The SHORT WAVE Magazine

40p

VOL. XXXVI | JANUARY/FEBRUARY 1979 | NUMBER 11/12

LOWE ELECTRONICS LTD

TS120

MULTUM IN PARVO

We introduce yet another exciting innovation from Trio in the new TS120V HF transceiver. Equally at home in mobile or home station situations, the TS120V packs more features into a small package than any other comparable model.
Measuring only 9½" x 3¾" x 9¼"—which is about the size of a packet of cornflakes, the TS120V can best be described as a miniature TS820. The rig covers all bands 80–10 metres—and all of 10 metres 28–30 MHz so it's ideal for transverter driving, has digital readout built in, vox, break-in CW, RIT, noise blanker and the unique Trio passband tuning system used in the 820. The power output is 10W. and a matching linear will be along shortly.

The TS120V is clearly a winner for mobile operation but is equally attractive at home and is perfect for the VHF/UHF enthusiast who requires a high performance I.F. system for his transverters.
The transceiver is based on an advanced PLL system and the digital readout gives you the correct operating frequency at all times unlike many other rigs. Remember my previous comments about Trio attention to detail
For ease of operation, the TS120V is unsurpassed; simply select the band required. tune the VFO to the frequency you want and there you are : no preselector or PA tuning to worry about. and a distinct safety feature for the mobile operator.
We at Matlock, have all fallen in love with the TS120V and we feel sure that you will too. At it's price of **£435** including VAT (and including digital readout, vox, etc.) we have no doubt that this transceiver will be another winner from Trio. See it soon.

TR7500

THE SENSIBLE 2 METRE RIG

The TR7500 is really the commonsense 2 metre FM mobile. In a small 6" x 2⅜" x 9¼" package, Trio have packed a 15 Watt transmitter, a sensitive and selective receiver and an advanced synthesiser which gives you operation across the whole 2 metre band 144–146 MHz in the recommended 25 kHz channel spacing.

Ease of operation is the hallmark of the TR7500 with its brilliant channel number display. Need to operate on S20? Turn the main knob until the display reads 20; move to S24, simply turn to 24. Repeater operation is equally easy, requiring only the touch of a switch to have repeater or reverse repeater functions. Dial readout? You guessed, it's simply 7 for R7, 4 for R4, and so on.

Designed especially for the U.K. market, the TR7500 is a good example of the Trio advanced engineering approach as an inspection will show. Why not see it at your nearest authorised Trio stockist and make up your own mind about commonsense plus quality.

P.S. A scanner is available for the TR7500 from M.R.S. Communications —see our address box.

TR7500 — £235, including VAT. Matching **PS-6 — £63·00,** including VAT

AR240

FULL COVERAGE 144-148 MHz.
CHANNEL SPACING 5 KHz.
FULLY SYNTHESISED.
+600 & —600 KHz. SHIFT.
1750 Hz. TONE BURST.
1½ W. OUTPUT.

SURELY THE MOST AMAZING HAND HELD TRANSCEIVER YET!

The AR240 is a truly staggering rig. In a small hand held unit, you have a fully synthesised 2 metre FM transceiver covering 144–148 MHz in 5 kHz steps. Frequency selection is by direct reading top mounted decade switches giving instant access to any frequency in the tuning range. Power output is over 1W and the receiver sensitivity is not only excellent, it's maintained across the full tuning range by automatic voltage controlled tracking. Both up and down 600 kHz repeater shifts are built in as is a 1750 Hz tone burst.

What more could you ask for in a hand held ?

AR240 price including Nicad Pack and Charger — **£215** inc. VAT

FOR COMPLETE CATALOGUES SIMPLY SEND 40p IN STAMPS TO MATLOCK.

PAUL G3VJF

ICOM FOR QUALITY

The IC-240 is so popular that ICOM are making more and more

This photo shows the IC–240 with the optional "Superscan" fitted on the top. The Superscan provides the option of the ability to tune manually over the range 144–146 MHz on transmit and up to about 148 MHz on receive in 25 kHz steps. It has full 6 digit frequency readout and can be set to scan frequencies in the range 145–146 MHz and stop on an occupied channel. Any number of channels up to 39 can be locked out by pressing the lockout button and these frequencies will be passed over on future scans The Superscan gives an added dimension to your IC–240 when used for base station use where extra channels and digital readout are worth having.

IC–240 alone ... ... £168 less VAT ; **£189** with VAT
Superscan alone ... £69 less VAT ; **£77·62** with VAT
IC–240 with Superscan fitted
£230·22 less VAT ; **£259** with VAT
Fitting charge for Superscan if not bought with 240 **£6**
(instructions for doing it yourself are provided).

The IC–240, one of the first of the new generation of synthesised transceivers to appear on the market, is still one of the most popular. It offers all you really want for mobile use on 2m. plus a feature not found in all sets with digital display, keypads on the microphone or other gimmicks—IT IS EASY TO USE ON THE MOVE WITHOUT LOOKING!—and that MUST contribute to safety on the road.

You get a choice of 22 channels with all the UK and European repeater channels plus all the commonly used simplex channels already wired on the programmable matrix board. The dial is marked in channel numbers with 7 spare positions marked A to G for you to programme with any other channels you chose on the now standard **25** kHz channel spacing. Should 12½ kHz spacing arrive (and for your sake we hope it won't) it will be very easy to modify the IC–240 to cover the in-between half channels, making 44 in all. To change channel you just turn the dial to the channel you want, with easy to feel click stops, and that's all. No 5 kHz button to get all confused about ! Repeat shift for normal or true reverse repeat and high or low power are selected by easy to feel toggle switches and the access tone is automatically introduced on duplex. After testing all the mobile transceivers around on the UK market we still find that the 240 is as good as any, and better than some, when it comes to receiver and transmitter performance. The high sensitivity of the receiver coupled with excellent strong signal handling capabilities and high selectivity is hard to beat as is the excellent speech quality and very clean signal of the transmitter. At least one, and by the time this is published, probably two repeaters use a single IC–240 with both the transmitter and receiver operating at the same time. IC–240s have a long good service record for reliability and when they do go wrong we at least understand how to mend them.

If you want to add extra facilities for base station use it is easy to obtain all 80 channels by using only 8 toggle switches and diodes—or you can build your own scanner if you are digitally minded. If not you can BUY the Superscan for **£77** which will give you receiver coverage to about 148 MHz (transmit in 2m. band only), six digit LED readout and scanning facilities with up to 40 channel lock-out. Again this is designed for 25 kHz spacing but will cope with 129 kHz with minor modification to your 240.

SOME OF THE ICOM RANGE HAS BEEN REDUCED DUE TO A FAVOURABLE EXCHANGE RATE WITH THE YEN. SO TAKE ADVANTAGE OF THE LOWER PRICES NOW.

So — Why go for anything more expensive ?

AGENTS (phone first—All evenings and weekends only, except **Norfolk** and **Burnley**)
Scotland—Jack GM8GEC (031-665 2420) **Norfolk**—Ted G3FEW (05088 632)
Wales—Tony GW3FKO (0222 702982) **Burnley** (0282 38481)
North West—Gordon G3LEQ (Knutsford (0565) 4040) **Yorkshire**—Peter G3TPX (022678 2517)

H.P. TERMS AVAILABLE
FOR ALL MAIL ORDERS AND SALES DURING BUSINESS HOURS
YOUR SOLE AUTHORISED UK IMPORTER FOR ICOM

Access — Buy it with Access

THANET ELECTRONICS

143 Reculver Road, Beltinge, Herne Bay,. Kent
Telephone : 02273 63859 (2 lines)
Direct Ansafone line (evenings) 64283

Access

AMATEUR ELECTRONICS UK

AEUK — Your number one

AS FACTORY APPOINTED DISTRIBUTORS WE OFFER YOU— WIDEST CHOICE, LARGEST STOCKS, PROMPTEST DEAL AND FAST, SURE SERVICE RIGHT THROUGH.

The widest choice from 2–10

The Yaesu range is now so great that it simply caters for every taste—this makes it a *must* to browse through Yaesu's main catalogue—please see our offer on facing page.

Above we show the now firmly established FT–227R 2m. Mobile now also available in its scanning versions. On the right is the superb FT–225RD, the 2m. base station that has everything, designed for the man who insists on the best. At left is the FT–202R Hand-held—so compact but so effective.

The FT–901DM is the base station *par excellence* and its receiver performance alone is simply out of this world. Together with the range of matching ancillary units—which are growing all the time—this builds a station which fulfils every conceivable requirement for the operator who demands the ultimate.

HOW TO REACH US (EASY PRIVATE PARKING ON OUR 70ft. FORECOURT)

FROM SOUTH AND EAST. We are located approximately two miles from Junction 5 of the M6 from which follow signposts to Birmingham. Within ½ mile turn right at Clock Garage and proceed towards city. After one mile look for traffic lights at Fox & Goose and immediately over the lights take minor left fork into Alum Rock Road. We are located one mile from this point.

FROM NORTH. Leave M6 at Junction 6 (Spaghetti) and follow left fork down to traffic island beneath motorway complex. Take third turning off to Lichfield. One mile further on follow A 4040 to the right and within 100 yds. veer again to the right, approximately one mile further on brings you to the Fox & Goose. Turn right and see preceding directions.

FROM THE WEST AND SOUTH/WEST. Follow M5 then M6 to Spaghetti Junction (see above). Alternatively, leave M5 at junction 4 or 3 and proceed to inner ring road. Turn South on ring road and leave on A47 (East). We are located three miles from this point.

Hours: 9.30-5.30 Continuous including Saturdays—Early closing Wednesday, 1 p.m.

Access

Access or attractive H.P. terms readily available for on-the-spot transactions. Full demonstration facilities. Free Securicor delivery.

Access

SHORT WAVE MAGAZINE

(GB3SWM)
ISSN: 0037-4261

Vol. XXXVI — JANUARY/FEBRUARY, 1979 — No. 423/424

ADVERTISERS' INDEX

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.**

Prices shown in advertising in this issue do not necessarily constitute a contract and may be subject to change.

AUTHORS' MSS

Articles submitted for Editorial consideration must be typed double-spaced with wide margins on one side only of quarto or foolscap sheets. Photographs should be lightly identified in pencil on the back with details on a separate sheet. All drawings and diagrams should also be shown separately, and tables of values prepared in accordance with our normal setting convention—see any issue. Payment is made for all material used, and it is a condition of acceptance that full copyright passes to the Short Wave Magazine, Ltd.. on publication.

E. & O. E. VAT Reg. No. 239 4864 25

You'll make a first-class rig with Heathkit.

HR-1680 SSB/CW RECEIVER
- ★ High performance.
- ★ Built-in AC power supply or external battery operation.
- ★ Excellent sensitivity.
- ★ Complete 80-10M coverage.

HA-201A 10W 2M AMPLIFIER
- ★ Operates from car battery.
- ★ Ideal for portable or hand held rigs.
- ★ Up to 10W for 1.5W input (8W for 1.0W input).
- ★ 40W amplifier also available (HA-202A).

SW-717 4-BAND SHORT WAVE RECEIVER
- ★ Ideal novice kit, assembled in a few hours.
- ★ Full 550kHz to 30MHz coverage.
- ★ Slide rule tuning. ★ Signal strength meter.
- ★ Built-in AM rod antenna and connection for external antenna.

This is just a small selection from the big range of Heathkit radio equipment kits.

Each one has an excellent specification and an advanced design, so you can build a top-quality rig for yourself.

The step-by-step instructions make it easy for you, and your success is guaranteed.

Full details are in the Heathkit catalogue. Send for your copy now.

To Heath (Gloucester) Limited, Dept XXXXX, Bristol Road, Gloucester, GL2 6EE.
Please send a copy of the Heathkit Catalogue. I enclose 20p in stamps.

Name____________________

Address____________________

SWM/1/79

If you are already on the Heathkit mailing list then you'll automatically receive a copy of the latest catalogue without having to use this coupon.
Registered in England, number 606177.

HEATH
Schlumberger

There are Heathkit Electronics Centres at 233 Tottenham Court Road, London (01-636 7349) and at Bristol Road, Gloucester (Gloucester 29451).

Optimum Performance with KW Ancillaries

DECCA-KW107 SUPERMATCH
Antenna Tuning System Incorporates E-ZEE Match, SWR/RF power meter; Dummy Load: Antenna switch.

DECCA-KW109 SUPERMATCH
A high power version of the KW107 is available.

DECCA-KW ANTENNA SWITCH. Selects up to 3 Antennas. Low-insertion loss up to 200 MHz. 1kW p.e.p. rating.

DECCA-KW E-ZEE MATCH
Antenna Tuner 10-80 metres, matches 50/75 ohm input to co-ax fed antenna's, also twin feeder and single wire systems.

DECCA-KW BALUN Mk. II
The Decca-KW Balun is broadband–3 to 30 MHz, rated up to 2 KW p.e.p. 1 : 1 Ratio 50 ohms "unbalanced" feed to "balanced" output. Water-proof moulded case. Suitable for Dipole and Beam Antenna.

Other KW Favourites—Decca KW Dummy Load. KW Traps (original and the best); KW Trap Dipoles; Stockist for HY-Gain beams and Verticals; CDR Rotators; Shure Microphones, etc.
Write or phone for catalogue..

KW

Amateur Radio Products,
DECCA COMMUNICATIONS LTD.
Cramptons Rd., Otford, Sevenoaks, Kent TN14 5EA
Tel.: Sevenoaks (0732) 50911

SERVING RADIO AMATEURS WORLD-WIDE

FOR THE RADIO AMATEUR AND AMATEUR RADIO

The SHORT WAVE Magazine

EDITORIAL

Article Competition

In order to encourage new (and old!) talent to write, we propose an article competition commencing with the volume which starts with the next issue: all work published in a given volume of *Short Wave Magazine* will be considered at the end of that volume, and a prize of £50 awarded to the piece judged to be the best. "Best" in this context will take into account such factors as originality, simplicity of construction and testing, usefulness in the amateur radio scene, and so on; we might add that the occasional shaft of humour will also be considered. The prize is clearly to be understood as just that: all material will be paid for on publication in the normal way, and the prize will be a separate thing. So start writing!

While on the subject of articles, we would like to see more projects on complete transmitters or receivers, aerials and so on. It is our view that, despite a widespread belief to the contrary, anyone with an R.A.E. pass should be able to build and get working an SSB transmitter, given that the construction methods and testing are set out in clear detail so that the beginner-constructor can fault-find and test out each part as he completes it, thus making the final setting-up something other than "getting the brute to play."

G3KFE.

WORLD-WIDE COMMUNICATION

FOR THE RADIO AMATEUR AND AMATEUR RADIO

The SHORT-WAVE Magazine

EDITORIAL

Article Competition

In order to encourage new (and old!) talent to write, we propose an article competition commencing with the volume which starts with the next issue: all work published in a given volume of *Short Wave Magazine* will be considered at the end of that volume, and a prize of £50 awarded to the piece judged to be the best. "Best" in this context will take into account such factors as originality, simplicity of construction and testing, usefulness in the amateur radio scene, and so on; we might add that the occasional shaft of humour will also be considered. The prize is clearly to be understood as just that: all material will be paid for on publication in the normal way, and the prize will be a separate thing. So start writing!

While on the subject of articles, we would like to see more projects on complete transmitters or receivers, aerials and so on. It is our view that, despite a widespread belief to the contrary, anyone with an R.A.E. pass should be able to build and get working an SSB transmitter, given that the construction methods and testing are set out in clear detail so that the beginner-constructor can fault-find and test out each part as he completes it, thus making the final setting-up something other than "getting the brute to play."

G3KFE.

COMMUNICATION and DX NEWS

E. P. Essery, G3KFE

Ten Metres

Last time round G2ADZ (Chessington) just missed the 'bus, so he takes pole position this time. Bill sticks to CW, and for November he found all W call areas, VE1-7, KV4AA, VP9GG, HI8MOG, K6OJ/C6A, W6QL/6Y5, XE3BL, VK2FU, VK6NDJ with 10 watts, VK2NNX, VK5NRD, VK6NCD, VK5LU, VK5NTX, FY7EOL, ZL3GQ, ZL2UW, FMØXF, FYØBE, FY7BC, AP2TN, 9K2DR, VU2DAS, C6AAZ, VS6CZ, TF5TP, STØRK, ZS's, W4UY/PJ7, HBØBLC, TR8RG, CX8DT, C5AAO, KL7RA, and HS1ABD. Some choice specimens there! There were a couple of interesting anomalous effects noted: November 6 around 1800, when ZL3GQ was audible by scatter, with the beam more or less anywhere between East, through North to West, strongest at *NW*, though only workable with the beam *NE*, when he was 579. The second interesting one was November 25, the contest day, when an Aurora manifestation showed on the band around 1700; the first QSO was with GM3YOR followed by lots of G's and Europeans all with the characteristic Aurora note, and at 1750 who should show up but KL7RA—with a watery but T9 signal—for a first QSO with that country for Bill. One would guess that the KL7 must have glanced off the Aurora.

G2BJY (Walsall) is another stick-to-Ten man, also CW, who starts with a mention of the recent "interruption to service" of Geoff Watts' *DX News Sheet*—Geoff seems to be out of the wood now and back in business with a revised format. G2BJY mentions he has now collected some 82 countries on Ten this year, and by cutting back on the gardening and sticking to one-band work he has managed to shake off the bug that hit him earlier in the year. For the current period, there are AF5U, C5AAO, CN2AQ, CT2AO, CX1EK/W4, HI8MOG, IT9ILA, KV4AA, PY1HQ, PY1DHG, PY2FCM, many UA9's, UF6FN, UH8HCL, UJ8JAS, UK9OAD/U8W (Turkoman), RL7GDC, UL7AFD, UL7PAS, RX9XAA, VE1-3, VE6AYI, lots of W's including W7's in Utah, Montana, Wyoming, Oregon and Washington), YV1AD, ZP5NW, ZS2CW, ZS4D, W6QL/6Y5.

G3XAP (Stowmarket) has been playing with his inverted-L and by putting in a trap at 7·1 MHz it should have become multiband—but on 14 and 28 MHz it won't play; indeed Phil has it in mind that the PA just won't match on Ten—though when there are no sunspots, the PA gives out *lots* of RF of course! On the evening after he wrote, G3XAP fully intended to deal with the aerial problem, and then make noises in the Antipodes.

Excellent, says G4DMN (Wirral), when he could get on; and in his holiday and week-end breaks he managed to screw up some 150 countries on Ten during 1978. This time there were AP2KS, FB8XS, JT1BG, VS6EZ, XE1XF and 5T5ZR.

F9UO (Verriere-le-Buisson) sits up in his tower-block and with a Joystick works the world; on Ten, we note CW with ZL3GQ, ZL3IS, W4TW, AC2K, UK4CAW, W2AXZ, K4FU, W1FVX, W6VD and W2FC. Incidentally, the ZL's had already been worked on 14 MHz, so on that occasion they worked 80-40-15-10 QSO's with ZL3GQ, and 40-15-10 contacts with ZL3IS.

Coming Events

We rather think 1979 will be an even better year for DX-chasers than 1978. Spratley, for instance, or Bouvet—this last should be still available by the time this comes to be read. Then there is the Peter Is. effort, 3YØBZ, which should be active by the time you get this, and hopefully will be there through the summer. Somalia is another one to keep an ear open for, with I2FGP/601FG scheduled for another stint there. Recently we were talking to a VU national (not an amateur) about—among other things—the Laccadives, and lo!, a day or two later came the news that a group of VUs's were planning to activate this one, they being members of the Bangalore radio club; the callsign will probably be VU4RC or VU5RC. Then there are noises about Aves Is. being made, aimed at around March-April, not to mention a 1980 Malpelo effort.

Had enough? No? Then what about the Andaman Is. which we believe P29JS will be activating ere long. Not to mention the places headed for independance; Marshall Is., Palau Is., the Federated States of Micronesia, and even a bit of land which lies between Mexico and the U.S., which we understand is the result of a change in the Rio Grande channel!

'CDXN' deadlines for the next three months—
March issue—February 13th
April issue—March 1st
May issue—April 5th
June issue—May 3rd.
Please be sure to note these dates.

Top Band

We must mention this one, insofar as we have a letter from GM3IAA, now 81 years young, and highly chuffed to have clicked with VK6HD and so made his WAC on Top Band at last. Now that is some achievement—we would have given long odds that geologically Jim's home spot up in Inverness would put any question of a WAC out of court—but Jim made it, along with the winning of the Handicap Mixed Doubles Tennis at Grantown Tournament. A fair double, that, at 81! On a different tack, Jim has had his QSL card to UW3PAW back from Box 88 with the stamp "Return—Unknown" on it, though he has the QSL's for UB5WF and UO5AA from back in 1961, so no real worry there.

Noises have been made at your conductor about his getting on to Top Band and Eighty and 'doing something', as one comment had it—well we can and we are trying our best. We have gear for the band, and an aerial planned out and ready to be made, which should give a reasonable signal on both bands without our eternal earth-resistance problem. There didn't seem to be any time to spare after going to the trouble of pacing out the distance in 9-inch lino-tiles and putting the marking where they should go, and anyway it's been somewhat Arctic round this neck of the woods. But, by the time this comes to print we might—just might —be able to put a signal out. If so, there will be no objection to reports!

G2NJ (Peterborough) has switched his interest for the moment from 80 to Top Band with a view to picking up the threads of old friendships. One daytime QSO was with G3VOA, now in Oakwood Centre, Colchester, who transmits by controlling and keying the rig with his foot, as he has done so ever since becoming licensed not far from here. Then there was the GM of 81 years who was keying as well as ever, and G3IFF down in Havant, with a 1-V-1 receiver built in 1950 "in admiration of the old methods."

21 MHz

For many folk, this band is just about the ideal for a communicator —reasonable DX, TV noises not as bad as they are on 14 MHz, and all nice and gentlemanly. Which reminds us—we hear a whisper that there is a chap who is attacking the problem of TV timebase noises with some vigour, having established that, in his case at least (and here too, come to think of it!) the timebase harmonic is actually picked up by the amateur station aerial as a radiated signal.

F9UO uses green for his 21 MHz QSO, and he also does a fair amount of initial weeding-out so as to keep in focus the interesting ones. On 21 MHz we noted 5T5PG, W2FC, ZL3GQ, ZL3IS, KØPNE, W60V and K1RH.

Our next reporter is G4DMN who simply says "nothing worked!" —which is not to say he hasn't been active on other bands, as chronicled elsewhere.

Only two sessions on the band are noted by G3XAP, which is not to say his improvised multi-bander isn't loading up on the band—it is, and with a good SWR too. Between them the two sessions accounted for all W call areas, VE1, 2, 3, 4, 6 and 7, which must indicate something about the skill of the op. or the length of the sessions!

We should have some more reports, but thanks to the heavy weather, the mail has been delayed —first class now taking three days instead of the customary two, and second class out beyond its normal one week. Doubtless, on Monday, when the piece is ready for setting, the packet will surface . . . anything through the Big Smoke, which means about everything!

Twenty

Here we have the give-and-take of the busiest band, open at almost any time of the day or night to somewhere, *if* you can resolve the signal under the nice big fat TV timebase harmonics and their associated whiskers. Mr. J. L. Baird and his Idiot's Lantern have much to answer for by way of ether-pollution, whether one counts the programmes or the noises-off. Mind, we did get dragged to the box on New Year's day, to watch that bit of *Blue Peter* referring to our old friend G3UUZ and his Christmas on the Bishop Rock. However, he seems to have *hidden* the rig specially for the occasion! But it was nice to see him hale and hearty even if he was a bit more solemn than usual.

As may be gathered, the writer found the TV set to be, one way and another, a bit of a nuisance, save in the matter of G3UUZ. On the dark side we have to note the occasion on which YI2BGD was, it seems, being heard quite well in U.K. to judge by the reports he was getting; but it just wasn't worth our while to call him as he was right underneath a TV harmonic.

G4DMN didn't spend too much time on Twenty, for the reasons already mentioned, but he did find time to hook FB8XS, FW8AC and YI1BGD.

At F9UO we find Rene working his CW to K1RH, W4NG, VE1BIF, KV4AA, W2BA, W2BBK, KP4USN, KV4SZ, VE1BOD, UI8ADQ, UQ2GCV, EA7AVL, VE6LU, N3EA, W1FB, OH3FM and JA1BWD, not to mention the assorted European and other small fry.

CQ 'Hall Of Fame'

Last time around it was our own Geoff Watts; this (1978) year's award has been given to W6AM, Don Wallace in recognition of some 68 years of amateur radio activity, most of it at the top of the tree. Don sits, and has sat at the top of the *DXCC Honour Roll* for more years than your scribe cares to think, and in addition is up to some 250 countries from his kilowatt mobile rig. As for the home spot, Rhombic Farm is a bit of a legend; it once had 13 rhombics, but now has but nine, using 61 poles and 45 miles of wire —some of those poles are 140-footers, be it noted. Quite apart from the activity side, W6AM has done more than his fair share of waving the flag for our hobby, having given talks on DX in 90 countries. A deserved honour indeed.

Forty

One of the original breeding-grounds of radio 'funny noises,' not to mention Iron or Bamboo Curtain output statistics and stations who all seem to boast the call "CQ." One of these days, when we're feeling patient, we will listen to one of the latter just to see if he ever does append a call to his CQ! On the other hand, there is 'gold in them thar hills' if you are a skilled enough receiver operator.

G4DMN says he only looked at it a couple of times, to find and work K6MYC and FK8CC.

The writer has been more interested in receivers this month, comparing the TS-520 receive function with the KW-77, Eddystone 888 and a PM-2 receive half—the latter a direct-conversion type which is part of the QRP rig. Quite an entertaining hour or two at the bench, and rather revealing—we will seriously have to look into a high-performance direct - conversion receiver with a good, best-possible DBM front-end, and see how this compares with a conventional full superhet and CW filter on 7 MHz. We will be ready to bet that the direct-conversion receiver will be a winner, purely on the quality of front-end. If only we amateurs as a clan would stop bellowing for "more gain" in a receiver, and its inevitable following overload, cross-mod and all the rest, in favour of *just enough* gain to take a minimum signal and lift it to a just usable output signal into the phones or speaker, combined with a good strong-signal front-end design, we'd be a lot better off.

F9UO mentions OY7ML, F5IH, KØPNE and DFØSAR, the last one being some sort of special in the Saarland. The F5IH is of interest in that it was an emergency medical call for rare blood, asked for by Monte Carlo TV. The blood was located at the National Transfusion Centre in Paris, which then got in touch direct with the Monte Carlo Centre. This must be one of the first medical calls in Europe for twenty years, and in fact it became a means of "fiddling" drugs out of the authorities.

Here and There

A surprising bit of news is to hear that G2JL is to part with his *Reine de Mai;* he has had this yacht since 1952 (she was built in 1910) and has cruised with the calls G2JL/MM and FØGR/MM on 7 MHz regularly.

SWL's will be interested to note that there will be a series of Set Listening Periods this year; the first week-end of each month, to cover all bands, CW and Phone. Log all stations heard, the station they are calling or working and RS(T) date and time, and rush the log off to D. A. Whitaker, Hillcourt, 57 Green Lane, Harrogate HG2 9LN bands for the rest of the year are: Feb. 4, 1·8 MHz CW, 0700-0900; March 3-4 3·5 MHz Phone 2300-0100; April 7 1600-1800 on 28 MHz CW; May 6, 0700-0900 on 14 MHz Phone, June 3, 0500-0700 on 7 MHz CW; July 7, 0500-0700 7 MHz Phone; August 4, 1000-1200, 21 MHz CW; September 2, 1300-1500 for 28 MHz Phone; October 7 for 0600-0800, 3·5 MHz CW; 0600-0800 on Top Band CW on November 3; and finally on December 1, 1800-2000 on 14 MHz CW. We have already mentioned where the logs should go, and with them should go some notes on equipment used, aerials, conditions, and so on. We could possibly add that colleague Justin Cooper would doubtless be interested too.

If you think you are a snappy operator in the VHF Field Day, take a look at your QSO rate—9Y4VT, in the course of racking-up some 8 million points plus in the CQ Phone contest, managed a best of *296 QSO's in one hour*!

Apropos that Desecheo operation, there seems to be a stalemate, in that KV4KV and WØDX are getting out the QSL's; ARRL are rejecting them as an illegal operation, on the grounds of a letter from the KP4 authority which administers Desecheo. On the other hand we have it that WØDX and KV4KV are just standing pat on the ground that the "authority" who wrote to the DX Advisory committee hasn't got *any* authority to say yea or nay. This gets complicated, so if you worked 'em, save the card until the dust settles!

It has been noted that the YI1BGD signal has come up a bit of late; we understand that they now are using a two-element quad with the Atlas rig; and rumour hath it that the FT-101 and the FT-560 which were sent earlier in the year might have been released to them and set to work. They are at present stuck on Twenty—usually around 14225 kHz, give or take a bit. 14310 kHz has also been mentioned.

Ever heard of the Kingdom of Redonda? Well, now, it's an interesting tale. Start from first base; Antigua goes independent in 1979, and when it does it will have to assume responsibility for this (genuine) kingdom, an island which is a mile-and-a-half long by a half-mile, rising 100 feet above sea level. Now, it was originally claimed by one Shiel, back in 1865, and his son was duly crowned King by the Bishop of Antigua. Then Britain annexed Redonda and made it a dependency of Antigua; *but* it in no way invalidated the sovereignty of King Philip. Thus King Juan the Second will be travelling to Redonda sometime in the early part of 1979. He lives in Sussex, and is named Jon Wynne-Tyson, and he *could* give us a new country for DXCC—well, how about that!

Eighty

A place for the brave and the QRP. G2NJ has to a large degree absented himself, spending more time on Top Band. However, he did hear G2CAS in Harrogate with 1·5 watts, G3KLF at 2 watts, and G4CQK at three watts, all good solid QSO's; another QRP-QRP one overhead was that of SP6COT working another SP, the input being three watts.

"Very poor" says G4DMN, who admits that this must at least partly be accounted for by the sunspots which are making such a bonanza for ten metres. Richard isn't complaining though, with some 151 countries worked on the band in 1978 and 45 States. One supposes it was to be expected with the five-band awards, but G4DMN now notices a few stations with eighty-metre rotatable aerials of the quad or beam variety. He worked AI5E, AE7H, CN8DO, C6ANX, CN8HC, EL2AK, FM7AV, HH2MC, JA6BSM, JA6LCJ, JY4MB, K5JX, K5MK, KØHA, KØZZ, KBØEH (N. Dakota!), FGØEUU /FS, N5HH, N2KK/6, ST2SA, N5VV, TF5TP, TI2TB, VP2SK, VE4SL, VE8MA, W5YU, W5XZ, W6EA, W6NLZ, W7FU, WØGYH, WAØTKJ, WØMJ, ZL4QL/A, ZL2BT, F9UW/3A, 6W8DY, 8P6GN/P and 9G1FF.

At G3XAP, the inverted-L seems to have been doing its thing, with CW contacts registered in the logs of W1, 2, 3, 4, 6, 8 and Ø, UA9, UF6, TF3US for a new one, and 4N1Z—as to the last, he QSL's by way of YU1JRS, and had stations queuing up to work them. That being the case, reasoned G3XAP, they must be worth working, so he joined the queue. Clearly an ex-soldier is G3XAP!

Finale

That's it for another month. Deadline dates are in the body of the piece, and again we must note that there is one lot of mail which should have been written into the earlier paragraphs which is still shivering somewhere in the snows—assuming it turns up in its own good time, we'll take it in next time. So—73 and DX.

The mailing route you know—"CDXN," SHORT WAVE MAGAZINE, 34 High Street, WELWYN, Herts AL6 9EQ.

ANTENNAS—THE WEAK LINK, PART VII

IMPEDANCE MATCHING

A. P. ASHTON, G3XAP

IN the article on feeders it was stated that for a perfectly matched system certain criteria had to be met, namely: the characteristic impedance of the feeder has to be equal to the feed impedance of the antenna, and that balanced antennas should be fed with balanced feeders —coaxial cable being used for unbalanced antennas. We also said that the "balanced to unbalanced" condition could be corrected by the use of a 'balun', and that if we are to use a system that accepts a high SWR on the feeder, we must ensure that the transmitter can be coupled to the feeder in an efficient manner in order that we can still obtain an efficient power transfer.

In this article we will look at various methods of impedance matching, both between the feeder and antenna, and between the feeder and the transmitter/ receiver—and we will also consider baluns, some of which are not strictly associated with impedance matching. The discussion will be divided into four sections: matching with the feeder itself; matching at the antenna; matching at the transmitter; baluns.

Matching with the Feeder

If we attach a feeder to an antenna whose feed impedance is not the same as the feeder's characteristic impedance, then standing waves will appear on the feeder. However, if we know the characteristic impedance and the feed impedance, we can calculate the impedance at certain points on the feeder. Consider Fig. 1 which shows the standing waves on a feeder of 75 ohms characteristic impedance when connected to a resonant antenna with a feed impedance of 20 ohms (for example a 3-element Yagi). Note that the maximum value of V is 3·75 times the minimum value, as the Standing Wave Ratio is 3·75 : 1 (75/20), and that the same ratio applies to the current. It will also be seen that at distances of half and one-and-a-half wavelengths from the antenna, the voltage and current are at the same value as they are at the antenna feed-point itself, and hence the impedance at these points is the same as the antenna's feed impedance. (In practice the values of voltage and current do drop slightly, moving from the transmitter towards the antenna due to feeder losses).

Note also that at distances of a quarter, three-quarters and one-and-a-quarter wavelengths from the antenna we have a situation where the current is at its minimum values and the voltage at its maximum—these, therefore, being maximum impedance points. We can calculate the impedance at these points by using the formula:

$$Z_O = \sqrt{Z_R \times Z_S} \quad or \quad \frac{Z_O}{Z_R} = \frac{Z_S}{Z_O}$$

where Z_O is the characteristic impedance of the feeder, Z_R is the antenna feed impedance, and Z_S is the impedance on the feeder at points spaced at odd numbers of quarter-waves from the antenna. In the example shown

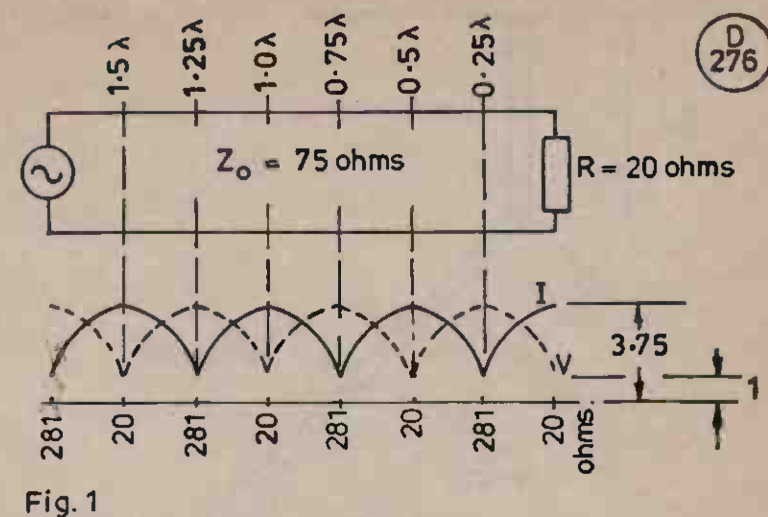


Fig. 1. Standing waves on a 75-ohm feeder connected to 20-ohm resistive load.

in Fig. 1, therefore, the impedance at these points is 281 ohms. Hence, had we been faced with the problem of feeding the 3-element Yagi with a feedpoint impedance of 20 ohms, we could have simply attached a quarter-wavelength of 75-ohm twin feeder to the antenna feed-point and then attached 300-ohm twin feeder between the 75-ohm section and the transmitter, *see* Fig. 2a. The SWR on the 300-ohm feeder will be less than 1·1 : 1, (300/281), and the entire system will be very efficient, but it should be noted that the transmitter will probably not accept a balanced load of around 300 ohms, and we must use a matching unit at the transmitter end of the feeder.

An alternative method would be to use 75-ohm twin feeder all the way from the antenna to the transmitter, and ensure that the feeder is either an odd number of quarter-waves long (which will give an "input impedance" of 281 (ohms), or an even number of quarter-waves long which will give an input impedance of 20 ohms. Either load will be purely resistive, but in both cases we must use a matching unit to ensure that the transmitter "sees" an input impedance of around 50 or 75 ohms (see later section). With the latter case, however, losses are likely to be higher than with the previous method, as the higher SWR will lead to higher feeder losses, but, provided that the feeder will withstand the voltages encountered (*i.e.* the feeder is of good quality), this system will still be comparatively efficient.

A further example of this type of matching would be a vertical antenna with a feed impedance of 25 ohms—by using a quarter-wave of 50-ohm coaxial cable, we "invert" the impedance to 100 ohms ($50 = \sqrt{100 \times 25}$) —this example being briefly touched on in the article on feeders. If the antenna were simply fed with 50-ohm feeder, the SWR would be 2 : 1 (50/25), but by using a "50-ohm quarter-wave matching transformer", and then using 75-ohm feeder between this and the transmitter, we have an SWR of only 1·33 : 1 (100/75). This system is shown in Fig. 2b.

When multiples of half or quarter-wavelengths of feeder are used in impedance matching applications, it is obvious that the feeder's length must be accurately determined. When dealing with test instruments in a later article, we will see how to cut specific lengths of feeder, and this information will enable us to determine that our matching section will act efficiently. Feeders cut to these

ANTENNAS—THE WEAK LINK, PART VII

IMPEDANCE MATCHING

A. P. ASHTON, G3XAP

IN the article on feeders it was stated that for a perfectly matched system certain criteria had to be met, namely: the characteristic impedance of the feeder has to be equal to the feed impedance of the antenna, and that balanced antennas should be fed with balanced feeders —coaxial cable being used for unbalanced antennas. We also said that the "balanced to unbalanced" condition could be corrected by the use of a 'balun', and that if we are to use a system that accepts a high SWR on the feeder, we must ensure that the transmitter can be coupled to the feeder in an efficient manner in order that we can still obtain an efficient power transfer.

In this article we will look at various methods of impedance matching, both between the feeder and antenna, and between the feeder and the transmitter/receiver—and we will also consider baluns, some of which are not strictly associated with impedance matching. The discussion will be divided into four sections: matching with the feeder itself; matching at the antenna; matching at the transmitter; baluns.

