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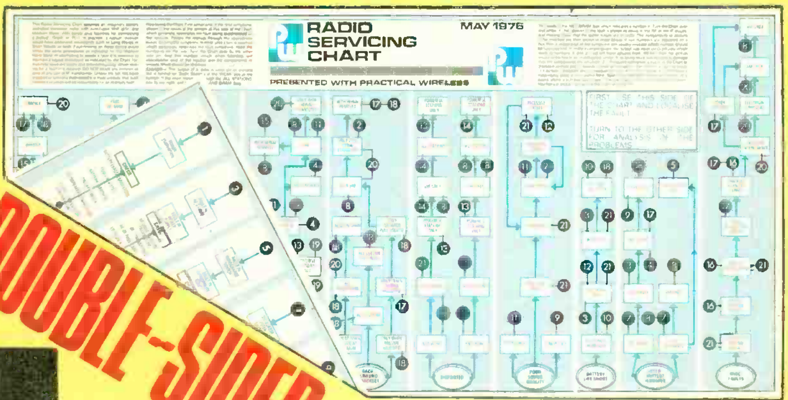

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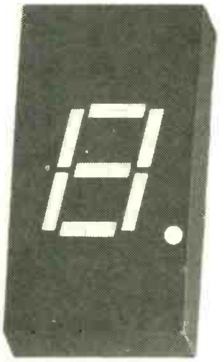

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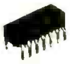

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PRACTICAL WIRELESS

VOL. 52 NO. 1
ISSUE 831
MAY 1976

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EXTRA THIS MONTH!

DOUBLE-SIDED RADIO SERVICING CHART

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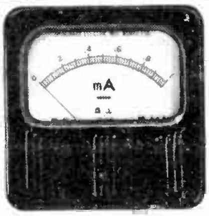

RANGES

100μA
500μA
50-0-50μA
100-0-100μA
500-0-500μA
1mA
1-0-1mA
5mA
10mA
50mA
100mA
500mA
1A DC
2A DC

5A DC
10A DC
15A DC
30A DC
50A DC
5V DC
10V DC
15V DC
20V DC
50V DC
150V DC
300V DC
30V AC*
50V AC*

150V AC*
300V AC*
500V AC*
1A AC*
5A AC*
10A AC*
20A AC*
30A AC*
50A AC*
500mA AC
50mV DC
100mV DC

* Moving iron (all others are moving coil).

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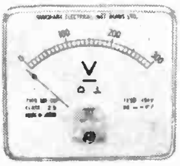

Dimensions: Front 110mm x 120mm wide
Panel Hole: 85mm
Accuracy ±2·5%

RANGES

50μA
100μA
200μA
500μA
50-0-50μA
100-0-100μA
500-0-500μA
1mA
1-0-1mA
5mA

10mA
50mA
100mA
500mA
1A DC
5A DC
15A DC
30A DC
10V DC
20V DC

50V DC
150V DC
300V DC
15V DC
300V AC
1A AC*
5A AC*
10A AC*
20A AC*
30A AC*

* Moving iron (all others are moving coil).

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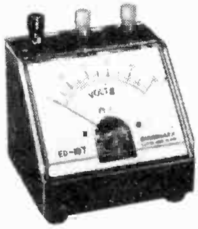

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5A DC
5V DC
10V DC

15V DC
20V DC
50V DC
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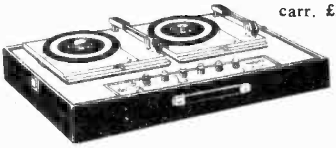

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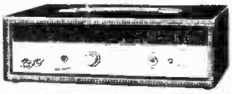

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250-0-250v. 100mA 6·3v. 3·5a.	£2·90
250-0-250v. 100mA 6·3v. 2a. 6·3v. 1a.	£3·20
350-0-350v. 80mA 6·3v. 2a. 0-5-6·3v. 2a.	£3·20
250-0-250v. 100mA 6·3v. 4a. 0-5-6·3v. 3a.	£4·35
300-0-300v. 100mA 6·3v. 4a. 0-5-6·3v. 3a.	£4·35
300-0-300v. 130mA 6·3v. 4a. 0-5-6·3v. 1a suitable for Mullard 510 Amp.	£5·20
350-0-350v. 100mA 6·3v. 4a. 0-5-6·3v. 3a	£4·35
350-0-350v. 150mA 6·3v. 4a. 0-5-6·3v. 3a.	£5·20

FILAMENT OR TRANSISTOR POWER PACK

Type: 12v. 1a. £1·10, 6·3v. 1·5a £1·06, 6·3v. 2a. £1·10 6·3v. 3a £1·70, 6·3v. 6a. £2·60, 12v. 3a. or 24v. 1·5a. £2·60 0-9-18v. 1½a. £2·26, 0-12-25-42v. 2a. £3·19

AUTO (STEP UP/STEP DOWN) TRANSFORMERS

0-110/120v. 200-230-250v. 50-80w. £2·90 150 watts £5·20, 250 watts £6·87, 500 watts £9·84

CHARGER TRANSFORMERS

0-9-15v. 1½a. £2·08, 2½a. £2·26, 3a. £2·32, 5a. £2·84, 6a. £3·19, 8a. £3·48

OUTPUT TRANSFORMERS

Standard Pentode 5000 to 3 ohm, or 7000 ohm to 3 ohm £1·12. Push Pull 8 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 10-12 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 510 etc. £4·35; Push Pull 15-18 watts, sectionally wound 6L6 KT66 etc. from 3 or 15 ohm. £3·71p. Push Pull 20 watt high quality sectionally wound EL34 6L6 KT66 etc. to 3 or 15 ohm, fully shrouded. £6·37p.

SELENIUM RECTIFIERS
F.W. (Bridged)

All 6/12 v. D.C. output. Max. A.C. input 18v. 1a 45p, 2a 57p, 3a 65p, 4a 95p, 5a £1·15.

L.F. CHOKES 150mA, 7-10H, 250 Ω £1·28; 100mA, 10H, 200 Ω £1·10; 60mA, 10H, 400 Ω 41p.

