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NOV 1979

FREE
PRACTICAL AERIAL DATA CHART

AERIAL SPECIAL

ALSO:

AERIALS FOR 160m
MW/LW LOOP AERIALS

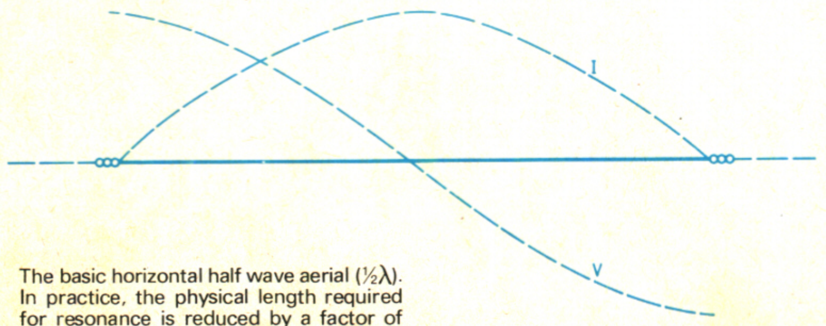
AND:

HI-FI GLOSSARY Continuing

PRACTICAL AERIAL DATA CHART

Presented Free with Practical Wireless - Nov. 1979

Basics

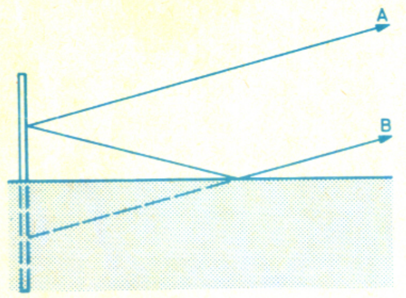


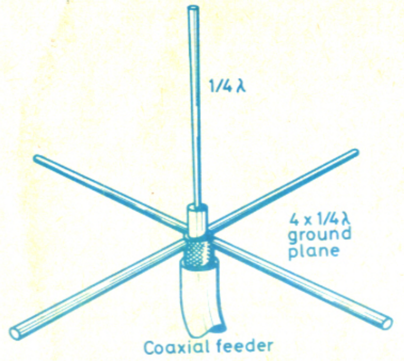
The basic horizontal half wave aerial (½λ). In practice, the physical length required for resonance is reduced by a factor of 0·95 (0·95x½λ) due to the effect of insulators and nearby objects. A simple formula for the practical half wave aerial is 143/F (MHz) metres. At resonance the induced voltage V will be maximum at the **ends of the aerial (high impedance) while** the current I will be maximum at the centre.

The basic Marconi aerial is a quarter-wave vertical with the lower end close to the ground, and it is used mainly on the lower frequencies. If this aerial is erected over a perfectly conducting ground then an image of the aerial is formed, which simulates a half-wave aerial. In practice the 'perfect' earth is formed from a number of long wires (radials) laid on or just under the surface of the earth.

It is not necessary for the aerial wire to be physically the correct length for a particular frequency or wavelength. It can be **made shorter or longer electrically to** achieve the same state of resonance by using an aerial tuning unit (a.t.u.).

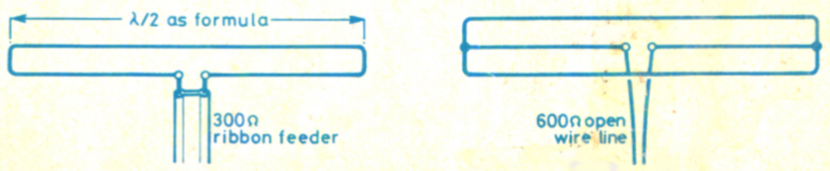
At higher frequencies, such an aerial is commonly mounted well above earth, and relies upon λ/4 radials entirely for its reflecting "earth plane." Such an aerial is known as a ground-plane.





Folded Dipole

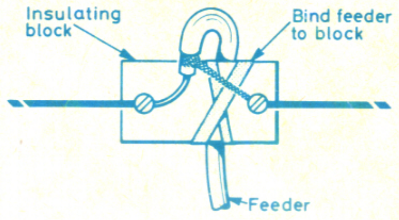
The folded dipole (a) will transform the input impedance by a factor of 2^2 or 4x70 =280 ohms so that it can be fed with a flat ribbon feeder of 300 ohms impedance, provided the wires forming the folded dipole are the same diameter. If a three-fold dipole is used, the input impedance will be 70x3^2 =630 ohms which will provide a good match to an open line feeder.



Dipole Construction

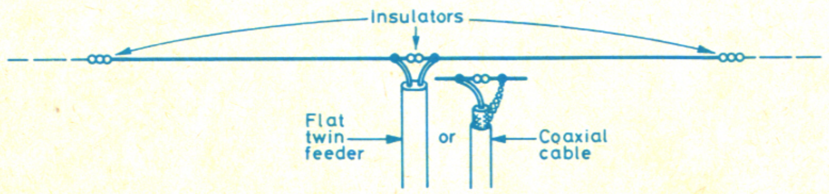
A practical method of feeding the aerial with low impedance feeder. The loop in the top of the feeder is essential to prevent the ingress of rain and dirt. The end of coaxial cable can be sealed with plastic insulating tape or compound.

"T" connectors providing mechanical anchorage and watertight termination for the feeder cable are also available from a number of our advertisers catering for the radio amateur.



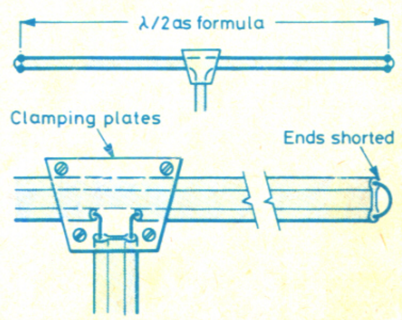
Half Wave Dipole

As the impedance at the centre of a half-wave aerial is approximately 70 ohms, flat twin or coaxial feeders will provide a good impedance match to the aerial ensuring maximum signal transference. The aerial, length calculated from the formula given, is cut at the centre and an insulator inserted, the wires of the feeder being connected either side of the insulator.

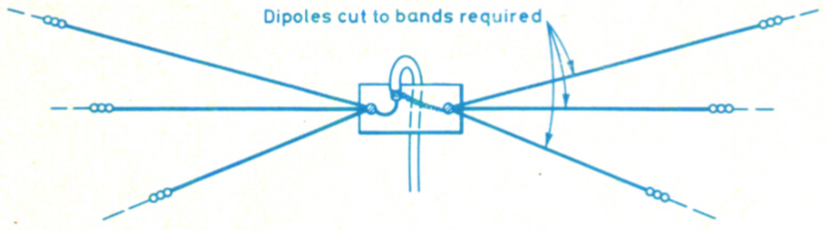


Folded Dipole Construction

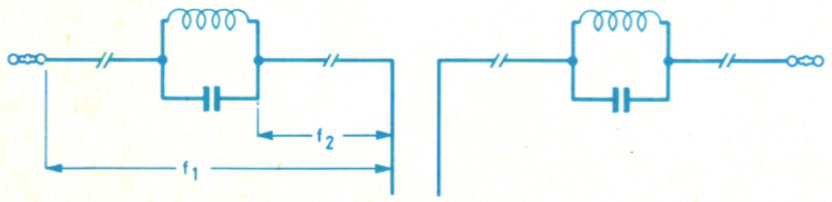
A practical folded dipole using 300 ohm ribbon feeder for both the aerial and the feeder. One conductor only of the aerial is cut at the centre and the feeder inserted and the joints soldered. The junction should be clamped between pieces of insulating material and properly waterproofed.



Multiband Dipole



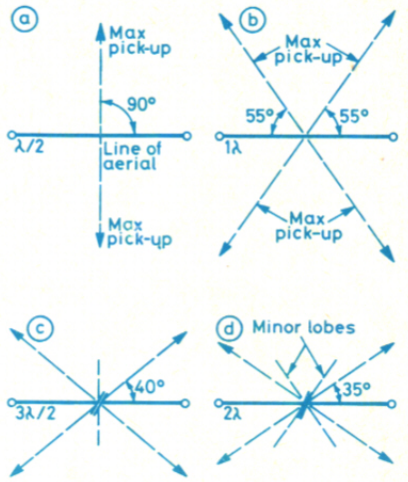
If dipoles are required for optimum performance on several frequency bands they can be connected in parallel at their centres and fed with a common feeder thus providing multiband facilities in a minimum of space. The ends of the dipoles may be tied off to any convenient supports and the dipoles need not all be in the same plane. Note that a dipole cut for, say, the 7MHz amateur band, will be three half waves on the 21MHz amateur band thus eliminating the need for a separate aerial for that band. Another approach, known as the Trap Dipole, uses parallel tuned circuits (traps) in the dipole elements. The length f_1, for example, might be appropriate for 14MHz, and the length f_2 for 21MHz. The tuned circuits would be designed to resonate at 21MHz, effectively isolating the end sections of the dipole from the feeder at that frequency. On 14MHz, the tuned circuits would have a low impedance, and the whole of the elements come into use. Some trimming of the sections compared to the calculated lengths, is necessary to compensate for the effect of the traps.



Directivity

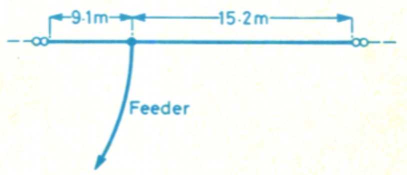
Signal pick-up of a half-wave aerial is maximum at right angles to the line of the wire (a). If the wire is one wavelength long maximum pick-up is from four directions (b). By choosing the right length of aerial and adjusting its orientation the maximum pick-up lobes can be made to cover all the land areas of the world.

Longer aerials result in the appearance of minor lobes (c) and (d) which reduce directivity and improve all round coverage. With an aerial many wavelengths long maximum reception is along the line of the wire.



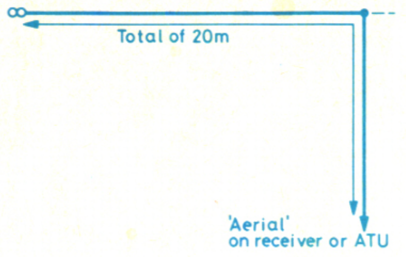
Windom

A useful general coverage aerial for the h.f. bands is the Windom which uses a single wire feeder tapped on to the horizontal wire. An aerial length of about 24m will work especially well on the 13,25 and 49 metre bands.



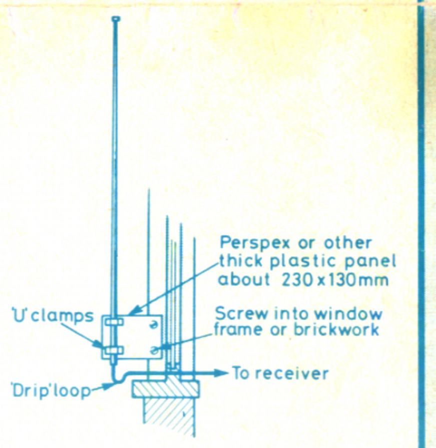
Long Wire

A long length of copper wire, with one end connected to the receiver, is probably the most commonly used aerial. For best results it should be erected out of doors. The inverted "L" aerial is a good all-round performer especially if the vertical section can be 7m or more long. If the overall length is around 20m it will function well on the amateur bands without an aerial tuning unit but an a.t.u. will make it even better. The combination of horizontal and vertical polarisation will help with DX signals where the received signal's polarisation can vary considerably from minute to minute.



Rods and Whips

For the flat-dweller, often without access to a roof or loft space, the only answer may be a vertical rod aerial 3 or 4m long, made from aluminium or copper tubing. An a.t.u. is essential here to bring the aerial to resonance on the various bands. Being very short this aerial will perform better on the higher frequency bands such as 10 and 15m. A commercial whip aerial, with a base-mounting insulator, of the type intended for mobile use can also be useful in this situation.

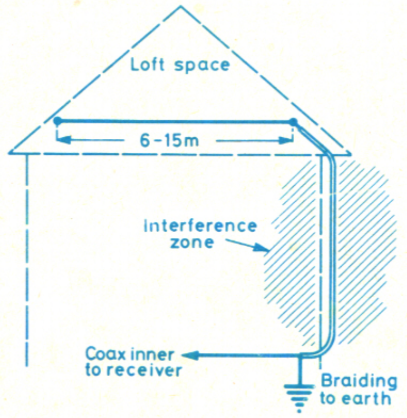


Indoor Aerials

A long wire aerial can be erected in restricted loft spaces and inside roofs even if it means draping it round the rafters! If electrical noise is a problem then the lower part of the aerial can be a length of coaxial cable with the outer screen connected to the receiver chassis or earth.

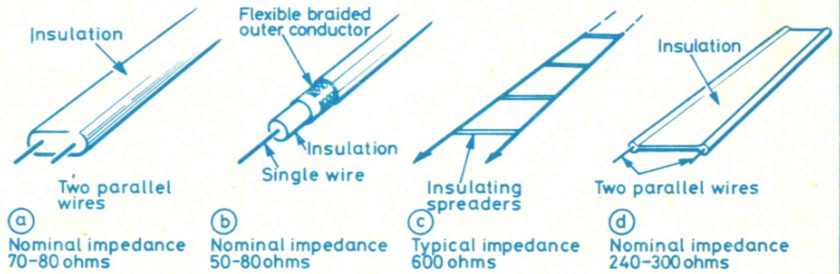
A similar aerial can be strung around a room, and even quite a small room will enable a 12 metre length to be used.

One convenient form of aerial can be obtained by using the coaxial cable of a TV aerial, the outer braiding being connected to the aerial socket of the receiver. Important!—disconnect the TV aerial from the TV set before using it in this form.



Feeders

Since the aerial should be located in the clear and generally as high as possible to produce maximum signal strength it is necessary to use a feeder to connect the aerial to the receiver. Low impedance feeders may be flat twin (a), coaxial (b) or flat ribbon (d). High impedance feeders consist of two wires spaced apart by insulators every foot or so (c).



PRACTICAL AERIAL DATA CHART

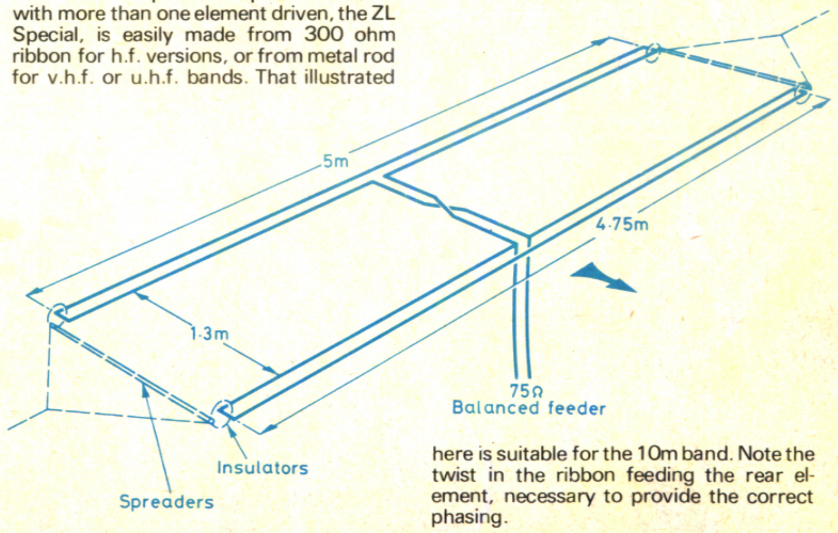
MULTI-ELEMENT AERIALS

Multi-element aerials fall into two basic groups: those with more than one element directly driven, and those with one element driven and the remainder parasitically excited—in other words picking up radiation from the driven element and re-radiating it. In both cases, the radiation from the various elements interacts to give increased field strength in some directions and reduced strength in other.

This description assumes the aerial is being used for transmission, but since aerials behave in a reciprocal fashion, it is equally true for reception, the "driven" elements being those that are connected via a feeder to the receiver.

ZL Special

One of the simplest examples of an aerial with more than one element driven, the ZL Special, is easily made from 300 ohm ribbon for h.f. versions, or from metal rod for v.h.f. or u.h.f. bands. That illustrated here is suitable for the 10m band. Note the twist in the ribbon feeding the rear element, necessary to provide the correct phasing.



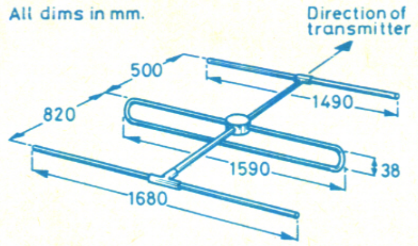
Yagi

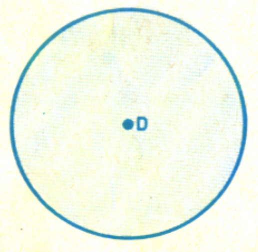
The most common version of the parasitic aerial array, the Yagi, will be familiar to all in its application to v.h.f. and u.h.f. TV and to v.h.f. f.m. sound reception. Its basic form, the "H," is formed by adding a single rod to a half-wave dipole, spaced some small fraction of a wavelength from it. By making the rod slightly longer than the dipole, it acts as a reflector, modifying the response pattern to a cardioid (heart-shape) pattern. In practice this is not a perfect cardioid, and there will an unwanted rear lobe.

Adding a second rod, slightly shorter than the dipole, on the opposite side to the reflector, will reinforce and narrow the main lobe of the response pattern. A 3-element Yagi suitable for v.h.f. f.m. sound reception is shown. The frequency of maximum response is 95MHz.

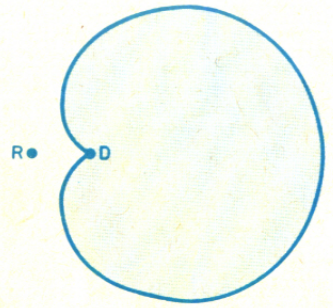
Further directors may be added in front of the first, each slightly improving the gain of the aerial array, up to a limit of about 36 elements, after which no significant increase is obtained.

Adding parasitic elements reduces the impedance of the dipole, as seen by the feeder, and a folded dipole is frequently used, to help to compensate for this.





Circular radiation pattern of dipole (viewed end-on)



adding a reflector

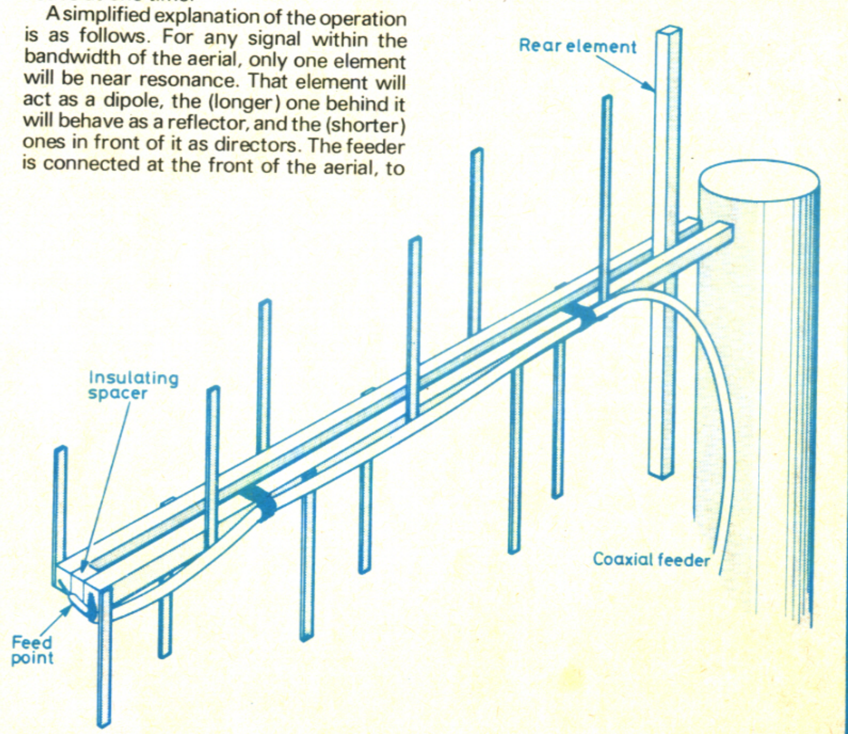
Log-Periodic

One of the disadvantages of the Yagi is its fairly narrow bandwidth. Where a broad range of frequencies is to be covered, and there is no space for multiple aerial arrays, the Log-Periodic aerial may be useful, though its gain is lower than a Yagi.

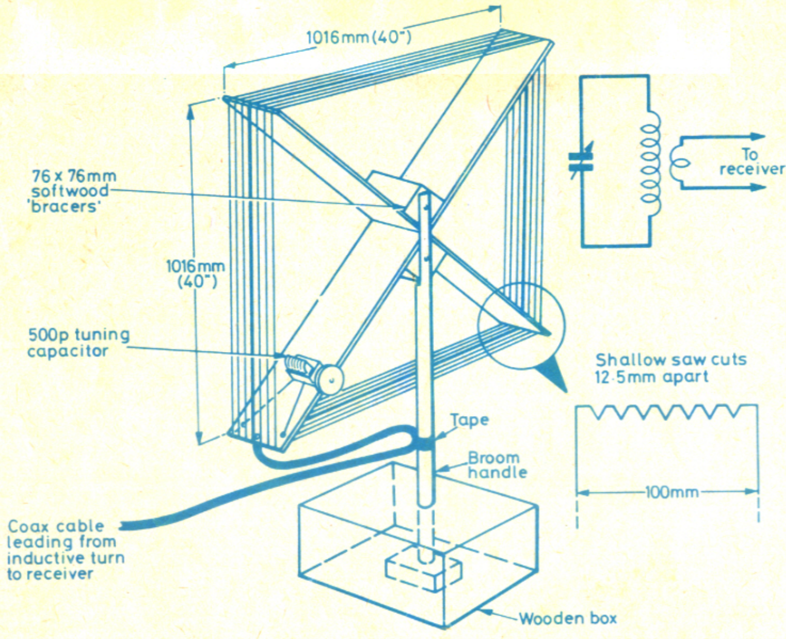
The name arises from the fact that there is a constant mathematical relationship in the length and positioning of each element, compared with its predecessor in the series. All elements, except the rearmost reflector, are driven, though not all are active at one time.

A simplified explanation of the operation is as follows. For any signal within the bandwidth of the aerial, only one element will be near resonance. That element will act as a dipole, the (longer) one behind it will behave as a reflector, and the (shorter) ones in front of it as directors. The feeder is connected at the front of the aerial, to the transmission line formed by the twin parallel booms on which the elements are mounted. Alternate half-elements are connected to opposite booms, to provide the necessary phase-change between successive elements.

The length and spacing of successive elements reduces from the back by a factor n, less than 1. For a given bandwidth, a shorter array has fewer elements and a lower gain, and a lower value of n.



MW Loop



For frequencies between 500kHz and 2MHz the loop aerial takes a lot of beating. It consists of 7 turns of wire (5 or 6 turns for higher frequencies) around a wooden framework as illustrated. The ends of the wire connect to a 500pF tuning capacitor. A second wire, wound around the centre turn connects to a coax cable which goes to the aerial and earth sockets on the receiver or preferably to a balanced input.

The loop forms a tuned circuit in conjunction with the capacitor with the inductive loop providing a low impedance feed to the receiver. The capacitor has to be tuned for each frequency and the selectivity is excellent. The loop is highly directional and by rotating it, interfering stations can be virtually eliminated. The tuning is very sharp and it is advantageous to fit either a slow motion drive to the capacitor or to wire a small value variable trimmer in parallel with it (10pF to 20pF).

The gain is not as high as that of a long wire aerial but this is more than outweighed by the much improved signal-to-noise ratio and the directional characteristics. The direction of a station can be determined within a few degrees by nulling it out to take its bearing. The broom-handle can be fitted into a box as shown with the bottom fitting into a recessed slot to prevent it slipping.

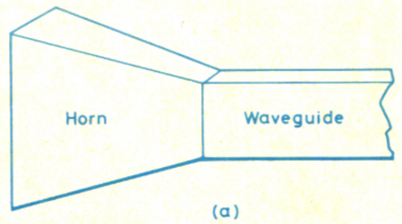
The main frame can be made of 6mm thick plywood or softwood. The wires should be wound very tight and should be kept that way (under tension the wire tends to stretch slightly). The softwood blocks merely act as bracers and as supports for the broom handle.

Microwaves

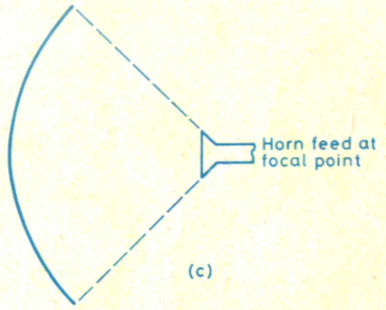
Radio frequency signals of centimetric wavelength are carried to a receiver, or from a transmitter, by a rectangular-section tube called waveguide, whose internal dimensions will impose limits on the upper and lower cut-off frequencies, in much the same way that ordinary aerials exhibit a critical resonant frequency.

A simple microwave antenna, the pyramidal horn (a) is basically a flared-out extension of the waveguide, its surfaces envisaged as having an infinite number of radiating elements. An analogy would be a megaphone.

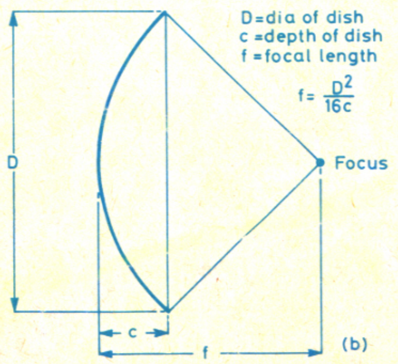
The parabolic reflector (dish) as shown (b) may be compared to a torch or headlight where the light source is at the focal point. The dish may be fed from the front (c) by a small horn at the focal point, or from the rear (d) by waveguide, using a reflector and dipole to suit the frequency. The gain and beamwidth of a dish is dependent upon its diameter in relation to the operating frequency. Using the formula for generating a parabola, dishes may be constructed in fibre-glass and the reflective surface covered with kitchen foil, alternatively, fine mesh wire netting, although this latter method would result in some losses.



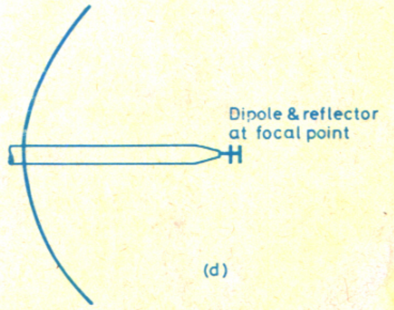
(a)



(c)



(b)



(d)

Frequency Bands

SHORT WAVE BROADCAST BANDS

Band (metres)	Frequency (MHz)		Dipole Length (m)
120	2·300 to	2·495	—
90	3·200	3·400	—
75	3·900	4·000	—
60	4·750	5·060	—
49	5·950	6·200	23·17
41	7·100	7·300	19·81
31	9·500	9·775	14·63
25	11·700	11·975	11·89
19	15·100	15·450	9·14
16	17·700	17·900	7·92
13	21·450	21·750	6·58
11	25·600	26·100	5·54

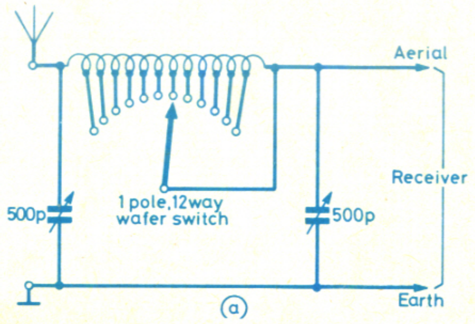
SHORT WAVE AMATEUR BANDS

Band (metres)	Frequency (MHz)		Dipole Length (m)
160	1·800 to	2·000	78
80	3·500	4·000*	39
40	7·000	7·300**	20·12
20	14·000	14·350	10·06
15	21·000	21·450	6·7
10	28·000	29·700	4·88

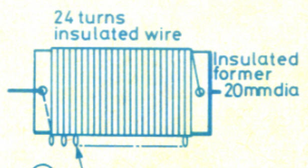
*UK 3·500-3·800
**UK 7·000-7·100

Aerial Tuning Unit

For best results an end-fed wire aerial or rod aerial should be matched to the receiver input circuit with an Aerial Tuning Unit (a). The inductor (b) is wound making a loop every other turn, the loops then being soldered to the switch tags. Fit each tuning capacitor with a calibrated knob or dial and number the switch positions. Adjust the capacitors and switch position for maximum signal strength noting that the three adjustments are very much inter-dependent. Log dial and switch readings for future reference.



(a)

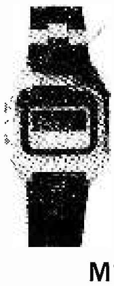


(b) Taps alternate turns

Planning Consent

In the UK, any aerial support erected at a height exceeding 10 feet above ground level is subject to the Town and Country Planning Acts. Before embarking on any major aerial installation, it is advisable to contact the local Council Surveyor, and if necessary to apply for planning permission.

QUARTZ LCD 5 Function



Hours, mins, secs., month, date, auto calender, back-light, quality metal bracelet.

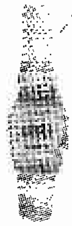
£6.65

Guaranteed same day despatch.

Very slim, only 6mm thick.

M1

SOLAR QUARTZ LCD 5 Function



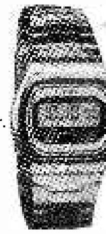
Genuine solar panel with battery back-up. Hours, mins., secs., day, date. Fully adjustable bracelet. Back-light. Only 7mm thick.

£8.65

Guaranteed same day despatch.

M2

QUARTZ LCD 11 Function SLIM CHRONO



6 digit, 11 functions. Hours, mins., secs., day, date, day of week. 1/100th, 1/10th, secs., 10X secs., mins., Split and lap modes. Back-light, auto calendar. Only 8mm thick. Stainless steel bracelet and back. Adjustable bracelet. Metac Price

£10.65 Thousands sold!

Guaranteed same day despatch. M3

QUARTZ LCD ALARM 7 Function

Hours, mins., secs., month, date, day. 6 digits, 3 flags plus continuous display of day and date or seconds. Back-light Only 9mm thick.

£12.65

Guaranteed same day dispatch. M4

MULTI ALARM 6 Digits 10 Functions

* Hours, mins., secs.
* Months, date, day.
* Basic alarm.
* Memory date alarm.
* Timer alarm with dual.
* Time and 10 country zone.
* Back-light.
* 8mm thick.

£18.65

M5

FRONT-BUTTON Alarm Chrono Dual Time

6 digits, 5 flags. 22 functions. Constant display of hours and mins., plus optional seconds or date display. AM/PM indication, month, date. Continuous display of day. Stop-watch to 12 hours 59·9 secs., in 1/10 second steps. Split and lap timing modes. Dual time zones. Only 8mm thick. Back-light. Fully adjustable open bracelet.

£22.65

Guaranteed same day dispatch M6

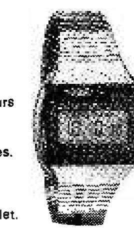
SOLAR QUARTZ LCD Chronograph with Alarm Dual Time Zone Facility

6 digits, 5 flags. 22 functions. Solar panel with battery back-up. 6 basic functions. Stop-watch to 12 hours 59·9 secs., in 1/10 sec., steps. Split and lap timing modes. Dual time zones. Alarm. 9mm thick. Back-light. Fully adjustable bracelet.

£27.95

M7

ALARM CHRONO with 9 world time zones

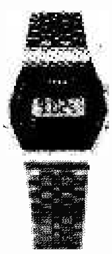


* 6 digits, 5 flags.
* 6 basic functions.
* 8 further time zones.
* Count-down alarm.
* Stop-watch to 12 hours 59·9 secs. in 1/10 sec. steps.
* Split and timing modes.
* Alarm.
* 9 mm thick.
* Back-light.
* Fully adjustable bracelet.

£29.65

M8

SOLAR QUARTZ LCD Chronograph



Powered from solar panel with battery back-up. 6 digit, 11 functions. Hours, mins., secs., day, date, day of week. 1/100th, 1/10th, secs., 10X secs., mins. Split and lap modes. Back-light, auto calendar. Only 8mm thick. Stainless steel bracelet and back. Adjustable bracelet. Metac Price

£12.65

Guaranteed same day despatch. M9

SEIKO Alarm Chrono

LCD, hours, mins., secs., day of week, month, day and date, 24 hour Alarm, 12 hour chronograph, 1/10th secs., and lap time. Back light, stainless steel, HARDLEX glass.

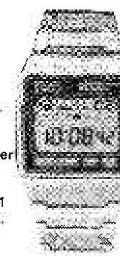
List Price £130.00

METAC PRICE

£105.00

M10

SEIKO MEMORY BANK

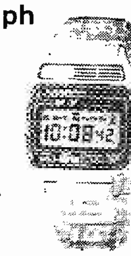


Calendar watch M354 Hours, mins., secs, Month, day, date in 12 or 24 hour format all indicated continuously. Monthly calendar display month, year and all dates for any selected month over 80 year period. Memory bank function. Any desired dates up to 11 can be stored in advanced. 2 year battery life. Water resistant.

List Price £130

Metac Price **£79.50** M11

SEIKO-STYLE Dual time-alarm Chronograph



Mineral glass face. Battery hatch for DIY battery replacement. Top quality finish with fully adjustable bracelet.

£35.00

M12

HANIMEX Electronic LED Alarm Clock

Features and Specification: Hour/minute display Large LED display with p.m. and alarm on indicator. 24 Hours alarm with on/off control. Display flashing for power loss indication. Repeatable 9-minute snooze. Display bright/dim modes control. Size 5.15" x 3.93" x 2.36" (131mm x 11mm x 60mm). Weight: 1.43 lbs (0.65 kg). AC power 220V.

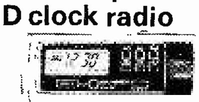
£9.65 Thousands sold!

Mains operated.

Guaranteed same day despatch.

M13

HANIMEX portable LCD clock radio



* Time set & alarm controls.
* Snooze & sleep controls.
* Wake to music or alarm.
* AM/PM indicator.
* Battery operated. No plug required.
* Receives all standard AM radio broadcasts.
* Drawstring carrying case included.
* Back-light.
* Batteries supplied free.
* Quartz crystal controlled.

£17.95

M14

QUARTZ LCD Ladies 5 Function

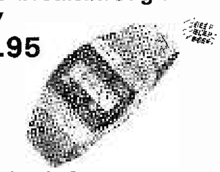
Only 25 x 20mm and 6mm thick. 5 function. Hours, mins., secs., day, date and back light and auto calendar. Elegant metal bracelet in silver or gold. State preference.

£9.95

Guaranteed same day despatch.

M15

Price breakthrough only £18.95



OUTSTANDING FEATURES

* DUAL TIME. Local time always visible and you can set and recall any other time zone (such as GMT). Also has a light for night viewing.
* CALENDAR FUNCTIONS include the date and day in each time zone.
* CHRONOGRAPH/STOPWATCH displays up to 12 hours, 59 minutes, and 59.9 seconds.
* On command, stopwatch display freezes to show intermediate (split/lap) time while stopwatch continues to run. Can also switch to and from timekeeping and stopwatch modes without affecting either's operation.
* ALARM can be set to anytime within a 24 hour period. At the designated time, a pleasant, but effective buzzer sounds to remind or awaken you!

Guaranteed same day dispatch. M16

HOW TO ORDER

Payment can be made by sending cheque, postal order, Barclay, Access or American Express card numbers. Write your name, address and the order details clearly, enclose 30p for post and packing or the amount stated. We do not wait to clear your cheque before sending the goods so this will not delay delivery. All products carry 1 year guaranteee and full money back 10 day reassurance. Battery fitting service is available at our shops. All prices include VAT.

Trade enquiries: Send for a complete list of trade prices – minimum order value £100.
Telephone Orders: Credit card customers can telephone orders direct to Daventry or Edgware Rd., 24 hour phone service at both shops: 01-723 4753 03272-76545.

CALLERS WELCOME
Shops open 9.30 - 6.00.

Metac ELECTRONICS & TIME CENTRES

North & Midlands
67 High Street, DAVENTRY
Northamptonshire
Telephone: 03272 76545

South of England
327 Edgware Road
LONDON W.2
Telephone: (01) 723 4753

practical WIRELESS

NOVEMBER 1979
VOLUME 55
NUMBER 11
ISSUE 873

BRITAINS LEADING JOURNAL FOR THE RADIO & ELECTRONIC CONSTRUCTOR

Published by IPC Magazines Ltd., Westover House, West Quay Rd., POOLE, Dorset BH15 1JG

QUERIES
While we will always try to assist readers in difficulties with a *Practical Wireless* project, we cannot offer advice on modifications to our designs, nor on commercial radio, TV or electronic equipment. Please address your letters to the Editor, Practical Wireless, at the above address, giving a clear description of the problem and enclosing a stamped self-addressed envelope. Only one project per letter please.

Components are usually available from advertisers. A source will be suggested for difficult items.

SUBSCRIPTIONS
Subscriptions are available to both home and overseas addresses at £10.60 per annum, from **"Practical Wireless" Subscription Department, Oakfield House, Perrymount Road, Haywards Heath, West Sussex RH16 3DH.**

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Limited stocks of some recent issues of *PW* are available at 80p each, including post and packing to addresses at home and overseas.

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NEWS & VIEWS

FOR OUR CONSTRUCTORS

GENERAL INTEREST

☆ FREE THIS MONTH

PW Aerial Data Chart—Double-sided and packed with useful info

We regret that Burglar Alarms Part 3 has had to be held over

Our December issue will be published in early November
(for details see page 37)

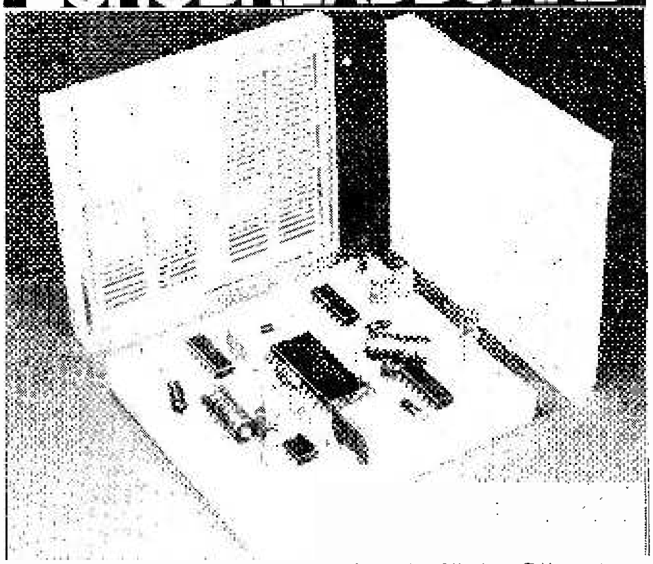
THE NEW

EUROSOLDERSUCKER

This 195mm long, all metal, high suction, desoldering tool with replaceable Teflon tip enables removal of molten solder from all sizes of pcb pads. Primed and released by thumb, it incorporates an anti-recoil system and built in safety guard. **Only £7.25 inc. VAT & P.P.**

THE UNIQUE

EUROBREADBOARD



Logically laid out to accept both 0.3" and 0.6" pitch DIL packages as well as Capacitors, Resistors, LED's, Transistors and components with leads up to .85mm dia.

500 individual connections in the central breadboarding area, spaced to accept all sizes of DIL package without running out of connection points, plus 4 Integral Power Bus Strips around all edges for minimum inter-connection lengths.

All connection rows and columns are now numbered or lettered enabling exact location indexing.

Double-sided nickel silver contacts for long life (10K insertions) and low contact resistance (< 10m. ohms)

Easily removable, non-slip rubber backing allows damaged contacts to be rapidly replaced.

No other breadboard has as many individual contacts, offers all these features and costs only £6.20 each or £11.70 for 2 — inclusive of VAT and P.P.

Snip out and Post

David George Sales, r/o 74 Crayford High St., Crayford, Kent DA1 4EF

David George Sales
r/o 74 Crayford High Street,
Crayford, Kent, DA1 4EF.

PW1179

Please send me 1 EuroSolderSucker @ £7.25 ☐
or 1 EuroBreadBoard @ £6.20 ☐
or 2 EuroBreadBoards @ £11.70 ☐

Please Tick

(All prices are applicable from July 1st, 1979 and include VAT & P.P., but add 15% for overseas orders).

Name . . . .

Company . . . .

Address . . . .

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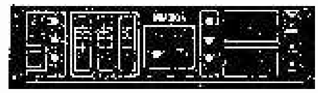
Tel. No. . . . .

Please make cheque/P.O.'s payable to David George Sales

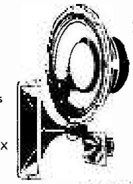
Now, complete your system!



Citronic MM313 Mixer

Ideal for the DIY enthusiast building up a complete disco system 4/6 ch mono. inc, LED indicators, connections via phono sockets at rear. Bargain price, including PSU £89.70.

