paths from the anode/grid to the cathode, because of the size and construction of the circuit components. This difficulty may also apply to high power 14 and 21 mc transmitters if the circuit components are of large size.

To obtain a short return path under these circumstances, it is often necessary to use a special fixed condenser of the tubular or vacuum type, connected directly between anode /grid and cathode. These capacitors can be constructed using short lengths of 50-ohm Uniradio 4 coaxial cable, or by making up tubular condensers with short lengths of brass, copper, or dural tube. Details of suitable condensers are shown in Figs. 2 and 3. The 50 $\mu\mu$F vacuum condensers found in the ARC5 series of "Command" aerial coupling units are excellent for this purpose, if the large shunt capacity can be tolerated when calculating the tank-circuit constants for the correct L/C ratio. Several transmitters using these surplus condensers have been described in American publications; a typical example is a 28 mc 150-watt Phone/CW rig designed by Rand, W1DBM, and described in the April, 1951, issue of *QST*. The present experimental 14 mc transmitter at G6LX uses one of these capacitors as a fixed tank condenser in a combination Pi/L network, in conjunction with a variable inductance, the value of 50 $\mu\mu$F being just right for the voltage/current ratio in use.



Another view of the G3BFP 130-watt TVI-proofed transmitter, with the outer copper mesh cover removed.

The South London Group have for some time been experimenting with Pi and combination Pi/L networks as tank tuning elements. Several transmitters have been constructed, and so far results indicate that these circuits are superior to the more normal types, for harmonic attenuation. Certain difficulties exist, however, when these circuits are used with triodes, owing to the difficulty of obtaining exact neutralization with valves having a large grid to anode capacitance.

Trap Circuits

Much has been written in recent years about the use of parallel-resonant traps installed in the anode circuits of the driver and final amplifier valves. Under favourable circumstances an anode trap will provide some measure of harmonic attenuation, providing it is so arranged that it will not couple electrically or magnetically in phase with other parts of the tank circuit. This last point has not been made clear in previous articles dealing with this subject, and may explain why traps often tend to increase rather than attenuate the harmonic to which they are tuned ! Trap circuits can also be potent radiators at their resonant frequency, and this can give misleading results during adjustment.

A series-resonant L/C trap connected between anode/grid and cathode has also been

suggested by some writers, and is quite effective for attenuating a particular harmonic. However, its use is not recommended since it can resonate with the lead inductance of other circuit components and cause parasitic oscillation.

Trap circuits are, of necessity, fairly high Q, and must be adjusted even when a small change of fundamental frequency is made. Since harmonics can be attenuated by other means, the use of trap circuits in a transmitter is not recommended.

Universal Aerial Coupler

CONSTRUCTION AND OPERATION

W. N. STEVENS (G3AKA)

This article describes a very useful switched coupler unit suitable for feeding almost any type of aerial from either single-ended or push-pull RF amplifiers. The form of construction as illustrated here can easily be adapted for alternative layouts, as may be required in particular cases.—Editor.

ENVISAGING the testing of various types of aerials, on various bands—previously denied due to extremely cramped conditions at the QTH from which the writer has recently moved—better arrangements for aerial coupling seemed necessary.

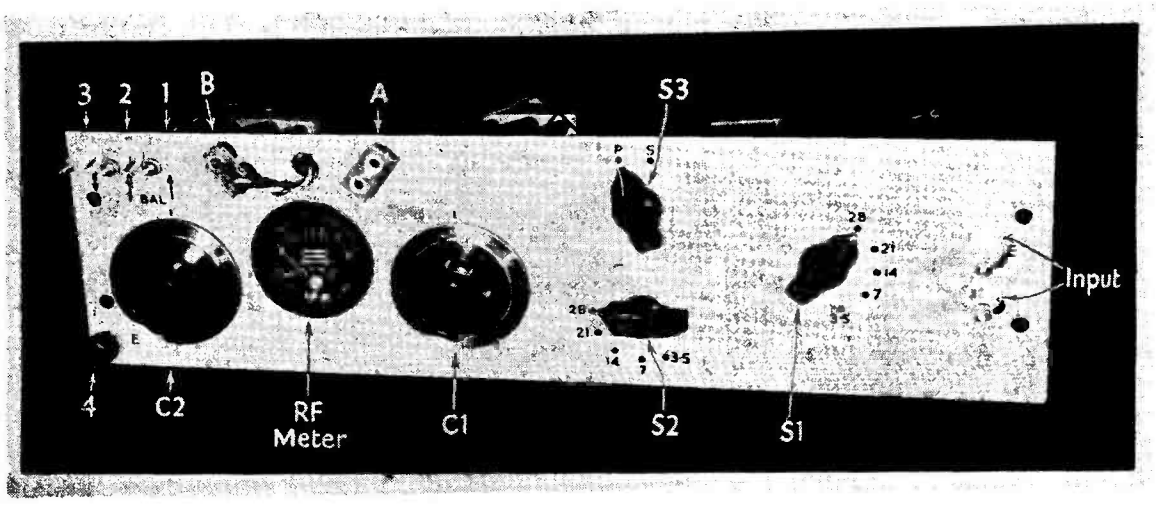
The coupling unit in mind would have to provide for series and parallel tuning, for use with long wire systems worked against ground and balanced aerials of various kinds. And the necessity for plug-in coils and the need for odd crocodile clips had also to be dispensed with somehow.

In all such types of coupling unit there is bound to be some compromise, but in the design described here this is more than offset by the convenience and versatility of the unit.

No provision is made for 1.7 mc, as this was not necessary at the writer's QTH—the Top Band rig has its own aerial coupler incorporated. Although this simplifies the unit, some readers may wish to include a 1.7 mc range and details for this are given for those wanting such facilities.

The circuit diagram of the coupler is shown in Fig. 1, the inset outlining the basic arrangement; in this, the PA link coil is part of the loading coil, both of which are tuned by the condenser. This obviates the need for a separate link coil at the coupler end which is a great advantage where multi-band operation is called for, and also enables a simpler switching system to be used in the coupler. Using this feed system it will be found that the PA link can be made smaller than usual—suggested sizes are given later.

Originally, it was intended to use just one coupling coil, tapping it at appropriate points



The panel appearance of the G3AKA Aerial Coupling Unit. The layout and general arrangement could be modified to suit particular requirements.

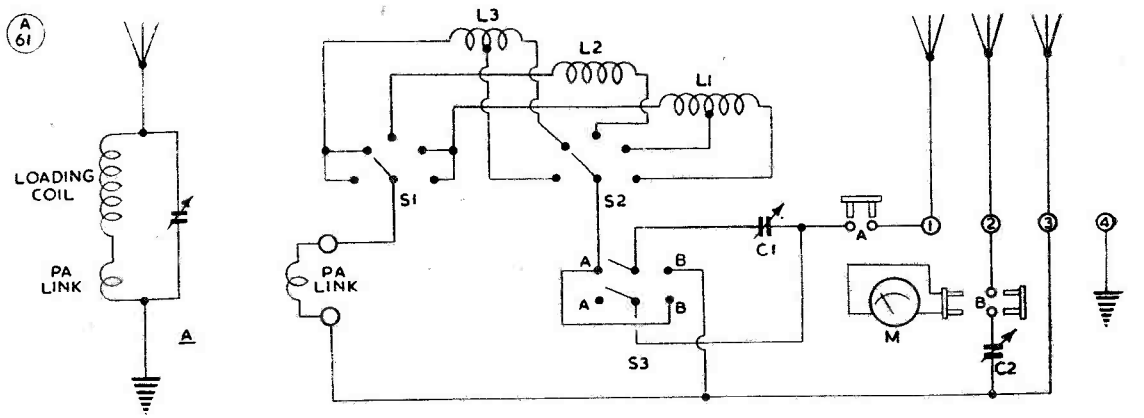


Fig. 1. Circuit of the Aerial Coupler Unit described in the text and illustrated in the photographs.

for band selection. Although the idea works reasonably well in practice, the writer has never liked the thought of all that RF playing around in the section of the coil not being used. Whether this is left "floating" or is shorted out (making a closed circuit) there will be plenty of RF making merry in the unused part of the coil. That, of course, is the advantage of plug-in coils.

However, having decided *not* to use plug-in coils, a compromise was arrived at, using three coils for the five bands. The first coil tunes to 3.5 mc, with a tapping for 7 mc; the second covers 14 mc only; the third covers 21 and 28 mc. Although this worked out nicely, since the writer is interested mainly in 3.5 and 14 mc (both of which use the full coil provided), it seemed to be the *only* way taking into account the space available.

Two switches are shown in the diagram for range selection (S1 and S2) and indeed they are used in the model being described. It would be more convenient, however, to use ganged switches: the writer was not able to find suitable components at the time—plenty of five-ways but none suitable for ganging, and no five-way two-pole types. Others may be more fortunate in their "shopping" or may have the specific types in the spares box. Those used in the original model came from TU-10-B units and are of the necessary heavy duty type with really sturdy contacts. The latter is the important point in the selection of the switch to be used.

The switch S3 enables the coil to be either series or parallel tuned, position A for series and B for parallel. In the application of this coupler for Marconi type aerials, terminals 3 and 4 are joined together by a shorting link, thus earthing the system. Fig. 2 shows some of the applications of the unit with different types of aerial and it will be necessary to refer to the diagrams in conjunction with the circuit.

Switch Motions

For instance Fig. 2 (a) and (b) show the basic circuits as used for parallel and series tuning of an end-on aerial, already described. When used to parallel-tune a Hertz aerial, Fig. 2 (c), the feeders are taken to the output terminals 1 and 3, and S3 switched to the B position. In series tuning a Hertz aerial, Fig. 2 (d), the feeders are connected to terminals 1 and 2, and S3 switched to the A position. Other combinations are obvious. Terminal 3 is shorted to terminal 4 in any arrangement using a grounded aerial system and is disconnected on any Hertz type system.

Having only one RF meter to spare (and panel space being crowded anyway) a plug-and-socket arrangement was adopted. The meter can be plugged into position A or B as desired; the vacant socket is shorted across with a shorting plug. Although a reading at position A would be sufficient with some types of aerial, in cases like the Zepp the two positions are necessary to indicate correct balance. The second condenser C2 may not always be required in the series tuning arrangement and this can be dispensed with to simplify the unit. The distribution of current

Coil and Link Data

COIL	TURNS	SPACING	LINK TURNS
L1 (3.5 mc)	35	close	4
L1 (7 mc)	20*	close	3
L2 (14 mc)	10	one turn	2
L3 (21 mc)	5	one turn	1½
L3 (28 mc)	2½*	one turn	1

(* *tapped from link end of coil*)

S1 positions: 1—28 mc; 2—21 mc; 3—14 mc; 4—7 mc; 5—3.5 mc.

is the same with one or two series tuning condensers but the second was included as it is useful in balancing stray capacities in the coupler unit and in shifting the voltage node to an optimum point on the loading coil.

Construction

The complete unit is built on to a panel measuring 19in. x 6in., which is bolted to a metal housing completely to screen the unit. Rack mounting would be suitable. The general disposition of components can be clearly seen from the photographs, so there is no need to elaborate on details.

The input terminals are ceramic feed-throughs, as are the output points. The coils are mounted on ceramic stand-offs; the switches and variable condensers are also, of course, of ceramic insulation. The two smaller coils are air-spaced with polystyrene spacers to give support to the coil shape and the large coil is wound on a 1¾in. diameter former. All coils are wound with 16 SWG wire.

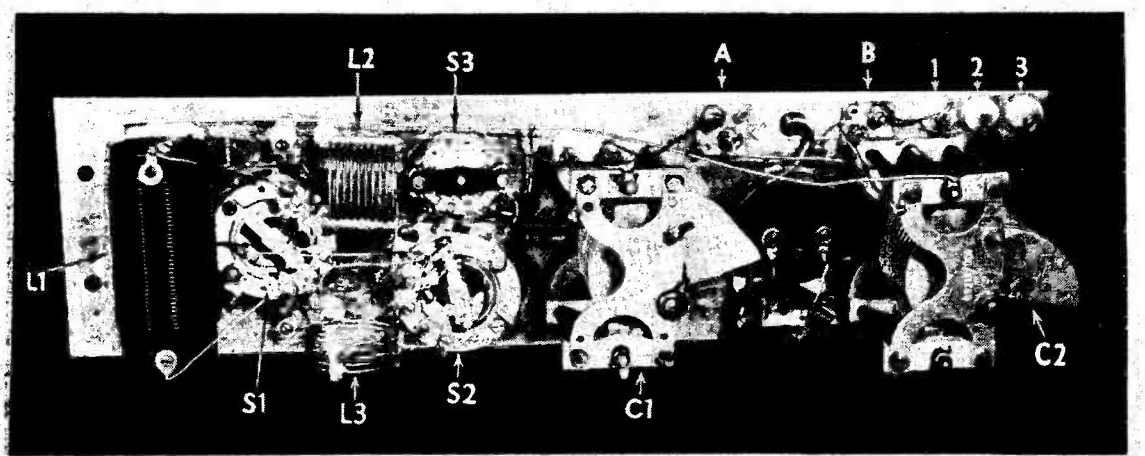
The plug and socket arrangement for the RF meter was fabricated from an odd strip of polystyrene and standard plugs and sockets. A square inch of polystyrene drilled to accommodate two sockets and two fixing bolts provided one socket holder. The meter lead feed-through was simply a piece of polystyrene drilled to suit. For the meter plug, two plugs were fitted to a short piece of polystyrene, the leads wired in, and then "cased in" with another similar piece of insulant fixed with dope. Actually, one strip of polystyrene could be used for both sockets and meter lead feed-through, but a suitable strip was not on hand at the time—this would, however, simplify matters. The shorting plug was made up with a small piece of paxolin and two plugs wired across.

Since the circuit is not always earthed, as in Fig. 2 (c), (d), (e), the rotors of the variable condensers must be insulated from the metal panel—the whole housing itself being earthed for obvious reasons. The two variable condensers available were of the three-bolt fitting and as these were connected to the rotor end-plates they could not be directly bolted to the panel. This was overcome by fitting the condensers to two stout pieces of polystyrene (salvaged from two unused receiving type variables) and then bolting the strips to the panel, making sure that the condenser bolts were well countersunk into the insulating material.

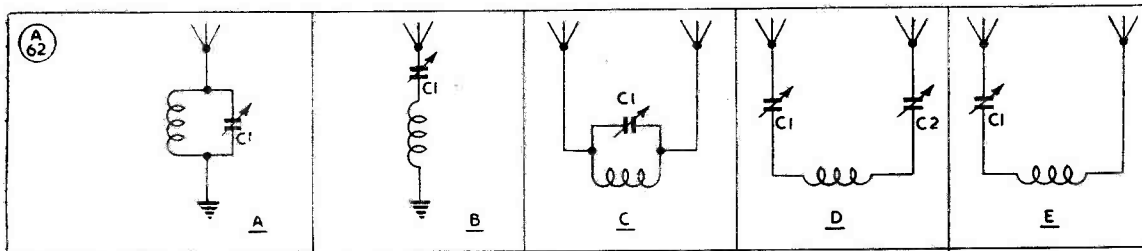
Setting Up

Winding details for the coils are given in a separate table and also details for the PA links. These figures must not be taken as final, for whilst they were suitable in the model as illustrated, some slight modification will almost certainly be necessary in other versions due to different circuit capacities and similar variations.

With the PA tuned for minimum dip and the link loosely coupled, the coupler is adjusted for maximum aerial current, taking note of the PA anode current reading. The link is then slightly increased (about a turn) and the process repeated: it is then decreased



Rear view photograph of the Universal Aerial Coupler, with all main parts identified.



	A	B	C	D	E
S3	B	A	B	A	A
M	A	A	A/B	A/B	A
3 & 4	JOINED	JOINED	DISCONNECTED	DISCONNECTED	DISCONNECTED
OUTPUT	1	1	1/2	1/2	1/3

Fig. 2. Switching makes possible these five different modes for coupling in the aerial.

(about a turn, also) and retuned. This will indicate whether more, or less, turns are required for optimum "draw" and it is well worth taking the time to get things operating at full efficiency on each of the bands to be covered. The link, incidentally, should be about half to three-quarters "in" the tank coil for correct loading.

If 1.7 mc is contemplated the most convenient method is not to increase the size of the largest coil but to parallel another variable (which can be pre-set behind the panel) across C1: it should have a capacity of about 250 $\mu\mu$F and, with the main variable C1 set to about mid-capacity, adjusted for optimum draw. Then C1 is used for subsequent tuning adjustments.

There may be difficulty in tuning the 21 and 28 mc bands, particularly the latter, if the variables used have high minimum capacities. Should this difficulty be experienced by those wishing to use components to hand, one suggestion is the switching of a low value pre-set condenser in series with C1 (and C2 is desired) to reduce the minimum capacity to a value which will enable 21 and 28 mc to be tuned correctly.

The coupler can be used equally well with a single-ended or a balanced RF amplifier. If used with a single-ended stage the link should be taken to the low impedance end, as in normal practice.

To avoid undue losses, the three coils should be fairly well spaced. Note in the photograph that L2 is on a different axis from L1 and L3. The coils should not be placed much closer to each other than shown—at least one diameter.

DRILLING THROUGH GLASS

There are several ways of getting aerial connections through windows—squeezing the lead in the jamb; drilling the window frame; putting in a dummy wooden pane; fitting a perspex pane and drilling neatly through that; or drilling the existing glass panel. This latter method has now been made much easier by the new "Mason Master" Type A drills, which have a specially shaped point of tungsten carbide which will bite into the hardest glaze. These drills can be used with any ordinary hand brace or electric drilling tool; prices and sizes range from 6s. 6d. for the $\frac{1}{8}$in. dia. drill to 10s. 3d. for the $\frac{1}{2}$in. size. If not available from your local ironmonger, the manufacturers are: John Perkins & Smith, Ltd., London Road Works, Braunston, Nr. Rugby.

DX ZONE MAP

There is a steady demand for the third reprint of our *DX Zone Map*, which gives the keen DX man all the essential information about the Zone areas and the prefixes comprising each zone. A five-colour map of the world drawn to a great circle projection centred on the U.K., the *DX Zone Map* is designed for wall mounting and is a handsome addition to any station. The price is 6s. post free, of The Circulation Manager, Short Wave Magazine, Ltd., 55 Victoria Street, London, S.W.1.

CARDS IN THE BOX

We are without forwarding addresses for the stations listed below, for which we are holding card(s) at the Bureau. Please send a large stamped addressed envelope, with name and call-sign, to: BCM/QSL, London, W.C.1—which is a full and sufficient address from any part of the world, guaranteeing delivery of G and SWL cards. If publication of the call-sign/address is required in our "New QTH" feature, and subsequently in the *Radio Amateur Call Book*, that should be mentioned when claiming the cards. As the G department of our QSL Bureau is cleared at regular fortnightly intervals, there may be a few days' interval before the cards are sent off.

G2BTL, 3ACZ, 3BKX, 3BVU, 3CKA, 3DDO, 3DUS, 3DWA, 3DWE, 3EFT, 3ESF, 3FWI, 3GFZ, 3GSS, 3GTK, 3HBC, 3HWF, 3IAO, 3IDV, 3IFS, 3IFW, 3IJX, 3IKE, 3ILF, 3ILN, 3ILT, 3ILX, 3IMP, 3INB, 3INS, 3IOI, 3IQK, 3IRL, 3ISM, 3IWC, 3IXX, 3JPG, 5CC, 8WZ, GD3GMH, GI3HHM, GM2FNF, 3FIU, 3FNR, 3IKD, 3JDR, GW3AP, 5JI.

DX COMMENTARY

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

VE6MN

LAST month we opened by saying that we always seemed to start writing this Commentary in a spell of dismal DX conditions. This month things have reformed, and we are writing immediately *after* a very brilliant spell, but we are too busy at present to keep running into the shack to see what's happening! Suffice it to say that for the two or three days preceding this, all bands have been behaving themselves; the 21 mc band has even been open to W6 as late as 1800 GMT.

The *CQ* Contest (Phone half) was blessed with very good conditions—round about October 22-28 they were excellent in patches. Then the CW half (November 1-2) saw a bad falling-off, although high activity does a lot to compensate for poor propagation. For a week or so they remained poor, but by November 11 the WWV code was back from 4 to 7 again, and the North Atlantic path was wide open — together with most of the others.

It is obvious that although the general level is still low, the occasional peaks bring us up almost to the level of 1949 or even 1948 — but they don't last long enough!

The DX on 21 mc

The 21-mc band has been very interesting, but still suffers from lack of activity. Most afternoons the W's have been banging in, and their numbers are increasing steadily. Mornings see the odd VK around, sometimes with really good signals. VK2AWU, 2ANN, 4EL, 4FJ and 4HR have been among the best. No more ZL's have shown up since the odd QSO's with ZL1AH last month.

G6QX (Hornchurch) slung up a 45-ft. Windom and began to get the DX right away. His list (ZE, ZS, TA, PY, LU, CR7, VP9, 4X, FF, W and VE) is representative of the stuff that comes through most days. G5FA (London, N.11) has raised VK4HR and ZL4GA—making him WAC—and others were TA, VE3 and the usual oddments.

G3FXB (Hove) worked 11 Zones and 13 countries during the Contest (CW), but nothing new among them. G3GUM (Formby) spends a lot of time on the band, and among his best are ZD9AA, 3V8AN, VK4HR and KV4AA, with ZD7A and BP7NM as Star Gotaways. 'GUM notes (and others confirm) that the extra 200 miles north makes all the difference between a 579 QSO and a 329 Gotaway. European stations (and even those in Southern England) can hear and work all sorts of stuff that doesn't percolate into the North. (All the same, note scores in Marathon—G2BJY, 3GUM and 8KP are all located well North.)

