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MARCH
1976

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PRACTICAL WIRELESS

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

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BACK NUMBERS

We regret that we are unable to supply back numbers of Practical Wireless. Readers are recommended to enquire at a public library to see copies. Requests for specific back numbers of Practical Wireless and Television can be published in our CQ Column.

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We regret that we cannot answer technical queries by telephone nor can we provide information or advice on manufacturers' products other than that given in the magazine. We will endeavour to assist readers who have queries relating to articles published but we cannot offer advice on modifications to our published designs. All correspondents expecting a reply should enclose a stamped addressed envelope.

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TRANSFORMERS

ALL EX-STOCK—SAME DAY DESPATCH				VAT 8%			
MAINS ISOLATING				12 and or 24 Volt			
PRI. 120/240V. SEC. 120/240.				PRIMARY 240-250 VOLTS			
CENTRE TAP WITH SCREEN							
Ref. No.	VA (Watts)	£	p & p	Ref. No.	Amps	£	p & p
07*	20	3.77	0.58	111	0.5	0.25	1.54
149	60	4.69	0.72	213	1.0	0.5	1.86
151	100	5.33	0.85	71	1	1	2.41
152	250	10.32	1.41	18	4	2	2.97
153	350	12.47	1.41	70	6	3	4.43
154	500	14.33	1.61	108	8	4	5.09
155	750	17.94	1.85	72	10	5	5.50
156	1000	20.57	1.85	116	12	6	5.80
157	1500	34.89	1.85	17	16	8	7.48
158	2000	38.92	1.85	115	20	10	10.91
159	3000	61.48	1.85	187	30	15	14.20
* 115V or 240V Sec. only				226	60	30	17.67

30 VOLT RANGE				50 VOLT RANGE			
Prim. 200-240V				Prim. 200-240V			
Sec. 0-12-15-20-24-30V				Sec. 0-19-25-33-40-50V			
Ref. No.	Amps	£	p & p	Ref. No.	Amps	£	p & p
112	0.5	1.90	0.58	102	0.5	2.71	0.58
79	1.0	2.52	0.72	103	1.0	3.55	0.72
3	2.0	3.77	0.72	104	2.0	4.95	0.85
20	3.0	4.70	0.85	105	3.0	6.10	0.97
21	4.0	5.36	0.85	106	4.0	7.98	1.12
15	5.0	6.73	0.97	107	6.0	12.71	1.25
17	6.0	7.52	1.25	118	8.0	13.63	1.61
88	8.0	10.20	1.41	119	10.0	17.75	1.61
89	10.0	10.36	1.25				

60 VOLT RANGE				AUTO TRANSFORMERS			
Prim. 200-240V				Ref VA Auto Taps			
Sec. 0-24-30-40-48-60V				No (Watts)			
Ref. No.	Amps	£	p & p	Ref. No.	VA	£	p & p
124	0.5	2.48	0.72	113	20	1.75	0.51
126	1.0	3.68	0.72	64	75	3.05	0.72
127	2.0	5.33	0.85	4	150	4.33	0.72
125	3.0	7.90	0.97	66	300	6.11	0.85
123	4.0	9.19	1.41	67	500	9.36	1.25
40	5.0	10.24	1.25	84	1000	14.36	1.61
120	6.0	12.07	1.41	93	1500	19.02	1.85
121	8.0	15.75	1.85	95	2000	25.41	1.85
122	10.0	19.40	1.85	73	3000	36.84	1.85
189	12.0	20.25	1.85				

CASED AUTO TRANSFORMERS			
240V mains lead input & USA 2 pin outlets.			
Ref	VA	P&P	Ref
20VA	£3.29	P&P £0.72	Ref 113W
150VA	£6.37	P&P £0.85	Ref 4W
500VA	£10.97	P&P £1.25	Ref 67W
1000VA	£18.39	P&P BRS	Ref 84W
2000VA	£28.71	P&P BRS	Ref 95W

SCREENED MINIATURES				HIGH VOLTAGE			
Ref	mA	Volts	£	Ref	mA	Volts	£
238	200	3-0-3	1.62	39	Prim.	200/220 or 400/440	
212	1A	0.6-0.6	1.93	58	Sec.	100/120 or 200/240	
13	100	9-0-9	1.56	25			p & p
235	330	330 0-9-0-9	1.64	51	VA	Ref.	£
207	500	500 0-8-9-0-8-9	2.02	51	250	43	0.97
208	1A	0-8-9-0-8-9	3.07	58	350	247	1.41
236	200	200 0-15-0-15	1.56	25	1000	250	26.31
214	300	300 0-20-0-20	2.0	58	2000	252	44.12
221	700(DC)	700 0-12-0-12-20	2.38	58			
206	1A	0-15-20-0-15-20	3.63	72			
203	500	500 0-15-27-0-15-27	3.15	72			
204	1A	0-15-27-0-15-27	4.14	72			
5112	500	12, 15, 20, 24, 30	1.97	58			

BRIDGE RECTIFIERS			
50V	2A	35p	
100V	2A	40p	
200V	1A	45p	
400V	1A	65p	
600V	2A	50p	
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P & P 15p. VAT 25%			

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Terms: Dep. £15-99 and 18 fortnightly paymts. £5-38. (Total £112-83)
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Terms: Dep. £9-00 and 18 fortnightly payments £4-61 (Total £81-88).

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Terms: Dep. £7-95 and 18 fortnightly paymts. £3-33. Total £67-89.

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T12/60	12" 60w	£20.00	£14.95
T12/100	12" 100w	£35.00	£25.95
T15/70	15" 70w	£27.00	£19.95
T15/100	15" 100w	£38.50	£27.95
T18/100	18" 100w	£42.50	£29.95

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250-0-250v. 80mA 6.3v. 2a. 0-5-6.3v. 2a. £2.60
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300-0-300v. 130mA 6.3v. 4a. C.T. 6.3v. £5.20
1a. for Mullard 510 Amplifier £2.20
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350-0-350v. 150mA 6.3v. 4a. 0-5-6.3v. 2a. £5.20
425-0-425v. 200mA 6.3v. 4a. C.T. 6.3v. 3a. £9.85
425-0-425v. 200mA 6.3v. 4a. 6.3v. 4a. 5v. 3a. £10.00
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250-0-250v. 70mA 6.3v. 2a. 0-5-6.3v. 2a. £2.60
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250-0-250v. 100mA 6.3v. 2a. 6.3v. 1a. £2.20
350-0-350v. 80mA 6.3v. 2a. 0-5-6.3v. 2a. £2.20
350-0-250v. 100mA 6.3v. 4a. 0-5-6.3v. 2a. £4.25
300-0-300v. 100mA 6.3v. 4a. 0-5-6.3v. 2a. £4.25
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350-0-350v. 100mA 6.3v. 4a. 0-5-6.3v. 2a. £4.25
350-0-350v. 150mA 6.3v. 4a. 0-5-6.3v. 2a. £5.20

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Type: 12v. 1a. £1.10, 6.3v. 1.5a. £1.06, 6.3v. 2a. £1.10, 6.3v. 3a. £1.70, 6.3v. 4a. £2.60, 12v. 3a. or 24v. 1.5a. £2.60 0-9-18v. 1.1a. £2.25, 0-12-26-42v. £2.10

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0-110/120v. 200-230-250v. 50-80w. £2.90 150 watts £3.20, 250 watts £3.37, 500 watts £3.84

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OUTPUT TRANSFORMERS
Standard Pentode 5000 to 3 ohm, or 7000 ohm to 3 ohm £1.12, Push Pull 6 watts EL84 to 3 ohm or 15 ohm £1.68; Push Pull 10-12 watts 6v. 6 to 3 ohm or 15 ohm £2.61; Push Pull 10-15 watts to match 6v. 6 to 3, 5, 8 or 15 ohm £2.72; Push Pull EL84 to 3 or 15 ohm 10-12 watts £2.61; Push Pull Ultra Linear for Mullard 612 etc. £4.35.

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AT FANTASTIC LOW PRICES!

50 WATT SPEAKER

HEADPHONES MICROPHONE

TWIN TURNTABLE WITH PRE-AMP. and POWER AMPLIFIER Complete with lid

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Units listed below

(a) DISCOMASTER TWIN TURNTABLE CONSOLE with integral 100W amplifier

(b) PAIR OF HI-FI 'PHONES

(c) MATCHING 'MIKE'

(d) PAIR 50 WATT SPEAKERS Black Rexine covered Cabinets Size approx. 18" x 18" x 8"

(a) (b) (c) & (d) Carr. £4-00

£169-99

DEP. £19-99 & 18 fortnightly payments of £9-75 (Total £195-49).

STEREO VERSION

of Above System Or DEPOSIT £34-95 and 18 fortnightly pymts. £209-95 Carr. £5-00

TDI DISCO CONSOLE

Incorporating twin BSR MP60 type turntables and Acos Cartridges with diamond styl. Separate Vol. controls for each turntable. Also MONITORING FACILITIES, plus Treble and Bass Controls. Separate input for 'mike' with vol. control. Black Vynide covered Cabinet with lid. Or-DEP. £9-95 and 18 fortnightly pymts. £89-95 Carr. £1-50

TD2S STEREO VERSION OF ABOVE

Terms DEPOSIT £20 and 18 fortnightly payments £8-71 Carr. £1-60 (Total £140-78)

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at unbeatable Prices. Send for Catalogue.

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All power ratings are R.M.S. continuous. 2 YEARS' GUARANTEE High flux ceramic magnets. ALL CARRIAGE FREE. *SPECIAL PRICE

'POP' 100	'POP' 60	'POP' 50T
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£38-95	*£19-99	£14-95
Dep. £3-95 and 8 mthly payments £4-60 (Total £43-75)	Dep. £3-95 and 8 mthly payments £3-87 (Total £26-91)	Dual Cone. Terms for pairs Dep. £3-90 & 8 mthly pymts £4-24. Total £37-82 PAIR SUITABLE ALL PURPOSES

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Response 3KHz-20KHz with 2 to 4 mid. Non elect. filter available 55p. Rating 50 Watt Imp 8Ω

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For Lead Guitar, Mic, Gram, Radio, Tape (Not for use with Bass instruments) Inc. 3 inputs and 2 vol controls plus Treble & Bass, TREMOLO with associated controls. Attractively finished in black with silver-finished fascia. Compact size Fitted carrying handle. Deposit £9-25 and 8 mthly payments £6-76 (Total £66-33)

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ALL PURPOSE FULL RANGE

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£21-50

RSC PHANTOM 50 COMBINED AMP. AND SPEAKER £59-95

Rating 50 watts. 3 inputs, 2 vol. controls. Bass, Treble, Presence Carr. £1-50 Dep. £7-95 & 8 mthly. pymts. £7-43 (Total £67-79)

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Solid state. 4 Sep. controlled inputs Plus master vol. control. Ind. Bass and Treble Controls. Protection against serious o/p overloading. O/p for spkrs. 8 to 15 ohms. Size 17" x 7" x 7 1/2". 200-250V. A.C. mains. O/p 50w R.M.S. Deposit £8-60 £48-60 & 8 mthly. payments £5-75. Total £54-60 Carr. Free.

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£39-95

£25-95

REGENT 50X 50 WATT AMP.

A powerful high quality unit for lead, rhythm guitar, vocalists, gram, radio, tape. 50w Peak O/P rating. Not for Bass Guitar.

★ Two Fane heavy duty high flux 12in. spkrs.

★ Four Jack inputs and two Volume Controls for instant use of up to four pick-ups or 'mikes'. Bass and Treble controls. Send S.A.E. for leaflet. Carr. £2-50

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Hundreds of new components—pots, resistors, capacitors, switches, PC Boards with transistors, diodes and zeners, loads of odds and ends. Only £3.25.

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All prices quoted include VAT and UK/BFPO postage. Most orders prices despatched on day of receipt. S.A.E. with enquiries or for List please. Send 10p for Multimeter catalogue—free on request with orders over £3. Official orders accepted from Schools etc. Export/Wholesale enquiries welcome. Surplus components always wanted.

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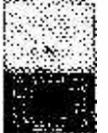
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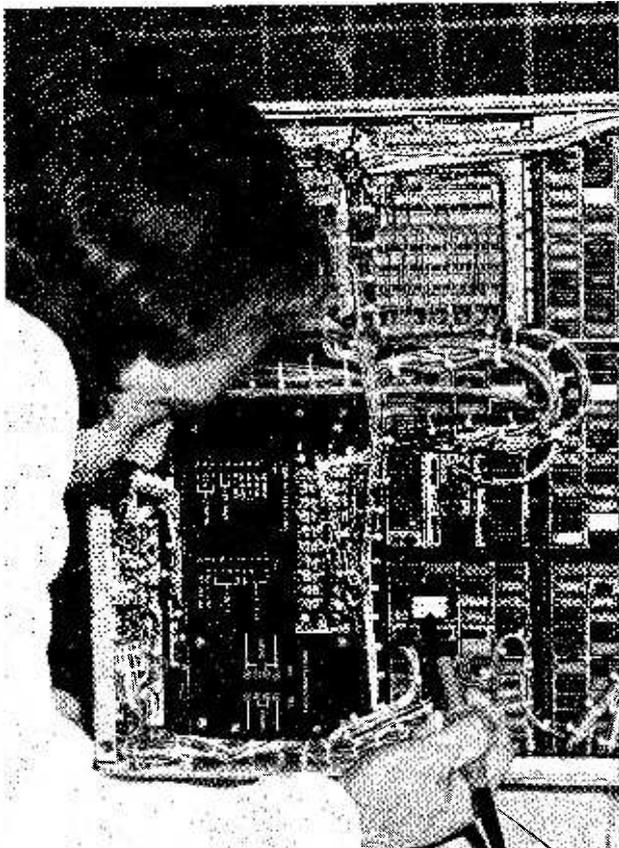
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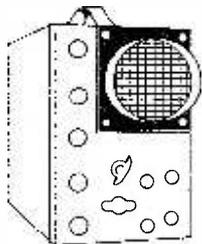
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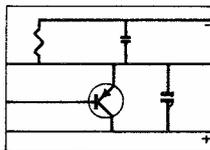
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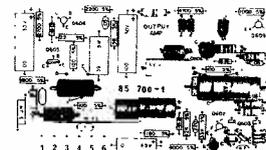
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FEBRUARY ISSUE
INCLUDES

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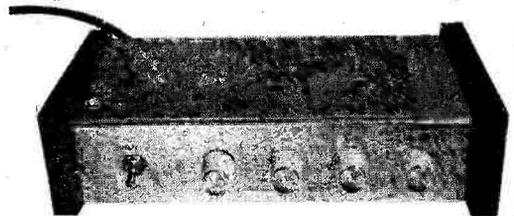
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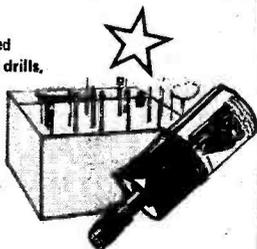
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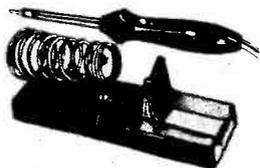
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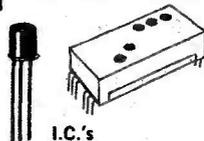
IN 4001 - 8p ea.)
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IN 4003 - 9p ea.)



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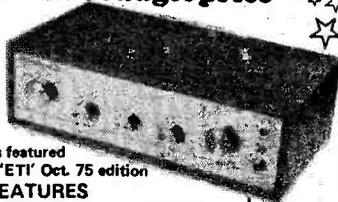


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TIP 2955	£1.14 s	7824	- £1.50 s
TIP 3055	- 61p s	±15V D.I.L.	- £2.82 s
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BC 238C	- 12p H	TBA 800	- £1.60 H
BC 239C	- 14p H	TBA 810S	- £1.80 H
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ZTX 108	- 11p H	ZN 414	- £1.30 H
ZTX 109	- 13p H	ZN 424	- £1.25 H
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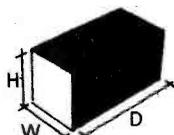
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Electronic/conventional ignition switch. Gives instant changeover from "Sparkrite" ignition to conventional ignition for performance comparisons, static timing etc., and will also switch the Ignition off completely as a security device. Includes: switch, connectors, mounting bracket and instructions. Cables excluded.

PRICES

D.J.Y. assembly kit £10-93 incl. V.A.T. post and packing. Ready built unit £13-86 incl. V.A.T. post and packing. (Both to fit all vehicles with coil/distributor ignition up to 8 cylinders.) Switch for instant changeover from "Sparkrite" ignition to conventional ignition £2-98 incl. V.A.T. post and packing. R.P.M. limiting control £2-42 incl. V.A.T. post and packing. (Fitted in case on ready built unit, dashboard mounting on kit.)

CALLERS WELCOME

ORDER NOW PW3.

To ELECTRONICS DESIGN ASSOCIATES
82 Bath Street, Walsall, WS1 3DE
Phone 33652.

From Name

Address

Qty.

Sparkrite Mk 2 DIY Ass. kits @ £10-93

Sparkrite Mk 2 Ready Built Negative earth @ £13-86

Sparkrite Mk 2 Ready Built Positive earth @ £13-86

Ignition changeover switches @ £2-98

R.P.M. Limit systems in the above units @ £2-42

I enclose cheque/P.O.s for £.....

Cheque No.
(Send SAE if brochure only required)

print-a-kit now bring you

PAK STRIP

(Pat. applied for)

The easiest way yet to mount D.I.L. IC's etc.

PAK STRIP is a thin, flexible fibre glass board with a self-adhesive backing.

You can bend it, drill it, cut it with scissors prick holes in it, solder to it, stick it to anything.

It is so versatile its many applications are limited only by the ingenuity of the user.

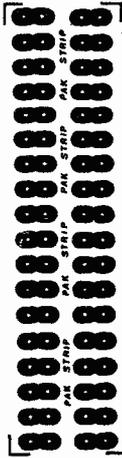
Star points of PAK STRIP

- ★ Will cut with scissors
- ★ Has a self-adhesive backing
- ★ Can be used to surface solder D.I.L. IC's, light displays, etc.
- ★ Miniature and standard potentiometers can be mounted on the take-off pads
- ★ Type B can be used for grouping cables, mounting diodes, resistors etc.
- ★ No need to drill holes for nuts and bolts... just stick down...

REMEMBER! a surface soldered D.I.L. IC will remove easily.



Type A
1 pitch for
D.I.L. IC's etc.



Type B
General purpose
group board

One Type A PAK STRIP will mount 11 8-pin D.I.L. IC's

Sample PAK STRIP 35p plus a SAE VAT incl.

8" x 5" board with 6 strips £1-00 VAT & Postage inc.

8" x 10" board with 12 strips £3-00 VAT & Postage inc.

Please state Type A or B when ordering: S.A.E. for details.

TERMS: Cash with Order or pro-forma invoice: Trade enquiries for quantity prices invited. Overseas add 25p per sheet.

print-a-kit

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SEMI-CONDUCTORS

TRANSISTORS

BRAND NEW FULLY GUARANTEED

Type	Price	Type	Price	Type	Price	Type	Price	Type	Price	Type	Price	Type	Price	Type	Price	Type	Price		
AC107	*0.20	AF114	*0.25	BC153	0.18	BC304	*0.37	BF115	*0.25	BFY50	*0.20	OC71	*0.15	2N706A	*0.12	2N2905	*0.21	2N3704	0.18
AC133	*0.19	AF115	*0.25	BC153	0.29	BC440	*0.31	BF117	*0.46	BFY51	*0.20	OC72	*0.15	2N708	*0.14	2N2906A	*0.21	2N3705	0.12
AC135	*0.20	AF116	*0.25	BC154	0.29	BC460	*0.37	BF118	*0.71	BFY52	*0.20	OC74	*0.15	2N914	*0.15	2N2906	*0.16	2N3706	0.12
AC137	*0.30	AF117	*0.25	BC137	0.19	BD115	*0.63	BF119	*0.71	BFY53	*0.18	OC75	*0.16	2N918	*0.31	2N2906A	*0.19	2N3707	0.13
AC122	*0.12	AF118	*0.36	BC158	0.12	BD118	*0.61	BF121	0.46	BSX19	*0.16	OC76	*0.16	2N1131	*0.20	2N2907	*0.20	2N3708	0.08
AC126	*0.18	AF124	*0.21	BC159	0.12	BD121	*0.61	BF123	0.51	BSX20	*0.16	OC77	*0.28	2N1132	*0.22	2N2907A	*0.22	2N3709	0.09
AC127	*0.19	AF125	*0.21	BC160	*0.46	BD123	*0.67	BF125	0.46	BSY25	*0.16	OC81	*0.16	2N1302	*0.15	2N2923	0.15	2N3710	0.09
AC128	*0.19	AF126	*0.29	BC161	*0.51	BD124	*0.70	BF127	0.51	BSY26	*0.16	OC81D	*0.16	2N1303	*0.15	2N2924	0.15	2N3711	0.09
AC129	*0.19	AF127	*0.29	BC167	0.12	BD131	*0.51	BF122	0.56	BSY27	*0.16	OC82	*0.16	2N1304	*0.18	2N2925	0.15	2N3819	*0.29
AC132	*0.15	AF139	*0.31	BC168	0.12	BD132	*0.61	BF133	0.46	BSY28	*0.16	OC82D	*0.16	2N1305	*0.18	2N2926G	0.13	2N3820	*0.51
AC134	*0.15	AF178	*0.51	BC169	0.12	BD133	*0.67	BF134	0.46	BSY29	*0.16	OC83	*0.29	2N1306	*0.21	2N2926Y	0.11	2N3823	*0.29
AC137	*0.15	AF179	*0.51	BC170	0.10	BD135	0.41	BF155	*0.71	BSY38	*0.19	OC139	*0.50	2N1307	*0.21	2N2926O	0.10	2N3903	0.29
AC141	*0.19	AF180	*0.51	BC171	0.10	BD136	0.41	BF156	*0.49	BSY39	*0.19	OC140	*0.20	2N1308	*0.24	2N2926R	0.10	2N3904	0.31
AC141K	*0.30	AF181	*0.51	BC172	0.10	BD137	0.46	BF157	*0.56	BSY40	*0.29	OC169	*0.28	2N1309	*0.28	2N2926B	0.10	2N3905	0.29
AC142	*0.19	AF186	*0.51	BC173	0.15	BD138	0.51	BF158	0.56	BSY41	*0.29	OC170	*0.28	2N1613	*0.20	2N3053	*0.18	2N3906	0.28
AC142K	*0.26	AF239	*0.38	BC174	0.15	BD139	0.56	BF159	0.61	BSY95	*0.13	OC171	*0.28	2N1711	*0.20	2N3054	*0.47	2N4287	0.18
AC176	*0.20	AL100	*0.48	BC175	0.15	BD140	0.61	BF173	*0.52	BSY95A	*0.13	OC200	*0.28	2N2147	*0.73	2N3055	*0.42	2N4288	0.18
AC180	*0.20	AL103	*0.68	BC177	*0.19	BD145	*0.81	BF176	0.36	BU104	*0.24	OC201	*0.29	2N2148	*0.58	2N3402	*0.29	2N4289	0.18
AC180K	*0.30	BC107	*0.08	BC178	*0.19	BD175	*0.61	BF179	*0.31	MJE521	*0.56	OC202	*0.29	2N2218	*0.20	2N3403	*0.29	2N4290	0.18
AC181	*0.20	BC108	*0.08	BC179	*0.19	BD176	*0.61	BF180	*0.31	MJE2955	*0.88	OC203	*0.28	2N2219	*0.20	2N3404	*0.29	2N4291	0.18
AC181K	*0.30	BC109	*0.08	BC180	*0.25	BD177	*0.67	BF181	*0.31	MJE3055	*0.57	OC204	*0.26	2N2220	*0.22	2N3405	*0.43	2N4292	0.18
AC187	*0.22	BC113	0.10	BC181	0.25	BD178	*0.67	BF194	0.12	ME8440	*0.51	OC205	*0.26	2N2221	*0.20	2N3406	*0.29	2N4293	0.18
AC187K	*0.28	BC114	0.16	BC182	0.15	BD179	*0.71	BF195	0.12	MPF102	*0.43	OC309	*0.41	2N2222	*0.20	2N3407	*0.77	2N4293	0.18
AC188	*0.23	BC115	0.16	BC182L	0.15	BD180	*0.71	BF196	0.15	MPF104	*0.38	OC371	*0.44	2N2368	*0.18	2N3614	*0.69	2N4572	0.12
AC188K	*0.23	BC116	0.16	BC183	0.15	BD185	*0.67	BF197	0.15	MPF105	*0.38	ORP12	*0.60	2N2369	*0.15	2N3615	*0.78	2N4573	*0.32
ACY17	*0.26	BC117	0.19	BC183L	0.15	BD186	*0.67	BF257	*0.46	OC19	*0.36	ORP60	*0.60	2N2369A	*0.15	2N3616	*0.78	2N4575	*0.32
ACY18	*0.24	BC118	0.10	BC184	0.20	BD187	*0.71	BF258	*0.61	OC20	*0.65	ORP61	*0.60	2N2646	*0.48	2N3646	*0.09	2N4569	*0.41
ACY19	*0.24	BC119	*0.21	BC184L	0.20	BD188	*0.71	BF259	*0.67	OC22	*0.47	TIP29	*0.44	2N2904	*0.18	2N3702	0.12	40361	*0.41
ACY20	*0.24	BC120	*0.21	BC186	*0.29	BD189	*0.77	BF262	0.56	OC23	*0.48	TIP30	*0.52	2N2904A	*0.21	2N3703	0.12	40362	*0.51
ACY21	*0.24	BC137	*0.21	BC187	*0.29	BD190	*0.77	BF265	0.56	OC24	*0.57	TIP31	*0.56						
ACY22	*0.24	BC139	*0.41	BC207	0.11	BD195	*0.87	BF270	*0.38	OC28	*0.38	TIP32A	*0.68						
AD140	*0.49	BC140	*0.31	BC208	0.11	BD196	*0.87	BF271	*0.31	OC29	*0.30	TIP41A	0.68						
AD142	*0.49	BC141	*0.31	BC209	0.12	BD197	*0.92	BF272	*0.81	OC28	*0.51	TIP42A	*0.81						
AD143	*0.39	BC142	*0.31	BC212L	0.13	BD198	*0.92	BF273	0.36	OC29	*0.51	TIS43	*0.21						
AD149	*0.51	BC143	*0.31	BC213L	0.13	BD199	*0.98	BF274	0.36	OC35	*0.43	UT46	*0.28						
AD151	*0.35	BC145	0.46	BC214L	0.17	BD200	*0.98	BF279	*0.28	OC36	*0.51	ZN414	*1.11						
AD182	*0.36	BC147	0.10	BC225	0.26	BD205	*0.81	BFX84	*0.22	OC40	*0.20	2N696	*0.13						
AD161 & AD162(MP)	*0.69	BC148	0.10	BC226	0.38	BD206	*0.81	BFX85	*0.31	OC42	*0.25	2N697	*0.14						
		BC149	0.12	BC301	*0.28	BD207	*0.98	BFX86	*0.22	OC44	*0.16	2N698	*0.25						
		BC150	0.19	BC302	*0.25	BD208	*0.98	BFX87	*0.25	OC45	*0.13	2N699	*0.31						
ADT140	*0.51	BC151	0.20	BC303	*0.31	BDY20	*1.02	BFX88	*0.22	OC70	*0.15	2N706	*0.16						

Type	Price	Type	Price	Type	Price	Type	Price												
2N2905	*0.21	2N3704	0.18	2N2906A	*0.21	2N3705	0.12	2N2906	*0.16	2N3706	0.12	2N2906A	*0.19	2N3707	0.13	2N2907	*0.20	2N3708	0.08
2N2907	*0.22	2N3709	0.09	2N2907A	*0.22	2N3710	0.09	2N2908	*0.15	2N3711	0.09	2N2909	*0.15	2N3712	0.09	2N2910	*0.15	2N3713	0.09
2N2911	*0.15	2N3714	0.09	2N2912	*0.15	2N3715	0.09	2N2913	*0.15	2N3716	0.09	2N2914	*0.15	2N3717	0.09	2N2915	*0.15	2N3718	0.09
2N2916	*0.15	2N3719	0.09	2N2917	*0.15	2N3720	0.09	2N2918	*0.15	2N3721	0.09	2N2919	*0.15	2N3722	0.09	2N2920	*0.15	2N3723	0.09
2N2921	*0.15	2N3724	0.09	2N2922	*0.15	2N3725	0.09	2N2923	*0.15	2N3726	0.09	2N2924	*0.15	2N3727	0.09	2N2925	*0.15	2N3728	0.09
2N2926	0.13	2N3729	0.09	2N2927	*0.15	2N3730	0.09	2N2928	*0.15	2N3731	0.09	2N2929	*0.15	2N3732	0.09	2N2930	*0.15	2N3733	0.09
2N2926Y	0.11	2N3734	0.09	2N2926O	0.10	2N3735	0.09	2N2926R	0.10	2N3736	0.09	2N2926B	0.10	2N3737	0.09	2N2926G	0.13	2N3738	0.09
2N2926O	0.10	2N3739	0.09	2N2926R	0.10	2N3740	0.09	2N2926B	0.10	2N3741	0.09	2N2926G	0.13	2N3742	0.09	2N2926Y	0.11	2N3743	0.09
2N2926G	0.13	2N3744	0.09	2N2926Y	0.11	2N3745	0.09	2N2926R	0.10	2N3746	0.09	2N2926B	0.10	2N3747	0.09	2N2926G	0.13	2N3748	0.09
2N2926Y	0.11	2N3749	0.09	2N2926R	0.10	2N3750	0.09	2N2926B	0.10	2N3751	0.09	2N2926G	0.13	2N3752	0.09	2N2926Y	0.11	2N3753	0.09
2N2926R	0.10	2N3754	0.09	2N2926B	0.10	2N3755	0.09	2N2926G	0.13	2N3756	0.09	2N2926Y	0.11	2N3757	0.09	2N2926R	0.10	2N3758	0.09
2N2926B	0.10	2N3759	0.09	2N2926G	0.13	2N3760	0.09	2N2926Y	0.11	2N3761	0.09	2N2926R	0.10	2N3762	0.09	2N2926B	0.10	2N3763	0.09
2N2926G	0.13	2N3764	0.09	2N2926Y	0.11	2N3765	0.09	2N2926R	0.10	2N3766	0.09	2N2926B	0.10	2N3767	0.09	2N2926G	0.13	2N3768	0.09
2N2926Y	0.11	2N3769	0.09	2N2926R	0.10	2N3770	0.09	2N2926B	0.10	2N3771	0.09	2N2926G	0.13	2N3772	0.09	2N2926Y	0.11	2N3773	0.09
2N2926R	0.10	2N3774	0.09	2N2926B	0.10	2N3775	0.09	2N2926G	0.13	2N3776	0.09	2N2926Y	0.11	2N3777	0.09	2N2926R	0.10	2N3778	0.09
2N2926B	0.10	2N3779	0.09	2N2926G	0.13	2N3780	0.09	2N2926Y	0.11	2N3781	0.09	2N2926R	0.10	2N3782	0.09	2N2926B	0.10	2N3783	0.09
2N2926G	0.13	2N3784	0.09	2N2926Y	0.11	2N3785	0.09	2N2926R	0.10	2N3786	0.09	2N2926B	0.10	2N3787	0.09	2N2926G	0.13	2N3788	0.09
2N2926Y	0.11	2N3789	0.09	2N2926R	0.10	2N3790	0.09	2N2926B	0.10	2N3791	0.09	2N2926G	0.13	2N3792	0.09	2N2926Y	0.11	2N3793	0.09
2N2926R	0.10	2N3794	0.09	2N2926B	0.10	2N3795	0.09	2N2926G	0.13	2N3796	0.09	2N2926Y	0.11	2N3797	0.09	2N2926R	0.10	2N3798	0.09
2N2926B	0.10	2N3799	0.09	2N2926G	0.13	2N3800	0.09	2N2926Y	0.11	2N3801	0.09	2N2926R	0.10	2N3802	0.09	2N2926B	0.10	2N3803	0.09
2N2926G	0.13	2N3804	0.09	2N2926Y	0.11	2N3805	0.09	2N2926R	0.10	2N3806	0.09	2N2926B	0.10	2N3807	0.09	2N2926G	0.13	2N3808	0.09
2N2926Y	0.11	2N3809	0.09	2N2926R	0.10	2N3810	0.09	2N2926B	0.10	2N3811	0.09	2N2926G	0.13	2N3812	0.09</				

COMPONENTS

ANTEX Equipment

SOLDERING IRONS	
X25. 25 watt	*£2.45
Model G. 18 watt	*£2.70
CCN 240. 15 watt	*£2.90
SK2. Soldering Kit	*£3.90

BITS	
102 for model CN240	*42p
104 for model CCN240 8/16"	*42p
106 for model CN240 3/32"	*42p
1100 for model CCN240	*42p
1101 for model CCN240 2"	*42p
1102 for model CCN240 1 1/2"	*42p
1020 for model G240	*42p
1021 for model G240 3/16"	*42p
1022 for model G240 3/16"	*42p
50 for model X25	*44p
51 for model X25	*44p
52 for model X25 3/16"	*44p

ELEMENTS	
Model ECN 240	*£1.10
Model EG 240	*£1.35
Model ECCN 240	*£1.55
Model EX25	*£1.20

SOLDERING IRON STAND	
ST3 Suitable for all models	*£1.10
Antex heat shunt	*10p

PLUGS & SOCKETS

PLUGS	Price
PS1 D.I.N. 2 Pin (Speaker)	0.10
PS2 D.I.N. 3 Pin	0.10
PS3 D.I.N. 4 Pin	0.14
PS4 D.I.N. 5 Pin 180°	0.15
PS5 D.I.N. 5 Pin 240°	0.15
PS6 D.I.N. 6 Pin	0.16
PS7 D.I.N. 7 Pin	0.17
PS8 Jack 2.5mm Screened	0.17
PS9 Jack 3.5mm Plastic	0.11
PS10 Jack 3.5mm Screened	0.17
PS11 Jack 1/2" Plastic	0.14
PS12 Jack 1/2" Screened	0.20
PS13 Jack Stereo Screened	0.20
PS14 Phono	0.09
PS15 Car Aerial	0.14
PS16 Co-Axial	0.14

INLINE SOCKETS	
PS21 D.I.N. 2 Pin (Speaker)	0.13
PS22 D.I.N. 3 Pin	0.13
PS23 D.I.N. 5 Pin 180°	0.19
PS24 D.I.N. 5 Pin 240°	0.19
PS25 Jack 2.5mm Plastic	0.15
PS26 Jack 3.5mm Plastic	0.13
PS27 Jack 1/2" Plastic	0.28
PS28 Jack 1/2" Screened	0.27
PS29 Jack Stereo Screened	0.28
PS30 Jack Stereo Screened	0.35
PS31 Phono Screened	0.17
PS32 Car Aerial	0.20
PS33 Co-Axial	0.20

SOCKETS	
PS35 D.I.N. 2 Pin (Speaker)	0.07
PS36 D.I.N. 3 Pin	0.09
PS37 D.I.N. 5 Pin 180°	0.09
PS38 D.I.N. 5 Pin 240°	0.10
PS39 Jack 2.5mm Switched	0.11
PS40 Jack 3.5mm Switched	0.11
PS41 Jack 1/2" Switched	0.28
PS42 Jack Stereo Switched	0.28
PS43 Phono Single	0.07
PS44 Phono Double	0.09
PS46 Co-Axial Surface	0.09
PS47 Co-Axial Flush	0.19

INSTRUMENT CASES

(In 2 sections, Black Vinyl covered top and sides and bezel)

No.	Length	Width	Height	Price
BV1	8"	5 1/2"	2"	*£1.25
BV2	11"	6"	3"	*£1.62
BV3	6"	4 1/2"	1 1/2"	0.92
BV4	9"	5 1/2"	2 1/2"	*£1.39

20p P & P Per Box.

RECORD CASES	
7 in. E.P. 18 1/2" x 7" x 8"	*£2.48
(50 records)	
12 in. L.P. 13 1/2" x 7 1/2" x 12 1/2"	*£3.30
(50 records)	

CASSETTE CASES	
Holds 15. 10" x 3 1/2" x 5". Lock and handle	*£1.50

8-TRACK CARTRIDGE CASES	
Holds 14. 13 1/2" x 5" x 6". Lock and handle	*£2.20
Holds 24. 12 1/2" x 8" x 5 1/2". Lock and handle	*£3.20

BI-PAK

P.O. BOX 6, WARE, HERTS

ALUMINIUM BOXES

No.	Length	Width	Height	Price
BA1	5 1/2"	2 1/2"	1 1/2"	*0.45
BA2	4"	2 1/2"	1 1/2"	*0.45
BA3	4 1/2"	2 1/2"	1 1/2"	*0.45
BA4	5 1/2"	4"	1 1/2"	*0.54
BA5	4 1/2"	2 1/2"	2"	*0.45
BA6	3"	2 1/2"	1"	*0.39
BA7	7"	5"	2 1/2"	*0.79
BA8	6"	4"	2"	*£1.02
BA9	6"	4"	2"	*0.65

(Each complete with 1/4" deep lid and screws). PLEASE ADD 20p POSTAGE AND PACKING FOR EACH BOX.

COMPONENTS

CARBON RESISTOR PAKS

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

R1	50 Mixed 100 ohms-820 ohms 1/8th W.	0.60
R2	50 Mixed 1K ohms-8.2K ohms 1/8th W.	0.60
R3	50 Mixed 10K ohms-82K ohms 1/8th W.	0.60
R4	50 Mixed 100K ohms-820K ohms 1/8th W.	0.60
R5	30 Mixed 100 ohms-820 ohms 1/8th W.	0.60
R6	30 Mixed 1K ohms-8.2K ohms 1/8th W.	0.60
R7	30 Mixed 10K ohms-82K ohms 1/8th W.	0.60
R8	30 Mixed 100K ohms-820K ohms 1/8th W.	0.60

THESE ARE UNREPEATABLE PRICES

REPANCO CHOKES & COILS

RF Chokes	CH1 2.5mH	0.27
	CH3 7.5mH	0.29
	CH5 1.5mH	0.28
	CH2 5.0mH	0.28
	CH4 10mH	0.31

COILS DRX1 Crystal set	0.29
DRR2 Dual range	0.42

CARBON POTENTIOMETERS

Log and Lin	
47K, 10K, 22K, 47K, 100K, 220K, 470K, 1M, 2M.	
VC1 Single Less Switch	0.20
VC2 Single D.P. Switch	0.60
VC3 Tandem Less Switch	0.60
VC4 1K Less Switch	0.20
VC5 100K Log anti-Log	0.60

HORIZONTAL CARBON PRESETS

0-1 Watt	0.09
10, 20, 470, 1K, 2.2K, 4.7K, 10K, 22K, 47K, 100K, 220K, 470K, 1M, 2M 4.7M.	

REPANCO TRANSFORMERS

240V. Primary. Secondary voltages available from selected tappings 4V, 7V, 8V, 10V, 40V, 50V and 25V-0.25V.			
Type	Amps	Price	p & p
MT/50/1	1	£1.79	0.45
MT/50/1	1	£2.24	0.48
MT/50/2	2	£3.06	0.60

COIL FORMERS & CORES

NORMAN 1/2" Cores & Formers	0.07
1" Cores & Formers	0.09

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V81 containing approx. 50 sq. ins. various sizes all 0.1 matrix	*0.60
V82 containing approx. 50 sq. ins. various sizes all 0.15 matrix	*0.60

CABLES

Cables	Per Metre
CP1 Single lapped screen	*0.08
CP2 Twin Common Screen	*0.11
CP3 Stereo Screened	*0.12
CP4 Four Core Common Screen	*0.21
CP5 Four Core Individually screened	*0.28
CP6 Microphone Fully Braided Cable	*0.11
CP7 Three Core Mains Cable	*0.11
CP8 Twin Oval Mains Cable	*0.08
CP9 Speaker Cable	*0.08
CP10 Low Loss Co-Axial	*0.14

C280

CAPACITOR PAK
Containing 75 of the C280 range of capacitors assorted in values ranging from 0.1uF to 2.2uF. Complete with identification chart.

FANTASTIC VALUE
ONLY £1.20

Add 8% VAT to all prices marked *.
Remainder add 25%.

PLEASE NOTE THE ABOVE DIRECTIONS

VAT

COMPONENT PAKS

Pak No.	Qty.	Description	Price
C1	200	Resistors, mixed values approx. count by weight	0.60
C2	150	Capacitors, mixed values approx. count by weight	0.60
C4	75	1/8th width Resistors, mixed preferred values	0.60
C5	5	Pieces assorted Ferrite Rods	0.60
C7	1	Pak Wire 50 metres assorted colours	0.60
C8	10	Reed Switches	0.60
C9	3	Micro Switches	0.60
C10	15	Assorted Pots & Pre-sets	0.60
C12	30	Paper Condensers preferred types, mixed values	0.60
C13	20	Electrolytics Trans. types	0.60
C14	1	Pack assorted Hardware—Nuts, Bolts, Grommets, etc.	0.60
C16	20	Assorted Tag Strips and Panels	0.60
C19	2	Relays 6-24V Operating	0.60
C20	3	Sheets Copper Laminate approx. 200 sq. ins.	0.60

Please add 20p post and packing on all component packs, plus a further 10p on pack nos. C1, C2, C19 and C20.

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SOLVE THOSE STICKY PROBLEMS

CYANOACRYLATE C2 ADHESIVE

The wonder bond which works in seconds bond plastic, rubber, transistors, components permanently, immediately!

