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JUNE 1977
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PRACTICAL WIRELESS

VOL. 53 NO. 2
ISSUE 844
JUNE 1977

BRITAIN'S PREMIER MAGAZINE FOR THE DO-IT-YOURSELF RADIO AND ELECTRONICS CONSTRUCTOR

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Published by IPC Magazines Ltd., Fleetway House, Farringdon Street, London EC4A 4AD. Tel. 01-634 4444

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Binders £2·10 and indexes 45p (inc. VAT) can be supplied by the Post Sales Department, IPC Magazines Ltd., Lavington House, 25 Lavington Street, London, SE1 0PF.
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● NEWS & COMMENT

● CONSTRUCTIONAL

● OTHER FEATURES

TRANSFORMERS
ALL EX-STOCK—SAME DAY DESPATCH

AUTO TRANSFORMERS

Ref	VA (Watts)	Taps	£
113	20	0-115-210-240	3·14
64	75	,, ,,	4·73
4	150	0-115-200-220-240	6·69
66	300	,, ,,	8·82
67	500	,, ,,	13·39
84	1000	,, ,,	21·12
93	1500	,, ,,	23·62†
95	2000	,, ,,	34·17†
73	3000	,, ,,	47·63†

CASED AUTO TRANSFORM

240V cable in & 115V USA 2 pin out.

20VA	£5·67	Ref 113W
150VA	£9·30	Ref 4W
200VA	£11·93	Ref 65W
300VA	£14·32	Ref 66W
500VA	£16·91	Ref 67W
1000VA	£22·84	Ref 84W†
2000VA	£37·82	Ref 95W†

60 VOLT RANGE

Prim. 220–240V
Sec. 0–24–30–40–48–60V

Ref.	amps	£
124	0·5	4·69
126	1·0	6·02
127	2·0	8·36
125	3·0	11·47
123	4·0	13·92
40	5·0	15·24
120	6·0	17·86
121	8·0	19·56
122	10·0	24·09
189	12·0	26·57

SCREENED MINIATURES

Ref	mA	Volts	£
238	200	3-0-3	2·74
212	1A, 1A	0-6, 0-6	3·41
13	100	9-0-9	2·45
235	330, 330	0-9, 0-9	2·56
207	500, 500	0-8-9, 0-8-9	3·27
208	1A, 1A	0-8-9, 0-8-9	4·65
236	200, 200	0-15, 0-15	2·56
214	300, 300	0-20, 0-20	3·36
221	700 (DC)	20-12-0-12-20	4·04
206	1A, 1A	0-15-20, 0-15-20	5·54
203	500, 500	0-15-27, 0-15-27	4·95
204	1A, 1A	0-15-27, 0-15-27	6·18
5112	500	12, 15, 20, 24, 30	3·45

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SEC 120/240V
PRIM & SEC CENTRE TAPPED

Ref	VA(Watts)	£
07*	20	5·10
149	60	7·11
150	100	7·85
151	200	12·59
152	250	14·81
153	350	18·08
154	560	21·55
155	750	28·20†
156	1000	37·97†
157	1500	45·51†
158	2000	53·24†
159	3000	80·78†

*115V or 240V Sec. only.

12 and or 24 Volt

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Ref.	12V amps	24V amps	£
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213	1·0	0·5	3·24
71	2	1	4·02
68	3	–	5·43
18	4	2	5·08
85	5	–	5·79
70	6	3	6·75
108	8	4	8·04
72	10	5	8·58
116	12	6	9·89
17	16	8	11·36
115	20	10	15·80
187	30	15	19·88
226	60	30	24·78†

30 VOLT RANGE

Prim. 220-240V
Sec. 0-12-15-20-24-30V

Ref.	Amps	£
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79	1·0	4·37
3	2·0	6·21
20	3·0	7·51
21	4·0	8·61
51	5·0	9·99
117	6·0	11·50
88	8·0	14·44
89	10·0	14·85

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200V	4A	1·04
400V	4A	1·21
400V	6A	1·44
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1000	250	25·92
2000	252	54·80†

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Sec. 0-19-25-33-40-50V

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103	1·0	5·55
104	2·0	7·82
105	3·0	9·86
106	4·0	12·19
107	6·0	17·56
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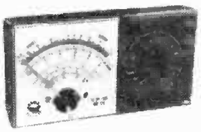

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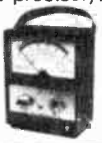

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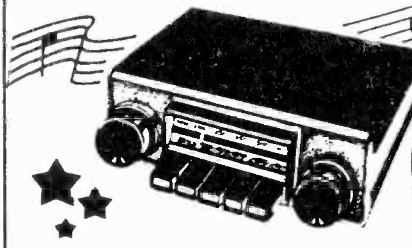

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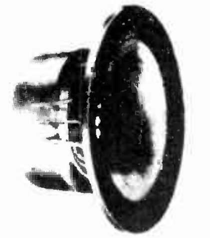

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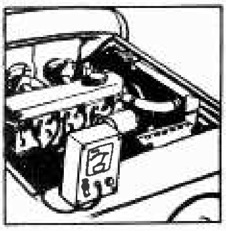
PULSE ELECTRONICS LTD
(PW 1) 6 GOWER ROAD, ROYSTON, HERTFORDSHIRE
Phone Royston (0763) 43695

Doram kits

DORAM KITS CONTAIN EVERYTHING DOWN TO THE LAST NUT!

£5·70 + S

Dwell Meter



IDEAL FOR THE D-I-Y MOTORIST!

£5.70 + S VAT Subject to availability
(Order code 991-568)

The Dwell Meter permits easy adjustment of worn or pitted contact breakers, based on the electrical contact time and not on the mechanical distance between the points. The improved accuracy obtainable by using this self contained unit, ensures greater precision than may be obtained using Feeler Gauges.

O'seas orders—add 15% for P+P. All items offered for sale subject to the Terms of Business set out in Doram Edition 3 catalogue, price 60p. The Doram Kit brochure is also available, price 25p. Combined price only 70p which also entitles you to 2x25p vouchers, each one usable on any order placed to the value of £5.00 or more (ex. VAT).

DORAM ELECTRONICS LTD.
P O BOX TR8, WELLINGTON RD. IND EST., LEEDS LS12 2UF

An Electrocomponents Group Company

CARAVAN/CAR CONNECTOR

The famous Clanc connectors heavy cast body enclosing the electrical socket and plug —screw together cannot be pulled out or come out with vibration. Socket screw on cover keeps out dirt when caravan is not connected. Socket £2·50. Plug £2·85p or Socket fixed to solid angle iron (ready for mounting) £3·50.

3 CORE CURLY LEAD

Water and oil proof, terminating each end with 3 pin Clang plug, length extended approx. 10ft. Price £6·00 + 75p.

12v AUTOMATIC SWITCH

It can sometimes be a problem to find your car or caravan in a big car park or caravan site after dark, so why not fit a light that will come on automatically when it gets dark. We are offering a kit for this, comprises: light sensitive switch, 12v bulb and bulb holder in tubular casing with coloured lens, with wiring diagram.

Price £3·00 + 37½p + 20p + 2p. Main operation switch available £3·95.

TAPE HEADS ETC.

2 track record/playback 75p.

4 track record/playback £1·10.

Erase head 2 track 50p, 4 track 90p.

Mu metal shields and holders 65p each.

2 track r/p head and 2 track erase head schedule and fixed on mounting plate ready for tape £1·85.

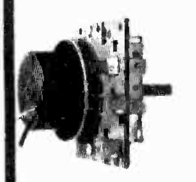
INDUCTION MOTORS

230v mains operated—precision made as used in fans—record players. Tape recorder—heaters etc. etc. ½ stack (as illustrated) £1·35. ¾ stack £1·75. 1" stack £2·25.

MOTORISED DISCO SWITCH

With six 10 amp changeover switches. Multi adjustable switches are rated at 10 amp each so a total of 2000w's can be controlled and this would provide a magnificent display. For mains operating £4·25 post & VAT Paid. Ditto 9 switch £4·95 Post & VAT Paid. DITTO BUT 12 SWITCH £5·75 POST & VAT PAID.

DELAY SWITCH



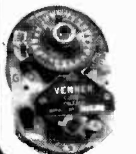
Mains operated—delay can be accurately set with pointers knob for periods of up to 2½ hrs. 2 contacts suitable to switch 10 amps—second contact opens few minutes after 1st contact 95p.

WAFER SWITCHES

6 pole 2 way	12 pole 2 way	18 pole 2 way
5 pole 3 way	10 pole 3 way	15 pole 3 way
4 pole 4 way	8 pole 4 way	12 pole 4 way
3 pole 5 way	6 pole 5 way	9 pole 5 way
2 pole 6 way	4 pole 6 way	6 pole 6 way
2 pole 8 way	4 pole 8 way	6 pole 8 way
1 pole 10 way	4 pole 9 way	6 pole 9 way
1 pole 12 way	2 pole 10 way	3 pole 10 way
all £1·32 each	all £2·41 each	all £3·12 each

Multi bank switches up to 72 pole 2 way—to 12 pole 12 way quickly made to special order.

24 HOUR TIMERS

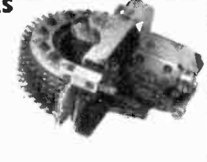


VERMEN
As illustrated with sun correction made for G.P.O. phone boxes unused and perfect £2·25 20 amp switching contacts.

SMITHS
Timer heart similar to Autoset etc. 2 13 amp on/off per 24 hrs. £4·15.

TIMAC
Module really miniature (approx 2" cube) but with 2 15 amp on/off per 24 hrs. £4·50.

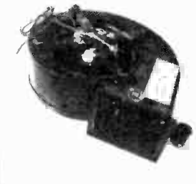
UNISELECTORS



These are pulse operated switches as used in automatic telephone switchboards etc. A 24v pulse moves the switch through one switch way all we have are of the 25 switch full wiper type, the following sizes are in stock:

3 bank	£4·80 + 37p	3 bank & Homer	£5·40
4 bank	£5·94 +	5 bank	£7·02
8 bank	£9·72 +	10 bank	£10·80
12 bank	£12·96 +		

BLOWER FAN



Centrifugal type blower/fans with rectangular outlets designed to fit into trunking for heat blowing etc. will also function as extractors main voltage motors—three sizes available small (overall size approx 4½" × 4" × 4") £4·50—medium (overall size 9" × 8" × 3" approx) £6·50—large (overall size 12" × 12" × 10" approx) £13·50.

CENTRAL HEATING HEARTS

Randal (illustrated) replacement in 3060 etc £6·75.

HORTSMAN £6·30.

SMITHS Controller 10/100 complete in wall mounting case £7·50.

THIS MONTH'S SNIP

HI FI RECORD PLAYER

Stereo 5 watts per channel. Russian made but guaranteed repairable. Travel damaged or test line rejects, in need of attention, consist of mains operated record deck — mounted in wooden plinth with super 10 watt amplifier. Controls are "on/off", "Tape/phone", "mono/stereo", "Base", "Treble", "Balance", "Volume". We are offering these at price of record deck only so are a bargain not to be missed only £6·75p, post £2·00p. Note cartridge and all spares are available at low prices.

MAINS TRANSFORMER BARGAINS

20v ½ amp	£1·25
18v 1 amp	£1·55
6·3v 2 amp	£1·39
25v 1½ amp	£1·75
24v 2 amp	£2·00
50v 2 amp	£4·50
9v 1 amp	£1·25
8·5v-0-8·5v ½ amp	£1·25
10v 20v 30v 40v 250 watt loading	£5·50
20 watt auto 115v	£1·25
100 watt auto 115v	£1·75

THERMOSTATS

Refrigeration as illustrated with 36" capillary £1·62.

Limpet Stat must be mounted in close contact calibrated 90°–190°F 15 amp contacts £1·62.

Appliance Stat fix like a volume control—15 amp contact 30°–80°F 85p.

ditto but for high temps £1·25

Over Stat—with Serson and capillary 85p

TERMS:

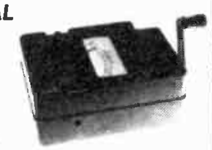
Cash with order—delivery same day as order received prices includes VAT and carriage unless stated but orders under £6 must add 50p to offset packing etc.

BULK ENQUIRIES WELCOMED.

J. BULL (ELECTRICAL) LTD

(Dept. PW), 103 TAMWORTH RD.
CROYDON CR9 1SG

WEE MEGGER
A VERY SPECIAL OFFER



Most famous testing instruments. Made by Evershed & Vignol, a must for every electrical contractor and service man. In perfect going order having been thoroughly reconditioned for the G.P.O. Price £14·00 + £1·12p. Post 80p + 6p.

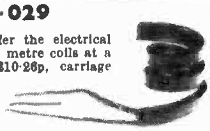
LOW R.P.M. MOTORS

Made by Crouzet — Smiths — SAIWA — Venner and similar famous companies—all supplied ready for 230/240v 50hz mains working at £2·75 each. Following speeds in stock when preparing this advert.

1 rev per day	6 rev per day
1 rev per hour	12 revs per hour
½ rev per min	1 rev per min
2 rpm	1½ rpm

5 rpm 15 rpm 20 rpm 25 rpm 30 rpm

REMEMBER 7·029



We are still able to offer the electrical equivalent of this in 100 metre coils at a very special price of £10·26p, carriage £2·50p. Our remaining stock of this is 3 core and earth, this is a little larger physically than twin and earth but if space limited then just remove the unwanted core before taking cable into small socket box.

FREE Telephone line. If you are using the above cable for taking a supply to a shed or remote point then the third core can be used as a telephone line. For lighting we can offer 1·5mm. Three core at £6·50 carriage £1·60.

MULLARD UNILEX

A mains operated 4 + 4 stereo system. Rated one of the finest performers in the stereo field this would make a wonderful gift for almost any one in easy-to-assemble modular form and complete with a pair of Goodmans speakers this should sell at about £30—but due to a special bulk buy and as an incentive for you to buy this month we offer the system complete at only £14·00 including VAT and postage.

IT'S FREE!

Our monthly Advance Advertising Bargains List gives details of bargains arriving or just arrived—often bargains which sell out before our advertisement can appear—it's an interesting list and it's free—just send S.A.E. Below are a few of the Bargains still available from a recent list.

Luminous Rocker Switch, suitable for 13 amps at mains voltage, these are illuminated with neon through amber panel, snap-in fixing into hole size 1⅛" × 1⅛". Special bargain, 35p + 5p.

Chrome Plated Metal Legs, heavy duty, really good quality, made originally for an expensive Decca outfit, height 12", £1·50 per set of 4 plus post 30p.

Students Relay Parcel. 10 Multi contact 600 type relays all different coil values covering most experimenters needs. Total retail value approx. £10—yours for £3 plus 30p post.

BSR Record Auto-changer, current model of very high repute with a ceramic stereo cartridge £10·95 + £1·37. Post £1·00 + 12½p.

Speaker bargain, 13" × 8" E.M.I. 10 watt speaker with twin tweeters and cross-over a really fantastic performer. Regular price over £8 each—we have a limited quantity ½ ohm coil £5 + 50p each post and insurance.

Motor with fan blade—if you want something to cool or if you are making a cooker hood or a blower heater etc. this may be the answer. Quiet running induction motor with a set of Smith's fan blades, approx 5" dia. £2·00 + 16p. Post 40p + 4p.

Microswitch bargain—Honeywell, brand new 10 amp 250v gold on silver contacts, standard fixing, normal operation. Price 10p + 1p—10 for £1, post & VAT paid.

Cooling fins—heavy duty for TO3 type semi-conductors extruded aluminium, size 4½" × 3". Price 50p each.

Instrument cases—portable, about the size of portable typewriter, actually 13" × 10" × 4" thick approx. with carrying handle. Inside these boxes there is a mains transformer with two outputs 12v and 6v and two full wave rectifiers with smoothing condensers as well as many other useful components, fuse holders etc. May be just the thing you are looking for for that portable instrument. Price £3·50 + 28p. Post 70p + 7p.

Fluorescent kit for 5ft tube. This is another exceptional bargain. It comprises polyester filled almost silent running 65w choke made by GEC, starter and holder, tube ends and terry clips to hold the tube and wiring diagram etc. **THIS MONTH'S SNIP** at only £1·75 + 12p the lot + 50p + 4p post and packing. Just what sort of a bargain this is will be realised when you look at the new prices for chokes only: the recommended list price of 65w is now over £3·50.

SEMICONDUCTORS—COMPONENTS

DIODES

Type	Price	Type	Price	Type	Price	Type	Price
AA129	£0·08	BY100	£0·16	BYZ11	£0·31	OA91	£0·07
AAY30	£0·09	BY107	£0·12	BYZ12	£0·31	OA95	£0·07
AAZ13	£0·10	BY105	£0·18	BYZ13	£0·26	OA182	£0·07
AAZ17	£0·10	BY114	£0·12	BYZ16	£0·41	OA200	£0·08
BA100	£0·10	BY124	*£0·12	BYZ17	£0·36	OA202	£0·08
BA102	£0·32	BY126	*£0·15	BYZ18	£0·36	SD10	£0·06
BA148	£0·15	BY127	*£0·16	BYZ19	£0·28	SD19	£0·06
BA154	£0·12	BY128	*£0·16	OA10	£0·35	IN34	£0·07
BA155	£0·14	BY130	*£0·17	OA47	£0·07	IN34A	£0·07
BA156	£0·14	BY133	*£0·21	OA70	£0·07	IN914	£0·06
BA173	£0·15	BY164	£0·51	OA79	£0·07	IN916	£0·06
BB104	£0·15	BY176	*£0·75	OA81	£0·07	IN4148	£0·06
BAX13	£0·07	BY206	£0·00	OA85	£0·09	IS44	£0·05
BAX16	£0·08	BYZ10	£0·36	OA90	£0·07	IS920	£0·06

SILICON RECTIFIERS

Type	Price	Type	Price	Type	Price	Type	Price
IS920	£0·06	IN4003	£0·07	IS020	£0·10	IS031	£0·25
IS921	£0·07	IN4004	£0·08	IS021	£0·11	IN5400	£0·13
IS922	£0·08	IN4005	£0·09	IS023	£0·13	IN5401	£0·15
IS923	£0·09	IN4006	£0·10	IS025	£0·14	IN5402	£0·16
IS924	£0·10	IN4007	£0·11	IS027	£0·16	IN5404	£0·17
IN4001	£0·05	IS015	£0·09	IS029	£0·20	IN5406	£0·21
IN4002	£0·06					IN5407	£0·25

TRIACS

2 AMP TO5 CASE

Volts	No.	Price
100	TR12A/100	£0·31
200	TR12A/200	£0·51
400	TR12A/400	£0·71

10 AMP TO48 CASE

Volts	No.	Price
100	TR110A/100	£0·77
200	TR110A/200	£0·92
400	TR110A/400	£1·12

6 AMP TO66 CASE

Volts	No.	Price
100	TR16A/100	£0·51
200	TR16A/200	£0·61
400	TR16A/400	£0·77

10 AMP TO48 CASE

Volts	No.	Price
100	TR110A/100	£0·77
200	TR110A/200	£0·92
400	TR110A/400	£1·12

THYRISTORS

600mA TO18 CASE

Volts	No.	Price
10	THY600/10	£0·13
20	THY600/20	£0·13
30	THY600/30	£0·19
50	THY600/50	£0·22
100	THY600/100	£0·25
200	THY600/200	£0·38
400	THY600/400	£0·45

1 AMP TO5 CASE

Volts	No.	Price
50	THY1A/50	£0·26
100	THY1A/100	£0·27
200	THY1A/200	£0·28
400	THY1A/400	£0·36
600	THY1A/600	£0·45
800	THY1A/800	£0·58

3 AMP TO66 CASE

Volts	No.	Price
50	THY3A/50	£0·25
100	THY3A/100	£0·27
200	THY3A/200	£0·33
400	THY3A/400	£0·42
600	THY3A/600	£0·50
800	THY3A/800	£0·65

5 AMP TO66 CASE

Volts	No.	Price
50	THY5A/50	£0·36
100	THY5A/100	£0·48
200	THY5A/200	£0·50
400	THY5A/400	£0·57
600	THY5A/600	£0·69
800	THY5A/800	£0·81

5 AMP TO220 CASE

Volts	No.	Price
400	THY5A/400P	£0·57
600	THY5A/600P	£0·69
800	THY5A/800P	£0·81

7 AMP TO48 CASE

Volts	No.	Price
50	THY7A/50	£0·48
100	THY7A/100	£0·51
200	THY7A/200	£0·57
400	THY7A/400	£0·62
600	THY7A/600	£0·78
800	THY7A/800	£0·92

10 AMP TO48 CASE

Volts	No.	Price
50	THY10A/50	£0·51
100	THY10A/100	£0·57
200	THY10A/200	£0·62
400	THY10A/400	£0·71
600	THY10A/600	£0·99
800	THY10A/800	£1·22

16 AMP TO48 CASE

Volts	No.	Price
50	THY16A/50	£0·54
100	THY16A/100	£0·58
200	THY16A/200	£0·62
400	THY16A/400	£0·77
600	THY16A/600	£0·90
800	THY16A/800	£1·39

30 AMP TO94 CASE

Volts	No.	Price
50	THY30A/50	£1·18
100	THY30A/100	£1·43
200	THY30A/200	£1·63
400	THY30A/400	£1·79
600	THY30A/600	£3·50

No.	Price
BT101/500R	£0·80
BT102/500R	£0·80
BT106	£1·25
BT107	£0·93
BT108	£0·98
2N3228	£0·70
2N3525	£0·77
BTX30/50L	£0·33
BTX30/400L	£0·46
C106/4	£0·60

ORDERING

PLEASE WORD YOUR ORDERS EXACTLY AS PRINTED, NOT FORGETTING TO INCLUDE OUR PART NUMBER

VAT

ADD 12½% TO PRICES MARKED* ADD 8% TO OTHERS EXCEPTING THOSE MARKED †, THESE ARE ZERO RATED

SUPER UNTESTED PAKS

Pak No.	Qty.		Order No.	Price
U50	100	Germ. gold bonded OA47 diode	16130	£0·60
U51	150	Germ. OA70/81 diode	16131	£0·60
U52	100	Silicon diodes 200mA OA200	16132	£0·60
U53	150	Diodes 75mA 1N4148	16133	£0·60
U54	50	Sil rect top hat 750mA	16134	£0·60
U55	20	Sil rect stud type 3 amp	16135	£0·60
U56	50	400mW zeners DO7 case	16136	£0·60
U57	30	NPN trans BC107/8 plastic	16137	*£0·60
U58	30	PNP trans BC177/178 plastic	16138	*£0·60
U59	25	NPN TO39 2N697/2N1711 silicon	16139	£0·60
U60	25	PNP TO59 2N2905 silicon	16140	£0·60
U61	30	NPN TO18 2N706 silicon	16141	£0·60
U62	25	NPN BFY50/51	16142	£0·60
U63	30	NPN plastic 2N3906 silicon	16143	*£0·60
U64	30	PNP plastic 2N3905 silicon	16144	*£0·60
U65	30	Germ. 0071 PNP	16145	£0·60
U66	15	Plastic power 2N3055 NPN	16146	£1·20
U67	10	TO3 metal 2N3055 NPN	16147	£1·20
U68	20	Unijunction trans IIS43	16148	£0·60
U69	10	1 amp SCR TO39	16149	£1·20
U70	8	3 amp SCR TO66 case	16150	£1·20

Code Nos. mentioned above are given as a guide to the type of device in the pak. The device themselves are normally unmarked.

COMPONENT PAKS

Pak No.	Qty.		Order No.	Price
C1	200	Resistor mixed value approx. (count by weight)	16164	*£0·60
C2	150	Capacitors mixed value approx. (count by weight)	16165	*£0·60
C3	50	Precison resistors. Mixed values	16166	£0·60
C4	80	¼W resistors mixed preferred values	16167	*£0·60
C5	5	Pieces assorted ferrite rods	16168	*£0·60
C6	2	Tuning gangs. MW/LW VHF	16169	*£0·60
C7	1	Pack wire 50 meters assorted colours single strand	16170	£0·60
C8	10	Reed switches	16171	*£0·60
C9	3	Micro switches	16172	*£0·60
C10	15	Assorted pots	16173	*£0·60
C11	5	Metal jack sockets 3×3·5mm 2×standard switch types	16174	*£0·60
C12	30	Paper condensers preferred types mixed values	16175	*£0·60
C13	20	Electrolytics trans. types	16176	*£0·60
C14	1	Pak assorted hardware—nuts/bolts, gromets, etc.	16177	£0·60
C15	5	Mains slide switches ass.	16178	*£0·60
C16	20	Assorted tag strips and panels	16179	£0·60
C17	15	Assorted control knobs	16180	*£0·60
C18	4	Rotary wave change switches	16181	*£0·60
C19	2	Relays 6-24V operating	16182	*£0·60
C20	1	Pak. copper laminate approx. 200 sq.in.	16183	£0·60
C21	15	Assorted fuses 100mA-5 amp	16184	£0·60
C22	50	Metres PVC sleeving assorted size and colour	16185	£0·60
C23	60	½ watt resistors mixed preferred values	16188	*£0·60
C24	25	Presets assorted type and value	16186	*£0·60
C25	30	Metres stranded wire assorted colours	16187	£0·60

SLIDER PAKS

Pak No.	Qty.		Order No.	Price
S1	6	Slider potentiometers, mixed values	16190	*£0·60
S2	6	Slider potentiometers, all 470 ohms	16191	*£0·60
S3	6	Slider potentiometers, all 10kΩ lin	16192	*£0·60
S4	6	Slider potentiometers, all 22kΩ lin	16193	*£0·60
S5	6	Slider potentiometers, all 47kΩ lin	16194	*£0·60
S6	6	Slider potentiometers, all 47kΩ log	16195	*£0·60

CERAMIC PAK

Containing a range of first quality miniature ceramic capacitors. Unrepeatable value.

Pak No.	Qty.		Order No.	Price
MC1	24	miniature ceramic capacitors, 3 of each value—22pF, 27pF, 33pF, 39pF, 47pF, 68pF, and 82pF	16160	*£0·60
MC2	24	miniature ceramic capacitors, 3 of each value—100pF, 120pF, 150pF, 180pF, 220pF, 270pF, 330pF and 390F	16161	*£0·60

LINEAR PAKS

Manufacturer's "Fall Outs" which include Functional and part-Functional Units. These are classed as "out of-spec" from the maker's very rigid specifications, but are ideal for learning about ICs and experimental work.

U721—30 Assorted Linear Types, 709 741, 747, 748, 710, 588, etc.
ORDER No. 16227 *£1·50

U76SD FM STEREO DECODER
5 ICs 76110 equivalent to MC1310P-MA767. Data supplied with pak.
ORDER No. 16229 *£1·50

U76A AUDIO POWER OUTPUT AMPLIFIERS
8 assorted types. SL403, 76013, 76003, etc. Data supplied with pak.
ORDER No. 16228 *£1·00

74 SERIES PAKS

Manufacturer's "Fall Outs" which include Functional and part-Functional Units. These are classed as "out-of-spec" from the maker's very rigid specifications, but are ideal for learning about ICs and experimental work.