G8KP (Wakefield) lists TA, KP4, FF8, EA9, CR7, TF and others. G3BKF (Witham) is fully TVI-proofed on 21, as well as other bands, and worked ZD7A and ZD9AA, the latter several times. G5BZ (Croydon) lists ZD7, ZD9, VK, W6, KZ5 and VP9.

G2BJY (West Bromwich), now at the head of the ladder, except for W4COK, found some of the good patches very good, and on October 21 at 1015 GMT he called CQ and found a queue of VK2's waiting for him, all anxious for their first G contact. Nice QSO's were ZD9, ZD7, HE9LAA, CR7, KP4, FA, OQ and many others. He also heard AP2L, VP9BF and ZS3K.

New ones for G6QB during the

CALLS HEARD, WORKED AND QSL'd

month were CO2MO (1830), 3V8AN, ZB1, AP4UN (1100), ZD7A (1540 and 1100), VP9BG, CE3AG and KZ5BS. GC3EML (Jersey) added VE and CN to his score.

Other news of the band comes from W4COK, who has worked 59 countries thereon (55 of them since July 1). During the *CQ* Contest he raised VR2CG and ZK1AA; later he heard a W5 calling AC3PT. Others worked were EA9, ZP and VP7. W2WZ raised KA2KW, ZD7, FF8 and ZS3, and quite a few W's worked VS2CH. TA3AA holds the record both for his signal-strength and his key-clicks on the band; during the Contest he was stronger than any local station on any band, and at one time his clicks were audible from 21000 to 21150 kc! (It is only fair to add that he has since been heard *without* them.)

All this adds up to a very interesting state of affairs on 21 mc, which is bound to get better and not worse. But why does everyone squeeze in between 21000 and 21050? The QRM there is quite bad at times, with 400 kc of vacuum higher up for the asking. And we have a hunch that when conditions become really good (especially on the North Atlantic path) the QRM is going to be something really out of this world.

LATE FLASH: G3DCU and G3FNJ parted in London, N.W.6, some 18 months ago. Now, as VK2AWU and ZC4RX, they have just met on the 21 mc band for the first time.

21 MC MARATHON

(Starting July 1, 1952)

STATION	COUNTRIES
W4COK	55
G2BJY	53
G3GUM	51
G8KP	50
G6QB	48
G5BZ	37
G2YS	37
G6GN	36
G8OJ	32
GC3EML	31
G3FXB	30
G6QX	22
G5FA	20
G3ABG	17
G2DHV	6

Top-Band Topics

We put One-Sixty next in order of importance, because Things are Happening. In a separate panel we give the dates and full operating procedure for the Top Band Transatlantics; no standard log forms are being provided this year, because all that we want in your reports is a list of times, call-signs and RST. The big news is that the W's are breaking through *already*—earlier than ever before, and that W1LYV worked GW3FSP and G6BQ on November 9, around 0600 GMT.

W8BKP promises to appear shortly, according to G3BKF. WØNWX, formerly W4NNN (Newton, Iowa), writes to say that he will be on with an 1100-ft. wire anyway, and that after the last golfer disappears on Saturday afternoon he intends to have a further 970-ft. or even 1240-ft. running in the opposite direction. He hopes to make the first WØ contact with Europe. (Incidentally, SWL G. C. Allen's reception, last year, of WØTQD is now fully confirmed and certainly constitutes a record for overland reception on the 1.7 mc band.)

Coming back to more local working, we were very pleased to forward WABC Certificate No. 1 to GI3HFT (Belfast). He turned in cards for QSO's with 39 English counties, 14 Scottish, 4 Welsh and 3 Northern Ireland. Others are known to be quivering on the brink, but getting the cards seems to be harder than working the stations. WABC No. 2 is sitting all ready to be filled in—who will claim it? Meanwhile, all congratulations to GI3HFT, the pioneer in this line.

One of those toeing the line is G2NJ (Peterborough) — held up for QSL's. He tells us that G5PP/P, having provided us with Westmorland, has now taken a Tx into Rutland and obliged with

The 14 mc ground plane aerial at G6TJ, Malvern. The vertical section is of steel rod from a tank aerial, and there are three radials. Feed is by 75-ohm coax matched into the base of the assembly.

another rare one. 'NJ has worked HB9HT and has heard OK31A calling UQ2AN on the band.

G2BOF (Sutton) has worked 59 of those 60 counties; he recently called CQ GM and back came OH7OH! He has also heard ON4 calls on the band—but they are definitely *not* licensed for 160.

G8KP raised 56 counties in his first 17 days on the band, starting in late October; others worked were OH3NY (ten times), OH7OH, HA5BT, OK's and HB9HT. On November 9 he heard W1LYV at S7. 'KP says "Agitate for some more DX up here—how about ZC4, CN2 and the rest?" OK—we agitate, here and now; will anyone reading this make an effort to put themselves on this band right away? They will find no lack of potential contacts.

G3NA (Hereford) has come back to the Top Band after two years, the manners of the HF band occupants having driven him away. His very first QSO was with GM3JDR (Caithness), a former SWL who used to send out very fine reports to 160-metre

stations. If you want Hereford for WABC, look out for G3NA every Monday and Thursday, 1830-2030 GMT on 1890 kc. He is not VFO and will listen QMF (and if you don't know what that means you ought to, so we won't explain). 'NA has a 10-watt licence, just as in pre-war days, and doesn't run more than five of them; he uses a 132-ft. aerial tuned against earth, and a TRF receiver.

Another W who will be looking hard for G's this winter is W2QHH (Hamilton. N.Y.), who has worked GW but not G. He wants it desperately to help towards his *Magazine DX Award*.

GM3OM (Stirling) made a QRP contact with G2QX (Luton), the latter using 2 watts. GM3OM went down in steps from 10 watts to 0.5 watt, signals falling from 569 to 549 in the process. He gives the following list of active Scots for the benefit of WABC-strivers: — GM3FSV (Orkney), 3CZC (Argyllshire), 3JDR (Caithness), 8FM (Midlothian), 2CAS (Kincardineshire), 3GAY (Banff), 3HXT (Morayshire), 3GUS (Fife), 6FB (Renfrew), 3EDU (Dumbartonshire). Also he adds that OH3NY is most anxious to make his WABC and appeals for QSL's from all stations worked.

Concerning recent asides in this "Commentary" about amateur chatter and the lightships, G6LB (Chelmsford) says that some of the remarks emanating from the latter have made him raise *his* eyebrows at times; they don't seem to appreciate the fact that they are not on a telephone circuit, but broadcasting for all to hear. (All the same he makes no excuses for any amateur who parks on them and causes unnecessary QRM.)

So much for Top Band, which is becoming a very lively feature of this column and attracting more and more support each month. It still has the old-time friendly atmosphere, although we have heard one or two hints of the cosh-boys moving in — but let's hope we can cope with *them*.

The DX on Twenty

We are not going to list all the odd bits of individual DX that people have been working on Twenty; the band remains much as usual, and everyone who uses it knows more or less what goes on. Here are a few of the more unusual stations, with a credit to the correspondent mentioning them as either heard or worked.

FB8BE and VK6GU have been around (G6QX); ZD7A was very active, but has of course left and should by now be in this country; QSL's to ZS6GV (G3GIQ, London, W.5); KH6ARA (ex-W2AIS), FP8AP, C8KP (?), F9JD/FC (G3FJU, Welling); KX6AI. LB6XD, EQ3TT, FK8AB, C3AR and C8KP (EI4X, Dublin); SV5UN, KA2OM, PJ2AD (G3FXB); MP4HBK, Oman, EQ3TT, FY7YB and PZ1OY (G3GUM); VP5BF, Turks Is. (G5BZ); ZS9I (G2DPY, Shoreham, gave him his first G QSO).

That's the shortest possible summary of the DX that seems to have been available. Now for a few individual remarks about the band. G8UA (Burnley) came up with an indoor dipole in the loft and fed it with 65 watts from a T20. On this he worked W and VE, CO, EQ, EA8 and 9, TF, FP8 and the like; G8UA reports this "to encourage fellow-sufferers" who are confined to indoor aerials. He asks us to print, if possible in large red letters (sorry!), that the signal VA is grossly misused; time and time again people sign off with it and then come back again to the same station. This, of course, causes a lot of bad feeling, because anyone else is perfectly entitled to call the DX station you have just *signed off with* if you have sent it. If the DX station is expected to come back with his fond farewells, don't send it—use K. Keep the VA for your *final*. (And look up the meaning of "final" in any good dictionary, if you have forgotten it.)

This is, without doubt, the very sloppiest piece of amateur procedure, and it's been going on for years and years! It's just as bad as that terrible "Overoffanclear" phenomenon.

G3IHI (Swindon) suggests that DL2SU's difficulty in getting out with a B2 is due to the aerial. When 'IHI was a ZB2 he found

TOP BAND TRANS-ATLANTIC TESTS 1953

DATES AND TIMES: December 28; January 11 and 25; February 8 and 22. From 0500—0800 GMT daily.

FREQUENCIES: W/VE stations mostly in the band 1800-1825 kc, but others also in the bands 1875-1900 and 1975-2000 kc. British stations in the band 1750-1800 kc *only*.

PROCEDURE: W/VE stations call at the hour, ten minutes past and so on—*i.e.* at 0500, 0510, 0520, etc.

British stations call at five, fifteen and twenty-five minutes past—*i.e.* at 0505, 0515, 0525 and so on.

British stations should not on any account operate in the W/VE band of 1800-1825 kc.

NOTES: From past experience it has been found that British stations tend to congregate too near to 1800 kc, whereas many more would have been logged had they spread out over 50 kc or more.

Long CQ calls are not encouraged, but if they are given, the call-sign should be sent more often than the CQ—for obvious reasons.

It is preferable to wait for the end of a W station's five-minute call and then to reply to him (not necessarily for the full five minutes).

Watch W1BB, who usually sends lists of British stations heard and much other useful information.

LOGS: After each section of the Tests, please send a list of stations heard or worked, simply giving time, frequency and RST.

Further details will appear in the January and February issues.

that a 68-ft. end-fed aerial simply would not work with a B2; as soon as he converted it to a centre-fed dipole he made WAC.

Just as we were wondering why VE2J1 was always louder on our northerly long wire than the westerly one, G3GUM's letter turned up. He informs us that VE2J1 is 'way up on Hudson Strait, 1000 miles from the nearest town and isolated from the world for several months. He is VE1AAS, and an op. at one of the weather stations. Incidentally he is in Zone 2.

EI4X has no use for beams or long wires and uses a ground-plane aerial on Twenty. He finds it does a fine job and recommends it.

Phone Section

We still receive very few reports of Phone DX on Twenty (or any other band) but GM2DBX (Methilhill) obliges again. He even wondered whether we were suppressing the phone correspondents, but we shouldn't do a thing like that. Recent phone contacts were with FM7WF, VP6SD, CE2CC, TI2TG, TF5TP, VP7NT and VP9TT. 'DBX is still looking for a VE8 in Yukon for his WNACA, also an XE who will QSL for 36 Zones confirmed. QSL's received recently were from CR4AG, HC1FG, KZ5AB, AG2AF, VS2DL and KA2OM. Of 101 countries worked this year on phone, 'DBX has 72 confirmed.

G3FXB has also been plying the mike as well as the key; he has worked KG4AF, KA2OM, TI2TG, EA9AR, EA6AR, HZ1MY, CR6BW, YV5AB and quite a few others.

No, we're neither pro-CW nor anti-Phone—but the fact remains that the great bulk of the DX *is* worked on CW. So it's up to the phone minority to blow their own trumpets a little louder. We will be glad to report their doings, if they tell us about them.

The DX on Forty

The much-maligned Forty has been yielding some good DX, especially during the recent Contest. New ones for several people (on CW) were IT, TA, VP5, FF8 and SV5. Others were also heard on the band. G5FA snagged ZE3JP. ZC4's and the like, and reports SV5UN as working "ZD9AB" — a pretty obvious phoney, surely?

G3FXB did well with CE3AG, VQ4, HZ, JY, ZE, FF, KV4 and other nice ones. Heard but not worked were ZD2DCP, PJ2AD, VP9BF and ZS's. G8KP likewise pulled out the odd plum, such as CE's, ZD4, CT3, YV, VP4 and 9, LU, ZE, ZS and so on. Quite a band, it was!

G3BKF has been specialising in Forty technique and comes out of it with VP8AP (0630), OA4ED (0700), VP4LZ (2245) and many others. He says that the band is often open when one wouldn't imagine it, and that lack of DX activity is what makes it dull. ZL4JA told him that he hears Europe most evenings (our time). 'BKF can notch up a total of 102 on the band now.

G5BZ worked most of the worthwhile stuff during the Contest, and so did a few other reporters, who just say this and don't comment on anything or anyone in particular.

Activity on Eighty

Who should pop up on this band during the Contest but ZD4AB, skedding with G6KP, who couldn't pull him through local key-clicks. He has since been heard several times. G5MP (Hythe) logged 38 countries on the band, and worked 33 of them, including KV4AA, OX2KK, VP9BF, EA9, FC, Trieste, ZC4, 4X, 9S, W's and VE's. Gotaways were ZD4AB, ZS's and two KZ5's. He wonders whether anyone has worked all W districts on Eighty this past year or so, W7 being a difficult one.

G3BKF says ZL's have been workable almost every morning, with W's, VO1P and the like at night. G3FXB netted F9QV/FC, TA, CN, 4X, CT3, EA9 and VP9BF, and VE1ZZ called him one night after a local QSO.

Ten-Metre Doings

After a fine uplift last month our Ten-Metre correspondents have died on us again, the only real report coming from G3GIQ (London, W.5). On phone he has raised CR4, CR6, CX, EA8, LU, MI, ZS7C, ZD7A, ZS9G and the usual South Africans. But he does think conditions have fallen off once more. During the Contest he could hear VU, Africa, South America and VP6 all at the same time, and he mentions that ZS1BV always seems to come through, often being the only DX signal on the band.

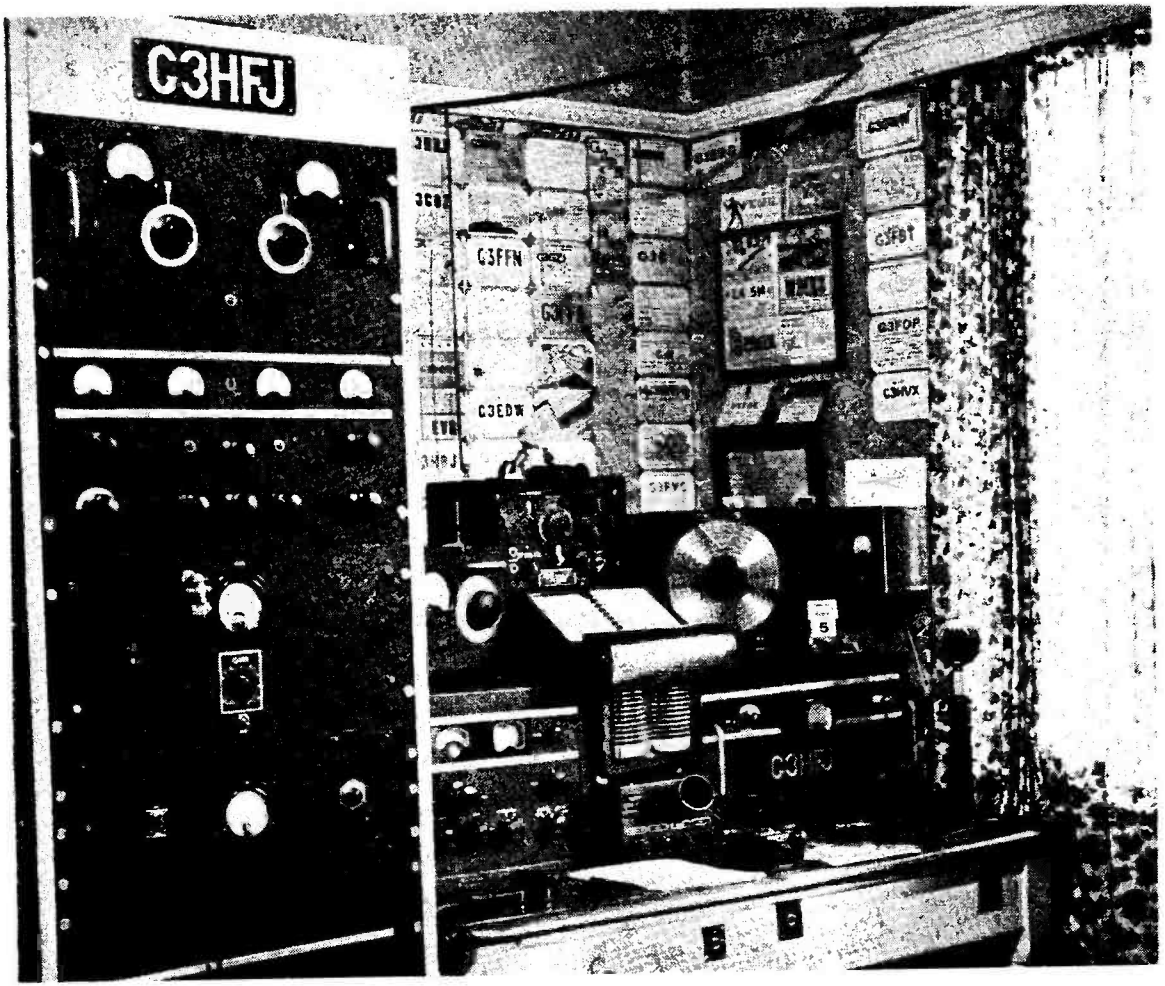
News from Overseas

VS2CY is now home and will be starting up soon as GW3IKJ. He wants to thank GM3DHD for putting by far the strongest and most consistent signal into

FOUR BAND DX TABLE

POST WAR

Station	Points	3.5 mc	7 mc	14 mc	28 mc	Countries	Station	Points	3.5 mc	7 mc	14 mc	28 mc	Countries
DL7AA	508	72	128	208	100	215	G6YR	310	19	43	147	101	166
W2QHH	505	93	94	212	106	212	G3ABG	286	35	79	142	30	149
G6QB	501	52	100	214	135	230	G2BW	268	24	57	144	43	151
G2AJ	433	42	81	192	118	211	G8VG	259	34	76	123	26	140
G5BZ	427	54	94	215	65	219	G2YS	251	42	45	124	40	142
G2VD	413	46	84	175	108	184	GM2DBX	234	5	31	117	81	137
G6LX	392	58	56	172	106	194	G3GUM	218	31	38	148	1	159
G2WW	370	21	62	182	105	190	G6TC	213	17	59	100	27	119
G5FA	365	33	111	148	73	163	GM3EDU	197	37	41	96	23	116
G3FXB	357	52	99	167	39	172	G3FXA	193	22	46	117	8	124
G6QX	332	48	85	142	57	161	G3FPQ	193	45	22	114	12	117



G3HFJ, Harrow Weald, Middlesex, is a very fine installation in the modern style. The rack transmitter on the left is self-contained for Ten phone only. The small unit to the right of the AR88, labelled "G3HFJ," is an all-band CW rig running 25 watts to an 807. The receiver is used with a panoramic adaptor, seen with the hooded screen to the immediate right of the AR88. Aerials are a 3-element beam for Ten, and a 90ft. long-wire for all other bands.

Malaya, where the only band of any use seemed to be Twenty. VS2CR, however, is the first of the VS2's to start activity on 21 mc. and has already had many nice contacts.

ZS2AT (East London) worked VQ9DB on Twenty and naturally wonders if he's genuine. Another unusual one was MDAGX, an RAF Sunderland testing equipment at Addu Atoll, Indian Ocean. 'AT has been very interested in the pro-and-anti Contest debate and remarks that it is usually the Lids and "those with no DX technique (poor copyists)" who decry these things, and the CW enthusiasts enjoy them. He adds "Anybody can bawl down a mike but anybody is not necessarily a good CW operator. The answer is—if you don't want Contests, don't join in . . . if you can't stick Crooners, *switch off!*"

ZE3JO (Salisbury) says he *likes* Contests but doesn't go all out and nearly kill himself. He enters for the fun of the thing and couldn't care less where he appears in the results. He says the high-power business is getting pretty awful, what with some of the signals from DL, I, SM and even G, and he would like to see a limit of 50 watts (never uses more than 30 himself).

W2QHH continues to chase the *Magazine DX Award* and suggests that our DX Table should now be a 5-band or even 6-band affair. New ones for him were LB6XD and ZD7A; he also heard MP4BAU (Qatar) on Forty, on which band he also wants ZB2A and EA8BF very badly.

Strays

Some of the things they say! Inspired by G8KP's tropical greenhouse, G3GUM says the Thing at the LF end of Twenty is an Electronic Banyan Tree. . . . It wants lopping a bit, especially on the HF side. G6QX asks whether 21-mc cards can count for the Four-Band Award. We

can't think of any justifiable reason for stopping them.