OUR PRICE ONLY 69p for 2gm phial

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S222	5 pin DIN plug to 5 pin DIN socket length 1.5m	68p
S237	5 pin DIN plug to 5 pin DIN plug mirror image length 1.5m	£1.20
S238	2 pin DIN plug to 2 pin DIN socket length 5m	68p
S270	2 pin DIN plug to 2 pin DIN socket length 10m	80p
S271	5 pin DIN plug to 2 phono plugs connected to pins 3 & 5 length 1.5m	70p
S275	5 pin DIN plug to 2 phono sockets connected to pins 3 & 5 length 23cm	68p
S318	5 pin DIN socket to 2 phono plugs connected to pins 3 & 5 length 23cm	68p
S404	Coiled stereo headphones extension cord extends to 7m	£1.40
S217	3 pin DIN plug to 3 pin DIN plug length 1.5m	80p
S219	5 pin DIN plug to 5 pin DIN plug length 1.5m	80p
S474	3.5mm Jack to 3.5mm Jack length 1.5m	68p
S600	5 pin DIN plug to 3.5mm Jack connected to pins 3 & 5 length 1.5m	80p
S700	5 pin DIN plug to 3.5 Jack connected to pins 1 & 4 length 1.5m	80p

SWITCHES	
DP/DT Toggle	0.28
SP/ST Toggle	0.22

P&P

Postage and Packing add 25p unless otherwise shown. Add extra for airmail. Minimum order £1.00.

BIB ACCESSORIES

REF 'D'	2 Hi-Fi Cable & Flex Tidy	*34p
REF 'I'	Tape Head Cleaning Kit	72p
REF 'P'	Hi-Fi Cleaner	*30p
Model 9	Wire Stripper	*£1.00
REF 23	1/2" Tape Editing Kit	*£1.80
REF 24	3/4" Cassette Ed'ng Kit	*£1.84
REF 29A	Salvage Cassette	*44p
REF 32A	Stylus Balance	£1.28
REF 33	Splicing Tape	*38p
REF 36A	Record & Stylus Cleaning Kit	*32p
REF 41	8 Track Cartridge Head Cleaner	88p
Model 42	Groov-Kleen	*£1.84
REF 42/S	Roller & Brush for REF 42 & 2000	*24p
REF 43	Record Care Kit	*£2.76
REF 45	Auto Changer Groov-Kleen	*98p
REF 46	Spirit Level	*72p
REF 48	Record Dust-Off	*26p
REF 52A	Cassette Tray	54p
REF 53	Hi-Fi Stereo Test Cassette	*£2.40
REF 56	Hi-Fi Hints & Tips Book	*48p
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REF 60/S	Replacement Brush Velvet Pad and Base Sticker for Model 60	*24p
REF 62	Cassette Head Cleaner (Liquid)	*48p
REF 71	Record 'Dust Off' (Displays of ten)	*68p
REF 71A	Record 'Dust Off' (Bubble Pack)	*70p
REF 75	Index Record	*£1.50
REF 76	Stylus Cleaner	*36p
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TYPE B1223. 200 ohms impedance. Complete with stand, on/off switch and 2.5mm and 3.5mm plugs. Suitable for cassette tape recorders. PRICE £1.67

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Supplying 6, 7.5 or 9 Volt DC at 200 mA. In moulded case forming a 2 pin 5A main plug. 2 metre output lead with 4-way multiplex giving 2.1 and 2.5 mm sockets and 3.5 mm plugs. Price £2.40. Post 15p. plus 8% VAT



2" and 4" PANEL METERS

SIZE: 60mm Wide x 45mm High x 40mm Deep.	I.R. Movement	SIZE: 110mm Wide x 82mm High x 43mm Deep.	I.R. Movement
0-50 micro A.	1250	0-50 micro A.	1400
0-100 micro A.	850	0-100 micro A.	730
0-500 micro A.	170	0-500 micro A.	200
0-1 mA	170	0-1 mA	200
0-5 mA	170	0-5 mA	200
0-10 mA	8	0-10 mA	8
0-50 mA	0.5	0-50 mA	0.5
0-100 mA	0.5	0-100 mA	0.5
0-500 mA	0.5	0-500 mA	0.5
0-1 AMP	0.5	0-1 AMP	0.5
0-2 AMP	0.5	0-2 AMP	0.5
0-25 Volt	15K	0-25 Volt	15K
0-50 Volt	80K	0-50 Volt	30K
0-300 Volt	300K	0-300 Volt	300K
"g" Meter	170	"g" Meter	200
VU Meter	5250	VU Meter	5250

VU Meters are complete with detectors. Modern wide view. Price 2" £3.20 Post 10p. Price 4" £4.00 Post 10p. Lamps 60p per set. plus 8% VAT

1 watt CARBON FILM RESISTORS
1 watt at 70°C E 12 range 10Ω-1MΩ 5% tol at above 470 KΩ 10% tol at 95p per 100. plus 28% VAT

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Special Offer
Compact General Purpose Mini Multimeter. Input Resistance 1000 ohms per volt. Ranges: AC Volts 0-15, 50, 250, 1000 V. DC Volts 0-10, 50, 250, 1000 V. DC Current 0-1 mA, 0-100mA. Resistance 0-100K ohms. Size 90 x 24 x 90 mm. Complete with Batteries, Test Prods. Instructions. Special price £3.95 Post 30p. plus 8% VAT



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Input Resistance 20,000 ohms per volt. Overload protection 150 μA movement, clear scale. Ranges—AC Volts 0-10, 50, 250, 1000V. DC Volts 0-5, 25, 125, 500, 2500V. DC Current 0-50 mA. Resistance 0-60 Kohms, 0-6 Mohms. Decibels -20 to +22 dB. Carrying Case, Test Prods and Batteries included. Size: 11.5 x 8.3 x 2.7 cm. Price £9.95. Post 20p. plus 8% VAT

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ADD 8% VAT ON ALL TRANSFORMER PRICES

CASED TRANSFORMERS

Housed in smart resin-coated steel cases, with 3-core primary cable and outlet socket, fused primary winding. Isolation types are fitted with 3-pin outlet sockets, and are available with 110 volt or 240 volt output. (Please state). Auto types are fitted with 2-pin flat style sockets up to 500 VA. 3-pin sockets from 750 to 3000 VA. See Auto and Isolation sections for prices.

SAFETY ISOLATING

Prim. 120/240V. Sec. 120/240V. Centre Tap with Screen.

VA (watts)	Ref. No.	Price Cased £	Price Plugs 2 Pin + 1 Earth £	Price Open £	Post £
20	148	5-25	0-98	3-75	0-72
80	149	9-08	0-98	4-70	0-72
100	150	9-37	0-98	5-35	0-85
200	151	13-29	0-98	8-61	0-97
250	152	13-81	0-98	10-31	1-18
350	153	16-54	0-98	12-50	1-28
500	154	18-38	0-98	14-31	1-44
750	155	23-72	1-25	22-12	O.A.
1000	156	27-44	1-25	30-87	O.A.
1500	157	44-37	1-25	34-98	O.A.
2000	158	62-45	2-25	38-91	O.A.
3000	159	77-18	2-25	61-61	O.A.

12 & 24 Volts Prim. 200-240V.

VA	Ref. No.	Price £	Post £
12V 24V	242	1-68	0-34
0-3	0-15	1-11	0-46
0-5	0-25	1-11	0-46
1	0-5	2-13	0-61
2	1	2-47	0-81
4	2	3-07	0-97
6	3	4-50	0-72
8	4	5-11	0-85
10	5	7-2	0-85
12	6	11-6	0-85
15	8	17	0-97
20	10	11-5	1-18
30	15	18-7	1-36
40	20	23-2	1-63
60	30	22-6	1-70

30 Volts

VA	Ref. No.	Price £	Post £
0-5	112	2-04	0-61
1	79	2-57	0-66
2	3	3-91	0-72
3	20	4-80	0-85
4	21	5-58	0-85
5	61	6-75	0-96
6	117	7-58	0-97
8	88	9-93	1-18
10	89	10-27	1-18

AUTO TRANSFORMERS

VA	Ref. No.	Price Cased £	Price Plugs 2 & 3 pin £	Price Open £	Post £
Tapped at 115, 220, 240 Volts	115	4-31	0-25	1-88	0-61
Tapped at 115, 200, 220, 240 Volts	150	4	6-99	4-28	0-72
	200	65	7-67	5-21	0-78
	300	66	8-67	6-11	0-85
	500	67	11-82	9-48	1-18
	750	68	14-31	11-30	1-28
	1000	84	18-38	14-35	1-44
	1500	93	23-28	19-22	O.A.
	2000	95	35-07	25-49	O.A.
	3000	73	50-61	34-87	O.A.

50 Volts

Ampe	Ref. No.	Price £	Post £
0-5	102	2-71	0-61
1	103	3-58	0-76
2	104	5-30	0-85
3	105	6-10	0-85
4	106	7-97	1-08
6	107	12-93	1-18
8	118	13-75	1-44
10	119	17-79	1-86

60 Volts

Ampe	Ref. No.	Price £	Post £
0-5	124	2-51	0-72
1	126	3-75	0-72
2	127	5-38	0-85
3	125	7-91	0-97
4	123	9-20	1-18
5	40	10-82	1-18
6	120	12-10	1-36
8	121	15-74	O.A.
10	122	20-10	O.A.
12	189	18-87	O.A.

MINIATURE AND EQUIPMENT

Sec. 1 Volts	Sec. 2	Milliamps	Ref. No.	Price £	Post £
3-0-3	—	200	238	1-58	0-34
0-6	0-6	500	500	234	1-58
0-6	0-6	1000	1000	212	2-12
0-0-9	—	100	—	13	1-60
0-0-9	—	320	320	235	1-62
0-8-9	—	500	500	207	1-89
0-8-9	—	1000	1000	308	2-79
15-0-15	—	—	—	240	1-55
0-15	—	200	—	236	1-58
20-0-20	—	30	—	241	1-55
0-20	—	150	—	237	1-58
0-15-20	—	500	—	205	2-88
0-20	—	300	—	214	2-03
0-20	—	—	NO SCREEN	116	3-45
20-12-0-12 20	—	700 (D/C)	—	221	2-50
0-15-20	—	1000	—	206	2-85
0-15-27	—	500	—	203	3-18
0-15-27	—	1000	—	204	4-85

PLASTIC CASED SILICON BRIDGE RECTIFIERS

One Amp	Two Amp	Four Amp	Six Amp
50 P.I.V. 20p	50 P.I.V. 55p	100 P.I.V. 65p	50 P.I.V. 65p
100 P.I.V. 25p	100 P.I.V. 40p	200 P.I.V. 55p	100 P.I.V. 70p
200 P.I.V. 25p	200 P.I.V. 45p	400 P.I.V. 65p	200 P.I.V. 80p
500 P.I.V. 30p	400 P.I.V. 50p	600 P.I.V. 75p	400 P.I.V. 90p

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POWER UNIT Type CC 12-05

Output switched 3, 4.5, 6, 7.5, 9 and 12 volts at 500 mA D.C. Operates from 240 V mains, suitable for Radios, Tape Recorders, Record Players etc. Size 7.5 x 5.0 x 14.0 cm. Price £4.15. Post 35p. + 8% VAT



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6mm dia., 12mm length leads length approx. 20mm. Recommended ballast resistor 180K ohms for 240 Volt operation. Price: Packet of 10 for 60p. Postage 15p. plus 8% VAT

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Four inputs. Four way mixing. master volume, treble and bass controls. Suits all speakers. This professional quality amplifier chassis is suitable for all groups, disco, P.A., where high quality power is required. 5 speaker outputs. A/C mains operated. Slave output. Produced by demand for a quality valve amplifier. Suitable carrying cabinet £14. Price **£85** carr. £250

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This famous unit now available. 10 watts. 8 ohm.

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8" or 10" x 6" ELAC HI-FI SPEAKER

Dual cone plasticised roll surround. Large ceramic magnet. 50-16,000 cps. Bass resonance 55 cps. 8 ohm impedance. 10 watts.

£4.35

10in round £f.

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Fluted Wood Fronts

MODEL "A". 20 x 13 x 12in.

For 12 in. dia. or **£12.50** Post

10in. speaker. 85p

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Reflex cabinet will accept 1-12in.

bass unit, 1-5in. mid range, 1-3in.

tweeter. Teak finish. Grooved front

£21.50 Carr.

23

LOUDSPEAKER CABINET

WADDING 18in. wide, 20p ft.

GOODMANS CONE TWEETER

3 1/2 in. diam. 18,000 C.P.S. 25 WATTS 8Ω **£3.60**

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Add musical highlights and sound effects to recordings. Will mix

Microphone, records, tape and tuner with separate controls into

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battery operated.

STEREO VERSION OF ABOVE £8.85.

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Push-Pull Ready built with volume, treble and bass controls. 18 watt battery operated. Mains Supply £3.45.

THE "INSTANT" BULK TAPE ERASER & HEAD DEMAGNETISER.

Suitable for cassettes, and all sizes of tape reels. A.C. mains 200/240V.

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OFFERING 1001 USES for every type of heating and drying applications in the home, garage, greenhouse, factory (available in manufacturing quantities). Approx. size 10 1/2 x 8 1/2 x 1/16 in. Operating voltage 200/250V. a.c. 250 watts approx. Printed circuit element enclosed in asbestos fitted with connecting wires. Completely flexible providing safe Black heat. British-made for use in photocopyers and print drying equipment.

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Post 60p



30-14,500 c/s. 12in. Double cone, woofer and tweeter cone together with a BAKER ceramic magnet assembly having a flux density of 14,000 gauss and a total flux of 145,000 Maxwells. Bass resonance 40 c/s raised 25 watts. NOTE: 3 or 8 or 15 ohms must be stated.

Module kit. 30-17,000 c/s with tweeter, crossover, baffle and instructions. **£14.50**

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BAKER SPEAKERS "BIG SOUND"

Robustly constructed to stand up to long periods of electronic power. As used by leading groups. Useful response 30-13,000 cps. Bass resonance 55 cps.

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12in 30 watt 3, 8 or 15 ohms.

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12in 40 watt 3, 8 or 15 ohms.

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12in 60 watt professional model. 8 ohms or 15 ohms.

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15in 75 watt 8 or 15 ohms.

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MAJOR 50 WATT ALL PURPOSE TRANSISTOR AMPLIFIER

All purpose transistorised.

Ideal for Groups, Disco and P.A.

4 inputs speech and music. 2-way mixing. Output 8/15 ohm A.C. mains.

Separate treble and bass controls.

Guaranteed. Details S.A.E.



£49 Carr. £1.00

Latest 100 watt Model as illustrated **£65**

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Covered Black Rexine with Handle **£75**

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Teak veneered 1/2 thick wood cabinet.

Size 18 1/2 in x 14 1/2 in x 8 1/2 in. Weight 23lb.

This cabinet features a wide mesh Silver Grill covering a separate compartment for mounting Tweeters or Mid-Range Horn. The fully sealed bass compartment is cut out for 6 1/2 in Woofer. 27-50. Carr. 85p. Rosewood Version £8.50. Carr. 85p. Baffle could be cut for larger speaker.



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Cabinet extra 25.

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P50/1AC 60p

P60/3CC 40p

PCA1 85p

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OPT1 65p

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Twin gang £1.20

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4 pole. 240 v. Size 3 1/2 x 2 1/2 in.

1200 rpm. Spindle 1/2 in. diameter. 120v version 75p.



£1.85

Post 45p

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120V or 240V a.c. 2,400 rpm

2-pole. Size 2 1/2 x 2 1/2 in.

£1.25

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BAKER DISCO SPEAKERS

HIGH QUALITY—BRITISH MADE

2 x 12" CABINETS

for Disco or PA all fitted with carrying handles and corners Black finish.



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50 Watt—**£43** ea.

70 Watt—**£46** ea.

SUPERB HI-FI

12in 25 watts

A high quality loudspeaker. Its remarkable low cone resonance ensures clear reproduction of the deepest bass. Fitted with a special copper drive and concentric tweeter cone resulting in full range reproduction with remarkable efficiency in the upper register.

Bass Resonance 25cps

Flux Density 16,500 gauss

Useful response 20-17,000cps

8 or 15 ohms models.

£17 Post

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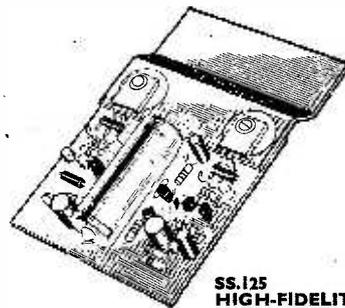
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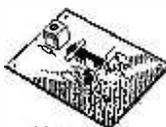
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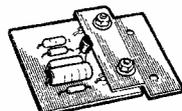
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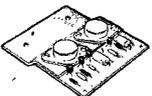
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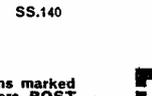
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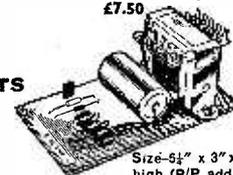
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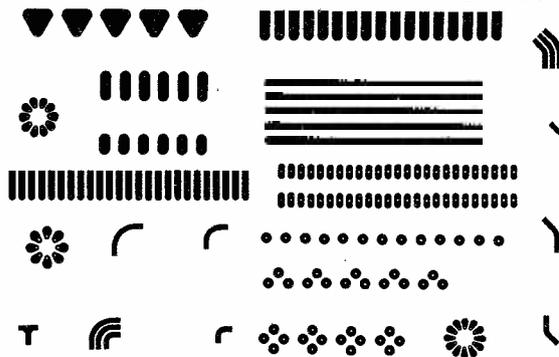
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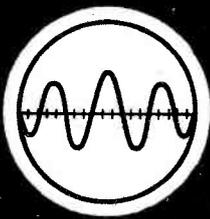
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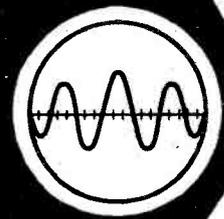
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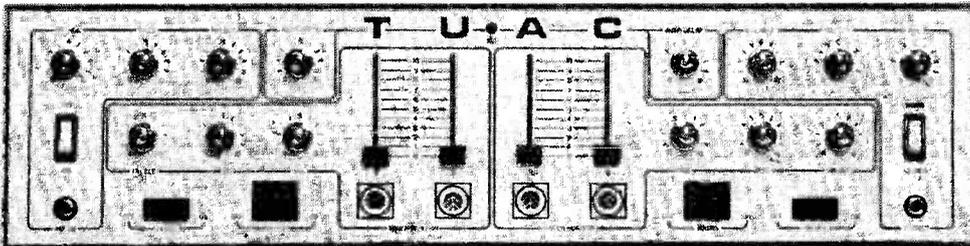


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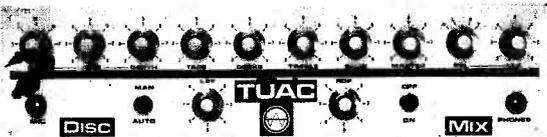
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£7.50

PSU 2 for supplying disco mixer £5.50

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4 Channel sound to light sequence

chaser 1000 watt per channel £17.25

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Add sequence chasing and dimming

effects to TUAC 3 channel

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120 WATT R.M.S. POWER AMPLIFIER MODULE

USES 150W 16A RCA DEVICES

Compare these features:

- 10 Transistors 4 Diodes—Fibre Glass P.C.B.
- Typical Distortion—0.4% ; Noise—80dB
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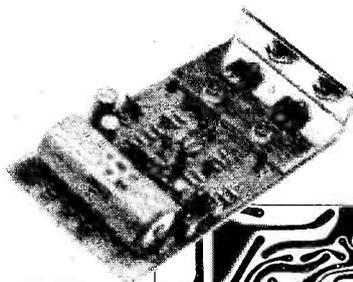
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the new
SA1208D
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SYSTEM 7000 DISCOTHEQUE CONTROL UNIT

Design and performance to professional standards

- Complete and ready to plug in
- Totally encased—no soldering at all
- Tough, bold, two tone stainless panel—for panel mounting or freestanding
- Mono or stereo versions
- Front and rear output terminations to suit style of usage
- Inputs for 2 ceramic cartridges/tape/microphone
- Autofade with depth and threshold controls
- Wide range treble and bass controls on both channels
- Individual deck controls AND left/right fader
- Low noise (—80dB) 20Hz — 50kHz ± 1dB
- Suits all Saxon amplifiers and most other makes
- ½ watt headphone monitor—five position switch with mute positions



- **CONTROLS**—L. to R.: Mic Vol/Treble Bass, Autofade depth, L/Deck Vol, R/Deck Volume, Tape Volume, Treble, Bass, Master, Monitor Volume, Monitor Selector-On-Off
- Variable autofade stainless steel panel

MONO £34.50

STEREO £49.50

MODULAR DISCO MIXERS MONO & STEREO

Printed circuit sub-assembly version of the above mixers—ideal for those wishing to incorporate Saxon's superb specifications into their own systems—all the electronics are provided.

You require only plugs and sockets plus one switch to complete the wiring. All other controls are already mounted on the P.C.B. Comprehensive wiring instructions are supplied with circuit and very clear diagrams.



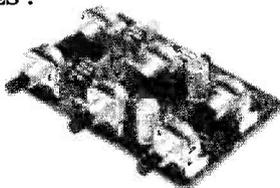
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STEREO £27.50

MULTI-PURPOSE MODULAR MIXERS—A SYSTEM 7000 BREAKTHROUGH—UP TO 20 CHANNELS MONO/STEREO

■ P.C.B. MODULES :

- Ready assembled with all controls
- Simple terminations—solder or edge connector
- Consumption 10mA at 18v



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(up to 20 may be used)	Stereo 1M7001S	£9.00
MIXING MODULE	Mono 1M7002M	£5.50
(only 1 required)	Stereo 1M7002S	£9.00

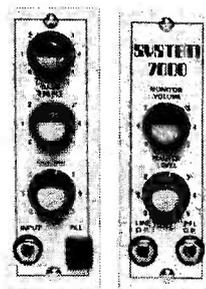
Provides headphone output & mixes all inputs to output level. Suits all mixing requirements for groups—clubs discos etc.

■ COMPLETELY WIRED WITH STAINLESS PANEL:

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- Inputs for all sources inc mag. cartridge
- Wide range bass and treble controls
- Only one mixing module required
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- ½w monitor power
- Mono and stereo modules may be used together
- Feeds most amplifiers
- Modern low noise circuitry
- 20Hz — 30kHz ± 1dB
- Echo send/return facility
- Send for details
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- Individual monitor buttons

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Stereo mixer module	£12.00



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it's the complete answer!

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New! TWO STROBES TO MEET ALL REQUIREMENTS

SUPERSTROBE

- Built in Saxon reliability
- 1 flash/2 secs.—up to 20/sec.
- Compact black Bondene case
- Appearance matches other Saxon units
- Ideal for the mobile disco or smaller club



SUPERSTROBE £24.75

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- Giant 80 watt tube
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PRO-STROBE £38.50

New! 150 WATT LIQUID WHEEL PROJECTOR

- Complete with wheel
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- Wide range of extra effects may be attached
- Sturdy construction
- Adjustable feet



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Spare wheels £4.90

TOTAL CONTROL WITH SYSTEM 7000 LIGHTING CONTROL UNIT AND SUPERFECT MODULE

- Full control of 3KW of lights (1KW/channel)
- Audio control *plus* sequence *plus* override
- Variable speed sequence with slider function control
- Stainless steel two tone panel—matches mixer
- 13 transistors 8 diodes—advanced control circuitry
- High audio sensitivity—operates from any amplifier
- Attractive Bondene case—free standing or panel mounting
- Individual tone controls *plus* master audio control

This unit offers the performance of units offered at nearly twice the price.

£38.00

inc. case & plug—ready to use.



SUPERFECT MODULE

- All features as the System 7000 lighting control unit
- Requires only panel and plug socket, etc.
- Slider control supplied
- Glass fibre P.C.B.
- 8 amp RCA triacs
- Complete light show in one unit with instructions



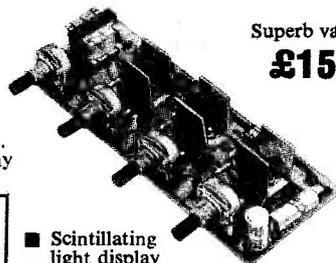
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This P.C.B. sub-assembly of the System 7000 lighting control unit is recommended for those wishing to incorporate Saxon's excellent specs. in their own systems.

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- Glass fibre P.C.B.
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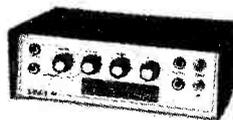
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- Twin output sockets
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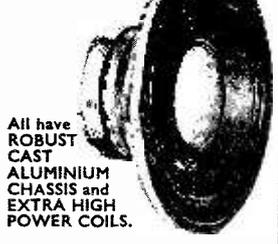
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Amp. D.C. 6 ranges: 50µA - 500µA - 5mA - 50mA - 500mA - 5A.

Amp. A.C. 5 ranges: 250µA - 2.5mA - 25mA - 250mA - 2.5A

Ohms 4 ranges: Low Ω - Ωx1 - Ωx10 - Ω x 100 from 1/10 dl Ω until 5 Mega Ω

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BC148	10p	BDV55	£1-85
BC149	10p	BF194	10p
BC157	10p	BF195	10p
BC158	8p	BF196	12p
BC159	9p	BF197	12p
BC172B	12p	BFY29	25p
BC237	15p	BFY51	20p
BC238	12p	BSX60	60p
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BC320A	20p	TIP42A	£1-05
BC321A	20p	2N1302	20p
BC322B	20p	2N1304	25p
BC327	18p	2N243	70p
BC328	18p	2N2889	12p
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*matched pair

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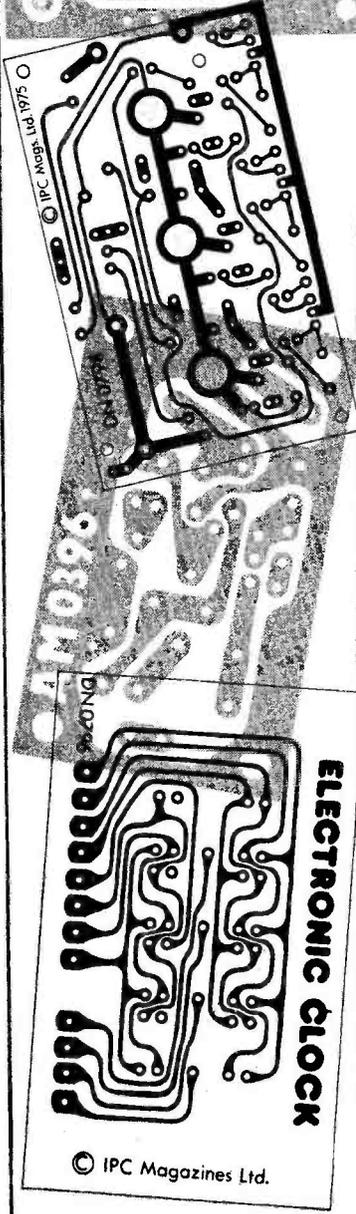
EDITORIAL ANNOUNCEMENT

NEW!

PRACTICAL WIRELESS

PCB SERVICE FOR READERS

As a result of continued requests from readers we are happy to announce the start of a printed circuit board service for projects published in Practical Wireless. A list of PCBs now available, plus ordering coupon, will be found below. The list will be extended as new PCBs are made available. Generally the boards will be of epoxy glassfibre, drilled and roller-tinned. For the time being PCBs for projects published in PW before December 1975 are not available through this new service



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Please supply PCB/s as indicated by tick/s in box/es

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Dec 75	Disco System, Light Modulator	AM0423	2.70 + 18	<input type="checkbox"/>
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Wild Life Contest

PRIZES worth more than £1,000 are to be awarded in the 1976 'Scotch' Wildlife Sound Recording Contest, organised for the eighth consecutive year by 3M United Kingdom Limited's Recording Materials Division.

Top Award for the overall winner of the contest, which is open only to British amateur tape recordists, is a Sennheiser MKH 815T transistorised condenser gun microphone, together with power pack and accessories, donated by Hayden Laboratories. New to the competition are special awards for cassette recordings and stereo entries: a Wollensak 4766E hi-fi cassette deck with Dolby noise reduction circuitry (recommended price £288) goes to the entrant submitting the best entry made on a cassette machine, and a pair of Monitor MA5 Series II speakers will go to the recordist entering the best stereophonic recording.

In addition, a Grampian parabolic reflector with DP6 microphone, and a pair of Rotel stereo headphones will be awarded for the most original recording, and specially commissioned watercolours featuring the subject of their recordings will go to the six class winners (three in the novices' section and three in the section for experienced entrants).

Subject categories are: birds, mammals and insects, and outdoor habitat. Scotch Classic recording tape or cassettes will be bonus prizes for all winners and runners-up, and all entrants will be invited to the prizegiving luncheon in London. The overall winner—3M Wildlife Sound Recordist of the Year—has a seat reserved on the judging panel for the following year's competition.

There is no entry fee, and copies of the rules and entry forms— together with hints on wildlife recording by lecturer, author and international recording contest winner Richard Margoschis—are available from *Bill Bowles, Public Relations Executive, 3M United Kingdom Ltd., 380 Harrow Road, London W9 2HU*. Closing date for receipt of entries is March 31, 1976.

Practical Wireless, March 1976

Marshalls Ltd.

MARSHALLS of Cricklewood recently announced that they have been appointed as distributors for Mullard Ltd. and National Semiconductors Ltd.

Products covered by the new franchises will be available not only through their main branch at 42 Cricklewood Broadway, London N.W.2 but also at 1 Straits Parade, Fishponds, Bristol BS16 and at 85 West Regent Street, Glasgow G2 2QD.

Sutton & Cheam

THE 27th Annual Dinner & Ladies' Festival of the Sutton & Cheam Radio Society is being held on 6th March, 1976. Tickets are available from A. V. Tillin, G3MES, 11 Great Ellshams, Banstead, Surrey, SM7 2BA. Tickets are £4.50 for seniors and £3.50 for juniors. Time: 6 for 6.30 p.m.

Och Aye

THE Central Scotland Hamfest will be held at Wrangholme Hall Community Centre, Jerviston Road, New Stevenson, Motherwell, ML1 4UQ on March 14th. Doors open at 2 p.m. Many Amateur equipment distributors will have stands there and there will be a Home Built Equipment Contest with a difference—entries will be tested with professional test gear to make sure they work! In addition, there will be a sale of useful gear and components—not junk it is stressed—there will be a teach-in on the Central Scotland 2m Repeater at 3 p.m. and a talk-in station will be operating on 145.5MHz (GM3PXX). There will be a demonstration of slowscan TV and RTTY and refreshments will be available. Further gen from D. H. Plumridge, GM3KMG, Mid Lanark Amateur Radio Society, at the Wrangholme Hall address mentioned above.

VHF Convention

THE next National VHF Convention will be held at Brunel University, Uxbridge, Middx, on 8-9 May, 1976. The accommodation is vastly better than at previous venues and there is more exhibition space which will not need to be disturbed by the dinner. Residential accommodation is also available.

Radio Society of Great Britain, 35 Doughty Street, London, WC1N 2AE.

Heathkit Catalogue

THIS is the front cover of the new Heathkit catalogue which is available from *Heath (Gloucester) Ltd., Bristol Road, Gloucester, GL2 6EE*. Please enclose a 10p stamp for return postage.

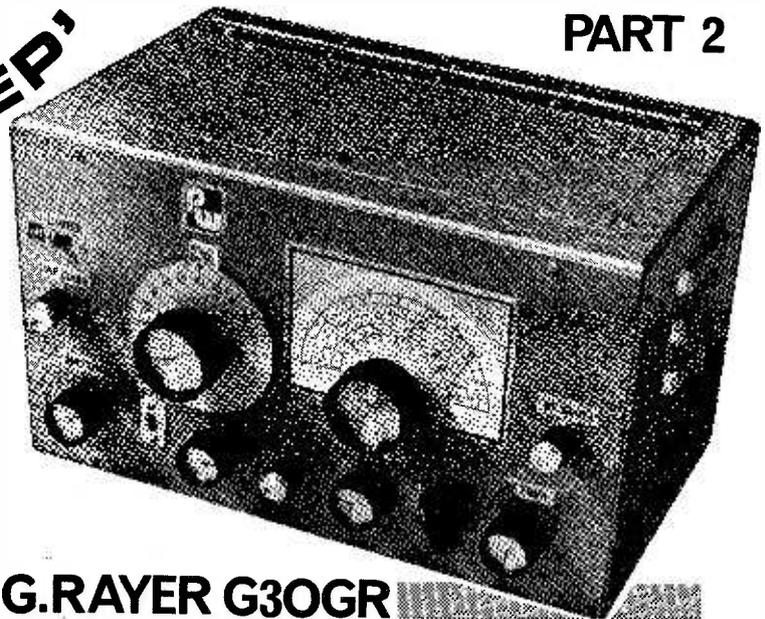
The following new models are introduced. GB-1201E Digital Electronic Stop Watch Kit; BD-1157 Car Intrusion Alarm Kit; TD-1089 Electronic Doorbell Kit; CI-1079 Digital Rev. Counter Kit; CO-2500 Solid State Ignition Analyser Kit; HW-104 SSB Transceiver Kit; HS-1661 Station Speaker Kit; HWA-104-1 10 Metre Access Kit; HW-8 CW Transceiver Kit; HW-2026 Synthesised 2 metre FM Transceiver Kit; HW-2021 Hand Held 2 metre Transceiver Kit; IM-4100 30MHz Frequency Counter-Timer Kit.



'STEP BY STEP'

PART 2

GENERAL COVERAGE RECEIVER



F.G. RAYER G30GR

BEAT FREQUENCY OSCILLATOR

Fig. 10 shows the circuit of this unit. Its purpose is to provide a carrier at the detector diode, to heterodyne with incoming CW to produce an audio tone, or to replace the carrier removed during the generation of SSB signals. The BFO is wired upon a board as in Fig. 11. No particular difficulties are likely here. Fit pins so that leads may be taken to the BFO switch and a flexible lead to take to the positive point on the audio board. A wire is also necessary for capacitor VC9.

The coil is close wound using 32SWG enamelled wire. Begin at X, Fig. 11, wind 12 turns, form a tapping, and continue in the same direction with 50 further turns, ending at Y. The BFO unit is fixed under the chassis, near VC9. Earth VC9 to one of the tags in Fig. 11 or to an adjacent chassis tag. An insulated lead runs from VC9 to C29 and from C29 the lead passes up through the chassis to D1 positive/IFT3 pin 4. Take the switch leads to the BFO on/off switch S2, which is next to VC9.

It is necessary to tune the BFO coil to 1.6MHz, with VC9 half closed. To do this, tune in any steady

AM signal, with the BFO off. Switch on the BFO and rotate the core until a strong heterodyne appears with the transmission. Adjust the core for zero beat so that if VC9 is turned either way, an audio tone is heard, increasing in pitch. Check that this happens on all signals because, if the adjustment were made at a high frequency, harmonics of the BFO might be responsible.

The BFO is not used for AM reception. To receive CW, tune in the CW correctly, switch on the BFO and adjust VC9 for the desired pitch. Signals should not be too strong at the detector. This means that for CW reception, RF gain is usually turned back, while AF gain is turned well up. For SSB reception,

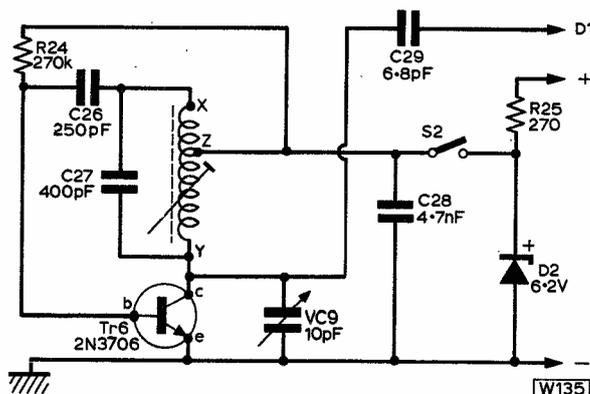


Fig. 10: Circuit of the optional BFO unit.

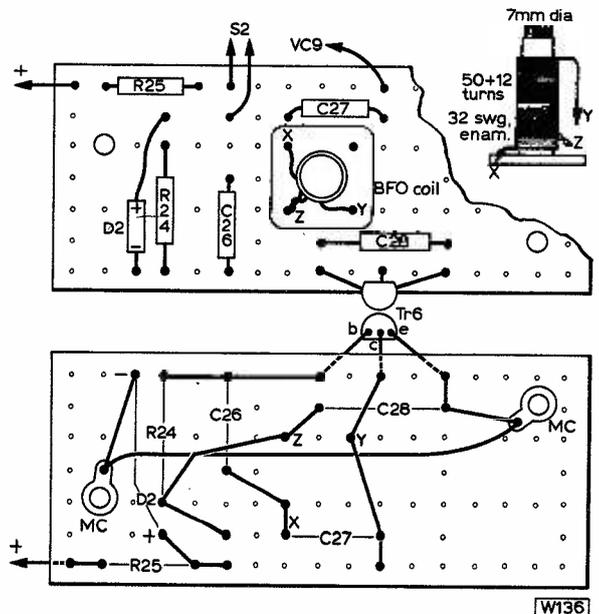


Fig. 11: Layout of the BFO on veroboard. The coil is home-made on a 7mm former with core.

the BFO is used in the same way, except that adjustment is much more critical. If the BFO is tuned to the wrong side the SSB speech is inverted and cannot be resolved. Amateur bands 14MHz and above use upper sideband, 7MHz and below use LSB. No difficulty should arise in receiving SSB, provided the level of the SSB signal at the detector is kept down, as described for CW reception. If a signal of reasonable strength is tuned in and the RF gain is turned up while AF gain is reduced, to maintain about the same volume level, a point is reached where SSB resolution becomes worse or even impossible. So all signals have to be kept below this level at the detector.

ADDITIONAL IF STAGE

The additional IF amplifier, placed between the mixer and existing IF section, will increase selectivity and sensitivity. It is quite feasible to use this as an extra IF stage of similar type, with a worthwhile improvement in reception. If so, the IF gain control described should be included, as it is often necessary to turn this back to avoid overloading of later stages, and to allow satisfactory CW and SSB reception. It is also possible to fit an improved type of IF stage here, and the circuit in Fig. 12 employs a single crystal, with adjustable phasing. An advantage with this circuit is that only a single crystal is needed, while varying degrees of selectivity can, in effect, be obtained by use of capacitor VC10.

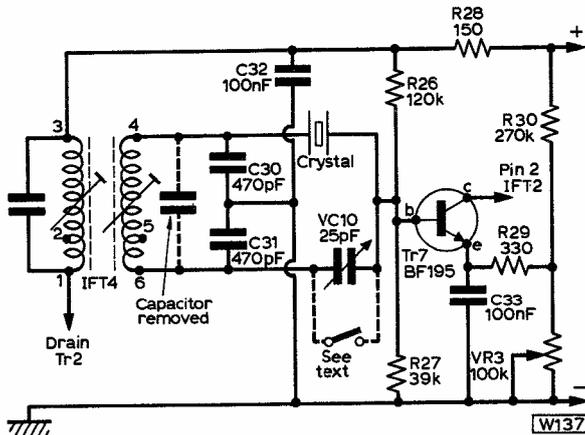
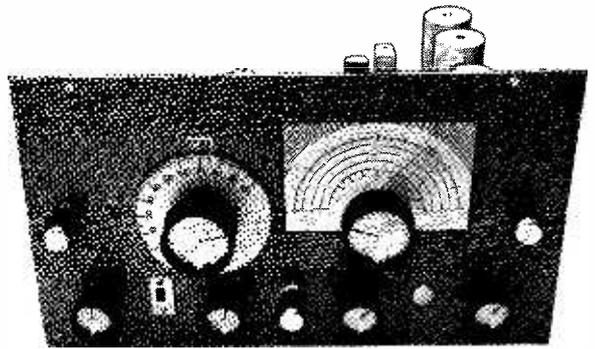


Fig. 12: The additional IF stage incorporates a crystal filter at the IF of 1.6MHz.

As no centre-tapped IFT is available, it is necessary to modify IFT4 by carefully removing it from its screening can and taking out the fixed capacitor which is between pins 4 and 6. It is then replaced. The two external capacitors C30 and C31 replace the internal capacitor and provide a centre-tap. When VC10 is adjusted so that it balances the stray capacitance of the crystal, selectivity is at maximum. This balancing will normally require only a few pF so that VC10 will be nearly fully open. VC10 is purposely made large, so that considerable unbalance is possible, to reduce selectivity. It is also necessary to render the crystal circuit inoperative, for "normal" selectivity. This can be arranged by turning the extreme corner of the rear moving plate of VC10 outwards, so that when VC10 is fully closed, it shorts, giving a circuit straight through from pin 6 to the base of Tr7. Note that C30 and C31 prevent shorting of Tr7 base bias.

Practical Wireless, March 1976



The front panel before the noise limiter and bandswitching were added.

An alternative method of cutting out the crystal is to fit a contact which is 'made' by rotating VC2, so that the crystal itself is shorted. This has the advantage that the crystal is completely inactive, and it avoids the "whoop" which can arise when tuning quickly and signals encounter the unbalanced crystal resonance.

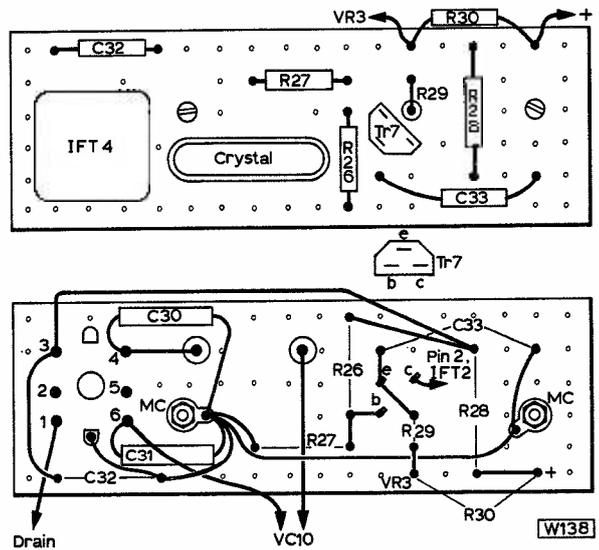


Fig. 13: Component layout for the crystal IF stage.

