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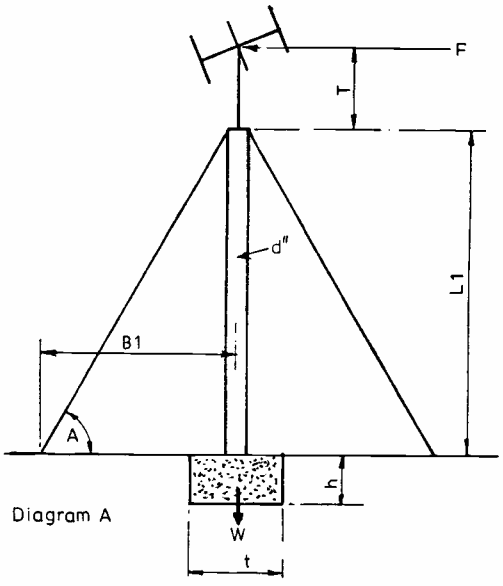
The SHORT WAVE Magazine

VOL. XXXVII APRIL 1979 NUMBER 2



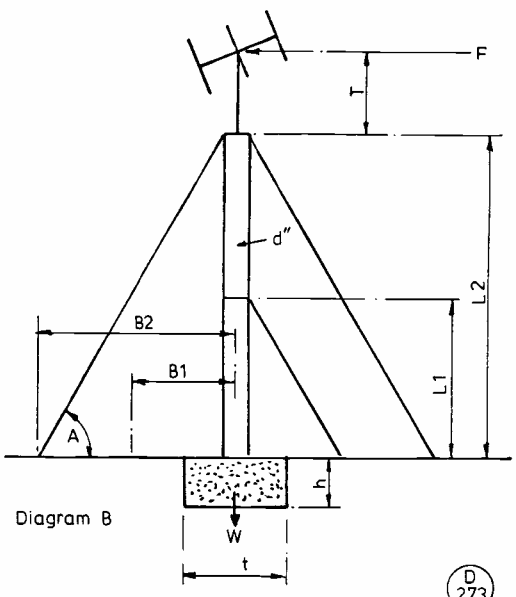


Fig. 7. MASTS, GUYS AND FOUNDATIONS

section will slip over these rods and be secured by a set screw. (A simple jig could be made to achieve a neat bending job of the ¼in. rod). Apart from the cost of materials the only "outside" cost would be for the welding which could be undertaken reasonably by the local garage. Do not attempt to construct this in aluminium as welding by any method materially reduces its strength. It will be necessary to rub down to free from surface rust the pipe sections and rod and then apply a weak solution of phosphoric acid (*e.g.* Jenolite); this creates a chemical action changing iron oxide (rust) into iron phosphate—a rust preventer. The mast can now be painted. Suitably guyed this type of mast could quite safely be extended to a height of 70 feet.

Guys and Guying

The formulae shown in Table 4 are used to determine the guy loads for diagrams 'A' and 'B', Fig. 7.

The top set of guys in diagram 'B' will have to take all the wind force on 'T' plus the antenna load and in addition about half the force between the top and lower set of guys. Each guy wire should have a *breaking strength* of about four times the load as calculated. Guys (angle 'A') should never exceed 60° to the horizontal.

The value of 'K' in the formula for various angles at 'A' is shown in Table 5.

In Fig. 7, if the mast is round, then 'd' will be the tube diameter. If it is of lattice construction the 'actual' unit area of one face will have to be calculated. For the triangular mast given as example, the 'actual' face area is $(2 \times 10\text{ins.}) + (10\text{ins.} \times \frac{1}{4}\text{in.}) = 22{\cdot}5\text{ins.}^2$ or $22{\cdot}5 \times \frac{12}{10} = 27\text{ins.}$ per foot length.

This must be multiplied by 1·75 as a safety factor. The value of 'd' in the formula then becomes $27 \times 1{\cdot}75 \times \frac{1}{12} \times \frac{1}{12} = 0{\cdot}33\text{ft.} = 4\text{ins.}$

The value of 'M' in the formula is dependent upon the number of guys in the set.

TABLE 4 — Guy Loads

Round Section Masts	Triangular Section Masts
Diagram 'A' $KM\left[\left(\frac{20 \times L_1}{2}\right) + F\left(1 + \frac{T}{L_1}\right)\right]$	Diagram 'A' $KM\left[\left(\frac{30 \times L_1}{2}\right) + F\left(1 \times \frac{T}{L_1}\right)\right]$
Diagram 'B' Upper Set $KM\left[20d\left(\frac{L_2 - L_1}{2}\right) + F\left(1 + \frac{T}{L_2 - L_1}\right)\right]$	Diagram 'B' Upper Set $KM\left[30d\left(\frac{L_2 - L_1}{2}\right) + \left(1 + \frac{T}{L_2 - L_1}\right)\right]$
Lower Set $KM\left(\frac{20L_2 \times d}{2} - \frac{FT}{L_2 - L_1}\right)$	Lower Set $KM\left(\frac{30L_2 \times d}{2} - \frac{FT}{L_2 - L_1}\right)$

TABLE 5

Angle 'A'	K Factor	Ratio $\frac{B_1}{L_1}$ or $\frac{B_2}{L_2}$	Guys in set	'M' Value
			3	1·150
59°	1·94	0·6	4	1·000
51°	1·60	0·8	5	0·649
45°	1·41	1·0	6	0·578
40°	1·30	1·2	7	0·457
36°	1·23	1·4	8	0·415

Foundations for the Mast

First calculate the total combined weight (W) of the tower, beam, rotator and concrete base in lbs. (Concrete weights approx. 150lbs/ft.^{3}). This will enable us to calculate 't' and 'h' in the diagrams 'A' and 'B', Fig. 7.

$$t\ (\text{ft.}) = \sqrt{\frac{W}{100}}$$ and to calculate 'h':

(*i*) for single set of guys (Diagram 'A') with round mast,

$$h = 1 + \left[10L_1d - \frac{FT}{L_1}\right]\frac{1}{200t}$$

for single set of guys (Diagram 'A') with triangular mast,

$$h = 1 + \left[15L_1d - \frac{FT}{L_1}\right]\frac{1}{200t}$$

(*ii*) for double set of guys (Diagram 'B') with round mast,

$$h = 1 + \left[15L_1d\right]\frac{1}{200t}$$

for double set of guys (Diagram 'B') with triangular mast,

$$h = 1 + \left[20L_1d\right]\frac{1}{200t}$$

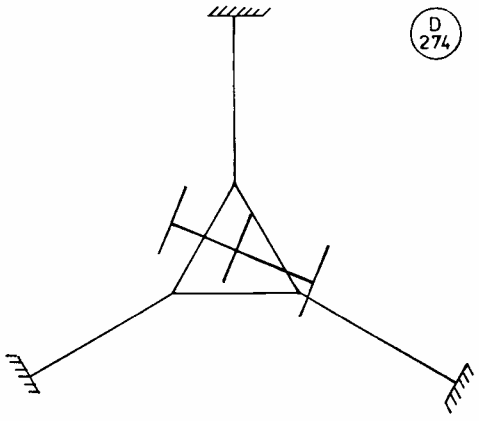


Fig. 8 PLAN VIEW OF MAST AND GUYS

Rotators

Most manufacturers of rotators supply a technical specification (some only on request) but unfortunately this information—whilst valid—only provides a part of the answer required. With large arrays the braking moment is important as is the starting torque; the brake action determines the ability of the rotator to hold the array and prevent it "hunting" in high winds. The starting torque has to overcome the weight of the array in order to turn it.

The compressive stresses (vertical loads) are relatively insignificant when compared with the Bending Moments, torque and braking moments. The most important criteria for a rotator is the bending moment, which coupled with torque, is the most damaging factor. (Refer to the relatively short length of tube from the rotator to the modest 2m. beam discussed earlier).

Some commercial masts use a long sleeve tube as an alignment bearing in which the drive tube rotates, thus

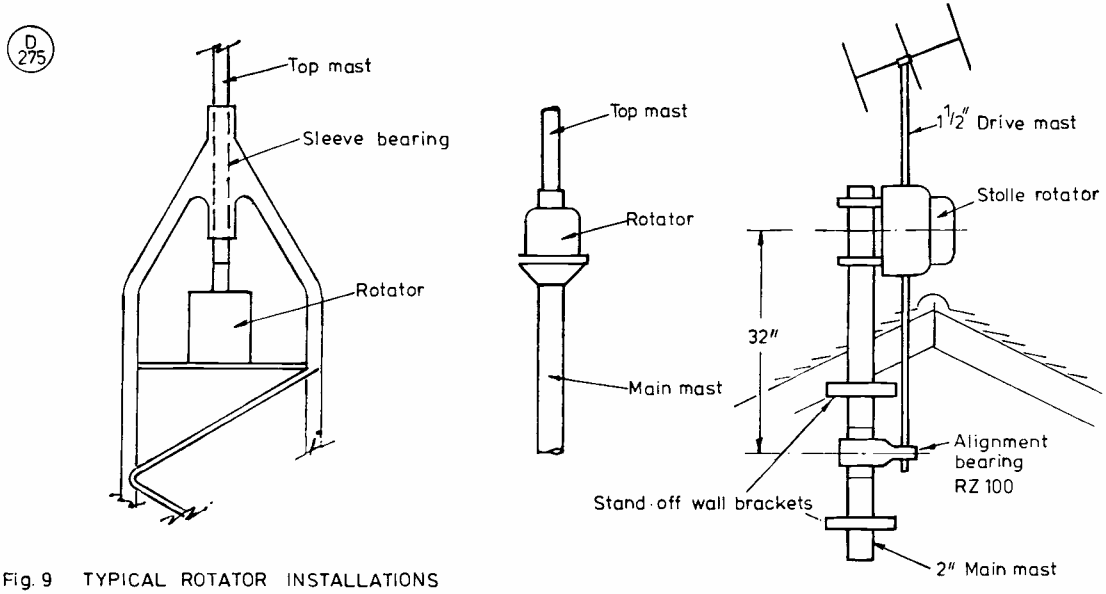


Fig. 9 TYPICAL ROTATOR INSTALLATIONS

removing the Bending Moment from the rotator to the sleeve tube; this could present problems for the home constructor. The Bending Moment ($M_{max.}$) can be increased by use of alignment or thrust bearings and this is sound practice. Some commercial masts use a long sleeve tube in which the connecting tube rotates, but this again presents problems for the home constructor.

At the end of World War II it was possible to acquire propeller-pitch motors which made admirable rotators after some modification; they were sturdy beasts and could handle the job comfortable but they needed low volts at high currents and coupling up to magslips (selsyns) and waterproofing. The amateur rotator took over from the propeller-pitch motor with all its attendant problems but the modern article, especially those of light-weight, suffered from a loss of robustness and this we must take into account. For the longer beams the more robust rotators will, if properly installed and treated, give years of trouble free service, but they will soon fail if misused or overloaded. Some typical rotator installations are shown in Fig. 9.

Corrosion

It has been stated that the greater the tensile strength of aluminium the more it suffers from the effects of corrosion from the atmosphere: to enhance the life of aluminium in the open, protective painting is necessary. First an etch-primer is applied after ensuring the metal is clean and free from grease or oxydisation; a finishing coat of cellulose paint can now be applied either by brush or spray. The materials used for clamps, screws and fittings should be preferably of aluminium or stainless steel (to Spec. 18/8). Brass especially, and mild steel, should be avoided like the plague as they will set up corrosion by electrolytic action which will cause the aluminium to disintegrate. It is good practice to run all joints and screws in a paste mixture of anhydrous lanolin and pure turpentine. Smear also all screws and joints after fixing with anhydrous lanolin cream.

Imperial v. Metric Units

In the examples and formulae Imperial units have been used: these are still in use and quite valid.

Conclusion

Perhaps the least known subject, and yet a vitally important part of amateur radio, concerns the antenna. The days when a length of wire strung between two trees coupled to the transmitter with a length of 600-ohm open-wire feeder have long since gone. Nowadays we have exotic beam antennas held up by masts and remotely tuned by rotators, the varieties and types of which are quite bewildering unless the underlying principles of design are understood. Both the design parameters and choice of rotators are quite wide, and without resorting to complicated mathematics the calculations are straightforward (albeit perhaps a little tedious). This should pose no deterrent to the keen amateur.

It is hoped this paper (whilst not claiming to be an exhaustive treatise) will to some extent shed a little light on this dark subject.

POWER FET'S AND RF

T. P. ELLIS, G8HIO

THE development of power FET devices has been talked about for many years, but the hardware has been notable by its absence. Recently, however, development has been concentrated on the fabrication of Vertical FET's as a means of achieving higher channel current density. Fig. 1 shows the typical cross-section through a conventional JFET and Fig. 2, by contrast, shows the cross-section of a vertical power JFET. Devices of the latter construction are available, such as the Sony 2SK60 (N-channel, 63W) and 2SJ18 (P-channel, 63W), and the Yamaha 2SK77 (N-channel, 200W) which are utilised in the respective Companies' audio products. The devices however, retain the disadvantages of conventional JFET construction and also exhibit high input capacitances, and thus their use above 1 MHz is severely restricted.

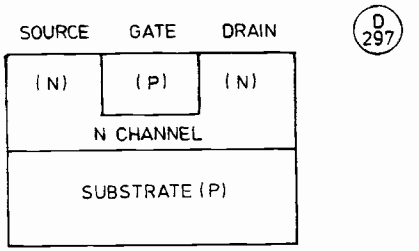


Fig. 1 CONVENTIONAL N-CHANNEL JFET

VMOS

More recently much development has been concentrated on the fabrication of Vertical MOS (VMOS) FET devices.[1] The construction of a VMOS FET device is shown in Fig. 3.

A key advantage of the V-channel fabrication technology is that the upper frequency determining element, the gate length, is fixed by a diffussion process, permitting easy realisation of micrometre and even shorter gate lengths, with the added advantage of high attainable transconductance values.

The non-planar electrode arrangement, in contrast to the horizontal structure of Fig. 1, allows the interconnection of large area devices with less parasitic capacitance, thus making possible devices for high frequency power applications. Bipolar power transistors do not require special vertical structures, since their natural mode of current flow is vertical.

The V-channel fabrication yields further advantages in operation.

1. Both walls of the 'V' serve as channels, so that a single gate metal stripe controls two channels. The resulting short channel provides high current per unit of channel width.

2. No secondary breakdown due to the ON resistance having a positive temperature coefficient. A localised hot spot in a VMOS device causes the current through that area to decrease, thus lowering the dissipation. VMOS devices may therefore be paralleled without the

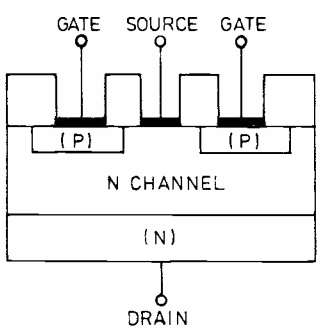


Fig. 2 VERTICAL CHANNEL JFET

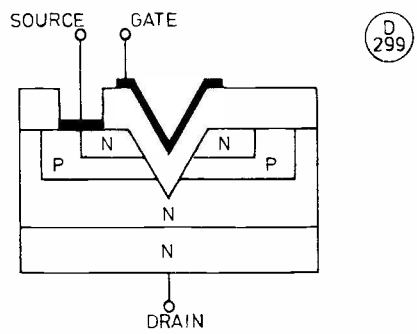


Fig. 3 VERTICAL MOSFET CONSTRUCTION (Siliconix)

Table 1a	Breakdown V_{DS} Volts	Max. cont. I_D Amps.	Typ. forward gfs. m℧	Typ. Cin pF	Typ. Cout pF	Package
Siliconix						
VN33AJ	35	2·0	250	33	38	TO–3
VN84GA	80	12·5	2000	640	300	TO–3
VN33AK	35	2·0	250	33	38	TO–39
VN86HF	80	2·0	240	87	35	TO–202
VMP4	60	2·0	240	34	35	380–SOE Flange
C.T.C.						
BF25–35	65	3·5	700	—	37	—
BF50–35	65	5·0	1500	—	77	—
BF100–35	65	10·0	2200	—	170	—

use of equalising resistors, as the current sharing tends to be self equalising.

4. Excellent linearity; VMOS devices are capable of lower high-order intermodulation distortion, with products typically 5 to 10dB lower than bipolar transistors.

4. Because they draw virtually no DC input power, and have no thermal runaway problems, biasing networks can be very simple.

VMOS devices do, however, have some disadvantages.

1. About 10 volts is required at the gate for maximum drain currents; this drive requirement maybe reduced with further device development, but will not reach the low levels needed by bipolars, which only require the base-emitter junction to be forward biased.

2. High drain source voltages required for linear operation, about 24 volts, as compared to present bipolar devices.

3. VMOS is of an MOS structure, and therefore requires the same handling requirements. Devices are produced with a Zener of approximately 15 volts breakdown connected between the gate and source, but this forms a voltage-dependent capacitance. Devices with no static protection are therefore used for RF applications.

VN33AJ	VN35AJ			
VN66AJ	VN67AJ	V_{DS}	Max. =	60
VN98AJ	VN99AJ	V_{DS}	Max. =	90
VN33AK	VN35AK			
VN66AK	VN67AK	V_{DS}	Max. =	60
VN98AK	VN99AK	V_{DS}	Max. =	90

Table 1b. Equivalent devices. *Note:* **The equivalents shown in the first column have a lower specified ON resistance than those in the second.**

Available VMOS

At present there are only two manufacturers producing VMOS devices for RF applications with a product range available in Britain. These companies are *Siliconix* and *C.T.C.*, of which only *Siliconix* devices are freely available at present.[2] [3]

The main device parameters are outlined in Tables 1a and 1b, but it should be remembered that as VMOS is in its infancy, the devices and their type codes are constantly changing. Further parameters for devices specifically for RF purposes are shown in Table 2.

Prices for the devices are difficult to quote at present, but an idea of costs to be expected are as follows: VMP4, £14·00; VN33AJ, £9·00; VN35AK and VN67AK, £4·00; and approximately £1·00 to £1·50 per watt for the *C.T.C.* devices, all excluding VAT.

Applying VMOS Devices

Fig. 4 shows the area in which VMOS will probably be applied in relation to currently available devices.

It has been advocated that use is made of the common source and common gate configurations, the common drain connection is not only more susceptible to unstable operation, but requires special drive circuitry since its voltage gain is less than unity. The common source configuration exhibits a large input impedance variation,

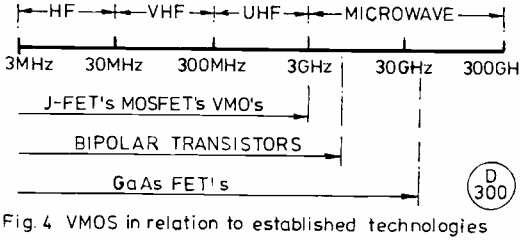


Fig. 4 VMOS in relation to established technologies

	Min. power gain, dB	Max. power in, watts	Max. power out, watts	Small signal noise figure, dB
VMP4 (1)	10	—	20	2·5
BF25-35 (2)	—	2·5	25	—
BF50-35 (2)	—	5	50	—
BF100-35 (2)	—	10	100	—

Table 2. (1) Results at V_{DS} = 24v., I_D = 0.2A, f = 175 MHz; (2) Results at V_{DS} = 35v., f = 175 MHz.

the reactive component changing by almost three orders of magnitude from 1 to 1000 MHz. In contrast, the common gate configuration results in an input impedance which is fairly flat with frequency. The characteristics therefore suggest that below 1000 MHz the common gate configuration is the more stable, whereas the reverse is true at higher frequencies.[4]

Applications

VMOS has been established for use in RF amplifiers operating in Classes A, B, C and their derivatives. A 2-metre transverter has been constructed utilising a VN66AJ VMOS as the 5 watt *p.e.p.* power amplifier. The stage has a measured performance of 12dB gain and two-tone 3rd order intermodulation distortion of —30dB relative to the carrier.[5]

VMOS, however, is not subject to minority carrier storage, and therefore is suitable for high-efficiency switching-type RF amplifiers of Classes D, E and F. Theoretically, amplifier efficiency cannot extend beyond 50 per cent for Class A, 78·5 per cent for Class B, and typically 85 per cent for Class C. In contrast, a theoretical efficiency of 100 per cent is attainable in a switching amplifier, but in practice is unattainable with VMOS owing to the relatively high ON resistance. In practice however, a 5-watt Class E amplifier has been built with an efficiency of 90 per cent.

A further advantage of VMOS is their excellent small signal noise figure: the VMOS PA of the previously mentioned transverter has been measured as having a gain of 11dB and a noise figure of 2·4dB at 146 MHz when used as receive amplifier with no circuit changes. This implies that a highly linear PA can be constructed which, with suitable input and output switching, can be used as a receiver pre-amplifier with a high dynamic range.

Probably the most impressive application is the use of the VMP4 as a broadband amplifier, shown in Fig. 5. The amplifier is claimed to have a gain response within ±0·5dB from 40 MHz to 265 MHz. The only special component is the 0·15μH feedback inductor—a moulded choke is not suitable as it has too low a resonance. The amplifier may be used as a medium power amplifier of 1-2 watts *p.e.p.* output or, with changes in the input transformer to optimise the small signal noise figure, an untuned 'front-end' for a VHF receiver with a 3rd order intercept point of 47dB.[6]

The configuration used for a 200 MHz amplifier with a variable bias network has been outlined[7]. The amplifier, with its neutralisation network was measured as having a gain of 18dB, a noise figure of 2·5dB, and a reverse attenuation of over 50dB.

VMOS has also been shown to have advantages over bipolar counterparts for AM power amplifiers. A power amplifier has been constructed utilising a VMOS device[8]; low level modulation was utilised, the gate being modulated instead of the usual drain modulation method. The high gate impedance allows the use of low power modulation circuitry, the gate bias V_{GS} being varied; modulation in the practical stage is supplied directly by a 741 op-amp. The power amplifier was measured as having an efficiency of 52 per cent as compared to 62 per cent for the stage when used as an unmodulated Class-C amplifier. Modulation performance has been shown to be excellent even at levels as high as 93 per cent.