Matching with the Feeder

If we attach a feeder to an antenna whose feed impedance is not the same as the feeder's characteristic impedance, then standing waves will appear on the feeder. However, if we know the characteristic impedance and the feed impedance, we can calculate the impedance at certain points on the feeder. Consider Fig. 1 which shows the standing waves on a feeder of 75 ohms characteristic impedance when connected to a resonant antenna with a feed impedance of 20 ohms (for example a 3-element Yagi). Note that the maximum value of V is 3·75 times the minimum value, as the Standing Wave Ratio is 3·75 : 1 (75/20), and that the same ratio applies to the current. It will also be seen that at distances of half and one-and-a-half wavelengths from the antenna, the voltage and current are at the same value as they are at the antenna feed-point itself, and hence the impedance at these points is the same as the antenna's feed impedance. (In practice the values of voltage and current do drop slightly, moving from the transmitter towards the antenna due to feeder losses).

Note also that at distances of a quarter, three-quarters and one-and-a-quarter wavelengths from the antenna we have a situation where the current is at its minimum values and the voltage at its maximum—these, therefore, being maximum impedance points. We can calculate the impedance at these points by using the formula:

$$Z_O = \sqrt{Z_R \times Z_S} \quad or \quad \frac{Z_O}{Z_R} = \frac{Z_S}{Z_O}$$

where Z_O is the characteristic impedance of the feeder, Z_R is the antenna feed impedance, and Z_S is the impedance on the feeder at points spaced at odd numbers of quarter-waves from the antenna. In the example shown

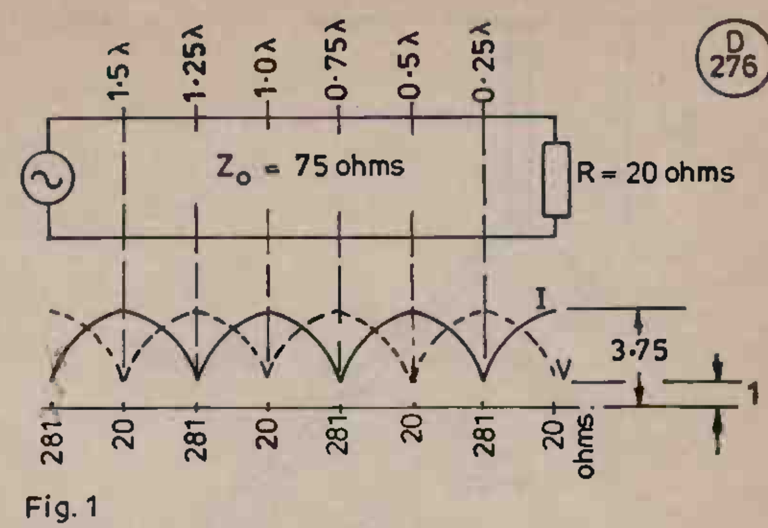


Fig. 1. Standing waves on a 75-ohm feeder connected to 20-ohm resistive load.

in Fig. 1, therefore, the impedance at these points is 281 ohms. Hence, had we been faced with the problem of feeding the 3-element Yagi with a feedpoint impedance of 20 ohms, we could have simply attached a quarter-wavelength of 75-ohm twin feeder to the antenna feed-point and then attached 300-ohm twin feeder between the 75-ohm section and the transmitter, *see* Fig. 2a. The SWR on the 300-ohm feeder will be less than 1·1 : 1, (300/281), and the entire system will be very efficient, but it should be noted that the transmitter will probably not accept a balanced load of around 300 ohms, and we must use a matching unit at the transmitter end of the feeder.

An alternative method would be to use 75-ohm twin feeder all the way from the antenna to the transmitter, and ensure that the feeder is either an odd number of quarter-waves long (which will give an "input impedance" of 281 (ohms), or an even number of quarter-waves long which will give an input impedance of 20 ohms. Either load will be purely resistive, but in both cases we must use a matching unit to ensure that the transmitter "sees" an input impedance of around 50 or 75 ohms (see later section). With the latter case, however, losses are likely to be higher than with the previous method, as the higher SWR will lead to higher feeder losses, but, provided that the feeder will withstand the voltages encountered (*i.e.* the feeder is of good quality), this system will still be comparatively efficient.

A further example of this type of matching would be a vertical antenna with a feed impedance of 25 ohms—by using a quarter-wave of 50-ohm coaxial cable, we "invert" the impedance to 100 ohms ($50 = \sqrt{100 \times 25}$) —this example being briefly touched on in the article on feeders. If the antenna were simply fed with 50-ohm feeder, the SWR would be 2 : 1 (50/25), but by using a "50-ohm quarter-wave matching transformer", and then using 75-ohm feeder between this and the transmitter, we have an SWR of only 1·33 : 1 (100/75). This system is shown in Fig. 2b.

When multiples of half or quarter-wavelengths of feeder are used in impedance matching applications, it is obvious that the feeder's length must be accurately determined. When dealing with test instruments in a later article, we will see how to cut specific lengths of feeder, and this information will enable us to determine that our matching section will act efficiently. Feeders cut to these

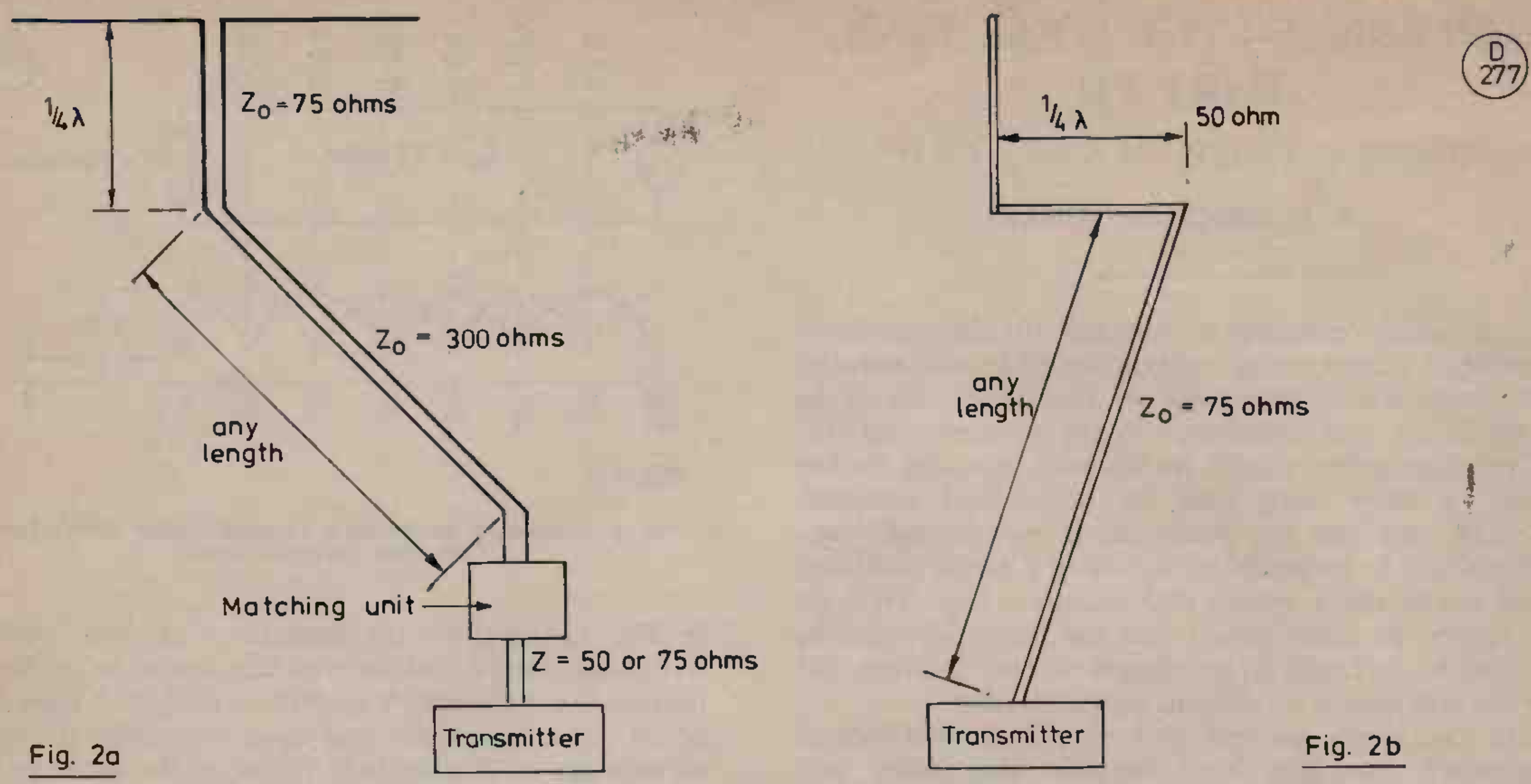


Fig. 2. (*a*) **Half-wave dipole using transformer of quarter of 75-ohm feeder ;** (*b*) **Vertical antenna using transformer of quarter of 50-ohm feeder.**

specific lengths are known as "tuned feeders", and due to the high voltages and currents which can be encountered when dealing with large degrees of mis-match, open-wire feeders are best for this application, as losses with this type are very low.

Matching at The Antenna

This is the most common point for impedance matching, as it ensures that the feeder will operate with a very low SWR, and hence with minimum losses. There are a large number of techniques available, and these will be discussed in turn.

Folded elements: Folding is a very efficient method of matching, and consists of attaching additional conductors between the two ends of the antenna to form arrangements such as those shown in Fig. 3. If one additional wire is added, there is an impedance transformation of 4 : 1, this being raised to 9 : 1 by using a total of three conductors. However, these ratios assume that the conductors are of the same diameter, and are positioned fairly close together; for conductors of different diameters—Fig. 3c—the spacing will affect the actual ratio, as will the ratio of the diameters of two conductors, and it is therefore possible to increase an antenna's feed impedance over a wide range of ratios.

This latter technique is applicable to the driven element of Yagi antennas, where the elements are normally constructed of tubing and an additional conductor clamped across its ends will be rigid and maintain the prescribed spacing from the driven element. With wire dipole antennas, the conductors can be spaced by means of spacers similar to those described in the article on feeders; or, for the two-conductor folded dipole, we can actually use a length of 300-ohm twin feeder-opening the centre of one conductor for feeding, and shorting the conductors at the end of the ribbon, *see* Fig. 3d. (*Note:* the ribbon is not being used as a feeder, there is no need to correct the length for the Velocity Factor).

Referring back to the 3-element Yagi discussed above, we can see that if we use a "folded" element instead of a "single" driven element, the feed impendance of 20 ohms would be raised to 80 ohms, and this would be a very good match for 75-ohm feeder, the SWR being 1·07 : 1 (80/75), and this technique is very frequently used for VHF/UHF beam antennas.

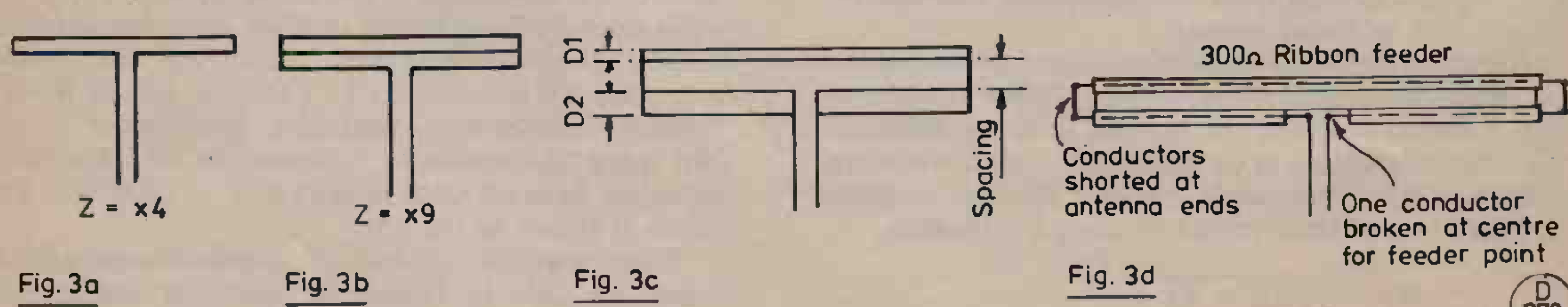


Fig. 3. (*a*) **Simple folded dipole ;** (*b*) **Three-conductor folded dipole ;** (*c*) **Folded dipole using conductors of different diameters. With this technique a wide range of impedance transformations may be obtained ;** (*d*) **The use of 300-ohm 'ribbon' feeder for the construction of folded dipoles.**

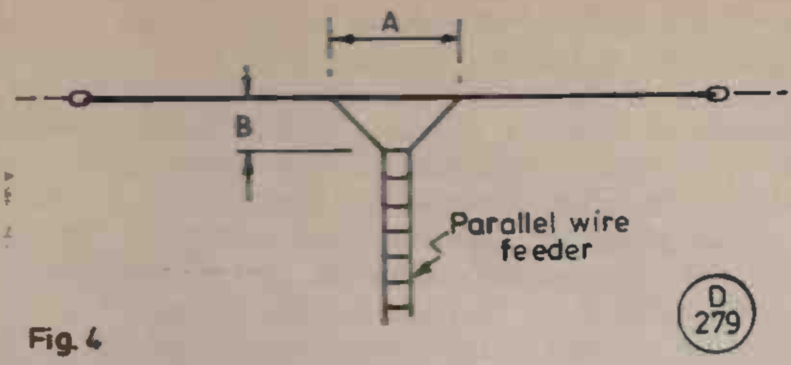


Fig. 4. The Delta Match; lengths 'A' and 'B' are discussed in the text.

A half-wave horizontal dipole for 1·8 MHz would usually be very low in terms of wavelengths above ground, a typical height being 50ft. (0·1 wavelengths). A typical feed impedance at this height would be around 30 ohms, and by using three conductors as shown in Fig. 3b, this figure would be transformed up to around 270 ohms, providing a very good match for 300-ohm twin feeder (SWR 1·1 : 1). Another alternative is to use a two-conductor folded dipole to give a feed impedance of 120 ohms (30 × 4) and insert a quarter-wave of 75-ohm feeder to "invert" this 120 ohms to 47 ohms, thus providing a virtually perfect match to 50-ohm feeder. However, a quarter-wave of feeder on 1·8 MHz is relatively long (about 90ft. with a Velocity Factor of 0·66) and the antenna may be too close to the transmitter for this method to be suitable. Information regarding the various impedance transformations which can be obtained by using conductors of different diameters, and at various spacings, can be obtained from the ARRL *Antenna Book*.

Antenna Height: In the earlier article in which we dealt with the factors which influence an antenna's feed impedance, we saw that the height above ground has a large effect, and impedance can be altered by raising or lowering the antenna. This is a method which is overlooked by most amateurs, but can be very effective in reducing feeder SWR. Its use may be somewhat limited when dealing with antennas such as Yagis or Quads, since, as they are fixed to masts or towers, their heights are usually governed by the physical height of these structures, and other methods of matching are far more suitable.

Consider, however, the case of a half-wave dipole on, say, 14 MHz, and assume that we intend mounting it at a height of 25ft. above ground: this height corresponds to an electrical height of around 0·35 wavelengths, and this will give rise to a feed impedance of around 100 ohms. By making the extra effort required to erect the antenna at a height of about 35ft. (a half-wave), a feed impedance of about 75 ohms will result, and we have a perfect match for 75-ohm feeder. It will be seen that this method of impedance matching has somewhat limited potential, but should not be overlooked when planning an installation.

The Delta Match: This method was mentioned in the article on feeders and relies simply on the fact that as the impedance of the half-wave antenna increases as we move outwards from its centre, we can pick the appropriate points at which the impedance is the same as the characteristic impedance of the feeder. It should be noted, however, that this method is only applicable to parallel-wire feeders—either open wire or 300-ohm "ribbon". The technique is shown in Fig. 4, and the major difficulty is in picking the points on the antenna which are of the required impedance.

For 600-ohm open-wire feeder, experiments have shown that for a half-wave antenna, length 'A' is about 120/f ft., and 'B' is about 148/f ft.—where *f* is the frequency in MHz. In practice, errors in placement are not too important since even if the actual impedance at the point of attachment of the feeder was 100 per cent in error (*i.e.* the impedance was 300 or 1200 ohms), the SWR on the feeder would only be 2 : 1; and as we have said, provided that we can couple the transmitter efficiently to the input end of the feeder, the losses caused by this SWR on open wire feeders are negligible.

Similarly, if we wished to use 300-ohm ribbon feeder (rather than the "folded" dipole configuration), we could use the Delta Match for this also. Data gathered by experiment at G3XAP suggests that for a 300-ohm feeder, lengths 'A' and 'B' should be around 70/f and 85/f respectively—again, the loss due to feeder SWR will be very low if the incorrect points are used. It is possible to detect the presence of standing wave on twin feeders (this will be discussed when we consider Test Instruments), and the purist can therefore adjust the Delta Match to obtain a near-prefect match. It should be recognised that as the feeder wires are "fanned out" at the antenna, they will radiate at this point owing to the reasons discussed in the article on feeders.

The T-Match: This is similar to the Delta Match, the difference being that instead of "fanning out" the feeder to the points of attachment on the antenna, rigid conductors are positioned parallel to the antenna, and the feeder is attached to the inner ends of these, *see* Fig. 5a. These rods however display inductive reactance and this must be cancelled out if the system is to present a purely resistive load. The antenna element can be shortened in order to obtain capacitive reactance, hence cancelling out the inductive reactance present, or capacitors can be inserted in the T rods to tune out the reactance—Fig. 5b.

It is not possible to be specific about the length and spacing of the T-rods and values of capacitance as these

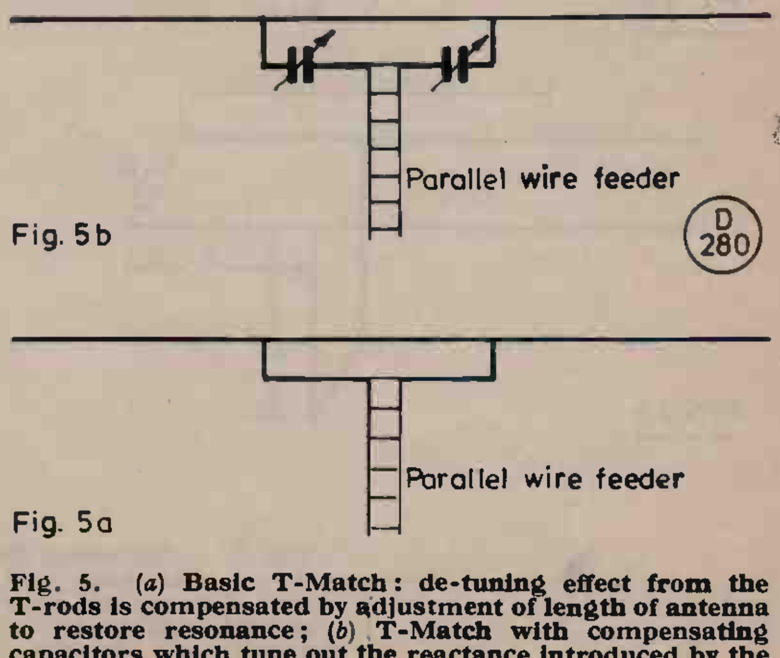


Fig. 5. (*a*) Basic T-Match: de-tuning effect from the T-rods is compensated by adjustment of length of antenna to restore resonance; (*b*) T-Match with compensating capacitors which tune out the reactance introduced by the T-rods.

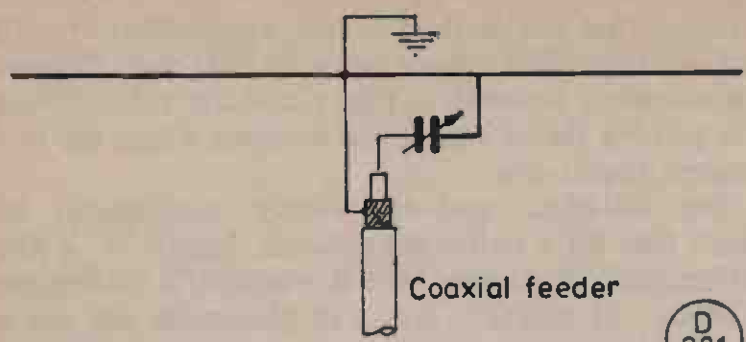


Fig. 6

Fig. 6. The Gamma Match: this technique permits a balanced antenna, such as an Yagi, to be fed with coaxial feeder. The feeder screen is connected directly to the centre of the driven element, which should be earthed at its centre.

will vary considerably from one antenna to another. The T-match is normally only used with rigid antenna elements (such as beam antennas), as movement of the rods and the antenna in relation to one another will cause a detuning of the system.

The Gamma Match: The basic Gamma Match is shown in Fig. 6, and it will be noted that it can be considered as "half a T-match"! The Gamma Match permits a balanced load (*e.g.* the driven element of a Yagi) to be fed with an unbalanced feeder and is commonly used for single-band Yagi antennas. The placing of the Gamma rod in close proximity to the driven element can have the effect of detuning the array from its design frequency, and there is a tendancy to tune the Gamma capacitor to give minimum SWR on the feeder at the original design frequency. The correct procedure is to either adjust the array dimensions to restore resonance at the desired frequency, or to carry out the Gamma adjustments at the new resonant frequency. By varying the length of the rod and the value of the capacitor it is possible to obtain a virtually perfect match to either 50 or 75-ohm coaxial feeder. The actual method of adjustment will be discussed in a later article.

Stub Matching: Referring back to Fig. 2a, we saw that the value of impedance on the quarter-wave of feeder varied from 20 ohms (at the feedpoint) to 281 ohms (at the end of the quarter wave). At any point between these two extremes the impedance will be somewhere between these two values, and therefore, there must be a point where the impedance is 75 ohms—the characteristic impedance of the feeder from which the matching section is constructed! We can therefore make use of this fact and feed at this point with 75-ohm feeder; but, since the actual length of feeder between this point and the antenna is less than a quarter-wave, the 75-ohm point will also display reactance, which must be cancelled out. This is done by introducing another reactance at this point which is equal in value but opposite in type (*i.e.* inductive or capacitive) to that which we wish to cancel.

This reactance is introduced by means of a "stub" of feeder, and Fig. 7 shows the arrangement for the two cases in which the antenna's feed impedance is (*a*) lower than the feeder's characteristic impedance and (*b*) where it is higher. Fig. 7a shows how the method can be used with coaxial feeder—the actual case shown being that for a ground plane antenna. We require, however, to calculate the lengths 'A' and 'B' shown in the diagrams, and this is done by use of the following formulae:

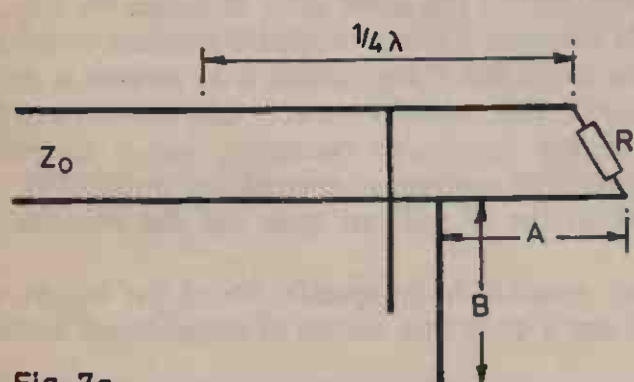


Fig. 7a

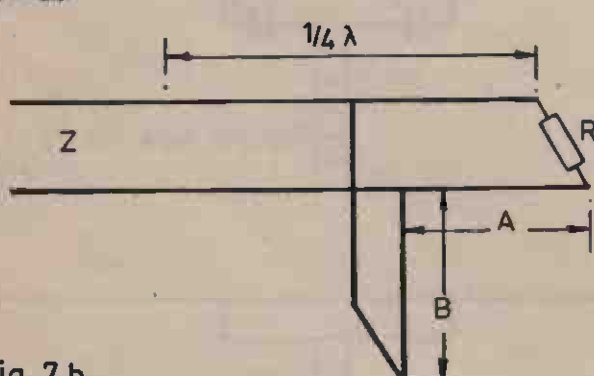


Fig. 7 b

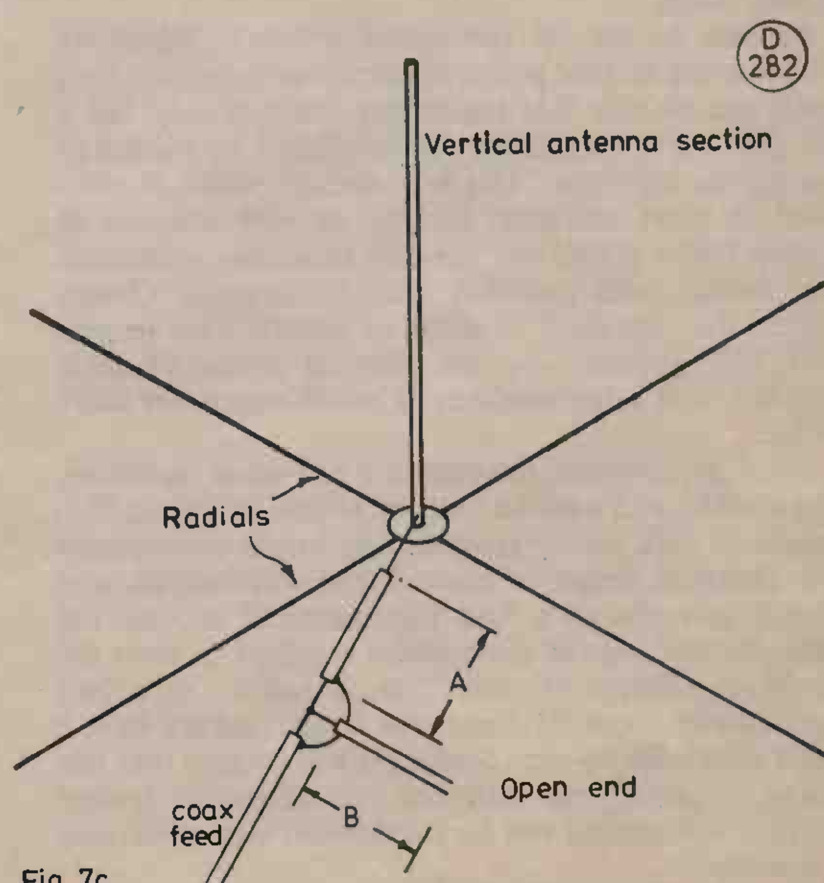


Fig. 7c

Fig. 7. (*a*) Matching with open stub, where R is less than Z_o; (*b*) Matching with closed stub, where R is greater than Z_o; (*c*) Stub matching for a ground-plane antenna using coaxial feeder. As the feed impedance is lower than the feeder's characteristic impedance, an open stub is employed.

If Z_R is greater than Z_O (closed stub),

$$\tan A = \sqrt{SWR} \quad \ldots \quad (1)$$

$$\cot B = \frac{SWR - 1}{\sqrt{SWR}} \quad \ldots \quad (2)$$

and, if Z_R is less than Z_O (open stub),

$$\cot A = \sqrt{SWR} \quad \ldots \quad (3)$$

$$\tan B = \frac{SWR - 1}{\sqrt{SWR}} \quad \ldots \quad (4)$$

These formulae give lengths in electrical degrees, and to convert these to wavelengths, we can use the formula:

$$\text{Length (wavelengths)} = \frac{\text{Length (degrees)}}{360} \quad \ldots \quad (5)$$

We must then take into account the Velocity Factor of the feeder in order to arrive at the physical lengths required, and we do this by use of the formula:

$$\text{Length (feet)} = \frac{985 \times VF \times \text{length (wavelengths)}}{f} \quad \ldots \quad (6)$$

where VF is the Velocity Factor and f is the frequency in MHz.

Let us now consider the case shown in Fig. 7c, and assume that the antenna's feed impedance is 20 ohms, that we wish to use 75-ohm coaxial feeder with a Velocity Factor of 0·66 and that the antenna is resonant on 14·100 MHz. The SWR is 3·75 : 1 (75/20), and from equation (3) and (4) we find that cot A = $\sqrt{3{\cdot}75}$ = 1·94, and hence A = 27·3°, tan B = 2·75/ $\sqrt{3{\cdot}75}$ = 1·42, and so B = 54·9°. (The actual values of 'A' and 'B' in degrees are obtained from Mathematical Tables). Using formula (5), we arrive at lengths of 'A' and 'B' of 0·076 and 0·153 wavelengths respectively, and from formula (6) we find that the physical length of 'A' is 3·50 feet, whilst 'B' is 7·05 feet.

Antenna Length: The feed impedance of an antenna is dependent on its length, and we can therefore change the value of feed impedance by simply changing the antenna length. However, this gives rise to a non-resonant condition, and the reactance introduced must be cancelled out. For example, a quarter-wave vertical antenna mounted over an efficient earth system will have a feed impedance of around 25-30 ohms, and this can be raised to 50 ohms or to 75 ohms by making the electrical length of the antenna about 102° (0·28 wavelengths), or 113° (0·32 wavelengths) respectively. The reactance introduced is cancelled out by insertion of a variable capacitor at the feed point, as shown in Fig. 8. Tuning of this system consists of adjusting the capacitor until a minimum value of SWR is present on the feeder.

In addition to the methods discussed for impedance matching at the antenna itself, there is another technique available, namely matching with Lumped Constants. If the resistive and reactive components of an antenna's feed impedance are known, it is possible to make up a network that will both remove the reactance and perform the required impedance transformation. This network consists of inductances and capacitors, and these may be connected in series and/or parallel depending upon the actual conditions to be corrected. However, the author has omitted this technique for the following reasons:

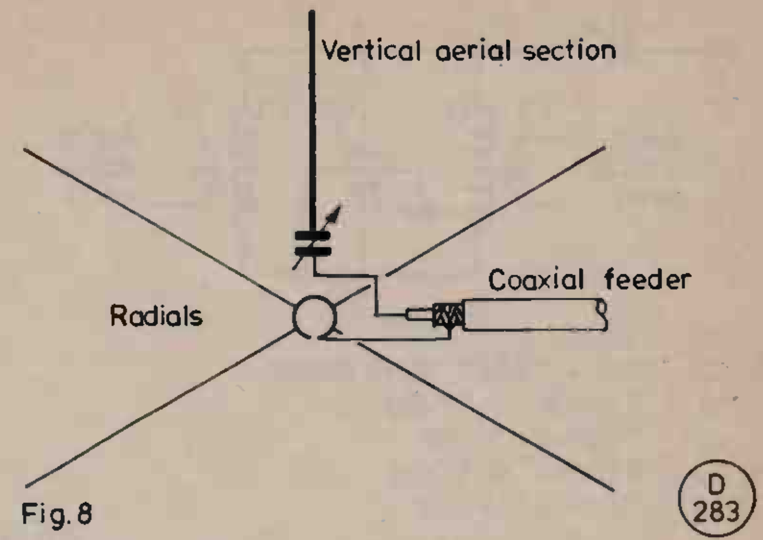


Fig. 8. Matching a ground-plane's feed impedance to the feeder by making the antenna's length greater than a quarter-wave; the reactance is removed by inserting the series capacitor. For details of lengths, *see* text.

(*a*) The average amateur does not possess equipment which will enable him to obtain the required values with sufficient accuracy.

(*b*) The subject is beyond the scope of this series.

(*c*) Having used the technique fairly extensively, the author believes it to be inferior to the methods discussed above. Resonance is the most important property of an antenna, and this state is best achieved by the simple methods already described, namely adjustment of antenna length or the insertion of simple tuning components such as the series capacitor.

However, readers wishing to gain a full appreciation of all the techniques available are urged to read further on the subject, and most antenna books include a section on Lumped Constants.

Matching at The Transmitter

As stated earlier (in the article on feeders), energy reflected from the antenna back into the feeder owing to an impedance mis-match is not lost *provided that the transmitter can be efficiently coupled to the input end of the feeder*. Losses resulting from the presence of standing waves are solely associated with the "real" resistance of the conductors comprising the feeder, and leakage between the feeder conductors through the dielectric. Because of this, if we wish to operate a system that accepts the presence of standing waves, we should use 'low-loss' feeders—preferably of the high impedance open-wire type. Modern transmitters (and receivers) are designed to match into low impedance coaxial cable (50 or 75 ohm), so a versatile "antenna matching unit" should be capable of accepting power from the transmitter through low impedance unbalanced feeders, and coupling it to the input of either balanced or unbalanced feeders, with input impedances varying from as little as 10 ohms to values of several thousand ohms. It is very important to understand right from the outset that a matching unit installed at the transmitter end of the feeder merely enables power to be transferred into the feeder—*it will not correct the standing waves present on the feeder, and in no way can it improve the efficiency of the antenna/feeder system.* The actual functions carried out by the matching unit are as follows:

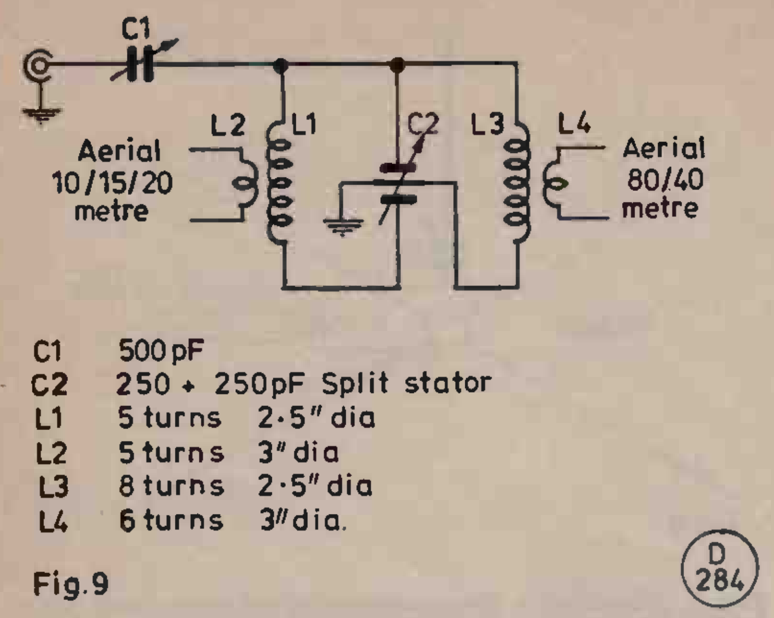


Fig. 9. **The HF antenna matching unit mentioned in the text; note that L1 is mounted inside L2, and L3 is mounted inside L4. More detailed constructional information is contained in the RSGB** ***Radio Communication Handbook*****.**

(*a*) It permits power to be fed efficiently into the feeder.
(*b*) It prevents power reflected back from the antenna from reaching the power amplifier of the transmitter.
(*c*) It provides a balun action.
(*d*) It reduces the quantity of harmonics and other *spurii* generated by the transmitter which is radiated either from the antenna or from the feeder.

Many designs for matching units have been evolved, and it is not practical to detail them all. However, a very versatile unit is that described in the RSGB's *Radio Communication Handbook*, and details are given in Fig. 9. This has been found to function extremely well with many different antenna types, and the author can certainly recommend it, having used one for around 10 years. Although designed to accept balanced feeders, it has been found that if coaxial cable is used, the inner may be connected to one end of the input coil, the other end of the coil being connected to earth along with the screen of the feeder, and the unit still functions very effectively. There are, of course, many other designs of matching unit, and these can be found in practically any book on Amateur Radio.

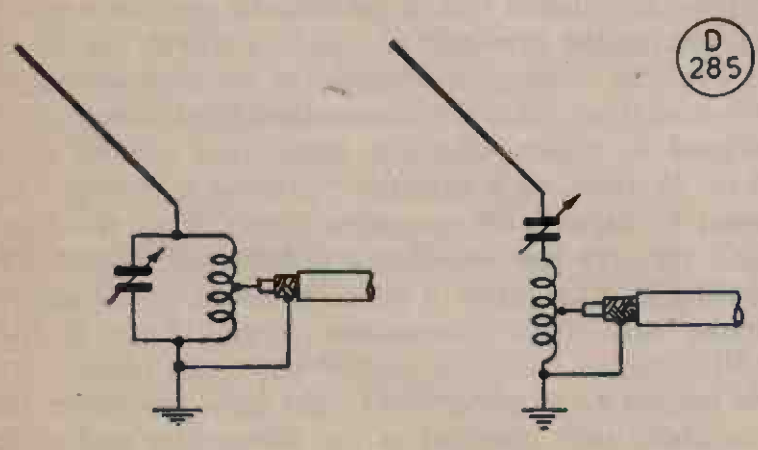


Fig. 10. **(*a*) Tuner unit for use with end-fed antennas whose length is a multiple of a half-wave (parallel-tuned circuit); (*b*) Tuner unit for use with end-fed antennas whose length is an odd multiple of quarter-waves (series-tuned circuit).**

Matching at the transmitter location is also necessary when an end-fed wire is used, with the end of the wire brought right down to the transmitter. Antennas of this type are easiest to match if their length is such that the wire is either a quarter or a half-wavelength long at the *lowest* frequency at which it is to be used. For example, a wire approximately 135ft. long will be about a quarter-wave long on 1·8 MHz, and multiples of half-wavelengths on all the other bands from 3·5-28 MHz. With such a wire, there is little reactance present and tuning is simplified—tuners suitable for such antennas are shown in Fig. 10. Note that there are two very important points to be aware of with end-fed quarter-wave antennas: firstly, they are fed at a point of high current (low impedance) and an efficient earth is essential if the antenna is to be efficient; secondly, because this high-current portion of the antenna is also the portion from which maximum radiation occurs, and because this portion is actually inside the shack, the station equipment can become "covered with RF" if each item is not efficiently earthed.

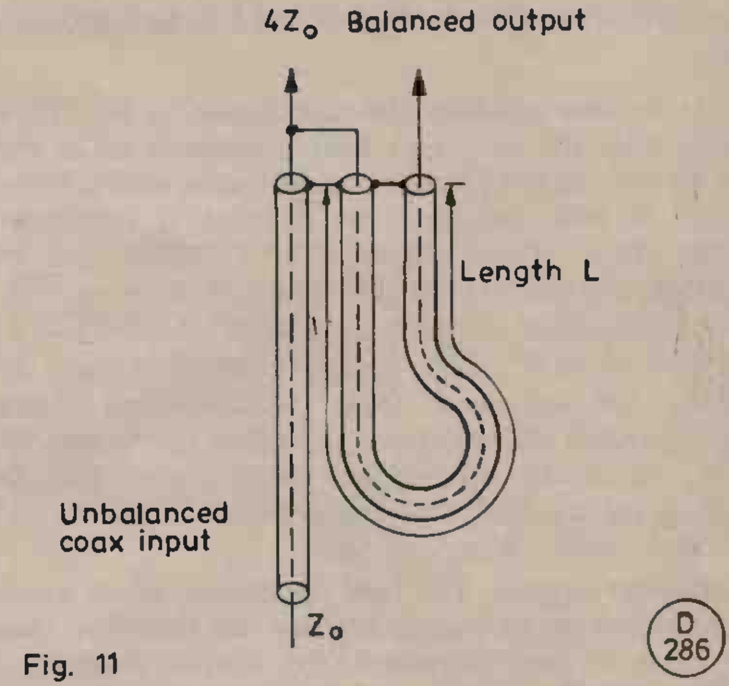


Fig. 11. Coaxial balun giving an impedance transformation of 4 : 1 ; length 'L' is a half-wave on the frequency for which the balun is designed, and must take into account the Velocity Factor of the coaxial cable used.