Fig. 13 shows the construction of the unit which is mounted behind the main tuning capacitor, see photographs. Long bolts are used to allow C30 and C31 to clear the chassis. A hole is required under the IFT for connections to VR3 and the phasing capacitor VC10. The capacitor must be completely isolated electrically from the chassis. It is mounted on a piece of paxolin or other insulating material about

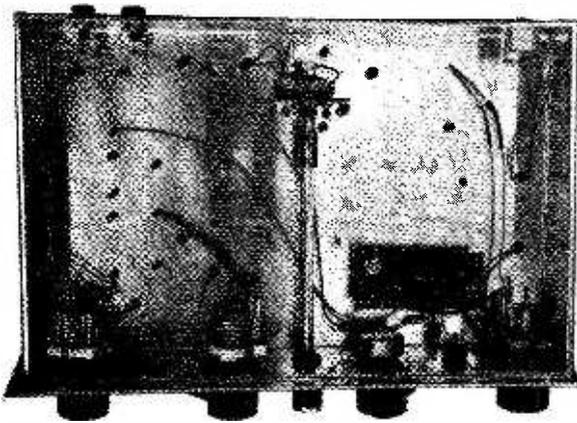
★ components list

NOISELIMITER

R35 200kΩ C36/C37 100nF
D3/6 OA47 or similar germanium diode
S9 Switch, SP on-off

MAINS POWER UNIT

R36 2.7kΩ D7/8 1N4001 or similar
T1 Transformer, 240V/9-0-9V 100mA



Under the chassis before the bandswitch and associated coils had been incorporated.

1³/₄ x 1¹/₂in in size, which is bolted to a 1¹/₂in bracket, or two small brackets. It is positioned so that short leads can run to it down through the chassis. It is operated by an insulated 1/4in dia. rod about 4¹/₂in long passing through a bush in the panel.

ADJUSTING THE CRYSTAL FILTER

Fig. 14 should be of help in dealing with this aspect of the filter. For best possible adjustment a signal generator is necessary, but a very useful degree of selectivity should be obtainable without it. In Fig. 14, A is the response curve of the IF transformers alone. At resonance, response is maximum, falling away either side as the receiver is tuned a little one way or the other from that giving best reception. Curve B is the sharp peak obtained with the crystal when balanced by VC10. When the IFT's and crystal are on the same frequency, A and B will occur at the same tuning point, as in Fig. 14. But where the crystal and IFT's are on slightly different frequencies (as may be expected) curve A and curve B will occur at slightly different tuning points.

If a meter is connected, as described earlier, and the receiver is tuned across a steady AM signal, the flat peak A and sharp peak B may possibly be observed. If so, tune the signal to peak B and adjust all the IFT cores slightly to move peak A to peak B. This will give an improved signal strength reading on the meter. When this is reasonably correct, adjust

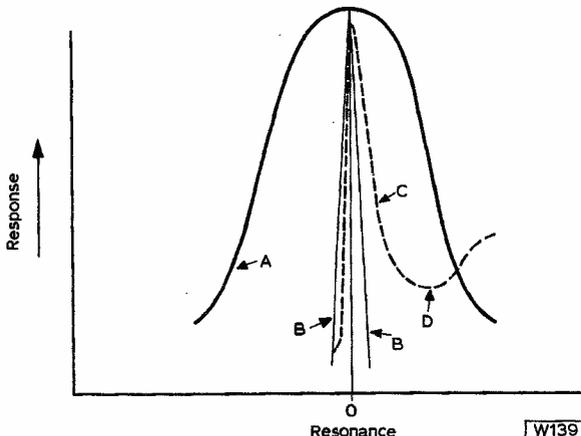


Fig. 14: The various IF bandwidths obtainable with the crystal filter are shown as B, C and D. The bandwidth with IFT's alone is shown by response curve A.

VC10 for the sharpest possible peak. If VC10 is set too high, in capacitance, the crystal curve resembles C, while too little capacitance causes the notch D to move to the other side of the pass-band. With a correctly adjusted filter, the rejection notch D can be moved across the pass-band by VC10, to eliminate or reduce an unwanted carrier. Deliberate unbalance is also obtained with VC10, to reduce selectivity.

Best possible adjustment requires an unmodulated signal from a generator as the sidebands caused by modulation will lie partly outside the pass-band. Otherwise find a setting which causes noticeable loss of upper frequencies with any AM signal, with a fall in background noise, and much sharper tuning. As such a filter is not normally kept in circuit all the time, it can be cut out by either of the methods already described.

BANDSWITCHING

Bandswitching obviates the need to change sets of coils by hand, but needs quite a lot of wiring, so whether or not it is provided must depend on personal choice. Fig. 15 gives details of the circuit used. For four bands, a 4-way 6-pole switch is used. It is necessary to use a switch with three separate wafers, each with two poles. The front wafer is S3 and S4, the middle wafer is S5 and S6, and the rear wafer is S7 and S8. A standard Maka-Switch was used as it is quite small. The wafers are actually 2-pole 6-way, but two ways are left unused.

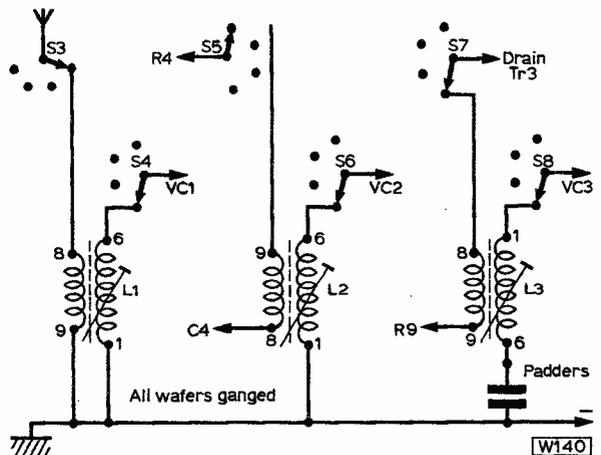
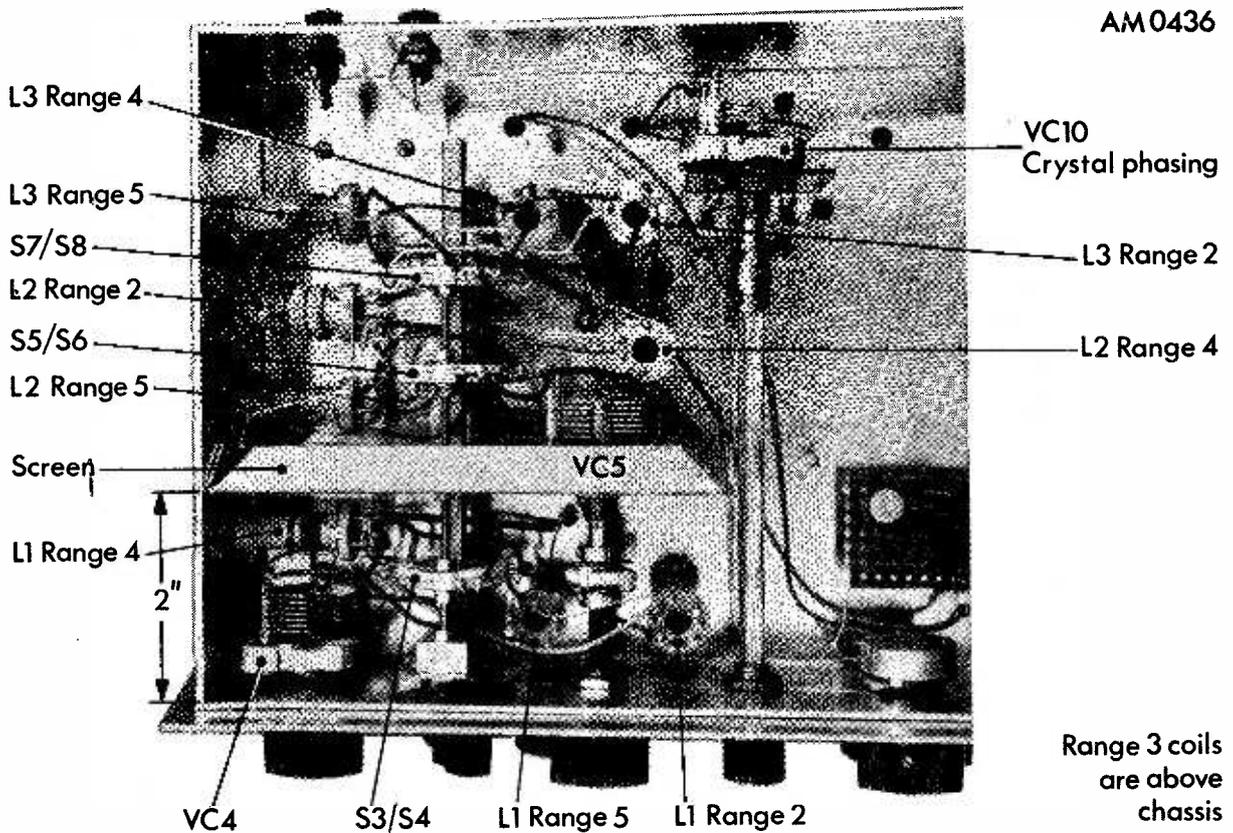


Fig. 15: Connections for one range of the bandswitch. Each range should be fitted and tested before adding the next.

Referring to Fig. 15, S3 switches the aerial to the primary of L1. The remaining three ways of S3, not connected in Fig. 15, are wired to the primaries of the other three aerial coils. S4 goes to VC1, bandspreading and trimmer capacitors as well as the RF gate circuit C1. Wafer S5 switches the RF stage drain circuit. All the four lower ends of the primaries of L2, pins 8, are connected together and to the positive circuit. Wafer S6 switches the variable capacitors and C5. All the windings return to chassis. S7 switches the oscillator drain to pin 8 of each coil, as necessary, and all these windings (pin 9) return to the positive supply circuit for this stage. S8 switches all the oscillator capacitors and gate circuit. The appropriate pin of L3 has its own padder, as already explained, returned to chassis.

It may be preferable to fit the coils for one range only, and to check that the receiver works correctly,



Close-up of the corner of the chassis to show placement of components when bandswitching is introduced.

before fitting the other coils. If any doubt is felt about the way in which the switch makes internal circuits, check it with a meter for each position. In this way errors can be avoided. It is not intended to give a wiring diagram for the switching and coils, as this is largely a matter of duplication. Some wiring points do, however, arise.

COIL WIRING AND LOCATION

Unscrew the RF/mixer/oscillator unit, so that connections can be reached. A number of holes should be drilled in the chassis below it, remembering that these should permit short through connections and keep aerial and RF circuits away from following circuits and components. The plug-in coil assembly can be retained for Range 2 or Range 3. Disconnect the leads to permit wiring as in Fig. 15 and take colour-coded wires down through the holes.

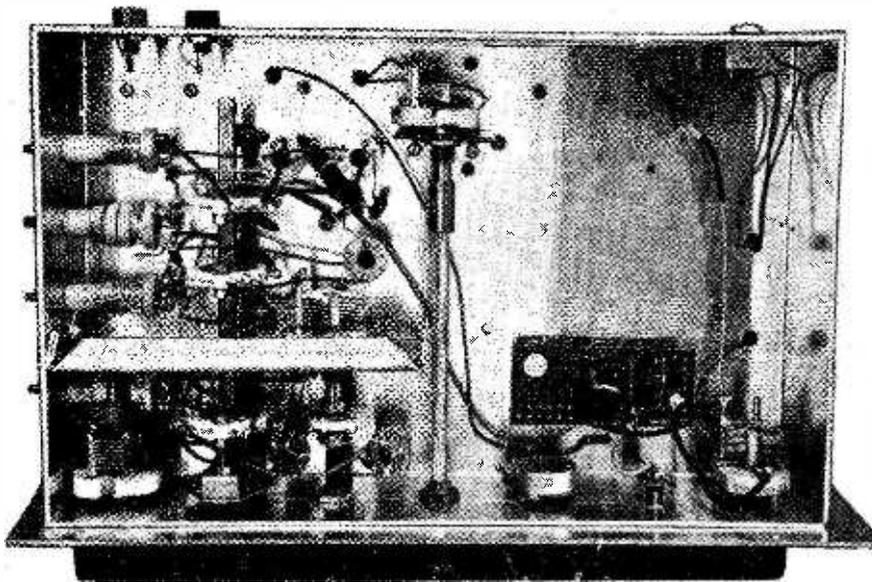
A 5 x 2in flanged universal chassis side is drilled so that holes line up with the bandswitch and mixer trimmer holes in the panel. The Maka-Switch is assembled with threaded rod and nuts so that this screen is 2in from the front panel, between the RF and mixer circuits, see photograph. Assemble with wafer S3/4 in front of this screen. To further segregate circuits, the mixer trimmer is now fitted to the screen and operated through an extension shaft and coupler. The shaft runs through a panel bush.

The lead from the aerial socket runs through the side of the chassis at the back, along the outside, and in opposite S1. A short length of coaxial cable,

kept inside, is preferable. Viewing the receiver from the front and below, fit L1, Range 7, immediately adjacent to S3/4. Fit Range 4 coil on the chassis side, behind the aerial panel trimmer. Range 3 coil occupies the plug-in holder above the chassis. Range 2 coil is between the extension shafts to mixer trimmer and phasing capacitor. The chassis returns for these coils are made to a tag secured by the bolt holding the front of the tuning capacitor to the chassis.

Range 5 Yellow coil is immediately behind the screen, on the chassis side, with pins near S5/S6. Range 4 coil is near the mixer trimmer. Range 3 coil is in the mixer assembly, and Range 2 coil is adjacent to Range 5, on the side of the chassis. Range 5 oscillator coil is on the chassis side, with pins near wafer S7/S8. Range 4 coil is also near this wafer, with Range 2 coil beside it, nearer the phasing capacitor. Range 3 occupies the top holder as before.

All coils are mounted so as to give reasonable clearance from each other and any metal surfaces. It will be found helpful to solder colour-coded leads to the switch contacts, such as blue for aerial, brown for VC1, pink for drain and so on, as before. The padders are returned to a tag held by the bolt securing the back of the ganged capacitor. All leads must be short and direct. Note that the type of switch which shorts all unused contacts together on any wafer may be used for S3/S4 and S7/S8, but cannot be used for S5/S6 as this will short-circuit the positive supply to chassis, via the secondaries of L2. Separate oscillator trimmers can now be used for each range, for individual adjustment of the HF ends of the bands.



View under the chassis with all optional stages fitted. The BFO board is on the lower right side, the crystal filter phasing capacitor at rear centre and the handswitch with coils for three of the four ranges at the left.

TRANSISTOR GAIN

Wide spreads in gain can be expected in some of the transistor types. The resistor R13 is to stabilise the IF amplifier against oscillation from this cause. Stability also depends somewhat on individual wiring and alignment. In some cases R13 might be omitted, or reduced in value, without instability arising. Here, it would be shown by oscillation or even loss of signals, when the IF's are peaked, or oscillation on weak signals only.

In a similar way, should the additional IF stage tend to oscillate with VR3 at maximum gain, a resistor may be placed in the circuit at the base of Tr7. Use short leads, connecting it directly from Tr7 to the junction of R26/R27. A usual value would be 220Ω to 1kΩ or so. Unnecessarily high values may reduce gain.

AUDIO PRE-AMPLIFIER

The circuit is shown in Fig. 16 and the unit is placed between the diode D1 and audio IC via C16 and VR2. The few extra components can be mounted on the space left for this purpose on the audio board, adjacent to VR2, or may be assembled on a separate small circuit board. The negative line is taken to one of the tags on the chassis.

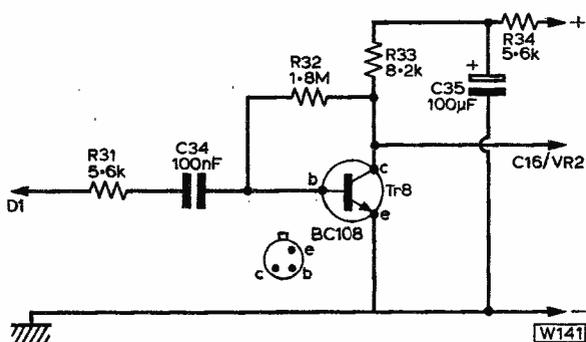


Fig. 16: If this additional audio stage is needed it can be added to the main audio board.

AUDIO LIMITER

The receiver sensitivity allows the copying of signals of under 1μV (measured at 29MHz) so sudden bursts of noise may arise when tuning across a band. These can be strong signals or static or other types of interference. The discomfort caused is particularly severe with headphones unless volume is kept well down at all times. These effects are practically eliminated by fitting the audio limiter circuit shown in Fig. 17.

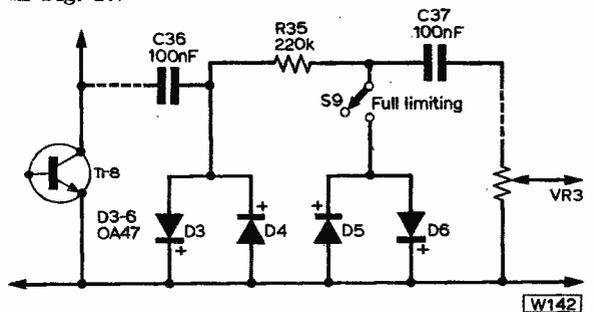


Fig. 17: Circuit of the switchable noise limiter providing partial or full limiting.

Tr8 with its associated components and gain control VR3 are already present. A small 2-way slide switch S9 is fitted to the panel above VR3. The resistor, capacitors and four diodes are supported by the switch tags. A tag on the switch mounting screw provides a chassis return for the diodes. Diodes D3 and D4 provide a permanent degree of limiting. With the switch closed for full limiting signals do not exceed a level set by VR3. As unnecessarily severe clipping of strong signals by the diodes causes a loss of audio quality, the switch allows the limiting to be reduced for general reception.

Headphones of 8 to 16Ω impedance may be plugged directly into the output jack. With higher impedance phones, a 15Ω ½W resistor can be connected across the jack socket. This can be permanently soldered in place as the reduction in signal strength with a speaker is not important. Its purpose is to provide

continued on page 964

HOTLINES

ON RECENT DEVELOPMENTS

DIAL A GAME

So you're one of the many electronics games lovers who has a 'teletennis.' But now you've got a problem—what do you go for next? A robot that lollops around the house after you pouring your Martini and lighting your cigar on command? Or should you go for something really practical like an electronic bank manager of your very own?

Stop worrying, your troubles are over; well, very nearly. An enterprising gentleman in the United States has come up with an idea which will appeal to all who love electronics games and conventional ones too. The idea is to programme a dirty great computer (he is buying it at this very moment according to reports) that can be accessed or talked to over the ordinary telephone lines. If this system gets off the ground, users will be able to dial the number and play the computer at chess, or golf, solitaire, football, chequers etc. plus word games or mathematical amusements.

The initial set-up is to be used in the New Jersey area because our entrepreneur believes that there are already a large number of people in that location who have the necessary terminal equipment to converse with the computer. Up to 32 users will be able to play their games simultaneously in the prototype arrangement.

Cost to the player/user is a suggested three dollars per hour of computer time, which is not too expensive. But before you get excited, you need the terminal equipment which, at the time of writing, sells for between £250 and £750 in the US. However, prices of this equipment are dropping all the time, so when the system—if the system—comes to England, the costs should be considerably lower by then. If you just happen to have a teletype terminal and a graphics display readout, then you won't need anything.

I can remember a senior person from the Italian company Olivetti saying (about 7 years ago) that the ultimate in home entertainment would not be a television receiver which merely allowed one to watch TV programmes. The ideal is that such a receiver shall be able to be connected to the telephone lines and

that a person would be able to study French (simply dial up the lesson required) or mathematics etc. besides being able to play games. Think I'll brush up on my boxing. I can hardly wait to ring up Mohamed Ali for a quick video punch up. (Ginsberg is the greatest!).

SPELLIN KOREKTLIE

Optical character readers have been in use for some time. The idea is that machine-printed characters of the alphabet can be read automatically by a photosensitive device and a printout obtained—or the information could be transmitted or stored etc. Japanese giant Hitachi has gone one step further with the idea. This company has produced a machine which can "read" automatically, hand-written English language and numbers. It can do this at 500 hand-written characters per second and twice as fast for machine written ones.

One of my computer orientated associates informs that a machine called the IBM 1287 (which incidentally, can only read machine-written characters) costs twice as much and operates at half the speed of the Hitachi unit.

If one links this piece of news with the last item on computer access via the telephone line, then fascinating ideas become a real possibility. Think of writing your letter and then feeding it into a machine. You dial a number and that's that; your letter is immediately printed out at its destination. Instant post and no paper involved. I wonder if the machine will curekt spellin errors?

HYPERCUBES

Say the word "microprocessor" and you're accepted as being one of the "in" crowd in electronics. These are the beasties which began rumours not so long ago about a complete computer on a single chip. The complexity of microcomputers seems to be increasing as these tiny ICs do more and more in organising the computer and its tasks. Very few chips are now required to make a computer and that number is shrinking all the time. Give the microprocessor a memory chip as a mate and you're really in business. Of

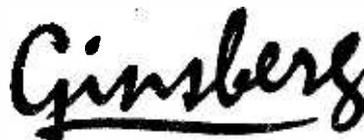
course, it wasn't long before some bright soul wondered about making up an array of microprocessor/memory modules. The latest reports indicate that someone, somewhere is quite definately building a Six Million Dollar Man—well, the head at least and certainly the brain.

The buzz word here is "Hypercube" Nope, not a gross of Oxo's, it consists of each microprocessor in the arrangement communicating with eight others. I am not joking when I say that one company has plans to interconnect 10,000 (ten thousand) microprocessor modules. Another system, currently in the pipeline has eight microcomputers in a system which should be able to handle well over half a million words of memory and can execute 3,000,000 instructions every second.

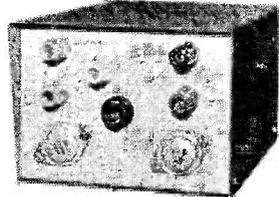
In case you're still unimpressed I'll say another secret word—Hypercube II. Correct; there's already a next generation version lurking. In Hypercube II we are talking about a system in which memory chats happily to memory, and in which the execution rate runs at around 16,000,000 instructions every second. I hear that Hypercube II is to be sold for about \$80,000. Even more impressive is Hypercube III—available for a mere \$400,000. I dare not mention the specifications of the latter. With simple pocket calculators taking the arithmetical thinking away from school children, think what Hypercube could do. Perhaps we humans will not have to think at all in the future—then we will all be politicians!

VIVE LA B.P.O.

Facts from a recent survey in the US should prove useful ammunition if you're at a party and the conversation lags a little. For example, there are more telephones than people in Washington D.C. The cost of having a telephone laid on in Japan is about £300! In France it costs around £110—and there's a 15 month wait. Vive la BPO.



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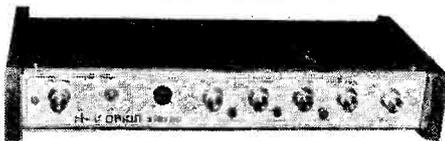
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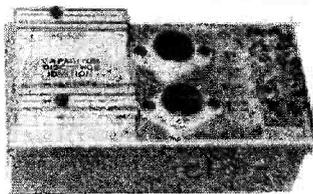
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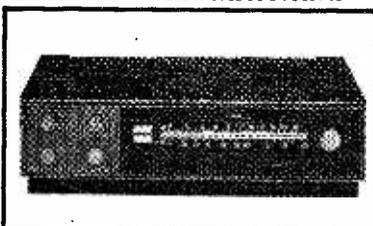
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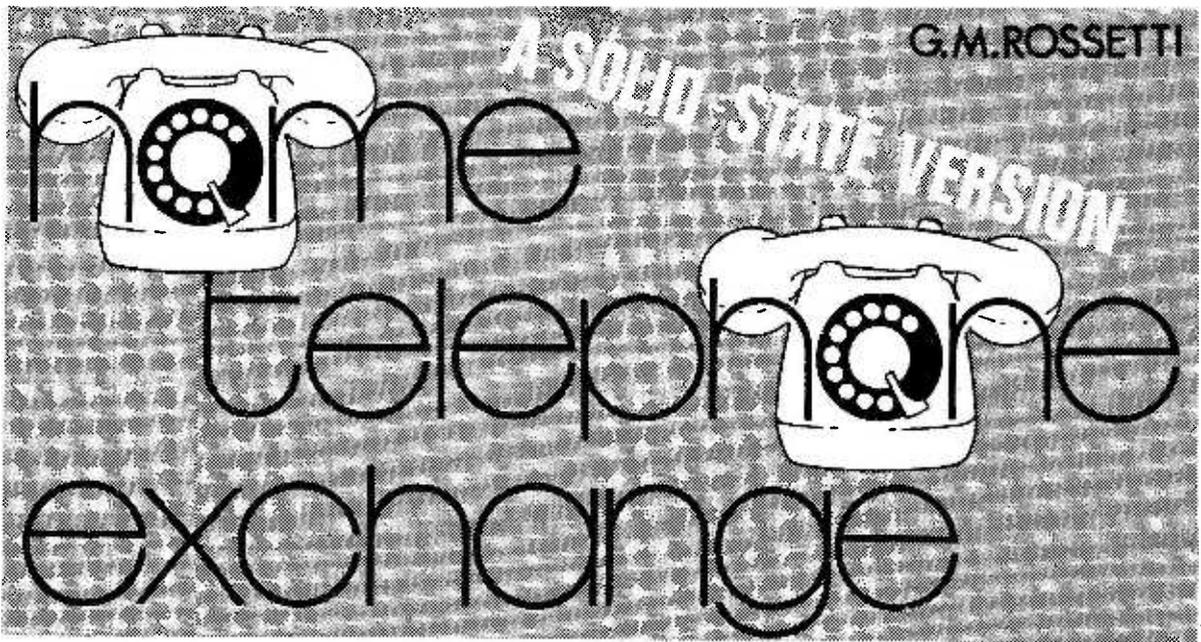
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THIS article has been written to supplement the Home Telephone Exchange published in February 1975. For a home telephone exchange however, cheapness and size are major considerations, and it is for these reasons that the circuitry described here is entirely solid state. Cost has been cut by about £6.00 by leaving out ten reed relays, shunt diodes and several other components. However two more low cost IC's are needed, a 7413 and a 7408. Also a 74141 decoder has been used instead of the 74145.

In the power supply section the 7V supply is not required, and a 60V supply has to be found. This is simply achieved, because the ringing supply is no longer required and the same transformer can be used to produce this 60V supply.

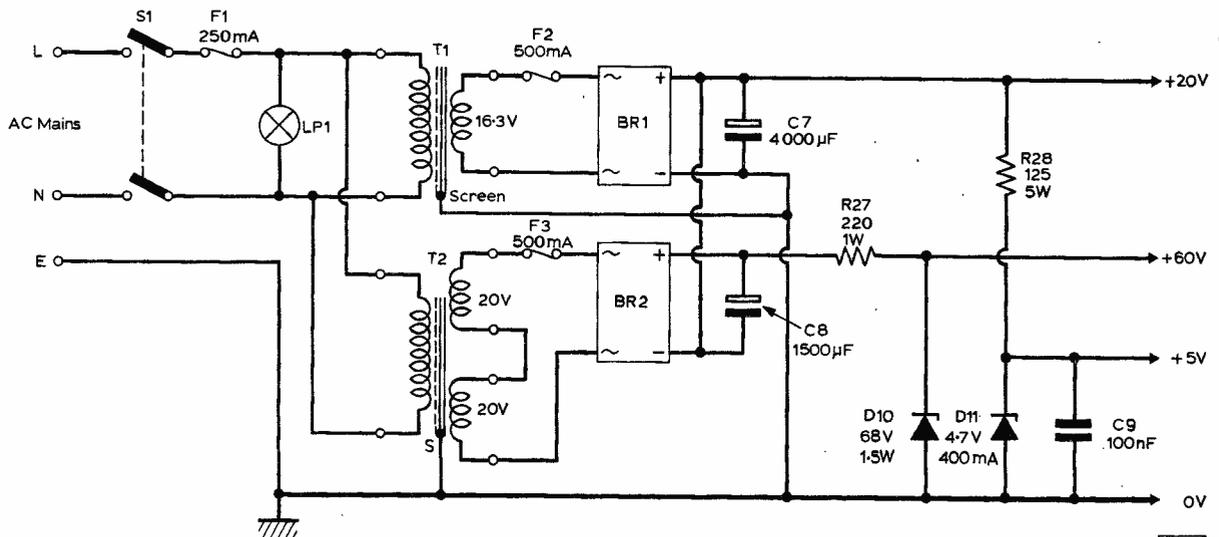
Circuit operation is identical so far as counting and generating the ring pulse is concerned. How-

ever a transistor, Tr1 is used to detect the dial pulse instead of RLA.

Circuit description

The major difference to the circuitry is in the way the selected line is rung. The binary output of IC2 is fed to the decoder, IC4, through AND gates. IC5b is normally low and until it goes high the decoder will not operate. At the end of the dial period the monostable IC3 goes high for the duration of the ring pulse. IC5a is enabled and produces a pulse train with a frequency of 16Hz. This is now inverted by IC5b and the pulses enable the AND gates of IC6. The decoder is thus pulsed on and off at 16Hz.

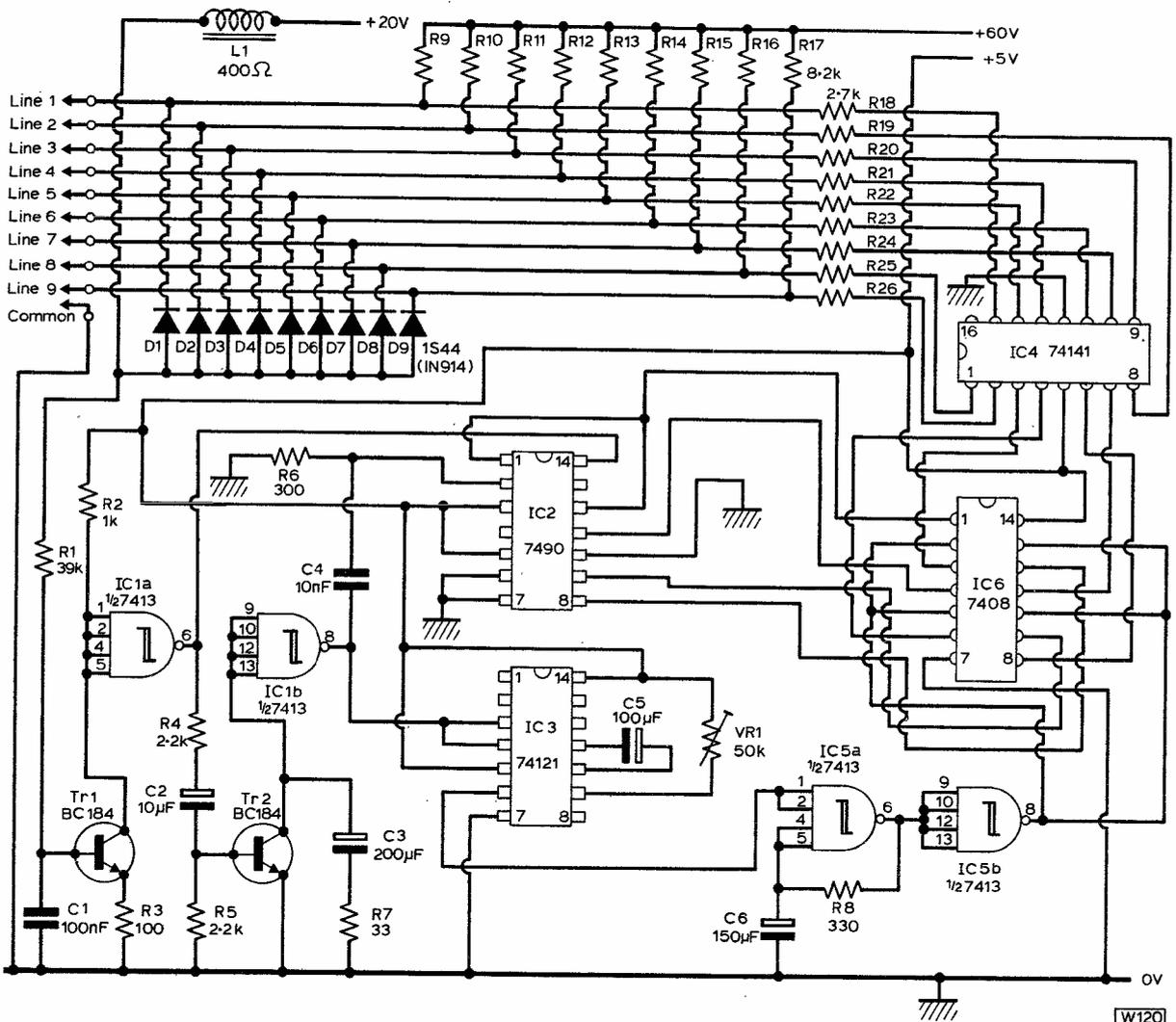
When IC4 is in the ON mode, it decodes the binary



W121

Modified power supply using both secondary tappings of T2 linked in series to give a +60V output. This is at the expense of the 'Ringing' supply.

Practical Wireless, March 1976



Complete circuit diagram of the modified home telephone exchange. Notice the absence of reed relays and shunt diodes and the introduction of two new IC's which carry out the same tasks.

output from IC2 and the selected decimal output goes low. This output is now connected to the called telephone line through 2.7kΩ resistors. Normally the line is at a potential of 60V, but when the decoder operates to the ring pulse, this drops to about 15V. The result is that a 45V AC voltage at 16Hz is superimposed on the called telephone line and this rings the magneto bell.

There are however two disadvantages, neither of which is of much significance in a home telephone

system. Firstly the transmission efficiency is slightly lowered by the shunting effect of the 2.2kΩ resistors. Secondly the bell ringing is not as loud nor as shrill as with a 60V pp voltage at 50Hz. In normal home circumstances, however, this can be an advantage! Moreover there is no possibility of the called subscriber getting an acoustic shock if the receiver is put to the ear before the ringing has stopped. In such circumstances, the AC voltage across the receiver is barely audible.

Resistors		Semiconductors	
R1	39kΩ	Tr1	BC184
R2	1kΩ	Tr2	BC184
R3	100Ω	IC1	SN7413
R4	2.2kΩ	IC2	SN7490
R5	2.2kΩ	IC3	SN74121
R6	330Ω	IC4	SN74141
All	½W 5%	IC5	SN7413
R7	33Ω	IC6	SN7408
R8	330Ω	D1-D9	1S44 or 1N914
R9-R17	8.2kΩ	D10	BZX61 68V 1.3W zener
R18-R26	2.7kΩ	D11	BZY88 4.7V 400mW zener
R27	220Ω 1W	Br1/2	1A bridge rectifiers
R28	125Ω 5W		
VR1	50kΩ min. preset		
Capacitors		Miscellaneous	
C1	100nF 6V	F1	250mA anti-surge.
C2	10μF 6V	F2	500mA.
C3	200μF 6V	F3	500mA.
C4	10nF 6V	L1	400Ω choke.
C5	100μF 6V	LP1	mains neon indicator.
C6	150μF 6V	T1	mains transformer/16.3V.
C7	4000μF 40V	T2	mains transformer/20+20V.
C8	1500μF	S1	DPST toggle switch.
C9	100nF		

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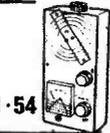


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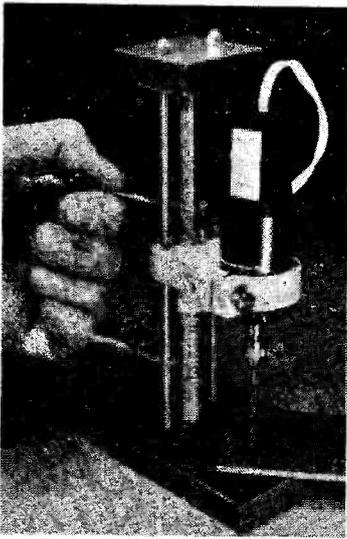
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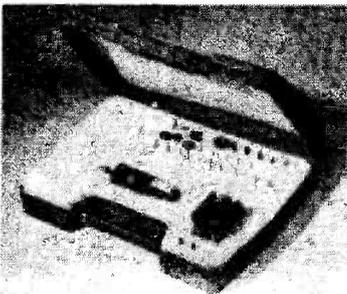
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Radio Break-through

A look at interference in Hi-Fi equipment Part 2

H. LEEMING G3LLL, FSERT, T. Eng. (CEI)

IN Part 1 it was shown how the addition of a few capacitors at strategic points could greatly reduce or even eliminate radio interference break-through in audio amplifiers.

The addition of these components cannot have added more than pence to the cost of the amplifier, but the improvement was dramatic. Previous to the modification the noise produced by my own A21 as the 'fridge cut in was nerve-shattering, but now we cannot even hear it at all! Transmitters which previously produced a deafening response from a distance of 100m or more, now hardly produce a whisper with the aerial mounted, for test purposes, in the same room as the hi-fi installation.

From the above experience it would seem that there is now no reason at all as to why audio equipment should not incorporate RFI protection measures as standard practice the component costs being negligible. From the makers point of view RFI protection has much to recommend it. Apart from gaining greater customer satisfaction, manufacturers can, it would seem, reduce the cost of returns under guarantee by introducing these simple measures. Transistors, as readers will be aware, do not usually fade out like valves but suddenly "depart" leaving little evidence of the reason for their breakdown. Indications would seem to point to the fact that many transistor failures have been due to the effect of "spikes" on the mains supply voltage and there is direct proof that at least two hi-fi amplifiers blew their driver transistors at the same instant as the mains suppressor capacitor broke down, being a very strong indication of some high voltage transient.

Certainly the Sugden amplifiers, whilst being quite reliable in the first place, seem to have developed an almost phenomenal reputation for reliability since the RFI components were put in as standard and we can only presume that this is due to these components excluding mains transients from the circuit.

EXTERNAL CURES

Having now seen how protection can be built into audio equipment, let us next look at what can be done externally when the makers' attempts (or lack of same!) at RFI protection prove inadequate under a particular set of circumstances. The natural reaction of the non-technical user to the advent of RFI is to blame the source of radiation. Whilst it might be possible to suppress refrigerators and other switched appliances you can not, as suggested by one dealer, in reply to an RFI complaint, "get the GPO to suppress the transmitter" as the whole purpose of transmitting equipment is to radiate electro-magnetic waves. Apart from the very

occasional case therefore, where it may be possible to minimise a particular RFI problem by altering the type or position of the transmitting aerial, there is very little that the operator of a licenced radio transmitter can do to cure RFI problems. The onus of solving the trouble therefore falls on either the user of the audio equipment, or on the dealer who has supplied it.

It is worth pointing out here that it would seem that under recent legislation the retailer is liable to see that goods sold are "reasonably suitable for the purpose for which they are intended". I am no lawyer but I take it that if a customer of my company suffers a complaint of severe RFI with new high fidelity equipment which we have supplied, my company is at least morally liable, and more than likely, legally liable to sort out the problem. (*Perhaps on this point any reader who is better qualified to express a legal opinion might like to drop a line offering his comments to the Editor, whom I am sure will find room to publish anything dealing with this rather interesting question.*)

OUTSIDE LEADS

Fortunately, most audio system RFI troubles are due to signal pick-up on external leads which act as aerials. In general, low frequency radio signals tend to come in via the mains supply, signals at say 1 to 10 MHz via the speaker and VHF aerial connecting leads, and higher frequency signals tend to be received on the gram and radio connecting leads. This must only be taken as a very rough guide though, and the only way to be sure which lead is causing the trouble is to disconnect them one by one so that it can be ascertained as to how the RFI is entering the circuit.

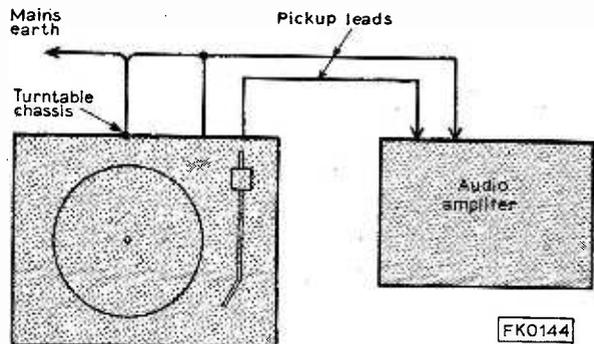


Fig. 5: If a turntable and amplifier are wired as shown here there is a risk of interference problems due to the common earth wire.

Where the loudspeaker leads are concerned, these should either be shortened to only a few inches whilst tests are made, or the leads should be disconnected externally and a test made via headphones fed through isolating resistors of say 220Ω each, so as to "choke off" the 'phone leads, from an RFI point of view. Don't forget to try disconnecting the earth and mains leads by pulling out the three-pin mains plug quickly, whilst the unit is operating. If the RFI fades out with the music, coupling via the mains is not to blame, but if it clears for the second or so that the equipment continues to operate from the charged up reservoir capacitors it can be taken that the interference is arriving via the mains or earth connections to the plug.

Whilst disconnecting leads do not forget to try disconnecting the FM aerial feeder, even if the trouble only occurs on gram. The coaxial cable makes a very good medium and short wave receiving aerial, and in some cases of RFI, the trouble will disappear if the VHF aerial is disconnected whilst playing records!