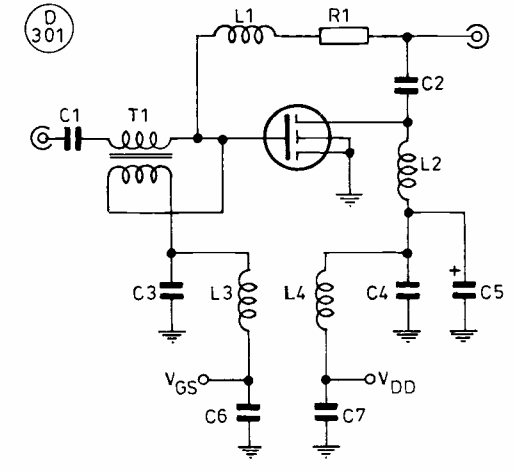


Fig.5 Broadband amplifier using the VMP4 device

Table of Values

Fig. 5

R1 = 180R
C1 = 200 pF
C2 = 470 pF
C3, C4 = 1000 pF
C5 = 1 μF, 50v.
C6, C7 = 500 pF
T1 = 4 turns, 28 s.w.g., as twisted pair on ferrite toroidal core
L1 = 6 to 8 turns, 32 s.w.g., on ¼-watt 1M resistor, to produce 0·15 μH
L2 = 0·18 μH
L3, L4 = 0·22 μH

References

1 "VMOS—A Breakthrough In Power MOSFET Technology", Siliconix Application Note AN76-3.
2 "VMOS Power FETs Design Catalog", Siliconix Ltd., May 1978. (Available from Siliconix Ltd. UK).
3 "C.T.C. Provisional Data", Communications Transistor Corporation. (Available from Walmore Electronics Ltd.).
4 "Vertical Geometry Is Boosting FETs Into Power Uses At Radio Frequencies", by S. Ludvick (C.T.C.). *International Electronics*, 2/03/1978, pp. 105-108.
5 "Two-Meter Transverter Using Power FETs", by L. Leighton *Ham Radio*, Sept. 1976, pp. 10-15.
6 "VMOS Power FETs In Your Next Broadband Driver", Siliconix Technical Article TA76-1.
7 "A New Technology: Application Of VMOS Power FETs For High Frequency Communications", Siliconix Technical Article TA76-2.
8 "VHF/AM Transmitter Using VMOS Technology", by V. Petrovic and W. Gosling (Bath University), *Electronic Engineering*, June 1978, pp. 65-67.

CLUBS ROUNDUP

BY *'Club Secretary'*

THE response to our attempt to operate a scheme which will avoid the need for club scribes to write each month has been overwhelming. However, it hasn't yet overwhelmed us: nonetheless it is vital that someone in the club looks at the information each month and makes *sure* any alteration is notified before it can be an embarrassment to us or the group.

New Club Proposed

G8OOW is quite definitely very keen to form a club in his district, and we are equally definitely surprised at the implication that there isn't one there already! Roger is thinking in terms of **Louth,** Lincolnshire, and the surrounding area. Anyone interested please get in touch as follows: R. D. Wilson, G8OOW, 112 Upgate, Louth, Lincs., or telephone him on Louth 2220.

The Mail

Addiscombe are primarily a contest club, but that doesn't stop them doing other things . . . like getting together at the Spread Eagel, Portland Road, S. Norwood on Tuesdays at about 9.15 p.m.

AMSAT-UK provides facilities for all those interested in space satellites (*Oscar* or RS) to keep up with the goings-on in this area, and indeed to make an active contribution. Details from the Hon. Sec. at the address in the Panel.

On to the mobile chaps, and their club, **A.R.M.S.**; anyone, listener or transmitting amateur, with an interest in /M would be well advised to join the group.

Ashford next—the one in Kent, that is—and the gang foregather at their Hq. on the top of Hart Hill, near Charing, on Tuesday evenings.

There seems to have been a bit of a change at **Barking**; they now only mention meetings on Thursdays, with a Morse class on Tuesdays. However, they are still at the same Hq., Westbury Recreation Centre, Westbury School, Ripple Road, Barking Essex.

Have you a teleprinter? If you have and intend to get it going on the air, then you should join **B.A.R.T.G.**; details from the Hon. Sec. at the address in the Panel.

Another special interest is amateur television, and here the club to join is **B.A.T.C.** A sub. is worthwhile just for the *CQ-TV* magazine they put out, which is full of useful and sensible circuits and data. Details from the Hon. Sec.—*see* Panel.

At **Bishops Stortford** they have a place at the British Legion Club, which is situated at the top of Windhill. They can be found here on the third Monday in the month, and since the last AGM things appear to be moving along nicely and attendances rising.

Down South to **Bournemouth** who have April 6 and 20 at the Dolphin Hotel, Holdenhurst Road. The former date is for an Auction Sale of Equipment and Gear, while the latter is reserved for G2KV to discuss the basic principles of Radar.

The name of **British Rail** indicates clearly enough the chaps the group want to recruit—details from the Hon. Sec., *see* Panel.

On to **Bury** now, and we note their Hq. address is at Mosses Community Centre, Cecil Street, Bury; the booking is for the second Tuesday in each month.

Quite a lot of clubs have got a little out of sync. with our deadlines—sorry, chaps!—and one of these is **Cheltenham,** where we also note for the Panel a new Hon. Sec. The group get together at the Old Bakery, Chester Walk, which is at the rear of the Public Library, on the first Thursday and the third Friday in each month.

Moving on again, we come to **Cheshunt;** Church Road, Church Lane, Wormley, Herts., every Wednesday is the routine here.

Chichester have quite a large catchment area and a nice central Hq. at Room 34A, Lancastrian Wing, Chichester High School for Boys, Basin Road, Chichester; the clan gathers on the first Tuesday and the third Thursday each month.

According to our records, **Chiltern** are at the canteen of John Hawkins Ltd., Victoria Street, off Oxford Road, High Wycombe on the last Wednesday of the month. However, we have a small element of doubt and recommend a call to the Hon. Sec. before setting off if you are on a first visit.

Deadlines for "Clubs" for the next three months—
(*May issue—March 30th*)
June issue—April 27th
July issue—May 25th
August issue—June 29th
Please be sure to note these dates!

Chippenham on a Tuesday evening means a visit to the Liberal Club, 20 Gladstone Road, where the group are to be found between 7.30 and 10.0 p.m.

Cornish have their AGM on April 5, at SWEB Clubroom, Pool, Camborne, and on May 5 a talk by the Station Officer of St. Just Coastguard Station—this one should be an interesting variation from the amateur radio themes, the more so because the group has, to a very large degree, to be self-supporting in the matter of lectures and talks at meetings.

Crawley foregather at Trinity Church Hall, Ifield, and at members' homes alternately, the dates being the second and fourth Wednesday evenings—check with the Hon. Sec. for details.

The chuckle of the month is from **Cray Valley,** where the *Newsletter* editor made the mistake of asking the troops to authorise an increase in the size of this issue; a warranted certain way of drying up the supply of any material! Christchurch Centre, High Street, Eltham, is the Hq. address for a lecture on the first Thursday and Natter on the third one.

Crystal Palace will be found on March 17, listening to G5XB discussing the invaluable work of the Intruder Watch; the third Saturday, at Emmanuel Church Hall, Barry Road, London S.E.22. In addition, there is an informal on the first Tuesday in each month at various members' homes—to attend one of these it would be a courtesy to ask the Hon. Sec., at least for the first visit. His address is in the Panel.

The venue for **Derby** is 119 Green Lane, where they have a room of their own every Wednesday. April 4 is a

Junk Sale, and on 11th G3SZJ will talk about Simple Photography. April 18 is down for G3RKL to talk about the GB3HH and GB3SF repeaters, and on 25th there is a Film Show.

Dartford Heath D/F is, so far as we know, the only club in the country with a prime interest in amateur radio D/F activity. They foregather at the Scout Hut in Broomhill Road, Dartford on the first and third Friday evenings—but in summer-time check with the Hon. Sec. to make sure they aren't taking advantage of a long evening to organise an evening hunt!

We are in some doubt about the details for **Exeter,** and would appreciate being put straight by a member. However, we can say that we believe the Hq. address is the Community Centre, St. Davids Hill, and the date the second Monday. The contact is as shown in the Panel.

Now we must mention the **G-QRP Club;** as the name implies, it is for the low-power operator with an upper limit of around five watts, and boasts some 500 members. We could add that the *Newsletter* is one of the most interesting we see, and always full of worthwhile construction or modification projects.

It's the second and fourth Thursdays at Watling Community Centre, 145 Orange Hill Road, Burnt Oak, if you want to join the **Edgware** gang.

Next we turn to **Guildford,** where the dates are April 13 and 27; the former is the NFD preamble, and the latter is the AGM. The only snag is that the Hq. is not quoted, and for that we must refer you to the Hon. Sec.—*see* Panel.

April 6 at **Hereford** is a visit to Barton Road Telephone Exchange, while the 20th date is still open at the time of writing; however trot along to the Civil Defence Hq., Gaol Street, Hereford, and there will most certainly be some entertainment organised.

Over the water this time, to **IRTS Region 1;** the *Newsletter* contains an interesting comparison with the newsletter of mid 1949—thirty years ago there were lots of inputs to the newsletter, mostly about the latest home-brew projects, and EI3CP concludes that some of

Names and Addresses of Club Secretaries reporting in this issue:

ACTON, BRENTFORD & CHISWICK: W. G. Dyer, G3GEH, 188 Gunnersbury Avenue, Acton, London W3 8LB.
ADDISCOMBE: P. J. Hart, G3SJX, 42 Gravel Hill, Croydon, Surrey CR0 5BD. (*01-656 9054.*)
AMSAT-UK: R. Broadbent, G3AAJ, 94 Herongate Road, Wanstead Park, London E12 5EQ.
A.R.M.S.: N. A. S. Fitch, G3FPK, 40 Eskdale Gardens, Purley, Surrey CR2 1EZ.
ASHFORD (Kent): J. A. Clarke, G3TIS, Yeomans Cottage, The Street, Brook, Ashford, Kent. (*Wye 812888.*)
BARKING: A. Sammons, G8IZN, 80 Lyndhurst Gardens, Barking, Essex IG11 5BZ.
B.A.R.T.G.: J. P. G. Jones, GW3IGG, Heywood, 40 Lower Quay Road, Hook, Haverfordwest, Dyfed.
B.A.T.C.: M. Cox, G8HUA, 13 Dane Close, Broughton, Brigg, South Humberside.
BISHOP'S STORTFORD: T. E. White, G8LXB, 79 Elmbridge, Old Harlow, Essex.
BOURNEMOUTH: G. D. Cole, G4EMN, 3A Cavendish Road, Bournemouth BH1 1QX. (*Bournemouth (0202) 20027.*)
BRITISH RAIL: R. V. New, 29 Little Dock Lane, Plymouth, Devon PL25 2LZ.
BURY: E. R. Thirkell, G4FQE, 59 Oulder Hill Drive, Bamford, Rochdale. (*Rochdale 32730.*)
CHELTENHAM: G. Cratchley, G8MZV, 47 Golden Miller Road, Prestbury, Cheltenham. (*Cheltenham 43891.*)
CHESHUNT: R. E. Chastell, G8LNM, 4 Fairley Way, Cheshunt, Herts. EN7 6LG. (*Waltham Cross 35393.*)
CHICHESTER: T. M. Allen, G4ETU, 2 Hillside, West Stoke, Chichester PO18 9BL.
CHILTERN: N. C. Ambridge, G4FRL, 53 The Avenue, Chinnor, Oxon. OX9 4PE.
CHIPPENHAM: P. J. Tuck, 178 St. Edith's Marsh, Bromham, Chippenham, Wilts. SN15 2DJ.
CORNISH: T. S. Evans, G3VGO, "Glengormley," Carnon Downs, Truro, Cornwall. (*Devoran 864255.*)
CRAWLEY: A. V. H. Davis, G3MGL, 41 Gainsborough Road, Crawley, West Sussex RH10 5LD. (*Crawley 20986.*)
CRAY VALLEY: P. J. Clark, G4FUG, 42 Shooters Hill Road, London SE3.
CRYSTAL PALACE: G. M. C. Stone, G3FZL, 11 Liphook Crescent, London SE23 3BN. (*01-699 6940.*)
DARTFORD HEATH D/F: A. R. Burchmore, G4BWV, 49 School Lane, Horton Kirby, Dartford, Kent DA4 9DQ.
DERBY: Mrs. J. Shardlow, G4EYM, 19 Portreath Drive, Darley Abbey, Derby DE3 2BJ. (*Derby (0332) 56875.*)
EDGWARE: D. L. Lisney, G3MNO, 119 Draycott Avenue, Kenton, Harrow HA3 0DA. (*01-907 1237.*)
EXETER: Mrs. M. Jefford, 29 Dukes Road, Budleigh Salterton, Devon EX9 6QL.
G-QRP CLUB: Rev. G. C. Dobbs, G3RJV, "Willowdene," Central Avenue, Stapleford, Nottingham.
GUILDFORD: L. Bright, G4BHQ, 4 Dagley Farm, Shalford, Guildford, Surrey.
HEREFORD: S. Jesson, G4CNY, 181 Kings Acre Road, Hereford. (*Hereford 3237.*)
IRTS Region 1: J. Ryan, EI6DG, 23 Dollymount Grove, Clontarf, Dublin 3.
LOUGHOR: T. Griffin-Thomas, "Riverside Manor," 77 Castle Street, Loughor, Nr. Swansea, W. Glamorgan. (*Swansea (0792) 893392.*)
LOUTH (Lincs.): R. Wilson, G8OOW, 112 Upgate, Louth, Lincs. (*Louth 2220.*)
MELTON MOWBRAY: R. Winters, G3NVK, 32 Redwood Avenue, Melton Mowbray, Leics. LE13 1TZ. (*Melton Mowbray 3369.*)
NORTHERN HEIGHTS: L. Cobb, G3UI, 27 Moorlands Crescent, Cousin Lane, Halifax, West Yorks. (*Halifax 60574.*)
ORMSKIRK: P. J. Kay, G4GCB, 24 Laurel Avenue, Bursbough, Ormskirk, Lancs. (*Burscough 892416.*)
PETERBOROUGH: L. Critchley, G3EEL, 36 Waterloo Road, Peterborough, Cambs.
R.A.I.B.C.: Mrs. F. Woolley, G3LWY, 9 Rannoch Court, Adelaide Road, Surbiton KT6 4TE.
REIGATE: F. H. Mundy, G3XSZ, Westview, rear of Manor Farm, off Reigate Road, Hookwood, Surrey. (*Horley 73878.*)
ROYAL NAVY: M. Puttick, G3LIK, 21 Sandyfield Crescent, Cowplain, Portsmouth, Hants. PO8 8SQ.
SALTASH: C. Squires, G3XCS, 5 Frith Road, Saltash, Cornwall.
SILVERTHORN: C. J. Hoare, G4AJA, 41 Lynton Road, South Chingford, London E4 9EA. (*01-529 2282.*)
SOLIHULL: R. A. Hancock, G4BBT, 80 Ulleries Road, Solihull, West Midlands B92 8EE.
SOUTHDOWN: B. Chuter, G8CVV, 15 Coopers Hill, Willingdon, Eastbourne, East Sussex BN20 9JG.
SOUTHGATE: J. Fitch, G8EWG, 16 Kent Drive, Cockfosters EN4 0AP. (*01-440 7353.*)
STEVENAGE: T. J. Tugwell, G8KMV, 11 The Dell, Stevenage, Herts. SG1 1PH.
STOURBRIDGE: S. Shacklock, G4IP, 12 St. Peter's Road, Stourbridge, West Midlands DY9 0TY.
SURREY: R. Howells, G4FFY, 7 Betchworth Close, Sutton, Surrey SM1 4NR. (*01-642 9871.*)
SUTTON & CHEAM: J. Korndorffer, G2DMR, 19 Park Road, Banstead, Surrey. (*01-255 8729.*)
SWANSEA: P. Jones, GW4GRI, 27 Gorwydd Road, Gowerdon, West Glamorgan. (*Swansea 873986.*)
THAMES VALLEY: R. J. Blasdell, G3ZNW, 92 Bridge Road, Chessington, Surrey KT9 2ET.
VERULAM: A. Clarke, G8MAE, 24 Kiln Ground, Hemel Hempstead, Herts. HP3 8EZ.
W.A.C.R.A.L.: L. Colley, G3AGX, Micasa, 13 Ferry Road, Wawne, Nr. Hull, HU7 5XU.
WEST KENT: B. P. Castle, G4DYF, 6 Pinewood Avenue, Sevenoaks, Kent TN14 5AF.
WIRRAL (West Kirby): M. McIntosh, G8NMG, 8 Brancote Gardens, Bromborough, Wirral, Merseyside.
WOLVERHAMPTON: J. Cook, G8EDG, 75 Windmill Lane, Castlecroft, Wolverhampton WV3 8HN.
WORCESTER: M. Tittensor, G4EKG, 16 Durcott Road, Evesham, Worcs. WR11 5EQ. (*Evesham (0386) 41105.*)
YEOVIL: D. L. McLean, G3NOF, 9 Cedar Grove, Yeovil, Somerset.
YORK: K. R. Cass, G3WVO, 4 Heworth Village, York.

the magic has been lost. However, IRTS is in good shape, as a contact with the Hon. Sec. will demonstrate.

Loughor is a place near Swansea, where there is a local group based on Loughor Boating Club as their Hq. We understand they get together on alternate Mondays, and any more details may be obtained from the Hon. Sec. at the address in the Panel.

For **Melton Mowbray** the place is the St. John Ambulance Hall, Asfordby Hill, Melton Mowbray, and the day the third Friday. More details if required from the Hon. Sec. at the address in the Panel.

The British Sub-Aqua Club, Mountain, Queensbury, is home to the **Northern Heights**; April 10 is the AGM and you can 'Meet the Committee' on 24th.

If you want to join **Ormskirk** you will have to get in contact with the Hon. Sec. first, because they rotate between members' homes every Wednesday. His address is in the appropriate line of the Panel.

Peterborough next, and here the venue is the Scout Hut, Occupation Road on the third Friday each month.

R.A.I.B.C. are next on the pile, and every regular reader will know them; however, for the benefit of the newcomer, the 'I' and 'B' in the name stand for Invalid and Bedfast—people to whom, in many cases, amateur radio is an only link with the outside world. If you know of someone who ought to be a member, pass the word to the Hon. Sec.—likewise pass the word if you can *help* in any way.

Now we come to **Reigate,** who have the third Tuesday every month at the Constitutional Centre, Warwick Road, Redhill; we believe there is also an informal, though we have no details.

Anyone who has had a connection with the Royal Navy, can become a corporate member of the **Royal Navy A.R.S.**, with an Associate membership available to MN and foreign navy types. Details from the Hon. Sec.—*see* Panel.

On to **Saltash** and here we understand the contact is G3XCS—*see* Panel for details.

At **Silverthorn** the Hq. is at Friday Hill House, Simmons Lane, Chingford, London E.4 and this gives a fair idea of the coverage achieved. They foregather in their quarters at this stately home every Friday.

Manor House, High Street, is the home of the **Solihull** group, where they can be found on the third Tuesday each month.

Southdown have the first Monday in each month unless that clashes with a Bank Holiday in which case they postpone things a week; the venue is Chaseley Home, South Cliff, Eastbourne.

Another 'Scout Hut' Hq. comes up next, namely that of **Southgate;** it is located in Wilson Street, Winchmore Hill, and the gang are there on the second Thursday of each month.

What is now known as British Aerospace Plant 'B' in **Stevenage** is home to the local group; but no doubt the older residents will recall it better as Hawker Siddeley Dynamics, or even de Havilland. The actual place to aim for is the staff canteen, on the first and third Thursdays.

Stourbridge are based on the library in Longlands School, Brook Street, Stourbridge, where they can be found on the first and third Mondays; try 1930 for 2000, and everyone has time to have a natter before the meeting proper commences.

It is April 4 for the AGM, and April 18 for the R.A.E. revision session, at *T.S. Terra Nova,* 34 The Waldrons, South Croydon, if you are thinking of the **Surrey** club.

On to **Sutton & Cheam** where they have two Hq. places; Sutton College of Liberal Arts (SCOLA), and Rays Social Club, London Road, N. Cheam. The general form is to have meetings on the third Friday and the last Wednesday, with the former at SCOLA and the latter at Rays—but the current newsletter doesn't give the details so we have to refer you to the Hon. Sec., *see* Panel.

We have already mentioned one group near Swansea, and now we come to the **Swansea** club itself; they meet on alternate Tuesdays at Sketty Park Sports and Social Club, Aneurin Way, Sketty Park, Swansea.

Library Hqs. seem popular south of the Thames—now we have **Thames Valley** who have their base at Giggs Hill Green Library in Thames Ditton, on the first Tuesday in each month.

Its April 26 for **Verulam,** when they will be receiving a talk by Vero Electronics, Ltd. at their venue of the Civil Defence Hall in Chequer Street Car Park, St. Albans. In addition, there is an informal at the RAFA Hq. in Victoria Street, St. Albans.

WACRAL is the new name of the group we used to know as WAMRAC, having dropped its reference to Methodism in favour of the word Christian, as its membership is now so inter-denominational. Details, from the Hon. Sec.—*see* Panel.

Details for **West Kent** now; April 3 and 17 are informals with Morse practice sessions and chat at the Drill Hall in Victoria Road. As for the formal sessions, these are at the Adult Education Centre, Monson Road, Tunbridge Wells—April 27 being down for the AGM.