74G—100 Gates assorted 7400-01-04-10-50-60, etc.
ORDER No. 16224 £1·20

74F—50 Flip-Flops assorted 7470-72-73-74-76-104-109, etc.
ORDER No. 16225 £1·20

74M—30 MSI. Assorted Types. 7441-47-90-154, etc.
ORDER No. 16226 £1·20

VEROBOARDS PAKS

VB1—Approx. 30sq.in various sizes. All 0·1in matrix.
ORDER No. 16199 60p

VB2—Approx. 30sq.in various sizes. 0·15in matrix.
ORDER No. 16200 60p

ELECTROLYTIC PAKS

A range of paks each containing 18 first quality, mixed value miniature electrolytics.

EC1—Values from 0·47µF to 10µF.
ORDER No. 16201 *60p

EC2—Values from 10µF to 100µF.
ORDER No. 16202 *60p

EC3—Values from 100µF to 680µF.
ORDER No. 16203 *60p

C280 CAPACITOR PAK

75 Mullard C280 capacitors, mixed values ranging from 0·01µF to 2·2µF complete with identification sheet.
ORDER No. 16204 *£1·20

CARBON RESISTOR PAKS

These paks contain a range of Carbon Resistors, assorted into the following groups:

R1—60 mixed ¼W 100-820 ohms.
ORDER No. 16213 *60p

R2—60 mixed ½W 1-8·2kΩ.
ORDER No. 16214 *60p

R3—60 mixed ½W 10-82kΩ.
ORDER No. 16215 *60p

R4—60 mixed ½W 100-820kΩ.
ORDER No. 16216 *60p

R5—40 mixed ¼W 100-820Ω.
ORDER No. 16217 *60p

R6—40 mixed ¼W 1-8·2kΩ.
ORDER No. 16218 *60p

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½in 2BA	843	£0·54	1in 6BA	848	£0·50
¼in 2BA	844	£0·63	½in 6BA	849	£0·30
			¼in 6BA	850	£0·33

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Type	No.	Price	Type	No.	Price
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2BA	856	£0·60	6BA	858	£0·36

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Type	No.	Price	Type	No.	Price
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2BA	860	£0·15	6BA	862	£0·12

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2BA	852	£0·36	6BA	854	£0·30

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162	5¼in	4in	1½in	74p*
163	4in	2½in	2in	64p*
164	3in	2in	1in	44p*
165	7in	5in	2½in	£1·04*
166	3in	6in	3in	£1·32*
167	6in	4in	2in	86p*

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200V RMS	BR1/200	£0·30
400V RMS	BR1/400	£0·35

SILICON 2 amp

Type	Order No.	Price
50V RMS	BR2/50	£0·40
100V RMS	BR2/100	£0·45
200V RMS	BR2/200	£0·50
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Panel mounting 20mm	509	£0·22
Panel mounting 1¼in	510	£0·24

QUICK BLOW 20mm

Type	No.	Type	No.	Type	No.
150mA	611	1A	615	3A	619
250mA	612	1·5A	616	4A	620
550mA	613	2A	617	5A	621
800mA	614	2·5A	618	All 5p each	

ANTI-SURGE 20mm

Type	No.	Type	No.	Type	No.
100mA	622	1A	625	2·5A	628
250mA	623	2A	626	3·15A	629
500mA	624	1·6A	627	5A	630
		All 7p each			

QUICK BLOW 1¼in

Type	No.	Type	No.	Type	No.
250mA	631	500mA	632	800mA	634
		All 7p each			
Type	No.	Type	No.	Type	No.
1A	635	2·5A	638	4A	641
1·6A	636	3A	639	5A	642
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BLUE	1983	£0·22*
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Description	No.	Price
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Miniature SPST toggle, 2 amp 250V a.c.	1959	£0·55*
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Miniature DPDT toggle, centre off, 2 amp 250V a.c.	1961	£0·85*
Push button SPST, 2 amp 250V a.c.	1962	£0·65*
Push button SPST, 2 amp 250V a.c.	1963	£0·68*
Push button DPDT, 2 amp 250V a.c.	1964	£0·80*

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Description	Order No.	Price
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2 pole 6 way	1966	£0·48*
3 pole 4 way	1967	£0·48*
4 pole 3 way	1968	£0·48*

MICRO SWITCHES	Order No.	Price
Plastic button gives simple on-off action Rating 10 amp 250V a.c.	1969	£0·20
Button gives 1 pole change over action Rating 10 amp 250V a.c.	1970	£0·25

DISPLAYS

Type	Order No.	Price
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Comment Impossible!

APART from the 22,000-odd amateur radio licensees in this country there are tens of thousands of enthusiastic listeners to the amateur bands. Many of the latter are just as keen to know what is going to happen to the bands at the World Administrative Radio Conference in Geneva in 1979 as the licensed amateur.

To recap, the IARU (International Amateur Radio Union) represents just about all the national radio societies of the world and it consists of three regions. Region 1 comprises Europe and Africa, Region 2 is North and South America while Region 3 is Asia, Australia and Oceania. Believe it or not, the IARU has a plan ready for the frequency allocations it would like to see granted to the Amateur Service at the Conference. Few people can even begin to visualise the enormous amount of work that this has entailed already.

However, it is very important to remember that no national society, or even IARU itself, has a direct voice at WARC. This is a point that is frequently overlooked by those who ask 'what's the RSGB doing about protecting our bands'? National societies can only put their proposals to their own appropriate administration, the Home Office in this country. Nevertheless, if every national society throughout the world can present essentially the same proposals to its own administration there is a far greater chance of achieving success when the Conference sees such a united and massive demand. The big stumbling block is the fact that every nation at the Conference, whether it be the US or Togoland, has just one vote regardless of its standing in the field of radio communications or the number of licensed radio amateurs it has, if any!

The March issue of *Radio Communication*, journal of our own RSGB, mentions that the Home Secretary, in a written reply to an MP's question, said that although a substantial measure of consultation with users and manufacturers of radio equipment had already taken place a wider programme of consultation was desirable before the UK's proposals for the Conference were formulated. The Home Secretary added that comments from all interested bodies **and members of the public** should be sent to the Home Office, Radio Regulatory Department. Waterloo Bridge House, Waterloo Road, London SE1 8UA by 30 April 1977. (Copy, please, to RSGB).

Since the amateur band proposals represent only a very small part of the radio frequency spectrum that will be considered by the Conference it would be nice to know what all the other 'interested parties' would like to grab! It would be nothing short of a miracle if a member of the public could cast his/her eyes over the mountain of bumph involved and come up with his/her comments by 30 April!

As a matter of interest the general proposals for the HF amateur bands are for exclusive world-wide bands from 1·8 to 2·0MHz, 3·5 to 4·0MHz, 6·8 to 7·3MHz, 14·0 to 14·5MHz, 21·0 to 21·5MHz with the present allocation of 28·0 to 29·7MHz. Additional bands on the same basis are requested for 10·1 to 10·6MHz, 18·1 to 18·6MHz and 24·0 to 24·5MHz. Strangely enough, the American Amateur Radio Relay League (ARRL) and their Federal Communications Commission both agreed on the additional bands but when FCC's final proposals came out there was no mention of them. Another proposal is for a band at 160 to 200kHz, yes, kHz! But only for Regions 2 and 3 and not our Region 1. Our punishment, I suppose, for having long wave broadcasting in Europe already!

ERIC DOWDESWELL *Assistant Editor*

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

Don't miss this!

THE Wessex Amateur Radio Group has organised a special programme for Friday 20th May when 'Dud' Charman BEM G6CJ will be giving his now famous lecture on 'Aerials and Propagation', PLUS Ken Alford G2DX talking on the 'Early Days of Wireless'. The venue on this occasion is the Bournemouth School, East Way, Bournemouth at 7.30pm sharp. Further information from Hon. Sec. G. Cole G4EMN, 6 St. Anthony's Road, Bournemouth.

Infocard

OUR attention has been drawn by Infocard Limited, to the fact that they have been using this name for their products for some years. On this basis they claim ownership to it. In the light of this information, we will not issue any further cards under that name.

Otley rally

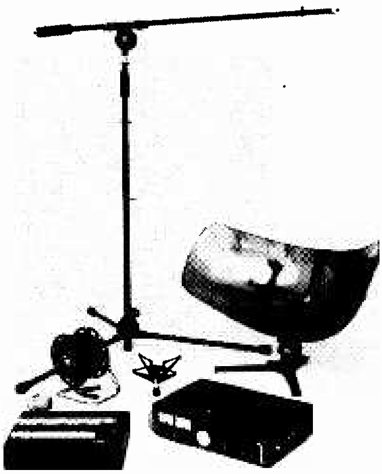
ON the 22nd May the Otley Radio and Electronics Society will be holding the Northern Mobile Rally at the Victoria Park Hall, Keighley, Yorks. Amongst the exhibitions will be Trade stands, a Talk-in Station operating on FM and SSB on 2m, raffles, and a children's film show.

Further information from the Rally Manager, J. E. Annakin, G8DFZ, 25 Ashfield Place, Otley, West Yorks LS21 3JN.

Chirp . . . chirp . . .

ENTRANTS have until the end of October to record the sounds of the countryside for entry in the competition. Competition—? well it's 3M's Scotch Wildlife Sound Recording Contest and carries a top prize of £500-worth of JVC 'sound safari' recording equipment, with other prizes amounting to a further £500.

There are several categories in which the enthusiast can enter, and these are for both experienced and novice amateur recordists—for birds, mammals, insects, and outdoor habitat recordings, with special awards for the most



original, best entry on cassette, and best entry in stereo. Naturally, entry is completely free.

All entrants will be invited to the grand prizegiving and luncheon in London (whether they are prizewinners or not), and prospective candidates should apply for rules and entry forms from *R. Richmond, PR Executive, Recording Materials Division, 3M UK Ltd., 380/384 Harrow Road, London W9 2HU. Tel: 01-286 6044 Ext. 244.*

. . . other rallies cannot reach

THE Ipswich and Mertlesham Radio Clubs are organising what they call 'The East Suffolk Wireless Revival'. It is intended, say the Clubs, to bring back the participating type of radio rally where the enthusiast or just generally interested hobbiest can find something of interest, or inspiration, as well as a chance to spend his money!

At the time of writing there are some eleven events planned, amongst which will be a static 2m DF hunt, SSTV demonstrations, Drive-in test facility for mobiles, full 2m Talk-in using GB3PO, a home construction competition and Trade stands.

The venue will be the Civil Service Sports Ground, Straight Road, Bucklesham, Ipswich (near the Suffolk Show Ground, eastern side of Ipswich and adjacent to the A45). Opening will be from 11 am to 4 pm and will be on Sunday, May 29th.

RTTY lectures

THE British Amateur Radio Teleprinter Group invites any club which would like a lecture on amateur RTTY, given by one of the Group's team of lecturers, to write to:—*The Secretary, GW3IGG, 40 Lower Quay Road, Hook, Haverfordwest, Dyfed SA62 4LR.*

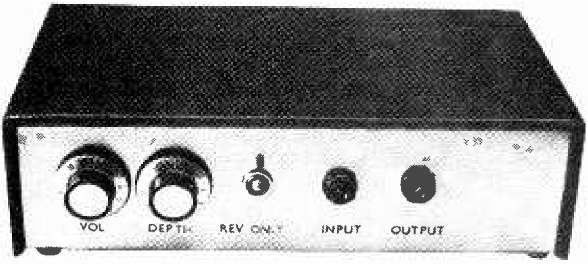
The BARTG will also be holding its annual convention on Saturday, May 21st, at the Village Hall, Meopham, Kent. Features of the convention include lectures, bring-and-buy stalls, a tape factory and trade stands. Doors open at 11 am, and anyone arriving at Meopham Station before 1.15 pm will be transported to the Hall.

Free chart

THe principal feature of the latest brochure to be issued by the printed circuit companies in the Nevin Group is a comprehensive fold-out wall chart. It contains a wealth of information and data of interest to people who design PCB's. Apart from metric conversions and drill sizes it gives data for conductor current ratings, recommended protective finishes, preferred relationships of hole sizes to pad diameters and other essential information. The brochure is available, free of charge, from Nevin Electric (Holdings) Ltd., 9 Arkwright Road, Poyle Trading Estate, Colnbrook, Bucks. Tel. Colnbrook (02812) 2325.

REVERBERATION amplifier

S.C.PARSONS



HOME-MADE tape recordings can often sound uninteresting even if the sound quality is very high, an impression which can usually be traced to a lack of reverberation. If tearing up the carpets in the living room doesn't appeal to you, there is another way of imitating the sound of a recording chamber and this is by using a reverberation amplifier.

Mechanical vibrations

There are several alternatives open to the amateur electronics enthusiast who wishes to build a reverberation amplifier, and the one chosen here uses a springline. This consists of a long coiled wire supported at either end in a compliant mounting. If mechanical vibrations are set up at one end by a transducer, they will travel comparatively slowly down the spring and "bounce" back, modifying oncoming waves. The output is taken from another transducer at this far end, and with correct amplification can sound very much as if heard in a large

★ components list

Resistors

R1	120kΩ	R8	12Ω
R2	22kΩ	R9	22kΩ
R3	3·3Ω	R10	680kΩ
R4	10kΩ	R11	390kΩ
R5	15kΩ	R12	22Ω
R6	6·8Ω	R13	22Ω
R7	6·8Ω	All 10% ¼W	

VR1 1kΩ log or lin potentiometer
VR2 2kΩ skeleton pre-set
VR3 10kΩ log potentiometer with DPST switch

Capacitors

C1	15μF 40V elect.	C5	47nF
C2	15μF 40V elect.	C6	15μF 40V elect.
C3	1nF	C7	470μF 40V elect.
C4	10nF	C8	470μF 40V elect.

Semiconductors

Tr1	BC108	D2	1N4001
Tr2	BC108	D3	IN4001
Tr3	BC108	D4	15V 1·3W zener
Tr4	BC214	D5	15V 1·3W zener
D1	1N914	IC1	741 op-amp 8 pin

Miscellaneous

Springline, HR42 available from Henry's Radio or the 'Short Spring Line' from Maplin Electronics, or Watford Electronics. PCB, 130 × 80mm available from the Readers PCB Service, page 131. T1, mains transformer. S1, SPDT switch. Two knobs with skirts. Jk 1/2, mono jack sockets. Terminal block. Aluminium box with lid approx 280 × 160 × 70mm. Mains lead, wire, stand-off pillars, fuse & holder, etc.

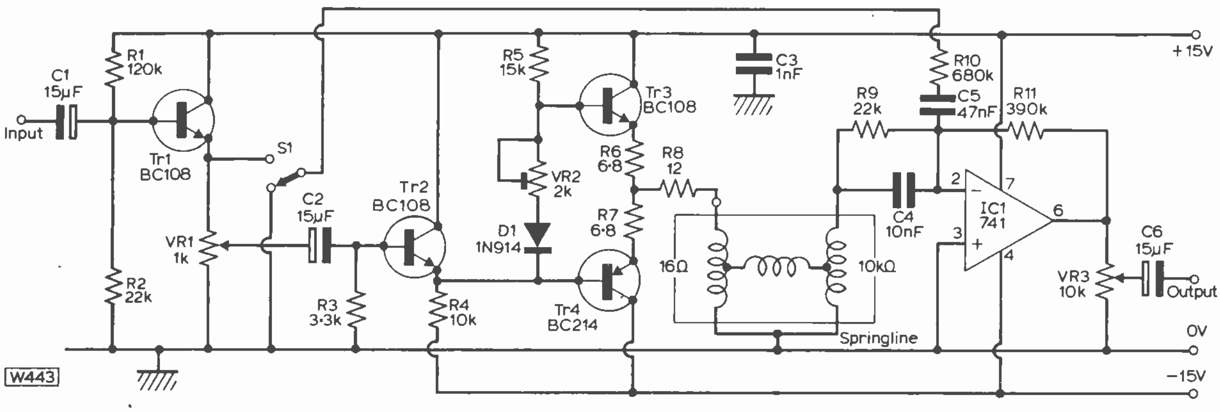


Fig. 1: Full circuit diagram of the Reverberation Unit. The mains power supply circuit is shown in Fig.4.S1 enables full reverberation to be obtained when switched to 0V.

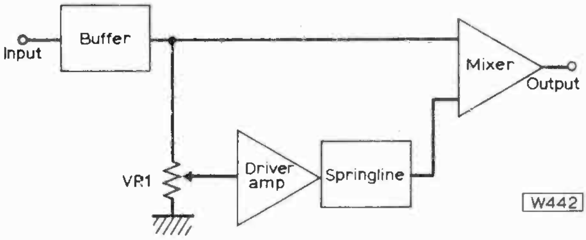


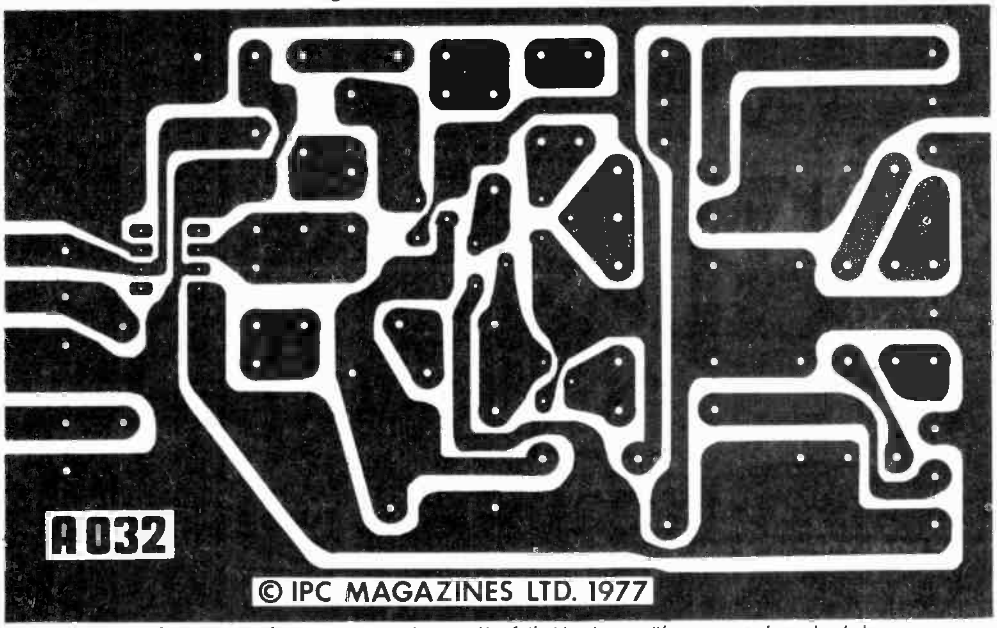
Fig.2: Block diagram showing the basic stages in the circuitry of the reverberation amplifier.

cathedral. The block diagram of the unit is shown in Fig. 2.

The input is buffered in the first stage and then splits. Part of the signal goes directly to the mixer, and part goes via a depth control to the driver amplifier necessary to match the low input impedance of the springline. The output of the latter is then taken to the mixer so that by varying the setting of the depth control, the amount of signal passing through the springline to the mixer can be varied, and hence the depth of the reverberation effect controlled.

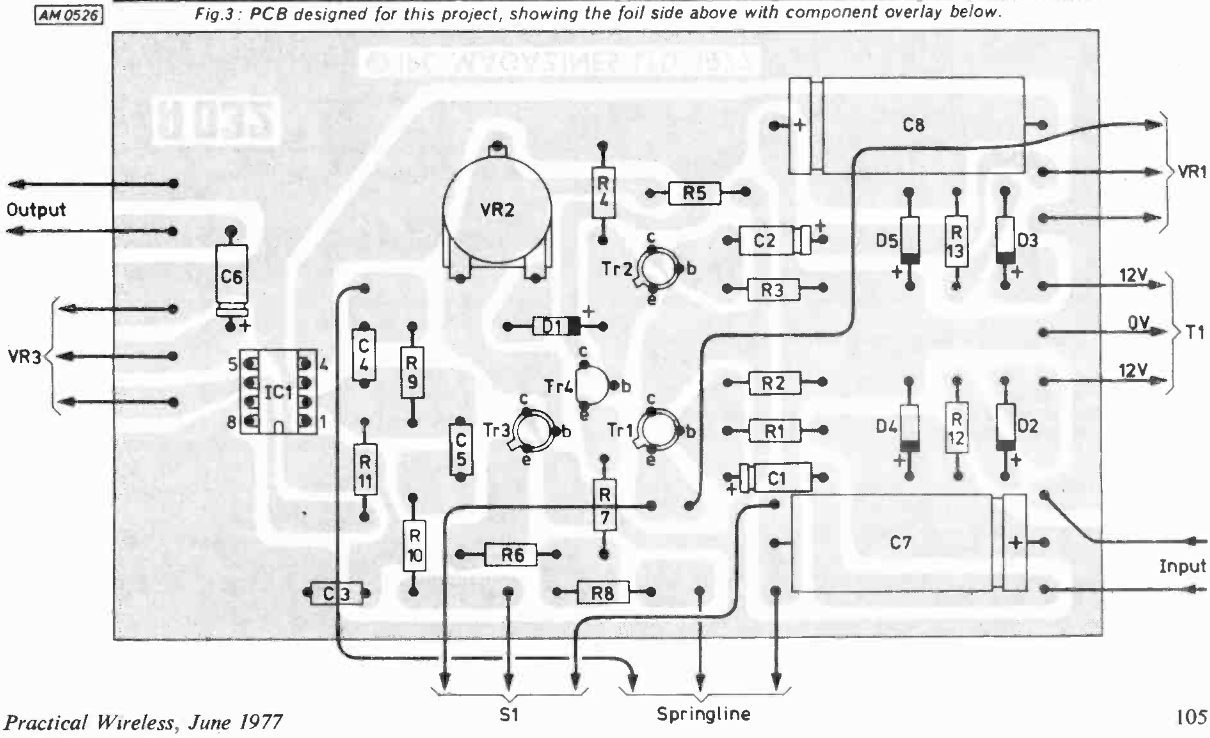
Circuit details

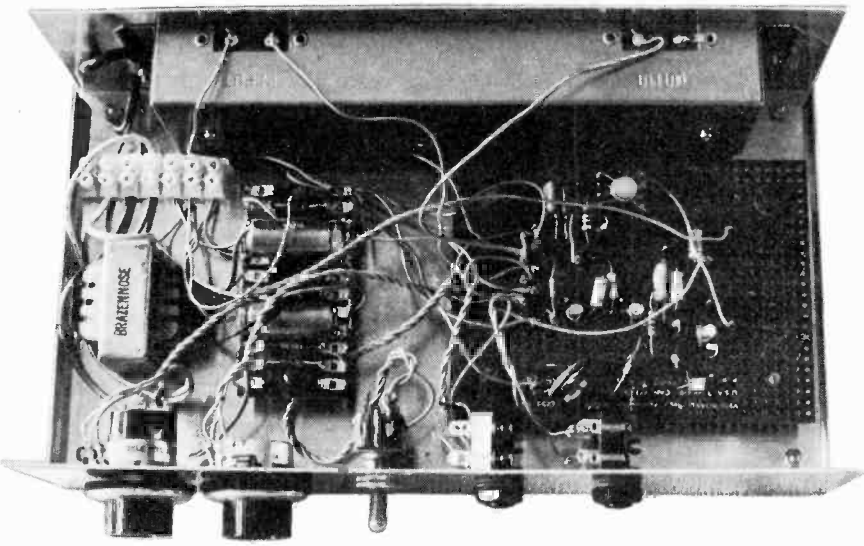
Fig. 1 shows the circuit diagram, where Tr1 and its associated components form the input buffer, and VR1 the depth control. The signal at the emitter of



AM0526

Fig.3: PCB designed for this project, showing the foil side above with component overlay below.





Photograph of the inside of the Reverberation amplifier showing the prototype model, using Veroboard and tag strip for component mounting.

Tr1 is unaffected by the setting of VR1 and goes via S1 direct to the mixer. Tr2, 3 and 4, form a driver amplifier which is fairly unusual in that it powers the springline directly (ie without the normal capacitor). If this were not so, the signal coming out of the springline would be almost unintelligible. Unfortunately, this method involves the use of a split power supply and some method of forcing the driver amplifier output to track the 0V line, or a heavy current will flow through the output transistors. This tracking is a secondary function of Tr2.

The mixer is a 741 op-amp, chosen because it simplifies the circuit and allows frequency compensation for the springline output (the response of the springline falls off rapidly above 4kHz, although resonances occur right up to the end of the audio range). The op-amp also provides a low output impedance, which means that a 1kΩ potentiometer

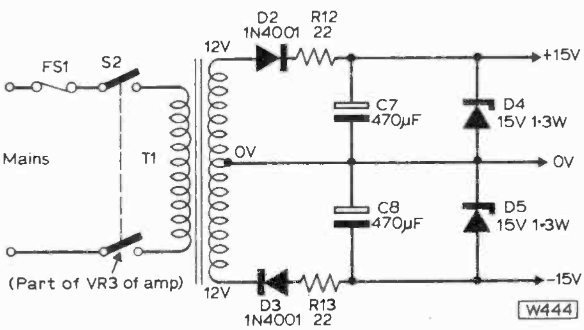


Fig.4: Suggested circuit for the power supply, giving the twin supplies neccessary for the 741, Tr2 and Tr4.

could be used for VR3 if necessary. S1 is optional and when the wiper is connected to 0V, only full reverberation is obtained. This allows the depth to be separately controlled in a synthesiser, for which the unit was designed. Alternatively the wiper could be connected to the positive end of C2 and the other contacts to the wiper of VR1 and 0V; in this way reverberation could be switched out if necessary.

Fig. 4 shows the circuit diagram of a suitable mains power supply. Although it can't supply a very heavy current it's quite suitable for this type of application.

Fig. 3 shows the PCB full size. There are no special points to be watched except the orientation of semiconductors and electrolytic capacitors. It is quite a good idea to use an 8-pin DIL holder for IC1, and screened wire to connect the springline output to the board, to reduce the hum level from the transformer.

Alignment

Set VR2 to minimum resistance, switch on, and measure the output relative to 0v. If it is not within half a volt, switch off and check for faults. If all is OK connect an earphone or speaker with an impedance of over 14Ω and apply a signal to the input. Adjust VR2 until distortion just disappears.

GAS/SMOKE SENSOR ALARM
April 77

Figaro Engineering (Ireland) Ltd., Shannon Airport, Co. Clare, Ireland, importers of the TGS812 sensor, have asked us to point out that this sensor has been in continuous use for more than eight years and that its life, when used in accordance with the manufacturer's recommendations, is that of a semi-conductor device. Sensors can thus be mounted directly on printed circuit boards.

PW can supply a dimensioned drawing of the TGS812 pin configuration on receipt of an SAE. Mark outer envelope 'TGS812'.

Reporting THE BBC'S 500TH. WORLD RADIO CLUB

RON HAM F.R.A.S.