The ultimate range of speakers



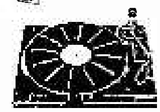
We carry a good selection of high quality chassis for the DIY speaker constructor: 12" or 15" Bass speakers and Dual Concentrics Exponential horns from £13.80, or our fabulous Piezo Horns which handle a 5K–20K frequency range in any PA system up to 100W (No X over required) and cost only £6 32 each

Projectors

Come and see our specially selected projectors from £50.60 (Squire Multi-fect 150) to £83 37 (Tutor IIE DDU) plus the widest array of projector attachment and effects that you'll ever see on continuous demonstration

Ropelights

Great effect at discos 7 metres long. Multiway connectors. 4 channel £46.00 (inc pack of spare bulbs)



Turntables

Our unsurpassed Disco experience has enabled us to select the best turntables for your requirements. For example the new BSR P200 belt drive ONLY £28 75

Bulgin Octal plugs and sockets

There's always hundreds of Bulgin Octal multiway plugs and sockets in stock at Roger Squire's. Each pin rated 6A. Perfect for your Sound to Light System. P552 SOCKET.£0 69 P551 PLUG £1.72

Many disco accessories

All Roger Squire's shops have a service department which carries large stocks of DISCO SPARES & ACCESSORIES

Multiway Cables
4 core (6A) 63p/metre
5 core (6A) 78p/metre
6 core (6A) 92p/metre

ALL SHOPS OPEN TUE.SAT
LATE NIGHT WED.
(UP TO 8 PM)

PERSONAL CALLERS ONLY

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MANCHESTER 251 Deansgate 3. 15 mins from City Centre Tel: 061 831 7676
GLASGOW 1 Queen Margaret Road (off Queen Margaret Drive) Kelvinside 20, just behind the BBC. Tel: 041 946 3303

J. BIRKETT

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AIRSPACED TRANSMITTING VARIABLE CAPACITORS 80pf @ **£1·80,** 30 + 30pf @ **£2·20.**
BUTTERFLY PRE-SET VARIABLES 25 × 25pf @ **50p,** 38 × 38pf @ **60p,** 38 × 38pf Wide Spaced @ **65p.** Spindles easily extended.
UNMARKED GOOD 2N 3866 TRANSISTORS at 3 for **75p.**
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VHF TRANSISTORS AF 239 @ **50p,** 2N 5179 @ **60p,** 2N 5180 @ **50p,** BFY 90 @ **50p,**
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SOLDER-IN FEED THRU's 6·8pf, 300pf, 1000pf. All **20p** doz.
LOUDSPEAKERS $1\frac{3}{4}$" 8 ohm, $2\frac{1}{4}$" 65 ohm, 3" 150 ohm all at **85p.**
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BF 679 STRIPLINE 1000 MHz PNP TRANSISTOR @ **25p.**
MINIATURE 3 GANG VARIABLE 25×25×25pf @ **75p.**
DIVIDE BY 2 300 MHz COUNTER I.C. with data @ **65p.**
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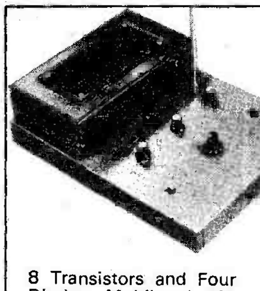
VHF POWER TRANSISTOR 10 watt 175 MHz 13 volt R5174 @ **£2·50.**
DAU TRIMMERS 2 To 9pf, 7 To 35pf, 6 To 45pf, 8 To 125pf, 8 To 140pf All at **16p** each.
VHF SOLDER-IN TUBULAR TRIMMERS 6pf @ **10p** each.
CERAMIC TRIMMERS 2·5 To 6pf, 3 To 10pf, 4·7 To 20pf, 6 To 35pf, 10 To 60pf All at **15p** each.
POSTAGE STAMP TRIMMERS 10pf, 30pf, 50pf, 1000pf, All **10p.** ea.
VARIABLE CAPACITORS Direct Drive. $\frac{1}{4}$" Spindle. 5pf @ **75p,** 10pf @ **75p,** 125+125pf @ **55p,** 100+200pf @ **55p,** 200+200+25+25pf @ **55p.** With S.M. Drive. 200+300pf @ **55p,** 500+500+25+25pf @ **55p,** 250+250+20+20+20pf @ **75p.**
SPECIAL 3 GANG VARIABLE 25+25+25pf @ **75p** each.
DUAL GATE MOS FETS like 40673 @ **33p,** 4 for **£1·10,** 2N 3819 **FETS** @ **20p,** 6 for **75p, DUAL GATE** MFE 131 @ **50p,** J310 @ **20p,** BF 244 @ **25p,** BF 256 @ **25p,** E111 @ **12p. E112** @ **10p**
CERAMIC FILTERS TOKO 10·7 MHz CFS 10·7 MHz @ **27p.**
MURATA 10·7 MHz SFW 10·7 MHz @ **50p,** SFC 10·7 MHz @ **27p,** SFC 5·5 MHz @ **27p,** 455 KHz B.W. ± 7 KHz @ **50p.**
STC-ITT CRYSTAL FILTER 10·7 MHz B.W. ± 7·5 KHz @ **£5.**
ALLOY DIE CAST BOXES 6" × 3·3/16" × 2" **9 £1·15,** 3 for **£2·85.**
VERNITRON FM4 10·7 MHz FILTERS @ **50p,** 3 for **£1.**
30 ASSORTED 10XAJ CRYSTALS @ **£1·10, 20.FT 241A CRYSTALS** @ **£1·10, 20 ASSORTED FT 243 CRYSTALS** @ **£1·50.**
VARI-CAP DIODES BA 102 @ **20p,** BB 121 @ **15p,** MV 1636 @ **20p,** BB 105 @ **20p.**
EUROPEAN PLUG AND SOCKET 3 Pin, 2M of Cable at **75p** pair.
10 ASSORTED PUSH BUTTON BANKS less Knobs for **£1·30.**
10 ASSORTED SLIDER POTENTIOMETERS for **£1.**
25 STUD MOUNTING 10 AMP DIODES untested @ **60p.**
50 BC 107-8-9 TRANSISTORS assorted untested @ **60p.**
50 2 Watt ZENERS assorted untested @ **60p.**
50 OC 71 TRANSISTORS untested @ **75p.**
25 5 AMP STUD MOUNTING S.C.R's untested @ **75p.**
TBA 120S FM IC.'s untested with data @ 6 for **60p.**
10 20 AMP STUD MOUNTING DIODES untested @ **60p.**
20 PHOTO TRANSISTORS AND DARLINGTONS assorted untested @ **£1.**
ELECTROLYTIC CAPACITORS 2000uf 450v.w. $5\frac{1}{2}$" × 3" @ **£2·25.**
PAPER CAPACITORS 10uf 370 V.A.V. w. $5\frac{1}{2}$" × $2\frac{1}{2}$" × $1\frac{1}{2}$" @ **£1·50.**
MINIATURE 12 WAY CERAMIC TAG STRIPS @ **15p.**
Please add 20p for post and packing on U.K. orders under £2. Overseas orders, postage charged at cost.

RADIO EXCHANGE LIMITED

New Model RX002



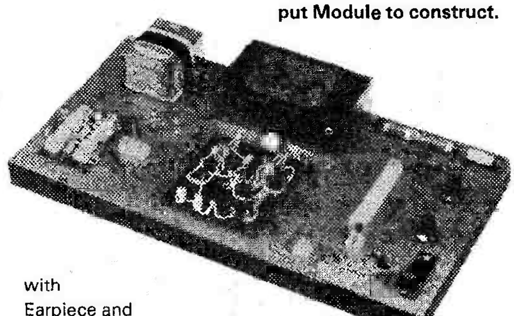
Wave-band coverage as RX001 but with Tone Control, extra Transistor, for more power, 39" Telescopic Aerial and Battery Economiser Switch. Uses Every-Ready PP7 battery. Flat Area Size 13" x $9\frac{1}{2}$" x $1\frac{3}{8}$".

Kit comes complete with instruction manual pictorial and circuit diagrams.

8 Transistors and Four Diodes. Multiband AM Receiver.

£12·99 + P & P £1·30

New master kit EMK mark II

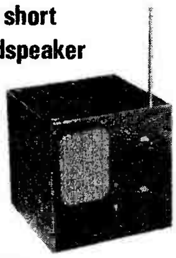


With special Power Output Module to construct.

A completely Solderless construction kit, with Ready Drilled Bakelite Panels, Nuts, Bolts, Wood Screws, etc. Also in the Kit, Transistors, Capacitors, Resistors, Silicon and Germanium Diodes, Integrated Circuit and LED, Potentiometer, Switch, Tuning Capacitor, Wire Sleeving, Knobs, Dials, Loudspeaker and Speaker Case, Crystal Earpiece, Ready Wound Medium Wave and Long Wave Ferrite Rod Aerial. A range of Circuits with Pictorial Diagrams and Instructions are supplied with the Kit. Covering Medium Wave and Long Wave Radio Receivers with Earpiece and Loudspeaker Output Stages, Amplifiers, Test Equipment, Metronome and Noise Generators, Morse Code Practise Oscillator with Key and Circuits using the IC and LED supplied. Everything necessary to build and operate the Projects supplied in the Kit. Battery used PP9 volt (not supplied).
Size 19"x$9\frac{1}{2}$"x$1\frac{3}{8}$".

£17·99 + P & P £1·30

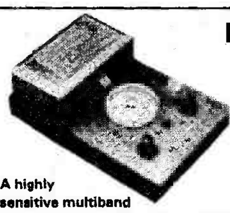
SXB2 – Powerful two band short wave loudspeaker receiver



8 Transistors and 4 Diodes. A world of listening on the Short Wave Frequencies, with this highly sensitive self contained Short Wave Radio. Complete with Telescopic Aerial, Loudspeaker, Gain and Tuning Controls and all components necessary to build it. Covering approximately 60 metres to 18 metres. Uses Ever-Ready PP9 volt battery. Kit comes complete with Instruction Manual, Pictorial and Circuit Diagrams.
Size $6\frac{3}{8}$" x $6\frac{3}{8}$" x $6\frac{3}{8}$".

£10·95 + P & P £1·30

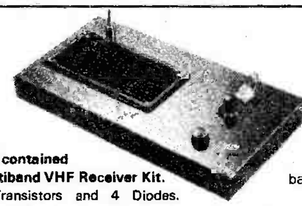
New model RX001



A highly sensitive multiband AM Receiver giving Room Filling Volume; Covering Medium Wave, Long Wave, Trawler Band and Three Short Wave Bands, Seven Transistors and four Diodes, Push-Pull output stage with quality Loudspeaker and internal Ferrite Rod Aerial. Kit includes all parts to build it up including rubber feet and ready drilled Panels. Comprehensive Instruction Manual for stage by stage construction. Uses 9 volt battery not supplied.
Flat area size $9\frac{1}{2}$" x $6\frac{3}{4}$" x $1\frac{3}{4}$".

£10·70 + P & P £1·30

New model ECK2-(M.)



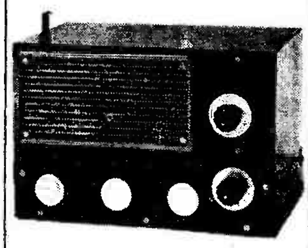
Self contained Multiband VHF Receiver Kit. 8 Transistors and 4 Diodes. Push-Pull output. Quality Loudspeaker, Gain Control, Swivel, Chrome Plated Telescopic Aerial, VHF Tuning Capacitor, Resistors, Capacitors, Transistors etc. Will receive T.V.

Sound, Public Service Band, Aircraft, VHF local Stations etc. Operates from 9 volt battery (not supplied with Kit).

Size $12\frac{1}{2}$" x $6\frac{3}{8}$" x $1\frac{3}{8}$".
Complete kit of parts.
Kit comes complete with manual pictorial and circuit diagrams.

£9·99 + P & P £1·10

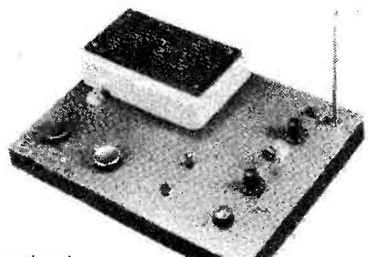
New Romer Ten Model R.K.3.



Multiband V.H.F. and A. M. Receiver. 13 Transistors and Six Diodes.
Quality Loudspeaker with Multiband V.H.F. section covering Mobiles, Aircraft, T.V. Sound, Public Service Band Local V.H.F. Stations, etc. and Multi-band A. M. section with separate Tuning Capacitor for easier and accurate tuning, covering M.W.1, M.W.2, L. W. Three Short Wave Bands S.W.1, S.W.2, S.W.3 and Trawler Band. Built-in Ferrite Rod Aerial for Medium Wave, Long Wave and Trawler Band, etc., Chrome-plated 7 section Telescopic Aerial, angled and rotatable for peak Short Wave and V.H.F. reception. Push-Pull output using 600mW Transistors. Gain, Wave-Change and Tone Controls. Plus two Slider Switches. Powered by PP9-9 volt battery.
Complete kit of parts including carrying strap. Building Instructions and operating Manuals.

£16·95 + P & P £1·30

V.H.F. AM Multiband Receiver VX8



This is an updated version of our excellent RK3 Model; Employing a new Flat Look, different layout, extra Slider Switch and projected loudspeaker Case. Waveband Coverage and components including 39inch Telescopic Aerial as the RK3. Complete with VX8 instruction manual and diagrams, uses 9 volt battery.
Size 13" x $9\frac{1}{2}$" x $1\frac{3}{8}$"

£17·95 + P & P £1·30

V.H.F. Air converter kit

Build this converter kit and receive the aircraft band by placing it by the side of a radio tuned to medium wave or the VHF band and operating as shown in the instructions supplied free with all parts. Uses a retractable chrome-plated telescopic aerial, gain control, V.H.F. tuning capacitor, transistor, etc.
Size $5\frac{1}{2}$" x $1\frac{1}{2}$" x $3\frac{1}{2}$".
All parts including case and plans.

£6·05 + P & P 90p

E.V.6 Plus One

Build this exciting new design. Now with 7 Transistors and 4 diodes. MW/LW. Powered by 9V battery. Ferrite rod aerial, tuning condenser, volume control, and $2\frac{1}{4}$" loudspeaker. Attractive case with speaker grille. Size 9" x $5\frac{1}{4}$" x $2\frac{1}{4}$" approx. All parts including Case and Plans.
Total Building Costs:

£8·20 + P & P £1·10

I enclose £ ________ for ________

NAME ________

ADDRESS ________

PW1179

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61A High Street, Bedford MK40 1SA Tel: 0234 52367
● Callers side entrance "Lavells" Shop. ● Open 10–1, 2.30–4.30 Mon.–Fri. 9–12 Sat.
Reg. No. 788372

All prices include VAT

'WINTON'

50+50 watts, of quite extraordinary amplifier.

Summer has gone, the tan has faded, and the chilly Autumn evenings are a sharp reminder that the long dark nights of Winter draw rapidly nearer, but don't view the prospect with dread, why not turn them to your advantage?

NOW is the time to unearth the soldering iron, and make a positive move towards the Hi-Fi upgrade you've been promising yourself for years.

Where better to start than with the WINTON?, the Amplifier par excellence that has been the success story of 1979, with a specification and performance that is totally unprecedented in this price range, (as well as several above it!) The great bonus of course, (beside keeping you out of the wife's way) is that you will have sufficient money left to pursue the upgrade even further, a new cartridge perhaps?, or a really good pair of speakers, and you are ¾ of the way towards a system that can take on all comers, – and win.

You will find it an extremely interesting and absorbing project, we have known cases where a customer has not been seen in his local pub for nearly a week, thereby giving rise to some very ugly rumours, but as a start, act NOW, send us a 10p stamp and we'll send you a 'spec sheet that will make you sit quietly for a while reflecting upon how ordinary some Amp's really are, or get involved at once, send us your cheque for the Extraordinary Amplifier, Power MosFet's rule O.K.?

The Superlative WINTON is available for your convenience packed as follows:

Pack (A)	All Capacitors and Fixed Value Resistors, (inc. 7 Amp ripple Res. Caps.)	£21.93
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Pack (C)	Printed Circuit Board (Tinned, Drilled, & Overlay Printed) & Pins	£8.28
Pack (D)	Hardware Pack, consisting of precision formed & punched Chassis, Black Epoxy finish Heat Sinks, Teak Veneered Cabinet, all screws, wire, fuseholders, etc., and a super Brushed Silver Aluminium Fascia Panel.	£40.25
Pack (E)	All Semiconductors, (including HITACHI POWER MOS-FETS)	£31.21
Pack (F)	Special LOW HUM FIELD Toroidal Transformer	£17.61
COMPLETE KIT,	of all parts necessary to build the P.W. WINTON	£130.00

Order with complete confidence (C.W.O. only please) from:

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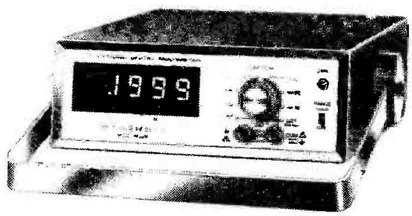
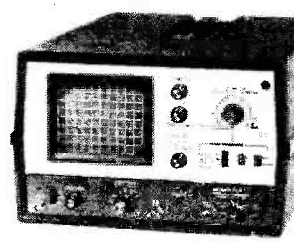
Green Hayes, Surlingham Lane,
Rockland St. Mary, Norwich, NR14 7HH.

Please Allow 28 Days For Delivery. ALL PRICES INCLUSIVE OF V.A.T. & CARRIAGE

What's new from Heathkit?



IM 2212—Auto Ranging DMM



IO 4105—Single Beam 5MHz Oscilloscope

IM 5217—Portable Multimeter

Plus
* GD 1290—VLF Metal Locator
* HX 1681—CW Transmitter
* IR 5201—XY Recorder
* CI 1525—Car Temperature Indicator

These brand new self-assembly kits are designed to the highest specification.
The step-by-step instructions make them easy to build at your leisure in your own home.
And first class quality makes them excellent value for money.
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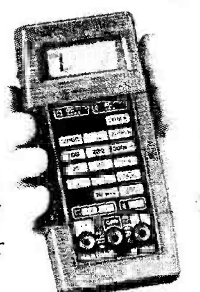

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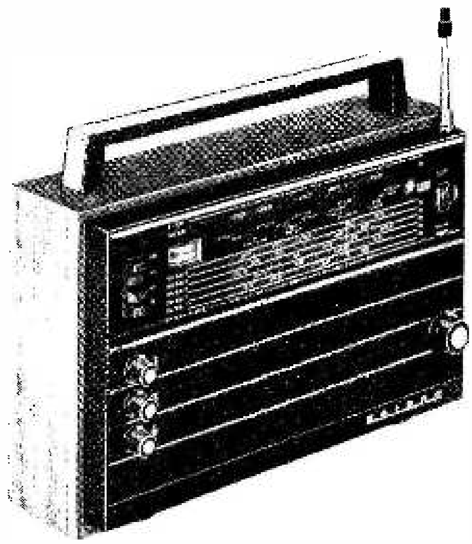
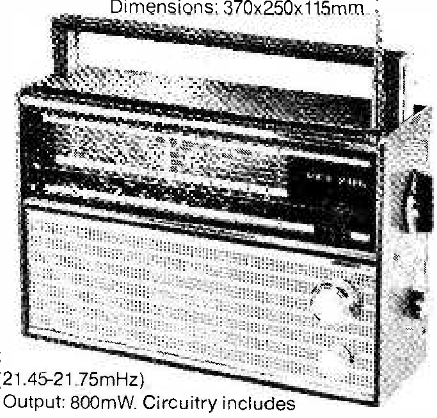
Vega are long on Short Wave Value



Vega value is convincingly demonstrated in the superb short-wave coverage of the 206, Spidola and Selena models: no less than *six* short-wave bands on the 206 and Spidola, five (including "trawler" bands) on the Selena. Engineered in the USSR to the highest electronic standards, these powerful portables – and the other models in the range – give you top performance (for complete "home" listening too) and reliable service at competitive prices.

Vega Selena 210/2 MB
Superhet portable receiving VHF/FM, long, medium and 5 short-wave bands: 19.85-19.4m (15.1-15.45mHz): 25.8-24.8m (11.7-12.1mHz): 31.6-30.7m (9.5-9.77mHz): 50.4-41.0m (5.95-7.3mHz): (marine) 186.9-76.0m (1.605-3.95mHz). Intermediate frequency: 465kHz. Rated Output: 500mW (max. 750mW) 31 semi-conductor circuitry. Independent bass and treble tone controls. Automatic frequency control. Built-in mains convertor. Sockets for: line aerial, earth, tape-recorder, earphone or extension speaker. Inbuilt ferrite rod aerial for long and med waves, 8-section telescopic swivelling antenna for VHF/FM and short waves. Battery condition/tuning meter. Dimensions: 370x250x115mm. Weight: 4.08kg (9lb) without batteries. **Price: £39.34 inc VAT.**



Vega 206 Superhet portable receiving long and medium waves plus 6 short-wave bands: 150-60m (2-5mHz): 60-40m (5-7.5mHz): 32.35-24.8m (9.3-12.1mHz): 19.85-19.4m (15.1-15.45mHz): 16.95-16.75m (17.7-17.9mHz): 14-13.8m (21.45-21.75mHz). Intermediate frequency: 465kHz. Rated Output: 150mW. Circuitry comprises 12 semi-conductors including voltage stabilising diode, plus turret waveband selector, treble control, inbuilt ferrite rod aerial for med and long waves, 7-section telescopic antenna for short waves. Sockets for: line aerial. 9v DC external power source, tape-recorder, earphone or extension loudspeaker. Dimensions: 229x297x105mm. Weight. 2.7kg (6lb) without batteries. **Price: £24.15 inc VAT.**

Vega Spidola 250 Superhet portable receiving VHF/FM, long, medium and 6 short-wave bands: 150-60m (2.0-5.0mHZ): 60-40.5m (5.0-7.4mHz): 31.6-30.7m (9.5-9.78mHz): 25.7-24.8m (11.7-12.1mHz): 19.85-16.75m (15.1-17.9mHz): 14-13.8m (21.45-21.75mHz) Intermediate frequency: 465kHz. Rated Output: 800mW. Circuitry includes 23 semi-conductors, independent bass and treble tone controls, automatic frequency control. Battery condition/tuning meter. Inbuilt ferrite rod aerial for long and medium waves. 8-section telescopic swivelling antenna for VHF/FM and short waves. Sockets for: line aerial. 9v DC external power source, tape recorder, earphone or extension speaker. Dimensions: 250x365x105mm. Weight: 3.4kg (7.5lb) without batteries. **Price: £34.79 inc VAT.**

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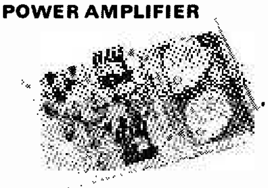

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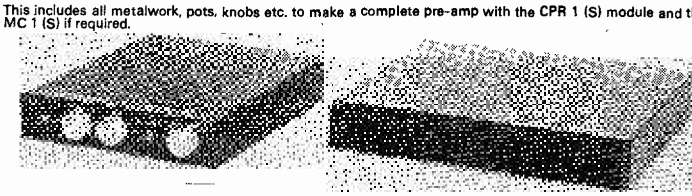

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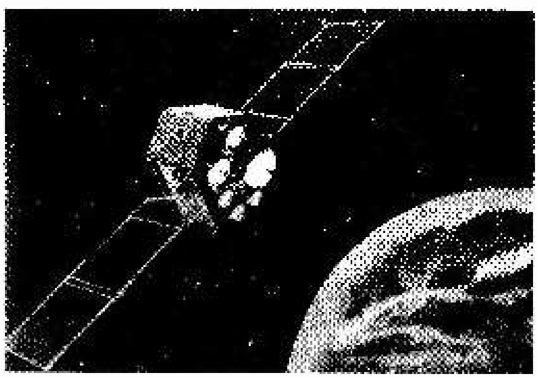

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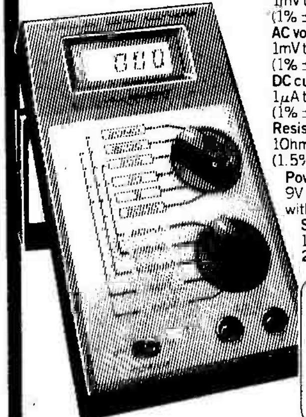

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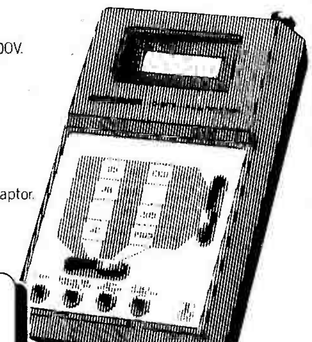

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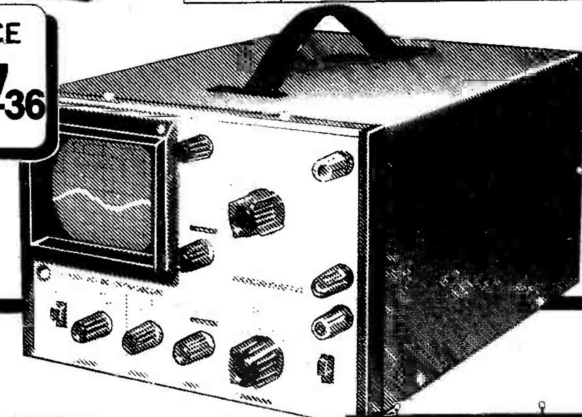

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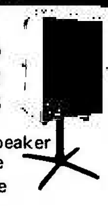

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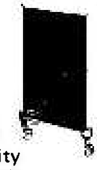

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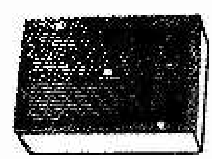

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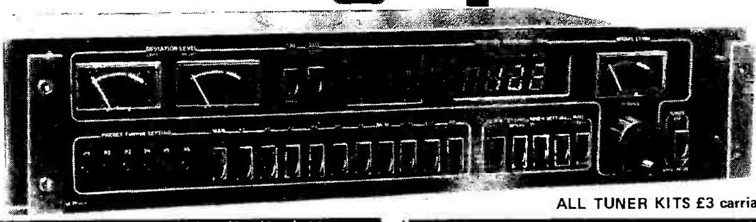

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Hardware packages are available separately if you wish to house your own designs in a professional case structure. Please deduct the cost of electronics from complete prices.

LW MW FM LCD Digital Frequency Display - July PW feature

Update your old radio, or build this into a new design. Or use it as a servicing aid - this low power unit with LCD display reads direct frequency in kHz/MHz, or with usual AM/FM IF offsets for received frequency. Low power LCD means no RFI - 15-20mA at 9v even with the divide by 100 prescalar. FM resolution is 100kHz, AM 1kHz. Sensitivities better than 10mV

Complete kit £19.50 + £2.93 VAT, built and tested module £27.00 + £4.05VAT

Ambit stocks and distributes a wide range of frequency counter LSI for all types of DFM- part two of the catalogue contains details of the MSM5523/4/5/6 range, and the versatile MSL2318 divide by ten or hundredprescalar IC. The DFM1 combined counter for AM,FM SW and direct/clock/stopwatch/timers - details available, but SAE please !

PW SANDBANKS PI METAL LOCATOR

Maintaining our professional approach to home constructor kits, we offer the pulse induction 'Sandbanks'. Now with injection molded casing for greatly improved enviromental sealing. £37.00+£5.55vat

VHF MONITOR RX WITH PLESSEY IC

4/9 channel version of the PW design but using standard (fundx9) crystals, and TOYO 8 pole crystal filter with matching transformers. Coil sets from our standard range to cover bands from 40 to 200MHz. Complete module kit £31.25 +£3.90vat.

MICROMARKET

OSTS overflow:

6800P	650p	8212	230p	2102	170p
6820P	600p	8216	195p	2112	340p
6850P	275p	8224	350p	2513	754p
6810	400p	8228	478p	4027	578p
6852	365p	8251	625p	2114	1000p
8080	630p	8255	540p	+15% VAT	

RADIO and AUDIO MODULES : Consistently the most advanced

FOR FM

EF5801·3·4 series: 6 stage varicap tuning, all with oscillator output

5801	Dual gate MOSFET RF stages, bipolar mixer	£17.45 + 2.61VAT
5803	Dual gate RF/mixer stages, amplified LO out	£19.75 + 2.96VAT
5804	'Hyperfi' series, with internal PIN diode agc, and ultra wide range tuning system	£24.95 + 3.74VAT
EF5402	4 stage varicap tuner with TDA1062 and LO output. Uses FET/IC input. PIN agc	£10.75 + 1.61VAT

FOR 30-200MHz

The EF series are available on special order to cover bands (usually approx 20% of the centre frequency) in the range described. Details in our price list.

FOR FM IFs at 10.7MHz

7030	single 6 pole linear phase filter IF with HA1137	£10.95 + 1.64VAT
7130	two 6 pole linear phase filter IF with CA3189E	£16.25 + 2.44VAT
7230	Hyperfi IF, switched bandwidth, AGC IF preamp, linear phase ceramic filters with diode switched narrow filter	£24.95+3.74VAT

DECODERS for MPX (STEREO)

Various types, guaranteed the world's biggest and best ranges

LARSHOLT FM TUNERSETS

7252	MOSFET front end combined with CA3089 IF	£26.50 +3.97VAT
7252	JFET front end, combined with IF and decoder	£26.50 +3.97VAT

FM/AM tuning synthesiser, see details elsewhere in th is advertisement

COMPONENTS FOR RADIO/COMMUNICATIONS/AUDIO/TV etc.

As usual, Ambit brings you the latest and best, a small selection of which is shown in this advertisement. The Ambit catalogues contain information on most of the devices mentioned here - and an order for the new part three will ensure you stay up with latest developments. Data photocopying service described in pricelist info.

RADIO ICs for FM		vat
CA3089E	1.94	29
CA3189E	2.45	37
HA1137W	2.20	33
HA11225	2.20	33
SN76660N	0.75	11
RADIO ICs for AM/FM		
TDA1090	3.35	50
TDA1083	1.95	29
TDA1220	1.40	21
IF AMPLIFIERS		
KB4406	0.50	07
MC1350	1.20	18
see comms ics also		
COMMUNICATIONS		
KB4412	2.55	38
KB4413	2.75	41
SD6000	3.75	56

SL1600 series		
SL1610	1.60	24
SL1611	1.60	24
SL1612	1.60	24
SL1613	1.89	28
SL1620	2.17	33
SL1621	2.17	33
SL1623	2.44	37
SL 624	3.28	49
SL1625	2.17	33
SL1626	2.44	37
SL1630	1.62	24
SL1640	1.89	28
SL1641	1.89	28
SL6640	2.75	41
SL6690	3.20	48
MC3357	3.12	47
MC1496	1.25	19
NE544	1.70	25

Audio preamps		vat
LM381N	1.81	27
LM382N	1.65	25
KB4436	2.53	38
KB4438	2.22	33
TDA1028	3.50	53
TDA1029	3.50	53
TDA1074	3.75	56
Audio power		
TBA820M	0.75	11
TBA810AS	1.09	16
LM380N	1.00	15
ULN2283	1.00	15
TDA2002	1.95	29
HA1370	2.99	45
TDA2020	2.99	45

2SJ133/2SJ48 £10.00 + £1.50 pr. various high voltage drivers etc. from correctly matched Hitachi series transistors. (All 120v types)

FETs, MOSFETs, bipolars. and various others: see PL

OSTS: Remember all OSTS stocks are obtained from BS9000 approved sources - your assurance that all devices are very best first quality commercial types. Some LPSN TTL is presently in great demand, so please check by phone before ordering .

TTL: Standard AND LP SchottkY

All prices listed in pence *

	'N'	'LSN'
7400	13	20
7401	13	20
7402	14	20
7403	14	20
7404	14	24
7405	18	26
7406	38	
7409	17	24
7410	15	24
7411	20	24
7412	17	
7413	30	
7414	51	
7415		24
7416	30	
7417	30	
7420	16	24
7421	29	24
7423	27	
7425	27	
7426		27
7427	27	29
7428	35	32
7430	17	24
7432	25	24
7437	40	24
7438	33	24
7440	17	24
7441	74	
7442	70	99
7443	115	
7444	112	
7445	94	
7446	94	
7447	82	89
7448	56	99
7449		99
7451	17	24
7453	17	
7454	17	24
7455	35	24
7460	17	
7463		124
7470	28	

	'N'	'LSN'
7472	28	
7473	32	38
7474	27	38
7475	38	40
7476	37	38
7478		38
7480	48	
7481	86	
7482	69	
7485	104	99
7486		40
7489	205	
7490	33	90
7491	76	110
7492	38	78
7493	32	99
7494	78	
7495a	65	99
7496	58	120
7497	185	
741XX series		
74107	32	38
74109	63	38
74110	54	54
74111	68	
74112		38
74113		38
74114		38
74116	198	
74118	83	
74120	115	
74121	25	
74122	46	
74123	46	
74124		137
74125	38	44
74126	57	44
74128	74	
74132	73	78
74136		40
74138		60
74139		60
74141	56	

	'N'	'LSN'
74142	265	
74143	312	
74144	312	
74145	65	97
74147	175	
74148	109	191
74150	99	
74151	64	84
74153	64	54
74154	96	
74155	54	110
74156	80	110
74157	67	55
74158		60
74159	210	
74160	82	130
74161		78
74162		130
74163	92	78
74164	104	130
74165	105	
74167	20	
74169		200
74170	230	200
74172	625	
74174	87	120
74175	87	110
74176	75	
74177	78	
74181	165	350
74183		210
74184	135	
74185	134	
74188	275	
74190		92
74192	105	180
74193	105	180
74194	105	
74196	99	110
74197		110
74198	150	
74199	160	
74247		90
74253		105

	'LSN'
74257	108
74260	153
74273	124
74283	120
74293	95
74365	49
74366	49
74367	43
74368	49
74373	77
74374	77
74377	124
74379	130
74393	140

VOLTAGE REGS:

7800 series 1Amp pos	95p
7900 series 1Amp neg	100p
78M series ½Amp pos	90p
78LCP 100mA	35p
78MGT2C variable	175p
79MGT2C variable	175p
723CN variable IC	65p
NE550	73p
L200 variable V and I	195p

MAINS EMI FILTERS

(BS etc approved types)

1 Amp in IEC chassis connector	4.83
6 Amp in IEC	5.83
5 Amp wirein	3.87

(Toroid cores in Cat no. 2)

MISC. Counter/timer, scalar devices............

NE555 30p NE556 78p NE558 180p
LM3909 72p

95H90DC divide by 10/11 to 320MHz	780p
11C90DC divide by 10/11 to 650MHz	1400p
8629 divide by 100 to 175MHz min	420p
MSL2318 divide by 10/100 to 175MHz min	420p
ICM7216BIPI : 8 decade 10MHz DFM counter and full function timer, with direct drive for an LED display (mpx). Uses 10MHz xtal	1982p
ICM7217AIBI ; 4 decade programmable counter with direct LED drive	950p
ICM7207 clock pulse generator	495p
ICM7208 : 7 decade counter display	1495p
ICM7106CP : LCD DVM (3½ digit)	955p
ICM7106CPK : evaluation kit for 7106	24.80
ICM7107CP : LED DVM (3½ digit)	955p
ICM7107CPK : LED DVM kit for 7107	20.65
OKI MSM5523/4 : LED/Fluorescent display driver IC for time/timer/stopwatch/ AM/FM received frequency display and direct counter (use MSL2318 prescalar) inc Crystal	1400p
MSM5525 : AM/FM frequency only couner, for fluorescent displays (6LT06) inc xtal	1100p
MSM5526 : as MSM5525 but for LCD	1100p
4 digit LCD for ICM7106 or MSM5526	1100p
10 LED (2½x5mm) bar graph driver PCB for LOG or LIN (specify). Kit ex leds	300p

IMPORTANT: ALL PRICES SHOWN EXCLUDE VAT - WHICH MUST BE ADDED AT 15% OVERALL.
PLEASE NOTE THE REDUCED CMOS/LPSN TTL RANGES DUE TO CURRENT SUPPLY SHORTAGE

CD4000

4000	17
4001	17
4002	17
4006	109
4007	18
4008	80
4009	58
4010	58
4011	17
4012	17
4013	55
4014	95
4016	52
4017	80
4018	80
4019	60
4020	93
4021	82
4022	90
4023	17
4024	76
4025	17
4026	180
4027	55
4028	72
4029	100
4030	58
4035	120
4040	83
4042	85
4043	85
4044	80
4046	130
4048	60
4049	55
4050	55
4051	65
4052	65
4053	65
4055	135
4059	563
4060	115
4063	109
4066	53
4068	25
4069	20
4070	20
4071	20
4072	20
4073	20
4075	20
4076	90

4522	149
4528	102
4529	141
4532	125
4538	150
4539	110
4543	174
4549	399
4554	153
4558	117
4560	218
4562	530
4566	159
4568	281
4569	303
4572	25
4584	63
4585	100

LINEARS

CA3130E	84
CA3130T	90
CA3140E	
CA3140T	72
LM301AH	67
LM301AN	30
LM339N	66
LM348N	186
LM3900N	60
709HC	64
709PC	36
710HC	65
710PC	59
723CN	65
741CH	66
741CN	27
747CN	70
748CN	36
NE531N	105

7 SEG DISPLAYS

HP5082 series.......

Red	7650	233p
	7653	233p
Yell	7660	233p
	7663	233p
Grn	7670	233p
	7673	233p
Fairchild FND 500/507		150p

MORE FROM THE GENERAL AMBIT CATALOGUE RANGES:

Varicap tuning diodes for AM/FM/TV :
1-9 v AM tuning (Cr 15:1) from TOKO–

KV1211	double matched	175p	26p vat
KV1210	triple matched	245p	37p vat
KV1215	triple snap-apart	245p	37p vat
MVAM115	single 15v	105p	16p vat
MVAM125	single 25v	105p	16p vat
MVAM2	double 25v	148p	22p vat
BB204/104	double FM	40p	6p vat
BA102	single AFC etc	30p	4p vat
BA121/ITT210	single afc	30p	4p vat
BB105B	single UHF	40p	6p vat
PIN DIODES, BANDSWITCH types			
BA479	PIN attenuator	35p	5p vat
TDA1061	Pi-form atten.	95p	14p vat
BA182	Bandswitch	21p	3p vat

All RF semiconductors stocked in depth. Please ask for quantity pricing details.

MPU controllable digital freq. synthesiser PCB. Preliminary:
Serial data controlled, with the standard swallow count system for maximum speed of operation. Multiple time constant filters, suitable for AM/FM and other communications/generator applications. Not for beginners. Full preliminary data package £1 + SAE. No phone enquiries answered on this system for the time being. Watch this space........ Projected cost of the controller PCB less than £30: comprises the two modulus counter, prog.div., phase detector, multiple TC loop filter/integrators.

TOP GRADE LEDS by AEG: PRICES ARE EXC. VAT (add 15%)

SIZE	Red	Green	Yello	Orang
5mm	14p	16p	15p	20p
3mm	13p	15p	18p	19p
2½x5	17p	20p	20p	24p

Quantity discounts for LEDs:
10 per type - less 10%
100 per type - less 30%
100 mix in 10s - less 25%

FUTABA FLUORESCENT VACUUM DISPLAYS for CLOCKs etc

5LT02	clock display (static drive) with AM/PM flags	£9 + 1.35
5LT03	DFM display for MSM5525 LSI counter	£9.45 + 1.42 vat
6LT06	5 digit DFM display (GI AY58100) mpxed	£9.75 +1.46 vat

TOKO COILS, FILTERs, CHOKES, etc for AM/FM/TV comms–

(please add VAT @15%)

TYPE	Size: 5mm	7mm	10mm	
AM IF	55p	33p	30p	Various for ICs, transistor etc.
FM IF	55p	33p	33p	Various for ICs, transistor etc.
SW coils			33p	Two impedance series
OSC coils	55p	33p	33p	For LW/MW/SW
TV vif/sif			35p	

Various coils in the range 20kHz to 300MHz - see TOKO catalogue

CERAMIC and MECHANICAL FILTERS (inc MURATA TYPES)

CFT455B/ CFT455C 60p; CFX014 -180p; CFU455C - 85p
CFT470C · 60p; CFU470C -65p
MURATA CFU455H and CFU455F cermic block filters 1.95ea
MURATA CFM455 series ladder filters. D,E,F,G,H bandwidths available now (20,16,12,8,6 kHz) £8.35 ea (metal encapsulated)
SFD455B, SFD470B, SFD472B 85p ea
CFM2 series mechanical elements types A,B,C,D (4-10kHz bandwidth) - 65p ea. (As used in RCME feature)

MULTIPLEX/PILOT TONE FILTERS, FM IF FILTERS (see cat and:)

CFSE10.7/SFE10.7 - stereo FM IF ceramic filters (sim FM4 etc)	50p
CFSB10.7/SFE10.7MJ · mono bandwidth ceramic FM IF filters	50p
SFE10.7ML · ultra linear phase stereo ceramic IF filters	70p
CDA10.7 - 10.7MHz ceramic discriminator (for CA3089 etc)	70p

Current news: A PCB for the Mullard DC tone and volume control system is now available £3 + 0.45 VAT. HMOS PA modules for 60-100W - kit £14 +£2.10VAT, heatsink £4.10+0.61. FM radio control system crystals £3.75 pair inc VAT (Sept. on). MK50366N: static drive clock/timer IC £3.78 + 0.57 VAT. 12½kHz channel spacing 8 pole 10.7MHz XTAL filter by TOYO type H4402 £15.50 + £2.32VAT. A further updated pricelist is now available, and we would like to remind you that enquiries can only be answered if accompanied either by an official business letterhead, or an SAE. STOP PRESS: TOKO's new split-apart triple AM tuning diodes are in stock £2.45 + 37p VAT, (KV1215). S BL1 diode DBM 1-500MHz - £4.25+0.64p.

Terms: CWO please. Account facilities for commercial customers OA. Postage 25p per order. Minimum credit invoice for account customers £10.00. Please follow instructions on VAT, which is usually shown as a separate amount. Overseas customers welcome - please allow for postage etc according to desired shipping method. Access facilities for credit purchases.

Catalogues: Ambit. Part 1 45p. Part 2 50p 90p pair. TOKO Euro shortform 20p. Micrometals toroid cores 40p. All inc PP etc. Full data service described in pricelist supplements.

Hours/phone: We are open from 9am -7pm for phone calls. Callers from 10am to 7pm. Administrative enquiries 9am to 4.30pm please (not Saturdays). Saturday service 10am to 6pm.

AMBIT catalogues are guaranteed to contain the most up-to-date and best informed comment on modern developments and advances in the field of radio and audio. There is no competetive publication that even approaches the broad range of parts/information on modern techniques.

ambit® international 2 Gresham Road, Brentwood, Essex.

Quality audio modules and accessories for

S450

STEREO FM TUNER
Fitted with phase lock-loop

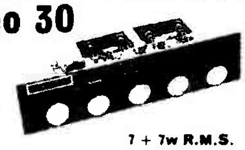
£26·73
+ 40p p&p

FREQUENCY RANGE	88–108 Mhz
SENSITIVITY	3·0 µV
BANDWIDTH	250 kHz
SPURIOUS REJECTION	50 dB
SELECTIVITY ± 400 kHz	55 dB
AUDIO OUTPUT (22·5 kHz deviation)	100 mV
STEREO SEPARATION	30 dB
SUPPLY REQUIREMENTS	20 to 30V (90mA max)
AERIAL IMPEDANCE	75 ohms
DIMENSIONS	240mm × 110mm × 32mm

The 450 Tuner provides instant programme selection at the touch of a button ensuring accurate tuning of 4 pre-selected stations, any of which may be altered as often as you choose, simply by changing the settings of the pre-set controls. Features include FET input stage. Vari-Cap diode tuning. Switched AFC LED Stereo Indicator.

Stereo 30

COMPLETE AUDIO CHASSIS



£22·06
+ 66p p&p

7 + 7w R.M.S.

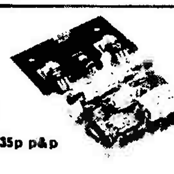
OUTPUT POWER	7 Watts RMS
LOAD IMPEDANCE	8 ohms
TOTAL HARMONIC DISTORTION	Less than ·5% (Typically ·3%)
FREQUENCY RESPONSE	50 Hz to 20 kHz ± 3dBs
TONE CONTROL RANGE	± 12 dBs at 100Hz and 10kHz
SENSITIVITY	190 mV for full output
INPUT IMPEDANCE	1 M ohms
TRANSFORMER REQUIREMENTS	22 V.A.C. rated at 1A
DIMENSIONS (Less controls and panel)	200mm × 130mm × 33mm

The Stereo 30 comprises a complete stereo pre-amplifier, power amplifiers and power supply. This, with only the addition of a transformer or overwind will produce a high quality audio unit suitable for use with a wide range of inputs i.e. high quality ceramic pick-up, stereo tuner, stereo tape deck etc. Simple to install, capable of producing really first class results, this unit is supplied with full instructions, black front panel, knobs, main switch, fuse and fuse holder and universal mounting brackets.

AL60

AUDIO AMPLIFIER MODULE
25 Watts RMS

25w R.M.S.



£5·39 + 35p p&p

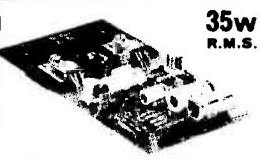
OUTPUT POWER	25 Watts RMS
SUPPLY	30–50 V
LOAD IMPEDANCE	8–16 ohms
TOTAL HARMONIC DISTORTION	Less than ·1% (Typically ·06%)
FREQUENCY RESPONSE	20 Hz to 30 kHz × 2 dBs
SENSITIVITY	280 mV for full output
MAX. HEAT SINK TEMPERATURE	90°C
DIMENSIONS	103mm × 64mm × 15mm

This high quality audio amplifier module is for use in audio equipment and stereo amplifiers and provides output powers up to 25 RMS with distortion levels below 0 1%.

AL80

AUDIO AMPLIFIER MODULE

35w R.M.S.



£8·54
+ 35p p&p

OUTPUT POWER	35 Watts RMS
SUPPLY	40–60 V
LOAD IMPEDANCE	8–16 ohms
TOTAL HARMONIC DISTORTION	Less than ·1% (Typically ·06%)
FREQUENCY RESPONSE	20 Hz to 30 kHz × 2 dBs
SENSITIVITY	280 mV for full output
MAX. HEAT SINK TEMPERATURE	90°C
DIMENSIONS	103mm × 64mm × 15mm

The AL80 is similar in design to the AL60 above and is of the same high quality but provides output powers up to 35W with distortion levels below 0 1%.

AL250

POWER AMPLIFIER

125w R.M.S.