We have a letter from a club calling itself "Wirral" which is not, so far as we know, connected with the Wirral club we have known for many years. To avoid confusion we will call this one **Wirral (West Kirby),** who are based on the Sports Concourse, West Kirby on the 2nd and 4th Wednesdays. Various talks and activities are planned for the coming months.

No mistaking **Wolverhampton** though; they are at Neachells Cottage, Stockwell End, Tettenhall, every Monday evening.

It is just the first Monday in the month for **Worcester,** they having a place at the Old Pheasant, New Street, Worcester.

The weekly routine is favourite at **Yeovil** where the Hq. is in Hut 101, Houndstone Camp, Yeovil, every Thursday evening.

York also gather weekly, on Fridays *except* the third one in each month, and always they seem to have something going on in the way of "showing the flag"—the latest is a meeting to decide their participation in the 1980 York Festival. Find them at the United Services Club, 61 Micklegate, York.

Finale

That's the pile for this time; next month and future deadlines are in the 'box' in the body of the piece, and your information should be addressed to "Club Secretary," SHORT WAVE MAGAZINE, 34 High Street, Welwyn, Herts. AL6 9EQ, to *arrive* by the deadline given. This usually will mean that a letter travelling through London to reach us should be allowed a day or two extra.

COMMUNICATION and DX NEWS

E. P. Essery, G3KFE

AS we commence our offering this month the first warming spell of weather since this hard winter began has arrived; the result was that over the weekend while the CQ WW WPX Contest was being fought out your scribe was unable to operate as outdoor tasks of greater import were outstanding. And, we must admit, *had* there been a few hours available it would have been a toss-up between the contest and the peace to be found in sailing a dinghy down the river in the sun!

However, there is much for us to discuss, so we must turn to the mail. Readers will have noted a certain shortage of correspondents last time, though just as soon as the copy had gone far enough to be out of reach a flood descended on us.

Conditions

Anyone trying to argue that these are not the Good Days as compared with 1976 will have his work cut out: the flux holding up above 200 for a week at a go, and 14 MHz becoming quite noticeably a night rather than a day band, not to mention DX opening on Ten just about every time you have a lunch-time listen-round.

Ten Metres

It really is quite amazing what can be found and worked from the most unpromising locations; from the car parked amid a mass of others and surrounded by steel-framed buildings, yet with Ws piling in on top of more interesting DX beneath them. An alternate is the ten-metre dipole cut and hung out of the shack window, about a half-wave above ground as to the centre and one leg, but with the other leg falling away to one side to avoid the TV set feeder (as TV and rig mutually upset each other); a listen on this monstrosity at the right time has shown VK and ZL, and lots of interesting places between there and here.

G3CED and his fleapower gave Ten a whirl, and as so often noted over the years, found it the best band for real DX with minimal gear. Lots of Ws, a first UJ8 with QRP, Europeans of course, and even a cheeky CQ—it takes a nerve to run a CQ call at that sort of power level, and expect anyone to come back!

G2HKU (Sheppey) mentions K4FW, 9J2BO, VE2AH, N5TP, K5VT, ZC4BI W4DHZ, EA8QO (LA7Y), PY1ZAE and AF9C.

At Yeovil, G3NOF found things were quite good to the U.S. from noon to around 2000 most days, with the odd morning activity from JA and VK. AP2KS, N7RK (Arizona), W7RKE (Utah), 9K2DR, and all W call areas were worked on SSB.

G2BJY (Walsall) stuck to CW, and this mode yielded QSOs with ISØFIC, ISØNZA, JA1DNZ, LU6DYR, UAØSAR, VE7CXD, VE1, VE2, VE3 and VP9L.

Another CW man is G2DHV (Sidcup) who has commissioned an R.216 for the band, and reports QSOs with W1-2-3-4-5-8-9, UT5, W7TCI/5, RQ2, RB5, WB6VVH/9, KA7AWH, WA7SHP, YV1AD, 5B4CY, ZP8BH, W7TC, K6DC, VP2SZ, ZP5 and W6BRT.

G5BVU (Bottisham) is AI2A at home, and oddly enough has the same surname and christian name as G5BIU—and both have discovered QRP. David writes to comment that he believes it when he sees it; and he doesn't have ideal conditions for the "seeing" with something like 100 metres of cable between the rig and the trap vertical aerial. An optimistic estimate indicates that maybe one watt of RF was actually put into the aerial, and while the G and EU stuff was fairly easy, it took a while before W9AWD (Florida) obliged with a first two-way to the U.S.A.

G2HLU (Reading) has a long and interesting letter covering all sorts of things; Ten has been the big draw for Harold, in particular CW, having noted the quite alarming amount of QRM on the SSB end, even though there is so much room. He leaves out the Ws—save for a comment that there were plenty of W6, W7 and VE7; the best were JAs, KH6, VR3AH (a jolly one that—the first VR3 *heard* let alone worked!) and XE2MX. On a slightly different tack, G2HLU treated himself to a Junker key to replace the old Type D used for many years. This had an interesting effect, in that before the purchase the straight key was used for about 10 per cent of the time and the el-bug for the rest, it has now become more like fifty-fifty as the Junker is that much less tiring to drive; with the old key, it was just a matter of keeping in practice or reverting to it when the brain refused to control the el-bug once in a while. The writer has believed for years that one can "lose" the el-bug on occasion no matter how much one uses the thing, and it's nice to know that someone else has a similar problem!

At G4DMN (Wirral), the cold weather gave incentive to stay in the shack, albeit one outdoor foray was made for the purpose of aerial-erection. Ten was noted as "excellent" with FR7BE, HROQL, RM8MBN, RAOJBP, VE1-7, VS6GY, W1-7, ZF1SV, ZL4BO, YS9RVE and WA1SQB/HC8 entered in the log.

Not much activity is reported on the air by G3PPR (Sherborne) from the school station, although they do have a ground-plane for Ten which yielded a few Ws; the time is being spent on the design and erection of a Quad for 21/28 MHz, for which the 'civil engineering' had been completed at the time of writing, as well as the actual beast, which was due to go up in the air on the day after the letter was posted. A few weeks earlier they had an R.A.E. pass, and Rod was hoping for another G4 call in the club just as soon as the Morse is passed. Fingers crossed!

SSB on Ten is an unusual activity for G3RJV (Nottingham) even though it is still QRP. Five watts into a dipole at 15 feet gave him YN1H, 8P6CC, 6Y5MB, SV4GP,

5B4EP, a long QSO with WOMWO/MM2, W1-2-3-4-5-7-8-9, VE1-2-3, UK9HAR, UA9CMS, UA9HHI, RA9FMI, UI8ZAC, and a two-way QRP QSO with UA3ACQ running four watts from Moscow for an RS57 both ways.

21 MHz

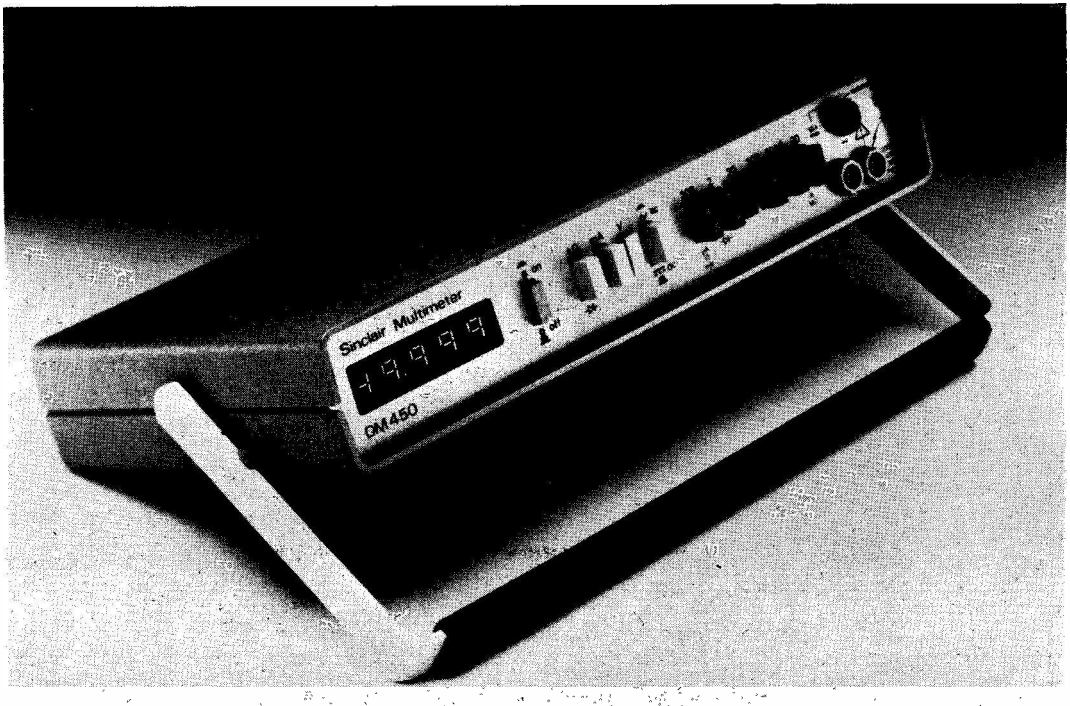
G4DMN comes in to bat first; Richard seems to have spent most of his time on the LF Bands, but he does mention SSB contacts on 21 MHz with STØHF, TI2KT, VP1MW, VP2MCX, XT2AT and YBØADW.

Another one who spent lots of time elsewhere is G2HLU who worked 7X4AN and missed out on CP1AC.

G2DHV seems to have been pretty active on the band, and his CW signals accounted for all W call areas, VE1-4, KP-4, 4Z4, K7HDK, JG3EKS, WB6ADT (University of California), VK3NNH, VK3NRK, VK5NNF, VK5NDY, KA6, VK6NCD, JA2PIW, VE4HW, OY9K, WB6ETQ, WB7UBN, WA6QVB, SM5HIH/MM, WØAAA/5, KB9AB, K7BBD—a fine crop indeed.

G3NOF found conditions on 21 MHz to be good to most areas; long-path VK, ZL, JA, from 0730, followed by the short path opening at about 1000. Little was heard from Africa, but in the depths of winter Ws have been around from noon until 2300, while a week or two later they remained in evidence until the small hours. SSB QSO's were made with JA6PJ, JF3SGI, JR6RVG, KG4FW, N7RA (Arizona), S8FXT, VE6MP, VE6TY, VE7AKL, VE7DGI, VK2NCL, W7XA (Arizona), WA7LCP (Oregon), WB7PTZ, ZL3QA, ZL4BX and all U.S. call areas. The second letter added EA8TE, VP2DXF, 7X5KSF.

G2BJY (Walsall) has chosen 21 MHz for his present activity; after brewing-up for this activity he also gave a going-over to the ten-metre machinery (plus a few mods, of course!) so that output is up from 50 to 80 watts. CW it is, and EA9URE, YV5BLT/2, FP8HL, many Js, PYs, UAOYT, SU1MI, VK4XA, TF3LJN, some oddball Italian prefixes, JAOAXV, JAOCUV/1, JA2AT, JA2FUA, JA3CXL, JA3LXN, JA4OQH, JA4OUZ, JE2HIW, JE2NZE, JH1EDD, JI1VLV, JJ1EXH, JL1BDI, JR1EBL, TF3HNN, KL7MF, KV4AA, LU9EY,



The new Sinclair DM-450 is a 4½ digit, 5-function multimeter with a basic accuracy of 0.05 per cent of reading; the instrument weighs 1½lbs. and is powered by four C size cells. Price £99 plus VAT. Further information is available from the Instrument Division, Sinclair Radionics Ltd., London Road, St. Ives, Huntingdon, Cambs. PE17 4HJ.

UK6GAB, YV5BLT/2, ZL1AMM, ZL1AXN and ZL2TX.

G2VF (Southampton) runs 30 watts to a triangular aerial which he can energise on all bands. On 21 MHz this aerial yielded CW contacts as far afield as W6, WO, W1-4, EUs assorted, N5JB, and of course the inevitable I and U stations.

G3CED (Broadstairs) scorns all this high-power stuff, using just two watts of CW to a Joystick; this made noises to several East Coast and middle-west Ws, PY, SM5KAS/QRP who had 1 watt to a dipole for a two-way in QRP, and a sked with WB3BDQ which was fairly solid despite the fading and generally poor conditions.

Another QRP man is G2HKU who used his HW-8 just once for a CW QSO with HA8CH/P; but then along came the second letter which mentions SM5KAS, YU4VIB, YU4VOY, SMØFY, N2LK, SM3BCS and YU4EXA, plus QRO contacts with PY2SO and N4GG.

Twenty

While it still carries a lot of traffic, there can be no doubt that the rise in conditions from the bottom of the sunspot cycle to the position we see now has siphoned off much activity, while the pestilential Thing which pops up regularly is an even bigger drawback. However, there are some hardy ones; their reports follow.

G4DMN took the odd peek at the band, and came up with SSB to JT1AO, JT1BF, VP8SU in S. Georgia, ZD9GH, 5U7AG, 8Q7AF and 8Q7AG.

G2HLU says his logs are very uninteresting for the most part, because he has so many hobbies, not to mention keeping the house upright and earning a crust! One DX QSO was FY7BH, and another activity was that of taking on some of the newly-licensed Ws: a small number at a time because it sometimes takes a half-hour to make a basic exchange of not very much at not many w.p.m., and they then want to QSL direct. It gives the chap at the other end a big thrill to work his first G or first EU, but nobody seems to have told him about the simplifications that get the message (sorry!) through without spelling out fully, for example, "so back to you old man." G2HLU is so right, and one wonders whether the licence requirements should not require some knowledge of the essential abbreviations.

G2DHV (Sidcup) has now got an R.209 on the band again after a lapse of some twenty years; it listened to the CW from a UO5, UH8, UI8, UA9, UX9, VK2, JA2AA, VE7IW, JA1SXH, CN2 and UF6.

G3NOF found activity on the bands sometimes right through the 24 hours, and doing some unusual things at times. That does not include the bombs, which did not, fortunately, affect any members of the Yeovil club or their families, although it was very close to G3NOF's office. The VK/ZL/JA chaps have been in on long-path at 0800, then on short-path, following this by reappearing in the evening around 1930; and on top there has been much short-skip stuff about. One morning saw a WAC heard within two minutes; if one had worked them all it would have constituted something of a record we think! CP1GN, DU1MEL, EA9URE, EP2LI, EP2MT, FG7TD, FK8AC at 1812z, FK8CR at 0855z FWOTT at 0914z, JA5BSQ, KA2MI one morning, KL7BRD, KL7D, KL7HFQ, KL7JDR, KV4AA, OD5JP, P29JS, TI2VVR, VKs, VP2LDZ, VP8SU, VP9CP, VR1AE (1913z), VU2HI, WA4YPJ/AM over the Atlantic, ZD7SD, ZD8RG, ZD9GH, ZLs, ZSs, 5H3BP, 6W8DY, 8P6JA, 9G1JV, 9X5PM, CT2BB, JY5ZM, KL7DP, KL7ENY, KL7HCC, KL7MF, several VKs, VP2VBK, VP9IR, W6NE/KH6 and 7X2DG.

G2VF's triangle aerial radiates, even though your scribe has some difficulty in reading the log copy! We noticed a lot of European signals and 4N1Z, plus some which look to be DX but could not be deciphered. Which, we might remark, is nothing new—G3KFE often can't read his own writing!

G3CED's fleapower CW managed to find itself in various European logs, and also made it across the Pond to get a 559 report from N2KW.

G2HKU made SSB contacts with KL7IYH, KL7JAR (a YL), ZL1QQ, ZL1VN, ZL2NF, ZL3FV, ZL3RS and ZL3SE; CW was used to work PY1APS, ZL1AXM, JH2UVL, 9J2BO, ELØAN/MM, W6RZ and VK2QL.

Here and There

The Isle of Man Millenium celebration is due in the first week of July, and from 0001 clock on June 30 till 2359 clock on July 8, the GD stations may use the prefix GT. Naturally, there is an award to go with it, and the award requires one to work four GD's and on GT call if one is in Europe; stations outside Europe need three GD callsigns (in 1979 but with the proviso that no GD QSOs can be counted during the period when the optional GT prefix is about). Claims should go to GD4FWQ, Isle of Man Amateur Radio Society, 20 Terence Avenue, Douglas, I.o.M., together with 12 IRCs or four U.S. dollars (or the equivalent), to arrive before March 31, 1980. The same address will get you any more details you may need.

Guildford club have been in existence now for 60 years and to celebrate their Diamond Jubilee they are having an award; the requirement is to work not less than five members of the club between March 1 and August 31, 1979; the QSOs are to be on two bands or more (*i.e.* if four of the QSOs are on one band, then for the fifth contact a different band must be used). Claims to be from a range of at least 50 Km from Guildford *except* on 23cm. where this restriction does not apply. For lists of the frequencies where the gang congregate for award purposes, and other details, write to Brian Grist, G3GJX, QTHR; applications containing log info. (no QSLs) to G3KMO, who is also QTHR.

The G-QRP Club, are making the next step along the line, which is to try and promote QRP-to-QRP contacts, and to that end they are going to run "Activity Week-ends" on June 23/24, August 4/5, September 4/5 and October 6/7. The daily times will be 0900-1100z for 14060 MHz, 1100-1300z on 21060 or 28060 kHz, 1400-1500z on 3560 kHz for inter-G working, 1600-1900z 21060 or 28060 kHz, 1900-2200z on 14060 kHz. There will also be 2030-2130z on 3560 kHz for some inter-G working. It should be noted that the preferred spot on Eighty for the QRP chaps has been moved to 3560 kHz, and one will

quite often find QRP club members around that neck of the woods. There is also a similar Activity Period over the Christmas holidays —details of this, and of the club itself, from G4BUE, "Alamosa," The Paddocks, Upper Beeding, Steyning, West Sussex BN4 3JW.

The word is passed round that the SPs are on Top Band with a licence which gives them 1750 kHz to 2 MHz —it would be nice if *we* got that bottom bit back again, come to think of it!

On a different tack, the Thing on 3720 kHz was a geological survey in ZL, believe it or not! No wonder it was louder there than here. The users were quite unaware of the havoc they were causing until they were located and put right.

Looking forward a little, we hear that OZ1CRH has received permission for YA, and has the call YA2MI; if this is correct it will be the first operation from Afghanistan in several years. Prior to the YA operation, Masood will be in AP, signing AP2LJ. If the YA effort comes off it will probably be at the end of April or the beginning of May. QSLs to WA8AJG.

West Coast DX Bulletin has some interesting things on the Poltava Pestilence, The Caviar Grinder, or the Woodpecker, depending on which part of the world you come from. Prople have tried calling it as H5HHH, and some have noted it changing from around the 25 w.p.m. to twice that; this apparently implies it is looking out to 7500 Km and hence painting the target twice as often to get a good response. A rasp on the signal is caused when they use noise modulated FM signals to better distinguish between replies and QRM; a spread of several signals punching out dots over some 10 kHz, preferably at a close match to the speed sent by Poltava, sometimes shuts it up for a while. If there is a flat spectrum over some 10 kHz or so, this is an indication of FM too, this time to enhance range resolution. Again several stations sending dots within a few kHz of it seem to check it. Sudden changes of signal strength indicate the thing is beaming in a different direction and it often appears that if your own beam is swung onto the long path you pick it up again. In fact, ploys like this can be effective in telling much about long-haul propagation, and indeed about the clever tricks the radar designers can get up to.

We understand that the new chap to arrive on Marion Is. in May will not be an operator but a technician, who is taking his own gear and aiming to be very active.

You may recall a mention of Redonda in this piece a while back: the latest we hear is that stamps are now being issued—Antiguan stamps overprinted 'Redonda'. It just *has* to be a new country looking for someone to operate from there! It is an offshore spot from Antigua, and the stamps appear to be OK with Antigua and acceptable for international mail.

If you are looking for a Comoros contact—don't; we have it that the authorities have cancelled the tickets, and that D68AD is QRT and looking for a move to a new work location.

One hears that the odd BY signal is being heard—which must mean that Phoney Phred reads at least one DX column.

The Aves Is. operation mooted by the Radio Club Venezolano, YVOAA, will begin around noon on April 28 for three days, working all bands Eighty-Ten plus hope of a bit of Top Band and *Oscar*. QSLs to the club at Box 2285, Caracas DF, Venezuela.

Low Bands

With all the troops going HF, there hasn't been all that much doing lower down. However, Top Band is seeing lots of signals that haven't been heard in a long time, possibly after hearing over the grapevine about the new countries which are about; and of course 3560 kHz is the favourite of the QRP chaps. As space becomes short we must just note the highlights.

G2HKU reports on Top Band; SSB contacts with PAØPN, PAØKJF, PAØPAU/A, and PAØINA, and CW ones with GW3KOR, F9KP, DJ8WL, DF9FM, GW3JI, OK1HAS, SP2BMX, GI3JEX, I2XOG, OK2SOD, DJ5GW, OK3LL, OK1DFF/P, OK1DKW, GM3LWS, GU5CIA, OH2BNP, SP3DOI, F6CNI, YU3EF, YU3ZV, GU3HFN, GM5PJ, EI9J, W4DHZ, DL1RK, HB9AJU, GM3ZSP, GI3IVJ, GM4ALK/A, PAØLOU and PAØQRP. Eighty CW worked a couple of Ws and a UA9, not to mention a QRP contact with OK1DKW. 7 MHz saw CW to CM2HB and a brace of Ws.

An interesting one for G2NJ was the Top Band CW QSO with DJ3CY; when Nick said he was using a wartime B2 set, the DJ came back to add that he was using a German wartime transmitter. QRP stations noted on Top Band were OK1DKW, OL5AUY, and HB7BE. As to Eighty, G2NJ has been spreading the word about the QRP Club change of frequency to 3560 kHz; and G2NJ mentions that among the many QRP stations he worked, the most interesting was G3LGX in Fareham who had 800 milliwatts, with which he had made a two-way contact with GM3OXX. At the time of writing G2NJ says that G2CAS has been stopped from his customary /P work by the vile winter weather, but no doubt as the snow goes away we may hear him out and about again.