For tuners of the type shown in Fig. 10, most efficient power transfer will occur if the ratio of inductance to capacitance is kept within certain limits—if the value of capacitance is around 1 to 2 pF per metre of wavelength, the ratio will be sufficiently close to the optimum. When antennas of this type were used at G3XAP, two tuners were used—one for 1·8, 3·5 and 7 MHz, and one for 14, 21 and 28 MHz—because, if a single tuner is used for all six bands, on the higher frequencies (especially on 28 MHz) it will be found that the adjustment of the variable capacitor becomes very critical, and only a small number of turns of the coil are required; therefore it is very difficult to maintain the correct L : C ratio. With suitable switching, it is possible to rapidly convert the tuners from parallel to series operation as the need arises. Details of tuning of antennas with the matching unit located at the transmitter-end of the feeder (or antenna) will be discussed in a later article.

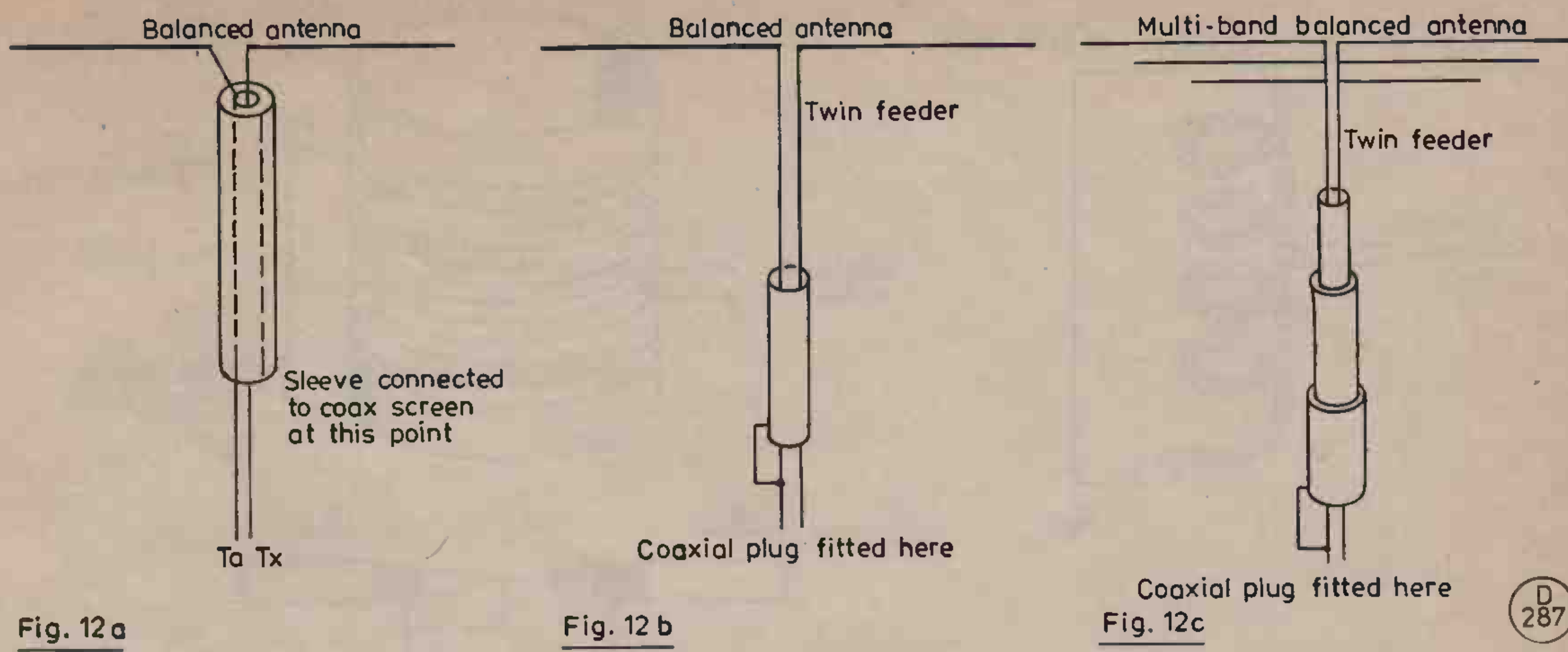


Fig. 12. (*a*) Coaxial-sleeve balun permitting balanced antenna to be fed with coaxial feeder; the coax inner conductor is connected to one side of the antenna, and the screen to the other; (*b*) Coaxial-sleeve balun used at transmitter end of twin-feeder permits use of coaxial plug for connection to transmitter, matching unit, SWR bridge etc. One feeder conductor plus the sleeve are connected to the shell of the coax plug, the other feeder conductor is connected to the centre pin of the plug; (*c*) Multi-band balanced antenna with concentric sleeve baluns for each frequency. The sleeves are connected together at the end where the plug is fitted, and the plug is fitted in the same manner as with the single-band version.

It should be noted that even if the SWR on the feeder is 1 : 1, it is still good practice to use a matching unit because the Q of a typical HF transmitter's output pi-network is around 10—15, and this is not sufficient to suppress all unwanted signals—the matching unit will provide useful additional protection.

Baluns

As has been mentioned already, the use of an unbalanced (coaxial) feeder with a balanced antenna should be avoided unless a balun is inserted at the feed point. Many operators use dipole antennas with coaxial feeder and apparently experience no ill-effects, but it is a fact that the overall efficiency of the system will be improved if a balun is fitted. In the article on feeders, it was stated that one of the advantages of coaxial cable is that the "residual radiation" from the two conductors is contained within the cable itself, but this is only true if the feeder is used with an unbalanced antenna, or with a balanced antenna with balun. Baluns take several different forms: some are single-band, resonant devices, whilst others are broad-band; some baluns provide an impedance transformation whilst others are 1 : 1 devices. We will discuss the various types in turn:

4 : 1 Coaxial Balun: This device is shown in Fig. 11 and provides a 4 : 1 impedance transformation as well as balun action. A folded dipole with a feed impedance of 300 ohms may be fed with 75-ohm coaxial cable by inserting such a balun at the feed point. However, on the lower frequencies, such a device becomes physically large (a half-wave of coaxial cable with a Velocity Factor of 0·66 will be 90ft. long on 3·5 MHz!); together with the fact that they are resonant, and hence single-band devices, these baluns are not often used by amateurs.

Coaxial Sleeve Baluns: This 1 : 1 balun is simple to construct, consisting of a quarter-wave sleeve fitted over a section of feeder. Fig. 12a shows how such a device can be used to feed a half-wave dipole with coaxial cable, whilst Fig. 12b shows how such an antenna, fed with balanced feeder, can be converted to an unbalanced state for connection to a transmitter or SWR bridge with unbalanced input. The sleeve can be made from the braid of old coaxial cable and is easily fitted by bunching it up and smoothing it out after fitting. This is also a single band device, but W6SAI (in many of his publications) suggests that sleeve baluns can be mounted over each other for multi-band antennas, *see* Fig. 12c. This has been tried at G3XAP with satisfactory results on a 3-band Cubical Quad fed with 75-ohm twin feeder. Note that the quarter-wavelength does not take any Velocity Factor into account—it is the free-space quarter-wave.

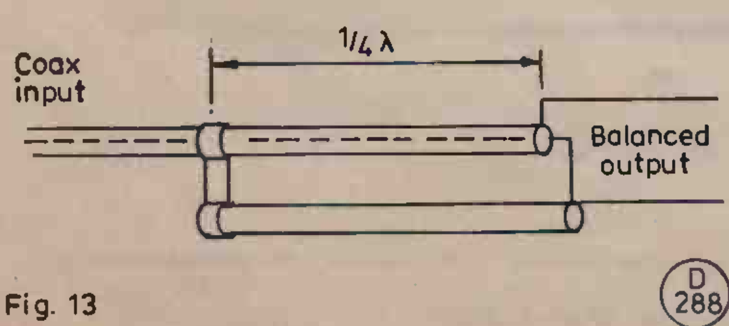


Fig. 13. Quarter-wave open balun or Pawsey stub.

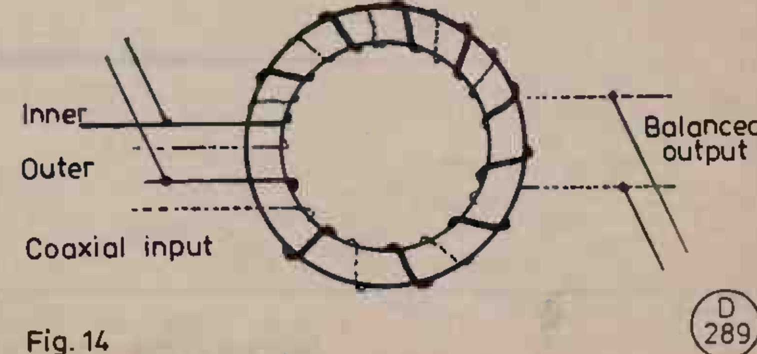


Fig. 14. Broadband toroidal balun.

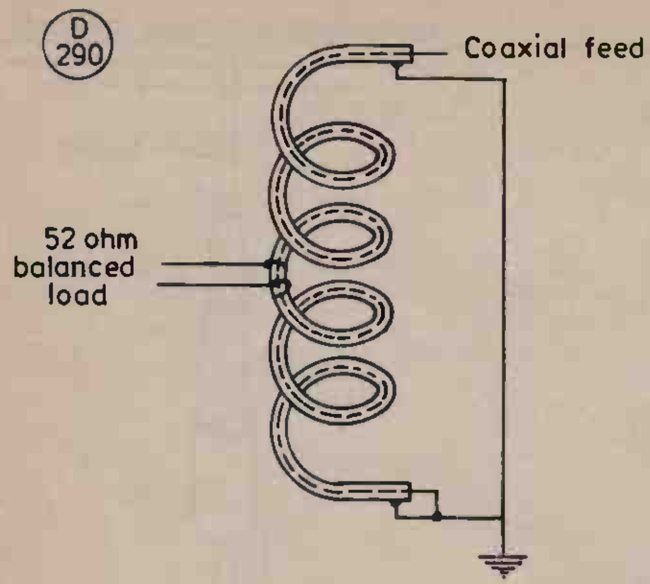


Fig. 15a

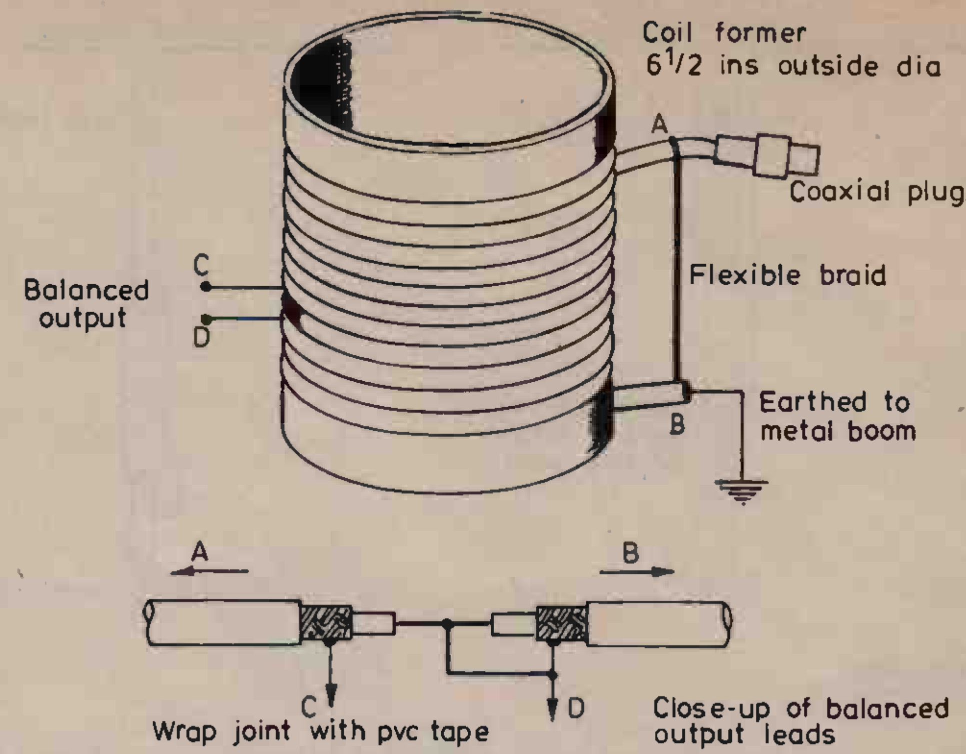


Fig. 15 b

Fig. 15. (*a*) **Broadband coaxial balun;** (*b*) **Broadband coaxial balun.**

The Pawsey Stub: This device—also known as a quarter-wave open balun—is closely related to the sleeve balun, and is also simple to construct. It is shown in Fig. 13 and, again, it is a single-band, 1 : 1 device.

Torroidal Baluns: These are broadband devices, but are somewhat more complex than those described above. As can be seen from Fig. 14, they consist of bifilar windings on a torroidal core and have the advantage of being very light and compact. However, the choice of material for the core is extremely important, as low quality cores can give rise to large losses—especially on the higher frequency bands (21 and 28 MHz). These devices are available in kit form and ready-made, and in spite of the fact that G3XAP is very much a "do-it-yourself" antenna man, it is suggested that this is one area where purchase is probably better than construction.

The Coxial Broad Band Balun: Figs. 15a and 15b show this device, and was taken from W6SAI's *Beam Antenna Handbook* (3rd Edition). Again, this balun has been used at G3XAP with satisfactory results. It consists of a 16ft. 6in. length of coaxial cable coiled up into a 9-turn coil, the outer ends forming a coaxial input, and the centre-point being used for a balanced output—after suitable modification, as shown in Fig. 15b.

Summary

The above list of matching techniques does not pretend to be exhaustive—there are many omissions such as impedance matching by the use of "lumped constants." The author has found, however, that there is a lot to be said for the old axiom "keep it simple", and an amateur attempting to use complex techniques can cause more problems than he cures!

It should now be apparent to readers that if we are able to establish that our antenna is resonant and what its feed impedance is, there are a number of ways in which we can match it to a feeder and hence be assured that our transmitter's output power is being radiated. The next article will therefore deal with test instruments, and the sensible interpretation of the results obtained from them.

Finally, it cannot be overstressed that the peace of mind resulting from knowing that the antenna/feeder system is acting in an efficient manner is well worth striving for!

to be continued

March issue will appear on Friday, March 16th.

R.A.E. Q & A.

MODEL ANSWERS TO THE MAY 1978 EXAMINATION

IT should be noted that this set of answers is of academic interest only, as from May 1979 the format and the syllabus will be changed completely.

The examination was in two parts, failure in either part resulted in failure of the paper as a whole. The two questions in Part 1, both to be answered, carried 15 marks each. Any six questions from Part 2 were to be answered; they were worth 10 marks each.

PART 1

Qu. 1. The Amateur Licence A is subject to six specific limitations of use covering:
(*a*) situations in which the station may not be established;
(*b*) frequencies and classes of emissions to be used;
(*c*) operators and their qualifications;
(*d*) broadcast messages in the amateur service;
(*e*) use of radioteleprinter;
(*f*) language and content of these messages.
State these SIX limitations.

Ans. 1.

(*a*) Not in any dock, estuary or harbour, or in any aircraft or public service vehicle.

(*b*) Only within the bands listed in the schedule attached to the licence, with emissions specified in the schedule for the band in use. Use of spark is specifically forbidden.

(*c*) Operators should hold a current licence issued by the Secretary of State, or hold an amateur radio certificate. Such an operator is to sign the log for his contacts, and shall be at all times under the control and supervision of the licensee.

(*d*) No broadcast messages other than an initial call (CQ).

(*e*) Radioteleprinter to be at 45·5 or 50 baud speed only.

(*f*) No grossly offensive or obscene message may be sent; all message to be in plain language (save for procedural signals); to contain nothing in the nature of third-party messages, business, advertisement or propaganda; or for a religious, political, social or commercial organisation, or anyone other than the licensee and the person with whom he is in direct contact.

Qu. 2.

(*a*) At what percentage modulation should a double-sideband (A3) amplitude-modulated radio-telephone transmitter be operated for satisfactory communications?

(*b*) What is the effect on the radiated signal if a modulation depth greater than 100 per cent is used?

(*c*) Describe a method of monitoring an amplitude modulated signal in order that the desired depth of modulation is not exceeded.

Ans. 2.

(*a*) As great a modulation depth as is consistent with not exceeding 100 per cent modulation on peaks and, more important, on troughs; the latter in effect switches the carrier off for the period during which the signal exceeds 100 per cent modulation.

(*b*) Distortion of the radiated signal which reduces intelligibility, and which cause spurious signals to be generated, some of which appear in the pass-band but others spread out for many kilohertz on either side of the signal carrier which appear as "splatter" and essentially have the range of the signal proper. Thus they cause world-wide interference.

(*c*) Since the process of splattering just described is a departure from linearity of the output stage under modulation, it follows that the PA anode current will change with over-modulation. In practice a slight movement of the PA anode current will occur under proper modulation levels, due to the non-linearity of the valve characteristic and possibly also the power supply regulation, around two per cent of the standing anode current; over-modulation immediately causes a marked departure from the steady meter reading of anode current. Thus the requirement is to monitor the anode current and ensure it stays substantially constant: it being understood that the initial setting-up of the transmitter is of such nature that any serious faults such as parasitic oscillation or downward modulation have been corrected, before faith is placed in the anode current meter as a modulation indicator.

PART 2—Answer *any six* questions from this part. Each question to carry ten marks.

Qu. 3. (*a*) Describe how an electro-magnetic wave in the frequency band 3-30 MHz can be refracted and reflected by the ionospheric layers.

(*b*) What is meant by the term "Maximum Usable Frequency" (m.u.f.) with reference to long distance radio communication between two points on the earth's surface?

Ans. 3. (a) Radio waves in the specified frequency range are subject to bending (refraction) when they meet layers of ionised gas. The effect is analogous to the effect when a straight stick is dipped in water and appears to be bent at the air-water interface. The "critical frequency" is the highest one at which a signal sent up vertically will be returned to earth, and the m.u.f. is several times higher. There are several ionised layers, known as D, E and F layers, of which the latter splits on occasion into F1 and F2 layers. It is normally the F or F2 layer which does the work of bending, the D and E layers being mainly absorbers. Thus since all the layers are generated by the sun's rays, it follows that the lower bands are only useful for local (ground wave) contacts in daylight, but sustain long-range communication at night; while the effect of absorption by the D and E layers becomes less as frequency is increased, causing the higher frequencies to sustain long-distance communication by day. The latter fail at night when the m.u.f. drops and refraction ceases. As indicated, the ionisation occurs due to the sun. It is greatest at times of high sunspot count when m.u.f.'s rise on some paths to above 30 MHz. There are seasonal and monthly effects too.

(*b*) When the term m.u.f. is used practically, it refers to the highest frequency which will support communication between two specified points at a given time. The Optimum Working Frequency would be around 15 per cent lower in frequency than the m.u.f. to ensure the continuity of traffic despite momentary changes in m.u.f.

Qu. 4. (*a*) (*i*) What is meant by a linear amplifier?

(*ii*) Why is this type of amplifier necessary for high-power amplification in a single-sideband transmitter?

(*b*) What is the advantage of Class-AB1 operation of a linear amplifier device over Class-A or Class-B?

Ans. 4. (*a*) (*i*) A linear amplifier is one in which the output is a faithful reproduction of the input signal in all respects.

(*ii*) As the SSB signal is generated at low level, linear amplification is required to bring it up to the desired peak envelope power without further distortion.

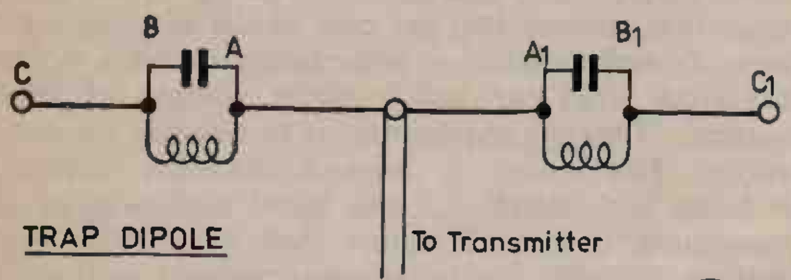


Fig. 1 To go with Question 5

(*b*) Class-A is good but inefficient in terms of power input for signal output; however it presents a constant high impedance to the driver stage. Class-B biases the grid almost to cut-off and drives the grid as far positively as can be done without distortion. Thus the input impedance seen from the driver stage varies markedly over the cycle, from high to low impedance; this often causes the *driver* stage to distort and so signal quality deteriorates. Class-AB1 biases the valve further back than Class-A, but not as far as Class-B; in addition it is not allowed to run into any significant degree of grid current, so that the driver stage will not see a changing load. An additional benefit is that the onset of grid current can be monitored and used electronically to reduce the system gain (ALC) thus reducing distortion due to over driving the transmitter.

Qu. 5. (*a*) Describe with the aid of a sketch a dipole aerial using wave-traps (tuned rejector circuits) to enable it to be used on two or more harmonically-related frequency bands.

(*b*) Describe the action of the wave-traps.

Ans. 5. (*a*) See Fig. 1. The aerial may be imagined to be for 1·8 and 3·5 MHz. Section A-A' and the feeder will act as a normal dipole on 3·5 MHz. The traps B, B' are resonant at 3·5 MHz and so no energy will pass them; thus sections B-C and B'-C' are not energised. Now we may look at 1·8 MHz. As we are well below the resonant frequency of the traps, they "look" like inductors, and they load the aerial such that the resonance at the lower band is achieved with a shorter length of wire than the length predicted by the usual formula:

$$L = \frac{468}{F}$$ feet, where L is the total length of the aerial, broken at the centre for feed, and F is the frequency for which the aerial is to be designed. The shortening results in a reduction in bandwidth and a slight loss of signal on the lower band, which is a small penalty to pay for multiband operation with one centre feed line and low VSWR.

(*b*) It is almost impossible to describe the action of the wave-traps further; and as will have been noted above, the traps serve as electrical isolators so that on each band the required lengths of wire are energised.

Qu. 6. Fig. 2 shows the IF and detector stages of a receiver. With the aid of this diagram.

(*a*) explain the purpose of automatic gain control (AGC).

(*b*) state the method of obtaining AGC and describe the action of the AGC system in the given circuit.

Ans. 6. (*a*) The object of the exercise is to try and obtain a constant level of AF output across the track of VR1, despite variations in the level of the IF signal injected into the left-hand transformer.

(*b*) Signal is detected at diode D, the RF component decoupled off and AF is presented to R5 and VR1 in series. R5 is a low resistor, of the order of a few hundred ohms, VR1 around 5K. The AGC line is taken off at the junction of these two, and further decoupled at C9 before passing through R6 and C6. At this point the time constant is such that all the AF is filtered off and the remainder is a voltage level corresponding to the level of signal observed at the diode D, and of such polarity as to tend to reduce the gain of TR1 when it rises, and to increase gain when there is little signal output from D. Thus the output level at audio fed from VR1 is kept steady despite changes due to fading.

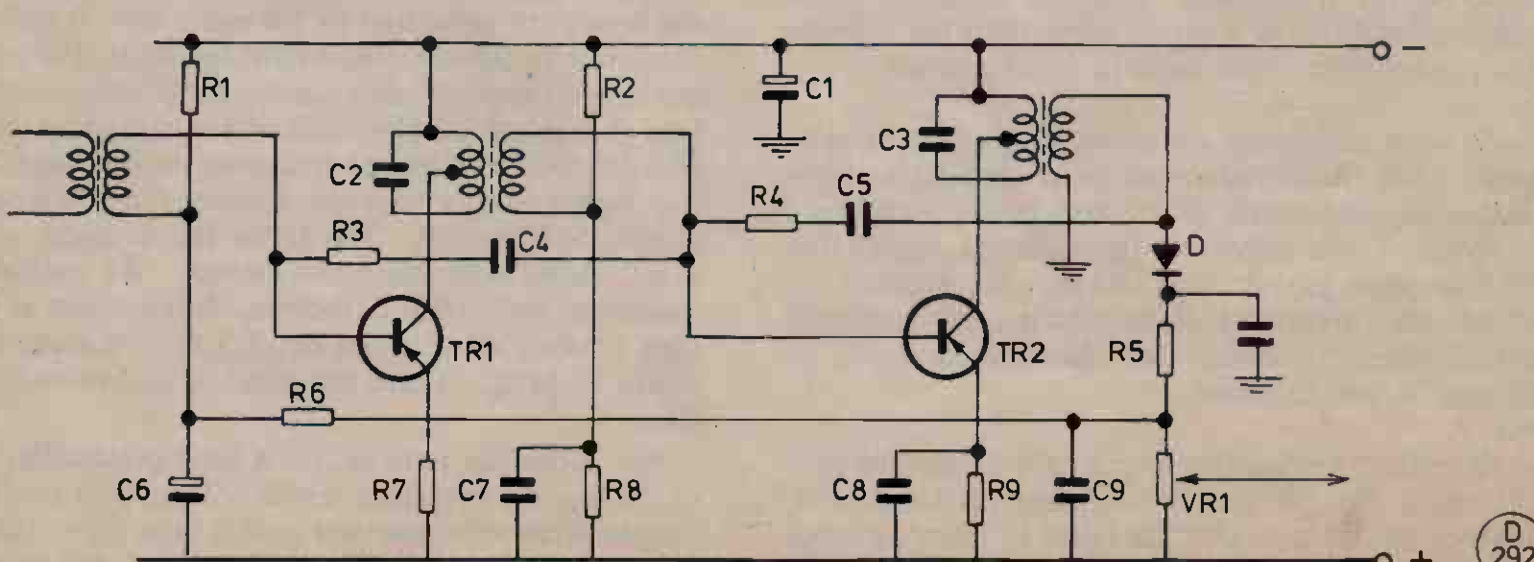


Fig. 2 To go with Question 6

Qu. 7. (*a*) State a typical use for each of the following types of capacitor:

(*i*) Silvered mica
(*ii*) paper dielectric
(*iii*) electrolytic.

(*b*) Which one of these types requires a DC polarising potential and why is this necessary?

(*c*) What is the total capacitance of three capacitors of 1 microfarad, 2 microfarad and 3 microfarad which are connected

(*i*) in series
(*ii*) in parallel.

Ans. 7. (*a*) (*i*) In RF circuits where there may be some power—for example the coupling capacitor between the anode of a PA valve and its shunt-fed tank circuit.

(*ii*) Paper dielectric is all but obsolete, being replaced by various plastic foil constructions. It was used in high voltage power supply smoothing where electrolytics were inadequate, and was also found as decoupling capacitor for valve IF stages around 465 kHz.

(*iii*) The electrolytic contains a high capacitance in a small volume, the dielectric being a layer of oxide only a few microns thick. However, the dielectric is chemically formed by voltage—*see* below. It is used in power supplies, and for coupling and decoupling in audio amplifiers.

(*b*) The electrolytic; as its name implies the dielectric is formed by the presence of a DC voltage, and the dielectric tends to disappear in storage. Thus the capacitor needs continual "forming" by having DC volts across it in service, and by re-forming from a high-impedance supply for an hour before use after storage. Although still polarised, the tantalum types are better in terms of shelf life and leakage current in service.

(*c*) (*i*) The relationship is:

$$1/C_T = 1/C1 + 1/C2 + 1/C3 \qquad (1)$$

Putting in values, we get:

$$1/C_T = \tfrac{1}{3} + \tfrac{1}{2} + 1/1.$$

$$= \frac{2 + 3 + 6}{6} \text{ or } 11/6$$

Inverting both sides, we get:

$$C_T = 6/11 \text{ microfarad, or } 0{\cdot}55\ \mu F.$$

(either the fractional or the decimal answer would be acceptable.)

(*ii*) $C = C1 + C2 + C3 \qquad (2)$

Whence C is 3 + 2 + 1

i.e. C = 6 microfarads.

Qu. 8. (*a*) (*i*) What is meant by an alternating current of sine waveform?

(*ii*) State *one* method by which such a current may be generated.

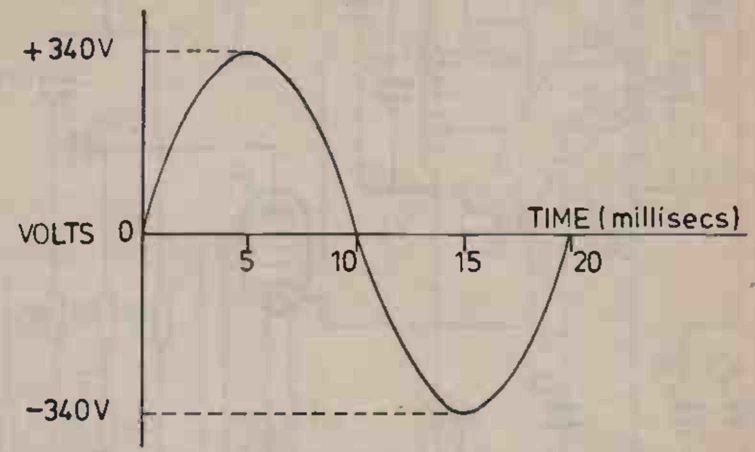
(*b*) An alternating e.m.f. has a peak value of 340 volts and a frequency of 50 Hz. Sketch a curve showing one cycle of this voltage and indicate the time after commencement of the cycle when maximum and minimum voltage values occur.

(*c*) What is the r.m.s. value of the voltage?

Ans. 8.

(*a*) (*i*) A sine wave is the curve traced out by the sine of an angle; when plotted over 360 degrees the result is one cycle of sine wave form.

(*ii*) A sine-wave may be generated by a Wien bridge oscillator to a close degree of accuracy. A rough approximation to a sine wave of current is the one delivered by the electricity mains supply.



One cycle of a 340V peak 50Hz sinewave
Fig. 3 To go with Question 8 D 293

(*b*) See Fig. 3. (*Ed. note:* strictly speaking one cycle may be considered as beginning from *any* part of the wave and continuing on for 360 degrees. However, it seems implicit in the wording of the question here that one is to regard the cycle as starting from zero, and it is so drawn in Fig. 3).

(*c*) 340 x 0·707 = *240 volts r.m.s.*

Qu. 9. With the aid of block diagrams explain the differences between the demodulation of double-sideband (A3) and single-sideband suppressed carrier (A3j) signals.

Ans. 9.

See Fig. 4. When the double-sideband signal reaches the detector, which is non-linear, the effect of the non-linearity is to separate the composite signal into its component parts, adding the two audio sidebands and passing them on, and passing the carrier component through decoupling and away—Fig. 1 of the exam.-paper (our Fig. 2—*Ed.*) shows such a circuit. In effect,

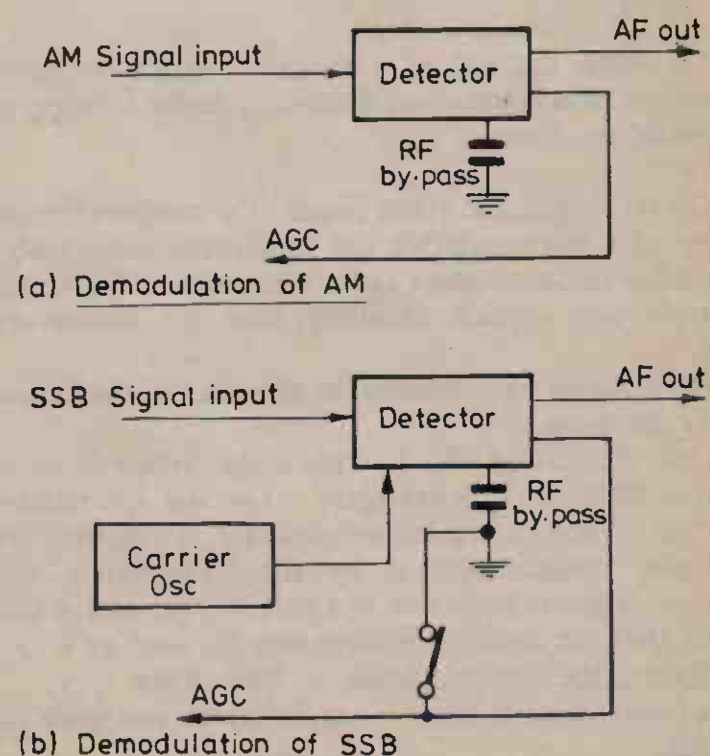


Fig. 4 To go with Question 9 D 294

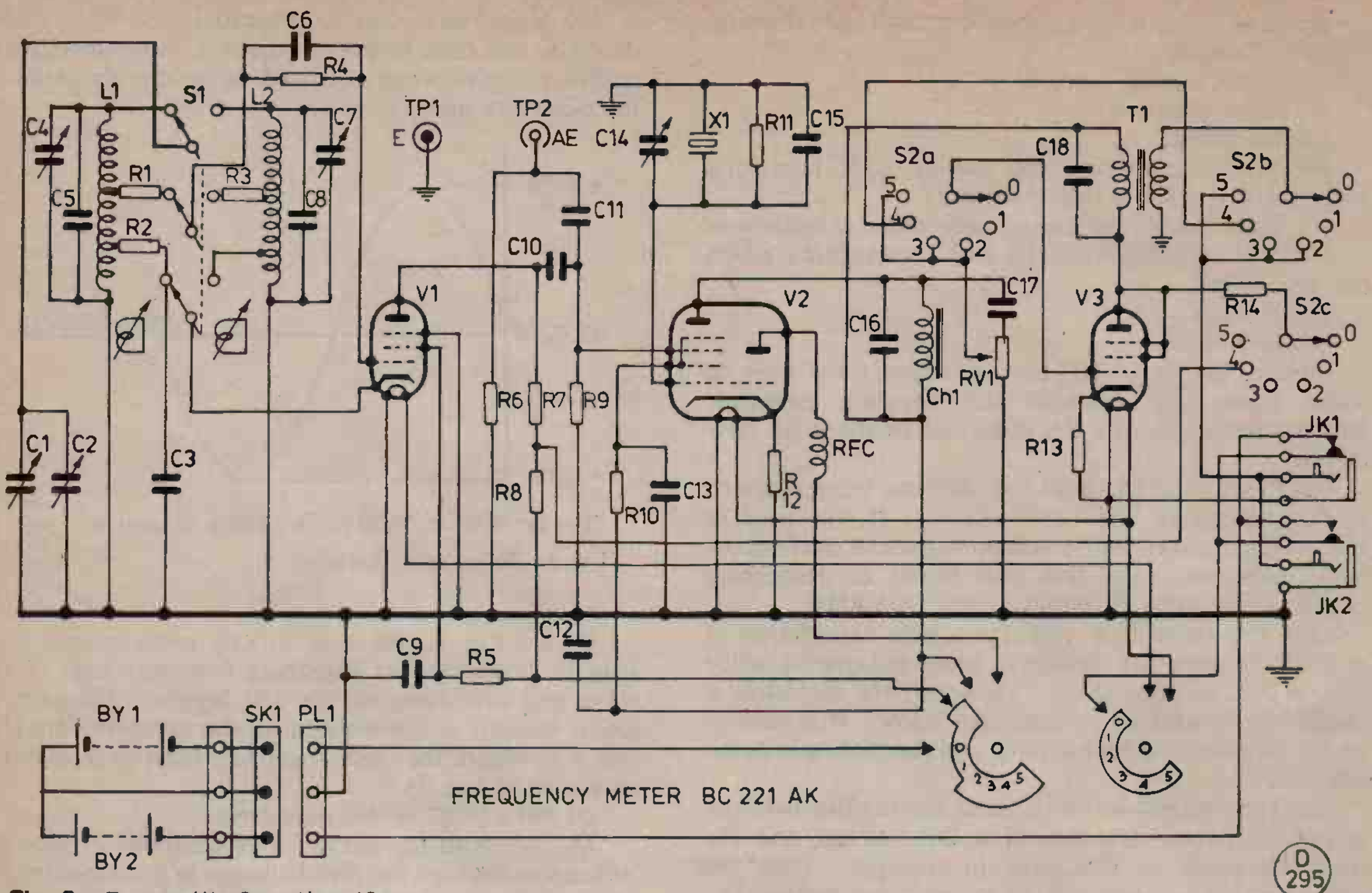


Fig. 5 To go with Question 10

the sidebands are separated by relation of their sideband frequencies to the carrier signal. If one now removes one sideband, nothing has been lost and the receiver can still cope; but when the carrier wave is also suppressed at source, one needs to reinsert a "carrier" into the system at the receiving end. This is usually done by switching on the receiver beat frequency oscillator and setting it to the correct relationship with the sidebands as judged by the ear.

Qu. 10. Answer *either*

(*a*) With the aid of a circuit diagram explain the operation of a heterodyne frequency meter incorporating a crystal oscillator.

or

(*b*) (*i*) Sketch the front panel of a modern frequency meter of a type suitable for measuring accurately the frequency of an amateur radio transmitter. Name all the controls and explain carefully how the instrument is used.

(*ii*) State on what factors the accuracy of the frequency meter depends.

Ans. 10. (*a*) See Fig. 5. This is the circuit of the well-known BC221-AK wavemeter. On the left-hand side will be found a variable-frequency oscillator, which has two ranges selected by the "Frequency Band" Switch. The middle valve is a mixer type, and it will be noted that the hexode portion can be used as a crystal oscillator, the crystal being a 1000 kHz type. The right-hand valve is an AF amplifier for use with headphones.

Operation is as follows. At least 15 minutes warm-up time is recommended; more is suggested from experience. The BC-221 is supplied with a set of calibration curves. Turn the wavemeter to 'Check' and tune the dial to the crystal check-point number as indicated by the calibration chart as being nearest to the desired frequency; the 'Corrector' knob may now be tuned to zero-beat with headphones plugged in. Now turn the function switch to 'Operate' and tune the dial to the desired frequency by the calibration chart. With a small piece of wire on the 'ANT' terminal, the transmitter may now be tuned to zero-beat with the BC-221 as heard in the wavemeter headphones.