WAZ MARATHON, 1952

Station	Zones	Countries
G5BZ	36	151
G8FC	36	114
G3FXB	35	131
G2VD	35	119
G6QB	34	124
G6QX	34	100
G3FXA	34	96
G2DPY	33	126
G6YR	33	103
G3GUM	32	104
G3DOG	32	93
G3FPQ	32	85
GM2DBX (Phone)	31	101
G3BDQ	27	98
G5FA	27	77
G3CMN	27	55
G2BW	25	87
G3TR (Phone)	25	80
G3ABG	24	86
G3HDL	22	67
G3HZL	18	56
G5GK	17	24
G3IGZ	16	59
G2CMQ (Phone)	14	42
G2BAM	13	48
G6TC	12	37
G3FPK	11	31
G3IHI	11	33
G2BJN	10	37
G2VJ (Phone)	8	12
DL2SU	4	28
G4QK	4	7
G2BP	3	17
G3GVY	2	11

***NOTE:** New entries in this table must not include QSO's dating back more than two months from the time of entry. Regular reporters should send in their score month by month — three months' failure to do so will be taken to indicate loss of interest and the score will be deleted.*

Last month a reader cast doubts on CR6CC, saying that the other CR6's had never heard of him. Now G2BPJ (Leeds) forwards CR6CC's QSL, received direct by Air Mail; it seems that he is in the town of Uige, probably out of ground-wave distance of the other CR6's in New Lisbon, and unknown to them.

Contests

The results of the *CQ* Contest for 1951 (CW Section) show that G2AJ led the British contingent with a score of 123,422 points; G8KP was second with 53,793 and G2VD third with 47,736. The leaders on the various bands were G5MP on 80, G4CP on Forty, G2LB on Twenty and G2AJ on Ten.

In the similar affray this year the only score we have yet been told of is G3FXB's, which is 67,425 as against 43,030 last year.

G2DPY writes to report that this year's FOC Marathon Contest was won by G3EBH with 116 points, G3BRV being the runner-up, as he was last year. The winner worked FOC members in 16 countries on five bands.

Stop Press Notes

Further news of Ten: G2BW (Walton-on-Thames) stuck to the band through both halves of the *CQ* Contest; in the phone event he worked 14 countries, including ZS9, but in the CW half the band was very bad and produced only six QSO's.

G2BOF (Sutton) has worked GM3FSV (Orkney) for his sixtieth county, so WABC is now just a matter of waiting for the postman. . . .

G3TR (Southampton) has been playing with aerials and has not had much time on the air, but a ZL Special has brought in a few new ones (PZ, KG4, MI3 and 4X).

G3HDL (Liverpool), the other indoor-aerial expert, is waiting to go into hospital for another op. and is rather sorry for himself. We all wish him the best of luck and a quick return to health and all bands.

FLASH NOTE: Permission having been given by the GPO for the use of phone on the 21 mc band in time for the week-end November 15/16, a surprisingly large number of G's rose to the occasion. VP6SD, OD5AB and the VE's appeared to be in the greatest demand, all of them having to cope with long queues. VK2AWU was also there on phone, and made dozens of European contacts. So now we have another fine, active DX band on which to break new ground.

Deadline for next month will be **first post on Saturday, December 13.** Please make sure of catching this, because of the Christmas rush and the usual dislocation of posts. Address to: "DX Commentary," *Short Wave Magazine*, 55 Victoria Street, London, S.W.1. And, as this is our last opportunity, may we wish you all the best of everything needed to make up a Merry Christmas and a Happy and Prosperous 1953? 73, BCNU—and Mri Xmas.

TEN-METRE PARTY

All G's able to operate on Ten, phone or CW, are invited to come on that band for Sunday, December 7, to work who or what they can, local or otherwise. Reports will be greatly appreciated for the next issue.

MULTICORE MAKE SILVER SOLDER

With the co-operation of Johnson Matthey of Hatton Garden, Ersin Multicore Solder is now available in Comsol alloy. This tin/lead/silver solder has a melting point of nearly 300° C, which is 113° C above the melting of the usual tin/lead alloys.

Ersin Multicore Comsol solder is normally supplied in 16 SWG and is intended for soldering processes where components are likely to be subjected to excessive working temperatures. Projector lamps and some types of electric motors are examples. It is believed that Comsol may also be suitable for use on radio and electrical equipment being subjected to sub-zero temperatures, although research into this is at present still proceeding.

Generally, this new product will be supplied direct to manufacturers, the price being slightly less than that charged for Ersin Multicore 60/40 alloy.

An Amateur Oscilloscope and its Application

DESIGN & CONSTRUCTION OF COMPLETE CRO UNIT

PART II

F. T. WILSON (G2XX)

Our contributor discussed in some detail last month the lesser known applications of the Oscilloscope in amateur practice. The second part of his article shows how a suitable Unit can be easily and cheaply built from surplus resources.—Editor.

THE oscilloscope as built up is illustrated in the photograph and a circuit diagram of the complete instrument is given in Fig. 20. At this point it is as well to explain that what were considered unnecessary refinements have been omitted. Such items as attenuators, X-plate amplifiers and a built-in variable frequency calibrator would be useful but were regarded as complications which were not wholly justified. In the writer's experience horizontal deflection amplifiers are seldom used, attenuators can just as easily be made up and connected across the input terminals when required, and a 50 c.p.s. calibration voltage, which can be employed quite successfully up to about 5,000 c.p.s., is much simpler than adding extra valves. These facilities can, of course, easily be included.

For the benefit of those who wish to modify the design to meet individual requirements some information is provided on the basic circuits used.

Choice of Tube

The choice of a tube must largely be governed by what is available. Possibly one of the best tubes for the purpose is the VCR97 with its 6in. screen, but the chief disadvantage is the high voltage required (2kV for proper operation). The optimum screen size seems to lie between 3in. and 4in. and such tubes usually operate at relatively low voltages of 800 to 1,000. The tube in the CRO described is a Mullard E41-G4, a type now obsolete. This has a 4in. screen, operates at a maximum final anode potential of 1,000 volts, and is designed for symmetrical deflection. Its main advantage is that a good specimen has a particularly small spot size giving a very finely focused trace, but otherwise it is no better than such tubes as the 3BP1, 5BP1, and VCR138A, all of which are obtainable from advertisers in the *Magazine*.

Timebase

After trying many of the usual timebase circuits the Miller-transitron was selected as the most suitable. This has its limitations no less than other circuits, but, provided care is taken to keep stray capacities down to a reasonable level, its performance is quite predictable and it requires the minimum number of valves.

The Miller timebase generator provides one of the simplest and most effective methods of obtaining timebase linearity and consists of a single stage high gain amplifier with a feedback condenser between anode and grid, as shown in Fig. 18(a). For changes in the output voltage of the amplifier, Vo, the corresponding changes in Vg are very small. If a constant voltage V1, much greater than Vg, is connected to the input, the voltage across R is constant so that, to a first approximation, the condenser C is connected to a constant-current source. The condenser voltage and therefore the output voltage vary almost linearly with time.

The operation of the circuit is as follows: Neglecting the input conductance of the valve, the same current flows through R and C. The voltage across R is V1-Vg, so that then the current through R is $\frac{V1 - Vg}{R}$. This is also the current through C and the variation of Vc is therefore given by:

$$\frac{dVc}{dt} = -\frac{Ic}{C} = -\frac{1}{CR}(V1 - Vg)$$

But $Vc = Vo - Vg$ so that

$$\frac{d}{dt}(Vo - Vg) = -\frac{1}{CR}(V1 - Vg)$$

Providing Vg is negligible compared with V1 and the gain of the valve is large so that changes in Vg are small compared with changes in Vo, this last equation becomes approximately

$$\frac{d}{dt}(Vo) = -\frac{V1}{CR}$$

From this we can derive the rate of change in anode potential in volts per second and thus the speed of the timebase. The timebase speed is constant and depends only on V1, C and R, being independent of valve characteristics. HT

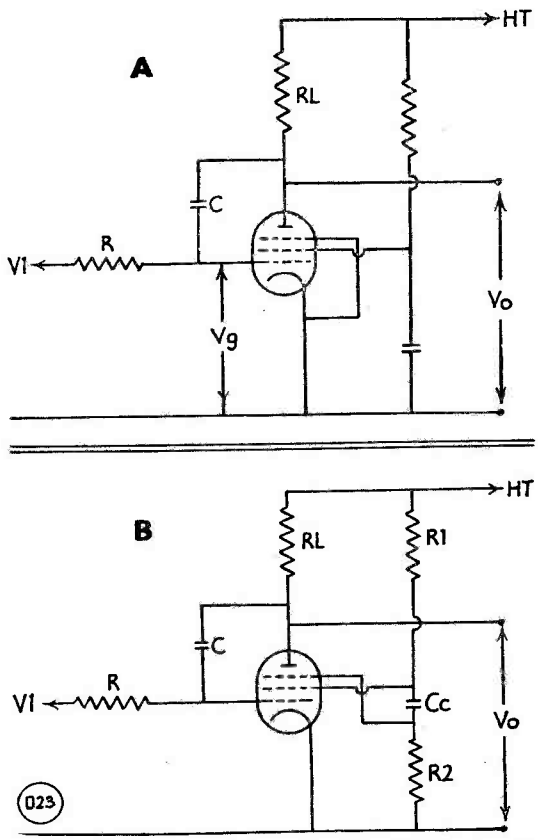


Fig. 18. (A) The basic Miller time-base circuit; (B) The Miller-Transitron circuit; (C) Waveforms as seen from (B), see sketch below.

voltage, etc. It can be varied by changing V1, R, and/or C.

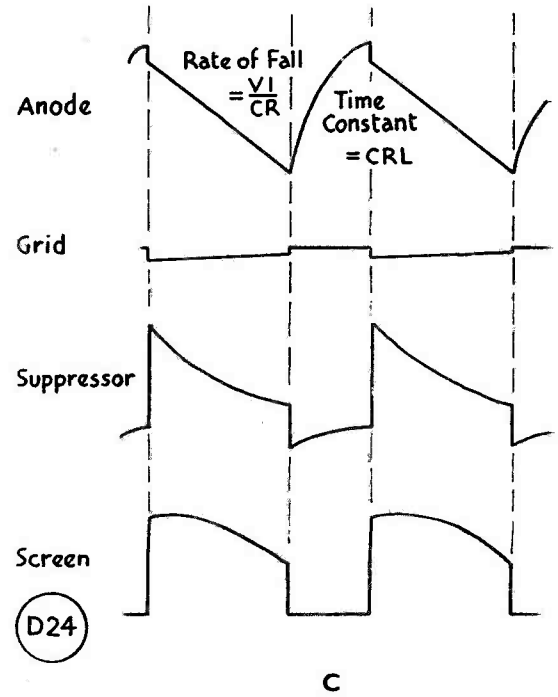
To make use of this circuit as a self-running timebase some method of making it flash back automatically at the end of the run-down is needed and the transitron principle is applied, resulting in the basic circuit shown in Fig. 18(b). Assuming that the anode is running down, the current through the valve will be increasing and the screen voltage is falling while the grid voltage is rising. This process continues until the valve saturates as the anode approaches cathode potential, at which point the screen current increases sharply, causing a sudden fall in screen voltage. This fall is fed back to the suppressor *via* Cc so that the suppressor falls, cutting off anode current and causing the screen to draw even more current. The action is cumulative; anode current falls to zero and the anode returns exponentially to HT with a time constant CRL. Nothing can now happen until the suppressor returns to earth as Cc discharges through R2.

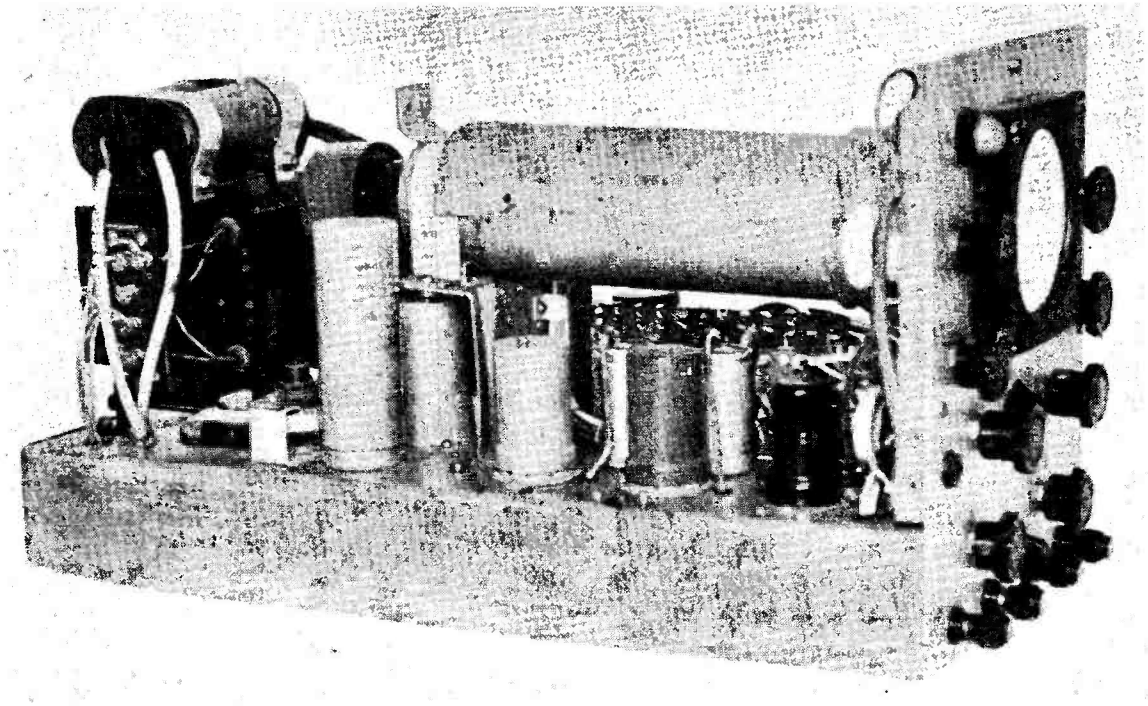
When the suppressor has risen sufficiently, anode current will start to flow again; this current will be taken from the screen current and the screen voltage will rise. In consequence the suppressor will rise more rapidly and again the action is cumulative until both screen and suppressor fly positive and anode current flows normally when the run-down will start again. The fly-back time is controlled by the values of Cc and R1 which are chosen so that the recovery time of the suppressor is the same as or slightly shorter than that of the anode. Fig. 18(c) shows the waveforms at different points in the circuit.

Deflection Amplifiers

Y-plate amplifiers being considered a necessity, suitable circuits had to be chosen. It was decided to make the timebase speeds variable from approximately 16 c.p.s. to 200 kc and the amplifiers had to be sensibly flat over the same range or better. Frequency compensation by the use of inductive anode loads, often used in video amplifiers, is not always satisfactory and recourse was had to negative feedback. The basic circuit is shown in Fig. 19(a) and the equivalent network in Fig. 19(b).

This is a voltage feedback using parallel negative feedback and is sometimes referred





General constructional view of the Oscilloscope as built up by G2XX. The tube can be a 3BPI, 5BPI, VCR138A or one of similar size from the Osram range.

to as an anode follower. Feedback is obtained quite simply by connecting a potentiometer consisting of two resistors, R1 and R2, in parallel with the anode load RL. These resistors should be large in value compared with RL to avoid any shunting effects. The feedback voltage is taken from the junction of R1 and R2 and is in series with the applied voltage Vs. The feedback constant β is given by

$$\beta = \frac{R2}{R1 + R2}$$

and the voltage fed back will be 180° out of phase with the input if the anode load RL is a pure resistance. Assuming the load to be purely resistive, therefore, and $\frac{1}{m}$ negligible (m being the magnification of the valve), the output voltage will depend entirely on the values of R1 and R2 and is quite independent of valve characteristics, variations in the supply voltages and the value of RL. The amplification is substantially independent of the frequency of the applied input voltage and negligible phase shift occurs. In practice, of course, RL can never be purely resistive since there must always be some capacity between anode and cathode of the valve. However, this capacity can safely be neglected in all normal applications.

Another advantage of negative feedback is that it reduces the output impedance of the amplifier. For the circuit shown in Fig. 19(a) the output impedance is given by

$$\cdot Z = \frac{m + 1}{gm} \text{ ohms}$$

where m is the gain of the valve with feedback and gm is the mutual conductance. The smaller m becomes therefore, the lower is the output impedance and for very small values of m the stage is comparable with a cathode follower.

Quite clearly there is a limit to the gain which can be realised from such an amplifier if all its advantages are to be retained and this limit is about 20 times. In practical design it is better to work on much lower gain and cascade stages until the necessary amplification is obtained.

Description

The oscilloscope illustrated in the photograph is built on an aluminium chassis

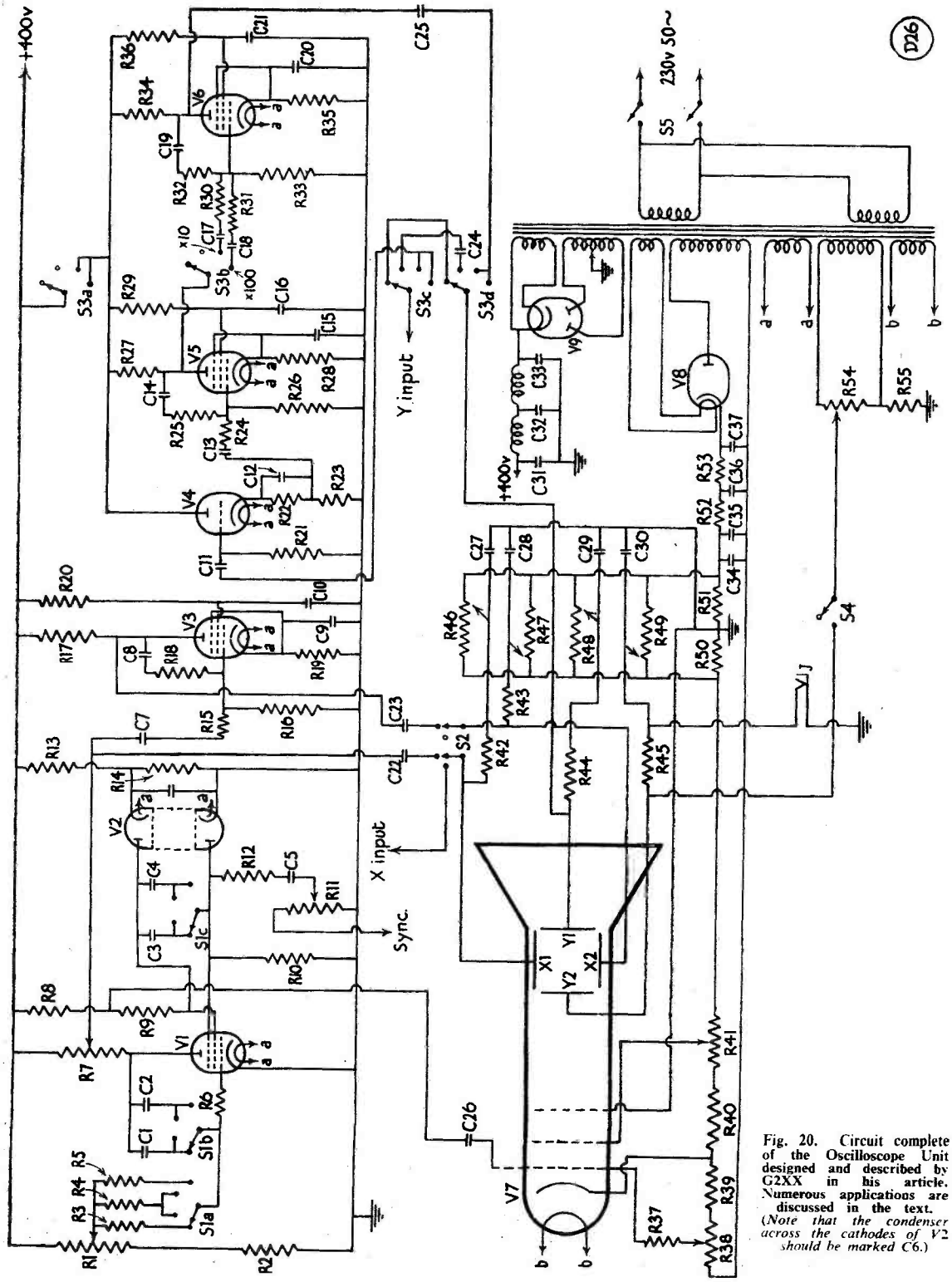


Fig. 20. Circuit complete of the Oscilloscope Unit designed and described by G2XX in his article. Numerous applications are discussed in the text. (*Note that the condenser across the cathodes of V2 should be marked C6.*)

Table of Values

Fig. 20. Circuit of the Oscilloscope complete.