'CDXN' deadlines for the next three months—

May issue—April 5th
June issue—May 3rd
July issue—June 7th
August issue—July 5th

Please be sure to note these dates.

G2HLU says he only used the band for the odd CW rag-chew contact—Harold reckons they'll still be there to be used after the sunspots have made Ten and then broken it!

G4DMN found 3·5 MHz SSB quite good until he started to have aerial troubles at a time when the West Coast Ws were quite good. Richard mentions QSOs with AF5K, HC1NEK, K5MK, N5RQ, OA4AKP, W1XK/PJ7, W6KG/TI5, VP2DAY, VP2LFZ, VP2MCX, VP9JT and YS9RVE.

Having been out into the snow to put up an aerial for 7 MHz, G4DMN thought he had better use it, so he put SSB signals out to CE7BIY, CO2JA, CO2FH, CX3AN, FK8CC, HC1FM, TU2FH, VE7DFW, VP2LGB, VP2DAY, YN5JAR, YS9RVE, YV, ZF, 5T5s,

9Y4ND, and a crop of Ws nicely covering the central and western reaches.

G2VK and his triangle aerial, plus 30 watts, seems to have managed quite nice contacts around Europe on 3·5 and 7 MHz, taking advantage of the directional effects noted on these bands, and carrying out tests.

G3CED completely ignored Eighty, and only made a handful on Forty, doubtless due to the attractions of the HF bands.

Nasty

G4EAN (Nottingham) recently received a chain letter, which appears to have emanated from the States, and to have seen European amateurs and VKs. We cannot stress too much that these things are a deception, and finding one circulating among licensed amateurs is a very unpleasant surprise. G4EAN broke the chain, and we hope that anyone else getting one will do likewise. It appears to have originated from a firm called Imperial Sales Co., Tennessee, and we can make a shrewd guess that they have just picked out some names with a pin and hoped the recipients would be gullible. Be warned!

Finale

That seems to be about it for another month, deadline dates are in the 'box,' and your report should be posted to reach us by these dates; and please don't expect a first-class letter to reach us in 24 hours—that was good enough a couple of years ago, but now . . . Address, as always, to your scribe, "CDXN," SHORT WAVE MAGAZINE, 34 High Street, WELWYN, Herts. AL6 9EQ.

NEW QTH's

This space is for the publication of the addresses of holders of new callsigns, or changes of address, in EI, G, GC, GD, GI, GM and GW of stations not already listed. All addresses published here will appear in the U.K. section of the American "CALL BOOK" in preparation. Please write clearly and address on a separate slip to QTH Section. Be sure to give correct County designation and post-code. In the case of direct subscribers needing Change of Address, please state for card index adjustment. Address items for this space to: "New QTH Page," *SHORT WAVE MAGAZINE*, 34 *HIGH STREET, WELWYN, HERTS., AL6 9EQ.*

EI6DI, R. Northridge, "Rathlin," Carysfort Avenue, Blackrock, Co. Dublin. (*Tel: Dublin 881187.*)
EI7DF, R. Walsh, Bay View House, Strand Road, Sutton, Dublin 13.
EI8DH, B. Walsh, Athboy, Co. Meath.
EI8DJ, D. Kelly, "Olivette," Camden Road, Crosshaven, Co. Cork.
GB2RN, R.N.A.R.S. H.M.S. Belfast, c/o 78 Lansdowne Drive, Hackney, London E.8.
G4GTP, D. M. Austin, 105 Coombe, Sherborne, Dorset DT9 4DF. (*Tel: Sherborne 2631.*)
G4GUX, J. H. D. Kuipers, 2-A Heronsdale Road, Woodingdean, Brighton, E. Sussex BN2 6QG (*name and address appearing in August 1978 issue was that of G4GXU*).
G4GXU, G. W. Grieveson, 6 Spinney Bank, Kings Sutton, Banbury, Oxon. OX17 3RL (*appeared in error under G4GUX in August 1978 issue*).
G4HKE, L. R. Woodings, 19 Lambourne Avenue, Huntley, Glos. GL19 3HW. (*Tel: Longhope 830762.*)
G4HLN, L. C. Bennett (*ex-G8OAZ*), 7 Maple Avenue, Fishponds, Bristol, Avon. BS16 4HJ. (*Tel: Bristol (0272) 651841.*)
G4HLT, M. E. Eckhoff, 45 Malthouse Square, Beaconsfield, Bucks. HP9 2LE. (*Tel: Beaconsfield 6094.*)
G4HME, L. W. Bailey (*ex-G8NQU*), 47 Millers Park, Wellingborough, Northants.
G4HMS, R.N.A.R.S. H.M.S. Belfast, Symons Wharf, Vine Lane, Tooley Street, London SE1 2JH.
G4HOH, W. V. Thursfield, 9 Aynsley Close, Green Park, Cheadle, Staffs. (*Tel: Cheadle 3036.*)
G4HRV, D. A. Ashton (*ex-G8RCT*), 12 Juniper Close, Swindon, Wilts. SN3 4DZ.
G8OAO, B. A. Austin, 105 Coombe, Sherborne, Dorset, DT9 4DF. (*Tel: Sherborne 2631.*)
GM8PCJ, E. I. Fraser, 3 Rimbleton Avenue, Glenrothes, Fife KY6 2AS. (*Tel: 0592-752762.*)
G8PCV, Trent Polytechnic Amateur Radio Society, Trent Polytechnic Students Union, Shakespeare Street, Nottingham.
G8PEW, J. G. Finley, 70 Edinburgh Avenue, Gorleston, Great Yarmouth, Norfolk NR31 7HA. (*Tel: Great Yarmouth 67980*) (*house No. is incorrect in 1979 RSGB Call-Book.*)
G8PIT, H. G. D. Glasson, 76 Anthonys Avenue, Lilliput, Poole, Dorset BH14 8JJ. (*Tel: Canford Cliffs 707013.*)
G8PJY, G. L. Southwell, 5 Southgate, Hornsea, N. Humberside HU18 1AQ.
G8PQP, A. C. Langford, 2 Southview Drive, Leicester, Leics. LE5 5SG. (*Tel: Leicester (0533) 738988.*)
GM8PSM, A. McGugan, 29 Langmuir Avenue, Kirkintilloch, Glasgow, Strathclyde G66 2JQ. (*Tel: 041-776 6266.*)
G8PTU, P. T. Reeves, 82 Potton Road, Eynesbury, St. Neots, Huntingdon, Cambs. PE19 2NN.
G8PYZ, A. J. Jolly, 20 Crawford Avenue, Chorley, Lancs. PR7 2QT.
G8RBO, H. A. Collier, 12 Coronation Drive, Higher Fold, Leigh, Lancs. WN7 2UU.
G8REI, R. I. Houghton, 50 Severn Way, North Brickhill, Bedford MK41 7BH. (*Tel: Bedford 43348.*)
G8RGQ, T. L. Scrimshaw, 10 Somerdale Road, Northfield, Birmingham, W. Midlands B31 2EG.
G8RMA, F. J-C. Raen (OZ1EVA), 19 Gore Park Road, Eastbourne BN21 1TG.

CHANGE OF ADDRESS

EI9CN, L. Mc. Griskin, 42 Woodland Drive, Ard Easmuinn, Dundalk.
EIØDH, P. J. Dunne, 25 Riversfield Estate, Midleton, Co. Cork.
G2BZQ, R. Q. Marris, P.O. Box 972, Somerville, New Jersey 08876, U.S.A.
GW2FZG, K. R. Boot, 12 Frondeg, Llandegfan, Menai Bridge, Gwynedd LL59 5TN. (*Tel: Menai Bridge 713010.*)
G3LSJ, C. S. Gerrard, 80 Eastfield Avenue, Hollytree Meadows, Haxby, York.
G3LZM, M. A. Bush, 52 Barrs Court Road, Hereford HR1 1EQ. (*Tel: Hereford (0432) 6144.*)
G3OAK, C. J. Dempster, 48 Western Avenue, Woodley, Reading, Berks. RG5 3BH.
GW3OIN, J. G. Nicholas, 36 Coast Road, Rhyl, Clwyd.
G3OMC, A. E. Jenkinson, 40 Walker Road, Chadderton, Oldham, Lancs. OL9 8DB. (*Tel: 681-1926.*)
G3OXH, K. W. Brooker, The Warden's Bungalow, "Bredhurst Shelter," Matts Hill Road, Hartlip, Sittingbourne, Kent ME9 7XA.
G3RIR, N. Ackerley, 24 Macaulay Road, Lutterworth, Leics. LE17 4XB.
G3WTV, K. J. Baker, 16 Woodfield Road, Radlett, Herts.
G3XBE, A. F. Walton, 40 Rooley Crescent, Bradford, W. Yorkshire BD6 1BX.
G4AGM, R. H. G. Williams (*ex-VP8JR/DA2XW/DJØHY*), Flat 47, "Tarranbrae," 176 Willesden Lane, London N.W.6.
G4ASH, I. Roberts, 2 The Quadrant, Marshalswick, St. Albans, Herts. AL4 9RA.
G4BPG, R. Brown, 10 Crossgates, Meadow Rise, Wadworth, Doncaster, S. Yorkshire.
G4DCS, H. J. Paice, 100 New Street, Grantham, Lincs. NG31 8BB.
G4EHS, J. L. Dowsett, "Cornerways," Cox Park, Gunnislake, Cornwall.
GM4EIW, J. Dunnington, 20 Maple Road, Abronhill, Cumbernauld, Glasgow.
G4EMN, G. D. Cole, 3-A Cavendish Road, Bournemouth BH1 1QX. (*Tel: 0202-20027.*)
G6TZ, R. Bottomley, 54 Delius Street, Coventry, W. Midlands CV4 9NE. (*Tel: Coventry 467857.*)
G8CID, D. A. L. Austin, 85 Hoblands, Haywards Heath, W. Sussex RH16 3S. (*Tel: Haywards Heath 56812.*)
G8OLJ, A. J. Picard, "Holm-Dene," 38 North Lane, East Preston, Sussex BN16 1HW. (*Tel: Rustington 5713.*)

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READERS

Wanted: Valves, types ESA-1500, AH238, BR1126, RG3/1250 and GXU4.—Eaton, G3SMK, QTHR. (Tel: Earlswood 3423 after 7 p.m.).

Sale: Eddystone 830/7 general coverage receiver with base speaker, excellent condition, recently checked over, £350 or near offer. Buyer collects.—Macdonald, 9 Lochview Avenue, Gourock (32384), Scotland.

For sale: KW-2000 with interconnected Scorpion 50w. 2m. SSB transverter, £180. Buyer collects. Replies acknowledged by telephone. (Nottingham).—Box No. 5683, Short Wave Magazine Ltd., 34 High Street, Welwyn, Herts. AL6 9EQ.

For sale: Barlow-Wadley XCR-30 Mk. II with FM (bought Dec. '78), fully de-bugged and realigned by Barlow, as new, no longer required as owner returned to UK, £130 or near offer.—Ring Kaznowski, Norwich 60534.

Selling: Termination wattmeter, 7 ranges, 0·3-300 watts, 50-ohm lead, for use on AC mains or internal nicads, £35. BC-221 with charts and power-pack, £20. BC-221, no charts or case but checked working, £6. Pye Vanguard mobile, high-band, with control box/cables, £28. Pageing transmitter, 5 watts output, would make QRP rig, with manual, £20. R.220, £6. Monitor 'scope unit, £10.—Ring Barnes, G4DVH, Ulverston 54466.

Shack clearance: Fully crystalled 2200G 2m. transceiver, with nicads and charger etc., £110 cash (buyer collects). Two-metre 5-over-5 slot-fed antenna, £5. Marconi VFO unit, transistorised, 2·3-5·3 MHz, ten 300 kHz ranges, compact, needs 250v. DC stabilised supply, £8. Constant voltage transformer, 190-260v. input, 230v. r.m.s. output, 60w., £4. 15 Mullard Type NIC50 nixies with drivers, £5 the lot. Two 5m. rolls of black PVC heatshrink (4·5mm. shrinks 50% at 120°C). Old Avo R/C bridge, working, £5.—Ring Mash, Malvern (068-45) 63270 evenings.

Selling: Bench oscillator, £60. Transistor/diode tester, £25. Type 51 waveform generator, £10. Hudson VHF amplifier, £10. UHF radio/transmitter tester, £10. Type VCR-139 cathode ray tube, £5. Marine band crystals: 9·13750 MHz, 9·10625 MHz, 9·12500 MHz, £2 each. Carriage extra, s.a.e. with enquiries.—Hayward, Sunnyfields, Lighthouse Road, St. Margaret's Bay, Dover, Kent.

For sale: FT-DX500, reasonable condition, £250.—Russell, 70 Belmont Road, Portswood, Southampton. (Tel: 0703-35611, daytime.)

Selling: Trio 2200GX, as new, with extras and in original packing, £130. EC-10 Mk. II with mains PSU, £95. **Wanted:** FT-101, approx. £360 offered.—Ring Gaunt, 0609-2068 office hours.

Sale: Collins TCS transmitter, £50. Jason FM tuner unit, £10. Type 715 Racal/BCC VHF receiver, £25. Carriage extra, s.a.e. with enquiries.—Hayward, Sunnyfields, Lighthouse Road, St. Margaret's Bay, Dover, Kent.

For sale: Dentron MT-3000A tuner, £220. FDK-2700 Mk. II, multi-mode, £390. Solid-state linear, 80 watts, £75. Daiwa remote masthead antenna switch and 2-metre pre-amp., £25. Vibroplex 'de luxe' key and case, £25. Hansen VHF SWR/Power bridge, £20. Two 10-ele quads, £10 each. Shure 526T desk mic. plus pre-amp., £25. IC-215 transceiver, 15 channels plus RR6, all accessories, £145. YO-100 monitor 'scope, £95. Yaesu SP-101B speaker, £10. All items carriage extra.—Smyth, GM3XNE, 4 Afton Place, Ardrossan, Ayrshire. (Tel: 0294-67326.)

Sale: DX-160 Rx, 150 kHz to 30 MHz, all modes, 5 bands, with matching speaker and manual, mint condition (new £130), bargain £70 or near offer.—House, 10 Leagh Close, Kenilworth, Warks. (Tel: Kenilworth 54556, 6-8 p.m.)

Sale: Yaesu FR-101D, 2-160m., with matching speaker and front cover, excellent condition, £400. Yaesu headphones, new and boxed, £6. Hy-Gain 18AVT, 10-80m., weather proofed and boxed, £45. Jaybeam 5Y/2M antenna, new and boxed, £6. One 3-way antenna switch, £3. Buyers collects.—Ring Hitchcock, 01-359 7064.

VE3TR, located approx. 75 miles East of Toronto, Ontario, is seeking a UK ham who would be interested in exchanging his house/flat/static-caravan, car and station, for any period mutually agreeable between two and six months, beginning preferably next October. Full details of my house and location etc. in first letter.—J. Pollard, VE3TR, RR.1 Baltimore, Ontario, Canada, Kokico.

For sale: Jaybeam D8/2M antenna, new, still in box, genuine reason for sale, £14. Buyer collects.—Ring Norton, Dewsbury (0924) 452303.

Sale: Racal RA-17, good condition, £230 or near offer. Callers after 6 p.m.—Zagorski, 7 Reid Road, Invergordon, Ross-shire.

For sale: B.62 receiver, excellent condition, with SSB converter, £50. AR88, fair with manual, BFO needs attention, £35.—Ring Barnes, Hele 420 (Devon).

Wanted: Control box for Storno 'Viscount'; also 30-way plug, and microphone. Details and price please.—McGhie, Boyach Crescent, Isle of Whithorn, Wigtownshire.

Selling: TR-7010 2m. SSB Tx/Rx, as new, one owner, with $\frac{5}{8}$-whip, £135. "G3ZVC" 9 MHz SSB Tx/Rx, with KVG XF9B filter, kit constructed on commercial PCB, £40 or near offer.—Parker, G3OLX, QTHR. (Tel: Burgh Heath 55271.)

Selling: Racal RA-17 Mk. II, very good condition, £230 or near offer. Marconi TF-801D/1 signal generator, very good condition, £150 or near offer.—Ring Betts, Watford 28566 ext. 298 daytime.

For sale: Drake DSR-1, superb Rx, solid-state, 10 kHz to 30 MHz continuous, synthesised, digital readout to 100 Hz, AM/SSB/CW/RTTY/ISB, bandwidths 6·0·4 kHz, 2 watts output, as new, with manual, boxed (current price over £2000), £695.—Ring East, G8PKD, 01-486 8286.

Sale: AR88LF, good condition, with case and manual, £60 or near offer. Prefer buyer collects.—Ring Johnson, Wakefield 78538.

Wanted: Valve/transistor testers, in good condition and with manual. Full details and price (inc. carriage) please.—Box No. 5684, Short Wave Magazine Ltd., 34 High Street, Welwyn, Herts. AL6 9EQ.

Sell or exchange: FT-221R, as new, fitted pre-amp., with accessories and manual, £290 or *exchange* for Icom IC-202/215 with cash adjustment. Technical Associates speech processor, £15. Type 6S6 tape reader, new, £10.—Clark, G8NPM, QTHR. (Tel: Wickford 4317 evenings and weekends.)

Wanted: 'Suitcase' sets, Marks 119, 122, 128/128A, 217: a Mk. III, Type 3 Mk. II (B.2), BP5/T5, AR11, A3. Incomplete or damaged items considered.—Ring Taylor, G3UCT, Fleet (02514) 6998.

Selling: Eddystone 1001 general purpose communication receiver, excellent condition, with ten-position crystal facility 550 kHz to 30 MHz. variable mains 100-260v. and 12v. internal/external battery operation, (today's price £770), £300.—Ring Wevell, 041-779 2137.

Wanted: Ham returning to hobby requires reasonably priced HF transmitter, QRP or otherwise. W-H-Y?—Hardy, 71 Scalpcliffe Road, Burton-on-Trent, Staffs.

For sale: KW-2000B with AC/PSU, immaculate, complete service by K.W. two months ago, £250. KW-1000, 1200w. linear amplifier, perfect, £150. KW-110 Q-multiplier, £20. K.W. LPF, £20. Or offers for the Lot? Wanted: VHF gear, *e.g.* FT-200 plus Europa. W-H-Y?—Ring Morse, G4FRB, Cirencester 5409.

For sale: Trio TR-2300 with nicads, £150. Microwave Modules 500 MHz counter, £49. Datong RF clipper, £35. QM-70 2m. converter, 28-30 MHz, £10. VHF SWR/Power meter, £15. HF SWR/Power meter, £6. All in mint condition, unused and boxed.—Ludkin, G4BKM, QTHR. (Tel: Denham 4358.)

Sale: Robot SSTV Type 80A camera and 70B monitor. Two CCTV cameras. 70cm. parabeam. 70cm. colinear. 2m. 8-ele. crossed Yagi. Stolle rotator. AR22R rotator. 70cm. converter, 28 MHz IF. 70cm. varactor tripler. Heath OS-2 'scope.—Ring Le Sueur, Downland 55908 evenings. (Surrey).

Wanted: Concerning Eddystone 770R Series 1 receiver: any reader able to help with advice or work. The Rx is in good condition and values/voltages OK, but VHF sensitivity is pathetic—what is likely fault? In payment, complete MCR-1 Rx, or radio magazines, or cash.—Fleetwood, The Red House, Spetchley, Worcs.

For sale: Emigrating, must sell: Yaesu FR-101DD Rx with all optional extras and Landliner SP-101P speaker/patch-unit, £445. FL-101 Tx, 1·8 to 30 MHz (with free SWR meter and trap dipole), £280. All equipment in good condition, complete with leads, manuals and original packing. Yaesu YD-844 bench mic., new and boxed, £15. Marconi precision hand key, with filter, £25. S. G. Brown headphones with detachable earpads, £5. Ceramic aerial insulators, 3in. ribbed (pack of 8), £2. —Sirignano, G4FZG, QTHR. (Tel: Bedford 56144.)

Wanted: Beginner requires general coverage or amateur bands receiver.—Ring Cash, Sedgley 2333.

Sale: TS-700, as new, and to 700G standard, £290. E.M.I. CCTV camera Type 8A, vidicon marked but worth it for lens, £25. Microwave Modules 28-432 MHz transverter, £60. Prefer buyers collect.—Ring Gorrill, GM8BOV, 031-331 2755.

For sale: FRG-7 receiver, £140. Microwave Modules 144/28LO converter, £16. Both mint condition.—Ring Shilvock, Brierley Hill 79209.

Shack Clearance: Send large s.a.e. for lists of valves, xtals, wavemeters, transmitters; also Heathkit RA-1 Rx and digital frequency meter. (Berks.).—Box No. 5685, Short Wave Magazine Ltd., 34 High Street, Welwyn, Herts. AL6 9EQ.

Sell or exchange: FRG-7, £175 or **exchange** for Eddystone EA-12 which must be in mint condition. Microwave Modules 144/28 converter, £15. Buyers collect or pay carriage.—Ring Norton, Dewsbury (0924) 452303.

Sale: Good used valves: five 5B254/M's, £1 ea; hundred EI8OF's, £1 ea; hundred EL85's, 50p ea; twenty-five OA2's, 20p ea.—Thomas, GW4BCD, 13 Northways, Porthcawl, Mid. Glam. (Tel: Porthcawl 8963 after 6 p.m.)

May issue: Due to appear May 18th. Single copies at 50p post paid will be sent by first-class mail for orders received by Wednesday, May 16th, as available—Circulation Dept., Short Wave Magazine Ltd., 34 High Street, Welwyn, Herts. AL6 9EQ.

Sale: Clover-leaf antenna for two-metres, £5 or near offer. Eight metres of RG214U low-loss cable, 50-ohm, £3 or near offer.—Hadley, G8LJW, 021-773 6488.