WITH over 32,000 members throughout the world and a weekly audience running into millions the BBC World Service had something to celebrate on 11th February when they recorded the 500th edition of their popular programme, World Radio Club. Since it began on 1st July, 1967, the programme has provided a club atmosphere especially for the shortwave enthusiast and for those who are fascinated by the many aspects of radio communication. To achieve this, the BBC producers have used a variety of "outside" people, well known in the world of radio, to complement their regular team, and many of them were among the special guests attending the celebrations at Bush House, Home of the BBC World Service.

For the first time, and to mark this special occasion, an audience of radio enthusiasts was invited to participate in the programme and to put questions to the panel of experts chaired by regular presenter Frank Hennig G3GSW. Questions from the floor about modes of transmission, the problems of fading, amateur call signs, frequency allocation and the sunspot cycle were answered by panellists Bill Wood, Head of the BBC's Engineering Information Department, Desmond Colling of the International Short Wave League, and of course Henry Hatch G2CBB, the programme's resident engineering personality.

The atmosphere of the recording session was alive and one could sense the enthusiasm and warmth between the BBC's staff who stage-managed the affair, the panellists as they answered the questions, and the entire studio audience. It was great to hear Reg Kennedy, regular producer of WRC, relate the story of the tape recorder which suddenly emitted smoke when he and Peter Baresby, former chairman of the programme, were flying some 2000ft over the North Atlantic, in a piston aircraft, doing an interview for WRC with the RAF, showing that not all of their outside broadcasts go smoothly. Temporary producer Richard Lambley G8LAM read a letter of good wishes from the European DX Council, and George Jessop G6JP, General Manager of the RSGB was asked to comment about radio amateurs who gave their call signs too quickly!

Lord Wallace of Coslany, President of the Radio Society of Great Britain (left), was interviewed by Frank Hennig during the 500th edition of the World Radio Club.

The panellists in the programme were (left to right); Desmond Colling of the International Short Wave League; Frank Hennig, the regular presenter; Henry Hatch, the programme's resident engineering personality, and Bill Wood, Head of the BBC's Engineering Information Dept.

Another bonus for the audience was to hear the current RSGB President, Lord Wallace of Coslany, telling Frank Hennig that now he is President every one calls him 'George' and it was obvious from the smile on his face that he was thoroughly enjoying both the Presidency and his evening as a guest of the BBC. The technical press was well represented, Practical Electronics, Practical Wireless and Radio Communication just to name a few, and everyone that the writer spoke to had nothing but praise for the programme and all wish it well for the next 500. This historic meeting of the World Radio Club was preceded by a small cocktail party.

versatile AF GENERATOR

C. TOMS

THIS article describes a versatile AF waveform/function generator based on the 8038 integrated circuit. It provides sine, square and triangular outputs selected by a front panel switch. A single capacitor C2, Fig. 1, controls output frequency while a front panel calibrated potentiometer VR1 controls the capacitor charging current; the output frequency can be varied from 20Hz to 20kHz in a single range. Since the sine wave output is derived from the non-linear characteristics of a PN junction, the junction bias conditions are critical. VR3 and 4 give precise front panel bias adjustment. A 731 high slew-rate operational amplifier acts as a low impedance buffer to avoid loading the rather high (10kΩ) output impedance of the 8038.

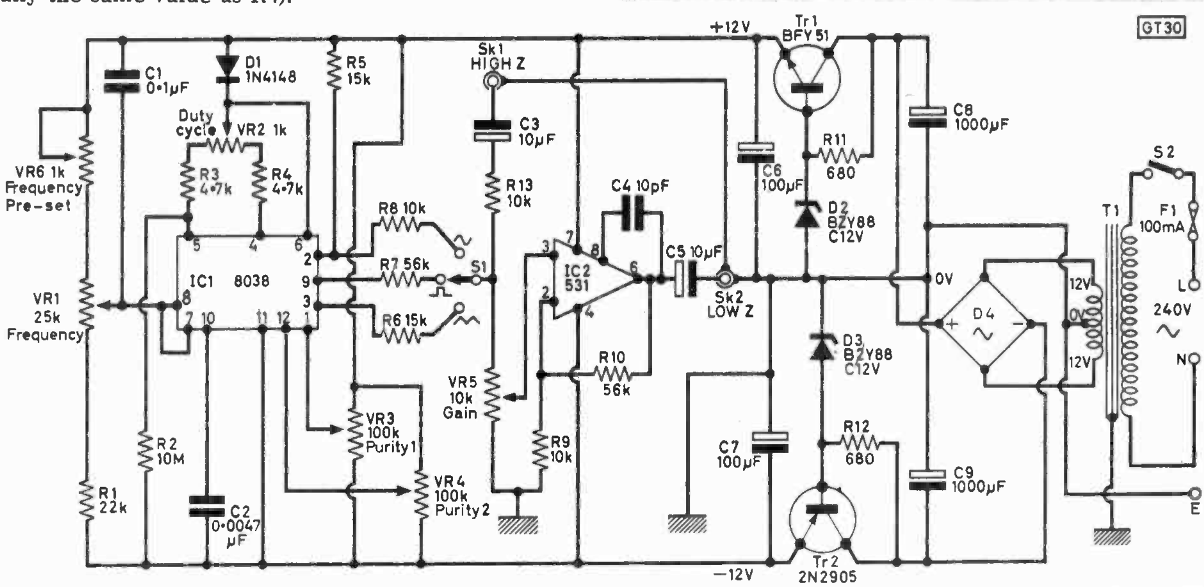
Waveform timing

Fig. 2 shows the phase relationships between all three output waveforms when operating with a duty cycle of both 20 and 50%. A 50% duty cycle is achieved when R3=R4. VR2 enables variation of the duty cycle over a 20% range allowing the symmetry of all waveforms to be adjusted. For optimum performance, the charging current through the timing capacitor C2 must be held within the range 10μA to 1mA. With pins 7 and 8 of IC1 shorted, this can be determined from the value of R3 (which has nominally the same value as R4).

$$I = \frac{V_{CC}}{5 \times R3}$$

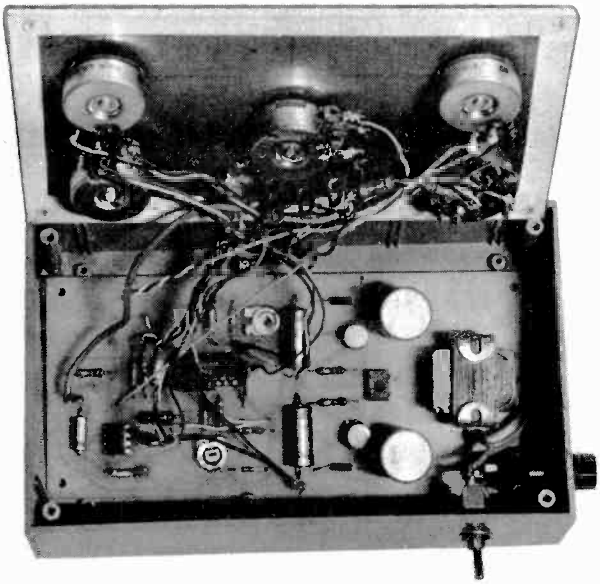
For good thermal stability, C2 should be a high quality polystyrene or silver mica type.

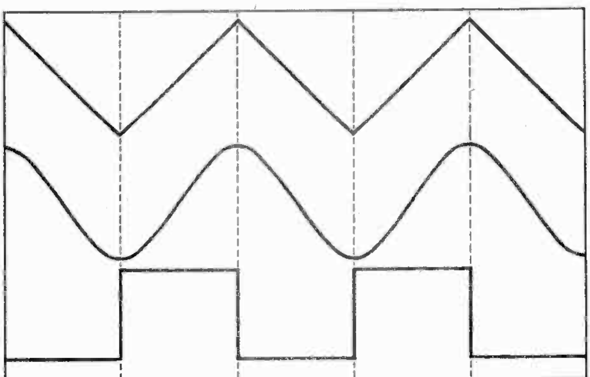
Fig. 1: Circuit diagram of generator and power supply. The miniature type mains transformer is mounted on the PCB.



Frequency

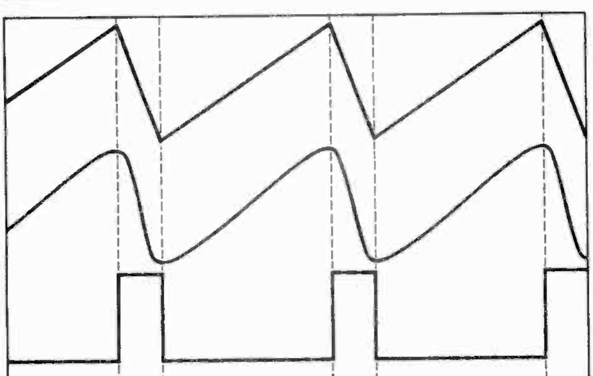
The frequency of the oscillator is a direct function of the DC voltage existing between pin 8 on IC1 and Vcc. Originally intended by the chip manufacturer as an FM sweep facility, it provides the principal variable control but can be pre-set by VR6 for easy calibration.





SQUARE-WAVE DUTY CYCLE 50% GT31

Fig.2: The upper drawing shows the various waveforms when operating with a duty cycle of 50%. The lower drawing illustrates the effect of VR2 adjustment.



SQUARE-WAVE DUTY CYCLE 20% GT32

Construction

The circuit board should be assembled as shown in Fig. 3. It is probably better to assemble the power supply section first so this may be tested separately before adding the rest of the components. It should be checked between the junction of C6 and C7 and each supply rail (the top and bottom end of each capacitor respectively) for a reading of about 12V. Having established that the power supply is working, disconnect from the mains and assemble the remaining components interwiring the controls as shown in the photograph. The instrument should now be ready to test.

★ components list

Resistors

R1 22kΩ	R7 56kΩ	R13 10kΩ
R2 10MΩ	R8 10kΩ	VR1 25kΩ log
R3 4·7kΩ	R9 10kΩ	VR2 1kΩ pre-set
R4 4·7kΩ	R10 56kΩ	VR3 100kΩ lin
R5 15kΩ	R11 680Ω	VR4 100kΩ lin
R6 15kΩ	R12 680Ω	VR5 10kΩ lin
All 0·25W 5%		VR6 1 kΩ pre-set

Capacitors

C1 0·1μF ceramic disc	C6 100μF 25V
C2 0·0047μF	C7 100μF 25V
C3 10μF 25V	C8 1000μF 25V
C4 10pF	C9 1000μF 25V
C5 10μF 25V	

Semiconductors

D1 1N4148	IC1 8038
D2 BZY88 C12V	IC2 731
D3 BZY88 C12V	Tr1 BFY51
D4 Bridge rectifier 0·5A 50V PIV	Tr2 2N2905

Miscellaneous

T1 12-0-12V 50mA mains transformer for PCB mounting. S1 1 pole 3 way wafer switch. S2 SPST mains switch. F1 100mA fuse 20mm. Case suggested type 509737 from RS Components.

Resistors R5, 6 and 7 correct the sine, square and triangle outputs from IC1 to nominally the same amplitude. The outputs are switched by S1 to the top of the gain control VR5; the high impedance output is taken from S1 via C3 and R13. The NE531 high slew-rate operational amplifier is used in a conventional inverting configuration with frequency compensation effected by C4. The output of IC2 is taken to the low impedance output socket via C5.

Power supply

The power supply comprises a simple bridge arrangement providing both negative and positive supply rails. Each side is stabilised by a zener diode (D2 and 3) in conjunction with a series pass transistor (Tr1 and 2). The actual output voltage will be 0·5V below the nominal zener diode voltage due to the base-emitter drop in the series pass transistors.

Sinewave distortion

External purity adjustment of the sine wave is effected by VR3 and 4. After correct adjustment of these controls, less than 5% total harmonic distortion can be achieved. It also provides the facility for introducing a degree of controlled distortion which may be useful in some applications.

Testing and calibration

As a quick audible check, a 3 to 15Ω loudspeaker may be connected to the low impedance output and the instrument switched on. A tone should be heard which varies in frequency with rotation of VR1. The calibrated scale shown in the photograph can be copied but it may be very very inaccurate for individual instruments. The reason for this concerns the resistance vs rotation for log-law pots. Correlation may be acceptable in potentiometers from an individual manufacturer but there is usually very little where the sources of supply differ. In the event, the prototype used a pointer knob on VR1 covering a 270° sweep.

Initially, select squarewave output and set the purity and duty cycle controls to mid travel. Set the frequency control to 50Hz and connect an oscilloscope

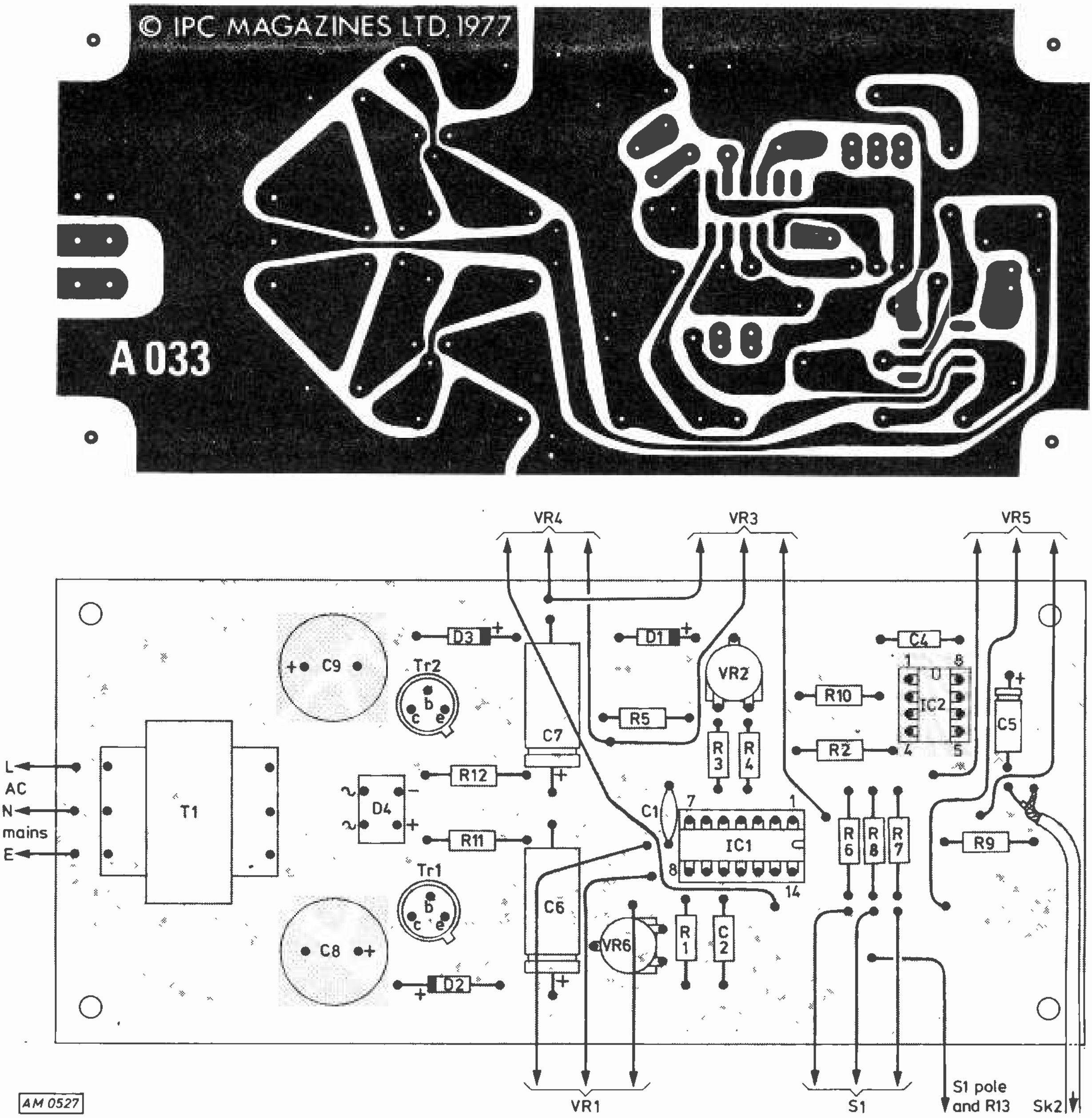


Fig.3: The top drawing shows the PCB copper side to actual size. Note that, when soldering the mains transformer into the board, care should be taken to avoid solder splashes around the mains input pins. The lower drawing shows the PCB reversed for component identification.

or frequency counter to the low impedance output. Adjust the frequency pre-set VR6 until the counter or 'scope display indicates a 50Hz output from the waveform generator. Adjust pre-set VR2 for a 50% duty cycle as shown in Fig. 2. Select the sinewave outputs and adjust purity controls VR3 and 4 for minimum distortion of the sinewave. Note the positions. The instrument is now ready for use. PW

HOTLINES

ON RECENT DEVELOPMENTS

Long life cell

Having recently reported in Hotlines about Lithium batteries, I can now announce that I actually know what they look like. The ones I've seen are about 140mm long and about 40mm in diameter. These have a 30AH capacity at a drain of 1A. One cell has a 2·8V nominal terminal voltage and an energy density of 134 watt-hours per pound. The shelf life of these devices is some five years and they will operate at −65°F. Price (in the U.S.) is put at around ten dollars but that's in very large quantities.

Still on Lithium cells, a Japanese manufacturer will soon be marketing these batteries which they will make very small, like 23mm in diameter by 2½mm thick. Such a cell will have a 2·8V nominal voltage and a current capacity of 140mA hours. In calculator applications using liquid crystal readouts, some sources believe that these batteries would last something like five years (5 years!).

Clear enough?

Projection television is back in the news. I hear that one company is about to demonstrate a 1,000-line colour television projector. I will report on this as and when news comes in, but things like single electron gun, and colour-selection diffraction grating which does not require registration are all being bandied about.

Amateur radio enthusiasts (Hams) who are interested in very high frequency working will delight in the news about a new UHF transistor just about to make its debut. This device gives 40W of CW with a gain of 9dB at 2GHz (for the uninitiated we're talking about two million million cycles every second). A common manufacturing mode with higher power UHF devices has been to lay down a number of separate transistors on a single chip and to connect them all up internally to operate in parallel as one big, single transistor. The problem has been that slight differences in these individual transistors causes each to operate slightly differently and thus incur power losses. The new devices are manufactured using ion implantation techniques to assure more uniform individual transistors which are then wired up to make the one big one. I wonder watt next.

Electret relay

Relays have been with us for many years but there has been some interesting development in this field of late. First, I see there is a 3A relay now available which weighs only 0·16oz. and stands just 10mm high. These relays have 2·5mm pin spacings making them ideal for PCB mounting, and are SPDT devices able to switch their 3A DC at 24V DC.

Looking at another kind of relay makes one wonder about further developments in this field. The new one is called an electret relay. A few years ago the electret was just a laboratory curiosity. Then, electret microphones were developed and so the principle had a commercial application. Now, it seems that this electret idea is to become a new family of relays but with certain very attractive advantages. For example, they require anything up to 100,000 times *less* power to switch than conventional relays of the electromagnetic ilk. The basic operation is quite simple. An electret (a piece of dielectric material that has a permanent electric polarity) is put between two plates of a shorted capacitor. This causes two electric fields (either side of the electret) and induces charges on the two plates of the capacitor. If the electret lies exactly midway between the two plates, then the fields will be equal and it will stay exactly half way between them. If, however, the electret is moved, even slightly, towards one of the plates, then it will immediately be attracted towards that plate and will switch over to it. By feeding in a pulse of the opposite polarity, the electret can then be made to switch over to the opposite plate. Thus it acts like a bistable, and the electret itself can be thought of as an electric analogue of the magnet.

Super Seekit?

Because treasure hunters are rife in Britain, any news of something different in metal detection is almost certain to arouse interest. Most PW readers will have seen circuitry for the BFO-type metal detector and will have heard about things like induction balance and crystal filter devices. Just to whet your appetite a bit further, I hear that one American laboratory has come up with an instrument called an "ultrasensitive three-axis superconducting magnetometer". If it sounds impressive, just listen to what it can do. It measures very tiny changes in magnetic and electric fields underground and it does this in three dimensions—simultaneously (sounds like some of these Yoga postures!). It can locate a geothermal-energy source when it is 30 miles (that's thirty miles) underground. Might be worth getting one to check on that old rumour about the King's treasure in the Wash area? Sorry, it's experimental at the moment and definitely not for sale.

Warm vidicons

Most people have heard of a vidicon tube, but what about a pyroelectric vidicon? These are tubes used as the sensor element in infra red TV cameras and other imaging systems. While they work very well indeed they do have one snag; they need to be at sub-zero temperatures.

Now, various companies have come up with pyroelectric vidicons which are happy to function at room temperatures and so they avoid the enormous costs associated with providing cryogenic equipment (that's the posh name given to the gear which keeps all at sub-zero temperatures). One company has recently launched a pyroelectric vidicon tube 25mm in diameter and about 150mm long. The interesting thing about this tube is its excellent resolution: for a 250 line height TV picture it has a temperature resolution to within 0·5°C.

Ginsberg

MONOLITHIC VOLTAGE REGULATORS

Brian DANCE M.Sc

Part 2:- VARIABLE REGULATORS

LAST month we saw how 3-terminal regulators can be used in very simple circuits to provide regulated fixed output voltages. Most of the variable voltage regulators to be discussed this month have more than three connections and used in slightly more complex circuits. Unlike most fixed regulators, each type of variable regulator requires a different type of circuit.

THE 723 TYPES

The 723 type of variable regulator has become an established type which is produced by many manufacturers. This device is produced in a circular metal package and also in a 14-pin dual-in-line package under type numbers such as L123 (SGS-ATES), LM723 (National Semiconductor), SF.C2723 (Thomson CSF), μA723 (Fairchild and Signetics), MC1723 (Motorola) and SN72723 (Texas Instruments).

The 723 device can itself deliver an output of up to 150mA over a range of 2V to 37V but the load current can be increased by the use of a more complex circuit with an external power transistor. The internal circuit is shown in block form in Fig. 10 together with the pin numbers for the 14-pin dual-in-line package. (There is no zener connection in the circular metal package.)

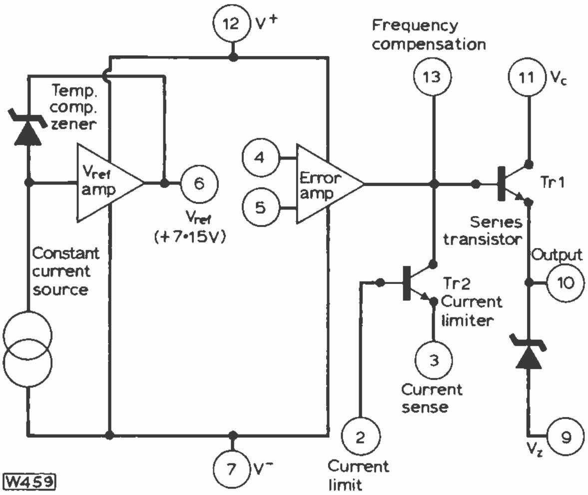


Fig. 10: Basic block diagram of the circuitry in the 723 type of voltage regulator.

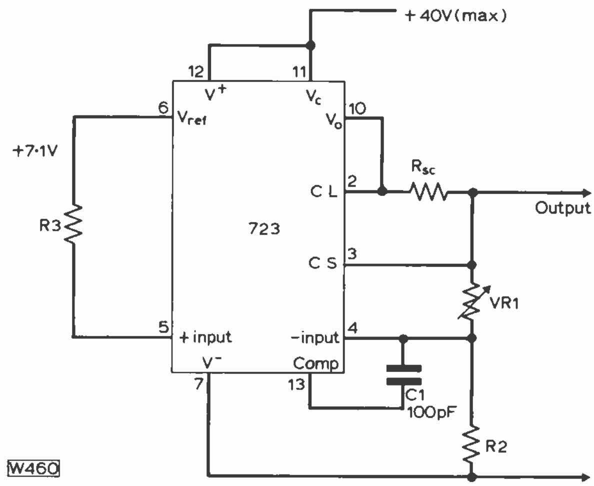


Fig. 11: Method of using the 723 to provide a regulated output voltage of 7 to 37V.

Unlike the 3-terminal fixed regulators, the 723 should not be regarded as a completely built regulator, but rather as a versatile package which the good designer can connect up in many ways with external components to produce a wide variety of circuits. In all circuits the maximum supply voltage is 40V, but, in addition to its use as a regulator, the 723 can be used as a comparator, gated amplifier, multivibrator, etc. Space limitations enable only a few of the numerous circuits to be shown here and in all cases the pin numbering applies only to the dual-in-line version.

7 TO 37V REGULATOR

The circuit of Fig. 11 shows how the 723 can be used to provide a regulated output of 7 to 37V; it should be considered in conjunction with Fig. 10. The amplified V_{ref} from pin 6 is connected via R3 to the non-inverting input of the error amplifier (pin 5). The output from pin 10 is connected through R_{sc} to the potential divider VR1 and R2 from which feedback is taken to the inverting input of the error amplifier. The feedback action of the circuit maintains this input at the potential of V_{ref}. The output voltage is therefore equal to V_{ref} (VR1+R2)/R2. For minimum temperature drift R3 should equal VR1 in parallel with R2, but R3 may be replaced by a wire link for circuit simplicity. Generally R2 may be of the order of 5kΩ. The no-load quiescent current of the 723 is only about 2·3mA and the dropout voltage about 3V.

The maximum output current is determined by the value of R_{sc}. When the output current flowing through this resistor produces a voltage drop of about 0·65V, the current limiter transistor Tr2 of

Fig.10 will conduct and will remove the base drive from Tr1 so that the output voltage falls. Thus if $R_{sc}=10\Omega$ the maximum current will be set at about 65mA. This current-limiting facility not only protects the 723 (which can dissipate 1W) but can also be used to protect any devices fed by the regulated supply.

The circuit of Fig. 12 is similar to that of Fig. 11, but the transistor Tr1 boosts the maximum output current which can be taken to over 1A. If required, R_{sc} can be switched in value to provide limiting at various output current levels.

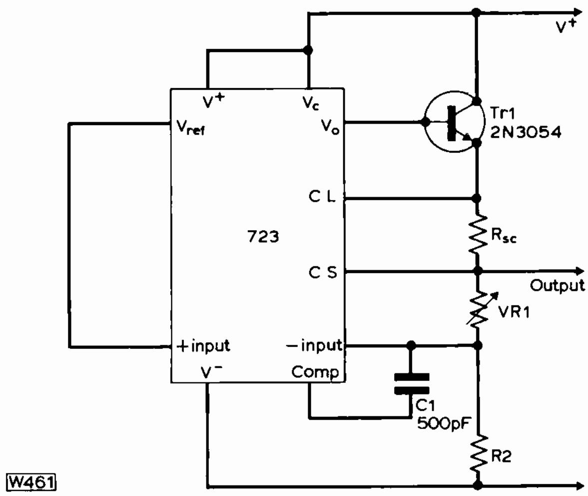


Fig. 12: Use of an external transistor to increase the maximum output current.