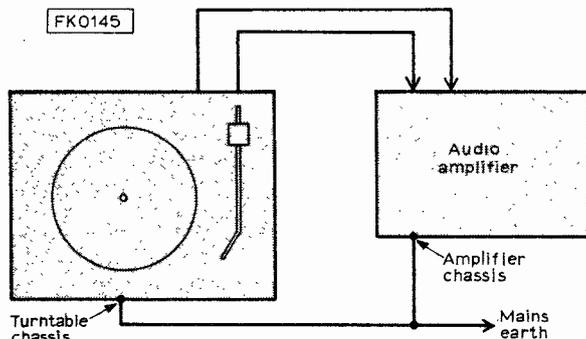


Fig. 6: Here the earth wire to the two chassis is separated from the pick-up leads.

Once it is established as to which leads seem to be causing the trouble, a general tidying up of the system can be tried, and will often work wonders. Leads are frequently much too long tending to increase their effectiveness as aerials. At this juncture however, do **not** cut the leads to shorten them as the extra length may be needed, but coil any excess length up into the smallest possible separate coils immediately at the rear of the amplifier. Besides reducing the effective length of the "aerial" such a coil tends to act as an RF choke, and where the trouble is not too bad, may be sufficient to effect a cure.

If the RFI appears to be coming along the gram pick-up leads it is as well to examine the earthing arrangements, as wiring the gram unit as Fig. 5 tends to send any RFI received on the earth lead straight into the amplifier's input. Wiring the unit as Fig. 6 is far less likely to lead to trouble.

TIDYING UP

Having generally checked over the wiring of the system, tidying it up as necessary and sorting out which leads still seem to be acting as aerials, the final approach is to stop the offending leads passing on the radio frequencies to the amplifier. This can be done quite simply by the use of ferrite cores or ferrite aerial rods, as shown in Figs. 7, 8 and 9. If plenty of spare lead is available the original lead can be wound round the ferrite, otherwise adaptors

can be made up using a length of lead, a plug and a socket. The number of turns used is not critical and few turns only will be required to cure troubles in the VHF range, whilst 20 or 30 turns may be needed to cut out transmitters in the short wave bands. Note that the turns of wire should not be overlapped, so whilst a full core will be reasonably effective, even on the medium wave bands, two in series may occasionally be necessary at the lower frequencies.

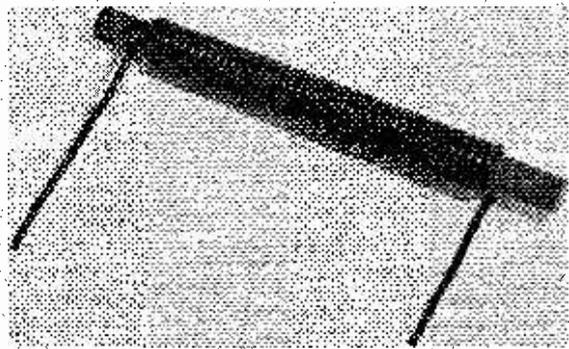


Fig. 7: Interference being picked up on a lead can often be reduced or eliminated by winding the lead on a ferrite rod as used in ferrite rod aerials.

Whilst on the subject of frequencies, it is almost too obvious to state that a much more intelligent approach to any RFI problem will be made if the frequency of the transmitter being received is known. With broadcasting stations this should not present much difficulty but with other stations, such as taxi services, details of the frequency may not be readily available so perhaps the simplest way is to ask the operators! Failing this, a glance at the aerial system used by the transmitter will usually give some indication as to the approximate frequency. Stations using the VHF band usually have aerials with elements not more than a few metres long, whilst stations on the short wave bands will either use wire aerials or beam aerials with the elements 5m or more long, usually.

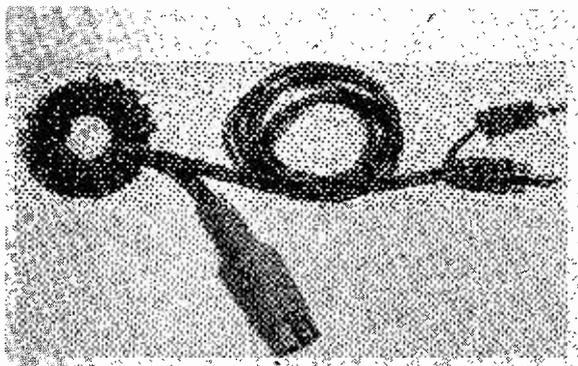
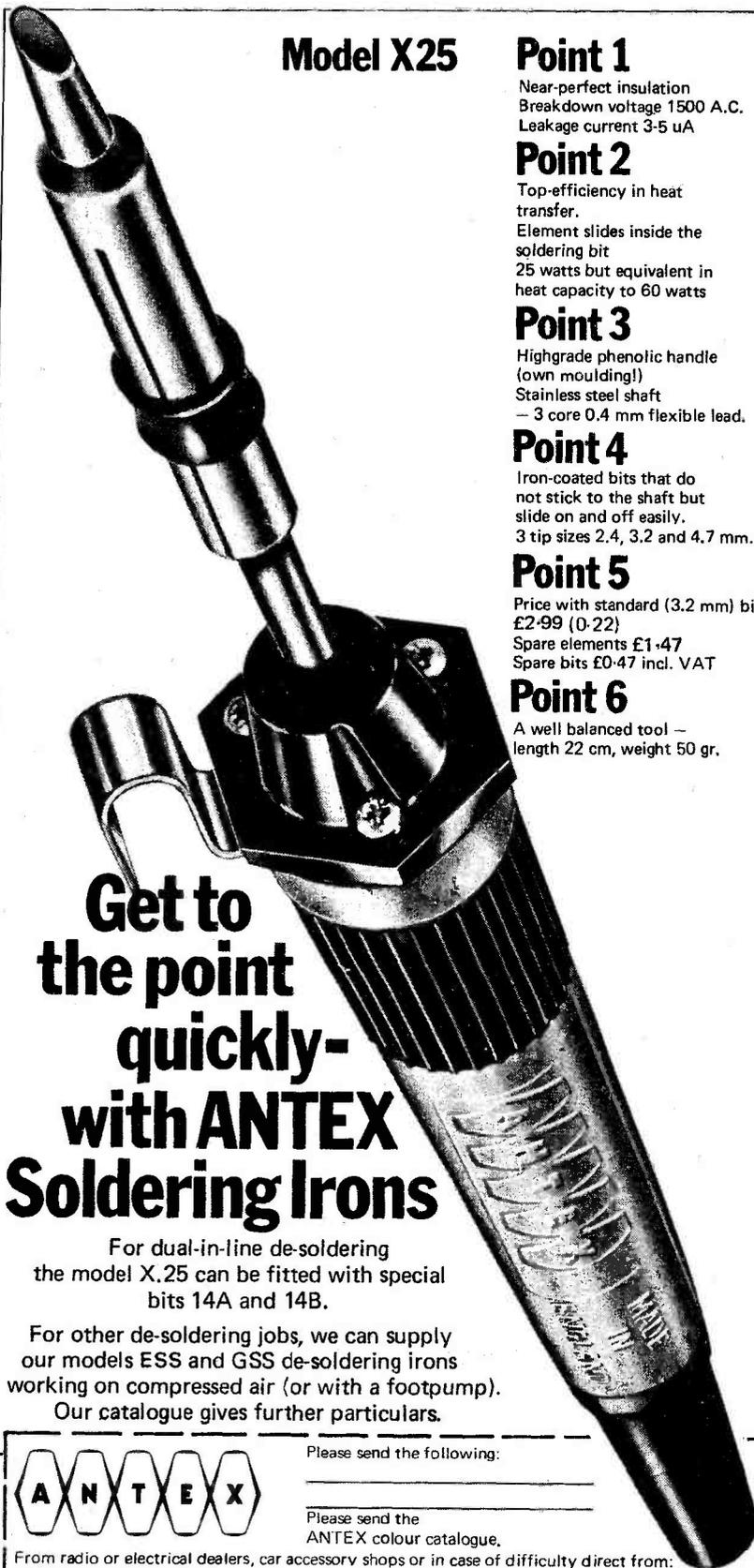


Fig. 8: Twin leads wound on a ferrite ring will be even more effectively decoupled than when using a ferrite rod.

The ferrite core treatment will be found extremely effective and is especially advised where it is not desirable to make any internal alterations to equipment. It is equally applicable to all the inter-connecting leads and also functions well if used on the mains lead to act as a mains filter. As an alternative, where troubles due to interference arriving via the mains



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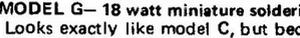
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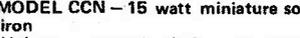
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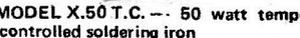
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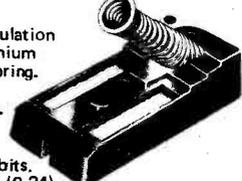

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MODEL CCN — 15 watt miniature soldering iron
Unique — ceramic shaft — no measurable leakage — capacitance 30 pf. Tested at 2000 volts A.C. Length 16 cm. Complete with standard iron-coated bit 2.3 mm. £3.21 (0.22). 4 other slide-on and-off bits available from £0.45 Spare elements £1.69. Suitable for the most delicate soldering job imaginable.


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lead are concerned, a commercial type mains filter of the type used to suppress vacuum cleaner interference will also be found quite effective.

As mentioned previously it is quite possible for the coaxial feeder of the FM aerial to pick up local radio signals. The problem is to pass on the wanted FM signal, which is "inside" the cable, without allowing the unwanted signal, which is on the outside

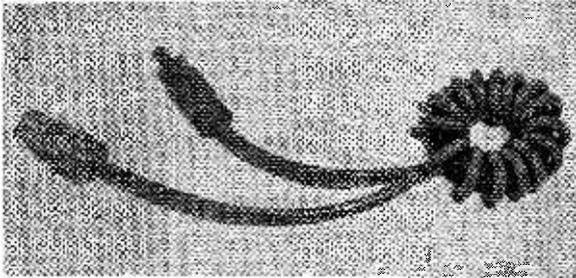


Fig 9: Coaxial leads can also be wound on a ferrite ring. The leads should be anchored to the core with fine thread.

of the cable, to pass. This can be done as shown in Fig. 10, whilst a practical transformer using a miniature ferrite core, and another type of transformer using only coaxial cable is shown in Figs. 11 and 12. The ferrite transformer gives the minimum loss of wanted signal with the maximum attenuation of RFI, but the coaxial Faraday loop has the advantage of simplicity and does not need any special parts.

SELF-HELP

Perhaps it is worth noting that curing RFI does take a lot of time and patience, particularly as the co-operation of an operator of a radio station may have to be sought, to make test transmissions. The main requirements for solving the problem are not

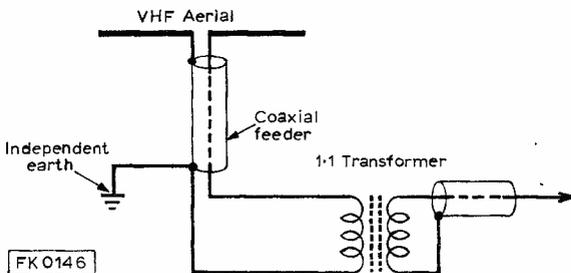


Fig. 10: Method of reducing interference introduced on aerial feeder, using a 1:1 ratio transformer.

technical skill, but trial and error which can be extremely time consuming, hence unless the equipment is new and is attended to free under guarantee the cost of getting an outside technician to do the work for you, could well be exorbitant. The best approach therefore is self-help, although it is always worthwhile writing to the manufacturer of the equipment to see if they have any standard remedies that are simple to apply.

If, after trying your best, you do require further help it will usually be well worthwhile having a word with the local Post Office interference engineers.

Where the amateur radio operator is concerned the problem is often in "reverse", being one of a

Practical Wireless, March 1976

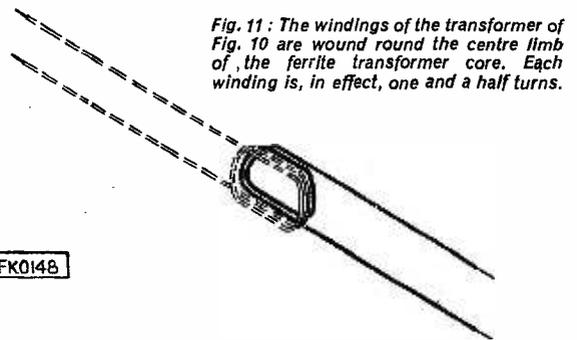
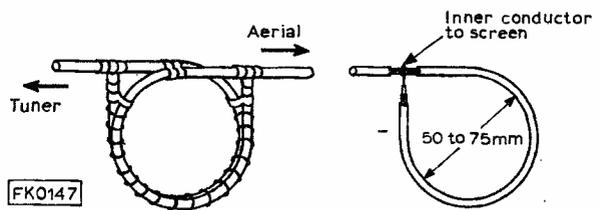


Fig. 11: The windings of the transformer of Fig. 10 are wound round the centre limb of the ferrite transformer core. Each winding is, in effect, one and a half turns.

FK0148

neighbour's complaint of "interference". Here the difficulty is one of, first, delicately pointing out the position. A statement on the lines of "Yes, it is a nuisance, lots of audio equipment pick up refrigerators and radio transmitters due to inadequate protection in the design" may be a good start, as the owner of an inadequately protected high-fidelity installation is more than likely to be suffering from the electrical noise from his own refrigerator. If the equipment is relatively new and under guarantee, suggest that the owner contact his dealer and state that test transmissions can be made to help them cure the fault. Don't get into any



FK0147

Fig. 12: Method of constructing the Faraday loop form of coupling transformer.

argument, and if the user or the dealer tries to argue the position, suggest that they contact the local Post Office engineers for an independent opinion.

On the other hand, where the complainant takes a reasonable view of the trouble, especially if the equipment is out of guarantee, a little help is a very good way to build up good neighbourly relations. With the increase in sales of audio equipment, no active amateur should be without knowledge of the problem, and in this connection a small stock of ferrite cores is very advisable, so that any troubles can be cured at an early stage.

LEGISLATION

As a final point, it is interesting to note that at the moment an attempt is being made to get legislation passed in the US Senate to the effect that it will be illegal to sell, in the United States, audio, radio and television equipment which is not protected against the unwanted reception of local radio transmitters. If this bill should become law there is no doubt that manufacturers in other countries will have to take note of it, or loose a vast export potential. Hopefully, such a move could well do much to solve the problem on a world-wide basis.

The larger ferrite cores are available from Waters and Stanton Ltd., 31 Spa Road, Hockley, Essex, for 30p each plus 30p p/p any quantity. The small core for the transformer can be obtained from the author at Holdings Ltd., 39 Mincing Lane, Blackburn BB2 2AF for 10p plus an SAE.



Indian reader

I am a radio hobbyist and have occasionally read old copies of Practical Wireless which has captured my imagination. I have also constructed some of the projects described in your magazine. However, nowadays I don't even get those occasional old copies.

Although I would dearly love to subscribe to PW, I can't due to recent restrictions. To get by this problem I was wondering if any of your readers would be kind enough to offer gift copies, which will be fully compensated for, by either similar copies of an Indian journal or through supply of any material of interest.

Failing this, I would be more than happy to receive mailing of old copies. Many thanks.—**CT Aloysious Williams, c/o Champadi Trades & Agencies, Champadi House, No. 1/884, Cochin-1, S. India.**

Buzz words

After reading your editorial 'Software Gobbledegook' I felt that I must attempt to put the situation in perspective. The Microprocessor is regarded by those who use them as 'God's gift etc.' because it is the solution to problems of control and/or computation that would otherwise require costly hard-wired logic, but for which, it is hard to justify full Minicomputer control.

The Microprocessor cuts development time of a project by allowing the designer to wire-up his circuit with numbers rather than copper and this brings two main advantages. First, any modifications that are required during

development can be implemented more quickly, and secondly, a system once constructed using such a technology is quickly repeatable.

There are a number of Microprocessors on the market, all doing a similar job but often in different ways and it is the task of the designer to select that which is most suitable for his task. To embark upon this daunting venture the engineer must first become educated in this 'Software Gobbledegook' and it was with some fear that I commenced this self-education.

The 'Computer Language' worries the newcomer because it is strange, and it is all the more strange because he has never even heard the words before. He has never needed to hear the words before! Not long ago the word Laser did not exist, it was created out of five other words to name a device that has had a considerable effect on our technology. However we do not ridicule the word, because it has been completely assimilated into our vocabulary.

Although it is hard to swallow, my point is that Mr Average Engineer will have to carry on complaining about not understanding these devices because apart from the enticing propaganda, no short article will ever convey the operation of them. The only way to come to terms with them is to get down and understand the 'software Gobbledegook'.

Systems have now reached a state of complexity that often call for these annoying 'Buzz Words'. They have been invented to combine a patching-up of holes in our language and stimulate memory recall of certain operations. They have resulted in 'Buzz Word artists' who talk in them because they are the sole tools of their trade. The only solution is to learn to talk them yourself; become your own interpreter.—**Brian Frost BSc (Paignton).**

6p per page

I have noted the inserts in Practical Wireless CQ columns for back issues of PW which you no longer supply. I have a library of over 20 years of PW (and other mags. such as Practical Electronics, Practical Television etc) and would like to supply copies

of wanted articles to help out those readers who cannot obtain back issues, or have no easy access to libraries.

I can only supply copies of specific articles, not back issues, but it would be of help to some of your readers.

I think a charge of 6p per page would be reasonable, and hope that you will mention the service in your letters or CQ columns.—**J Heinrichsons, Belle Vue, Kirkpatrick Fleming, Lockerbie, Dumfriesshire.**

Inconsistent prices

I am wondering if you are aware of the excessively wide price ranges offered by your advertisers. For my sins I run a small evening institute class for budding electronics enthusiasts, and needing some OC71 transistors for a project I went into a well-known retailer's shop. On being told that the OC71's were 25p plus 25% VAT I decided that eight would be enough.

On reaching home I thought that, out of idle curiosity, I would consult my Jan '76 PW to see how I had fared. The price range for six suppliers taken at random ran from 10p to 18p, all plus 25% VAT. I am trying to allow for the 'caveat emptor' aspect of it all but I am still left with the feeling that the whole thing is more than a mild racket. I am aware of the 'old' and the 'new' stock and 'prices ruling at the time of despatch' platitudes so regularly trotted out but having allowed for all this one still has the conviction that we are being 'taken for a ride' in no uncertain terms!—**B A Pearson (Beckenham, Kent).**

While sympathising with Mr. Pearson it must be remembered that the ads. in PW are finalised weeks before the date of publication of a particular issue. The transistor advertised for 18p could very well cost 25p by the time it was bought by Mr. Pearson. Transistors range from brand new ones by reputable makers to unmarked ones of dubious characteristics which may very well account for the variations in price. Would any of our advertisers care to comment?—Ed.

GENERAL SERVICING

An occasional series by LES LAWRY-JOHNS

chatting this time on—

2-CAR RADIOS

EARLY car radios were fearsome devices seemingly weighing as much as the vehicle in which they were painstakingly fitted! First, the power unit probably sited under the bonnet so that the buzz of the vibrator did not intrude into the plush comfort of the interior. Next, the amplifier, somewhere near the front passengers' feet or knees, with only the tuner fitted into the dash, and the loudspeaker cunningly concealed in or around the glove compartment with perhaps a second under the rear parcel shelf.

Dismantling this lot for service was the work of many a terrified junior and the bench service was a daunting prospect if only the number of screws holding the screening covers in place was considered! Fortunately we do not have to think about such complication in these days of solid state compact presentation but this has its own drawbacks as our fingers do not get any smaller and our eyes do not magnify on their own.

Getting started

This article will assume the radio is not more than about ten years old, as things can get complicated if we have to consider hybrid designs which abounded before this. Therefore we have an all-transistor set needing only the addition of a loudspeaker and an aerial to get things going from our bench supply of a fairly steady 12V or so. The first essential is a means of **stopping** it working! A quick-blow fuse of some 1A must be included in the supply line to prevent damage should a fault develop or the supply accidentally reversed, as human beings are remarkably slow at switching off when the smoke starts to rise!

Let us start therefore with an inoperative radio. If the fuse has failed and it can be inspected, it is instructive to have a quick look at this. If it is severely blackened it is likely to have been underrated in the first place or may be of the anti-surge variety (small built-in spring) and the set is likely to have been damaged more than would have been the case had the correct type been fitted. The first thing to ascertain is whether the radio has previously worked in the vehicle or if it has just been fitted. If the latter is the case it is obviously possible/probable that the radio is wired or switched for positive earth and the vehicle is negative earth.

If this has happened it may only be necessary to reverse the polarity of the set supply to get it

working, although the supply input filter choke may appear to be the worse for wear. It is quite common for the supply input to be taken to this type of choke before the on/off switch but there are variations. The choke itself is pretty robust and can take a heavy overload without becoming open-circuit but it may appear somewhat discoloured and even swollen as a result. On the other hand, on/off switches are not so hardy and will often be found inoperative as the result of an overload, or inoperative due to no other reason than their own fragility.

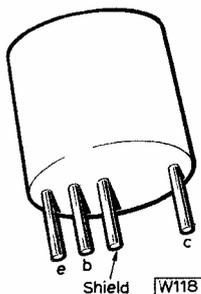
Some more up-to-date radios have a safety diode which will blow the fuse if the wrong polarity is applied, which can also short out on its own account and blow the fuse anyway, whilst some have a bridge rectifier which applies the correct polarity to the set whichever way it is connected. Usually, however, there is a cross-over switch marked + and - or a means provided internally to reverse the supply. Earlier Radiomobile and Motorola sets of 1964 vintage needed two separate lots of lead swops, one on the rear panel and another on a small strip near the on/off switch. Later versions needed only two leads to be swopped over and then this was changed to a carousel which was rotated to point to the required polarity.



—human beings are slow at switching off when the smoke starts to rise—

Common faults

On the subject of these earlier Radiomobile and Motorola receivers, they did exhibit one or two very common defects which, if known, can cut servicing time by half. One is the habit of AF117 transistors to develop collector to screen shorts. It is a fair bet that if the volume control can be heard to be operating when switching on or a nice hum is heard when the centre contact of the control is touched, one of the AF117 transistors has this defect. Happily, the screen lead can be nipped through without much trouble and can likewise be reconnected if desired, such disconnection not introducing instability or changes in alignment.



AF117 transistors can develop a short between the collector and the screen. Cutting the screen lead-out can cure some of the problems that arise.

It is a matter of moments to inject signals or make disturbance tests working back from the detector through the IF stages (or stage, in some cases) to the mixer-oscillator and then the RF. Once the stage has been identified the lead can be nipped in the bud to restore normal working. Looking at the base of an AF117, there are three leads close together, the screen being the last of the three and in the centre of the transistor, there being a gap between this and the collector which is the remote one.

Having made this point we hasten to add that there are lots of other faults which can occur to produce the same symptoms and we do not wish a horde of berserk wirecutters to descend upon innocent transistors in the belief that one snip is all that is needed to restore cheerful news from Radio 4! Oh! no, many a slip 'twix cup and snip. The more routine tests will be described later and should be followed when there is any doubt at all. Short cuts (no pun) are all very well but are no substitute for logical stage by stage testing.

Intermittent faults

Another common and very irritating fault is that which comes and goes very intermittently. The following case is an illustration. "My set will go perfectly for days and then suddenly it will go quiet so that I can only just hear it. Sometimes I can switch it off and then on again and it will be fine, another time I can't get it back no matter what. My brother reckons its the power valve as it often happens when I go under a bridge". We write, "intermittent reception" on the label and assure the customer that his brother could well be right since bridges are not all they should be nowadays but we will put it on a soak test to see what it does.

The customer then goes home to tell his brother



—a horde of berserk wirecutters descend upon innocent transistors—

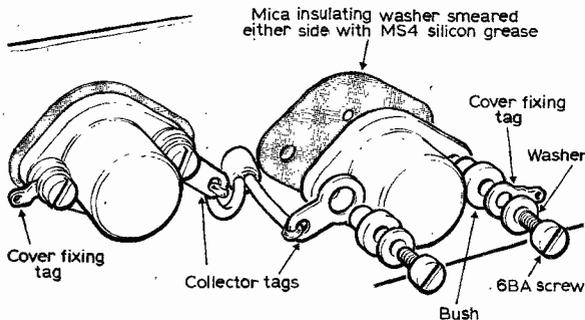
that he's a little worried because we must have thought he meant a bridge over a river and we were going to try the set in a bucket of water. Thinks, "Still, if they muck it up, they'll have to give me another one, won't they?"

On test, the set may behave itself for a time or may go quiet as described until disturbed by test signals or voltage readings being taken which may restore normal signals, again for an indefinite time. This can be most annoying to say the least but sooner or later it will go quiet (not right off) long enough to locate the offending stage. In all probability the source of the trouble will be found around the final IF transformer and that one of the coil cores will not tune. At this point the sound may well come back at full blast and the coil core will then tune. This is because the seat of the trouble has been disturbed. The circuit shows that each coil is shunted by a 400pF capacitor. One of the capacitors is becoming intermittently open circuit and will therefore have to be replaced.

To do this it is necessary to remove the solder from the tags on the print including the tags of the screening can. Once removed the can can be dismantled to reveal two small capacitors sitting on top of the coils. If one has the patience and industry to get as far as this, no further advice is needed except to say that both capacitors should be replaced and that the value is not unduly critical (we usually fit 390pF as we have these to hand as a rule) since the final tuning is by means of the cores. The fact that the earlier IF stage uses identical capacitors of course means that these could equally be responsible. However, we have not found this to be the case and that is the can nearest the volume control (on a separate panel) which has been found to be the one hiding the offender. This, of course, relates to the Radiomobile 900 Motorola 717 and associated models only, and similar faults in later models and other makes will almost certainly be due to other causes.

Coming much more up to date and still concerning Motorola and their different models in the 112 range, now completely different to Radiomobile, we find the majority of troubles are due to transistors, not now

quite so easily dealt with. The output transistors are bolted to a separate heat sink screwed to the panel at each end, with the transistor leads going through the panel in neat little groups of three. Having established that one of the output transistors is at fault, the task of replacing it, or them, at first sight appears daunting. In actual fact it is not at all difficult once one accepts that all three must come out at once complete with the heat sink. Using some sort of solder-sucker or desoldering braid, remove the solder from all nine contacts, remove the two screws holding the heat sink and lift the lot out. Having removed the defective item(s) one then has to nicely bend the lead outs so that they all go into their respective holes without too much fiddling. It is often the case in these models that the output (and audio) is in order however and a hum test at the detector diode or volume control will confirm this.



Close-up of an output transistor assembly. Re-assembly of the bits in the right order calls for a certain amount of care.

We then have to check through the IF stages with signal injection followed up with voltage readings to ascertain the point where the signals stop and the voltages are wrong. Nine times out of ten one of the small black transistors will be found at fault. The actual type number may be almost too small to see but it will probably be something like ED1502C or some such number. There are a host of suitable replacements in the range of NPN IF transistors with or without forward gain characteristics. If the stage is AGC controlled, fit one with forward gain suitability; if it is straight biased fit one without. If in doubt use a BF241 or equivalent.

This assumes the voltmeter has said that there is something wrong and that a "cold" ohms test confirms that the transistor is defective. But, there are times when the signals stop at a particular stage and the associated transistor cannot be faulted. The particular IF transformer shows continuity of windings but one winding seems to be almost a dead short. So you take it out and guess what . . . a little silver capacitor (just about where we came in, isn't it?). It's probably 390pF too! Surprise! Surprise!

The Pye-Ekco series

Another popular range of car radios came from the Pye stable, differing in presentation and facilities yet following a common pattern of basic circuitry. From the front they could be recognised by the push button on/off on one side and the wavechange on the other and from the rear by the AD161-AD162 output transistors, sometimes covered by a plastic housing. Typical models would be Pye 2070 or Ekco CR938.

Polarity change over is effected by swopping over the green and blue leads, roughly behind the volume control, and access is by means of removing the 6BA screws from the rear and swinging up the covers. Access to the components under the push button assembly at first sight appears a formidable task but in fact presents few problems as the whole unit can be removed once the four leads are removed from the rear and the front (8BA) and rear two screws and pillars are taken out. Usually this is only necessary when it is desired to replace the BC108 audio preamplifier, which isn't very often.

The IF module which occupies the rear centre gives very little trouble and nor does the associated circuitry. It is fair to say that most faults which do occur can be rectified with only the covers swung open. These faults seem in the main to concern the output transistors, AD161-AD162, and the driver AC128. In nearly all cases where the supply fuse has blown (and not due to connecting to the wrong polarity) the output transistors will be found at fault.

Usually the AD162 will be found to have an emitter-to-collector short. It is rare to have to replace any resistors as the only low value one is that between the base pins (10 ohms) which incidentally must be correct. There are no emitter resistors to cook up.



—the task of replacing it appears daunting—

Usual routine is to remove the base and emitter leads, test the transistors to ensure that these are indeed at fault and then replace them as a pair, together with the AC128 which could well have caused the trouble in the first place (although it may bitterly deny this). Replacement of one of the output pair may prove less costly but in all probability the thing will fail again in a short time and therefore prove even more costly both in money and in goodwill. When tests tend to suggest that non-operation is not due to a fault in the output or driver stages, it is likely that the BC108 is at fault and a meter check on the print side, having identified the base, emitter and collector tracks, may well prove this to be the case. It should be appreciated that a fault in

the preamplifier stage can shut off the succeeding stages or cause the output to be very weak and distorted.

General notes

It is unfortunate that the average car owner tends to regard fuses as pieces of thick wire and that any one will do provided it is about 35A! The fact that the type of radio we have been considering needs a fuse link of no more than 2A is often ignored or just not realised. The consequence is that in the event of a short in the set or the set being incorrectly connected, a heavy flow of current looks for the weakest point and all too often this is not the fuse. Therefore we often find that when the set is connected up for test, it is evident that although the supply is being applied, it is not getting very far. It then becomes necessary to trace it from the input through the choke(s) to the on/off switch.



—thought we were going to try the set in a bucket of water—

If the choke is intact, but the switch is dead, it is very likely that the print is being used to connect the two and that this has curled up and died in some quiet corner of the panel. If a lead is used the switch may be blown out or the switch may be intact and the return to the panel somewhere along the print is open circuited. This is particularly the case in some of the very small sets imported from the Continent generally, and indeed some of the print is deliberately made weak at one point so that the break will occur here.

Loudspeaker wiring

From time to time we still come across loudspeakers which have one speech coil tag earthed to the speaker frame. In one case we found that this was the reason why the fuse failed when the set was fitted in the car but worked well on the bench. It should also be borne in mind that loudspeakers in cars are subjected to extreme of heat, cold and damp which can distort the speech coil thus causing it to rub against the pole-piece. As the body of the speaker could well be earthed this could give rise to the above mentioned trouble.

Incidentally, domestic audio systems, such as I discussed in the first part of this series, often suffer from a form of distortion not easy to describe but easy to recognise, usually confined to one channel in a stereo system or, more precisely, to one loudspeaker. With the volume well up the effect is not so noticeable but as it is reduced the effect is more obvious and objectionable. Having changed the speakers over to confirm that only the loudspeaker is to blame, one is faced with the fact that it will have to be replaced. Taking it out of the cabinet and applying pressure gently on the cone it will be heard rubbing against the central magnet. This is usually caused by heat (too loud, too long!) which has distorted the speech coil, or perhaps it is just another one which was never centred properly in the first place!

Cheaper radios

A large number of imported sets, usually from the Far East, are or were cheap to buy but rather expensive to repair. The majority suffer from a burned-out output stage and the design is such that the repair involves not only the replacement of the output pair, usually equivalents of the AC128, but also the replacement of up to four resistors at the same time. Such a repair is rarely worthwhile and should not be undertaken other than as a self inflicted exercise!

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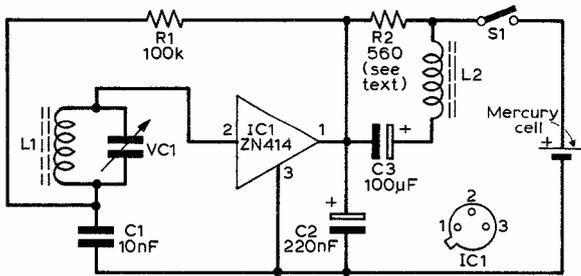
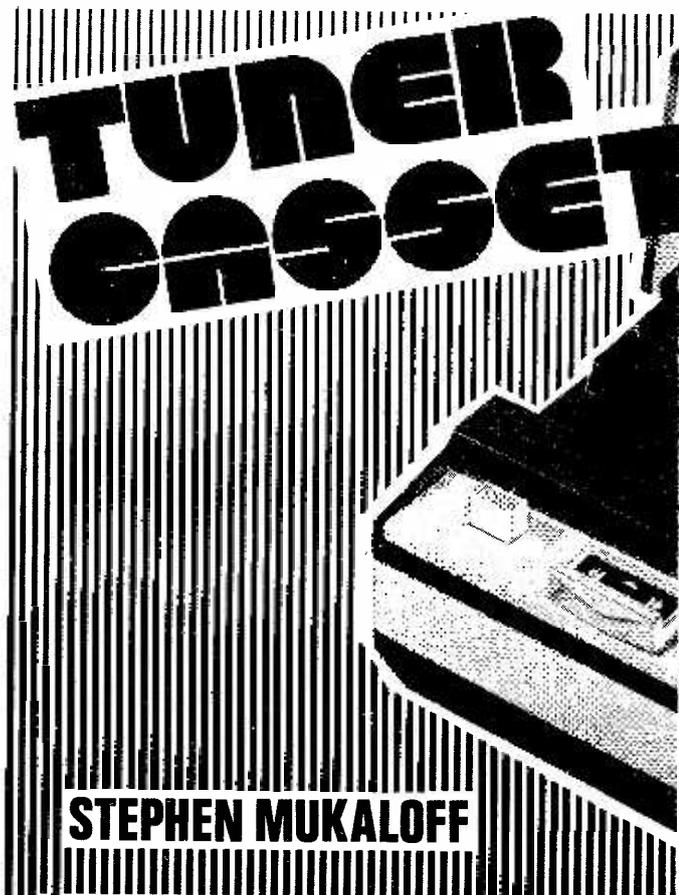
ON SALE IN MARCH

HAVING got thoroughly fed up with playing my small collection of tapes over and over again I had a yearning to be able to listen to some of the radio programmes by means of my cassette player. I had made up a simple radio tuner and fed it into my audio hi-fi system and it worked, after a fashion.

One day I had bad tape-jamming trouble in a cassette. As I fixed the tape and was putting it back together again I realised that the two parts of the case were held together with four screws and it suddenly dawned on me that an empty cassette might, just might, be a home for a radio tuner. The tuner would just be pushed into the player like any ordinary cassette. Problems immediately loomed up, most of which were concerned with the very limited height available for components inside the cassette.

I remembered seeing adverts for the Ferranti ZN414 integrated circuit that seemed to be almost a complete radio in itself. That would go in the cassette as would a single mercury cell and that was supposed to be enough for a ZN414. Flat ferrite rod, instead of the more usual circular type, was available so that headache was removed. But, how to connect the output of the tuner, presuming it worked at all? I had made up my mind that the cassette had to snap in and that no other external connections could be tolerated.

Normally, the tape, carrying a varying magnetic field, passes in front of the head inducing currents which are amplified. In effect the tape is a one-turn primary of a transformer. The solution seemed to be to construct the equivalent of a head which would automatically couple to the head in the cassette player when the tuner cassette was pushed in. The tuner head would carry the output from the radio receiver.



W144

Fig. 1: The circuit of the Tuner Cassette is very simple. The output coupling coil is shown as L2.

Although the drain on the mercury cell was very low, around $300\mu\text{A}$, it was felt necessary to include a switch operating automatically when the cassette was inserted or removed. In the end the switch turned out to be a short piece of phosphor bronze wire!

Owing to the very high input impedance of the ZN414 a single tuned circuit at the input provided good selectivity. In ordinary crystal sets and simple transistor radios the tuned circuit is quite heavily damped producing the poor selectivity that is the usual complaint with these circuits. The frequency range covered by a parallel tuned circuit with a

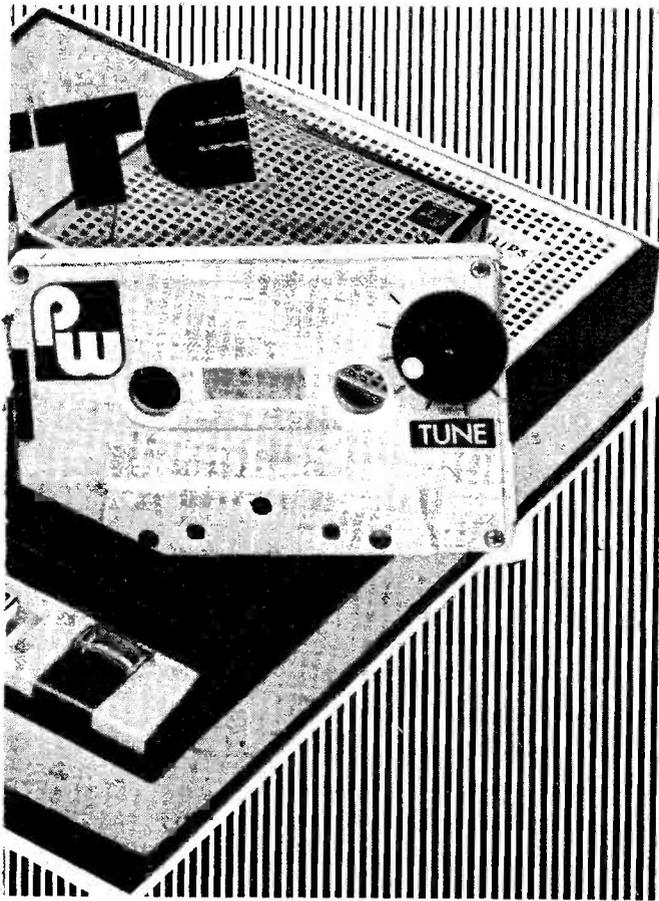
variable capacitor is equal to the square root of the ratio of capacity change (minimum to maximum). For instance, if the capacity range is 30 to 270pF the tuning range will be root $270/30$ or 3. If a coil is wound so that the LF end of the range is, say, 500kHz then the HF end will be $3 \times 500\text{kHz}$ or 1500kHz . These calculations would, in practice, be modified by stray circuit capacities but they show how coils can be wound for any required range. In the tuner cassette described here the tuning capacitor is 60pF maximum and tunes a range from 650 to 1500kHz .

It was thought that the aerial, wound on a flat ferrite rod, would be badly screened when the cassette was in the player but in practice this did not happen and has not proved a handicap. The player should be rotated to give the best results with any particular station as should be done with any radio employing a ferrite rod aerial for signal pick-up. In the south-east of England many stations could be received during daylight and many more after dark but results may vary considerably over other parts of the country.

The Circuit

As can be seen from Fig. 1 the circuit is very simple indeed. Resistor R2 has an effect on both the sensitivity and the selectivity of the tuner and values between 100Ω and $1.5\text{k}\Omega$ can be tried. Temporarily a small preset of say $1.5\text{k}\Omega$ can be connected in series with a resistor of 100Ω and adjusted

The Tuner Cassette is the subject of British Provisional Patent 52095, held by the author.



for optimum results. The part of the preset in use can be measured and a similar value resistor used in the tuner in place of the 100 Ω and preset.

The head in the tuner is shown as L2 and this is placed in such a position as to offer maximum coupling with the head in the player.

Construction

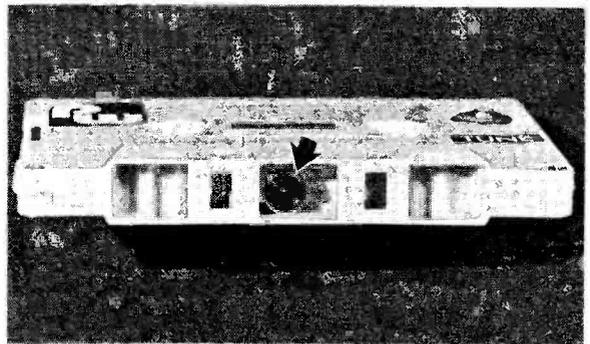
Two types of cassette will generally be found, one with the halves pressed or cemented together and the other with four or five screws so that the cassette can be opened easily. The latter type is recommended for this project. Unscrew the cassette and remove all the innards including the tape, magnetic guard and any pulleys. The half carrying the magnetic guard will be considered as the bottom part of the cassette. Any labels are best removed with methylated spirit rather than solvents of the thinners type.

Remove pips A and B from both halves, Fig. 2, and cut away part of the web from the bottom half, shown as C. This is best done by cutting the web vertically with a small hacksaw-type blade and breaking it away with a pair of pliers. Cut away the edge of the bottom at D for a distance of 20mm. Then cut a similar slot in the top half but 3mm deep as shown in Fig. 2. Ensure that the edges of the slot coincide when the halves of the cassette are fitted together.

The mercury cell holder, Fig. 3, was made from Perspex about 3mm thick but any similar insulating

material will suffice. A strip of the same Perspex was glued to the holder as shown. The complete holder should be filed until it is a good fit in the slot in the cassette. Now drill a pilot hole through the Perspex and follow this with a drill about 10mm diameter but take great care not to split the material. Now countersink the hole on the correct side with a 12mm drill until the cell rests as shown in Fig. 3 with the smaller diameter (negative) side just proud of the Perspex. The countersinking is best done by hand to avoid damage to the holder if the drill should snatch. The holder is eventually plugged in with the negative pole upwards.