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PREVIOUSLY ADVERTISED INC.
DISCOUNT LINES
ARE STILL AVAILABLE.

RSC PRICES INCLUDE VAT

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AT FANTASTIC LOW PRICES!

Units listed below
(a) **DISCOMAJOR TWIN TURNTABLE CONSOLE with integral 100W amplifier**
(b) **PAIR OF HI-FI H'PHONES**
(c) **MATCHING 'MIKE'**
(d) **PAIR 50 WATT SPEAKERS** Black Rexine covered Cabinets Size approx. 18" × 18" × 8"

(a) (b) (c) & (d) Carr. £4·00 **£159·95**

DEP. £19·95 & 18 fortnightly payments of £9·19 (Total £185·37)

STEREO VERSION

of Above System
Or DEPOSIT £34·95 and 18 fortnightly pymts. £11·19 (Total £236·37) **£209·95** Carr. £5·00

TDI DISCO CONSOLE

Incorporating twin BSR MP60 type turntables and Sonotone or Acos Cartridges with diamond styli. 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. £14·95 and 18 fortnightly pymts. £5·47 (Total £113·41) **£99·95** Carr. £1·50

TD2S STEREO VERSION OF ABOVE

Terms DEPOSIT £20 and 18 fortnightly payments £6·71 (Total £140·78) **£125·00** Carr. £1·60

FANE DISCO 60C SPKR UNITS

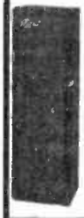
Supplied with above in lieu of L12/50 units for **£25** pr. extra

Fabulous specialist range Spkrs in heavy Vynide covered cabinets with protective Corner pieces. List Price £87·00 pr.

SYSTEMS UP TO 300 WATTS OUTPUT

AT UNBEATABLE PRICES. Send for Catalogue

DISCOMASTER TWIN TURNTABLE POWER CONSOLE £119·95



Twin McDonald MP60 type turntables. Sonotone or Acos cartridges with diamond styli. Facilities as TDI Console but with built-in 100 watt Power Amplifier, complete with lid. Or Dep. £18·95 and 18 fortnightly pymts £6·78 (Total £135·99) Carr. £2·50

STEREO VERSION £155 or DEPOSIT £25 and 18 fortnightly pymts £8·30 (Total £174·40). Carr. £3

R.S.C. COLUMN SPEAKERS

IDEAL FOR VOCALISTS AND PUBLIC ADDRESS

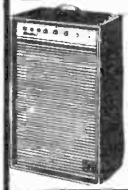
All types 15 Ohms covered in Vynide & Vynair

TYPE C132 40-50 WATTS £27·95

Incorporating two exceptionally efficient 13" × 8" speaker units. Dep. £3·95 and 8 monthly payments £3·50 (Total £31·95) Carr. 65p

TYPE C4/80 70 WATTS. Fitted four 12" 25 watt Highly sensitive high flux speakers with high power voice coils. Size approx. 54" × 14" × 11". Dep. £9·00 & 12 mthly pymts. £4·00 (Total £57·00) Carr. 85p **£49·95**

ALL RSC PRICES INCLUDE VAT



INTEREST REFUNDED on Credit Purchases settled in 3 months

SUPER MINSTREL 10 W GUITAR AMP.

Incorporating Tremolo and 10" Speaker. Output 10 watts R.M.S. Continuous. 3 Jack Inputs for Microphone and Instrument. Mains Neon Controls: Volume, Tone, Tremolo Speed, Tremolo Intensity.
Terms: DEPOSIT £7 78 and 8 monthly payments £3·40 (Total £34·93) Carr. free **£29·99**

FANE CRESCENDO SPEAKERS

FULL RANGE AVAILABLE AT ALL BRANCHES

RSC PHANTOM 50 COMBO AMP. £59·95

Rating 50 watts. 3 inputs, 2 vol. controls—Bass, Treble Presence. Carr. £1·50 Suitable for Lead or Rhythm Guitar, mic., Radio, Tape etc. Inc. High Flux 12" 50w Speaker. Dep. £7·95 & 8 monthly payments £7·48 (Total £67·79).

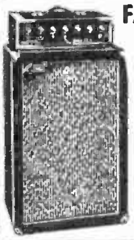
PHANTOM 50/GP all purpose version of above. **£69·95**

Extra high sensitivity. Suitable for Bass Guitar. Carr. £1·75
Or Dep. £9·95 & 8 monthly payments £8·70 (Total £79·55)

FAL PHASE 50-4 AMPLIFIER 50 WATT

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" × 7" × 7½". 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

FAL PHASE 50-4 WITH L12/2 70 W TWIN SPEAKER UNIT



Vynide covered. Fitted with protective corner pieces. Carr. £2·50. **£88·00**
Or Dep. £10·00 & 12 monthly payments £7·67 (Total £102·04)

or with

L125 100 W TWIN SPKR UNIT

Suitable for all purposes inc. Bass Guitar Carr. £2·50 **£94·50**
Terms. Dep. £14·50 & 18 fortnightly payments £5·15 (Total £107·20)

FANE ULTRA HIGH POWER SPEAKERS & KITS

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

'POP' 100
18" 100 Watt
14,000 gauss
8/15Ω
£38·95
Dep: £6·95 and 8 mthly payments £4·60 (Total £43·75)

'POP' 60
15" 60 Watt
14,000 gauss
8/15Ω
***£19·99**
Dep. £2·99 and 8 monthly payments, £2·62 (Total £23·95)

FOR BASS GUITAR, ELECT. ORGAN, ETC.

'POP' 50T
12" 50 Watt
13,000 gauss
8/15 ohm **£12·95**
Dual Cone. Terms for pairs Dep. £5·90 & 8 mthly pymts £3·00. Total £29·90
PAIR SUITABLE ALL PURPOSES

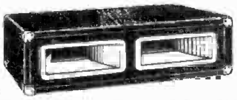
'POP' 25/T 12" 25W

Dual cone. 15 ohm Imp. (Not for Bass Guitar use). **£10·99**
Terms for Pairs: Deposit £3·98 and 8 mthly paymts of £2·75 (Total £25·98). Carr. free.