2 TO 7V REGULATOR

One of the main disadvantages of the 723 device is that a different circuit must be employed when the output voltage is to be less than V_{ref}. The circuit of Fig. 13 can provide outputs of 2 to 7V. The potential divider R1 and R2 reduces the V_{ref} voltage to V_{ref} R2/(R1+R2) before it is applied to the non-inverting input; the output potential is equal to this latter potential. C_{ref} prevents any short-term variation in the potential of the non-inverting input. The remainder of this circuit operates in the way discussed previously.

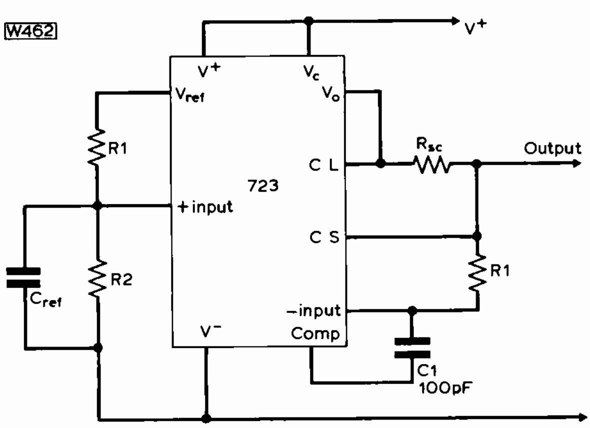


Fig. 13: In this application the output voltage, 2 to 7V, is less than the internal reference voltage.

THE CA3085

Another versatile voltage regulator device is the RCA type CA3085 (available from Electronic Component Supplies Ltd., Thames Avenue, Windsor, Berkshire). It can provide outputs of 1·8 to 26V at a maximum current of 100mA, the maximum input voltage being 30V. The device is available as an 8-pin dual-in-line package and as an 8-lead metal can package.

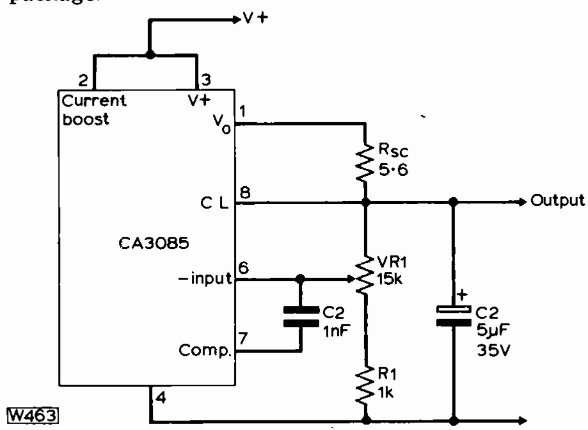


Fig. 14: Another voltage regulator circuit, this time using an RCA CA3085.

A typical CA3085 circuit is shown in Fig. 14. The 1·6V reference voltage is available at pin 5, but no connection is made to this pin in the circuit shown. A 5μF capacitor from pin 5 to negative will reduce noise at the output. An output current of 100mA will produce 0·56V across the sensing resistor R_{sc} and current limiting will commence at about this level. Similarly, if R_{sc} is 22Ω limiting will start at about 25mA output current. The output voltage is V_{ref} (VR1+R1)/R1. As in the case of the 723, the CA3085 can be used for many purposes, for example, as a general purpose operational amplifier.

THE μA78G AND μA78MG

A very different approach has been adopted in the Fairchild μA78G 1A regulator and in the similar μA78MG 0·5A regulator. These devices have only four connections and require a minimum of external components. Short-circuit protection and thermal overload protection are both incorporated on the chip. Indeed, the writer felt that they would be almost indestructible if operated from the correct voltages until he accidentally connected the control voltage pin to the power supply!

A typical circuit for these devices is shown in Fig. 15. The value of R1 is chosen so that the recommended current of 5mA flows through this resistor (the control pin is at a potential of 5V). The output voltake is (R1+VR1)/R1 times the 5V control potential. The control pin current is about 1μA and the dropout voltage about 2V.

Various other circuits using these devices are available for high output currents, for dual tracking voltage regulators, etc. The μA78MG is available in a miniature plastic package rather like an 8-pin dual-in-line device but with only four connecting pins at each corner and with metal tabs for heat sinking in the centre of each side of the device. The μA78G 1A device is available in a plastic package with a

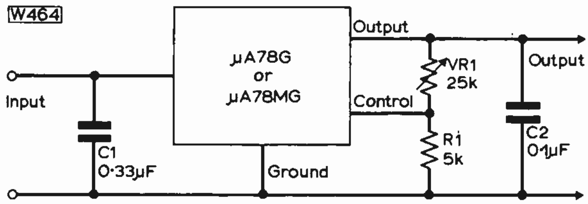


Fig. 15: In the Fairchild μA78 type regulators only four connections are required.

metal tab for bolting to a heat sink and also in a metal case rather like a TO-3 transistor case. Similar 1A and 0·5A devices are available for negative outputs under the type numbers μA79G and μA79MG.

THE LM317

The LM317 is one of the most impressive regulator devices the writer has yet seen; it is the first 3-terminal variable voltage regulator and has a really excellent performance, yet can be used in simple circuits. This new device can be obtained in a TO-3 metal transistor power package (the LM317K), in a small TO-5 transistor type package (the LM317H) and in two plastic packages with tabs for bolting to a heat sink (the LM317T and the LM317P).

The LM317K and LM317T can provide a current of at least 1·5A (typically 2·2A) at any voltage from 1·2V upwards, whilst the LM317H and LM317P can provide output currents of up to about 0·8A. The devices have current limiting (which begins at about 2·3A) and thermal shutdown circuitry (which operates at about 175°C).

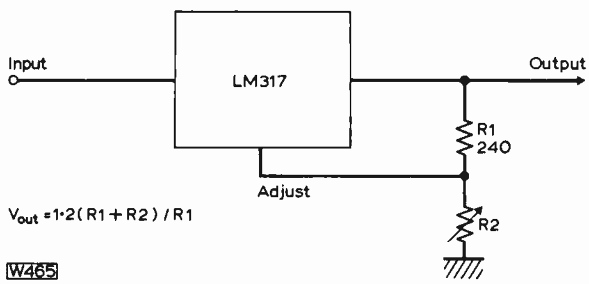


Fig. 16: In the LM317 series of regulators the external connections are reduced to three.

The reference voltage used in the LM317 devices is not obtained from a conventional zener regulator, but is a 1·25V source based on the band-gap energy of silicon. This not only enables the device to operate from input voltages well below the normal 7V zener reference voltage, but also provides less noise at the output than a zener circuit. Excellent hum rejection is obtainable from the LM317 (about 80dB with a 10μF capacitor between the adjust terminal and ground).

The LM317 devices can be used in the simple circuit of Fig. 16. The current flowing in the adjustment terminal is a constant 50μA and the device maintains a constant 1·2V across the resistor R1. Thus 5mA flows through R1 and R2. An optional output capacitor (about 1μF) will improve the transient response, whilst a 0·1μF input by-pass capacitor is recommended. The dropout voltage is not greater than 2·5V. The maximum permissible voltage between the input and output terminals of a LM317 device is 40V. However, the regulator itself is "floating" in the circuit shown in the sense that it is not connected to ground. Thus if R2 is large enough to ensure that the output remains within 40V of the input potential, the input voltage can have any desired value. Indeed, supplies of several hundred volts can be regulated with this circuit.

SWITCHING REGULATOR

The new Texas Instruments TL497 switching regulator in a 14-pin dual-in-line package should soon be available. This can provide outputs of up to 0·5A with power efficiencies of 60% or more. Designed to switch at 10kHz up to over 50kHz, this device contains all of the semiconductors required to build a regulator which can provide output voltages greater than the input voltage and which can invert the polarity of the input voltage. However, an inductor is required.

VARIABLE DUAL TRACKING

The Raytheon RC4194 14-pin dual-in-line device (available from Doram Electronics Ltd. Order code 306-011) can be used as a variable output voltage dual-tracking regulator for ±0·05V to ±30V at currents of up to 150mA. A single variable resistor adjusts both supply lines simultaneously. The device incorporates short-circuit current limiting (at about 300mA) and thermal shutdown circuitry which comes into operation at 175°C chip temperature; the maximum dissipation is 0·9W. Tracking is better than 1%.

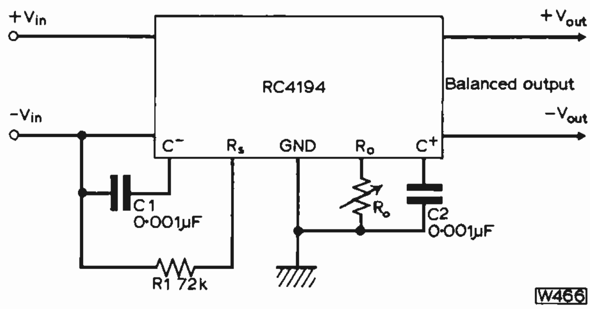


Fig. 17: The Raytheon RC4194 needs only a single potentiometer to control the output of this dual-tracking regulator.

A typical circuit for the 4194 is shown in Fig. 17, each output voltage being 2·5 times the value of R_o in kilohms. The resistor R1 may consist of 120kΩ and 180kΩ resistors in parallel. As in the case of most regulators, the output current can be greatly increased by the use of external power transistors.

Unbalanced tracking supplies can also be obtained using this device. For example, if R_o is set to 15kΩ, this gives a ±6V supply. If a 20kΩ resistor is now connected from the 'balance' pin to the negative line, the −6V supply will be unchanged but the positive line will be increased to +12V. Such a +12V, −6V supply is useful for feeding to 710 comparators.

HIGH CURRENT DEVICES

Variable output regulators able to deliver 10A over a range of +2 to +35V in one device and over a range of −4V to −30V in the other are available from Doram Electronics Ltd. They can dissipate up to 100W and are encapsulated in TO-3 power transistor cases.

THE PW 'SEEKIT' METAL LOCATOR

W. OPEL

The circuit theory and the construction of the PCB and the search coil were given in Part 1 of this article. This month covers the Faraday shield information for the search head and the setting-up procedure.

PART 2

COIL SHIELDING

To minimise the effects that wet grass or sand have on the search head the coil is almost entirely encased in a metal shield.

The simplest method of making a shield is to use strips of aluminium kitchen foil. The strips should be about 1 inch wide although the actual width isn't important, being a compromise between ease of winding a narrow strip and the fewer turns required with a wider one.

Starting at one end of the coil, commence winding the foil around the coil as if binding it. A leader of about 2 inches should be left at the start and each turn must overlap the previous one. The binding is continued to within about ½ to 1 inch of the end of the coil. It is essential that the foil does not completely enclose the coil. The final turn is stuck in position and, to ensure that the foil doesn't move, a spiral of wire can be added followed by further adhesive tape.

Due to the difficulties of winding the aluminium strips smoothly the end product might appear a little lumpy but, since the coil won't be visible in the finished locator, it doesn't matter.

The foil leader at the beginning of the coil is connected to one wire lead-out and that connection becomes the earthy end of the assembly.

SEARCH HEAD ASSEMBLY

Before the completed coil is mounted into the head assembly the leads should be connected to the coax cable or, if changeable heads are to be used, to a coax socket. The connections must be bound with adhesive tape to ensure a sound mechanical assembly.

The coil, with its coax lead or socket, can be mounted in the moulded head shown in the photographs or into a home-made head. In either case it should be held in place initially by sticky tape. Trying to remove a defective coil after it has been fully encapsulated (or even firmly stuck) into the head can be frustrating and will almost certainly result in the destruction of the case.

The moulded head has provision for the lead to come through the material just behind the handle fixing location. This position is also satisfactory for mounting the socket if used. When the heads are designed to be changeable this location is best. When only one head is to be used a neater result is obtained by feeding the coax lead up the handle stem and directly into the control case.

Because of the Faraday screen the head can be used under water provided the coil and the coax lead are made watertight. This can be achieved by encapsulating the head in epoxy resin (but not until testing has been completed). The depth of water which can be scanned is a function of the length of the handle and the lead since the control box isn't watertight.

The head assembly can now be connected to the control box and setting-up can commence.

SETTING-UP

The testing and setting of the unit is best carried out with the printed circuit board out of the case and the search coil held in position with adhesive tape. The main test instrument is a multimeter with a range for measuring low resistance.

The first check is on the search head assembly. For this the low ohms range is required. The resistance of 20-odd turns of 20SWG wire is not very much but it is detectable. Any reading on the meter will show that there is not a short circuit between the Faraday shield and the 'hot' end of the coil.

Having checked the coil assembly it should be plugged into the board connection. The current drawn by the circuit can now be measured. If the stabilising circuit is not used the current should be between 8mA and 12mA depending on the voltage used. If the stabiliser is used the current drawn should be about 18mA. Significant differences indicate problems with the board construction. Generally if the current is too high look for solder bridges and if too low for unsoldered joints.

Assuming the current readings are close enough to be satisfactory there are various key voltages that should be checked. The first of these is between earth and the junction of R9, R10 and R13. This voltage depends on the setting of the core of the primary of L3 (the pink side) and it should be possible to adjust the core so that the voltage will swing above and below earth. Providing this is so, adjust the setting of the coil to give a voltage of about 0·4V positive.

The second is to ensure that the oscillator is working. Connect the meter between earth and the anode (ring end) of D3 and it should read about 1V negative. It it doesn't then check the oscillator carefully with particular care being given to the search coil connections. There is nothing to be gained by further measurements unless the oscillator is working correctly. If an oscilloscope is available the frequency of oscillation can be checked. It should be around 80kHz to 90kHz but is not critical.

Set the tuning control, VR1, to midway and the meter control, VR3, to minimum. Rotate the blue core in the detector (L3) until an audio note is heard. This will go from a very low frequency to a high howl. The meter should also indicate. The operational setting of the core will be that which gives half scale on the meter. At this setting the tone will automatically set itself to the optimum level.

If the meter reads but there is no audio tone the amplifier can be checked by applying the positive supply voltage to the junction of R22 and R23 through a 1MΩ resistor. The audio should be heard. If it is not then the components associated with the two sections of IC1 used for the amplifier must be re-examined.

10V STABILISER

The unit is designed to run on standard HP7 size batteries or on the alkaline alternatives. The alkaline types have a long life and a fairly level voltage characteristic so they provide stable operating conditions for the locator. The standard batteries, on the other hand, have a drooping voltage characteristic in addition to their shorter life. This drooping voltage causes drift in the unit and results in misleading readings or in needless corrections.

To overcome the falling voltage a stabiliser circuit, Fig.9, can be incorporated such that the electronics operate on 10V. This enables the batteries to be used down to an end voltage of about 11V and at that level they will be failing fast so the first sign of trouble will be the advice to change them.

The circuit will function equally as well on 10V as on 12V, once set, but if set for 12V it will not generally be possible to use the locator on 10V without re-adjusting L3.

The printed circuit board has provision for mounting the components for the stabiliser and the overlay pattern, (Fig.6) shows the wiring to the switches for either battery type.

To conform with the Wireless Telegraphy Act (1949) a licence is required to use the Seekit Metal Locator.

Under section 1(1) of the Act (Pipe Finder/Metal Locator Licence) frequencies between 0 and 150kHz can be used although preferably limited to 85kHz to 90kHz and 110kHz to 145kHz. The Seekit has a design frequency between 80kHz and 90kHz and has been approved by the Home Office.

A licence for five years costs £1·20 and an application form can be obtained from: The Home Office, Radio Regulatory Department, Waterloo Bridge House, Waterloo Road, London SE1. The completed form should make reference to the PW Seekit.

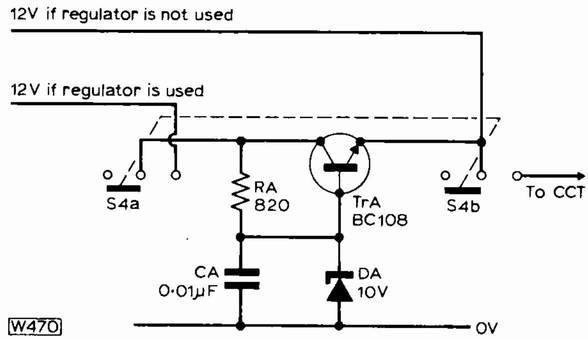


Fig.1. The circuit of the stabiliser. Note that the drawing calls for a 10V zener and the parts for 9·1V. Either will do but 9·1V is preferred.

★ components list

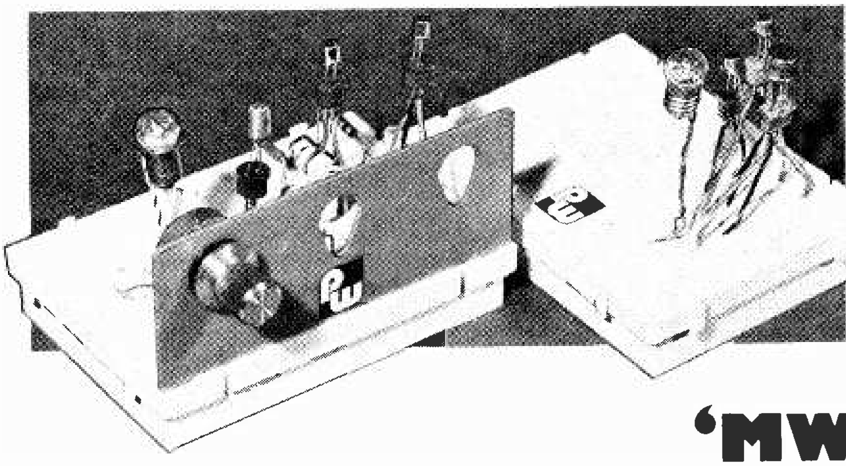
Stabiliser	
RA	820Ω 10% ½W
CA	0·01μF
TrA	BC108
DA	9·1V, 400mA Zener diode

The photographs in the headings of part 1 and 2 show the unit mounted in the moulded case and search head, but, of course, the locator will work equally as well in any other suitable box and with a home-made search head. Several plastic boxes are available and size and style become a matter of personal choice provided the surface area and total volume are sufficient. Plastic conduit or waterpipe provide suitable handle material and can be bent or flattened after softening in boiling water or over a flame. If using a flame try a few practice runs first and remember to keep the pipe over the flame not in it. The search head is a little more difficult but the bottom of a plastic bucket or cake container would probably be sufficiently strong but remember to wind a coil to suit.

The moulded case and search coil housing are available from Ambit International and this company can supply a search coil and Faraday shield wound, tested and encapsulated (with light weight foam) into the search head moulding. The unit has a moulded-in coax lead of over 1 metre long included.

S-DeCnology

DAVID GIBSON



THIS MONTH

'MW Receiver'

THIS month's S-DeC project differs from all previous ones in this series. It is not an electronic device, but a simple two transistor receiver which gave surprisingly good results on test in Hertfordshire. Several foreign stations were received besides the more popular British medium wave transmissions. The circuitry employed attempts to extract all possible service from the first transistor Tr1, which is used as an RF amplifier and an AF amplifier. Regeneration is also used in the first stage which gives additional signal "boost" and sharpens the tuning giving improved station separation. It is ideal as a small portable receiver and it runs from only 3V.

you will need . . . .

R1	1MΩ	C3	170pF
R2	4·7kΩ	C4	100nF
R3	10kΩ	Tr1	BC108
R4	470kΩ	Tr2	AC126
VR1	50kΩ pot.	D1	OA90
C1	10pF	D2	OA90
C2	1nF	L1	ferrite slab 93 x 17 x 3mm

VC1/VC2 twin gang 500pF+500pF variable capacitor
EP1, Acos 'red spot' 1kΩ earpiece.
3V battery, S-DeC.28 SWG enamelled copper wire.
S-DeC leads with plugs. One Blob Board (if required).

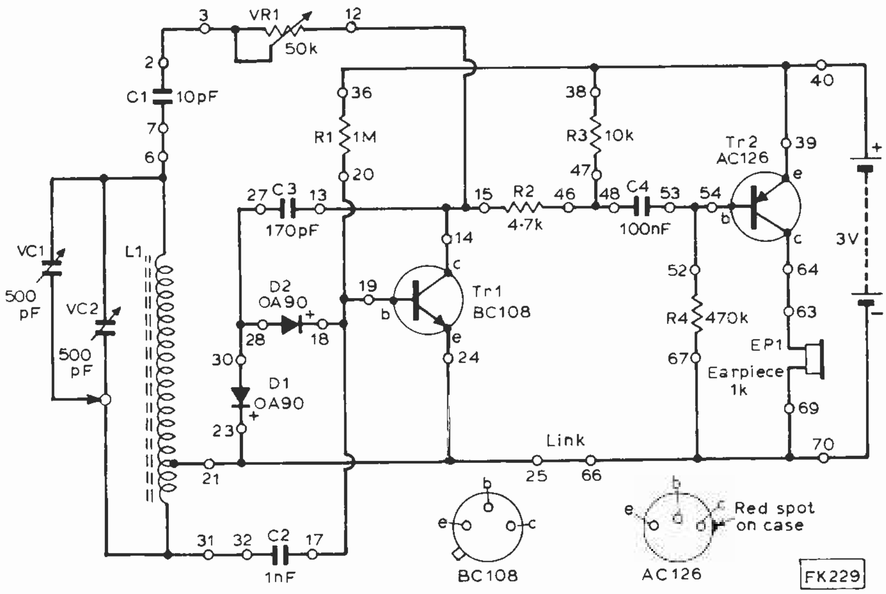


Fig. 1: Circuit diagram of this months 2-transistor MW receiver. Note that the supply voltage is only 3V, and should not be exceeded, if optimum reception is to be achieved. Note:— An alternative aerial on a round ferrite rod is described in the text. The frame of the ganged capacitor goes to hole 6 of the S-DeC.

Lazy signals

Looking at the circuit diagram Fig. 1, the signal is first tuned by VC1/VC2 and L1, fed to the base of Tr1 and amplified at RF. This amplified signal now appears at the collector of the BC108 (Tr1) and from here it has a choice of paths. To turn sharp right into R2 means that it will immediately have to overcome 4·7kΩ of resistance. It can, of course make a beeline for the 50kΩ potentiometer, VR1. Its last choice is to tackle the 170pF capacitor, C3. Now most signals are lazy and will choose the line of least resistance. The "resistance" of the capacitor (C3) at 750kHz is less than 200Ω—a nice low value compared to 4·7kΩ (R2) and 50kΩ (VR1). In practical terms the signal, or various percentages of it, will travel all three paths but most will go through C3 where it encounters a pair of diodes. These rectify the RF signal and present a rough AF signal to the base of Tr1 via D2. Tr1 now amplifies the signal again, but this time at audio frequencies and again the amplified signal appears at the collector of Tr1. This time, things are a little different. The 170pF capacitor now has a "resistance" of many hundreds of thousands of ohms (to the AF signal) and so it is persuaded (or rather the bulk of it is) to develop across R2 which forms an audio load for the collector of Tr1. From here, the audio signal is fed via C4 to the base of Tr2 and amplified to feed the earpiece which forms its collector load.

Signal regeneration

So we've now persuaded two transistors to do the work of three transistors; but there's another way we can get even better performance—regeneration or reaction. Let's retrace our steps to the collector of Tr1 and let us arrive just as the amplified RF signal gets there. You remember there were three paths. Let's look at the one to the potentiometer VR1. A tiny (very tiny) part of the signal will manage to get across VR1 and get to the capacitor C1. This 10pF component offers a very low "resistance" to RF (but a very high "resistance" to AF) and so this tiny part of the original RF signal goes across C1 and on through the coil L1 and back again to the base of Tr1. Here, it arrives in such a way as to reinforce the original signal which caused it, thus giving that signal an extra boost. This feedback of signal is called reaction or regeneration. Since the potentiometer is a variable resistor, we can control the amount of regeneration—too much will cause the circuit to oscillate and "howl"; too little will give only a very small (barely worthwhile) amount of boost.

Another advantage of regeneration, is that it improves the apparent "Q" of the tuned circuit—this is the thing which decides how sharply the circuit will tune in stations. One which tunes very broadly will tend to allow one signal to interfere with another. But with a higher "Q", the tuning becomes very much sharper and so station separation improves. With this receiver, station separation is excellent and sensitivity is also extremely high despite the low voltage used.