£20·49 + 76p p&p

OUTPUT POWER	125 Watts RMS continuous
OPERATING VOLTAGE	50–80 V
LOADS	4–16 ohms
FREQUENCY RESPONSE	25 Hz 20 kHz measured at 100 Watts
SENSITIVITY FOR 100 WATTS O/P AT 1 kHz	450 mV
INPUT IMPEDANCE	33 K ohms
TOTAL HARMONIC DISTORTION 50 WATTS into 4 ohms / 50 WATTS into 8 ohms	0·1% / 0·06%

This unit, designated AL250, is a power amplifier providing an output of up to 125W RMS, into a 4 ohm load.

AL30A

AUDIO AMPLIFIER MODULES

10w R.M.S.

£4·36 + 35p p&p

MAXIMUM SUPPLY VOLTAGE	30 V
POWER OUTPUT for 2% THD	10 Watts RMS
TOTAL HARMONIC DISTORTION	Less than ·25%
LOAD IMPEDANCE	8–16 ohms
INPUT IMPEDANCE	100 K ohms
FREQUENCY RESPONSE	50 Hz–25 kHz ± 3 dBs
SENSITIVITY	75 mV for full output
DIMENSIONS	74mm × 63mm × 28mm

These low cost 10 watt modules offer the utmost in reliability and performance, whilst being compact in size.

SPM80

STABILISED POWER SUPPLY

£5·06 + 35p p&p

INPUT A.C. VOLTAGE	33–40V
OUTPUT D.C. VOLTAGE	33 V nominal
OUTPUT CURRENT	10 mA–1·5 amps
OVERLOAD CURRENT	1·7 amps approx.
DIMENSIONS	105mm × 63mm × 30mm

Designed to power two AL60s at 15 Watts per channel simultaneously. Circuit Techniques include full short circuit protection.

PA100

STEREO PRE-AMPLIFIER

£18·46
+ 45p p&p

FREQUENCY RESPONSE	20 Hz to 20 kHz × 1 dB
TOTAL HARMONIC DISTORTION	Less than ·1% (Typically ·07%)
SENSITIVITY INPUTS 1. TAPE	100 mV/100 K ohms } For an output 250 mV
2. RADIO TUNER	100 mV/100 K ohms
3. MAGNETIC P.U.	3·5 mV/50 K ohms
EQUALISATION	Within ± 1 dB from 20 Hz to 20 kHz
BASS CONTROL RANGE	± 15 dBs at 75 Hz
TREBLE CONTROL RANGE	+ 10–20 dBs at 15 kHz
SIGNAL/NOISE RATIO	Better than 65 dBs (All inputs)
INPUT OVERLOAD	Better than 26 dBs (All inputs)
SUPPLY	20 to 40 V
DIMENSIONS	300 × 90 × 33mm (less controls)

A top quality stereo pre-amplifier and tone control unit, the PA100 provides a comprehensive solution to the front end requirements of stereo amplifiers or audio units. The six push button selector switch gives a choice of inputs together with two filters for high and low frequencies.

MPA30

MAGNETIC CARTRIDGE PRE-AMPLIFIER

£3·43
+35p p&p

Enjoy the quality of a magnetic cartridge with your existing ceramic equipment using the MPA 30 which is a high quality pre-amplifier enabling magnetic cartridges to be used where facilities exist for the use of ceramic cartridges only.

SENSITIVITY	3 5 mV for 100 mV output
EQUALISATION	Within ± 1 dB from 20 Hz to 20 kHz
INPUT IMPEDANCE	50 K ohms
SUPPLY	18 to 30 V—re earth
DIMENSIONS	110 × 50 × 25mm (inc DIN socket)

PA12

STEREO PRE-AMPLIFIER

£8·95
+ 35p p&p

The PA12 Stereo Pre-Amplifier chassis is designed and recommended for use with the AL 20/30 Audio Amplifier Modules, the PS12 power supply and the T538 Transformer. Features include on/off volume, Balance, Bass and Treble controls. Complete with tape output.

FREQUENCY RESPONSE	20 Hz–20 kHz (—3dB)
BASS CONTROL	± 12 dB at 60 Hz
TREBLE CONTROL	± 14 dB at 10 kHz
INPUT IMPEDANCE	1 Meg. ohm
INPUT SENSITIVITY	300 mV
CROSSTALK	—60 dB
SIGNAL/NOISE RATIO	—65 dB
OVERLOAD FACTOR	± 20 dB
TAPE OUTPUT IMPEDANCE	25 K ohms
DIMENSIONS	152mm × 84mm × 25mm

PS12 POWER SUPPLY MODULE

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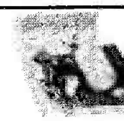

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P. & P. 40p

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3. MAGNETIC P.U.	3·5mV/50 K ohms	
EQUALISATION	Within ± 1dB from 20Hz to 20kHz	
BASS CONTROL RANGE	± 15dBs at 75Hz	
TREBLE CONTROL RANGE	+ 10-20dBs at 15kHz	
SIGNAL/NOISE RATIO	Better than 65dBs (All inputs)	
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The Penalty of Progress

WITH any fast-moving, technologically-based subject, progress will always leave a trail of obsolescence. Wireless, and electronics, are no exceptions. How often have you decided to build a project described in one of the magazines, only to find that the following month another magazine comes out with a similar project but using the latest technology and having a performance several times better than the one you are building.

Often authors will submit project designs which are accepted for publication several months into the future. In spite of all our efforts to ensure that supplies of the components used will be available for the foreseeable future, it often happens that manufacturers of a key component decide to withdraw the device from sale, leaving the poor home constructor high and dry.

In most instances, it is possible to find an alternative device to replace the obsolete one, hopefully without any major changes to the circuits, but this is not always so. In any case, often the first hint of trouble we get is a string of letters from irate constructors demanding to know where they can obtain the offending item.

In the course of a year we receive many letters from readers who have decided to build projects featured in *Practical Wireless* many years ago and then find that they can no longer obtain a key component. Just what makes readers decide on out-of-date designs is a mystery. Perhaps they have some of the parts already in their junk box. The fact remains, however, that with the changing techniques used in our hobby, the life-span of a design such as a hi-fi amplifier or a tuner can be measured in months rather than years. Look at the output stages of amplifiers. Not so long ago they used interstage and output transformers and every component stockist worth his salt kept a large stock of suitable transformers. Now no designer would dream of using a transformer in the audio path and hence, with no demand for them, dealers no longer stock them and manufacturers no longer make them.

Already many transistors have fallen by the wayside and have become difficult to obtain, and recently integrated circuits such as the LM373 have been declared obsolete by the only manufacturer.

The message should by now be clear—if you must look through old issues, and are tempted by any projects in them, please check first that you can obtain all the components. Especially check for the use of audio frequency transformers or germanium transistors, as these are likely to be your downfall.

Do not, however, be put off building the latest super project featured in your favourite magazines just because next month may see it rendered obsolete by an even more state-of-the art design. If we all did that then progress would surely cease.

★ ★ ★ ★ ★

We regret that, with effect from this issue of Practical Wireless, it has been necessary to increase our cover price to 55p. We had hoped to avoid this, but the effects of inflation have proved too much for us.

PW PERSONALITY

Fred Judd—*PW* Contributor

A regular contributor to *Practical Wireless* for nearly 20 years F. C. (Fred) Judd has spent a lifetime in radio and electronics. Was in the RAF 60 Group (Radar) during the war and for many years after in marine radar research and development followed by some 25 years as a technical journalist. He is retired now and lives in Norfolk but for the past 7 years was Technical Editor to *Practical Hi-Fi* magazine (an IPC publication).

He has written numerous books concerned with radio, audio and electronics and thousands of articles published in the UK and many other countries. As a radio amateur first licensed in 1934 (A.A. call 2BCX) and class A licensed since 1946 as G2BCX, the major interest has been transmitting aerials which has resulted in a number of original designs for the h.f. bands as well as the now popular "Slim Jim" and others for v.h.f. and u.h.f. operation. His latest book, on aerials for 2m, is soon to be published by Newnes-Butterworths.

Speech Processing in amateur transmitters

A. J. NAILER* T. Eng.CEI AFSERT G4CFY

There are two forms of speech processing, frequency and amplitude. The frequency limits are already established, with the audio bandwidth covering 300–2700Hz. Any further reduction in bandwidth would tend to reduce quality, and would make the transmitter respond better to one voice rather than another. Nevertheless, bandwidth limitation to 2400Hz benefits all modes of transmission, and should be incorporated in at least a simple form.

FREQUENCY PROCESSING

Combinations of high-pass and low-pass filters should be used to restrict the audio bandwidth, to improve the audio signal-noise ratio by reduction of the background noise. The transmitter will also be concentrating more of its power into information-carrying sidebands, so improving its "talk power" and communications effectiveness.

Audio bandwidth limitation of s.s.b. transmissions is not so necessary, due to the passband characteristics of the sideband filter. Hence, frequency response shaping is mainly applicable to amplitude-modulated, double-sideband full carrier or suppressed carrier, and frequency-modulated systems.

Frequency processing was rarely used on the old amplitude-modulated transmitters, but most frequency-modulated transmitters built today incorporate it. The a.m. signals would have benefited if some form of audio bandwidth tailoring had been included.

AMPLITUDE PROCESSING

Audio Clipping

Amplitude limiting of audio dynamic range for f.m. transmitters is required in order to limit the overall deviation. This restricts the bandwidth of the transmitted signal and ensures that the receive discriminator does not run into distortion. No increase in output power occurs due to the use of this clipping on f.m.

In an f.m. system, the frequency of the carrier is changed in proportion to the amplitude of the modulating signal, with the positive half-cycle of audio producing a corresponding increase in carrier frequency and vice-versa. If the audio wave is larger at one frequency rather than another, a greater deviation is produced, regardless of the frequency of the modulating frequency. Now if the audio is clipped, then the rate of change of carrier frequency is dependent mainly on the rate of change of audio frequency. This then is the most common form of speech processing.

Amplitude limiting by the use of clipping diodes produces a number of audio in-band harmonics. These waste transmitter output power in unwanted sideband signals but don't detract from the apparent quality of the received signal, and the clipping does provide a measure of linearity in the relationship between carrier deviation and modulating frequency. One important factor of this form of limiting is that it allows a reasonable amount of deviation for high audio frequencies which carry much of the intelligibility.

If we look at the spectrum of normal speech, we find that the largest amplitude signals occur between 100 and 800Hz. Tests have been done on reduced-bandwidth audio, and have found that most intelligence is carried in the band between 800 and 1200Hz. The graph Fig. 1 shows that the amplitude of speech components in this region may be as little as one third (−10dB) related to the lower frequency audio. The difference in amplitude is known as the dynamic range and any reduction in this will increase the "talk power" and hence the communication effectiveness. This is why most f.m. transmissions above the noise appear so easy to copy, though in fact the spectral purity of the speech is not very good.

The modulator section of most commercial f.m. transmitters contains an amplifier, followed by back-to-back clipping diodes, and then a low-pass filter network to limit the speech and intermodulation products to about 3kHz. The intermodulation products are formed in the clipper by the mixture of individual speech tones, as well as harmonics of these and the original tones. For example, assume we

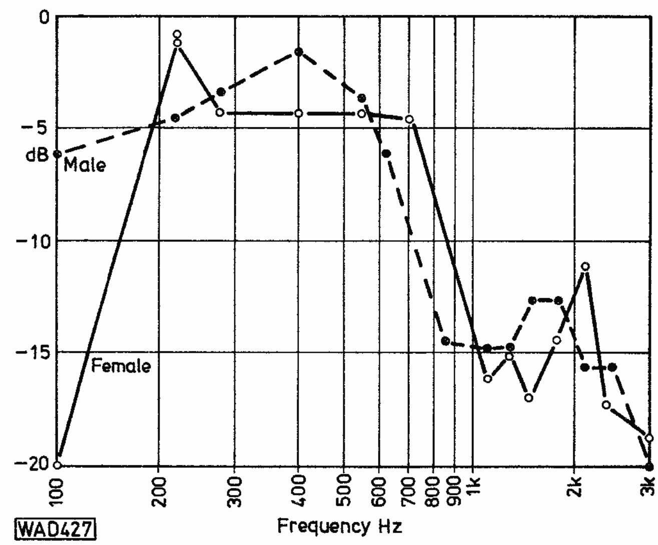


Fig. 1: Spectrum of normal speech, showing greatest amplitude in the range 100 to 800Hz

*Proprietor, Spectrum Communications

generate two tones such as 700Hz and 1200Hz. Now the clipper will produce harmonics of these at 1400Hz, 2100Hz, 2800Hz, etc., and at 2400Hz, 3600Hz, etc., also the sum and difference of the original tones, and harmonics of these, viz:

$1200 - 700 =$	500	First order i.p.
	1000	2nd order
	1500	3rd order
	2000	4th order
	2500	5th order

and sum $1200 + 700 = 1900$, plus 2×1900, etc.

If we now compare the original audio spectrum with the one following clipping we get a nasty looking result, as shown in Fig. 2. All the above signals occur within the required audio passband and cannot now be removed. The transmitted signal will divide its power proportionately between all of these in the form of sidebands. Power put into multiple sidebands does not produce as effective a signal as one where power is concentrated into few sidebands. These intermodulation products within the voice passband are changing in time with the main speech tones, and hence help to give the speech a fuller sound at the receiver, but only where the received signal is well above the noise and fully limiting.

Phase modulation systems rely on both the frequency and amplitude of the modulating signal, so after clipping we now modify the amplitude proportional to audio frequency in a manner which makes the receiver resolve the signal the same as normal f.m. This amplitude tailoring is de-emphasis and can be produced by a resistor and capacitor after the low-pass filter to give 6dB/octave roll-off above 700Hz. We have now covered all the requirements for a good-quality phase modulator as used in many of the popular 2m f.m. transceivers. The system schematic is shown in Fig. 3.

Frequency-modulated transmitters may be fitted with a pre-emphasis network with a rising characteristic from 1kHz up to the roll-off at 3kHz. This pre-emphasis produces a much brighter sounding audio from a receiver fitted with the corresponding de-emphasis network. A modulator of this type would also improve the intelligibility of a conventional a.m. transmitter over short, strong-signal paths, and there may be an advantage in maintaining a high percentage of modulation, although the extra in-band spurii would waste much power and would drastically reduce the range of the transmission.

Audio Compression

In order to overcome the audio in-band problem which occurs when clipping is used, a self-adjusting gain-controlled audio amplifier can be used to compress the dynamic range of the speech. Such a system can be used on its own to raise the average percentage of modulation for a.m. transmitters, and can be used to precede the clipper in an f.m. transmitter so that a constant clipping level is maintained. The basic system requires an amplifier followed by a rectifier, and a voltage-controlled attenuator such as an f.e.t. across the input of the amplifier, see Fig. 4.

To reduce the dynamic range of the speech without distortion, the control loop in a compressor must act quickly enough to adjust the gain continuously over each syllable. The majority of compressor circuits are designed with fairly long time-constants and can only react fast enough to adjust the level at word rate. This is useful to ensure that overmodulation doesn't occur, and that a fairly constant peak amplitude is maintained regardless of distance from the microphone.

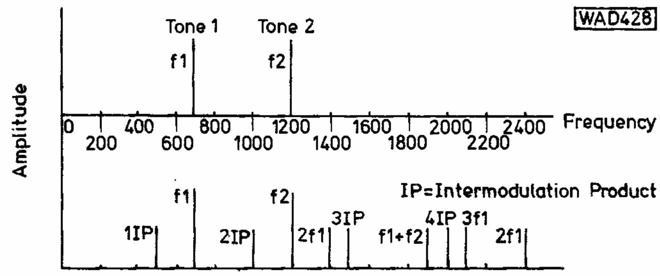


Fig. 2: Intermodulation products produced by clipping two non-harmonically related tones (700 and 1200Hz)

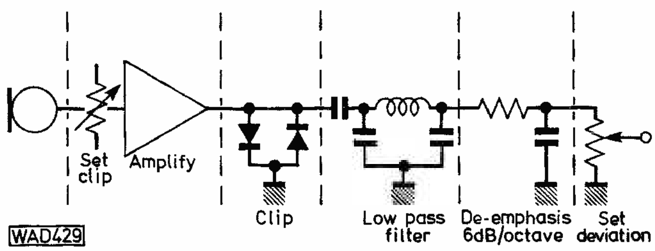


Fig. 3: Schematic of the audio chain in an f.m. transmitter using phase modulation

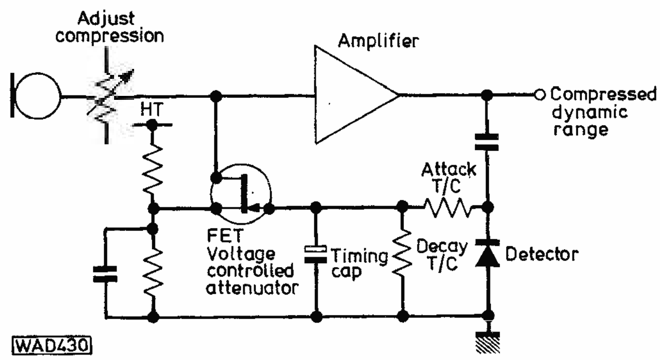


Fig. 4: Using a field-effect transistor as a voltage controlled attenuator in an audio compressor

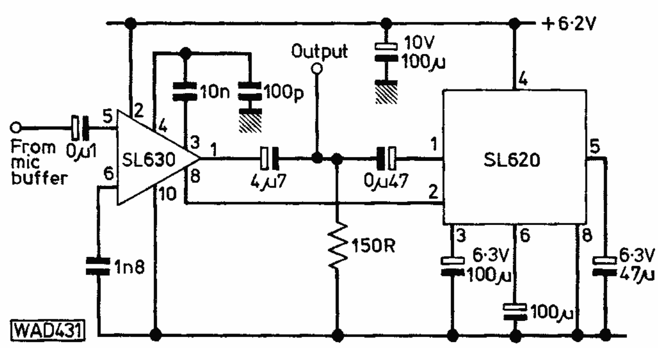


Fig. 5: An audio compressor system with dual a.g.c. time constants, using Plessey SL600 series devices

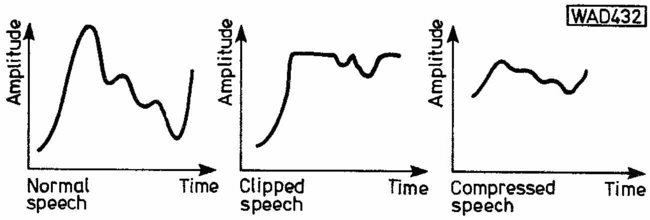


Fig. 6: A graphical comparison of Normal (unprocessed), Clipped and Compressed speech

Ideally then, a compressor unit should have a dual a.g.c. system, so that the average level is set with a long time-constant loop and the speech amplitude adjusted with a short time-constant loop. Basic response times are fast attack, slow decay on the slow loop, say 200ms attack and 1 second decay, and 5–20ms attack with 200ms decay for the fast response. The easiest method of achieving such a system is to use the Plessey SL630 and SL620, and a suitable practical circuit is shown in Fig. 5. This arrangement can be used to improve the communications effectiveness of all modes of speech transmissions.

A graphical comparison of clipped and compressed speech is shown in Fig. 6, and apart from the in-band spurii generated by clipping, constant amplitude audio is still as recognisable and as easy to read as unprocessed speech.

The old amplitude-modulated systems suffered much because 100 per cent modulation occurred only sporadically, and the average level of modulation was about 30 per cent. Most long-haul contacts usually existed only by the operator shouting into the microphone, to raise the average level of modulation sufficiently to give solid copy at the other end. This also had the effect of splattering the signal all over the band locally, so that neighbouring amateurs couldn't hear the distant stations. A good compressor would have given the solid copy without the

continued on page 47 ▶▶▶

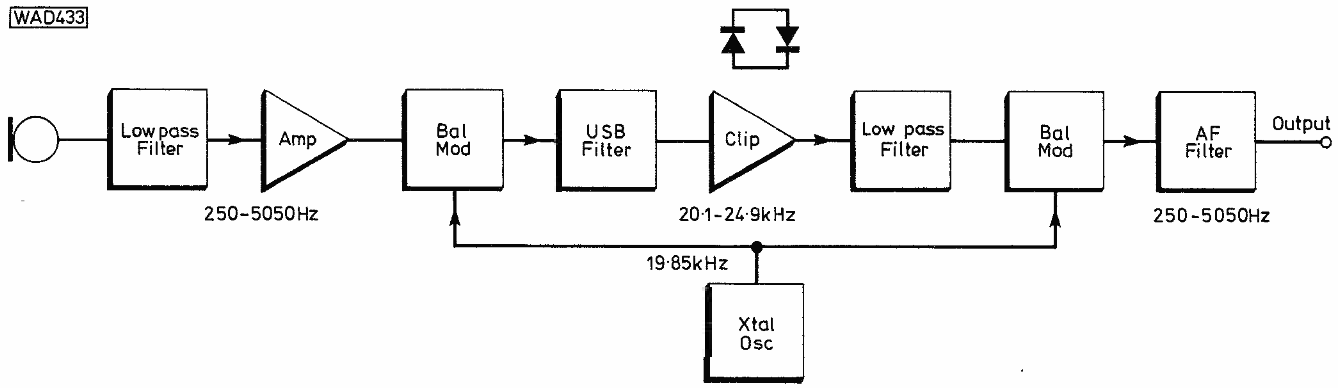


Fig. 7 (above): Block diagram of the Radio Liberty r.f. speech clipper

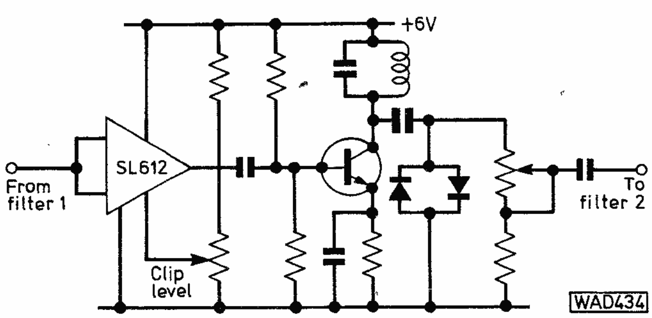


Fig. 8 (left): Part of the circuit diagram of the K6JYO r.f. speech clipper, designed for use with the Collins S-Line transmitter

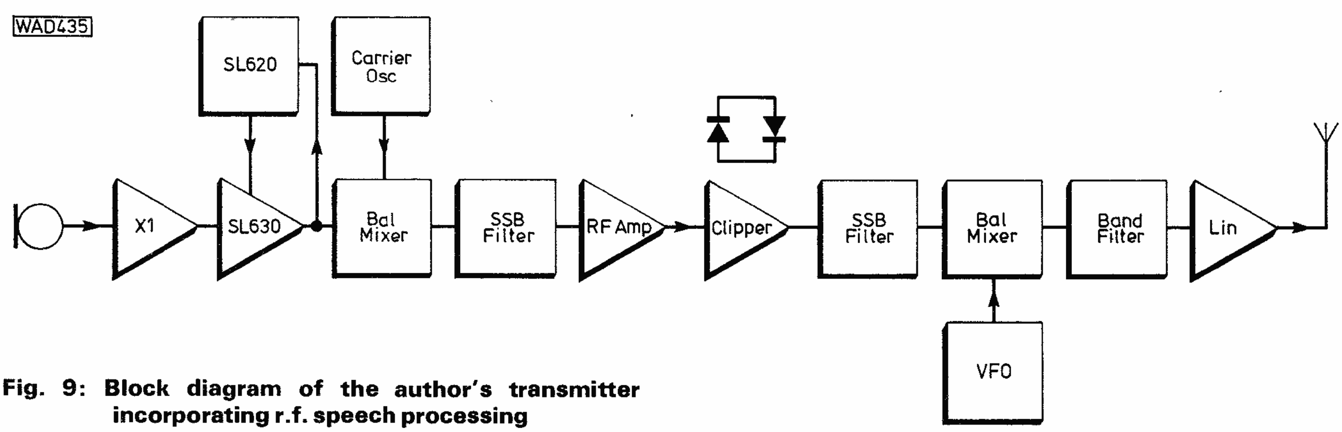


Fig. 9: Block diagram of the author's transmitter incorporating r.f. speech processing

NEWS... NEWS... NEWS...

PW Questionnaire

In selected copies of our August 1979 issue, a questionnaire card was inserted, seeking information from our readers on what they think of *PW*, and what changes, if any, they would like to see.

Regretfully, for operational reasons, we could not include questionnaires in every copy. In all, 5000 were issued, and readers were invited to estimate how many would be returned by the closing date of 31 August. A small prize was offered for the person coming closest to the correct number.

The number returned was 1128, and the best estimate came from *Mr John Slaven (Jr.), Perth, Scotland,* who estimated 1127.

Our congratulations to the lucky winner, and our thanks to all readers who gave us their views.

New Catalogue

Claimed to be Europe's only guide to second user electronic test equipment, Electronic Brokers' new autumn 1979 catalogue lists a wide range of equipment, including hard-to-get-items, and several new products now being marketed by the company.

A procurement service for overseas customers wishing to buy new instruments in the UK, together with details of the company's brokerage service for high value equipment are shown in the 64 page catalogue, which is available free to bona fide companies writing in on their own letterheads. For private individuals, the charge is £1.00, and overseas enquiries—£2.00 to cover postage.

Electronic Brokers Ltd., 49/53 Pancras Road, London NW1 2QB. Tel: 01-837 7781.

RAE Reprint

A reprint of the complete *PW* series—So You Want to Pass the RAE?—including details of the new examination format introduced in 1979, is now available.

Please note that the prices for the RSGB publications mentioned in the reprint have recently been changed. You should check with the RSGB for the latest information.

Order your copy by completing and returning the coupon on page 54.

RAE Courses

We have details of two RAE courses whose enrolment dates will be passed by the time this issue is published. However, it may be possible for readers living in the area, to join the course after it has started.

The courses are: Bradford, West Yorkshire, RAE course, tutor *Douglas Parker G4DZU* and Morse code course, tutor *David Redman G4IDR*, to be held at the *Joseph Priestly Institute of Further Education.*

Manchester, RAE and Morse code, tutor *A. B. Langfield G3IOA,* to be held at *Openshaw Technical College, Whitworth Street, Openshaw, Manchester 11.*

Exhibitions

"Internepcon UK 1979", to be held between 16 and 18 October at The Metropole, Brighton, Sussex.

"International Business Show", to be held between 23 October and 1 November at The National Exhibition Centre, Birmingham.

Swansea Goes Stereo

The full stereo programme service of Radio 1/2 and Radio 3 from the BBC's new v.h.f. transmitters at Kilvey Hill, Swansea, started on Friday, 27 July. These programmes will be available to about 90 000 listeners in an area which includes: Swansea, Neath, Port Talbot, Porthcawl, Clydach, Pontardawe, Pontardulais, Gorseinon, Llanelli and Burry Port.

Slant polarisation is being used, to benefit those with v.h.f. portable or v.h.f. car radios. It is recommended, however, that permanent domestic aerials should be fitted with the rods horizontal. Aerials already used to receive Radio Cymru (which has been transmitted from Kilvey Hill since May 1978) should be suitable for receiving the new service also.

Radio 1/2 will be on 89·5MHz with Radio 3 on 91·7MHz and Radio Cymru on 93·9MHz, in the v.h.f. (f.m.) band.

Listeners needing technical advice or information about the new service are invited to contact: *Peter Fear, Engineering Information Officer, BBC, Broadcasting House, Llandaff, Cardiff CP5 2YQ. Tel: (0222) 564888.*

ME Centre

The National Microprocessor and Electronics Centre, which opened on Tuesday, September 25, featured oscilloscopes as its first three-day "mini-exhibition".

Visitors to the centre will be able to see a wide selection of oscilloscopes—all of which are available within the UK market—collect relevant data, talk to the makers and see the centre's permanent electronic products exhibition.

The ME Centre, as it is known, is situated within the London World Trade Centre, close to the Tower of London. It will be open five days per week throughout the year and, at this stage, it is expected that a three-day "mini-exhibition" will be held every other week. Admission to the centre will be free.

Alongside the permanent and "mini" displays is to be a data bank which will contain details and data on electronic products available within the UK. As this library expands to become fully comprehensive it will be committed to microfilm and visitors will then be able to take away with them Xerox copies of manufacturers' data in a given product area.

The Government, through the Department of Industry, has offered its full support and it is intended that the DoI will encourage overseas buyers and interested trade delegations to call first at the centre to assess the industry at large before selecting companies to contact or visit.

For more information contact: *National Microprocessor and Electronics Centre, London World Trade Centre, London E1 9AA. Tel: 01-488 2400.*

IBA Sales Service

The Independent Broadcasting Authority have appointed Conrath Consultant Services Ltd. as exclusive engineering marketing consultants and advisers from 1 August 1979.

The firm will be responsible for the negotiation of marketing and know-how agreements covering those broadcast equipment designs, design rights and prototypes which the IBA is willing to sell or licence.

Independent Broadcasting Authority, 70 Brompton Road, London SW3 1EY. Tel: 01-584 7011.

Club News

A new electronics club for young people has recently been started at Margate, Kent, and is called "Thanet Electronics Club".

The organiser, Dr Ken Smith of the University of Kent at Canterbury, views the club as an ideal way of introducing boys and girls to electronics.

A welcome is extended to any young people who may be interested in joining and to more experienced readers who may be able to offer assistance in some capacity.

Thanet Electronics Club meets at 7.30pm on Thursday evenings, at *The Quarter Deck, Margate, Kent.*

Mullard Data Book

Readers may be interested to know that the 1979/1980 edition of the Mullard Data Book is now available.

As usual, it contains fully-updated abridged data on the company's range of valves, TV picture tubes, semiconductors, integrated circuits, capacitors, resistors, modules, assemblies and loudspeakers used in the consumer electronics industry.

Each product section is separated from the others and is printed on different coloured paper for quick reference. Additional sections cover lists of Mullard technical publications and names and addresses of component stockists.

The book is available at £1 (cash with order, please) from: *The Technical Press Ltd., Freeland, Oxford OX7 2AP.*

Technical Data

RCA Solid State has produced a new technical manual, No. CMS 272, covering characteristics and applications of the company's range of COS/MOS integrated circuits. Included in the manual are characteristics of B-Series COS/MOS circuits, information on designing with COS/MOS circuitry, useful circuits and applications, details on custom large-scale integrated circuits, and an introduction to the RCA COSMAC microprocessor and how it interfaces with memory and input/output circuitry.

Cost of the RCA COS/MOS technical manual in the UK is £2.80 plus VAT and is available from: *RCA Solid State—Europe, Sunbury-on-Thames, Middlesex TW16 7HW. Tel: (09327) 85511.*

Currently available from Mullard Ltd. is a wallchart entitled "Mullard Multi-text".

Measuring 59 × 84cm this new multi-coloured chart gives comprehensive information on the company's wide range of integrated circuits for television text display systems.

Requests for copies should be addressed to: *Department CIH, Mullard Ltd., Mullard House, Torrington Place, London WC1E 7HD.*

Business News

Continental Specialties Corporation (UK) Ltd. has appointed UK instrument distributor Electroplan Ltd. as a master distributor for selected items from the CSC ranges of prototyping aids and low-cost logic test equipment.

The latest CSC catalogue is now available free, from: *CSC (UK) Ltd., Shire Hill Industrial Estate, Saffron Walden, Essex CB11 3AQ. Tel: (0799) 21682.*

Swift-Sasco, the recently formed electronic component distribution organisation, has signed an agreement with Sprague, one of the world's largest manufacturers of electronic components, to stock and distribute an extensive range of Sprague capacitors. Products covered by the agreement include solid and wet tantalum capacitor types (including ranges which meet BS9000 specifications), aluminium electrolytic capacitors, and multilayer ceramic devices. For the wet-tantalum devices, Swift-Sasco is the sole UK stockist.

A catalogue is available, for details contact: *Swift-Sasco Ltd., P.O. Box 2000, Gatwick Road, Crawley, Sussex, R10 2RU. Tel: (0293) 28700.*

New IEETE President

Mr J. M. Ferguson, CBE, FEng, FIEE, FIMechE, FITE, has succeeded Mr J. H. H. Merriman, CB, OBE, as President of The Institution of Electrical and Electronics Technician Engineers (IEETE).

Formerly, Director of Engineering, GEC Power Engineering Ltd., Mr Ferguson is now an Engineering Consultant; he is a past President of The Institution of Electrical Engineers.

IEETE, 2 Savoy Hill, London WC2R 0BS. Tel: 01-836 3357.

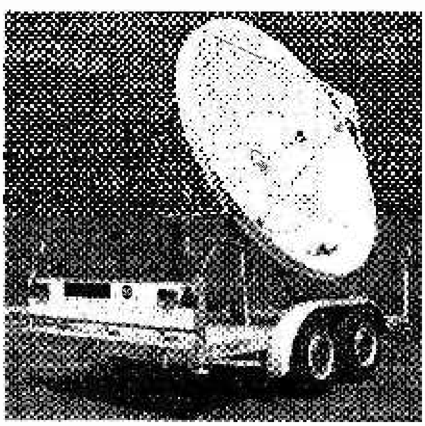
UK Space Link

Colour television news pictures were sent via satellite from Jersey in the Channel Islands to the UK mainland for the first time during the annual general conference of the National Union of Mineworkers, held between 4 and 6 July, 1979 at St Helier.

Independent Television News received coverage of the NUM conference for inclusion in news bulletins through the European Orbital Test Satellite by means of the IBA's transportable "up-link" terminal—the first of its type to be built and used in Europe.

The experimental transmissions are being made with the assistance and permission of the British Post Office and the States of Jersey Telecommunications Board. This is the first time that such a communications link has been established from Jersey.

The IBA experimental transportable station was first demonstrated in September 1978 at the International Broadcasting Convention, when an ITN news bulletin was transmitted via OTS from Wembley Conference Centre. This first demonstration won for ITN the Royal Television Society's 1979 International Current Affairs Award for new techniques. In May 1979 the equipment was demonstrated at the Internation Television Symposium held in Montreux, Switzerland.



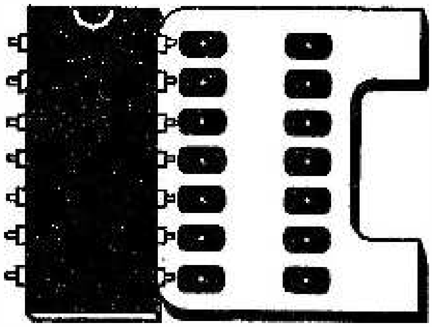
The trailer-mounted 2·5m antenna used with the IBA's experimental transportable station

Colour TV pictures can be transmitted from the transportable link to OTS which is stationed 22 300 miles above equatorial Africa and then down again to the Post Office satellite communications earth station at Goonhilly, Cornwall.

The IBA experimental station has been built as a test bed to assist OTS studies and to provide experience in the use of satellite systems for major outside events. If an operational service were to be established, this type of terminal could be used over a wide area of Europe where conventional microwave links could not be readily set up.

The self-contained transmitter is built in a "container" cabin (3m × 2·3m × 2·5m) which can easily be transported on a medium-sized lorry to which a trailer is attached, carrying a 2·5m diameter "dish" aerial.

Independent Broadcasting Authority, 70 Brompton Road, London SW3 1EY. Tel: 01-584 7011.



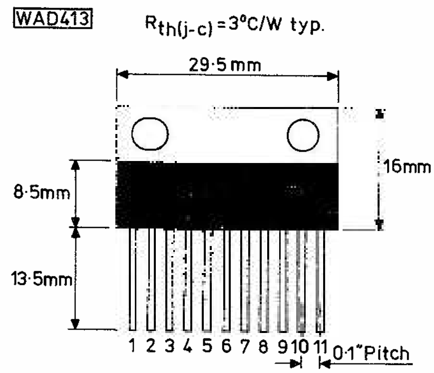
OF THE MONTH 77

Brian DANCE M.Sc

THOMSON-CSF TDB0791 POWER OP. AMP.

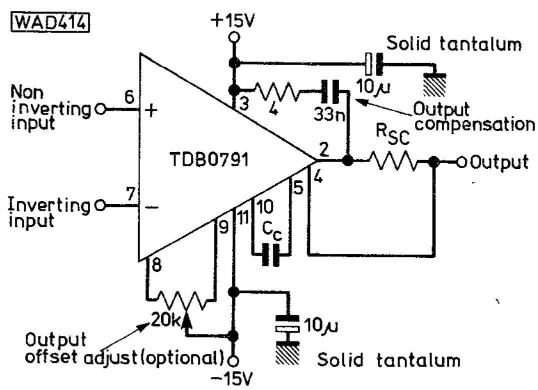
The conventional integrated circuit operational amplifier is an extremely versatile electronic component, but one of its limitations is that the maximum current it can deliver is typically limited to little more than 10mA. The Thomson-CSF TDB0791 device is rather similar to the well-known 741, except that it can deliver output currents of up to 1·25A peak, 1A mean. It provides a high output-power capability, and is intended for such applications as audio power amplifiers, servo amplifiers and regulated power supplies.

The TDB0791 is thermally and short-circuit protected. If the device is operated in such a way that the internal silicon chip becomes too hot for safety, the output current is automatically reduced so that the power dissipation is kept to a safe value. However, it is never wise to operate a thermally-protected device in such a way that the chip becomes so hot that the thermal protection circuit operates for more than a short time, as the high temperature tends to cause premature failure. The internal short-circuit protection will limit the maximum output current from the device to a safe value and provides protection if the output is accidentally shorted.



1	V⁻
2	Output
3	V⁺
4	Current sense
5	Compensation
6	Non inverting input (+)
7	Inverting input (−)
8	Offset adjust
9	Offset adjust
10	Compensation
11	V⁻

Fig. 1: The TDB0791-SP single-in-line package and connections



G	C_c
1	100p
10	5p
100	Not req.

R_{SC}	I_{SC}
0·6Ω	1A
1·5Ω	500mA
3Ω	250mA

Fig. 2: A basic circuit (without feedback) for the TDB0791-SP

The Case

The TDB0791 is available in various packages. The TDB0791-SP is encapsulated in the rather unusual type of case shown in Fig. 1. This is an 11-pin single-in-line case, since there are 11 pins in a straight line. (Dual-in-line devices are much more common.) The device is fastened to a metal bracket which can be bolted to a metal heat sink so as to keep the temperature of the chip sufficiently low.

The size of the heat sink required depends on the amount of power being dissipated in the device, but will increase with the output current and the applied voltage. The maximum internal dissipation is 15W and the maximum operating voltage ±15V; damage may occur at applied potentials exceeding ±18V.

Connections

The connections of the TDB0791-SP are shown in Fig. 1 and a circuit in Fig. 2. It can be seen that the device has the normal non-inverting and inverting inputs; an optional potentiometer may be used for adjusting the mean output voltage so that it is exactly half-way between the +15V and −15V supplies. The power supply decoupling capacitors and the frequency compensation capacitors must have short leads and must be connected close to the device pins.

No negative feedback is shown in the Fig. 2 circuit, but normally negative feedback will be used to control the gain and response. The required value of the compensation capacitor C_c decreases with higher gain as shown in Fig. 2.

The resistor R_{sc} is the current sensing resistor, which determines the current which can flow before the current limiting action occurs. If R_{sc} is 0·6 ohm, a current of 1A will produce a voltage drop of 0·6V across this resistor. This is adequate to start an internal transistor conducting so that the output current is limited. As shown in Fig. 2, the output current is limited at lower values as the value of R_{sc} is increased. Thus the value of R_{sc} may be chosen so that the required maximum output current is obtained, but it should not be less than 0·6 ohm, since the device cannot reliably deliver over 1A. The short-circuit current falls with increasing case temperature.

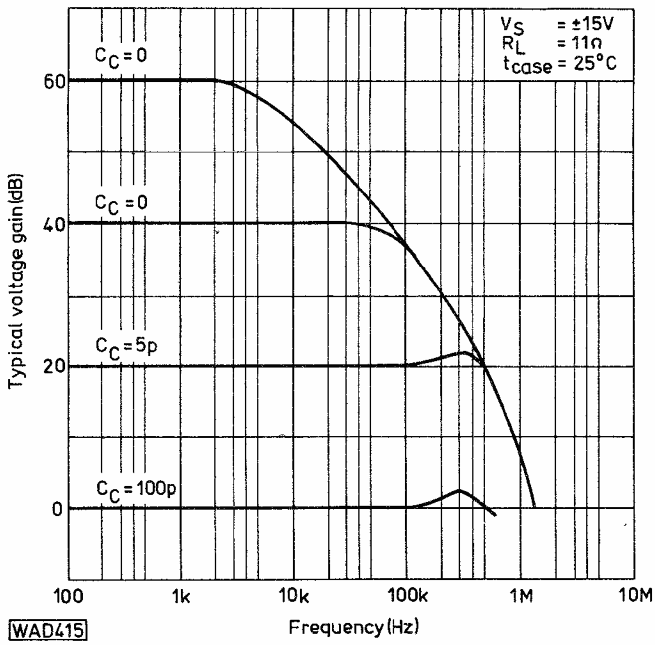


Fig. 3: Variation of gain with frequency with various amounts of negative feedback

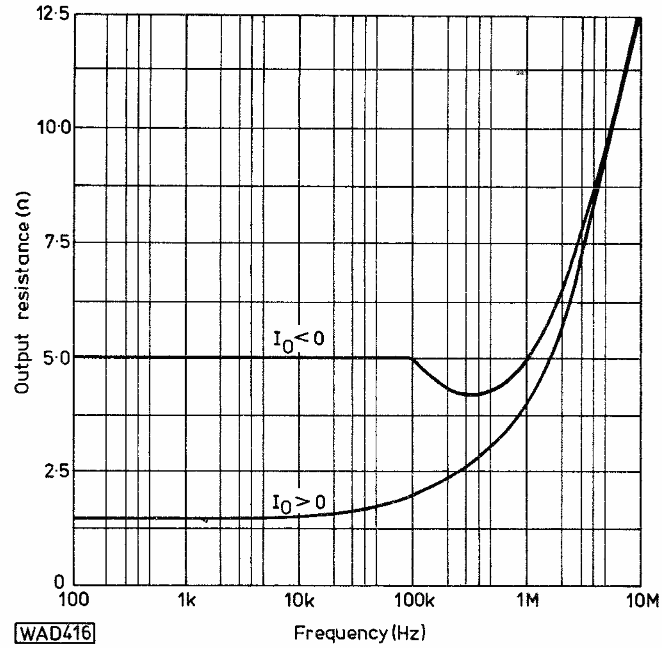


Fig. 4: Variation of the output resistance with frequency

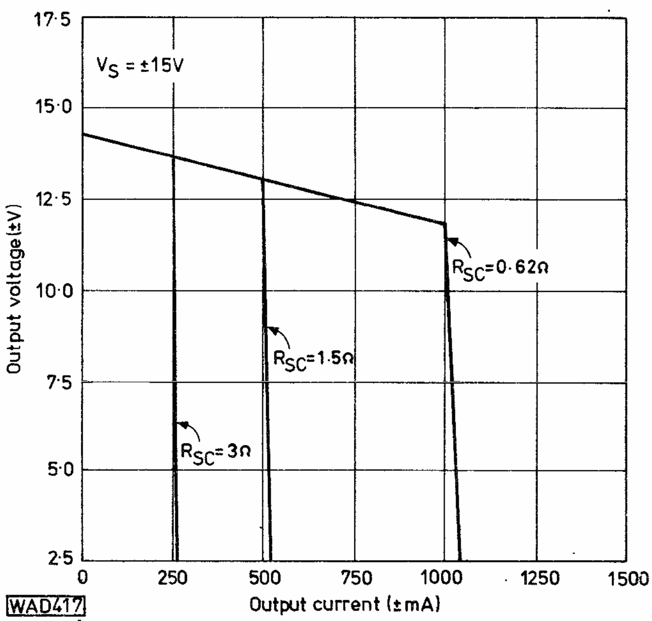
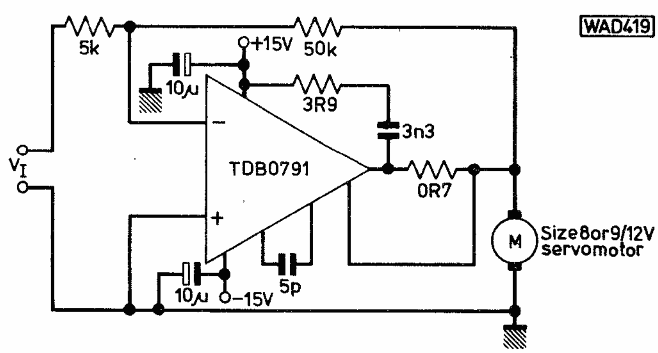


Fig. 5: Maximum output voltage swing at various values of the output current. Note the effect of the ◄ value of the current limiting resistor, R_{sc}

Fig. 6: A circuit for controlling the speed of a d.c. ▼ motor from a steady input voltage



Characteristics

The input resistance of the TDB0791 is typically 1 megohm (minimum value 300 kilohm). The gain without feedback is about 20 000 at zero frequency, but falls with frequency to about 150 at 10kHz when C_c is 5pF. The variation of the gain with frequency when negative feedback is applied is shown in Fig. 3. It can be seen that a voltage gain of 20dB (10 times) can be obtained with a fairly level frequency response up to more than 100kHz, whereas with a gain of 40dB (100 times) the gain commences to fall at frequencies below 100kHz. A gain of 60dB (1000 times) results in a constant gain only up to about 3kHz. The increase of the output resistance with frequency is shown in Fig. 4 for the case where the output current is greater than zero and for the case where it is less than zero (that is, the current flows into the output pin).