Now, drill, or preferably file, a hole E, Fig. 2, in the top of the cassette, through which the tuning capacitor will protrude. The ferrite aerial L1 consists of 120 turns of 36SWG enamelled copper wire closewound on one end of a ferrite slab 18 x 4mm x 65mm long. The ferrite as supplied will be longer and can be snapped off in a vice or the required line of break struck on a sharp edge. The end can



The output coupling coil L2 is shown arrowed in this photo of the finished Tuner.

be nibbled with flat nose pliers to finish it off if the break is rough. Secure the ends of the winding with adhesive or Sellotape and then glue the assembly into the bottom of the cassette as shown in the photographs.

The tuning capacitor VC1 is a 60pF ceramic trimmer glued into the bottom of the cassette, using the hole in the top as a guide to its exact position. The trimmer's tags should be cut off short. The rim of the ZN414 should be filed away on opposite sides

★ components list

Resistors

R1 100k Ω R2 560 Ω Both 5 or 10% $\frac{1}{4}$ W

Capacitors

C1 10nF ceramic disc
C2 220nF tantalum bead
C3 400 μ F tantalum bead
VC1 60pF ceramic trimmer

Miscellaneous

1C1 ZN414, Mercury cell, Mallory RM675, L1, see text. Ferrite slab, 18 x 4mm x 65mm long. Ferrite bead (anti-parasitic type) usually 5mm long, 4mm dia. with 2mm hole. Cassette, preferably empty. Piano or phosphor bronze wire, about 22SWG. 7m of 34SWG enam. copper wire. About 6m of 36SWG enam. copper wire.

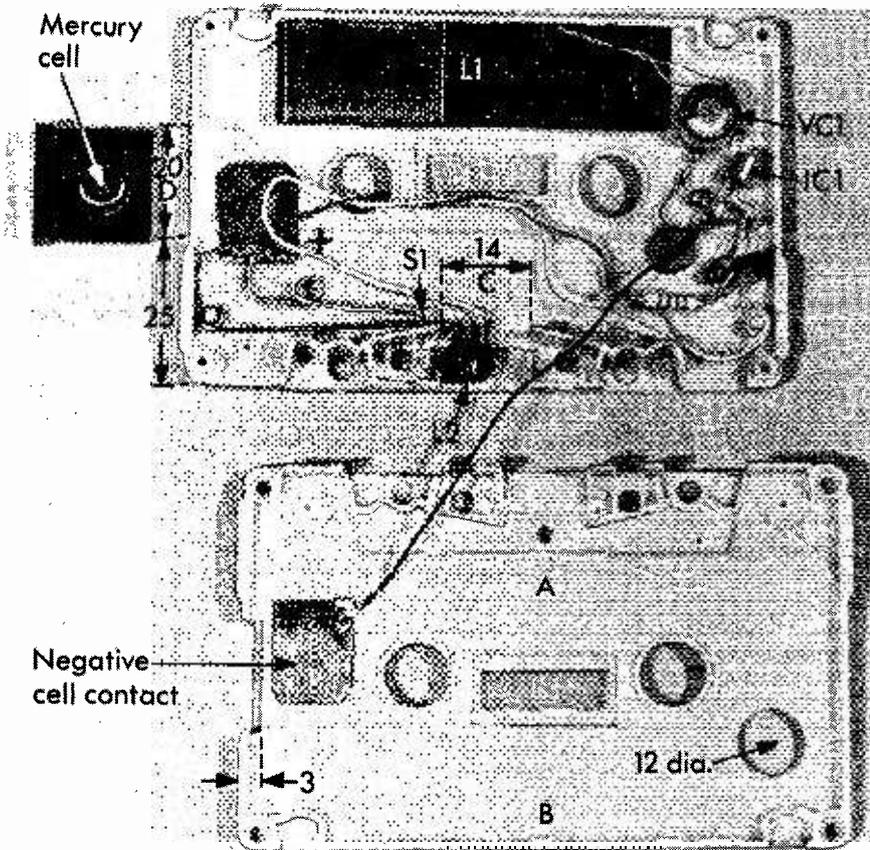


Fig. 2: left, the halves of the cassette opened out to show the details of the slot for the mercury cell, the contacts for the cell, and the general assembly of the Tuner. Switch S1 is formed by the contact between the two spring arms.

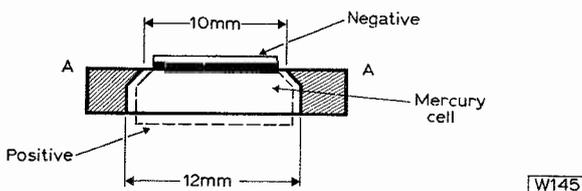
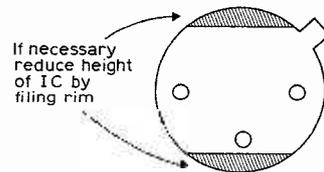
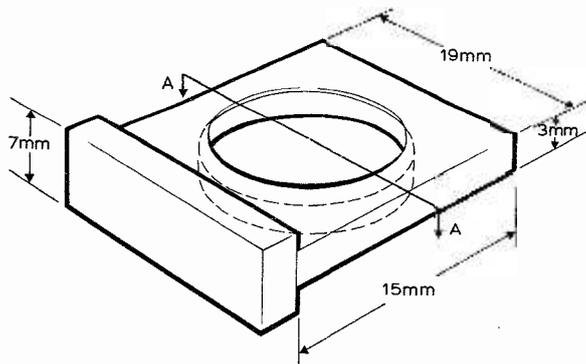
Fig. 3: bottom left, illustrates the holder for the mercury cell as devised by the author but any other similar arrangement will be satisfactory.

Fig. 4: below, shows how the rim of the IC can be filed away carefully to reduce its height to fit the cassette.

Hole to the left is referred to as hole 'E' in text.

AM0437

All dimensions in mm.



if it is too large for the particular cassette used, see Fig. 4. The IC should be treated gently in this process, holding it in the fingers. Do not use pliers or a vice! But check first before filing.

The battery contacts are made from thin brass,

such as used for shims. Tin or other metal which can be soldered can be used but it must be thin or the cell assembly will not fit in the cassette.

Coupling Coil

The coupling coil L2 is wound on a ferrite bead. Make two cardboard cheeks and bolt them to the bead with a bolt and nut, usually 8BA will do, Fig. 5. Wind on 7m of the 44SWG enamelled copper wire in uniform layers. This is best done by holding the bolt in the jaws of a hand drill and securing the drill in a vice. A power drill is not recommended with this very fine wire. Apply a few drops of Durofix or aeroplane dope on top the winding, keeping it clear of the cheeks. When dry remove one cheek only and dope that side of winding. Remove other cheek and dope remainder of coil.

The coil is glued to one end of a spring arm, Fig. 6a, made from piano or phosphor bronze wire, the loops in the arm being formed round a small drill.

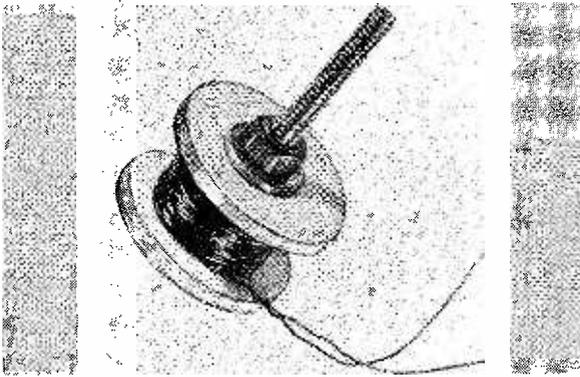
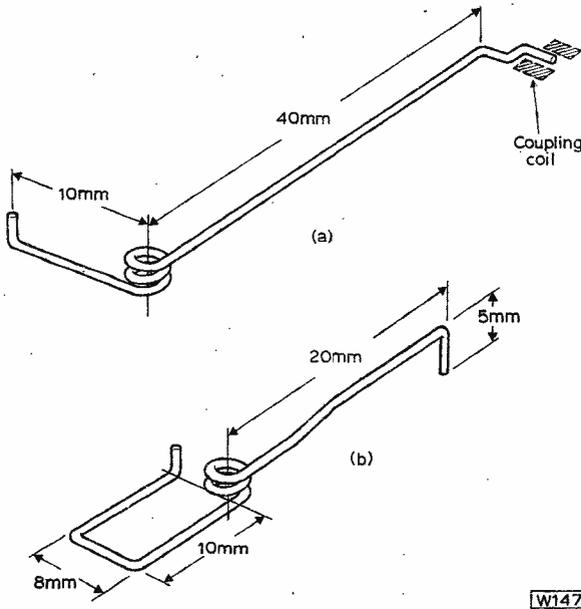
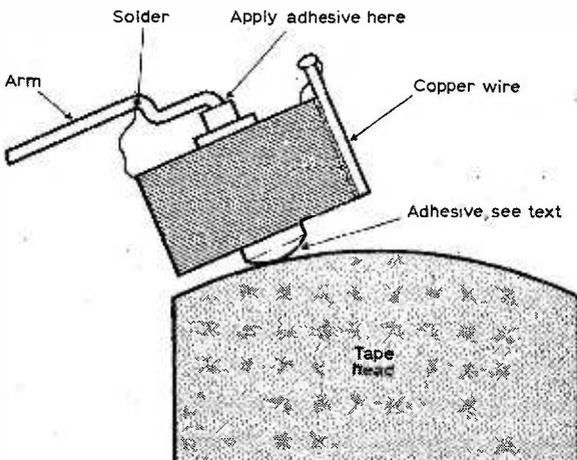


Fig. 5: The ferrite bead is held between cardboard cheeks while about 400 turns (7m) of wire is wound on.



W147

Fig. 6: Details of the two spring arms. The coupling coil L2 on its ferrite bead is fitted to the end of the upper arm.



W148

Fig. 7: The position of the coupling coil on the head of the cassette player is fairly critical but can be adjusted when the Tuner is finished.

Practical Wireless, March 1976

Check the arm for fit in the bottom of the cassette, the loop going over the spigot in the bottom left hand corner. Now drop the bottom of the cassette into the tape recorder, switched to the "Play" position. The coupling coil should be placed on the end of the arm and adjusted so that it is resting on the left-hand side of the head. This adjustment is important because if the coil shades both poles of the head the induced voltages will cancel out. Apply a couple of drops of adhesive to the coil and arm and allow to dry in position. Carefully remove arm and coil and apply more adhesive to make a solid joint. A very thin coat of adhesive can be applied to the face of the ferrite bead where it rests on the head. This will eliminate any risk of electrical noise being caused between the head and the bead.

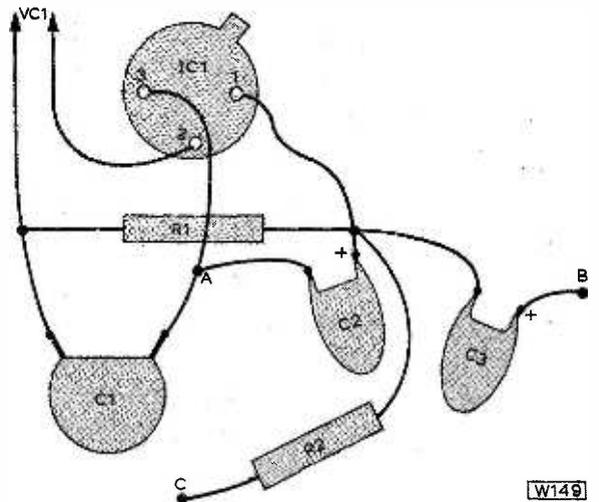
Solder one end of the coupling coil to a short length of copper wire glued to the coil, Fig. 7 and solder the other end of the coil to the arm. A thin flexible wire goes from the copper wire to the end of C3. Another similar wire runs from the end of the arm to resistor R2.

Switching

A second spring is formed as shown in Fig. 6b and then glued to the bottom of the cassette so that there is a small gap between this arm and the arm carrying the coil. This forms the on-off switch S1. Solder end of contact arm directly on the positive contact plate. Place the bottom of the cassette into the player and connect an ohmmeter across the switch contacts. Adjust the gap between the arms so that a short circuit is indicated when the player control knob is pushed forward and an open-circuit when it is switched off.

As there is no room for a circuit board the few remaining components are soldered together as shown in Fig. 8 and the assembly glued to the bottom of the cassette, see photographs. Keep all leads as short as possible or feedback may result. If flats have been filed on the IC ensure that these are horizontal or the halves of the cassette will not close.

Connect the ends of the ferrite rod aerial winding to the tags on the tuning capacitor plus the two



W149

Fig. 8: The components shown above are wired together before being fitted into the bottom half of the cassette.

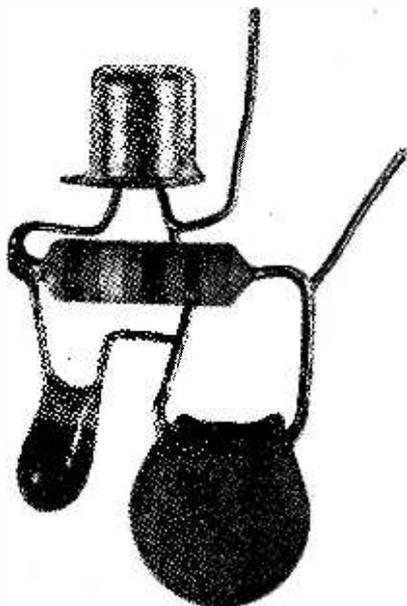


Photo of part of the component assembly shown in Fig. 8.

leads from the component assembly. Remember to scrape the enamel from the ends of the wire before soldering. Connect a flexible wire from the cell negative plate, top half of cassette, to point A, Fig. 8, the lead from the coupling coil to point B. Finally, another flexible lead from the end of the coil supporting arm to R2, point C. And that's it!

The tuning capacitor can be adjusted to a particular station and left or a thin plastic disc can be glued to the top of the capacitor ensuring that it is close to the top of the cassette. The author used an edge control knob taken from the volume control of an old transistor radio.

Checking out

Check that the wiring is correct and then screw the cassette together. Insert the cell holder with the cell in place with the negative side (smaller diameter) at the top. Slip the cassette into the cassette player and switch to "Play". Turn up the volume control and tune in a few stations to get the feel of the tuner. If the volume control has to be turned up too far to get reasonable volume try adjusting the position of the coupling coil on the head, as explained earlier, as this adjustment can be very critical. Don't forget that the player may need turning round for best volume from a station.

PW

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REPRINT OF PW's
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Send 75p + 10p (post & packing) to: Chief Cashier
 (PW Tele-Tennis), IPC Magazines, Tower House,
 Southampton St., London, WC2E 9QX.

GENERAL COVERAGE RECEIVER—contd from page 940

an audio load for the IC. Because of the limiter action, RF and IF gain controls must be set so that severe clipping does not arise, so these controls will only be at or near maximum gain for weak signals.

MAINS POWER UNIT

The unit shown in Fig. 18 may be constructed to the same dimensions as a PP9 battery, see photograph in Part 1. The case is readily made from a single 8 x 2in universal chassis flanged runner, with the flanges cut so that it can be bent into an open box 2 $\frac{3}{4}$ x 2 $\frac{1}{2}$ x 2in. A PP9 battery top with studs is fixed across the end and the sides are closed with 2 $\frac{3}{4}$ x 2 $\frac{1}{2}$ in pieces held with self-tapping screws. Anchor mains L, N and E wires at a tag strip, which also earths the box. A further tag strip supports the diodes and capacitor. Ensure that the connections to the battery studs are in the correct polarity.

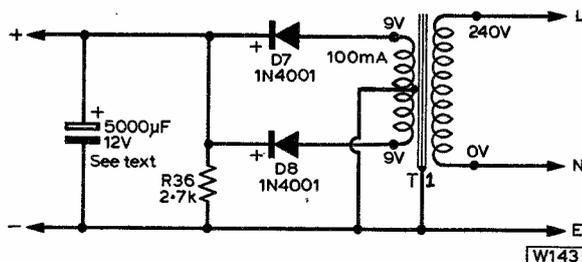


Fig. 18: Circuit of the optional power supply unit built into an old battery case, shown in Part 1.

The capacitor across the battery supply at the audio amplifier (C23) can be changed to 5000µF 12V when it was found that no hum whatever accompanied reception. The actual voltage is somewhat higher than that from the battery and it may be found necessary to back off the RF gain a little on high frequencies, to avoid instability, though this depends on loading by the aerial.

Note:—In Fig. 9 Part 1, should read "S1 is ganged with VR2," not VR1.

PW

KINDLY NOTE!

EMERGENCY LIGHT UNIT January 76

We wish to acknowledge the considerable assistance given to the author of this project by the Special Batteries Division of Ever Ready and by Doram Ltd. who supplied the cells for the prototype.

TV SOUND TUNER November 75

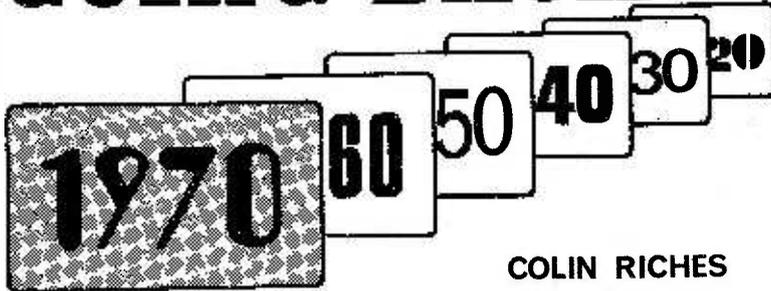
In Fig. 5 the bottom edge of the panel cut-out should be 34mm and not 44mm from the bottom of the panel.

DIGITAL READOUT SYSTEM

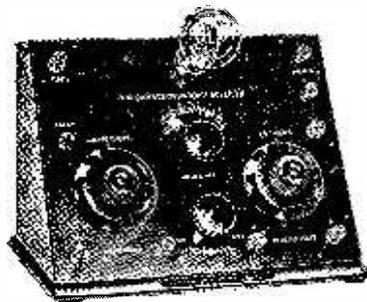
December 75

In Fig. 12, page 653, the polarity of the 5V supply to the board is incorrect and should be reversed to that shown.

GOING BACK...



COLIN RICHES



Gamages single valve broadcast receiving set.

pany comprising the 'Broadcaster' HT battery, LT battery, phones, aerial wire, insulators, switch and tube. Price complete £22.10s."

Wireless Notes—1922

IN the summer of 1922, Paris police found a wireless outfit amongst the apparatus of a group of burglars, Buckingham Palace had a wireless receiver installed and New York City was told it could have its own broadcasting station. The sum of £10,000 was set aside for this purpose and the aerial was erected on the roof of the Municipal Building.

Amundsen's expedition to Wrangel Island took a wireless outfit with it. The apparatus was capable of receiving messages within a radius of 2,000 miles. The receiving station at Clifden, which had been in the hands of Irish 'rebels' was burned down by them and the work of this station was taken over by Ongar, in Essex.

An enterprising fairground manager installed a wireless station amongst his booths and roundabouts and charged the public 6d. to listen in to wireless concerts.

Three wireless exhibitions were held during the Autumn, two were housed in the Central Hall, Westminster and the third at the Horticultural Hall.

Also in 1922 one could obtain a pamphlet entitled "the Wireless Weather Manual: A Guide to the Reception and Interpretation of Weather Reports and Forecasts Distributed by Wireless Telegraphy in Great Britain." It was published by the Meteorological Office and could be obtained from H. M. Stationery Office.

A Service offered

IRECENTLY received a letter from Mr. Tom Bowett. He says, "As a reader of your 'Going Back' feature I am writing to offer a service which may be of

Practical Wireless, March 1976

interest to other readers.

"I have in my possession a copy of a booklet entitled 'A Handbook of Call Signs' as given free with *Amateur Wireless*, September 19th, 1925. During the past few years I recall some people writing to radio magazines trying to trace the holder of a particular call sign and I have also heard such references over the air.

"I would be pleased to check through this booklet to try and trace either the holder of a particular call sign or the call sign of a particular radio amateur of the period. Call signs 2AA-6ZY plus certain international call signs are listed.

"I would obviously appreciate an s.a.e. with any enquiries." So, if anyone does need to trace a vintage call sign, they can contact Mr. Bowett at 167 Burnage Lane, Burnage, Manchester, M19 1EE.

Gamages again

SEVERAL readers have written expressing interest in the Gamages wireless sets so here is some gen on another Gamage favourite—the Single Valve Broadcast Receiving Set. This was described as, "A most efficient and compact set, comprising tuning unit and valve detector. Wavelength 300-500 metres, but any wavelength may be obtained by the addition of an ordinary Honeycomb coil. Note the position of the Marconi 'R' valve—the filament being held vertical, cannot touch the grid when sagging takes place. The tuning coil entirely eliminates self-induction and self-capacity effects.

Telephony can be received up to 40 miles, and spark signals over a considerable distance. The complete set, licensed by the P. M. G. and the Marconi Com-

A Flick of the Switch

THIS book contains over 1000 photographs of vintage U.S. receivers ranging from 1930 to 1950. Also included are sections on amateur gear, commercial and military equipment.

The author, Morgan McMahon became a radio amateur in the days when, as he says, the local ham was considered the 'neighbourhood nut'. His aim, and an exceedingly commendable one—is to preserve the heritage of vintage radio in an enjoyable way, by writing a series of books on the subject.

The book is published by Vintage Radio, Box 2045, Palos Verdes Peninsula, California, 90274 and copies are obtainable, in the UK from Tudor Rees, 64 Broad Street, Staple Hill, Bristol, BS16 5NL. Price is £4.15 soft cover post paid (no VAT to pay) and £5.75 hard cover post paid (no VAT).



Front cover of the book

Now...the most exciting Sinclair kit ever

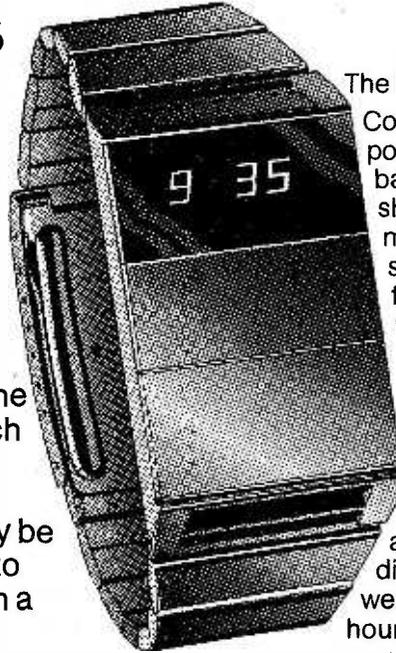
The Black Watch kit

At £14.95, it's

★ **practical** – easily built by anyone in an evening's straightforward assembly.

★ **complete** – right down to strap and batteries.

★ **guaranteed.** A correctly-assembled watch is guaranteed for a year. It works as soon as you put the batteries in. On a built watch we guarantee an accuracy within a second a day – but building it yourself you may be able to adjust the trimmer to achieve an accuracy within a second a week.



The Black Watch by Sinclair is unique. Controlled by a quartz crystal... powered by two hearing aid batteries... using bright red LEDs to show hours and minutes and minutes and seconds... it's also styled in the cool prestige Sinclair fashion: no knobs, no buttons, no flash.

The Black Watch kit is unique, too. It's rational – Sinclair have reduced the separate components to just four.

It's simple – anybody who can use a soldering iron can assemble a Black Watch without difficulty. From opening the kit to wearing the watch is a couple of hours' work.

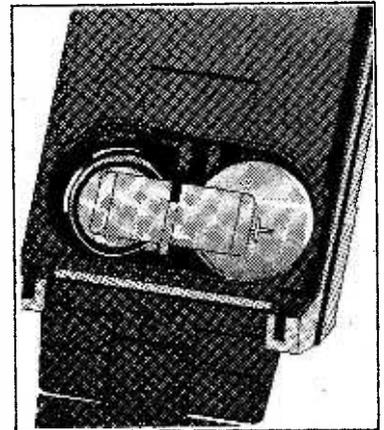
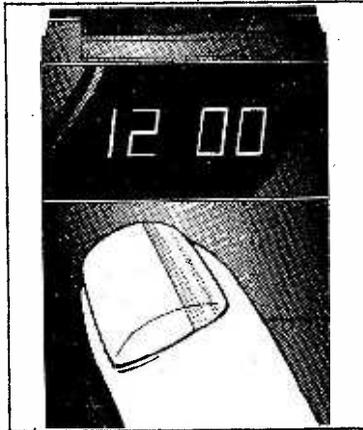
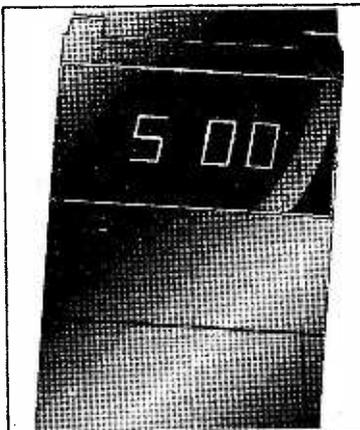
The special features of The Black Watch

Smooth, chunky, matt-black case, with black strap. (Black stainless-steel bracelet available as extra – see order form.)

Large, bright, red display – easily read at night.

Touch-and-see case – no unprofessional buttons.

Runs on two hearing-aid batteries (supplied). Change your batteries yourself – no expensive jeweller's service.



The Black Watch – using the unique Sinclair-designed state-of-the-art IC.

The chip...

The heart of the Black Watch is a unique IC designed by Sinclair and custom-built for them using state-of-the-art technology – integrated injection logic.

This chip of silicon measures only 3 mm x 3 mm and contains over 2000 transistors. The circuit includes

- a) reference oscillator
- b) divider chain
- c) decoder circuits
- d) display inhibit circuits
- e) display driving circuits.

The chip is totally designed and manufactured in the UK, and is the first design to incorporate all circuitry for a digital watch on a single chip.

...and how it works

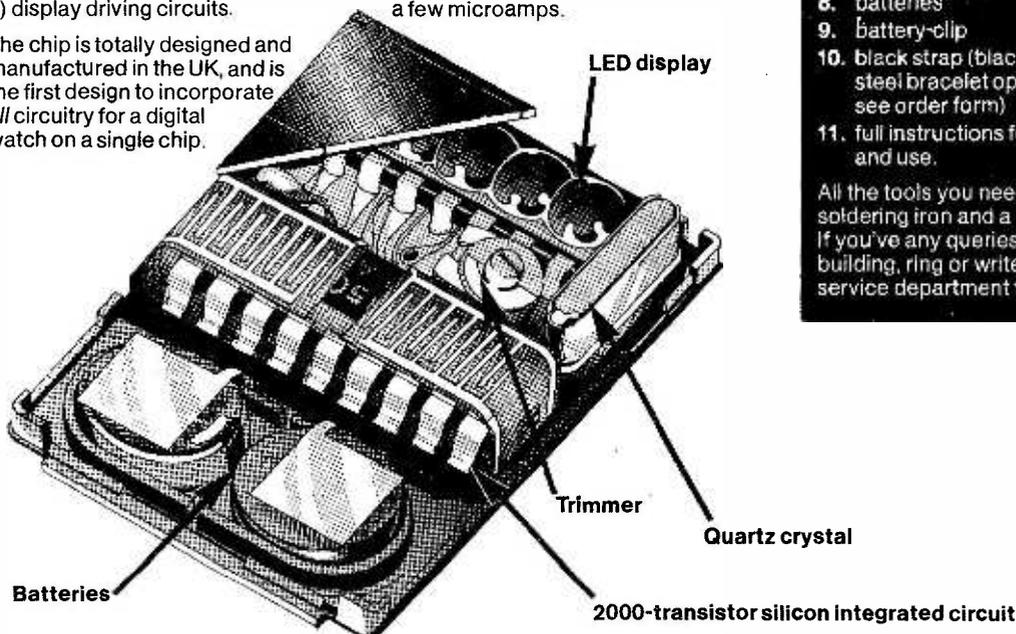
A crystal-controlled reference is used to drive a chain of 15 binary dividers which reduce the frequency from 32,768 Hz to 1 Hz. This accurate signal is then counted into units of seconds, minutes, and hours, and on request the stored information is processed by the decoders and display drivers to feed the four 7-segment LED displays. When the display is not in operation, special power-saving circuits on the chip reduce current consumption to only a few microamps.

Complete kit £14.95!

The kit contains

1. printed circuit board
2. unique Sinclair-designed IC
3. encapsulated quartz crystal
4. trimmer
5. capacitor
6. LED display
7. 2-part case with window in position
8. batteries
9. battery-clip
10. black strap (black stainless-steel bracelet optional extra – see order form)
11. full instructions for building and use.

All the tools you need are a fine soldering iron and a pair of cutters. If you've any queries or problems in building, ring or write to Sinclair service department for help.



Take advantage of this no-risks, money-back offer today!

The Sinclair Black Watch is fully guaranteed. Return your kit in original condition within 10 days and we'll refund your money without question. All parts are tested and checked before despatch – and correctly-assembled watches are guaranteed for one year. Simply fill in the FREEPOST order form and post it – today!

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Total £

..... (qty) Sinclair Black Watch kit(s) at £14.95 (inc. black strap, VAT, p&p).

* I enclose cheque for £..... made out to Sinclair Radionics Ltd and crossed.

..... (qty) black stainless-steel bracelet(s) at £2.00 (inc. VAT, p&p).

* Please debit my *Barclaycard/Access/American Express account number

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Address _____

PW/3

Please print. FREEPOST – no stamp required.

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CMOS Crystal Calibrator

M. E. THEAKER B.Sc

RADIO AMATEURS, short wave listeners and users of digital measuring equipment frequently require a signal source of precise known frequency. The crystal calibrator here described provides such a source and is suitable for the calibration of VFO's, communication receivers, frequency meters, etc. It provides accurate outputs at 1MHz, 100kHz, 10kHz, 1kHz, 100Hz, 10Hz and 1Hz. The lower frequencies, although possibly superfluous for the calibration of receivers and frequency meters, are suitable for checking counters and provide a general source for operating digital circuits at a slower speed than normal in order to examine their operation in more detail, when fault-finding for example.

OPERATION

The crystal calibrator, Fig. 1, comprises five sections: a crystal oscillator, a six decade divider circuit, a frequency selection circuit, an output stage and a voltage regulator to supply the circuits. The crystal oscillator produces an approximately square wave at 1MHz which is fed to the six decade divider and to the frequency selection circuit. The six decade divider provides outputs at 100kHz, 10kHz, 1kHz, 100Hz, 10Hz and 1Hz which are also fed to the frequency selection circuit. This circuit provides the means of selecting any one of the seven frequencies or a combination of frequencies simultaneously.

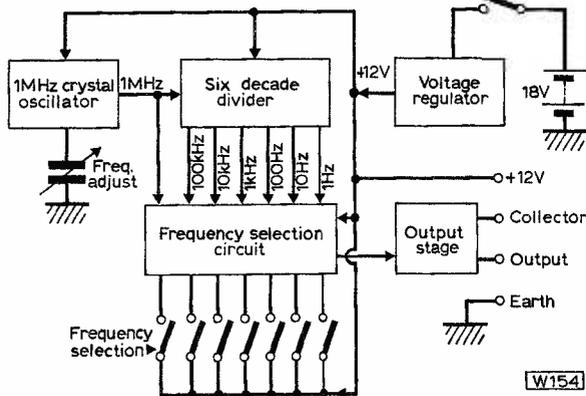


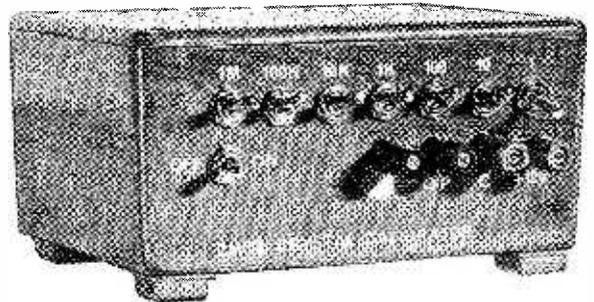
Fig. 1: Block diagram of the crystal calibrator.

CMOS integrated circuits were used to build the calibrator in order to minimise the current consumption of the calibrator. Even with fairly frequent use the batteries should last for a long time. The output current available from CMOS circuits is rather

low, typically no more than 500 μ A, so for this reason an output stage follows the frequency selection circuit in order to boost the calibrator's output capability.

THE CRYSTAL OSCILLATOR

The heart of the calibrator is a 1MHz crystal oscillator, Fig 2a. This is constructed using one-third of a CD4007A circuit as an inverter. Two feedback circuits are applied to the inverter; the first is DC feedback through resistor R1, which biases the output voltage to be equal to the input voltage, typically one half of the supply voltage. The second is AC feedback through the crystal X1. The equivalent circuit of the crystal is shown in Fig. 2b and it can be seen that two resonant frequencies can occur,



the series resonance of L and Cs, and the parallel resonance of L and Cp. These two frequencies are in practice quite close together.

The crystal is incorporated in a pi network consisting of R2, X1, C1, VC1 and C2. This network provides feedback for the inverter only at the series resonance frequency of the crystal. The variable capacitor, VC1, provides the necessary trimming to ensure that the oscillator can be adjusted to run at exactly 1MHz. The AC feedback is quite large to ensure that the output remains in saturation for as long as possible. This not only ensures fast rise and fall times, but also minimises the current consumption.

THE DECADE DIVIDERS

There are seven different decade dividers available in the various CMOS ranges of integrated circuits. One of these, the MC14518C/CD4518BE, is a dual decade counter/divider and was chosen in order to produce a compact layout for the crystal calibrator. Two divide-by-ten outputs are available from each decade counter, Fig. 3. One, Q2, has a mark/space

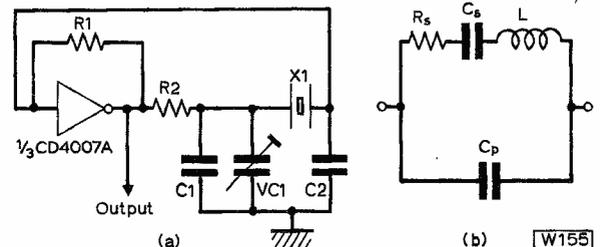


Fig. 2: Crystal oscillator circuit and equivalent electrical circuit.

★ components list

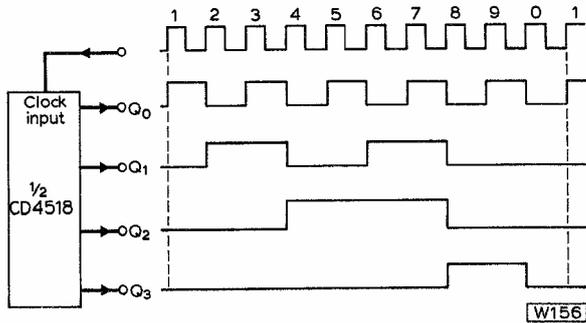


Fig. 3. Waveforms to be expected from the decade dividers.

ratio of 2:3, the other, Q3, a mark/space ratio of 1:4. The choice of mark/space ratio has considerable influence on the harmonic content of the output waveform. This choice is of particular significance when using the calibrator with a communication receiver as it will determine the number of useful calibration points.

The Fourier Analysis of a repetitive rectangular waveform, such as produced by the oscillator and divider circuits shown in Fig. 3, states that the amplitude of the n th harmonic, A_n is $A \sin(n\pi d/T)/n\pi$ where A is the amplitude of the rectangular wave. This means that for a square wave with a mark/space ratio of 1:1, the ratio d/T is equal to 0.5 and therefore the amplitude of the first harmonic is the same as that of the square wave, the third harmonic has an amplitude of one-third that of the square wave, the fifth harmonic's amplitude is one-fifth, etc. There are, in theory, no even harmonics. In practice, because of the slight differences in the top and bottom of the waveform and differences in the rise and fall times, there will be some even harmonics, but they will be much less in amplitude than the odd harmonics.

The dual decade divider chosen does not possess a square wave output but instead provides a choice of a mark/space ratio of 2:3 or 1:4. The corresponding

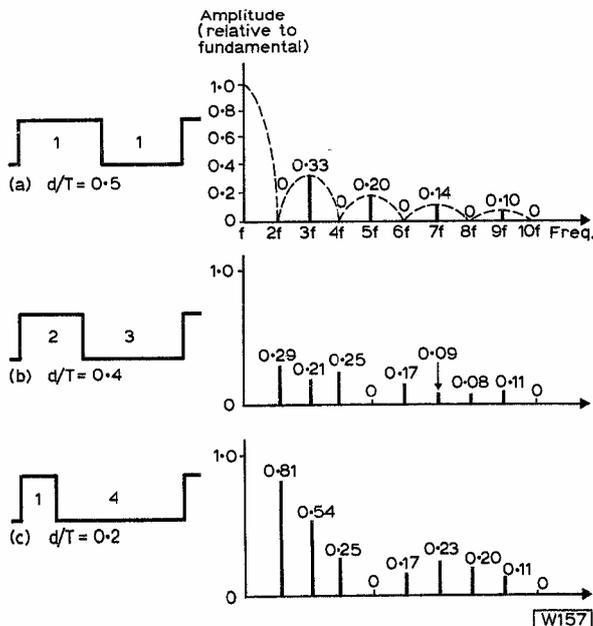


Fig. 4. Diagrams to show the harmonic content of the waveforms.

Resistors	
R1 20M Ω (2 x 10M Ω)	R10 27k Ω
R2 22k Ω	R11 1k Ω
R3 to 9 1M Ω (7 off)	
All 5 or 10% $\frac{1}{4}$ or $\frac{1}{2}$ W	
Capacitors	
C1 100pF polystyrene	VC1 60pF trimmer
C2 22pF polystyrene	
Semiconductors	
IC1 CD4007 AE or MC14007CP	IC6 CD4068BE or MP14068CP
IC2 } CD4518BE or	IC8 78L12WC (Fairchild) or equivalent
IC3 } MC14518CP	Tr1 BSX20 or 2N2369A
IC4 } MC14518CP	
IC5 & 7 CD4011AE or MP14011CP	

Miscellaneous

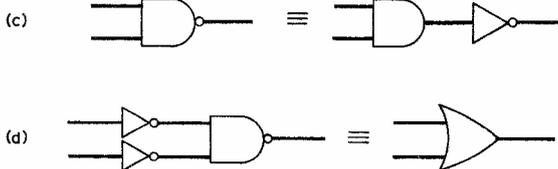
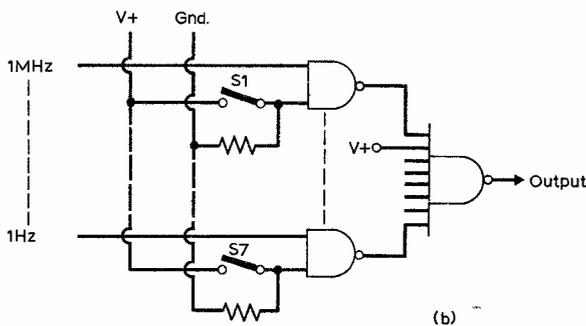
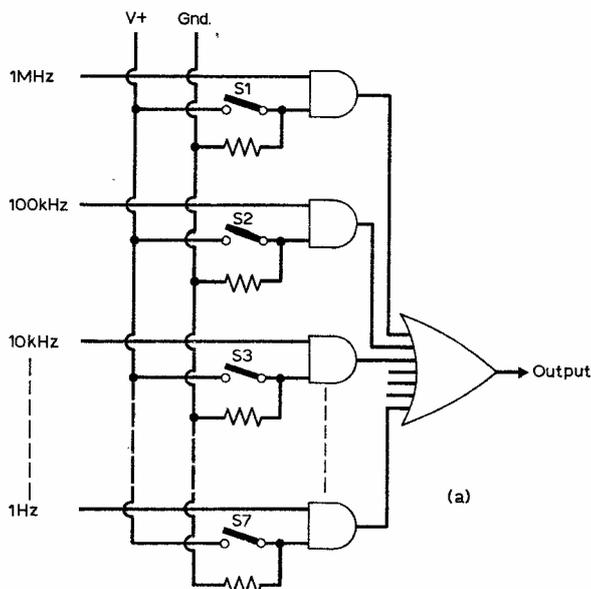
X1, Crystal 1MHz type HC6U. Switches, SP on-off, miniature, 8 off, OR 1 off and 1 SP 8-way rotary switch. Terminals, miniature 4 off. Batteries PP3, 2 off, with connectors. IC holders, 14 pin 4 off, 16 pin 3 off. Diecast box, approx. 115 x 88 x 55mm ($4\frac{1}{2}$ x $3\frac{1}{2}$ x $2\frac{1}{4}$ in.) or similar. PCB, Readers PCB Services, (see ad.) The eight IC's with IC socket strip are available from Sintel, 53N Aston Street, Oxford for £5.27 inc. VAT and p/p.

d/t ratios are 0.4 and 0.2 respectively. The effects of the different ratios are shown in Fig. 4. This shows the amplitudes of the harmonics relative to the fundamental (or first harmonic). It can be seen that the square wave has (in theory) all even harmonics missing and that the waveforms with mark/space ratios of 2:3 and 1:4 have no fifth, tenth, etc. harmonics. In practice there will be small amplitudes of these harmonics for the same reason as explained above. Fig. 4 also shows that the amplitude of the harmonics with a mark/space ratio of 1:4 is generally greater than that of the other two examples. For this reason the Q3 output of the decade divider which provides the mark/space ratio of 1:4 was chosen and the Q3 outputs of the six decade dividers, together with the approximately square wave from the 1MHz crystal oscillator are fed to the frequency selection circuit.

FREQUENCY SELECTION CIRCUIT

To avoid the unnecessary routing of the signal via a front panel switch, the frequency selection switches operate gates situated on the circuit board. The basic logic circuit for frequency selection is shown in Fig. 5a. There are seven frequency selection switches, one for each frequency. This enables each frequency in turn or all frequencies simultaneously to be switched to the output stage. This method of switching as opposed to a rotary switch selecting one frequency has the advantage that one frequency may be modulated by another or several others, Fig. 6. So if S1 alone is closed, the 1MHz signal appears at the output. If S1 and S2 are closed, the 100kHz signal modulates the 1MHz producing a frequency spectrum of 1MHz, 2MHz etc., each with sidebands of 100kHz, 200kHz, etc. Or if S1 and S3 are closed, the frequency spectrum consists of 1MHz, 2MHz, etc., each with sidebands of 10kHz, 20kHz, etc.