Technically, the process is that the tunable oscillator is, after checking by beating with the crystal, *mixed with* the crystal, which will produce a spectrum of frequencies. Imagine the VFO portion tunes, say, 2-3 MHz; clearly at 2 and 3 MHz there will be check points with the crystal oscillator, and when they are mixed there will be a whole series of outputs from the mixer. If the VFO is tuned to 2·5 MHz there will be outputs from the mixer at 0·5, 1·5, 2·5, 3·5 MHz, and so on. Thus, although the heterodyne wavemeter is capable of high accuracy it has several responses and care must be used to ensure that the transmitter is tuned up on the correct band (using an absorption wavemeter) before locating the frequency accurately with the wavemeter. The BC-221AK version diagrammed has the extra facility that the signal may be modulated at a turn of the function switch, which is a very useful identification in receive applications.

(*b*) (*i*)

See Fig. 6. The front panel of the frequency meter (often loosely termed 'counter') may be as shown. A

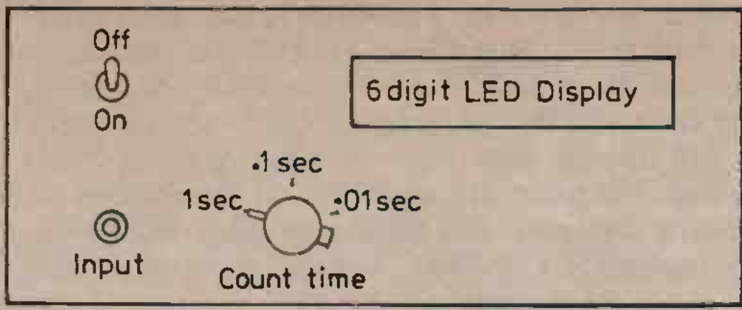


Fig. 6 To go with Question 10(b)

small pick-up loop may be arranged to give adequate signal to the counter; the transmitter radiates a continuous carrier and the meter reads this out digitally as a frequency.

(*ii*) The counter accuracy depends almost entirely on the accuracy of the master 'clock' crystal oscillator which defines the time for which the counter counts; another factor is the plus-or-minus one count in the last digit which results from the input to the chain staying at either logic 'O' or logic '1' at the commencement of the count. Additionally, presence of modulation will obviously confuse the counter. The higher the frequency the more accurate the clock count (this refers to the frequency of the clock). Assuming a six-digit counter, "over-range" may be used to obtain, say, an eight-digit read-out. This is done as follows: the clock period is set to 1 second, and a reading taken. The clock is then set to 0·01 sec. and another reading taken. Assume the frequency is 110 MHz; the 0·01 second count will show a series of zeros, while the 1·0 sec. count will show 110000; combining the two gives a count of 110 MHz plus-or-minus the error of the clock oscillator plus-or-minus one count; the machine is "over-ranged" on one count and losing two digits at one end, while the second reading will give the two missing digits but lose two at the opposite end.

The Digital Frequency Meter may have its range extended by a pre-scaler or a mixer stage; in the latter case the error inherent in the mixer stage must also be taken into account in assessing the worth of a measurement.

THE MONTH WITH THE CLUBS

By *"Club Secretary"*

WE must run straight on into the mail if we are to avoid space being taken up which could be usefully used for articles and projects—our Advertisers press us so hard for space!

Seriously, though, it is becoming important, if we are to be able to give worthwhile coverage of the hobby, that we keep space in this column down; and at the same time we would like to be able to help the club finances by so organising ourselves that a "serial entry" for the next few months can be accepted, thus saving the cost of postage each month. Mind, if your club feels rich enough to continue to send us a newsletter regularly, we would appreciate it. A serial entry for several months, though, *must* be validated by the name and address of the Hon. Sec., and give details of the pattern, *e.g.* 'first and third Thursday' plus the club Hq. address—maybe with a note on how to get there if it is a bit hard to find—and the name address and phone number (with both exchange and STD code where applicable) of a contact to whom we can refer enquiries. Usually this will be the Hon. Sec., but we do know of some cases where a different arrangement is preferred for any one of a number of good reasons. So—there it is, as and from next month; and we hope readers will pass the word to their club Hon. Sec., and get him to save some postage!

The Mail

First stop **Cornish,** at the SWEB clubroom, Pool, Camborne where on February 1, they have G3OCB talking about Home Construction. We could make a guess that with the escalation in the cost of living, many more people will be thinking about at least partly home-brew stations.

At **Melton Mowbray** they are based on the St. John's Ambulance Hall, Asfordby Hill, Melton Mowbray, where they will be found on February 16, to hear a talk about RTTY by G8RBY.

Change of venue is noted by the **Chiltern** group, having taken up an offer to hold their meetings at John Hawkins' furniture factory in Victoria Road, off Oxford Road—the A40—in High Wycombe. We see for February 28 they have a Junk Sale, and it is also noted that the new Hq. offers possibilities of a "brew-up" at some time during the evening.

B.A.R.T.G. is the one for all those radio amateurs and SWL's who are into the teleprinter mode. There is, of course the *Newsletter*' which is an effort any club could be proud of, both as to presentation and contents; not to mention the advertisements which indicate the way of getting hold of those hard-to-get bits for an RTTY station.

Now to **Sutton & Cheam,** who will be at Sutton College of Liberal Arts on February 16, and on February 28 they go to Ray's Social Club, London Road, North Cheam. For details about the programme, you will have to get in touch with the Hon. Sec.—*see* Panel for his address.

Another change of venue to be noted, this time at **Verulam** where the Hq. address is now the ex-Civil Defence Hall, Chequers Street Car Park, St. Albans.

Deadlines for "Clubs" for the next three months—
(*March issue—February 13th*)
April issue—February 23rd
May issue—March 30th
June issue—April 27th
Please be sure to note these dates!

It is here that the members will be heading on February 22, to hear Mr. D. Standley of the GPO, who will be talking about "Interference, its Causes and Cures." This should be of great interest and we recall one of their *Newsletters* years ago commenting that there was not a single member free of TVI on 14/21/28 MHz. The date for this is the fourth Thursday; in addition the second Thursday in each month is set aside for an informal at the R.A.F. Association in Victoria Street, St. Albans.

Again a change of Hq. address; this is a temporary one for **Chippenham,** at the Liberal Club, 20 Gladstone Road, Chippenham, where they can be found on Tuesday evenings.

Now to **Derby** and 119 Green Lane, Derby. February 7 is a Bring & Buy Sale, followed on 14th by a Night on the Air; February 21 sees a Cheese and Wine party, and they end up with a Film Show on 28th.

Worcester are still at the "Old Pheasant" in New Street, and they will be having a talk by G3PGQ on Using Transistors—a good hint to the lads to get building for the Home-Brew contest later in the Spring.

Into the West Country again, to **Exeter** and the Priory School in that city, where at 1400z on February 11, they will have a talk on WARC 79, by the Chairman o. the IARU Working Group, G3GVV. For more details, contact the Hon. Sec—*see* Panel.

Over the border into GW, to **Swansea** who report the change to a new Hq., which is Sketty Park Sports and Social Club, Aneurin Way, Sketty Park, Swansea, where they have a booking every other Tuesday evening. Details and dates are to be obtained from the Hon. Sec.—*see* Panel.

Although the **G-QRP Club** is, as its name implies, a group for the low-power merchants, one can safely say there is something here for *everyone;* the simple receiver that one can build for oneself, the simple one-band transmitter for this band or that, a bit about aerials, a collection of reprints of articles culled from the amateur radio press world-wide available to those interested, and a low membership sub. What more can one want? Oh, yes, apart from bumping in to one or other of the gang on the air, there is a meeting at least once a year in the tea-bar at the Leicester Show! Details from the Hon. Sec.—*see* Panel.

Cheshunt are at the Church Room, Church Lane, Wormley, every Wednesday evening. Look for Church Lane between the Queens Head and the Old Star on the A1170; the junction of the A1010 and A1170 puts you to the south of Church Lane; head north and it will be found on your left immediately after the "pelican" crossing. Once in Church Lane your target is on the left just before the river crossing. As to the programme it seems essentially to be an alternation of natter sessions and talks or film-shows.

A change of Hoc. Sec. is noted by **Dartford Heath D/F,** and is reflected in the Address Panel. They are "at home" on February 9 and 18; the former for a talk on map reading, and the latter for a D/F Hunt. However, we are not sure of the venue, for which we must refer you to the Hon. Sec.

Yeovil were in at the start of the transistor era, and they claim that the first DX contact was made by the club, G3CMH, and G3CAZ in Haslemere, a distance of 90 miles, on 3·505 MHz with some 30 milliwatts of power, on February 21, 1954. They are going to use this claim to mount three special activities: firstly to repeat, 25 years later *exactly* the original QSO—so we hope no-one will dispute their right to 3·505 MHz at 1340z on that day, February 21; secondly, on the evening of the following day they will have a detailed lecture by the club chairman, G3MYM, talking about the technical and historical aspects of the 1954 activity—February 22, Hut 101, Houndstone Camp, Yeovil. Finally, on the afternoon of February 25, G3CMH is going to come on the air with 30 milliwatts on Eighty, and there will be a special QSL for all the stations they work. Since this will be an equivalent of the original device, it will be a CW job. All from the Hq. address just mentioned. (*Ed. note:* while this may have been the first attempt at a reasonably long-distance QSO on 3·5 MHz, there had already been some interesting activity on Top Band; G5CV, G3CCA, and G3HMO immediately spring to mind, all on the air in 1953, one with solar power, and all reported in our pages at the time.) Lastly, we should mention that the group are at the address mentioned every Thursday evening.

At **Cheltenham** the address to look for is the Old Bakery, Chester Walk; February 1 for the visit of G3GKA, RR for RSGB Region 20, and February 16 for the Constructors contest.

It is some time since last we heard from the club in **Ashford,** Kent. They now have their meetings every Tuesday, at a Hq. at the top of Hart Hill, near Charing. By the sound of it they have a pretty well equipped set-up for the HF bands, at VHF and up into the UHF area.

Someone has thought of a delightful title for the talk on February 20 at **Reigate**—Logic for Illogical People! However, we have to refer you to the Hon. Sec. for the venue, as we also must for the informal meeting dates.

The **Maidstone YMCA** write in with the first mention of their Mobile Rally on Sunday, May 29; it is at the 'Y' Sportscentre, Melrose Close, Maidstone from 1100. This address serves also for the club's weekly gatherings. Enquiries in connections with the Rally go to J. C. Parker, 42 Mote Road, Maidstone (50350), while the Hon. Sec.—*see* Panel—carries the details of the normal meetings should you so require.

We have mentioned **IRTS Region 1** and their *Newsletter* many times in this column, and we still find it to be one of the best; a nice mix of personality news, club news and the technical stuff. Details from the Hon. Sec. at the address in the Panel.

It is the first Tuesday and the third Thursday in each month for **Chichester,** the Hq. being at Room 34A, Lancastrian Wing, Chichester High School for Boys, Basin Road, Chichester. February 5 is down as an Alignment evening, and on 15th, G4GVB will be talking about Marine Radio.

Now to **Hereford,** where they meet in the County Control, Civil Defence Headquarters, Gaol Street, Hereford, on the first and third Friday of each month.

Peterborough have a Junk Sale, at the Scout Hut, Occupation Road, on February 16, commencement at 7.30.

Every Tuesday you can find the **Northern Heights** group at the British Sub-Aqua Club, Mountain, Queens-

Names and Addresses of Club Secretaries reporting in this issue:

ACTON, BRENTFORD & CHISWICK: W. G. Dyer, G3GEH, 188 Gunnersbury Avenue, London W3 8LB. *(01-492 3778.)*
ADDISCOMBE: P. J. Hart, G3SJX, 42 Gravel Hill, Croydon, Surrey CRO 5BD. *(01-656 9054.)*
ASHFORD (Kent): J. A. Clarke, G3TIS, Yeomans Cottage, The Street, Brook, Ashford, Kent TN25 5PF. *(Wye 812888.)*
B.A.R.T.G.: J. P. G. Jones, GW3IGG, Heywood, 40 Lower Quay Road, Hook, Haverfordwest, Dyfed SA62 4LR.
BISHOPS STORTFORD: H. Allison, G3XSE, 89 Birchanger Lane, Birchanger, Bishop Stortford, Herts.
BURY: E. R. Thirkell, G4FQE, 59 Oulder Hill Drive, Bamford, Rochdale *(32730)*.
CHELTENHAM: G. Gearing, G3JJG, 158 Leckhampton Road, Cheltenham *(34287)*.
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. *(West Ashling 463.)*
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: S. T. S. Evans, G3VGO, "Glengormley," Carnon Downs, Truro, Cornwall. *(Devoran 864255.)*
CRAWLEY: A. V. H. Davis, G3MGL, 41 Gainsborough Road, Crawley *(20986)*, West Sussex RH10 5LD.
CRAY VALLEY: P. J. Clark, G4FUG, 42 Shooters Hill Road, London SE3. *(01-858 3703.)*
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. *(0332 56875.)*
EXETER: Mrs. M. Jefford, 29 Dukes Road, Budleigh Salterton, Devon EX9 6QL. *(03954 3735.)*
HEREFORD: S. Jesson, G4CNY, 181 Kings Acre Road, Hereford.
I.R.T.S. (Region 1): J. Ryan, EI6DG, 23 Dollymount Grove, Clontarf, Dublin 3.
MAIDSTONE YMCA: G. A. Hastie, 79 Rochester Crescent, Hoo, Rochester, Kent ME3 9JJ. *(Medway 251387.)*
MELTON MOWBRAY: R. Winters, G3NVK, 32 Redwood Avenue, Melton Mowbray *(3369)*, Leics. LE13 1TZ.
NORTHERN HEIGHTS: L. Cobb, G3UI, 27 Moorlands Crescent, Halifax *(60574)*, West Yorks.
PETERBOROUGH: L. Critchley, G3EEL, 36 Waterloo Road, Peterborough, Cambs.
G. QRP CLUB: Rev. G. Dobbs, G3RJV, "Willowdene," Central Avenue, Stapleford, Nottingham. *(Sandiacre 394790.)*
REIGATE: F. H. Mundy, G3XSZ, Westview, rear of Manor Farm, off Reigate Road, Hookwood, Surrey. *(Horley 73878.)*
SOUTHGATE: J, Fitch, G8EWG, 16 Kent Drive, Cockfosters, EN4 0AP. *(01-440 7353.)*
SOLIHULL: R. A. Hancock, G4BBT, 80 Ulleries Road, Solihull, West Midlands B92 8EE.
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, Gowerton, West Glamorgan. *(Swansea 873 986.)*
VERULAM: B. Pickford, G4DUS, "Netherwood," 130 The Drive, Rickmansworth *(77616)*, Herts.
WAMRAC: L. Colley, G3AGX, Micasa, 13 Ferry Road, Wawne, Hull, Yorks. HU7 5XU.
WORCESTER: M. Tittensor, G4EKG, 16 Durcott Road, Evesham, Worcs. WR11 6EQ.
YEOVIL: D. L. McLean, G3NOF, 9 Cedar Grove, Yeovil, Somerset.

bury, with an Alignment evening on February 13—a spectrum analyser will be in attendance along with G8CHN and G3TQA—and on 27th the Construction Competition will be judged. The dates in between will be natter sessions.

Now we have to trot along to **Solihull,** where we have it that the February 20 meeting will be occupied by way of a Surplus Sale. As always, the venue will be the Manor House, High Street, Solihull.

G4CLF is travelling all the way up to **Bury** on February 13, to talk about the Plessey SL-series linear IC's; but the group can be found every Tuesday at the Mosses Youth and Community Centre, Cecil Street, Bury.

Looking at the **Surrey** *Newsletter*, we see that they get together on the first and third Wednesdays of each month, at *T. S. Terra Nova*, 34 The Waldrons, South Croydon. However, we are a bit ahead of the game in writing this piece, so for the details we refer you to the Hon. Sec.—*see* Panel.

Southgate will be hearing from Miss Yolande Tomlinson on Thursday, February 8. She has titled her talk "Mostly Hot Air" and will cover the history of the lighter-than-air type of craft, balloons and airships, backed up by slides and photographs, mostly of her own work.

It is an informal on February 14 for **Crawley,** says the current newsletter to hand, so we will have to pass you on to the Hon. Sec. for the address; at the same time he will doubtless give you the date for the formal, at Trinity United Reformed Church, Ifield, and the speaker.

Christchurch Centre, High Street, Eltham is the home of **Cray Valley** group; they are there on the first and third Thursdays, doors opening 7.30 for 8.0. In general the routine is to have a lecture or whatever on the first date in each month, reserving the nattering for the other evening. That gives us February 1 which is a Slide Show and Ladies Night, and 15th for the natter.

At **Bishops Stortford** they will just be recovering from the AGM, so at this writing there would appear to be some doubt as to "what gives." However, we can say that the routine is to foregather on the third Monday in each month at the British Legion Club, Windhill, Bishops Stortford; visitors and new members all welcome.

Addiscombe are primarily a contest club, and they foregather every Tuesday from 9.15 in the Spread Eagle, Portland Road, South Norwood. They seem to have a pretty fair spread across the contest field, effectively from Top Band up into the UHFs.

It is February 20 when the **Acton, Brentford & Chiswick** lads assemble, at Chiswick Trades and Social Club, 66 High Road, Chiswick; the talk will be by G3XPC, who will discuss his trip to Nigeria.

This will be the last time we hear from **WAMRAC;** they have been turning from a Methodist to an inter-denominational group, and so the change has been made to be World Association of Christian Radio Amateurs and Listeners, WACRAL for short. Details from the Hon. Sec.—*see* Panel.

73

That's the lot for this time: deadlines shown in the 'box.' And, note our initial paragraphs, for the format, which will be the norm in future. Cheers!

Names and Addresses of Club Secretaries reporting in this issue:

ACTON, BRENTFORD & CHISWICK: W. G. Dyer, G3GEH, 188 Gunnersbury Avenue, London W3 8LB. *(01-492 3778.)*
ADDISCOMBE: P. J. Hart, G3SJX, 42 Gravel Hill, Croydon, Surrey CRO 5BD. *(01-656 9054.)*
ASHFORD (Kent): J. A. Clarke, G3TIS, Yeomans Cottage, The Street, Brook, Ashford, Kent TN25 5PF. *(Wye 812888.)*
B.A.R.T.G.: J. P. G. Jones, GW3IGG, Heywood, 40 Lower Quay Road, Hook, Haverfordwest, Dyfed SA62 4LR.
BISHOPS STORTFORD: H. Allison, G3XSE, 89 Birchanger Lane, Birchanger, Bishop Stortford, Herts.
BURY: E. R. Thirkell, G4FQE, 59 Oulder Hill Drive, Bamford, Rochdale *(32730)*.
CHELTENHAM: G. Gearing, G3JJG, 158 Leckhampton Road, Cheltenham *(34287)*.
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. *(West Ashling 463.)*
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: S. T. S. Evans, G3VGO, "Glengormley," Carnon Downs, Truro, Cornwall. *(Devoran 864255.)*
CRAWLEY: A. V. H. Davis, G3MGL, 41 Gainsborough Road, Crawley *(20986)*, West Sussex RH10 5LD.
CRAY VALLEY: P. J. Clark, G4FUG, 42 Shooters Hill Road, London SE3. *(01-858 3703.)*
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. *(0332 56875.)*
EXETER: Mrs. M. Jefford, 29 Dukes Road, Budleigh Salterton, Devon EX9 6QL. *(03954 3735.)*
HEREFORD: S. Jesson, G4CNY, 181 Kings Acre Road, Hereford.
I.R.T.S. (Region 1): J. Ryan, EI6DG, 23 Dollymount Grove, Clontarf, Dublin 3.
MAIDSTONE YMCA: G. A. Hastie, 79 Rochester Crescent, Hoo, Rochester, Kent ME3 9JJ. *(Medway 251387.)*
MELTON MOWBRAY: R. Winters, G3NVK, 32 Redwood Avenue, Melton Mowbray *(3369)*, Leics. LE13 1TZ.
NORTHERN HEIGHTS: L. Cobb, G3UI, 27 Moorlands Crescent, Halifax *(60574)*, West Yorks.
PETERBOROUGH: L. Critchley, G3EEL, 36 Waterloo Road, Peterborough, Cambs.
G. QRP CLUB: Rev. G. Dobbs, G3RJV, "Willowdene," Central Avenue, Stapleford, Nottingham. *(Sandiacre 394790.)*
REIGATE: F. H. Mundy, G3XSZ, Westview, rear of Manor Farm, off Reigate Road, Hookwood, Surrey. *(Horley 73878.)*
SOUTHGATE: J, Fitch, G8EWG, 16 Kent Drive, Cockfosters, EN4 0AP. *(01-440 7353.)*
SOLIHULL: R. A. Hancock, G4BBT, 80 Ulleries Road, Solihull, West Midlands B92 8EE.
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, Gowerton, West Glamorgan. *(Swansea 873 986.)*
VERULAM: B. Pickford, G4DUS, "Netherwood," 130 The Drive, Rickmansworth *(77616)*, Herts.
WAMRAC: L. Colley, G3AGX, Micasa, 13 Ferry Road, Wawne, Hull, Yorks. HU7 5XU.
WORCESTER: M. Tittensor, G4EKG, 16 Durcott Road, Evesham, Worcs. WR11 6EQ.
YEOVIL: D. L. McLean, G3NOF, 9 Cedar Grove, Yeovil, Somerset.

bury, with an Alignment evening on February 13—a spectrum analyser will be in attendance along with G8CHN and G3TQA—and on 27th the Construction Competition will be judged. The dates in between will be natter sessions.

Now we have to trot along to **Solihull,** where we have it that the February 20 meeting will be occupied by way of a Surplus Sale. As always, the venue will be the Manor House, High Street, Solihull.

G4CLF is travelling all the way up to **Bury** on February 13, to talk about the Plessey SL-series linear IC's; but the group can be found every Tuesday at the Mosses Youth and Community Centre, Cecil Street, Bury.

Looking at the **Surrey** *Newsletter*, we see that they get together on the first and third Wednesdays of each month, at *T. S. Terra Nova*, 34 The Waldrons, South Croydon. However, we are a bit ahead of the game in writing this piece, so for the details we refer you to the Hon. Sec.—*see* Panel.

Southgate will be hearing from Miss Yolande Tomlinson on Thursday, February 8. She has titled her talk "Mostly Hot Air" and will cover the history of the lighter-than-air type of craft, balloons and airships, backed up by slides and photographs, mostly of her own work.

It is an informal on February 14 for **Crawley,** says the current newsletter to hand, so we will have to pass you on to the Hon. Sec. for the address; at the same time he will doubtless give you the date for the formal, at Trinity United Reformed Church, Ifield, and the speaker.

Christchurch Centre, High Street, Eltham is the home of **Cray Valley** group; they are there on the first and third Thursdays, doors opening 7.30 for 8.0. In general the routine is to have a lecture or whatever on the first date in each month, reserving the nattering for the other evening. That gives us February 1 which is a Slide Show and Ladies Night, and 15th for the natter.

At **Bishops Stortford** they will just be recovering from the AGM, so at this writing there would appear to be some doubt as to "what gives." However, we can say that the routine is to foregather on the third Monday in each month at the British Legion Club, Windhill, Bishops Stortford; visitors and new members all welcome.

Addiscombe are primarily a contest club, and they foregather every Tuesday from 9.15 in the Spread Eagle, Portland Road, South Norwood. They seem to have a pretty fair spread across the contest field, effectively from Top Band up into the UHFs.

It is February 20 when the **Acton, Brentford & Chiswick** lads assemble, at Chiswick Trades and Social Club, 66 High Road, Chiswick; the talk will be by G3XPC, who will discuss his trip to Nigeria.

This will be the last time we hear from **WAMRAC;** they have been turning from a Methodist to an inter-denominational group, and so the change has been made to be World Association of Christian Radio Amateurs and Listeners, WACRAL for short. Details from the Hon. Sec.—*see* Panel.

73

That's the lot for this time: deadlines shown in the 'box.' And, note our initial paragraphs, for the format, which will be the norm in future. Cheers!

A HIGH FREQUENCY CONVERTER

A DESIGN TO EXTEND THE RANGE OF GENERAL COVERAGE RECEIVERS UP TO 30 MHz

N. H. KEMPT, G3NRB

MANY older receivers are limited in utilisation by a lack of the higher frequency bands. This is particularly true of a number of otherwise excellent surplus types such as the Collins TCS series, which perform magnificently on the ranges provided between 1·5 and 12·0 MHz, but no further without extensive 'surgery.' There are plenty of converter designs around for specific HF amateur bands, but the writer's object was to extend the general coverage of a TCS up to 30 MHz with the minimum of complication and the minimum of mathematics in converting the dial readings.

The unit described here converts inputs of 12 MHz to above 30 MHz down to outputs of between 2 MHz and 12 MHz. A 10 MHz crystal controlled local oscillator produces an injection of either X1 or X2 crystal frequency (X3 if required), so its a simple matter of adding either 10 MHz or 20 MHz (or 30 MHz) to the dial reading on the main receiver. In other words, to receive 14 MHz, the main receiver is tuned to 4 MHz and the converter oscillator to 10 MHz. To receive 24 MHz the main receiver stays on 4 MHz but the oscillator would be selected to give 20 MHz. To receive 29 MHz the receiver would be tuned to 9 MHz and the oscillator to 20 MHz, and so on.

In order to exploit the full capabilities of the converter, the companion receiver should tune at least 2-12 MHz, otherwise there will be gaps in the final coverage. If the main receiver tunes 3 to 9 MHz for instance, the converter would only allow reception of 13 to 19 MHz and 23 to 29 MHz when using the add-10 or add-20 modes. However, in this case there is the possibility of placing the oscillator on the high side of the received frequency and subtracting, but this defeats the simplicity of the original idea. It would be possible to adapt the general technique using a different crystal frequency to meet individual requirements.

Table of Values

Fig, 2

R1	= 39K	C2	= 6800 pF
R2	= 100K	C3	= 1500 pF
R3	= 220 ohm	C4	= 6800 pF
R4	= 10 ohm	C5	= 33 pF
R5	= 150 ohm	C6	= 15 pF
R6	= 100K	C7	= 1500 pF
R7	= 100K	C8	= 100 pF
R8	= 220 ohm	C9	= 150 pF
R9	= 1000 ohm	C10	= 270 pF
R10	= 10K	C11	= 6800 pF
R11	= 10K	C12	= 0·047 μF
R12	= 470 ohm	C13	= 10 μF 25v.
VR1	= 5K linear	C14	= 1000 μF 12v.
TR1	= 40673	VC1, VC2,	
TR2	= 40673	VC3	= 220 pF max.
TR3	= 2N2222		16 pF min.
D1	= 50v., 1A. Bridge		Transistor BC radio airspaced
VS1	= 6·1v. Stabiliser		variables with gangs paralled
C1	= 6800 pF		or similar.

L1	= 15 turns 24 *s.w.g.* close-wound ¼-inch former, coupling 3 turns over earthy end.
L2	= 15 turns 24 *s.w.g.* close-wound ¼-inch former, tap 10 turns from C4 end.
L3	= 15 turns 24 *s.w.g.* close-wound ¼-inch former, tap 10 turns from C6 end.
RFC 1	= 2·5 mH choke.
X1	= 10 MHz Crystal
T1	= Mains Input to 6·3 volt 100 mA Transformer.

Notes: All fixed resistors are ¼-watt; C1 to C12 are polystyrene, silver mica, ceramic etc.; C13 and C14 are electrolytic.

Circuit Description

The converter consists of an RF amplifier using a 40673 or equivalent dual gate MOSFET, feeding a

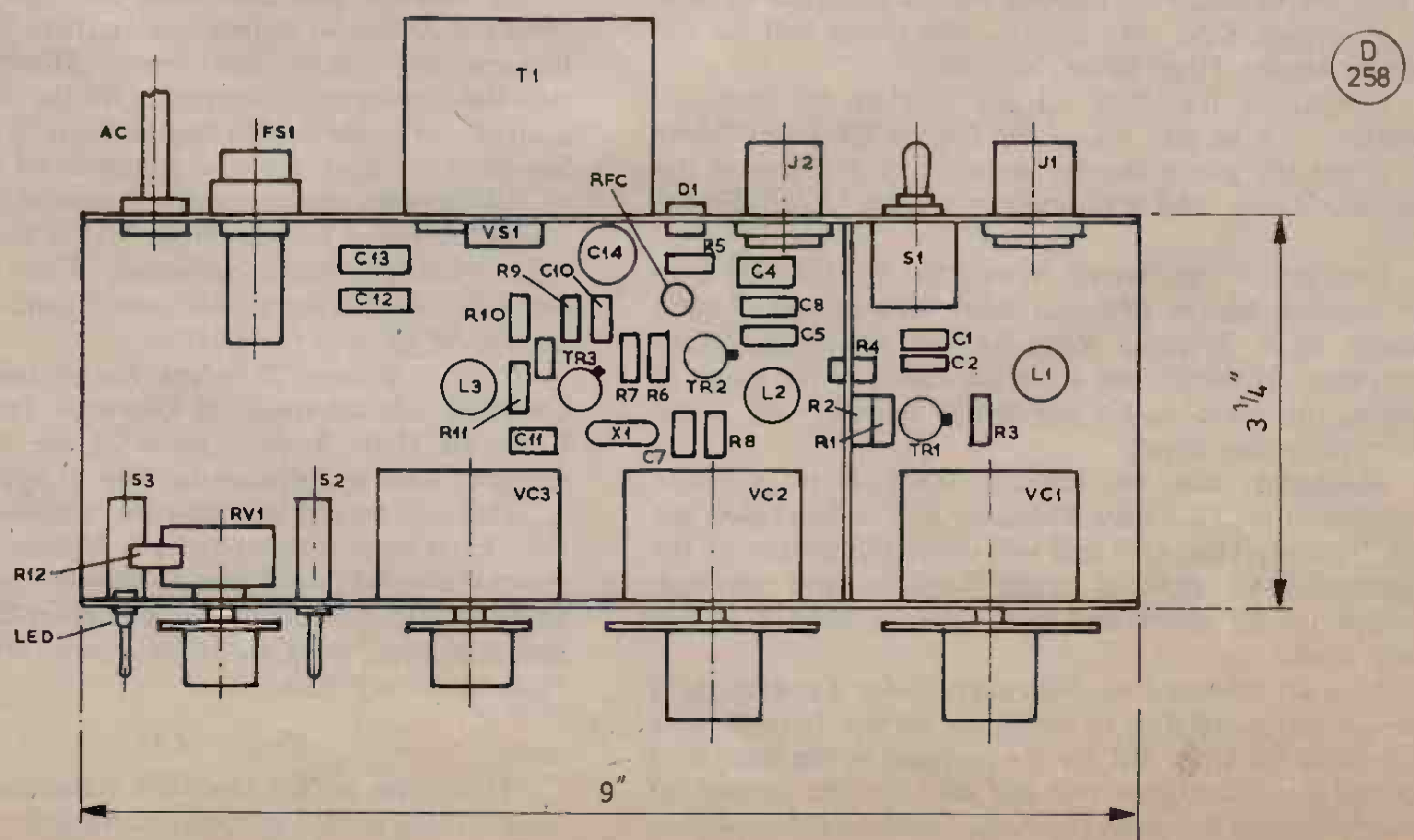


Fig. 1 HF CONVERTER – COMPONENT LOCATION

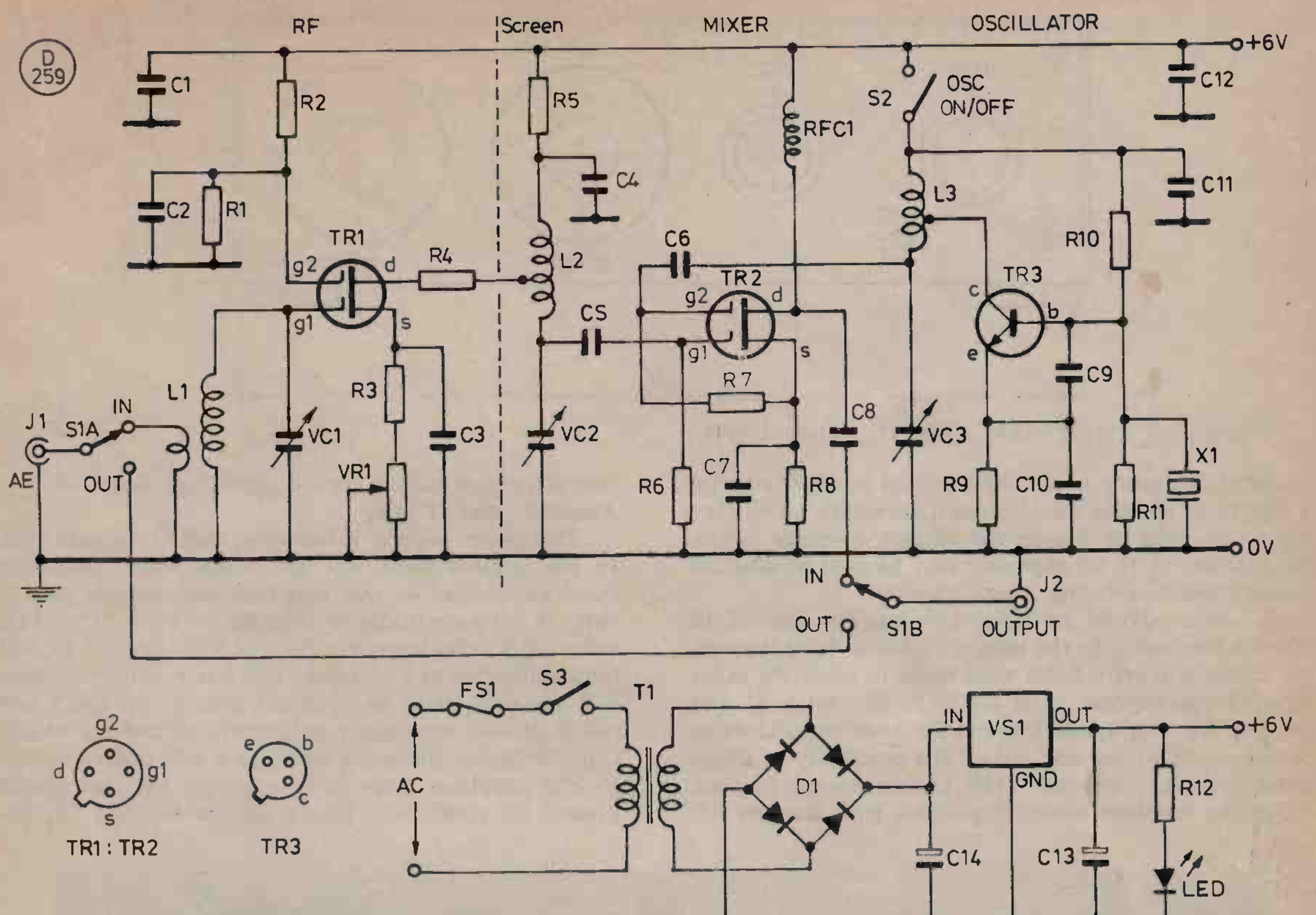


Fig. 2 HF CONVERTER CIRCUIT DIAGRAM

similar device as a mixer. A 2N2222 is employed in the 10 MHz crystal and harmonic oscillator.

The incoming signal is link-coupled to the RF input tank which tunes approximately 10 to 35 MHz in one range. The output of the RF FET is tuned by a similar LC arrangement with the drain tapped part way down from the high end. A ten-ohm stopper in the RF drain aids stability although in some cases, dependent on frequency and input characteristics, self oscillation of the RF stage can occur. However, reduction of the RF Gain control to below the take off point adequately takes care of this problem whilst ensuring that maximum gain is available if it can be used.

The RF stage output is capacitor-coupled into G1 of the mixer, and the local oscillator into G2; the sum frequencies are taken from the mixer drain to the outboard receiver across an RF choke. A tunable LC circuit was tried in this position but offered little benefit and would have added another panel control.

The oscillator is a sure-fire circuit with the crystal operating on the 10 MHz fundamental. The collector circuit feeding the mixer is tuned by VC3 to either 10, 20 or 30 MHz, as required. Various types of overtone arrangements were tried but none could be made to produce the desired results with only one crystal. A switch is provided to turn the oscillator off, which is useful for checking if a signal is a converter function or direct breakthrough, and also enables the unit to be used as a receiver pre-amplifier, producing worthwhile gain and an improvement in image rejection.

Construction

The prototype was constructed in a second-hand box which happened to be about the right size. Unfortunately the previous owner of the box had drilled holes in all the wrong places on the front panel; this required the fitting of an escutcheon to mask them. Lacking anything better, this was made from 3/32nd balsa wood with holes cut to allow recess of the tuning dials and knobs to almost flush with the original metal. The balsa was varnished on both sides and glued in position. Panel writing on the wood was done in ink prior to application of the last coat of varnish. The end result was quite pleasing and sufficiently durable.

Ideally either a printed circuit or perforated board should be used in the construction. The original was built around ceramic tag blocks removed from an old command receiver. An approximate location of the various components is shown in Fig. 1.

Individual variable capacitors were used for tuning the RF and Mixer sections, mainly because a suitable two-gang unit was not available. Operation would be much simplified with both ganged together, and in this case a separate small RF peaking trimmer should be added. If variable capacitors with built-in trimmers are used, these should be disconnected or set to minimum before assembly.