HIGH POWER TWEETER PH50

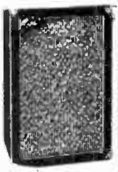
Response 3KHz-20KHz with 2 mfd. Non elect filter available 55p. Rating 50 Watt Imp 8 Ω **£6·65**

TITAN T2H HIGH FREQUENCY UNITS



Incorporating a pair of Highly Sensitive Horns with substantially flat response to over 15 kHz. Rating 70/100 watts. Imp 8 or 15 Ω. Or Dep. £4·95 & 8 monthly payments £4·38 (Total £39·99). **£35·95** Carr. 55p

HIGH QUALITY L'SPEAKER UNITS

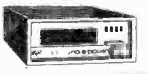


ALL 2-TONE VYNIDE & VYNAIR FINISH

L12/2 50-WATT Fitted pair of 12" 35 watt high flux speakers. Music rating 100w. Imp. 8-15 ohms. Carr. £1·50. Terms: Dep. £5·11 & 8 monthly payments. of £5·11. (Total £45·99). **£39·95**

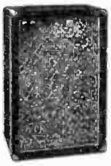
L12/50 12" 50 WATT 13,000 lines 15 ohms. Terms: Dep. £4·95 and 8 mthly pymts. £3·37 (Total £31·91) Carr. 55p. **£26·95**

I.S.E. JINGLE MACHINES JINGLE 8+



Employing Standard 8 Track Cartridge Or Dep. £4·85 & 8 monthly pyts £4·85 (Total £43·65). **£37·95**

HEAVY DUTY CABINETS



Black Vynide covered. Fitted Protective Corner Pieces. Cut for various Speaker Combinations. Carr. £1 each unit. Sizes approx.:

18"	× 18"	× 9"	£10·95
24"	× 24"	× 12"	£19·95
36"	× 24"	× 12"	£26·95
36"	× 24"	× 12"	£26·95
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LIQUID WHEEL PROJECTORS from £29·95

'SOUND TO LITE' SYSTEM

PULSAR special price complete kit **£106·95**

Dep. £14·95 and 18 fortnightly payts. £5·93. (Total £121·69). Super SL Unit. 1000 watt per channel. Manual override buttons. 2 spotbanks with 6 bulbs (3 sep. colours) 5 yd. and 10 yd. leads, fitted plugs. Units sold sep.

FAL SOUND-TO-LITE UNIT £21·60

„ 3-WAY SPOT BANK Excluding Bulbs Each **£16·20**

COMPLETE SYSTEM Carr £1·50. **£55**
Incl. 2 Spotbanks and bulbs.

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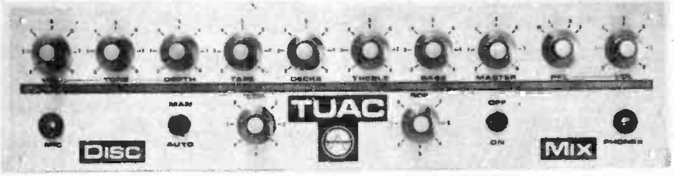
TUAC

TRANSISTOR UNIVERSAL AMPLIFICATION CO. LTD.
163 MITCHAM RD. LONDON SW17 9PG 01-672 3137/9080

MONO DISCO MIXER WITH AUTO FADE

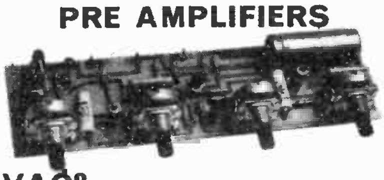


Designed for the discerning D.J. of professional standard. Offering a vast variety of functions. Controls: Mic Vol; Tone, over-ride depth, auto/Manual Sw; Tape Vol; L & R Deck Faders; Deck Volume; Treble and Bass; H. Phon Vol Selector; Master Vol on/Off Sw. Max output 1V RMS.
Specification: Deck Inputs—50mV into 1MΩ; Deck Tone Controls—treble +20 −10dB at 12kHz, Bass +22 −15dB at 40Hz; Mic Input—200 ohms upwards, 2mV into 10kΩ; Mic Tone Control—Total Variation Treble 15dB, Total Variation Bass 10dB; Tape Input—30mV into 47kΩ; Power Requirements—30–50 volts at 50mA.

£31·50

PANEL SIZE
18 x 4¼in.
DEPTH 3in.

PRE AMPLIFIERS



VAO8

Designed for use with TUAC power amplifier modules. Extensive research has gone into various wide range tone control circuits to produce superb sound quality. Thousands are already in use in high quality professional amplification systems.

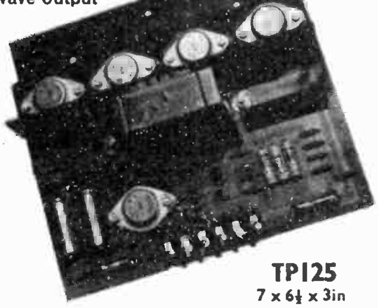
VAO8 Vol. Treb, Mid and Bass controls. HI. IMP. FET. I/P suitable Mid. Guitar, Radio, Crystal/Ceramic P.U. Sensitivity 4mV. Treble +35dB at 16kHz. Mid +20 −15dB at 1kHz Bass +20 −10dB at 40Hz. **£6·50**

VAO6 Vol, Treb, and Bass controls. Sensitivity 8mV. Treb +28 −15dB at 12kHz, Bass ±18dB at 40 Hz. **£5·50**

SVAO8 STEREO PRE AMP Vol, Treb, Mid and Bass controls, I/P suitable, Guitar, Radio, Crystal/Ceramic P.U. Sensitivity 4mV. Treble +35dB at 16kHz. Mid +20 −15dB at 4kHz. Bass +20 −10dB at 40Hz Plus Full Balance Control. Full I/C operation supply voltage ± 15VDC. **£12·50**

★ TUAC AMPLIFIER MODULES ★ POWER AND QUALITY ★

- 125 watts RMS continuous sine wave output



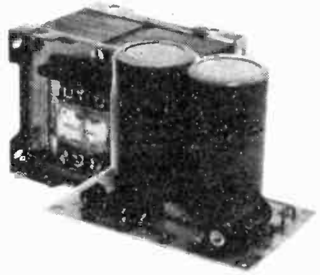
TP125
7 x 6¼ x 3in

£19·50

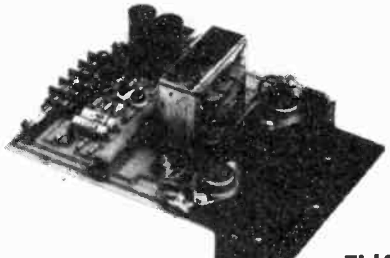
- 4 R.C.A. 150 watt 15 amp output transistors

- Rugged layer wound driver transformer
- Short—Open—and Thermal overload protection
- Only 6 connections

Power supplies vacuum impregnated. Transformers with supply board incorporating pre-amp supply.