R1 = 2 megohm variable
R2 = 86,000 ohms ½ watt
R3 = 10 megohm ½ watt
R4, R15,
R16, R18,
R21 = 1 megohm ½ watt
R5, R10,
R12, R20,
R29, R36 = 100,000 ohms ½ watt
R6, R19,
R22, R28,
R35 = 220 ohms ½ watt
R7, R38 = 50,000 ohms variable
R8, R37 = 10,000 ohms ½ watt
R9, R23 = 33,000 ohms ½ watt
R11, R41 = 500,000 ohms variable
R13 = 120,000 ohms ½ watt
R14 = 47,000 ohms ½ watt
R17, R27,
R34 = 30,000 ohms 1 watt
R24, R31,
R55 = 27,000 ohms ½ watt
R25, R26,
R30, R32,
R33 = 270,000 ohms ½ watt
R39 = 22,000 ohms ½ watt
R40 = 470,000 ohms ½ watt
R42, R43,
R44, R45 = 2.2 megohm ½ watt
R46, R47 = 2 megohm ganged potentiometers
R48, R49 = 2 megohm ganged potentiometers
R50, R51 = 560,000 ohms ½ watt
R52, R53 = 47,000 ohms 1 watt
R54 = 250,000 ohms variable
C1 = .0005μF, 500V, silver mica
C2 = 50μμF, 500V, silver mica
C3 = .001μF, 500V, silver mica
C4 = .0003μF, 500V, silver mica
C5 = .05μF, 450V, paper
C6, C11,
C13, C16,
C18, C21,
C22, C23.
C24, C25 = 0.1μF, 500V, paper
C7, C8,
C14, C17.
C19 = .01μF, 500V, moulded mica
C9, C12,
C15, C20 = 25μF, 25V, electrolytic
C10 = 0.25μF, 450V, paper
C26 = .01μF, 2kV, moulded mica
C27, C28.
C29, C30 = 0.5μF, 600V, paper
C31 = 16μF, 500V, electrolytic
C32, C33 = 8μF, 500V, electrolytic
C34 = 0.25μF, 2kV, paper
C35 = 0.1μF, 2kV, paper
C36, C37 = .01μF, 3kV, paper
S1 = 3-pole, 4-way wafer switch
S2 = 2-pole, 2-way wafer switch
S3 = 4-pole, 4-way wafer switch
S4 = Single-pole on/off toggle switch
S5 = Double-pole on/off toggle switch
J = Single open-circuit jack
V1, V3,
V5, V6 = EF50
V2 = EB34
V4 = 6J5
V7 = E41-G4 (Mullard), and *see* text.
V8 = 5Z4G
V9 = 2X2/879
T1 = Mains transformer: Primary: 100/240V 50 c/s Secs: 350-0-350 at 100 mA 900V at 1mA 2.5V at 2A 5V at 3A 6.3V at 3A
T2 = Mains transformer: Primary: 230V 50 c/s Secs: 50V RMS 4V at 1A

measuring 18in. x 8in. x 2½in. deep. All the controls are mounted on the 10in. x 8in. front panel and are, starting at the top and reading from left to right, horizontal shift, brilliance, amplitude, focus, vertical shift, timebase range, timebase speed, X-plate switch, input switch and sync control. The jack to the left of the vertical shift control is connected across the Y2 shift potentiometer so that a meter can be plugged in to read the vertical deflection in volts. To the right of the timebase speed control is the calibration voltage on/off switch. The four terminals along the bottom of the panel are X-plate, Y-plate, sync and earth.

Looking at the left-hand side of the chassis, the valve immediately behind the panel is the cathode follower, in line with which are the two vertical deflection amplifiers. At the right - hand side of the chassis are the timebase valve, double-diode and paraphase amplifier in that order. It is not suggested that the layout shown is the best possible; that is far from being the case. It is merely offered as one convenient arrangement. There is plenty of scope for individuality in CRO construction and there are still ex-Government chassis available which lend themselves to adaptation.

Referring to the circuit diagram again, V1 is the timebase valve. The grid is returned, through one of three resistors, to the slider of R1 which is connected in series with R2 across the HT supply. R1 is the timebase speed control and, in conjunction with R2, R3, R4, C1 and C2, gives four ranges of 16 to 200 c.p.s., 160 to 2,000 c.p.s., 1,600 c.p.s. to 20 kc, and R16 kc to 200 kc. Flyback is controlled by C3 and C4 connected between screen and suppressor and switched by another wafer on the timebase range switch. The output is taken from the slider of R7 which forms an amplitude control. This method of amplitude control is not ideal, but it is the simplest and is at least substantially independent of the timebase speed. The sawtooth voltage from V1 is fed to the X-plate switch and to the grid of the paraphase amplifier. By arranging for the timebase to be disconnected from the X-plates and for X1 to be connected to a terminal on the panel, the oscilloscope can be used without a timebase or with an external timebase when required. Sync voltage is fed to the suppressor through C7, R11 and R12. A separate sync input terminal is not really necessary and, to avoid extra leads, it would be preferable to make the connection internally with a switch to remove the sync voltage when it is not needed.

The double-diode performs two functions. One section is connected between the suppressor and earth to limit the positive excursion of the suppressor; this helps to stabilize the flyback period. It is, however, not essential and, if omitted, will not affect the performance of the circuit. The right-hand section, it will be noted, is connected to the screen and controls the upper limit of the screen voltage through R13 and R14. The screen waveform (*see* Fig. 18c) is a positive-going square wave which can be fed to the grid of the CRT and used to brighten up the trace during the forward stroke, so providing flyback suppression. Since the screen waveform is not quite flat on the

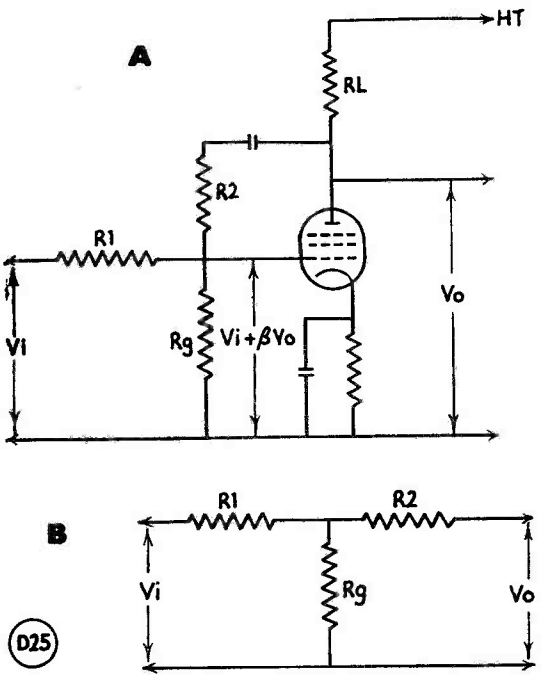


Fig. 19. (A) Basic voltage feed-back amplifier circuit; (B) The equivalent electrical network.

top the diode is included to ensure that a perfectly square waveform is applied to the grid of the CRT. The addition of this diode to the circuit is also a refinement which is not essential but its omission will cause a variation of brilliance along the trace.

Part of the timebase sawtooth is fed to the grid of V3. The circuit of this valve is very similar to that used for the deflection amplifiers, the only difference being that the constants are arranged to give a gain of unity. The use of symmetrical timebase deflection and symmetrical shift voltages cannot be too strongly recommended. Cathode-ray tubes designed for oscillographic purposes invariably have only two anodes and consequently suffer from two drawbacks; interaction of focus and brilliance and deflection defocusing. Unfortunately, very little can be done about the interaction problem but, by ensuring that all voltages applied to the deflector plates are symmetrical it is possible to eliminate the defocusing effect, although in very bad cases it may be necessary to feed the Y-plates through a paraphase amplifier as well.

V5 and V6 are the vertical deflection amplifiers and their development from the basic circuit of Fig. 19(a) is clear. It was decided that gains of 10 and 100 times would probably meet most requirements and two stages were therefore included, each giving a gain of 10, an arrangement which has proved very satisfactory. In order that trouble would not arise from stray capacities at the upper frequency limit the resistor values have deliberately been made low, resulting in a low input impedance. To counteract this a cathode follower is inserted between the input terminal and the amplifier so that, with the amplifier in use, the oscilloscope input impedance is not materially lowered. Switching is done in the second stage.

The input terminal and also the Y1 plate are connected to the moving contacts on a two-wafer, four-position Yaxley switch; a third moving contact is connected to HT. In the extreme anti-clockwise position of the switch the input terminal is DC connected to the Y-plate. Position 2 of the switch connects a condenser between the terminal and the Y-plate. The remaining two positions bring the amplifiers into operation, giving gains of 10 and 100 times respectively. This switch avoids the necessity for re-arranging the input connections between one test and another.

Power Supplies

The power supplies are conventional and require no detailed description. 300 to 400 volts at 30 mA is adequate for the timebase HT and the EHT may be anything from about 750 volts upwards according to the cathode-ray tube used. In accordance with good design practice the iron-cored components should be mounted, as far as possible, behind the tube and the tube enclosed in a mu-metal shield to eliminate the effects of magnetic fields, both internal and external.

The writer was fortunate in possessing a very small compact Ferranti transformer intended for oscilloscope use. This has a 200/230 volt primary and four secondaries; 300-0-300v, 1,000v, 6.3v and 5v. A 2.5v secondary has been added to supply the 2X2 EHT rectifier. It is unlikely that many readers will have such a component and the problem of obtaining an EHT supply then arises. The obvious solution is to use a separate transformer, but this may introduce complications due to spreading the magnetic field. One very satisfactory answer is shown in Fig. 21. Here an ordinary 350-0-350 volt transformer supplies both HT for the timebase and EHT for the tube. This method is very successful and can be recommended.

The 50 c.p.s. calibration voltage referred to earlier is obtained from the mains, off a winding on the CRT heater transformer, giving 50 volts

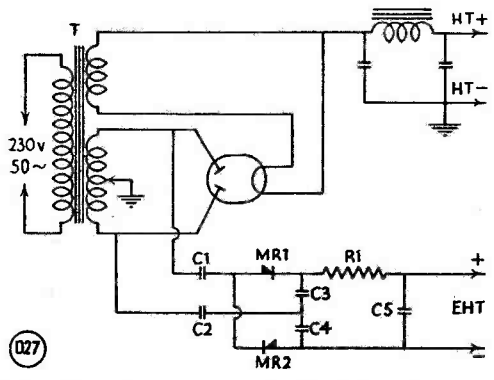


Fig. 21. Alternative power supply circuit for Fig. 20 giving HT and Tube EHT from one transformer.

Table of Values

Fig. 21. Power supply circuit for the CRO.

T = Transformer: Primary 230V; Secondary 350-0-350 or similar
C1, C2 = .01μF
C3, C4 = .5μF
C5 = .25μF
R1 = 47,000 ohms
MR1, MR2 = Metal rectifiers, Westinghouse 36EHT, H or J type

(Other values as in Fig. 20).

RMS, applied across a preset potentiometer mounted on the chassis; part of the voltage is taken from the slider and fed through the calibration on/off switch to the Y2 plate.

Testing

It is not anticipated that any difficulty will be experienced with an oscilloscope built around the circuit given, but the following brief notes may be helpful.

Disconnect the timebase with the X-plate switch and set the shift controls to approximately mid-position. By varying the brilliance and focus controls together it should be possible to obtain a finely-focused spot on the screen. Take care to keep the brilliance as low as possible to avoid burning the screen. The spot can then be centred by the shift controls which may be checked to ensure that the amount of spot movement is adequate. If no spot is visible and it is known that all the electrode voltages are correct, the four deflector plates should be strapped to the final anode. Failure to obtain a spot under these conditions indicates a faulty tube.

Assuming that a spot has been obtained, reconnect the timebase and set the range switch to the lowest frequency range. A horizontal line should appear on the screen. Now set the range switch to each position in turn and check that all the timebase ranges are operating. If no trace is obtained the timebase should be switched off and an AC voltage applied to the X-plate input terminal of sufficient amplitude to sweep the spot across the screen. This is, in effect, a 50 c.p.s. timebase and the internal timebase operation can be checked by examining the waveforms.

Checking the actual timebase speeds is relatively easy up to about 5,000 cycles by feeding a 50 c.p.s. waveform to the Y1 terminal and examining the Lissajous figures obtained on the screen. Above 5 kc a BFO is necessary; alternatively, a 100 kc crystal oscillator with a 10 kc multivibrator may be used, the output being rectified by a germanium crystal.

The internal 50-cycle calibration voltage is useful both for frequency and amplitude calibration. By setting the slider of the potentiometer to give a known RMS value the peak-to-peak amplitude of the waveform on the screen can be calculated and thereafter used for measuring the amplitudes of external waveforms by comparison. In the same way, the gain of the amplifiers can be measured by feeding in a known RMS voltage, calculating the peak-to-peak value, then measuring the amplitude of the displayed waveform.

DYNATRON T.54

Any reader who may happen to have the working manual or handbook on this fine pre-war all-band receiver is asked to communicate with us, marking the letter "For the attention of the Editor." Its loan is requested for a blind, bedridden ex-R.A.F. officer who has been given one of these receivers to help while away his weary hours; the set needs a thorough technical going-over to put it into proper working order, and for that the instruction manual is essential.

OUR ANCIENT IS STIRRING

In response to many unexpected enquiries (well, several—more than three, anyway) we are sorry to have to admit that G1BF, ex-G9BF, old pal MO1FFI, is once again burning to give us all the benefit of his unreliable advice and questionable experience. Having returned but recently from that happy land beyond the Oder, he is bursting with gen about Box 88, the real meaning of WSEM, and Popoff's latest claim to have invented the gas-fired 813. It is therefore not improbable that we may have to admit G1BF to a fairly early issue, if by some misfortune it should happen that his piece will just fill an awkard space.

CORRECTION—"AMATEUR OSCILLOSCOPE"

A slight error crep' in at p. 528 of this excellent article in our November issue. The captions under Figs. 16 and 17 became transposed, sketch D22 being the "Example of the riding trace."

ABAC for VHF Aerial Design

A. J. R. PEGLER, A.M.I.Mech.E. (G3ENI)
Lieut.-Cdr. (E), R.N.

This very useful paper will serve as a guide to VHF aerial design in all the standard types of element layout and spacings. As the author explains, the gain factors may not be realised in practice, but they will always be comparative, so that the data are entirely reliable.—Editor.

THE newcomer and old timer alike are frequently faced with the problem of choosing a suitable and efficient aerial system from the multiplicity of available types. The ABAC described in this article has been calculated by the writer with a view to facilitating this choice, and is based on numbers of elements and power gain.

In the case of broadside and colinear arrays, element lengths are half-wave at the frequency in use, and may be calculated from the formula :—

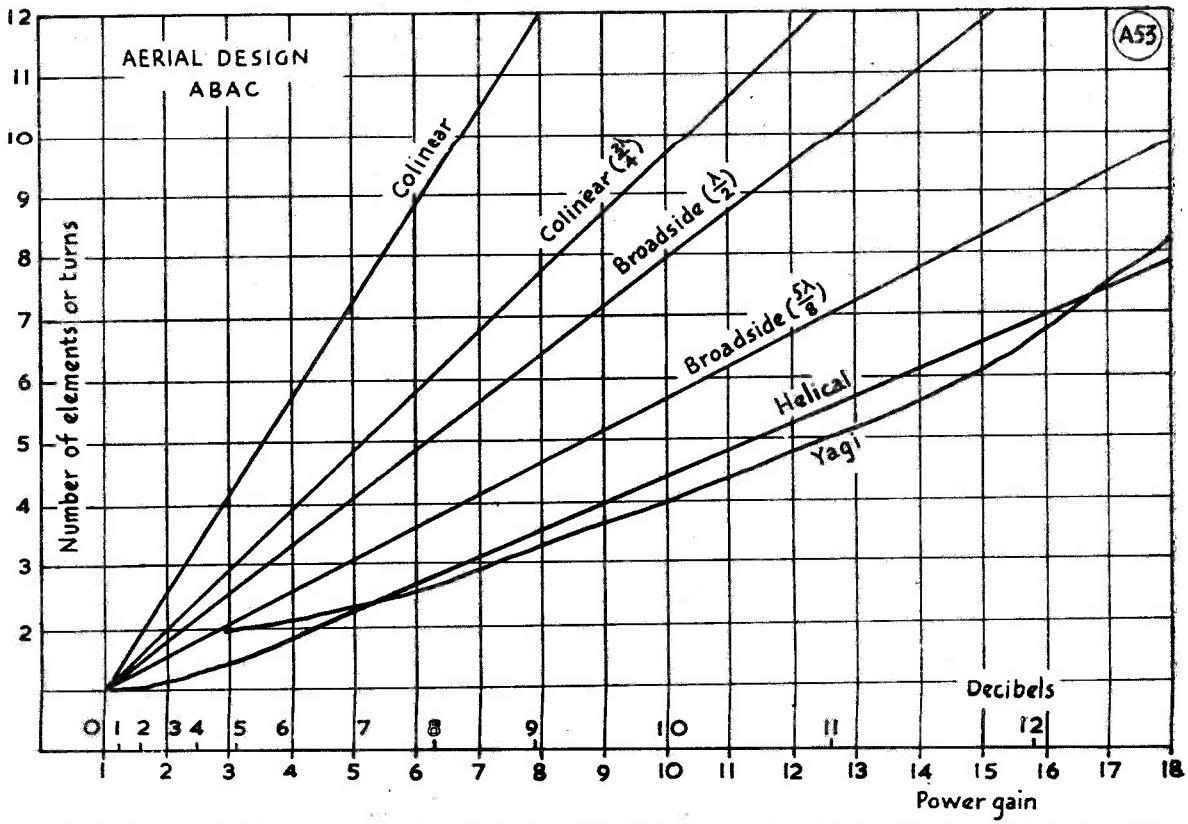
$$\text{Length (inches)} = \frac{5905}{F\,(\text{mc})} \times K$$

where K is a reduction factor. The value of K will vary between 0.92 and 0.98 and is controlled by the ratio of conductor length/diameter and "end effect." In the case of Yagi aerials, the element lengths and spacing are adjusted for optimum performance.

In the Helical aerial one turn is assumed to represent one element and is one wavelength in circumference in the case taken. The spacing between adjacent helices is one quarter wave.

The ABAC can be used in the following manner :—

(a) To determine the gain of any given array.
(b) To design a variety of arrays in order to obtain a particular gain.
(c) To enable the best gain to be obtained from a given number of elements.
(d) To translate power ratios into decibels gain without the use of logarithms.



The ABAC drawn by G3ENI for the design of VHF arrays of the more usual types. The "turns" data refer only to helical beams. Some examples of the application of this ABAC are given in the text. Note that the first Colinear should be marked $\frac{\lambda}{2}$

The following examples illustrate the use of the ABAC :

(a) (i) A three-element colinear array with three-quarter-wave spacing gives 5 dB gain.
(ii) A two-over-two colinear broadside array with half-wave spacing (" Lazy H ") gives 6 dB gain.
(iii) A four-element broadside array with five-eighths spacing (" City Slicker ") gives 8.5 dB gain.
(iv) A four-element Yagi array gives 10 dB gain
(v) A three-over-three Yagi with half-wave spacing gives 12.5 dB gain.
(vi) A five-turn helical array gives 10.5 dB gain

(b) The following are some of the arrays that can give about 10 decibels gain :—
(i) Four-element Yagi array.
(ii) Six - element five - eighths spaced broadside array.
(iii) Eight - element half - wave spaced broadside array.
(iv) Eight-element colinear broadside stack with reflectors.

(c) The following are some of the arrays that can be designed using four elements :—
(i) Colinear $\frac{1}{2}$ wave spacing ($4\frac{1}{2}$ dB).
(ii) Colinear $\frac{3}{4}$ wave spacing (6 dB).
(iii) Broadside $\frac{1}{2}$ wave spacing (7 dB).
(iv) Broadside $\frac{5}{8}$ wave spacing ($8\frac{1}{2}$ dB)
(v) 2/2 colinear broadside array (6 dB).
(vi) 2/2 Yagi stacked $\frac{1}{2}$ wave (8 dB)
(viii) 4-element Yagi (10 dB).

(d) Translation of power ratios and decibels gain :—
(i) Power ratio of 4 equals 6 decibels.
(ii) Power ratio of 10 equals 10 decibels.
(iii) Gain of 9 decibels equals power ratio of 7.9.

For any particular power gain, the choice of array to be used naturally depends on the type of communication circuit in use and its attendant propagation path. Height and ground reflection factors should also be taken into account. The following generalisations can be made, however, for horizontally polarised aerials :

(a) For narrow horizontal and broad vertical directivity use colinear or Yagi arrays.
(b) For narrow vertical and broad horizontal directivity use stacked broadside arrays.
(c) For narrow vertical and narrow horizontal directivity use broadside and colinear combinations on stacked Yagis.

The helical aerial produces circular polarisation and gives good vertical and horizontal directivity. It is normally backed by a ground plane reflector, and with this its feed impedance is about 140 ohms.

It should be appreciated that the ABAC is based on the use of a theoretically perfect aerial installation, and in practice the performance realised may be less than indicated. However, this will not normally affect any comparisons.

METAL CUTTING TOOL

While punch tools of various designs are readily available for making the smaller holes in a metal chassis—up to 1½in. dia.—it is not so easy to find something to excavate the larger diameters without a lot of blood, toil and bad language. A patented cutter, somewhat similar to a fretsaw blade but having a spiral cutting edge, is now to be had for the purpose; it fits (with adaptors) an ordinary hack-saw frame or fretsaw, and will cut easily through metal, plastic or wood, needing only to be guided round the mark. These blades are cheap and effective, and should be obtainable at any good ironmonger. The name is " Tyler Spiral Blade," and the manufacturers are: Spiral Saws, Ltd., Bedford Avenue, Trading Estate, Slough, Bucks.

SCALAMP ELECTROSTATIC VOLTMETER

The Scalamp Electrostatic Voltmeter was developed primarily for use in testing EHT for cathode-ray tubes and in similar HV circuits. Its compactness, portability, ease of operation, and accuracy make it suitable for a very wide range of applications. In many spheres of industry and research high voltages are measured by use of antiquated and cumbersome equipment which depends for accuracy on the skill of the operator and the conditions under which the measurements are made. In the Scalamp instrument, a specially designed vane is held in the proximity of an insulated electrode by a taut suspension of the galvanometer type, with the movement magnetically damped. The lamphouse is integral with the front panel, with the optical system carried on the inside face; the external face is a removable panel in which the illuminating bulb is fitted. The standard instrument is designed for use on 200-250v. AC mains, with provision for operation off a 4-volt battery for portable work, or where no mains supply is available. All parts are enclosed in a sealed plastic case to prevent dust trouble, and the only orifice—for the " Set Zero " knob—is protected by a thick rubber ring. Three models of Scalamp Electrostatic Voltmeter are available: Type 11308, 1-5kV, DC or AC; Type 11309, 3-10kV, DC or AC; Type 11310, 5-18 kV DC, and 5-12 kV r.m.s. AC. Accuracy is 1% on all ranges DC, and on AC up to 12 kV r.m.s., at any frequency up to 100 mc. Manufacturers: W. G. Pye & Co., Ltd., Granta Works, Cambridge.