The coils are all wound on quarter-inch *Aladdin* or similar formers; no cores are required. If possible the

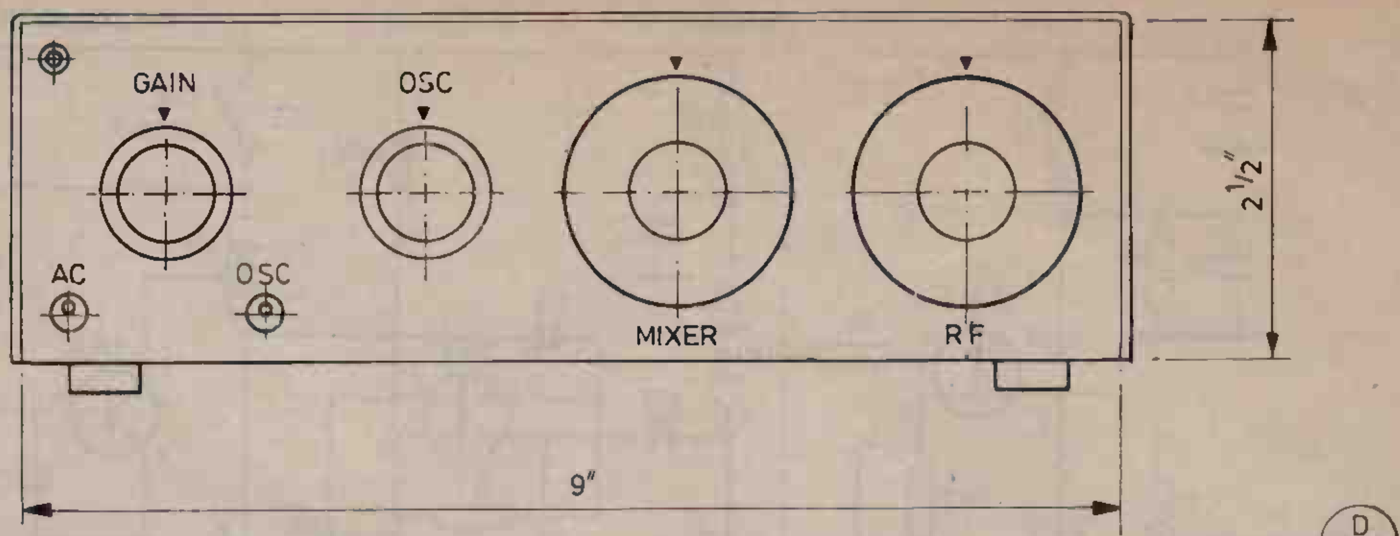


Fig. 3 HF CONVERTER – FRONT PANEL LAYOUT

resonant frequency of the coils should be checked with a dip meter and the variable capacitors with which they are to be used to ensure the correct coverage before installation. A 10 pF capacitor may be used to simulate circuit capacities during measurement.

A screen should be fitted between L1 and L2 to prevent feedback. In the original R4 was fitted through the screen and extra holes were made to allow for other through connections. The IN/BYPASS switch S1 was fitted to the rear apron between the coax connectors to permit direct wiring and reduce the possibility of direct breakthrough. Normal VHF constructional practice should be followed as far as possible with shortest RF connections, common ground points per stage, etc.

Assembly and Testing

The power supply, if included, should be built first. In the original there was insufficinet space inside for the transformer, so this was mounted outside on the rear. A full wave bridge rectifies the 6·3 volts AC and the resulting 9 volts approximately of DC applied to VS1 for stabilisation to 6 : 1 volts. This is not really necessary, and the unit could be operated directly off the 9 volt rail if desired with slight adjustment of resistor values. Current figures following relate to 6 volt operation.

The oscillator stage is next on the list and should present no problems. Check current through S3, this

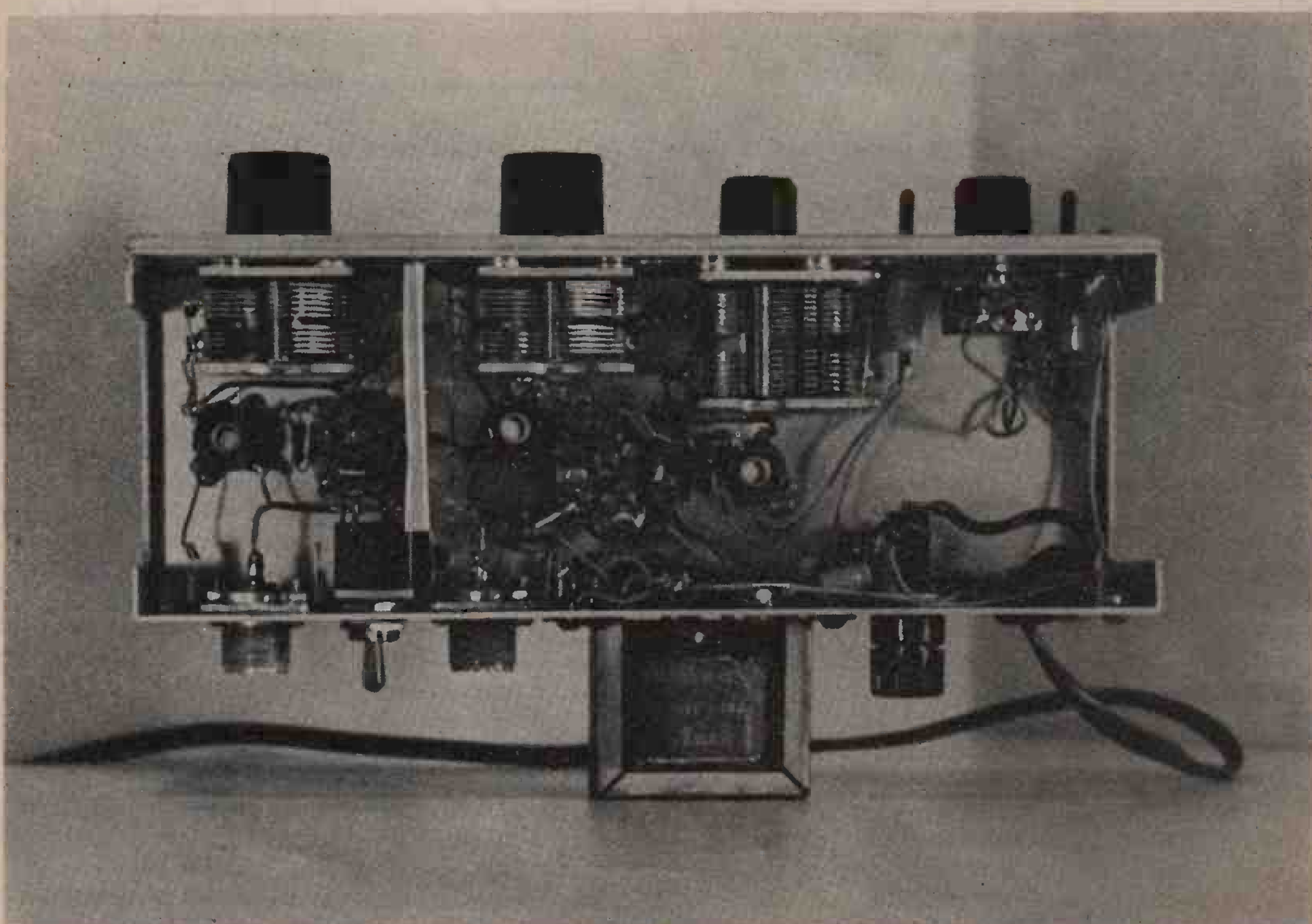


Fig. 4. Top view of the G3NRB Converter.

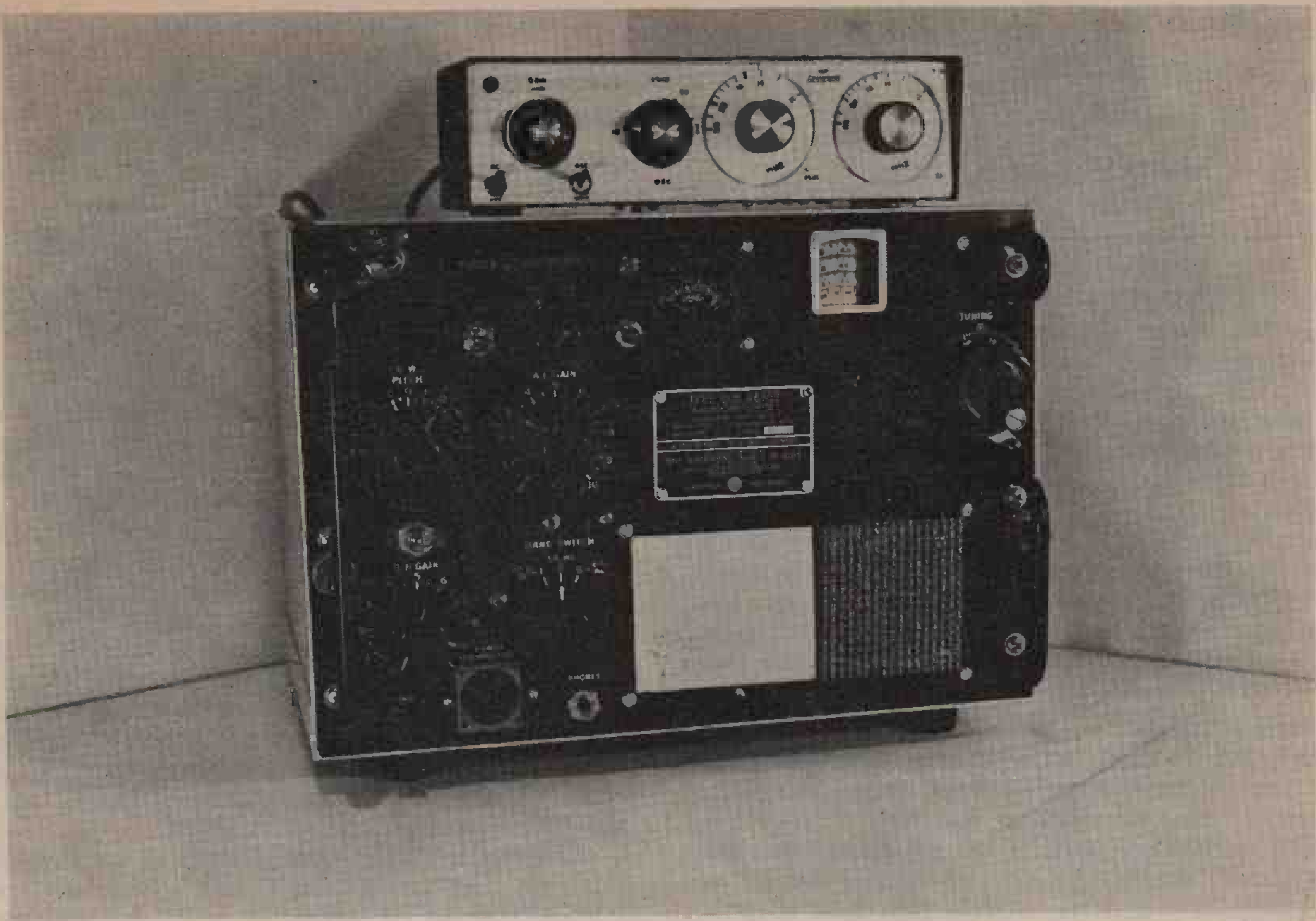


Fig. 5. The G3NRB Converter with a TCS receiver.

should be around 2mA; swing the tuning capacitor VC3. There should be a dip in current as the capacitor approaches full mesh corresponding to 10 MHz resonance. There should be a lesser dip around one-third mesh at 20 MHz, and another fluctuation at nearly open, this being 30 MHz. If a frequency counter is available, check the 10 MHz output for accuracy; if not, use a receiver to beat against the 10 MHz standard frequency transmission and note the audio beat frequency. Ideally it should be near zero, but will depend on the design of the crystal. In the original it was about 100 hertz off which did not warrant further adjustment. If more than 500 hertz, try small capacitors in parallel with the crystal. If this is the wrong way, C9 may be reduced in value to raise the frequency, or capacitors fitted in series with the crystal.

Wire up the Mixer department right through as far as R4; connect the meter in series with RFC1 supply and check the current to TR2 which should be in the order of 3mA. The converter can be partially tested at this point by connecting a receiver to the output and an aerial *via* a 15 pF capacitor to R4. Set VC3 to the 10 MHz position, receiver to about 5·1 MHz, and adjust VC2 to about half-mesh, where peaking should be heard together with signals from the 15 MHz broadcast band.

Having established that things look hopeful this far, put the RF Amplifier together and tidy up; check current into the RF Amplifier is in series with R2. This should be approximately 4mA with the RF gain control at maximum, reducing to 0·5mA at minimum.

Ensure that the converter output is connected to the receiver with a properly made up coax connector and connect aerial to J1. Tune to 15 MHz as before, peak Mixer and RF together and things should sound pretty lively. If the RF stage seems unduly prone to oscillation, reduce lead lengths in this area, examine decoupling and layout etc.

With a signal generator or aerial noise, check that the RF and Mixer tuning covers the range 12 to 30 MHz or more; calibrate VC1 and VC2 dials. On the original, marks were made every MHz to 20 MHz, then at 25 and 30 MHz. The oscillator need only be marked at 10, 20 and 30 MHz positions as determined by best results.

The output should be clean of spurious signals except for the oscillator at 10 MHz intervals. Harmonics from the main receiver oscillator may be detected at some frequencies but should not present a problem in normal usage. Sensitivity has not been measured on a calibrated generator; however, comparing received signals on frequencies which can be covered by both the TCS directly or *via* the converter show a considerable improvement when converted, suggesting excellent sensitivity.

In conclusion, this unit should definitely prove a worthwhile project for those using older receivers, those with limited coverage, poor HF performance or stability.

RUSSIAN ROULETTE

HOW TO FIND AND USE THE RUSSIAN SATELLITES

NORMAN FITCH, G3FPK

Introduction

THE first Soviet satellites carrying amateur radio transponders were launched on October 26, 1978. Unlike AMSAT, which keeps the amateur radio fraternity fully informed about OSCAR launches, there was no authentic pre-launch publicity from the USSR authorities, just hints from various sources that something was in the wind.

Initially, therefore, everyone in the western world lacked any essential information concerning the orbit period, inclination, power requirements, or even the uplink and downlink passbands. However, a substantial amount of data is now available which enables this article to be published.

Spacecraft Description

The launch on October 26 was a multiple one and it seems that two amateur satellites were ejected into orbit, along with other non-amateur hardware. They are identified as *RS-1* and *RS-2*, it being suggested that the letters mean "Radio Sputnik" or "Radio Sport,"—the latter because amateur radio is considered a sport in the USSR.

The transponders are "Mode A" type devices with an uplink in the two metre band and a downlink in the ten metre band:

Uplink: 145·880 — 145·920 MHz
Downlink: 29·360 — 29·400 MHz

The two metre receiving aerial is an inverted "Vee," and the ten metre transmitting aerial a quarter wave whip. The satellite is not magnetically stabilised as are the AMSAT ones. It is understood that *RS-2* is an identical back-up for *RS-1*.

The relationship between the uplink and downlink frequencies is:

$F_d = F_u$ — 116·52 MHz $\pm$ Doppler shift where F_d and F_u are the down and up frequencies in MHz. The telemetry beacon is on 29·400 MHz nominally and listeners have reported *Codestore* type messages being transmitted on 29·380 MHz, once or twice.

Orbit Parameters

RS-1 is in the highest orbit yet for an amateur radio transponder with an *apogee* of 1,724 kms. and a *perigee* of 1,688 kms. The orbit is inclined at 82·5556° to the equator. The latest period for one revolution as communicated from Russian sources is 120·389430 minutes. On a "line of sight" basis, the average maximum ground range would be 8,500 kms. depending upon one's latitude.

This orbit is rather different from those of past and present AMSAT satellites. First, it traverses the polar regions on the "opposite" side which makes the plot of the path on a polar projection map almost a straight line. Second, the satellites go round in the opposite sense to the AMSAT ones in that the morning orbits are the *ascending* ones and the evening passes the *descending* ones.

A graphical presentation of AOS, TNA and LOS in minutes after equatorial crossing, northbound, is given in Figure 1. For an example of how to use it, take an orbit which crosses the equator at 340° west of Greenwich, over central Africa. Looking along the bottom of the graph, we find that at 340° the satellite should come over the horizon in six minutes at a true azimuth of 145°. It would be nearest to the listener 11½ minutes later at a beam heading of 76° and would be expected to disappear at an azimuth of 14° after a further 11½ minutes.

The graph has been drawn for the author's QTH but is reasonably accurate for England. For a user living in central Scotland, the "sausage" would need to be rotated slightly clockwise by approximately two minutes at the 360°, about its centre, since northbound orbits would be heard that much later, while southbound passes from 160° equatorial crossing would be heard a couple of minutes earlier. For the London area, orbits which cross the equator at about 6°W and 159°W pass overhead, giving a calculated maximum access time of about 25½ minutes. However, the very high MUF's at the present time enable *RS-1* to be heard all the way round the Earth at times *via* ionospheric propagation. Ten of the twelve daily orbits are in range of the U.K. being those crossing the equator between 300°W, *via* the Greenwich Meridian, round to 225°W.

Converning the longitude increment per revolution, there are slightly conflicting figures. Over the 80 metre AMSAT net on November 19, a Russian estimate of 30·227° was stated. Without going into a lot of maths, the author cannot verify this figure with the period and with the Earth's axial rotation in degrees per minute. Other estimates of 30·1° per revolution have been mentioned. While these differences do not appear very great, within a month predictions could be way out.

Ground Station Requirements

The most important factor about the *RS* transponder is that its receiver is so sensitive that *only very little e.r.p. is necessary for reliable access.* This point cannot be stressed too often. If more than a few watts *e.r.p.* are aimed at the satellites, the transponder will shut down, thus denying everyone the opportunity to communicate.

The extreme sensitivity means that a basic ten watt Tx feeding a ground plane or omni-directional, fixed aerial should suffice, thus eliminating the need for tracking. This should bring satellite communication to those running low power stations using simple aerials, even loft ones, provided a reasonably sensitive ten metre Rx is used.

The Telemetry

The telemetry from the *Radio Sputniks* is a bit more complicated in format than that for *Oscar 7.* Each group comprises a letter, two figures, and a letter, such as P73K, etc. The first letter indicates the parameter being measured and the two figures the value, while the last letter seems to indicate the state of the transponder.

The TLM is sent in frames consisting of either 7 or 30 groups although when analysed, only 18 parameters are being measured, the other 12 being duplicates. The TLM data is set out in Table 1 and is as up-to-date

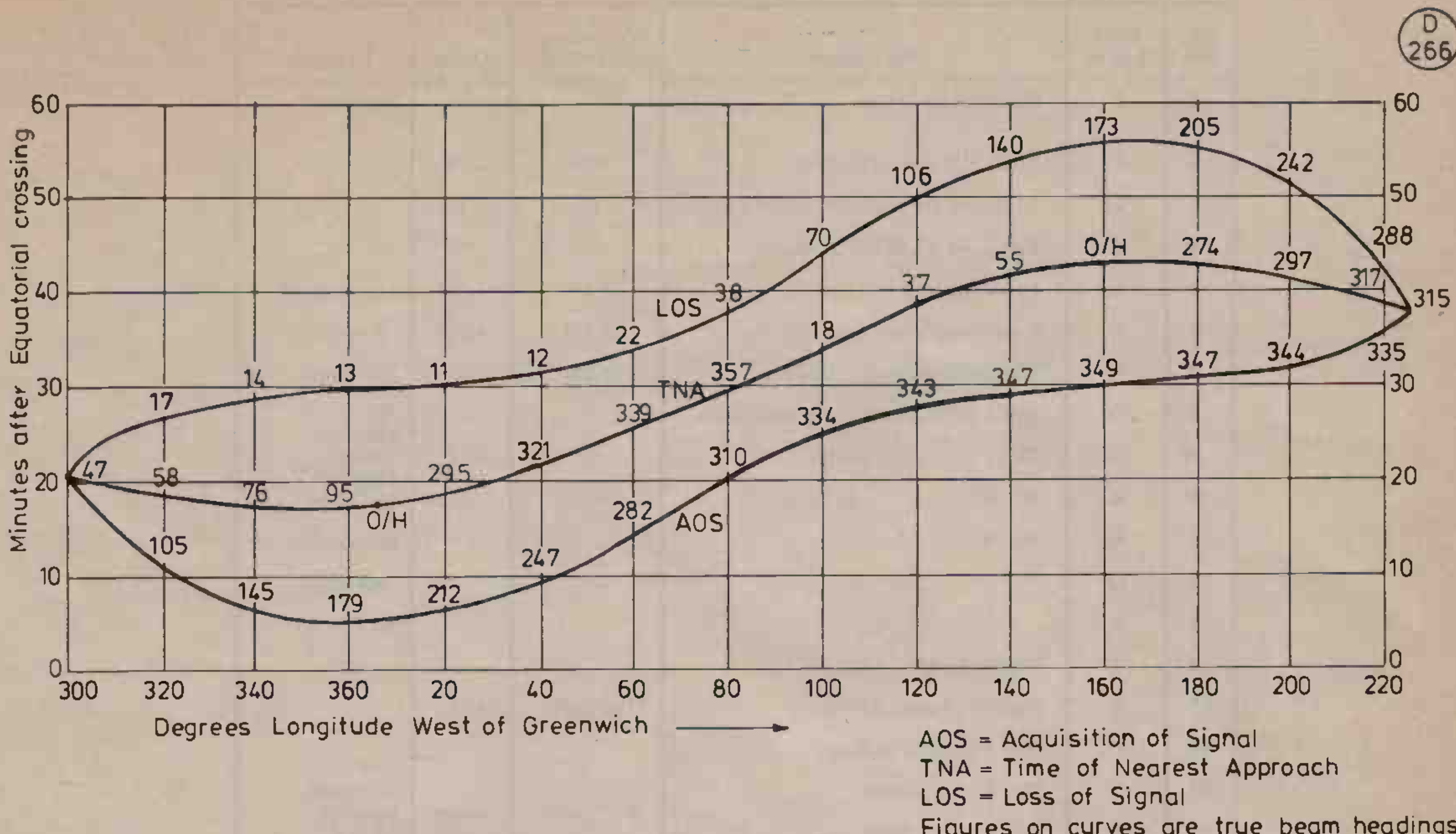


Fig. 1 RS SATELLITE PREDICTION CHART (Compiled for London)

as possible at the time of writing. Some points to note are that when Channel 2 or 13 reach a count of 99, the transponder will switch off. When the satellite is in total darkness, Ch. 8-11 and 23-30 should read 99, while they will read 01 in full sunlight. It is assumed that when the count on Ch. 14 rises to 99, the transponder will shut down.

At the end of a 7 group frame, the TLM will be punctuated with the letters "RS" after which the next frame will be transmitted. After each 15 groups of the longer frame, "RS" is sent. When "RSRS" is sent, it indicates that the transponder Tx is also working. To positively identify the two halves of the long frame, the first group will end in a letter "U", for example, and the second group, "K." It has been found that when the last letter is "O," "R" or "W" the transponder will be working with QSO's taking place. When the last letter is "D," "K," "S" or "U" then only TLM will be on.

It has been suggested that the first letter of each group is really a number in reverse binary code, with the dash in the morse character indicating binary 1 and the dot, binary 0. Two examples will serve to illustrate this theory:

"C" or — . — . equals 1010 in binary, which is equivalent to $1 + 0 + 4 + 0 = 5$, decimal.

"O" or — — — equals 111 in binary, which is equivalent to $1 + 2 + 4 = 7$, decimal. Following this concept through from P to S results in figures of 6 5 4 3 2 1 0 7 6 5 4 3 2 1 0, so fixing the position of a group within a frame unambiguously. It will be noticed that the first seven groups are prefaced by four bit characters and the remaining eight by three bit characters.

Operating Schedule

The Russians have stated that the *RS* satellites are scheduled for amateur communication use on Saturdays and Sundays and that Wednesdays are reserved for special experiments, as with the AMSAT satellites. Even so, *RS-1* has been in transpond mode, albeit erratically, on other weekdays.

Feedback

The Moscow Radio Club is anxious to receive TLM reports, especially at times when the satellites are out of range of the Soviet Union. General reception reports are sought with comments upon the strength of the TLM beacon and amateur stations. Comments upon the effectiveness and reliability are needed so that the performance can be evaluated. Such reports will have an important influence on decisions concerning the launching of future *RS* satellites. These reports may be sent directly to:

Moscow Radio Club
P O Box 88, RS3A
Moscow
U.S.S.R.

Lists of stations using the *RS* satellites have been requested, together with times and dates.

Conclusions

This series of Russian satellites should prove very useful now that *Oscar 7's* batteries are starting to fail, tiding amateur satellite users over, with *Oscar 8*, until the first AMSAT *Phase III* satellite is launched next May. Those requiring the latest predictions and informa-

Ch. No.	First Letter	Parameter	Decoding Formula	Units	Remarks
1	P	Calibration level	—	—	always 01
2	C	Total RF power output	10N	mW.	
3	F	Temp. of transponder electronics	N	°C	
4	Z	Temp. of TLM electronics	N	°C	
5	L	Power supply voltage	0·2N	volts	16 nominal
6	B	9 volt regulator	0·2N	volts	9 nominal
7	H	7·6 volt regulator stabilizer	0·2N	volts	7·6 nom.
8	O	No. 1 solar panel volts indication	—	—	No absolute values. Usually 15, 16 or 17 nominally
9	W	No. 2 ditto	—	—	
10	K	No. 3 ditto	—	—	
11	U	No. 4 ditto	—	—	
12	G				As Ch. 1
13	R				As Ch. 2
14	D	Probably ALC voltage			
15	S	Battery charge current	10(50-N)	mA.	
16	P	No. 1 battery voltage	0·2N+12	volts	Normally between 12 & 17
17	C	No. 2 ditto			
18	F	No. 3 ditto			
19	Z	No. 4 ditto			
20	L				As Ch. 1
21	B	Battery charge resistor temp.	N	°C	
22	H				As Ch. 15
23	O				As Ch. 8
24	W				As Ch. 9
25	K				As Ch. 10
26	U				As Ch. 11
27	G				As Ch. 8
28	R				As Ch. 9
29	D				As Ch. 10
30	S				As Ch. 11

Table 1. Telemetry decoding information. ***Note:*** **A typical frame would be P01U C17U F35U Z33U, etc.**

tion should listen to the AMSAT nets, as follows:

80m. Sundays from 1015 local 3780 kHz
2m. Sundays from 1930 local 144·28 MHz (London)
2m. Wednesdays from 2100 local 144·280 MHz (NE Coast)

International nets are held on 21·280 MHz and 14·280 MHz but the author is uncertain of the times. A special Soviet station with the call RS3A operates on 14·280 MHz in connection with the Russian satellites.

Acknowledgements

Data for this article have been gleaned from many sources, including off the above-mentioned nets. The TLM information was provided by AMSAT-UK Chairman Pat Gowen, G3IOR, whose source was Leonid Labutin, UA3CR. AMSAT-UK has reliable lines of communication with both Russian and U.S. amateur satellite organisations. Full details of AMSAT-UK can be obtained from the Secretary, for a stamped, addressed 9in. x 4in. envelope, to:

Ron Broadbent, G3AAJ
94 Herongate Road
LONDON, E12 5EQ

• • • SWL • • • SHORT WAVE LISTENER FEATURE

By Justin Cooper

ONCE in a while someone comes along with a request for articles on "elementary subjects" and reviews of general-coverage broadcast receivers. However, unless we run a series of pieces starting from scratch—that is, effectively an R.A.E. course series—we can't hope to meet the first requirement; the two current multi-part articles will in due course come to the bottom, and before then we will be looking at this whole question. But we do feel, along with the Boss, that the very basic stuff is probably better obtained by reading and thinking.

On the second point, readers will be glad to know that we shall soon be reviewing gear of all kinds.

As for the question of making a start in home-brewing bits for the station, there are in essence two things to overcome before one can make a success: lack of confidence in the outcome, and paradoxically, an over-ambitious project. However, *any* bigger project can be broken down into a group of smaller ones, and the lack of confidence will be assuaged rapidly once a simple task has been completed with some success. The main thing is to drop nothing until you have got it working, even though the process is one of grope-and-hope. In his professional life, your J.C. finds himself fault-finding only when the test staff acknowledge defeat, so that he has no escape. Recently, such a situation arose; all tests made indicated different areas for the fault, so we "forgot" those and started again from the assumption that we had made the usual wrong deduction somewhere. Three more times round the circle and we were beginning to wonder whether it would ever be sorted out! Then, by pure chance, the high-voltage wire—of special material—was noticed to emit a moment of brightness at a point near its centre: an open-circuit piece of wire no less, and to boot, the piece we were using to make the tests with, so no wonder the results didn't make sense! But, when the results were looked at on the assumption that the wire was o/c, the results all fell into place.

However simple, the circuit can be broken down to simpler parts still, so that every bit can be tested as it is wired up. For example, imagine a two-stage mic. amplifier. First the mic. socket is connected, and a 'scope will show a waveform when the microphone is plugged in, and spoken into. Next one can build the first transistor stage, checking carefully as each part goes in, that it is in the right place in the circuit. We can now apply a bit of power to see if microphone noises still appear where we saw them at first, and then that we can see a larger version at the output of the first stage (*i.e.* between collector and earth). Now we know this bit is OK, we can set to and build the second stage, checking each component as we wire it in.

Once built, we can now be fairly sure that the fault will not lie in the stage we have already tested out, though nonetheless we put the microphone in its socket and repeat the checks on the first stage input and output, then going on to look at the second stage output where, to our horror, we find—nothing! First check that all the components are wired in their right places, then that you have joined the second stage supply volts, both to the HT rail *and* the earthy leg, before going on to the assumption that something is wrong with a component. If the DC voltages are checked and prove to be reasonably correct, then you can check each capacitor (remembering that you checked that it wasn't shorting before you wired it in), so it will be if anything an open-circuit one, which is easily enough checked by putting another oné in parallel.

Finally, the transistor: here, one can check that it is wired in correctly and that it still works. The simplest transistor check is just the ohms range of the testmeter; if we consider its parts, any transistor, whether germanium or silicon, *npn* or *pnp*, looks like two diodes both of which either face the base connection, or turn their back on it. So if the transistor is OK it will read o/c between collector and emitter, from base to collector like a diode, and from base to emitter like a diode also. A diode, recall, conducts one way only, and reversing the testmeter will either make it conduct or not conduct. If, say, the base-emitter junction is conducting whichever way round the meter goes, then that diode, and hence that transistor, is a dud. And, as a matter of interest, since the meter terminals are marked positive and negative, and since the polarity of the leads almost always reverses on the ohms range, we can say whether the transistor is a *pnp* or *npn* device. So, we progress, finding and clearing-up the faults on each individual stage as we go along. This can be well within our abilities, whereas fault-finding the circuit when it is all built-up and complete may be quite beyond us.

Finally, it is well to bear in mind the difference between fault-finding something you are building and the same process on an existing unit that has packed up. A new unit will almost certainly reveal itself as a wiring-up error, with possibly a dud transistor or electrolytic capacitor as a result; but the unit which has been 'doing its thing' quite faithfully for years will be wired up correctly but have a dud component.

The Mail

Perhaps we should start by mentioning *D. C. Casson* (*Reading*) who seems to have had the misfortune to have his initial entry lost. However, since his second one has no errors in it, we have provisionally put him in the table as though the first one had come to hand.

A relative newcomer to the SWL game is *G. Emson* (*Havant*) who has an Eddystone 750—a good old general-coverage box indeed. However, the N78 valve was a little sorry for itself and so Gerry wrote to Eddystone, and was very pleased to receive a replacement in just three days. On a different tack, the question of the odd numbers some SWL's have after their names. These are membership numbers of various societies, such as RSGB or ISWL, which are allocated to them so that the QSL Bureau system can handle their reports and incoming cards. ISWL can be contacted at: 1 Grove Road, Lydney, Glos., GL15 5JE, while RSGB are at 35 Doughty Street, London WC1N 2AE.

An incentive now for the CW-minded listeners; *G4GOF* (*Fairlight Cove, Hastings*) says that he promises to QSL any report on his signals provided it tallies with his log, is on a CW QSO, and includes a stamped addressed envelope. Jess can usually be found between 0630-0730, 0800-0900, 1300-1400, and 1800-2000, all times GMT of course, and anywhere between Eighty and Ten. On a different line, G4GOF wonders whether there is a list of all the HF beacons in the world, with their operating frequencies and schedules—anyone able to answer?

The simple HAC receiver has been giving sterling service to *R. Jacobs* (*Margate*) who shoots up to some 617 on the Ladder. To help things along, apart from the upsurge in conditions there have been the home-brew ATU and some juggling with aerials to help along.

M. Ribton (*Oxted*) sent his letter to the wrong address last time round, and so it was returned. He has now pushed his Joystick up to some 45 feet, and down below a nice shiny FR-101DD sorts out the signals. Of the DX, we notice YI1BGD took some 50 minutes to locate after the pile-up was noted, and the M1 was not claimed; this last brings up the total to 618.

Africans are a little rare, laments *K. A. Burch* (*Plymouth*) but nonetheless he seems to have a goodly selection of those few to remain available.

Like so many others, *E. W. Robinson* (*Bury St. Edmunds*) guessed the issue would be late, and sent his list in early—thanks to *everyone* who did this—a great help. He also notes the absolute flood of new call letters from the USA and "specials" from all over the place, most of the latter being out after points in the CQ WW, or similar contests.

The "invisible" aerial certainly seems to be doing the trick, exults *B. L. Henderson* (*Chetnole*), even though as yet no ATU is built to extract the signals it picks up. However, the return to SWL after 25 years is still giving interest, and the next move seems to be along the line of a converter for 144 MHz. There is one snag about this approach to VHF, and that is the problem of FM —a good CW/SSB receiver won't cope with FM by slope detection like the old AR88D or HRO would, simply because the IF response is so square and nearly ideal for SSB. However since most of the FM is channelised one could either build up a switched FM receiver all-same NR-56, plus a converter for the CW and SSB, not to mention the old-fashioned AM which is still to be found on the 144-145 MHz segment of the band. The converter could well be selected from the *ARRL Handbook* or the RSGB (*VHF-UHF Manual*.

ANNUAL HPX LADDER

Starting date, January 1, 1978

SWL	PREFIXES	SWL	PREFIXES
K. Piper (Bognor Regis)	486	D. G. Sim (Southampton)	389
D. C. Casson (Reading)	482	K. M. Rogers (Lutterworth)	364
B. L. Henderson (Chetnole)	463	P. Matthews (Eastwood)	268
Mrs. J. Brooks (Loughborough)	444	S. Farkas (Birmingham)	247
J. Doughty (Birmingham)	440	C. Stevens (Derby)	226
R. C. Mackay (New Romney)	422	R. G. Williams (Borehamwood)	218
		B. Musselwhite (Warminster)	205

200 Prefixes must be heard for an entry to be made, all since January 1, 1978. See also HPX Rules.

HPX LADDER

(All-Time Post War)

SWL	PREFIXES	SWL	PREFIXES
PHONE ONLY		*PHONE ONLY*	
K. Kyezor (Irchester)	1964	P. Rooney (Chester)	789
B. Hughes (Worcester)	1694	R. Towlson (Nottingham)	764
S. Foster (Lincoln)	1692	J. Nichol (S. Croxton)	761
R. Shilvock (Kingswinford)	1621	D. J. Byers (London N.7)	758
J. Fitzgerald (Gt. Missenden)	1552	M. Shaw (Huddersfield)	753
R. Carter (Blackburn)	1510	K. Kniveton (Kingswinford)	706
M. J. Quintin (Wotton-u-Edge)	1416	S. T. Bowen (Kippax)	659
E. V. Robinson (Bury St. Edmunds)	1407	D. A. Robinson (Felixstowe)	646
P. C. Jane (East Looe)	1375	D. Hill (Crawley)	644
H. A. Londesborough (Swanland)	1332	A. Twelves (Rhos-on-Sea)	637
M. C. P. Bennett (Datchet)	1319	L. Stockwell (Grays)	626
J. H. Sparkes (Trowbridge)	1159	M. Ribton (Oxted)	621
Mrs. J. B. Jane (East Looe)	1095	R. Jacobs (Margate)	617
H. M. Graham (Harefield)	1060	P. Leather (Camberley)	552
M. Rodgers (Harwood)	1030	G. Brazil (Dublin)	529
A. R. Holland (Malvern)	988	P. Ramsay (Steventon)	508
K. A. Burch (Plymouth)	911	*CW ONLY*	
M. Law (Chesterfield)	902	H. A. Londesborough (Swanland)	1124
D. Taylor (Harborne)	902	D. W. Waddell (Herne Bay)	836
B. T. Mackness (Dagenham)	881	J. H. Rosling (Bakewell)	750
P. L. Shakespeare (Foulness)	858	P. L. Shakespeare (Foulness)	626
K. Linge (Willington)	813	H. Scott (Wetherby)	622
D. Brooks (Loughborough)	811	K. Kniveton (Kingswinford)	310
		D. L. Hill (Crawley)	284

Minimum score for an entry is 500 for Phone, 200 for CW. Listings in accordance with HPX Rules, and to include only recent claims. A "Nil" return is permissible in order to hold a place.

J. Doughty (*Great Barr*) finds his time a bit limited but at the time of his letter he was looking forward to great things on the bands—and he looks to be on a winner at that!

Next we have a fat letter from *A. Twelves* (*Rhos-on-Sea*) who reckons the period in review qualifies for 'memorable' status. However, he has a little moan about the "two by one" American calls not being in the Prefix List from Geoff Watts. To be fair to Geoff Watts, there seems to be a strong suspicion that even the FCC haven't decided what they are going to do, quite apart from the odd moment when their computer goes on the blink. Alan mentions the odd SM mobile on CW, explaining to an astonished G that he had the key strapped to his right leg. Safety buffs would no doubt shriek "Danger" but in fact it is quite reasonably easy to work /M on CW, provided one can "store" the incoming over in the mind, can use a side-swiper or el-bug tied to the leg or a suitable mount on the car, and have a tape-recorder to keep the log or is prepared to use the Home Office "easy logging" clause. One would be quite surprised to know how much CW one can store—old J.C. is a fan of Radio 3, and on the MW channel, at least till November 23, GNI was a fine image signal; on the way through the lanes to and from work one can copy GNI almost 100%. One hopes the new frequency will have something similar to practice on!

Talking about CW, we have a couple of letters from *H. Scott* (*Wetherby*) who was trained as W/Op. 'way back during the war; Haydn was quite surprised himself at the speed with which the code came back to mind and speed improved. Being in business, Haydn reckons he has to make up his mind between SWL-ing on the one hand and R.A.E. on the other—there just isn't enough time for both! Incidentally, here we have another SWL getting tangled up in the two-by-one American calls.

A new reporter is *C. Stevens* of *Derby*, who has an indoor wire tacked to an ATU and feeding an FR-DX400 receiver; there are converters for two and four metres but as yet no beams for them, although at the time of writing Clive was rotating schemes through his mind, based on the idea of a pole outside.

J. W. E. Thomas (*Axminster*) is looking for more information on receivers and digital displays. For the latter one could do worse than study the counter recently offered in *Short Wave Magazine*, May and June 1978 issues; and for the former a visit to the revived Axe Vale club to see the locals and pick their brains seems indicated!