PS 250 for supplying 2 TP125s	£22·00
PS 60/60 for supplying 2 TL60s	£19·50
PS 125 ± 45 volts for TP125	£13·75
PS 100 ± 43 volts for TL100	£12·00
PS 60 ± 38 volts for TL60	£11·50
PS 30 ± 25 volts for TL30	£7·50
PSU 2 for supplying disco mixer	£5·50



TL60
5 x 5 x 3in

- 60 watts RMS continuous sine wave output
- 2 R.C.A. 110 watt 15 amp transistors

£13·50

TL100
5 x 5 x 3in

- 100 watts RMS continuous sine wave output
- 2 R.C.A. 150 watt 15 amp transistors

£16·25

Specification on all power modules. All output power ratings ± 0·5dB; Output impedance 8-15 ohms; THD at full power 2% typically 1%; input sensitivity 60mV into 10kΩ; Frequency response 20Hz-20kHz ±2dB; Hum and noise better than—70dB.

STOCKISTS—CALLERS ONLY

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A1 Music Centre, 88 Oxford Street, Manchester (Tel. 061-236 0340)
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Electra Centre, 58 Lancaster Road (Tel. Preston 58488)
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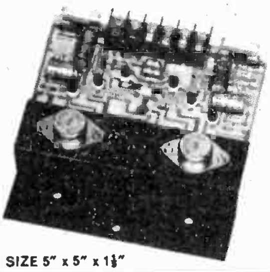

SIZE 5" x 5" x 1½"

TL30 New from TUAC TL30 D.C. coupled power amplifier module.

- OUTPUT POWER 30 WATTS RMS CONTINUOUS SINE WAVE
- OUTPUT IMPEDANCE 8-15 OHMS
- T.H.D. AT FULL POWER 0·5%
- SIGNAL TO NOISE RATIO −85dB
- INPUT SENSITIVITY 60mV INTO 50K OHMS
- FREQUENCY RESPONSE 25Hz—50kHz
- 8 TRANSISTORS
- 4 DIODES
- ONLY SIX CONNECTIONS

£9·75

Send large stamped addressed envelope with all enquiries or send £1 (refundable against purchase) for fully illustrated 20 page catalogue.

FUZZ LIGHTS

RED GREEN

BLUE AMBER

240 volt a.c. Long Life Candle Bulb, Revolving Reflector, adds a new dimension to disco lighting effects.

£19·50

TUAC

MANUFACTURERS OF ELECTRONIC AND AMPLIFICATION EQUIPMENT.
PERSONAL SHOPPERS MON TUES THURS FRI and SAT
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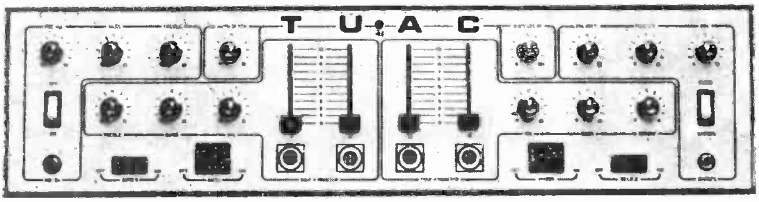
TUAC STEREO DISCO MIXER



INPUTS. Four identical stereo inputs available with any equalisation. Two magnetic and two flat supplied as standard. High quality slider control on each channel. Volume treble, and bass controls for each pair of sliders. Sensitivity mag., 3mV (R.I.A.A. comp.). Flat 50mV at 1kHz. Bass controls ± 18dB at 60Hz. Treble controls ± 18dB at 15kHz.

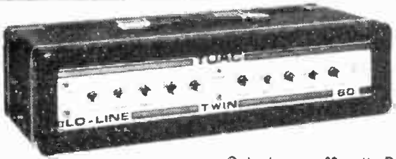
OUTPUTS. Up to 3 volts (+12dB) available. Attenuated output for TUAC Power Modules. Rotary Master and Balance controls. Band width 15Hz–25kHz ±1dB.

P.F.L. Output 250mV into 8 ohms. Rotary Volume Control. Monitoring facility for all 4 channels. Selection via touch sensitive illuminated switches. Switched visual cue indicator.

£75

Size: 25in long x 6in high x 3in deep

MISCELLANEOUS FACILITIES. Two illuminated deck on/off switches. Mains illuminated on/off switch. Auto fade illuminated on/off switch. Mains powered with integral screen and back cover. Complete with full instructions.