The maximum output voltage swing which can be obtained at various output currents with different values of R_{sc} is shown in Fig. 5. It can be seen that at small output currents a swing of ±14V (a total of 28V) can be obtained. The quiescent supply current does not exceed 25mA at 25°C.

continued on page 39▶▶▶

SHEER SIMPLICITY

Developments in Optical Fibre Communications

Margaret McDONAGH

In our January 1979 issue, we carried an article giving some technical information on results of early Post Office experiments with optical fibre transmission. Trials described then have now reached a satisfactory conclusion, and the Post Office is ready to begin the installation of optical fibre cables on traffic-handling routes.

★ Post Office Features & Information Bureau

Jan Harrison, technician at the Post Office's Research Department compares an optical fibre cable with a coaxial cable. Eventually, fibre optic cables will be able to carry 96 000 telephone calls at the same time

Photo courtesy the Post Office

Optical fibre transmission is in its comparative infancy—yet its future within the telecommunications system of tomorrow seems assured. The conception of optical fibres is only fifteen years old—and the Post Office's Research and Development Department were quick to seize on the idea that transmission systems using glass fibres to transmit short pulses of light with little distortion and attenuation over long, long distances was feasible.

While most exchange equipment is costly, the largest single expense in any telephone system is the miles of telephone cable. The backbone of today's telephone system and its trunk routes is the coaxial cable, which first came into general use in 1936. While this type of cable has given good service it has two disadvantages—it consumes valuable metallic resources and is relatively "lossy", so that signals need to be boosted by regularly spaced repeaters. This prompted Post Office researchers to look for new and cheaper ways of sending messages, very much in the way it researched satellite communications. One solution lies in optical fibres—hair-thin strands of glass which can carry conversations in the form of light and are light-weight, easy to install, hardwearing, and have so little loss that very few, if any, repeaters are required.

Already it is possible for a single pair of glass fibres to carry 4000 telephone conversations. At present ten or twenty such fibres are being included in a cable that measures only 7mm diameter. Many more fibres could be incorporated if required, without substantially increasing the cable size, so that 100 000 two-way speech circuits could be carried in a cable the thickness of a finger. The same cable could equally well transmit 200 television channels.

Using Optical Fibres

Fibre optics work like this. At either end of a long hair-thin fibre are connected two terminals, one a transmitter, the other a receiver. The role of the transmitter is to convert electrical signals—that is normal telephone calls—into pulses of light. This light then travels through the glass fibre and into the receiving terminal.

Each fibre consists of a very fine glass rod contained within a glass tube and fused together, with the centre core made of slightly denser glass than the outer. The inner core acts as a light pipe. By shooting a beam of light along this central core the light is trapped by the outer cladding and rebounded back to a point further along the central core—a process known as total internal reflection. This causes a travelling pulse of light to zig-zag down the optic fibre at high speed, until it feeds into the receiving terminal. At the receiving terminal the light is then converted back into conventional electrical signals, capable of being absorbed into the telephone network.

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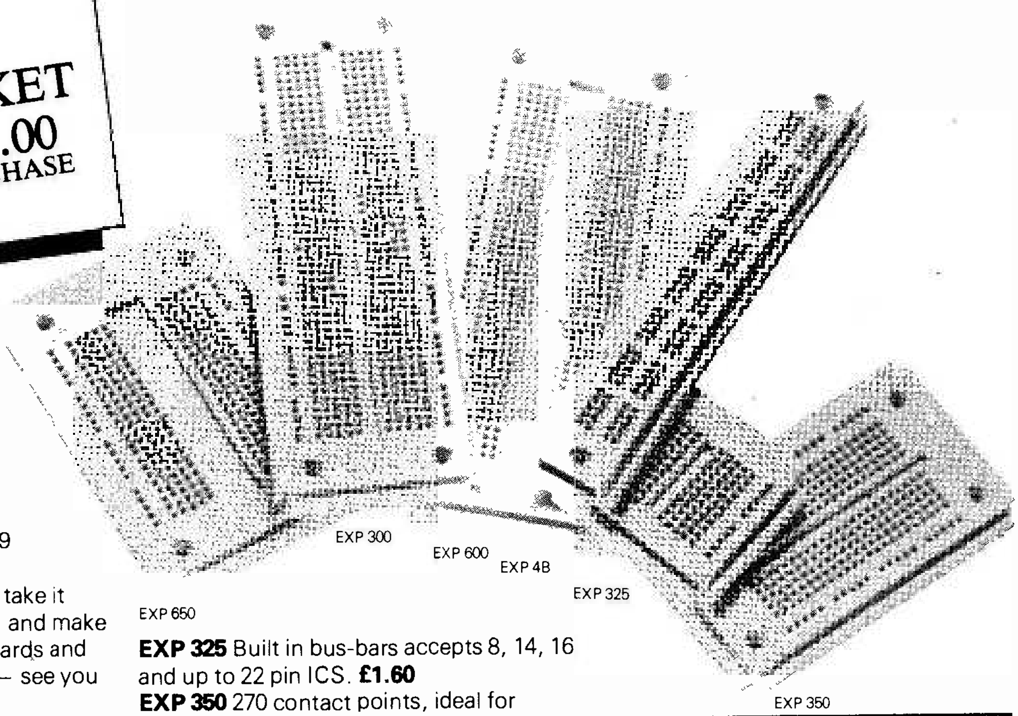

All over Britain, hobbyists are discovering Britain's Best Breadboard Buys. At the London Breadboard exhibition '79 on Stand Nos. F1, F2 and G1, G2, CSC will be exhibiting their full range of breadboards.

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Precision Instrument Labs., Instrument House, 727 Old Kent Road, London SE15

MANCHESTER
Shudehill Supply Co., 53 Shudehill, Manchester M4 4AW

BUCKINGHAMSHIRE
West Hyde Development, Unit 9, Park Street Industrial Estate, Aylesbury, Bucks HP20 1ET
Best Electronics (Slough) Ltd., Unit 4 Farnburn Ave., Slough, Bucks SL1 4XU

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3. EXP 303 which includes three items. Two matchboards and an EXP 300 solderless breadboard - £8.60
4. EXP 304 which includes four items. Two matchboards and EXP 300 breadboard and a scratchboard workpad – £9.30

This coupon entitles the holder to a free ticket worth £1.00 to Breadboard '79, with the purchase of any listed breadboards

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SHEER SIMPLICITY
Optical Fibre Communications

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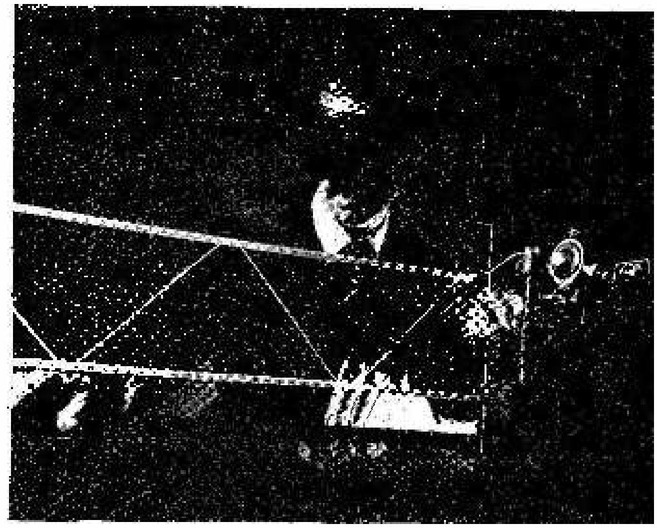


Post Office researcher, David Heatley shows how the principle of optical fibre communication works. A beam of light zig-zags down the central core of a hair-thin glass rod

Photo courtesy the Post Office

The Material

In preparing a fibre, great care has to be taken to ensure that the glass is of the purest quality. If it is not, then the light beams pulsing through it will be deflected by alien particles. So pure must the glass in the fibre be, that if formed into a window one kilometre thick, it would be as transparent as a few millimetres of ordinary glass. And it only takes ten grams of pure glass to make one kilometre of fibre.

The breakthrough in optical fibre communication came in 1966 with a paper published by two researchers at Standard Telecommunications Laboratories Ltd. Then, the optical fibres theory was simply that—a theory. It had to be presumed that the chemical purity of glass could be improved by a factor of about one thousand times. And it had to be presumed that solid state lasers, light emitting diodes and optical detecting devices could be developed and that simple fibre termination would be feasible.

At this time, transmission losses in optical fibres were around the 2000dB per kilometre region, and calculations indicated that losses must be reduced to nearer 20dB per kilometre if transmission systems were to be viable. Not only has this target been achieved—it has been exceeded by a considerable margin. Fibre losses well below 1dB/km have already been recorded. With the success of feasibility trials that have been under way since 1977, the Post Office is now ready to go ahead with the world's most comprehensive optical fibre network.

The Future

Estimated to cost about £8m it will involve 15 routes in England, Scotland and Wales, will use 3500km of fibre, and will start carrying telephone calls in September 1980. The network will give the Post Office experience of optical fibre systems at all stages of installation, commissioning and operation—and will bring communications of the twenty-first century one step nearer reality. ●

PRODUCTION LINES

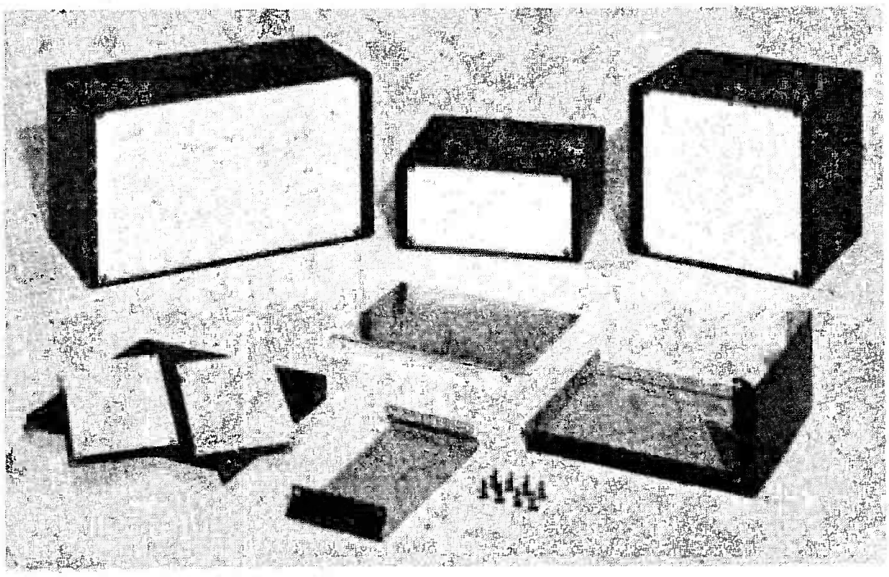
alan martin

New Cases

Perancea Ltd. announce a new range of instrument cases. The "Pack-Flat" cases, as their name implies, arrive in flat packs for easy storage and can be assembled in seconds. A major feature is the separate aluminium chassis on which the components can be mounted, avoiding unsightly fastenings on the exterior of the case.

Made from "Colorcoat", a textured p.v.c. coated steel, they are supplied in a black grained finish with white front and rear panels. Available in eight stock sizes from 180 × 152 × 80mm up to 307 × 152 × 156mm.

For details of availability in your area, write to: *Perancea Ltd., 131 First Avenue, Bush Hill Park, Enfield, Middlesex.*



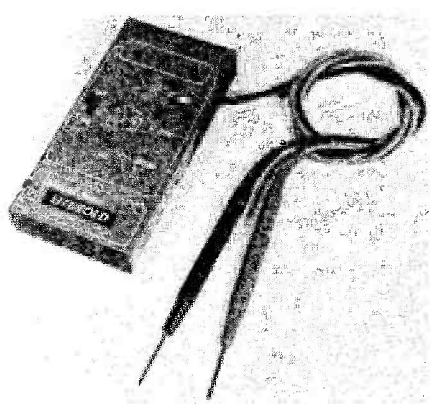
Transistor Tester

Litesold are introducing a new, low priced transistor tester.

The neat and compactly designed instrument will identify and test the condition of the *pn* junctions of most semiconductor devices, the exceptions being f.e.t.s or germanium transistors with a V_{be} less than 2V, and uses two separate and self-identifying probes.

The coloured l.e.d.s indicate which probe is applied to the cathode side of any *pn* junction and whether the junction is operational, open-circuit or short-circuit. The tester, therefore, indicates whether the transistors are of *pnp* or *npn* type and identifies the leads.

The transistor tester measures approximately 120 × 60 × 20mm and is powered by an internal PP3 battery.

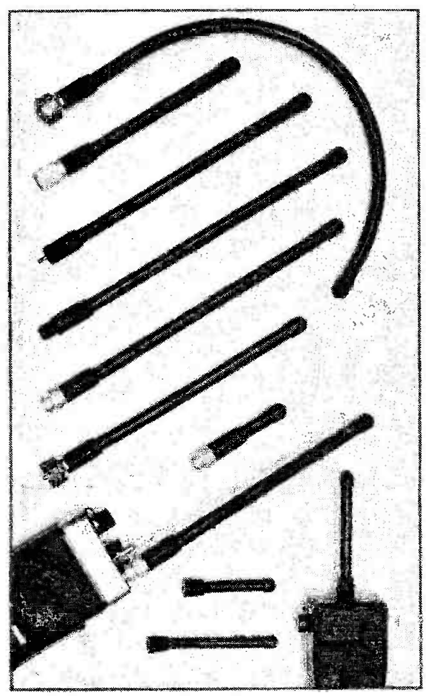


Priced at £23.90 which includes P&P and VAT, the tester is available from: *Light Soldering Developments Ltd., 97–99 Gloucester Road, Croydon, Surrey. Tel: 01-689 0574.*

Antennae

Panorama, the London-based antenna specialists have recently introduced two new ranges of antennae for the amateur.

The new PVX series of helical antennae for portables, offer modern styling and economic pricing without sacrificing any of the features of flexibility, ruggedness and performance. The PVX has a parallel copper plated helical element sealed into a smooth sided flexible covering by moulding over the termination with nylon and by bonding on the top cap after the antenna has been trimmed to length. Any resonant frequency within the range 27–500MHz can be supplied and a large variety of terminations are available. The PVX has a nominal impedance of 50 ohms and a typical bandwidth of 10% with a power rating of 25 watts.



Panorama have also introduced a new modular series to their extensive range of vehicle whips and mounting bases for v.h.f. and u.h.f. radio communications. The seven modular units consist of quarter-wave whip, u.h.f. gain whip, v.h.f. high band gain whip, hinge joint, quick-fit boot mount, general purpose mounting and low-profile mounting for v.h.f. use. The whips are stainless steel with moulded-on tip. Exposed metal parts are chrome-plated brass and all mouldings are in dark grey nylon. Coils are moulded over to give mechanical strength, weather protection and a smart appearance.

For literature and details of availability and price contact: *Panorama Antennas Ltd., 73 Wadham Road, London SW15 2LS. Tel: 01-874 5300 and 01-870 5192.*

NEW BOOKS

RADIO REPAIR
by Les Lawry-Johns
Published by Newnes Technical Books
87 pages, 166 × 112mm. Price £1.55

The author gives readers the benefit of his long experience in radio servicing in this very readable little volume. A question-and-answer approach is used to cover receivers stage by stage, and there are special sections on car radios, unit audio equipment, valved radios, curing noisy operation, plus general notes on fault finding, and recommended tools and spares kits.

MASTER HI-FI LOUDSPEAKERS AND ENCLOSURES
by Dave Berriman
Published by Newnes Technical Books
128 pages, 216 × 132mm. Price £2.95

This book is for the reader who wishes to know more about loudspeakers and enclosures—how they work, why they are made as they are, how to choose and how to use the best loudspeaker. Technical knowledge is not necessary, as fundamental theory essential to understanding is explained in a non-mathematical descriptive manner. Crossover networks, room acoustics and fundamentals of sound and hearing are also covered.

ELECTRONIC DESIGNER'S HANDBOOK (3rd Edition)
by K. Hemingway
Published by Business Books
348 pages, 215 × 134mm. Price £12.50 (hard-backed)

The book's sub-title: A practical Guide to Transistor Circuit Design, really sums up its aim. Covering only analogue circuits, it is intended to help a recently qualified electronics engineer or physicist who lacks experience in practical design. Its treatment is therefore at a fairly advanced level, but it is written in a very readable way.

BEGINNER'S GUIDE TO TAPE RECORDING
by I. R. Sinclair
Published by Newnes Technical Books
167 pages, 186 × 120mm. Price £2.95

This book presents the principles and techniques of tape recording in a simple, non-mathematical way. Advice on using tape recorders covers microphones, recording from disc or radio or another tape, plus more advanced techniques such as editing, mixing, multiple tracking, slide synchronisation, movie sound and nature recording. No detailed knowledge of electronics is necessary to make good use of the information provided.

TELEVISION INTERFERENCE MANUAL (2nd Edition)
by B. Priestley
Published by the Radio Society of Great Britain
80 pages, 210 × 148mm. Price £1.60 including p&p

A readable and illuminating introduction to solving both the social and technical aspects of this most challenging problem for radio amateurs. The book includes a wealth of reference material.

LEARNABOUT . . . MAKING A TRANSISTOR RADIO
by G. C. Dobbs
Published by Ladybird Books
52 pages, 172 × 114mm. Price 30p

Though this particular book has been around for a few years now, we mention it here in response to requests from our readers for a book describing the most basic of constructional projects for a radio receiver. A crystal set, followed by sets using one, two and three transistors are included.

INTEGRATED CIRCUITS—How to Make them Work
by R. H. Warring
Published by Lutterworth Press
133 pages, 215 × 132mm. Price £3.95 (hard-backed)

This book provides an introduction to integrated circuits and how to use them in practical circuits. The types of i.c.s covered are: Arrays; Op. Amps; Audio Amplifiers; Complete Radio Circuits; Multivibrators; Voltage Regulators; Electric Motor Speed Controllers; Active Filters; Digital Circuits; Electronic Organs; Miscellaneous. A total of 84 different working circuits are given, providing the experimenter with much food for thought.

LEARNABOUT . . . SIMPLE ELECTRONICS
by Rev George C. Dobbs
Published by Ladybird Books
52 pages, 172 × 114mm. Price 30p

Just the book for a youngster who is always worrying you to build electronic gadgets for him or her, or for one that you want to get interested in such items. Circuits that will flash lights, or make noises, or play tunes are presented in a practical and straightforward fashion, culminating in a simple electronic organ with vibrato.

TELECOMMUNICATIONS SYSTEMS FOR TECHNICIANS—1
by G. L. Danielson and R. S. Walker
Published by Newnes-Butterworths
103 pages, 246 × 184mm. Price £2.95

This volume is intended for use by students at their first level of TEC (Technician Education Council) studies in telecommunications and electronics, and is therefore written with the needs of the beginner in mind. As such it provides an excellent introduction to a wide range of subjects, as can be seen from the list of chapter headings: Transmission of Information; Modulation and Demodulation; Radio Waves and their Uses; The Cathode Ray Tube; Television; Radar; Radio Navigation; Telephony and Telegraphy; Routing a Signal (Telephone Exchange Systems); Transmission of Speech by Landline; Data Communication (including Computers). It should be stressed however that this is a *systems* book, and does not go into the detail of circuits required to achieve the various functions.

continued on page 75▶▶▶

SPECIAL PRODUCT REPORT

micron PL-7D FM

27MHz RADIO CONTROL KIT

Radio control of models has become an expensive hobby over the last few years. There are several reasons for this. The radio systems themselves have become very sophisticated, with fully proportional control of several different functions being commonplace. Also, with the increase in illegal Citizens' Band transmissions causing havoc in some areas, the designers of r.c. systems have had to turn to either f.m. techniques, or move into the only other permitted frequency band, at 459MHz.

In the early days of r.c. models the majority of operators built their own radio equipment as well as the model, but lately this has not been the case and it is even possible to get a model aircraft into the air without having to actually build anything yourself.

However, there are several kits produced to enable anyone who has the ability to build a model, to assemble a complete r.c. system. With the ever increasing problems of interference on the 27MHz radio control band any r.c. system should really use f.m techniques and have as tight a bandwidth as possible.

With this in mind Micron Radio Control have produced a kit for a 27MHz f.m. system. Micron actually make a wide range of kits including both a.m. and f.m. systems together with servos and accessories to match.

We tested the PL-7D f.m. transmitter kit together with the dual bandwidth f.m. receiver and Micron's servo kit.

The components came packed in a plain, stout cardboard box and were sealed in individual polythene bags, one bag for each part of the kit.

The instructions supplied with the kit were in the form of a set of drawings, obviously drawn with the intention of putting the modeller at ease. Two sheets dealt with the transmitter, one each the receiver and servos. A set of notes covered general constructional points and gave some very useful hints, while a separate sheet dealt with setting up procedure. Unfortunately this covered all of the Micron systems and proved to be a little bit confusing.

The drawings appeared rather strange to someone used to the more conventional electronic constructional ones such as appear in *PW*, but, after a few minutes study, proved to be easily followed. Anyone who has ever built a model would have little or no trouble in following the drawings.

As it seemed to be the key unit in the system, and also looked the most impressive part of the kit, I decided to build the transmitter first. The case was supplied ready bent, but in sections which had to be screwed together using self-tapping screws and two plastic end cheeks. A 'dry' run without screws showed that the bottom pressing, supplied with the nameplate already stuck in place, was about 1mm too high at the front. This was easily remedied by marking off the 1mm strip with a sharp modelling knife and then carefully cutting the strip away using scissors. This then allowed the metal parts to fit snugly into the plastic sides and stick panel. Micron say that this has now been corrected and no trouble should be encountered. Pilot holes were drilled in the plastic sides to take the self-tapping screws and the case assembled. The two open gimbal control sticks were screwed into place together with the meter, on-off switch and the loop for a neck-strap.

The open gimbal sticks, which are made by SLM, come ready assembled and just need screwing to the plastics moulded front panel, making sure that the dust excluding foam sheet is properly positioned before tightening the fixing screws fully.

With the case assembled attention was turned to the electronics. The transmitter has the r.f. section on one p.c.b. with the encoder on a separate, larger board. This could be very useful if, as some people foresee, the authorities allocate another frequency band somewhere around 35MHz to r.c. modellers.

The p.c.b.s supplied were of good quality and proved easy to solder to. The components were also first rate and I particularly liked the very comprehensive way in which the capacitors were identified. Capacitors are probably the most difficult components to identify, different makers having their own ideas on coding. Micron have countered this by providing a sheet giving drawings of each type of capacitor used showing particularly the markings. No problems were encountered in assembling the r.f. board. Take care that the correct pins are removed from the Toko can and that the insulating enamel is removed from the two coils. I found it easier to fit the heat sink fins onto the BSX61 output transistor before soldering it in place. The two wound coils are fitted with ferrite dust cores which proved impossible to move when it came to setting up. It might be better to remove the cores before assembly, leaving them out until you are ready to tune the transmitter. I found that the only way to move the cores was to apply a clean, hot soldering iron to the core while gently turning it with a small screwdriver. The heat loosens the core allowing it to be unscrewed. The latest kits have these cores specially treated to prevent them sticking in the formers.

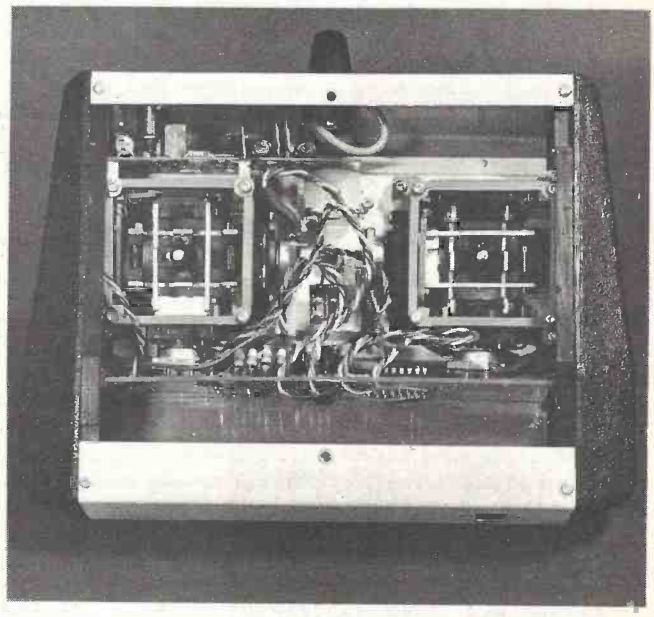
The encoder board was very simple, the c.m.o.s. integrated circuit being fitted into a socket when the board is finished. The instruction sheet suggests that you use a stainless steel draining board, if you have one, as an earthed assembly bench when inserting c.m.o.s. devices. This seems a very good idea which should go a long way to eliminating problems of static. The advice given on handling c.m.o.s. devices was sound and clearly put over, and could even be followed by those who think that they are well versed in such matters.

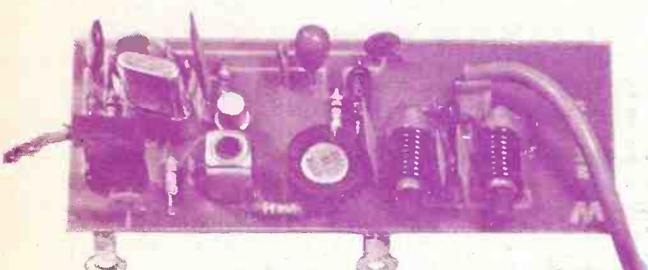
The p.c.b.s fitted neatly into the case, with the two NiCad batteries carried in the bottom of the case in a pair of simple nylon cable clips. The aerial, which is centre loaded and telescopic, screws easily into a plastics mount fitted on top of the case. A socket is mounted in the bottom of the case to take a charger socket.

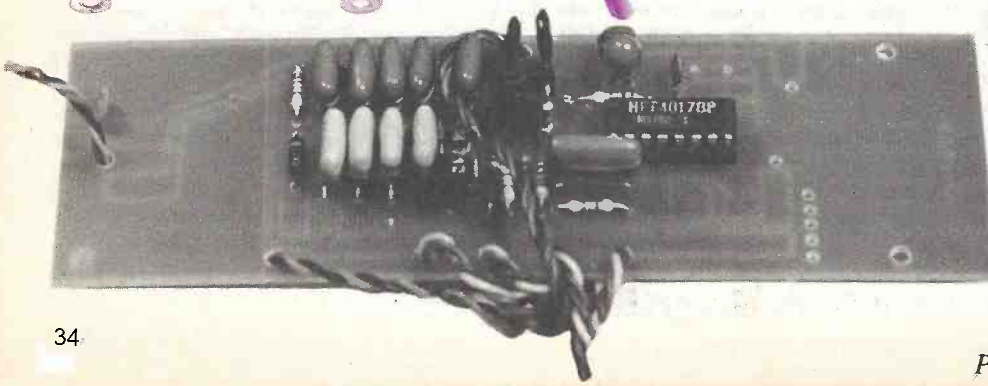
The f.m. receiver and decoder was tackled next. The version supplied was the 20kHz bandwidth which Micron reckon is satisfactory for sport or club flying. A Murata CFK455 filter can be fitted to the same board to reduce the bandwidth to 10kHz allowing up to 32 frequency spots to be used when operated with only f.m. sets alongside. This filter can be fitted at a later date if required, without modifying the p.c.b. and only removing one capacitor. Again, like the transmitter, all the components are easily identified and only the coil and i.f. cans need careful modifying by cutting off certain pins as shown on the plans. One leg of the quad-in-line i.c. has to be removed and the i.c. soldered directly into the board. So long as a hot iron is used with a clean bit no trouble should occur. As with any form of soldering, cleanliness, a hot iron and good quality cored solder is all that is needed, along with the right frame of mind. Remember, he who hesitates is lost!

The decoder is on a matching p.c.b. which comes with a 7-way SLM gold plated connector block already soldered in place. However, the p.c.b. itself was not pre-tinned like the other boards although no trouble was encountered. The decoder i.c. used is a c.m.o.s. device and is soldered directly onto the p.c.b. without a socket. Obviously care must be taken to prevent static electricity building up and killing the device, but otherwise no problems should be met. Care is needed when soldering the interconnecting wires to the

continued on page 36

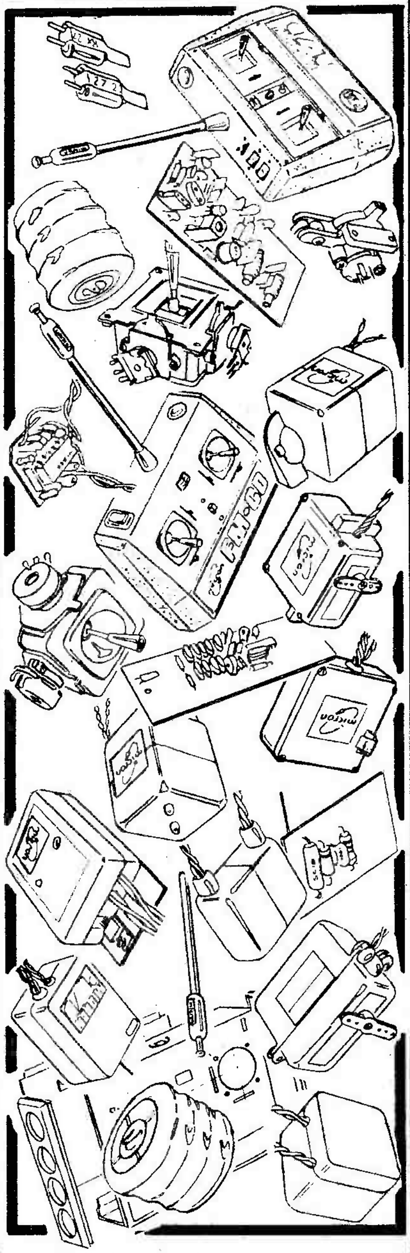






Above left is the completed Micron f.m. receiver. Two p.c.b.s are used and the crystal can be changed simply. The photo above shows the inside of the completed transmitter without the batteries fitted. The two p.c.b.s which together make up the Tx are shown on the left with the r.f. board above the encoder.

WHOLE NEW WORLD OF ELECTRONICS



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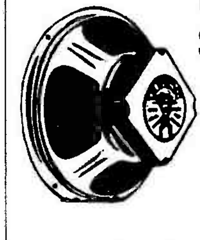

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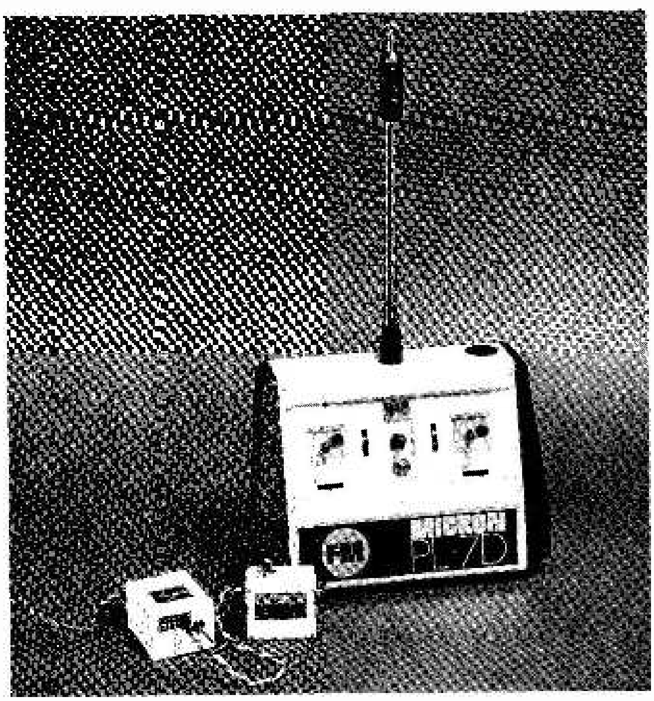
tracks of the two p.c.b.s to avoid melting the insulation where the wires pass through holes in the boards. The two boards fit into the plastics case with a piece of foam sandwiched between them.

The smallest unit is the servo amplifier. Based on the Signetics NE544 i.c. this is built onto a small p.c.b. measuring 20 × 21mm and is unusual in using a d.i.l. socket to carry the i.c. instead of mounting it directly on the board. Although this adds extra weight it does allow for possible servicing of the amplifier unit and also allows all components to be mounted on the one side of the board, unlike some other designs. Construction is simple as, although the board is small the component count is also low, and the p.c.b. pads are large in area. The servo mechanics supplied were very good, the output shaft running in ball bearings and fitted with metal gears. The case is split so as to allow all the parts, including motor and amplifier to be mounted before the case is closed, the amplifier p.c.b. being held in place with a small piece of self-adhesive foam rubber. A gold-plated SLM connector is suppled to match the socket fitted to the receiver.

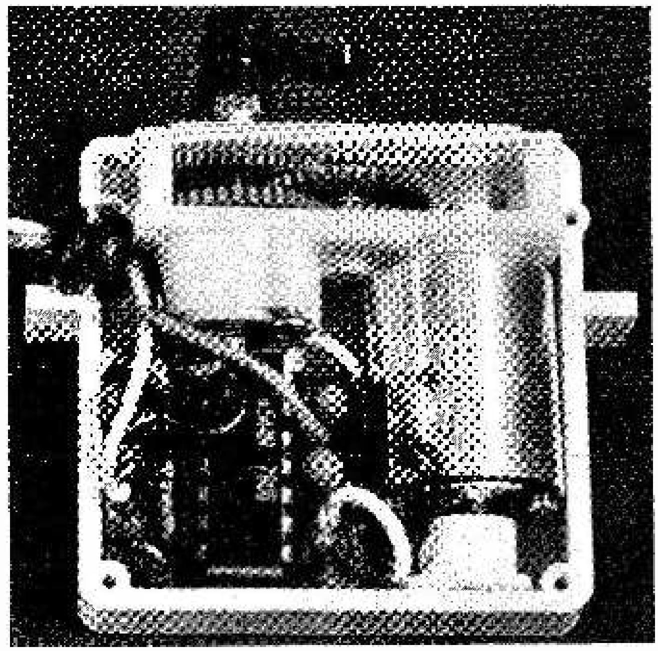
Setting Up

The transmitter actually worked first time with no trouble. Tuning proved simple once the two dust cores had been moved. A simple r.f. field strength meter was used for tuning purposes, the two cores being adjusted to give maximum indication on the meter. Micron sell a kit for making a tuning indicator using a multimeter if you have not got a field strength meter. The screened Toko coil has to be adjusted with the r.f. board removed from the case as it is not possible to reach the core through the access hole for the crystal. The Tx tuned very easily and as a check on the functioning of the encoder the output waveform was displayed on an oscilloscope. This checked out all right so the receiver was tuned next.

The instructions were followed and a multimeter hooked up to two 4·7kΩ resistors as shown in the appropriate sketches. Switching on the Rx gave a deflection on the multimeter but, when the Tx was switched on nothing happened. A check on the Rx board showed that I had fitted



The final result showing the transmitter, receiver and one servo. The outfit looks very professional



The Micron servo is seen here larger than life. The i.c. is mounted in a socket for easy servicing and simplified construction.

a transistor the wrong way round so this was removed and checked on the multimeter. It still proved to be a transistor in spite of its ordeal so it was inserted the correct way round and the Rx switched on again Success, the meter performed in the manner described in the instructions and the Rx was tuned. The only real difficulty was in placing the Tx far enough away from the Rx without taking it outside the workshop.

With the Tx and Rx both tuned correctly the servos were plugged into the appropriate sockets and checked for control movement. This was correct and the system was now reckoned to be set up.

Although the complete system has yet to be installed in a model, it works very well on the bench. The Micron servo is very smooth and quiet in operation with power to spare, while the control sticks are pleasant to use. The Tx is easily converted to a 7-channel version by the addition of a small auxiliary p.c.b. to the encoder unit, no changes being needed to the Rx.

The overall appearance of the various parts of the system is on a par with professionally produced systems—in some instances the Micron system is better looking—no hint being given of home construction when finished.

Micron also provide a servicing and alignment service if needed, either at their specially set up service centre at Barrow-in-Furness or by one of their twenty or so specially appointed specialists listed in the instructions.

Building your own r.c. gear is not only very satisfying, but can also save you a lot of money. The price of a ready built Micron f.m. system is about £40 more than the kit. With four evenings work needed to build the kit this works out at £10 per night, well worth the effort.

Dick Ganderton.

Prices

PL-7D f.m. 4-channel kit £111.75 inc. VAT.
Rechargeable batteries (three) £18.36.
Micron charger kit £3.58.
Transmitter tune pack £0.92.
Full technical details, circuit diagrams etc. £2.00.

The PL-7D f.m. kit was kindly supplied by Micron Radio Control, Hayworth Road, Sandiacre, Nottingham. Tel: 0602 395418.

NEXT MONTH IN...

practical WIRELESS

extra RADIO DATA supplement

A mine of reference information on building and using radio equipment, for the amateur or broadcast bands enthusiast

Radio control series begins

Radio control of model aircraft, boats and cars is a popular pastime. Our proportional system caters for the needs of most enthusiasts and uses the latest f.m. techniques to achieve superb performance while remaining simple to build. Don't build any other design until you have seen ours

& Special Xmas Offer

An ideal gift for the radio enthusiast, combining multiple time-zone watch, calendar, stopwatch, timer and alarm. With liquid crystal display

AERIALS for 160 Metres

PART 1

J.R.GREEN G3WVR

A number of readers considering building the VMOS Top Band Transmitter, which appeared in the July issue of *PW*, have requested further details of suitable aerial systems for use on the 160 metre band.

The problem on this band is, of course, the very long length of wire required to produce a true quarter-wavelength aerial system, something in the region of 39 metres, or 128 feet. Shorter aerial systems can be tuned to resonance by means of a loading coil, but there will inevitably be some loss of power in the inductor used, and the shorter the aerial, the greater the loss.

Long-Wire Aerials

Some may have gardens long enough for 128 feet of wire, strung to a convenient tree, or a pole at the end of the garden. However, height is important, and for field days and the like, a kite or (slightly more predictable in behaviour) a balloon may usefully be pressed into service as a practical alternative to a skyhook!

A suggested system is shown in Fig. 1. This may be connected directly to the output socket of the transmitter, or via the shortest practicable length of 50Ω coaxial cable.

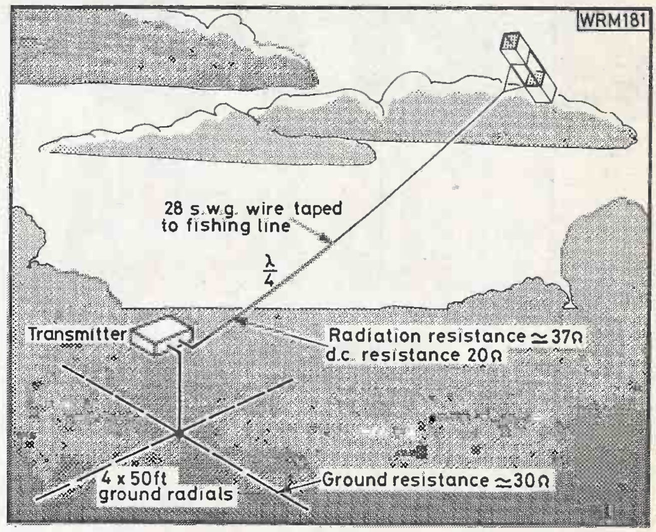


Fig. 1: A kite or balloon-supported, quarter-wave aerial system

A Tree Aerial

By using an eighth-wavelength aerial, with a loading coil, use can be made of a 60ft tree, as shown in Fig. 2. The aerial should be connected to the tap on the coil which gives the maximum reading on the ammeter.

Using a catapult to erect an aerial can be a hazardous business, and the following procedure should be followed to minimise the risks. (See Fig. 3)

1. Spool out the wire as shown.
2. Make sure that the wire from the weight exits at the **top** of the catapult pouch.
3. Hold the catapult well away from yourself, and sideways.
4. Turn your head away before firing.
5. Always wear a glove—a thick one!
6. Make sure that there are no people, animals, or property around that could be injured or damaged by a foul shot.

Remember—catapults are dangerous.

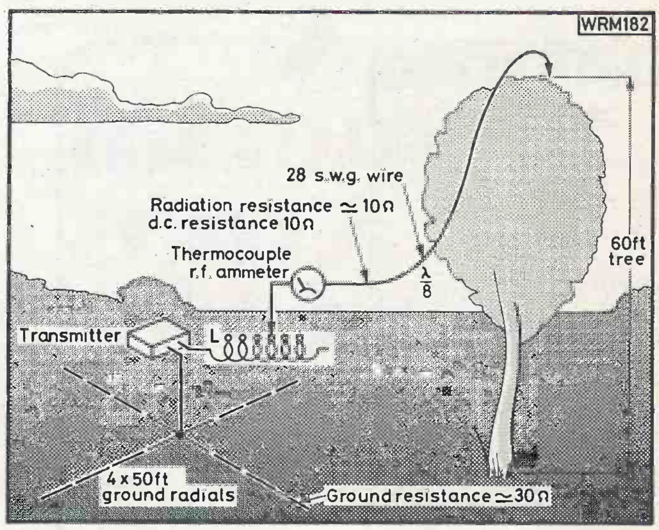


Fig. 2: An eighth-wave aerial system, erected with a catapult and lead weight. Loading coil L is 40 turns of 22 s.w.g. on a 50mm dia. former, tapped every 4 turns

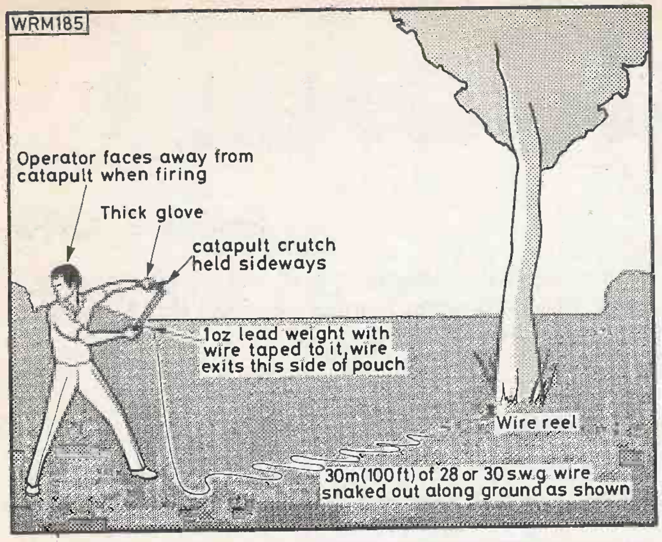


Fig. 3: Erecting an aerial by catapult. The operator should stand about 30m from the trunk of the tree

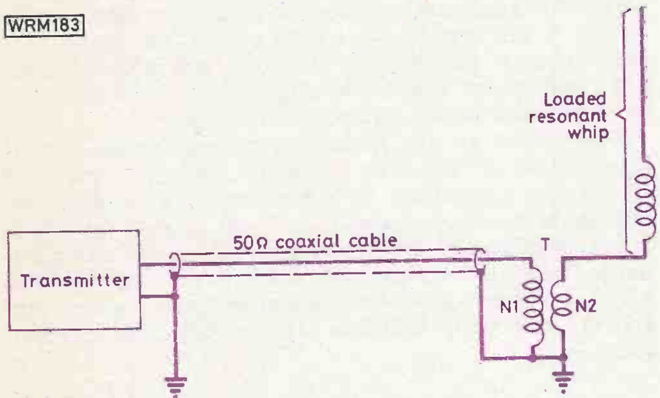


Fig. 4: Loaded whip aerial for mobile use. Transformer T is an r.f. matching transformer with step-down ratio N_1:N_2 of around 2:1–3:1 (see Fig. 5)

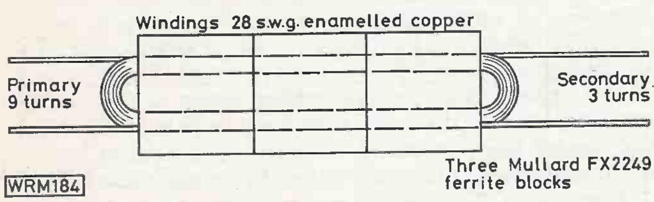


Fig. 5: An r.f. matching transformer suitable for use in the loaded whip aerial system of Fig. 4

Mobile Whip Aerial

For mobile use, the aerial will be very much less than a quarter wavelength long. A whip aerial, such as shown in Fig. 4, must be accurately tuned to resonance by means of the loading coil at its base, or centre. In other words, its impedance must be real.