J. Timms (*London N4*) has been shop-gazing, so that now he has to try and make up his mind between Sony Yaesu, Trio or Drake receivers; one would have thought that from where he is he could do it the ideal way, which is be listening to each one. One thing this writer wouldn't bother with is a digital display, simply for the reason that one is too inclined to think of the numbers on a digital display as perfectly accurate, just because they appear as numbers, when they are in practice only as accurate as the clock oscillator and divider chain. For some reason one does not fall into this particular trap so much with a conventional dial display and calibrator.

Next we have a letter from *J. Waters* (*Derby*). Jack has an FR-50B receiver and would like to improve its performance. However, the budget is tight and he would like to hear from anyone with operating experience of the Datong Active Receiving Aerial, Type AD170. A pity Jack doesn't mention his present aerial to give some sort of comparison, but nonetheless he would appreciate letters to him at 33 Quarn Drive, Kedleston Road, Allestree, Derby.

A new definition of the latest U.S. prefixes comes from *K. Linge* (*Willington*)—he calls it "a population explosion" and wonders just what on earth the FCC are up to. However, to his own situation; the list is a little shorter than usual because Ken is commuting each day.

Neither *D. Brooks* (*Loughborough*) nor his XYL have had much time for listening lately. There has been a change of QTH, with its inevitable aftermath of searching for this or that item packed away, and then the matter of Morse practice with a view to a G4 call each in the near future. We'll keep the columnar fingers crossed!

J. Nicol (*South Croxton*) seems to be busier than ever since his retirement; the current activity has been along the line of "sorting-out" the shack to make it, as Jim says, "a nicer place to hibernate in!" Morse and R.A.E. are also firmly in hand, and now there is room to move in the shack, lots of other things can be tackled. No doubt about it, a tidy shack with room to move about is a blessing—you should see our Editor clearing space for the chart in his shack on which he is doing his coastal navigation homework. It takes longer to make room than to do the work! But it must be said that there is even less room on board, and tidiness then becomes vital, as indeed it does when one has a /M station. As for hibernation, we wouldn't go so far as that, even though most of us with a "separate" shack, whether dedicated room or garden shed, will admit to having on occasion used it as a refuge from storm and tempest in domestic or business relationships.

Apart from his R.A.E., *K. Kniveton* (*Kingswinford*) has been hearing a couple of interesting ones, in the "ZA1BY" who turned into an I2 when called by a G station, and YI1BGD heard on CW on 28050 kHz around 1630z. The first one has undertones of that kind of late eighteenth-century naval morality in which it was quite legitimate to fly false colours to bait the trap, so long as the proper flag was run up just as the trap was sprung. As for the CW YI1BGD, we wonder a little; we know the YI1BGD operation has been planning expansion, but we don't know whether this is a fulfilment of the desire to move from one-band limitations placed in the orginal licence.

J. Doughty (*Birmingham 44*) is a bit puzzled about the rules as they relate to the Annual and the All-Time HPX. Simple enough—the Annual is just that, with a twelve-month cycle from January 1 to December 31. If you go over 500 you are reckoned to have a fair idea as to what it is all about and so you go on to the All-Time. If at the end of 1978 you haven't made the 500, put your list to one side and start again for 1979. A lot of prefixes will appear in both lists by the time the 1979 one gets to the magic 500, but there will be some which only appear in one or the other list, and maybe a few from earlier years still if you are an old-timer. All these can be added to the total when the All-Time Ladder is reached.

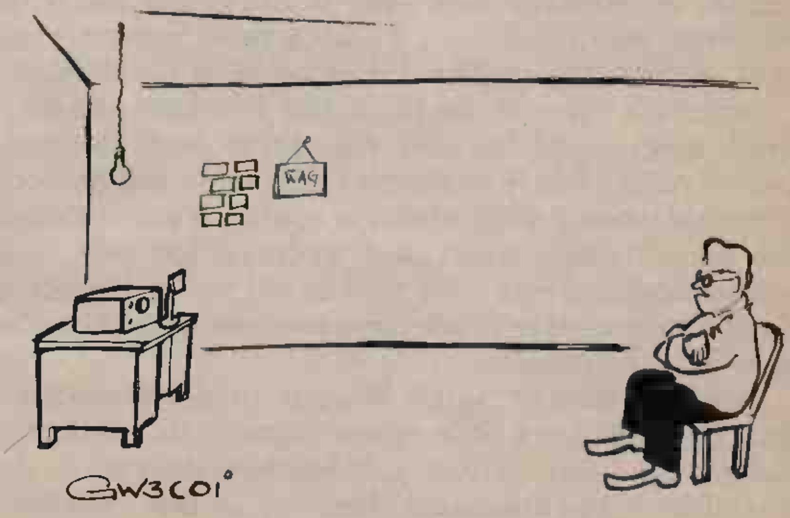
Others

These include *J. Timms* (*London N4*); *D. Taylor* (*Harborne*); *L. Stockwell* (*Grays*); *P. Matthews* (*Eastwood*); *R. Towlson* (*Nottingham*); *M. J. Quintin* (*Wotton-u-Edge*); *M. Shaw* (*Huddersfield*); *M. Rodgers* (*Harwood*); *M. Law* (*Chesterfield*); *H. A. Londesborough* (*Swanland*).

Finale

The end of yet another year of "SWL" and so the time for us to mention the start of a new, 1979 Table; final scores for the 1978 Ladder should appear in the March 1979 "SWL" piece. If you have enough to make an entry for the 1979 ladder, by all means send it along and we shall take note of it. Meantime, happy listening to you all, and all your letters addressed to your scribe at SHORT WAVE MAGAZINE, 34 High Street, Welwyn, Herts., AL6 9EQ.

Note: Deadline for May issue, March 22nd.



". . . we have an excessive gain problem at this time . . ."

THE LAW OF MURPHY

OR FANNY HILL'S DILEMMA

DAVID GORDON, G4OG

THIS magazine has been responsible for the continual execration of an excellent fellow: poor Murphy, you make him take the blame for everything.

The weather becomes gorgeous, hand conditions out of this world—just as Field Day finishes: Murphy. Its a DX Competition weekend and come Friday night, the XYL develops 'flu and you've got to look after the junior ops: Murphy. Page 508 of *S.W.M.* for October 1978—a relay sticks on receive in the middle of a much sought after QSO with Wyoming: Murphy strikes again. The poor fellow confided in me that the last straw was when an apparent definition of his law was recently published. *Sic*—"If anything can go wrong, it will."

No, No, *No*! You've got it all wrong and if you don't watch out, 'e'll 'ave yer.

Speaking personally the most erudite source defines Murphy's Law as follows: "If it is physically possible to mis-assemble or incorrectly operate a particular device, then somebody, someday, will so mis-assemble or incorrectly operate said device." All quite simple and straightforward. Lets have no more of this chauvinistic tendency to blame a poor Irishman for everything that goes wrong.

A few examples of Murphy *really* at work. Many of you will remember the little local difficulty at the Echo Fisk oil rig several months ago. All sorts of expensive experts left their expensive swimming pools and travelled very expensively to sort out the trouble. And what did they do? They fitted the shut-off valve to cap off the oil *upside down*. Why? Because it was 'physically possible' so to do. And Murphy was waiting. It made him particularly pleased of course, because the incident received world-wide publicity.

Two more illustrations, from a rich field which has brought delight to Murphy over the years, that of Aviation. It used physically to be possible to assemble flying control cables in an aeroplane the wrong way round. Let us consider the case of incorrectly assembled elevator controls. Normally, when you pull the stick back on an aircraft, up goes the nose—but if you've got the wires the wrong way round . . . ? On a more sombre note, many readers may recall a *Viking* accident in the fifties; a non-return valve in the main fuel line from the starboard tanks could be, and was, fitted back to front. Result? All the fuel from the port wing tanks was pumped into the starboard wing where, of course, it was unusable and an aeroplane won't stay airborne for very long without engine power. No need to tell you intelligentsia of the simple ways in which these two examples have now been Murphy-proofed.

Let now turn to watch Murphy prowling restlessly amongst hardware a little nearer home to us. Probably one of the most perfect *anti*-Murphy devices is the coaxial cable and associated plugs and sockets. Do what he will, it is just not physically possible to assemble a coax plug the wrong way round, nor is it possible to plug said plug into coax socket incorrectly. (I sense Murphy stirring restlessly beside me as I write, but none of us have ever done it—have you?) The vile 13-amp. plug and its beastly little baby brother the 2-amp. 3-pinner are different kettles of sea food altogether. You can't plug 'em in wrong but there's nothing to stop you wiring them up incorrectly. They are one of Murphy's 'things'—the joy it brings him when you connect BROWN to E. I suppose the only answer here is three different sizes of conductor with correct terminal sizes to match —and a nightmare problem for the mass producer.

Here's a (true) story that had Murphy in convulsions. This was the assembly of my shiny new TA-33jr. antenna. Now the elements and boom of the TA-33 are colour-coded for ease of assembly though travelling time, the journey up to the top of the tower and various other factors can make the painted colour marks wear a bit thin. From memory there was a sort of maroon coloured dab of paint on the director which was repeated on the director end of the boom and so on. But it is physically *possible* to clamp the director on to the reflector end of the boom and *vice-versa!* Now if you're like me with a new antenna, all you want to do is to get it up in a hurry and then get back into the shack where you know the whole world (including elusive Wyoming) is going to jam the band in answer to your first call. It really didn't look all that funny and it was quite a while before I realised what I'd done; I glanced up at it one fine morning and did a sort of double-take.

Readers will, by now, have thought of all sorts of pro- and anti-Murphy situations. Some pros: Locking yourself out of your car in the middle of nowhere (or on a double yellow line); lighting the wrong end of a cigarette in the cinema (Murphy smokes a clay pipe of course—no chance of him being hoisted by his own petard); insertion of the U2-type family batteries into transistorised equipment—the PP3 can be safely categorised as Murphy proof. Some antis: Insertion of (I think) all types of valves in their sockets—can you imagine Murphy's bleats of joy consequent upon the invention of the transistor? Insertion of, but *not* the wiring up of Din plugs; the device on my dishwasher which physically prohibits if from starting until the cover is on (my downstairs neighbour has reason to wish I hadn't been able to open the door of the washing machine when it was full of soapy water). The list is endless snd its not a bad exercise for the insomniac.

So let us all beware and not imprecate Murphy when its not his fault—as an ex-Royal Air Force pilot I exhort you to take note of Gremlins, of the laws of Parkinson and Sod—and so forth. Let the right devil be given his correct dues or the wrong devil may take umbrage and find ways of getting into something which is really no business of his (Murphy has just passed me a drawing of his first prototype assembly of a coax plug with the braid going to the centre conductor).

How does Fanny Hill come into this, I hear you say. Well, although *Short Wave Magazine* is not really a family journal in the true sense, at least you *can* leave it lying around the house and not keep it in the back of the sock drawer with the Playfairs and Mayboys. So suffice it to say to those readers who, like me, are admirers of the lovely lady, that you may remember her encounter with the lusty sailor and her subsequent remonstrations to which he replied, "Any port in a storm my dear."

A gentle reminder that the Leicester Exhibition was not *all* expensive hardware and queues to the cafeteria ! *Top left*, Noreen Walsh of Lowe Electronics Ltd. shows off the new TR-2300 to G3TRB, SWL Jack and G3FMW ; *top right*, Anne Fah on the Microwave Modules Ltd. stand describes a fine point of a linear amplifier to G8ALQ (left) and G3XKZ. With Anne is the firm's principal, G3VXK ; *2nd left*, three members of the British Amateur Television Club on their stand : *left to right*, G8IQU, G8CJS and G4GEE ; *2nd right*, Carol Norcliffe and Christine Wood of P.M. Electronic Services doing business with (*l. to r.*) G8MNX, G8NVH, G8KHJ and G8IMC ; *bottom left*, trade must have been good for Dave Stockley, G4ELP, of Thanet Electronics, because he even treated Pauline, G8NNB, to an ice-cream ! *bottom right*, serious study going on at the Western Electronics (UK) Ltd. stand by, *left to right*, G8FFC, G8EBI, G8REM and G8LJW.

CONSTANT DEVIATION COMPRESSOR FOR A TWO-METRE TRANSMITTER

TERRY FLATT, G4AZF

IN the course of designing a two-metre transmitter, it became apparent that some means of controlling the maximum deviation would be required. Whilst this does not itself present a problem, setting up the transmitter to produce a nominal 3 kHz deviation and the disciplined microphone technique required to maintain this is not always easy. Indeed, to many amateurs it seems to be an eternal pre-occupation, as evidenced by the annoying and seemingly endless whistling and listening for over-deviation pips on many repeaters.

This circuit was devised with the intention of obviating the problems usually associated with setting up the deviation controls on a transmitter, and of maintaining the settings with reasonable variations of microphone and microphone technique; it was also necessary to use a minimum number of easily available components, and to be simple to set up.

After investigating a number of methods for gain control, *e.g.* FET's, diode attenuators and current controlled amplifiers, it was discovered that *National Semiconductors* produce a variable attenuator IC in an eight-pin package, which is available from *R.S. Components* as RS. 306-803. This IC has a gain control range approaching 90 dB for a 3v. change in control voltage and, with the addition of a few discrete components, forms a very useful basis for a speech compressor or microphone level control amplifier. At first sight, its large dynamic range looks very attractive and it would not be very difficult to devise a circuit which makes full use of it. However, after a little thought, it can be seen that this is not really a practical proposition as such a wide range would imply that at maximum gain any small sound in the room would modulate the transmitter, and at minimum gain, the microphone would be giving several volts of output! Since the first situation is undesirable, and the second virtually impossible, we can relax some of the design requirements of the control circuitry, and the final design is shown in Fig. 1.

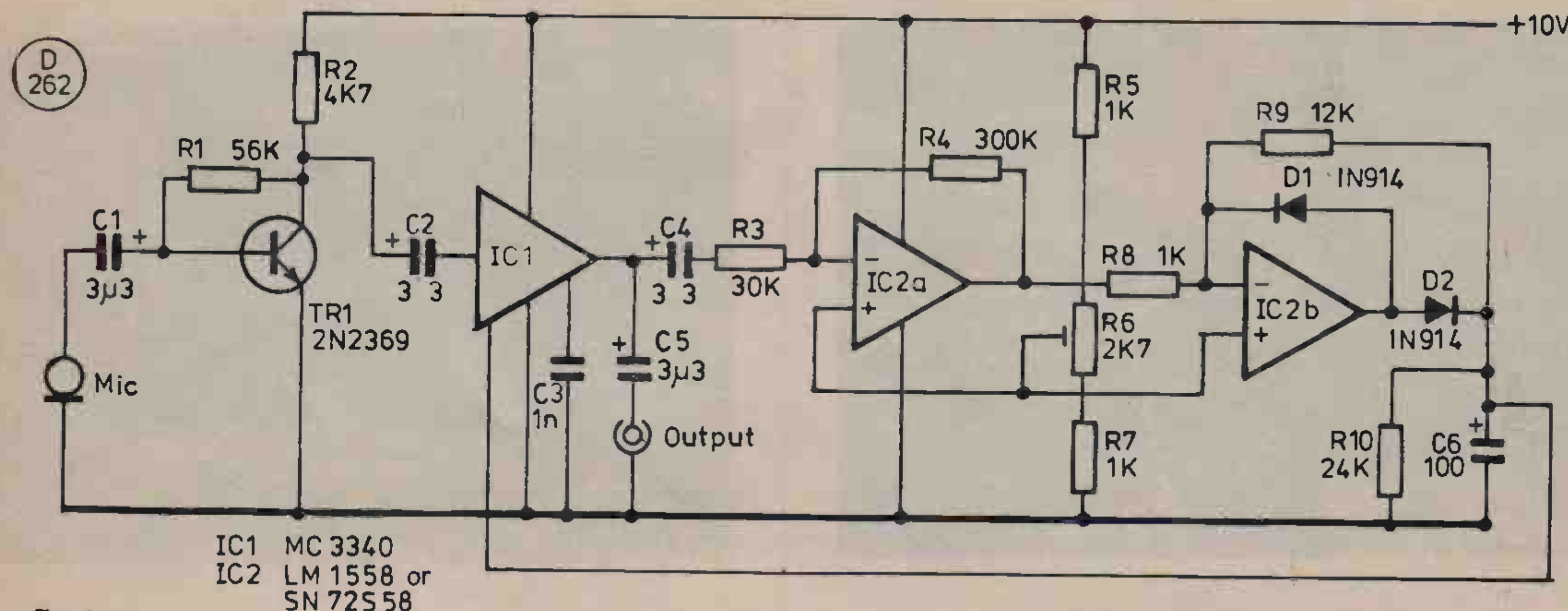


Fig. 1

The Circuit

Transistor 1 is a single-stage amplifier which provides sufficient gain to enable the unit to be used with low output microphones, and should not run into distortion with higher output types. IC1 is the gain controlled stage, and the output from this is taken to the transmitter and to the input of IC2A.

IC2A is connected as an AC amplifier whose gain is set by the ratio of R3 and R4, and the working point is set by the potential divider R5, R6 and R7; in order not to affect the AC gain of the amplifier, R5, R6 and R7 have been assigned comparatively low values. IC2B is connected as a rectifier which has a minimum DC output voltage, and this is also controlled by the potential divider R5, 6 and 7. The output of the rectifier is taken

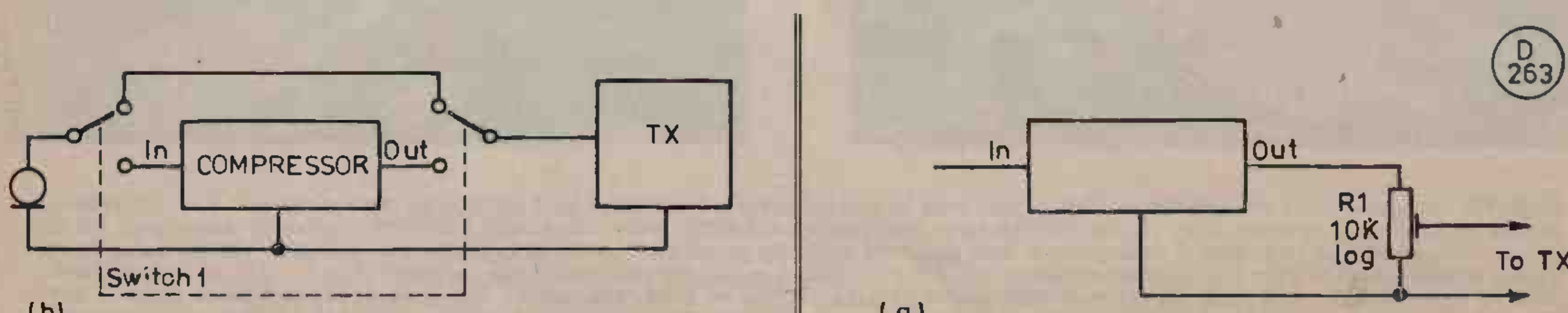


Fig. 2

to the gain control input of IC1, and to C6 and R10.

C6 and R10 provide a time constant which allows the gain of the compressor to remain constant for the short term variations which occur in normal speech, but allow the gain to vary with different average changes in speech level. The selection of these two components affect the characteristics of the compressor and their final values will depend on the personal preferences of the user; the author suggests that the values shown should be used initially, and listening reports may be used to determine whether their values ought to be changed. Reducing their values too much will result in unpleasant pumping noises, and increasing them too much will mean that recovery from extreme speech peaks will take a long time. The values given seem to be a reasonable compromise between communication quality and fairly natural sounding speech.

Setting-Up

R6 has two functions; one is to set the working point of IC2A, but primarily to set the minimum control voltage of IC1. To do this properly, all that is required is a high impedance voltmeter connected across C6, then turn R6 until the voltage at C6 just begins to rise. It is a good idea to do this slowly, otherwise the time constant at C6 will tend to give misleading results. The voltage at C6 should now be about 3·35 volts, although this may vary with different samples of MC3340. Increasing the voltage at C6 slightly above this value will delay the onset of gain control, and again, listening tests should determine whether or not this is beneficial.

Adjustment of R6 should be all that is required to set up the circuit. The only other difficulty that might be encountered is the biasing of TR1, and this can be checked by measuring the voltage at the junction of R2 and C2; this should be about 5 volts. If it differs from this by more than half a volt, increase R1 if it is too low, or decrease R1 if it is too high. This should not be too difficult, but it is not worth trying to get closer than half a volt to the figure stated.

When you have got to this stage you must decide what maximum input your transmitter requires. This is not difficult if you have a deviation meter but if you don't possess, or have access to, one (have you read your licence lately?) you will have to use a roundabout strategy. Temporarily arrange the circuit in Fig. 2b, and with the help of a local station you can rely on to give reliable reports you should be able to compare the deviation with the compressor until, with normal speech, it is about the same as that from the microphone with a steady, fairly loud continuous tone.

The maximum output voltage is approximately 200mV. peak-to-peak, and this may be adjusted by changing the value of R3. Increasing R3 will increase the output voltage, and decreasing it will have the opposite effect. (If you don't like playing with different fixed resistors, you can put a 10K pot on the output of the compressor, as shown in Fig. 2a).

Although the compressor was designed to be built into a two-metre transmitter there seems to be no reason why it could not be used with any existing transmitter. Since it has a relatively low output at a reasonably constant level, connecting it between the microphone and microphone-input of the transmitter should not really cause any insuperable problems. It must be remembered, though, that it was not designed as a high-grade speech processor, and if you want to use it in this kind of way you should also be prepared to incorporate some filtering between it and the transmitter. However, it is so simple to build and set up that it may well be worth experimenting along these lines.

POINT OF VIEW

Below we print a paragraph from the BARTG Newsletter, written by G8LT with reference to the comments by Norman Sedgwick, G8WV, in our June 1978 issue. We have no particular remark to make in either direction, except to say that, since both views are sincerely and honestly held by well-known amateurs of impeccable technical ability, BARTG's request that we publish this paragraph of G8LT's column was accepted instantly;—

"More in sorrow than in anger did I read *Part IV* of an otherwise excellent series of articles by G8WV in *S.W.M.* on the subject of RTTY which expressed such a one-sided view that it seems to call for some comment if none has been made elsewhere. While theory and practice in relation to the actual bandwidth needed by the different modes may be far apart, as witness some of the signals that can be heard, the question is posed as to where RTTY fits in and serves a 'useful' purpose in an amateur station, a point that might equally well be asked about CW and SSB. The Home Office licence restricts us to the CCIt No. 2 International 5—unit teleprinter code at speeds not exceeding 50 bauds so for the moment ASCII, error correction and other luxuries are barred. The 'usefulness' of RTTY in the amateur context has presently to be sought elsewhere. Technical training is still the most important reason that various governments give for allowing the amateur service to exist and with WARC not far away we would be wise to remember this fact. Such training in the science of machine telegraphy is as important today as the building and understanding of CW and AM gear was in the days when G8WV was a newcomer to the field. The upsurge of interest in RTTY of recent years has come mainly from those who are not content with a "black box" and pounding a key. No science stays still, least of all RTTY. As a body we can point to the steady improvements that have come about in demodulators, the enormous impact of microprocessors which spawn new applications in RTTY every month, to name but a few. As a medium for passing information such as satellite orbital predictions, propagation forecasts and detailed alpha-numeric information at machine speeds, it excells as many who use it for this purpose on a regular basis can testify. Add to this Auto-start Selcal and a host of other interesting developments no wonder so many get 'hooked' on it. Let us not sell RTTY short—it is surely here to stay: 'warts and all.'"

VHF BANDS

NORMAN FITCH, G3FPK

Awards News

FOR some time now many readers have realised that our VHF Century Club award has become far easier to win on 2m. in particular, although it remains a considerable achievement on 4m. and 70 cm. Recently some readers have accumulated the minimum of 100 confirmations just a few months after being licensed. Accordingly, we are proposing to issue awards based upon QTH squares confirmed which should present a greater challenge, while retaining the established VHFCC.

The awards will be known as the QTHCC, the basic requirement being the possession of confirmations from at least 100 different QTH squares—*e.g.* ZL, AM, BI, etc.—on the chosen band. The starting date will coincide with our "Squares Table," *i.e.* January 1, 1975, and stickers will be issued for every additional 25 squares confirmed.

The QTHCC Awards will be available both to fixed and portable stations but portable operation must be from the same site, such as the regular one used for contests. If during the period of collecting the cards an applicant moves his permanent QTH, provided the move is within a 50 kilometre radius of the original QTH, he will not need to start again from scratch.

Only one class of award is proposed with no endorsements for mode or propagation method. However only direct contacts are eligible *via* sporadic E, auroral, tropospheric and meteor scatter propagation or moonbounce. QSO's via repeaters and satellites are excluded. All applications must be made on a claim form which can be obtained by sending a self-addressed envelope to: Awards Dept. (QTHCC), Short Wave Magazine, 34 High Street, WELWYN, Herts., AL6 9EQ.

The form contains the complete rules. It may be a little while before the certificates are printed but applications will be processed as received.

Derek Purkiss, G8NNJ, is the sole recipient of the latest VHF Century Club award number 306 for 2m. His interest in the hobby stretches back to the days of the R1155 and CR100 receivers. More recently, the purchase of an *FRG-7* Rx, plus a chance meeting with a local G4 licensee, spurred Derek on to taking the R.A.E. His present station in Romford, Essex, comprises an *FDK* "Multi 2700" and 5-ele. *ZL-Special* aerial. A 50 watts amplifier and 12-ele. beam were being constructed when the award was claimed.

On a much more irreverent note, Bob Lane, G4AWU, has sent along a specimen copy of the "R.D. Award," the R.D. meaning rubber duck. The beautifully prepared certificate has been designed and produced by fellow Yorkshireman Ian Harwood, G8LHT, and entitles the recipient to membership of the "Ultimately Kinky Flimsy Mackintosh Group." 50 qualifications are listed, any of which entitles the claimant to the award. These include such gems as, "Anyone who thinks CW means Citizens Wireless," "Anyone who thinks repeaters should have QSL Managers," and "Anyone who thinks propagation is not possible between channels." For further information, an *S.A.E.* to either G4AWU or G8LHT is suggested. (Don't bother us! Ed.)

Beacon Matters

Brian Bower, G3COJ, has sent along details of proposed U.K. beacon frequency changes to comply with the agreements reached at the IARU Region 1 Conference last April. These are: GB3VHF (AL52j) to 144·925 MHz; GB3NEE (ZO12a) to 144·935 MHz and GB3GI (XO41j) to 144·945 MHz. These QRG's have not yet been agreed by the Home Office. A new site will have to be found for GB3NEE to avoid interference to the GB3TW repeater. It seems that it will be some while before these changes are possible. GB3SUT is QRT for a major rebuild, according to GB2RS.

HB9RO, the VHF Manager of the Swiss national society, USKA, has asked the RSGB to suggest a new QRG for HB9HB, presently on 144·125 MHz, and 144·865 MHz is a possibility. In a letter to G3COJ, Jacques Talayrach, F9QW, the VHF Manager of the REF, mentions FX4UHF (ZD52b) on top of La Rhône mountain on the Franco-Spanish border. Brian has copied it once on about 432·86 MHz.

Licences for two 24 GHz beacons have been applied for in the Isle of Wight and Alderney, probably the first amateur beacons anywhere in the world in this band.

More and more complaints are being received by letter, telephone and on the air concerning the almost continual use of 144·90 MHz by a group of FM fixed and mobile stations in the London area. It has been pointed out to these amateurs many times that this is the middle of the internationally agreed beacon sub-band and that their inconsiderate actions make reception of FX3THF and FXØTHF impossible for those wishing to check propagation or tweak up receivers.

Your scribe has listened to the lengthy harangues which have ensued when polite requests for a QSY have been made. Attitudes seem to range from downright, bloody-minded, refusal to even consider the idea, to a more reasonable agreement to shift, " . . . in the spirit of amateur radio," as one occupant put it. In the 144·500-144·850 MHz part of the band, there is just one spot frequency our licences require we should avoid—144·54 MHz. In the current band plan there are five frequencies recommended for RTTY, Data, FAX, ATV talkback and Raynet in this part of the band, which leaves acres of space for this group, one would have thought. There is no reason either why "channel-mania" should suggest only one QSO per 25 kHz. Why not use odd-ball frequencies like 144·711 or 144·562 MHz?

It is hoped that current users of 144·90 MHz will ask themselves what they expect to achieve by antagonising their fellow amateurs, before official complaints are lodged. In this context it is pertinent to quote Clause 4 (1) of our licence; *viz:* "The apparatus comprised in the Station shall be so designed, constructed, maintained *and used* that the use of the Station does not cause any undue interference with *any wireless telegraphy*." (Our italics.) It would appear that beacons licensed to operate continuously would be included in the, " . . . any wireless telegraphy" category.

Jimmy Bruzon, ZB2BL, writes that they are shortly expecting the new 6m. beacon Tx which will be on 50·035 MHz. They are also awaiting a mains supply at the top of "The Rock" so that it can be installed. It is then hoped to put the 4m. beacon back on the air with the aid of a filter from G3UUT *via* G4CFF to get rid of the 3rd harmonic which falls on the Spanish TV Ch. 10.

Rumour has it that the Lannion 2m. beacon, FX3THF, now beams towards Rhodesia with an 18-ele. long *yagi* in connexion with the TEP study programme. Nothing like a bit of optimism!

VHF Convention

March 10 is *the* date for all VHF men to congregate at The Winning Post Hotel, Whitton, Middx. Geoff Stone, G3FZL, has passed along the information on this annual RSGB event. The trade show will be component, module and accessory orientated, with no complete transceivers. There are three lecture streams planned. Stream "A" is devoted to Techniques covering SS/TV G8CGK; Microprocessors for VHF by G4CDU and the RTTY repeater GB3PT by G8MEI. Stream "B" is entitled Propagation Studies including Sporadic E by G3USF; Tropo. by G3LTP and auroral by G2FKZ. The "C" stream is for Microwave addicts with lectures on receiving systems by G3WDG; on microstrip techniques by G8DEK and on operating microwave equipment in the field by G4CNV. As usual, the talks will be in the Whitton School.

The Winning Post Hotel is on the northern side of the A316 Chertsey Road, the NGR being TQ 141731. Entry to the trade show and lectures is £1·00 (50p under 18) and the full ticket including the evening buffet supper will set you back £4·00.

Contests

Correction: Apologies to G8OGL whose station achieved second place in the Fixed section of the 144 MHz QRP contest on July 30 last year with

THREE BAND ANNUAL VHF TABLE
Final Placings, December 31, 1978

Station	FOUR METRES Counties	FOUR METRES Countries	TWO METRES Counties	TWO METRES Countries	70 CENTIMETRES Counties	70 CENTIMETRES Countries	TOTAL Points
G3SPJ	61	8	66	16	43	9	203
G2AXI	46	7	59	15	38	8	173
GD2HDZ	45	5	61	11	42	9	173
G4ERX	38	5	57	16	37	11	164
G3CO	50	7	54	15	28	9	163
G8GXP	—	—	73	21	54	9	157
G8GML	—	—	64	14	53	12	143
G4CMV	—	—	64	26	41	11	142
G8LEF	—	—	63	17	46	16	142
G8BKR	—	—	72	16	41	6	135
G4GEE	15	2	58	12	38	6	131
G4BWG	23	4	58	18	19	7	129
G8HHI	—	—	62	19	38	7	126
G4AEZ	29	4	48	12	26	5	124
G3KPU	—	—	58	13	36	8	115
G8LHT	—	—	59	14	31	11	115
GI8EWM	—	—	68	13	21	6	108
G3BW	—	—	55	16	31	5	107
G3FIJ	31	3	44	9	17	3	107
G8IFT	—	—	62	15	24	3	104
G4DEZ	—	—	75	28	—	—	103
G3FPK	—	—	78	24	—	—	102
GJ8KNV	—	—	51	19	21	9	100
G8MFJ	—	—	61	14	22	2	99
G4BYP	9	3	44	9	25	6	96
G8KSS	—	—	70	19	—	—	89
G8KOF	—	—	62	18	6	2	88
G4FRE	1	1	49	8	24	3	86
G8ITS	—	—	46	9	26	4	85
G4HAO	—	—	68	12	—	—	80
GJ8ORH	—	—	42	16	15	6	79
G8APZ	—	—	57	16	4	1	78
G4GXT	—	—	61	11	—	—	72
GM4CXP	2	2	45	14	2	2	67
G4FKI	14	1	33	6	10	1	65
G8OGD	—	—	42	9	9	5	65
G8JJR	—	—	51	10	—	—	61
G8BIJ	—	—	50	9	—	—	59
G8GRT	—	—	35	4	15	3	57
G8MKW	—	—	47	9	—	—	56
G8NYS	—	—	44	8	—	—	52
G4GET	—	—	42	9	—	—	51
GJ8AAZ	—	—	31	6	7	5	49
G8JGK	—	—	29	9	—	—	38

516 points from 114 QSO's. G4APL was in third place.

Coming events: Feb. 4 from 1000 to 1500 GMT is when the 432 MHz Fixed station contests take place. Two sections; single op. and multi-op. The weekend March 4/5 sees the 144/432 MHz affair from 1600-1600 GMT, while on April 6/7 respectively, the 1296 and 432 MHz Open contests are scheduled.

Trans-Equatorial Studies

Martin Harrison, G3USF, has passed along news about the continuing trans-equatorial propagation tests between Europe and South Africa in the 2m. band. Up to late November, results had not been as good as in the April/May period, but Roland Whiting, 5B4WR, has been hearing the ZE2JV beacon from time to time.

On November 5, between 1715 and 1725 GMT, Costas Fimerellis, SV1DH, in Athens, heard the ZS6DN beacon at good strength over a calculated 7,117 kms. path; "... obviously a notable event even though a QSO did not result," to quote Martin. In an attempt to determine the propagation mode on 2m. simultaneous tape recordings of the 2m. and 10m. ZE2JV beacons are being made by the participants at the European end. The "pulsing" noted on ZE2JV's signal on 28·331 MHz is associated with these tests.

SV1DH has passed information that in early November, FM contacts were made on 2m. between TU and EA8, representing up to 2,700 kms. distance. Costas also mentioned FM QSO's between CT3 and CN, but that would not seem to be an exceptional distance and could be achieved quite easily *via* normal tropospheric propagation.

Six Metre Happenings

Jimmy Bruzon, ZB2BL, reports what is believed to be the first 50 MHz QSO between Gibraltar and Brazil and which took place on October 23 at 2222 GMT with PY1RO. The CW reports were RST 549 at each end and then PY1RO came on SSB with a RS 54 report from Gibraltar. Jimmy was using a *Pye* Base Station putting out 15 watts to a 5-ele. yagi beaming due south! The Rx was a *Yaesu* FR-101 which Howard, G8PCU, brought all the way from England. At the time of the QSO with Brazil, Bernard Webb, G4EMR/ZB2DV, was in the shack and also worked PY1RO.

The QSO's took place on the ZC2VHF beacon frequency of 50·004 MHz and it is believed that other PY stations have heard this beacon. PY1RO has also copied the Cyprus 6m. beacon 5B4CY on 50·498 MHz on November 1 between 2200 and 2300 GMT and it is thought that TEP was involved. 5B4CY is beaming towards South Africa so Brazil is way off that azimuth.

According to G3USF, PY1RO is hoping to commission a beacon on 50·005 MHz with 20 watts to a five-eighths wavelength aerial, on a 24-hours per day basis. Likewise, ZS5TR plans an entry in the 6m. beacon stakes some time.

Repeater Notes

The following VHF repeaters are now operational: GB3NB on R1 from Tacolneston, Norfolk; GB3PR on R3 from Perth and GB3CF on RØ in Leicester. This latter would suggest that simplex working on SØ should now cease to avoid accidentally accessing the Leicester relay.

On UHF, another five repeaters are operational: GB3HC on RB6 from Hereford; GB3HE on RB14 from Hastings; GB3NR on RBØ from Norwich; GB3PB on RB10 from Peterborough and GB3SP on RB4 from near Pembroke in Dyfed.

The Satellite Scene

Ron Broadbent, G3AAJ, the secretary of AMSAT-UK, advises that they are producing a three months calendar for the Russian satellites *RS-1* and *RS-2*. For details and costs send an *s.a.e.* to him at 94 Herongate Road, London, E12 5EQ.

Predictions for the ailing *Oscar 7*' *Oscar 8* and the Russian birds are still being broadcast over GB2RS although it was suggested earlier they would not be. The periods for *RS-1* and *RS-2* are quoted as 120·389433 minutes and 120·416521 mins. respectively, the corresponding longitude increments being 30·227° and 30·234° west per revolution. *RS-1* is very easily over-loaded by the power-mad western european brigade and it is rare to have a successful contact through it. *RS-2's* Rx appears to be some 10 dB.

TWO-METRE ANNUAL TABLE

Final Placings
at December 31, 1978

Station	Counties	Countries	Total
G4DEZ	75	28	103
G3FPK	78	24	102
G8GXP	73	21	95
G4CMV	64	26	90
G8KSS	70	19	89
G8BKR	72	16	88
G3SPJ	66	16	82
G8HHI	62	19	81
GI8EWM	68	13	81
G8KGF	62	18	80
G8LEF	63	17	80
G4HAO	68	12	80
G8GML	64	14	78
G8IFT	62	15	77
G4BWG	58	18	76
G8MFJ	61	14	75
G2AXI	59	15	74
G4ERX	57	16	73
G8APZ	57	16	73
G8LHT	59	14	73
GD2HDZ	61	11	72
G4GXT	61	11	72
G3BW	55	16	71
G3KPU	58	13	71
GJ8KNV	51	19	70
G4GEE	58	12	70
G3CO	54	15	69
G8JJR	51	10	61
G4AEZ	48	12	60
GM4CXP	45	14	59
G8BIJ	50	9	59
GJ8ORH	42	16	58
G4FRE	49	8	57
G8MKW	47	9	56
G8ITS	46	9	55
G3FIJ	44	9	53
G4BYP	44	9	53
G8NYS	44	8	52
G4GET	42	9	51
G8OGD	42	9	51
G4FKI	33	6	39
G8GRT	35	4	39
G8JGK	29	9	38
GJ8AAZ	31	6	37

516 points from 114 QSO's. G4APL was in third place.

Coming events: Feb. 4 from 1000 to 1500 GMT is when the 432 MHz Fixed station contests take place. Two sections; single op. and multi-op. The weekend March 4/5 sees the 144/432 MHz affair from 1600-1600 GMT, while on April 6/7 respectively, the 1296 and 432 MHz Open contests are scheduled.

Trans-Equatorial Studies

Martin Harrison, G3USF, has passed along news about the continuing trans-equatorial propagation tests between Europe and South Africa in the 2m. band. Up to late November, results had not been as good as in the April/May period, but Roland Whiting, 5B4WR, has been hearing the ZE2JV beacon from time to time.