TWIN 60

£80·00

Output power 60 watts R.M.S. Four inputs, two channels each with volume, treble, middle and bass controls. Variable waveform control

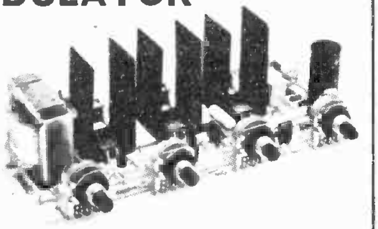
★ **Lo-Line Twin 125** (125 watts version)	**£98·00**
★ **Lo-Line 60** (single pre-amp version)	**£65·00**
★ **Lo-Line 125** (single pre-amp version)	**£81·00**
★ **Lo-Line 125** slave output power 125 watts R.M.S.	**£70·00**

▲▼ All Lo-Line Amplifiers are 25½in long x 11½in high x 6½in deep ▲▼

NEW TUAC LO-LINE STEREO 250 125 WATTS PER CHANNEL — £130

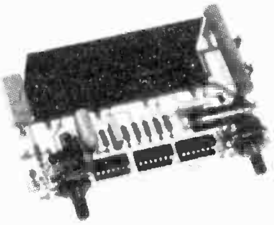
3 CHANNEL LIGHT MODULATOR

- RCA 8A Triacs
- 1000W per channel
- Each channel fully suppressed and fused
- Master control to operate from 1W to 100W
- Full wave control
- 12 easy connections



£15·50 (Single Channel Version 1500 Watts £7·25)

4 CHANNEL SOUND TO LIGHT SEQUENCE CHASER—4LSMI



- RCA 8A Triacs
- 1000W per channel
- Fully suppressed and fused
- Switched master control for sound operation from ½W to 125W
- Speed control for fixed rate sequence from 8 per minute to 50 per second
- Full logic integrated circuitry with optical isolation for amplifier protection
- Full wave control
- 13 easy connections

Patents applied for **£17·25**

ADD SEQUENCE CHASING AND DIMMING EFFECTS TO YOUR TUAC 3 CHANNEL LIGHT MODULATOR

- Speed Control 3 per min. to 10 per sec.
- Full logic integrated circuitry
- Dimmer control to each channel
- 9 easy connections

SEQUENCE DIMMER MODULE—3SDMI **£11·75**

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79	1·0	3·38
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20	3·0	5·99
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51	5·0	8·32
117	6·0	9·33
88	8·0	12·38
89	10·0	12·71

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Prim. 200-240V
Sec. 0-24-30-40-48-60V

Ref	Amps	£
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127	2·0	6·67
125	3·0	9·58
123	4·0	11·45
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68	3	–	4·60
18	4	2	3·98
85	5	–	4·91
70	6	3	5·56
108	8	4	6·41
72	10	5	6·86
116	12	6	7·42
17	16	8	9·13
115	20	10	13·52
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104	2·0	6·26
105	3·0	7·63
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107	6·0	15·08
118	8·0	16·46
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235	330, 330	0-9, 0-9	2·04
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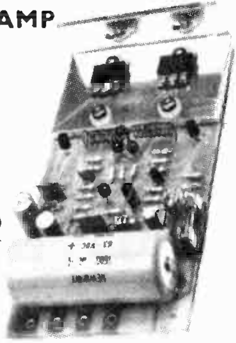

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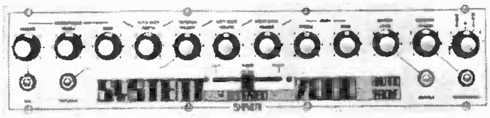

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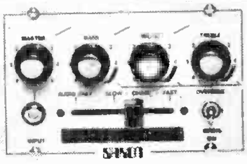

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5R4GY	·94	6CW4	1·17	7B6	·88	25L6G	·70	5763	1·76	EB91	·23
5U4G	·50	6D3	·75	7B7	·82	25Y5G	·60	6057	1·00	EBC41	·88
5V4G	·59	6DE7	·88	7H7	·88	25Z4G	·50	6060	1·00	EBC81	·45
5Y3GT	·55	6DT6A	·88	7R7	2·00	25Z5	·75	6067	1·00	EBF80	·40
5Z3	·88	6EW6	·88	7Y4	·80	25Z6G	·80	7193	·62	EBF83	·50
5Z4G	·55	6E5	1·17	7Z4	·80	28D7	2·00	9002	·59	EBF89	·40
5Z4GT	·55	6F1	·80	9D7	·70	30A5	·76	9006	·50	EBL21	2·34
6/30L2	·80	6F6G	·60	10C2	·76	30C15	·80	ACPEN	1·17	EC86	·90
6A8G	1·46	6F13	·90	10DE7	·88	30C17	·85	AC2/PEN/DD	1·00	EC88	·90
6AC7	·60	6F14	·88	10F1	·88	30C18	·85	AC6PEN	·60	EC92	·55
6AG5	·35	6F15	·76	10F9	·76	30F5	·75	AC/TH1	1·00	ECC33	2·00
6AH6	·80	6F18	·64	10F18	·60	30FL1	1·10	AL60	1·17	ECC35	2·00
6AJ5	·76	6F23	80	10LD11	·82	30FL2	1·10	ATP4	·50	ECC40	1·20
6AK5	·47	6F24	1·00	10P13	·88	30FL13	·64	AZ1	·50	ECC81	·40
6AK6	·70	6F25	1·17	10P14	2·34	30FL14	·82	AZ31	·60	ECC82	·39
6AM8A	·70	6F28	·78	12A6	·75	30L15	·82	AZ41	·50	ECC83	·39
6AN8	·82	6F32	·70	12AC6	·90	30L17	·76	BL63	2·34	ECC84	·40
6AQ5	·53	6G6G	·60	12AD6	·90	30P4MR	1·05	CL33	1·85	ECC85	·47
6AR5	·80	6GH8A	·88	12AE6	·90	30P12	·80	CY1C	1·00	ECC86	1·00
6AS7	1·17	6GK5	·78	12AT6	·47	30P19/30P4	·88	CY31	·70	ECC88	·55
6AT6	·53	6GU7	·88	12AU6	·53	30PL1	1·00	DAF91	·40	ECC189	·80
6AU6	·40	6H6GT	·29	12AV6	·59	30PL13	1·20	DAF96	·60	ECC807	1·41
6AV6	·53	6J5GT	·58	12BA6	·53	30PL14	1·29	DC90	·70	ECF80	·50
6AW8A	·90	6J6	·85	12BE6	·59	30PL15	·90			ECF82	·50
6AX4	·88	6J7G	·35	12BH7	·59					ECF86	·88
6B8G	·85	6JU8A	·88	12BY7	·85					ECF804	2·63