Wanted: FL-200 transmitter, or similar, to match FR-50B. Also prop. pitch or Cowl Gill motor.—Ring Barber, Street 45763 (Somerset).

Wanted: Collins 30-L1 linear amplifier and 312B-5 VFO unit. Details and price please.—Ring French, G3LGL, Kinver 2461 (West Midlands).

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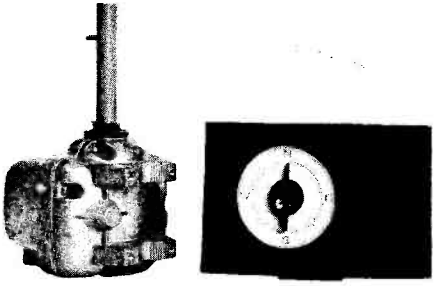
Communications Ltd



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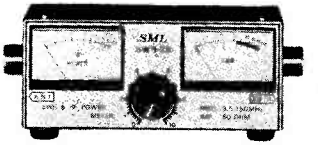

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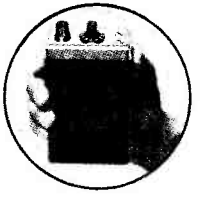

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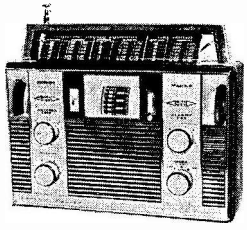

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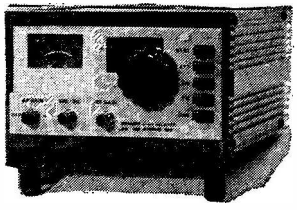

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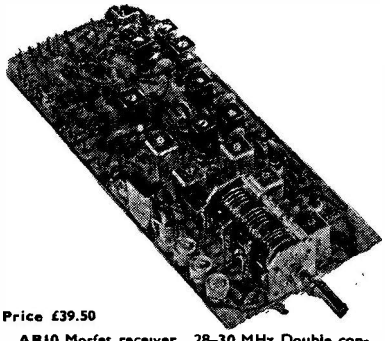

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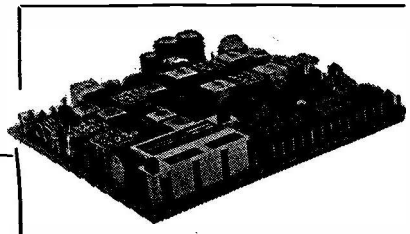

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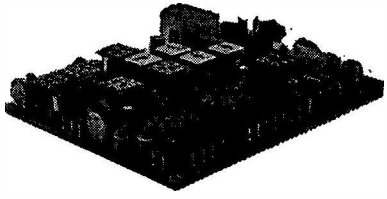

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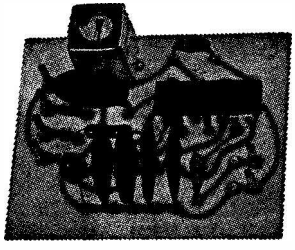

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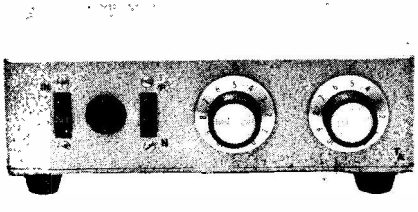

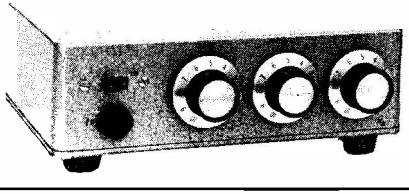

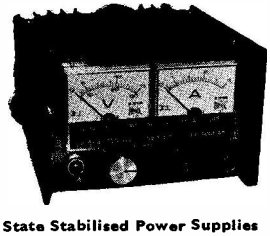

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SHORT WAVE MAGAZINE

(GB3SWM)

ISSN: 0037-4261

Vol. XXXVII APRIL, 1979 No. 426

CONTENTS

Editor: **PAUL ESSERY, G3KFE/G3SWM**

Advertising: **Charles Forsyth**

Published at 34 High Street, Welwyn, Herts., AL6 9EQ, on the last Friday of the month, dated the month following. *Telephone: 04-3871 5206 & 5207*

Annual Subscription: *Home: £5·50, 12 issues, post paid*
Overseas: £5·50 ($10·00 U.S.), post free surface mail

Editorial Address: **Short Wave Magazine, 34 High Street, Welwyn Herts. AL6 9EQ, England.**

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The SHORT WAVE Magazine

EDITORIAL

The G.P.O.

We must apologise to readers for the long delay they experienced in receiving their copies of the March issue of *Short Wave Magazine*. As many will be aware, the *Magazine* is printed in Tunbridge Wells, which means that the first point in the distribution system (for the vast majority of copies) is Tunbridge Wells G.P.O. Sorting Office. Now Murphy (or perhaps someone far more menacing) had it that at the crucial time there was an unofficial overtime ban and work-to-rule at this particular sorting office, virtually shutting it down—the effect being that the subscriber copies, and newsagents parcels, were left untouched for *ten days*.

Added to this, the difficulties at the G.P.O's main London sorting office (Mount Pleasant), through which many copies pass, and the Post Office's complete inability to handle second-class mail in anything like the time they promise, resulted in a total delay of between two and three weeks.

The current postal situation is one which is just as frustrating for us as it is for readers and we do hope that readers understand that, to *our* immense annoyance, there is *nothing* we can do about it.

While on the subject of the posts, we suggest that readers who like to contribute to our regular feature articles should always mail first-class and allow at least three days for delivery, in order to meet the deadlines.

All the foregoing indicates a disgraceful situation in a monopoly "service," and one which we trust will not be of long duration.

Equally, the foregoing is not meant to cover-up our own difficulties of late—merely to show that the fault is not always with us, and that the G.P.O. is not helping us one little bit.

G3KFE.

VHF BANDS

NORMAN FITCH, G3FPK

VHF Convention

THIS year's RSGB VHF Convention at The Winning Post Hotel on March 10 attracted an estimated 800 visitors according to Geoff Stone, G3FZL, compared with 676 in 1978. Weatherwise, it was a dismal day and your scribe left Riddlesdown in a snow storm. Nevertheless, this did not deter VHF enthusiasts and the exhibition area in the hotel was packed from the beginning.

Twenty-four traders and groups comprised the exhibition, plus the RSGB and the Bring-and-Buy stalls. To accommodate all the exhibitors, there were some stands at the Whitton School where the afternoon lectures were given. The exhibitors were limited to components and accessories, in theory, although the proverbial "black boxes" were available, under the counter. The ceiling in the hotel was dominated by the big, 16-ele. *Tonna* aerial. These become very popular since *Randam Electronics* began importing and marketing much of the *Tonna* range last summer. Precision power dividers for groups of beams are now available.

Cambrian Electronics had a range of *Eimac* valves, socket hardware and data on show. It is refreshing to find a firm so keen to give free technical advice to *bona fide* inquirers before a sale, as well as after-sales assistance. A surprising amount of very useful *Eimac* literature is available. Graham Packer of *Packer Communications* reported satisfying sales of the little VHF/UHF preamplifier based on the popular DJ7VY design. The bandwidth is 70-570 MHz, so it covers three amateur bands and FM broadcast as well. The gain is about 19 dB and the very large dynamic range, coupled with very low *noise figure* make this one of the best preamplifiers on the market.

Events like this always attract the home constructor so naturally those exhibitors offering components did a brisk trade in new and surplus items. With the very high cost of postage these days, considerable savings can be effected by buying from several different firms at such events, particularly in the heavier goods, such as cable, which W. H. Westlake were offering in the school part of the trade show.

The afternoon lectures were very well attended. Your scribe poked his nose into Streams A—General—and C—Microwaves, but opted for the B Stream, devoted to propagation. As always, Charlie Newton, G2FKZ, gave a very informative, entertaining and well illustrated talk on the current *Aurora* theories. He mentioned the unique "Spy Network" that thousands of radio amateurs, world wide, provide when they send in reports of *Ar* events. He now gets weekly information from The National Bureau of Standards' Radio Propagation Laboratory in Boulder, Colorado, thanks to Dick Grubb, WØQM, who is a Research Director at the N.B.S. Dick is G3FNL and an old college friend of Angus McKenzie, G3OSS, through whom this contact was established. One result of this cooperation is that the forecasting of *Ar* events is more accurate.

Martin Harrison, G3USF, gave a most interesting talk on *Sporadic E* propagation, illustrated with tape recordings of FM broadcast and amateur *E's* signals. These revealed to the uninitiated now exasperatingly fleeting some of the reflexions can be. Martin stressed that, unlike *Ar* events, there is no way to even begin to warn operators that *E's* propagation is expected in a day or week; it is, after all, *sporadic*, in the true meaning of the word. There are "seasons" though, and various indicators that such propagation is imminent for those with the necessary time to listen.

An important point mentioned was that when you hear broadcast FM on Band 2, it is almost certain that *somewhere* in Europe, *E's* QSO's are taking place on 2m. When such stations are heard, it is a sound idea to put out CQ calls for, if everyone is only listening, nobody will know if there is *E's* propagation!

The lecture was devoted to temperate zone *E's*, *auroral E* having been dealt with by Charlie Newton, earlier. However Prof. Harrison did play a tape from Roland Whiting, 5B4WR, of his record-breaking 2m. QSO last year with Ray Cracknell, ZE2JV, *via* transequatorial propagation. It was fascinating to hear the "auroral" sound of these multipath signals from over 6,000 kms. away. These propagation lectures were chaired by fellow columnist Ron Ham, in a very efficient manner.

The day was rounded off with a social evening and buffet supper, attended by 125 guests. The 1980 event will be on March 8, possibly using the Whitton School for the whole event and the Winning Post for meals, drinks and the evening social. Congratulations to the RSGB VHF Committee for organising the affair and it was a pleasure to meet so many readers.

Awards News

The new Magazine QTH Squares Century Club award has been welcomed, it seems, particularly since it is "back-dated" so that it is not necessary to start collecting QSL cards all over again. The full rules and an application form are available on receipt of a self-addressed envelope at the Welwyn office.

The first "His and Hers" VHF Century Club certificates have been awarded to Sheila and Dave Williams, for 2m. operation from Cumbria. No. 308 goes to Sheila who, after a couple of years as a short wave listener, got her G8KPL call in 1975. Dave was also a listener for several years before getting his G8JAG call in 1974. He started with mobile operation using AM. After initial AM operation, a *Trio* TS-700G was purchased but, due to a poor home QTH, much portable operation was done.

In early 1977, they moved to the present Dalton-in-Furness home and later that year bought a TS-700S. Last year, Dave built a 4CX250B amplifier which runs 250 watts PEP output to the 10-ele. *Parabeam* at 45ft. Recent acquisitions are a 70 cm. transverter and 88-ele. *Multibeam* and they are now active on 2m. and 70 cm. SSB. There are plans for an amplifier for 70 cm.

and to get going on 23 cm. later this year. Dave's certificate is No. 309.

Contests

Results: The Single-Operator, all-mode section of the 144 MHz Fixed Contest of Dec. 3 was won by G8KMW with 2,450 points. Second was John Heys, G3BDQ, with 1,771 pts. The Multi-Op. all-mode part was won by G3ZIG with 2,823 pts. with the University of Nottingham Station, G3UNU, runners up with 2,659 pts. The FM Only section was won by G8LHW with 82 pts.

Coming Events: The 1,296 MHz Open contest is scheduled for April 7 from 1600-2400 GMT, followed the next day by the 432 MHz Open and SWL event from 0900-1700 GMT. On April 22, the 144 MHz CW event will take place from 0900-1700 GMT and on the following Sunday, April 29, the 70 MHz Open contest, from 0900-1500 GMT. The first big event in May is the 432/1296/2304 MHz affair on May 5/6 from 1600-1600 GMT.

Beacon Notes

At the VHF Convention on March 10 Brian Bower, G3COJ, told us that the new microprocessor keyer had been installed in GB3VHF and that the beacon had been under a "soak test" on dummy load for a couple of weeks. Brian brought the Tx to the Convention. So before this appears, the Wrotham beacon should be on its new frequency of 144·925 MHz.

During this severe winter, the 70 cm. Emley Moor beacon lost a director from one aerial due to ice. The 23 cm. Dunstable Downs beacon is now back on the air with its new call, GB3DUN. During a recent QSO with F1CRP, Alain told your scribe that the Lannion 2m. beacon FX3THF (YI13d) may be silent for a long time—may be a year or more. Its keeper, Henri Roger, F5ZA, reckons it is not worth repairing so a new one will have to be made. Unfortunately, Henri has no time to build a new, modern Tx. However, this would seem to be an ideal project for a local club to build.

Chris Bartram, G4DGU, mentioned that the frequency of GB3WHA, nominally 432·81 MHz, tends to wander. He makes the valid point that, with present day technology, beacon QRG's and outputs should be very accurate. Chris wonders whether the correct type of crystal was used.

THREE BAND ANNUAL VHF TABLE
January to December 1979

Station	FOUR METRES Counties	FOUR METRES Countries	TWO METRES Counties	TWO METRES Countries	70 CENTIMETRES Counties	70 CENTIMETRES Countries	TOTAL Points
G4DEZ	—	—	56	16	—	—	72
G2AXI	13	1	35	6	13	2	70
G3FIJ	13	1	35	8	11	1	69
G3FPK	—	—	56	10	—	—	66
G8LHT	—	—	35	4	17	2	58
G4ERG	—	—	43	9	—	—	52
GM4CXP	2	1	31	11	1	1	47
G4GXT	—	—	38	7	—	—	45
G4HAO	—	—	36	6	—	—	42
GD2HDZ	2	2	9	2	20	2	37
GI8EWM	—	—	22	6	—	—	28

The Satellite Scene

The telemetry from the Russian satellite *RS-1* indicates trouble in batteries nos. 1 and 4 which have been indicating very low voltages. Throughout February, the transponder was not switched on. It may be that they will recover now that the spacecraft is seeing more of the sun. On a recent AMSAT net, a reference orbit was quoted for Feb. 17 as follows: No. 1362 at 01h. 26m. 43s. at 66·8°W. based on a visual sighting from a South African observatory by ZS1DI. Pat Gowen, G3IOR, has learned from UA3CR that there are three control stations in the Soviet Union, RS3A in Moscow, RSØA in Vladivostock, and RS3B, which appears to be a mobile station.

The Stanford Research Institute has an orbiting satellite which has beacons in the 70 cm. and 23 cm. bands. These are 200 mW. continuous carrier (AØ) signals on 435·9702 MHz and 1239·073 MHz. The orbital parameters are: period 105·729 mins.; longitude increment per revolution 26·432°W; inclination 99·655°; apogee 1025·968 kms.; eccentricity 0·045. A reference orbit given on the AMSAT net on March 11 was for Feb. 26 at 0h. 04m. 44s. at 188·8°W.

Latest news on AMSAT's first *Phase 3* satellite is that the uplink band will be 435·14-435·29 MHz and the downlink 145·99-145·84 MHz with a beacon on 435·97 MHz. The launch date is early March, 1980.

Repeater Notes

The Humberside VHF repeater GB3HS on R2 was scheduled to come into service on March 4. Further information from G3KDC. Another UHF repeater GB3NN, serving northeast Norfolk on RB2 was due on from Bacton on Mar. 9. Barrie Stevens, G8KKA, is the secretary of the Mendip Repeater Group which was formed on Oct. 4 last. Their immediate goal is to establish a VHF repeater, possibly on RØ, to fill a gap in the coverage of GB3BC, GB3SN and GB3NC. Coverage tests from the likely site have proved very encouraging. Anyone interested in joining the group should contact Barrie at 25 Hazel Terrace, Midsomer Norton, Bath, BA3 4BG.

Two Metre TEP

George Vernardakis, SV1AB, from Athens, has sent an account of the World record-breaking 2m. QSO's between Greece and South Africa, which were the culmination of many hours of patient listening. Throughout almost every evening in February, the ZE2JV beacon was received. On the 11th, the ZS6DN beacon was heard from 1803 to 1815 GMT but no QSO resulted as the operator was not at home.

On Feb. 13, ZS6DN was again heard at 1815 GMT and this time a QSO took place between Costas Firmerellis, SV1DH, in Athens and Dave Larsen, ZS6DN, in Pretoria, a distance of 7,117 km. Unfortunately, SV1AV was not at home. On Feb. 16, ZS6DN's signals were again heard so George put out a call on the 10m. TEP net and later completed a tape-recorded QSO with Dave at 1820 GMT, thus creating a new World record of 7,127 km. on 2m.

One interesting point is that SV1AB has received the South African signals both with horizontal and vertical polarisation, in the latter case best reception being with a 20° elevation! George confesses to having no theories about that at the moment. The signals were typical TE sounding with T6 notes at best. However, during February, the ZE2JV signals were received for up to two hours at a time, occasionally of T9 quality.

The gear at ZS6ND comprises a 100 watts Tx to a 4 x 10-ele. group. At SV1AB, 200 watts to 16-ele., and at SV1DH, 300 watts to a *Parabeam*. George concludes, "I am glad to report that we do have some more stations taking part in the tests; like YU1EU from Belgrade; LZ1AB in Sofia; 9H1BT in Malta and EA3XS and EA3ADN from Barcelona."

Six Metres

Although we do not yet have an amateur band around 50 MHz, nevertheless, a number of British and European stations have been taking part in crossband 6/10m. tests with U.S.A. stations. Brian Bower, G3COJ (Bucks.), reports the band having been open briefly to North America and Africa but that so far, propagation has not been a patch on that in the 1956/7 winter. On Feb. 8 and 9, he heard WB2RLK/VE1 around 1330 and worked him on the 10th at 1314. The following day, Brian worked W2IDZ at 1324 and heard various others up to 1440, including W4WD and WB8IWI/4. On the 17th, the WB2/VE1 was worked again at 1346; he was S9 but faded out in 2-3 mins. The beacon VE1SIX on 50·088 MHz was first heard at 1332 but faded three minutes later. The band then died till 1710 when AD1C, who is 15 years old, and W1JR were worked, with W1MX heard. No trans-Atlantic signals were heard after Feb. 17.

Graham Taylor, G8HVY (Dorset), found 6m. wide open between 1405 and 1445 on Feb. 15. WB2RLK/VE1 was a colossal signal—he runs 1 kW. to an 11-ele. *Yagi*—and other signals heard were, W3XO, W2UTH, W2AXU, N2ASC, WB2VWI, W3VTH, K1IKN, W2EIF and WB2RYY, plus VE1SIX, which was S9. Graham uses a *Yaesu* FT-620B with 3N211 preamp. and a 5-ele. *Yagi*. Others who have been hearing and/or working the W's crossband include Al Slater, G3FXB (Sussex) and Brian Meaden, G3BHT (W. Midlands). Inquests are held on 28·885 MHz on Sundays around 1700 GMT with WA5CEB in New Mexico in the chair, but your scribe has heard this net during the week, too.

On March 4, G3COJ (Staffs.) heard ZS6LN working crossband with Henry Souchet, 9H1CD at 1415. At 1428, G3COJ heard the ZS6PW beacon on 50·03 MHz and 7 mins. later worked ZS6LN crossband. By 1440, 6m. ZS signals had disappeared in the U.K. but were still being heard strongly by 9H1CD. The "TE chat frequency" of 28·33 MHz was used for inquest purposes by Brian, Henry, ZS6LN and ZS6PW. From Athens, SV1AB reports receiving Rhodesian TV on Ch. 2 daily, both video and sound, in the evening. George has made crossband QSO's with ZS6PW and ZS6LN, too, and has copied the ZS6VHF beacon on 50·04 MHz.

From Leeds, welcome to new correspondent Kevin Jackson who sent a very detailed account of DX TV reception at VHF. The F2 layer stuff started on Feb. 6 with TV pictures from stations 6,000 miles away plus U.S.A. police and paging systems, and Middle East military traffic. At some times, "snow-free" pictures were received on a 3ft. piece of wire. Russian TV pictures on R1—49·75 MHz—have been received from Baku, Dushanbe and Frunze. On Feb. 13, Kevin writes: " . . . two programmes seen at 0933 and 1013 GMT; a Chinese announcer in the standard issue boiler suit followed by progs. consisting of paddy fields and people in sanpan hats." A clock in one picture indicated 9 hours ahead of GMT so the station received was probably Kirin. From Feb. 17, no F2 signals have been observed, but in a "P.S.," Kevin mentions TSS (Russia) TV on Ch. R1 at 1019 GMT, on Feb. 26.

Two Metres

Congratulations to Fausto Minardi, I4EAT, who worked his 50th country on 2m. on Feb. 24. This was 4U1ITU in Geneva, operated by FØBJT, and it was a tropo. contact. Fausto wonders if this is the first "half-DXCC" on VHF? We would imagine that Dave Price, GW4CQT, and Clive Penna, G3POI, cannot be far short of that goal now.

By Feb. 25, the barometric pressure in Southeast England was 1044 mb. The centre of the anti-cyclone wandered off Eastwards and declined but did not bring any sign of the lift many had been expecting. Syd Harden, G2AXI (Hants.) found G DX conditions up around Feb. 20/21 for Midlands QSO's, while on the 22nd, they were good towards the South coast and East Anglia. On the 25/26th, he had, " . . . a good run along both sides of the Channel."

Bob Mackean, G4HAO (Liverpool) reckons February was quite a fair month, notable dates being the 4th, 5th and 25th. However, school work had meant limited time on the air. Arthur Breese, GD2HDZ, reports very poor conditions and minimal activity as observed from the island. Up to Feb. 20, Geoff Brown, GJ8ORH, who was due to take his morse test in mid-March, had 10 countries *confirmed* on the band this year and 60 QTH squares worked.

From Borders, Derrick Dance, GM4XCP, reports little to get excited about on the band although he says he hears lots of weak CW DX around 144·05 MHz. His best DX in Feb. was Colin Wooff, G3SPJ (London), who is heard regularly over the border in and out of the QSB. He is glad to hear more folk using the key these days. During an *Aurora* on the 26th, he worked LA7KK (FU62j) for square no. 132 on 2m.