Aerial details

Construction on the S-DeC is very simple. Just plug the components into the S-DeC holes marked on the circuit diagram Fig. 1. You can also use the full size S-DeC diagram of Fig. 2. The coil was wound with 28swg enam. copper wire on a piece of flat ferrite slab which measured 93mm long by 17mm wide by 3mm thick. The start of the winding may be secured to the rod by a piece of plastic insulation tape (or even sellotape will do). Wind on five turns and form a big loop of wire which you should then twist until you are left with a very small loop at the end of a 25mm piece of twisted wire. Carry on winding another 55 turns and secure the end of the wire. Make sure to clean all the enamel off the ends

continued on page 130

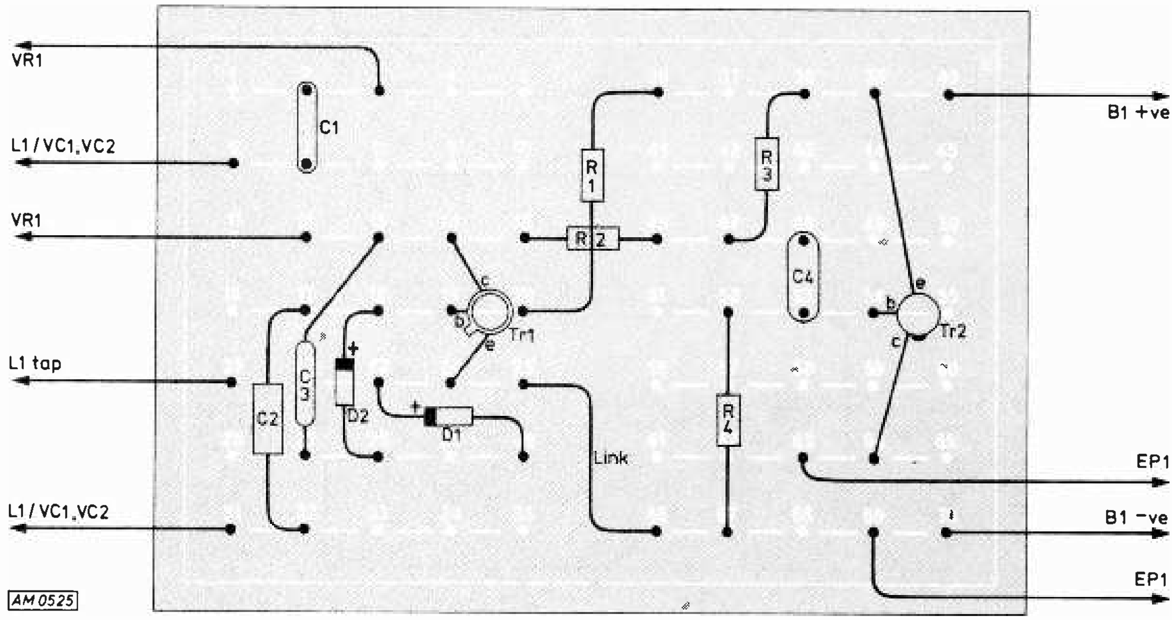
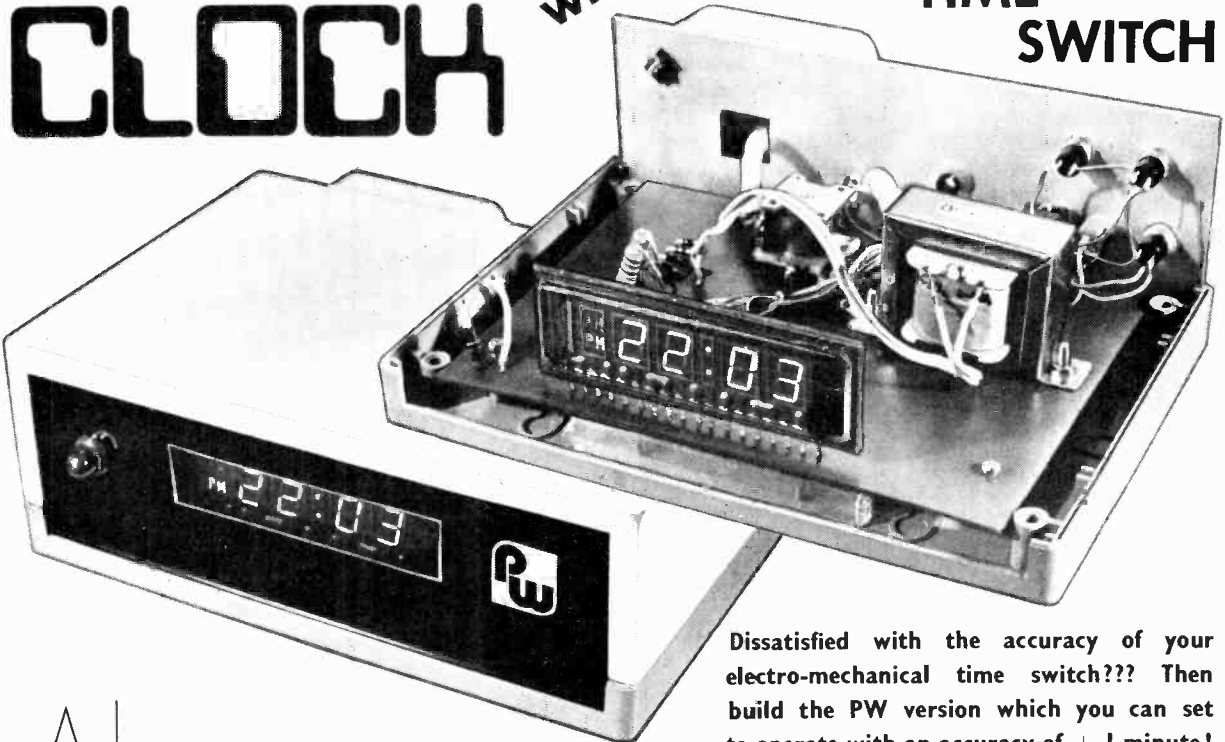


Fig. 2: Full size drawing of the S-DeC, giving component location and hole numbers. The ferrite aerial, tuning capacitor, battery, VR1 and the earphone are all connected via leads, and not on the S-DeC itself.

PW

IN NEXT MONTH'S PRACTICAL WIRELESS

24-HOUR DIGITAL CLOCK with PRECISION TIME SWITCH



Dissatisfied with the accuracy of your electro-mechanical time switch??? Then build the PW version which you can set to operate with an accuracy of ± 1 minute! An all-electric Digital Clock PLUS a Precise Timer for an external circuit.

Also:~

Get the sporting events on our Radio 2 TUNER & A 20W IC Audio AMPLIFIER

ON SALE 3rd JUNE

TELE~ TENNIS / FOOTBALL / SQUASH / PELOTA

plus:~

ON-SCREEN SCORING & SOUND EFFECTS

THE General Instruments AY-3-8500 television games integrated circuit allows a complex multigame unit to be built using very few additional components. The single device provides for 4 ball games and 2 shooting games. This article will describe a unit for the 4 ball games.

THE AY-3-8500

Before describing the construction of the unit it will be useful to give a description of the special IC. The device is in a standard 28 pin dual-in-line package with pins 1, 14, 15 and 28 not being used. Pins 2 and 4 are ground and plus 8V respectively.

★ components list

Resistors

R1	47kΩ
R2	1kΩ
R3	10kΩ
R4	2·2kΩ
R5	220Ω
R6	220Ω
R7	47kΩ
R8	1kΩ
R9	47kΩ
R10	47kΩ
R11	47kΩ
R12	47kΩ
R13	33kΩ
R14	47kΩ
R15	1kΩ
R16	6·8kΩ
R17	4·7kΩ
R18	1kΩ
R19	100Ω
R20	100Ω
VR1	10kΩ standard horizontal preset
VR2	10kΩ standard horizontal preset
VR3	1kΩ standard horizontal preset
VR4	100kΩ linear
VR5	100kΩ linear

All fixed resistors are ¼W, 5%

Capacitors

C1	2200μF, 25V
C2	0·22μF
C3	0·22μF
C4	1000pF polystyrene
C5	1000pF polystyrene
C6	100pF polystyrene
C7	100pF polystyrene
C8	0·22μF
C9	0·22μF
C10	10μF, 10V
C11	1000pF disc ceramic
C12	10pF plate ceramic
C13	3·3pF plate ceramic
C14	22pF plate ceramic
C15	5·6pF plate ceramic
C16	1000pF disc ceramic, 250V
C17	1000pF disc ceramic, 250V
C18	47μF, 10V tantalum

Switches

S1	1 pole 6 way rotary.
S2	Single pole, biased off, miniature push
S3	S.P.S.T. miniature toggle.
S4	S.P.S.T. miniature toggle
S5	S.P.S.T. miniature toggle
S6	S.P.S.T. miniature toggle
S7	D.P.S.T. miniature toggle, mains rated

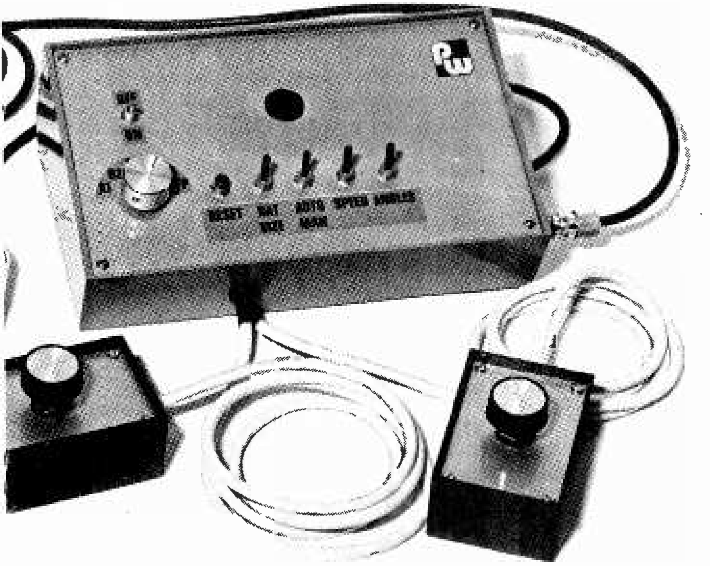
Semiconductors

Tr1	BC108
Tr2	BC108
Tr3	BC108
Tr4	BC108
Tr5	BSX20
D1	1N4001
D2	1N4001
D3	1N914
D4	1N914
IC1	AY-3-8500 G.I.
IC2	MC7808 or 78L82AWC

Miscellaneous

T1, mains transformer, 2 secondaries each 0–12V at 250mA, fixing centres 53·5mm. FS1, fuse holder, chassis mounting, 20mm and 200mA fuse. PCB from Readers PCB Service. Speaker, miniature, 40Ω. Former 4mm with dust core. Wire 40SWG enamel covered, 1metre long. Wire 22SWG, tinned copper, 250mm long. Case sloping top, 216mm x 130mm x 47mm (front) x 79mm (back), Watford code NJSF2 Doram code 509-608. Boxes, 2 off, 85mm x 56mm x 37mm, Watford code NJHC1 Doram code 509-636. (Note, these cases provide an attractive cover but any case of similar size can be used). SKT1, coax socket. Coax cable and 2 coax plugs. 2 grommets. Mains cable. Board pins. DIL socket (see text). Heat sink for IC2

D.S.COUTTS



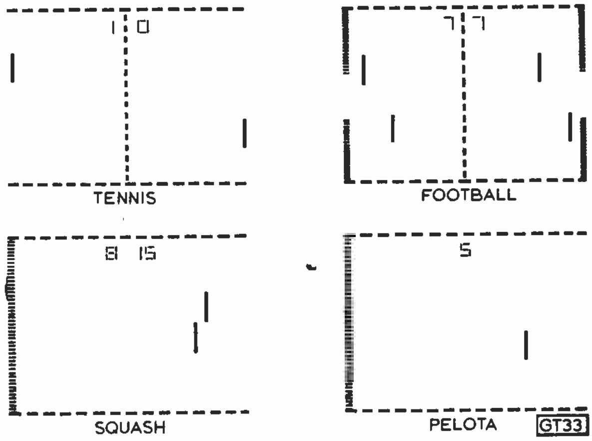


Fig.1. The outlines of the four games that can be played using this unit. The sizes of the individual dots may not be as shown due to tube distortion and sharpness of focus.

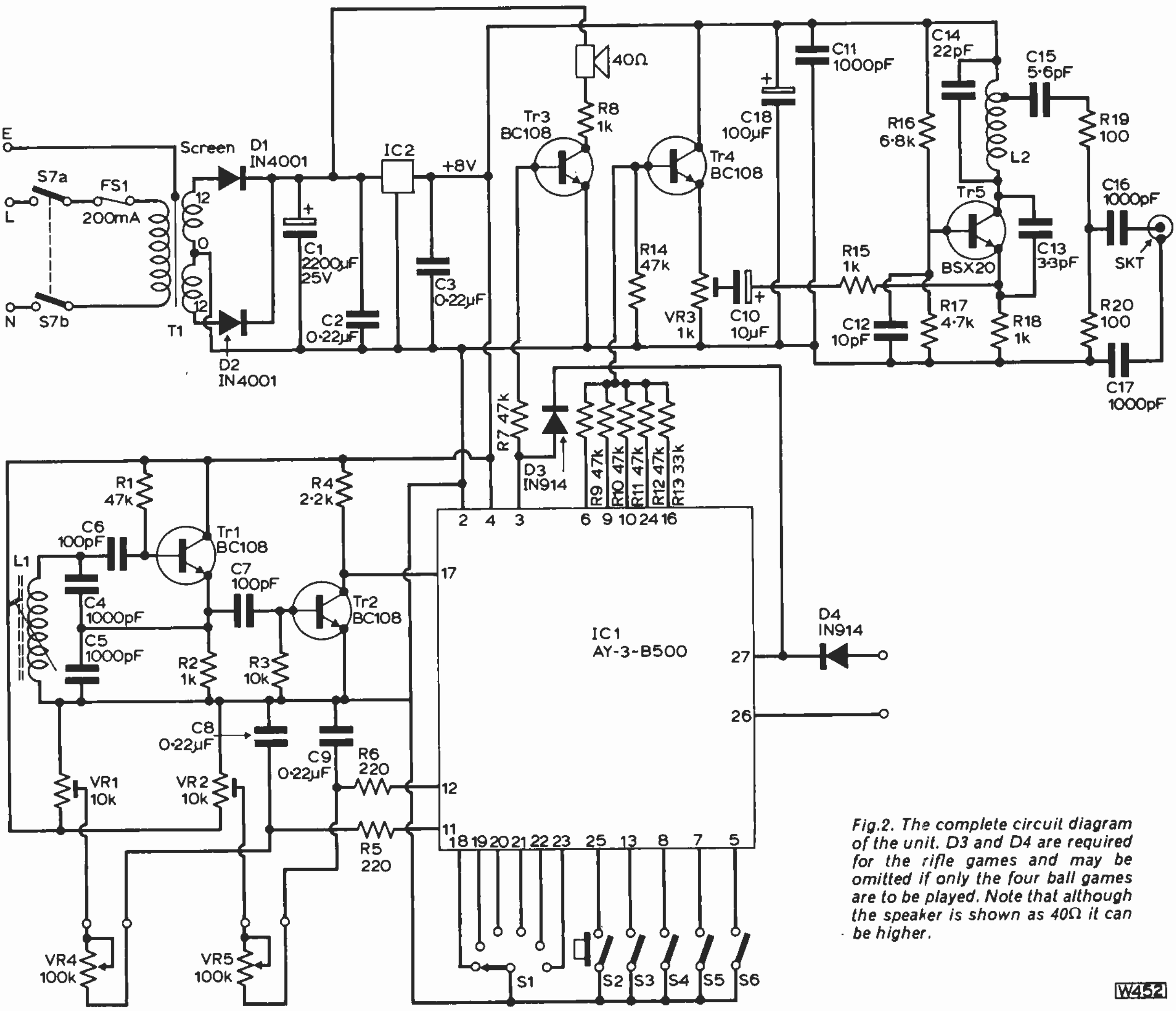


Fig.2. The complete circuit diagram of the unit. D3 and D4 are required for the rifle games and may be omitted if only the four ball games are to be played. Note that although the speaker is shown as 40Ω it can be higher.

Pin 3 gives an output of 500Hz, 1kHz or 2kHz which corresponds to the ball hitting the line, the ball hitting the bat and a scoring signal.

The ball will bounce off the correct bat at an angle determined by the condition of pin 5. When it is left open circuit the angle is constant over the whole bat except that the reflection is 'up' in the upper section of the bat and 'down' in the lower section. When pin 5 is connected to ground the bat is divided into four vertical sections. The angles in the centre two sections are as before but the outer two reflections are at steeper angles.

Pin 7 controls the ball speed. If left open circuit the ball travels slowly (suitable for beginners) if connected to ground the ball speeds up.

Automatic or manual service is selected by pin 8. If the ball leaves the court when pin 8 is open circuit it will remain off until the pin is grounded momentarily. If pin 8 is left switched to ground the ball will serve automatically, travelling in the direction that it left the ground (ie. if the right hand player scores then the ball will be served from the right hand side).

Pin 11 is the right player input and an R/C network on this pin controls the vertical position of the right bat or, in football, both right bats. Pin 12 provides similar control for the left hand player. The size of the bats is controlled by pin 13. When switched to ground the bat size is half that resulting from leaving it open circuit.

Pin 17 is the clock input and a 2MHz signal is required.

The choice of games is made by pins 18 to 23, depending which of them is grounded. The display for each of the four ball games is given in Fig. 1.

Pin 2 provides a reset facility. Switching it to ground resets the score to zero and when the ground connection is removed the ball will be served from the left. When either player scores 15 the game is finished. Both bats become transparent to the ball and the score remains static. The game is restarted by pushing and releasing the reset button.

Pins 6, 9, 10, 16 and 24 are outputs corresponding to ball, right bat, left bat, sync and field/score outputs. Their functions are explained later.

The two shooting games utilise pins 26 and 27.

CIRCUIT DESCRIPTION

The complete circuit diagram circuit diagram of the unit is given as Fig. 2.

The secondary of the mains transformer is given as 12-0-12V. In fact, the transformer specified has two secondaries, each of 12V. These need to be wired in series (ie, the OV of the first to the 12V of the second) and the ground connected to the junction. D1 and D2 provide full wave rectification, smoothing is by C1 and the resultant DC is regulated by IC2. High frequency decoupling is provided by C2 and C3 on the input and output of the regulator. C11 and C18 give additional decoupling to the 8V rail.

Tr1 is a 2MHz oscillator, its output being buffered by Tr2 before being fed to IC1.

VR1, VR4, R5 and C8 are the timing components for the right hand player. VR4 is the hand control and changes the charging current of C8 thus moving the vertical position of the bat. VR1 sets the voltage towards which C8 charges and alters the sweep of the bat. R5 limits the current during the discharge period at frame flyback. The corresponding controls for the left hand player are VR2, VR5, R6 and C9.

Tr3 drives the speaker, with R8 limiting the volume. If greater volume is required the value of R8 can be reduced but, on the prototypes, it was sufficient for most domestic uses.

The video and sync outputs are summed by R9 to R13 and drive Tr4, an emitter follower. VR3 in the emitter allows the modulation level of Tr5 to be adjusted.

Tr5 is VHF oscillator operating at about 170MHz with harmonics extending into the UHF band. The output is divided by R19 and R20 and the unit is DC isolated from the display monitor by C16 and C17.

Switches S1 to S6 control the games and functions already described, (see Fig. 7 for details also).

CONSTRUCTION

Before commencing construction of the electronics it is necessary to drill the mounting holes in the case. The board can be used as a template to ensure they are in the right position. The board will ultimately sit with the modulator section at the front right and with its right hand edge about 10mm from the right side of the case. This allows the leads of C16 and C17 to be kept short. The mounting holes for the board are 6 BA.

Having drilled the base, the remaining holes can be marked out as Fig. 3. These holes will be sized to suit the grommets and the coax socket. It is also advisable to drill a series of 5mm holes in the base and in the back to assist ventilation.

Mark the top panel as Fig. 4 and drill the holes to suit the components used. A suitable hole size for the speaker is 20mm. Label the panel and mount the switches. The speaker is glued to the panel using a rapid-cure epoxy but first glue a piece of speaker fret over the hole.

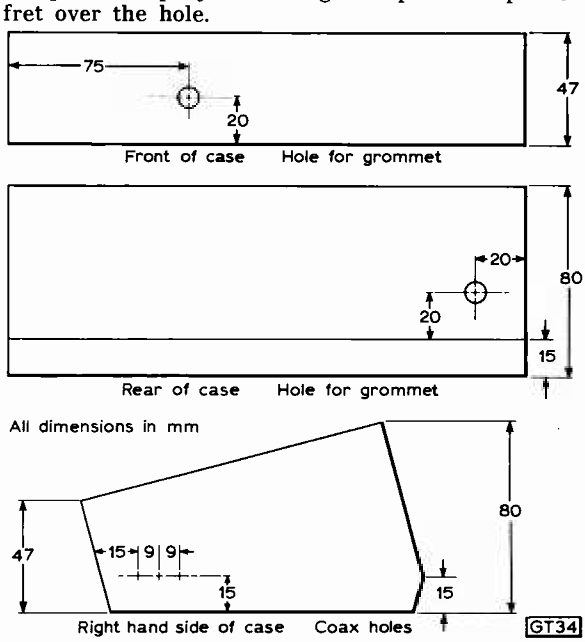


Fig. 3. Suitable drilling hole locations and sizes are shown for the box specified. The single hole in the front of the case is for both the bat control leads. It is easier to identify the bats if two holes are made, one at each end of the front.

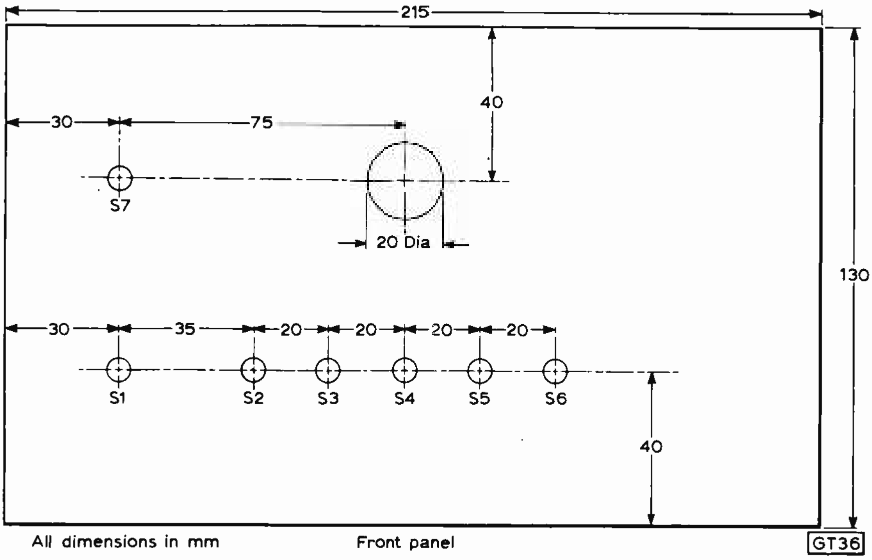


Fig.4. The drilling details for the lid of the case specified. If a different case is used, ensure that there is sufficient depth beneath the panel for the switches.

Most of the components are mounted on a single sided PCB. Fig. 5. shows the wiring pattern and Fig. 6 the component locations. The former for L1 is stuck in position, again using rapid-cure epoxy, and when the adhesive has set, 50 turns of 40 SWG are wound onto the former. After soldering the ends as shown in Fig. 6, the screening can is fitted. It is better to wind the coil after the former is fixed to the board because although it is difficult to wind it is even more difficult to hold the winding in place whilst the epoxy sets.

The remaining components, except for the coil L2 and IC1 are mounted (not forgetting the wire link). L2 is 3 complete turns of 22 SWG tinned copper wire wound on a former so that the diameter of the coil is 6mm ($\frac{1}{4}$ inch) after the former is removed. A short length of wire is soldered to the coil $\frac{3}{4}$ of a turn from one end. The coil is mounted in position and the screen is soldered to the four pins at the corners of the oscillator section. Leave the top of the screen off. It may be necessary to adjust the frequency. Details of the screen are given as Fig. 7.

It is strongly recommended that a socket or Soldercon pins are used for IC1. This device is of MOS construction and is liable to damage if incorrectly

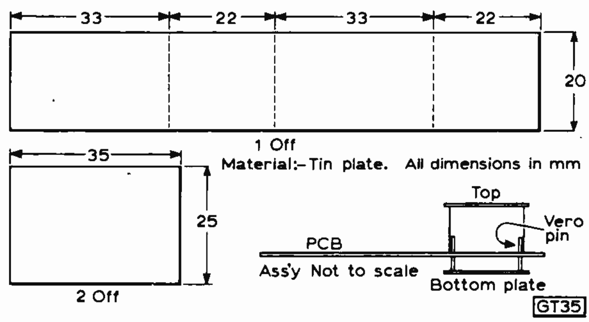


Fig.7. Cutting and folding details for the screen required round the modulator section. Since the position of the pins is fixed the folding needs to be fairly accurate to allow for soldering.

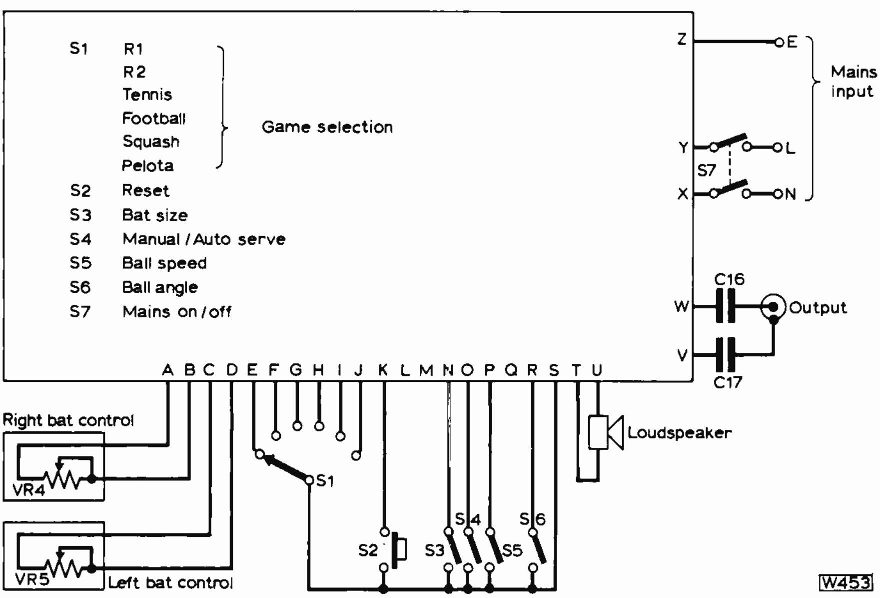


Fig.8. The connections from the PCB to the control are shown separately in this diagram to permit easy assembly. The same connections are shown, but not identified, on the circuit diagram (Fig.2.)

handled. If for any reason it is necessary to solder the IC directly into the board the soldering iron must have an earthed tip and a heat shunt should be used on the pin being soldered. The socket need only be a 24 lead type since the end pins on each side are unused. If a socket is used do not insert IC1 yet.

Recheck the board for solder bridges and for good soldered joints and then mount it in the box. The dimensions given for the box specified allow for 6mm ($\frac{1}{4}$ inch) spacers beneath the board.

Connect the off-board components to the pins as shown in Fig. 8. The leads for the bat controls should be about 1 metre long and be twin cable. The variable resistors are mounted in small boxes.

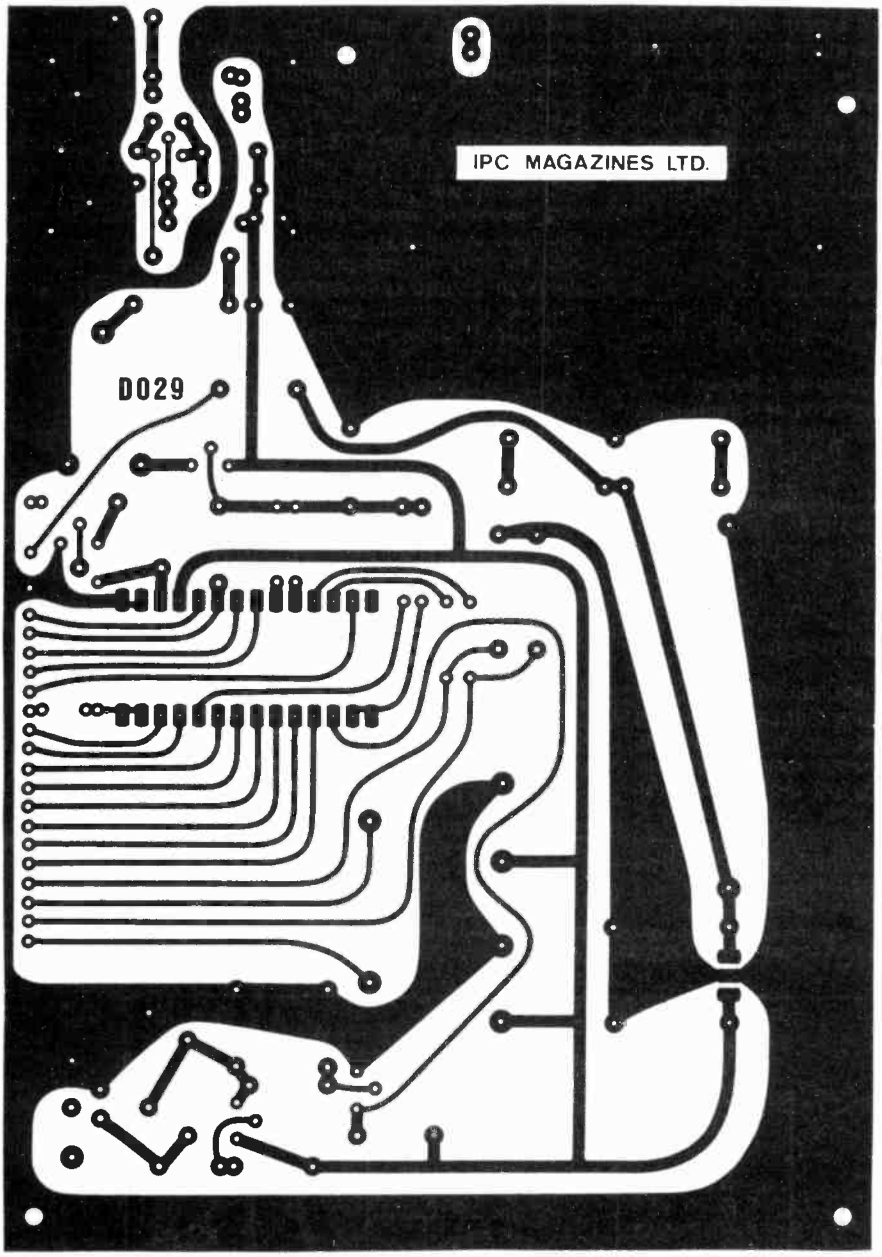
Some pins on the board are not used in this 4 game unit although S1 is shown wired for all 6 games. Pins E and F can be left unwired.