VHF BANDS

A. J. DEVON

A "SHORT" month and something of a slump in VHF conditions have resulted in the usual phenomena of moderate activity and rather fewer reports than usual. There are only 14 claims for the Tables this time, though three more stations have got into Annual Counties. Here, G3WW still maintains a good lead, but it will not be long before the others creep up as we get more scores in.

If we were to pick out evenings when conditions have been about average for the time of year (which would mean "poor" to many people), these dates would be October 8, 12, 14, 15, 17-23, and November 1st. For the period to November 11, G3EHY reports that he and GI3GQB were able to obtain solid contact on 14 evenings, with GI3GQB heard in Banwell, but not workable, on a further 9 nights; on 15 occasions nothing could be made to happen at all. This gives a 44% "possibility of communication" for the five weeks over their 268-mile path which, all things considered, is a pretty satisfactory result, reflecting great credit on both ends of this important nightly schedule. Louis says it puzzles him why more G's cannot work into Northern Ireland (beams should be aimed north-*west*, by the way, and not as stated last month !). He and GI3GQB always scrape round for some other GDX to work after the schedule, so it is worth standing by for the end of their QSO.

During the month, 100-mile paths have been consistently open and easily workable, and it can now be taken that this should be the expected radius of action of practically all VHF stations, almost irrespective of conditions and location. This is, of course, a broad statement, but is justified by the results most people are now getting — though there are individual cases where certain directions may be difficult, if not impossible, due to some abnormal local screening effect.

New VHF Ground Record

Arising from the discussion on the subject of ground records in "VHF Bands" for October, we have an interesting letter from F8KY (Marseilles). He gives the checked distances for certain EDX contacts as follows : G5YV/F8MG (October 9, 1951), 1026 Km ; F8KY/FA8JO (July 30, 1951), 1032 Km ; and F8KY/FA8JO (August 14, 1951, from new QTH at Venelles), 1073 Km.

These are all normal home-location contacts, and unquestionably hand the ground record to F8KY/FA8JO in respect of their QSO over 666 miles on August 14 last year. It may well be argued that this is not "European" because FA8JO is in North Africa — which is true enough. But we have already (*see* October) suggested that the factor of geography must be taken into account ; for radio purposes both stations are in the Region 1 area, as defined by the Telecommunications Conference at Atlantic City in 1947. So we do not propose to split any hairs on this one.

In his letter, F8KY explains that he is making his claim only in the interests of accuracy, in order to keep the facts right. For our part, we welcome his intervention, and are very glad to have precise details about these QSO's. It is now for some northerly G — like G3BW or G5YV — to work F8KY himself and give the ground record another good lift.

Marathon — Final Session

The last leg took place over the week-end October 25-26, under indifferent conditions but with a higher level of activity than for any week-end except the August session.

A great deal of the story, but not all, is told in the Table herewith, which gives the results for all four legs. Score adjustments to eliminate one leg (where a participant played in all four rounds) will affect totals somewhat, but not the placings, which come out as shown in the Table. Taking their best three scores by eliminating the third leg, G3EHY and G5YV are first and second with only 68 points between them — but a long way in front of the rest. In the corrected scoring, G5DS is only 15 points ahead of G4RO for third and fourth positions, and thereafter the totals and placings are as shown for all participants. Half the entrants put in logs for three legs. In some cases — notably G3BW and G3WW — the final positions could have been a good deal better had they been able to turn out more often. In particular, G3BW's score is very good indeed for a single entry.

Scoring as between the stations in the 4th-11th positions is interesting because it is directly comparative : They are well distributed across the country, and the points difference between G4RO (St. Albans) and G4GR (Marshfield, Mon.) is 286 on three legs — the latter's disadvantage being that he was always short of locals and semi-locals. Taking geography into account, G2BAT's performance is outstanding, as practically all his contacts had to be GDX.

High scorer in the fourth leg was G3EHY (396 pts.), who was able to make four 20-point QSO's, followed by G3WW with 290 pts. ; he made 27 contacts in 18C, including ON4BZ for 25 pts., total operating time being 11 hours. Third highest scorer for this session was G8IL, who had 29 contacts in 15C, with G3VM worked twice for 20 pts. From further down the list, G2DSW's 212 for the fourth leg is noteworthy, and G2DHV's entry — the "pillar of support" — a gallant

MARATHON VHF CONTEST

Aggregate Scores

ALL FOUR LEGS

(July 19-20, August 23-24, September 27-28, October 25-26)

Station	Location	Score 1st	2nd	3rd	4th	Aggr.	Aerial	Input	Converter	Zone
G3EHY	Banwell, Somerset	633	603	172	396	1,804	8-ele Stack	120	4RF-M-Osc/BC342	I
G5YV	Leeds, Yorks.	543	805	124	216	1,688	5-ele Yagi	90	6J6/S640	C
G5DS	Surbiton, Surrey	130	324	209	256	919	16-ele Stack	55	6J6/DST100	J
G4RO	St. Albans, Herts.	230	401	143	—	774	5-ele Yagi	25	4RF-M-Osc/BC348	G
G3VM	New Costessy, Norfolk	392	—	109	222	723	4/4 Yagi	90	3RF/TCS	G
G8IL	Salisbury, Wilts.	—	381	56	263	700	4/4 Yagi	100	6J6/RME69	H
G2BAT	Falmouth, Cornwall	125	405	—	110	640	16-ele Stack	100	G2IQ/AR77	I
G3WW	Wimblington, Cambs.	335	—	—	290	625	5/5 Yagi	140	G2IQ/BC348	G
G3GDR	Watford, Herts.	99	328	—	129	556	16-ele Stack	20	6J6/BC348	G
G3GO	Roade, Northants.	139	236	122	—	497	12-ele T'stile	30	RF-M-Osc/1155	G
G4GR	Marshfield, Mon.	205	—	78	145	488	16-ele Stack	100	4RF-M-Osc/AR88	F
G3HVO	Parkstone, Dorset	196	283	—	—	479	10-ele Colinear	20	3-stage/HRO	H
G8DA	Gloucester	109	227	61	—	397	5-ele Yagi	25	2RF-M-Osc/S.640	H
G3BW	Whitehaven, Cumb.	387	—	—	—	387	16-ele Stack	60	6J6/AR88	C
G2DSW	Southampton, Hants.	—	171	—	212	383	5-ele Yagi	50	G2IQ/SX28	H
G2FCL	Shipley, Yorks.	—	352	26	—	378	3-ele Yagi	60	2RF-M-Osc	C
G2XC	Portsmouth, Hants.	—	314	—	—	314	4/4 Yagi	25	6AK5	H
G5MR	Hythe, Kent	—	171	—	71	242	3/3 Yagi	95	2RF-M-Osc/SX16	J
G6LI	Grimsby, Lincs.	—	240	—	—	240	4 s'td. Dipole	150	Cascode	E
G3CQC	Newton Abbot, Devon	—	210	—	—	210	4/4 Yagi	25	3-stage	I
G4MR	Slough, Bucks.	—	94	45	51	193	4-ele Yagi	20	6J6/BC800A/RF27/R107	G
G3DVK	Rawmarsh, Yorks.	—	161	—	—	161	4/4 Yagi	22	Cascode/CR100	C
G5HN	Caversham, Berks.	—	155	—	—	155	16-ele Stack	35	5-stage/HRO	H
G2FJR	Sutton Bridge, Lincs.	—	133	—	—	133	16-ele Stack	45	2-stage/AR88	E
G6PJ	Sheffield, Yorks.	20	108	—	—	128	3/3 Yagi	60	G2IQ	C
G2DHV	London, S.E.13	37	—	19	31	87	4-ele Yagi	18	5-stage/FBXA	J

one, for which he can take due credit.

On the equipment side there is not a great deal to say, and any attempt at an analysis would be misleading as there are so many imponderables at each location. Broadly, however, it can be said that power input had little to do with the results ; there is considerable variation in the beam systems in use ; and several of the more successful stations are using as many as four RF stages in the converter. We could do with a lot more information as to how these are arranged — whether broad-banded, or continuously tuned, or a combination of the two with part of the RF end fix-tuned and one or two stages peaked, or what ; whether the converter is CC or SEO, and if the latter the fundamental frequency of the oscillator ; the IF chosen ; and what degree of break-through is being tolerated in those cases where the IF is tuned. It would be very interesting to have this information from the multi-RF stage exponents : G3EHY, G3VM, G4GR and G4RO.

Marathon Contest Reflections

It cannot be said that this Contest has been a howling success as regards the support it received — in fact, in some quarters there was some pronounced anti-contest activity ! However, this does not alter the fact that fewer stations took part than we had hoped and expected, and a good many of those who did play for two or more legs decided for one reason or another not to send in a log. On the other hand, with the possible exception of the August week-end, the dates chosen failed to coincide with even reasonably good conditions, and experience has always shown that this inevitably affects activity, both real and apparant.

The leaders, G3EHY and G5YV, at all times worked very hard for their points, and the final result they have been able to turn in is a tribute to their technical efficiency and

operating skill, to say nothing of their persistence and enthusiasm.

Some have said that the Contest was too long — others that no better basis for a contest could have been devised. The rules have been criticised as too complicated — whereas it is also agreed that essentially they were simple. (Our own comment is that they had to be written to allow for all eventualities. That some of these possibilities did not actually arise is beside the point ; they could have done).

The basis of scoring seems to have found general favour — at least, it has not been criticised, except for one suggestion that a strict mileage basis would have been more acceptable. Not one single query was received on the interpretation of the rules, and every set of log sheets we received showed that they had been clearly understood, and followed " to the letter and in the spirit."

What has emerged is the central fact that while there are a number of VHF operators who are always vociferating for " More activity on the band, especially during TV hours," most of them agreeing, and indeed suggesting, that "A contest seems to be the only way to promote activity," when it comes to it very few of them are prepared to support a contest specifically designed to maintain activity ! This is not to suggest that everyone could, or should, have been on all the time for every week-end, but rather that a great many more stations might have been there more frequently, even if they did not want to send in an entry.

For our own part, we have gathered a great mass of interesting statistical data — the total of logs received for all four legs is no less than 61 — and the thanks of your A.J.D. is due to the operators who have taken the trouble to run all the way with us on this Marathon. We shall now be able to think a lot more clearly about the whole business of organising contests.

VHF Century Club

No claims having been received this month for VHFCC Certificates, we take the opportunity of mentioning that total membership of the Club is now 135, and that during the last six months some 30 certificates have been issued. Membership is open to all those who can show QSL cards for 100 or more stations worked two-way on the VHF bands, and to gain a VHFCC Certificate is an achievement of no ordinary merit — though there are some who say that nowadays it is harder to get the cards than to work the stations !

TWO-METRE ACTIVITY REPORT

G4GR, Marshfield, Mon.

WORKED : G2YB, 3ABH, 3EHY, 3FIH, 3HXO, 3WW, 3YH, 4DC, 5DS, 5UD, 8DA, 8IL, 8OU, GW2BNQ. (*Marathon October 25-26 only*).

G8IL, Salisbury, Wilts.

WORKED : G2AHP, 2ATT, 2BAT, 2DSW, 2UN, 3ANB, 3EDD, 3EHY, 3FAN, 3FIH, 3GAV, 3GDR, 3HVO, 3HWJ, 3VM, 3WW, 4GR, 4RO, 4SA, 5DS, 5MR, 6AG, 6JK, 8OU. (*Marathon October 25-26 only*).

G2DHV, Lewisham, London. NGR 51/384776.

WORKED : G2AHP, 2AJ, 2BRR, 2DTO, 2FKZ, 2FVD, 2MV, 3BPM, 3CWW, 3DT, 3FD, 3FGB, 3GBO, 3GDR, 3HBW, 3IIR, 3ISA, 3SM, 4DC, 5DS, 5LK, 6TA.

HEARD : G2AOK/A, 2DSW, 2DUV, 2FTL, 2FWO, 2HCG/P, 2HDZ, 2HGR, 2IQ, 3AEX, 3APA/P, 3AUR, 3AVR, 3BEX/P, 3BW, 3CAT, 3CGQ, 3CVO, 3DIV/P, 3ECA, 3EYV, 3FAW, 3FIJ, 3FMK/P, 3FSG, 3FZL, 3GDR, 3GZD, 3HAB, 3HZK, 3TKW/P, 3ISA, 3VM, 4RO, 5YV, 6JK, 6QN, 6RH, 8HK, GW2ADZ, 8UH. (*July to October*).

G6PJ, Sheffield, 8, Yorks.

WORKED : G2HQ, 2XS, 3CCH, 3FRE, 3MY/P, 5NV, 5YV, 6NB, 6XX.
HEARD : G2DRA, 3BKQ, 3BLP, 3EHY, 3GHO, 6CI, GW5MQ. (*October 6 to November 6*).

G2DSW, Southampton, Hants.

WORKED : G2AHP, 2ATT, 2BAT, 2NM, 2UN, 2YB, 3BHS, 3BPM, 3EUQ, 3FAN, 3GAV, 3GBO, 3GDR, 3HBW, 3HCK, 3HVO, 3HWJ, 3HXJ, 3VM, 3WW, 5DS, 5MR, 5UD, 6AG, 6JK, 8IL. (*Marathon October 25-26 only*).

G3HBW, Wembley, Middlesex.

WORKED : G2AHP, 2ANT, 2BM, 2DHV, 2DSW, 2DUV, 2FFG, 2NM, 3ANB, 3BKQ, 3CAT, 3GBO, 3HXO, 3HZK, 3IEX, 3IOO, 4MW, 5LK, 5UM, 8LN, GW5MA/P.
HEARD : G2HCG, 2XV, 3AUS, 3BHS, 3CCP, 3FAN, 3FUM, 3IAI, 3VM, 4SA, 5YV, 8IL. (*October 4 to November 2*).

GW5MA/P, near Blaenavon, Mon.

WORKED : G2AHP, 2AIW, 2ANT, 2FNW, 2HDZ, 2MR, 2MV, 2NH, 2UN, 2XV, 2YB, 3ANB, 3AZT, 3BLP, 3BVJ, 3CGE, 3DJX, 3DLU, 3EDD, 3EHY, 3EYV, 3FAN, 3FD, 3FIH, 3FUM, 3GDR, 3HAZ, 3HBW, 3HXS, 3EIR, 3MA, 3WW, 3YH, 4CI, 4DC, 4RO, 4SA, 5BM, 6AG, 6JK, 6YU, 8DA, 8OU, 8QY, 8SC.
HEARD : G5YV, 6CI. (*October 18-19*).

G5DS, Surbiton, Surrey.

WORKED : G2ANT, 2BRR, 2DHV, 2DSW, 2NM, 2YB, 2YC, 3ANB, 3BHS, 3EDD, 3EHY, 3EYV, 3GBO, 3HWJ, 3HXO, 3HXS, 3HZK, 3IOO, 3MI, 3VM, 3WW, 4GR, 4MR, 4SA, 5MR, 5UD, 5YV, 6FO, 8IL, GW8UH. (*Marathon October 25-26 only*).

G3VM, Norwich, Norfolk.

WORKED : G2ANT, 2DSW, 2UN, 2XV, 3EDD, 3GDR, 3WW, 4DC, 4PV, 5DS, 5UD, 5YV, 6NB, 8IL. (*Marathon October 25-26 only*).

G3YH, Bristol, Glos.

WORKED : G3DLU, 3DJX, 3EHY, 3FIH, 3HSD, 3HXO, 4GR, 8DA, GW5MA/P, 8U.
HEARD : G2AJ, 2FFG, 2YB, 3ANB, 3BLP, 3FUM, 3GHO, 3HXS, 3ION, 3IIT, 3IWA, 3VM, 3WW, 4CI, 4DC, 4RO, 4SA, 5DS, 6NB, 8OU. (*October 15 to November 12*).

G3DLU, Weston-Super-Mare, Somerset.

WORKED : G2YB, 3CGE, 3EHY, 3FIH, 3GOP, 3YH, 4GR, 8FC, GW3BNQ, 5MA/P.
HEARD : G2DTD, 2HIF, 2NH, 3BHS, 3DJX, 3FUM, 4RO, 5DS, 5MA, 8IL, 8OU. (*October 6 to November 10*).

G3EHY, Banwell, Somerset.

WORKED : G2AAW, 2AHP, 2BAT, 2HCG, 2MV, 2YB, 3ABH, 3ALN/A, 3ANB, 3ASG, 3BJQ, 3BPM, 3DLU, 3ELT, 3EYV, 3FD, 3FIH, 3GDR, 3HAZ, 3IAI, 3IER, 3IOO, 3WW, 3YH, 4DC, 4GR, 4RO, 4SA, 5DS, 5UD, 8DA, 8IL, 8OU, GI3GQB, GW2ADZ, 3BNQ, 5MA/P, 8UH. (*October 10 to November 11*).

G8IL, Salisbury, Wilts.

WORKED : G2AHP, 2ATT, 2BAT, 2BM, 2DSW, 2FFG, 2UN, 2ZU, 3ANB, 3BHS, 3BPM, 3CGE, 3EDD, 3EHY, 3FAN, 3FIH, 3FKF, 3GAV, 3GDR, 3HVO, 3HWJ, 3ION, 3VM, 3WW, 4GR, 4RO, 4SA, 5DS, 5MR, 6AG, 6JK, 8DV/A, 8OU, GW8UH.
HEARD : G2DTO, 2XV, 3HXO, 3YH, 4DC, 5UD, 5YV. (*During October*).

G5MR, Hythe, Kent.

WORKED : G2DSW, 3GDR, 3HCK, 5DS, 8IL.
HEARD : G2UN, 3DIV, 3GBO, 3WW, 4GR, 6AG, 6NB, 8OU. (*Marathon October 25-26 only*).

Some Station Reports

G2HDZ (Pinner) goes up a bit in the Tables, and explains that he has not been so active on Two recently because he is busy getting ready for 70 cm ; G5DT has been heard on the new converter, to which it is hoped shortly to add a good aerial and a transmitter. G8VR (London, S.E.2) has returned after five months abroad, and will be on Two again by now ; he also intends to get fully equipped for Seventycems.

G2HIF (Wantage) is busy on a big rebuild so is " submerged under a tidal wave of components, tools and sheet metal " ; his suggestion about lack of activity during TV hours is not that there is a TV problem for most people, but rather that the majority have come to *expect* that there will be nobody on — so they don't bother to look for what they don't hope to find. His idea is to make one evening a week a regular activity period between 2000 and 2230, Thursdays being a good choice because it is an off-night for those who do want to look at TV. So we will test this suggestion, starting immediately. Will *you* try and get on next Thursday about 8.0 p.m., prepared to call CQ and listen round ? G2HIF also has a good deal to say about the QSL problem. his idea being that we should print the calls of operators

G3AZT operating G3AUT/P on 144 mc when located near Priors Marston, Warwickshire. The Tx was to the G6VX design (July 1948) using a pair of 6C4's running 8 watts, with 6C4's also in the modulator. The converter was 6J6-6.16-R.208, the aerial being a 4-element wide-spaced beam, fed through Telcon 300-ohm T-matched line.

who QSL 100%. Then they can be pursued by those who, for one reason or another, have not had a card from *them* ! But the trouble is that most people do QSL fully — the puzzle is to find what happens to the cards. The real answer, as we see it, is probably compounded of a number of factors working together : Leaving QSL'ing till " later " ; cards sticking in the bureaux through lack of envelopes ; no proper system at some stations for handling QSL cards ; a disinclination to send a card till the other man's is received ; the general feeling that there is no particular hurry about QSL'ing anyway.

Bob of G5MA has been out and about again, this time down to Blaenavon, Mon., where he operated as GW5MA/P for the week-end October 18/19, from a site 1,500 ft. above sea level, which proved to be a very fine location. By mid-day on the Sunday, he had knocked off a total of 45 different stations, some as far East as the Surrey area ; he was not, however, able to make himself heard at G5YV. Bob runs an input of about 12 watts CW on these occasions, and is always a good signal. This time, he had a little trouble with his beam in the high wind, and had to make temporary repairs with sheet cut from a condensed milk tin ! As the weather is now changing to the inclement, the Blaenavon trip was his last /P foray for the season — so we shall have to wait till about May or June next year for some of the rarer counties. In the general correspondence, we have had many messages of praise, thanks and congratulation to pass on to G5MA from those who have derived interesting QSO's — and perhaps a new county — in the course of his rambles this year. And he is a good, solid QSL'er, too. Well done, Bob !

From Perivale, G2AHP reports steady activity, and among other points of interest, remarks that he has now worked G3CAT nearly 40 times ; new contacts for him were G3FOL (Ewell, Surrey) and G4GT at St. Albans for the latter's first QSO. Contrary to the usual experience, G2AHP says he does find " the odd station popping up for a QSO during TV hours." G3HBW (Wembley) thought the period October 17-19 best for conditions, when he worked G3IOO (Oswestry) and GW5MA/P ; he has noted a remarkable increase in signal strength from G2NM recently, and wonders " what the secret is ?". Well, Gerry, what is it ?