The real impedance plus losses should be less than 50Ω, and a step-down matching transformer will be required, with a turns ratio N_1:N_2 of 2:1 or 3:1. This transformer can be similar to that used for T1 in the VMOS Transmitter, taking the form shown in Fig. 5.

NEXT MONTH—TOP-LOADED VERTICALS

IC OF THE MONTH
Thomson-CSF TDB0791

▶▶▶continued from page 27

Typical Applications

A d.c. servo amplifier for driving a motor is shown in Fig. 6. The feedback resistor values are chosen to provide a gain of about 10 times. An input of 1V will therefore produce about 10V across the motor at a current of up to 1A, the current again being set by the value of the output resistor. The input voltage can thus be used to control the motor speed.

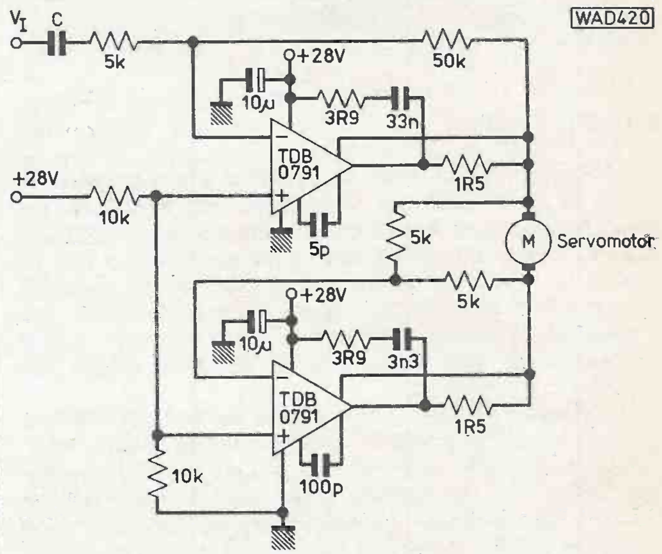


Fig. 7: A circuit for controlling the speed of an a.c. motor from an alternating input voltage

The circuit of Fig. 7 employs a pair of TDB0791 operational amplifiers to drive an a.c. motor, the two amplifiers operating in push-pull. The circuit gain is again about 10 times so that a small input signal can be used to produce a much larger voltage across the motor.

In both of the circuits of Figs. 6 and 7, the input current can be quite small compared with the motor current. A steady input voltage is required for the operation of the Fig. 6 circuit, whereas an alternating input voltage is fed to the Fig. 7 circuit. The value of the input capacitor C in this circuit depends on the alternating frequency of the input voltage and should not have too high an impedance at the frequency concerned.

Availability

The TDB0791-SP is available from Watford Electronics, price £3.50 each plus 30p postage and packing, plus VAT.

HI-FI GLOSSARY

2

Gordon J. KING

As apparent from last month's instalment, although we are running through the alphabet there are bound to occur related items which are not in alphabetical order. These are indexed, as in Part 1, at the conclusion of this instalment.

C

CANTILEVER

This is the part of a pickup cartridge which couples the stylus to the *transducer,* which is usually based on the *electromagnetic* or *piezo-electric* principle. Although fixed at the far end, the stylus end of the cantilever is free to vibrate to follow the modulation pattern in the recorded groove of a gramophone record. These vibrations are coupled through the cantilever to the transducer, which changes them into an equivalent electrical output for coupling to the amplifier.

Top-flight cartridges are designed so that the intrinsic resonances of the cantilever are well tamed. Sadly, resonance modes can and do occur, and they are partly responsible for *"coloration"* and the different quality sounds that different pickup cartridges produce. For example, certain resonance modes can encourage peaks or troughs (sometimes referred to as *"suck-outs"*) along the frequency response. The resonance modes can be vertical, lateral or torsional. A great deal of the craft of hi-fi pickup cartridge design lies in minimising these and other resonances. One or two cartridges, notably the Decca magnetic series, avoid the use of the normal type of cantilever (or *stylus arm*) by arranging for the stylus assembly to pass directly through the magnetic circuit.

CAPSTAN

In essence, this is a very accurately turned spindle which, aided by a *pinch wheel,* transports the magnetic tape of a reel-to-reel or cassette tape machine past the recording/replay and erase heads at a constant speed. Both long- and short-term speed constancy is absolutely essential to avoid *wow and flutter* aberrations. Thus, both the accuracy of the spindle and its speed of rotation are of paramount importance. A large mechanical "flywheel" often forms a part of the capstan spindle to help "iron out" speed irregularities by virtue of its inertia. Some of the more recent (and expensive) machines adopt the electronic equivalent to mechanical inertia, which is basically servo-control on the motor, such that more power is turned on when the load increases and less when the load decreases. Another scheme is based on a phase-lock loop circuit, which compares the angular phase of the capstan against a reference signal, a correction signal then being produced when there is an error which serves to correct the capstan drive motor.

CAPTURE EFFECT

This refers to f.m. reception. Because the information carried by the carrier-wave causes not the amplitude of the wave to vary, but instead its instantaneous frequency (at a rate depending on the frequency of the information (e.g., sound modulation) and by an amount (*deviation*) depending on the intensity (i.e., *depth of modulation*)), any f.m. receiver can be designed so that it is not at all sensitive to amplitude variations of the carrier-wave (a.m.).

This is achieved by the nature of the f.m. detector (a ratio detector, for example, is particularly insensitive to a.m.) and by the application of amplitude limiting in the receiver's intermediate-frequency (i.f.) stages.

Now, when an f.m. receiver is presented with two or more signals of very close frequency, there is a tendency for an a.m. component to be resolved, but because the receiver is essentially insensitive to a.m. there is very little or no interference. What happens is that the strongest signal "captures" the receiver, and it is this one which is heard. The others are pushed well down in the background and are essentially inaudible. This is called the capture effect.

CAPTURE RATIO

The degree of rejection of weaker co-channel signals depends on the design of the f.m. detector and amplitude limiting. Some residual f.m. does occur owing to the presence of more than one signal, but this is small, especially when the f.m. detector has a sufficiently wide bandwidth (up to 1MHz is not uncommon). The efficiency of the capture effect is measured in terms of the capture ratio, which is a dB value indicating how much stronger the wanted signal needs to be than the unwanted one for the interference to be 30dB below full modulation output.

State-of-art f.m. tuners and receivers have a capture ratio of a mere 1dB. To achieve similar rejection at a.m. the wanted signal would need to be many more dB stronger than the unwanted one. The capture effect is one of the biggest attributes of the f.m. system of broadcasting. It also works with respect to the components of noise (which is responsible for background "hiss"). Thus, as soon as the aerial signal is greater than the effective input value of the noise signal, the receiver is captured by the signal and the noise is pushed right into the background, ultimately resulting in a signal/noise (S/N) ratio of 70dB or more, weighted.

CCIR

This is short for *International Radio Consultative Committee* and refers to specified standards of tape equalisation, noise weighting, etc.

HI-FI GLOSSARY

CLASSES OF AMPLIFIER

In hi-fi parlance (and elsewhere) the nature of the *power* amplifier is defined as a particular class, and the four in use are:

Class A

Where the valves or transistors operate on the linear parts of their *transfer (input/output) characteristics*. The devices thus draw a "constant" current from the supply regardless of the amplitude of the signal. This mode of amplification is relatively inefficient and large heat sinks are essential when transistors are used in the power stages.

Class AB

Basically, this type of power amplifier is biased so that low-amplitude signals are handled by the linear parts of the transfer characteristic, while higher level signals are handled on the positive half-cycles by one of the push-pull output pair and on the negative half-cycles by the other of the pair of valves or transistors. Above a certain signal amplitude, therefore, the current drawn by the amplifier increases with increasing signal amplitude, which makes it a little more efficient than class A.

Class B

The standing bias of this class of push-pull power amplifier is such that at zero signal the current drawn is theoretically zero. When signal drive is applied, the positive and negative half-cycles are split so that one half of the push-pull stage is driven on positive half-cycles and the other half on negative half-cycles, the signal being re-formed as a whole at the loudspeaker. Pure class B implies that the standing or *quiescent current* is zero.

In practice, the push-pull stage is always biased for a small quiescent current (bringing it more towards class AB) to avoid the discontinuity effect on the transfer characteristic at low signal levels. Unless this is done, a disturbance called crossover distortion mars the reproduction (see under Crossover Distortion).

Class D

This is a "digital" type of amplification which is based on *pulse width modulation*. The analogue signal is first converted to a digital or pulse format, whose mark/space ratio corresponds to the analogue information. The pulses are then caused to switch on and off the power transistors, and because the average current of the pulse chain passed to the loudspeaker corresponds to the encoded analogue information, it is the original analogue signal which operates the loudspeaker after low-pass filtering required for integration and for ridding the output of the high-frequency pulses.

Because the output transistors are either fully on (bottomed) or fully off (cut-off), the efficiency of this class of power amplification is significantly above that of the other classes.

COMPLIANCES

This term relates to the yielding quality of a material and in hi-fi is commonly used to express the "elasticity" of the suspension of a pickup stylus or loudspeaker cone. Prior to the system of SI units (*Le Systeme International d'Unites,* or International System of Units), it was expressed in cm deflection per dyne of force. Indeed, it is expressed still in this way in many pickup cartridge specifications. A so-called "compliance unit" is equal to 10^{-6}cm/dyne, which means that for each dyne of applied force a stylus suspension of that compliance value would yield one-millionth of a centimetre. This may seem an incredibly small deflection, but it must be remembered that a dyne force is approximately equivalent to the pull of gravity on *one-thousandth* of a gram at 45 degrees latitude and sea level!

Many hi-fi cartridges have a compliance of 35cu or more (e.g., 35×10^{-6}cm/dyne) and would thus deflect that number of times more than the above example. Compliance, then, is the reciprocal of stiffness—the higher the compliance value, the softer the suspension.

In SI units the deflection is given in metres and the force in newton (m/N), and as a newton is equal to 10^5 dyne and a metre to 10^2cm, a "compliance unit" in SI units resolves to 10^{-3}m/N. Some cartridge specifications have now started to use this expression.

A cartridge stylus, of course, cannot be rigid. It must be free to move to follow the groove modulation "wriggles" without applying too much stress to the groove or calling for a large *tracking force.* A side issue is the *low-frequency resonance* of the pickup system which (in Hz) is equal to $\frac{1}{2\pi\sqrt{MC}}$, where C is the compliance of the cartridge in m/N and M the effective mass of the pickup arm in kg. The plan is to arrange these two quantities so that the resonance falls around 10–15Hz. A resonance of lower frequency is in danger of being excited by disc warps and ripples, with a consequent impairment to the tracking. This demands either an arm of very low effective mass or a cartridge of low or moderate compliance.

CLIPPING

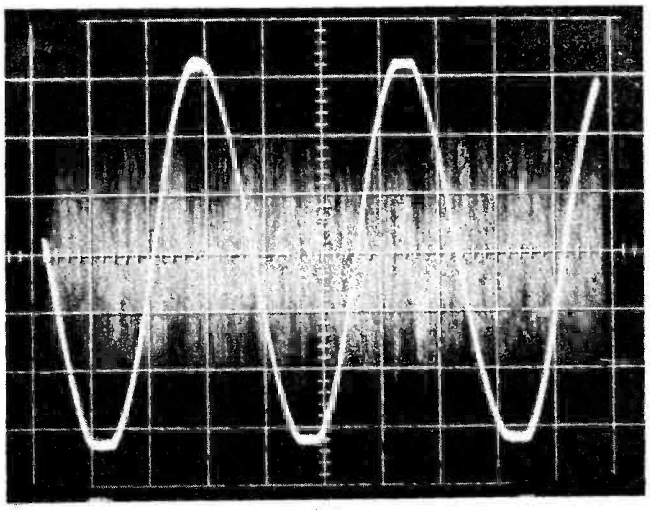
This term is often used to describe a particularly irritating brand of distortion resulting from the peaks of the audio signal being clipped as shown in Fig. 7. This can happen when a low-level or power amplifier is over-driven. That is, when no more output can be obtained by increasing the amplitude of the input signal.

Clipping generates a host of disconcerting harmonic and intermodulation distortion which puts a nasty edge on the reproduction. The trouble often arises when a relatively small power amplifier is driving hard into loudspeakers of low efficiency in an endeavour to raise the in-room sound intensity. The only solution to the problem is to use a more powerful amplifier or loudspeakers of higher efficiency.

CROSSOVER DISTORTION

This type of distortion results from the discontinuity at the crossing point of the transfer characteristics of a push-pull class B power amplifier when there is zero or inadequate quiescent current. Fig. 8 shows the discontinuity and an approximation of the type of distortion.

HI-FI GLOSSARY



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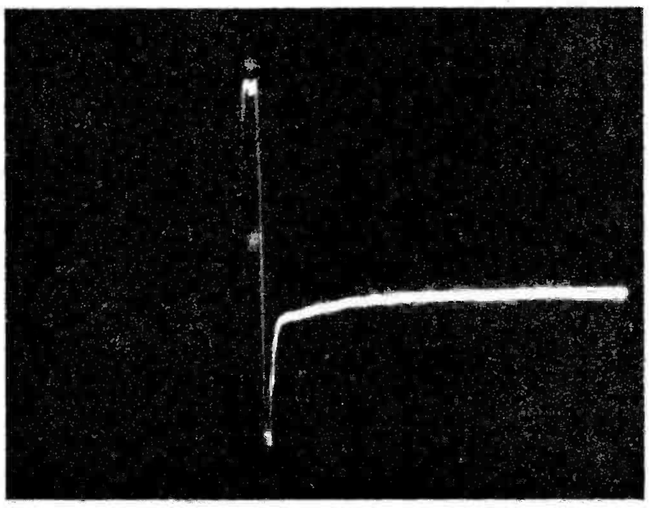

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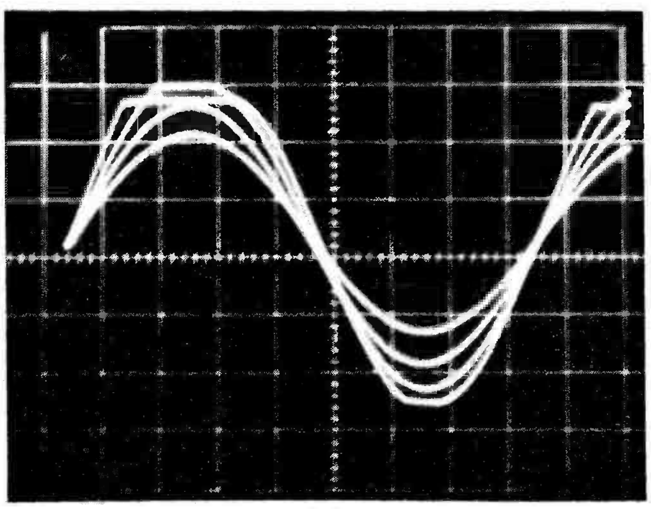

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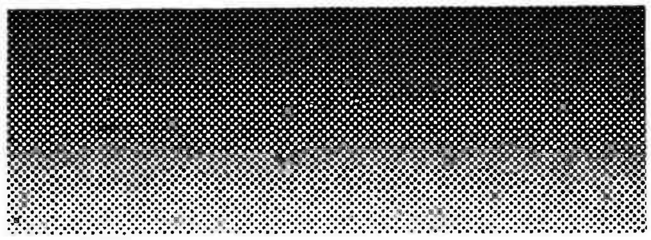
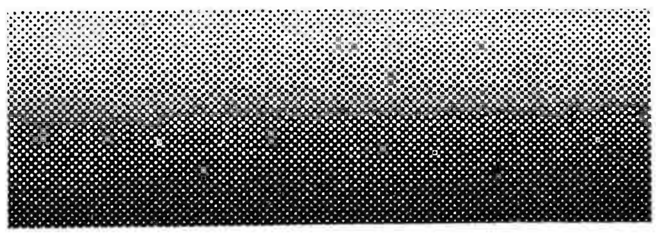


Fig. 7: Examples of peak clipping. (a) Peaks of sine-wave are here clipping at the level indicated while the superimposed noise signal of lower amplitude is free of clipping. (b) Very short-duration transient pulse of output amplitude in excess of the output capacity of a power amplifier, showing peak clipping. (c) Clipping in the pickup preamplifier as the output is increased. The two lower amplitude waves correspond to inputs of 75 and 100mV and are free of clipping, while the two higher amplitude waves correspond to levels of 125 and 150mV showing the onset of serious clipping. Clipping of this nature in the pickup preamplifier cannot usually be cleared by retarding the volume control. The only solution lies in attenuating the input signal if the pickup output is too high for the preamplifier



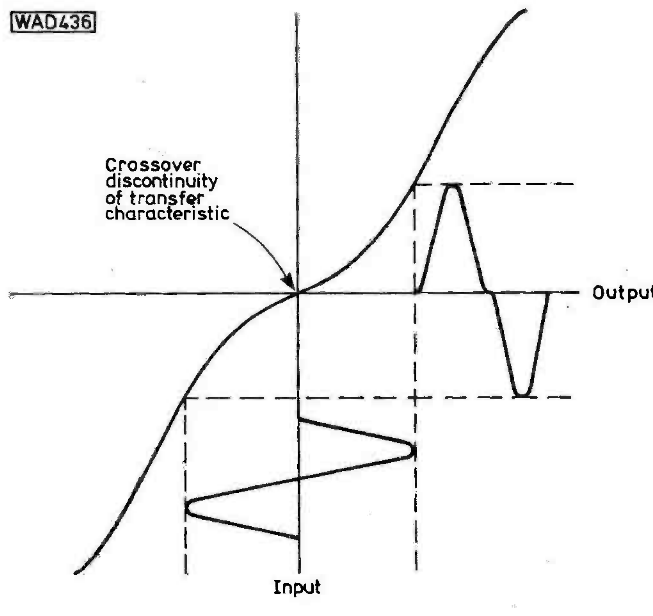


Fig. 8: Transfer characteristic discontinuity which is responsible for crossover distortion of the nature shown

HI-FI GLOSSARY

Distortion from this cause is far more apparent at low rather than high reproducing levels. If you feel that your hi-fi is giving this trouble, listen close to the loudspeaker at very low output for a "grating" type of roughness, which diminishes as the volume is advanced. This can often be cleared by turning on more quiescent current by the internal preset(s) provided for this adjustment. Excessive quiescent current, however, will cause over-heating of the heat sinks and may destroy the output transistors. Transistor portable receivers are particularly prone to the trouble as the battery runs down.

CROSSTALK

The breakthrough of signal from one channel or circuit to another is known as crosstalk. For example, if a hi-fi receiver is switched to tape monitor and in the background can be heard the radio programme, then this is crosstalk between the radio and tape monitor circuits.

Similarly, the effect of breakthrough from one stereo channel to the other (left-to-right and right-to-left) is also crosstalk, though in hi-fi parlance the term *stereo separation* is more commonplace.

Crosstalk is expressed as the dB ratio between the output signal level in the speaking channel and that in the inactive or non-speaking channel. Stereo separation is also expressed in this manner. Crosstalk between circuits in a hi-fi receiver or amplifier should be 50dB or more, maybe falling a little with increasing frequency, while that between stereo channels (stereo separation) should not be much less than 30dB at middle frequencies. Fig. 9 shows the crosstalk over the frequency spectrum between the left and right f.m. stereo channels.

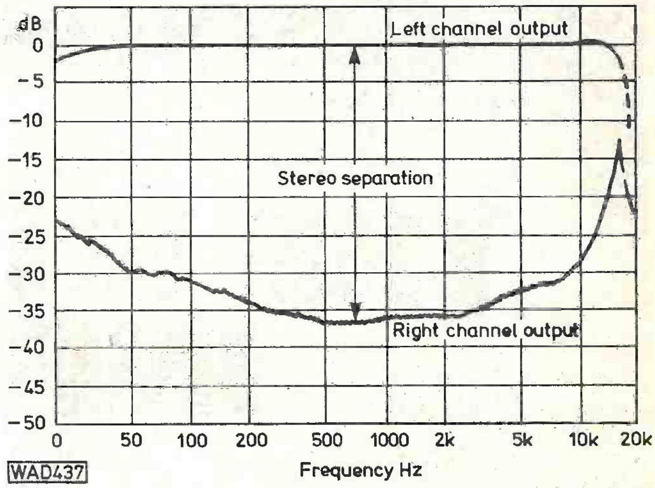


Fig. 9: Crosstalk or stereo separation between the left and right f.m. stereo channels. Note the reduction in ratio with increasing frequency

D

DAMPING FACTOR

Owing to the negative feedback applied to hi-fi power amplifiers to keep the distortion at a very low value, the output source impedance of the amplifier is of a very low value, sometimes less than 0·1 ohm. The damping factor is the ratio of the impedance of the loudspeaker to that of the amplifier source. Hence with a source impedance of 0·1 ohm and a loudspeaker impedance of 8 ohms, the damping factor would be 80.

The connected loudspeaker thus "sees" the low source impedance which tends by electromagnetic means to damp overshoot of the cones following a sharp, short transient. One of the major overshoot problems is with the cone of the bass unit (*woofer*) since its natural low-frequency resonance (a function of the suspension compliance and cone mass—see under Compliance) tends to excite overshoot around the 30 to 60Hz mark. For this reason, therefore, the damping factor should hold at a high ratio at very low frequencies as well as at middle and high frequencies.

Index of Partly Defined Jargon

CCIR
Coloration
Depth of modulation (f.m.)
Deviation (f.m.)
Electromagnetic principle
Low-frequency resonance
Piezo-electric principle
Pinch wheel
Pulse width modulation
Quiescent current
SI Units
Stereo separation
Stylus arm
Suck-out
Tracking force
Transducer
Transfer (input/output) characteristic
Woofer
Wow and flutter

TO BE CONTINUED

THE SUN'S INFLUENCE

Ron HAM

Although our sun has little importance among the millions of stars in the Milky Way galaxy, it is very important to us here on earth, because it provides our light, heat and natural energy. The majority of stars, and our sun is no exception, are nuclear furnaces radiating waves, in varying degrees, across the electromagnetic spectrum. With the advent of the optical telescope in the 15th century, astronomers learnt much more about the stars, our sun and the planets which make up our own solar system.

Radio Astronomy

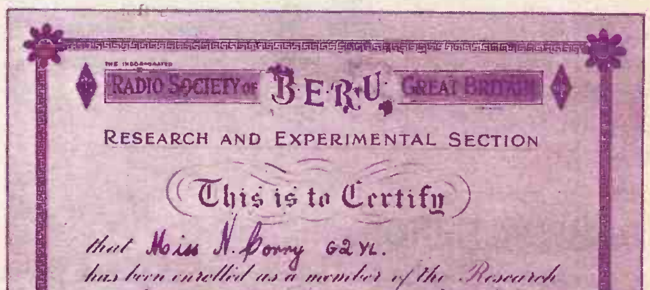
During 1931, American radio engineer Karl Jansky, using specialised apparatus, detected radio noise around 21MHz, coming from the Sagittarius arm of the Milky Way. At first, few people realised the significance of Jansky's discovery. After all, astronomical observations for at least the previous 300 years had been made with an optical telescope. To suggest that invisible waves coming from the stars could be recorded on a paper chart took a fair bit of understanding.

The fact that stars had been emitting radio waves for untold millions of years remained unknown until the art of making radio receivers was about 35 years old. It is generally accepted that radio waves travel at the speed of light, 186 000 miles per second, in other words almost 6 million, million miles in one year, or in astronomical terms, a light-year. For example, radio waves from the Crab nebula, in the constellation of Taurus, take some 3300 years to reach us, whereas radio waves from our sun, a mere 93 million miles away, are received on earth just 8·3 minutes after they are generated.

Radio Telescope

The work of a visual astronomer is limited to the hours of darkness and then the skies must be clear and, unless he is studying the moon, free of moonlight. A radio telescope, however, can record celestial radio waves at any time, unaffected by overcast skies, but its results are sometimes troubled with static from electrical storms and a variety of man-made interferences. Briefly, a simple radio telescope comprises a high-gain directional aerial, securely mounted and pointed toward the source being observed. In some cases an aerial head amplifier is used before the incoming signal is fed to the main receiver, usually a purpose-built superheterodyne, with a d.c. amplifier connected to its detector circuit to drive a pen recorder.

Although certain frequencies are set aside internationally for astronomical observations, a radio astronomer can use any part of the radio frequency spectrum providing that


THE INCORPORATED RADIO SOCIETY OF B.E.R.U. GREAT BRITAIN

RESEARCH AND EXPERIMENTAL SECTION

This is to Certify

that Miss N. Corry G2YL.

has been enrolled as a member of the Research and Experimental Section of the Radio Society of Great Britain.

Signed

Date 2-11-34.

Fig. 1: The special Research and Experimental Section certificate issued to section members by the RSGB

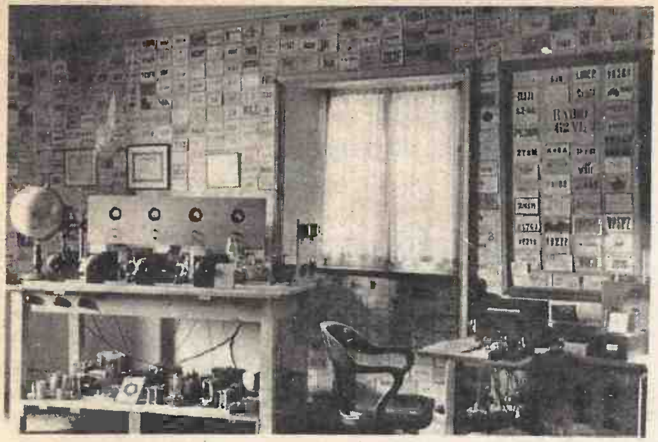


Fig. 2: The 1935 shack of Miss Nell Corry G2YL. All her equipment, including the transmitter on the left, was home-brewed. With this station, she established a world record on 27 October, 1935, by working all continents on 10m in 6 hours and 20 minutes. The log books, QSL cards and Morse key used on this historic occasion are now in the author's collection

it suits his observational requirements and is free of terrestrial transmissions. For an amateur to make a useful contribution in the field of radio astronomy, he would need a very large aerial system with precise settings both in altitude and azimuth, a low-noise, high-gain receiver, and access to a computer, to extract any meaningful information from the data gathered during his observations. The high installation and running costs of a radio observatory prevent the majority of amateurs setting up such a project.

Radio Noise

The noise collected by a radio telescope is very similar to that which is generated within the wiring and components which make up the telescope's receiver. Therefore, it is important that this internal noise level is measured before the aerial is connected, so that the incoming waves are positively identified. When thermionic valves were used, a great deal of noise came from the valve itself and the high electrical currents flowing through its associated components. Much of this problem was overcome when transistors replaced valves, because they are far less noisy and require only a fraction of the current to drive them.

Short-wave Communications

From its birth toward the end of the 19th century, the story of radio has been a fascinating one. Very soon enthusiasts were building receivers, and transmitters, which allowed them to listen to signals travelling around the world, and enabled people from the ends of the earth to converse with each other. We owe a great deal today to those early radio amateurs who pioneered the signal paths around the earth, often when contemporary thinking said it was impossible.

Between the two world wars, great strides were made in opening up the short-wave bands for both communications and broadcasting. This work was exciting because there was much to learn about echoing and rough signals, fading, sudden ionospheric disturbances and sometimes complete and extensive radio blackouts. Scientists were aware then that the complex rays from the sun caused changes in the ionosphere which, of course, explained why short-wave signal paths via the ionosphere varied between day and night.

The Research and Experimental Section

The Radio Society of Great Britain, founded in 1913, has always encouraged its members to send reports of their findings to the Society for publication, and in the 1930s they set up a Research and Experimental Section, Fig. 1, which had separate groups and its own columns in the RSGB's monthly journal, the *T & R Bulletin*.

In January 1936, Miss Nell Corry G2YL, became author of the "28 Mc/s Group" report, which she compiled each month from her own 10m work and from information she received from amateurs and short-wave listeners around the world.

Fortunately for posterity, Nell was a very methodical individual and kept daily records of the 28MHz information she received, until early 1940, in a set of four diaries which have survived the passage of time and are now in the author's collection. Analysis of these diaries revealed that over the 4-year period 1936-1939, aurora was reported on 53 days, echoing on signals on 26 days, fadeouts on 140 days and a "hissing" noise on 107 days.

Solar Radio Noise

It was this "hissing" noise that was the important revelation, and further investigation by the author showed that during 1935, Denis Heightman G6DH, a member of the Research and Experimental Section, heard this strange "hissing" sound above the background noise of his 10m receiver. Denis, an experienced wireless operator, consistently noted that the "hissing" occurred only during daylight hours, and usually preceded a radio disturbance. Very soon he rightly concluded that the "hissing" noise was

The T. & R. Bulletin.

The " Hiss " Phenomenon.

A strange phenomenon, first observed by the writer in late 1935, was the appearance, at irregular times, of a radiation which took the form of a smooth hissing sound, when listened to on a receiver. It was pointed out by G2YL that on the days when hiss was heard that there had frequently been fade-outs or poor conditions on the high frequencies. G2GD has also noted that when the hiss has been received magnetic storms are also reported. On one day the hiss may only last for a few seconds and not be heard again that day. On other occasions it will last as long as five minutes, then disappear and reappear again within a few minutes, repeating the process several times. It invariably starts at a weak strength and gradually builds up to a maximum, then gradually fades away again. The phenomenon apparently originates on the sun, since it has only been heard during daylight, and it has been suggested that it is caused by a stream of particles shot off from the sun during abnormal activity.

May. 1937

Fig. 3: The final paragraph of Denis Heightman's article in the May 1937 edition of the *T & R Bulletin*

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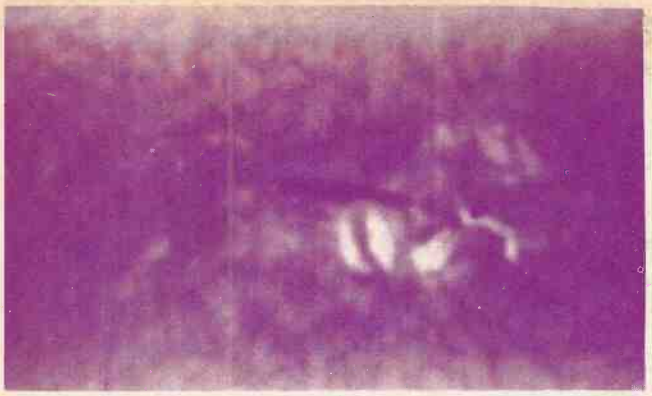

Fig. 4: Flares occurring around a sunspot group, photographed by Cmdr Henry Hatfield with his spectrohelioscope on 28 May, 1978

coming from the sun, and in 1936 he reported his findings to the Editor of *Wireless World* and Professor (later Sir) Edward Appleton. Later, he outlined his observations in a comprehensive article published in the RSGB's *T & R Bulletin*, Fig. 3.

From Nell Corry's diaries and her journal reports, the author found that some 24 other radio amateurs and short wave listeners had heard the "hissing" noise and furthermore it was not limited to 28MHz, because, at midday on 31 July, 1938, Miss Barbara Dunn G6YL heard the hissing noise in the 5m band, confirmed by 2BIL, and Denis Heightman heard it again at 56MHz on 25 June, 1939.

Although amateur radio activity was suspended at the outbreak of war on 3 September, 1939, a few carried on listening, and the "hissing" was heard again during February, March and November, 1940 and March, June and July, 1941. The next known report about solar noise came in February 1942 when British radar receivers, working between 60 and 80MHz, suffered severe interference which contemporary scientists attributed to a large group of sunspots. Also in 1942, American scientists discovered radio noise in the microwave part of the spectrum coming from what is called the "quiet" sun.

Since the war, many radio observatories have studied the sun at a variety of radio frequencies, and it is now known that when sunspots are present (Fig. 4) the sun is said to be "active". Then, depending on the type of activity, solar radio noise will be heard, at varying degrees, between 30 and 300MHz with a peak in the 130-170MHz range.

Practical Observation

During the mid-1930s, several astronomers gave the 28MHz propagation group information about the sun, derived from their visual observations. With the discovery of the "hissing" noise in 1935, group members showed that they could observe the sun by radio, which was unaffected by overcast skies. The pre-war journals described Heightman's discovery as "The 'Hissing' phenomenon", which we often hear today in the 2m band when the sun is "active".

Through years of concentrated effort by both optical and radio astronomers, we now know that when great eruptions occur on the sun, vast amounts of nuclear waste are ejected, along with streams of particles. These may strike the earth's atmosphere some 20-40 hours later, disturbing the ionosphere and h.f. communications, or causing an aurora to manifest, with consequent risk of disruption to our v.h.f. signals. Radio provides an early warning of these events, because, when a solar eruption takes place, it emits radio waves which arrive here in 8·3 minutes, sounding like a "whoooooosh", or hissing, above the receiver background noise.

The Spectrohelioscope

Some years ago, Cmdr Henry Hatfield, Sevenoaks, built a complex optical instrument called a spectrohelioscope, Fig. 5 (see page 934, *PW* April 1978), to study the sun's surface. Henry uses this instrument, when the skies are clear, in conjunction with his 136 and 1296MHz radio telescopes and can often see the active area, such as a flare or filament, within a sunspot group (see page 65, *PW* May, 1978), which is causing the prevailing radio noise.

Some Spectacular Events

In July 1974, I had an 8-element Yagi directed towards the sun and feeding a 136MHz receiver, another system with a 3-element beam facing north-east on 70MHz, a vertical dipole connected to a set monitoring the R1 TV channel, 49·75MHz, and a long wire aerial feeding the 10m beacon monitor. Suddenly, one morning, a massive solar flare occurred and I heard the noise sweep across the frequencies and get stronger. Being inquisitive, I used the h.f. receiver to follow the noise, and found that it overpowered all signals down to 8MHz for about six minutes and then gradually faded away back up to 136MHz.

Early in August 1972, the static discharges from a local thunderstorm were frequently causing large spikes to be drawn on the chart of my radio telescope. Then, suddenly, a large burst of radio noise from the sun, 93 million miles

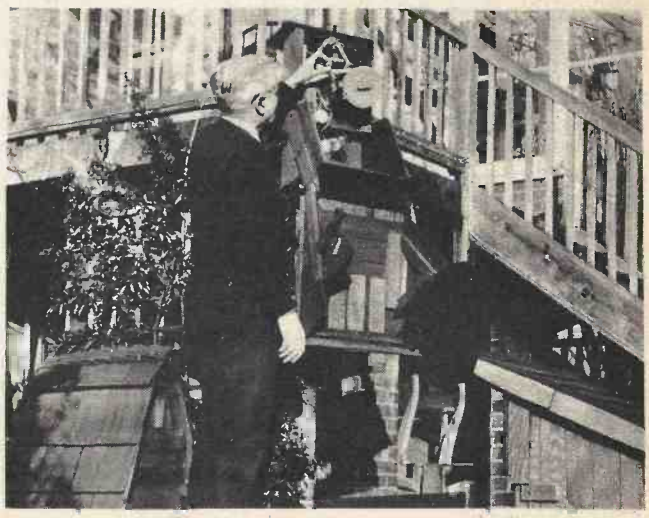

Fig. 5: Cmdr Hatfield adjusting the mirror of his spectrohelioscope which gathers the sun's light and transmits it to a second mirror housed in the building at bottom right. It then passes through an electrically-adjusted lens under the shingle cover (bottom left) to more complicated equipment in his observatory

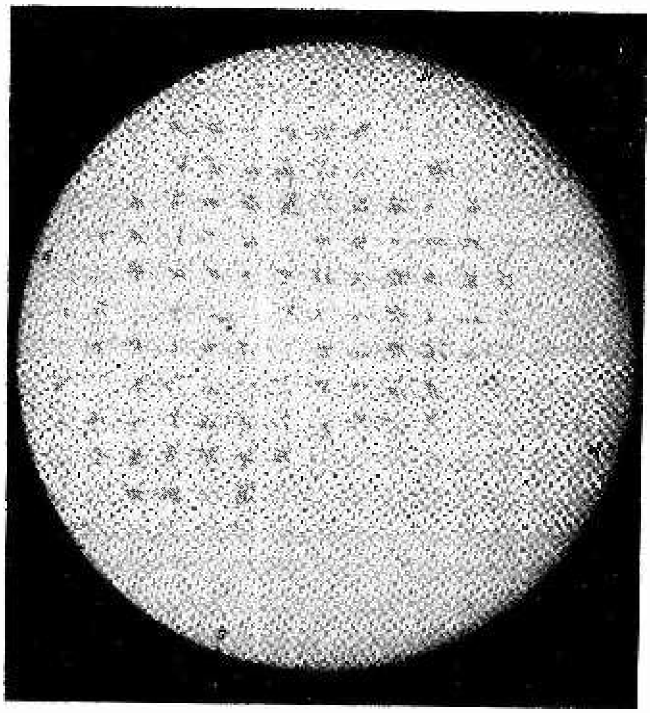

Fig. 6: Two groups of sunspots photographed by Cmdr Henry Hatfield on 7 August, 1975

away, overpowered the local static from 90 to 200MHz, for some eight minutes. This massive burst was the forerunner of a very big solar storm which occurred two days later, upsetting the ionosphere and creating one of the most extensive auroras for many years, visible as far south as Spain. The effect on v.h.f. was amazing; one amateur told me: "It was like an umbrella, Tone-A signals were coming from all directions."

Although sunspots (Fig. 6) are stationary, they appear to travel across the sun's disc due to its 27-day rotational period.This makes it possible for a very large sunspot group to re-appear for a second and third time, and it's not uncommon for a sunspot to be active when it appears on the east limb and remain so until it turns the corner on the western limb, some 13 days later. A typical example of this was the solar event which began with a few small bursts of radio noise on 6 September, 1974, developed into a severe radio noise storm lasting several days, and ended on the 19th. During the event there were many individual bursts lasting from 1 to 16 minutes, covering from 50-150MHz. All this resulted in an extensive aurora on the 15th and frequent reports by the BBC World Service about ionospheric disturbances affecting their long-distance signal paths.

The Unexpected

Patience is a dominating factor in solar observation. Many days, and sometimes weeks, can pass by with nothing more than a receiver noise trace on the recording chart. Then, suddenly, there it is—solar noise, and you have the first warning of an aurora or ionospheric disturbance which means DX by Tone-A for the v.h.f. enthusiast, and (most likely) dead bands for the h.f. operator.

Whatever happens, it is important that we amateurs record our observations for posterity just as methodically as our predecessors did, more than forty years ago.

Speech Processing in Amateur Transmitters

▶▶▶ *continued from page 23*

splatter and might have reduced the television interference potential of the transmitter.

RF Clipping

In 1970, at the International Broadcasting Convention, Messrs Herrick and Fallis of Radio Liberty described a speech clipper for broadcast use based on the principle of clipping at r.f. rather than a.f. The signal was then converted back to audio and fed to the modulator of the broadcast transmitter in the normal manner. The block diagram of the Radio Liberty clipper is shown in Fig. 7.

The operating principle is that the signal is first frequency tailored to the required speech bandwidth and amplified before being converted to r.f. in a balanced modulator. The resultant double-sideband signal is then passed through an upper-sideband filter and into an r.f. clipper, a low-pass filter is used to remove r.f. harmonics before reconverting the signal to audio again in a balanced modulator. Another a.f. filter is then used and the signal further amplified to increase the signal-to-noise ratio before going into the main transmitter. Clipping levels up to 12dB were used with an overall distortion of less than one per cent.

This type of system has the merit that it can be used with any transmission mode, and is ideal for the user of commercial equipment as no modifications are necessary to the transmitter, because the unit plugs directly into the microphone socket. It must be pointed out though, that amplitude limiting raises the mean power level of a.m. and sideband transmitters, and this puts extra requirements on the power amplifier h.t. supply, and additional supply smoothing might be needed. Commercial r.f. speech processors of this type are available to us, with the Comdel CSP11 and Datong types as classic examples.

K6JYO Clipper

A circuit diagram by K6JYO appears in *Amateur Radio Techniques* as an add-on unit for the Collins S-Line transmitter. Only part of the full circuit is shown here (Fig. 8), but the r.f. clipper can be seen to be straightforward and has the advantage that the clipping level can be adjusted for operator needs. This circuit follows the sideband filter, and feeds into a second sideband filter to remove harmonics before conversion to the required amateur band in the normal manner.

Full Speech-Processed Sideband Generator

For optimum r.f. clipping, it is best if the audio dynamic range has already been reduced so that the r.f. clipping level is never excessive. An arrangement which gives the required result is the SL630/SL620 compressor feeding a balanced modulator and sideband filter. This is then followed by an r.f. clipper and second filter. The resultant signal can be converted direct to the required band with a double-balanced mixer and local oscillator. The transmitted signal will be at an almost constant amplitude, and will maintain readability at very low received signal strength.

A block diagram of the transmitter is shown in Fig. 9 and will be the subject of a constructional article in due course.

HOTLINES

A REVIEW OF RECENT DEVELOPMENTS

In general, the author does not have any more information on products than appears in the article.

Solid Valves

Remember valves? How about tetrodes? Well a German company has launched a solid state m.o.s. tetrode and although it looks like many other semiconductors it can work efficiently up to 1000MHz. The market is seen as a replacement/substitute for bipolar devices in u.h.f. tuners. It is claimed to offer improved large-signal characteristics compared to the bipolar transistor, an advantage which reduces cross-modulation problems. The magic number to look for is BF960. It has an 18dB power gain, while noise at 800MHz is typically 2·8dB. Doubtless some of the v.h.f./u.h.f. Ham fraternity will be interested; seems a pity to waste such an excellent device on TV tuners!

Neutrinocomms

Talking of Hams leads me to think of Citizens' Bands and radio communications generally. It also leads me to a morsel of fascinating news. How about a radio communications system that is unstoppable? Like you can't jam it, or interfere with it, nor do anything at all to it. Perfect reception in any conditions, day or night and in spite of what those damn sunspots are up to. Gather round children, there is just such a system. The only way to prevent communications using this new method is to demolish the transmitter or the receiver.