ECH21	2·34	EY81	·50	PCF86	·50	QS150/15	1·90	VP41	·88	ACY21	·25	BY127	·23
ECH35	1·60	EY83	·70	PCF200	1·00	QV06/20	3·50	VR105	·59	ACY22	·20	BYZ10	·33
ECH42	·80	EY84	·92	PCF201	1·05	R19	·75	VU111	·80	ACY28	·23	BYZ11	·33
ECH81	·40	EY86/7	·40	PCF801	·65	TH233	1·00	VU120	1·17	AD140	·47	BYZ12	·33
ECH83	.52	EY88	·60	PCF802	·50	TP2620	1·00	VU120A	1·17	AD149	·64	BYZ13	·33
ECH84	·50	EY91	·50	PCF806	·60	UABC80	·47	VU133	·80	AD161	·59	FSY11A	·29
ECL80	·50	EZ40	·55	PCH200	1·00	UAF42	·75	W107	·75	AD162	·59	FSY41A	·29
ECL82	·45	EZ41	·55	PCL82	·45	UBC41	·60	W729	1·17	AF114	·33	OA9	·16
ECL83	·82	EZ80	·35	PCL83	·50	UBC81	·60	X66	1·46	AF115	·20	OA10	·55
ECL84	·70	EZ81	·35	PCL84	·50	UBF80	·47	Z759	5·85	AF117	·25	OA47	·13
ECL85	·70	GY501	·82	PCL86	·55	UBF89	·47	**Transistors & Diodes**		AF121	·39	OA70	·20
ECL86	·47	GZ32	·59	PCL805	·70	UBL21	2·34	1N4744	·18	AF124	·33	OA73	·20
EF22	1·00	GZ33	1·46	PEN45	1·00	UC92	·60	2N404	·23	AF125	·22	OA79	·12
EF40	·88	GZ34	·80	PEN45DD	1·00	UCC84	·90	2N966	·68	AF126	·23	OA81	·12
EF41	·82	GZ37	1·20	PEN46	·60	UCC85	·53	2N1756	·64	AF180	·62	OA85	·12
EF42	·90	HABC80	·80	PEN453DD	2·00	UCF80	·90	2N2147	1·10	AF186	·71	OA90	·16
EF73	1·76	HL23DD	·80	PENDD 4020	1·00	UCH21	2·34	2N2297	·29	BA115	·18	OA91	·12
EF80	·30	HL41DD	1·00	PFL200	·82	UCH42	·88	2N2369	·18	BA116	·23	OA95	·12
EF83	1·45	HL42DD	1·00	PL33	·50	UCH81	·47	2N3053	·42	BA129	·16	OC44	·13
EF85	·40	HN309	1·76	PL36	·70	UCL82	·45	2N3121	3·22	BA130	·13	OC45	·14
EF86	·50	HVR2	1·00	PL81	·53	UCL83	·64	2N3703	·25	BA153	·20	OC46	·20
EF89	·35	HVR2A	1·17	PL81A	·60	UF41	·82	2N3709	·26	BC107	·16	OC70	·16
EF91	·50	KT41	1·17	PL82	·48	UF42	·82	AA119	·20	BC108	·16	OC71	·14
EF92	·60	KT66	2·93	PL83	·50	UF80	·41	AA120	·20	BC109	·16	OC72	·14
EF97	·94	KT81	2·10	PL84	·50	UF85	·52	AA129	·20	BC113	·33	OC74	·29
EF98	·95	KT88	5·75	PL504/500	0·82	UF89	·47	AAZ13	·23	BC115	·20	OC75	·14
EF183	·40	KTW61	1·76	PL505	1·65	UL41	·75	AC107	·20	BC116	·33	OC76	·20
EF184	·40	KTW62	1·76	PL508	1·10	UL84	·49	AC113	·33	BC118	·29	OC77	·35
EF804	1·75	KTW63	1·17	PL509	1·65	UM80	·60	AC126	·16	BCY10	·59	OC78	·20
EH90	·44	MHLD6	1·00	PY33/2	·50	UY41	·50	AC127	·22	BCY12	·64	OC78D	·20
EL32	·60	P61	·60	PY80	·47	UY85	·50	AC128	·26	BCY33	·26	OC81	·14
EL34	1·00	PABC80	·45	PY81	·40	U10	1·17	AC132	·26	BCY34	·29	OC81D	·14
EL35	3·00	PC86	·70	PY82	·40	U12/14	1·17	AC154	·33	BCY38	·29	OC82	·14
EL37	3·00	PC88	·70	PY83	·45	U19	4·00	AC156	·26	BF158	·23	OC82D	·14
EL41	·60	PC95	·70	PY88	·47	U25	·70	AC157	·33	BF159	·33	OC83	·26
EL81	·70	PC97	·42	PY500A	1·11	U26	·65	AC165	·33	BF163	·26	OC84	·31
EL83	·70	PC900	·30	PY800	·45	U33	1·75	AC166	·33	BF173	·49	OC123	·29
EL84	·36	PCC84	·40	PY801	·45	U35	1·75	AC168	·49	BF180	·39	OC169	·29
EL86	·60	PCC85	·50	PZ30	·50	U45	1·17	AC176	·71	BF181	·52	OC172	·46
EL95	·70	PCC88	·65	QQV03/10	2·10	U81	·80	AC177	·36	BF185	·52	OC200	·59
EL360	1·80	PCC89	·50	QS75/20	1·00	U191	·50	ACY17	·33	BFY50	·29	OC201	·59
EL506	1·20	PCC189	·80	QS95/10	1·00	U251	·94	ACY18	·26	BFY51	·25	OC202	·55
EM80	·53	PCF80	·47			U301	·65	ACY19	·25	BFY52	·26	OC203	·39
EM81	·76	PCF82	·50			U403	·90	ACY20	·23	BY100	·23	OC204	·39
EM83	·64	PCF84	·70			U404	·75			BY114	·23	OC205	·55
EM84	·47					U801	·80			BY126	·20	OC206	1·17
EM85	1·20					U4020	·75						
EM87	1·10					VP23	·65						
EMM803	2·50												
EY51	·50												

MATCHED TRANSISTOR SETS:—
LP15 (AC113. AC154. AC157. AA120) ·68p per pack. 1—OC81D & 2—OC81, 55p. 1—OC44 & 2—OC45, ·55p. 1—OC82D· & 2—OC82 ·62p. Set of 3—OC83 ·84p.