A suitable length of coaxial cable needs to be terminated at both ends and a mains cable, preferably terminated with a 13A ring main plug, completes the wiring.

Now remove the IC from its protective foam and insert it into the holder.

SETTING UP

Set the core of L1 flush with the top of the former and space L2 to approximately 7·5mm long. Set VR1, VR2 and VR3 to mid position, select football on the games unit and select auto serve. Switch the unit on, push and release the reset button S2. Tones should be heard at regular intervals from the unit as the ball hits the game boundaries etc.



◀ *Fig.5. The wiring pattern of the printed circuit board, shown full size. For those intending to make their own boards we would stress the need for great care in laying out the IC pads and the modulator section. The earth section could be increased to conserve the etchant.*

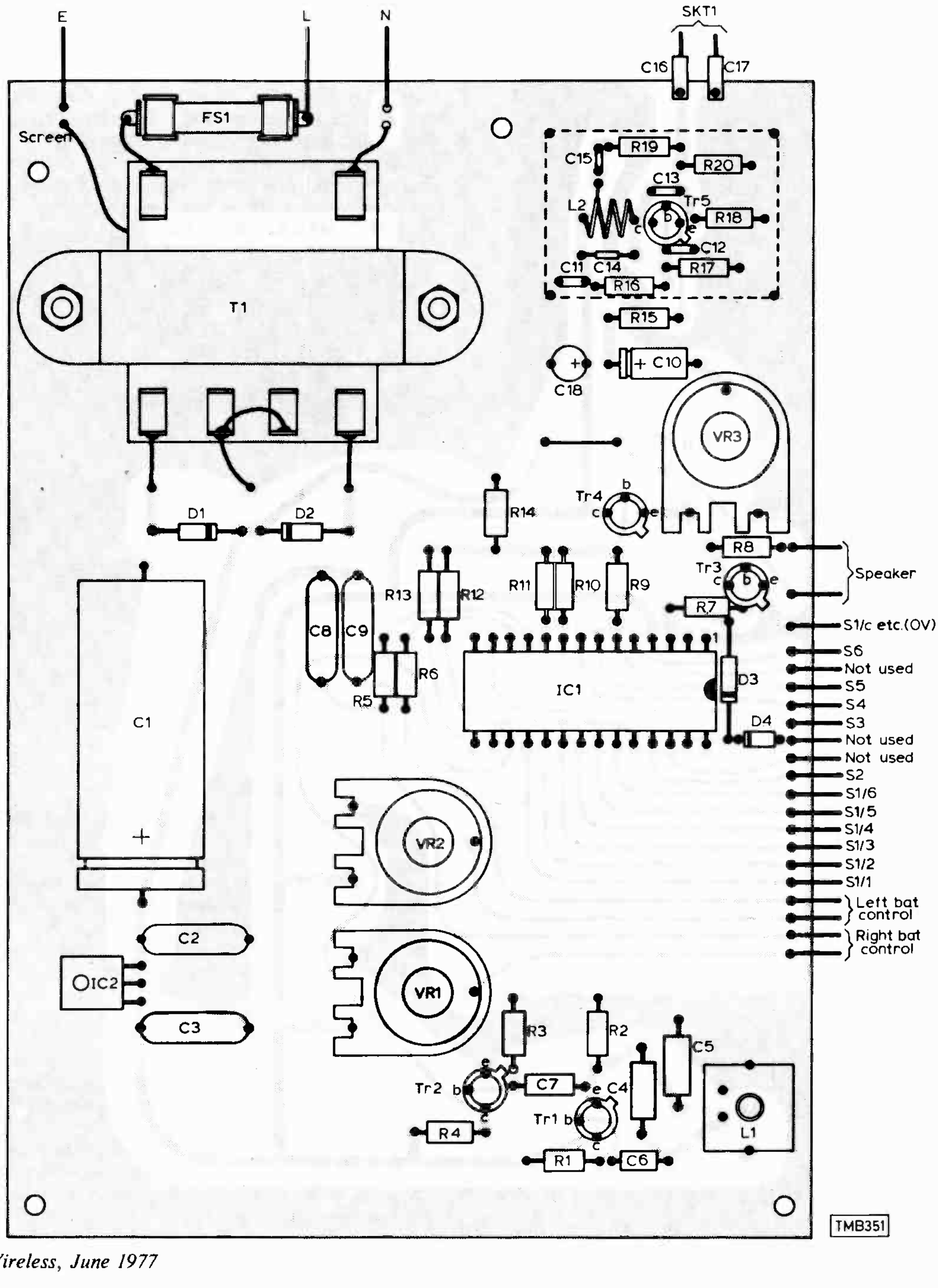
▶ *Fig.6. The component layout and orientation for the PCB. Although the outputs are not identified they conform to those shown in Fig.8. Note the tight layout of the modulator section and hence the need for careful cutting and folding of the screen.*

If all is well, switch the monitor on, allow it to warm up, select a spare U.H.F. channel and plug the games unit into the aerial socket. Carefully tune the viewer until the signal from the games unit appears on the screen, it may only consist of white streaks covering the screen. Slowly screw the dust core into L1 until the streaks on the screen resolve themselves into the outline of the football pitch as shown in Fig. 1. It may be necessary to re-adjust the viewer, tuning again for a good signal. Several signals will be picked up throughout the U.H.F. band, choose the best one.

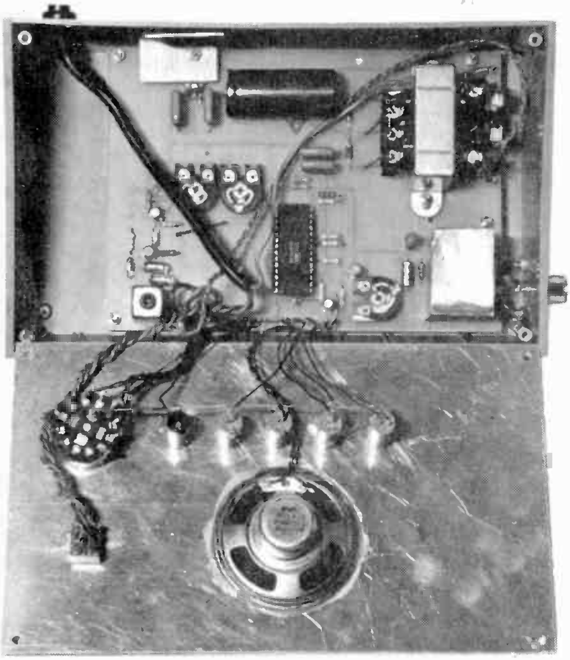
When the reset button is pushed and released the football field should appear locked solid on the screen, if it does not adjust L1 slightly one way or the other until it locks into sync each time it is reset. When the field is stable on the screen, VR3 may be adjusted anticlockwise to increase the contrast and the brightness control on the viewer may be turned down slightly to reduce the background. (If VR3 is turned too far anticlockwise sync will be lost.)

If the signal from the unit is close to a TV station L2 may be altered in length to move the games frequency up or down the band a little, then the screening cover can be fitted.

Check that the bats sweep across the screen. VR1 and VR2 may be turned anticlockwise to reduce the



sweep of the bats but if they are turned too far the bats will disappear since the ramp will not reach the I.C. trigger level. Check the other games and the various switch functions and if it all checks out, screw the lid on the case.



A general photograph of the unit with the lid removed. The retainer for the mains cable has been removed to allow the lid to be inverted. It should be positioned to avoid too much cable inside the box when re-assembled. The short leads of the capacitors coupling the board to the output socket can be identified. These two capacitors prevent any possibility of mains being fed to the unit from the television chassis if the set has its mains reversed.

FAULT FINDING

If the unit does not work, check all wiring very carefully. Check the +8 Volts supply to the I.C., modulator and the clock generator. If an oscilloscope is available, check that the oscillator is working and producing sufficient drive for the buffer, Tr2, and is approximately 2MHz.

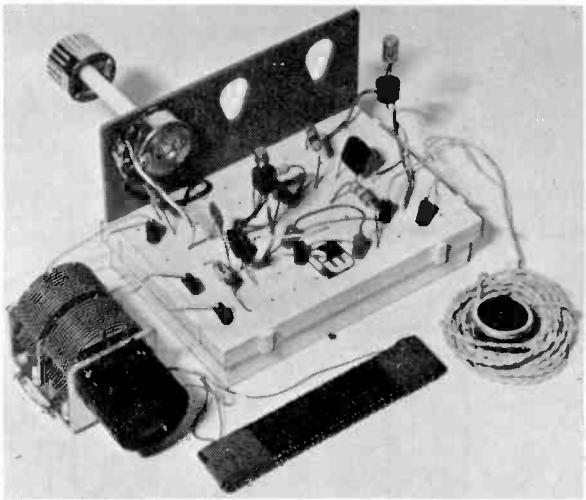
If the I.C. has +8 Volts and a good clock signal, check the sync output. This should consist of negative going pulses 4μS wide, at 64 μS intervals with an approx. 300 μS frame pulse every 20 mS. If this is present, check the field and score output on pin 24, this should be a positive-going pattern repeating every 20 mS. If this is present, check that both these signals appear at the wiper of VR3. If all is well up to this point and the unit is still not working, check the modulator construction very carefully. As it is difficult to check if it is working it is possibly easiest to substitute a new transistor for Tr5.

Watford Electronics have offered to keep their special reduced price for the AY-3-8500 open to readers of Practical Wireless *until the end of June 1977.*

S-DeCnology—*continued from page 122.*

of the wire, especially the tapping loop and tin these connections before soldering on some wired S-DeC plugs. If desired, the wire from the coil itself may be plugged into the S-DeC but you will still need to use some form of single core wire from the tapping point to the S-DeC because the twisted wire, being double thickness, will not easily plug into the S-DeC and may even damage it if forced. A second ferrite aerial/coil was wound on a 125mm. length of ferrite rod, 9mm in diameter and also gave good results.

The tuning capacitor used in the prototype was a twin gang 500pF+500pF. There is no reason why a single capacitor of either 500pF or 350pF should not be used, but this will make some difference to the actual tuning scale covered by the receiver. The twin gang does give a useful opportunity for experiment. For example, with both sections connected in parallel—as shown in the circuit diagram of Fig. 1, one has a 1,000pF (or 1nF) variable tuning capacitor. By "unlinking" the two sections of VC1/VC2 to leave only one of them in circuit, one has a 500pF tuning capacitor. Again, connecting the two sections in series gives a 250pF tuning capacitor.



Rear view photograph showing the actual receiver, comprising S-DeC front mounted potentiometer, and external components.

Modification ideas

Experimentally minded constructors may care to try altering the coil. For example, using only 24 turns tapped at 2 turns gave all sorts of 'funny' foreign stations. It may even be possible to obtain good results high up in the short wave bands.

This little receiver runs from just 3V. This is the optimum voltage. If you use a higher voltage the performance will be degraded. The current drawn by the prototype (using 3V) was 1·5mA which suggests that batteries should last for a very long time indeed. It may also be possible to run the receiver from two, small rechargeable batteries which could be kept 'topped up' from solar cells using sunlight. Perhaps the set may be happy to work directly from solar cells?

Various component changes and modifications were tried but it's left to the constructor to experiment for himself, with different component values, to obtain the best possible results.

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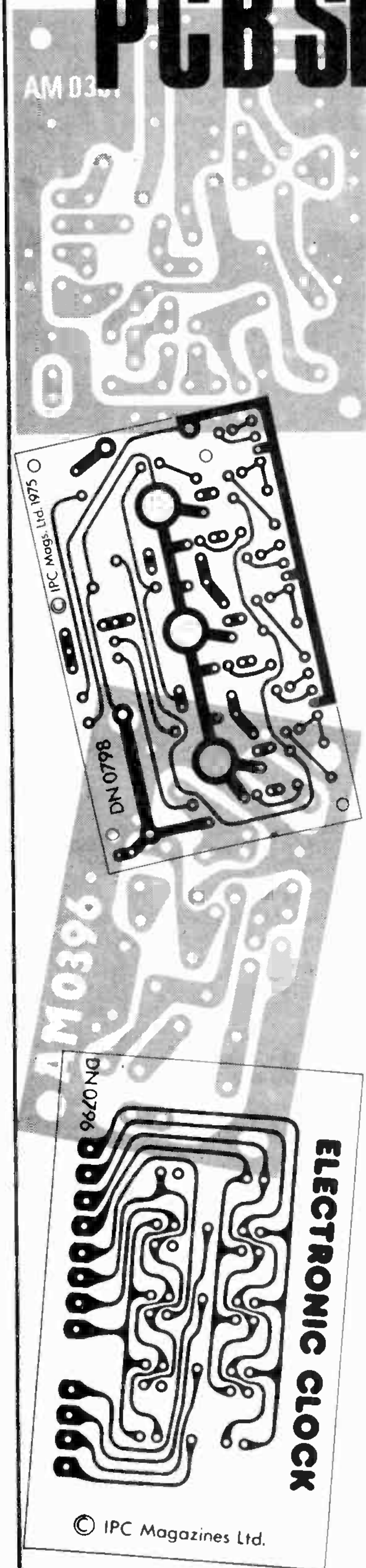
All boards, except SRBP, are glassfibre, drilled and roller-tinned



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June 77	Tele-Games	D029	3·22+18	☐

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PRODUCTION LINES

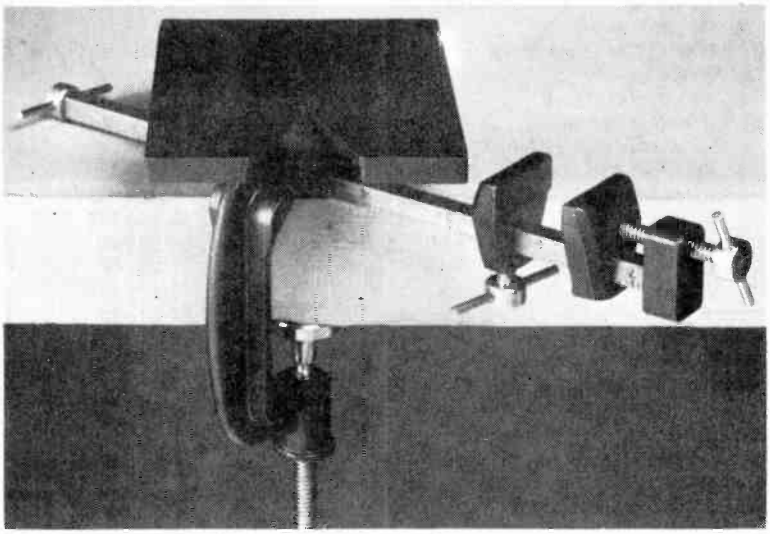
bill tull

Vice time

One of the most frustrating facts of life, is that we are born with only two hands. Ever tried filing or drilling, or some kinds of soldering when you really NEED that third hand? What we all need of course, is a vice (the sort you clamp to the bench I mean!), and H. R. Holmes Ltd., are now marketing an adjustable vice which is claimed to combine 8 tools in 1.

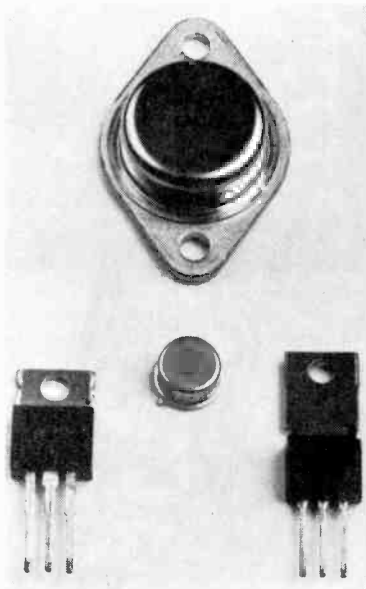
Called the Versa-Vice, the unit comprises an adjustable hand vice, G clamp, anvil plate and scribing pin, width and depth gauges, table vice and marking out table. Price is £4·80 plus VAT.

H. R. Holmes (Diecasting) & Co Ltd., Haldane, Halesfield 8, Telford, Salop, TF7 4EW.



Quite regular

A three terminal, positive voltage regulator, capable of supplying in excess of 1·5A and adjustable over an output range of 1·2V to 37V has recently been announced by Jermyn

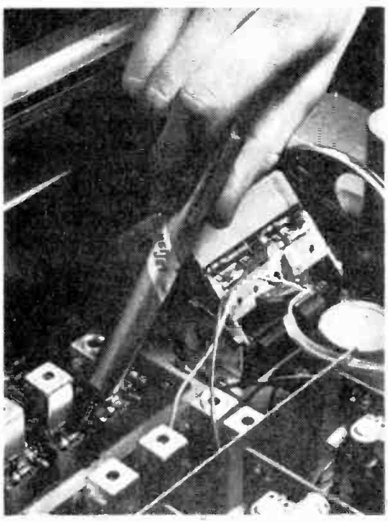


Distributors. Requiring only 2 external resistors to set the output voltage, the LM317 has typical line and load regulation figures of 0·01% and 0·1% respectively.

Other parameters include current limiter, thermal overload, and safe area protection. Also, as this regulator sees only the input to output differential voltage, supplies of several hundred volts can be regulated providing the maximum differential of 40V is not exceeded.

A choice of TO3, TO5, TO202 and TO220 packages is available, providing a total temperature range of −55°C to +125°C.

Jermyn Distributors, Sevenoaks, Kent. Tel: 0732 51174.



Probe for faults

One of the most useful pieces of equipment in the Service Technicians arsenal when tracing faults in Radio, TV and HiFi, is the signal injector. These take many forms, and the one produced by Carlo Gavazzi Ltd., the Pantec Usijet, is made in the form of a pen for clipping into the pocket.

The circuit consists of two signal generators—one operating at AF and the other at RF. The waveform derived from a blocking-oscillator type circuit produces a signal with a wide range of harmonic frequencies up to 500MHz. The fundamental frequencies are 1kHz and 500kHz, with an output voltage of 20V pk. to pk. Current consumption is about 25mA from a 1·5V self-contained cell. Price is £7·50 plus VAT.

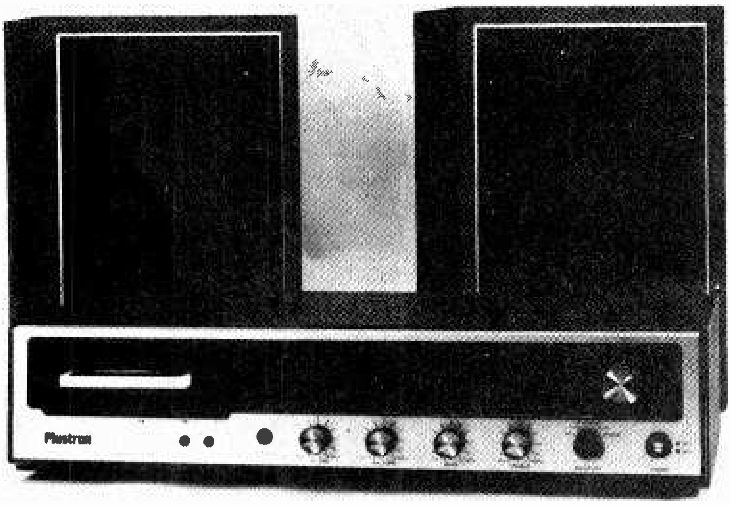
The Usijet, together with all Carlo Gavazzi products are now being distributed by *Precision Instrument Labs., Instrument House, 212 Ilderton Road, London, SE15. Tel: 01-639 0155.*

Tape 'Plus' tuner

Unit audio, music centres, what ever you care to call it, can be obtained almost everywhere in almost every type of combination. I say almost, because there is one combination that is comparatively rare—that is cassette recorder/amplifier/speakers and/or tuner. To fill this gap, Plustronics have launched their new combination, called the Plustron CTA 200. This unit comprises an AM/FM stereo receiver with integral cassette recorder, supplied complete with matching speakers. Radio coverage on MW is 540—1600kHz, SW 6—16MHz, LW 150—350kHz and VHF 88—108MHz, while the cassette tape system boasts a wow and flutter of less than 0·35% and S/N ratio of 40dB. Power output into an 8ohm load at 1kHz is 8W.

Imported, distributed and fully guaranteed by Plustronics Ltd., the Plustron CTA 200 has, what the firm call, a 'Guide Price' of £123·49 complete.

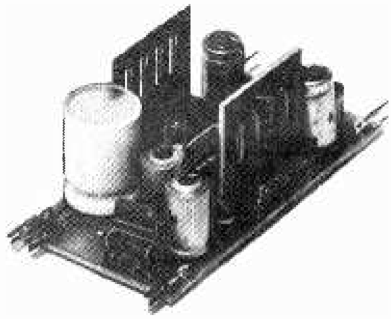
Plustronics Ltd., Hempstalls Lane, Newcastle, Staffs, ST5 0SW. Tel: 0782-615131.



Robust amps

'Indestructable' is the term given to two new amplifier modules recently made available in the UK by Chékits Ltd.

The kits are designed for the professional and constructor markets, and are based on two SGS amplifier



IC's. Although both are of similar component construction, they differ in power output and sensitivity ratings. The 75-X, which has a maximum rating of 10W into 4 ohms at 20V utilizes the TCA940 chip, while the 75-B, its less powerful brother, uses the TCA810AS and has a maximum output of 7W into 4 ohms at 16V. Both are equipped with thermal limiting circuitry, while the 75-X is short circuit protected.

The quoted sensitivity figures range from 6·5mV input for 50mW output, to 90mV input for 9W output for the 75-X. For the 75-B. 6mV input gives 50mW output. and 80mV input gives 6W output. All figures quoted are into a 4 ohms load,

Both modules are constructed on 1·6mm Epoxy Glass Fibre board and measure 86 x 43 x 30mm (total dimensions with components). Price for the 75-X and 75-B is £4·50 and £3·59 inclusive respectively.

Further information from *Chékits Ltd., 56 Fortis Green Road, London, N10 3HN.*

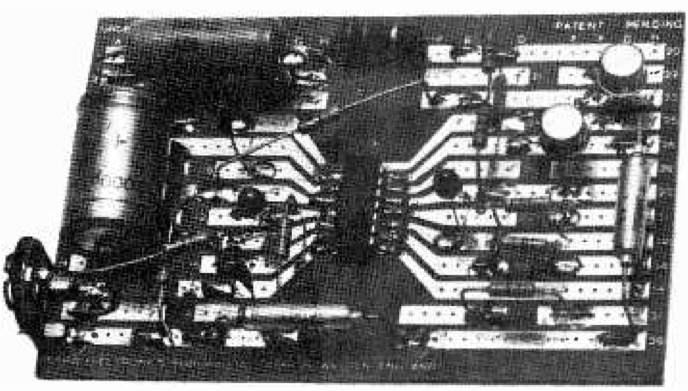
Blob board

For the past few months, PW has been publishing articles based on the S-DeC. Now, we have mentioned in these articles, that if the builder wishes to keep the project, but use the S-DeC for another project, then he should transfer the components to a Blob Board. Blob Board, do I hear you say? Well as can be seen from the photograph it is extremely simple to use—the component layout is drawn on the Board with a felt tip pen. The components are then laid over their respective drawings, and soldered in position.

All Blob Boards are roller tinned to facilitate easy and reliable soldering, while components can be re-used and re-soldered making circuit prototyping and modifications both fast and easy.

There are twelve different Blob Boards available in a variety of patterns which, between them, are claimed to accommodate all components from discrete to IC's. The smallest board measures 3·6 × 2·4in and costs 20p.

P B Electronics (Scotland) Ltd., 57 High Street, Saffron Walden, Essex. Tel: 0799 22876.



CW filter unit

A. LANGTON

THIS simple bandpass filter was built to ease the reception of morse code in the presence of interference from other stations. It simulates a parallel resonant circuit with a Q of 25, the overall gain being fixed at unity. In Fig. 1 capacitor values are given for 800Hz and 1200Hz. In the prototype, soldered links select either frequency. If the Q is increased much above 25, the filter will "ring" and the keying will sound soft, making reception more difficult as the characters will begin to merge together.

Headphones of 600Ω impedance or greater can be used; blocking capacitors are not necessary at input or output as the IC2 earthing return ensures that the mean DC voltage at the input and output of the operational amplifiers is zero. The headphone socket into which this device is plugged should be isolated from high voltages by a capacitor or transformer within the receiver.

★ components list

Resistors (all 2% ¼W)
R1 330kΩ
R2 560Ω
R3 150kΩ

Capacitors
C1 0·01 and 0·015μF } see text
C2 0·02 and 0·033μF } see text

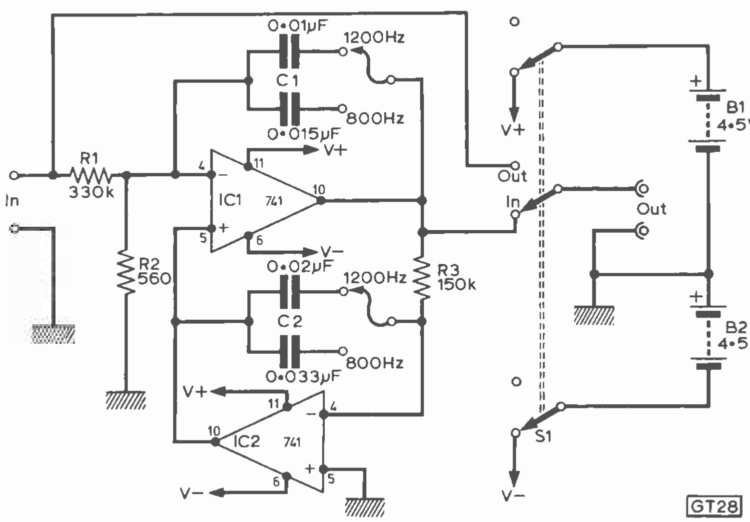
Semiconductors
IC1, 2 741 op amp.

Miscellaneous
S1 3 pole 2 way wafer switch. Plug and socket to suit headphones. B1, 2 4·5 to 12V batteries. Case measuring about 17 x 9 x 7 cm.