Brian of G6CI in Kenilworth is right on the edge of his VHFCC, wanting (at this writing) only three cards to get his claim in. He still

TWO METRES

ALL-TIME COUNTIES WORKED LIST

Starting Figure, 14
From Fixed QTH Only

Worked	Station
60	G3BW
58	G3BLP
57	G2OI (349)
56	G3EHY (365), G8SB
55	GW5MQ
54	G6NB
53	G2AJ (519), G5YV (364)
51	G3WW
50	G2HIF (191)
49	G4CI
48	G3ABA (282)
47	G2NH, G2HDZ, (331), G5DS (393), G5WP
46	G4HT (476), G5BY, G5MA
45	EI2W (132), G2XC, G5BM, G6XM (356), G6YU
43	G3BK, G3COJ, G5DF
42	G4SA, G5BD
41	G2FQP, G3BA, G3DMU, G3FAN (295)
40	G3CGQ, G3HAZ, G4RO (256), G8KL, G8OU
39	G2IQ, G3VM
38	G3APY, G8IL (300)
37	G2FNW
36	G3CXD, G3GHO (170), G3HBW, G6CB (312), G8IP
35	G2FZU (118)
34	G2AHP (321), G3AVO/A, G5JU
33	G2FCL (117), G3FZL, G6CI (129)
32	G2FVD, G5ML (131), G8IC, G8QY
31	G2FJR (103), G5RP
30	G5NF
29	G3AKU, G3BJQ, G6TA (194)
28	G3FIJ (143), G3HXO, GM3BDA, G8VR
27	G3AGS, G3BNC, G3DAH, G3GSE, G3HCU (152), G6GR
26	G3CFR (125), G3FIH, G3GBO (289), G4MR (189)
25	G5SK
24	G3FD, G3FXG
23	G3CWW (260), G5PY
22	G3AEP, G3ASG (150), G3BPM, G3GOP (122), G3HII, G5MR (128), GM3EGW
21	G6XY
20	G2HOP, G3EYV, G3FRY, G4LX, G6PJ
19	G3SM, G5LQ (176)
18	GM3DIQ
16	G2AOL, G3FEX, G3FRE, GC2CNC
15	G2DVD, G3DLU, G3IWA
14	G2DHV, G3GYY, G3ISA, G3YH

Note : Figures in brackets after call are number of different stations worked on Two Metres. Starting figure for this classification, 100 stations worked. QSL cards are not required to verify for entry into this Table. On working 14C or more, a list showing stations and counties should be sent, and thereafter added to as more counties are worked.

finds the GDX at times, but says that conditions have made it hard going. G6PJ (Sheffield) is now equipped for phone and has had some good semi-local contacts; during the month, he visited G6NB (Aylesbury) who is a regular contact. G6PJ also reports that he often hears weak, under-modulated carriers from the London direction after about 2230, and says it is a pity these stations do not sign on CW now and then.

A first report from G3IOO (Oswestry), who says he is on 145.6 mc "before, during and after TV and only too anxious to give the chaps a Shropshire QSO." From the correspondence, and what we have heard on the air, we know that he is putting out a nice signal; since October 8, he has scored 15C, which we gather might have been more if some of the stations he hears would tune above 145 mc.

GC2CNC (Jersey, C.I.) will be on after Christmas from a new QTH affording him an effective aerial height of 390 feet above sea level. Knowing Jersey as we do — though it was nearly 30 years ago — this should give him a clear getaway in all directions and make him a hefty signal along the South Coast even when conditions are off. GC2CNC is also getting going for 70 cm, and has already heard himself at a range of 3 miles.

Another OT, Jerry of G2XV (Cambridge), writing to offer some comments on the Marathon, reports that he is now all set with a converter on 70 cm; he and G2WJ have heard one another at a range of 20 miles on that band; other Cambridge stations up on 430 mc are G4MW and G5IG. G2XV suggests organised 70 cm activity periods — so why not the Thursday evening? *See* panel.

G3EHY (Banwell) as usual has been on every evening during the period "and nothing has been allowed to get rusty." He regrets the non-appearance of many of the northerly stations, normally workable, and his comment is that we shall only make real progress if people will come on when conditions do not seem to favour GDX, and try for it. On the other hand, he is full of praise for the stations who do show up regularly — the die-hards, who can always be heard irrespective of conditions, and who do so much to support organised activity on the band. During the great gale on the night of November 7, many beam assemblies were bent, battered or disarrayed (including our own, as storm gusts are not normally expected from the north-west). The 8-element stack at G3EHY was completely wrecked, but by the next evening he had a 5-ele Yagi up and ready for the GI3GQB schedule; two nights later, he got one of the best reports for the month from GI3GQB. To enable comparisons to be made on incoming signals, it is interesting to add that G3EHY uses an entirely separate array for reception, so that beam performances can always be directly compared. And it might also be added that contrary to general belief, everyone who has visited G3EHY agrees that his location *looks* a very poor one—he is less than 50 feet above sea level and a study of the contours shows high ground in nearly all directions.

We have another comprehensive report from G8IL (Salisbury), who was up on nine evenings during the month, and worked four new stations — a "really new one" being G3ION, Tetbury, Glos., on 145.33 mc, and able to get into Salisbury and Southampton any time with only 4 watts. G8IL's main interest is the possibility of arranging EDX schedules with stations in Southern France, North Africa, Spain and the Mediterranean area. As he rightly points out, possible openings into DL, ON, OZ, PA and SM are well covered by the mass of active stations in the London and Home Counties area and East Anglia, few of whom are in the habit of aiming south or south-east when there is an opportunity of working DL's; the latter are usually out of range of our westerly G's, anyway, who could be looking for EDX to the South when these openings occur. We are in process of collecting information on EDX stations who are properly equipped for Two and interested in DX working.

G3YH (Bristol) writes again with a calls heard list and a Counties claim — we are glad to see him back on the band after what seems to have been a long absence. From Cheltenham, G3FRY reports, with six new stations worked during the month, and G3FUM and G4DC heard. His Yagi at 50 feet is one of those that did survive the gale and the fact that he has now worked 20C confirms his belief that he is "no longer sitting behind the Cotswolds." G3FRY remarks that he QSL's 100%, but if anyone is missing a card from him — QTHR. G8DA (Malvern) had a thin time in the last leg of the Marathon, and is so occupied during the winter months that he has only an hour or so each week for radio — nevertheless, he is up one county with G3IOO.

G3DLU (Weston-super-Mare) was

THURSDAY VHF SESSION

Starting next Thursday, and every Thursday evening thereafter, all VHF operators are asked to come on for a QSO Party to be held between 2000 and 2230 GMT. There will be activity on both bands, Two and Seventy Centimetres. Make It A Date!

TWO METRES

COUNTIES WORKED SINCE SEPTEMBER 1, 1952
Starting Figure, 14

Worked	Station
42	G3WW
27	G5YV
26	G3GHO, G5DS
25	G2HDZ
23	G8IL
21	G4RO
20	G2AHP, G3HBW
18	G8DA
16	G6TA
15	G3DLU, G3IOO
14	G2FCL

Note: This Annual Counties Worked Table opened on September 1st, 1952, and will run until August 31st, 1953. All operators who work 14 or more Counties during this period are eligible for entry in the Table. The first list sent should give stations worked for the counties claimed; thereafter, additions claimed need show only stations worked in each county as they accrue. A certificate is given for all VHF operators who work 40C or more in the year, for which QSL cards must be shown. Cards are not, however, required for entry into the Table.

on for a total of 19 evenings during the period, and for the week from October 30 was concerned with re-erecting his two stacks ; he hopes to be running 80 watts into an 829 in the New Year. His CQ calls at 0630 daily during October failed to produce any reply ! G3DLU reports signs of two-metre activity on the part of G8FC, the R.A.F. Amateur Radio Society's station at Locking, " right on G3EHY's doorstep," and only four miles from G3DLU.

EI/GI VHF RSI

This new organisation, the VHF Research Society of Ireland, now has about 100 members, and is going great guns. The latest issue of their *Upper Spectrum* — which is to appear quarterly — is an ambitious 20-page printed production containing a number of interesting news items, and five technical articles. Four of these are reprints from *Short Wave Magazine ;* our Zone Plan allocations and VHF Progress Tables are also featured.

Of fourteen EI/GI stations with allotted two-metre frequencies, eight are in operation, as follows : EI2W (Dublin). EI3S (Dublin), EI9N(Dublin), GI2FHN (Co. Down), GI3AXD (Co. Antrim), GI3BIL (Co. Down), GI3GQB (Co. Down) and GI6VU (Co. Down.) With one exception, all these stations are shown as working in the Zone D frequency area, 145.8-146.0 mc. GI2FHN is on 145.800 and EI9N on 145.980 mc. A further four stations — EI2L, EI3L, EI9G and EI9U — are listed as in operation, but on unspecified frequencies, and nineteen more stations are stated to be coming on shortly. With one or two exceptions, it is expected that they will be on Zone D frequencies.

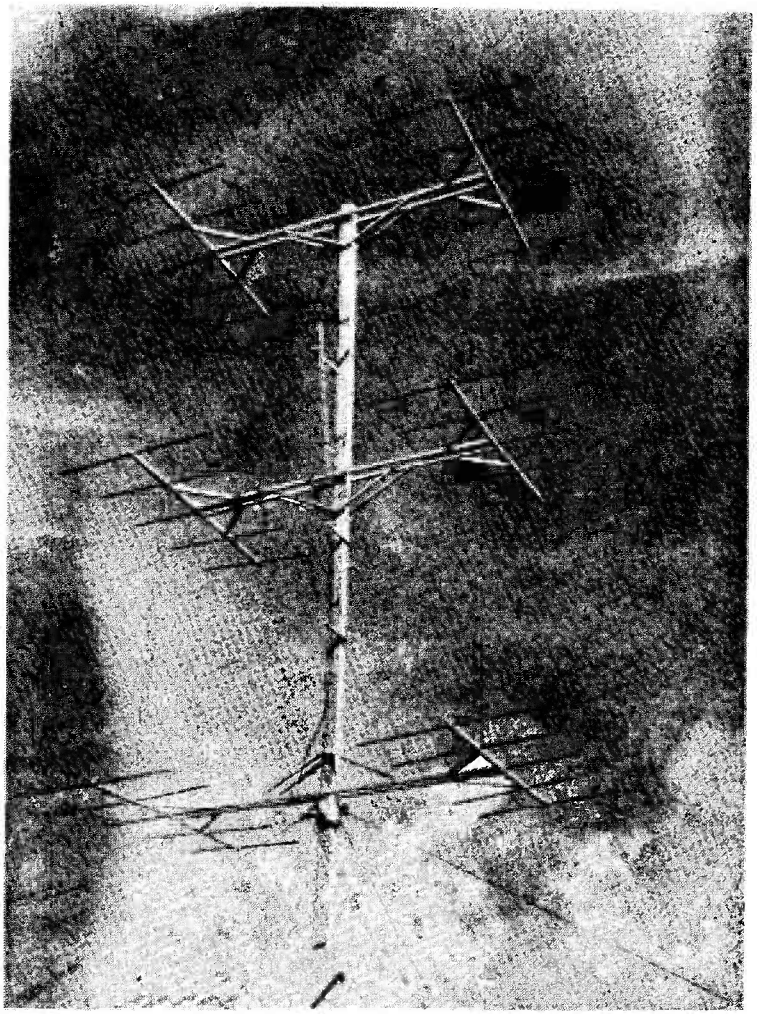
All this is a fine tribute to the energy, enthusiasm and foresight of EI2W, who is not only president of VHF RSI but has also taken on the onerous duty of producing *Upper Spectrum.* We shall watch progress with great interset, and wish him and the society luck in their endeavours.

Winter Work

While all VHF operators will hope that the winter period is not going to mean a season of hibernation on Two, for our part we hope that this wish will be translated into action — by a listen round and a CQ call whenever opportunity serves, irrespective of how conditions seem. We would also very much like to see some more regular schedule -keeping, like the G5YV/G8OU and G3EHY/GI3GQB undertakings, over useful distances and with the object of keeping up regular activity.

There is no reason to suppose that there will not be opportunities for good GDX during the winter months, but they will be " fleeting opportunity targets " as distinct from the longer periods of good (or at any rate better-than-average) conditions that we get during the summer. It is only regular operation and, where possible, steady schedule-keeping that will show up these conditions, and so add to our store of knowledge of VHF propagation during the winter period.

We shall be very glad to give publicity to any regular schedules, to hear from operators who would like to set up schedules, and to discuss in detail the results that may be obtained. It does not matter whether it is a nightly or a weekly schedule, so long as regularity is maintained. There are a number of stations well placed, and well-equipped, for work of this kind, and we very much hope that they will take up our suggestions in the



Design for a 30-element two-metre beam. as constructed by G5BY, Bolt Head. S. Devon.

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spirit in which they are offered.

On the equipment side, most operators will have their own ideas, though obviously there is always much to be done in the way of improving the converter or designing a new beam. About all such activities we shall also be interested to hear.

Reports

It is during the next few months that reports will tend to be fewer if activity does slacken off too much — and it is for that specific reason that we would ask all followers of this piece to let us have a regular report, even if it is only a "nil return." If one is on the band at all, there is always *something* to discuss, either as regards gear or operating results.

And Calls Heard. Lists will be of particular interest and importance during the winter, and everyone is requested to let us have these as often as possible.

Finally —

It only remains for your A.J.D. to wish all readers of "VHF Bands" a Very Happy Christmas, adding his sincere thanks to those who have so consistently supported this feature during the last few months — it is their co-operation that makes the result possible, and the reason why we so often receive generous tributes to the part *Short Wave Magazine* plays in the field of VHF.

Dead-line for the January issue is very early, because we must be ready for press well before Christmas if the *Magazine* is to appear on time in January ; so the closing date is **Saturday, December 13,** addressed A. J. Devon, "VHF Bands," *Short Wave Magazine*, 55 Victoria Street, London, S.W.1. Have a good Christmas ! 73, and with you again in the New Year.

Operators on G3AUT/P when on two metres during a recent field day. Left to right : G3AUT, G4KK, SWL Shepherd. G3AZT.

ADDITIONS TO OSRAM MINIATURE VALVE RANGE

B.309 AND N.309

A new Osram pentode, N.309, has been added to the list of miniature valves produced by this group. The valve is a high slope pentode, on Noval B9A base, suitable for the Video stage of TV receivers. Details are as follows:—

Heater current	0.3 amps
Heater voltage	15.0 volts
Anode voltage	200 volts
Screen voltage	200 volts
Mutual Conductance	10 mA/volt

Price with Purchase Tax, 25/1.

The other new valve, the Osram B.309, is a double triode amplifier with indirectly heated separate cathodes. Its characteristics are similar to the American 12AT7 and the B9A base is used. The heaters are separate and can therefore be connected in series or parallel. Details are as follows:—

Heater current	0.3 amps (parallel) 0.15 amps (series)
Heater voltage	6.3 volts (parallel) 12.6 volts (series)
Anode voltage	300 volts (max)
Mutual Conductance	5.5 mA/volt
Anode dissipation	2.5 watts per anode

Price with Purchase Tax, 25/1.

The B.309 will obviously be of great interest in connection with the design and construction of VHF receivers.

THE QSL BUREAU

Our QSL Bureau handles cards on a world-wide basis, mainly by direct mail. Its full use (both ways) is reserved to direct subscribers and BSWL members. Cards inwards are accepted for any G operator, irrespective of his affiliations. The Bureau address is: BCM/QSL, London, W.C.1.

SIMPLE TOP BAND Tx

Those interested in a straightforward 160-metre transmitter should see the December issue of our *Short Wave Listener & Television Review*, in which is described in detail a VFO-BA-PA rig which could be reproduced in any convenient form. A few copies of this issue are available at 1s. 7½d. post free, of The Circulation Manager, Short Wave Magazine, Ltd., 55 Victoria Street, London, S.W.1.

CHRISTMAS COMING !

Now is the time to be thinking about Christmas presents. If the problem is a radio one, and partucilarly if it is Amateur Radio, there could be no better choice than a year's subscription to *Short Wave Magazine*, covering the whole field of amateur transmission, with regular activity features not equalled by anything appearing in print, and with each issue of vital interest to every active operator. The cost for a year of twelve issues is but 30s., post free on publication to any part of the world. Order on : The Circulation Manager, Short Wave Magazine, Ltd., 55 Victoria Street, London, S.W.1.

CLUB NOTICE

As the Club space in our forthcoming (January, 1953) issue will be devoted to reporting the recent *Short Wave Magazine* Club Contest ("MCC") in detail, honorary secretaries of Club organisations are asked to note that the next date for announcements for the "Month with the Clubs" feature is January 14, addressed Club Secretary, *Short Wave Magazine*, 55 Victoria Street, London, S.W.1.

WOULD you consider Amateur Radio a *dangerous* hobby? There is no doubt whatever that it is — compared with, say, philately or the keeping of tropical fish. And yet we seldom think of it as such, while we are actively deriving enjoyment from it. I am not referring only to the possible dangers of high voltage treated with contempt, but to all the multifarious jobs that fill up an active amateur's time. Perhaps he is scrambling over the roof to care for his two-metre beam; next day he is bending some sharp-edged metal with a tool that could be positively lethal; and then perhaps he is working with a small gang, putting a heavyish mast into a quite inadequate hole in the ground. All these activities could be classed as energetic and dangerous, compared with those of the most rabid book-collector. And yet the unenlightened, listening to amateurs on the air, would think that theirs was not a particularly active or healthy hobby —one necessitating much cigarette smoking and late hours, perhaps, but certainly not in the least dangerous. Let's not be morbid— but don't forget, all the time, that you need your wits about you and that common sense is a valuable commodity.

THUNDER AND LIGHTNING

I believe I have already said a few words about those occasions when the sparks fly inwards, instead of outwards, from our aerials. But what of that strange phenomenon that we airily call "charged rain"? It does not seem to be fully understood as yet. A few days ago, during a shower, the familiar roar blotted out all but the strongest signals on my receiver, but I found that this noise, which was S8 on one of my aerials, was barely S4 on the other. Could this have been due to the "slant" of the rain, to which one aerial was broadside and the other end-on, or was the actual noise caused by rain falling somewhere else, and the difference due to the directional effects of the two aerials? Perhaps someone does know the answer to this, and, if so, I should be very interested to hear it. When the roar of charged rain gives place to the sharp crack of nearby lightning flashes, then it is time to cease one's investigations and firmly disconnect the aerials (*see* preceding paragraph!)

INTRUDERS

So many strange things are now to be heard on what were once the "amateur" bands that many people are getting restive about it. Their attitude, in the main, seems to be "Why don't we send a gunboat up the river?" Strange, this, for a nineteenth-century attitude doesn't go well with our very twentieth-century hobby. The days of gunboat-psychology have ended in all spheres of life, and although the authorities may now (after a seemly time-interval) request a foreign power to change the frequency of one of its stations (assuming that it would cause them no inconvenience to do so, and, of course, emphasising the fact that there is absolutely no hurry), this doesn't usually help us much. And if the foreign power concerned turns out to be —you know who, any request would be not only a waste of time but just a misguided effort altogether. On top of this we must face the fact that no one (except the amateurs and, possibly, the Services) would care very much if the amateur communication bands were completely and permanently QRM'd out. Which is only one reason why we should make full and careful use of them.

TALKERS AND WHISTLERS

The last thing I want to do is to start another Phone-*versus*-CW debate going, but I heard a point of view expressed the other day which seemed to hit a nail of some sort on the head. This was that the CW communicator is brief, terse and to the point; he gets through a QSO without wasting time, and yet says what he wants to say. On the other hand, the average Phone man doesn't seem to know when to stop; and, viewed dispassionately by a listening stranger, he seems to say the same old things over and over again as if he is afraid to pull the big switch. Another view somewhat strongly expressed was that "net" procedure is excellent when there is some *purpose* behind the net — for instance, a local Club discussion— but that those nets that just happen are terrible time-wasters. The chances are that each station in the net would be much happier in a straight QSO with one other fellow, but has to sit and listen to five or six young lectures before saying his own piece. Nets, in short, waste time while saving space.

CALL-SIGNS

Does anyone else play silly games with call-signs, the way some people do with motor-car registration numbers? One of my friends, having worked ZK2AA, FO8AB and FP8AC, in that order, about two years ago, started out with the idea of collecting an "AD," then an "AE," and so on. But this wasn't a good one at all, for he found that in the odd countries where very few amateurs exist, it is easy to pick up an AA, AB or AC, but when one gets much beyond that, things become more elusive. So this chap turned his attention to working stations with call-signs containing the same two letters as his own; and I have since found quite a number of people who do this. All very well for two-letter men, but not a very productive sport for the far more numerous owners of three-letter calls. About the only duplications of their call could come from U.S.A.

NEW QTH's

This space is available for the publication of the addresses of all holders of new U.K. callsigns, as issued, or changes of address of transmitters already licensed. All addresses published here are reprinted in the quarterly issue of the " RADIO AMATEUR CALL BOOK " in preparation. QTH's are inserted as they are received, up to the limit of the space allowance each month. Please write clearly and address on a separate slip to QTH Section.

G3AJX, G. Stanton *(ex-GM3AJX/ZB1AJX).* 5 Mountbatten Place, Springvale Estate, Kingsworthy, Hants.

G3GUU, C. H. Hall, 23 Seafield Road, Lytham, Lancs.

G3HXO, N. A. Eaton, 25 Stanford Road, Shefford, Beds.

G3HXS, P. L. Jeffery, 5 Station Road, Long Marston, Tring, Herts.

G3IDU, T. W. S. Roots, 32 Lansdowne Road, Walthamstow, London, E.17.