The difference about this system is that it doesn't send its signals around the earth's surface by reflection from layers in the upper atmosphere. Nor from dishes, microwave links or anything like that. This system simply fires its signals straight through the earth itself, from one side (transmitter) to the other side (wherever the receiver is). It's all made possible by little beasties called neutrinos.

The neutrino is reckoned to be an electrically neutral sub-atomic particle which, say the boffins, has zero mass at rest. Apparently the laws of momentum and energy conservation wouldn't work out properly in theory. So someone "invented" or postulated the neutrino and so the theory was satisfied. Then someone found one of the darned things. The idea in communications is to fire these poor neutrinos at such enormous velocities that they simply whizz straight through the earth itself and out the other side where they are detected. To use them for communications, one modulates the neutrino beam. Before any Hams who have already secured two or three £1000 stations and are looking to buy something different, I should add that the sort of equipment needed to get neutrinos going at the speeds required are things like atom smashing machines, proton accelerators, etc. Need I add that it is the Military who are examining the scheme so far. One use is for super-reliable contact with submarines no matter where they are. You cannot "receive" neutrinos, you can only detect them when they strike neutrons or protons in water. The latest information is that the experts reckon to try an atom smashing machine that has a 400 billion electronvolt capability. I suppose if they kept shoving that sort of power through the same piece of the earth, they might eventually bore a hole. Then they could poke a long telephone wire through and have a direct line.

Displays

Light-emitting diodes, bargraphs and 5 × 7 arrays have been with us for some time now, but I was pleased to see that one company has an old product but in a very new package, and this could prove quite useful. They've made a range of 5 × 7 l.e.d. arrays and these are available in red, yellow, orange or green. The nice thing about them is that they are so packaged that you can butt up the arrays in both horizontal and vertical directions to form larger and larger arrays. While the length/breadth construction allows this, underneath, the devices have a "standard" 0·1in pitch d.i.l. spacing of the connecting pins and so they can be plugged in directly to d.i.l. sockets or p.c.b.s without any problems. Some 2mA will drive the l.e.d.s although they are rather dim, and 10mA is a more normal drive current. One might envisage stacking these units together to form a large, flat cathode ray tube to give rough patterns for certain types of measurements. Or for displays in newscaster type readouts. Before you reach for your purse to get some (as I did) the company is mumbling things about only being $5·75 in lots of 1000.

Sunshine

It seems that some companies in the US have really taken the energy crisis seriously. I hear of one such outfit that's making solar cells and disguising them as roofing shingles. A batch of 52 were made up and sent to the Jet Propulsion Laboratory in Pasadena for testing. A spokesman is on record as claiming that just 19 silicon solar cells were carefully bonded to each of the 52 "shingles". The results to date indicate a power of 98 watts per square metre. One or two nice figures have also been bandied about in connection with this exercise. One is that, hopefully, the solar power costs will sink to about $1 per watt by the year 1985—not too long ahead. Less than 2000 of these "shingles" would, in theory, supply the average South Western US home with 90 per cent of its electricity—free. Definitely a shining example in conservation, but there's more to come.

Bubbles

I've actually seen one; well, a photograph, anyway. Your actual bubble memory—and very impressive it is, too. This harmless looking device is housed in a 20-pin dual-in-line package and seems to be a rather broad i.c. The package size is just 30 × 30mm and it's a 0·25 million bit memory. This is important because a strong possibility for bubble memories, if they can achieve a large enough storage capacity, is to replace disks in computer memory systems. The bubble memory has the enormous advantage that there are no moving parts. Rumours continue to circulate that the mighty IBM is currently developing a 4 million bit bubble memory device. Taking things a stage further, perhaps plug-in bubble memories will be used instead of cassettes for things like audio and/or video recording.

Ginsberg

MW/LW LOOP AERIALS

Charles MOLLOY G8BUS

It has been said that more broadcasting takes place on the medium waves than on all of the short wave bands put together. There are literally thousands of stations throughout the world operating on frequencies between 535kHz and 1605kHz. The latest counts reveal over 4000 in the United States alone! Inevitably this means frequency sharing, with many simultaneous broadcasts on a single channel, and the problem confronting the m.w. DXer is; how do I deal with co-channel interference?

The receiver cannot do it. Selectivity is the ability to select stations that are on different frequencies, so the problem does seem insoluble. Often it is. If, however, two stations on the same frequency lie in different directions from the DXer's QTH, it ought to be possible to separate them with a directional aerial. The internal ferrite rod aerial used in portable receivers is directional. Tune round the medium waves after dark until you come across two stations jumbled up together. Rotate the receiver about its vertical axis and you may find that you can listen to one station on its own with the receiver in one position and to the other station alone, with the receiver in another position. It is quite a fascinating exercise; anyone interested in "local radio" DXing should try it.

A ferrite rod aerial does not pick up enough signal to satisfy the m.w. DXer, so the m.w. loop has been developed (Fig. 1). It has a pick-up somewhere between that of a long wire and a ferrite rod aerial.

How does it Work?

Imagine a single-turn loop placed vertically so that its plane is broadside-on to an incoming signal. The wavefront will strike both vertical wires simultaneously, and equal, in-phase voltages will be induced in them, i.e. when the top of one vertical wire is positive then the top of the other will also be positive (Fig. 2). These two voltages are in opposition! Trace the path round the loop and you will find – + + –, so the net voltage applied to a receiver would be zero. This is the position of minimum pick-up, the null.

Now turn the loop through 90 degrees, so that the two vertical wires are in-line with the transmitter. The wavefront will strike the nearer of the two verticals before it reaches the second. There will be a phase difference; unequal voltages (at any instant) will appear across the two verticals and the difference between them is signal available to be applied to the receiver. This is the position of maximum pick-up.

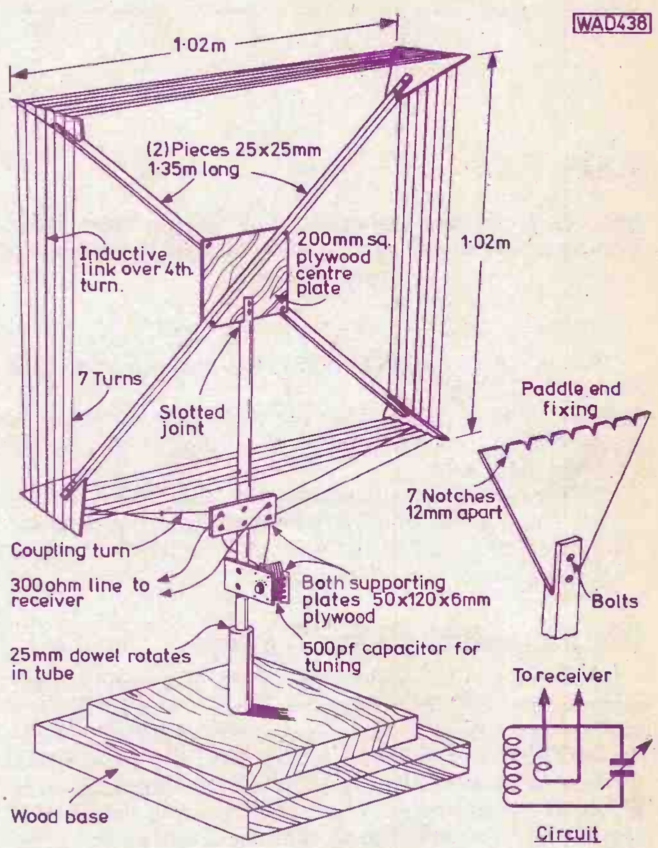

Fig. 1: Constructional details of the standard "40 inch" box loop for medium wave use, with corresponding theoretical circuit

A loop follows a cosine law. $V = V_{max} \cos \theta$ where θ = the angle between the direction of maximum pick-up and the direction the loop is actually pointing. V equals the signal pick-up from that direction. It is easy to plot a curve called a figure-of-eight (Fig. 3) using this formula. The loop is at the centre of the figure-of-eight and the distance from it to the curve is proportional to the signal pick-up in that direction.

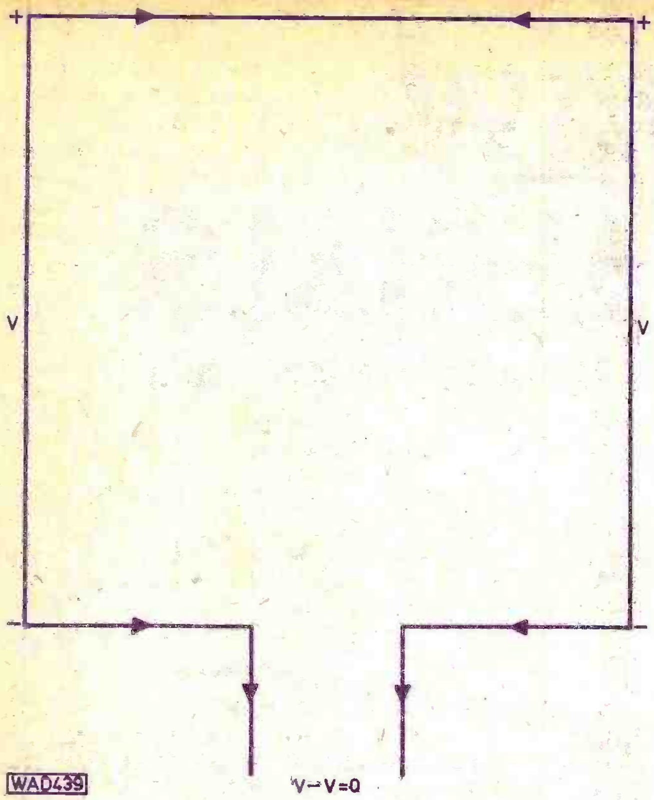

Fig. 2: Voltages induced in a single-turn loop, broadside-on to the transmitter, cancel to produce a null output

From this figure-of-eight polar diagram, two important features of a loop emerge:

a) The null is sharp while the maximum is broad. A loop is used to null-out QRM. It is the null that matters, not the maximum.

b) There are two nulls spaced 180 degrees apart. The loop will not null-out QRM coming from the opposite direction to the DX. It will null-out both of them together, which is not very helpful.

The Standard "40 inch" Loop

DXers in the UK have, after a lot of experimenting, produced the "40 inch" box loop shown in Fig. 1. It is a compromise between convenience and electrical performance. There are **two** windings. The main winding consists of seven turns, the two ends going to the tuning capacitor to form a tuned circuit. The second winding, which is a single turn, is wound next to the centre turn of the main winding and it picks up signal from the main winding by induction. This signal is then led off to the receiver.

The wire used for both windings is 22 s.w.g. single-conductor, plastic-covered copper wire known as hook-up or connecting wire and approximately 34m of it is required. It is desirable to use balanced feeder to connect the coupling winding to the receiver. My preference is for 300 ohm flat twin feeder, but plastic-covered lighting flex will do instead. The feeder is connected to the dipole (A, A1) terminals at the receiver, or to the Aerial and Earth sockets if there is no dipole input. The feeder goes direct to the receiver and **NOT** via an aerial tuning unit (a.t.u.).

A loop is easy to use. Tune the receiver to the wanted station. Peak it up with the loop tuning control. Rotate the loop until you get the best results. A loop can be used to reduce static (atmospherics) if it is coming from a single direction e.g. from the south during the summer. Rotate the loop until the static is reduced or it disappears. Similarly with sideband splatter. Peak the loop onto the desired station and rotate the loop until the splatter is reduced. Overloading in the early stages of a receiver is often prevented when a loop is used, giving rise to the unlikely but accurate claim that a loop will sometimes improve audio quality.

Problems with Loops

A number of *PW* readers have highlighted problems encountered while building or using a loop. The most usual is that the loop will not tune across the entire band. For example, it may only cover 540kHz to 1450kHz. If so, then you will have to reduce the number of turns, so remove one complete turn. If you remove only part of a turn you will affect the null. The loop, which now has six turns, may cover 600kHz to 1650kHz. You need more capacitance. Try a 220pF fixed capacitor in parallel with the tuning capacitor, but you will have to fit a switch and cover the band in two steps Fig. 4. The number of turns affects the h.f. end of the range. If the loop tunes too high then more turns are needed. If it does not tune high enough in frequency then fewer turns are needed. The capacitance affects the l.f. end. Too low a frequency, too much capacitance. Not low enough, too little. Adjust the h.f. end first and then the l.f. end.

It is not always possible to obtain a 500pF variable capacitor so use the nearest value you can get hold of. A twin-gang 330pF (per section) with the two sections in parallel i.e. both sets of moving vanes joined together and also the two sets of fixed joined to each other, gives a total of 660pF which should cover the band easily. Similarly, a 330pF variable with a 220pF fixed in parallel via a switch, will cover the band in two steps.

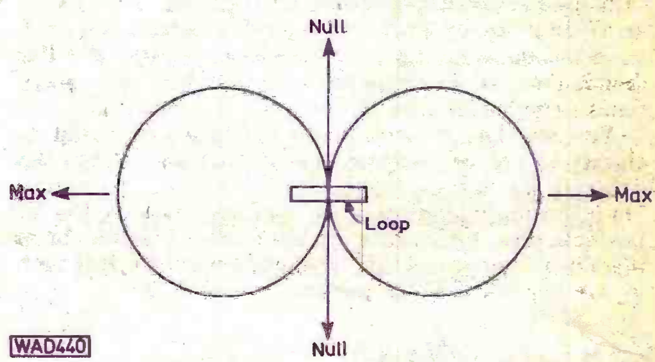

Fig. 3: The "figure-of-eight" polar response pattern of a loop aerial

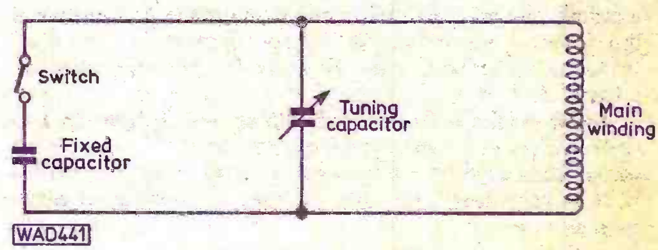

Fig. 4: Adding a switchable fixed capacitor allows a wider band to be covered in two ranges

What Type of Wire?

The type of wire for the windings is determined mainly by its mechanical properties. If the wire is too thin then it will break easily. If it is stranded then it may not be rigid enough.Too thick and a lot of force is needed to tension it. If it is made of steel it will be too springy (I have tried it with plastic-covered garden wire). Use the wire specified if you can get it. If not, use what is available.

Feeder

Some DXers use coaxial cable to join the loop to the receiver, which is a pity. You do not want the feeder to act as an aerial and pick up the station that is being nulled out by the loop. With balanced feeder the signal picked up by each of the two wires will be equal in value and will pass through the receiver in opposite directions (from A to A1 and from A1 to A). Since they are equal they will cancel out and the nett pick-up will be zero. When using coaxial cable, which is unbalanced, the screen will pick up more than the inner wire because the latter is screened. This may not matter too much if the receiver does not have a balanced input, but where dipole terminals are available, use balanced feeder.

Size

One of the most frequent questions is: "Can I use a different size loop?"

Yes you can. The pick-up of a loop depends on two factors: the number of turns and the area enclosed by them. As the turns are in series, the voltage developed across each will add up, so clearly the more turns the greater the pick up. You can compare two loops by using the formula At (A times t). The "40 inch" loop with 7 turns gives $A = 1{\cdot}04m^2$ and $t = 7$ so $At = 7{\cdot}28$. A "20 inch" loop with 13 turns gives $A = 0{\cdot}26m^2$ and $t = 13$ so in this case $At = 3{\cdot}38$. The "40 inch" has more than double the pick-up of the "20 inch"; $7{\cdot}28 \div 3{\cdot}38 = 2{\cdot}15$ times, to be exact.

You will find that large loops pick up more but are clumsy to use. Small loops are more convenient but they deliver a lot less. The "40 inch" is a good compromise, but if it is too large then try a "20 inch". Reader Bob Bell has developed a "20 inch" box loop with 13 turns for the main winding and a single turn for the coupler. It is tuned in two ranges with a total capacitance of 750pF.

Shape

Any shape that is symmetrical will do—round, rectangular, diamond or even triangular. A triangle with a short base and a high apex is used by some DXers in the United States, where it is known as the Wedge or Delta loop. The diamond is used by a few enthusiasts and where the main winding has all the turns in the same plane it is known as the Spiral Loop, which is the type I use (Fig. 5). Each turn is of a different size of course. In theory you will get a better null if the turns are all in the same plane, compared with the box winding used in the standard loop. In fact, the effect is very small with the standard loop, but it can be significant with loops that have a large number of turns.

It is very easy to knock up a spiral loop. Two pieces of wood, some tacks to hold the windings in place, 31m of wire, a tuning capacitor and there you are. It is a lot more difficult to make a good job of a spiral loop and I would hesitate before making another one.

Long Wave Loop

You can get a m.w. loop to work on the long waves by inserting a loading inductor in series with the main winding. I use a Repanco High Q Choke type CH1 which has an inductance of 2·5mH but any value between 2·5mH and 5mH will do. Unsolder one of the loop wires from the tuning capacitor and join it to one side of the inductor. Join the other side of the inductor to the vacated tag on the tuning capacitor.

Alternatively, you can extend the range of a loop by adding parallel fixed capacitance across the tuning capacitor, but the values required are so large (2200pF to reach 300kHz and 7000pF for 150kHz) that the tuning capacitor no longer functions. This will not matter, though, if you only want to listen to a single station, and this method is employed by Arthur Tate in the Shetlands, who endeavours to get better reception on 200kHz this way.

If you want to wind a special long wave loop then approx. $3\frac{1}{2}$ times the number of turns (25–28 for a "40 inch") are needed, but this loop will pick up $3\frac{1}{2}$ times the signal of a m.w. loop with loading coil, which may justify the effort in building it.

Tilting

This is not a medieval past-time! It is a method of increasing the depth of the null when the wavefront is twisted or rotated. It is popular with DXers in the United States, who have a lot of locally-produced QRM to deal with. When a station is being nulled out, the loop will be broadside-on to the incoming signal. If you pick up the loop and tilt it towards, or away from the station, at the same time holding the null position, you may get a deeper

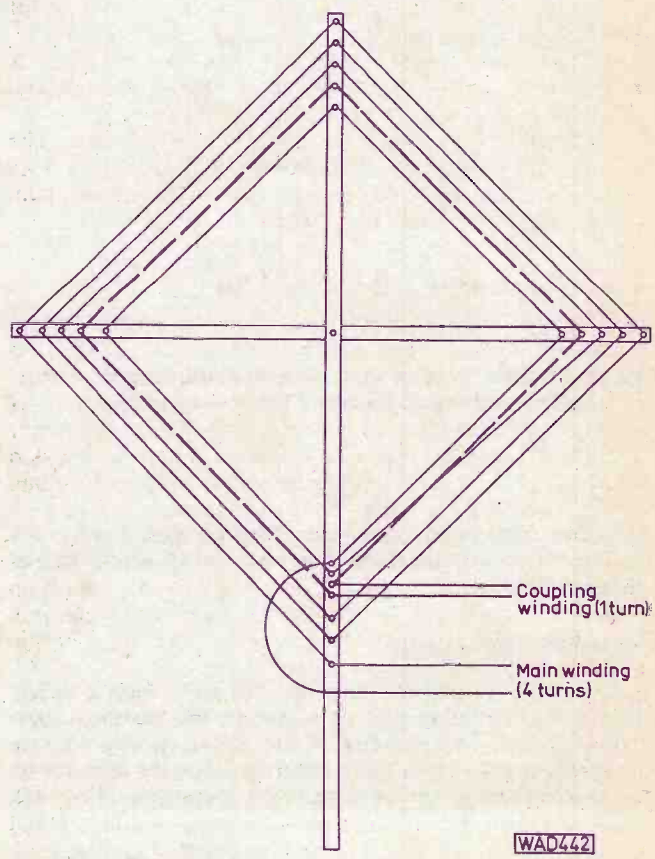

Fig. 5: Arrangement of a spiral loop

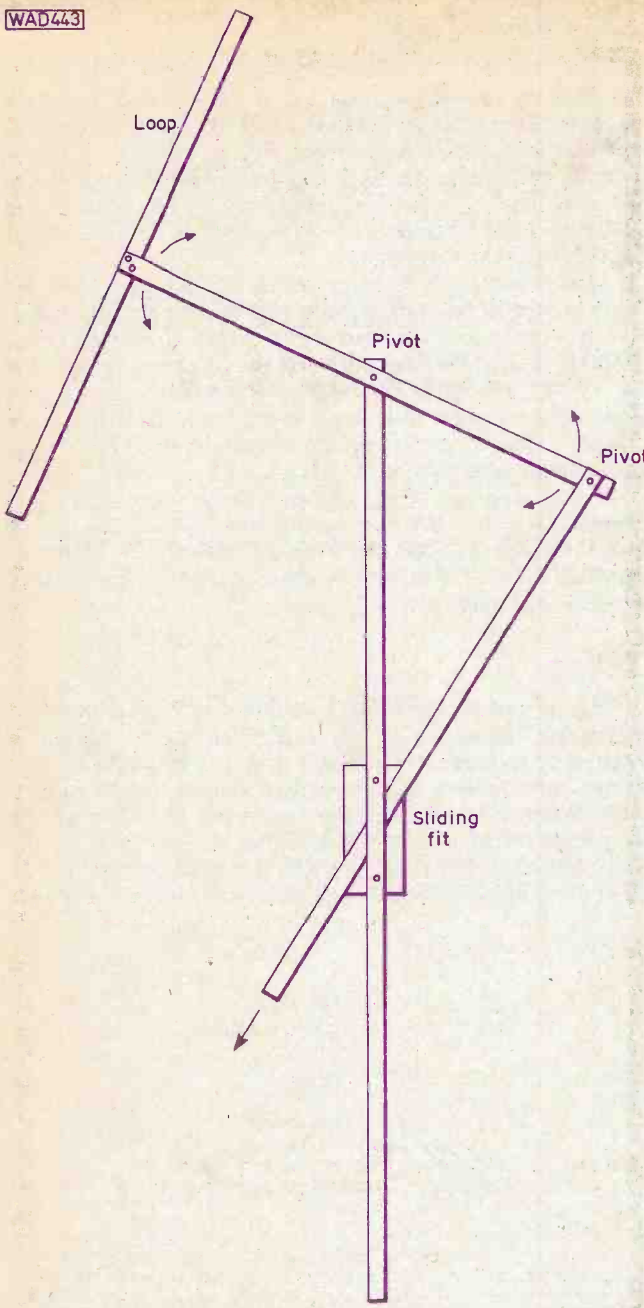

Fig. 6: Details of a simple wooden mounting which allows a loop to be tilted from the vertical

null. You can modify a normal loop so that there is no need to lift it off the floor. One method of doing this is shown in Fig. 6.

Coupling Winding

The single turn on the standard "40 inch" loop is called the coupling winding and its existence has puzzled quite a few readers. This winding is not joined in any way to the main winding. It is quite separate since the transfer of signal from the main winding is by induction. Why use a coupling winding? If you joined the main winding direct to the receiver then the loop would be damped and detuned by it. The two are in effect a 7 : 1 step down transformer which provides a better match.

Portable Receivers

Many DXers try to use a loop with a portable, forgetting that the receiver already has an aerial of its own. No null, is the result. If the loop nulls out a station then that station is still picked up by the internal aerial. You could of course rotate the portable as well as the loop and null out the QRM with both aerials, but in practice this would be very difficult to do. The solution of course, is to mount the receiver on a shelf near the centre of the loop so that the two nulls co-incide and loop and receiver can be rotated together. This arrangement really does work.

There is no need to connect the loop to the receiver, as inductive coupling will take place between loop and internal ferrite rod aerial. In fact if you build a loop solely for use with a portable you need not bother with a coupling winding at all. It is easy to check if the receiver has an internal aerial. If it can pick up stations on the medium waves without an external aerial, then obviously there must be an internal one.

The better type of portable receiver performs really well on the short waves but the pick up via the internal aerial is not great enough for serious DXing on the medium waves. This method of using a loop with a portable is really the only way that such a receiver will "deliver the goods" on the medium waves. DXers seriously interested in the medium waves should turn away from portables, even those with the title "communications" and look for a receiver such as the DX160, SRX-30, FRG-7, Trio 9R59-D/E, CR100 or AR88 which really are communications receivers. Be careful with the DX160. Some versions have a ferrite rod aerial attached externally to the rear which must be disconnected before a m.w. loop can be used.

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DFM module

In response to requests for received frequency displays for portable operation, Ambit have introduced the DFM3. This incorporates a 5-digit l.c.d., giving direct frequency display over the following ranges: l.w./m.w., with 100Hz resolution for the marine d.f. channels; l.w./s.w., with 1kHz resolution for up to 39·999MHz; v.h.f., with 10kHz resolution up to 200MHz typically (limited by prescaler-theoretical maximum is 399·99MHz); direct reading the above range without i.f. offset. The i.f. offsets include all standards around 450—470kHz for a.m., plus 2MHz and 10·7MHz for s.w. in addition to the 450–470kHz ranges, v.h.f. offsets are based around 10·7MHz.

The unit is supplied for panel mounting as a double deck system, with the rear section being devoted to input shaping and prescaler operations. The front section carrying the main i.c. and display, can be used independently in the a.m. mode only, providing facilities for portable d.f. receivers where the low current drain of 4mA is essential.

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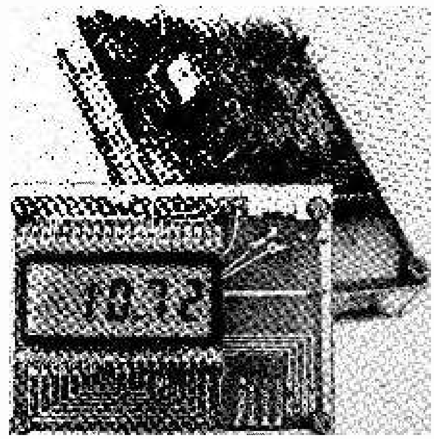

Two views of the DFM3

The display is static, thus creating no strobing interference, and enabling the last digit state to be incorporated in a simple frequency stabiliser system.

The DFM3 is made in England by Ambit, and the one-off ready-made price is £44.90 plus VAT. Available from: *Ambit International, 2 Gresham Road, Brentwood, Essex. Tel: (0277) 227050.*

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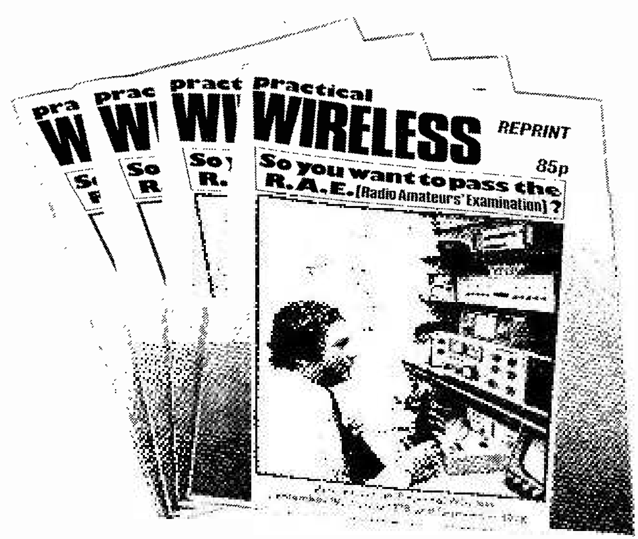

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Editing HOME-RECORDED CASSETTES

PART TWO

B. BARNARD

Experience of the d.c. editing desk which I described in a previous article indicates that it is an ideal tool with only one serious limitation for dealing with home recordings off radio: the inevitable noise imparted to the tape where we have to reduce the signal to zero. How serious this is must be a matter for individual opinion and the purpose for which the tapes are made. By keeping the gaps between musical items short (say, 2–3 seconds) and restricting the d.c. to the minimum necessary to obtain complete erasure, we can minimise the effect and for tapes made for background music or parties I believe the finished result is completely acceptable.

The man who takes his music seriously, however, may well disagree and for him the use of a.c. in the erase head is the only way. This means that a fairly powerful oscillator must be constructed and a modification to the domestic recorder made to allow the erase head to be isolated from the rest of the circuit while editing is taking place.

There is no great difficulty about this and the photograph on page 56 shows the fader unit which I have constructed in use with a Leak 2002 Cassette unit. None-the-less, it is no light matter to modify an expensive cassette recorder and, if the machine is under guarantee, it must be assumed that any modification would invalidate it. Safety is one of the highest importance and we must be sure that any modification does not impair the electrical safety of the instrument as presented by the manufacturer.

The a.c. fader has an oscillator capable of giving about 400mW of a.c. at a frequency of about 107kHz. The amplitude of the output will be variable by control of the d.c. input and this will vary the effect of the erase head on the recorded material on the tapes so that we can fade or cut, in or out, at will. This type of erasure is identical with that used in the recorder itself so our blank tape will be just as silent as that provided by the recorder.

A difficulty may arise in matching the head to the oscillator output: I believe the majority of erase heads—mine is one—are low impedance (indicated by a d.c. resistance of about 0·5 ohms) and are connected to the internal bias/erase oscillator collectors direct through a capacitor of about 0·1µF. If your erase head has a higher resistance than this, it may indicate that some matching arrangement is necessary and I will deal with this later on. It is very helpful to have the circuit diagram of your recorder as this will immediately indicate if there is a problem of this kind. If, for instance, the erase head is fed from a separate winding on the output transformer then we shall have to make similar provision in the fader unit.

The circuit of the Fader Unit is shown in Figure 1. Apart from the oscillator which I shall describe separately, there are few components: the major one is the fader control itself which is a 250 ohms wirewound, 3 watt, potentiometer. This controls the d.c. input to the oscillator and thus the amplitude of the output.

The l.e.d. is just as essential as it was in the d.c. version and must give a clear red warning light when the fader is on to avoid the danger of accidentally spoiling perfectly good recordings.

The two capacitors, 33µF and 1000µF, are concerned with making the control track perfectly silent in operation. A very important point since noisy fades are worse than no fades at all and, whilst on this point, I think it is a good idea to take the back off the wirewound variable resistor and apply a thin smear of Vaseline to the track. These precautions ensure dead silent operation.

The supply voltage is 15 volts d.c. The current consumption of the unit precludes the use of batteries and a mains power unit is essential. It seems rather extravagant to give it its own power unit considering it will only be used intermittently and I find it very convenient, as I mentioned in the previous article, to use the stabilised power unit described in *PW* December 1975 connected to the two terminals marked 'Power Supply' on the top deck of the unit.

The construction is, I think, clear from the photograph but if you decide to make it, you will have your own ideas on layout—there is nothing critical about it. The output of the oscillator is taken to a two-way terminal block screwed to the back of the wooden case.

The Oscillator

The oscillator circuit is shown in Figure 2. It is fairly typical of bias/erase oscillators used in good quality domestic cassette recorders, with two BFY51 transistors connected in a current switched multivibrator circuit. The amplitude of oscillation depends on the voltage at the supply terminals marked and the frequency is decided by the effective L and C of the transformer T1 together with the 0·1µF capacitor across the primary winding and the 100pF across the secondary. All the components including the transformer fit comfortably on a piece of Veroboard, 0·15 pitch, 127 × 95mm.

An oscilloscope is really essential if construction is to be free from problems. For instance, it clears all sorts of doubts out of the way if the 'scope is first connected across

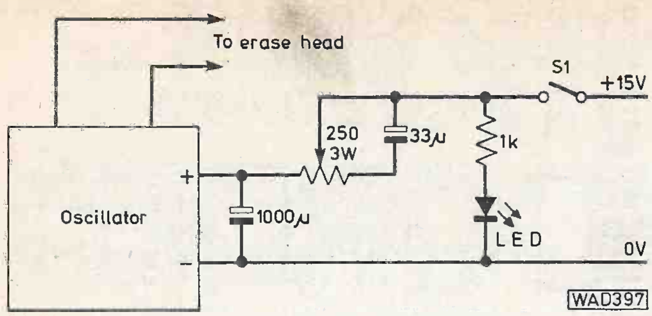


Fig. 1: The fader connections to the oscillator of the a.c. system

the erase head and the recorder put in the 'Record' mode: the amplitude and frequency of the internal oscillator may then be carefully noted from the display, the attenuators and the horizontal timebase. When our new oscillator is working, we can then adjust it to give an output that matches these settings reasonably closely.

Transformer

The transformer is wound on a bobbin having a centre hole 10mm diameter, cheeks 32mm across and the distance between cheeks is 22mm. A piece of ferrite rod of circular section about 30mm long which fits snugly into the centre hole is also required.

The two primary windings should be put on first: they consist of 6 turns, each of 26 s.w.g. enamelled wire, bifilar wound and the end of the first winding is connected to the start of the second and this junction point is the centre tap to which the positive supply is connected. These two windings should occupy all the space between the cheeks. Cover the primary with one layer of Sellotape and then commence winding the secondary.

The secondary requires some patience and care: 450 turns of 34 or 36 s.w.g. enamel covered wire are required. Wind them as neatly as possible and in such a way that they occupy all the space laterally between the cheeks. At this point note that if you have a matching problem, this winding should be tapped at 100 turns and 200 turns; one of these is almost certain to give a good enough match.

When the secondary winding is complete, give it a protective covering of Sellotape and wire it into the circuit. Check the oscillator with the 'scope; if you have wound the transformer with reasonable care there should be no problems as far as amplitude is concerned when 15 volts is applied to the power input sockets. However, the frequency may need some adjustment. As previously mentioned, it should be about 100kHz. The frequency of the bias/erase oscillator in the recorder is precisely set—usually 107kHz—but this is due mainly to considerations of the bias function and, for erase only, such precision is not necessary. Aim therefore for between 100 and 110kHz by trying different values of C1 and C2. In my case these turned out to be 0·1µF and 100pF as shown in the circuit diagram.

For those who prefer not to get involved in winding the transformer, there is another way. From the recorder circuit diagram it is quite easy to construct a duplicate circuit of the manufacturer's design and to obtain the transformer as a spare part. In this way, winding coils and testing with a 'scope is avoided.

Modifying the Recorder

The next problem is to modify the domestic recorder so that we can inject the 100kHz energy from the fader unit into the erase head when the recorder is in the 'Play' mode: to do this we must break the two wires from the internal oscillator to the erase head and substitute them with the leads from the fader unit whenever we wish to use the machine for editing. This has to be done with the least possible disturbance—to remove the chassis every time would be too much—and in such a way that the electrical safety of the instrument is not impaired.

Obviously details will vary between different types of recorders but I believe that the following guidelines which are based on the work I have done on the Leak 2002 will apply in most cases. Two small (2 amp type) terminal

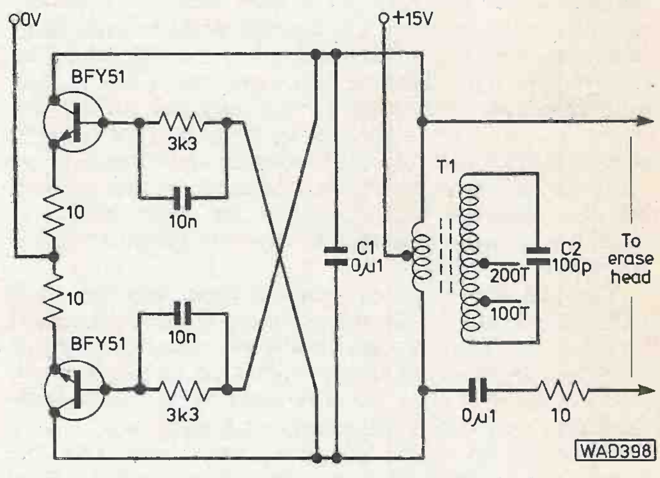
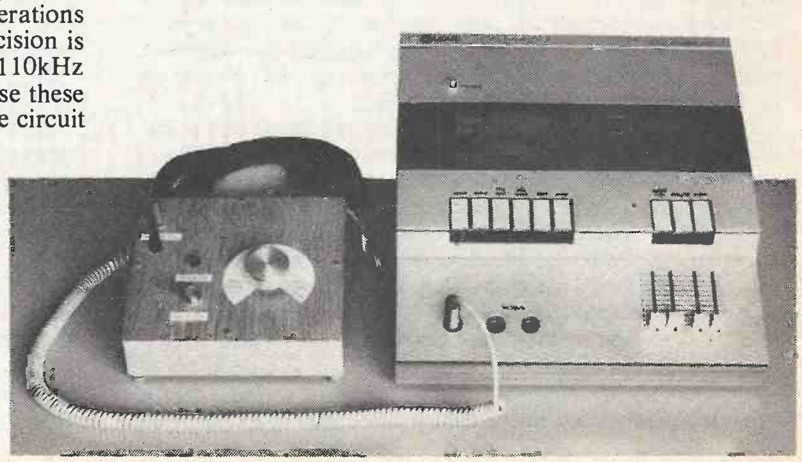


Fig. 2: The erase oscillator circuit diagram

blocks are interposed in the erase head leads: for reasons of safety, these must be mounted inside the instrument as we must not bring any of the wiring outside the cabinet. The most likely place and where they will be reasonably accessible is on the inside of the detachable base of the instrument. These blocks are quite small—95mm high—and can be fixed to the inside of the recorder base with small countersunk bolts—the bolt head inside and the



The author's a.c. editing system is seen here to the left of his Leak 2002 cassette recorder. The layout of components in the editor is not critical

protruding thread and nut fastened from the outside. The situation of the blocks must coincide with gaps in the chassis work so that they cannot touch or foul any of the electrical or mechanical parts. There are usually several such places and one should try and find one near the edge of the cabinet so that the base will 'hinge' on the leads whenever it has to be removed. Another consideration is the length and the dressing of the erase leads: they will most likely be found to follow one of the cableforms that link the various p.c.b.s in the recorder and they should be left in this position as far as possible and only dropped out when they reach a point near to the terminal blocks. To some extent, these requirements may be conflicting and a sensible compromise has to be made.

One terminal block is connected to the internal oscillator leads (now removed from the erase head) and the two leads from the erase head go to the other block. For normal operating the two blocks are linked with short pieces of wire and the erase head will perform its normal function in the 'Record' mode; for editing, we will lift the base, take out the link wires and connect the fader leads to the block carrying the erase head leads. Reverse the procedure when the editing session is over. The fader leads are fed to the block through two 3mm holes drilled in the base.

If for any reason the construction of the machine makes the foregoing impossible, there is another way of achieving the same objective. The fader output can be introduced to the erase head by way of the cassette playing box and the connections made direct to the head. Head connections are not accessible, however, when the instrument is in its cabinet so it is necessary to remove the recorder from its cabinet and a pair of stiff insulated wires are carefully soldered to the head terminals; these wires are bent through 180 degrees so that they protrude into the visible area just short of the line of the head faces. When the cabinet is back in place these wire ends are accessible and the erase head leads are soldered to them for normal operation: for editing, these leads must be desoldered and tucked carefully out of the way (they are not live in the 'play' mode) and the fader leads substituted by soldering or by the use of two very small crocodile clips. The greatest care must be taken that the two extension leads cannot touch the cassette or any of the mechanical parts and the same applies to the two wires detached for editing.

The Perspex dustcover over the playing box may be a minor problem: in many models the dustcover can be lifted independently of the cassette holder— the Leak 2002 is a case in point—so editing is done with this lifted. Others I have seen have the dustcover screwed to the carrier. The screws can easily be removed for an editing session.

Using the Fader

As we shall be editing on the domestic recorder in the 'Play' mode, we cannot see the tape as it travels and cannot therefore use visual cues: we have to rely on the tape counter. Tape counters on all the machines I have examined are too crude for this purpose. The unit drum revolves continuously and there are no marks on the drum to indicate units—let alone fractions of units. Added to this is the lack of a cursor in the window so that precise readings are impossible. There is a very simple modification which very largely overcomes these shortcomings and for fine editing it is essential. On the right-hand side of the units drum and just visible through the window are the plastic teeth that drive the drum; it is a simple matter to cover the extreme ends of these teeth with white model paint so they become readily visible; they are so disposed that they give a precise mark for each unit and one in between each unit. If we now fix inside the window a short length of white cotton centrally and along the length of the window, we have a cursor against which we can make quite precise readings. Starch the cotton first and fix with small spots of Bostik at each end.

As with the d.c. editing desk, recording with the a.c. fader in mind is greatly simplified. The modification we made for the erase circuit is wired for normal operation and the recorder set in the 'Record' mode in the ordinary way. Record level controls are adjusted and left in that position for the entire recording session. Only the 'Pause' control will be used: we wait for a musical item to end and record the disc jockey's chatter for a period of time which will be the approximate spacing of items after editing. With a.c. we have no noise problem during silent passages so we can make this anything we like: I usually allow five seconds. Press the 'Pause' button until the next item is announced: release the button and resume recording—if the talking spills into the new music, it doesn't matter, we will cut it out and fade the music in when we edit.

As far as the fader is concerned, I think most of its functions are obvious; as the controlling resistance has a linear track, the fading action really 'bites' over the last ninety degrees of its travel which makes rapid, smooth movement easy and avoids uncomfortable wrist twisting. The fader scale should show the points of "maximum signal" and "zero signal" and lines are drawn indicating where fading begins and where it is complete; these markings are most useful when using the device. Editing is monitored continuously in the headphones as it takes place.

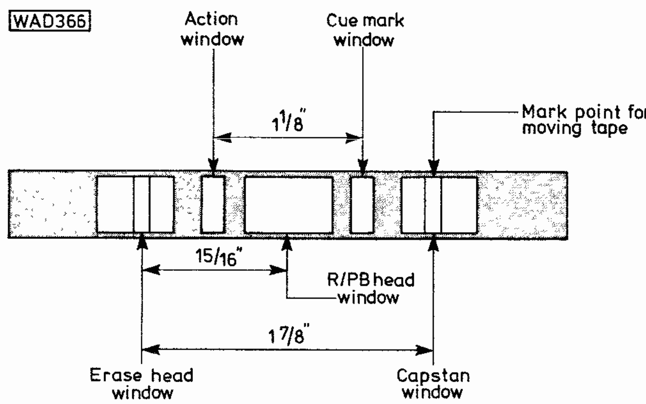


Fig. 3: Details of the Compact Cassette

Fade-outs

For a fade-out of music, erasure of talking and cut or fade-in of the new item, three cues are required. The first is the point where erasure is complete but the new item must be brought in: this is identified by playing the tape—probably several times—and listening on the phones. When it is accurately identified, press the 'Stop' button and set the counter to zero. The editing point is now opposite the play head and we have to compensate for this. Remove the cassette carefully so that the tape does not move and, using the bevelled stick and felt pen in the way described in the previous article, put a very small black dot on the extreme lower edge of the tape in the left-hand small "window". Now, by hand, rewind the tape until this dot is exactly in the centre of the right-hand small "window". The distance between these two small "windows" is the same as that between the play and erase heads, so our zero

continued on page 61 ▶▶▶

RADIO SPECIAL PRODUCT REPORT

FRG-7000

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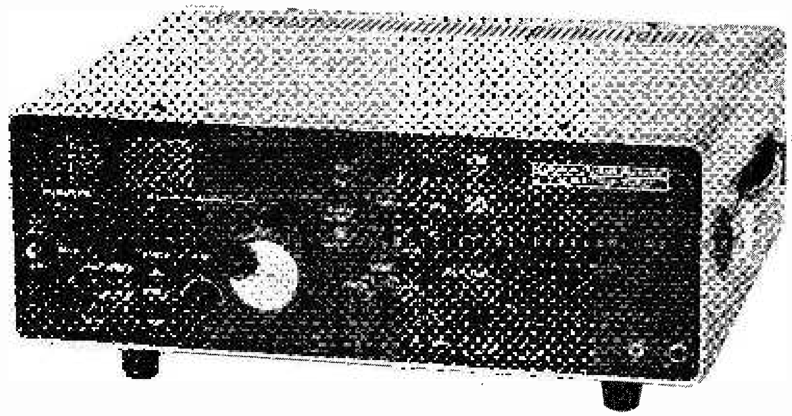

In the July 1979 issue of Practical Wireless we took a good look at the Yaesu FRG-7 general coverage receiver, fitted with an optional digital frequency readout. In this report we will look equally as hard at its more expensive and exotic brother receiver, the FRG-7000.