Fig.1: Circuit diagram of filter unit. Two sets of capacitor values are given corresponding to passband centre frequencies of 800 or 1200Hz. In the prototype either set of capacitors could be chosen by wiring in the appropriate pair with a soldered wire bridge on the circuit veroboard. Naturally, this arrangement may be replaced by a switched capacitor bank mounted on the instrument front panel. To work out other passband frequencies:

F varies as $\frac{1}{C}$

Use the given circuit values to work out other values of F and C. For instance, doubling the capacitor values halves the passband frequency.



Construction

Layout is not critical, and as so few components are used, it can easily be built on a scrap of Veroboard. The Veroboard layout diagram Fig. 2 shows the positions for fitting either 14 pin or 8 pin DIL 741 IC devices. It also includes both frequency options; the desired frequency is selected by strapping two pairs of pins.

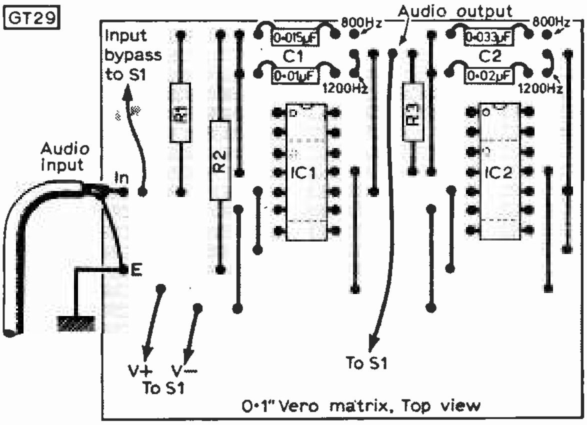


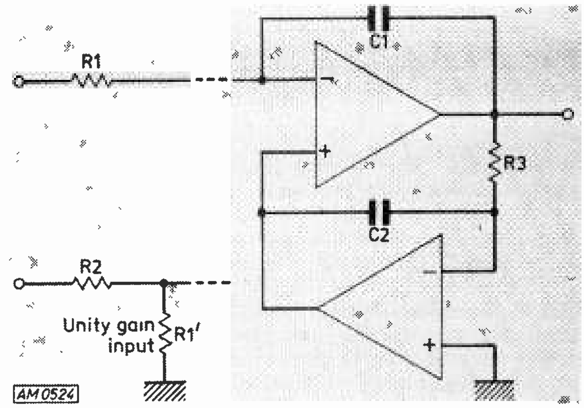
Fig.2: Suggested veroboard layout. The dotted outline shown on IC1 and 2 indicates the position of an 8 pin mini DIP 741 in lieu of the 14 pin device shown. No other changes are necessary.

A piece of Perspex with two 6BA tapped holes is used to secure the board to the case, the Perspex being glued along one edge of the circuit board with epoxy adhesive. There are, of course, many ways the board could be secured; it is up to the individual constructor to choose the most convenient way. The battery holder is another home-made item. It might be more convenient to use 9V batteries with press stud connectors and hold them in place with a simple clip.

The case, measuring 17 x 9·5 x 7 cm, is larger than necessary, but allows plenty of room for experiments or additions to the basic design. All parts except the circuit board are permanently installed within the case, which can form a small test rig for filter experiments: board replacement requires the minimum of unsoldering.

The total current consumption is about 6mA, and it will work on $\pm 4 \cdot 5$V to ± 12V. The filter can be plugged into the receiver as required; a front panel switch connects the headphones either to the input or output of the filter, disconnecting the power when not required.

Other circuit values



Use your pocket calculator to work out the circuit values for your own application:

Fo = passband centre frequency

R = MΩ

C = µF

$$F_o = \frac{1}{2\pi \sqrt{(R_1 . R_3 . C_1 . C_2)}}$$

To work out the 'Q' of the filter:

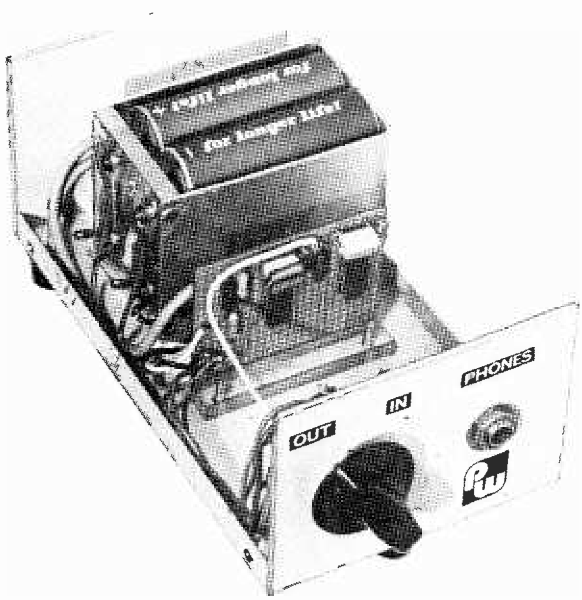
$$Q = \sqrt{\left(\frac{R_3 . C_2}{R_1 . C_1}\right)}$$

To reduce gain to unity.

$$R_2 = R_1 . Q^2$$

$$\text{and } R_1{}' = \frac{R_1 . Q^2}{Q^2 - 1}$$

PW



INDEXES FOR PW

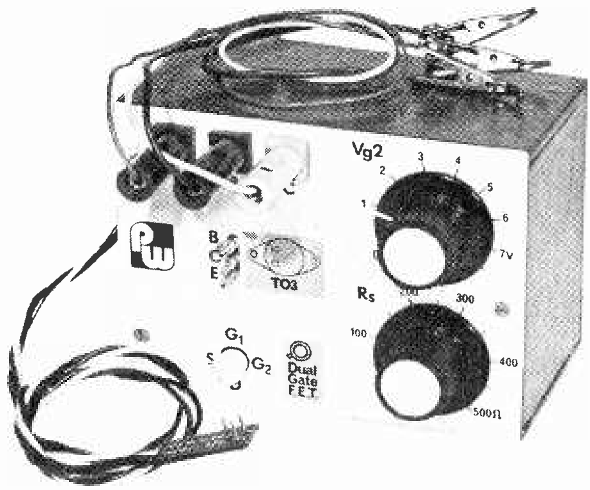
Readers are asked to note that further supplies of the index for Vol. 51 (May 75-April 76) are now available. See contents page for details on obtaining indexes.

The index for Vol. 52 (May 76-April 77) was presented free in the May 77 PW and this issue can be obtained from the same address.

extender for PW Transistor Tester

IAN HICKMAN

WHEN the P.W. Transistor Tester was developed, the aim was to produce an instrument of simple design, yet which would enable a wide range of semiconductor devices to be tested. The result was that whilst both P and N channel J.FETs and MOSFETs (both depletion and enhancement types) could be checked for drain saturation current I_{DSS} and pinch off voltage V_p, for depletion mode FETs intermediate values of drain current versus gate voltage could not be checked. More importantly, no provision was made for dual-gate FETS.



★ components list

Resistors

R1	22Ω 5% ¼W
R2	1MΩ 5% ¼W
R3	39kΩ 5% ¼W
VR1	500Ω
VR2	500kΩ

Miscellaneous

Piece stripboard, 0·1″ matrix, 5″ × 3¾″. 3 off 4mm sockets and plugs to suit (preferably different colours). 2 knobs to suit variable resistors. A 4 pin socket for TO5 transistors. 3 split pins to fit TO3 output pins. Piece of springy material for case connection of TO3 can. 2 ferrite beads. Wood and hardboard for case. Cardboard for top.

This Extender Unit covers these additional uses and also incorporates a socket which accepts TO3 transistors, thus facilitating the measurement or matching of power transistors. Finally, sockets for three flying leads enable connections to be made to transistors of any case style whatever.

CIRCUIT

Fig. 1 shows the circuit diagram. The socket for TO3 transistors and the banana sockets for flying leads are self-explanatory. Via the lead labelled

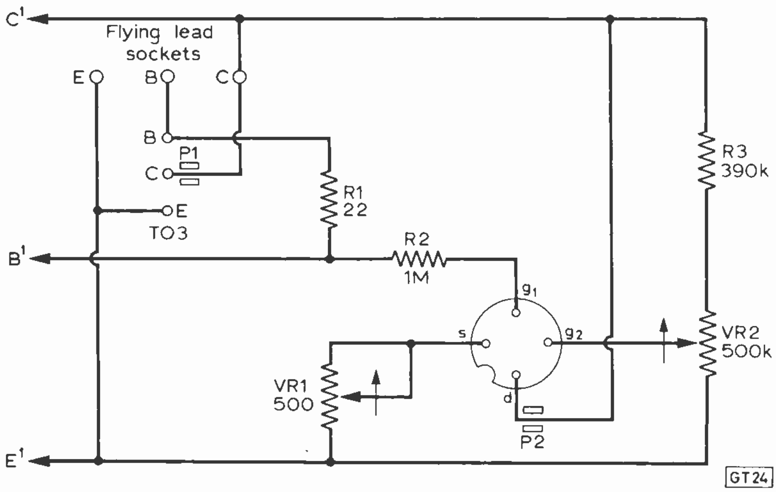


Fig. 1.
The circuit diagram for the extender. Note that power is drawn from the original test unit.

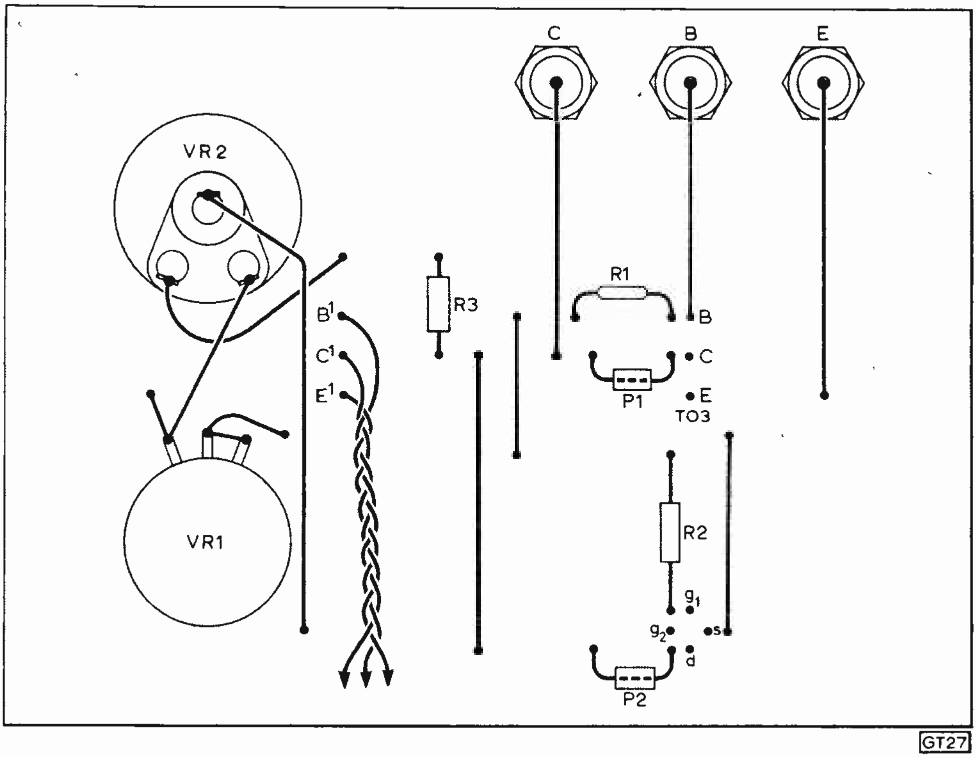


Fig. 2. The board cutting details and the components as mounted in the prototype. For a smooth top the components are soldered to the foil side and the leads do not pass through the holes.

C'B'E', which plugs into the connector panel of the P.W. Transistor Tester, they connect to transistors which cannot conveniently be plugged directly into the Transistor Tester. The four lead transistor socket is arranged to accept most TO72 type dual gate FETs, e.g. the economically priced General Instrument range including the MEM 614, as well as the popular and long-established RCA 40819 range and the earlier 40600 range (which has no gate protection diodes).

The voltage on gate 1 is controlled by the V_g control on the Transistor Tester, whilst the V_{g2} control (VR2 of the Extender Unit) controls the voltage on gate 2.

Together with source resistance control R_s (VR1 of the Extender Unit) a wide range of operating conditions and measurements can be set up and made.

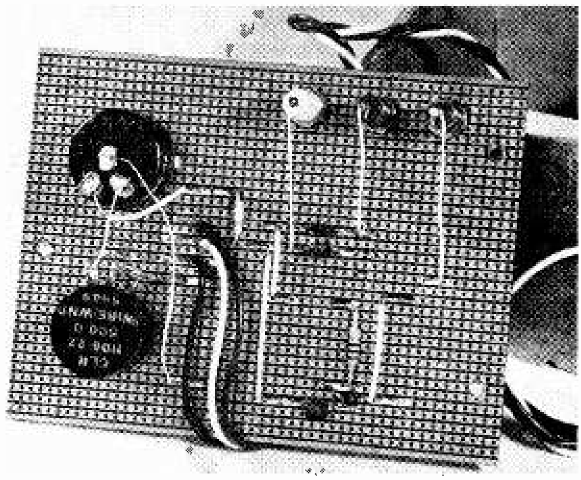
Anti-parasitic ferrite beads P_1 and P_2 are included in the collector and drain connections, together with a 22 ohm stopper in the base lead of the transistor socket and 1MΩ in the gate 1 lead of the dual gate FET socket, to ensure stability.

The V_{g2} control circuit draws less than 15μA from the collector supply and its effect on it can therefore be ignored.

CONSTRUCTION

The unit was made up on a piece of 0·1 inch pitch strip board, 5in x 3¾in, see Fig. 2. The TO3 socket used three slotted female pins taken from an old multiway connector, the tails of which were passed through the Vero board and soldered to the copper-strips. The outer two were at 0·4 inch spacing, but as the pins of a TO3 transistor are slightly further apart than this, the holes were eased with a small file. A TO3 transistor was plugged into the pins to

A photograph of the prototype board.



hold them whilst they were soldered. A springy connection to contact the case of the transistor was made to fit into the centre socket. It was also necessary to drill out the holes in the Vero board to take the pins of the FET socket.

A piece of white card was stuck over the top surface of the Vero board to carry the markings as shown in Fig. 3. The finished unit was mounted on wooden side pieces painted to match the original tester.

The lead connecting the Extender Unit to the Transistor Tester terminates in a small piece of strip board carrying three pins which plug into the triangular socket group. This prevents connection to the Transistor Tester the wrong way round.

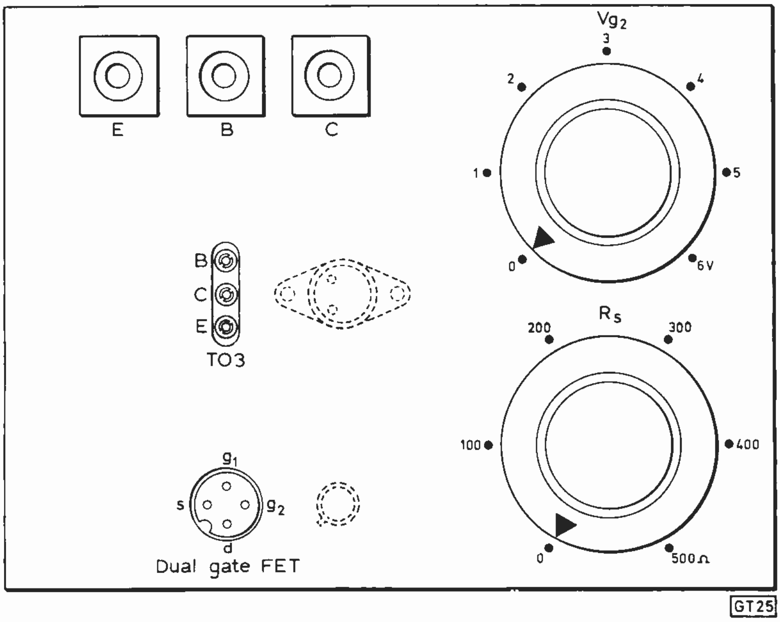


Fig. 3. The marking out of the board used on the prototype. Remember that the calibration of Vg2 and Rs cannot be copied direct from this picture. When making the preliminary markings during calibration allow enough room around the spindles to clear the knobs being used.

CALIBRATION

VR1, the source resistance control, can be calibrated sufficiently accurately with the aid of the ohms range of a multi-range meter, provided its batteries are fresh.

VR2 the V_{g2} control is more difficult, owing to the resistance being too high to use even a 30,000 ohm per volt meter. The best way, assuming a DVM is not available, is to connect the Extender to the Transistor Tester, switch on and set V_c to maximum. Connect the negative lead of a 0-12V power supply to E' and connect a multirange meter (30μA or 50μA range) between the positive terminal and the slider of VR2. By setting the power supply output in IV increments from 0 to 6V and at each step adjusting VR2 for zero reading on the meter, the calibrations can be marked in.

USE

The method of use for TO3 and other transistors is covered in the August 1976 issue of *Practical Wireless*.

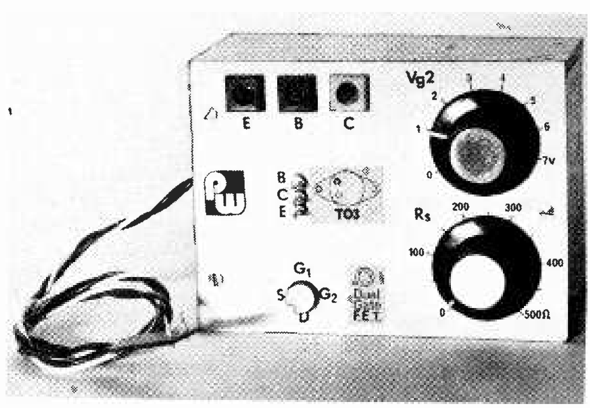
For use with dual gate FETS, first check that the connections are as shown in Fig. 2. If not, the leads must be crossed as appropriate. Assuming the dual gate FET is an N channel type (most are), set the V_g/h_{FE} control of the Transistor Tester to the 0V, the V_c control to maximum, the V_{g2} control of the Extender to +4V and the R_s control to 0Ω. Switch the Transistor Tester to NPN/DIODE and the zero signal-gate voltage drain current I_{DSS} can be read. The tolerance on this is very wide, typically 1 to 20mA, and could be between 0·5 and 35mA for some types.

However, the gain of a dual gate FET is usually quoted at a fixed current, say 5mA. To achieve this, gate 1 must be slightly positive or negative to the source, as appropriate.

In a practical circuit, the drain current variation from device to device can be reduced by setting V_{g1} to +2V, V_{g2} to +6V and putting a 390Ω resistor in the source circuit. Devices with a high I_{DSS} will then pass somewhat more than 5mA, thus biasing themselves back at gate 1 and low I_{DSS} devices will pass somewhat less than 5mA, thus biasing themselves on harder at gate 1. The suitability of this arrangement for any particular type of dual gate FET is easily checked with this extender unit.

Note that the V_{g2} voltage is derived from the V_c supply of the Transistor Tester and this should therefore be left at maximum when testing dual gate FETS. The reduction of current through the FET resulting from decreasing the V_{g2} voltage towards zero is readily checked.

As explained in the Transistor Tester article, single gate enhancement mode FETS are readily checked, but single gate depletion mode types could only be checked for I_{DSS} and V_p. With the Extender, intermediate values of drain current can be checked by using the R_s control. If V_g is set to 0V the reverse bias on the FET gate is simply the setting of the R_s control times the collector current. When checking single gate FETS, as the V_{g2} control is not used, the effect of varying the drain voltage by means of the V_c control of the Transistor Tester can also be studied.



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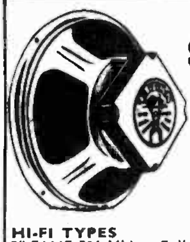

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6BA6	·39	10LD11	·74	50L6	·99	ECC85	·38	EM81	1·10	PCL84	·45	UL84	·42
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6BW7	·64	12BE6	·54	6067	·99	ECH42	·70	EY86/7	·36	PL84	·49	U26	·55
6C4	·39	12BH7	·54	7193	·55	ECH81	·34	EY88	·54	PL504	·89	U191	·45
6C5	·59	12BY7	·84	CL33	1·73	ECH83	·49	EY91	·49	PL509	1·79	VR105/30	·45
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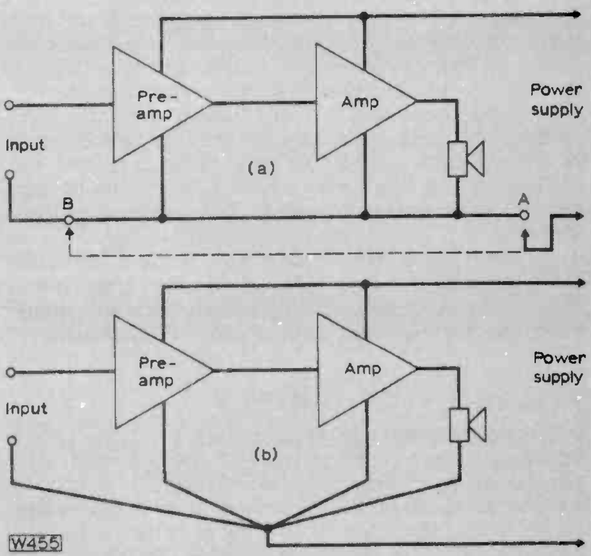
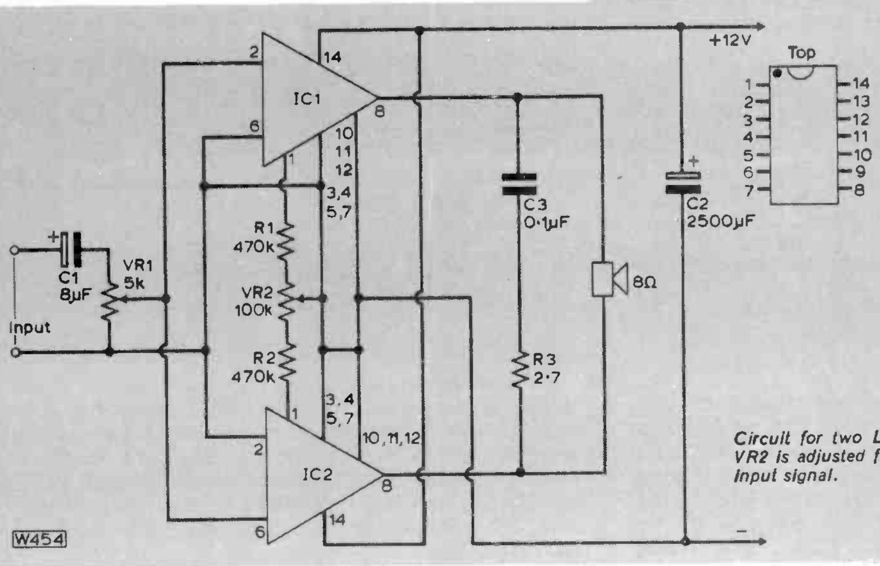
Many units having an IC main amplifier will have one or more transistors as pre-amplifiers, to raise the sensitivity to that needed for a microphone or other low-level input. The various negative earth line pre-amplifiers, tone-controls and other circuits shown earlier may be incorporated, as required.

EARTH LOOPS

Power supply circuits can usually be quite simple types, designed to provide the wanted voltage over the current range expected. Trouble may arise from the manner in which pre-amplifiers, amplifiers, or other units are connected to the supply. Where equipment has substantial gain and power output, incorrect earth circuits can cause problems. In Fig. 27a input currents and voltages may be extremely small, while output circuit currents may be in terms of amperes. With the power supply earth connected at point A, high currents here will not influence the input. But a connection which transferred the power supply circuit to B, for example,



27



26

Circuit for two LM380's in push-pull. Potentiometer VR2 is adjusted for minimum supply current with no input signal.

could cause instability due to the presence of high common earth return currents for the pre-amplifier. An alternative method of wiring is shown in Fig. 27b.

Electrical feedback may be by inductive or capacitive coupling from output leads (speaker) or components, or leads carrying high current (power) back into input (microphone, pick-up, tuner, pre-amplifier) circuits. It is avoided by a layout which places output components such as speaker coupling capacitors etc. away from input circuit components and by using screened leads at inputs to pre-amplifier and amplifier.

HUM PICK-UP

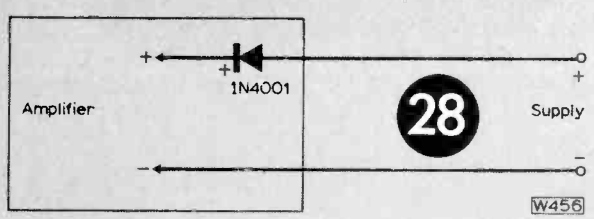
Hum is likely at 50Hz, 100Hz or 150Hz, these frequencies arising from the 50Hz supply. Hum at 50Hz may be caused by inductive, capacitive, or leakage coupling from mains circuits to inputs, due to the run of the wiring, or layout of power and other circuits. Screening and connectors should be checked and moving leads or pre-amplifiers around may help locate the cause. Such hum can also be caused by insufficiently smooth supplies from half-wave rectification, in which case these measures are likely to have little effect. Additional smoothing is needed, especially in early stages or pre-amplifiers.

A 100Hz hum comes from full-wave rectification, from insufficient smoothing, or circuits which result in transformer, rectifier or smoothing capacitor currents coupling into early stages. Layout should keep such circuits and components away from input circuits.

A 150Hz hum would normally be 3rd harmonic from core hysteresis, induced by the transformer into adjacent components or circuits. Layout should place the transformer clear of input components.

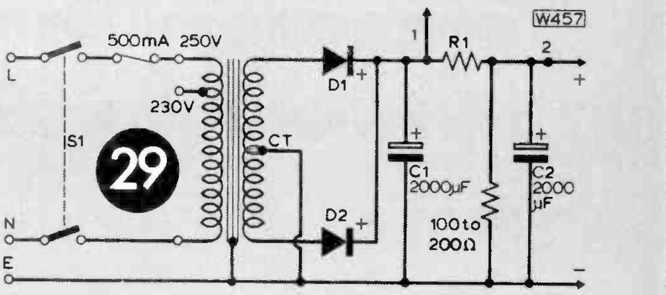
POLARITY OF SUPPLY

Wrong polarity can destroy transistors in circuit positions where current is not limited and non-reversible or clearly marked connectors should be used with home-built equipment. It is often worthwhile to include a protective diode in the amplifier, as in Fig. 28. The 1N4001 is suitable for currents up to 1A. Wrong supply polarity merely causes non-operation of the equipment.