G3IFA, F. Allsopp, 18 Vale Street, Derby.

G3IHE, D. Turner, 672 Filton Avenue, Bristol.

G3IKN, V. A. Stagg, 18 Oakfield Road, Southgate, London, N.14.

G3ILA, F. H. Hughes, Northdean, Meopham, Gravesend, Kent.

G3ILO, T. G. Spencer, The Western Lady, Peak Villa, Upper Cam, Glos.

G3ILO/A, T. G. Spencer, Cherry Tree Cottage, Slimbridge, Glos.

GW3IMQ, L. Miles, 5 Parc-y-Duc, Clyndu Street, Morriston, Swansea.

GM3IMR, Miss M. W. Rhodes, 156 Cardowan Road, Carntyne, Glasgow.

G3IMX, E. G. Jolliffe, Devona, Church Road, Gurnard, Cowes, Isle of Wight.

G3IND, D. H. Boyles, 45 Dunbar Road, Forest Gate, London, E.7.

G3INU, R. J. Appleby, 95 Oxford Road, Clacton-on-Sea, Essex.

GW3INV, E. Edwards, 32 Lorne Street, Wrexham, Denbs.

G3IOD, P. J. Everett, 129 Windsor Road, Forest Gate, London, E.7.

G3IQR, A. W. E. Barber *(ex-DL2QR),* 14 Park Crescent, Abingdon, Berks.

G3ITB, T. H. Bartlett, St. Anthony's, Church Close, West Runton, Cromer, Norfolk.

G3JHG, J. H. Greenwood 40 Malsis Road, Keighley, Yorkshire

CHANGE OF ADDRESS

EI5B, R. J. Toby, Ewell, Mount Anville Road, Deer Park, Dublin.

EI5T, I. A. L. Bowie, Clonard, Callan, Co. Kilkenny.

G2AJ, W. R. Joss, Denewood, Post Office Lane, Cleeve Hill, Cheltenham, Glos.

G2APF, J. Frampton, 77 Middleton Hall Road, Kings Norton, Birmingham, 30.

GM2CHN, D. Niven, 18 Botanic Crescent, North Kelvinside, Glasgow, N.W.

G2CNN, P. M. Branton, Black Bear Hotel, Wareham, Dorset.

G2HL, J. G. Woodage, 107 Camberley House, Redhill Street, London, N.W.1.

G2LT, E. Walker, 20 Dalewood Road, Sheffield, 8.

G2ZD, T. C. Whimster, Russets, Crowhurst, Battle, Sussex.

G3AEJ, S. Stobbs, Crig-a-tana, Kuggar, Ruan Minor, Helston, Cornwall.

G3AGW, H. A. Edwards, 61 Birchfield Way, Yew Tree Estate, West Bromwich, Staffs.

G3AKH, D. G. Lucas, 33 Broad Chare, Newcastle-on-Tyne, 1 *(Tel.: Newcastle 26304).*

G3BUK, W. J. Kelsey, 12 Chaucer Avenue, Littlehampton, Sussex.

G3DCT, P. H. Green, 115 Moulsham Drive, Chelmsford, Essex.

G3DMF, E. R. Parkes, 13 Finstock Avenue, Blurton, Stoke-on-Trent, Staffs.

G3EDT, J. E. Rickaby, 44 Cranleigh Drive, Cheadle, Cheshire.

GM3EDZ, T. P. Hughes, 20 St. Peter's Street, Glasgow, C.4.

G3EIX, P. J. Naish, B.Sc.(Eng.), 39 Yarwood Road, Chelmsford, Essex.

GM3EWC, R. B. Irvine, 6 Beechgrove Gardens, Aberdeen.

G3FCT, S. J. Coe, 98 Athelstan Road, Faversham, Kent.

GM3FGH, D. R. Leah, Clarach, Cairneyhill, Dunfermline, Fife.

GI3FKL, C. Castles, 12 Malton Drive, Upper Malone, Belfast.

G3FMR, T. Dwyer, 2 Whitmore Gardens, Kensal Rise, London, N.W.10.

G3FVD, R. K. Mildren, 7 Lower Bore Street, Bodmin, Cornwall.

GM3GIJ, F. D. Bell, 7 Cherrybank Road, Glasgow, S.4.

G3GPB, R. J. Radford, 4 Clifton Villas, Paddington, London, W.9.

G3GRQ, C. S. Hebden, 101 Vicarage Wood, Harlow New Town, Essex.

G3HHC, C. G. Eley, North End, Felsted, Dunmow, Essex.

GW3HJR, R. Morris, The Shack, Beddau Road, Caerphilly, Glam.

G3HNJ, F/Sgt. J. Clennell, 10 Weston Avenue, Leighton Buzzard, Beds.

G3IBO, B. G. Barnard, 32 Byron Road, Gillingham, Kent.

G3JD, W. H. Baker, 46 Dower Road, Torquay, Devon.

G6NP, W. Gill, 135 Balmoral Road, Morecambe, Lancs.

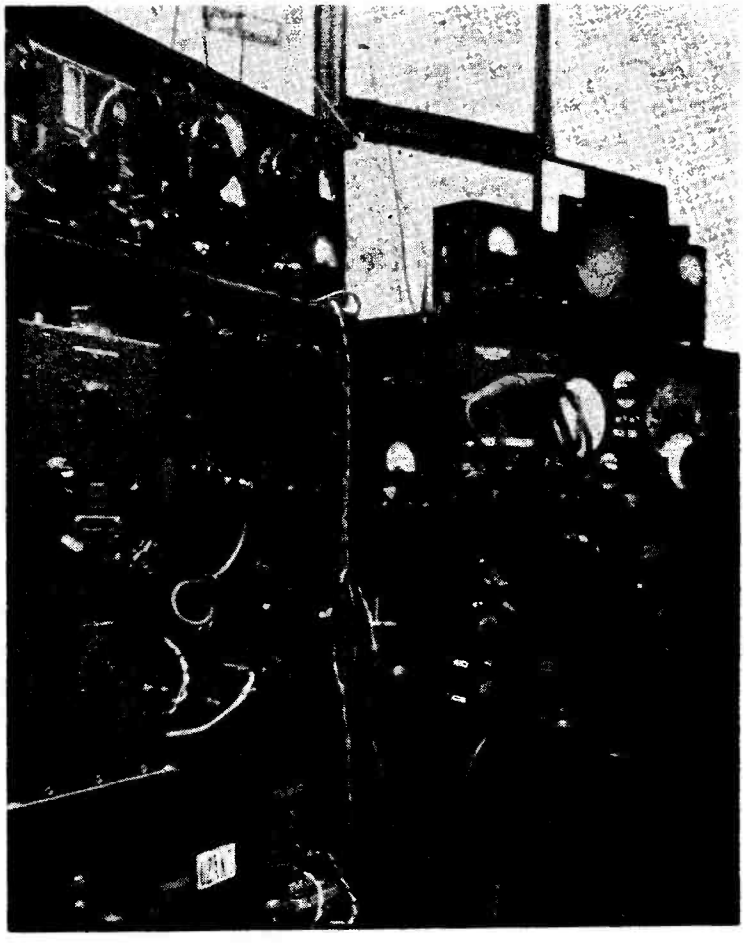
CORRECTION

G3IKO, D. W. E. Butterworth, 15 Waverley Avenue, Chingford, London, E.4.

G3IRT, A. J. B. Roberts, 23 Beta Close, New Ferry, Bebington, Cheshire.

G2AKT

The Other Man's Station



THIS time it is G2AKT, owned and operated by S. C. Keville at 25 Walmington Fold, Woodside Park, London, N.12, who started in 1931 with the AA call 2BBR. Having served in Army Signals in both wars, he was well qualified to become G2AKT in 1946.

The station as shown here consists essentially of VFO-6L6-6L6-807, adapted for crystal control when required, with an HRO Senior and a PCR stand-by for receivers. For about the last twelve months, operation has been Phone and CW on 20 metres only, using a folded dipole broadside East-West. When first starting up post-war, G2AKT was able to make WAC using CW and only 25 watts into a 30-ft. length of random wire in the roof-space.

There are no relays to stick, chatter or fall out at this station, because mechanical switching is used throughout—and we cannot remember how long it is since we have described an installation which was *not* relay controlled. At G2AKT, two double-pole switches are coupled for "one-hand control," giving HT "on" transmitter and "off" receiver, with separate manipulation for aerial change-over. It is all done no less rapidly than with relays, and it is of course quite possible to dispense with relays where no long power-carrying leads are involved.

On the phone side, plate-and-screen modulation has recently been discarded in favour of the system of Clamp control, with negative feed back and controlled carrier, as described by G3DZW in the September, 1952, issue of *Short Wave Magazine*. This is found to give entirely satisfactory results, and excellent quality with a D.104 crystal microphone. Separate power packs are provided for VFO, doubler unit, PA and the modulator.

Over the years, world-wide DX has been worked with the 25 watts, and G2AKT says he has "No intention of increasing power beyond the capacity of one 807." So here we have another example of an active and successful operator not interested in piling up the watts in order to blast through the QRM. If everybody thought the same, how much tidier our bands would be.

The Month With the Clubs

The Seventh MAGAZINE *Club Contest is all over bar the publication of the results, which will appear, as usual, in the next (January) issue. For this reason Club Secretaries are asked NOT to send in reports for next month. Any received will be held over for the February issue.*

This month we acknowledge receipt of publications from the following Clubs: MONTHLY NEWS (Surrey Radio Contact Club); NEWS-LETTER (Clifton); CQ CARS (Coventry); NEWS-SHEET (Purley).

Your "Club Secretary" takes pleasure in this opportunity of wishing all Club Secretaries, officers and members a Merry Christmas and a Happy and Successful New Year.

The next dead line is **January 14, 1953,** *for the February issue, and reports should as usual be addressed: "Club Secretary,"* SHORT WAVE MAGAZINE, *55 Victoria Street, London, S.W.1.*

Wirral
Amateur Radio Society

The AGM, in October, revealed a healthy state of affairs, and an almost completely new Committee was elected. G2AMV is now Chairman, G3FRT Treasurer and G3EGX Secretary. A lecture on High-Quality Reproduction was well attended, and meetings continue every other Wednesday at the YMCA, Whetstone Lane, Birkenhead. The next is on December 17.

Warrington & District
Radio Society

Recent lectures have been on "Adventures with a Tape Recorder" (G2YS) and "High Fidelity" (Goodmans Ltd.), both being much appreciated. The Annual Dinner will be held on November 21.

Stoke-on-Trent
Amateur Radio Society

This club continues to meet every Thursday at the rear of the Cottage Inn, Oakhill — 7.30 p.m. A full lecture programme has been arranged, together with practical work, Morse practice, operating G3GBU, junk sales, ragchews and the other various activities. The Hon. Sec. sends his best Christmas wishes to all members, past and present, at home and overseas.

Spen Valley & District
Radio & Television Society

Forthcoming events: December 17, High-Fidelity Reproduction; December 31, Open Meeting. On December 3 the Society paid a visit to the Holme Moss Television Station.

Nottingham Short Wave Club

They have now been able to re-commence meetings at a new QTH — No. 2 Church Street, Bramcote (workshop at rear). Meetings are held every Sunday from 10 a.m. onwards. Other evening meetings can be arranged if the demand is sufficient.

Neath, Port Talbot & District
Amateur Radio Club

At the AGM GW3FSP, the retiring Chairman, reported on a successful year's work and put forward reasons for the steady decline in active membership in the post-war years. It was decided to widen the scope of the club to include Television, Radio Control and other applications of electronics. GW2AVV is the new Chairman; the Hon. Sec. carries on. Meetings are on alternate Wednesdays at the Royal Dock Hotel, Briton Ferry—7.30 p.m.

Coventry
Amateur Radio Society

Recent meetings have included lectures on Grid Dip Oscillators and Two-Metre Receivers, with a demonstration of lining up an AR88 and an HRO with G3FAB's Wobbulator. The Club's "night-on-the-air" on the Top Band has recommenced — second Thursday of each month at 8 p.m. The Twenty-First Anniversary Dinner will be held on February 27 at the Hare and Squirrel, Coventry — tickets 10s. 6d. from the Hon. Sec. or Committee members. On December 22 the Children's Party will take place.

Chester & District
Amateur Radio Club

This club still goes strong with weekly meetings — every Tuesday at 7.30 p.m. at the Tarran Hut, YMCA. The Club Tx, G3GIZ, will shortly be on the air again. On December 14 there will be a Receiving Contest; on December 30, discussion on NFD plans; January 6, Tape Recording Troubles, by G2YS. Morse class every Monday at 8 p.m., also the "Evening Class" for the RAE.

Barnsley & District
Amateur Radio Club

On October 24 Mr. G. W. Wigglesworth, G2BH, gave a lecture on Nuclear Fission. This proved very interesting and came at a particularly opportune time.

East Surrey
Radio Club

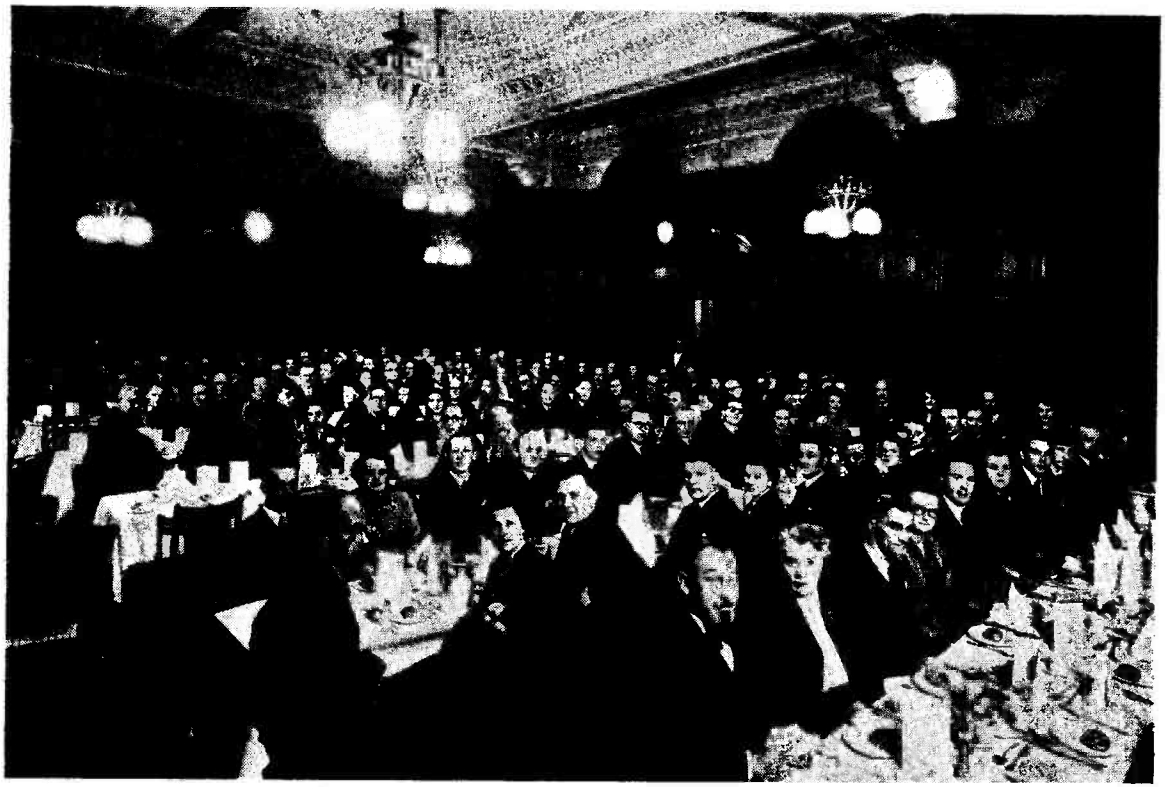
HQ has been moved to the Ex-Servicemen's Club, British Legion HQ, High Street, Redhill, where all future meetings will be held. The Club call is G3ISR.

Scarborough
Amateur Radio Society

The Club is active, with meetings every Thursday at 7.30 p.m. at its HQ in West Parade Road, Scarborough. *See* panel for Secretary's QTH.

West Lancs. Radio Society

The winter programme is under way and includes projected visits to the BBC and GPO, and a full series of lectures. Six of the present members will shortly be licensed, and two very keen YL's are on the books. Weekly Morse



Official photograph taken at the joint jubilee dinner of the Midland Amateur and Slade Radio Societies, held in Birmingham on October 25 last. The size of this gathering, commemorating such a long period of active existence, is a good indication of the strength of these well-established Midland societies and the sound organisation behind them.

classes, main lectures once a month, technical talks and "natter nights" fill the time — meetings are at 8 p.m. every Tuesday in the room over Gordon's Sweetshop, St. John's Road, Waterloo.

Bournemouth
Radio & Television Society

The recent Annual Hamfest was attended to capacity and brought the season to a hilarious close. For the New Year a full programme of visits, lectures and other activities has been arranged. December 5, General Meeting; December 12, Visit to the Transport Generating Station; December 19, Junk Sale. January 2, AGM — at the Cricketers' Arms, Windham Road, Bournemouth. New members and visitors will be welcome.

Brighton & District
Radio Club

Interesting lectures and demonstrations continue on alternate Tuesdays, the intervening Tuesdays being informal. December 9, Lecture on Audio Equipment (Goodmans Ltd.); December 23, Meters—Construction and Repair (Mr. P. Cashel); January 6, AGM.

British Two-Call Club

This Club is open to all holders of a G call who have also held an overseas call at some time. Membership is now 104, and the Club's "Six - Call Section" includes GM3AFG/MP4BAO, G5KW / HZ1KE, GW3BUX / YI2AM, G2DC / DL2RO and many well-known amateurs. If you qualify for membership, apply to the Hon. Sec. (QTH in panel) for an application form.

Edinburgh (Lothians)
Radio Society

Meetings are held on Thursdays, 7.30 p.m., at 25 Charlotte Square at fortnightly intervals. December 11, Bring - and - Buy Sale; January 8, Test Equipment; January 22, VHF Equipment. Note the break at Christmas time. Morse tuition and RAE classes are being run—at the last examination 75 per cent. passed.

Grafton Radio Society

Full activity continues, including a very successful stand at the Islington Handicrafts Exhibition. December 8, AVO Electronic Test Unit; December 22, Junk Sale; January 12, "Any Questions?" January 23, *Radio-Craft* PS7 Preselector. Morse classes continue and meetings are held on Mondays and Fridays.

Midland
Amateur Radio Society

The Joint Jubilee Dinner of MARS and Slade was a great success, the Guests of Honour being the Lord Mayor and Lady Mayoress of Birmingham.

Another notable guest was Mr. H. J. Dunkerley, Regional Controller of the BBC. The Christmas meeting of MARS will include a mock auction and other activities in keeping with the times—no lecture.

Purley & District Radio Club

A very successful Junk Sale was recently held, raising a substantial amount for Club Funds. There will be no meeting during December, the next being on January 23 at the Railway Hotel Purley—7.30 p.m.

QAU Club, Jersey, C.I.

Meetings have been held as usual during the past months, but attendances have been small. The visitor season ended in September, but it is hoped to renew old acquaintances next year. Activities on the air are very quiet at present.

Ravensbourne Amateur Radio Club

This group, associated with the Downham Men's Institute, meets on Wednesdays at 8 p.m. The Club Tx, G3HEV, is active occasionally, and members are building their own equipment. A basic course on radio and TV theory is being run, also Morse instruction. A prize is to be presented for the best home-constructed gear, to be exhibited next March.

Slade Radio Society

The Jubilee Dinner has already been reported, in the MARS paragraph. This function commemorated Slade's Silver Jubilee and MARS' Twenty-First. A recent lecture on High-Quality Tape Recording, with a demonstration of stereophonic sound reproduction, was attended by a record gathering of nearly 80. On December 19 there will be the annual "Fun and Games Evening" — 7.45 p.m. at the Church House, Erdington.

Stockport Radio Society

The first Social was held recently, with an attendance of over 80. Recent lectures have also been well attended and have covered Aerials (G2FOS) and Tape Recording. G3IOZ and G3IPZ are two newly-licensed members. Weekly RAE lectures are held and it is hoped that more members will be successful next May.

Sunderland Radio Society

Forthcoming events: Electronic Valve Assembly Technique (Mr. H. Pattinson), December 10; Wired Broadcasting (Mr. N. Farmer), January 7. Both at the Club Room, North Bridge Street, at 8 p.m.

Surrey Radio Contact Club (Croydon)

On November 11 G3BLP gave a talk on Modulation Methods. On December 9 there will be a lecture on the History, Design and Construction of AVO Meters, with a demonstration of some uses of the instruments.

Sutton & Cheam Radio Society

Two recent lectures have been on A Four-Band Table-Topper (G4DC) and Germanium Diodes (GEC). The December meeting will be the usual Christmas Junk Sale. G3ILT, a newly-licensed member, is a sightless amateur, and much credit is due to G3FOU, who so successfully coached him for the examination.

W.F.S.R.A. (Bedfast Club)

The Secretaryship has now been taken over by G3IHI of Swindon (*see* panel for full QTH). Readers are reminded that membership is open to anyone interested in radio who, through ill-health, is either confined to bed or cannot take part in normal outdoor activities. A free advice and servicing bureau has recently been formed, and "Area Engineers" have been appointed in many counties. Any reader either wishing for advice or willing to offer his services is asked to write to Ray Millard, 38 York Road, Brentford, Middlesex.