For some weeks now, when beaming at 345° from G3FPK, there has been a nasty sheet of noise centred around 144·065 MHz which would mask any DX signals. It appears to be a London phenomenon so more accurate QTF's are sought

so that the source of this nuisance can be pin-pointed.

During the 144/432 MHz Contest on March 3/4, the weather conditions on the Saturday night in S.E. England were appalling. The Harrow R.S. lads operating G3EFX/P near Lewes in E. Sussex, endured a howling gale but thick fog. They managed 505 QSO's, 170 of them with continentals. Best DX was 617 km. with a GM.

QTH LOCATOR SQUARES TABLE

Station	23 cm.	70 cm.	2 m.	Total
Station	23 cm.	70 cm.	2 m.	Total
G3POI	—	—	265	265
I4EAT	—	25	217	242
G8HVY	—	71	119	190
G8LEF	22	61	101	184
G3JXN	26	66	88	180
G8GML	11	63	106	180
G3SEK	—	—	179	179
G3IMV	—	—	172	172
G4CMV	—	30	140	170
G3COJ	23	66	80	169
G3CHN	—	—	167	167
GM4CXP	—	25	132	157
G3FPK	—	—	154	154
G4DEZ	—	—	150	150
G4BWG	—	29	118	147
G2AXI	2	52	91	145
9H1CD	—	13	127	140
G8BKR	1	30	108	139
G3OHC	4	33	101	138
9H1BT	—	—	138	138
G3XCS	—	21	111	132
G8HHI	—	30	101	131
GJ8ORH	—	30	99	129
G4BAH	—	32	92	124
G8IWA	—	40	83	123
G3BW	3	25	91	119
G8LHT	3	34	80	117
G8ATK	—	29	88	117
GM4COK	—	9	106	115
GD2HDZ	11	34	67	112
G4FCD	—	22	89	111
GJ8KNV	—	26	82	108
G3KPU	—	20	84	104
G4DKX	5	30	68	103
G4ERX	1	29	67	97
GM8NCM	—	12	84	96
G4FBK	—	5	90	95
G4AWU	—	—	94	94
G8KSS	—	—	93	93
G4AEZ	3	28	61	92
GJ8AAZ	1	24	67	92
G3FIJ	—	27	65	92
G3SPJ	5	21	63	89
G8GII	—	22	63	85
G8KGF	—	5	80	85
G6UW	—	—	85	85
G4GEE	—	27	56	83
9H1C	—	—	83	83
G8EOP	8	36	38	82
G8KPL	—	7	74	81
G8JAG	—	7	73	80
G8JHX	—	—	80	80
GI8EWM	—	18	61	79
G8JJR	—	—	79	79
G8LGL	—	1	74	75
G8IFT	7	18	49	74
G8KSP	—	2	72	74
G8ITS	—	16	56	72
G4GET	—	—	70	70
GD3YEO	—	8	59	67
G8KUC	—	7	60	67
G8KLN	—	1	62	63
G4CIK	—	—	62	62
G4GCQ	—	—	61	61
G8JEF	—	—	58	58
G8MFJ	—	9	48	57
GW4FJK	—	—	57	57
OZ9IY	—	—	53	53
G4GSA	—	1	48	49
G4GXT	—	—	43	43
G4EYL	—	—	41	41
G8JGK	—	—	41	41
G8PRG	—	—	15	15

Starting Date January 1, 1975. No satellite or repeater QSO's.

Operating from Harwell, the G3PIA team notched up 557 contacts including 16 DL's, 17 F's, 17 GM's, 21 ON's and 26 PA's. John Quarmby, G3XDY (Ipswich), found conditions very poor to the N.W. and only heard one weak Welsh portable.

Your scribe was too busy to take part seriously in the event but found conditions pretty rotten to the North and Northwest. Best DX was DLØWU (DL66b) on CW at 505 km. Steve March, G4BWG (London), did quite well to the East with 11 ON's, 16 DL's and 35 PA's. Ray Elliott, G4ERX (Essex), also found conditions abysmal and managed 69 QSO's on 2m.

Seventy Centimetres

A dearth of reports this month. During the March 3/4 Contest, G3XDY summed up conditions as, "grim." G4ERX had 80 QSO's, Ray's best DX being DC4QW (DM66h) at 460 km. The Harrow R.S. lads remarked on the lack of Welsh portables but made 77 contacts from ZK10d.

Twenty-three Centimetres

Claus Neie, DL7QY, is now fully operational from the new QTH in FJ61j. He now has the 23 cm. dish up and had already worked FL, GM, EK and CJ squares. Claus can be raised by telephone any time of the day, the number being 07951 7418 which probably means dialling from the U.K., 010 49 7951 7418. He is QRV on 70, 13, 9, 6 and 3 cm. On 3 cm. he has 5 watts RF of SSB/CW on 10·368 GHz to a 0·5m. dish.

Brian Harber, G8DKK (Beds.), now has 30-40 watts of SSB, derived from 1½ watts of 2m. drive to 3 watts of local oscillator at 1,152 MHz in a high level mixer. The aerial is a home-built 34-ele. *Parabeam* type.

DX-Pedition

Clive Penna, G3POI, passes along the news that PA3AHD plans a 24 hours-a-day operation from 4U1ITU in Geneva on June 3-16, so some *Scorpiids* MS skeds should be rewarding for those out of tropo.

Wishful Thinking

When Malcolm Andrew, G8NRP, was on holiday in France last summer, operating as FØEFE/P from CE square, he caught an *E's* opening. He has since received *five* QSL's from UB5DAA who claims a QSO at S9-plus-plus. But Malcolm did not hear the Ukrainian station. So it would seem that the art of the one-way QSO is being developed outside England, too! It's all in the mind, you know.

Deadlines

All your news, views and claims for the May issue by April 5 and for the June edition, by May 10, to: "VHF Bands," SHORT WAVE MAGAZINE, 34 High Street, WELWYN, Herts., AL6 9EQ. *73 de G3FPK.*

REVIEW

THE DATONG ASP AUTOMATIC SPEECH PROCESSOR

MANY radio amateurs enjoy chasing DX and participating in contests, the ultimate goal being to win something. Inevitably this means both working very weak stations down in the noise and making yourself heard through the QRM by the fellow at the other end. One obvious way to be heard above the majority is to boost the peak power of the Tx by using additional RF amplification. This can be an expensive solution.

Speech Processing

Speech waveform is very irregular and considerable energy is contained in the explosive consonants and sibilants, neither of which convey much intelligence. But if distortion and over-modulation are to be avoided, the system must be set up for these peaks. Consequently, the average level of the speech conveying intelligence can be quite low. To overcome this, speech processing can be used to boost the average audio level. This can be achieved by clipping or compression or a combination of both techniques.

Unfortunately, clipping the peaks of any complex waveform cannot fail to generate harmonic distortion. This fact is put to good use by severely clipping the output waveform from a low frequency crystal calibrator so that scores, or even hundreds, of harmonics can be identified for frequency spotting throughout a wide RF spectrum.

RF Speech Processing

If an audio sine wave of 700 Hz is clipped, for example, harmonically related signals at 1400, 2100, 2800 Hz, etc., will be generated. As these harmonics fall in the audio passband, they cannot be filtered out. A neat way out of this dilemma is to convert the audio signal to an RF one and do the clipping at this frequency. Harmonic distortion is thus removed an octave higher and can be easily filtered out. If this signal is then reconverted to the original audio passband, a clipped, but distortion-free signal results.

The *Datong ASP Automatic Speech Processor* uses this technique where the processing is carried out at 60 kHz. This part of the device is really a closed circuit SSB Tx and Rx, using a common local oscillator.

Audio Compression

Earlier, audio compression was mentioned. This is a system analogous to automatic gain control in receivers wherein very large changes in RF input due to fading are "ironed out" to produce very little change in the final audio level. All *a.g.c.* circuits work by reducing the overall gain progressively as the input signal increases.

The *Datong ASP* incorporates an audio derived *a.g.c.* circuit which caters for wide variations in voice input so that the RF processor always receives a constant peak amplitude signal. It works on both positive and negative peaks and has a long time constant of five seconds. A long time constant is an important feature which ensures that the background noises do not come up quickly when one stops talking between words. Additionally, loud transients, like dropping the microphone, do not cause an instantaneous gain reduction which would cut down the desired speech input.

Connections

The *Datong ASP* is simply connected between the microphone and the Tx. A four-pin socket is provided on the front panel to suit popular Japanese equipment, with a push button to select high or low input impedance. On the rear panel there are two phono-type sockets for PTT and audio output. A one metre length of twin screened lead is supplied with the matching phono plugs on one end and a Trio/Yaesu type four-pin plug on the other, wired to customers' choice.

As can be seen from the photograph, there is space for eight HP7 size batteries. Alternatively, the *ASP* can be powered from an external 6-16 volts DC source, such as a car battery, the current drain being a mere 15 mA. A 3·5 mm. socket and jack plug are supplied for this purpose.

Setting Up

A most useful feature of the *Datong ASP* is the inclusion of a 700 Hz tone oscillator. To set up the processor, the Tx microphone gain control is set to the usual level, then the tone button on the *ASP* is pressed and the pre-set control on the rear panel adjusted to give the recommended peak plate or collector current.

With no speech a LED labelled "LO" will light up. After a second or two of close talking into the microphone this should go out and another LED, labelled "OK" should come on and stay on throughout the over. A third LED marked "SPEECH" winks in sympathy with the modulation. The required amount of processing from nothing to 30 dB in 6 dB steps is selected by six push buttons on the front panel.

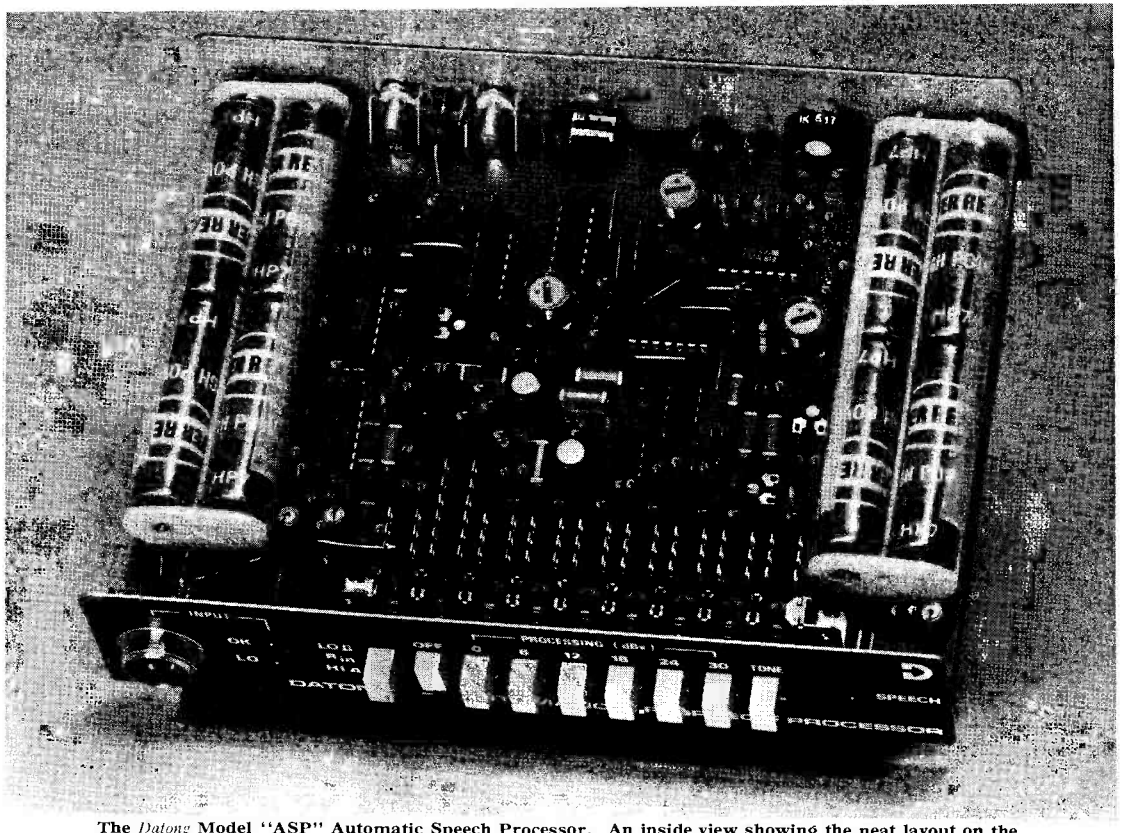
Taped Results

Before testing with the G3FPK station, the *Datong ASP* was used with a *Ferrograph* tape recorder so that comparisons could be made with the normal speech quality from the *Shure 444* microphone used on its own and then through the processor. The complete tape was then replayed and the waveforms monitored on an oscilloscope.

The immediate impression was that when the *ASP* was switched into circuit with no processing, the quality sounded a little deader. The specified frequency response of the *ASP* is 400-3400 Hz ± 3 dB and it probably drops off quite rapidly outside these limits. The response of the *Shure 444* is only 3 dB down on the 1000 Hz level at 5000 Hz and this would account for the greater "presence" when by-passing the processor.

It is recommended that the technique of close talking across the microphone be used to avoid picking up extraneous noises. Unfortunately this means that, when using higher levels of processing, breath intake noises become a nuisance and somewhat fatiguing to listen to. Users of *any* speech processing system must bear this in mind and should try to evolve a better microphone technique.

The 6 dB of processing sounded quite acceptable with a worthwhile increase in audio content. At 12 dB the



The *Datong* Model "ASP" Automatic Speech Processor. An inside view showing the neat layout on the single-sided, glass fibre, printed circuit board. On the rear panel from left to right are the sockets for p-t-t output, audio output and external DC supply. The pot on the right next to the batteries is the preset output level.

effect was enhanced even more. To this reviewer, any processing over 12 dB was somewhat fatiguing to listen to for any length of time. However, in fairness it must be confessed that the writer is used to listening to very high quality sound reproduction so has developed a dislike of artificial alteration of the original sound.

The most convincing proof of the effect of the step-by-step increase, then decrease of the amount of processing was accidentally discovered when winding the tape back at high speed with the replay amplifier on. The increase in audio content, or average talk power, was dramatically demonstrated in a few seconds.

Examination of the speech waveform on the oscilloscope revealed a constant peak level with more audio as the amount of processing was increased. A further series of tests was carried out feeding a pure sine wave into the microphone from an audio oscillator. No distortion could be detected at maximum processing of 30 dB, thus bearing out the manufacturer's claim of 0·5% total harmonic distortion at 1000 Hz with 30 dB of processing.

On Air Results

Most readers of this review will use a speech processor with an amateur transmitting station so it is essential that opinions of those at the receiving end be included. However, one must realise that such opinions are entirely subjective and not be swayed by either a flattering report or a very critical one. The writer never ceases to be amazed when listening to tests being carried out between other stations. Sometimes a quite badly distorted signal of wide bandwidth is given the "thumbs up" by a listener. Very often it transpires that the listener's receiver has a tiny "Mickey Mouse" speaker in the bottom of the case. How any assessment of quality can be made under these circumstances is very debatable.

When this review was undertaken, conditions on the VHF bands were mediocre thus affording opportunities to test the usefulness of the *ASP* under weak signal conditions. All stations noted a worthwhile increase in audio and intelligibility with 6 dB of processing and no adverse comments were received from local stations. During a QSO with G3BHT in Sutton Coldfield, when deep fading was experienced, the use of 12 dB of processing made all the difference between marginal copy and a QSA 5 report, keeping the Tx output to a peak power of about 40 watts. During this contact, 24 dB of processing was tried but, although the audio content was increased, intelligibility was degraded. Tests with other stations confirmed that 18 dB was about the maximum amount of processing that would produce a more intelligible result under weak signal conditions using the microphone and Tx described.

Construction and Appearance

The *Datong ASP* is very neatly built, all components being accommodated on one single-sided glass fibre printed circuit board. A stout 14 gauge wrap around case in anodised aluminium, measuring 184 x 44 x 153 millimetres deep, gives this device a smart appearance. The weight, excluding batteries, is 725 grammes.

Conclusions

The *Datong ASP* currently costs £65 plus VAT, a total of £73·13 in the U.K., including postage. It is a cost-effective way to boost transmitter performance, particularly when one realises that, unlike an RF amplifier restricted to use on certain frequencies, this is an audio device which can be used with public address systems, etc.

Of course, when using the *ASP* with a Tx, the output stage will be working harder, the more the processing used. Some of the popular TV sweep tubes in many LF/HF band gear may not last so long unless efficient cooling is provided. This is a fact of life whenever the average output power is increased.

As far as the writer is aware, there is no directly similar processor with which to compare the *ASP*. There is a variety of clippers and compressors from British, U.S. and Japanese sources but this *Datong* design appears to be the first one to dispense with the need for manual level control once the device has been set up for a particular station. It should be particularly advantageous in a multi-operator contest station and to increase the effectiveness of low power stations.

Datong Electronics Limited are to be congratulated once again on designing and marketing a novel amateur radio accessory with obvious export potential.

N.A.S.F.

Post Script

Since the main tests were carried out, Dr. David Tong, designer of the *ASP*, has suggested that a microphone with a flatter response than the *Shure 444* would be more suitable for use with the processor. So a flat response crystal microphone and a professional, low impedance, noise cancelling boom type were tried. However, the overall results were much the same so one concludes that the *ASP* can be used successfully with any decent microphone.

Finally, an observation concerning plate current meters. Many years of experience with HF and VHF transmitters has convinced the reviewer that the *only* way to be certain that one's SSB signal is linear is to monitor it on an oscilloscope. For example, if a Tx is tuned up on a carrier or single tone to a plate current at resonance of, say, 200 mA, then it will be found that the peak current due to the peaks of unprocessed speech should not exceed about 120 mA if "flat topping" is to be avoided. Using 18 dB of processing with the *ASP*, plate currents of 150 mA were indicated and this figure would increase a little with more processing.

A very important feature of the *ASP* is that, once set up with the tone for maximum linear output, it becomes impossible to exceed the peak plate current so one ends up with a loud-sounding signal which is narrow.

HOME-BUILT SSB TRANSMITTERS: PRACTICAL OR NOT

WAYS OF GETTING YOUR OWN SSB RIG ON THE AIR

LOOKING back through old volumes of *Short Wave Magazine* for information, one is very conscious that there have been very few SSB transmitter designs published; in the early years many articles discussed the complexities of SSB and its wonderful advantages as a phone technique on the amateur hands. If one looks at these, one is struck by the fact that, on the one hand, there is great stress on the new, stricter, requirements in terms of stability, spurious outputs, and more formal design than was the case with the older AM rig, which most people home-brewed; and on the other hand, of the few designs written up, the vast majority were decidedly complex tasks which would probably take up about a year of one's limited spare time, allowing a small amount of operating when in the shack! Furthermore, in many cases an array of test gear was deployed which would be enough to deter anyone not so well equipped.

Now, it is to some extent true that an SSB Tx is more complex than an AM box, and that it needs to be more stable than was tolerable with the old Top Band AM rig. Equally, it is also true that an SSB rig is only a superhet receiver turned 'base-over-apex,' and many people will happily build the receiver and yet shy from trying a transmitter design.

Now, the writer was for many years involved with the exciter used by the Royal Navy (now obsolescent), and he can say without fear of contradiction that the sort of labour used to build and test was progressively of lower and lower skill grading, as the bright lads progressively demanded first a shift into transistorised stuff, and then towards integrated circuitry. With possibly one exception, the test-gear used to test and set up this equipment (which was far more complex than anything an amateur would want to run, with good enough sideband suppression to enable operation in the ISB—Independent Sideband—mode), was very simple. One doubts if any amateur rig run at normal power inputs could cope with that requirement.

So, how come the average chap makes such a meal of a sideband rig, that he gives up and goes out to buy without even picking up the soldering-iron? Defeatism, pure and simple! Let's look and see what we are trying to build: break it down to modules—*see* Fig. 1 for the block diagram of a single-band SSB rig. Audio first, and that's not really a problem after looking at a few op-amp data sheets, or building a hi-fi for the junior op's pop noises. A VFO; just like we've always had. A *Sideband Generator* which will accept the audio, and the output of a crystal oscillator, and by either phasing or filtering will give us a baby SSB signal (forget Weaver's Third Method for the moment, let's keep it simple!). One, or maybe two, mixers to get our baby SSB signal on to the right frequency; if two mixers, then there'll be another crystal oscillator. Nothing complicated so far, save the sideband generator, and that is very largely

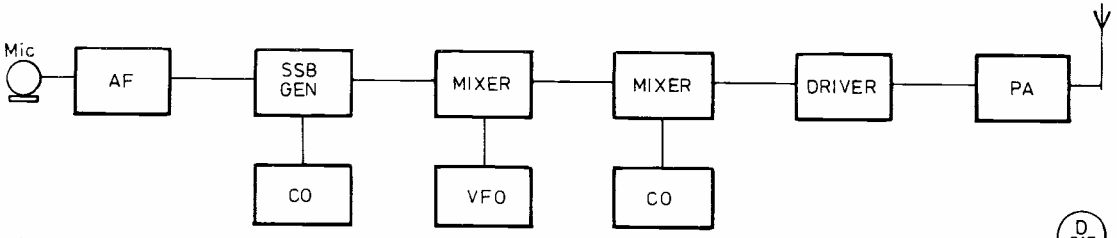


Fig. 1 BLOCK SCHEMATIC

Block diagram of SSB Tx : this is shown as a 'double-conversion' for use with a 455 kHz SSB generator on the HF bands. For 160 and 80 metres, or with a 9 MHz SSB generator, single-conversion could be used by deleting the mixer and CO nearest the driver stage.

mistakeable for an IF strip! All we have left to do is to build up the signal to the power level we want; there've been quite a few designs for linears written up, so obviously nobody is too fussed about *that*.