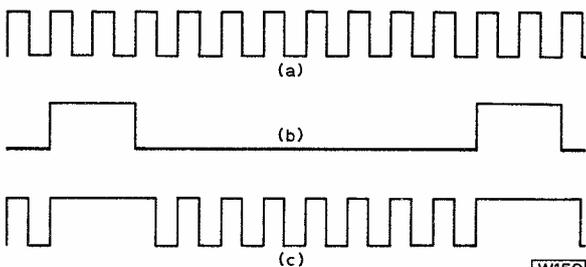
The inputs of CMOS circuits must never be left open-circuited. For this reason the switched inputs



W158

Fig. 5: Simplified circuits to illustrate the frequency selection method used in the calibrator.

Fig. 6: below, shows (a) 1MHz output waveform, (b) 100kHz output and (c) the 1MHz signal modulated by the 100kHz signal.



W159

of the gates are connected via $1M\Omega$ resistors to earth. Closing the appropriate switch applies a logic "1" to the input of the gate enabling the selected signal to pass through the gate. Opening the switch applies a logical zero to the gate input preventing the signal applied to the other gate input from passing through the gate. Although 2-input AND gates are available in CMOS, 8-input OR gates are not. So the circuit of Fig. 5b is used instead. This circuit is functionally identical to that of Fig. 5a. The reason for this is that a NAND gate may be considered as an AND gate followed by an inverter Fig. 5c and a NAND gate with inverters at each input may be considered as an OR gate Fig. 5d.

THE OUTPUT STAGE

The drive capability of CMOS circuits is, typically, only $500\mu A$. Whilst this is sufficient for driving 50 or more other CMOS circuits, it will not drive TTL, DTL or other logic families. For this reason an output stage consisting of a BSX20 high-speed switching transistor Tr1, Fig. 7, in an emitter follower configuration is used. In order that the output voltage level from this will be compatible with any circuit to which it may be connected, the collector of Tr1 is not connected to the calibrator's own supply but is instead brought to a terminal on the front panel. If this terminal is connected to the supply rail of the circuit being driven, then the voltage swing of the output stage will not exceed the maximum ratings of the circuit being driven. If, however, the calibrator does not make direct connection with the equipment being calibrated, as, for example, when loosely coupled to a receiver, then the collector terminal of Tr1 may be connected to the calibrator's own supply, via the front panel terminal.

THE POWER SUPPLY

Since the current consumption of the circuit is very low, battery operation is employed. A stable supply voltage is required in order to prevent undue frequency drift in the crystal oscillator and so a Fairchild 78L12WC IC voltage regulator, IC8, is used to stabilise the 18V battery supply to 12V. This three terminal voltage regulator is thermally limited and will supply 100mA, well in excess of the calibrator's requirements. A front panel terminal is connected to the output of the regulator to enable the output stage to be powered when required. This 12V terminal may also supply external circuits under test if required but the maximum current drain should not exceed 90mA or so.

CONSTRUCTION

Much has been said about the dangers of handling CMOS devices. Do not be afraid of them but take the following simple precautions and all will work out well. When the ICs are received they may be packed in electrically-conducting foam. Leave them in this until inserted in the circuit. If you wish to solder them directly into the circuit rather than use sockets as suggested below, use a soldering iron which has either an earthed bit or a highly insulated bit. Both types are sold specifically for use with MOSFET devices. When transferring the CMOS devices from the conducting foam to the circuit or IC socket, take care not to let them come into contact with plastic materials or synthetic materials, such as

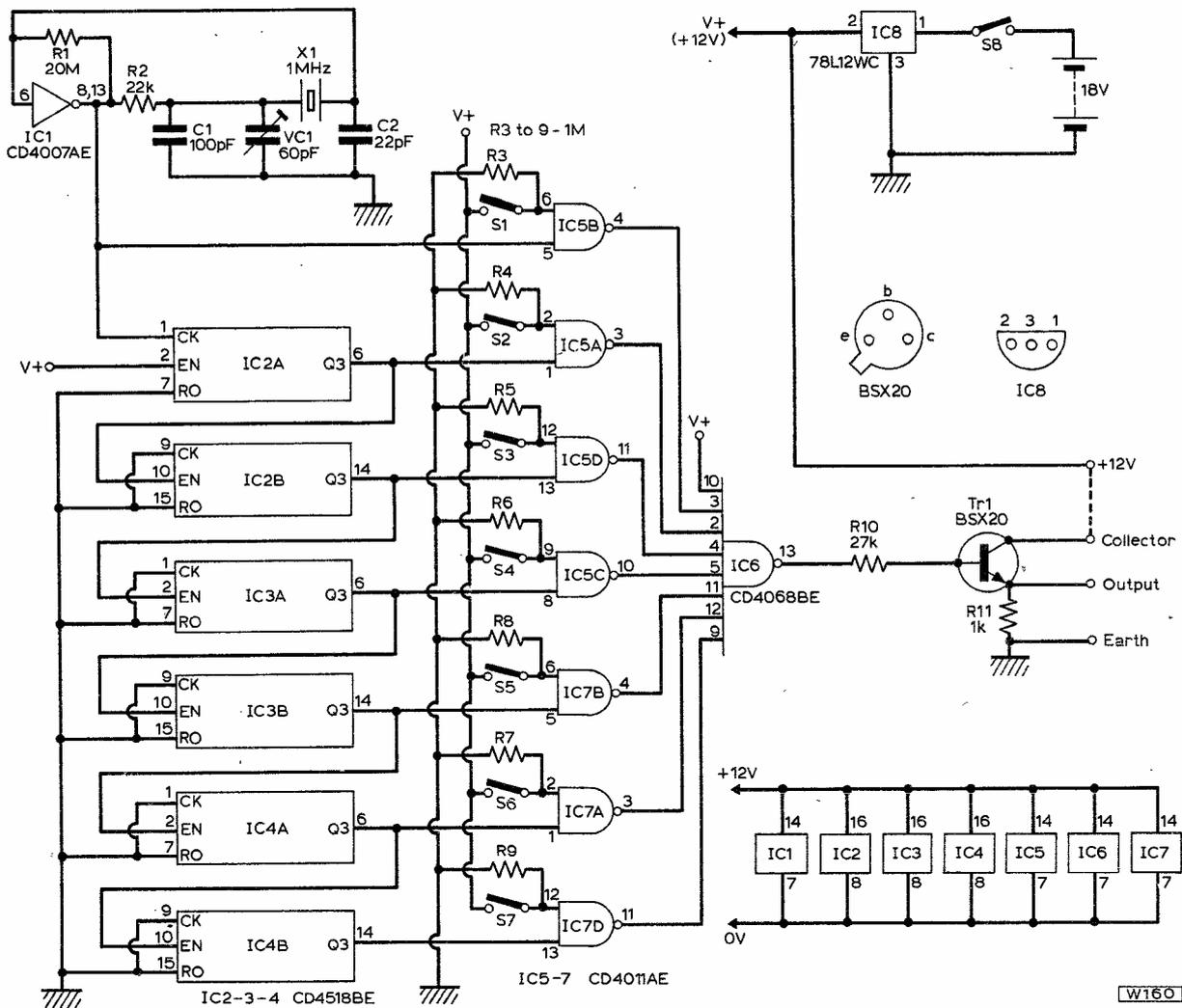


Fig. 7: Final circuit of the crystal calibrator. The frequency selector switches could be replaced by a rotary wafer switch but the facility of having one signal modulated by another would be lost.

nylon. As far as possible try to wear clothing of natural materials such as wool or cotton. On no account wear a nylon overall!

Try to minimise touching the CMOS leads, but touching them should rarely prove fatal for the device. A humid atmosphere is better than a dry one as it minimises the building up of static charges. Finally, don't worry! I have never known a CMOS device to die through electrostatic damage caused by mishandling. They do have input protection diodes and they are much more hardy than a lot of people are prepared to admit.

The circuit is built on a PCB, Fig. 8, then the wire links, resistors, capacitors and sockets for the ICs and quartz crystal connected. On no account solder directly to the pins of the crystal, nor to the crystal socket with the crystal inserted. Flying leads for connection to the switches and sockets can then be connected. After the case is drilled it should be painted and the lettering applied using Letraset, which is then varnished.

The board is then inserted into the case, Fig. 9, and held there by three 6BA screws with spacers and

nuts. The switches and terminals may then be connected to the circuit board and battery and, finally, the CMOS devices inserted in their sockets. The batteries may then be connected and the calibrator is ready for use. For those not requiring the multi-frequency output facility the wiring of a rotary switch is shown in Fig. 10.

USING THE CALIBRATOR

Connect the output collector terminal to the internal supply terminal. If an oscilloscope is available, the output waveform may be examined by switching the calibrator and selecting the frequencies in turn and together. If a frequency meter is available, the calibrator output may be checked for functioning. The standardisation of the calibrator must be carried out against a standard source. A digital frequency meter is not good enough for this purpose. In any case, this is one of the pieces of equipment you will wish to calibrate using the calibrator!

An extremely accurate frequency standard is available from the long wave BBC Radio 2 trans-

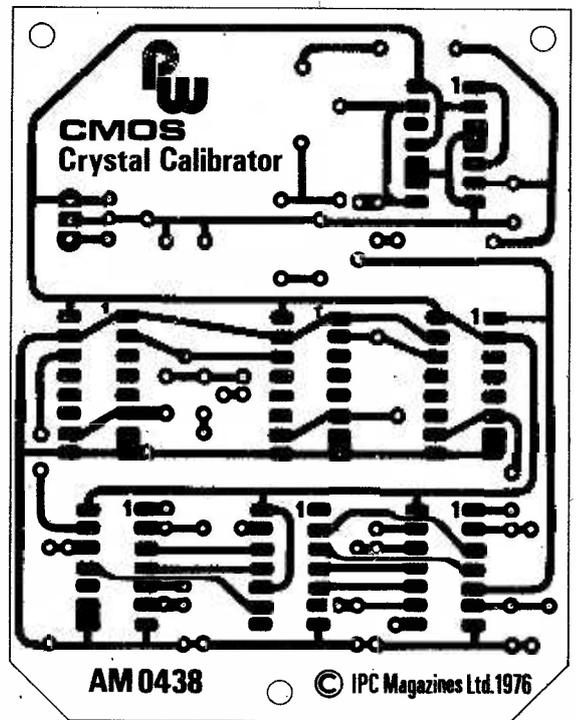
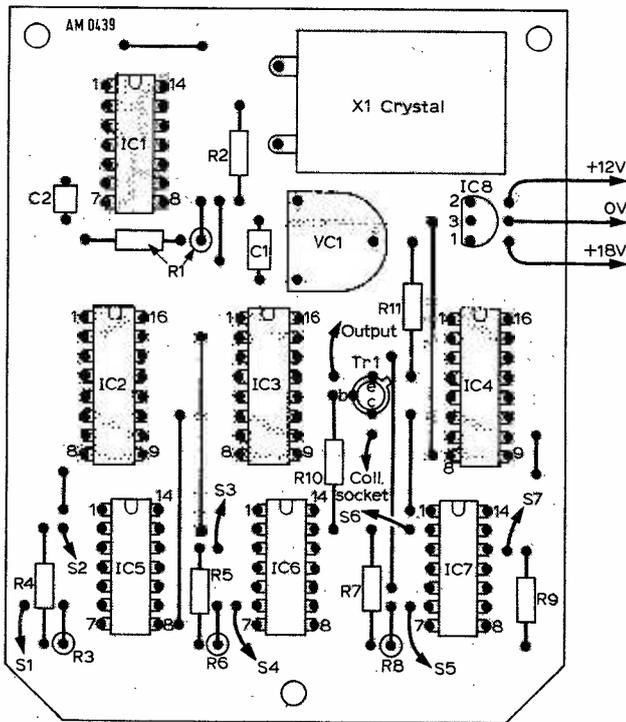
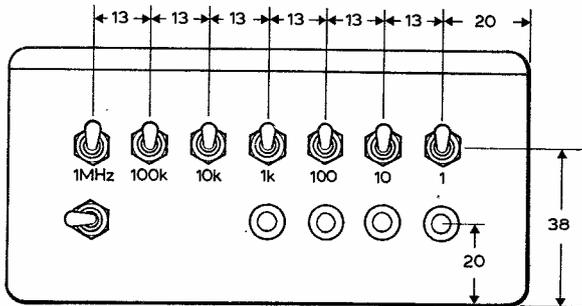


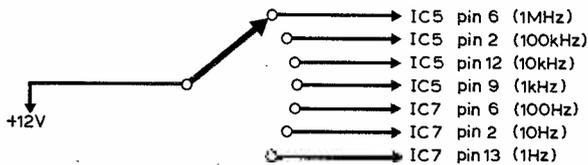
Fig. 8: The PCB is shown here actual size together with the component layout on the board.



Dimensions in mm

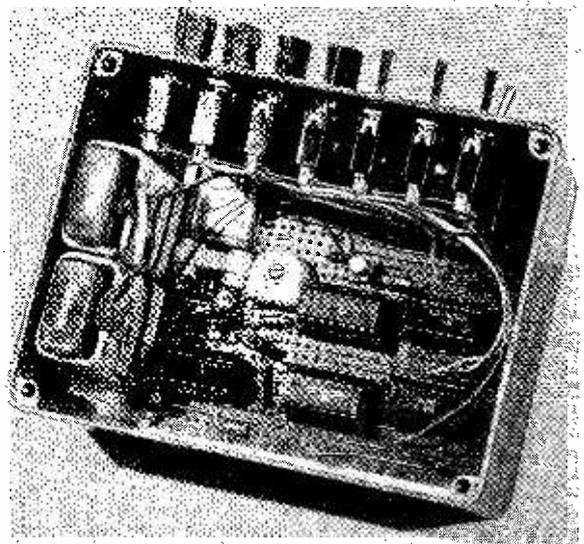
W161

Fig. 9: Details for the drilling of the front of the die-cast box.



W162

Fig. 10: Alternative connections for use with a rotary wafer frequency selection switch.



The finished calibrator with two PP3 batteries to the left, the crystal trimming capacitor in the centre and the 1MHz crystal in between.

missions on 200kHz. Tune a radio receiver to this programme and loosely couple the output of the calibrator by means of a wire lying near to the receiver aerial. With the calibrator switched on and the 100kHz frequency output selected, a beat frequency will be heard at the receiver due to the second harmonic of the 100kHz signal beating with the Radio 2 transmission. The variable capacitor VC1 should be adjusted for minimum beat frequency. If this is done by ear the calibrator can be adjusted within 2 or 3 Hz of the Radio 2 frequency, but if the

receiver is equipped with a signal strength meter the adjustment can be better than a fifth of a hertz. Bear in mind that this closeness of adjustment is at 200kHz and the corresponding accuracies of adjustment are 10 to 15 parts per million and 1 part per million respectively.

The calibrator may now be used to check a frequency meter. This is done by connecting the output stage collector to the calibrator's internal supply and connecting the calibrator output to the frequency meter to be checked. With the calibrator

continued on page 975

SPECIAL PRODUCT REPORT

HEATHKIT HD~1410

ELECTRONIC KEYER

THE relatively simple operation of sending Morse with a straight key has, like so many otherwise simple electronic functions, been a victim of progress in the last few years. With the ardent CW operator it has always been a matter of personal pride that he should send good Morse. Many, including the writer, still try to keep the standards up but it must be admitted that it gets a bit wearisome in a contest with many operators sending at 25 words per minute or more. But having mastered the code I see no reason not to use any aid which will make life easier!

HISTORY

There have been variations of the straight key but the breakthrough came with the 'bug' key with its horizontally operated paddle and vibrating dot contact, with a sliding weight for speed control. The newcomer to the 'bug' is always recognizable because he sends dots at 60wpm and dashes at 10wpm! However it is quite a simple matter to get the dot and dash ratio right using just an ohm-meter.

The mechanical 'bug' key was followed by electrical devices using relays and valves, pioneered by the late OZ7BO, with a single paddle. The newcomer could still make a mess of it however, with 'CQ' coming out as 'NNMA' without too much trouble! The development of transistors and integrated circuits brought new techniques and rapid changes to the 'el-bug' or electronic key, culminating in the 'squeeze' or 'iambic' keyer as exemplified by this Heathkit HD1410 Electronic Keyer.

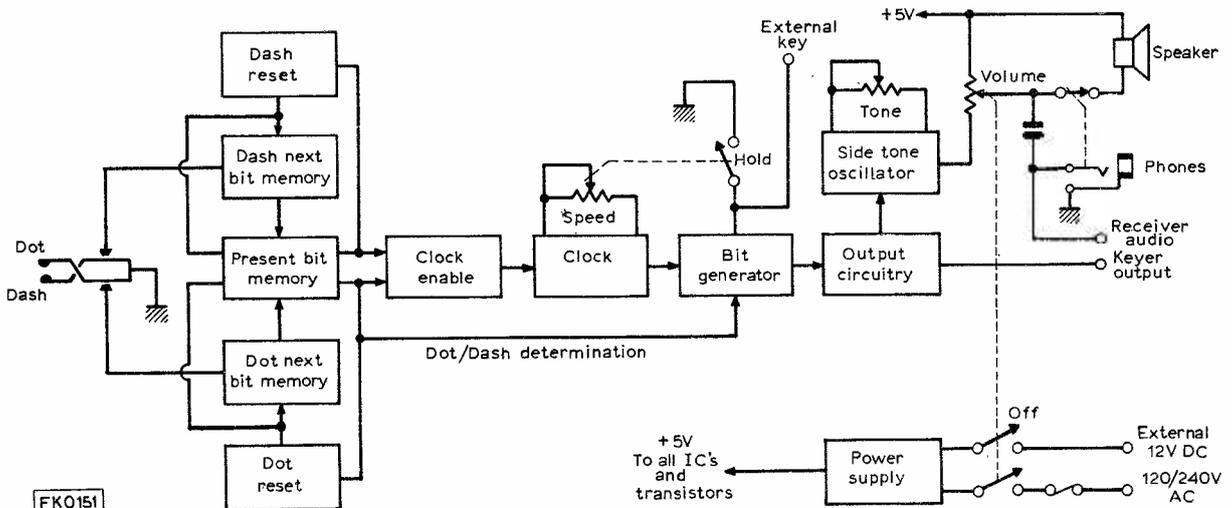
In case you feel a slight touch of inferiority complex coming on perhaps it should be explained that 'iambic' comes from the Greek 'iambus' or 'a foot of two syllables, a short followed by a long'—or dots and dashes to you!

Two independent paddles are used, one for continuous dots and the other for dashes. Each character is always correctly formed and is self-completing with the proper ratios being maintained at all times. A dash will come out



even if the dash paddle is tapped for a brief moment. The effect is quite uncanny when the keyer is set to a very low speed! The result is that Morse can be sent with an absolute minimum of wrist movement. For example, an A (: —) is sent by squeezing the paddles together ensuring that the dot one makes slightly before the dash paddle. For an N (— ·) the dash paddle is made first and if the action is held a C (— · ·) will emerge.

If one is accustomed to the mechanical bug key it is possible to use the same action on the squeeze keyer, producing good Morse, but the number of movements made



Block diagram summarising the functions of the various stages in the keyer.

SPECIFICATION	
SPEED	Variable from less than 10wpm to 60wpm or, alternatively, 10 to 35wpm.
KEYER OUTPUT	Positive line to earth with max. open circuit voltage of 300V, max. current of 200mA. Negative line to earth with max. open circuit voltage of 200V, max. current of 10mA.
AUDIO	Sidetone adjustable from 500Hz to 1kHz fed to internal speaker or headphone jack, min 500Ω.
CONTROLS	Volume/On-Off. Speed/Pull-to-hold (Internal: Sidetone frequency-paddle tension-paddle travel).
REAR PANEL	Keyer output. Headphones. External key. External DC supply. Receiver audio.
POWER SUPPLY	120/240V 50/60Hz 3-5W. 10 to 14.5V DC 150mA (negative earth).
DIMENSIONS	127mm wide, 76mm high and 190mm deep (5 x 3 x 7½ in. deep)
WEIGHT	1.25kg (2.75lbs) includes lead weight bolted to bottom of case.

There are 11 diodes, 8 transistors and 5 integrated circuits in the keyer.

will be greatly in excess of those required using the proper squeeze technique. This is covered in detail in the handbook and it does not take very long to get the hang of it but it is still a matter of wonder as to how so much Morse can come out with so few movements!

THE CIRCUIT

The block diagram shows the various stages in the keyer. When a paddle is operated the 'present bit memory' commands the clock enable circuit to start a bit and ensures that the present bit is completed before another starts. The 'next bit memories' retain the information of which bit is next, a dot or a dash, if a dot or a dash was keyed before the present bit is completed. After the present bit is completed the 're-sets' load the 'present bit memory' with the information that is in the 'next bit memories'. Each dot and dash and off time is uniform because of the clock which produces uniformly spaced pulses.

The bit generator then responds to the clock pulses and the dot-dash determining line to produce a dot, or a dash which is three times as long as a dot, and on off time. The output circuitry drives the keyer output and sidetone circuitry.

The power supply is a normal series regulated bridge circuit that supplies 5V for the keyer. A diode protects the power supply against reversed polarity when an external battery is used to operate the keyer.

CONSTRUCTION

The instructions in the handbook were followed implicitly and it took 12 hours on a Sunday from start to finish including time off for meals, coffee-breaks and 'Upstairs, Downstairs'! It is important in such projects not to spend too long at a stretch or interest flags and mistakes can occur.

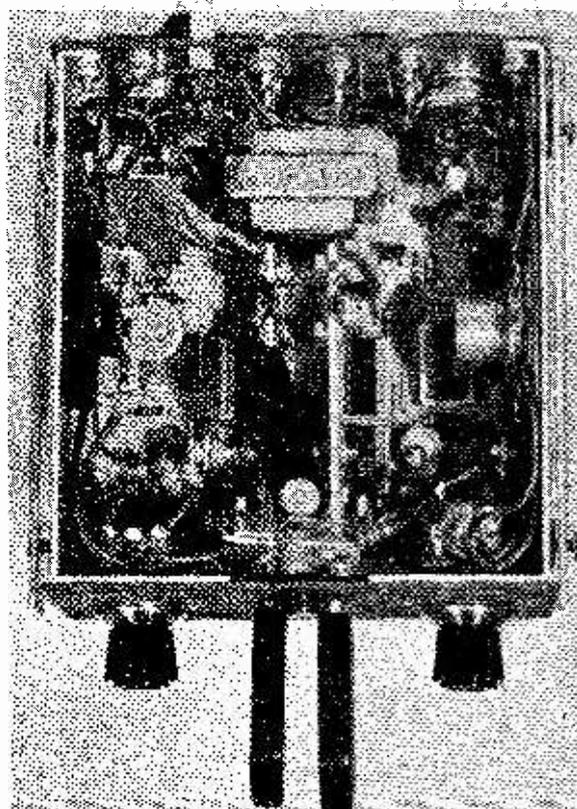
The Heathkit manual is impeccable, as usual, and the amount of detailed instruction incredible. The 10 to 35wpm option was selected as the alternative maximum of 60wpm was thought to be a bit high for contest work! Another interesting option is left or right hand operation of the paddles.

The solder supplied (American, presumably) was used but after a couple of joints it was abandoned in favour of the usual Multicore, which was noticeably superior. The mains transformer was wired for 240V input, of course, so the '1/16' ampere fuse supplied for 120V operation was redundant but was in fact used anyway! One day the correct '1/32' fuse will be fitted.

After carefully checking all the soldering on the PCB it was assembled into the casework and the various controls wired in, everything going according to plan. Following instructions, resistance tests were carried out with a multi-meter and proved frightening until the test leads were reversed! All was in order and the keyer worked the first time it was plugged in. The side-tone frequency was adjusted to about 1kHz and the paddle contacts adjusted for above-average gaps until experience of the keyer had been gained. The gaps are adjusted simultaneously by a common lever. The keyer was used on a 10W transmitter on the 160m amateur band keying the negative bias line (-45V) to the PA.

FACILITIES

Some keyers using solid-state devices end up with a mechanical relay which, by its very nature, imposes restrictions on keying at high speeds so it is good to see that the HD1410 is solid-state throughout, including the transmitter keying circuits. No adjustments are required whatever polarity of keying line is encountered in a transmitter. An



Looking into the top of the keyer the PCB is in the bottom, the mains transformer at the centre rear. The lever over the paddle assembly adjusts the gaps of the paddles simultaneously. The internal speaker is mounted on the right side of the cabinet. A piece of sheet lead is fastened to the bottom of the case to prevent movement of the keyer on the operating desk.

external key can be plugged in which will operate the keyer and the sidetone.

The audio output of a receiver can be fed into the keyer so that signals can be heard plus the sidetone of the keyer on transmit, a very useful feature indeed. Of course this arrangement can be done using external leads on any transmitter/receiver set-up but it is nice to realise that somebody thought of incorporating it into the keyer. For field days or portable work the keyer can be operated from a 12V battery and a lead is supplied for that purpose.

The keying waveform is very sharp as one would expect so the usual waveform shaping components in the transmitter are essential to avoid the radiation of objectionable clicks associated with steep-fronted waveforms.



The rear panel of the keyer has phono sockets for the various facilities including the feedthrough of signals from the receiver to the headphones in the keyer.

The keyer is a joy to use for the operator and surely must make the task of copying the code at the other end that much easier, especially under conditions of bad interference. Needless to say, the virtually perfect code excites a lot of favourable comment. Unfortunately, sending fast invites a fast reply and the keyer cannot help there! But it is not long before one gets accustomed to keeping the speed down which is such a pity with this delightful keyer!

AED

Price of kit £39.90 inc. VAT and P/P from Heathkit (Gloucester) Ltd. Gloucester GL2 6EE

CMOS Crystal Calibrator—continued from page 972

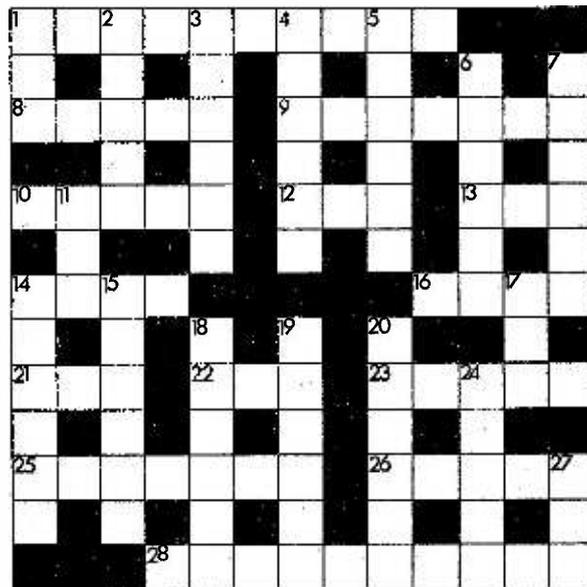
switched on, one frequency at a time should be selected, and the reading of the frequency meter observed. If the frequency meter is a digital one, the meter's clock oscillator should be adjusted until the meter reads correctly. If the frequency meter is of the analogue type, then usually a potentiometer may be adjusted in order to obtain the correct reading.

For calibrating a radio receiver the output collector should once again be connected to the calibrator's internal supply and a single wire connected to the calibrator output and placed in proximity to the receiver's aerial or aerial input. The 1MHz output of the calibrator should be selected and the receiver tuned until the signal is identified. If there is any confusion as to whether it is the calibrator signal or an external signal being received, the calibrator should be switched off, whereupon the signal should disappear. The point to which the receiver is now tuned is a multiple of 1MHz. Next, with the 1MHz signal still selected, the 100kHz switch should be closed, providing additional markers at 100kHz intervals. This process can be continued to provide 10kHz markers by closing the 10kHz switch.

To use the calibrator as a signal source for logic circuits under construction or under test, the output collector should not be connected to the calibrator supply but instead to the supply voltage of the circuit being driven.

Practical Wireless, March 1976

PW TECHNIGROSS PUZZLE No.12



ACROSS

- 1 Jammed part of USA with such electronics? (5, 4)
- 8 Use a bug? Has no option about it! (5)
- 9 Maths symbols make oscillating nice, Sid? (7)
- 10 Vessel transformer prohibition is back in? (5)
- 12 Owing three components of decouplers? (3)
- 13 Sheep sound without distortion by you? (3)
- 14 They used to be wired on a frame system (4)
- 16 He's involved in most antennae? (4)
- 21 Small resistance unit for Pam's rectifier? (3)
- 22 Eggs into valves! (3)
- 23 Distant little notice means unit of capacity? (5)
- 25 Colin is rebuilding such a transistor? (7)
- 26 His output resistance was unavailing! (5)
- 28 Flog your clothes to get such equipment! (10)

DOWN

- 1 Nothing in the vessel for a distress call? (3)
- 2 Aerial components with a reel set-up? (5)
- 3 Application of drugs to diode impurity process? (6)
- 4 Valve junction in Brazil of French design (6)
- 5 Not out of order with this rectifier? (6)
- 6 Local interference with standard English? (6)
- 7 One serious hook-up puts the navy behind? (6)
- 11 Relayed about half a nautical affirmative? (3)
- 14 Military band-pass with such sound? (6)
- 15 Basic aerial may be lucky with Spanish call (6)
- 17 Girl in the extra damping section? (3)
- 18 It makes a low sound childish! (3-3)
- 19 The attraction of inductance? (6)
- 20 Once more put on the air a new tune? (6)
- 24 German flower in her picture distortion (5)
- 27 Drum-type receiver (3)

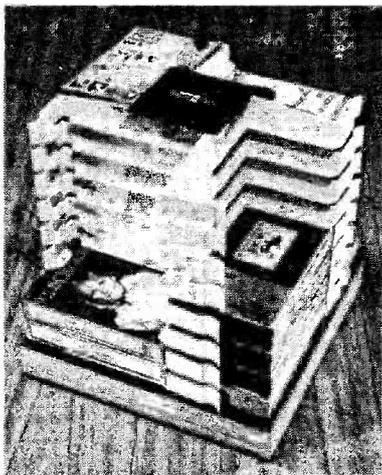
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ANSWERS NEXT MONTH

PRODUCTION LINES

colin riches

CASSETTE STORAGE

Plastic Engineers Limited of Glamorgan have introduced a de-luxe version of their Tape-Rax unit for the storage of cassettes. (Mentioned in Production Lines last year.)



The base of the Super Tape-Rax is finished in a simulated woodgrain effect and the actual cassette clip-type holders come in an attractive ivory finish.

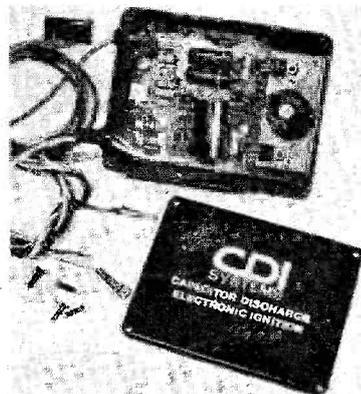
The excellent design of this unit enables it to be extended to hold additional cassettes. The Super Tape-Rax holds 32 cassettes in eight levels but the manufacturers can supply add-on units—each holding a further 16 cassettes on four levels. The unit, which is manufactured from virtually unbreakable plastic, revolves for easy cassette selection.

The recommended retail price of the Super Tape-Rax is £4.65—pretty good value for money and you should be able to obtain units from normal retail outlets. If however there is any problem, for a price of £4.97 inc. VAT, postage and packing, the manufacturers will supply direct. The add-on unit costs £1.60 inc. VAT, post and packing. *Plastic Engineers Limited (Dept. P.W.), Treforest Industrial Estate, Pontypridd, Glamorgan, CF37 5TP.*

ELECTRONIC IGNITION

C.D.I. Systems Limited of Beckenham, Kent market capacitor discharge electronic ignition systems. Capacitor discharge, as the name implies, is an electronic ignition which discharges a charged-up capacitor through the primary side of the coil. This is then stepped up by the transformer action of the coil to about 30kV. The speed and energy of the spark thus created start an engine—even if the sparking plugs are very dirty.

The company markets two types of unit—System 1 (£18.80 including VAT/postage) for high-revving or tuned cars, employs a reflective disc/sensor and this is used in place of the contact breaker points. The disc is simply slipped over the cam and secured by four screws. The sensor contains an infra-red LED which sends a narrow beam of light onto the



disc. This is then reflected back onto a photocell, a slot edge giving the firing 'signal'.

System 2 is a basic unit. The existing contact breaker points are still used, so fitting is very simple. Minimal point wear takes place however due to the low current passing through them. Price of the System 2 is £12.80 including VAT and postage. Both units also come in kit form: System 1 (£16.80) and System 2 (£10.80).

Further gen may be obtained from *C.D.I. Systems Limited, (Dept. P.W.) 112 Beckenham Road, Beckenham, Kent. Telephone 01-650-0723. (S.A.E. please). Mail order address is 275 Vale Road, Ash Vale, Aldershot. Telephone 0252-29316.*

ELECTROVALUE CATALOGUE

The Electrovalue Component Catalogue is produced annually with usually two following amended editions to keep information up-to-date. Catalogue No. 8—the latest—is bigger than ever, running to 144 pages. The Catalogue is available for 40p, post paid and includes a refund voucher for 40p available for spending on mail orders to the value of £5.00 or more.—*Electrovalue Limited, (Dept. P.W.) 28 St. Judes Road, Englefield Green, Egham, Surrey, TW20 0HB.*

joints of brickwork and locked by a single bolt.

Ideal for the majority of domestic aerial installations, the Rawlplug SSB1 has a recommended retail price of £2.21 plus VAT at 8%. *The Rawlplug Company Limited, (Dept. P.W.) Rawlplug House, 147 London Road, Kingston-upon-Thames, Surrey, KT2 6NR. Telephone 01-546-2191.*

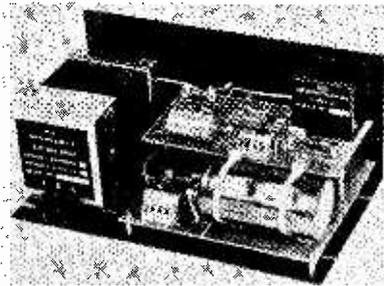
AERIAL MAST FIXING

The Rawlplug Company Limited have just released an ingenious new fixing for television and radio aerial masts. Called the Rawlplug SSB1, the new self-supporting bracket outdates the traditional and time-consuming lashing kit. With the SSB1, aerial rigs can be safely and strongly fixed in less than two minutes.

The SSB1 comes ready assembled and features two adjustable arms which are clipped into the mortar



TTL AND CMOS P.S.U.



Hybrid systems incorporating TTL and CMOS logic may be simplified by the inclusion of a new Weir composite power supply.

The 5V5A in its basic form produces an output of 5 volts at 5 amps and by the addition of an auxiliary card, designated 5-18V, a

TUAC MODULES

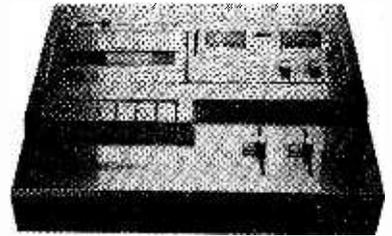
We recently had a chance to examine three of Tuac's modules—Four Channel Sound to Light Sequencer 4LSM1 is 1kW per channel unit having a switched master control for sound operation from 0.5W to 125W. A speed control sets a fixed rate sequence from 8 per minute to 50 per second. It will flash four sets of lights (each set up to 1kW) and it can also be used in a sound triggered mode whereby a music input is switched in and the lights flash in time with the music. Price is £22.

Sequence Dimmer type 3SDM1, has a control for varying the speed from 3 per minute to 10 per second and it is designed specifically for addition to the Tuac S1LMB light modulator. Price is £9.50.

The third item (S1LMB4) was the 3-Channel Light Modulator. Features are: R.C.A. 8A Triacs used, 1kW per channel; master control to operate from 1W to 100W; full wave control; 12 easy connections. Price is £15.50. A single-channel version (1500W) is available at £7.25. For further gen on these and other Tuac equipment write to *Tuac Limited, (Dept. P.W.) 119/121 Charlmont Road, London, S.W.17.*

second output, variable from 5 to 18 volts at 250mA is facilitated. Several units may be connected in parallel to increase the available output current.

The 5V5A is fused, re-entrant current limited and optionally crowbar protected. Regulation is less than 0.05% variation for a $\pm 10\%$ load change. Output resistance is less than 1 m Ω at DC, whilst impedance is typically under 200 m Ω and 100kHz. Price of the 5V5A is £24.50 for 1 off. Price of the 5-18V is £7.50 for 1 off. *Weir Instrumentation Limited, (Dept. P.W.) Durban Road, Bognor Regis, Sussex.*



Like the receivers, the cassette decks feature brushed silver and teak finishes. The TC4000 is priced at £79.95, whilst the TC5000D, which incorporates a Dolby circuit is £99.95.

CHINON HI-FI EQUIPMENT

A completely new range of hi-fi equipment has been launched by Dixons under their exclusive Chinon brand name. This new equipment is also available in Wallace Heaton shops—part of the Dixons Group.

The range consists of three receivers, two cassette decks and a record deck.

The AR6000 at £99.50, is the lowest priced of the receivers.

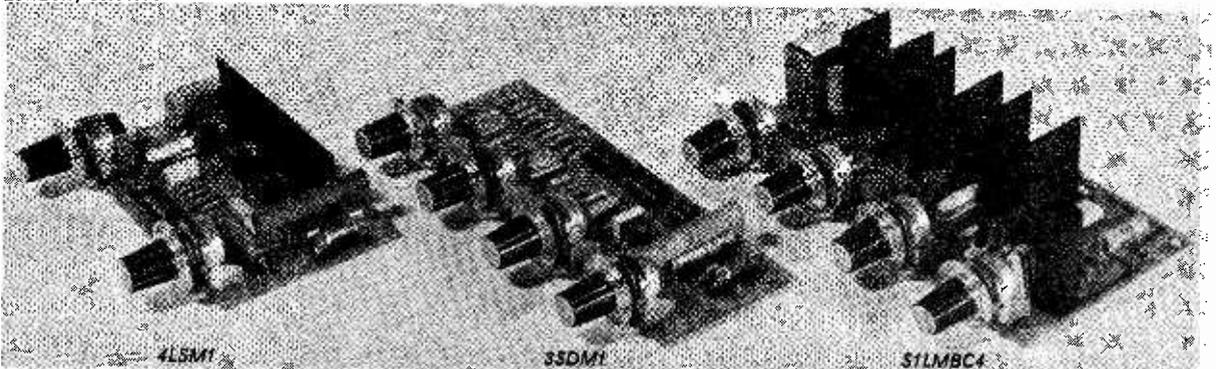
The AR7000 receiver, priced at £139.50 has a greater output—25 watts (8 ohms) RMS per channel, (both channels driven). Besides an FM tuning meter, there is also an AM/FM signal strength meter and this model has FM muting and hi filter switches.

Two switchable inputs are provided for magnetic cartridges and the auxiliary input can be utilised for crystal and ceramic cartridges. Also, two tape inputs are provided and these, used with tape monitor switches, enable tape-to-tape dubbing to be undertaken.

The AR8000 receiver (price £159.50) incorporates a sensitive AM/FM tuner section and an amplifier rated at 40 watts (8 ohms) RMS per channel (both channels driven).



The Chinon PL25 2-speed record deck is £57.95. It is belt-driven by a 4-pole synchronous motor. At the end of the record play the arm returns to rest position automatically and the turntable motor power supply is cut off. The S-shaped arm has a calibrated stylus pressure weight and is fitted with a factory balanced anti-skate device. Fitting a cartridge is made simple with the head shell which attaches to the pick-up arm with a locking collar. Speed selection is by twin buttons and the cue lever is conveniently positioned at the front of the deck. The teak finish plinth is fitted with a tinted, hinged dust cover. *Dixons Photographic Limited, (Dept. P.W.) 64 New Bond Street, London, W1Y 9DF. Telephone: 01-499 1707.*

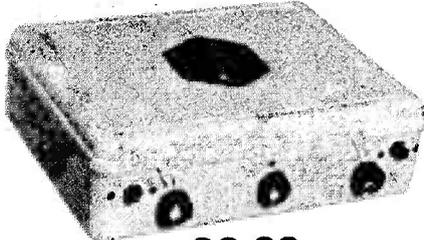


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- ★ Signal Injector.
- ★ Transistor Tester NPN-PNP.
- ★ 4 Transistor Push Pull Amplifier.
- ★ 5 Transistor Push Pull Amplifier.
- ★ 7 Transistor Loudspeaker Radio MW/LW.
- ★ 5 Transistor Short Wave Radio.
- ★ Electronic Metronome
- ★ Electronic Noise Generator.
- ★ Batteryless Crystal Radio.
- ★ One Transistor Radio.
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Components Include: 24 Resistors ● 21 Capacitors ● 10 Transistors ● 3 1/2" Loudspeaker ● Earpiece ● Mica Baseboard ● 3 12-way connectors ● 2 Volume controls ● 2 Slider Switches ● 1 Tuning Condenser ● 3 Knobs ● Ready Wound MW/LW/SW Coils ● Ferrite Rod ● 6 1/2 yards of wire ● 1 Yard of sleeving etc. ● Complete kit of parts including construction plans.