On November 5, between 1715 and 1725 GMT, Costas Fimerellis, SV1DH, in Athens, heard the ZS6DN beacon at good strength over a calculated 7,117 kms. path; ". . . obviously a notable event even though a QSO did not result," to quote Martin. In an attempt to determine the propagation mode on 2m. simultaneous tape recordings of the 2m. and 10m. ZE2JV beacons are being made by the participants at the European end. The "pulsing" noted on ZE2JV's signal on 28·331 MHz is associated with these tests.

SV1DH has passed information that in early November, FM contacts were made on 2m. between TU and EA8, representing up to 2,700 kms. distance. Costas also mentioned FM QSO's between CT3 and CN, but that would not seem to be an exceptional distance and could be achieved quite easily *via* normal tropospheric propagation.

Six Metre Happenings

Jimmy Bruzon, ZB2BL, reports what is believed to be the first 50 MHz QSO between Gibraltar and Brazil and which took place on October 23 at 2222 GMT with PY1RO. The CW reports were RST 549 at each end and then PY1RO came on SSB with a RS 54 report from Gibraltar. Jimmy was using a *Pye* Base Station putting out 15 watts to a 5-ele. yagi beaming due south! The Rx was a *Yaesu* FR-101 which Howard, G8PCU, brought all the way from England. At the time of the QSO with Brazil, Bernard Webb, G4EMR/ZB2DV, was in the shack and also worked PY1RO.

The QSO's took place on the ZC2VHF beacon frequency of 50·004 MHz and it is believed that other PY stations have heard this beacon. PY1RO has also copied the Cyprus 6m. beacon 5B4CY on 50·498 MHz on November 1 between 2200 and 2300 GMT and it is thought that TEP was involved. 5B4CY is beaming towards South Africa so Brazil is way off that azimuth.

According to G3USF, PY1RO is hoping to commission a beacon on 50·005 MHz with 20 watts to a five-eighths wavelength aerial, on a 24-hours per day basis. Likewise, ZS5TR plans an entry in the 6m. beacon stakes some time.

Repeater Notes

The following VHF repeaters are now operational: GB3NB on R1 from Tacolneston, Norfolk; GB3PR on R3 from Perth and GB3CF on RØ in Leicester. This latter would suggest that simplex working on SØ should now cease to avoid accidentally accessing the Leicester relay.

On UHF, another five repeaters are operational: GB3HC on RB6 from Hereford; GB3HE on RB14 from Hastings; GB3NR on RBØ from Norwich; GB3PB on RB10 from Peterborough and GB3SP on RB4 from near Pembroke in Dyfed.

The Satellite Scene

Ron Broadbent, G3AAJ, the secretary of AMSAT-UK, advises that they are producing a three months calendar for the Russian satellites *RS-1* and *RS-2*. For details and costs send an *s.a.e.* to him at 94 Herongate Road, London, E12 5EQ.

Predictions for the ailing *Oscar 7' Oscar 8* and the Russian birds are still being broadcast over GB2RS although it was suggested earlier they would not be. The periods for *RS-1* and *RS-2* are quoted as 120·389433 minutes and 120·416521 mins. respectively, the corresponding longitude increments being 30·227° and 30·234° west per revolution. *RS-1* is very easily over-loaded by the power-mad western european brigade and it is rare to have a successful contact through it. *RS-2's* Rx appears to be some 10 dB.

TWO-METRE ANNUAL TABLE

Final Placings at December 31, 1978

Station	Counties	Countries	Total
G4DEZ	75	28	103
G3FPK	78	24	102
G8GXP	73	21	95
G4CMV	64	26	90
G8KSS	70	19	89
G8BKR	72	16	88
G3SPJ	66	16	82
G8HHI	62	19	81
GI8EWM	68	13	81
G8KGF	62	18	80
G8LEF	63	17	80
G4HAO	68	12	80
G8GML	64	14	78
G8IFT	62	15	77
G4BWG	58	18	76
G8MFJ	61	14	75
G2AXI	59	15	74
G4ERX	57	16	73
G8APZ	57	16	73
G8LHT	59	14	73
GD2HDZ	61	11	72
G4GXT	61	11	72
G3BW	55	16	71
G3KPU	58	13	71
GJ8KNV	51	19	70
G4GEE	58	12	70
G3CO	54	15	69
G8JJR	51	10	61
G4AEZ	48	12	60
GM4CXP	45	14	59
G8BIJ	50	9	59
GJ8ORH	42	16	58
G4FRE	49	8	57
G8MKW	47	9	56
G8ITS	46	9	55
G3FIJ	44	9	53
G4BYP	44	9	53
G8NYS	44	8	52
G4GET	42	9	51
G8OGD	42	9	51
G4FKI	33	6	39
G8GRT	35	4	39
G8JGK	29	9	38
GJ8AAZ	31	6	37

deafer, which helps a little. At the beginning of February, *RS-2* will be crossing the Equator 31½ mins. after *RS-1* and about 8½° further west.

Meteor Scatter

MS seems to be the facet of the VHF scene which is rapidly gaining more enthusiasts. From Cumbria, Bill Hodgson, G3BW, has been putting YO square on the MS map and since November has concluded QSO's with: I1DMP (DF), I3LGP (GF), DM2BYE (HM), SM2CKR (KX), F6DWG (BJ), DK5RQ (GI), HB9MFL (DH), which was a CW/SSB contact, DF6NA (EJ), DJ5MS (GI), SM3FGL (IV) and I4EAT (FE). Bill writes: "The QSO with I4EAT was a revelation to me; imagine bursts of machine-gun-like morse for periods exceeding 50 seconds. Not spasmodic but almost continuous . . . "

Another who is consistently beavering away at it is John Hunter, G3IMV (Bucks.), now with 32 countries to his credit on 2m. During the recent *Quadrantids* he worked OH3YW in MU square for a new one and enters our table at 172. The *Geminids* in mid-December brought HG6KVB/P (KH) and F6BVA (DD) and on Dec. 24, John made it with HG1YA (IH) and on the 30th, with I5CFY (FD). For Clive Penna, G3POI, the *Quadrantids* produced a new country and square in ISØPUD (EZ). An interesting schedule was with SM3BIU (HX) during which they changed beam headings by 10° each 6 mins. in the one hour sked to test out offset calculations. It was found that best reflexions occured when they beamed at each other although random, as opposed to shower, reflexions led to some confusion.

Tony Horsfall, G4CBW (nr. Stockport) completed a *Quadrantids* QSO with OHØJN, but did not complete his schedule with that station. However, John did complete with IW3QBC (CG) on random and DM2BYE, but missed out on OK1OA. Clive Morton, G4CMV, (W. Yorks.) was active in the *Geminids* and completed matters with SM3COL (IW) in 12 mins. but took 1½ hours to work EA6BW (BZ) on Dec. 14, with bursts rarely exceeding two seconds. The EA6 was Clive's 30th country on 2m. Skeds with RA3YCR (RN), LZ1CD (MC) and HG1YA did not come off.

Bryn Llewellyn, G4DEZ (Oxon.), now has his two 16-ele. *Tonna* yagis working to good effect. *Quadrantids* QSO's were completed with: F1DIK (DD), SM5BEI (JU), OHØJN, IW3QBC, but those with SM3DCX, OH7TN and YU3TCD did not come off. All those on SSB, by the way. Martyn Baker, G8KGF (Oxon.), completed with OH1FA (LU) in 50 mins. and with OE5KE (HI) in just the hour in the *Quadrantids*. The final "Rogers" were missing in the F1DYD (CF) sked.

Ken Osborne, G8KSS (Avon), made it in 20 mins. on the random SSB frequency with SM3FGL, but the OE5KE contact took 1½ hours. Skeds with OH3YW and OH1FA were not completed. From Jersey, Phil Johnson, GJ8KNV, now has a 16-ele. *Tonna* aloft and was active in the *Geminids* during which he worked SP5JC (KM) and OE5JFL (GI), Poland being a new country. Alistair Simpson, GM8NCM (Fife), took part in the *Geminids*, his successes being: DJ3TF (FJ), SM3FGL, YU3TCD (GF), DC7UT (GM) and I1KTC (EF). He found the bursts this year very short.

The general consensus is that neither shower was all that good. Nevertheless, it is encouraging to learn how this challenging mode is catching on. For those seeking a reliable memory keyer design, your scribe has spoken to several MS types who have built the G4CIK design which was featured in the *Short Wave Magazine* for Dec. 1977, Sept. 1978 with corrections in Nov. 1978.

A number of operators in SSB MS skeds are now using 30 second transmission periods. Now most everybody should have accurate clocks—*not* those relying on the mains supply being 50 Hz though—there is no reason why this should not become the norm for this mode. However, for random SSB operation around 144·20 MHz the one minute periods should be used otherwise, chaos will ensue.

European Notes

Jimmy Bruzon, ZB2BL, now has his own 6m. converter back, thanks

Torbay Amateur Radio Society spent Field Day last year on Haldon Moor.

Boys from Bournemouth School Scout Group watching an RTTY demonstration during J-O-T-A. The station, GB3BSB, was operated by members of the Wessex A.R.G., and seen here are Martin Linda G4GTH operating, with Geoffrery Cole G4EMN looking on.

to G3COJ. He has worked PY1RO on several occasions now and also PY2XB. Jimmy is looking forward to getting going on SSB to try some *E's* with the U.S.A. this summer. Lack of time has caused ZB2BL to abandon MS work and he wants to get better organised with a 4CX250B amplifier before accepting further skeds. During 1978, he had no joy on 2m. although the beacon was heard in the U.K. a number of times.

Your scribe had the pleasure of a visit from Henry Souchet, 9H1CD, at the beginning of December. Of course, as always happens on these occasions, VHF conditions were abominable. Nevertheless, Henry is extremely proud of his British call, G4HRR, and was hoping to use it from various regions before returning to Malta in mid-January.

According to Clive Penna, G3POI, there was a good *aurora* on Christmas Day in parts of Europe during which SM2BYC (MZ01) worked UA9GL (CR02), a distance of 1878 kms.

Band Reports

What seems to be a near breakdown in the postal system lately has resulted in a lot of mail being "lost" somewhere between Welwyn and Purley. Also, conditions on tropo. have been pretty grotty lately so not too much to report.

For G3BW, 1978 was a "moderate" year, the highlight of which was the *E's* contact with IT9TDN (HY68b) on Aug. 8. Bill has a lot to say about the present trends in amateur radio, particularly the "appliance operator" syndrome. Quite rightly he points out that not all the newcomers can afford the black boxes and wonders if anyone has constructed a simple 2m. SSB transceiver lately? If so, he would like to see it described in the magazine.

Bob Lane, G4AWU, had an unusual 2m. QSO on Dec. 6 at 1510 GMT, when he worked WD5HEN/AM in Region 2. The operator was Wynn, the navigator of a B52D bomber flying at 37,000 feet, and he was using an *Icom* IC-245 to a quarter wave whip.

G4CMV's long letter covers November and December and Clive complains about the terrible conditions in December. The *aurora* on the 29th was a very brief affair during which GM3XNE (XR) and GM8NFG (Orkney) were heard. Summing up 1978, G4CMV did well on *Ar* but not so good *via E's*. Even so, nine new countries were worked.

John Dougherty's, G4FUT, letter missed the boat last month but listed some choice stuff worked in the *Ar* of Nov. 25, including HB9QQ in EH45e and UR2QB in NR16h, a QRB of 1766 kms. John is rather baffled by all the jargon on GB2RS concerning "A" indices, solar flux, etc., and would welcome an article explaining these things and how they relate to *Ar* events. (Guess Charlie Newton will explain at The Winning Post!).

Malcolm Pym, G4GXT, in North London, now has a 90 foot tower with a 16-ele. *Tonna* on top. This lot was erected by a possê on Jan. 6 and in the evening, Malcolm was working some nice DX to the south and southeast. He holds the call EI2VPU which will be used during this year. For Bob Mackean, G4HAO, 1978 was his most active year although he was disappointed that there were not as many prolonged spells of Euro-DX as he would have liked. He concludes that he is not going to make much of an impression on the *Ar* scene with 25 watts PEP.

For G8KSS, 1978 produced 77 QRA squares on 2m. compared to 58 in 1977. Ken is into MS now so hopes that 1979 will be even better. Derrick Dance, GM4CXP, confesses to not having been very active in 1978 but says, " . . . the bug is beginning to nip again!"

FOUR-METRE ANNUAL TABLE
Final Placings at December 31, 1978

Station	Counties	Countries	Total
G3SPJ	61	8	69
G3CO	50	7	57
G2AXI	46	7	53
GD2HDZ	45	5	50
G4ERX	38	5	43
G3FIJ	31	3	34
G4AEZ	29	4	33
G4BWG	23	4	27
G4GEE	15	2	17
G4FKI	14	1	15
G4BYP	9	3	12
GM4CXP	2	2	4
G4FRE	1	1	2

70-CENTIMETRE ANNUAL TABLE
Final Flacings at December 31, 1978

Station	Counties	Countries	Total
G8GML	53	12	65
G8GXP	54	9	63
G8LEF	46	16	62
G4CMV	41	11	52
G3SPJ	43	9	52
GD2HDZ	42	9	51
G4ERX	37	11	48
G8BKR	41	6	47
G2AXI	38	8	46
G8HHI	38	7	45
G3KPU	38	8	44
G4GEE	38	6	44
G8LHT	31	11	42
G3CO	28	9	37
G3BW	31	5	36
G4BYP	25	6	31
G4AEZ	26	5	31
GJ8KNV	21	9	30
G8ITS	26	4	30
GI8EWM	21	6	27
G4FRE	24	3	27
G8IFT	24	3	27
G4BWG	19	7	26
G8MFJ	22	2	24
GJ8ORH	15	6	21
G3FIJ	17	3	20
G8GRT	15	3	18
G8OGD	9	5	14
GJ8AAZ	7	5	12
G4FKI	10	1	11
G8KGF	6	2	8
G8APZ	4	1	5
GM4CXP	2	2	4

Finale

Congratulations to Colin Wooff, G3SPJ, clear winner of the Three Band Annual Contest. Many readers have got off to a flying start this year, thanks to some MS and the *Ar* of Jan. 7. As usual, it occurred while G3FPK was in the middle of editing this lot. The deadline for the April feature is March 8 and for May, April 5. All to: "VHF Bands," SHORT WAVE MAGAZINE, 34 High Street, WELWYN, Herts., AL6 9EQ.
73 de G3FPK.

Fig. 3.

Fig. 1.

Fig. 5.

Fig. 4.

Fig. 6.

These photographs should have accompanied 'Amateur Radio—Communication or Technology, or Both? Part VII' which appeared in the December issue: *Fig.* 1, sawing thin sheet aluminium clamped between two lengths of mild steel angle in a bench vice; *Fig.* 3, using a *Q-Max* sheet metal punch on 18 *s.w.g.* aluminium—the punch is clamped in the bench vice and the die drawn onto it by tightening the screw; *Fig.* 4, using a home-made circle cutter with a speed-reducing attachment and a standard pistol drill—backing for the sheet metal is a piece of ¾in. softwood; *Fig.* 5, using an *Abrafile* to cut a rectangular hole in a die-cast box lid; *Fig.* 6, bending a piece of 18 *s.w.g.* sheet metal.

RADIO SHACK LTD for DRAKE

JAYBEAM ANTENNAS—continued

	inc. VAT
PMH/2C. 2-way phasing harness ...	£5·96
Q4/2M. 4 element quad yagi	£18·98
Q6/2M. 6 element quad yagi	£24·75
D5/2M. Double 5 slot-fed yagi ...	£15·77
D8/2M. Double 8 slot-fed yagi ...	£21·02
SVMK/2M. Mounting kit	£5·62
UGP/2M. Unipole & ground plane ...	£8·12
HM/2M. Mobile halo with mast ...	£4·45
PMH2/2M. 2-way phasing harness for two 2m. ants.	£7·82
PMH4/2M. 4-way phasing harness ...	£18·62
D8/70cm. Double 8 slot-fed yagi ...	£17·71
PBM 18/70cm. 18 element Parabeam...	£21·38
MBM 48/70cm. 48 element Multibeam	£24·92
MBM 88/70cm. 88 element Multibeam	£33·15
TAS. 2m. 5/8 mobile whip	£13·59
U5. 70cm. Colinear 5·6dB	£20·25
DL. Double lashing chimney kit ...	£8·92
W6. 6" wall bracket	£2·83
W21. 21" wall stand-off bracket ...	£11·09
W24 HD. 24" wall stand-off bracket heavy duty	£15·77
SPM. 16' x 1" Portable Mast	£11·31
PME. 4' extension for double arrays ...	£1·91
A4. 4' 6" x 1½" mast	£2·89
A5. 5' x 1" mast	£2·16
A9. 9' x 1½" mast	£5·82
A10. 10' x 2" mast	£10·06
CP1. Cross-over plate 2" x 2"... ...	£2·50
JBL 59/6. 6" jointing sleeve for 2" masts only	£2·12
JBL 59/15. 15" jointing sleeve for 2" masts only	£5·00
JBL 29. Universal clamp 1½" boom to 1"-2" mast	£1·20
JBL 30. Universal clamp 1" boom to 1"-2" mast	£1·20
JBL 53. Universal clamp 1" boom to 1"-2" mast	£1·20
JBL 58. 3-hook guy wire clamp non-rotating	£1·31
JBL 63. Universal clamp 1-1¼" boom to 1-2" mast	£0·98
JBL 64. Die-cast clamp 1" boom to 1" mast	£0·93
JBL 65. Die-cast clamp 1" boom to 1"-2" mast	£0·98
JBL 73. Heavy-duty universal clamp ...	£1·64
MBP. Mast base plate for 2" diam. mast	£2·72

ATLAS

210X. 10-80m. SSB Transceiver ...	£495·00
215X. 15-160m. SSB Transceiver ...	£495·00
220-CS. Console & AC power supply	£129·37
DMK. De luxe mobile mount ...	£40·50
DCC. DC Cable	£9·84
MBK. Mobile Bracket Kit	£4·50
MT-1. Mobile Antenna Match Transformer	£18·00
PC-120. Plug-in Noise Blanker ...	£42·75
10 X. Crystal Oscillator	£45·00
DD-6C. Digital Dial	£180·00
VX-5. VOX accessory	£38·25
DL-300. Dummy Load	£11·81

CDE ROTATORS

AR-20	£38·81
AR-22L	£48·38
AR-30	£46·13
AR-40	£53·44
CD-44	£106·88
HAM-3	£145·13
BIG-TALK	£89·44
TAIL-TWISTER	£241·88

COAXIAL CABLE

UR-67. 52 ohms	...	per metre	£0·60
UR-76. 52 ohms	...	per metre	£0·20
T3234. 52 ohms	...	per metre	£0·55
UR-70. 75 ohms	...	per metre	£0·20
RG-174U ...	...	per metre	£0·30
300 ohm ribbon	...	per metre	£0·10

	inc. VAT
14 swg enamelled copper wire per metre	£0·12
4-core. Rotor control cable per metre	£0·20
5-core. Rotor control cable per metre	£0·25
8-core. Rotor control cable per metre	£0·35

TEN-TEC

509. ARGONAUT 5W. SSB/CW Transceiver 3·5–30	£247·50
540. TRITON IV. 200W. SSB/CW Transceiver 3·5–30	£495·00
544 Digital. TRITON IV. 200W. SSB/CW Transceiver 3·5–30	£618·75
545. OMNI-A Analogue Transceiver ...	£652·50
546. OMNI-D Digital Transceiver ...	£765·00
570. CENTURY 21. 70W. CW Transceiver 3·5–29 MHz	£220·50
574 Digital. CENTURY D	£281·25
405. Linear Amp. 100W. 3·5–30 MHz	£112·50
210/E (1A). 115/230v. AC/13v. DC PSU for Argonaut	£27·00
251/E (9A). 115/230v. AC/13v. DC PSU for Argonaut 405 ...	£67·50
262G/E (18A). 115/230v. AC/13v. DC PSU for Tritons	£108·00
247. Tuner	£49·50
277. Tuner/SWR	£58·50
212. Crystal 29·0–29·5 MHz for Tritons	£4·50
213. Crystal 29·5–30·0 MHz for Tritons	£4·50
240. Converter 160m. for Tritons ...	£72·00
241. Crystal Oscillator for Tritons ...	£22·50
242. Remote VFO for Tritons ...	£119·25
245. CW filter for Tritons	£19·80
249. Noise Blanker for Tritons ...	£19·80
276. Crystal Calibrator for Century 21	£19·80
KR-1A. Dual paddle assembly ...	£27·00
KR-5A. Single-paddle keyer. 6–14v. DC	£31·50
KR-50. Ultramatic keyer dual paddle 117v. AC/6-14v. DC	£85·50

HAL COMMUNICATIONS CORP.
Electronic TTY System

DS-3000. KSR version 3.X (ASCII/Baudot/Morse)	£1,134·00
DS-3000. KSR version 2.X (ASCII/Baudot)	£855·36
ST-6000. Demodulator/Keyer with 'scope	£432·00
ST-5000. Demodulator/Keyer ...	£194·40
RVD-1005. Visual Display Unit (Baudot)	£285·12
DKB-2010. Dual mode keyboard with 128 key buffer memory	£345·60

Telephone 01-624 7174 with your ACCESS or BARCLAYCARD number for immediate DESPATCH

ASTATIC MICROPHONES

T-UG9-D104. Golden Eagle gold-plated transistorised	£69·75
T-UPG-D104. Silver Eagle chrome-plated transistorised	£49·50
UG8-D104. The famous Crystal D104	£31·50
T-UG9-D104. Transistorised amplified D104 grip t-t	£40·50
T-UP9-D104. Transistorised amplified p.t.t. (grey or black)	£45·00
525 DL6. Dynamic Hand Microphone. 400 Z	£12·15
400. Dynamic Hand Microphone. "Buckeye"	£5·85

	inc. VAT
565 M6. Hand Microphone FET amplified. "Mariner"	£31·50
D104-M. Hand Microphone D104 FET amp. 4-wire	£24·30
D104-M6. Hand Mic. Microphone D104 FET amp. 6-wire	£28·35
555 4-wire. Hand Mic. noise-cancelling "Trucker"	£21·60
557 6-wire. Hand Mic. noise-cancelling "Trucker"	£26·10
531. Hand Mic. mobile. High Z ...	£7·65
539. Hand Mic. mobile, noise-cancelling	£7·65
1104C. Desk Microphone FET amplified	£36·00

TELEX COMMUNICATIONS INC.
Lightweight Headphones 3.2–20 ohms

HGC-91. Underchin 1·5 oz. with foam earpads	£8·08
HMC-2. Underchin 1·5 oz. with plastic eartips	£9·00
HT2-2. 1·6 oz. Twin Receiver headphone	£14·40

Dual Muff Headphones

C-610. 3·2–20 ohms Dual Receiver Magnetic	£6·75
5WL-610. 2000 ohms. Dual Receiver Magnetic	£7·99
C-1210. 3·2–20 ohms Dynamic foam padded	£18·45
C-1320. 3·2–20 ohms TELEX's finest	£25·65

Boom Microphone Headsets
(headphones as above)

CM-610. As C-610 with high Z Ceramic microphone	£29·70
CM-1210. As C-1210	£38·25
CM-1320. As C-1320	£47·25
CM-1320S. As CM-1320 with Single headphone	£36·90

(all the above headsets fitted ptt switch)

Microphones (hand-held battery powered)

ProCom I. Electret High Output ...	£11·70
ProCom II. Electret Variable Gain ...	£17·55
CB-73R. Dynamic Noise-cancelling (relay switch)...	£23·40
CB-73S. As above with 6-wire universal lead	£24·75

HUSTLER ANTENNAS

MO 1/2. Foldover masts	£13·84
BM-1. Bumper mount	£10·35
C-32. Ball mount	£5·05
C-29. Stainless steel spring	£7·75
RM-10. 10m. Resonator	£9·34
RM-15. 15m. Resonator	£10·17
RM-20. 20m. Resonator	£11·14
RM-40. 40m. Resonator	£13·84
RM-80. 80m. Resonator	£14·73
SF-2. 2m. 5/8 whip	£9·00
DCL. Discone VHF/UHF 40–700 MHz 50' coax	£20·47
DCX. Discone VHF/UHF 40–700 MHz	£13·84
CG-144. 2m. Colinear	£25·25
CGT-144. 2m. Colinear with mount	£36·00
G6-144A. 2m. Colinear for base station use	£51·75
4 BTV. 10–40m. Vertical	£75·15
RM-80S. 80m. High power Resonator	£19·00
QD-1. Quick-disconnect	£10·23
S105. Top section only of QD-1 ...	£7·88
HLM. Trunk-lip mount with coax ...	£12·57

WE ARE SITUATED just around the corner from WEST HAMPSTEAD UNDERGROUND STATION which is on the BAKERLOO LINE. A few minutes walk away is WEST HAMPSTEAD MIDLAND REGION STATION and WEST END LANE on the BROAD STREET LINE. We are on the following BUS ROUTES 28 : 59 : 159 : C 11.

WE ARE OPEN 9–5 MONDAY to FRIDAY 9–12.30 SATURDAYS.

We are closed for lunch between 1–2 p.m.

SECURICOR **DRAKE SALES SERVICE** **HIRE PURCHASE**

BARCLAYCARD Access

Radio Shack Ltd

188 BROADHURST GARDENS, LONDON NW6 3AY

Just around the corner from West Hampstead Underground Station

Telephone : 01-624 7174

Cables : Radio Shack, London NW6. Telex : 23718 Radack G. Giro Account No. 588 7151

Open Monday–Friday 9–5, Saturday 9–12.30. Closed for lunch 1–2

FRG-7 DIGITAL £226·50

LEE ELECTRONICS LTD.

ESTABLISHED FOR MORE THAN TWO DECADES
LONDON's LARGEST STOCKISTS OF YAESU ● ANTENNA SPECIALISTS ● STANDARD ● ICOM ● LUNAR JAYBEAM ● CDE ● QM70 ● ATLAS ● ETC.

FRG–7 — DIGITAL DISPLAY

Yes. The world famous FRG–7 is now available with digital read-out fitted by Lee Electronics in place of kHz dial
Special Price £216·50 + VAT
For customers who already own FRG–7's we can supply the digital read-out complete with installation instructions ... ... £39·50 + VAT
FRG–7 Digita £226·50 FRG–7 with analogue dial £187 + VAT
FRG–7 Perspex cover as illustrated £3·50 All plus 12½% VAT

MICROWAVE MODULES DESPATCHED TO ANY PART OF THE WORLD POST FREE

TRANSVERTORS
MMT 144/28 Transvertor £79·00
MMT 432/28S Transvertor with Oscar shift ... £119·00
MMT 432/144R Transvertor £151·00

VARACTORS
MMV 1296 23cm. Tripler £30·00

FREQUENCY COUNTERS
MMD 050/500 MHz Counter £63·89
M500P 10 Prescaler ... £25·00

LINEAR AMPS
MML432 100W. ... ... £220·00
MML144 80W. ... ... £120·00

CONVERTERS
MMC 432/28S for Oscar ... £26·58
MMC 432/144S for Oscar ... £26·58
MMC 70 4m. converter ... £18·00
MMC 70 LO 4m. Converter £20·00
MMC 144 2m. Converter ... £18·00
MMC 144 LO 2M. converter £20·00

ATV435/SI Converter ... £26·58
MMC1296/144/28 ... ... £30·00
MMC156/28 Marine ... £20·00
MMC28/144 up converter £18·00
All 2m. converters can be supplied with IF outputs of 2–4–12–14–18–28 MHz 70cm. models with IF outputs of 28–14–18 or 144 MH.

ALL MICROWAVE MODELS SUBJECT AT VAT IN UK 8% ON FREQUENCY COUNTERS, ALL OTHER MODELS 12½%

A.S.P. MOBILE AND BASE STATION ANTENNAS

Asp201 ⅝w. 2m. mobile ... £3·25
Asp2009 ⅝ 3dB 2m. mobile £7·25
Asp629 ⅛w. 3dB 2m. mobile £7·60
Asp677 ⅝ 3dB 2m. mobile £13·50
Asp E462 70cm. 3dB mobile £7·23
Asp E667 70cm. 3dB mobile £16·90
Asp A659 UK 70cm. 5dB base antenna ... £19·00

Asp 393 ⅛w. 3dB 2m. mobile £19·00
Asp no hole boot mount... £3·70
Asp magnetic mount ... £8·95
Asp cutter clip less cable £3·85
Asp 415 de luxe ⅛w. 2m.... £19·00
Asp 655 ⅝w. 2m. 3lb. Base Antenna ... ... £21·00

Special offer A.S.P. A680 U.K. 6dB 144/148 MHz Co-linear. Power handling 350W. Length approx. 12ft. List £51. Special offer £41·50.

+8% VAT and £1 P. & P.

ICOM RANGE

IC701 transceiver and power supply ... ... £888·00
IC215 2M Portable ... £141·33
IC202S 2M SSB ... ... £176·89
IC402 70cm. SSB ... ... £256·00
IC240 2M. Transceiver ... £168·00
IC245 2M. FM/SSB ... £354·17
IC211E 2M. FM/SSB ... £496·00
Xtals for 215/22 ... *per pr.* £4·50
Cases 202/215/402 ... £6·75
Mobile mounting Bracket 202/215 ... ... £10·75

YAESU MUSEN (All available for immediate delivery)

FT901DM ...	... £853·00	FT101E ...	... £515·00	CPU2500RK	... £308·00	FRG7000 ...	... £327·00
FT901D/DE	... £737·50	FR101D ...	... £525·00	FT225R ...	... £487·50	YO100 ...	... £145·00
FT301 ...	... £515·00	FR101DD ...	... £615·00	FT225RD ...	... £535·00	QTR24 ...	... £16·00
FT301D ...	... £588·00	FL101 ...	... £453·00	FT227R ...	... £213·00	YH55 ...	... £8·75
FP301 ...	... £98·00	FT7 ...	... £318·00	FT227RX ...	... £253·00	YC500J ...	... £168·50
FP301D ...	... £162·50	FL110 ...	... £130·00	FT202 ...	... £106·50	YP150 ...	... £58·50
FV301 ...	... £86·00	FP4 ...	... £35·00	FRG7 ...	... £187·00	YD844 ...	... £19·50
FC301 ...	... £108·00	FL2100B ...	... £311·00	FRG7DIG ...	... £227·00	YD846 ...	... £7·50

FREE DELIVERY WITHIN UK + 12½% VAT

FDK RANGE

ALL AVAILABLE FROM STOCK

ROTATORS

AR22 ... ... £43·00
CD44 ... ... £95·00
AR40 ... ... £47·50
HAM II ... ... £129·00
KR400 ... ... £85·00

STANDARD C432 70cm TRANSCEIVER

THIS 6 CHANNEL 2·2 WATT TRANSCEIVER COMES COMPLETE WITH LEATHER CARRY CASE AND FITTED WITH 433·2 AND 433·5 MHz. ... ... £169·00 + VAT

THIS SOPHISTICATED UNIT HAS EXCELLENT SENSITIVITY, OUT PERFORMING MOST OTHER RIGS, JUST THE UNIT NOW 70cm. REPEATERS ARE OPENING UP ALL OVER THE COUNTRY. A FULL RANGE OF ACCESSORIES ARE AVAILABLE FOR THIS MODEL.

ACCESSORIES
CMPO8 External Microphone ... ... £15·00 — 12½% VAT
SMP30 External Spk./Mic. ... ... £16·50 — 12½% VAT
BCA Base Charger ... ... £22·50 — 12½% VAT
C12 Wall Charger ... ... £5·75 — 12½% VAT
N–10 Set Ni-cad ... ... £8·50 — 8% VAT
Helical Antenna ... ... £3·50 — 12½% VAT

SST TUNERS

SST1 Random ... ... £22·00
SST2 Coax ... ... £26·75
SST3 Match unit ... ... £13·50

LUNAR LINEARS

2M10–80P (2m.) ... ... £120·00
2M25–150P (2m.) ... ... £155·00
2M10–250P (2m.) ... ... P.O.A.
ALL ABOVE PRICES + VAT, CARRIAGE FREE

J-BEAM ANTENNAS

ALL MODELS IN STOCK

HELICAL ANTENNAS

2m. with 13 BNC ... ea. £3·85
2m. with ph 259 ... ea. £3·85
2m. for IC215, Trio 2200 Gx, standard C146A ... ... £3·25
All + post 25p + 12½% VAT

Access BARCLAYCARD

INSTANT HP
PART EXCHANGES WELCOME

Open Monday - Saturday
400 EDGWARE ROAD, LONDON W2
01-723 5521 Telex 298765

SEND 30p FOR CATALOGUES AND PRICE LIST OF OUR FULL RANGE

SEM

P.O. BOX 6, CASTLETOWN, ISLE OF MAN Tel. MAROWN (0624-85) 277

OUR PRE-AMPLIFIERS WILL IMPROVE YOUR RECEPTION ON H.F., V.H.F. OR U.H.F.

SENTINEL AUTO 2 METRE PRE-AMPLIFIER
The pre-amplifier contains an r.f. operated switch for direct connection in the transceiver aerial lead, or for "mast head" use. The transistors are selected for a 1dB noise figure and gain is 18dB. 12v. d.c. operation. The r.f. switch has a delay for use on all modes.
£17·35* IN STOCK
70 cm. version, **£20·25* IN STOCK**

SENTINEL STANDARD PRE-AMPLIFIERS
Same circuits as above but without the relay switching. **£10·85***. 70 cms. version, **£13·50***. Both **IN STOCK** Other frequencies to order. Marine, Satellite Band in stock.

PA3
The original PA3 2 metre pre-amplifier, size about one cubic inch to fit inside transceivers. N.F. 2dB. Gain 18dB. **£6·80 IN STOCK**
PA3/70 for 70cms. size : $1\frac{3}{4}'' \times 1\frac{3}{4}'' \times \frac{1}{2}''$
£9·00 IN STOCK

H.F. WIDEBAND PRE-AMPLIFIERS 1–40 MHz
Ideal for pepping up your receiver on 15 and 10 metres. For use with OSCAR or with a short aerial they make an effective ACTIVE AERIAL. Gain 15dB, supply 12v.

SENTINEL STANDARD H.F. PRE-AMP.
£9·00 IN STOCK

THE SENTINEL AUTO H.F. PRE-AMPLIFIER
SAME circuit as above with an aerial change over relay for operation with your transceiver relay, for direct connection in your aerial co-ax, **£12·94* IN STOCK**

SENTINEL 2 METRE POWER AMPLIFIER/PRE-AMPLIFIER
We are now fitting the very latest type of power transistor available with a dissipation of 135W. and power gain of 4, e.g. 12W. IN, 48W. OUT. The circuit is linear for use on all modes.
The receive pre-amplifier use a J FET selected for a 1 dB noise figure and 18 dB gain. The r.f. relay switches between the two with a time delay for use on any mode. The relay can also be operated by the transceiver. Size is only 6″ x 2″ panel, $4\frac{1}{2}''$ deep. **£59·62 IN STOCK.** Or less the pre-amplifier, **£49·50.** Yes, they do work fine with the FT221 and TS700 series.

SEM Z MATCH
The necessity to terminate modern equipment with the correct NON REACTIVE impedance is solved with our Z Match. 15–5000 ohms. BALANCED OR UNBALANCED. SO239s and 4mm. terminals for co-ax or wire. Rated up to 1KW. Calibrated slow motion dials made adjustment and re-setting easy.
Price : **£39·44 IN STOCK**

SEM FORWARD AND REVERSE POWER METER
At last a forward/reflected power meter designed for the British amateur. FSD 500w., $\frac{1}{2}$ scale 100w. 1–30 MHz. The pick-up unit which connects in the aerial lead is separate from the readout for very convenient use.
Price : **£28·50**

SEM EUROPA C 2 METRE TRANSVERTER
200W. input, 2 dB N.F. Plugs straight into YAESU equipment and you are on 2 metres, any mode. **£112·50 EX STOCK.** 600 kHz repeater shift, **£12·50**
CPS10 Power Supply for Europe to use with other equipment. **£56·25 EX STOCK**

SENTINEL DUAL GATE MOSFET 2 METRE CONVERTERS—I.F.'s : 2–4 MHz, 4–6 MHz, 28–30 MHz. N.F. 2dB. Gain 30dB. Price : **£20·25 IN STOCK**

SENTINEL X—Same as above with an A.C. power supply. Price : **£24·75 IN STOCK**

SEM 70. 70cm. to 2 metre converter.
Price : **£20·25 IN STOCK**

SENTINEL 70. 70cms. to 10 metre converters.
Price : **£22·50 IN STOCK**

SENTINEL TOP BAND CONVERTERS—21·8–2·3 MHz to 14–14·5 MHz. Price : **£20·25 IN STOCK**

* SO239 sockets available on these units at an extra cost of £1·69.

Circuits and instructions provided with equipment. For more details of any of our equipment, please ring or write. Prices include VAT and delivery.

12 months guarantee. To order : C.W.O. or credit card. Just phone your credit card number for same day service.