So—where's the hassle? We'll let you into a secret—there isn't any!

How to do it

We've talked about the SSB transmitter in terms of a block diagram, so as to make it easier to visualise; and by building in the same fashion and getting each bit to go first before tackling the next block of the diagram is the whole simple secret, except for a few little details which we propose to look through now.

We have a couple of crystal oscillators to build (or maybe only one) and get going: one is the RF input to the sideband generator, and the other will be used with a mixer stage if required, to get you on to the desired band. Let's start with them; one of the things we can achieve is 'sideband inversion' depending on which way the mixer sees its signals. Thus, if we brew up lower sideband in the sideband generator, we can turn it into upper sideband at will in the mixers. Keep a hold of this, because it's important when you recall that convention says upper sideband on bands above 10 MHz, and lower on bands below 10 MHz. The crystal oscillator associated with the sideband generator will have a frequency set out in the bumph about your filter if you are going to do it that way, and you must be able to tweak its frequency to just the right place. If you are phasing—a much more elegant system all round, and much nicer to listen to—than your crystal oscillator will be on some frequency you've decided for yourself after a bit of head-scratching or calculation to avoid any "birdies" in the bands; at a pinch you could just take the frequency as being right—but it's better to get the frequency to be what is on the can, as you may as well give it a trimmer. The point about this is that a crystal's frequency is specified in a circuit in which the total shunt capacity of the crystal plus stray capacitances plus trimmer is given; so you twiddle the trimmer to get the right total and you are on the right frequency.

Make your crystal oscillator (CO) on a scrap of PCB offcut or *Veroboard*, with the crystal left out. Measure the current down the transistor, plug the crystal in and the current reading should show a change; if it doesn't, sort out your wiring or crystal or transistor! Once it seems to be perking, one can look at the output on a 'scope, or a receiver, or an RF probe and transistor, or valve voltmeter. None of these aids? Does a *harmonic* come onto an amateur band, or even an image frequency? If you are talking Top Band or Eighty, you might even turn to the RDF set in a boat, or the junior op's transistor portable with the short wave band; or have you a Class-D or BC-221, or even a counter?

So, now you've got your CO or CO's going, each on their own bit of PCB. Next, after putting these aside in a suitable box, we can start with the VFO. We know the coverage desired, which when mixed with our crystal oscillator(s), will bring us out 'on the band.' So, again to our humble scrap of PCB off-cut; but if you want good performance, send your variable capacitor to whoever you know who can ultrasonically clean it—it is quite surprising how a variable capacitor can be improved! (While we are on this subject, be quite sure whenever you are squirting contact cleaner of the *Lectrolube* type about that you don't let it reach the variable capacitors, or you'll find you have moved frequency somewhat!) The circuit doesn't much matter if it's put together right. For instance, double-sided PCB should not be used for the VFO, even though we like it elsewhere, as will be shown soon. The point is that with one side acting as a ground-plane, it has capacity to the other side, and so to various components in the frequency-determining parts of the VFO, both the ones that are drawn on the circuit *and* the other ones! This "capacitor" is very temperature sensitive. If possible,

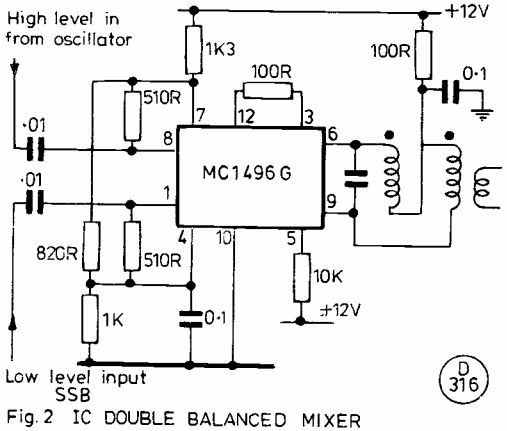


Fig. 2 IC DOUBLE BALANCED MIXER

IC double-balanced mixer ; *see* text for definition of 'high level' and 'low level'.

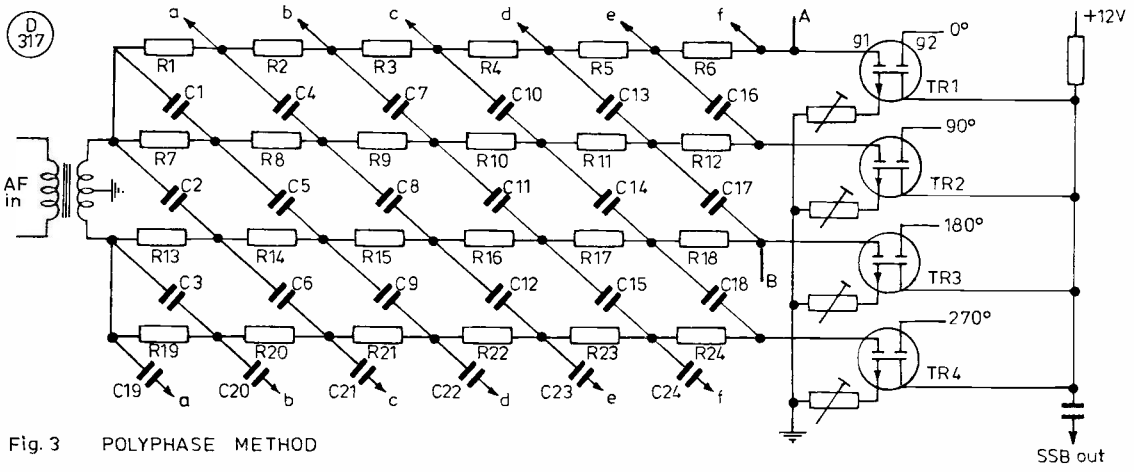


Fig. 3 POLYPHASE METHOD

Polyphase SSB generator. Note that the CO driving the TTL 7473 IC must run at *four times* the SSB generator nominal frequency, *i.e.* for an SSB generator output frequency of 2.5 MHz the CO input to the 7473 must be 10 MHz. Gate 2 of each dual-gate Mosfet goes to the 7473 output indicated. Adjust source pots for best sideband suppression ; to change sideband, switch A and B points.

one should use an inductor with no core, and certainly **not** a toroidal core; if you must have a core, adjust the turns ratio and capacitances so that you are where you want to be, with the slug barely seeing the coil. Fixed capacitance could well use polystyrene types, but the writer has been luckier than others with silver-mica types. Of course the transistor should have a good high F_T and be a gainy type so that the feedback to sustain oscillation can be kept down to a minimum; the value for F_T can be, for a rule of thumb, about 30 times the VFO frequency. Similar requirements govern the selection of an FET for a VFO. With single-sided PCB off-cut, one can mount all the components except the variable, and then stick the PCB to the capacitor so that the whole shooting-match is solid and 'moves as one." It all goes in its own box, preferably one of the die-cast ones.

As we have already indicated, the VFO and the CO when mixed will come out on the desired band, so if you have an amateur bands only receiver you can mix them and listen for the result on the band, tweaking until you get the frequency and bandspread right for the dial drive you happen to be using. Any old mixer will do for the moment, and why not a simple diode? Or, of course, we may just prove it is running by one of the methods we applied to the CO, and let the accurate trimming of it wait till later.

Table of Values

Fig. 3

C1, C2, C3, C19 = 0·047 μF, 5%
C4, C5, C6, C20 = 0·033 μF, 5%
C7, C8, C9, C21 = 0·022 μF, 5%
C10, C11, C12, C22 = 0·015 μF, 5%
C13, C14, C15, C23 = 0·01 μF, 5%
C16, C17, C18, C24 = 6800 pF, 2%

All resistors = 5·6K, Electrosil TR4, 2%.

X1, X2, $\overline{X1}$, $\overline{X2}$ output from TTL 7473, phase as shown. Four dual-gate Mosfet's modulator.

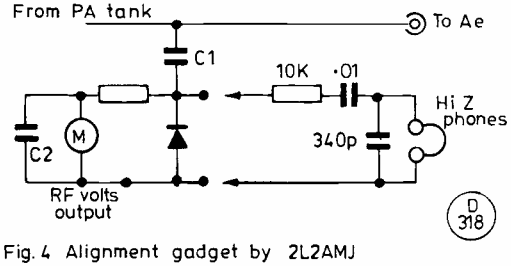


Fig. 4 Alignment gadget by 2L2AMJ

Alignment: the RF output meter and diode should be a part of the transmitter PA output, and the alignment gadget is connected as shown. With single AF tone into the mic., socket of the Tx, loading into dummy load, align/tune for a peak on the meter and minimum AF response in the 'phones.

Mixers

This is where the problems show up, and we offer two very fundamental rules which will keep you out of trouble. One is to be quite clear as to the sizes of the signal voltages to be applied to the ports of the mixer, and their relative amplitudes, and to stick at it until you get them right; the other is simply to *always* use a doubly-balanced mixer circuit if possible, to regard a singly-balanced mixer as a poor substitute, and to look down your nose at any 'normal' mixer. *Don't* look down your nose at a double-balanced mixer using four diodes as not very modern—not only is it as modern now as when it first appeared, but it also can give very fine results.

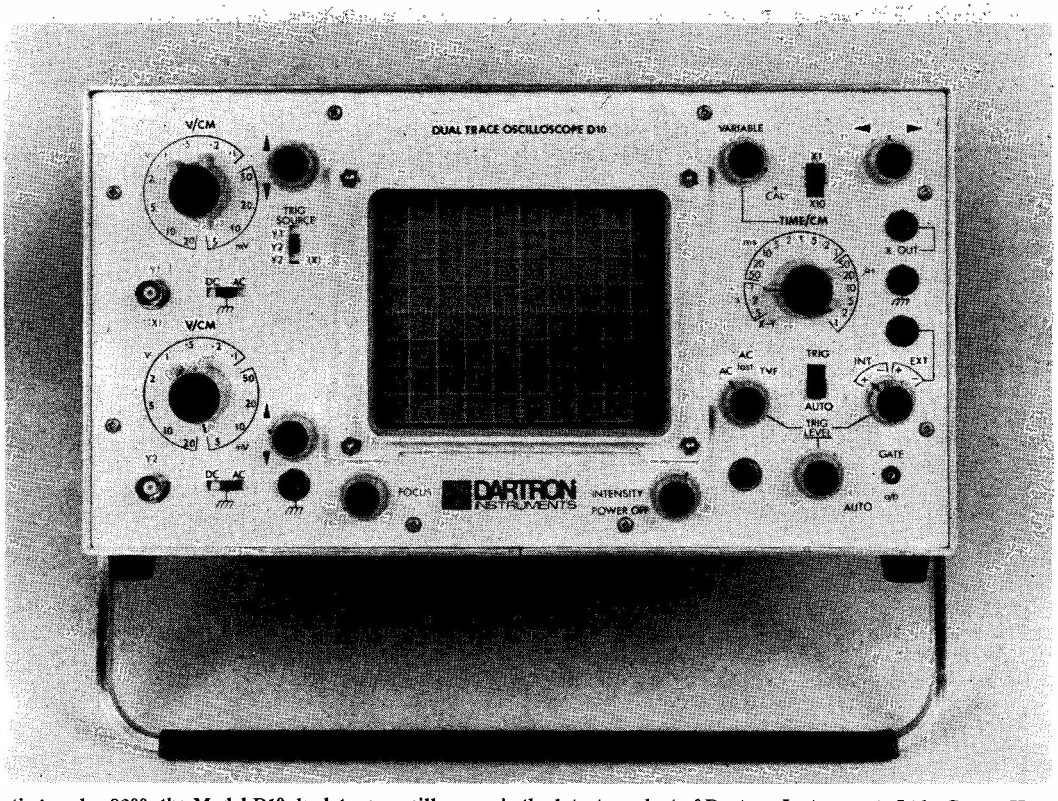
On the other hand, one could do a lot worse than go to a *Motorola* MC1496G; the high level signal into Pin 8 of the order of 300 mV, and the low-level signal into Pin 1 with no more than 10 mV maximum of modulation or modulated RF. Look at Fig. 2, and bear in mind that the IC in question when used at the front-end of a direct-conversion receiver is capable of hearing a signal

of 0·1 microvolt; the IC double-balanced mixer is preferred to the all-diode one simply because it doesn't need such hard driving from the local oscillator. Incidentally, if you are working a double-conversion arrangement and one of your mixers is going to have CW into both Pins 1 and 8, then while the high-level signal continues at 300 mV, one can get away with 100 mV. into Pin 1. But, as we have said, if you are putting a modulated signal into Pin 1, *keep it low*. Build the circuit up, and feed it with the frequencies required, taken from the oscillators already built, and see it play.

Sideband Generation

Here we have, as already noted, two choices: phasing or filtering. Phasing can be done by using the classic phasing network at audio, as has been shown in the handbooks for about thirty years; perhaps the best known are due to Dome, and the one originally popularised in the "SSB Jr." exciter by W2KUJ, published in the American *GE Ham News*, November and December 1951. At RF, one can use the low-Q phasing network, also of 30 years ago! What about a more modern approach? The polyphase method, originally written up by M. Gingell in 1973, and later written-up and discussed by G3VA and G3PLX seems to offer a good sideband suppression characteristic; one can build the circuit as shown (Fig. 3), and feed into the four polyphase modulators the output from a 7473 dual JK flip-flop, which in its turn is driven from the CO which feeds the sideband generator. The only difference is that now the CO is not at the nominal frequency of the generator but is four times higher, so that the gate outputs at Pins X1, X2, $\overline{X1}$, $\overline{X2}$, pins can go successively down the modulator FETS. The writer has tried the system and it works; two per cent components were used, which is rather better in tolerance than the drawing shows.

If, instead, you insist on filtering, go out and buy the filter and then design your generator around it. One can get the 9 MHz filter type from *KVG*, or lower-frequency ones from *Collins*, *Kokusai* (much used by *K.W. Electronics Ltd.* over the years), and the more recent *Toko* devices from *Ambit International* in Brentwood. These last types of filter all come around the 455 kHz mark, which is one reason for double-conversion



Costing under £200, the Model D10 dual-trace oscilloscope is the latest product of Dartron Instruments Ltd., Crown House, 280-282 Wood Street, London E17—from whom full details may be obtained.

at any band higher than 3·5 MHz. Check the blurb with the filter, looking down the side by 20 dB; that is the frequency you have to get your crystal oscillator on to. Feed audio into one port of a balanced modulator (call it a double-balanced mixer!) and RF in t'other; when balanced you get double sideband *minus* carrier and audio. Push it into the filter, taking great care that nothing leaks round it; that means metal screens between input and output, correct terminations and all the rest. One sideband will struggle through the filter, but the other one will not; so now you have SSB. Whether its **USB** or **LSB** depends on which side of the filter you put your CO; you can have two carrier crystals, switched, for this CO, and put one on either side, so you can switch sidebands, or you can go simple and sensible and so arrange your oscillators and mixing for the band that you come out on the sideband you prefer anyway. Take your choice.

So . . . you have got a whiff of SSB on the desired spot. What you need now is a straight Class-A amplifier stage to bring it up a bit, and then go to a valve in Class-A, followed by a 6146 or a pair in the PA. Alternatively, the valve Class-A stage may drive a transverter and take you into another band. Either way, it must be set up. For this you need a receiver which has a CW filter in it, and a 1 kHz oscillator of *good* waveform. If you only have SSB selectivity in the receiver then you can alter the oscillator to give 2 kHz of audio of good shape. Best of all—you'll see why in a moment—is to have both, even though you have a CW-selectivity receiver, *see* Fig. 4. One just runs the beast into a dummy load, and tweaks for maximum meter indication, at the same time putting on the alignment-gimmick and tweaking the sideband pots in the balanced modulator for minimal tone. If you have a 1 kHz tone into the mic. socket of the rig, and no carrier, then you will hear a 2 kHz tone, as upper and lower sidebands beat against each other; get rid of the tone by tweaking. Change to the 2 kHz oscillator, so now you hear a 4 kHz beat, and again you tweak for minimum tone and maximum meter reading.

There are two reasons for the choice of tone frequencies: the 1 kHz oscillator will have a second harmonic of 2 kHz, so there is only so far you can go in tweaking the 2 kHz away, and when you change to the 2 kHz audio tone the second harmonic is outside the audio passband. If you are phasing with a W2KUJ-type network you should repeatedly switch sidebands too, in order to get the best suppression of both tones when used on either sideband. Now, the point about the higher-frequency audio input, apart from telling us whether the tone second harmonic is significant by taking it outside the AF passband, is that if we switch from lower-frequency tone to higher, and the 4 kHz is equal to or greater than the 2 kHz signal, then the problem is less in the filtering or phasing networks than in the balance of the various double-balanced mixers (or modulators if you insist!); these therefore, be looked at with care and removed from the argument one by one. However, if you used the IC we suggested, you out not to have significant problems.

Summary

So, what have we done? We have presented you with a way of getting a home-brew SSB rig into being, some bits of circuitry, and the concept that each bit is to be *tested and got working before the next step is taken.* We say clearly and unequivocally that that last phrase is the only new idea we have presented to you (apart from maybe suggesting you try a few semiconductors instead of valves!). And, for the record, we have indicated that we don't think a transistor SSB PA is practical with simple test gear, or a load comprising an aerial which falls down or changes impedance with a puff of wind. Now, a VMOS FET would do the trick, and soon *Siliconix* will be selling 'em cheap. . . .

Oh, yes, and we called for a receiver with which to set-up—and then proceed to use a gimmick device instead: because when the gimmick device runs out of steam you'll have the receiver, and you'll need it if you intend to have a QSO with your new rig. You can't work 'em if you can't hear 'em.

NOVICE LICENCE PROPOSAL

A. D. Taylor, G8PG, writes to tell us (in his capacity as an Executive Committee Member of the recently formed European CW Association) that the E.CW.A. is examining the possibility of Western European nations introducing a CW-only Novice Amateur Radio Licence. This licence would be a stepping-stone for beginners who wish to qualify eventually for a full amateur licence; the proposed licence conditions are:

1. A simple examination covering regulations and radio theory.
2. A 5 w.p.m. Morse test (administered by any amateur who has held a full licence for at least 3 years).
3. Crystal control only, in defined segments of amateur bands (HF and VHF).
4. Maximum power input 10 watts.
5. Holders of an R.A.E. pass certificate need only pass the Morse test.
6. A Novice licence could only be held for 2 years in any 5 year period.

To try and establish the volume of support for such a proposal, G8PG asks that those in favour of the idea (whether licensed or not) should send their names and addresses to him—on a post card—at 37 Pickerill Road, Greasby, Merseyside L49 3ND.

The European CW Association consists currently of the Scandinavian CW Activity Group, The West German CW Activity Group, the TOPS CW Club (UK), and the G-QRP Club.

BEAM ANTENNAS, ROTATORS, MASTS AND GUYS

AN INSIGHT INTO SOME DESIGN PROBLEMS

HAROLD BEDFORD, A.R.I.C.S., G8MRH

This Paper was presented for discussion to members of the Reigate Amateur Transmitting Society and appeared in their monthly Newsletter. As it was thought worthy of wider circulation, it is reproduced here.

WHEN considering the design of beam antennas, the use of rotators, the erection of masts or towers together with the strain on guy wires, a knowledge of simple mathematics is required in order to apply some fundamental formulae, so that a safe and satisfactory design will result. The formulae are not involved, provided that the steps are taken in a logical sequence and the worked examples should make this clear and easily understood. In using the formulae be very careful to keep the "units" used the same and watch carefully the "powers" when cancelling out.

Guesswork coupled with luck may see you through but it usually means that the system is overdesigned. If the system fails, due allowance has not been made for some vital factor. Apart from the frustration caused—it always happens at a most inconvenient time—it could be costly especially if there is damage to life or property and insurers may quibble if they consider the design of a system to be unsafe. The objective is too match the strength of the materials used (aluminium or steel) with the maximum anticipated loads. Throughout we shall be dealing with 'moments.' A moment is a term used to denote the effect of a load or force applied at a distance from a point under consideration.

Symbols and Formulae

The following symbols and formulae will be used in the calculations: M_B = Bending Moment in ft/lbs. or lbs/ft.

Fig. 1a illustrates a beam cantilevered out from a wall, but obviously it would be a mast held at the base and extending vertically (W is weight in lbs. and L is in feet). In Fig. 1b the weight (W) would be replaced by a wind force (F) in lbs., and as the load is distributed it is the same as that applied at the mid-point of the beam as a point load. It is obvious that the bending moment (M_B) must be equal to the moment of resistance (M_R) at the point of anchorage (f is the tensile strength of the material in lbs. per sq. inch). For identical sections under load aluminium will have about three times the deflection of steel. This "low stiffness" or elasticity enables aluminium better to withstand shock or impact loads.

I is the second moment of area of cross section in ins.^{4}; C is the distance from the neutral axis to the extreme fibres; Z is the section modulus in ins.^{3} and equals $\frac{I}{C}$

The formulae and their relationships between I, Z and C for the two main types of sections most commonly used are shown in Fig. 2, and the strength of materials is shown in Table 1.

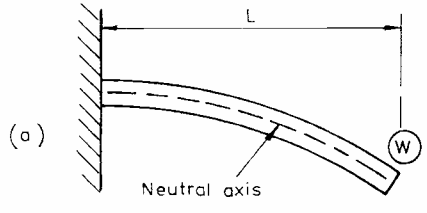
Allowable Design Stress is the ultimate in safety and is used by structural engineers to ensure safety in the most stringent cases of loading. It is covered by B.S.Spec. CP/118.

Proof Stress is the standard derived from a stress/strain curve which departs from a straight line by 0·2 per cent of its gauge length. In other words, if a load is applied the deformation will be proportional to the stress, and when the load is removed the tube will return to its original shape.