Bradford Amateur Radio Society

Meetings are held fortnightly at

The set-up, signing G3AFT/A, provided by Grafton for the Islington Borough Exhibition at the Town Hall on October 22-24, which was another very successful demonstration of Amateur Radio in action. Two transmitters were installed for operation on four bands, with an AR88 and an anti-interference aerial system, and good QSO's were obtained with the Continent and in most G areas. The Mayor and Mayoress of Islington and many Town Hall officials spoke to several of the G3AFT/A contracts. As always, this was a co-operative effort, with the Grafton members giving freely of their time and loaning equipment to make the undertaking the success it was.

66 Little Horton Lane, Bradford, the next meeting being on December 23 ("Above 200 mc") and January 6 ("Industrial Electronics"). On each of these dates there will be a Morse class at 7 p.m. New members and visitors always welcome.

Leicester Radio Society

The Hon. Sec., G2FMO, has had to retire for personal business reasons, and a vote of thanks was passed at a recent meeting, at which the new Secretary was elected (*see* panel). Recent events have been a Junk Sale and the second of a series of lectures on FM.

Swanton Morley Amateur Radio Club

At this RAF Amateur Radio Club, Novice Nights are held twice weekly, with lectures on all aspects of Tx and Rx design. The station, G3GLJ, is active every evening. Membership is 60, and all amateurs in the area will be welcomed.

NAMES AND ADDRESSES OF SECRETARIES REPORTING IN THIS ISSUE

BARNSLEY : P. Carbutt, 33 Woodstock Road, Barnsley.
BOURNEMOUTH : J. Ashford, 3 Stevenson Court, Alum Chine Road, Bournemouth.
BRADFORD : A. R. Bailey, G3IBN, Scarr Croft, Parkside, Bingley.
BRIGHTON : R. T. Parsons, 14 Carlyle Avenue, Brighton 7.
BRITISH TWO-CALL CLUB : G. V. Haylock, G2DHV, 63 Lewisham Hill, London, S.E.13.
CHESTER : N. Richardson, 1 Victory Villas, Upton Lane, Chester.
COVENTRY : K. Lines, G3FOH, 142 Shorncliffe Road, Coventry.
EAST SURREY : L. Knight, G5LK, Radiohme, Madeira Walk, Reigate.
EDINBURGH (LOTHIANS) : I. Mackenzie, GM3FGJ, 41 Easter Drylaw Drive, Edinburgh 4.
GRAFTON : A. W. H. Wennell, G2CJN, 145 Uxendon Hill, Wembley Park, Middx.
LEICESTER : W. N. Wibberley, 21 Pauline Avenue, Belgrave, Leicester.
MIDLAND : G. W. C. Smith, 84 Woodlands Road, Birmingham 11.
NEATH & PORT TALBOT : G. Thomas, B.Sc., 7 Evelyn Road, Skewen, Neath.
NOTTINGHAM : D. C. G. Johnson, G3EGE, The Bungalow, Marton Road, Chilwell, Notts.
PURLEY : A. Frost, G3FTQ, 18 Beechwood Avenue, Thornton Heath, Surrey.
QAU CLUB, JERSEY : Miss V. Hunt, c/o 5 Valley Gardens, Bel Royal, St. Lawrence, Jersey, C.I.
RAVENSBOURNE : J. H. F. Wilshaw, 4 Station Road, Bromley.
SCARBOROUGH : P. Briscombe, G8KU, 31 St. Johns Avenue, Scarborough.
SLADE : C. N. Smart, 110 Woolmore Road, Birmingham 23.
SPEN VALLEY : N. Pride, 100 Raikes Lane, Birstall, near Leeds.
STOCKPORT : G. Phillips, G3FYE, 7 Germans Buildings, Buxton Road, Stockport.
STOKE ON TRENT : J. R. Brindley, B.Sc., G3DML, 45 Rosendale Avenue, Newcastle, Staffs.
SUNDERLAND : C. A. Chester, 38 Westfield Grove, High Barnes, Sunderland.
SURREY (CROYDON) : S. A. Morley, G3FWR, 22 Old Farleigh Road, Selsdon, South Croydon.
SUTTON AND CHEAM : F. J. Harris, G2BOF, 143 Collingwood Road, Sutton.
SWANTON MORLEY : F/L. A. E. White, G3FNX, S.M.A.R.C., RAF Swanton Morley, East Dereham, Norfolk.
WARRINGTON : S. Wood, G3EZX, 12 Thelwall Lane, Latchford, Warrington.
WEST LANCS. : B. J. Whitty, G3HWX, 46 Argo Road, Waterloo, Liverpool 22.
W.F.S.R.A. (Bedfast Club) : D. W. Auton, G3IHI, 36 Elborough Road, Moredon, Swindon, Wilts.
WIRRAL : L. Roberts, 18 Croxteth Avenue, Wallasey.

NEW MINIATURE HIGH PERFORMANCE RF PENTODE

A new RF Pentode, the EF95, recently made commercially available by the Communications and Industrial Valve Department, Mullard, Ltd., will help designers of communications equipment to improve substantially the signal-to-noise ratio of receivers—even those operating at frequencies up to 200 mc. This advance is of particular significance in view of the present demand for progressively better receiver input noise factors, and for receivers to work nearer to the limit set by theoretical aerial noise considerations.

The EF95, which is constructed on the B7G base and has characteristics similar to those of the well-known American valve, 6AK5, goes a long way in meeting these requirements by providing the best possible performance so far obtainable from a conventional all-glass pentode.

Particularly interesting features of this valve are its extremely low input and anode to grid capacitances. These features, together with a slope of 5.1 mA/V, give a very useful slope-to-capacitance ratio. Another advantage of the EF95 is that its optimum performance is obtained at the very low HT of 180 volts. Good results can even be obtained with HT's down to 120 volts and below.

The principal characteristics of the EF95 are as follows:—

Heater Voltage	**6.3V**
Heater Current	**0.175A**
Anode Voltage	**180V—120V**
Mutual Conductance	**5.1mA/V—5.0mA/V**
Equivalent Resistance	**2,000 ohms**
Input Damping (at 50 mc)	**25,000 ohms**
Optimum Noise Factor (at 100 mc)	**3.5**

Full technical details are available on request from the Communications and Industrial Valve Department, Mullard Ltd., Century House, Shaftesbury Avenue, London, W.C.2.

TOP BAND TESTS

For this season we have again organised the Third World Series of DX Tests on the 160-metre band, for which support is promised not only from VE and W, but also by keen DX operators with what for this band are even more exotic prefixes. The main details are given in a panel appearing in "DX Commentary" in this issue—if you are interested in DX working on 1.7 mc, we hope to hear your call on the early morning air.

TEN-METRE PARTY

As mentioned elsewhere in this issue (*see* "DX Commentary"), it is proposed that all G's able to operate on the ten-metre band should show up on Sunday, December 7, prepared to work who and what they can, on either CW or phone. Ten may not be open for DX, but there are almost certain to be G's within range. Reports on activity and results will be welcomed for mention in the next issue of "DX Commentary."

SMALL ADVERTISEMENTS

9d. per word, minimum charge 12/-. No series discount ; all charges payable with order. Insertions of rzdio 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.

TRADE

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

QSL's and LOGS by MINERVA. The best there are.—Samples from Minerva Press, 46 Queen's Road, Brentwood, Essex.

WANTED: RCA Speech Amplifiers. Type MI-11220, J or K and Aerial Tuning Units, BC939A. Coils and tuning units for BC610 transmitters.—Offers, stating quantity and price, to PCA Radio, The Arches, Cambridge Grove, W.6.

WANTED: BC-610 Hallicrafters, ET-4336 Transmitters; SX28's, AR88's. Receivers and spare parts for above; best prices.—Write Box 864, c/o Spiers Service, 82 Centurion Road, Brighton, Sussex.

WANTED RCA 4331 Transmitters. — P.C.A. Radio, Cambridge Grove, Hammersmith, W.6. (*Telephone : Riverside 3279*).

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

WANTED NEW VALVES — 6K8, 6V6, 5Z4, FW4/500, KT33C, KT61, 6Q7, etc., etc. PROMPT CASH. — WM. CARVIS, 103 NORTH STREET, LEEDS 7.

TRANSMITTERS: BC610, ET4336. Receivers: AR88, BC348, SX24, etc. Frequency meters, test sets, etc., wanted urgently. We pay high prices instantly. — Write/phone: Pype-Hayes Radio, 606 Kingsbury Road, Erdington, Birmingham 24. (*Erdington 4942*).

QSL CARDS: Neat, attractive; reasonable prices. Samples. — Lovedee, BRS.15643, Mill Street, Barwell, Leicester.

CRYSTAL MICROPHONE INSERTS, BRAND NEW, BY FAMOUS MANUFACTURER. ALUMINIUM DIAPHRAGM AND HERMETICALLY SEALED UNIT. EXCELLENT FREQUENCY RESPONSE COUPLED WITH GOOD SENSITIVITY. IDEAL FOR USE WITH AMATEUR TRANSMITTERS AND TAPE RECORDERS. 10s. 6d. EACH, POST AND PACKING PAID. CASH WITH ORDER ONLY, TO:— TRUSOUND LTD., 196 KINGSLEY ROAD, HOUNSLOW, MIDDLESEX.

SCR536 Handie Talkie (also known as BC611 Transmitter Receiver) spare parts wanted, including cases, top and bottom lids, microphones, earphones, crystals and coils.—Details to Box 1176.

45/- offered for new boxed 813's. Other surplus valves purchased for cash.—Details to Box 1171.

SMALL ADVERTISEMENTS, TRADE—*continued*

VALVES WANTED: Type 805, 807, 813, 829B, 832, 866A, 931A, 100TH, 250TH, TZ40, 723A/B, 2K33, 2C43, CV129, CV323.—Quantity and price please, to: Pype-Hayes Radio, 606 Kingsbury Road, Birmingham 24. (*Phone: Erdington 4942*).

SITUATIONS VACANT

CROWN AGENTS FOR THE COLONIES. JUNIOR WIRELESS OPERATOR required by the Falkland Islands Dependencies Administration for service in South Georgia for one tour of 18 or 30 months in the first instance. Commencing salary according to age and qualifications in scale £310 rising to £370 a year. Free board and lodging. Free passages. Leave on full salary. Candidates, *UNMARRIED*, must hold a P.M.G. Second Class Certificate of Proficiency in Wireless Telegraphy and be able to maintain Radio Transmitters and Receivers, Creed High Speed transmitting apparatus and Marconi Auto Alarm equipment. Apply at once by letter, stating age, full names in block letters, and full particulars of qualifications and experience, and mentioning this paper to the Crown Agents for the Colonies, 4 Millbank, London, S.W.1, quoting on letter M.29484.B. The Crown Agents cannot undertake to acknowledge all applications and will communicate only with applicants selected for further consideration.

CROWN AGENTS FOR THE COLONIES. RADIO OFFICER required by Nigeria Government Posts and Telegraphs Department for one tour of 18-24 months in the first instance with prospect of permanency. Commencing salary in scale £750 rising to £1,175 a year (including expatriation pay). Outfit allowance £60. Free passages for officer and wife and assistance towards cost of children's passages or their maintenance in this country. Liberal leave on full salary. Candidates must possess a Postmaster General's Certificate in Radio Telegraphy, or an Air-Operator's Certificate or an equivalent Service qualification. They must have a thorough grounding in I.C.A.O. codes and procedures and have had recent experience with an administration or air operation company outside West Africa in operating wireless and direction finding ground stations for air services. Apply at once by letter, stating age, full names in block letters, and full particulars of qualifications and experience, and mentioning this paper to the Crown Agents for the Colonies, 4 Millbank, London, S.W.1, quoting on letter M.29270.B. The Crown Agents cannot undertake to acknowledge all applications and will communicate only with applicants selected for further consideration.

WALTER INSTRUMENTS LTD., Garth Road, Lower Morden, require Engineers for alignment of FM and AM VHF apparatus, conversant with laboratory test equipment. Five-day week; canteen; wages in accordance with experience.

G2NU (old timer 1911), extending production of Tx's for export markets, needs few Hams for development, etc. Age immaterial but well "genned." Simple, free, sleeping accommodation shortly available adjoining works. Hamshack available.—Write: Tropical Radio Co., Ltd., Senior Works, Staines, Middx. *Phone 3999.* Also available after hours.

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.

WANTED: Coil packs Nos. 1 and 4 for M.C.R.1 Receiver. All letters answered. — L. McDougall, 15 Cressage Close, Southall, Middlesex.

HIGH POWER DRIVER UNIT for 14, 21 and 28 mc, international rack mounting, each stage metered. Unit professionally built and ready to work, £10. 1196 receiver fully converted for use as rear end of double superhet, complete with BFO, valves, etc., £6. 500v. power pack, 230v. input, on aluminium chassis with two LT windings, £2 5s. 0d. TU5B cabinet 5s. Full details sent to serious enquiries. Carriage extra. — Corbett, 17 Tudor Avenue, Bebington, Cheshire.

NEW unboxed 6AK's, 7/6; CV666's, 6/-; ML6. 12SG7, 6AL5, 5/-; RCA 100 kc. crystal, 10/-; Taylor T20, 10/-. Please add postage.—G5UD, 17 Rosebery Avenue, Kings Lynn, Norfolk.

FOR SALE: HRO, complete with full set of coils, in good working order.—Buivydas, 10 Marlborough Street, Bloxwich, Walsall, Staffs.

BC221 and HRO coils to cover 160 metres, wanted. — Carpenter. 86 Lockett Road, Wealdstone, Harrow, Middlesex. (*Phone : HARROW 6945*).

R1155N, Top Band modified, spare valves, working, buyer collects, £8.—G3IIT, 145 Cambridge Road, Trumpington, Cambridge. (*Tel. : Trumpington 2235*).

TRANSMITTER, 120 watts, 10 and 20 meter bands, high level modulation; separate screen supply; voltage regulated VFO. Diagram and details available. £29.—Box 1167.

SELLING UP. AR88D with S-meter, speaker and manual. CR300, BC221 with power pack, no book. 150 watt CW transmitter, p/pull PT15, in 6ft. rack. All stages metered. 1131 modulator. Western Analizer. 45ft. aerial sectional pole. New assortment of useful equipment. Magazines. Buyer collects.—Offers to: G8NU, 29 Gorse Road, Blackpool.

WANTED: Chart for wavemeter Type 8834K. Will pay for loan of one if necessary.—91 Hotblack Road, Norwich.

10/- offered for 10 days' loan of CR100 manual. or 5/- circuit only.—Write in first place to: Tyson, Technical College, Clifford Street, York.

FOR SALE: Xmtr 14/28 mc in two sections. Xmtr: VFO, Doubler, 807 P/P, approx. 60 watts input, built-in tuning indicators and meters. Power Pack and modulator combined. Weight about 180 lbs. £20, or exchange for tape recorder. — Millar, Brook House, Fovant, Wilts.

SMALL ADVERTISEMENTS, READERS—*continued*

WANTED: B2 Tx/Rx complete power supplies, accessories, good condition. — Offers to VQ5CB, Kenneford, 68 Burford Gardens, Palmers Green, London, N.13.

URGENTLY REQUIRED: Any information, handbook, circuit, etc., Rx CR-100 Buy/Borrow. — D. L. Clifton, 19 Sandy Way, Shirley, Croydon. (*SPR. 3864*).

HALLICRAFTERS SX16 receiver 12 inch P.M. speaker and phones. Good condition, £25.—Graham, Redford, Willersley Avenue, Orpington.

EDDYSTONE S640, execellent condition, nearest offer to £21. P5 crystal 3534 kc, certificated. Power packs, etc. S.A.E. for details. Offers? — Ankers, 124 Headstone Drive, Harrow, Middlesex.

SELL: 690 new condition, S-meter; 144 mc converter; 5 watt phone Tx 2¼in. x 3¼in. enlarger. Offers?—166 Grace Street, Newcastle-on-Tyne 6.

URGENTLY required by VQ2: HRO Senior Bandspread coils JA, 14-30 mc; JB, 7-14.4; JC, 3.5-7.3; also E900-2050 kc; F480-960 (G.C.). Good price given.—Box 1175.

FOR SALE: AR77, in fair condition. Offers?—27 Highbury Avenue, Salisbury. (*SAL: 4305*).

SALE: AR88LF, untouched, excellent condition, RCA S-meter, set spare valves, crystal, quantity of spares including IF's, £65. Collect. Glasgow.—Box 1172.

VHF Equipment For Sale. G2IQ converter with valves, Muirhead illuminated dial. EDDYSTONE 640 S-meter. NAVY GGT CV 53 RF amplifier, 144 mc, with 4-volt transformer and valve. RCV/Tx BC 788 for 430 mc (Rcv: 2-6J6, 2-6AG5, IF 30 mc, Tx 6J6—*see QST*, July, 1948), complete with above valves. G5BY 430 mc converter as per *Short Wave Magazine*, with valves. AS8B, RF stage, unmodified less valve. NAVY osc. Unit W6283, 2-CV63's. NAVY P38 VHF ground station communication receiver, 100-150 mc, 13 valves, separate xtal osc., manually tuned osc. and receiver by 2 slow motion dials, switched tuning, S, audio, 1-5 mA m.c. meter. LR and HR outputs; Osc. and RF section, 5-EF54's, chassis and all parts silver plated; requires 250v HT 6.3 LT; in original transit case, weight 80 lbs. ALSO 12 valves and handbook for AR88D. FIVE 6AJ5's. HEAVY gauge ¼in. copper tube cut for 5 element Yagi, 144 mc. ALL in FB condition. Offer for above as a whole £42, or separate. Would prefer buyer to collect and accommodation offered for night for DX buyer. ALL offers considered and answered. S.A.E.—BRS 1579, 28 WELBECK ROAD, BOLTON. (*Phone 1083*).

GEAR TO CLEAR. Various transmitters and receivers. AR88LF, IFT's. 832 Holders. Xtals including 100 and 1000 kc. 6-volt car radio. Dynamotors. 6K8, 6V6, 6L6M, 6SG7M, 6K7M, 25L6GT, 6X5GT, 12SK7, etc., 5/6. S.A.E. List. — Armstrong, 40 The Oval, Mirehouse, Whitehaven.

SMALL ADVERTISEMENTS, READERS—*continued*

FOR SALE: 1155 complete with power pack, output stage, separate RF, in perfect condition. Nearest £10. M.C.R.1. brand new, complete with power pack and coils and phones. Nearest £7. Exchange 18 Set for 3 6C5G valves.—F. Norman, 11 Croft Row, Haverhill, Suffolk.

GERMAN ARMY VALVES For Sale. 2 volt RL2. 4.T1 (eleven), RL2, 4.P2 (seven). Also four bases. Must sell, what offers? — Box G.V., W. H. Smith & Son, Church Street, Weybridge, Surrey.

WANTED: CR100, case and chassis with dial and control, fair condition.—27, Highbury Avenue, Salisbury. *SAL. 4305.*

TS 47: VHF Test Oscillator, 40-500 mc, in absolutely mint condition, £55 o.n.o. WANTED: I-130A Signal Generator, also Instruction Manual.—Box 1177.

BC221 (p/p); V.F.O. (p/p); 40w. Tx (p/p); Box asstd. gear, including TU5B, 807's, 3in. CRT, 600v. 200 mA p/p, transformers, condensers, valves, resistor, meters, pots, etc.; £40 for quick sale.—Barton, How Renwick, Friargate, Penrith.

AR 88LF with plug-in 85 kc double conversion unit, £60; BC221, £20. Both in mint condition. RF26 and RF27, £2 each. Transmitter and remainder of station on sale to callers. *Tel.: SHE. 3629.* Troy, 35 Hermiston Avenue, Glasgow, E.2.

AR 88D: S-meter, speaker, alignment tools, set spare valves, manual. Overhaul specialists' recent test report available. First offer near £55. Delivered.—Box No. 1180.

S 640, little used, £18; BC221 with calibration chart and power pack, £10; R1155 (Band 4 needs attention), £7. Purchaser(s) collect, South Bucks., or add carriage and packing.—Box 1179.

EXCHANGE much more than £30 worth 100 valves, xtals, TBY8, meters, etc., for medium to QRO transmitter. No room for construction.—Details and S.A.E. for details to Box 1178.

ASTOUNDING BARGAINS: 5/- each valves. Tx., Rx. Test equipment. Clubs forming grab this chance. Give away prices. S.A.E. Lists. — Box 1168.

FOR SALE: BC221AK, as new, Int. Mod. P/Pack, £22. 813 new, boxed, £2. 1000 kc. Xtal, 15/-. — James, 25 Windsor Gardens, Hayes, Middlesex.

SALE: Eddystone 750 brand new, £47 10s.; 1155 New Panel; Int. p/pack, S-Meter, £12 10s.; Naval TV5 Tx, plug in coils, £7 10s.; Six inch oscilloscope, working order, £4 10s.—Box 1162.

FOR SALE: Army 12 set, £12; HRO coils all ranges, 30/- each. WANTED: 813's, 808's; also AR88, S27, BC221. Exchanges or cash adjustment. Will collect.—Box 1165.

CR300/2, with manual. Offers or plus cash for DST100, or any good communication receiver covering BC and 28 mc.—Box No. 1170.

CR100, 60 kc-30 mc. 717 1st RF, tuning meter. Excellent condition, £16.—306 Utting Avenue East, Norris Green, Liverpool 11. Lancs.

FERROGRAPH Tape Recorder. Records up to professional standards, £70. WANTED: Grid Dip Meter, All AC and wide range.—Replies please to Box 1174.

FOR SALE: Eddystone 740 still under makers' guarantee, £34 o.n.o., or would consider part exchange with unmodified BC348.—Box 1173.

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