J. BIRKETT

Radio Component Suppliers

25 THE STRAIT . LINCOLN . LN2 1JF

Telephone: 20767

MINIATURE VARIABLE CAPACITORS. 25+25+25pf at 75p.
MIKE INSERTS TYPE YA 8548 at 50p each.
SUB-MINIATURE TANTALUM. 4·7uf 10v.w. at 6 for 25p.
PLASTIC TRIACS. 400 PIV 6 amp at 60p each.
MC 3340 ELECTRONIC ATTENUATOR I.C. with data at 50p.
ERIE RED CAP MINIATURE. ·01uf 100v.w. at 5p each.
100uf 100v.w. **WIRE ENDED ELECTROLYTICS.** 5 for 35p.
10 amp S.C.R's. 100 PIV at 25p, 400 PIV at 50p, 800 PIV at 60p.
50 2 **WATT ZENERS.** Assorted untested for 57p.
MULLARD SOLID DIELECTRIC VARIABLE CAPACITORS. 195+80pf at 40p.
DISC CERAMICS. ·01uf 50v.w. at 20p doz., ·1uf 18vw at 25p doz.
DAU TRIMMERS. 2 to 9pf at 10p, 6 to 45pf at 10p, 0 to 125pf at 12p, 8 to 140pf at 15p, **VHF TETFER TRIMMERS.** 10pf at 18p.
VERNITRON FM 4 10·7 MHz FILTERS at 50p, 3 for £1.
COIL FORMERS. 3/16" dia. with core at 6 for 25p.
TRANSISTORS. BC 548 at 10p, 6 for 50p, BC 549 at 10p, 6 for 50p.
1uf 25v.w., **ELECTROLYTICS** at 6 for 25p.
RF SIGNAL TRANSISTORS. AF 239 at 50p, 2N 5179 at 50p, BF 362 at 25p, BFY 90 Type at 50p, MPS 6514 at 10p, BF 177 at 15p.
200 **ASSORTED RESISTORS.** ⅛, ¼ watt for 75p.
50. **AC 128 TRANSISTORS.** Branded but untested at 57p.
50. **BC 107–8–9 TRANSISTORS.** Untested for 57p.
100. **C280 CAPACITORS.** Assorted at 57p.
50. **ASSORTED ELECTROLYTICS** at 57p.
BOOKS by Geo. Dobbs, "Practical Test Equipment" at 75p, "Simple Short Wave Receiver" at 60p, "Practical Electronic Projects" at 75p. The three books for £1·60.
X BAND SCHOTTKY BARRIER DETECTOR DIODES. BAV 46 at 50p.
X BAND GUNN DIODES. CXY11A at £3 each.
X BAND GUNN DIODES with data at £1·65.
MBD 102 HOT CARRIER DIODES at 60p each.
R.F. SIGNAL TRANSISTORS. AF 239 at 50p, 2N 5179 at 50p, 2N 5180 at 50p, 2N 5109 at 50p, BF 362 at 25p.
VHF FETS. MFE 121 at 60p, E304 at 25p, J310 at 20p, BF 256 at 25p, 2N 3819T at 20p, 40673T at 33p.
DIVIDE BY 2 300 MHz COUNTERS with data at 65p.
DIVIDE BY 4 150 MHz COUNTERS with data at 65p.

600 MHz 8 DIGIT FREQUENCY COUNTERS. Mains Power Input 100–240 volt A.C. D.C. POWER Input 9–16 volts. Sensitivity 10–25 M volt. Range 1 Hz to 600 MHz.

HFC 600 Price : £115 inc. VAT

Please add 20p for post and packing on U.K. orders under £2. Overseas post at cost.

ANNOUNCING

THE BROOKES MB6/R/RT TELEX CONVERTER, THESE UNITS SUPERSEDE THE HB5 SERIES, AND ARE OF ACTIVE FILTER DESIGN.

AUDIO INPUT FROM RECEIVER, WITH T.T.L. AND C-MOS LEVELS FOR VDU's (SINGLE OR DOUBLE CURRENT) TO PRINTER MAGNETS, AND OSCILLOSCOPE OUTPUTS ARE AVAILABLE. RECEIVING SHIFTS ARE 170, 250, 425, 625 and 850, TRANSMITTING SHIFT 170 NEW TONES.

BUILT IN AN ULTRA MODERN CASE, FRONT AND BACK PANELS BEING BLACK WITH WHITE LETTERING. DIMENSIONS 84 x 304 x 210.

Just a Reminder

OF OUR POPULAR FDU7's FREQUENCY DISPLAY UNIT FOR THE FRG7, WHICH FITS IN PLACE OF THE kHz DIAL. *ALSO* THE FDU3 FOR THE SSR1 AND SRX30 WHICH IS NOW SUPPLIED IN AN ALUMINIUM CASE, FOR TOP OF THE RECEIVER USE.

ALL SUPPLIED WITH FULL FITTING INSTRUCTIONS

C.W.O. CHEQUE OR ACCESS ACCEPTED

		PRICE	*POSTAGE*
MB6/R	(RECEIVE ONLY)	£68·00	£1·30
MB6/RT	(AFSK/FSK)	£72·50	£1·50
FDU7	(DISPLAY UNIT FOR FRG7)	£39·00	80p
FDU3	(FOR SSR1 & SRX 30	£36·00	80p

B. BROOKES ELECTRONICS

69 LEICESTER STREET, NORWICH NR2 2DZ ENGLAND
Tel.: 0603 24573

U.K. DISTRIBUTORS
TO BE ANNOUNCED

INTERNATIONAL DISTRIBUTORS
"INTERMEDIARY" (INTERNATIONAL TRADE)
P.O. BOX 5599
1007, AN. AMSTERDAM, HOLLAND

TMP ELECTRONIC SUPPLIES

EVERY YAESU ITEM IN STOCK WITH 2-YEAR GUARANTEE AND FREE SECURICOR CARRIAGE IF REQUIRED, ALL EQUIPMENT SALES CONDUCTED PERSONALLY BY GW3TMP. ALSO IN STOCK: FULL RANGE OF AMIDON TOROIDAL CORES. S.A.E. FOR PRICES.

W2AU QUAD SPIDERS	**£26·81**
W2AU BALUNS 1 : 1 and 4 : 1	**£14·06**
SIGMA TWIN METER SWR/PWR. METERS 0–2 KW	**£20·52**
TOROIDAL BALUN KITS L.F.	**£3·98**
H.F.	**£5·11**
HIGH PASS FILTERS HP-3A	**£3·00**
UR67 LOW LOSS COAX	**50p**
UR43 STANDARD COAX	**18p**
HK708 MORSE KEYS	**£10·00**

All Prices inc. VAT and Postage

Also CDE Rotators, Control Cable, PL259 Plugs, Turn Buckles, Cable Grips, D Shackles, etc., etc., etc.

Britannia Stores, Leeswood, Mold, Clwyd CH7 4SD

Open daily 9.30-5 p.m. Early closing Tues. & Sat., 1 p.m.

Tel.: Pontybodkin 846 STD 035 287

("SITUATIONS" AND "TRADE")
15p per word, minimum charge £1.80. No series discount. All charges payable with order. Insertions of radio interest only accepted. Add 50 per cent for Bold Face (Heavy Type). Box Numbers 35p extra. No responsibility accepted for transcription errors. Replies to Box Numbers should be addressed to the Short Wave Magazine, Ltd., 34 High Street, Welwyn, Herts., AL6 9EQ.

TRADE

TS-520 super CW filters, 250 Hz bandwidth, £28·88. Access/Barclaycard.—**Holdings Ltd.,** 39/41 Mincing Lane, Blackburn, Lancs. BB2 2AF. (Tel: 0254-59595/6.)
Silk-screened Radio Masts on quality **T-Shirts,** personalised with your own call-sign, name or slogan, only £2·65. State s/m/l. Offer closes April 20th.—B. McAleer, 59 Castledine Street, Loughborough, Leics.

Coax cables at trade prices: UR43, UR67, UR76, UR57 and UR70. Also mains and multicores. S.a.e. for lists. —W. H. Westlake, Clawton, Holsworthy, Devon.

Join them on 29·6 MHz NBFM. Local net, or work 'W' NBFM mobiles/repeaters. Fit G3LLL's FT-101 NBFM adaptor; for 10m. or transvert to 2m. RPT shift available. S.a.e. for details.—**Holdings Ltd.,** 39/41 Mincing Lane, Blackburn, Lancs. BB2 2AF. (Tel: 0254-59595/6.)

Components! Histab R's and C's including unusual values, RF connectors, relays, plus many others. Bargain prices. Send long s.a.e. for list.—G3KTF (QTHR 1979.)

Valves new and boxed: 6JM6, 6HF5, 6JS6/C, 6JB6/A, 6KD6, 6LQ6, 6146B, and other types. S.a.e. for list.—Wilson, 20 Croft Gate, Harwood, Bolton, Lancs. (Tel: Bolton 54165.)

Bristol has an Amateur Radio shop: FDK Palm II, Multi U-11, Multi 700E, Multi 2700; Revco aerials; secondhand equipment available. Part-exchanges welcome.—Ring 0272-669454, or 0272-633647 after hours.

March issue: Due to appear March 16th. Single copies at 50p post paid will be sent by first-class mail for orders received by Wednesday, March 7th, as available.—Circulation Dept., Short Wave Magazine Ltd., 34 High Street, Welwyn, Herts. AL6 9EQ.

Good second-hand equipment always wanted. Come to **AMATEUR RADIO EXCHANGE** for the best deal.—2 Northfield Road, Ealing, London W13 9SY. (Tel: 01-579 5311.)

Radio Amateur Examination City & Guilds. Pass this important Examination and obtain your G8 Licence with an RRC Home-Study Course. For details of this and other Courses (GCE, professional examinations, etc.) write or phone: **The Rapid Results College, Dept. JV/1, Tuition House, London SW19 4DS.** Careers Advisory Service, 01-947 7272 or ring 01-946 1102 for Prospectus. (24-hr. Recordacall).

Dart Stationery presents **Reception Report Letters for the Dx-er.** Professionally styled letters, printed in two colours, on high-quality paper, and made into pads of 100 letters for tidy storage: 1 pad, £2·10; 2-plus pads, £1·80 per pad. All prices include post/packing. Every **order received carries a 10-day return of money guarantee if not completely satisfied.** Mail orders only, please. Please send cheque or P.O. payable to **Dart Stationery,** 20 Bromley Road, London E17 4PS.

Quality QSL cards, s.a.e. for samples by return post. Quick delivery.—Compalith Printing Services, 115 Promenade, Cheltenham, Glos. GL50 1NW.

READERS' ADVERTISEMENTS

8p per word, minimum charge £1.20, payable with order. Add 25 per cent for Bold Face (Heavy Type). Please write clearly, using full punctuation and recognised abbreviations. No responsibility accepted for transcription errors. Box Numbers 35p extra. Replies to Box Numbers should be addressed to the Short Wave Magazine, Ltd., 34 High Street, Welwyn, Herts., AL6 9EQ.

READERS

Wanted: German W.W.II military radio equipment. Does anyone have such equipment for sale, or know of someone who has? Good prices offered by collector.—Box No. 5674, Short Wave Magazine Ltd., 34 High Street, Welwyn, Herts. AL6 9EQ.

Sale: Hallicrafters digital synthesised Rx, 1·8 to 32 MHz, £150 or near offer. FSK-1 RTTY T/U, £5. Creed keyboard Tx, £5. Precision voltage source, £5. Garrard 401 transcription turntable, £25.—Buckland, 117 Barton, Avenue, Paignton (554345), Devon.

Selling: Marine-band crystals: 9·13750, 9·10625 and 9·12500 MHz, £2 each. Transistor/diode tester, £15. Type 51 waveform generator, £10. VCR-139A CRT, £5. Carriage extra. S.a.e. with enquiries.—Hayward, "Sunnyfields," Lighthouse Road, St. Margaret's Bay, Dover, Kent.

For Sale: Trio TS-820 transceiver, mint condition and in original packing, with handbook and service manual, no modifications or repairs, therefore bargain at £550.—Ring Taylor, G3SYJ, Ipswich 622942.

Wanted: FT-400, FT-560, FT-200, FT-101, or good Tx/Rx, or separates. W-H-Y? Details and price please. —Wilson, 20 Croft Gate, Harwood, Bolton, Lancs.

Exchange: Tandy TRS-80 16K Level II microcomputor with manuals, several game books and tapes *for* comparably valued HF transceiver. (Cambs.).—Box No. 5675, Short Wave Magazine Ltd., 34 High Street, Wel-Wyn, Herts. AL6 9EQ.

Sale: Eddystone 84OC, very good condition, with headphones and Joystick VFA, only £75. S.a.e. with enquiries please.—Hillan, 128A Bridge Street, Deeping St. James, Peterborough PE6 8EH.

For sale: Yaesu FR-50B with Heathkit communications speaker and Hamgear preselector, £60. Sentinel mains or battery 2-metre converter, 28-30 MHz, with Sentinel pre-amp., £15. Microwave Modules 4-metre converter, 28-30 MHz, £10. Pye AM base station receiver on 70·38 MHz, no case, £10. Pye AM base station transmitter on 70·38 MHz, £25. Pye base station mic., £10. Pye AM boot-mounted transistorised transceiver, with control gear, on 70·38 MHz, £25. Pye AM boot-mounted valve transceiver, on 70·38 MHz, no control gear but modified as self-contained unit, £15.—Ring Ruffell, Stoke-on-Trent 543605 after 8 p.m.

Offering: Standard C.146A 2m. hand-held, fitted 5 channels and BNC, with helical, speaker and mic. Seiwa MR-2G 12-channel 2m. Rx, fitted with 8 channels and BNC, with helical. Both in immaculate condition. Offers?—Colclough, Penney Sqn., A.A. College, Harrogate, N. Yorks.

For sale: Eddystone 680X, excellent condition, £85. Microwave Modules 144 MHz converter, 28 MHz IF, £10. Commercially-made 144-432 MHz QQVO-320 tripler, with PSU, £6. Magmount (new) with 144 MHz $\frac{5}{8}$-whip, £7. Magmount with $\frac{1}{4}$-wave 144 MHz whip, £4. Mini-Products Model C4 vertical dipole, 14-28 MHz, £18. Drake TV-3300LP low-pass filter, new, £10. TCC power/SWR meter, £4·50.—Woodhouse, 24 Hurst Park Avenue, Cambridge CB4 2AE. (Tel: Cambridge 64251).

Selling: Trio R-300 receiver, excellent condition and hardly used, in box and with manual, with Joystick System 'A', £140 or near offer. Buyer collects.—Ring Harris, Chesterfield 37037.

Sale: AR88D, complete, excellent condition, recently overhauled, £100. Must be collected from Bungay, Suffolk.—Ring Rainey, 050844-442.

Selling: Antenna system, comprising 2-element Gem-Quad, CD-44 rotator (both almost new), plus 40-foot 10-in. triangular Dural mast which breaks down to 6ft. sections and including heavy-duty hinged mounting base and 4 : 1 ratio winch, mast recently overhauled and painted battle-ship grey, with 24ft. wooden gin-pole against which mast is raised and lowered, quad and mast partially assembled but not installed, the lot (excluding coax, ropes and pulleys), £175. Buyer disassembles and collects; no part sale.—Henry, G3OFK, QTHR. (Tel: 0734-733674.)

Offering: Grundig Satellit 3000 21-waveband digital receiver, with preselector, both brand new, cash urgently required, list price over £400. Offers?—Ring Richardson, 0253-35141, evenings.

Wanted: K.W. VFO Type 4B.—Jenner, G3KIW, QTHR. (Tel: Fleet 22887.)

Wanted: BC-455 manual and modifications, also 62H modifications.—Eddy, Little Tregadles, Laity Moor, Ponsanooth, Truro, Cornwall. (Tel: Devoran 862148.)

For Sale: Trio TS-700S with matching speaker, £499. NAG-144 linear amp., £325. Both boxed and few hours use only.—Ring Mepham, Haywards Heath 57609, anytime.

Selling: American R.D.O. ship's Rx, 78-100 MHz, with R.D.P. matching panoramic adaptor, £100. B.29 VLF naval Rx, museum piece, £20.—Yates, 1 Islands Brow, St. Helens, Lancs. WA11 9PW.

Sell or exchange: Sony CRF-160, very good condition, £80. Or exchange for Eddystone 940 HF, or FRG-7, or W-H-Y?—31 Gordon Road, Shoreham-by-Sea (62086), Sussex.

Wanted: Yaesu FRG-7 short wave receiver, privately for cash.—Ring Cushing, Framlingham Earl (Norfolk) 05086-2923.

Selling: Realistic DX-150A receiver, £50. Codar PR-40 preselector, £10. Hamgear PM-IIA preselector, £10. Technical Associates XC-1 calibrator, £10. Kenwood Model S-599 speaker, £10. All in good condition.—Ring Goss, 0733-54289.

Wanted: DX-100 Tx, must be in good working condition; also K.W. Vespa Tx.—Ring Thomas, G8PVT, 021-382 4048.

Wanted: Heathkit DX-40U Tx, working or spares.—Ring Jesney, 0203-315788.

Sale: Yaesu twins: FL-101, new, £275; FR-101DD, all options, £370. TR-2200 FM Tx/Rx, channels S20-S24 and R5/7, with nicads and charger, mic., unused VB-2200 amplifier, boxed, complete, £110. Shure 444T mic., mint, £17.—Kenneford, G3MIN, QTHR. (Shoreham, Sussex).

Selling: Westminster UHF multi-channel, £120. Pocketfone PF2 3-channel UHF, £100. PF5 Pocketfone, ½-watt UHF, £70.—Ring Jolly, 0352-57239.

For sale: KW-2000B with AC/PSU, in excellent working order, complete with mics. and home-brew ATU, £180.—Baker, G4BUQ, Flat 2, 81 Lawrie Park Road, Sydenham, London S.E.26.

Wanted: Canadian No. 52 Set aerial feed-through C2 insulator (ZA/COOO88-CMC/114059). Ex-army WS-33, WS-53 and R.107.—Ring Taylor, G3UCT, Fleet 6998.

Wanted: Lafayette HA-800 and HA-600 communication receivers. Details and price please.—Box No. 5676, Short Wave Magazine Ltd., 34 High Street, Welwyn, Herts. AL6 9EQ.

For sale: Eddystone EA-12, late model (second owner), immaculate, professionally aligned, £130. KW-204, late model (sole owner), immaculate, spare 6146's, £200. Handbooks for both; carriage inclusive.—Hall, GM3HBT, QTHR. (Tel: Larkhall 883306 after 6 p.m.)

Sale: Yaesu YO-100 monitor 'scope, £95. Icom IC-215 with 15 channels plus RR6, nicads, charger, leather case and helical whip, £140. Yaesu SP-101B speaker, £10. All items in original packing and excellent condition.—Ring Smyth, GM3XNE, 0294-67326.

Sale: Redifon hi-band base station, 27 channels, mains, £55. Racal 4-channel mobile, SSB/AM/CW, 3-12 MHz, £55. Avo valve tester, £12.—Ring Mogford, Neath 820356.

Sale: Yaesu YP-150 power meter, £40. Yaesu YO-100 monitor 'scope, £100. Both mint. FT-620B, 4m., still available, £250.—Ring Gall, Downland (Surrey) 55342, early evenings.

Wanted: Pye Pocketfones, pair or just the receiver, in good condition.—Ring Hotham, G8FAS, Crewkerne 73331 daytime.

Wanted: No. 19 Set. Interested in any other surplus sets, and any surplus equipment manuals.—Ring Baynes, 01-949 2317.

For sale: FT-401B, immaculate, £300. **FT-221R,** 10 hours shack use from new, original packing and accessories, £320 or near offer.—Lee, G5FH, QTHR. (Tel: 04252-5974.)

Wanted: EC-10, any model. Will pay good price.—Ring Wilson, Morecambe 414146 evenings.

Wanted: Lafayette HA-600 receiver, working, or faulty one considered. Details and price please.—Box No. 5677, Short Wave Magazine Ltd., 34 High Street, Welwyn, Herts. AL6 9EQ.

Sale: Schaub-Lorenz "Intercontinental" portable radio, mains/battery, 150 kHz to 22 MHz and VHF, excellent tone and condition, £55.—Thomas, 16 Athelstan Close, Axminster, Devon.

Selling: FT-101E, still under manufacturer's guarantee, 2 months old, £460 no offers.—Ring Cole, Hornchurch 55733 evenings, Romford 21318 daytime.

For sale: Yaesu FT-221R, very good condition, £330. Jaybeam Q4/2M, £15; UGP/2M, £5 (both new). Stolle 2010 rotator, modified, £35. SWR-9 wall-mounting meter, new, £8. Buyers collect please.—Burgess, 20 Park View, Cheadle Heath, Stockport, Cheshire. (Tel: 061-428 7640.)

Selling: RTTY equipment: Marconi HU-12DD recording unit, Redifon AFS-12 twinplex converter with PSU, AFS-13 twinplex-combiner, CV-89 terminal unit for spares, B.40/C receiver, manuals included except CV-89, £60 the lot or offers.—Ring Burton, Wokingham 787457.

Sale: Realistic DX-160 with speaker and instruction book, excellent condition, £60.—Ring 041-942 7560.

For sale: Forced QRT means shack clearance. S.a.e. for list.—Jackson, G3LVZ, 73 St. Christopher's Caravan Park, Ellistown, Coalville, Leics. LE6 1FG.

Sale: IC-211E, perfect condition, with home-brew touch-pad, £450.—Ring Cole, Hornchurch 55733 evenings, Romford 21318 daytime.

Selling: Atlas 215X, new July 1978, with microphone and power cables, £375 or near offer.—Ring Taylor, Bloxwich 403145.

For sale: Yaesu FR-50B amateur bands receiver, 80-10m., mint condition, very little used since new, £70.—Kerr, 26 The Vale, Kirkella, Hull. (Tel: Hull 655619).

Wanted: Ex-W.D. Tx/Rx Sets, spares and manuals. —Dorsett, 15 Chalcrafts, Alton (88715), Hants.

Wanted: FRG-7, FRG-7000, or similar good receiver. Also Oscar pre-amp., 2m. converter, antenna etc. Will collect. Details and price please.—Davies, 54 Sharpenhoe Road, Barton, Beds. (Tel: Luton 881323.)

Wanted: For Pye W15M Westminster: 2nd oscillator AT26806/1 or AT25806/3; 10·7 MHz IF AT26849/1 or AT26849/4. Details and price please.—Green, G4EZM, 88A Eastpines Drive, Blackpool, Lancs.

Wanted: Ex-Army Type B or C loop aerial; Type CT-471C multimeter; modern receiver for 10-600 kHz; large diameter loop aerial.—Passfield, 144 Gilmore Road, Lewisham, London S.E.13. (Tel: 01-318 5290.)

Wanted: Contact with someone owning or familiar with W.D. Set R.216.—Ring Cleal, Lower Peover 2311 (reverse charges).

For sale: Two good rigs, one must go: Trio TS-520S, pristine condition, almost new, £435. **FT-277/101E,** with SP-101, dust cover, perfect and as new, £450.

Standard 146A, fitted S20, S22 and R7, brand new, unused, £100. KW-107 ATU, £60.—Ring Moscrop, G4EMG, 01-471 1762 daytime, 01-534 3460 evenings.

Offering: HW-101 with CW, SB-600 speaker, HP-23B, SB-200 linear and HM-102 wattmeter. Offers? (Going UHF).—Ring Sullivan, Bicester 42145.

Sale: Yaesu FR-101D receiver, brand new, £450.—Ring Allsopp, 0632-462606.

Wanted: Heathkit HW-100 transceiver with AC/Mobile PSU, mic., cables, speaker and manuals. Also, please can someone loan me circuit diagram for Eddystone EC-10?—Ring Koester, 04243-2177 evenings.

Selling: Stolle 2010 rotator, with control, bearing and 100-yds. of 5-core, all brand new, nearest £60 secures.—Snowden, Manor Farm, Amotherby, Malton, Yorks.

Sale: XCR-30 communications portable receiver, in mint condition, £100.—Ring White, Orpington (Kent) 24442 any evening.

For sale: Eddystone EC-10 receiver, complete with PSU and ATU/amp., £50.—Ring Lloyd, 0782-750904.

For sale: Gunn oscillator, £5. VLF Rx, 15-1500 kHz, £12. Ranger 2m. base station, £6. Variac, 20A., with spare core, £10. Microwave Modules 4m. converter, £10. 6-40 PA with PSU, less valve, needs finishing touches, £12.—Ring Mash, G8JAO, 06845-63270 after 7 p.m.

For sale: Icom IC-3PA power supply, as new, £35.—Ring Middleton, G4EJH, Bristol (0272) 843897 evenings.

Selling: Catronics ST5-B; Hal RVD-1005 VDU; Pye 9in. monitor; JRC Type NRD-3 general coverage Rx, 8 bands, 100 kHz to 28 MHz, 16 xtal-controlled channels, meter-tuned, transistorised, with manual, 19in. rack-mounted. **Wanted:** FRG-7000.—Ring Akines, 0472-71211.

Selling: Eddystone 730/4, excellent condition, with manual, £105. No. 10 crystal calibrator, powered from receiver, £7. Zenith Royal 3000-1 9-band portable, £90.—Freeston, Ivy House Farm, Ashby Magna, Lutterworth, Leics.

Wanted: Good 2-metre multi-mode receiver or transceiver, beam and rotator. Details and price please.—Ayres, G3UNP, 3 Swallow Close, Bushey Heath, Herts.

Selling: Complete station and test gear: National NCX-5 transceiver with AC/PSU and speaker, calibrator, plus NCX-D mobile PSU, £225. Sommerkamp FL-1000 linear, £100. Or package deal for all the above, £300. Codar AR-5 and PSU, £14. Marconi signal generators: TF-810A, 10-300 MHz, £25; TF-144G, 85-25 MHz, £25. Type 193A xtal test set, £10. CT-82 noise generator, £25. Type TF-3291 circuit magnification meter, with 10 inductors, £25. Tavasu mobile antenna with coils 160-15m., £8. GDO and coils, £10.—Cox, G3RYV, QTHR. (Tel: 0628-22551.)

Sale: Liner-2, with Belcom PSU, pre-amp., usual accessories, good condition, £120. HW-7 QRP transceiver, good condition, £30.—Ring Ranner, G8OGY, 01-432 4284 office hours.

For sale: FRG-7, hardly used, £100 no offers.—Ring Luton 51105.

Wanted: All types of HF transceivers, working or not, can collect, anything considered.—Ring Hall, Bolton 592929.

March issue: Due to appear March 16th. Single copies at 50p post paid will be sent by first-class mail for orders received by Wednesday, March 7th, as available.—Circulation Dept., Short Wave Magazine Ltd., 34 High Street, Welwyn, Herts. AL6 9EQ.

BETTER SHORT WAVE RECEPTION

by William I. Orr W6SAI and Stuart D. Cowan W2LX

New 4th Edition

In the latest edition of this excellent work for all those who own (or intend to own) a radio receiver, these two well-known and respected writers have produced chapters covering: the radio spectrum and what you can actually hear world-wide ; the tuning of a shortwave receiver ; the business of buying a receiver, both new and secondhand ; a description of the SW Rx in non-technical terms, together with receiver adjustment and alignment ; DX-ing above 30 MHz ; a description of the VHF receiver ; building and adjusting efficient aerials ; reception techniques.

Thoroughly readable and "digestible," this book is without doubt a very valuable addition to the book-shelf of any SWL.

160 pages £3·15 inc. post

Order from:

Publications Dept.,
SHORT WAVE MAGAZINE LTD.,
34 High Street, Welwyn, Herts., AL6 9EQ

WORLD RADIO/TV HANDBOOK 1979

The World's only complete reference guide to International Radio & Television Broadcasting Stations. It includes : Frequencies, time schedules, announcements, personnel, slogans, interval signals and much more besides of value to the listener.

Lists all International short-wave stations, including frequencies, for each country ; foreign broadcasts, long and medium wave stations (AM broadcast Band), TV stations and domestic programmes. Long recognised as the established authority by broadcasters and listeners. It is the only publication that enables you to identify BC stations quickly and easily. Enables you to fill more pages in your log book on the SW BC bands and helps you add more BC-station QSL cards to your collection.

£9.15

(The above price includes postage and packing).

from:

SHORT WAVE MAGAZINE
34 High Street, Welwyn, Herts. AL6 9EQ.

B. BAMBER ELECTRONICS

DEPT S, 5 STATION ROAD, LITTLEPORT, CAMBS., CB6 1QE

Tel.: Ely (0353) 860185 (Tuesday-Saturday)

CALLERS WELCOME BY APPOINTMENT ONLY

TERMS OF BUSINESS: CASH WITH ORDER. MINIMUM ORDER OF £2·00. ALL PRICES NOW INCLUDE POST & PACKING (UK ONLY)

PLEASE ENCLOSE STAMPED ADDRESSED ENVELOPE WITH ALL ENQUIRIES.

PLEASE ADD VAT AS SHOWN

Add 8% VAT (except where shown)

IC AUDIO AMP PCB. Output 2 watts into 3 ohm speaker, 12v. DC supply, size approx. 5½" x 1¼" x 1" high, with integral heatsink, complete with circuits, **£2·00 each.**

NICAD CHARGER CONVERTER PCB. (Low power inverter). Size approx. 4" x 1¾" x 1" high, 12v. DC supply, 60v. DC output, through pot on pcb, for charging Nicads, etc. (ideal for charging portable batteries from mobile supply). Only needs one BFY50/51/52 or similar transistor, which can be mounted direct on the pcb pins on board, fitted with a star-type heatsink (not supplied), **£2·00 each.**

THE NEW EAGLE INTERNATIONAL CATALOGUE IS AVAILABLE ON REQUEST containing Audio, In-car, and test equipment, etc.

WELLER TCP2 and PU20D PSU. Temperature controlled soldering iron with matching Power Supply Unit, containing sponge and spring stand, **£30·00.**

AND SPIRALUX. Tools for the Electronics enthusiast. S.A.E. for list.

AEI C510B/R MICROWAVE MIXER DIODES, up to X-Band, max. noise figure 8·5dB at 9·375 GHz, **80p each.**

Add 8% VAT (except where shown)

IC TEST CLIPS, clip over IC while still soldered to pcb or in socket, gold-plated pins, ideal for experimenters or service engineers. 28 pin DIL, **£1·75**; 40 pin DIL, **£2·00**. Or save by buying one of each for **£3·50.**

DECIMAL KEYBOARDS, pressure sensitive type, when pressed contacts go from O/C to approx. 25 ohms. Switches only, no encoders. Size approx. 3" x 3", with large square touch plates. 0–9 + Clear, A, B, Dual Watch, and spare. Few only, **£2·00** while stocks last.

MAINS TRANSFORMERS, TYPE 15/300. 240v. input, 15v. at 300mA output, **£1·50 each.**

MAINS TRANSFORMERS, TYPE 45/100. 240, 220, 110, 20, 0V input, 45V at 100mA output, **£1·50 each.**

LARGE ELECTROLYTIC PACKS, contains range of large electrolytic capacitors, low and high voltage types, over 40 pieces, **£3·00 per pack** (plus 12½% VAT).

GLASS BEAD FEEDTHROUGH INSULATORS, solder-in type, overall dia., 5mm., pack of approx. 50 for **50p.**

LARGE GLASS BEAD FEEDTHROUGH INSULATORS, as above but 8mm. dia. pack of approx. 50 for **70p.**

Add 8% VAT (except where shown)

10·7 MHz SSB XTAL FILTERS (2·4 kHz Bandwidth) Low imp. type, Carrier and unwanted sideband rejection min. –40dB (need 10·69835 and 10·70165 xtals for USB/LSB, NOT SUPPLIED). Size approx. 2" x 1" x 1", **£10·00 each.**

LOW PASS FILTERS (low imp. type) 2–9 MHz, small metal encapsulation, size approx. 1½" x ¾" x ¾", **75p each.**

DUE TO A CHANGE OF SUPPLIER, OUR STOCK ALUMINIUM BOXES AND VYNAL COVERED EQUIPMENT CASES WILL BE AS FOLLOWS:

Aluminium Boxes with Lids

AL1	3" x 2" x 1"	60p
AL2	4" x 3" x 1½"	70p
AL3	4" x 3" x 2"	80p
AL4	6" x 4" x 2"	90p
AL5	6" x 4" x 3"	£1·25
AL6	8" x 6" x 2"	£1·50
AL7	8" x 6" x 3"	£1·75

Vynal Equipment Cases

(Blue Vynal covered steel tops with plain aluminium lower sections.

BC0	5" x 2½" x 2¼"	£1·00
BC1	6" x 4½" x 2"	£2·00
BC2	6" x 4" x 3½"	£2·25
BC3	8" x 5½" x 2½"	£2·50
BC4	10" x 6½" x 3"	£3·00
BC7	12" x 6½" x 5"	£3·25

THIS MONTH'S SPECIAL OFFER

IDEAL FOR COMPUTER BUILDERS, Etc.

19 WAY RIBBON CABLE, DECIMAL CODED, 4 Metres for £1·25 + 8% VAT

13 WAY HEAVY-DUTY RIBBON CABLE, DECIMAL CODED (ideal for PSU runs) 3 Metres for £1·50 + 8% VAT

PLUGS & SOCKETS

BNC Plugs, new, **50p each.**

PL259 PLUGS (PTFE). Brand new, Packed with reducers, **75p each.**

80239 SOCKETS (PTFE). Brand new (4 hole fixing type), **60p each.**

N-TYPE PLUGS, 50 ohm, **60p each.**

GREENPAR (GE30015). Chassis Lead Terminations. (These are the units which bolt on to the chassis, the lead is secured by screw cap, and the inner of the coax passes through the chassis), **30p each, 4 for £1·00.**

FULL RANGE OF BERNARDS/BABANI ELECTRONICS BOOKS IN STOCK. S.A.E. FOR LIST.

TRANSISTORS

TO3 TRANSISTOR INSULATOR SETS 10 sets for **50p.**
BSX20 transistors (VHF OSC/MULT), 3 for **50p.**
BC107 (metal can), 4 for **50p.**
BC108 (metal can), 4 for **50p.**
PBC108 (plastic BC108), 5 for **50p.**
BFY51 TRANSISTORS, 4 for **60p.**
BF152 (UHF AMP/MIXER), 3 for **50p.**
2N3819, Fet. 3 for **60p.**
BC148 NPN SILICON, 4 for **50p.**
BC158 PNP SILICON, 4 for **50p.**
BAY31 Signal Diodes, 10 for **35p.**
BYX 38/300 Stud Rectifiers, 300v. at 2·5A, 4 for **60p.**
SCRs 400v. at 3A, stud type, 2 for **£1·00.**
TIP2955 Silicon PNP power transistor, 60v. at 15A, 90 Watts, Flat pack type, 2 for **£1·50.**
GERMANIUM DIODES, approx. 30 for **30p.**
IN4148 (IN914) DIODES, 10 for **25p.**
471CG RCA OP AMPS, 4 for **£1·00.**

SUB-MINIATURE ROTARY SWITCHES, 4 x 5 way make contacts. Size approx. ¾" dia. 1" deep, 3/16" spindle, **50p each.**

DIE-CAST BOXES Size approx.:

4·3" x 2·3" x 1·2"	(111 x 60 x 30mm.)	£1·25
4·8" x 2·3" x 1·5"	(121 x 60 x 38mm.)	£1·75
4·8" x 3·8" x 1"	(121 x 95 x 25mm.)	£2·10
4·8" x 3·8" x 2"	(121 x 95 x 51mm.)	£2·45
6·8" x 4·8" x 2"	(171 x 121 x 51mm.)	£3·10
4·8" x 3·8" x 3"	(121 x 95 x 76mm.)	£3·50
6·8" x 4·8" x 4"	(171 x 121 x 101mm.)	£4·75
8·6" x 5·8" x 2"	(222 x 146 x 51mm.)	£4·25
10·6" x 6·8" x 2"	(273 x 171 x 51mm.)	£5·30

SOLDER SUCKERS (Plunger type). Standard model, **£5·50**, Skirted model, **£6·00.** Spare nozzles, **65p each.**

Plastic Project Boxes
with screw on lids and brass inserts (in black ABS)

NB1	approx. 3½" x 2½" x 1½"	45p
NB2	approx. 4" x 3" 1¾"	55p
NB3	approx. 4¾" x 3¾" x 1¾"	65p
NB4	approx. 8¼" x 5¼" x 3½"	£1·50

SLOW MOTION MOTORS, 120V 50 Hz 1 RPM. Size approx. 2" dia., 1½" deep, with ½" spindle, **60p each or 2 for £1·00.**

HF CHOKES wound on ¼" x 1" long ferrites 4 for **50p.**

VHF CHOKES wound on 6-hole tubular ferrites, 5 for **40p.**

DUAL TO18 HEATSINKS 1" x ½" ¼" with screw-in clamps, 3 for **50p.**

CERAMIC TAG STRIPS (4 on 1mount), 10 mounts for **50p.**

TUNED COILS, 2 section coils, around 1 MHz, with a black smart tuning knob, which moves an internal core to vary the inductance, many uses, easily rewound, 3 for **50p.**

2-6pf, 10mm. circula ceramic trimmers (for VHF/UHF work), 3 pin mounting, 5 for **50p.**

ON/OFF/RX STANDBY SWITCHES for AM10B Cambridge and Vanguard control boxes, **40p each, 3 for £1.**

OSMOR REED RELAY COILS (for reed relays up to ½" dia., not supplied), 10v. 1K ohm coil, 2 for **50p.**

ALL BELOW — ADD 12½% VAT

BSR AUTOCHANGE RECORD PLAYER DECKS with cue device, 33–45–78 RPM, for 7", 10", 12" records. Fitted with SC12M Stereo Ceramic cartridge and styli. Brand new, **£14.**

GARRARD AUTOCHANGE RECORD PLAYER DECKS. Model 6,300 with cue device, 33–45–78 RPM, for 7", 10", 12" records. Fitted with KS41B Stereo Ceramic cartridge and styli. Brand new, **£16·00.**

TV LINE LINEARITY COILS. Special offer 10 for **£1·00.**

TV SCAN COILS, B/W, to fit 110 degree tubes, **£1·00.**

BARGAIN PACK OF LOW VOLTAGE ELECTROLYTIC CAPACITORS. Up to 50v. working. Seatronic manufacture. Approx. 100, **£1·50 per pack.**

A large range of capacitors available at bargain prices, S.A.E. for list.

TV PLUGS (metal type), 4 for **50p.**
DIN 3-pin LINE SOCKETS, **15p each.**
3 PIN DIN PLUGS, **15p each.**

ELECTROLYTICS

ELECTROLYTICS, 50μF, 450v., 2 for **50p.**
ELECTROLYTICS, 100μF, 275v., 2 for **50p.**
ELECTROLYTICS, 470μF 63v., 3 for **50p.**
ELECTROLYTICS, 1,000μF 30v., 3 for **60p.**
ELECTROLYTICS, 5,000 mfd. at 35v., **60p each**
ELECTROLYTICS, 5,000μF 50v., **60p each.**
ITT ELECTROLYTICS, 6,800 mfd at 25v., high grade, screw terminals, with mounting clip, **50p each.**

MULLARD ELC1043/05 VARICAP TV TUNERS, **£5·00 each.**

CELESTION 8" x 5" ELIPTICAL SPEAKERS, 20 ohm, 3 watts rates, **£1·50 each.**

Printed by The Courier Printing Co. Ltd., Tunbridge Wells for the Proprietors and Publishers, The Short Wave Magazine Ltd., 34 High Street, Welwyn, Herts., AL6 9EQ. The *Short Wave Magazine* is obtainable abroad through the following: Continental Publishers & Distributors, Ltd., William Dawson & Son Ltd.; AUSTRALIA AND NEW ZEALAND — Gordon & Gotch, Ltd.; AMERICA—International News Company, 131 Varick Street, NEW YORK. Registered for transmission to Canada by Magazine Post. *Januarv/Februar* 1979