Ultimate Stress is the maximum stress the tube will withstand before rupture; *i.e.* the tube will bend and remain permanently bent. In the design of Beam Antennae a compromise is called for: to design to the standards of "allowable design stress" will result in too heavy an array which will overload most rotators. Taking a reasoned judgement "proof stress," *i.e.* a tensile stress of 39500 lbs/ins.^{2}, has been used in the calculations (but see also the remarks under Para. 2 on the effects of wind). For tubing up to $\frac{1}{4}$in. wall thickness, some of the hard calculation work can be eliminated by using Table 2.

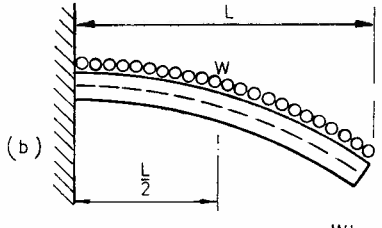
Effect of Wind

The formula is: F = A × P, where F is the wind load force in lbs., A is the effect area in sq. ft. on which the wind is acting, and P is the wind pressure in lbs/ft.^{2}. It is usual to quote wind velocity in m.p.h. and the pressures (P) for the velocities normally encountered are shown in Table 3.



Point load $M_B = WL$

(a) Single load on Cantilever Beam



Distributed load $M_B = \frac{WL}{2}$

(b) Distributed load on Cantilever Beam

FIG 1

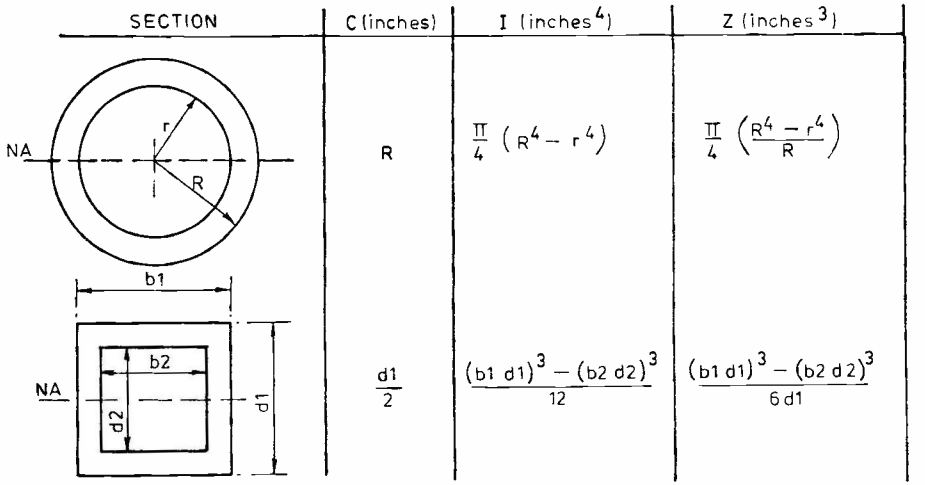


Fig. 2 TYPICAL SECTIONS OF MATERIALS USED AND RELATED FORMULAE

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Table 1. Spec. types 6061, 6063 and 6082 are generally available. Types 2024 and 7178 are aircraft-quality alloys not generally available, also very costly and needing anti-corrosive treatment to withstand the effects of weather.

Materials	Tensile Strength (f) in lbs/in.²				
Pine or Bamboo	4000				
Steel	40000				
Aluminium	Extruded tube up to ¼in. wall thickness				
International Spec.	B.S. Spec.	Use	Allowable Design Stress	Proof Stress	Ultimate Stress
7178	—	Aircraft	—	—	76000
6082TF	HE-30	Commercial	23500	39500	44800
6061	HE-20	Commercial	21267	34720	40550
2024	—	Aircraft	—	—	40000
6063TF	HE-9	Commercial	14112	23520	26880

It is good design practice to allow a wind load of 30 lbs/ft.² of area on *flat* surfaces and two-thirds of this, *i.e.* 20 lbs/ft.² on *round* cross-sections—*e.g.* masts or beam tube elements. This holds good for average conditions but obviously in exposed positions subject to abnormal winds, for instance the West Coast of Scotland, a higher loading should be used. Similarly in such places as Sheffield and Glasgow, which seem to suffer freak winds in each 10 year cycle.

Turbulence is always present when wind acts upon a round tube thus creating a vortex; overcoming this is a highly technical study and discussion in detail is well outside the confines of this paper. Briefly what happens is that the wind sets up oscillations of the tube, which

TABLE 2

Tube diam. (inches)	Wall Thickness (inches)	Weight, lbs./ft. Aluminium	Steel	I (Ins.⁴)	Z (Ins.³)	C (Ins.)
½	0·031	0·054	0·157	0·001	0·005	0·250
½	0·062	0·101	0·293	0·002	0·008	0·250
½	0·125	0·173	0·502	0·003	0·012	0·250
¾	0·062	0·159	0·461	0·008	0·021	0·375
¾	0·125	0·288	0·835	0·012	0·033	0·375
¾	0·080	0·170	0·493	0·016	0·037	0·438
1	0·062	0·216	0·626	0·020	0·041	0·500
1	0·125	0·405	1·174	0·034	0·067	0·500
1¼	0·078	0·300	0·870	0·036	0·064	0·562
1¼	0·062	0·274	0·795	0·041	0·071	0·625
1¼	0·125	0·520	1·508	0·071	0·113	0·625
1½	0·062	0·332	0·963	0·073	0·097	0·750
1½	0·125	0·635	1·840	0·129	0·172	0·750
2	0·062	0·447	1·296	0·179	0·179	1·000
2	0·125	0·865	2·508	0·325	0·325	1·000
2	0·250	1·616	4·686	0·537	0·537	1·000
3	0·125	1·328	3·851	1·169	0·779	1·500
3	0·250	2·540	7·366	2·059	1·373	1·500
4	0·125	1·790	5·191	2·859	1·429	2·000
4	0·250	3·463	10·043	5·200	2·600	2·000

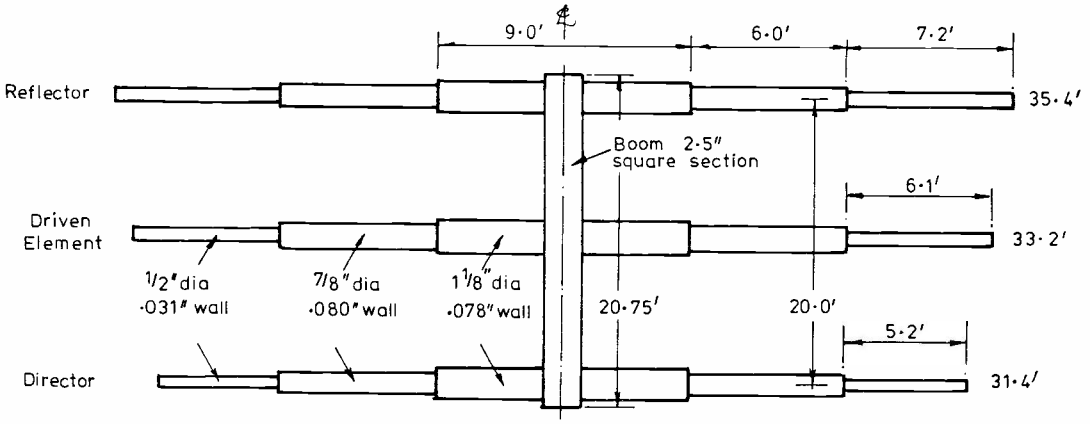

Fig. 3 THREE ELEMENT 20m BEAM WITH ELEMENTS CUT TO 14·15 Mc FOR GENERAL COVERAGE OPERATION WITH A SWR OF LESS THAN 1·5 : 1. GAIN APPROX 8·5dB (D 269)

if not damped will cause it to fail. Methods to minimise this could, in vertical masts, be to fill the tube with sand and in the case of elements to stretch a nylon rope tightly from end to end. 'Vortex shedding' on guyed cylindrical metal chimneys of factories is achieved by arranging around the outside of the chimney a helix of strip metal. Wind velocity increases with height above ground and the figures in Table 3 hold good up to a height of 50 feet. Between 50 and 150 feet above ground increase the wind loading by 50 per cent.

Enough information is now available to commence design.

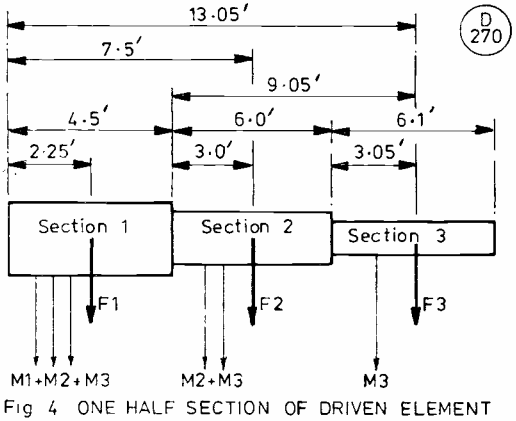

Fig 4 ONE HALF SECTION OF DRIVEN ELEMENT USED FOR MATHEMATICAL ANALYSIS

Designing the Beam Antenna

First determine the frequency for which the beam is to operate. Formulae for calculating element lengths, spacing, F/B ratios, SWR, power gain and bandwidth for desired frequencies are contained in the many handbooks. The array can now be sketched out with an approximation of tube sizes and lengths for each element. By using the formulae and tables, it can be ascertained if the assumptions made are viable.

TABLE 3

Wind Velocity M.P.H.	Wind pressure on a flat surface lbs/ft²
50	10·5
60	15·1
70	20·6
80	26·8
90	34·0
100	42·0

Example 1. Consider a 3-element 20 metre beam, Fig. 3. As the beam is symmetrical about its centre-line only one half-section need be considered for mathematical check. The driven element is chosen for example but both the reflector and director have to be analysed. All the elements are assumed to be to Spec. 6082TF aluminium. *See* Fig. 4.

Consider Section 3. ½in. Ø tube, 6·1ft. long, 0·031in. wall thickness:

$$M_{max.} = Z \times f = 0{\cdot}005 \text{ins.}^3 \times 39500 \ \frac{\text{lb.}}{\text{in.}^2}$$

$$= \frac{197{\cdot}5}{12} = 16{\cdot}46 \text{ft/lbs. max. permissible.}$$

$$\text{Wind load per foot} = 0{\cdot}5 \times \frac{1}{12} \times 20 = 0{\cdot}83 \text{ lbs.}$$

Tube weight per foot = 0·05 lbs.
Total load per foot = 0·88 lbs.
Total load on Section 3 = (F_3)
= 6·1 × 0·88 = 5·37 lbs.
Bending Moment M_3 = 3·05 × 5·37 = 16·4ft/lbs.
(As the load is distributed it acts at half the length, *i.e.* $\frac{L}{2}$). The design is sound as the Bending Moment (M_{actual}) is within the "max. permissible" ($M_{max.}$), *i.e.* 16·46ft/lbs.

Consider Section 2. $\frac{1}{8}$in. Ø tube, 6ft. long, 0·080in. wall thickness:

$$M_{max.} = Z \times f = 0{\cdot}037 \text{ins.}^3 \times 39500 \frac{\text{lb.}}{\text{ins.}^2}$$

$$= \frac{1461}{12} = 121{\cdot}8 \text{ft/lbs. max. permissible.}$$

$$\text{Wind load per foot} = 0{\cdot}875 \times \frac{1}{12} \times 20 = 1{\cdot}46 \text{ lbs.}$$

Tube weight per foot = 0·17lbs.
Total load per foot = 1·63lbs.
Total load on Section 2 (F_2) = 6·0 × 1·63 = 9·78lbs.
Bending Moment M_2 = 3·0 × 9·78 = 29·34ft/lbs.
Bending Moment M_3 = (6·0 + 3·05) × 5·37 = 48·60ft/lbs.
Total Bending Moment $M_2 + M_3$ = 77·94ft/lbs.
This is within the "max. permissible" *i.e.* 121·8ft/lbs.

Consider Section 1. $1\frac{1}{8}$in. Ø tube, 9ft. long, 0·078in. wall thickness:

$$M_{max.} = Z \times f = 0{\cdot}064 \text{ins.} \times 39500 \frac{\text{lb.}}{\text{ins.}^2}$$

$$= \frac{2528}{12} = 210{\cdot}6 \text{ft/lbs. max. permissible.}$$

$$\text{Wind load per foot} = 1\tfrac{1}{8} \times \frac{1}{12} \times 20 = 1{\cdot}88 \text{lbs.}$$

Tube weight per foot = 0·30lbs.
Total load per foot = 2·18lbs.

In this case it is only necessary to consider half the length of Section 1, *i.e.* about the centre-line of the boom.

Total load on Section 1 (F_1) = 4·5 × 2·18 = 9·81lbs.

$$\text{Bending Moment } (M_1) = \frac{4{\cdot}5}{2} \times 9{\cdot}81 = 22{\cdot}07 \text{ft/lbs.}$$

Bending Moment (M_2) = 7·5 × 9·78 = 73·35ft/lbs.
Bending Moment (M_3) = 13·05 × 5·37 = 70·08ft/lbs.
Total Bending Moment $M_1 + M_2 + M_3$ = 163·43ft/lbs.

The design is sound as the Bending Moment (actual) 163·43ft/lbs. is within the max. permissible *i.e.* 210·6ft/lbs. It is obvious that the shorter length of the director element may necessitate differing tube sizes or lengths. These should be calculated in a similar manner to that of the driven element.

It is noticeable, especially with 20-metre beams of aluminium tube construction, that there is considerable sag in the end elements; this is due to the elastic properties of aluminium—possessing about three times the elasticity of steel—and is the same for all grades of aluminium and is a function of tube diameter and wall thickness. As the array is evenly balanced about its centre point, *i.e.* at the attachment of the drive tube, it will not in itself produce a Bending Moment—only a compressive load equal to its weight. This can be calculated from the data given. The compressive stress of aluminium is taken as being equal to the tensile stress and provided a suitable rotator is chosen compressive stress will not be a problem. However, if desired a thrust bearing can be used to minimise the load on the rotator.

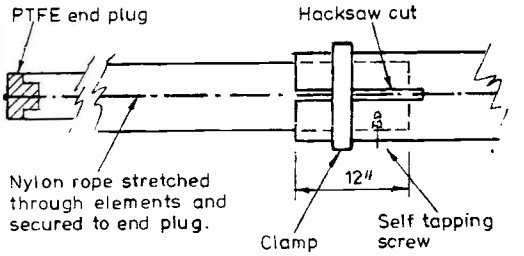

Fig. 5 DETAIL OF ELEMENT JOINTS AND VORTEX SUPPRESSION ROPE (D 271)

Having completed the design of the array consideration must be given to its attachment to the rotator. But first it is necessary to know the wind load that is likely to be experienced. This is calculated as follows:

Example 2. Referring to the design of the array the wind loads are:

(*i*) Area of the three centre-sections,

$$3 \times 9{\cdot}0 \times 1\tfrac{1}{8} \times \frac{1}{12} = 2{\cdot}53 \text{ sq. ft.}$$

(*ii*) Area of the three mid-sections,

$$6 \times 6{\cdot}0 \times \tfrac{7}{8} \times \frac{1}{12} = 2{\cdot}63 \text{ sq. ft.}$$

(*iii*) Area of end sections of the reflector elements,

$$2 \times 7{\cdot}2 \times \tfrac{1}{2} \times \frac{1}{12} = 0{\cdot}60 \text{ sq. ft.}$$

(*iv*) Area of end sections of the driven elements,

$$2 \times 6{\cdot}1 \times \tfrac{1}{2} \times \frac{1}{12} = 0{\cdot}51 \text{ sq. ft.}$$

(*v*) Area of end sections of the director elements,

$$2 \times 5{\cdot}2 \times \tfrac{1}{2} \times \frac{1}{12} = 0{\cdot}43 \text{ sq. ft.}$$

Total wind area of elements = 6·70 sq. ft.

As the elements are round, a wind load of 20lbs/ft.^{2} is used. The wind load on the elements is 6·7 × 20 = 134·0lbs. Now consider the boom: this is $2\frac{1}{2}$in. square section it is usual practice to use for calculation purposes the length of the diagonal cross-section, *i.e.* the side dimension × 1·4, and this is 3·5ins. As this surface is flat, a wind load of 30lbs/ft.^{2} is used.

$$\text{Wind load on boom} = 20{\cdot}75 \times 3{\cdot}5 \times \frac{1}{12} \times 30 = 181{\cdot}6 \text{ lbs.}$$

The most critical wind load is the one to be used in calculating the connecting tube to the rotator. In the example this is the *boom* wind load. Most manufacturers of commercially-made beams give the wind loading on the array and this obviates a lot of calculation. However, the beam has to be carried on a length of tube to connect to the rotator. Differing makes of rotators accept drive

tubes of varying diameters and it is good practice to adopt maximum tube diameter acceptable. The bending moment produced by the beam on the tube and the moment of resistance at the rotator are critical.

Connecting the Beam to the Rotator

A commercially-made antenna for 2-metres together with a readily available rotator will form the basis of calculation for the next example. Judging by the number of bent television masts one sees, plus the fact that the drive tube will have little load effect on the rotator it will be prudent to use the "allowable design stress" *i.e.* 23500lb/ins.^{2}.

Example 3. Using a J-Beam 6-element quad Type Q6/2M and a Stolle automatic rotator, is it required to know the maximum length of connecting tube between beam and rotator. The Stolle rotator will accept a tube of 1½in. maximum diameter; J-Beam give a wind load of 72·6lbs. at a wind velocity of 100 m.p.h. Aluminium tube 1½in. Ø with 0·125in. wall thickness, to spec. 6082TF will be used. Let L be the length of the mast in feet.

Using the bending moment formula:

$$M_{max.} = Z \times f = 23500 \times 0{\cdot}172 \times \frac{1}{12} = 336{\cdot}8 \text{ft/lbs.}$$

Wind load of antenna $= 72{\cdot}60$lbs.

$$\text{Mast wind load} = L \times 1{\cdot}5 \times \frac{1}{12} \times 20 = 2{\cdot}50L \text{ lbs.}$$

$$\text{Bending Moment, } M_{actual} = (72{\cdot}6 \times L) + \left[(2{\cdot}5L) \times \frac{L}{2}\right] \text{ft/lbs.}$$

(L
(— is used as this is a distributed load)
2

Equating the Bending Moment (M_{actual}) with the maximum Bending Moment ($M_{max.}$), L can be solved.

$72{\cdot}6L + 1{\cdot}25L^2 = 336{\cdot}8$

Re-arranging the equation $1{\cdot}25L^2 + 72{\cdot}6L - 336{\cdot}8 = 0$. Using the formula for solving a quadratic equation:

$$L = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Where $a = 1{\cdot}25$, $b = 72{\cdot}7$ and $c = -336{\cdot}8$, we have:

$$L = \frac{-72{\cdot}6 \pm \sqrt{72{\cdot}6^2 - 4(1{\cdot}25 \times -336{\cdot}8)}}{2 \times 1{\cdot}25} =$$

$$\frac{-72{\cdot}6 \pm \sqrt{5270 + 1684}}{2{\cdot}5} = \frac{-72{\cdot}6 + 83{\cdot}4}{2{\cdot}5} = 4{\cdot}32$$

= 4ft. 4ins.

This is the maximum length of tube allowable between the beam antenna and the rotator.

The use of the Stolle alignment bearing Type RZ-100 (which is in effect a thrust bearing) will increase the Bending Moment ($M_{max.}$) if installed as directed by 22lbs/M. If it is desired to arrange more than one antenna on the drive tube (or create a "Christmas tree") the wind loading on each antenna must be ascertained and the sum of these used for calculation. It will be readily appreciated why manufacturers of rotators state that the drive tube should be "kept as short as possible"!

Unsupported Masts

These can take the form of (a) pole type or (b) a lattice tower.

(*a*): It is possible to design a self-supporting pole mast up to a height of 50-60 feet by the same principle employed for beam elements to carry at the top a small rotator and a simple 2-metre array. However, to obtain "nesting" tube sections from about 2ins. diam. at the top to 4ins. diam. at the base, calculations show that it has to be over-designed by two or three times, which makes it uneconomic. The mast (or gin pole if it is to be made a tilt-over type) will need to be sunk into the ground for at least 10 per cent of the mast length and embedded in a concrete foundation. As mentioned previously, aluminium has about three times the elasticity of steel and in a strong wind such a mast carrying a top wind loaded array, plus rotator of about 50lbs. load, could sway in a circle about 5-7 feet radius. Having satisfied yourself and the local authority building regulations, the YL might nevertheless be somewhat anxious and it may unwittingly create a tourist attraction! Not really a practical proposition.

(*b*): A lattice type mast of triangular section which could be made by the home constructor is shown in Fig. 6. It consists of 10ft. lengths of 1in. diameter steel tube, with ¼ins. dia. steel rod bent as shown to form continuous braces on each of the three sides. The braces are welded at each point to the 1in. tube. A top and bottom plate are welded at the ends of each 10ft. length; solid rods extending 6-9 inches long to form a sliding fit with the next section are rivetted 6-9 inches into the ends of each length of tube. The next 10ft.

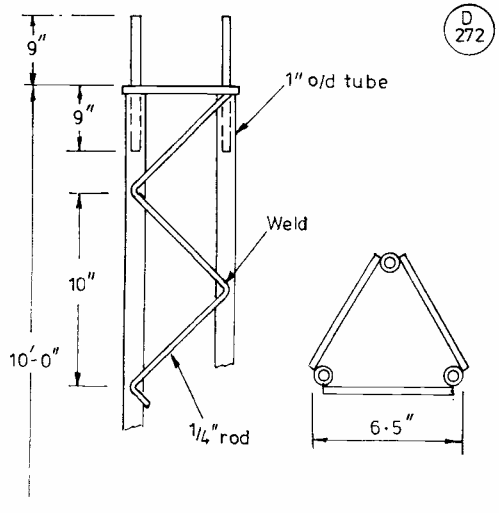

Fig 6 DETAIL OF LATTICE MAST CONSTRUCTION