Total Building Costs **£9.99** P & P 65p

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Self Contained Multi-Band V.H.F. Receiver Kit. 8 Transistors and 3 Diodes. Push/Pull output. 3" Loudspeaker, Gain Control. Superb 9 section swivel ratchet and retractable chrome plated telescopic aerial. V.H.F. Tuning Capacitor, Resistors, Capacitors, Transistors, etc. Will receive (subject to local reception conditions) T.V. Sound, Public Service Band, Aircraft, V.H.F. Local Stations, etc. Operates from a 9 Volt P.P.7 Battery (not supplied with kit)



Complete kit of parts including construction plans **£7.95** P.P. and Ins. 55p.

ECK 4

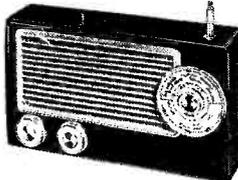
7 Transistors, 6 tuneable wavebands, MW, LW, Trawler Band, 3 Short Wave Bands. Receiver Kit. With 5" x 3" Loudspeaker. Push/Pull output stage, Gain Control, and Rotary Switch. 7 Transistors and 4 Diodes. 6 section chrome-plated telescopic aerial. 8" Sensitive Ready Wound Ferrite Rod Aerial. Tuning Capacitor, Resistors, Capacitors, etc. Operates from a 9 Volt P.P. 7 Battery (not supplied with kit). Complete kit of parts including construction plans **£7.25** P.P. and Ins. 55p.



TRANS EIGHT

8 Transistors and 3 Diodes, 6 Tuneable Wavebands: MW, LW, SW1, SW2, SW3 and Trawler Band. Sensitive Ferrite rod aerial for MW and LW. Telescopic aerial for Short Waves. 3in Speaker 8 improved type transistors plus 3 diodes. Attractive case in black with red grille, dial and black knobs with polished metal inserts. Size 9 x 5 1/2 x 2 1/2in approx. Push pull output. Battery economiser switch for extended battery life. Ample power to drive a larger speaker. Complete kit of parts including construction plans. (Overseas Seamail P. & P. £2.50)

Total Building Costs **£6.99** P.P. & Ins. 55p



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Build Radios, Amplifiers, etc.

Components include: Five units to construct
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Total Building Costs **£6.99**

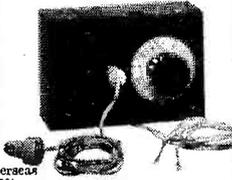
NEW EVERYDAY 6

6 Transistors and 3 diodes. Powered by 9 volt battery. Ferrite rod aerial 3" loudspeaker, etc., MW/LW coverage. Push Pull output. Complete kit of parts including construction plans.

Total Building Costs **£5.50** P.P. & Ins. 50p. (Overseas Seamail P. & P. £2.30)

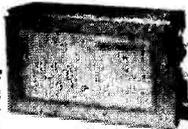
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Total Building Costs **£3.99** P.P. & Ins. 50p

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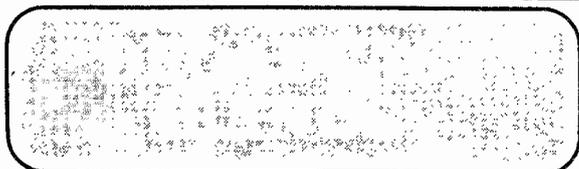
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Address

PW 3



MEDIUM WAVE DX

by CHARLES MOLLOY

F A. Ainsley of Hartlepool has sent in an excellent log of DX from the Caribbean. Using a medium wave loop aerial, differential amplifier and homemade receiver he picked up Georgetown, Guyana on 760kHz, Radio Belize on 834kHz and Martinique on 1310kHz, so obviously medium wave broadcasts from the Caribbean are capable of being logged in the UK at this time of the year. Listen for WKAQ in San Juan, Puerto Rico on 680kHz, Radio Progreso, Havana, Cuba on 690kHz (in Spanish); Paramaribo, Surinam on 720kHz (in Dutch); PJB in Bonaire on 800kHz with multilingual Trans World Radio broadcasts from a 500kW transmitter; Radio Caribbean in St. Lucia on 840kHz, Radio Barbados on 900kHz, ZDK St. John's, Antigua on 1100kHz and Radio Paradise in St. Kitts on 1265kHz. Each of these stations has been heard in Europe this winter.

DXers are sometimes advised to operate their receivers with the AGC switched to the ON position, the RF gain control set to maximum and the signal level adjusted with the audio gain control. This method is suitable for general short wave listening when the main interest is with strong signals. The automatic gain control operates on strong signals and automatically adjusts the gain of the RF and IF stages in sympathy with the level of the incoming signal, thus when the signal strength is high the receiver gain is low and when the signal fades the receiver gain increases. So the AGC is very useful for countering the effects of fading.

Unfortunately, this technique is unsuitable for DXing on the medium waves and is probably the main reason for the lack of success experienced by newcomers to the band. Much of the MW DX heard in Europe consists of signals which are subject to slow cyclic fading and often separated by only a few kHz from a strong local station. If the AGC is switched ON and an attempt is made to listen to a weak signal which is close to a strong one then the AGC will respond to the strong signal, the receiver gain will be reduced and the weak signal will be missed.

Always switch OFF the AGC when DXing on the medium waves. Set the AF gain to give a comfortable

volume at the headphones or loudspeaker and use the RF gain control to adjust the receiver sensitivity. Overloading will occur when a strong station is tuned in so the RF gain will have to be low but when searching for DX turn up the RF gain until the noise level appears. The receiver will now be in its most sensitive state. Fading, which is usually slow, is countered by manual adjustment of the AF gain and the DX can be followed right down to the level of static and receiver noise during the trough of the fading cycle. The DXer who tunes rapidly across the band with his AGC switched on will miss much of the DX. Tune slowly. Be patient, the signal may have faded temporarily and make sure the AGC is off.

Some of the best North American DX for several years has been heard in the UK this winter. During the month of October several broadcasters on the west coast of Canada and the United States were logged including KOMO in Seattle on 1000kHz; CKDA in Victoria, British Columbia on 1220kHz; CHQM in Vancouver on 1320kHz and KFBK in Sacramento, California on 1530kHz. Other rarities reported recently are WCCO in Minneapolis on 830kHz; WWL New Orleans on 870kHz; WHO Des Moines on 1040kHz; KMOX St. Louis on 1120kHz and KSL in Salt Lake City, Utah on 1160kHz. These loggings are a further indication of the improved conditions on the lower frequencies, now that we are approaching the minimum of the current sunspot cycle. If you have never heard North America on the medium waves, now is the time to try. At this time of the year the best time to listen is around midnight. When conditions are favourable a number of the high power outlets on the east coast of Canada and the United States should be audible, even with quite simple receivers. The most consistent one is CJON in St. John's in Newfoundland on 930kHz. It is easy to identify as its callsign is used frequently and local time in Newfoundland is three and a half hours behind GMT.

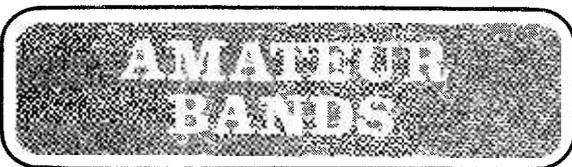
Harold Emblem reports again from Mirfield, in Yorkshire. He logged Nouakchott in the African Republic of Mauretania on 1349kHz recently and the station verified with a QSL card. Congratulations on a fine achievement Harold. DXers are not always content when they have logged a distant station and many wish to obtain a letter or card from the station, confirming their reception. International broadcasters are of course very pleased to hear from their audience and willing to send out QSL cards, programme schedules, pennants and other mementos of the occasion.

Although the majority of medium wave stations will verify, it is sometimes an achievement in itself to obtain a QSL from a distant station. The DXer



is located well outside the service area of his quarry and although the station staff (usually the Chief Engineer) may be surprised and pleased to learn that they have been heard at a great distance, the DXer should remember that he really has the status of an eaves-dropper and he is relying on goodwill for a reply.

A reception report to a medium wave station should contain enough programme detail, including the date and time in GMT, to enable the station to confirm that it was indeed their transmission that was heard. The report should be sent off as soon as possible and should request a verification of reception. It should always be accompanied by return postage. Foreign stamps are available from stamp dealers but more conveniently an International Reply Coupon can be bought at main post offices. An IRC is exchangeable in most parts of the world for stamps that will cover the cost of a letter to any part of the world by surface mail.



by **Eric Dowdeswell G4AR**

IT is very satisfying to get a number of letters each month from really raw recruits to our hobby. Some have no equipment at all while others have bought a set and then wonder where to go from there! Unfortunately, the set is not always suitable for our work. The main point is that these newcomers are the licensed amateurs of the future and it is very important that they be given every assistance and guided along the right lines from the outset. Some are "eavesdroppers" from the aircraft and public service bands, an activity which I strongly deprecate, so they usually get a firm and polite reply from me pointing out the virtues of the amateur and broadcast bands. They are often surprised to learn that there is an amateur band from 144 to 146MHz on VHF!

Finally, I direct the newcomer's attention to the Radio Society of Great Britain and send a copy of their list of publications. It is at this point that the system breaks down! On joining the RSGB the newcomer, if under 18 years of age and unlicensed, gets his Associate number (A1234 for example) and eagerly scans his first copy of the monthly magazine Radio Communication. What does he find of interest to the beginner? Next to nothing! It's not surprising that I seem to get more mail from the 'A' fraternity than the RSGB on the subject of the amateur bands!

Andrew Swiffin A8603 (Cheadle) comments on the improved conditions on Top Band but regrets that he

has not been able to devote much time to the bands owing to important exams. Quite right OM, they do come first. **Steve Cottis** A8961 (Harrogate) took time off to improve his aerial system, a 66ft end-fed being modified to a Windom. I would suggest that this be modified again to a VS1AA aerial which will perform well on several bands.

Paul Barker BRS34898 (Grangetown) reported an uneventful month but did manage to catch an interesting one in KC4AAA located at the geographical South Pole and Paul got it on to tape. **Paul Turner** (Bishops Stortford) has taken to the amateur bands with a Trio QR666 with a Microwaves module for the 2m band fed from a five-element yagi. On the HF bands he has a 100ft wire. **Jeremy Hinton** A8962 (Newcastle, Staffs) awaits the result of the December RAE with some trepidation. He has a B44 transceiver in the process of conversion to the 4m band so looks like he is going straight for his G4+3!

Peter Allen (Taunton) now has a shack in the garden so he can spread himself a bit. He's not been able to find any DX on the bands in the evenings which surprises me in view of all the other reports of activity, especially on 80m. He enjoyed himself going portable with G8IZE into the Quantock Hills where they worked into Germany and Switzerland on 2m.

Tim Charles (Colchester) was well pleased with his effort in the RAE so let's hope his optimism is borne out even though it means losing a contributor to this column! He had the excitement of hearing W2ACS/MM send out a Mayday call when the MV Scorpion was in trouble. DA1EK answered the call and the appropriate authorities alerted. Tim wisely looks at the CW end of the bands, often finding much of interest when there is little activity on SSB.

Old friend **Alan Rae**, now GM4ENN, got thrown in at the deep end. Buying a Swan 350 transceiver he promptly entered the CQ World Wide competition using a TA33Jr and 18AVQ aerials, and managed to keep going for about 20 hours. As he says, "it's much more difficult to work them than to just hear them!"

Log extracts

Alan Rae:— Worked 40m PJ8YFQ EP2TW 4X4QG 20m XJ2UN (Olympic Games call, Montreal) ZL4AP 15m ZB2BL SV1GA WA0HFW/P4

T. Charles:— 80m CR9AK JA4FHE VP2ABC 9M2DW 40m CP5KYS JA6AXH VK3XI ZL2ANT 20m CE4EV VP9L 8R1X 15m FG7XA FY7AK VP5AH 7X3OM 2m GI3JLA GM3YOR and GM4BVD all via auroral propagation

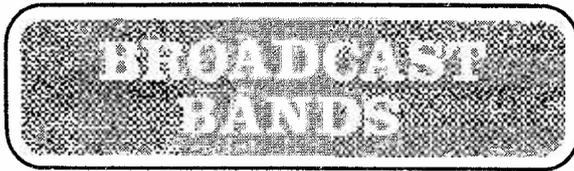
P. Allen:— 80m FP8DH 20m ZL1BD 15m C5AJ ZS1XG FY7BHI ZP5CD JH6PHQ 2m OJ0JEA SM7FJE OH5FF

P. Turner:— 20m KV4IJ VP6AH 2m DK8SYP OE1WWA UB5EC UK2RIL

P. Barker:— 20m C9MAF KC4AAA 9J2AB 20m SSTV EA1AX

S. Cottis:— 20m KR6BT SV0WKK (Crete) VE7TL VP2VBG

A. Swiffin:— 15m TR8SS VK5MS YN1RWG 3B8DN



SHORT WAVE BROADCASTS

by *Derek Bell*

MATELOTS and ex-matelots are asked for advice by **Dr. H. S. Brodribb** of St. Leonards-on-Sea. The good doctor has come into contact with an ex-WD short wave set that has set him a puzzle regarding its age. This set tunes from 15 to 1500 kHz and 1500 to 20000 kHz. The ranges are tuned by four "huge plug in coils" and the set weighs in at 62lbs. It is marked "Admiralty Pattern 1309K, Serial number MF24, Tuner Amplifier B13". Dr. Brodribb would be grateful if any members could identify this set and give him the date of manufacture.

Another mystery set is owned by **J. R. Curtis** of Beaminster who paid ten shillings for it (remember the ten bob note?). While it has no maker's name on, it is in a home-made cabinet and many of the components are marked, including valves VP4B and MHD4. Using this rig Mr. Curtis pulled in Radio Australia at 1600 on 9745 and is a little suspicious that this was a rebroadcast of the R.A. signal. I think you will find that it was the 250kW station at Brisbane and for that time of the evening, while not rare DX, was not unusual, the signals following the night path over Asia and Europe.

It is always a pleasure to hear from readers overseas and this time a letter from Tanzania, from **James Lyamba** of POB25344 Dar-es-Salaam. James has been having problems with a mixer circuit on his home-made set that has gone "up the spout". Having no local DX club or friendly local amateur or even corner radio shop to turn to he would like any DXer, who is so minded, to drop him a line and perhaps correspond regularly. So if any one wants to extend a helping hand please write to the above address.

Radio Berlin International dropped me a line recently to say that they have stopped temporarily the 1730 transmissions on 7260 and 1511 and if anyone has problems in finding them please drop down to the medium waves. For some strange reason Polish Radio from Warsaw has not yet adopted the usual method of frequency notation. Recently they sent me their schedule for November 1975 to May 1976. The announced times are between 0630 and 2300 on the 31, 41, 49 and 75m bands. For the student of languages this station is quite a boon since they do programmes in French, German and Italian and also in Esperanto, slotted between the regular languages at 0500, 0530, 1530, 1600, 2130 and 2200. Another unusual feature of this station is that their scheds. include airtime for what are called "Polish

Seamen". This amounts to six hours a day on six frequencies so one wonders how many Polish seamen there are to merit such a service, when the BBC World Service has only one Merchant Navy record prog!

There is a questionnaire being sent out by Polskie Radio at the moment that offers a free ten day trip to Poland to the lucky "contestant" whose form is drawn out of a hat. I must confess that this sort of scheme is a sore point with me since the questions seem to be a little too personal. They want to know not only the obvious "what is reception like in your area" but "what sort of education did you get", "what is your job" and "Do you find the manner in which we present international affairs convincing?" This latter question I think gives the clue to the whole purpose of the exercise!

This column recently mentioned receivers, including the short wave bands, costing around £50. From Ross-on-Wye, the QTH of **K. H. Smith**, comes word of a set, sold by a namesake bookselling firm, costing £16.75 with 1.6 to 26MHz plus long, medium and VHF bands, although K. H. says that an additional aerial is essential though this addition produces "gremlins". K. H. has managed to log WYFR Scituate, Mass on 17865 at 2000 and Kol, Israel on 9625 at 2000 to 2100.

This set would seem to be the answer to the beginner's prayer, although I have not heard of it or seen any review, so until that time I will content myself with just mentioning its existence.

Simon Knott, from Cambridge, winds up our innings this month with a selection of his best that are worth looking for. He runs a Trio 9R59DS hanging from the end of a 30m long wire and bids us try for the following:— IBRA Radio Sines on 9670 at 2050, Radio Pakistan on 6235 at 2100 and All-Asian Service, Sri Lanka on 9720 at 0200.

With that last little bit of night owling I must wish you and yours 73s and draw this months effort to a close.

BROADCAST BANDS

Short Wave reports by the 15th of the month to **Derek Bell** c/o Practical Wireless, Fleetway House, Farringdon Street, London, EC4A 4AD.

Medium Wave Logs to **Charles Molloy**, 132 Segars Lane, Southport, PR8 3JG.

AMATEUR BANDS

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

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TELEVISION

MARCH 1976

TV RECEIVING AERIALS

It is surprising how often the aerial is overlooked, since the results obtained from a receiver depend on the quality of the signal fed to its aerial socket. In the past there has been rather a lot of confusion about aerial performance and what exactly is required. Pat Hawker goes into the subject from an essentially practical viewpoint, describing what you can expect from the various types of aerial in use, and the requirements of different types of receiver in different geographical situations.

UP-DATING WITH A TRIPLER

Many older colour sets with a GY501/PD500 e.h.t. arrangement give trouble due to ageing in this part of the receiver. A simple solution is to use a tripler instead, dispensing with the line output transformer overwinding and thus increasing the reliability of the stage. Hugh Cocke explains how to go about this.

COLOUR FAULTS

John Coombes deals with the Z884 decoder panel used in the Rank RB23AV colour chassis, explaining common faults and how to tackle them.

In addition he describes his experiences to date with the Mitsubishi CT2000 colour receiver.

WHAT SCOPE?

In the second instalment of his series on test equipment E. Trundle considers what the TV serviceman requires of an oscilloscope and reviews six suitable instruments.

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 Eagle HMT10
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 Fane Pop 55, 8 or 16 ohm
 Fane Pop 60, 8 or 16 ohm
 Fane Pop 70, 8 or 16 ohm
 Fane Pop 100, 8 or 16 ohm
 Fane Crescendo 12A, 8 or 16 ohms
 Fane Crescendo 12BL, 8 or 16 ohms
 Fane Crescendo 15/100A, 8 or 16 ohms
 Fane Crescendo 15/125, 8 or 16 ohms
 Fane Crescendo 18, 8 or 16 ohms
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 Fane 920 Mk II horn
 Fane HPX1 crossover 200 watt
 Fane 13 x 8, 15 watt dual cone
 Fane 801T 8" d/c, roll surr.
 Goodmans Axent 100
 Goodmans Audiom 100 15 ohm
 Goodmans Audiom 200 8 ohm
 Goodmans Axlom 402 8 or 15 ohm
 Goodmans Axlom 8, 8 or 15 ohm
 Goodmans Twinaxiom 10, 8 or 15 ohm
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 Lowther PM6 Mk 1
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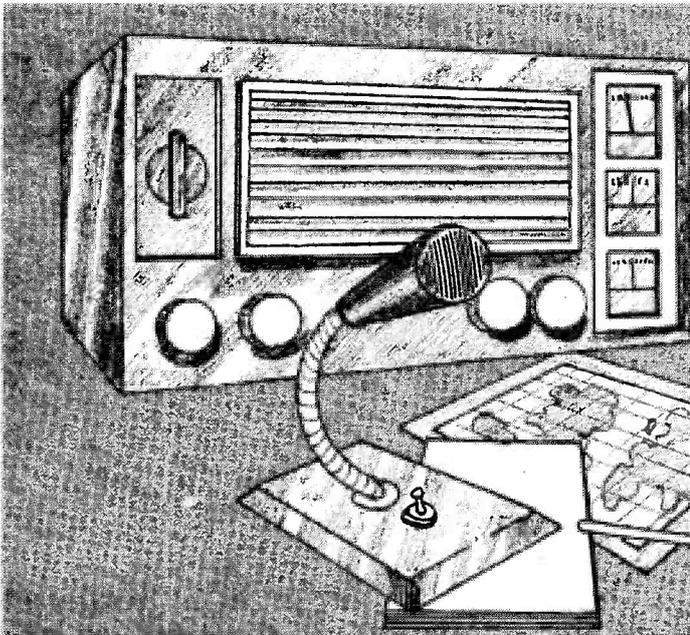
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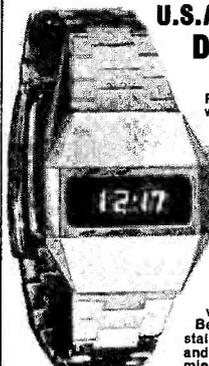
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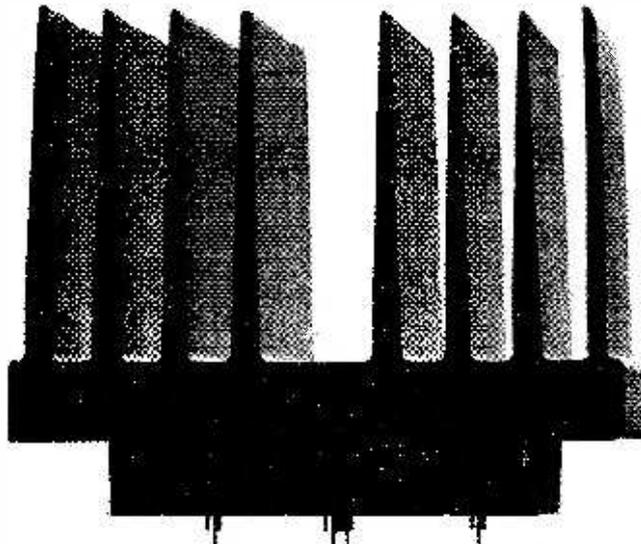
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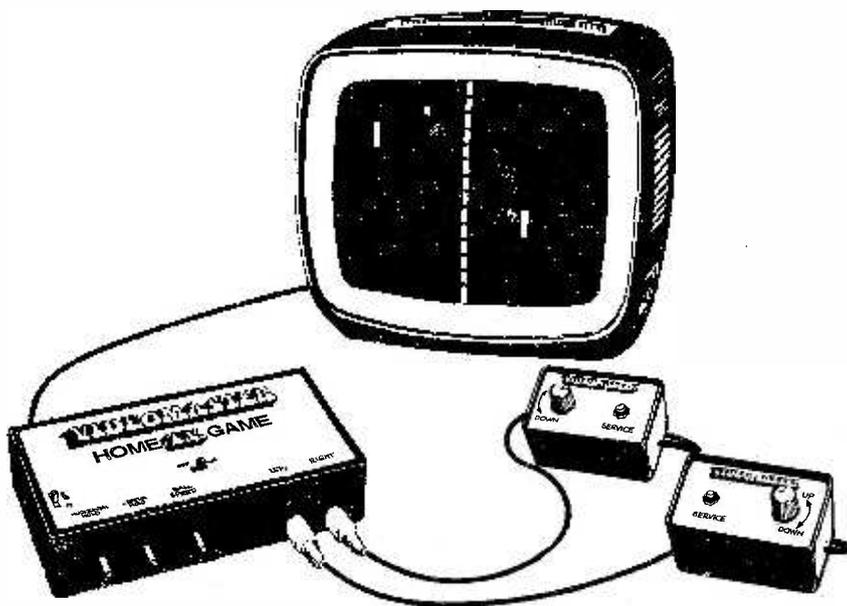
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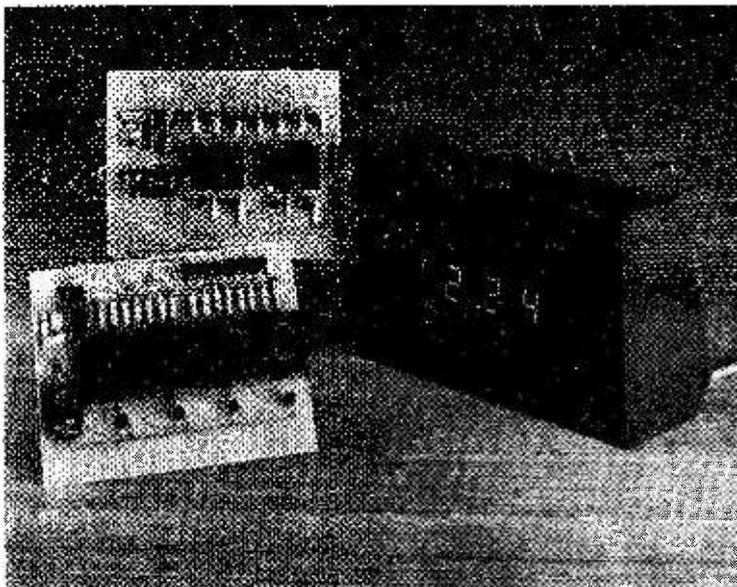
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PLEASE ADD 8% VAT TO TOTAL REMITTANCE.

FLAIRLINE SUPPLIES (Dept. PW3), 124 CRICKLEWOOD BROADWAY, LONDON N.W.2 01-450 4844

poly-planar
20-Watt Full Range Speaker

Completely replaces the conventional cone speaker
Super-thin construction permits new installation ideas.

Power capability: 40 watts peak. **Frequency range:** 40 Hz-20 KHz
Sensitivity: 85 dB/M for 1 watt electrical input. **Input impedance:** 8 ohms. **Operating temperature range:** -20°F to +175°F. **Size (WxDxL):** 1-7/16" x 11-3/4" x 14-11/16". **Weight:** 19 ounces.

£8.50 each Stereo pair £16.50
INCLUSIVE OF VAT AND POSTAGE

web europa
P.O. Box 9, Ruthin Clwyd

HIGH POWER BATTERY MOTOR

8/12v operated string enough to power a motor mower go-cart or similar. Speed easily variable. Series wound so virtually impossible to stop, very heavy duty. Snip at £3.50. VAT & Postage 85p.

Less Powerful 12 volt motor suitable for fan or Heater £2.00. VAT & Postage 65p.

PERMEABILITY TUNERS

M.W. tube stage ideal for use with ZN414 or similar circuit. Price 15p each + post and VAT 15p.

MAINS TRANSISTOR PACK

Designed to operate transistor sets and amplifiers. Adjustable output 6v., 9v., 12 volts for up to 500mA (class B working). Takes the place of any of the following batteries: PP1, PP3, PP4, PP6, PP7, PP9 and others. Kit comprises: main transformer rectifier, smoothing and load resistor, condensers and instructions. Real snip at only £1.50. VAT & postage 60p.

NUMICATOR TUBES

For digital instruments, counters, timers, clocks, etc. Hi-vac XN11. Price £1.25 each, 20p Post and VAT.

DC HIGH CURRENT PANEL METERS

3 1/2" wound wide angle 240 movement meters, flush mounting fitted with external shunts, made by Crompton Parkinson, brand new, still in maker's cartons. These are a real bargain at £5.00 each. Reasonable quantities available in the following ranges 0-10 amps, 0-20 amps, 0-30 amps, 0-40 amps, 0-50 amps. Post and VAT 50p each.

TAPE DECK

In metal case with carrying handle, heavy flywheel and capstan drive. Tape speed 3 1/2". Mains operated on metal platform with tape head and guide. Not new but guaranteed good working order. Price £1.50 plus VAT and Postage £1.50.

SOUND TO LIGHT UNIT

Add colour or white light to your amplifier. Will operate 1, 2 or 3 lamps (maximum 450w). Unit in box all ready to work. £7.95 plus 95 VAT and postage.

TELESCOPIC AERIALS

For portable, car radio or transmitter. Chrome plated—six sections, extends from 7 1/2 to 47in. 50p + 15p. Post & VAT. KNUCKLED MODEL FOR P.M. 80p + 17p Post & VAT.

OVEN THERMOSTAT

Made by the famous Diamond H Company, this has a sensor joined by a capillary to a variable control and when fitted with a knob is ideal for many ovens or processes, 50p each + post and VAT 15p

MAINS TRANSFORMERS

All standard 230-250 volt primaries	£ p
1v	1-78
2-4v	5 amp (special) .85
6-3v	2 amp 1.25
6-3v	3 amp 1.75
9v	1 amp .85
9v	3 amp 2.50
12v	1 amp 1.50
12v	1 amp 1.00
6.5v-0.8-5v	1 amp 1.50
18v	1 amp 1.50
24v	2 amp 2.25
24v	3 amp 3.00
12-0-12v	50mA 1.20
6-0-6v	50mA 1.20
8-0-8v	1 amp 1.50
18-0-18v	2 amp 3.50
25v	1 amp 1.95
50v 2 amp & 8v	1 amp 4.50
90v 5 amp & 5v	1 amp 4.50
27v	8 amp 4.50
30v	37 amp 22.00
80v tapped 75v & 70v	4 amp 5.50
230v-60mA & 6-3v	1.5 amp 1.75
275-0-275v at 90mA & 804v	3 amp 2.25
EHRT Transformer 5000v 23mA	(intermittent) 5-60
Charger Transformers	
6v and 12v	2 amp 1.50
6v and 12v	3 amp 2.25
6v and 12v	5 amp 3.50
Add 30p per piece to cover postage and VAT 26%	

HONEYWELL PROGRAMMER

This is a drum timing device, the drum being calibrated to equal divisions for switch-setting purposes with trips which are infinitely adjustable for position. They are also arranged to allow 2 operations per switch per rotation. There are 10 changeover micro switches, each of 10 amp type operated by the trips, thus 15 circuits may be changed per revolution. Drive motor is mains operated 5 revs per min. Some of the many uses of this timer are Machinery control. Boiler firing. Dispensing and Vending machines. Display lighting animated and signs. Signalling, etc. Price from makers probably over £20 each. Special snip price £9.95. £1.00 Post and VAT. Don't miss this terrific bargain.



BREAK-DOWN UNIT

Contains hundreds of useful parts some of which are as follows—66 silicon diodes equivalent OA91 8S resistors, mostly 1 watt 5% covering a wide range of values 4 x 1 mfd 400v mfd condensers, 15 x .01 mfd 100v condensers, 2 RF chokes 8 x B9 valve holders, 1 x 4H choke, 1 x 115v transformer, 1 boxed unit containing 4 delay lines also tag panels, trimmer condensers, suppressors, etc., on a useful chassis sized approx 9" x 6" x 7". Only 75p (the 86 diodes would cost at least 10 times this amount). This is a snip not to be missed. Post and VAT 75p.

HORSTMANN 24-HOUR TIME SWITCH

With 6 position programmer. When fitted to hot water systems this could programme as follows:

Programme	Hot Water	Central Heating
0	Off	Off
1	Twice Daily	Off
2	All Day	Off
3	Twice Daily	Twice Daily
4	All Day	Twice Daily
5	Continuously	Continuously

Suitable, of course, to programme other than central heating and hot water, for instance, programme upstairs and downstairs electric heating or heating and cooling or taped music and radio. In fact, there is no limit to the versatility of this Programmer. Mains operated. Size 5in x 3in x 2 1/2in deep. Price £5.50. 80p Post and VAT, as illustrated but less case.



THIS MONTH'S SNIP

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 anyone 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 £15.50 including VAT and postage.

GPO PUSH BUTTON DIALLING UNIT

Will take the place of the normal rotating dial has 10 numbered keys, so suitable for other digital systems. A desk mounting unit with rubber feet, this is a very intricate and expensive piece of apparatus. New and unused—our price only £9 each + £1.36 post and VAT.

TWIN OUTPUT POWER PACKS

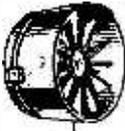
These have two separately R.C. smoothed outputs so can operate two battery radios on a stereo amp without cross modulation (they will of course operate on radio-tape-cassette-calculator in fact any battery appliance and will save their cost in a few months). Specs: Full wave rectification, double insulated mains transformer—total enclosed in a hard P.V.C. case—three core mains lead—terminal output—when ordering please state output voltage 41v, 6v, 7 1/2v, 9v, 12v or 24v. Price £3.95. Post and VAT included.

ONLY £1-50 FOR SEVEN ELECTRIC MOTORS

7 powerful batt. motors as used in racing cars and power models. Output and types vary for use in hundreds of projects—Tools, toys, models. etc. All brand new reversible and for 1 1/2-12v batts. Wiring diag. inc. VAT P Post 40p. FREE plan for min. power station.

BLACK LIGHT

As used in discotheques and for stage effects etc. Virtually no white light appears until the rays impinge on luminous paint or white shirts, etc. We offer 9' 6w tubes complete with starter, choke, lamp holders and starter-holder. Price £2.75 + 30p post. Tubes only £2. Post & VAT 50p. 170 Watt model £6.50 + 92p Post and VAT.



EXTRACTOR FAN

Cleans the air at the rate of 10,000 cubic feet per hour. Suitable for kitchens, bathrooms, factories, changing rooms, etc. It's so quiet it can hardly be heard. Compact, 5 1/2" casing comprises motor, fan blades sheet steel casing, pull switch, mains connector and fixing brackets £4.25 VAT & Postage £1.50.

Monthly list available free; send long stamped envelope.

TERMS: Where order is under £5 please add 30p surcharge to offset packing expenses.

J. BULL (ELECTRICAL) LTD.

(Dept. P.W.), 103 TAMWORTH ROAD,
CROYDON CRO IX.

YOU MAY BE IN TIME

For a valve voltmeter at £7.50—a signal generator at £8.50, an oscilloscope at £12.50—a frequency standard at £19.50 as these and many other good buys were offered in our December Advanced Advertising News. Send S.A.E. for a copy today. Subscribers received this list at least a month ago chances are best buys will have been snapped up so whilst writing why not send £1.25 and receive the next 12 issues in advance.

NOTE: PLUS SIGN AFTER THE PRICES INDICATES VAT.

Ferrite pot core (Vinkor) made by Mullard, maker's ref. No. LA 141074092K. Circuits size approx. 1 1/2" x 1 1/2", a size which is the same as type one specified for the Scroppo car ignition system. Price only 50p + 4p per pair. Post 15p + 1p.

12V DC motor made by Smiths, powerful, ideal for car blower; motor size 4" long x 3" diameter, 1" spindle, 1 1/2" long £2 + 15p. Post 40p + 5p.

Plinth and cover for 8BB pinch is tank colour and cover is smoky. Special offer £4 + £1. Post £1 + 20p. Covers available separately price £2 + 50p. Post £1 + 25p.

Plinth and cover for SP25. This is a deeper, rather nicer plinth, unfortunately more expensive. Price £5.50 £1.36 Post £1 + 25p.

Central heating controller, the Randall Mark 3, as fitted to Trianco and many other central heating systems. Has a two on/off per 24 hour clock switch and a 7 position selector switch. Price £6.50 + 52p. Postage 50p + 4p.

Light for growing. Putting back the clock makes us realise how short daylight is during the months of November, December, January and February. As plants cannot grow without light, short days represent a loss of growing time which can be supplemented by using fluorescent lighting, especially important now that heating represents such an expensive item. We can offer a very cheap form of fluorescent lighting, (we do not think any other firm can beat our price), 50' of fluorescent light £20 + £1.60 if you can collect, or £25 + £2.00 if we have to despatch by British Road Services. For this you get 10 x 5' tubes, 20 tube ends, 10 chokes, 10 starters and holders and 20 carry clips for mounting the tubes. You only have to supply the wooden battens and wiring up wire. Do not miss this offer—only 50 parcels now remain.

Connecting wire. Suitable for joining up these fluorescent lights is available, price £5 + 40p per 100 metres. This is a good quality flat, twin with heavy duty insulation. Post £1 + 8p per reel.

70 stranded very heavy duty wire rated at 15 amps but will carry considerably more than this. 600 metre drums only £10 + 80p per drum. Carriage £2 + 15p.

Multi-range test meter. 11 ranges all selected by central switch, first-class two jewel movement, Japanese made. The right size to put in your pocket, always carry one with you to save your legs and earn your money. Ranges as follows: AC 10, 50, 250, 000; DC 10, 50, 250, 000. Resistance 0-150,000 ohms. Current 0.1-100. A big purchase of these enables us to offer at £4.55 + 36p (post 40p + 3p), which is very little more than we originally sold these for 6 years ago.

9v Battery operated record player motors, on plate with turntable and mat. Price £4 + £1. Post 50p + 13p.

Instrument motor, mains operated, makes 1 rev in 4 hours, made by the famous Smiths Company. Price £1.50 + 12p. Post 10p + 1p.

We have other cabinets including large stereo gram types from £2 upwards and also a number of cabinets for portable players and radios from 50p upwards.

Key chain radio (microsonic) Whilst clearing out our Park Street store we came across a box of these, brand new, just as they left the factory, some had suffered in transit and storage but we tested them all and quite a lot are in working order. You might know someone who would like one for Christmas. We have not got many but are offering at £2 each. Post 40p + 10p. Please note this is just for the radio in its zipped around carrying case. The re-chargable batteries have depreciated beyond reclaiming and so we are not including these.

Thermostat with capillary with sensor joined by approx. 1 metre of capillary covering the temperature range 0-170°C capable of switching 16 amps at 250v. Made by the famous Eanco Company with screwed thread and spindle rather like a valve control—has dozens of applications. Offered at only 75p + 6p. Post 12p + 1p.

Aerials. For medium and long wave, wound and fitted on ferrite rod, 6" long by 1" diameter. Price 60p + 15p Post 10p + 5p.

Snacks, fire and gas alarm (SAGA Mark II) Winter is the worst time for fires because more heaters are used. Even all electric homes are now becoming an increasing fire risk. Colour television, blower heaters, electric blankets have all been the cause of tragic and disastrous fires, so the need for protection in the home becomes greater every day. Do not leave it until it is too late! The money invested in our SAGA Mark II spread over its useful life is negligible compared to the life of one of your dear ones. The SAGA will trigger off when the level of smoke, gas or heat exceeds normal. Price £15 + £1.20. Post 75p + 6p.

Blower/fan by Smiths, maker's ref FF8 0701-022. This is a mains operated blower, the special feature being that the motor is mounted inside the impeller, so making this a very compact. Fan housing size approx. 7 1/2" x 9 1/2" outlet size 3" x 3 1/2". Price £5.75 + 46p. Post 80p + 6p.

Dial thermometer by Rototherm, indicates from 50F to 250F, dial size 3 1/2", chrome and glass front. 75p + 6p. Post 10p + 1p.

Rocker switch 18 amp 250v, white, small snapin fixing into oblong hole, size approx. 1 1/2" x 1 1/2" engraved 'on/off'. 25p + 2p Post 1p.

BENTLEY ACOUSTIC CORPORATION LTD.