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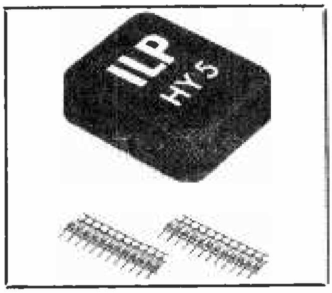
15—120 Watts!

The HY5 is a mono hybrid amplifier ideally suited for all applications. All common input functions (mag. cartridge, tuner, etc.) are catered for internally, the desired function is achieved either by a multi-way switch or direct connection to the appropriate pins. The internal volume and tone circuits merely require connecting to external potentiometers (not included). The HY5 is compatable with all I.L.P. power amplifiers and power supplies. To ease construction and mounting a P.C. connector is supplied with each pre-amplifier.



HY 5
Preamplifier

FEATURES
Complete pre-amplifier in single pack
Multi function equalisation
Low noise
Low distortion
High overload
Two simply combined for stereo

APPLICATIONS
Hi-Fi
Mixers
Disco
Guitar and Organ
Public address

SPECIFICATIONS
INPUTS. Magnetic Pick-up 3mV; Ceramic Pick-up 30mV; Tuner 100mV; Microphone 10mV; Auxiliary 3-100mV; Input impedance 47kΩ at 1kHz.
OUTPUTS. Tape 100mV; Main output 500mV. R.M.S.
ACTIVE TONE CONTROLS. Treble ±12dB at 10kHz; Bass ± at 100Hz.
DISTORTION. 0·1% at 1kHz. Signal/Noise Ratio 68dB.
OVERLOAD. 38dB on Magnetic Pick-up.
SUPPLY VOLTAGE ± 16-50V.

Price £4·75 + £1·19 VAT, P & P free.

The HY30 is an exciting New kit from I.L.P. It features a virtually indestructible I.C. with short circuit and thermal protection. The kit consists of: I.C., heatsink, P.C. board, 4 resistors, 6 capacitors, mounting kit, together with easy to follow construction and operating instructions. This amplifier is ideally suited to the beginner in audio who wishes to use the most up-to-date technology available.

Available June 76

HY 30
5 Watts into 8Ω

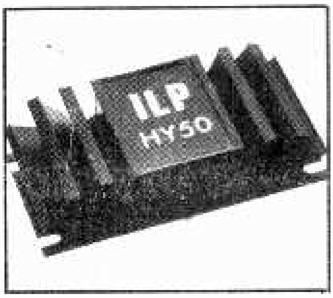
FEATURES
Complete Kit
Low Distortion
Low Distortion
Short, Open and Thermal Protection
Easy to Build

APPLICATIONS
Updating Audio Equipment
Guitar Practice Amplifier
Test Amplifier
Audio Oscillator

SPECIFICATIONS
OUTPUT POWER. 15W R.M.S. into 8Ω
DISTORTION. 0·1% at 15W.
INPUT SENSITIVITY. 500mV.
FREQUENCY RESPONSE. 10Hz-16kHz-3dB
SUPPLY VOLTAGE. ±18V.

Price £4·75 + £1·19 VAT, P & P free.

The HY50 leads I.L.P's total integration approach to power amplifier design. The amplifier features an integral heatsink together with the simplicity of no external components. During the past three years the amplifier has been refined to the extent that it must be one of the most reliable and robust High Fidelity modules in the World.



HY 50
25 Watts into 8Ω

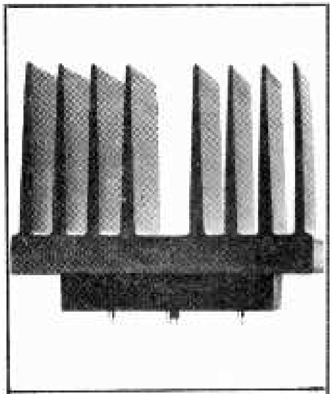
FEATURES
Low Distortion
Integral Heatsink
Only five connections
7 Amp output transistors
No external components

APPLICATIONS
Medium Power Hi-Fi systems
Low power disco
Guitar amplifier

SPECIFICATIONS
INPUT SENSITIVITY. 500mV.
OUTPUT POWER 25W RMS into 8Ω
LOAD IMPEDANCE. 4-16Ω
DISTORTION. 0·04% at 25W at 1kHz
SIGNAL/NOISE RATIO. 75dB.
FREQUENCY RESPONSE. 10Hz-45kHz −3dB.
SUPPLY VOLTAGE. ±25V.
SIZE 105 × 50 × 25mm

Price £6·20 + £1·55 VAT, P & P free.

The HY120 is the baby of I.L.P.s new high power range, designed to meet the most exacting requirements including load line and thermal protection this amplifier sets a new standard in modular design.



HY 120
60 Watts into 8Ω

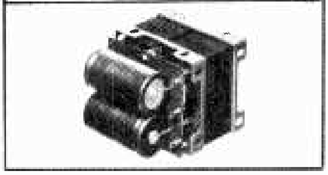
FEATURES
Very low distortion
Integral heatsink
Load line protection
Thermal protection
Five connections
No external components

APPLICATIONS
Hi-Fi
High quality disco
Public address
Monitor amplifier
Guitar and organ

SPECIFICATIONS
INPUT SENSITIVITY. 500mV.
OUTPUT POWER. 60W RMS into 8Ω.
LOAD IMPEDANCE. 4-16Ω
DISTORTION. 0·04% at 60W at 1kHz.
SIGNAL/NOISE RATIO. 90dB.
FREQUENCY RESPONSE. 10Hz-45kHz −3dB.
SUPPLY VOLTAGE. ± 35V
SIZE 114 × 50 × 85mm.

Price £14·40 + £1·16 VAT, P & P free.

The HY200 now improved to give an output of 120 Watts has been designed to stand the most rugged conditions such as disco or group while still retaining true Hi-Fi performance.