The FRG-7000 covers the medium and short wave bands starting at 250kHz and going up to 29·9MHz. The most notable features of this receiver are the full digital display and the rather complicated clock and timer facility, again digital in nature. Like the FRG-7 and most other commercial receivers of this type the FRG-7000 uses a synthesised heterodyne system, otherwise known as the Wadley Loop. The operation of the Wadley Loop was covered in detail in the FRG-7 report and will not be repeated here. However it offers stable performance.

The digital clock and timer facility has already been noted, but in use it is not the boon it could be. The mode of operation of the timer is extremely irritating. Once set, and the timer switch operated, the timer changes the state of the on-off switch at the first set time, and then changes it back again at the second. So that if, for instance, the set is switched off, then at the first set time the receiver will be switched on and then off again at the next set point. However, if the operator switches the power switch to on before the timer has performed the first change then the set will be switched off at the first set time, causing some consternation. In use we found it better to totally ignore the timer. The associated digital clock was useful as it could be switched to display either GMT or local time. Using the clock did mean, however, that the mains supply to the set had to be left on continuously if the chore of resetting the clock each time was to be avoided. The mains supply could be left on without power being applied to the receiver, the switch marked POWER being in fact only for the receiver side and not for the clock. If one manages to master the oddities of the timer then it can be used to switch remote equipment such as a recorder.

★ specification

Mode: AM, SSB (USB, LSB) CW
Frequency range: 250kHz to 29·9MHz
Sensitivity: SSB/CW Better than 0·7μV at S/N 10dB
AM Better than 2μV at S/N 10dB
Selectivity: SSB/CW ±1·5kHz (−6dB), ±4kHz (−60dB)
AM ±3kHz (−6dB), ±7kHz (−60dB)
Frequency stability: Within ±500Hz at any 30 minutes after warmup
Aerials: Random wire 0·25MHz to 1·6MHz
50Ω unbalanced 1·6MHz to 29·9MHz
Speaker: 4Ω
Audio Output: 2 watts
Power requirements: 100/110/117/200/220/234V a.c. 50/60Hz at 25VA
Dimensions: 360 × 125 × 295mm
Weight: 7kg (approx)

Controls

The controls are all mounted on the front panel and in general very clearly labelled and well positioned. The exception is the fine tune control. This is just a shade too coarse and positioned too close to the main tuning knob so that it is too easy to alter the setting of the main tuning control when trying to use the fine tune control. This is the same problem as occurred on the FRG-7, so perhaps the Yaesu designers have smaller hands than others. The main tuning control is very smooth, almost too smooth, but it can be stiffened up by screwing the knob further on to the spindle so increasing the friction between the knob and a felt washer.

The digital display shows both the MHz and kHz portions of the frequency tuned, and to indicate when the MHz portion is correctly tuned a light on the front panel, labelled UNLOCK, is extinguished.

The Preselector control is simpler to use than the FRG-7's as the drum is colour coded and also has a wider window. It is still rather fiddly in use and it proved easier to tune the preselector for maximum signal or noise strength.

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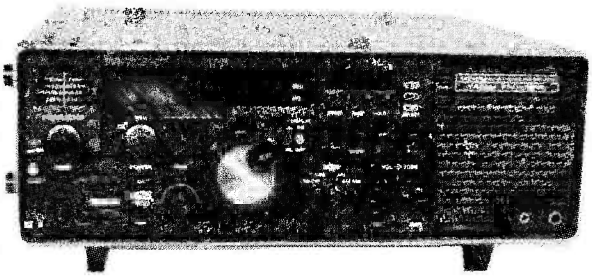

Deluxe Communications Receiver
See review in this issue

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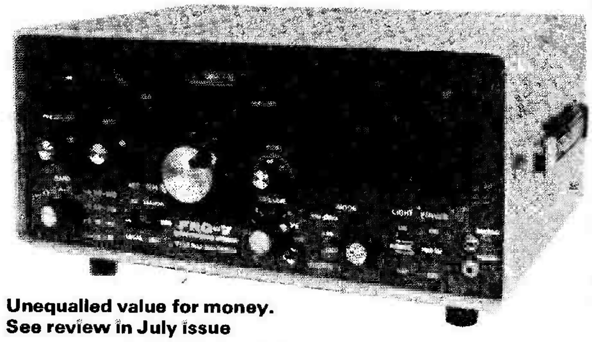
FRG7(D)



Unequalled value for money.
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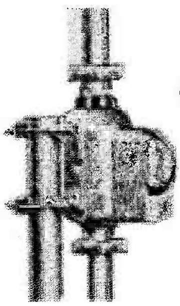
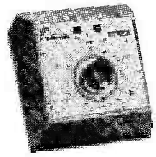


SCOOP!



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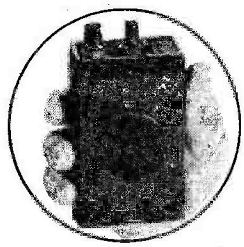

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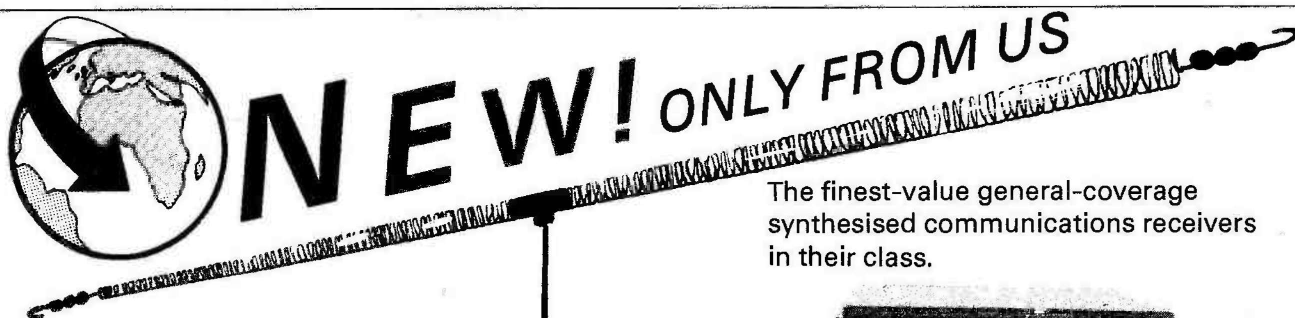

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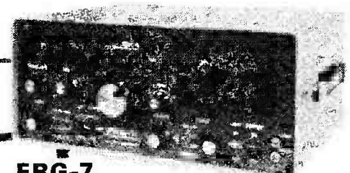

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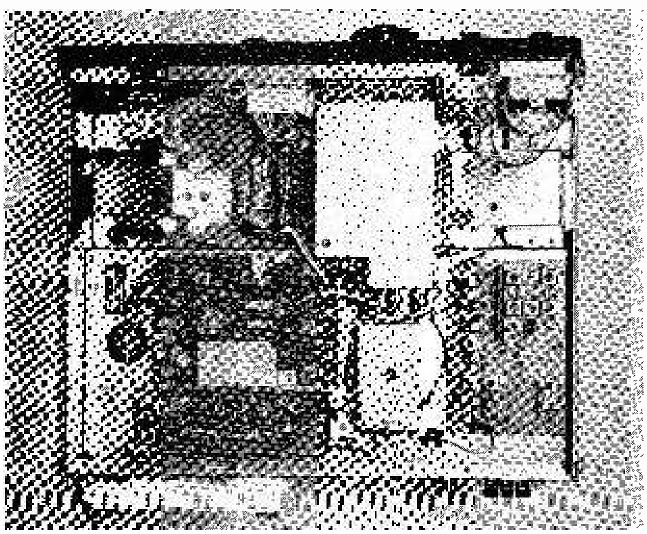
The mode in use is selected by a clearly labelled switch with positions for l.s.b./c.w., u.s.b., a.m. and a.m. with automatic noise limiter.

Selectivity is good with a separate filter for s.s.b. and c.w. which helps to make the set pleasant to operate. A two-position aerial attenuator is fitted to cope with a wide range of signal strengths.

The audio side of the receiver is adequate, a tone control being fitted to try to improve the quality. An external speaker can be used to improve the audio quality.

External connections are provided for headphones, recorder, remote control by the timer, external mute control, u.h.f. (SO239) socket for h.f. coaxial input and terminals for h.f. random wire and m.f. random wire aerials and earth. A full set of plugs for all the external connections is provided together with spare fuses and two lengths of aerial wire.

The handbook provided with the receiver is good with a general circuit description, together with installation and operating instructions. Details are also provided of maintenance and alignment procedures together with module and major component listings and identification. The circuit diagram shows all the receiver with the exception of the m.p.u.-controlled time and frequency display module. A world time conversion chart is provided at the back of the book to help with setting the clock.



Construction of the FRG-7000 is of a high standard with most of the components mounted on printed circuit boards.

It is inevitable that the FRG-7000 will be compared with the FRG-7 and its extra cost questioned. If you want a receiver which has a full digital display together with a clock and timer, all controlled by a microprocessor, then obviously you will go for the more expensive FRG-7000. The price difference between the two receivers is around £150 when the basic sets are considered, but this is reduced to under £100 if a digital readout and filters for s.s.b. are added to the FRG-7. The choice is up to you.

Price

FRG-7000 receiver £375·00 inc. VAT.

The FRG-7000 receiver reviewed was kindly loaned by South Midlands Communications Company Ltd., Osborne Road, Totton, Southampton SO4 4DN. Tel: 0703 86 7333, and we would like to thank them for their invaluable assistance in this respect.

Editing home-recorded cassettes

▶▶▶ *continued from page 57*

counter reading now relates to the erase head and is correct. The same process must be applied to all tape counter cues. After editing, these ink dots must be removed using cotton wool with methylated spirit; place the dot in the capstan "window" for this as there is more room and it is easier to get the tape really clean.

After establishing the first cue, rewind the tape in the machine for a short distance, play it and fix the second cue—the point just before the talking starts: note the counter reading.

The third cue is the point at which the fade-out must commence. This can be long or short and is established by rewinding the correct amount of tape for the time chosen; this, in turn, is found by checking the movement of the counter for specified times—my counter moves from zero to 2 in exactly five seconds.

Cuts

Very abrupt cuts are best done by using the power switch. But the fader should be used wherever possible as it gives a smoother transition from music to silence.

All that remains now is to start the tape playing and action the fader correctly as each cue comes up on the counter; it takes a little time to become expert and practice is essential. Record a cassette consisting of music ends, chatter and music beginnings and practice with it— in half an hour or so it will become easy.

The fine editing of tape is a challenging extension of the audio hobby; it requires skill and imagination and offers a very satisfying end product. I have described both d.c. and a.c. systems and explained their respective advantages and disadvantages—so the question arises why not combine the two and get the best of both? The oscillator and its controls can be mounted on the Editing Desk but it would be necessary either to replace the d.c. erase head with an a.c. type and mechanical difficulties of mounting and aligning the new head may then arise, or to fit a complete a.c. type tape transport. This would be quite simple but rather costly. ●

KINDLY NOTE!

PW "Trent", June and August 1979

For driving this linear amplifier from transmitters of up to 10W output, strap $\frac{1}{2}$W resistors between base and emitter of each power transistor Tr1 and Tr2. These can be 10Ω for 10 watts drive, with lower powers requiring higher values.

There has recently been a big reduction in the price of the PT 9784/A output transistors. These are now available at £25·88 per matched pair, including postage and packing and VAT, from R. B. Knight at the address given in the components list.

PW "Sandbanks" Follow-Up—2, August 1979.

Capacitor Cy (to be mounted on the reverse side of the p.c.b.) should be connected between the base of Tr5 and pin 7 of IC6 and not pin 2 as stated. The circuit diagram (Fig. 1) should also be corrected.

IC OF THE MONTH 78

Brian DANCE M.Sc

AEG-TELEFUNKEN TDA1062 FM FRONT-END

Linear integrated circuits are now widely employed in all types of radio and television equipment, but very few of the types currently available can be used at frequencies in the order of 100MHz or more. Commercially available f.m. front-end modules therefore tend to use discrete components for such applications, although integrated circuits are commonly used in the 10·7MHz i.f. amplifiers of v.h.f. receivers.

One of the first integrated circuits suitable for v.h.f. receiver front-ends, the Signetics SD6000, was reviewed earlier in this series (February, 1976). It has a very high performance, but contains only two m.o.s. transistors with their protective gate diodes and requires an external oscillator.

The TDA1062

The new AEG-Telefunken TDA1062 is an f.m. front-end device capable of operating at frequencies of up to about 200MHz and incorporating a much higher degree of integration than the SD6000. Particularly, it provides a unique opportunity for the constructor to make a v.h.f. front-end fairly easily.

The block diagram of Fig. 1 shows the functions incorporated into the TDA1062 chip with a few details of the external circuit. The signal from the v.h.f. aerial is fed through a signal frequency tuned circuit into pin 10 and hence to the radio frequency amplifier stage which has been designed so that it can handle quite a large input. The output from this stage (pin 8) is fed through another signal frequency, tuned circuit to the mixer input (pins 3 and 4). The mixer output at the 10·7MHz intermediate frequency is fed through a low-pass filter to pins 13 and 14, from where it passes into a 10·7MHz tuned circuit and hence to the intermediate frequency output.

It can be seen that the TDA1062 device incorporates an internal voltage regulator circuit which provides a stable voltage for the oscillator, the mixer and the oscillator amplifier/buffer stages. The use of this regulator enables excellent oscillator stability to be obtained.

An automatic gain control (a.g.c.) amplifier is included on the chip, but the circuit requires an external p.i.n. diode. (As its name implies, a p.i.n. diode has an intrinsic or *i* layer of high resistivity, almost pure semiconductor material between the *p* and *n* type materials of the semiconductor junction.)

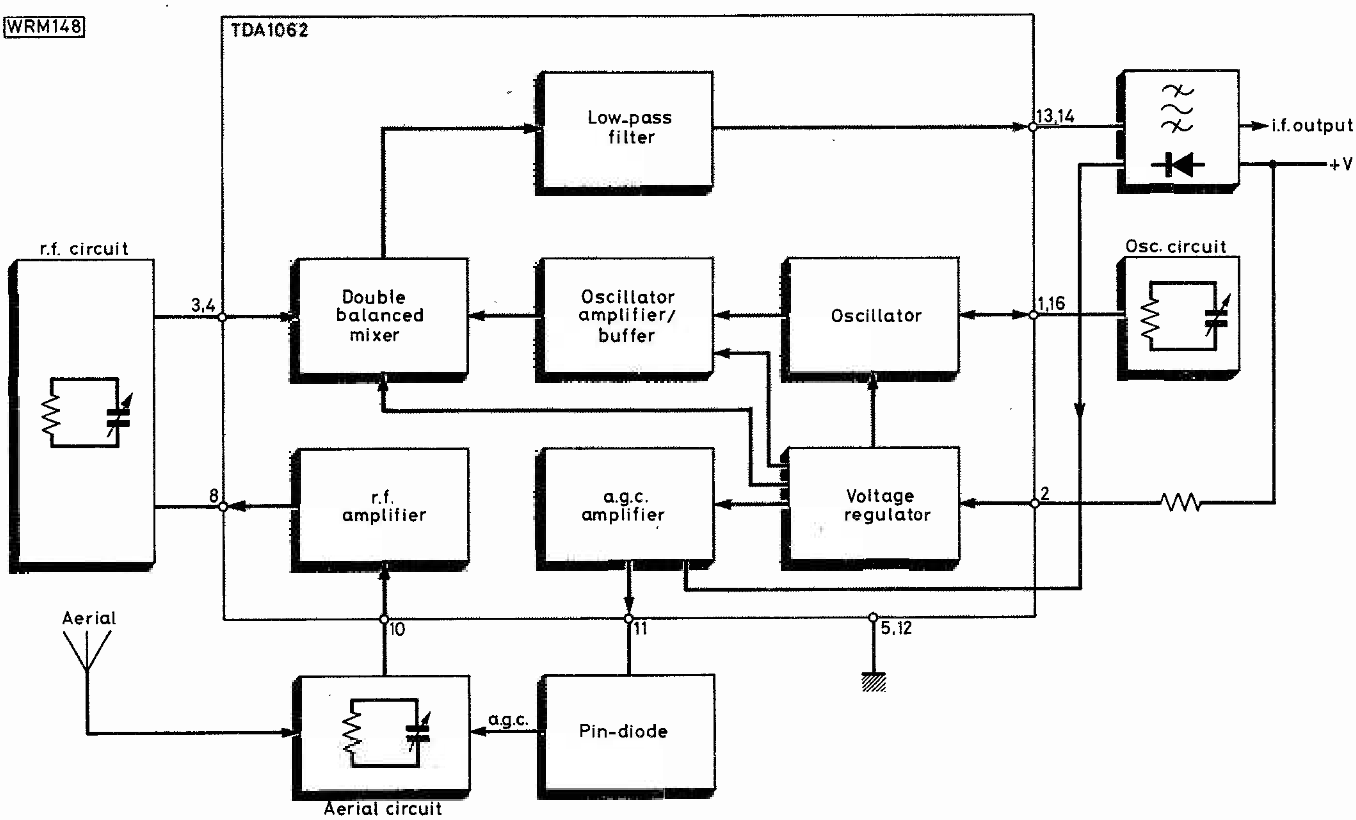


Fig. 1: Block diagram of the TDA1062 internal circuit together with some of the external circuitry

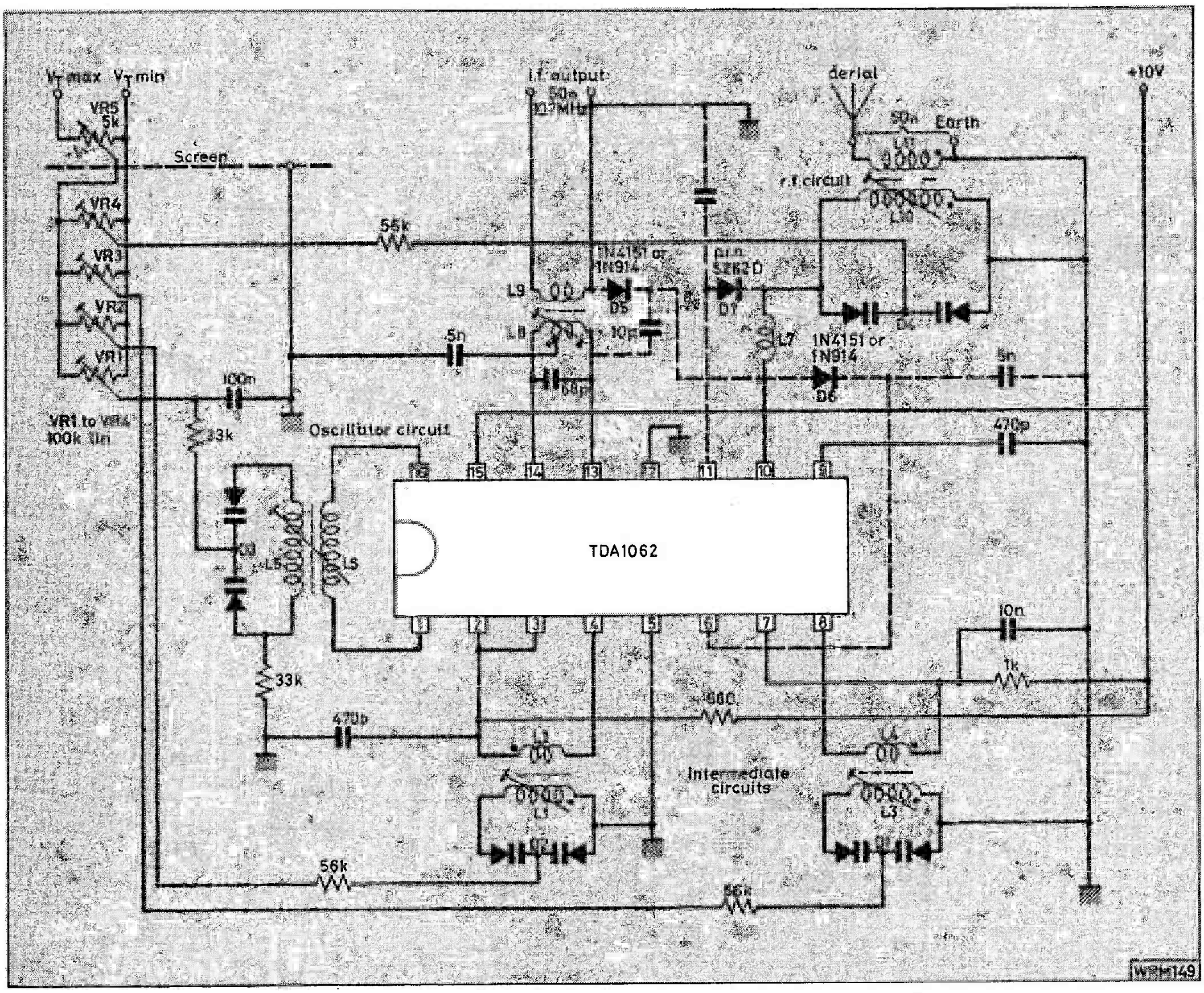


Fig. 2: A circuit for a v.h.f. receiver front-end using the TDA1062

A particular advantage of the TDA1062 is the use of a double-balanced mixer circuit which enables the oscillator frequency voltages at the mixer input and output to be kept very small and which reduces the amplification of the signal frequency itself by the mixer.

The oscillator circuit has been specially designed so that it can operate at low power levels. One of the resulting advantages is very low radiation from the oscillator reducing the possibility of interference with other parts of the circuit. The low power level of the oscillator also facilitates the use of varicap (varactor) diode tuning. If a large oscillator voltage is applied to a varicap diode, some conduction may occur at low tuning voltages and can result in the production of interfering harmonics, etc.

The low-pass filter in the mixer output circuit reduces oscillator harmonics and the mixing of harmonics to produce spurious frequencies.

Practical Circuit

A typical circuit for a v.h.f. front-end using a TDA1062 device is shown in Fig. 2. The supply voltage for the TDA1062, V^+, should be within the recommended range of 9V to 15V, the typical supply current being 30mA and the maximum permissible dissipation 400mW.

The circuit is tuned by four varicap back-to-back diodes type BB104. The diodes D3 tune the oscillator circuit, whilst D4 tunes the aerial circuit and D1 and D2 the

Coil data for Fig. 2

L1	$8\frac{3}{4}$ turns; 4mm diameter bobbin; 0·8mm diameter wire	
L2	$2\frac{3}{4}$ turns on earthy end of L1; 0·4mm diameter wire	
L3	$5\frac{1}{4}$ turns; 4mm diameter bobbin; 0·8mm diameter wire	
L4	$4\frac{3}{4}$ turns on earthy end of L3; 0·4mm diameter wire	
L5	$4\frac{3}{4}$ turns; 4mm diameter bobbin; 0·8mm diameter wire	
L6	$3\frac{3}{4}$ turns interwound with L5; 0·4mm diameter wire	
L7	19 turns; 3·5mm diameter air core; 0·15mm diameter wire	
L8	2 × 15 turns bifilar wound; 0·15mm diameter wire.	or use Toko coil KACS1506A
L9	2 turns; 0·2mm diameter wire on L8	
L10	6 turns; 4mm diameter bobbin; 0·8mm diameter wire	
L11	1 turn at earthy end of L10; 0·4mm diameter wire	

intermediate radio frequency circuits. The circuit requires regulated voltages for tuning the diodes of $V_{T\ max}$ and $V_{T\ min}$. The tuning control, VR5 may be a ten-turn helical potentiometer or a long slider potentiometer which enables the tuning to be set accurately; it taps off a voltage of any value between $V_{T\ max}$ and $V_{T\ min}$ which is applied to the tuning diodes through the alignment preset trimming resistors VR1 to VR4 inclusive.

The simple circuit of Fig. 3 can be employed to provide the two regulated voltages required for tuning the circuit of Fig. 2. The 7·5V Zener diode sets the value of $V_{T\ max}$ to 7·5V, whilst the potential divider in the base circuit of the BC238 transistor and the base-emitter voltage of this transistor set the value of $V_{T\ min}$ to approximately 2V. This relatively small variation of the tuning voltage from 2 to 7·5V enables the complete tuning range from 88MHz to about 108MHz to be covered. (In most varicap front-ends, a much higher tuning voltage is required for the complete coverage of this frequency band.) If a tuning voltage above 7·5V is available, one can search for any signals at higher frequencies.

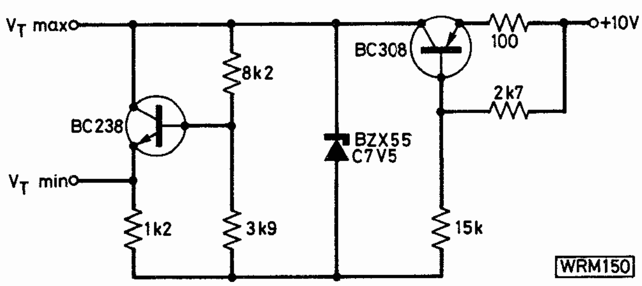


Fig. 3: A voltage regulator circuit which can provide the two stabilised tuning voltages for Fig. 2

Alignment

The alignment of the Fig. 2 circuit is relatively simple. The core of L5/L6 should be adjusted so that the low frequency end of the band is set to about 88MHz when the VR5 slider is at $V_{T\ min}$. The preset resistor VR1 should be set at the high frequency end of the band so that the maximum frequency of 108MHz is received when the slider of VR5 is set to $V_{T\ max}$.

The other inductors are aligned at the low frequency end of the band and VR2, VR3 and VR4 at the high frequency end for maximum signal. Repeated adjustments at each end of the band should not be required in order to obtain correct alignment with this circuit.

The output tuned circuit, L8 resonates at 10·7MHz and the coupling coil, L9 provides a 50Ω output to the succeeding i.f. circuit. The bandwidth at the output is about 500kHz.

The a.g.c. circuit in Fig. 2 is shown by dotted lines, D7 being the S262D diode. The a.g.c. starts to become effective at an input signal level of about −30dBm.

Performance

The typical power gain of the Fig. 2 circuit is 30dB and the noise figure is quoted as 5·5dB typical. These figures compare well with those of commercial front-end v.h.f. modules. The three signal frequency tuned circuits together with the design of the internal circuitry enable excellent rejection of spurious signals to be obtained. The quoted values for the image rejection, i.f. rejection and the spurious response rejection 5·35MHz from the centre frequency are 80dB (typical), 100dB (minimum) and 90dB (minimum) respectively.

The gain of the circuit is constant to within 1·5dB over the complete tuning range. The input and output impedances of 50Ω each match coaxial cable, but other impedances can be obtained by modifying the number of turns on L11 for the aerial input impedance or on L9 for the output impedance.

Readers may wish to compare the performance figures quoted for the TDA1062 circuit with those of various commercially produced v.h.f. front-ends on page 273 of our August, 1977 issue.

Conclusions

The TDA1062 is the first device to be made available which incorporates most of the circuitry required for a v.h.f. front-end in a single chip. The home constructor should find it much easier to use than to construct a front-end using only discrete devices, but never-the-less considerable care is required with the construction of circuits operating at such high frequencies. Many of the problems of obtaining a suitable component layout can be solved by the use of a commercially produced printed circuit board.

The TDA1062 should also be suitable for use in the 144MHz (2 metre) amateur band. It is available from Ambit International at £1.95 plus VAT together with a suitable diode and the necessary coils. ●

KINDLY NOTE!

VMOS Top Band Transmitter, July 1979

A few readers have experienced problems in obtaining some of the components used for this project. The following notes may be of assistance:

1. Capacitors C4 and 8 were incorrectly listed as ceramic disc. They should be polyester or polycarbonate types, but are not critical.
2. As an alternative to 350V polystyrene, capacitors C9, 10, 11 and 12 can be 350V d.c. working silvered mica types. C9 and 12 can be 1·5nF.
3. The oscillator f.e.t. Tr1 is fairly critical in its bias levels. Of those types tested by the author, only the TIS88A was found to be completely satisfactory.
4. Transistor Tr6 is not critical, and can be virtually any small-signal *pnp* type.
5. The barrel of a discarded ball-point pen provides an inexpensive source of 8mm diameter formers for L1, 2 and 3 in the low-pass filter.
6. Mullard FX2249 ferrite blocks are available from C. Bowes & Co. Ltd., (see advertisers' index). The winding arrangements are similar to those shown in Fig. 5 of "Aerials for 160m" in this issue, except that primary and secondary are transposed to provide a step-up.
7. As an alternative to a 10W speaker matching transformer, a mains transformer may be used, though this will be physically larger, and will not give such good results. The secondary winding should be 12-0-12V or 0-12-24V, and be capable of carrying 1A d.c. without saturating. Probably a minimum of 2A rating will be necessary. The mains primary is not used.

When setting up the modulator bias level, VR2 slider should be turned fully **clockwise** before applying power to the transmitter.

ON THE AIR

by Eric Dowdeswell G4AR

There seems to be a complaint prevalent among some readers who have the older valved receivers, namely "sensitivityitis". The symptoms are a degree of jealousy for the modern receivers that claim a "sensitivity of $0{\cdot}5\mu V$", whatever that might mean, and an inability to find the DX logged by other readers.

There are even those who spend pounds on a new set of valves, a waste of money in most cases. Now for the cure to this strange malady. First of all, if the set is getting stations at all on the amateur bands then there are three matters that can be actioned, any or all of which can prove effective.

First, spend a few more months just listening, to gain more experience in picking out the weak DX from under the general bedlam, choosing the right band(s) for the time of day. In other words don't look for DX on 80m in the middle of the day. Secondly, if you feel the set isn't quite up to scratch and that you are competent to wield a signal generator and trimming tools then try aligning the r.f. and i.f. stages of your set, but leave the first oscillator trimmers alone if the calibration is reasonably good. Thirdly, try improving the aerial system.

The order in which the cures are carried out will depend upon individual circumstances. If one is experienced on the bands with a fair receiver then the aerial ought to come in for attention first, looking for improvements in height, length and distance from houses, trees, etc., not forgetting the absolutely essential aerial tuning unit.

Do try to get more than one aerial up and preferably of different types to give a choice of directivity and angle of reception. In this connection always check on the direction(s) of optimum reception of any aerial erected, looking at the polar diagrams in an aerial handbook if you are not already conversant with them. Don't forget that the polar diagram for a wire will vary greatly from band to band, a null on one band becoming a point of best reception on another.

When studying an aerial's characteristics do use a proper Great Circle map based on the UK, usually London, and not maps from a school atlas! Mercator may have been a great navigator but his maps are useless for our purposes. As an example, if you want to put up a half-wave dipole for VK and ZL then the wire must run NW/SE as the Great Circle route is to the NE/SW and not to the NW/SE as you always thought! Great Circle maps are obtainable from HMSO, the RSGB and *Short Wave Magazine.*

If r.f./i.f. alignment is the order of the day do get a manual for your set and follow instructions. Use a proper signal generator and not some wobbly DX station as the signal source. Normally only the trimmers at the high-frequency end of the range will need touching as these are very susceptible to vibration, shock, etc. Go over the i.f. alignment several times as the settings on each i.f. stage are inter-dependent. If a crystal filter is fitted, switch it in and tune the signal generator for maximum on the output meter and not to precisely 465kHz or whatever it is supposed to be.

Don't touch the oscillator trimmers unless you have an adequate crystal calibrator or frequency meter, and **never** use a signal generator as a frequency meter because they are not meant to be accurate in terms of frequency.

Re-valving a receiver at random is most unwise as almost certainly it will then want re-aligning because of the changes in valve inter-electrode capacitance which form part of the r.f. and i.f. circuitry. Finally, if you have an old receiver don't expect the same degree of accuracy of dial calibration that can be obtained with a digital frequency readout or with a receiver using the Barlow-Wadley system, such as the FRG-7 and SRX-30. You can get along quite well with a crystal controlled marker generator feeding into the aerial socket of the set.

Here and There

An interesting letter from **Cyril Pratt** BRS42386 living in Steventon, Oxon, reveals that he and his XYL are both invalids, without transport, yet Cyril, although an OAP, finds time goes far too quickly for him. He's become a very keen listener to the amateur bands and has a 100ft wire up plus a 28MHz rotary dipole fashioned from aluminium tubing. Present project is a 144MHz converter to be followed by a suitable Yagi beam. Makes all my aches and pains seem as nothing! Must remember to stop grumbling at the odd twinge!

In Paignton, Devon, lives **Tom Hillier** of 23 Palace Avenue, and he'd like to hear of other users of the CR100 with a view to getting more out of his set, if indeed it is lacking at all. So if you've played around with one why not contact Tom? An interesting note from **Brian Burke** G4HIY on the matter of phonetics. A CQ call on 20m, using the proper phonetic alphabet, raised a KL7 who mistook the call and thought it was a GS4! Others thought it was a new country and Brian worked several new countries himself before he was able to get it over that he was just another G4! He, too, would like the proper names changed in the present ITU phonetic alphabet.

On the same subject G4FLK who was in RAF and civil telecomms from 1927 to 1965 quotes the phonetic alphabet used by Imperial Airways in the 30's and asks: "why the hell did they have to alter that?" Well, there was one before that, that started with "Ack", "Beer", etc., so no doubt there were grumbles when that was changed! Unfortunately there are always people around who do these daft things just to justify themselves in their job, not to make it easier for all concerned.

A brand new FRG-7 is the pride and joy of **Paul Bown** BRS40740 of Reading, Berks, fed from an aerial in the loft which I trust Paul will do his best to convert to an outside wire which his new acquisition deserves, plus an a.t.u. of course!

DXing

After trying baluns and other dB-losers in his aerial circuit **Pete Lucas** (Newport, Salop) has thrown them out and taken his vertical into his AR88 via an a.t.u. He very sensibly built a crystal calibrator and drew up some calibration graphs for the set, on the amateur bands at least. Pete logged OJ0MA on Market Reef for a new one, as it was for the many who logged and worked him. This was on 10m while on 15m it was VQ9s DS, JJ and TR for a useful trio. For those who copied SV1DC/A on Mount Athos, Pete says the QSL QTH is Box 161, Athens. Suppose I could take my HW32A on my annual visit to SV land and do ditto!

As the sole upholder of the ST call for a number of years I'm glad to read in the IARU Region 1 News that there is now a club in Omdurman 6T1YP and several active members such as 6U2AA, ST2FF, 6T2NI (YL-Nadia), ST2MM and ST2ID. Needless to say those new prefixes will be very welcome for the WPX chasers. Club QTH and QSL address is: PO Box 80, El Morada, Omdurman, Sudan. The same news source mentions the changes to the Nigerian prefixes which now run from 5N0 for the Lagos area through 5N1 to 5N9 for other areas. Until recently the only licensed stations were 5N0AAJ, 5N1AAE, 5N2AAV, 5N0AAM and 5N0NAS so all others should be treated with a pinch of salt. In Greece changes have been made, although SV1 remains Athens and district, but Crete now becomes SV9 rather than SV0 which is reserved for reciprocal licences. Past SV0s were reciprocal anyway.

After rather poor results with his *PW* Direct Conversion Receiver, **Allan Stevens** of Crowthorne, Berks, tried the aerial downlead of his TV set, and was pleasantly surprised with things like C5ABM in the Gambia, CM8DK, VP8HA and 5L2BS in Liberia, so imagine what a good aerial would do! However Allan reckons the *PW* job an excellent effort for the £10 it cost him to make it.

Reports on the various bands are welcome and should be sent direct, by the 15th of the month, to:

AMATEUR BANDS Eric Dowdeswell G4AR, Silver Firs, Leatherhead Road, Ashtead, Surrey KT21 2TW. Logs by bands, each in alphabetical order.

MEDIUM and SW BANDS Charles Molloy G8BUS, 132 Segars Lane, Southport PR8 3JG. Reports for both bands **must** be kept separate.

VHF BANDS Ron Ham BRS15744, Faraday, Greyfriars, Storrington, Sussex RH20 4HE.

Still our lone RTTY exponent **Dennis Sheppard** in Sheerness, Kent, gets copy on the three top h.f. bands with stuff like HK2ECH, PZ1AC and LU2DGO on 20m, 5Z4RT, 9G1JX and WB0KFB on 15m and PY5PW on ten. Regular **Bernard Hughes** of Worcester has progressed through many receivers from an Eagle SX40 to his present Drake R4C and is casting envious eyes on the so-called "ultimate receiver" the R820! Bernard has 306 countries confirmed out of 308 heard which is pretty remarkable. I am still trying to persuade him to go for his RAE as obviously there is nothing lacking on the receiving side. Recent catches include OA4CRB, VP8NO, XE1ABC on 80m, all after midnight, AP2P, CO3VR and TF3TF on 40m with CO2CI, HS1ABD, KB6FM, VR3AR, VK2AGT/LH (Lord Howe Is) on 20m. On 15m it was HK0BKX, P29NNL, 5U7AF and 5N0DOG with 10m providing C31YM, H44CT, TU2FH and XT2AT, all on s.s.b. using 10/15/20m dipoles and a 66ft long wire.

David Palmer (Stowmarket, Suffolk) was mislead into thinking he was doing well with indoor dipoles, getting the Europeans loud and clear, until he fixed up a long wire outside and started to find the real DX on his Trio JR310. On 20m it was HS1CB, HZ1TA, J7DAU (Dominica), VQ9TR and VS6HG with 15m coming up with A35WL, FK8CR, HM1SX, TR8RG, VP9JB, VQ9WJ, XT2AW, 6W8AE and 9X5PP. Sole catch of note on 10m was YB0ADW.

When not playing about with his transmitter **Mike Stollov** of Blackley, Manchester, heard C5ABK on 20m, CT3AF, HP1CY, HS1ABD, VP2ML on 15m with only 5T5CJ on 10m so it looks as if ten is down in the doldrums at the moment in spite of a slowly rising sunspot count. Mike uses an FRG-7 and 66ft wire plus a.t.u. **Peter Hawkes** (Stourbridge, W. Mids) is starting to study for his RAE, and being an electrician by trade ought not to find it too hard. His DX160 and long wire found ZL1BIL on 7MHz, VQ9JJ, OJ0MA, HC1LS on 14MHz and CT3AR, 3D2BM, HS1WR and 9N1MM on 21MHz with nothing to report on ten.

The trouble with **Bill Rendell** of Feock, near Truro, in Cornwall, is that all the DX he quotes is good stuff and I don't know what to leave out! His Heathkit AR3 with preselector and 115ft aerial heard C31SR, M1C, VP2MFE, VP8HA, VK8LD (that's a rare one indeed!), all 20m s.s.b. with 15m providing C6ANU, C31SQ, HC2HX, HM1QD, VP2VJ, VP8SO on Signy Is, XT2AW, YB0WR, ZD8WT, and 3B6CD on Chagos, also not heard all that often.

Bill comments on the odd effects that dust in the tuning capacitor of a receiver can have, especially on s.s.b., causing uneven tracking of the sections. He tried a vacuum cleaner with amazing results and recommends the idea to readers.

Allan Stevens, mentioned earlier, put his new Trio 9R59DS to good use with YB0WR on ten, VQ9WJ on Chagos on fifteen and VP2MAI, YS9EA and ZF1HJ in the Cayman Is. Unusual logging of UM8MAI on 160m c.w. from **Ian Marquis** (Leigh-on-Sea, Essex) as was XT2AW on 40m c.w., and in the same mode H44CF on 15. Finds on s.s.b. included F0CH/FC, OJ0MA and 9K2DR on 80m, FK8CR, FM7AV, FR7ZN, JT0LAJ (that's a nice one), SV1IW/A on Mount Athos and ZK1CQ (QSL to ZL1AMO), all with an FRG-7, dipoles and 120ft wire.

Last for this month is **Dave Coggins** from Knutsford, Cheshire, who drummed up something on 10m using a two-element quad to his DX160, like C5AAP, VP2MAY, XT2AW, ZS3BT and 9J2LL, which goes to show what something more than a wire can do. At the other end, on 80m, Dave logged CN8AK, F0CH/FC, HC1BI and YV1TO on his 60ft wire, with VP5PX, YS9RVE, PJ3AS

and VP2ML on 40m. On 20m it was TO8DO (Tahiti), VP8HZ, VR6TC (Pitcairn Is) and 5W1BP on W. Samoa. Finally on 15m it was YC6HS in Indonesia, ZF1HJ, 3D2BM (Box 590, Suva, Fiji), 6W8AR, FO8DT, H44CF, T2AAA on Tavalu and VK7GK.

Club Info

October 12 sees Ron Ham of *PW* VHF Column fame talking to the **West Kent ARS** on *Man on the Moon* at the Adult Education Centre, Monson Road, Tunbridge Wells at 8pm, with Bredhurst Electronics expounding on commercial gear on the 26th. Informal meetings at the Drill Hall, Victoria Road, on the alternate Tuesdays. Write to: Brian Castle G4DYF, 6 Pinewood Avenue, Sevenoaks, Kent, for more info.

For the latest news on meetings of the **Northern Heights ARS** contact: Geoff Theasby G8BMI, 12 Southfield Avenue, Riddlesden, Keighley, or ring 62859. *NHARS News* is good reading and the meetings are held every Wednesday at the Bradshaw Tavern, Bradshaw, Halifax. In **Bury** the **ARS** meets every Tuesday night at Mosses Centre, Cecil Street, and on Oct 9 a construction competition will be judged and there will be a film show. New faces are very welcome to the club which boasts an FT101 and up-to-date library. Write: M. Bainbridge G4GSY, 7 Rothbury Close, Ainsworth Road, Bury.

How about contacting **Mary Palmer** G8RZR about meetings of the **Mid-Warwicks ARS** held on the first and third Mondays at 8pm at 61 Emscote Road, Warwick. She resides at 12 Edmonds Close, Woodloes Park, Warwick. Several club meetings are being devoted to "Getting Started" in amateur radio, to help prospective RAE candidates with some practical work. A brief note from Stuart Hardy reveals that the **Nottingham AR Club** meets in the Sherwood Community Centre, Thursdays at 7.30pm, newcomers welcome of course.

Recently re-formed **Pontefract RS** has call G3FYQ with fortnightly meetings at Knottingley Town Hall 7.30pm with SSTV being the subject on Oct 18, courtesy G4IBN and G4FBA, and a film show on the night of Nov 1. Details from: Phil Butterfield G4AAQ, 43 Lynwood Crescent, Pontefract, W. Yorks, or ring 71071. Now to the **Edgware and District RS,** second and fourth Thursdays, 8pm, Watling Community Centre, 145 Orange Hill Road, Burnt Oak, Edgware. Oct 11 sees G3GC expounding on choosing a site for v.h.f. and Oct 25 means Barry Haines on using a personal computer. Club puts out RSGB slow Morse under call G3ASR so send for details to: Howard Drury G4HMD, 39 Wemborough Road, Stanmore, Middx or try 01-952 6462.

Please aim to get your logs and letters to me by the fifteenth of the month.

MEDIUM WAVE DX

by Charles Molloy G8BUS

Local Radio has crept into the m.w. band in the UK unobtrusively during the past ten years or so, and there are currently some 40 stations operating with powers of between 100 watts and 50kW, with a few more to come. They can be split into two groups, those run by the BBC and those belonging to the Independent Broadcasting Authority (IBA), the latter being commercial stations which carry advertising.