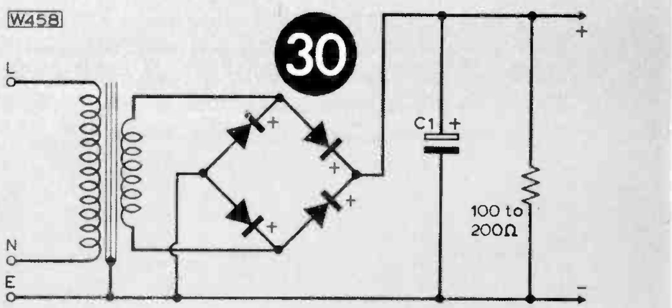
POWER SUPPLIES

Fig. 29 is typical of many power supply circuits. Current is supplied via a low rating (2A or 3A) fuse and 3-core cable providing line, neutral and earth circuits. When a single pole switch is fitted it must be in the Live conductor, but the double pole switch is recommended. The earth is connected to the transformer core and secondary circuit, and is only properly omitted when a double-insulated transformer is used. The small fuse at the primary may be omitted in some cases and some transformers will have no optional primary tappings.



Full-wave rectification is obtained using a centre-tapped secondary winding. In many cases current is then drawn directly from the point 1, only C1 being present for smoothing. R1 and C2 are usually found in the amplifier positive line feeding earlier stages, but in some cases may be present as part of the smoothing to furnish a lower voltage with additional smoothing. As earlier stages operate Class A, with steady current, R1 may be chosen to provide the wanted voltage.

Some transformers may have a separate low voltage secondary to operate a pilot lamp. Capacitors of about 1000pF may be shunted across D1 and D2. Occasionally high working voltage capacitors (say $0 \cdot 05\mu F$) may be shunted from live and neutral to earth to eliminate mains modulation hum. By suitable choice of transformer and diodes, any wanted voltage and current is available. Peak secondary voltage is approximately $1 \cdot 4$ times the RMS voltage (the latter being that shown by a meter). Thus C1 can charge to this value on no load, so it must be rated to at least $1 \cdot 5$ times the secondary voltage. As the diodes may have to withstand this and also the peak inverse voltage they must be rated at a minimum of $2 \cdot 8$ times the secondary voltage. E.g., a 12V transformer for this circuit would have a 12-0-12V secondary (actually 24V overall). Thus 50V diodes will be convenient for supplies of up to about 16V to 17V or so, with 100PIV diodes for up to 35V. Suitable diodes are 1N4001 (50PIV) and 1N4002 (100PIV) for most circuits (these are rated at 1A).



An alternative rectifier circuit, often used, is shown in Fig. 30. No secondary centre-tap is needed and the rectifier PIV is reduced. An 18V 1A secondary will provide about 24V at up to 1A, using 1A diodes. A resistor across C1 helps stabilise the voltage and is usually 100 to 200Ω, according to the current available, as transformer and rectifiers must meet this additional load.

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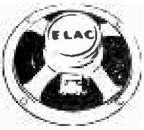

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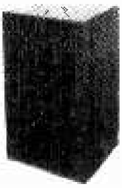

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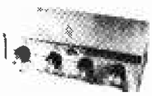

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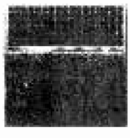

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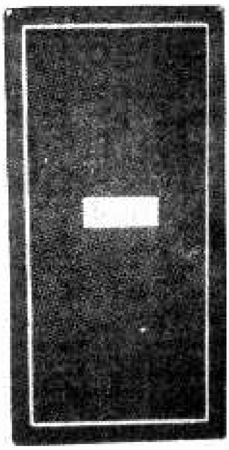

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ON THE AIR

AMATEUR BANDS

by Eric Dowdeswell G4AR

AN interesting letter from **Andrew Sharpe** G8MLM residing in Rowlands Gill (Tyne and Wear) who got his ticket last September at the grand old age of 15! His problem now is how to get on the air with a £1 a week pocket money! Unfortunately, Andrew has no local radio club nor local amateurs who might be able to help and it seems to me that he has been most valiant in struggling on his own thus far and passing the RAE. VHF gear can be a lot more complicated to build than for the HF bands so I have suggested to Andrew that he pass his morse code test and get on to the HF bands with a simple transmitter to start with. I am sure that all our readers will wish you well Andrew, but above all, don't give up!

On my suggestion **Eric Hill** of Bramley, Surrey, junked his pre-selector and noted 'a big decrease in noise'. He found 15m open for the States and Japan on the odd day or two and, like so many other readers, was glad to copy W6QL/VP2A on Antigua. QSLs to WA6AHF or via the Yasme Foundation, Box 2025, Castro Valley, California 94546, USA. **Don Waddell** found 80m to be the most interesting band on his FRG7 but says 'I'm too ashamed to mention my aerial'! With an FRG7 you should do as Eric Hill did and sell that pre-selector and spend the money on a decent aerial system!

The Hog's Back in Surrey was the scene of a small expedition when **Don Anderson** (Brookwood, Surrey) joined G8LVB operating there during a 144MHz competition. All this makes Don very determined to get the RAE at the first opportunity! Don belongs to the Farnborough and District Radio Society (the Hampshire one!) now happy with the call G4FRS and their first QSO was with founder member G2DX! This must be a record because they were probably the oldest and newest callsigns at the time! Write to their Sec. Chris Beezley G4FEA at 152 Westheath Road, Farnborough, Hants if you want to join in the fun and games, or simply look in on the Railway Enthusiasts Club, Access Road, off Hawley Lane, Farnborough on the second and fourth Wednesday of the month around 7.30pm.

Derek Gilbert and **Ian Horwill** seem to share the same receiver in Farnham, Surrey and they were duly puzzled by the N prefix that popped up on the bands in recent times. Just our old W friends again I'm afraid. Consultation of the Geoff Watts' Prefix-Country-Zone list would have sorted that one out pretty quickly so if you send 35p to 62 Belmore Road, Norwich you too can have all the answers at your fingertips! **BRS37901** sent in a list of DX heard on 20m sideband but omitted his QTH but would seem to be around Bournemouth. Rx is an AR88 and that's all I know!

One reader, who wishes to remain anonymous, was able to get a 9R59DS from another reader of this column and in consequence very kindly handed over his R107 to an RAIBC member in Bolton which should help an ill, 69-year-old widower to be very happy. I hope that Mr. Anon will now be able to send in some reports in future! Incidentally, anyone who feels like contacting the RAIBC should write to Sec. **Harry Boutle** G2CLP 14 Queen's Drive, Bedford. Regular **Robin Bayley** (Shifnal, Shropshire) has been experiencing QRM from a washing machine but since he's using only a few feet of wire round the shack this is hardly surprising! I think that your EC10 would benefit from a decent length of wire outside and screened feeders Robin, and thus make a good log even better. I was delighted to hear from **Albert Allnutt,** otherwise G4CQK, from Walton-on-Thames, Surrey who, seeing my review of the Heathkit HW8 QRP transceiver, reported his best DX to date with the same rig, as W4AIZ in Florida, using about $2\frac{1}{2}$ watts on the 15m band. His aerial is an end-fed wire 116ft long most of which is only 25ft above the ground. Much more fun than when using 150 watts and a multi-element beam!

B. Harrison continues to mystify us from Hastings by not revealing his/her first name! Since the log is written on one of my log sheets I can't sniff it to detect any perfume! One log entry is FO8GP on Clipperton Island on 80m so he/she knows a thing or two! **Paul Cowburn** is about the only correspondent who ever makes a note of stuff heard on CW. He doesn't profess to be much good at it yet but manages callsigns and reports. Now this is where Paul is very clever because he records it all on tape and plays it back at leisure to see what he has missed. Full marks for ingenuity OM! I would advise any reader who normally sticks to the relatively easy job of copying SSB to have a listen round the LF end of the bands for some of the very attractive DX to be found there on CW. It's not all 25wpm by any means!

Now for a personal request. I would very much like to borrow a copy of the manual for the venerable 'Calibrator, Crystal No. 10', for statting and return immediately. Any help would be very much appreciated.

The Wessex Amateur Radio Group seems to be a well organised bunch of people judging by the excellent newsletter received from Hon. Sec. **Geoffrey Cole** G4EMN. Meetings are normally held at the Club Room, Dolphin Hotel, Holdenhurst Road, Bournemouth but Friday 20 May is going to be something special. 'Dud' Charman BEM G6CJ is giving his now famous lecture on Aerials plus Ken Alford G2DX who will talk about the early days of wireless. The meeting starts at 7.30 sharp at Bournemouth School, East Way, Bournemouth on this occasion. Knowing both of these characters quite well I can assure any potential visitors that it will be an evening to remember. The Group has a 4m FM net on 70·26MHz with several stations on permanent watch. A net operates on Sundays on 10m or 28·575MHz to be precise. Info on the many other club activities from Geoff at 6 St. Anthony's Road, Bournemouth.

Paul Barker is still trying to get an SSTV picture from Oceania to complete all continents. To date 51 countries have been 'seen' so he shouldn't be too far off achieving this ambition. Paul, in Sunderland I should add, comments on the pictures from YU3NAW which he compares to 'closed circuit stuff'. What annoys me Paul, are the appalling hand-drawn captions used by many SSTV stations. After having probably spent a lot of money and a great deal of time to get on SSTV the whole effort comes up as a scrawl with a rough paintbrush on an odd bit of card! Surely a decent bit of artwork could be prepared for the callsign and name at least.

Log Extracts

D. Hallgarten:— 15m W7AO ZP5LX ZS6BNH **20m** A4XGX A6XB FR7ZL/T

P. Barker:— 20m SSTV EA5HH HA5KBM 15WC IT9DQZ K1CUW K4TGC LZ1MH OH5RM OK1JSU YU3NAW

P. Cowburn:— 20m CW FY7AS HI8MOG KS6GN VP2SA 8P6BU 20m HI8SRH HL9VA HV3SJ VS5MC YB0ABO 5W1AB 6W8GM **80m** CO2JA CP6EL JW7FD PJ8KG SV1DL VP2DAC W6QL/VP2A ZL2BT **160m CW EA8CR IK4AMO PY1RO YV1OB 4X4NJ**

B. Harrison:— 15m FY7BB ST2SA **20m** FG7XL 9D5D **80m** FM7WS HI8LC SV0WT

R. Bayley:— 15m A2GCO JA9CM W7WPR **20m** TG9FRJ 7Q7BA **40m** CT2AP EA9CR **80m** A4XVK FP8DX HK0COP KH6PP KW6OM 9J2WR

R. Thomas:— 20m ZL2BIU ZL3QN

D. Waddell:— 15m VP9PC WB6EWH/VQ9 9X5SM **20m CW FM7AV HI8MOG KG4JS VP2EE VP9HT 20m** C21PZ JW7FD VE8ML ZL4BX **80m** JW9WT VS6DO ZD8EW

All SSB except those in bold which are CW.

BROADCAST BANDS

MEDIUM WAVE DX

by Charles Molloy

ONCE again, Transatlantic DX dominates the scene on the medium waves with reports coming in from a number of readers of some really good DX. **Michael Tallent** in Stafford heard CJCA Edmonton, Alberta on 930 kHz with a Realistic DX160 and 300ft long wire while **Harold Emblem** in Mirfield logged CFAC in Calgary on 960 at 0035 on March 3rd using his Eddystone 740 and loop. DX from the Canadian Prairies is only heard in the UK when conditions are exceptional and both stations are very fine catches indeed. The story repeats itself further south, the more exotic type of DX from the United States being reported. An outstanding log from **Gordon Darling** in Reading, who uses a Marconi AD7009 and 34in loop, includes KOMO in Seattle on 1000kHz at 0415, KFBK Sacramento, California on 1530 at 0304, WCCO Minneapolis on 830 and WSM Nashville, Tennessee on 650.

DXing on the medium waves, which is better now than it has been for over ten years is attracting the attention of enthusiasts in other branches of the radio hobby. **Roderick Clews** (G3CDK) in Wallington, Surrey has been trying the medium waves with his newly-constructed loop and Hammarlund SP600 JX. He reports hearing 16 North Americans including KMOX in St Louis on 1120, WSB Atlanta, Georgia on 750 and KDKA Pittsburg on 1020. He mentions that the positioning of the loop appears critical to avoid mains borne QRM, a tip worth noting. Regular reporter **Derek Taylor** of Preston uses a Realistic DX160 and 48in. loop in his maisonette which is surrounded by large blocks of flats. In spite of this apparent disadvantage he pulled-in WJR Detroit on 760, WGY Schenectady on 810 (well known to old timers), WBAP Fort Worth, Texas on 820, WHAS Louisville, Kentucky 840, WWL New Orleans on 870 (close to AFN on 872), WOWO Fort Wayne, Indiana on 1190 and WOAI San Antonio, Texas on 1200. **F. A. Ainslie** in Hartlepool used his home-brew receiver to dig out WLW Cincinnati on 700, CBL Toronto 740, WLS Chicago 890 and WHO Des Moines (seldom heard in the UK) on 1040.

A home-built Aerial Tuning Unit (ATU) is used to peak-up the signal between **Clive Barwood's** 75ft long wire and an Ecko Mariner 4-valve receiver. Stations logged from his QTH in Grimsby are CBT Grand Falls on 540, WABC NY on 770, WGAR Cleveland 1220, St Pierre et Miquelon (near Newfoundland) on 1375 and WQXR NY on 1550. **Howard Hughes** writes from Crosby near Liverpool "I recently purchased a National Panasonic portable radio, which, within two days, yielded seven stations from the North American continent". These were CKVO on 710, CHNS 960, WINS 1010, WHN 1050 WNEW 1130 and inevitably, CJON on 930. Although winter is the season for North American DX it is possible to hear the east coast of Canada and the United States in mid-summer, during the hour before sunrise. QRM from Europe is minimal at this time which is a great help to the DXer who has neither a loop nor a communications receiver.

Those who are reluctant to get out of bed in the middle of the night need not abandon the medium waves, as there are a number of Africans to be heard after sunset. Listen for Gambia, with African style pop music on 648kHz after BBC Radio 3 on 647 closes down. Ougadougou in Upper Volta on 746 was logged recently by the writer at 2330 with African music and French announcements. Dakar in Senegal is generally a good signal, in French on 764kHz after Beromunster on the same channel signs off. Enugu, Nigeria on 1320 can be heard in English as a weakish signal before it goes off at 2305 and Conakry, Guinea on 1402 is usually strong after 2300, the announcements being in French. Two interesting loggings reported by **Joachim Gutschke** of Aurich-Sandhorst, West Germany are Radio Lages in the Azores on 650 and Radio Las Palmas in the Canary Islands on 953kHz.

PW reader **Siegfried Morgenrood** who lives in Cape Town uses an old domestic receiver, a Schaub Lorenz Viola, and a 10 metre long wire for DXing on the medium waves. With this set-up he heard the BBC Far East Relay in Oman on 1410kHz, Radio Antilles, Montserrat on 930, Voice of Peace, on board ship somewhere in the Red Sea, on 1540 and WCBS 880, WINS 1010, WBZ 1030. All of these can be heard in the UK, too.

The rig required by the MW DXer depends very much on the QTH. In places where interference and electrical noise are light, then a simple receiver and an outdoor aerial will give good results. The

DXer who lives in a country district in the north west of the UK should do well with such a set-up. The city dweller in the south however, will find it an advantage to construct a medium wave loop and to use it with a receiver which has a high degree of selectivity, such as a communications receiver.

Reports of Long wave DX seldom reach this column, which is a pity as this band, which has an attraction of its own, can produce surprises at times. That part of the spectrum between 151kHz and 281kHz is used for broadcasting by Turkey, Mongolia, Asiatic USSR, Morocco and Algeria as well as by a number of European countries. **Martin Mann** of Cambridge thinks that there may be others like himself who are attracted by the challenge of DXing on the longwaves and he reports hearing Morocco in Arabic on 209kHz, Algeria on 251 with the Voice of the Free Canary Islands, in English at 2200 and Minsk on 281. Algeria has a daily programme in English on 251 from 1900 until 2000.

Propagation on the long waves is similar to that on the medium waves. After dark the signal is refracted by the ionosphere and this is the time to look for DX. The groundwave travels much further on the LWs than on the MWs while the skywave can travel a considerable distance. Allouis in France on 164 has been heard in Australia and Europeans are heard regularly in the United States. Newcomers to the longwaves might try for Reyjavik on 209 at midnight on a Saturday night when the station gives a weather report before signing-off. Others to hunt for are Ankara on 182, Oslo on 218, Lahti Finland on 254 and the out-of-band Oulu on 433kHz which is in parallel with Lahti.

Finally, a mystery station on 534kHz. Every night at 2100 a carrier comes on followed shortly afterwards by a programme of music which continues until 2120 when the transmission ends. Occasionally there is a very short announcement in an unidentified language. First reported by Ralph Newman in Reading it has been heard several times by the writer. The direction appears to be from the north of Reading and Southport!

BROADCAST BANDS

SHORT WAVE BROADCASTS

by Derek Bell

HANDS up all those who feel that there are gaps in their log books that could be filled by the inclusion of a few Latin American local stations! Now, hands down and grab a pen and paper. **Roberto Levinstein** of 39 Coniston Road, London N10 is offering to supply for a stamped addressed envelope a DXers guide to Brazilian stations in the form of a two-sheet A4 size English-Portuguese dictionary.

This fact-packed broadsheet covers most aspects of DXing with translations of a mass of words needed when writing to Portuguese speaking countries. Alongside the technical terms is a pro-forma letter for a QSL and as Roberto, who is himself a Latin American, point out some African and Portuguese stations can be contacted using this dictionary.

Among the rarely logged stations that Roberto reports are the following:-

Radio Guaibia on 11795 at 2235
Radio Rio Mar on 9695 at 0100
Radio Relogio on 4905 at 0010
Radio Margarita on 1020 at 0100

It is nice to know that in this present sunspot minimum we have at least some DX to hunt. Long time readers of this column, and there are some for which I give thanks, will remember that I have always had a moan about the fact that Latin American were never keen to reply to QSL reports. This is with some justification since I have written no less than eleven letters without reply. It seems now that I may have omitted to include International Reply Coupons. **Lawrence Bennet** from Bristol has done just this and says he has had a pennant from Ecos Del Torbes logged on his Trio 9R plus 66ft long wire with ATU. Lawrence has a preference for early and bright listening getting up at around 0600 to tune the 60m band and he says that fadeout is around 0800. It seems unusual that a commercial station should only reply for an IRC but if that is the case then I might well try again. Also in the list are the following:-

Radio Bolivar on 4860 at 0600
Radio Santa Fe on 4965 at 0800
Radio Bolivar on 4770 at 2330
Radio Reloj on 4823 at 0700
Radio Continente on 5030 at 0830

There is a club just starting in the Bristol area for which Lawrence would like a mention and this column is only too pleased to oblige. The Bristol Pathfinders DX Club is one of those rare groups that asks no membership fee! Lawrence Bennet, 7 Maple Ave., Fishponds, Bristol is the address to contact although Lawrence gives no indication as to what is given from the club to the member for his free membership.

This column seems to cater for all tastes, or should I say that the radio stations reported do so. Those of us that are interested in outer space are advised to tune to the shows that are put out by Voice of America. **Peter Jones** of Abertillery, Gwent, reports that this station is giving away wall charts, photographs and decals of the American space shots. They have been conducting a quiz on the "Breakfast Show" about the space shots and ever eager to distribute information.

The new copy of WRTVH is on the market it seems, although I have not seen one. **Marcus Duncan** however has and comments that it seems unreliable. He looked for Voice of Greece on the indicated 9608 and found that they were on 9760. I will say that this massive tome is subject to the whims of the broadcasters who change freqs. in order to get the best propagation dependent on the particular year's trend. The Thornaby-on-Tees QTH of our Marcus is quite a mine of information as he reports that Radio Nacional Brasilia has changed its call sign to ZYF263 from the old PRL8 with an address reported as PO Box 04/0340, Brazilian Federal District, Brazil and its DX show to a weekly Friday session at 2115. With that I will close down and wish you and yours best 73s.

VHF

by Ron Ham

"THERE is a great deal of enjoyment to be had and a lot of knowledge about propagation to be gained by listening in, or taking part in the RSGB VHF/UHF contests" so said your scribe in our April issue which arrived on the bookstalls as VHF enthusiasts were gathering the main ingredients for this month's feature.

Early on February 26 the atmospheric pressure went above 30·0in for the first time in three weeks and by midnight it was at 30·2in where it stayed for 24 hours, taking off again to reach 30·5in by noon on the 28th. Once the AP was around 30·2in the VHFs were vulnerable and the first report of a disturbance came from **Alan Baker**, G8LGQ, Newhaven who worked G8KCP in Coventry on 2m during the morning of the 27th and also heard stations from DJ, PA0 and ON. In the late afternoon of the 28th, **Richard Lambley**, G8LAM, London, received strong signals from the AFN stations in Brussels (100·8MHz) and SHAPE HQ (101·5MHz) using his Leak Stereofetic receiver fed by a Jaybeam JBFM9S aerial.

What goes up must come down and around 1130 on March 2, while the AP was steadily falling, Alan Baker sat in his car on Devils Dyke, Brighton, with a 5/8 λ magnetically mounted aerial on the roof and calmly worked DB5PQ, HB9MUS, HB9MYQ/P, HB9FT, and HB9BDM via the Swiss repeater (HB9F2, Pizgloria, R4) and later he worked French stations via the Paris repeater (F6AXV on R6). For most of the morning your scribe received a strong picture from Lichfield on 189MHz, several continental broadcast stations in Band II and 569 signals from the 70cm beacons GB3EM and GB3SC; in each case only a dipole was used to feed the receiver.

From midday on the 2nd until early morning on the 4th, the VHFs were "quiet" and then the AP, down at 30·1in, turned upward sharply and by midnight it was at 30·5in and, a fortunate coincidence, it began to fall around 0800 on the 5th producing a tropospheric opening which reached it's climax during the 2m contest on the 5/6! **Joost Berden**, G3RND. Isle of Wight, sent a copy of his barograph chart covering the period Feb 28 to March 6, showing that his AP trace was almost identical to mine, and so was the chart used by **George Zitterstein**, G8ITS, City of London.

For most of the week Joost noticed that signals on 2m were better than usual and during the afternoon of the 5th he observed a "lift" toward the east but the signals were very unstable; however the opening between 10-1600 on the 6th was more positive both in easterly and westerly directions. Around 2000, Joost heard the Emly Moor beacon (GB3EM) on 70cms for about an hour. **John Wilson**, G8KIS, Amersham, only contested for half an hour during the evening of the 5th and worked a portable station on Dartmoor, an ON, a GC and was amazed to work into northern G over 450ft of local hills. This whole event seemed to have a variety of effects on propagation over different areas, for instance, G8ITS said that from his impossible VHF location he worked 126 stations during the contest and made a special point of the fact that conditions varied between the two days. His best DX came on the 6th when he worked a station on the Franco/German/Swiss border at 750km.

During the contest, G8LGQ, using SSB worked GW, HB9, ON, PAO, F, DB, DC, and Midland G, and noticed, as did G8ITS, G8KIS and your scribe, that GW stations were often strong enough to be heard off the back of the beam. G8LGQ heard from another amateurs that GI, GD, and GM had been worked from Sussex, and I heard one station say "it was a fantastic contest" and another said that some French stations had more than 1000 contest QSOs.

From late on the 5th to midday on the 7th, strong signals were received via my dipole from both GB3SC and GB3EM which was consistent with the co-channel interference on Band V TV and a report that a close neighbour of G8LAM received a solid colour picture from a West German UHF TV station. A similar theme was reported by **Des Walsh,** EI5CD, who says "In this region of south-east Ireland there is a very low density of amateur VHF/UHF activity and the terrain requires much ERP to beam over the mountains", however, things were different on the 5th and 6th when British UHF TV signals were pounding in to EI along with some Band III 819-line TV signals from France.

Nigel Golds, BRS36910, West Chiltington, Sussex has been operating VHF radio equipment in the Storrington ATC Squadron and now has his own AR88D installed at home and keeping a special watch for those 10m beacons while he swots for his RAE. Although the 10m band has been dead. signals from the Cyprus beacon (5B4CY), peaking 599, were heard at 1007 on the 10th and 1027 on the 16th. On March 8, **Cmdr. Henry Hatfield**, Sevenoaks, using his spectrohelioscope, observed two active regions on the east limb of the sun and on the 9th and 10th both Henry and myself recorded solar radio noise at 136MHz. To date, the only effect from this event that we know of is the ionospheric disturbance which was reported by the BBC World Service during the early hours of the 10th. George Zitterstein, G8ITS found the 70cm contest on March 20 rather flat although he did manage to work 100km into Newbury using only 3 watts.

My sincere thanks for your letters and reports and I hope to meet some of you at Alexandra Palace on May 7th when, in the afternoon, I will be in the chair for Dud Charman's aerial lecture.

BROADCAST BANDS
Short Wave Reports by the 15th of the month to Derek Bell, 169 Max Rd., Chaddeston, Derby.
Medium Wave Logs to Charles Molloy, 132 Segars Lane, Southport, PR8 3JG.

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Logs covering any amateur band/s in band/alphabetical order by the 25th of the month to **Eric Dowdeswell G4AR, Silver Firs, Leatherhead Road, Ashtead, Surrey, KT21 2TW.**

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Reports on VHF matters to Ron Ham, Faraday, Greyfriars, Storrington, Sussex RH20 4HE.

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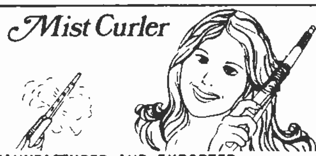

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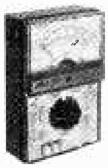

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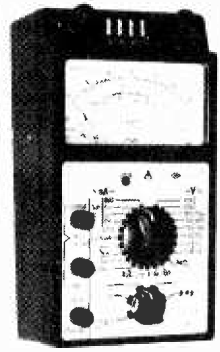

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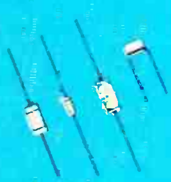

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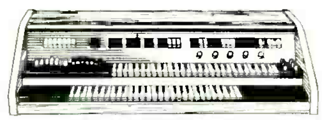

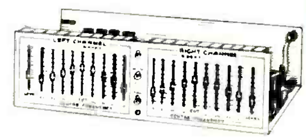

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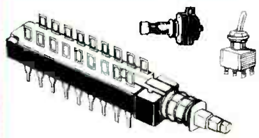

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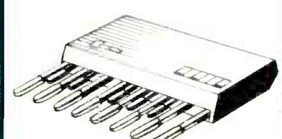

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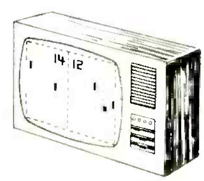

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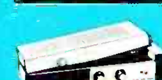

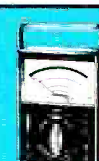


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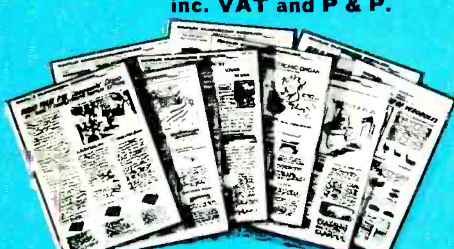

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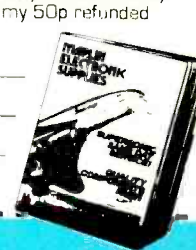

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