7a GLOUCESTER ROAD, LITTLEHAMPTON, SUSSEX
All prices inclusive of V.A.T. at 25% Telephone 4743

OB2	45	6BA6	41	6K7G	85	12E1	85A3	76	DF91	80	
OZ4	55	6BC8	90	6R8G	58	127GT	70	35C5	85	DF96	85
LA3	85	6BE6	41	6L1	234	12K5	117	35D5	90	DK40	88
1A6GT	59	6BE6	75	6L6GC	85	12K7GT	50	35L6GT	88	DKC2	115
1A7GT	60	6B76	84	6L7	58	12K9	85	35W4	80	DKC6	70
1B3GT	59	6BK7A	85	6L18	64	12Q7GT	50	35Z3	88	DL96	84
1H5GT	60	6BQ7A	84	6L19	200	12SC7	50	35Z4GT	82	DM70	80
LL4	25	6BR7	120	6LD20	88	12S8GT	55	35Z6GT	90	DM71	176
1N6GT	76	6BR8	125	6N7GT	70	12SH7	50	42	100	DY87/6	41
1R6	60	6BR7	164	6Q7G	50	12S37	60	43	100	DY902	47
1S4	39	6BW6	100	6Q7GT	80	12S47	76	50B5	100	EBQCC	257
1U4	70	6BW7	85	6Q7(M)	64	12SR7	75	50C5	70	ES0F	220
1U5	88	6BZ6	57	6R7G	70	14E7	74	60C6DG	80	ES8CC	120
2D21	60	6C4	47	6SA7	55	14H7	110	14E	80	ES92C	176
2GK5	75	6C5G	59	6SC7GT	50	19A55	85	50EH5	88	EL80F	117
2X2	70	6C6	47	6SG7	58	19G6	70	50L6GT	100	EL92CC	80
3A4	60	6C9	200	6SH7	55	20D1	80	89A2	75	EL145	82
3D6	47	6CB6A	47	6S37	64	20P2	88	85A3	75	EA50	40
3Q4	85	6CD6G	160	6SK7GT	59	20L1	129	90A4	92	EA76	100
3Q6GT	70	6CG8A	88	6SQ7	50	20P1	100	90C1	88	EACB80	45
3S4	47	6CL6	76	6V6G	80	20P3	94	90G6	281	EAC91	65
3V4	82	6CL8A	94	6V6GT	58	20P4	117	150B2	100	EAF42	88
4CB8	76	6CM7	88	6X4	47	20P5	150	215B2	59	EAF91	80
5C6	75	6CU5	89	6X5GT	50	25A6G	70	807	117	EB34	88
5R4G	94	6CW4	117	7B6	88	28E7	70	5702	100	EB91	88
5U4G	50	6D3	75	7B7	82	25V6G	60	5783	178	EBCA1	88
5V4G	69	6DE7	88	7H7	88	25Z4G	50	6057	100	EBCC1	45
5Y3GT	55	6DT6A	88	7R7	200	25Z5	75	6090	100	EBF80	40
5Z3	88	6EY6	88	7Y4	80	25Z6G	80	6097	100	EBF83	60
5Z4G	55	6E5	117	7Z4	80	28D7	200	7138	82	EBF89	40
6ZAGT	55	6E1	80	6D7	70	30A5	78	9002	85	EBL21	244
6/30L2	60	6P6G	60	10C2	76	30C15	80	90065	60	EC86	90
6A8G	146	6F13	90	10DE7	87	30C17	85	ACPEN 117	EC88	90	
6A7	60	6F14	88	10F1	88	30C18	85	AC2P/	EC92	95	
6AG5	85	6F15	76	10F9	78	30F5	75	DD/	EC93	200	
6AH6	80	6F18	84	10F18	80	30FL1	110	AC6PEN/	EC95	200	
6A75	76	6G23	80	10LD11	88	30FL2	110	AC/TH1	EC94	180	
6AK5	47	6F24	100	10P13	88	30FL18	84	100	EC91	40	
6AK6	70	6F25	117	10A14	234	30FL14	82	AL60	117	EC92	39
6AM8A	70	6F28	78	12A6	76	30L15	82	ATP4	50	EC93	39
6AN8	82	6F32	70	12AC6	90	30L17	76	AZ1	50	EC94	40
6AQ5	55	6G6G	80	12AD6	90	30P4MR	88	AZ21	80	EC95	47
6AR5	58	6H16A	88	12AD6	90	30L12	105	AZ41	50	EC96	100
6AS7	117	6GK5	76	12AT6	80	30P12	90	BL83	234	EC98	55
6AT6	58	6GU7	88	12AU6	53	30P15R	80	CL33	188	EC99	80
6AU6	40	6HG6T	59	12AV6	59	30P4	88	CY10	100	EC907	141
6AV6	53	6J6GT	23	12BA6	53	30PL1	100	CY31	70	ECF80	50
6AW8A	90	6J6	35	12BE6	59	30PL13	120	DAP91	40	ECF82	50
6AX4	88	6J7G	85	12BH7	59	30PL14	120	DAP96	60	ECF86	58
6B5G	35	6JU8A	85	12BY7	85	30PL15	90	DC90	70	ECF84	238

ECH21	234	EY83	70	PCF200	100	Q8150/15	190	VR105	59	ACY22	20	BY127	83
ECH35	160	EY84	92	PCF201	105	VR105	190	VU111	80	ACY28	23	BY210	83
ECH42	80	EY86/7	40	PCF801	85	VR105/20	117	VU120	117	AD140	47	BY211	83
ECH81	40	EY88	60	PCF802	50	R19	350	VU120A	117	AD149	84	BY212	83
ECH83	58	EY91	80	PCF806	60	TH233	75	VU133	80	AD182	89	BY213	83
ECH84	58	EY92	80	PCF807	60	TP2820	100	W107	75	AF114	33	FSY11A	29
ECL80	50	EZ41	55	PCF808	60	UABCR2	45	W729	117	AF115	30	OA9	16
ECL82	45	EZ80	35	PCF81	55	UAF42	75	X66	148	AF117	85	OA10	55
ECL83	82	EZ81	35	PCF82	55	UBC40	50	Z759	585	AF121	39	OA47	18
ECB84	70	GY501	82	PCF84	50	UBC41	80	Translators	80	AF124	39	OA70	20
ECB85	70	GZ32	89	PCF86	55	UBC42	80	& Diodes	80	AF125	39	OA71	20
ECB86	47	GZ33	146	PCF88	50	UBC43	80	IN4744	18	AF126	33	OA72	19
EP28	100	GZ34	80	PCF89	70	UBC44	80	2N4044	23	AF180	62	OA79	12
EP40	88	GZ37	120	PCF90	70	UBC45	80	2N4044	23	AF180	62	OA81	12
EP41	88	HABCS80	80	PCF91	70	UBC46	80	2N4044	23	AF180	62	OA82	12
EP42	90	HL23DD	80	PCF92	70	UBC47	80	2N4044	23	AF180	62	OA83	12
EP73	176	HL33DD	80	PCF93	70	UBC48	80	2N4044	23	AF180	62	OA84	12
EP78	80	HL41DD	80	PCF94	70	UBC49	80	2N4044	23	AF180	62	OA85	12
EP85	40	HL42DD	80	PCF95	70	UBC50	80	2N4044	23	AF180	62	OA86	12
EP86	60	HL43DD	80	PCF96	70	UBC51	80	2N4044	23	AF180	62	OA87	12
EP89	35	HL44DD	80	PCF97	70	UBC52	80	2N4044	23	AF180	62	OA88	12
EP91	50	HL45DD	80	PCF98	70	UBC53	80	2N4044	23	AF180	62	OA89	12
EP92	60	HL46DD	80	PCF99	70	UBC54	80	2N4044	23	AF180	62	OA90	12
EP93	80	HL47DD	80	PCF100	70	UBC55	80	2N4044	23	AF180	62	OA91	12
EP94	80	HL48DD	80	PCF101	70	UBC56	80	2N4044	23	AF180	62	OA92	12
EP95	40	HL49DD	80	PCF102	70	UBC57	80	2N4044	23	AF180	62	OA93	12
EP96	60	HL50DD	80	PCF103	70	UBC58	80	2N4044	23	AF180	62	OA94	12
EP97	80	HL51DD	80	PCF104	70	UBC59	80	2N4044	23	AF180	62	OA95	12
EP98	95	HL52DD	80	PCF105	70	UBC60	80	2N4044	23	AF180	62	OA96	12
EP99	35	HL53DD	80	PCF106	70	UBC61	80	2N4044	23	AF180	62	OA97	12
EP100	50	HL54DD	80	PCF107	70	UBC62	80	2N4044	23	AF180	62	OA98	12
EP101	50	HL55DD	80	PCF108	70	UBC63	80	2N4044	23	AF180	62	OA99	12
EP102	60	HL56DD	80	PCF109	70	UBC64	80	2N4044	23	AF180	62	OA100	12
EP103	70	HL57DD	80	PCF110	70	UBC65	80	2N4044	23	AF180	62	OA101	12
EP104	80	HL58DD	80	PCF111	70	UBC66	80	2N4044	23	AF180	62	OA102	12
EP105	90	HL59DD	80	PCF112	70	UBC67	80	2N4044	23	AF180	62	OA103	12
EP106	100	HL60DD	80	PCF113	70	UBC68	80	2N4044	23	AF180	62	OA104	12
EP107	110	HL61DD	80	PCF114	70	UBC69	80	2N4044	23	AF180	62	OA105	12
EP108	120	HL62DD	80	PCF115	70	UBC70	80	2N4044	23	AF180	62	OA106	12
EP109	130	HL63DD	80	PCF116	70	UBC71	80	2N4044	23	AF180	62	OA107	12
EP110	140	HL64DD	80	PCF117	70	UBC72	80	2N4044	23	AF180	62	OA108	12
EP111	150	HL65DD	80	PCF118	70	UBC73	80	2N4044	23	AF180	62	OA109	12
EP112	160	HL66DD	80	PCF119	70	UBC74	80	2N4044	23	AF180	62	OA110	12
EP113	170	HL67DD	80	PCF120	70	UBC75	80	2N4044	23	AF180	62	OA111	12
EP114	180	HL68DD	80	PCF121	70	UBC76	80	2N4044	23	AF180	62	OA112	12
EP115	190	HL69DD	80	PCF122	70	UBC77	80	2N4044	23	AF180	62	OA113	12
EP116	200	HL70DD	80	PCF123	70	UBC78	80	2N4044	23	AF180	62	OA114	12
EP117	210	HL71DD	80	PCF124	70	UBC79	80	2N4044	23	AF180	62	OA115	12
EP118	220	HL72DD	80	PCF125	70	UBC80	80	2N4044	23	AF180	62	OA116	12
EP119	230	HL73DD	80	PCF126	70	UBC81	80	2N4044	23	AF180	62	OA117	12
EP120	240	HL74DD	80	PCF127	70	UBC82	80	2N4044	23	AF180	62	OA118	12
EP121	250	HL75DD	80	PCF128	70	UBC83	80	2N4044	23	AF180	62	OA119	12
EP122	260	HL76DD	80	PCF129	70	UBC84	80	2N4044	23	AF180	62	OA120	12
EP123	270	HL77DD	80	PCF130	70	UBC85	80	2N4044	23	AF180	62	OA121	12
EP124	280	HL78DD	80	PCF131	70	UBC86	80	2N4044	23	AF180	62	OA122	12
EP125	290	HL79DD	80	PCF132	70	UBC87	80	2N4044	23	AF180	62	OA123	12
EP126	300	HL80DD	80	PCF133	70	UBC88	80	2N4044	23	AF180	62	OA124	12
EP127	310	HL81DD	80	PCF134	70	UBC89	80	2N4044	23	AF180	62	OA125	12
EP128	320	HL82DD	80	PCF135	70	UBC90	80	2N4044	23	AF180	62	OA126	12
EP129	330	HL83DD	80	PCF136	70	UBC91	80	2N4044	23	AF180	62	OA127	12
EP130	340	HL84DD	80	PCF137	70	UBC92	80						

RTVC

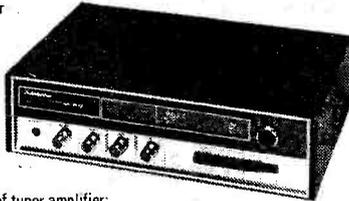
FOR SPEAKERS AT FANTASTIC REDUCTIONS

ELIZABETHAN STEREO TUNER AMPLIFIER

This compact Tuner Amplifier gives you full medium wave and V.H.F. coverage and FM stereo. With inputs for your turntable and tape recorder. It has rotary tuning, Volume, Balance, Bass and Treble controls and push button selection switches for Phono/tape FM Stereo, FM mono, Medium wave and A.F.C. has built-in stereo beacon and switched headphone socket.

Technical Specifications
15 transistors, 11 diodes, integrated circuit.

Power output 8 watts. Size of tuner amplifier: 4" x 10" x 15½" approx. Finished in selected rosewood veneer with brushed aluminium front panel and matching controls. **£29.00** + p & p £1.50.



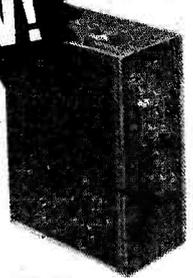
NEW!

THE 'COMPACT'

EASY BUILD SPEAKER KIT

A compact bookshelf speaker system giving a high electro acoustic efficiency for the low powered amplifier. The professional finish can be obtained with the minimum of tools, the infinite baffle type enclosures come ready mitred and professionally finished, simply apply glue, fold up around baffle board, and fix together with masking tape till glue dries.

The cabinet measures 12"x9"x5" deep approx finished in simulated teak, incorporating a quality 7"x4" elliptical speaker, power handling 4 watts, flux density 30,000 maxwells, impedance 8-15 ohms nominal, voice coil dia ¾" magnet size 2¾" approx.



£6.00 pair inclusive. P & P £1.70

SPECIAL OFFER

As above but with a BSR C123 Turntable in matching teak veneered plinth and a pair of 'Compact' easy to build speakers (see opp. panel) **£39.00** + p & p £3.00

BSR DECKS WITH PLINTHS AT FANTASTIC REDUCTIONS



MP 60 Type (illustrated)	£16.00
Less Cartridge	p & p £1.50
C141 (not illustrated)	£12.00
Auto. with Cue Fitted Stereo Cartridge	p & p £1.50
C123 (not illustrated)	£10.00
Auto. with Stereo Crystal Cartridge	p & p £1.50

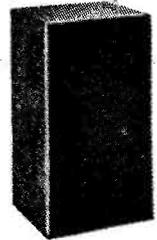
All plinths finished in matching Teak veneer.

EASY TO BUILD SPEAKER KITS

These superb simulated teak-finished speaker kits have been specially designed by RT-VC for the cost-conscious hi-fi enthusiast who wants top quality speakers but doesn't want to spend the earth. Built to EMI's exacting specification, these new RT-VC speaker kits (350 type kit) incorporate 13" x 8" woofer, 3¼" tweeter and matching crossover.

Easily put together with just a few basic tools. **Specification (each speaker):** Impedance 8 ohms. Power handling 15 watts RMS (30 watts peak). Response 20-20,000 Hz. Size 20" x 11" x 9½" approx. Comparable built units (EMI LE3) sold elsewhere for over £45 pair.

£22.00 pair complete + £5.20 p & p. Complete with crossover Components and circuit diagram



EMI 350 KIT

£7.25 + £1.20 p & p. Complete with crossover Components and circuit diagram

System consists of a 13" x 8" approx. woofer with a 3" tweeter, crossover components and circuit diagram. Frequency response: 20 Hz to 20 KHz. Power handling 15 watts RMS into 8 ohms. (Peak 30 watts.)



RTVC

VISCOUNT IV STEREO SYSTEM

System 1a. **£69.00**

The new 20+20 watt Stereo Amplifier incorporating the latest silicon transistor solid state circuitry, the RT-VC VISCOUNT IV gives you a powerful 20 watts RMS per channel into 8 ohms. Superb teak-finished cabinet, with anodised fascia to harmonise with any decor. Polished trim and knobs.

The VISCOUNT IV has a comprehensive range of controls - volume, bass, treble, balance, mono/stereo, mode selector, and scratch filter.

Front panel socket for stereo headphones. And a host of sockets at the rear - for left and right speakers, tape recorder, auxiliary, tuner, disc and microphone.

SPECIFICATION: 20 watts RMS per channel 40 watts peak. Suitable 8-15 ohms speakers. Total distortion @ 10 watts better than 0.2%. Six switched inputs: 1. Magnetic P.U. - 3 millivolts @ 47 K ohms (R.I.A.A.); 2. Crystal/ceramic P.U. - 50 millivolts @ 50 K ohms (R.I.A.A.); 3, 4, 6. Tape Tuner/Aux. - 140 millivolts @ 50 K ohms (flat frequency response); 5. Microphone - 3 millivolts @ 50 K ohms (flat frequency response).

CONTROLS: Push button ON/OFF, stereo/mono, scratch filter, 6 position rotary selector. Individual rotary controls for treble, bass, balance and volume. Headphone socket, tape out socket. Aux. mains output. Frequency response: 25 Hz to 25 KHz @ full rated output. Signal to noise ratio: better than -50 dB on all inputs. **Tone control range:** Bass ± 15 dB @ 50 Hz; Treble ± 12 dB @ 10 KHz. **Power requirements:** 200-250V AC. mains @ 60 watts. Approx. size: 15½" x 3" x 10".

MP60 type deck with magnetic cartridge, de luxe plinth and cover.

Two Duo Type IIa matched speakers - Enclosure size approx. 19¼" x 10¼" x 7¾" in simulated teak. Drive unit 13" x 8" with 3" tweeter. 15 watts handling, 30 watts peak.

Complete System with these speakers **£69.00** + £6.50 p & p.

System 2. **£85.00**

Viscount IV amplifier (As System 1a) MP60 type deck (As System 1a)

Two Duo Type III matched speakers - Enclosure size approx. 27" x 13" x 11½". Finished in teak simulate. Drive units 13" x 8" bass driver, and two 3" (approx.) tweeters. 20 watts RMS, 8 ohms frequency range - 20 Hz to 18,000 Hz.

Complete System with these speakers **£85.00** + £7.60 p & p.

PRICES: SYSTEM 1a
Viscount IV R103 amplifier £27.50 + £1.90 p & p.
2 Duo Type IIIa speakers £30.00 + £6.50 p & p.
MP60 type deck with Mag. cartridge de luxe plinth and cover £22.00 + £3.30 p & p.
Total if purchased separately: £79.50
Available complete for only: **£69.00** + £6.50 p & p

PRICES: SYSTEM 2
Viscount IV R103 amplifier £27.50 + £1.90 p & p.
2 Duo Type III speakers £48.00 + £7.50 p & p.
MP60 type deck with Mag. cartridge de luxe plinth and cover £22.00 + £3.30 p & p.
Total if purchased separately: £95.50
Available complete for only **£85.00** + £7.60 p & p.



20x20 SYSTEM

Scotland and the Orkneys P & P Surcharge System 1a £1.75 System 2 £3.50

PUSH BUTTON CAR RADIO KIT- THE TOURIST TT*



NO SOLDERING REQUIRED

NOW BUILD YOUR OWN £9.50
PUSH BUTTON CAR RADIO +£1.05 p & p.
 Easy to assemble construction kit comprising fully completed and tested printed circuit board on which no soldering is required. All connections are simple push fit type making for easy assembly. Fine tuning push button mechanism is fully built and tested to mate with printed circuit board.
TECHNICAL SPECIFICATION: (1) Output 4 watts RMS output. For 12 volt operation on negative or positive earth. (2) Integrated circuit output stage, pre-built three stage IF Module. Controls volume manual tuning and five push buttons for station selection, illuminated tuning, scale covering full, medium and long wave bands. Size chassis 7" wide 2" high and 4½" deep approx.

Speaker including baffle and fixing strip £2.00 +45p p & p. Car Aerial Recommended - fully retractable £1.60+40p p & p.
The Tourist I Kit For the experienced constructor. If you can solder on a printed circuit board you can build this model. Same technical specification as Tourist TT. **Price £8.20+£1.05 p & p.**

SPECIAL OFFER

The Tourist I Kit, same specification as Tourist TT complete with speakers, fixing kit and fully retractable aerial **£10.50** + p & p £1.50

*STEREO 21 QUALITY SOUND FOR LESS THAN £24.00



Stereo 21, easy to assemble audio system kit. No soldering required.
 The unit is finished in white P.V.C. and the acrylic top presents an unusually interesting variation on the modern deck plinth. Includes - BSR 3 speed deck, automatic, manual facilities together with stereo cartridge.
Two speakers with cabinets.
Amplifier module. Ready built with control panel, speaker leads and full, easy to follow assembly instructions.
Specifications - For the technically minded:
 Input sensitivity 600mV. Aux. input sensitivity 120mV. Power output 2.7 watts per channel. Output impedance 8-15 ohms. Stereo headphone socket with automatic speaker cutout. Provision for auxiliary inputs - radio, tape, etc., and outputs for taping discs.
Overall Dimensions. Speakers approx 15½" x 8" x 4". Complete deck and cover in closed position approx. 15½" x 12" x 6".

Complete only £23.20 +£3.00 p & p.

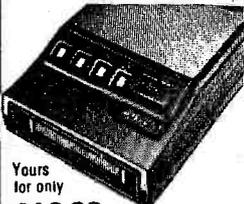
Extras if required. Optional Diamond Stylus £1.60.
 Specially selected pair of stereo headphones with individual level controls and padded earpieces to give optimum performance £5.80.

*DISCO AMPLIFIER



Reliant Mk IV Mono Amplifier, ideal for the small disco or house parties. Output 20 watts RMS into 8 ohms (suitable for 15 ohms).
 Inputs *4 electrically mixed inputs. *3 individual mixing controls. *Separate bass and treble controls common to all 4 inputs. *Mixer employing F.E.T. (Field Effect Transistors). *Solid State circuitry. *Attractive styling.
INPUT SENSITIVITIES - Input - 1). Crystal mic. guitar or moving coil mic, 2 and 10mV. (Selector switch for desired sensitivity.) - Inputs - 2), 3), 4). Medium output equipment - ceramic cartridge, tuner, tape recorder, organs, etc. - all 250mV sensitivity. AC Mains, 240V operation. Size approx: 12½" x 6" x 3½".
£20.00 +£1.35 p & p.

8 TRACK HOME CARTRIDGE PLAYER



Yours for only **£16.20** +£1.70 p & p.

Elegant self selector push button player for use with your stereo system. Compatible with Viscount IV system. Unisound module and the Stereo 21 Technical specification Mains input, 240V, Output sensitivity 125mV

SPECIAL OFFER

As above but complete with build yourself Unisound Amplifier Kit (see opposite panel) + 2 'Compact' easy to build speaker kits (see opposite page) **£25.00** + p & p £2.00

BUILD YOUR OWN STEREO AMPLIFIER*

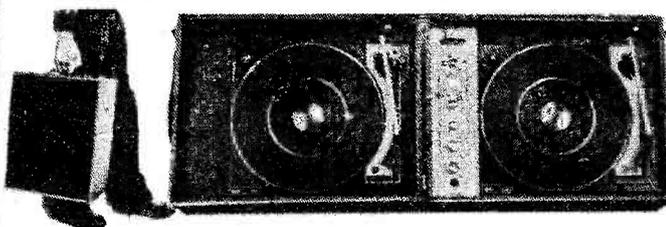


For the man who wants to design his own stereo - here's your chance to start, with Unisound - pre-amp, power amplifier and control panel. No soldering - just simply screw together. 4 watts per channel into 8 ohms. Inputs: 120mV (for ceramic cartridge). The heart of Unisound is high efficiency I.C. monolithic power chips which ensure very low distortion over the audio spectrum. 240V. AC only.

Also available with 2 speakers (7"x4") £10 + £1.75 p & p. **£8.95** + £1.05 p & p.
 Also available with the 'Compact' (see opposite page) easy build speaker kit £13.50 + £2 p & p.

INCORPORATES: Pre-Amp with full mixing facilities, including switched input for mic with volume control, switched input for auxiliary with volume control, bass and treble controls, volume control and blend control for turntables. Two B.S.R. MP60 type single play professional series decks, fitted with crystal cartridges.

PORTABLE DISCO CONSOLE*



TECHNICAL SPECIFICATION:
 Pre-amp - Output - 200mV.
 Auxiliary inputs - 200mV and 750mV into 1 meg. Mic input - 6mV into 100K. 240 volt operation.
 Turntables capacity - 7", 10" or 12" records. Rumble, wow and flutter Rumble Better than -35dB. Wow Better than 0.2%. Flutter Better than 0.06% (Gaumont Kalee meter).
 Finish - Satin black mainplate with black turntable mat inlaid with brushed aluminium trim. Tonearm and controls in black and brushed aluminium.

Console size -
 Unit Closed - 17½" x 13½" x 8½" (app.)
 Unit Open - 35½" x 13½" x 4½" (app.)
 This disco console is ideally matched for the Reliant IV and Disco 50 or any other quality amplifier.
 The unit is finished in black PVC with contrasting simulated teak edging, diamond spun control knobs with matching control panel.

Yours for only **£49.00** +£6.50 p & p.

All prices include VAT at current rates



DO NOT SEND CARD

Just write your order giving your credit card number

Mail orders to Acton. Terms C.W.O. All enquiries stamped addressed envelope. Goods not despatched outside U.K.

Leaflets available for all items listed thus* Send stamped addressed envelope. All items subject to availability. Prices correct at 1st Jan 1976 and subject to change without notice.

* Minimum order on ACCESS/BARCLAYCARD - £11.

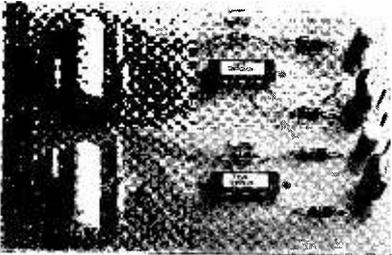


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Personal Shoppers EDGWARE RD: 9 a.m.-5.30p.m. Half day Thurs
 ACTON: 9.30a.m.-5p.m. Closed all day Wed.

tecknowledgely in consumer ICs - and their applications.

SGS Audio ICs



The much heralded TDA2020 is here. And just to make sure that you don't go wrong, so is the SGS application test circuit PCB for a stereo 15 + 15 (RMS) Hi Fi amplifier.

Prices :	IC	AUDIO	DISCRETES
TBA810AS	+HS 1.09	ZTX107/8/9	14p
TCA940E	+HS 1.80	ZTX413(LN)	17p
TDA2020	2.99	ZT212/3/4	16p
FM LINEAR	ICS	BD 535	nprp 7A/60v 52p
MC1350	0.70	BD536	pnpr 53p
CA3089	+QC 1.94	BD377	pnpr 3A/50v 29p
TBA120	+QC 1.00	BD378	pnpr 32p
MPX LINEAR	ICS	BD515	pnpr 2A/45v 27p
MC1310P	+LED 2.20	BD516	pnpr 30p
CA3090AQ	+LED 3.75	BD609	pnpr 10A/90v 70p
		BD610	pnpr 102p

We've moved

To accommodate expanded R & D facilities, AMBIT has moved sales and administration to 25 High St. Brentwood. The existing 37 High Street premises are retained for the engineering activities.

One of the first products of this move has been the development of a TV sound tuner, from an "off air" system, using its own varicap UHF TV tuner, with ICIF amplifiers and block filters by TOKO. And then one of our best ever circuits - an electronic touch tuner, with scanning mode, and facilities for 6 preset stations. The unit is suitable for use with FM, and now AM of course, and offers a complete tuner system, without any moving parts. Selection is by means of touch tuning in all cases, with manual scan and preset switching automatically interlocked.

Our R&D facilities are available for general consultancy to OEMs: further details on application. Standard project estimation fee, including project evaluation comment data is £15.00 payable in advance.

Modules & Kits

New modules:

8011	Totally touch tuned varicap controller built £14.99.
8005	Larsholt tuner set accessory unit, with pilot tone filter and audio stages, rectifier, IC stabilizer, meter driver circuits. £4.99 (kit)
8001	55kHz low pass filter (mpx birdy filter) £2.35 built £1.75 (kit)
2001	Stereo scratch and rumble filter, with continuously variable operating frequencies. £5.80 (built) £4.60 (kit)
3000	Stereo control preamp - a wide dynamic range, low distortion AF preamp, with vol, bal, bass and treble controls. kit £5.78
2020k	The TDA2020 stereo amp kit photographed on the left. £7.85
7700	TV off air UHF sound tuner - built £26.00 (4 preset stations)

9000 kit	AM/FM mpx tuner chassis, with mech. tuner	£17.50
7004 kit	MW/LW varicap tuner module, inc. ferrite rod	£9.95
7252	HIFI MOSFET FM tuner module by Larsholt	£24.00
7253	HIFI FET FM tuner module inc decoder	£24.00
5600	Hi Q MOSFET varicap tunerhead by TOKO	£11.25
EC3302	FET tunerhead from TOKO	£5.00

Complete FM Tuner kits, inc case, for use with the above modules: details SAE please. Prices range from £40 - £60.

Amongst our various accessories for entertainment electronics is a range of FM tuning, frequency and sig. strength meters with 12v, 50mA bulb. £2.50 ea.



ambit international
 25 high street, brentwood,
 essex. cm14 4rh. tel: (0277) 216029
 fax: 995194

Free price list with an SAE, catalogue of modules and parts 40p., including postage and VAT.

General Terms: CWO please, official bodies and companies please note min. invoice £7.50. PP for CWO orders 22p per order. (UK and Eire). Overseas customers please include sufficient for postage. VAT is not included, and must be added at 25%. In stock orders despatched within 48 hours.

VALVE BARGAINS

Any 5 64p, 10 99p, 50 £4. Your choice from the following list: ECH84, ECC82, ECL80, EF80, EF183, EF184, PC86, PC88, PCF80, PCF802, PCL82, PCL84, PCL85, PCL805, PCL86, PFL200, PL36, PL504, PY33, PY81, PY800, PY88, EH90, 30FL1, 30FL2, 30PL14. 6F28

Colour Valves 25p each
 PL508 PL509, PY500/A

Press 4 Button Transistor UHF Tuners £2.50

BARGAIN PACKS

All Components in the Bargain Packs are unused and marked.

Pack 1—Polyester (C280) Axial Leads Capacitors— 250V/W & 400V/W, very good mixed selection from 0.01 UF to 2.2 UF. Price 100 £1.25, 1000 £10.00 (our choice).

Pack 2— Resistor Packs. Good mixed selection of Resistors from 33 ohm to above 1m-ohms, ½ watt to 2 watt. Price 100/80p, 1000/£6.50.

Small Plastic Boxes (white) made out of high impact plastic with flick on lids. Ideal for most projects. All three types one price. Prices 15p each. Ten £1.10 Size (approx.): **Type 1—** 3½ins x 2½ins x 1in deep. **Type 2—** 3½ins x 2½ins x 2ins deep. **Type 3—** 3½ins x 3½ins x 1½ins deep.

Prices include V.A.T. P. & P. under £1/15p, £1 to £3/20p. above £3/30p. Overseas at cost. Money back guarantee on all orders.

ELECTRONIC MAILORDER LTD., 62 BRIDGE ST., RAMSBOTTOM, BURY, LANCS. Tel. Rams. 3036.

AERIAL BOOSTERS

We make three types of Aerial Boosters all for set top fitting, with Co-ax Plugs and Sockets.

B11—For Stereo and Standard VHF Radio
B12—For the older VHF Television, please state BBCI and ITV Channels.

B45—For mon. or colour this covers the complete UHF band.

All Boosters are complete with Battery and take only minutes to fit.

Price £3.90 each

All the Components below were originally made for Phillips Equipment
 We offer them at unrepeatable prices

TOKO COILS

85 FNS 4399 P.O.
 85 HNS 20030 P.O.
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 YRCS 3A 184 HM
 YRES 3A 185 AM
 YRES 30855 PRO
 YRES 30856 SN
 YHCS 30862 N
 154 TES 7A 5075 AO
 154 TES 7A 5076 N
 154 TES 7A 5074 ABM
 KACS 8449 SZ
 YXRS 30859 N
 RXOS 6A 5076 EK
 YMO SZA 717 N
 TKAC5 8448 PJQ
 L 5687 N
 YRCS 11098 AC2
 85 4397 P.C.
 All above at 20 for £1 + 25% VAT

Potentiometers

Double and Single and Slides some with switches mixed at 10 for £1 + 25% VAT

Capacitors and Resistors

Mixed Values app. 50% each at 500 for £2.50 + 25% VAT

Push Button Switches

Doubles, Singles, Fours and Sixes 5p ea., 10p ea., 15p ea., 20p ea. + 25% VAT + p.p.

Car Radio Push Button Sets

at 40p ea. Min. ord. £1 + 25p p.p. + 25p VAT.

Knobs to suit Potentiometers and switches 2p ea. + 8% VAT No P.P. if ordered with above.

Trimmers 3p each

Pre Set Skeleton 3p each Min. order 50p + 25p p.p. + 25% VAT

NUTS, BOLTS, SCREWS and WASHERS

Mixed 1lb Pack at 50p + 30p p.p. 8% VAT

K.K.S. TRADING CO. DEPT. R.C. 38 OAKDENE CHESHUNT HERTS

TERMS CASH WITH ORDER

Please Note Only Limited Amount. Regret Mail Order Only.

Crescent Quality Components

BARGAIN CAPACITOR 2,000MFD at 50v. DC wkg. Size 2" x 1 1/4" diameter. Tag ended. All new and unused. Our price 35p. + 25%.

BARGAIN PROJECT BOX
A plastic box with moulded extrusion rails for PC or Chassis panels with metal front plate fitted with four screws (all supplied). An ideal box to give a small project a professional finish. SIZE: (internal) 81mm x 51mm x 28mm. OUR PRICE 40p. + 8%

JBIID STEREO JUNCTION BOX
The most popular stereo junction box. Facility for two pairs of headphones and two speakers. 3 position switch selects headphones, loud speakers or both. A bargain at **£2.50** +25%

DENCO I.F. TRANSFORMERS

IPT.11. Midget IF transformers suitable for valves 'NEOSID' Iron dust core tuning, complete with screening can 75p Size—2.5m.m Square x 49m.m. Please State:- 465K/c. 1.6M/c. or 10.7 M/c.
IPT.13. Miniature IF transformer wound on ferrite pot core with adjustable core tuning complete with screening can 70p Size—11m.m square x 18m.m. 470K/c. 10.7 M/c. Interstage B.F. coil with encls. 70p
IPT.14. Miniature last IF transformer as above but 1.6 M/c. 62p
IPT.17. Miniature last IF transformer as above. 64p
IPT.18. 465K/c or 1.6M/c. Double tuned transformer complete with screening can. 82p Size—11m.m square x 38m.m.
IPT.15. A 10.7M/c IF transformer, Double tuned complete with screening can. 75p + 25% VAT Size—21m.m high x 11m.m square.

DENCO TRANSISTOR TUNING COILS
Coils for Transistor Superhets and Converters suitable for chassis or B9A base mounting.
T. COILS
BLUE: Aerial coil with base input winding
YELLOW: Interstage B.F. coil with encls.
RED: Oscillator coil for 465K/c I.F.
WHITE: Oscillator coil for 1.6M/c/s I.F.

VEROBOARD + 8%

2 1/2 x 3 1/2	85p	Plain-15
2 1/2 x 5	41p	15p
3 1/2 x 3 1/2	41p	20p
3 1/2 x 5	47p	34p
1 7/8 x 2 1/2	1.24p	92p
1 7/8 x 3 1/2	1.69p	1.32p
1 7/8 x 5	2.16p	1.37p

Pin insertion tool 81p
Spot face cutter 69p
Pkt 36 pins (state 1 or 15) 30p

LOUDSPEAKERS + 25%

2 1/2" 8 ohm	60p	LOW VOLTAGE STEREO AMPLIFIER
2 1/2" 40 ohm	60p	
2 1/2" 80 ohm	60p	8 Transistor Stereo Amplifier with Vol'e, Base, Balance and Tone Controls. Approx. 3 watts into 8 ohm per channel needs a 9/12 volt DC supply and is complete on a 2 1/2" x 7 1/4" P/C board.
5" 8 ohm	ceramic £1.25	
6 1/2" 8 ohm dual cone	ceramic £2.50	10-INCH 8 OHM DUAL CONE Manufactured by "ELAC" to a very high standard these loudspeakers are a real bargain SPEC:- Size=10" Dual Cone. Power=10 Watts Frequency=40-12000Hz +25% Our Price = £2.75p each
10" 8 ohm dual cone	ceramic £3.75	
8" x 6" 6 ohm Ferman't Magnet	£1.60	

RANGE	1.T	2.T	
Mc/s	0.15-0.4	0.515-1.545.	
METRES	2000-750	580-194	
RANGE	3.T	4.T	5.T
Mc/s	1.67-5.3	5-15	10.5-31.5
METRES	180-57	60-20	28-9.5

PRICE: BLUE: Range 1—80p; Ranges 2-5—74p
YELLOW: Range 1—86p; Ranges 2-5—74p
RED: Ranges 1-5—74p
WHITE: Ranges 1-5—74p + 25% VAT

Clock Chip + 8%
CT7001 MOS/LSI Digital Clock/Calendar Chip Plus full Circuits and Information leaflets **£5.95**
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Lit 704 Led Display for above **£1.10**
Or 4 for **£4.20**

POTENTIOMETERS All types 1" and less diameter

Singles	Dual
5K Log or	5K
10K Lin Less	10K
25K Switch	25K Less
50K 17p each	50K 8switch
100K	100K 53p each
250K	250K +25%
500K	500K
1M	1M
2M	2M

MAINS TRANSFORMERS
Open Type Double Wound Continuously Rated, two hole fixing clamp with color coded flying leads, varnish impregnated. Approx. size: 1 1/2" x 1 1/2" x 1 1/2" high Fixing centres: 2 1/2".

TR1	20-0-20v 100 m/s	All
TR2	12-0-12 v 100 m/s	240 Volt
TR3	8-0-8 v 100 m/s	Primary
TR4	6-0-6 v 100 m/s	Primary
TR5	3-0-3 v 100 m/s	Primary

Our Price £1.23 each + 8%

ANTEX SOLDERING IRONS AND SPARES

X25	25 watt = £2.45
X26	Spare Element = £1.20
X25	Spare Bits No. 50, 51, 52 = 44p each
C240/2	15 watt = £2.45
C240/2	Spare Element = £1.10
C240/2	Spare Bits No. 2, 3, 6 = 32p each

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AB11	4 1/2"	2 1/2"	2 1/2"
AB12	4 1/2"	2 1/2"	2 1/2"
AB13	6 1/2"	4 1/2"	2 1/2"
AB14	7 1/2"	5 1/2"	2 1/2"
AB15	8 1/2"	6 1/2"	2 1/2"
AB16	10 1/2"	7 1/2"	3 1/2"
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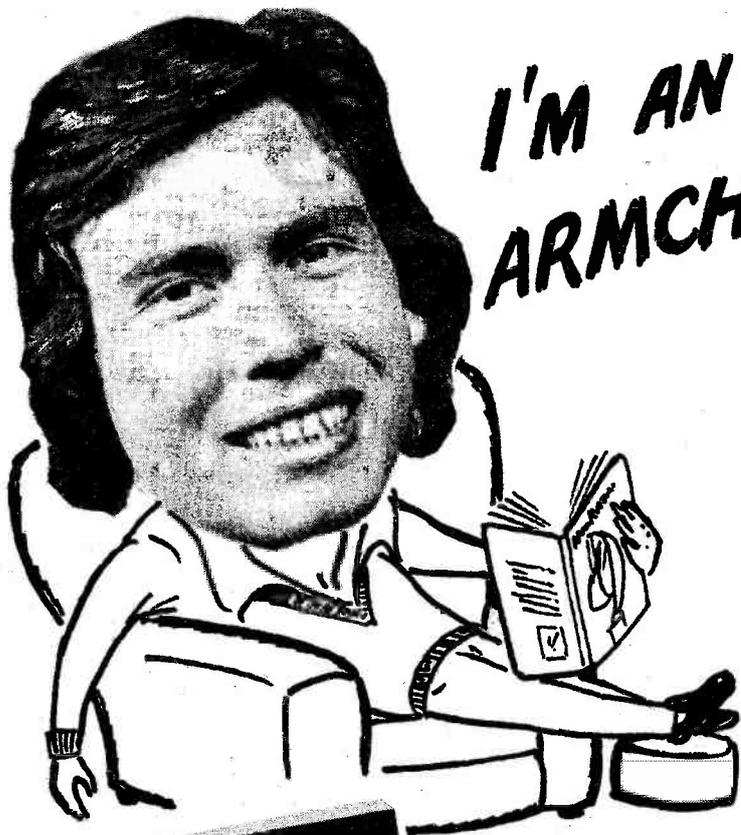
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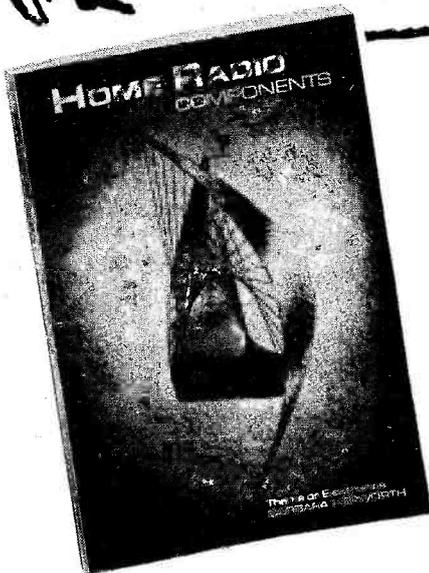
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90-0-9	0-5	1-96	89p
90-0-9	1-0	2-23	107p
10-0-10	2-0	3-06	20p
12-0-12	1-0	2-23	
12-0-12	2-0	3-13	
12-0-12	3-0	4-32	
15-0-15	1-0	2-88	
15-0-15	2-0	3-78	
18-0-18	2-0	4-32	
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0-10-12-14			
16-18	4-0	4-58	
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5mh	1 amp chokes	0-25	
20mh	2 amp chokes	0-35	
240v a.c.	solenoid	0-30	
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coil 2 reeds	N.O.	0-50	
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BB113	LW/MW/SW triple varicap	0-40	
IN4001		6p	
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IN4003		8p	
IN4004		9p	
IN4006		12p	
IN4007		13p	
OA70		6p	
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BA156		13p	
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47	10	7
220	10	7
330	10	9
15	16	7
33	16	7
88	16	7
220	16	9
220	16	9
330	16	12
1000	16	20
10	25	7
22	25	7
47	25	7
100	25	9
150	25	9
200	25	11
1250	25	24
5000	25	25
1000+1000	30	32
2500	30	40
4-8	40	7
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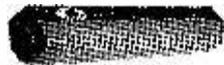
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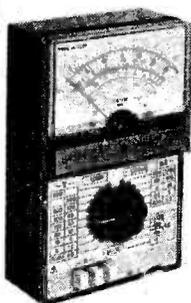
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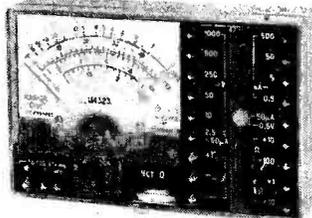
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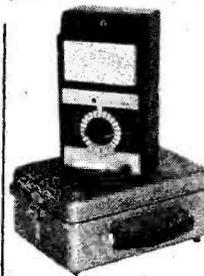
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7411	16p	13p	11p
7412	20p	23p	20p
7413	20p	23p	20p
7414	20p	23p	20p
7416	20p	23p	20p
7418	20p	23p	20p
7419	20p	23p	20p
7421	20p	23p	20p
7422	20p	23p	20p
7423	20p	23p	20p
7424	20p	23p	20p
7425	20p	23p	20p
7426	20p	23p	20p
7428	20p	23p	20p
7429	20p	23p	20p
7431	20p	23p	20p
7433	20p	23p	20p
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7436	20p	23p	20p
7437	20p	23p	20p
7438	20p	23p	20p
7439	20p	23p	20p
7440	20p	23p	20p
7441	20p	23p	20p
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7444	20p	23p	20p
7445	20p	23p	20p
7446	20p	23p	20p
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7450	20p	23p	20p
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7452	20p	23p	20p
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7459	20p	23p	20p
7460	20p	23p	20p
7461	20p	23p	20p
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7463	20p	23p	20p
7464	20p	23p	20p
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7466	20p	23p	20p
7467	20p	23p	20p
7468	20p	23p	20p
7469	20p	23p	20p
7470	20p	23p	20p
7471	20p	23p	20p
7472	20p	23p	20p
7473	20p	23p	20p
7474	20p	23p	20p
7475	20p	23p	20p
7476	20p	23p	20p
7477	20p	23p	20p
7478	20p	23p	20p
7479	20p	23p	20p
7480	20p	23p	20p
7481	20p	23p	20p
7482	20p	23p	20p
7483	20p	23p	20p
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7486	20p	23p	20p
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7488	20p	23p	20p
7489	20p	23p	20p
7490	20p	23p	20p
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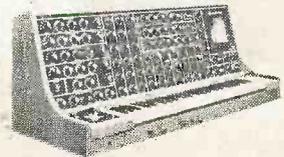
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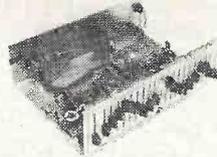
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