The BBC is to be found on 13 different frequencies which are: 756kHz (397m), 774 (388m), 855 (351m), 999 (300m), 1035 (290m), 1116 (269m), 1359 (221m), 1458 (206m), 1485 (202m), 1503 (200m), 1521 (197m), 1548 (194m), 1584 (189m). The majority of BBC outlets use the name of the town or city as part of their identification with, exceptionally, Radio Solent on 999kHz which is in Southampton, Radio Merseyside 1485 in Liverpool and Radio Humberside also on 1485 which is in Hull.

The IBA stations, which are on 990kHz (303m), 999 (300m), 1026 (292m), 1152 (260m), 1170 (256m), 1278 (235m), 1431 (210m), 1548 (194m), are more difficult to identify since most of them do not use place names. Beacon Radio on 990 is in Wolverhampton; Radio Trent 999 is in Nottingham; Downtown Radio 1026 in Newtownards in Northern Ireland; Radio Clyde in Glasgow, Metro Radio in Newcastle upon Tyne and Piccadilly Radio in Manchester are on 1152; Radio Tees in Stockton-on-Tees, Radio Victory in Portsmouth and Radio Orwell in Ipswich are all on 1170; Pennine Radio in Bradford is on 1278 with only 100 watts; Radio 210 Thames Valley on 1431 is in Reading while 1548 is shared between Capital Radio (London), Radio Hallam (Sheffield), Radio City (Liverpool) and Radio Forth (Edinburgh).

Manx Radio in the Isle of Man is in a category of its own. It was the first commercial radio station in the UK when it came on the air in 1964 and it is currently on 1368kHz (219m) with a power of 4kW.

DXing Local Radio

Although m.w. DXing is normally concerned with the reception of distant stations, a number of DXers have found that local radio too, can present a challenge. An ordinary transistor portable is ideal for this type of DXing owing to the directional properties of the internal aerial. Tune in a station on the medium waves then rotate the portable and two positions, 180 degrees apart, will be found where the station either disappears or its strength is reduced to a low value. These are the nulls and they are very useful for winkling out DX. Tune onto one of the shared frequencies such as 1152kHz, rotate the portable and, depending on your location, you may be able to separate one or more of the broadcasters on the channel. Of course a communications receiver and loop can also be used for local radio DXing.

At night-time, broadcasts from more distant stations will be heard while at twilight, when stations are fading in and out, some of the best catches are to be made. Twilight reception conditions may persist all day in mid-winter.

Be prepared for surprises. **Stewart Kinsley** writes from Coventry to say that he is puzzled by reception on 1548kHz. "From distances and powers I'd expect to pick up Capital Radio. The actual situation is that in the evenings I hear Radio Forth with Radio Bristol in the background, while in the mornings I hear R. Bristol". Reception was with a Drake SSR1 and 20ft non-directional aerial. You would do better with a m.w. loop Stewart.

Directional aerials are in use at some transmitters, which may account for the non-appearance of the London station. It is possible to create a null by using two or more masts joined together in a special way. There is an example beside the main railway line between Manchester and Leeds at Stalybridge where three masts, belonging (I believe) to Piccadilly Radio, should produce a directional pattern to "protect" Birmingham on the same channel. Such arrangements are commonplace in the United States where more than 4000 stations operate on the broadcast band (medium waves).

QSLs

Local radio stations are good verifiers but do send them an accurate report and enclose return postage. A full list of stations plus addresses is to be found in the *World Radio and TV Handbook,* while the Twickenham DX Club, 13 Tennyson Avenue, Twickenham TW1 4QX in the UK will supply non-members with a copy of Broadcasting Stations of Great Britain, which contains addresses, for three 7p stamps (UK) or two IRCs (abroad).

If you are stuck, then use the station's identification plus the name of the town. For example, BBC Radio Merseyside, Liverpool will surely be delivered by the Post Office though they would prefer Commerce House, 13–17 Sir Thomas Street, Liverpool L1 5BS, which is the full address. It is also a good idea to give some details of yourself and your hobby. The station may acknowledge your report over the air and who knows, you may even win a prize for being the most distant listener.

Geneva Plan

It is almost a year since the introduction of the Geneva Plan for the medium waves and it might be useful now to have a look at what the plan has done for (or to) m.w. DXing. It was feared that a common plan for Europe, Asia, Africa and Australasia would make DXing between these areas more difficult and to some degree this has happened. A note from **Arthur Cushen** of Invercargill, New Zealand, mentions that "with the 9kHz separation, European signals are not so numerous". New Zealand and Australia were previously using 10kHz separation which did not line up with Europe.

What was not expected though, was the non-observance of the new plan by many countries outside Western Europe. In particular a number of Middle East countries are still using pre-Geneva channels, at any rate for their lower power stations. Portugal is another offender where the higher power outlets have moved to 666, 756 and 1593, while the Radio Commercial programme is to be found on the old 692, 782, 1034 and 1562kHz.

In reply to Stewart Kinsley, the station on 1414kHz is Algiers 3 which should be on 1422. Malta is on 988kHz, Omdurman Sudan on 764, Nouakchott in Mauretania on 1349 and Amalias Greece on 1562, all pre-Geneva. It is still worth searching between the official channels for DX. Among the high power stations to be found, there is Iraq

This postage stamp is issued by West Germany to mark the occasion of WARC79, which takes place in Geneva in December

with 300kW on 755kHz, Sudan with 200kW on 960, Shiraz Iran on 985 with 400kW and Dubai on 1480 with 600kW.

Readers' Letters

John Rose who is Chairman of the Handicapped Aid Programme (UK) has asked me to mention that he has moved, and asks that all mail should be sent c/o EDXC, PO Box 4, St Ives, Huntingdon, Cambs PE17 4FE. The address given in the August issue of *PW* is now out of date.

Fred Pilkington (G3IAG), who alternates between Newmarket and Torremolinos, mentions that he sent the BBC a tape of Radio 2 on 909 and 693 made while he was in Spain. He won an album of Top Tunes for the best DX listener to the Saturday night programme. It does seem to pay to send in a little more than a bare reception report.

ST

Older readers will pause for a moment to mark the passing, at the age of 82, of Wing Commander John Scott Taggart. He was a Barrister-at-Law, writer, publisher and designer of the famous ST series of receivers which appeared in the early 1930s. During the first world war he was a wireless instructor in the army and during the second he was associated with radar, but it will be for his efforts to introduce the man in the street to the hobby of Wireless that ST will be remembered.

SHORT-WAVE BROADCASTS

by Charles Molloy G8BUS

When asked by potential recruits to the hobby for advice on the purchase of a receiver I usually answer: "What do you want to listen to?" Confusion is often the result, caused no doubt by the large choice of receivers of various types and prices that are on offer in the shops.

Receivers for BC Band Listening

The advice I normally offer for broadcast band listening only, is to get hold of a portable receiver with one or more short-wave bands and a telescopic aerial. With it you will be able to listen to short-wave broadcasts from all over the world. It need not be an expensive set, almost any receiver with short-wave coverage will do. If you decide after a while that the short waves are not for you, then the receiver can still be used for listening to Terry Wogan at breakfast time and nothing is lost. Many never progress beyond this stage of being a listener to short-wave broadcasts and who should say they are wrong!

Receivers for DXing

If your interest in radio is deeper, then you would soon find the limitations of this type of receiver. You will not be able to listen to the Tropical Bands, or to Radio Amateurs. Medium wave DXing and the reception of difficult short-wave stations such as Radio New Zealand, will also be out. In order to pick up radio amateurs you must have a receiver capable of resolving single sideband (s.s.b.) and Morse (c.w.). For serious m.w. DXing you need to be able to use a loop aerial which almost precludes portables which have an internal aerial of their own, so for both purposes a communications receiver, such as the FRG-7, SRX-30, AR88, etc., is indicated. For short-wave and tropical band DXing the better type of portable receiver such as the Grundig Satellit and others, is an alternative to the communications receiver and many experienced successful DXers operate with this type of equipment. Some of these portables are quite sophisticated and may even have a dozen or more bands, digital readout and two degrees of selectivity. Remember though, they should be capable of receiving s.s.b. and c.w. if you are interested in amateurs, and there should not be an internal ferrite rod aerial for the medium waves if you are interested in serious m.w. DXing.

As I said at the beginning, it all depends on what you want to listen to. It is worth remembering though, that a communications receiver is usually a good investment and it is possible to realise on one or to trade it in for something better, without too much difficulty. There is quite a trade in secondhand gear amongst radio amateurs.

B40 Receiver

According to **Peter le Quesne** of Dunedin in New Zealand, the Ministry of Defence, OS (NPS), Building 25A, Royal Arsenal West, London SE18 6TJ, UK, will supply manuals for the B40 and B41 receivers as well as manuals for modifications to them. They should be ordered as follows:

B40 Receiver. Handbook for AP57140 Series Receivers BR1617.
B40 Modifications. Handbook for AP57140 Series Receivers Modification BR1617 (Mods).
B41 Receiver. Handbook for AP57141 Series Receivers BR1618.
B41 Modifications. Handbook for AP75141 Series Receivers Modification BR1618 (Mods).

Peter concludes by saying that the B40 is certainly a fine receiver, in spite of the weight and size, and he understands that they are still in current use with the RNZ Navy. There are not many of them available on the surplus market in NZ, where the B40 fetches about NZ$100.00 and the B41 $40.00.

11 Metre Band

The current position at the time of writing appears as follows:

kHz	Station	Time
25 605	IBA Jerusalem	Afternoon and evening
25 620	Voice of America, Dixon	Early morning to Far East
25 630	Paris	Evenings
25 640	IBA Jerusalem	Afternoon and evening
25 650	R. Nederland, Malagasy	Mornings
25 650	BBC, UK	All day
25 690	Radio Liberty (Portugal)	All day
25 705	IBA Jerusalem	?
25 790	Radio RSA	All day
25 820	Paris	All day
25 880	VOA Bethany	Evenings
25 900	Paris Parallel 25820	All day
25 990	VOA Delano	Early morning to Far East
26 040	VOA Greenville	Afternoon and evening
26 095	VOA Dixon	Late evening

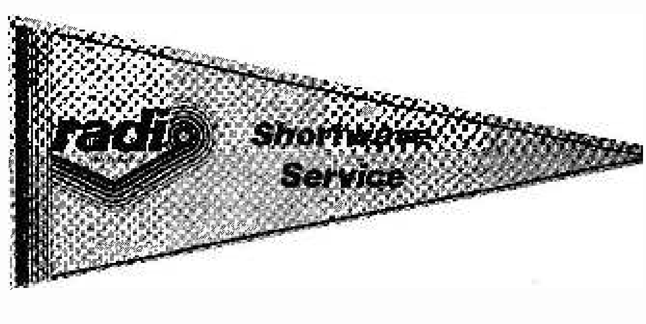
Radio New Zealand

In reply to my request in the May issue for up-to-date information on Radio New Zealand, **Mr R. G. Haggett** who is Manager Overseas Programmes at RNZ, has sent me the latest short-wave and frequency schedule, with times in GMT, which is valid until 28 October 1979.

Pacific Service		
11·835MHz	25m	1800 to 2105
17·860MHz	16m	2115 to 0815
15·345MHz	19m	1800 to 0625
6·105MHz	49m	0640 to 1030
Australia and NW Pacific		
11·945MHz	25m	0830 to 1215
6·105MHz	49m	1045 to 1215

The short-wave service operates two 7·5kW transmitters at Titahi Bay 15 miles north of the capital city, Wellington, and the aerials are orientated in such a manner that the main coverage areas are the Pacific and Australia.

Thanks also to reader **G. Watson,** of Awamutu NZ, who supplied similar information and who points out that the interval signal is the well-known bell bird. If you haven't heard Radio NZ then you can hear a recording of the bell bird in Mitch Murray's record *Long Live Short-Wave.*



The Pennant of Radio New Zealand Short Wave Service

Mr Haggett goes on to say that NZ time is normally GMT + 12hrs but between the last Sunday in October and the first Sunday in March they are on Summer Time which is GMT + 13. He goes on to say "a note for your readers, should they be fortunate to hear us, the usual 10-15 minutes of programme details will get a QSL card. We do like to receive (two) IRCs to enable us to airmail the card back with New Zealand stamps rather than franked. We would also like to hear a little about the person and his home so we may possibly give him a call on our *Mailbox* programme". *Mailbox* is on the air on the third Sunday of each month at 2215 NZ time. The address is: PO Box 2092, Wellington.

120 Metre Band

The first report of this column of DX on 120 metres comes from 15-year-old **Dave Wyatt** of Oswestry, who heard an unidentified station in Portuguese on several occasions on approx 2470kHz between 0115 and 0407. The rig is a BC348 and 90ft long wire. I logged what appears to be the same station on 2480kHz (measured with a frequency counter) at 2230 SIO222 with pops and Portuguese.

Harmonics from the medium waves have to be watched for on 120m, but nothing has been heard to account for this broadcast which for the moment must remain unidentified. There is DX to be heard during the afternoon in winter on 120. Look for China on 2340, 2360 and 2490kHz, Gwelo Rhodesia on 2336 and 2425 and possibly Tananarive in Madagascar on 2495kHz.

Reader's Letter

A TCS12 Rx plus a 90ft long wire are in use at Romsey by **Paul Fry** (BRS 42483) who is looking for information about the Mauritian Broadcasting Corporation. His wife comes from that country and would like to hear their broadcasts. Has anyone logged MBC recently? It is usually heard on 4850kHz in the 60m band, but it is scheduled to be on 9710 from 0200 to 1300. Any information received will be passed on to Paul.

VHF BANDS

by Ron Ham BRS15744

A gigantic solar burst blacks out the short-wave bands; BBC f.m. signals heard in Norway; Russian and Scandinavian television seen in the UK. These are the latest highlights from my readers' reports.

Solar

The sun was quiet from July 25 to August 13 when **Cmdr Henry Hatfield,** Sevenoaks, and I, recorded a few tiny bursts of radio noise at 136 and 146MHz respectively. At midday on the 14th (Fig. 1), I recorded a large burst of noise at 146MHz and Henry recorded it at both 136 and 1296MHz. During the morning of the 14th, Henry, using his spectrohelioscope, observed a plage

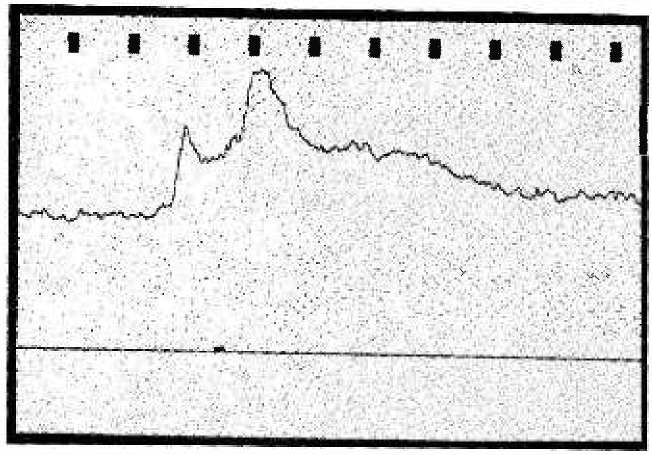


Fig. 1: A 10 minute section of the writer's recording chart showing the peak of the long solar burst at midday on August 14 on 146MHz. Cmdr Hatfield also recorded this at both 136 and 1296MHz. The lower black line indicates the normal receiver noise level

within a group of sunspots just past the c.m.p. and later, at 1542, while he was watching a new group of sunspots coming around the eastern solar limb, a flare with a bright spray, followed by an eruptive prominence, occurred also emitting a big burst of radio noise at 136MHz, and in six minutes it was over. Solar noise was also very strong in the 10m band at midday on the 14th. Several small bursts and some general increase in the noise level were recorded from the sun on August 15, 16, 17, 18 and 20 and an individual burst at midday on the 19th. Henry recorded another big burst between 0915 and 0930 on the 20th.

Sudden Ionospheric Disturbance

Henry Hatfield's pen recorder was sent off scale between 1411 and 1421 on August 18 when a massive burst of radio noise came from the sun. Later, **Charlie Newton** G2FKZ, London, told me that the biggest s.i.d. for a long time coincided with the solar burst and immediately blacked out the short-wave bands from about 3 to 30MHz, which, over the following few hours gradually returned to normal.

Aurora

No doubt the solar activity on the 13th was responsible for the patchy auroral event which manifested in two, approximately 45 minute, phases around 1800 and 2100, enabling amateurs in London to work stations on 2m in Scotland and Sweden.

The 10 Metre Band

"I've been an amateur astronomer for many years working mostly on variable stars, but interested, of course, in sunspots and in terrestrial effects", writes **Ted Waring** of Bristol, who has built a two-transistor receiver so that he can monitor the International Beacon Project stations on the 10m band. Ted heard signals from the Cyprus 5B4CY, 28·220MHz and German DL0IGI, 28·205MHz, beacons on August 7, 9, 10, 11 and 12 while **Gordon Goodyer** BRS37345, Petworth, Sussex, heard 5B4CY on the 6th and 10th and signals from the beacons at Bahrain A9XC, 28·245MHz and Mauritius 3B8MS, 28·210MHz, mainly in the afternoons on several days. I received signals from DL0IGI on eleven of the days between August 1 and 19, mainly due to sporadic-E disturbances.

Although the band was generally "quiet" between July 24 and August 20 there were some openings. In fact, **George Grzebieniak** RS41733, London, heard a short-skip event with lots of DFs, DMs, Gs, LAs and SMs and both Gordon Goodyer and **R. F. Nugent** G2FTS, Polegate, Sussex, reported periodic signals from VK and ZL.

EDXC

The European DX Council have established a new headquarters in the UK and are looking for service manuals or instruction books for communications receivers, ex-govt or domestic, to assist their members. Any offers to: Jonathan Marks, EDXC, PO Box 4, St Ives, Huntingdon, Cambs PE17 4FE.

Satellites

"OSCAR 7B still going well," writes **John Branegan** GM4IHJ, Saline, Fife. "I worked W5UCY near New Orleans at 4300 miles and GM8BKE worked Brazil, and with 14 transatlantic QSOs through 8J in a month, I cannot complain." Signals through OSCAR 8A have been giving John some good c.w. practice with OX5AF and UA6MA as a couple of rare ones.

Sporadic-E

Strong signals from several east-European f.m. broadcast stations came pounding into the UK between 65 and 73MHz, due to sporadic-E disturbances around 1830 on July 27, midday on August 2 and the early mornings of August 1, 14 and 17. On each of these days I heard a variety of Continental radio-telephone signals between 40 and 50MHz along with random RTTY and beacon signals not normally received in the UK.

DX TV

Between 0740 and 0820 on July 24, a sporadic-E disturbance, affecting the narrow bandwidth of 47 to 57MHz, caused television signals, identified by their test cards, from Norway Melhus and Steigen, Poland and Sweden to be received in the UK. Very often, along with a travel film, these test cards were mixing together or changing places with each other on the screen.

At 0840, what looked like a news programme, was introduced by the word HOBOCTON flashing around a tower (any ideas?), and at 0849, a clock labelled CCCP appeared showing the local time of 1149 which places the transmitter a long distance away. Soon after, test cards from Finland and Russia were fighting for predominance on my c.r.t. During the morning, **Sam Faulkner,** Burton-on-Trent, Staffs, received a test card from Norway Hemnes, John Branegan saw Norway Steigen and I received signals from Poland. Sam also received test cards from Spain and Portugal on August 3 and Poland on the 6th. John Branegan received signals from Norway and Sweden during the early evening of the 29th, a test card from Spain around 1120 on the 31st and Grunten, on E2, which was displacing pictures on R1 at 1420 on August 2nd and again between 1550 and 1645 on the 3rd.

It is always interesting to watch a mix up (Fig. 2), when strong signals are coming in on both E2, 48·25MHz and R1, 49·75MHz as they did at midday on August 2 and the evening of the 6th. At 0756 on July 31, I received

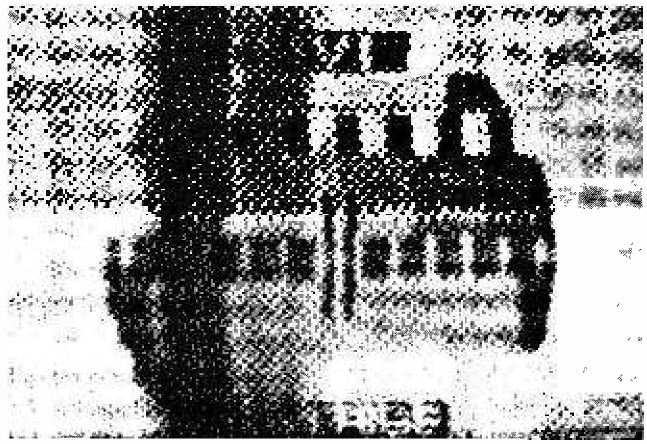


Fig. 2: Typical mix-up of pictures between R1 and E2 during an intense sporadic-E disturbance

a test card, +PTT SRG1, from Switzerland; at 0848, a strong Russian test card, and at 1729, pictures on R1. Strong pictures were received from Finland on August 3, Budapest at 0915 on the 7th, Poland at 0840 on the 8th, Russia at 1243 on the 9th and 0900 on the 14th, Poland at 0740 on the 15th and Russia at 0827 on the 17th and 1707 on the 18th.

Tropospheric

During the v.h.f. opening which accompanied the falling atmospheric pressure on July 27 and 28, the u.h.f. television channels were disturbed and around 2130 on the 27th, **Alan Baker** G4GNX, Newhaven, Sussex and **John Cooper** G8NGO, Cowfold, Sussex, heard EA8AK, on 2m, calling from the Canary Islands for about 30 minutes, but they could not raise him. Alan had to be satisfied with working F6DVY through the French repeater in Bologne FZ2VHF, R5 and GJ3YHU on s.s.b.

On July 30, **Bob Smith,** Mo i Rana, Norway, some 27km south of the Arctic Circle, writes: "I picked up Radio 3 from 2338 to 2341 BST and from 2343 to 2350 on 90·4 and 89·7MHz respectively (July 26/27) and then Radio 2, 90·05MHz, from 0002 to 0007. The signals were in full stereo for about 30 seconds with good hi-fi quality but with slight background hiss fading to mono for about 5 seconds and then disappearing altogether for about 10 seconds." Bob is using a Pioneer SX550 with an indoor dipole some 6ft above floor level, his QTH is only 30 metres a.s.l. and, a most interesting point, about 8km away from Bob's home an 800-metre-high mountain stands between him and the UK.

While these good conditions were declining on the 28th, Alan Baker worked F1CYB on 2m s.s.b. and, along with John Cooper, heard GU5MNX on the Scilly Isles. Throughout the event I frequently heard strong signals from stations working through the Bristol Channel GB3BC, R6 and the Kent GB3KR, R4, repeaters and G8DJW, near Dorset, was heard working through the Brighton repeater GB3SR, R3. The pressure remained below 30·0in from July 29 to midnight on August 3 then it rose sharply on the 4th to 30·2in and slowly declined through the 5th, 6th and 7th. During the change, Alan Baker worked G4IDO in Bedford on 2m c.w. and G8GXE in Slough on s.s.b. and the normal range of most repeaters increased considerably.

George Grzebieniak is looking for good tropospheric conditions in the future to try out his home-brew, G3JVL

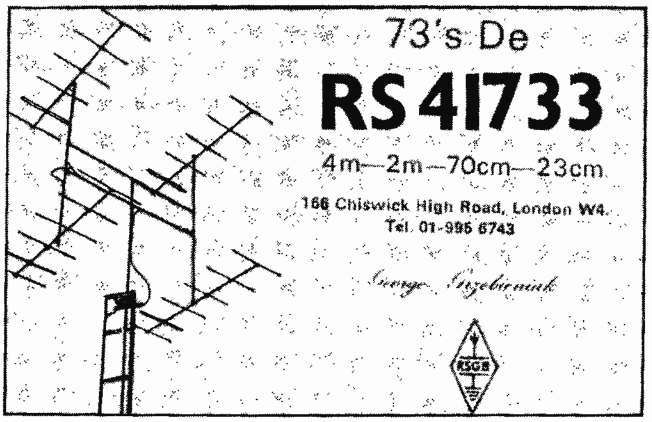


Fig. 3: The simple, but effective QSL card of v.h.f./u.h.f. listener, George Grzebieniak

23cm aerial and his new 23cm converter and, as seen in Fig. 3, his QSL cards are ready printed.

VHF NFD

Like **John Cleaton** G4GHA, Wareham, Dorset, George took part in the 2m section of the RSGB's VHF National Field Day on July 7 and 8 and while John was working into EI, F, GI, GW, GU and ON, George, situated on Prevale Hill, London, logged 23 Gs, 1 GW and 4 Frenchmen and his best DX was G4OWM/A in Durham.

NEW BOOKS

▶▶▶*continued from page 32*

A GUIDE TO AMATEUR RADIO
by Pat Hawker G3VA
Published by Newnes-Butterworths
128 pages, 246 × 186mm. Price £5.40 (hard-backed)
This is the 17th edition of the Guide, and has been completely reset, with much new material. It is intended to help the newcomer to amateur radio to learn about the hobby, covering receivers, transmitters and aerials for fixed, mobile and portable use, plus test gear. The new conditions for the UK amateur licences and the revised syllabus for the new format Radio Amateurs' Examination are incorporated, and a chapter of sample exam questions has been added, though these seem to be somewhat simpler than those used in the first of the new RAEs in May 1979.

RADIO AMATEURS' EXAMINATION MANUAL
by G. L. Benbow G3HB
Published by the Radio Society of Great Britain
114 pages, 244 × 180mm. Price £2.22 including p&p
The introduction of the multiple-choice question examination format for the RAE, plus the associated changes in the syllabus, have necessitated the complete rewriting of several chapters and extensive revision of the remainder in this, the eighth edition of the Manual. This book is intended to provide sufficient information to enable readers to pass the Radio Amateurs' Examination, this being necessary for all applicants for an amateur transmitting licence.

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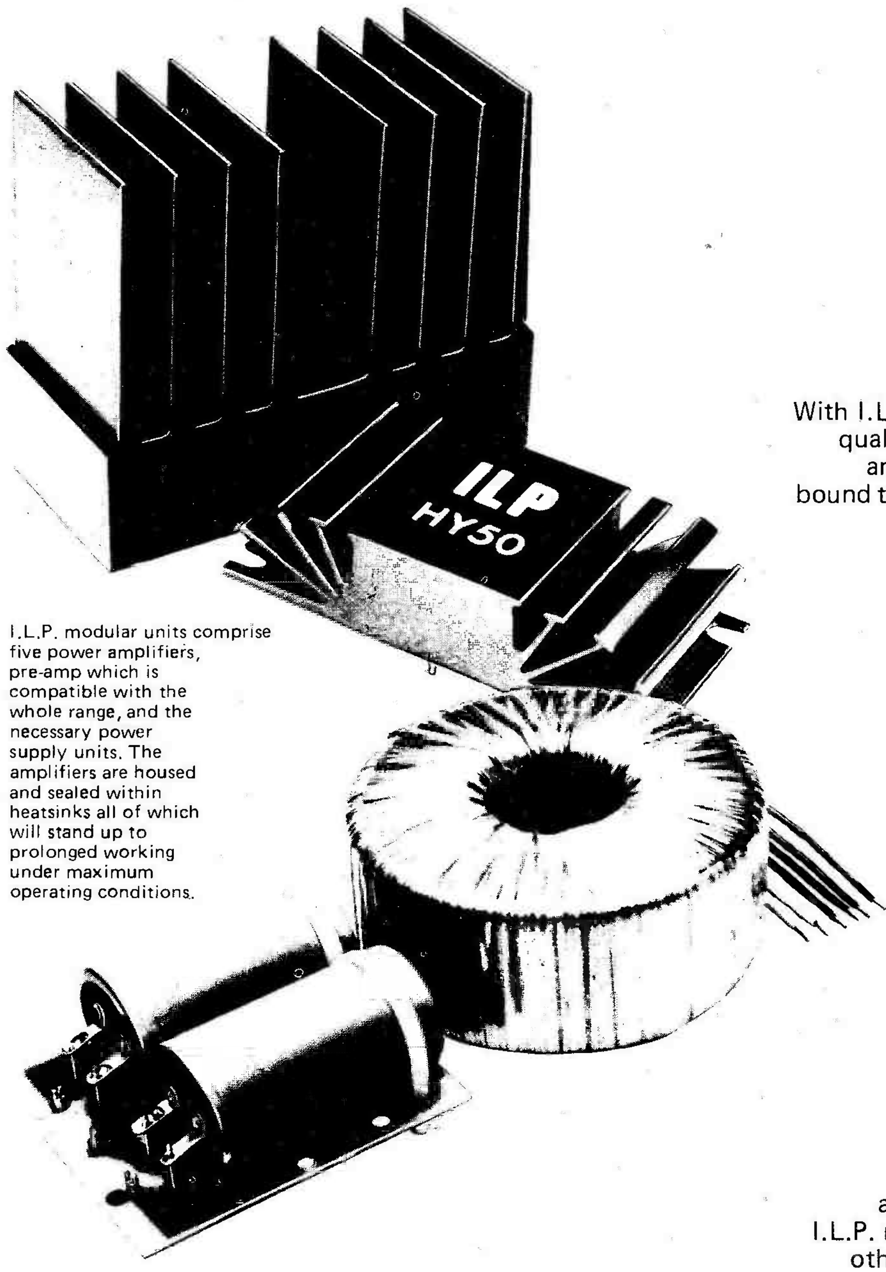

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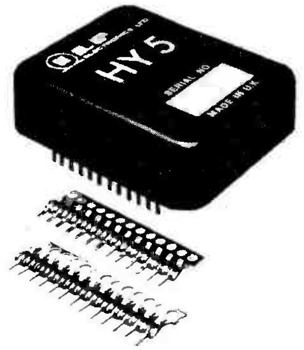

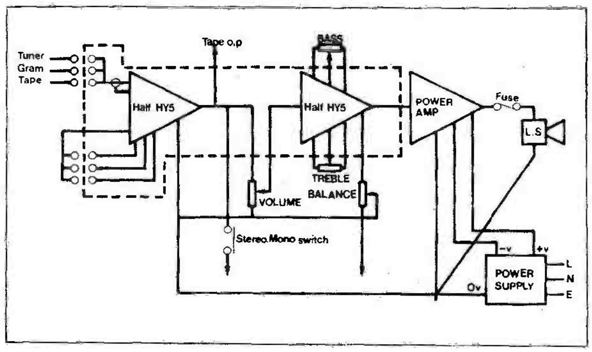

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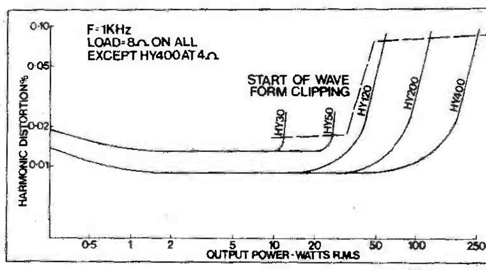

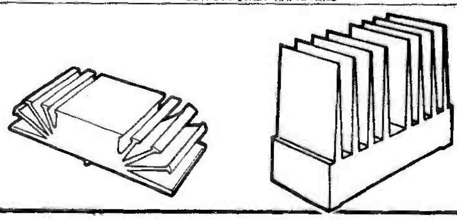

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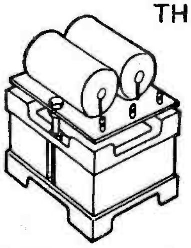

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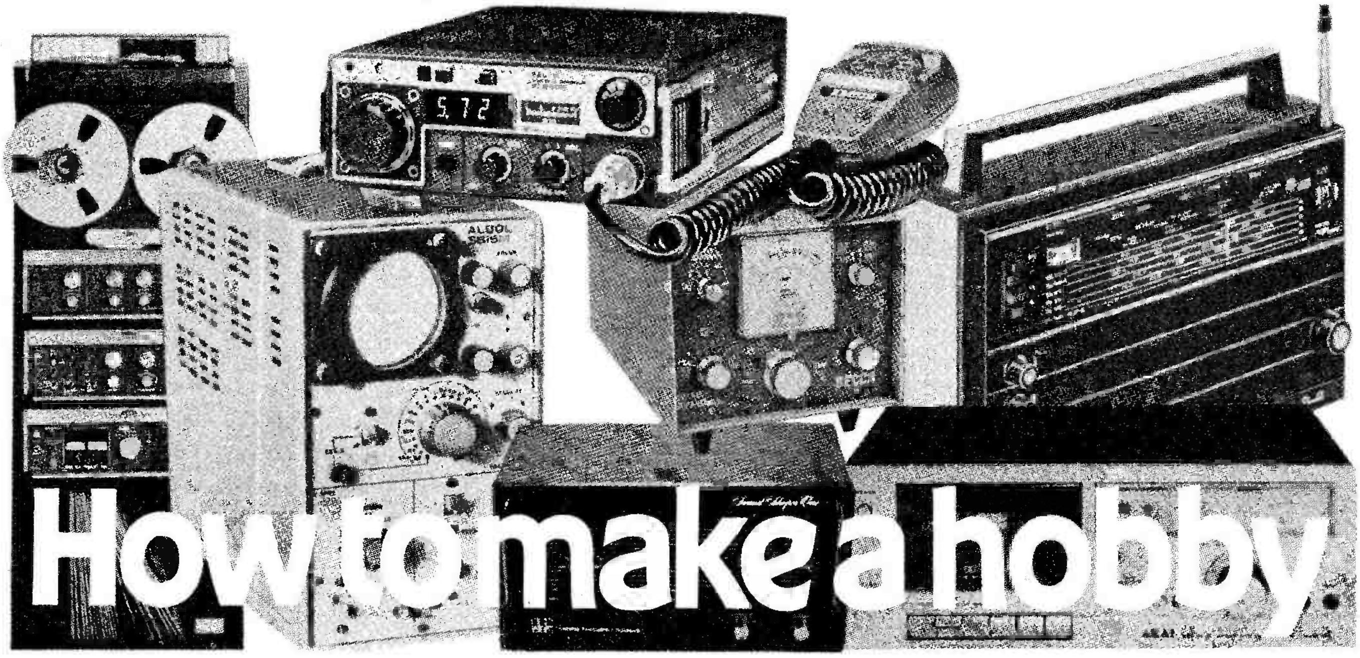

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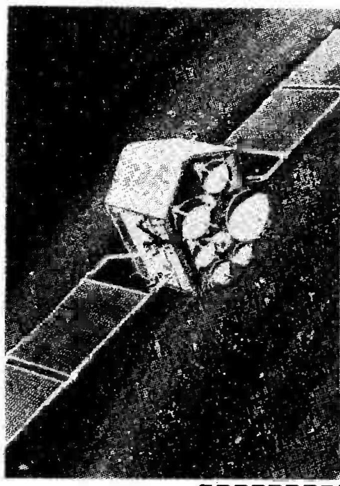

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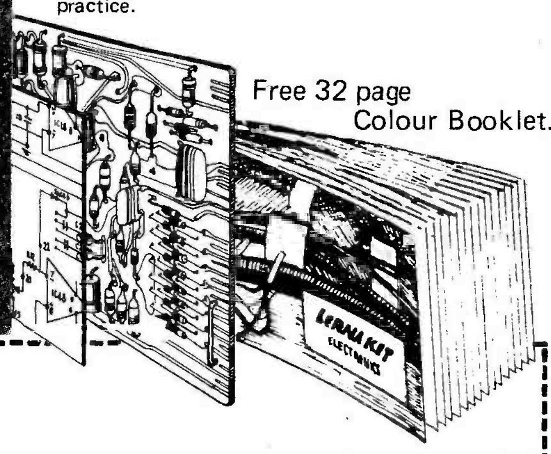

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100 watt with superb treble/bass overdrive. 12 months guarantee. Unbeatable at **£42;** 60 watt **£37;** 200 watt **£58;** 100 Watt twin channel sep. treble/bass per channel **£55;** 60 watt **£48;** 200 watt **£72;** 100 watt four channel sep. treble/bass per channel **£75;** 200 watt **£92;** slaves 100 watt **£32;** 200 watt **£49;** fuzz boxes, great sound, **£8·50;** bass **£9·50;** overdriver; fuzz with treble and bass boosters **£14;** 100 watt combo superb sound overdrive, sturdy construction, castors, unbeatable, **£89;** twin channel **£99;** bass combo **£99;** speakers 15in. 100 watt **£35;** 12in. 100 watt **£22·50;** 60 watt **£14·50.** 10 watt 10in. **£3.50,** 8in. **£3·00.**

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62 Thorncliffe Ave., Dukinfield, Cheshire.
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INDEX TO ADVERTISERS

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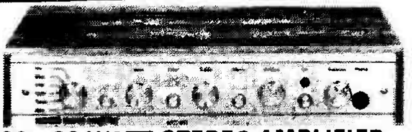


20 x 20 WATT STEREO AMPLIFIER

Viscount IV unit in teak simulate cabinet Silver finish rotary controls and pushbuttons with matching fascia, red mains indicator and stereo jack socket. Functions switch for mic magnetic and crystal pickups, tape tuner and auxiliary. Rear panel features fuse holder, DIN speaker and input sockets. 20 x 20 watts RMS 40 x 40 watts peak for use with 8 to 15 ohm speakers. Size 14¾" x 3" x 10" approx. *NEW* feature—units now includes a built in four channel stereo sound facility.

£31.90
£3.00 p&p

30x30 WATT AMPLIFIER IN KIT FORM

For the experienced constructor complete in every detail, same facilities as Viscount IV, but with 30x30 output. 60x60 watts peak. For use with 4 to 15 ohms speakers.

£31.50 p&p £3.00

SPECIAL OFFER

30 x 30 WATT AMPLIFIER KIT

with BSR P200 belt drive deck and Shure M75 cartridge.

£57.00
+ p&p £6.00

EMI SPEAKER BARGAIN

Stereo pair 350 kit. System consists of 13" x 8" approx. woofer with rolled surround; 2½" approx. Audax tweeter, crossover components and circuit diagram. Frequency response 20 Hz to 20 KHz. Power handling 15 watts RMS. 20 watts max. 8 ohm impedance.

£15.25
Per stereo pair
£3.65 p&p

BSR P200

Belt drive chassis turntable unit semi-automatic, cueing device **£25.50** p&p £2.60

A.D.C. QLM 30 Mk III Magnetic Cartridge to suit. **£7.95**

BSR

Manual single play record deck with auto return and cueing lever, fitted with stereo ceramic cartridge 2 speeds with 45 r.p.m spindle adaptor ideally suited for home or disco use

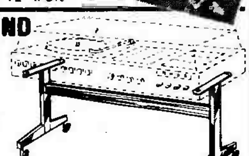
OUR PRICE **£11.25** p&p £2.75

GARRARD DECK MODEL CC 10A

Record changer with cueing device fitted with stereo ceramic cartridge ready to fit into your own plinth.

£8.15 p&p £2.05 Size 12" x 8½"

UNIT AUDIO STAND



Can be used with TV too! Finish in chrome with decorative wood spacer fitted with 4 Kenrick Mini Meteor castors.

£3.95 £1.50 p&p
24" x 12½" x 11½" approx.

BARGAIN FOR PERSONAL SHOPPERS ONLY

Altone UA4 Stereo System

Features 8 watt total output. Full size BSR manual turntable with cueing and auto return. Socket for tape in and out and stereo headphones

complete with speakers. **£35.75**

Micro Cassette Recorder
Pocket size—home or office use or when travelling **£14.25**

Battery operated fluorescent camping lamp.
Runs off 8 U2 batteries. **£4.80**

Mullard

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SEE OUR PRICES

1 PACK 1 2 x LP1173 10w RMS output power audio amp modules. + 1 LP1182/2 Stereo pre amp for ceramic and auxiliary input
OUR PRICE p+p £1.00 **£5.00**

2 PACK 2 2 x LP1173 10w. RMS output power audio amp modules + 1 LP1184/2. Stereo pre amp for magnetic, ceramic and auxiliary inputs
illus. OUR PRICE p+p £1.00 **£7.65**

ACCESSORIES

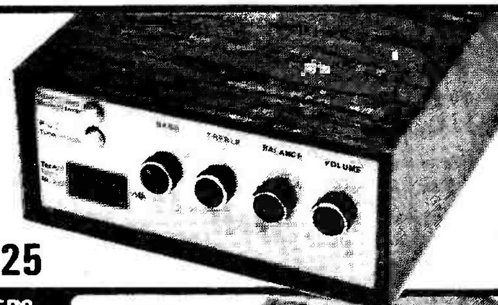
Suitable mains power supply parts, consisting of mains transformer, bridge rectifier, smoothing capacitor and set of rotary stereo controls for treble, bass, volume and balance **£3.00**
plus £1.50 p&p

Two Way Speaker Kit

Comprising of two 8" x 5" approx 4 ohm bass and two 3½" 15 ohm mid-range tweeter with two cross-over capacitors. **£4.05**
per stereo pair
plus £1.55 p&p

AVAILABLE ALSO TO PURCHASERS OF THE 10 + 10 AMPLIFIER KIT

10 + 10 AMPLIFIER KIT



An opportunity to buy a 10 watts per channel stereo amplifier kit which is suitable for use with a ceramic cartridge. The amplifier utilises proven Mullard modules and is available at a very competitive price. The amplifier kit comes complete with instructions and includes a Mullard LP1183 stereo preamplifier module, two LP1173 power amplifiers with integral heatsinks, a power supply, Zobel networks, front and back mounting panels, a finished fascia panel, all control potentiometers (bass, treble, volume and balance), switches, input, output and headphone sockets, wire, and an easily assembled wrap around cabinet to house the finished unit.
Size approximately 9¼" x 8¾" x 4"

p&p £2.25 **£12.25**

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LCD Solar 5 function with backlite stainless steel finish case and strap	**£7.40**
LCD Solar Chrono 9 function with backlite stainless steel finish case and strap	**£9.55**
Chrono stop watch 9 function with back lite stainless steel finish case and strap.	**£8.95**
Solar Alarm LCD stainless steel case and strap.	**£21.95**

AM/FM DIGITAL CLOCK RADIO Accurate 4 Digit Electronic Clock with ½" LED display Buzzer and snooze timer **£12.20**

100 Watt Power Amp Module	**£14.25**
Mains power supply for above unit	**£3.60**
DECCA 20w Stereo speaker kit comprising 2 8" approx bass units + 2 3½" approx tweeter inc crossovers	**£20.45**
'VIDEOMASTER' Super Score TV Game with pistol mains operation	**£15.95**
PORTABLE RADIO/CASSETTE RECORDER, AM/FM with clock, LW, MW, SW, VHF mains/battery operation	**£42.90**
ISP Radio Cassette recorder Mains/Battery AM/FM built in mic auto stop	**£24.50**

100 WATT MONO DISCO AMP

Size approx 14" x 4" x 10"
Brushed aluminium fascia and rotary controls
Five vertical slide controls, master volume, tape level, mic level, deck level. PLUS INTER DECK FADER for perfect graduated change from record deck No 1 to No 2, or vice versa. Pre fade level cont ol (PFL) lets YOU hear next disc before fading it in. VU meter monitors output level. Output 100 watts RMS 200 watts peak

p&p £4.05 **£66.45**

50 WATT MONO DISCO AMP

£30.60
p&p £2.70

Size approx. 13⅜" x 5¼" x 6¾"
50 watts rms. 100 watts peak output. Big features include two disc inputs, both for ceramic cartridges, tape input and microphone input. Level mixing controls fitted with integral push-pull switches. Independent bass and treble controls and master volume.

FOR PERSONAL SHOPPERS ONLY

DUO II SPEAKERS

Attractive teak finish, modern design, incorporating 2 speaker units–8" approx woofer and 2" approx tweeter 45 to 1800 Hz Impedance 8 ohms Power 15 watts RMS
18" x 13" x 7" approx
Per stereo pair **£16.50**

FOR PERSONAL SHOPPERS ONLY

STEREO RADIOGRAM CABINET

Finished in a natural teak veneer with opening top. Easily modified to accommodate stereo equipment of your choice.
Price **£10.95**
Size approximately 47" x 15½" x 15"

R T V C

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21B HIGH STREET, ACTON W3 6NG

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