HY 200
120 Watts into 8Ω

FEATURES
Thermal shutdown
Very low distortion
Load line protection
Integral heatsink
No external components

APPLICATIONS
Hi-Fi
Disco
Monitor
Power slave
Industrial
Public Address

SPECIFICATIONS
INPUT SENSITIVITY, 500mV. OUTPUT POWER, 120W RMS into 8Ω.
LOAD IMPEDANCE, 4-16Ω. DISTORTION, 0·05% at 100W at 1kHz.
SIGNAL/NOISE RATIO, 96dB. FREQUENCY RESPONSE, 10Hz-45kHz—3dB
SUPPLY VOLTAGE, ± 45V. SIZE 114 × 100 × 85mm.

POWER SUPPLIES
PSU36 suitable for two HY30's £4·75 plus £1·19 VAT P/P free
PSU50 suitable for two HY50's £6·20 plus £1·55 VAT P/P free
PSU70 suitable for two HY120's £12·50 plus £1·00 VAT P/P free
PSU90 suitable for one HY200 £11·50 plus £0·92 VAT P/P free

Price £21·20 + £1·70 VAT, P & P free.

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BRAND NEW FULLY GUARANTEED

Type	Price
AC117K	*0·30
AC126	*0·18
AC126	*0·14
AC127	*0·11
AC128	*0·11
AC128K	*0·26
AC141	*0·19
AC141K	*0·80
AC142	*0·19
AC142K	*0·26
AC153K	*0·24
AC176	*0·11
AC176K	*0·26
AC180	*0·20
AC180K	*0·30
AC181	*0·20
AC181K	*0·30
AC187	*0·17
AC187K	*0·23
AC188	*0·19
AC188K	*0·23
AD140	*0·49
AD142	*0·55
AD143	*0·49
AO149	*0·45
AD150	*0·65
AD161	*0·36
AO162	*0·36
AO161 & AO162(MP)	*0·69
AF114	*0·22
AF115	*0·22
AF116	*0·22
AF117	*0·22
AF118	*0·32
AF124	*0·28
AF125	*0·28
AF126	*0·26
AF127	*0·26
AF139	*0·31
AF178	*0·51
AF179	*0·51
AF180	*0·51
AF181	*0·51
AF186	*0·51
AF239	*0·38
AL102	*0·75
AL103	*0·75
BC107	*0·08
BC108	*0·08
BC109	*0·08
BC113	0·10
BC114	0·16
BC115	0·16
BC116	0·16
BC117	0·19
BC118	0·09
BC119	*0·31
BC120	*0·81
BC137	0·18
BC139	*0·41
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BC141	*0·31
BC142	*0·31
BC143	*0·31
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BC147	0·09
BC148	0·09
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BC151	0·20
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BC154	0·20
BC157	0·11
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BC159	0·11
BC160	*0·46
BC161	*0·51
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BC168	0·10
BC169	0·10
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BSY39	*0·19
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BSY41	*0·29
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BSY95A	*0·13
BU105	*1·90
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MJE2955	*0·88
MJE3055	*0·57
MJE3440	*0·51
MPF102	*0·28
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OC202	*0·29
OC203	*0·26
OC204	*0·26
OC205	*0·38
OCP71	*0·44
ORP12/ NSL4931	*0·46
ORP60	*0·41
ORP61	*0·41
TIP29	*0·40
TIP30	*0·45
TIP31A	*0·52
TIP32A	*0·60
TIP41A	*0·65
TIP42A	*0·72
TIS43	*0·25
UT46	*0·20
ZTX107	0·07
ZTX108	0·07
ZTX109	0·07
ZTX300	0·07
ZTX500	0·09
2N696	*0·10
2N697	*0·11
2N698	*0·20
2N699	*0·36
2N706	*0·08
2N706A	*0·09
2N708	*0·11
2N914	*0·15
2M918	*0·18
2N1131	*0·18
2N1132	*0·18
2N1302	*0·15
2N1303	*0·15
2N1304	*0·18
2N1305	*0·18
2N1306	*0·21
2N1307	*0·21
2N1308	*0·24
2N1309	*0·24
2N1613	*0·16
2N1711	*0·16
2N2147	*0·73
2N2148	*0·58
2N2218	*0·18
2N2218A	*0·19
2N2219	*0·18
2N2219A	*0·19
2N2220	*0·22
2N2221	*0·18
2N2222	*0·18
2N2368	*0·18
2N2369	*0·12
2N2369A	0·12
2N2646	*0·34
2N2904	*0·14
2N2904A	*0·18
2N2905	*0·18
2N2905A	*0·18
2N2906	*0·12
2N2906A	*0·14
2N2907	*0·15
2N2907A	*0·16
2N2923	0·15
2N2924	0·15
2N2925	0·15
2N2926G	0·09
2N2926Y	0·09
2N2926O	0·08
2N2926R	0·07
2N2926B	0·07
2N3053	*0·15
2N3054	*0·40
2N3055	*0·40
2N3402	*0·21
2N3403	*0·21
2N3404	*0·29
2N3405	*0·43
2N3614	*0·69
2N3615	*0·76
2N3616	*0·76
2N3646	0·09
2N3702	0·09
2N3703	0·09
2N3704	0·08
2N3705	0·08
2N3706	0·08
2N3707	0·08
2N3708	0·08
2N3709	0·08
2N3710	0·09
2N3711	0·09
2N3819	*0·14
2N3820	*0·40
2N3823	*0·16
2N3903	0·12
2N3904	0·12
2M3905	0·14
2N3906	0·14
2N4287	0·18
2N4288	0·18
2N4289	0·18
2N4290	0·18
2N4291	0·18
2N4292	0·18
2N4293	0·18
2N5172	0·12
2N5457	*0·28
2N5458	*0·28
2N5459	*0·28
40361	*0·30
40362	*0·35

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SUPER UNTESTED PAKS

Pak No.	Description	Price
U 1	120 Glass Sub-min. General purpose Germ. diodes	0·60
U 4	30 Germanium transistors like OC81, AC128	*0·60
U 5	60 200mA Sub-min. silicon diodes	*0·60
U11	20 PNP Sil, planar trans. TO-5 like 2N1132, 2N2904	*0·60
U15	20 NPN Sil. planar trans. TO-5 like 2N696, 2N697	*0·60
U19	20 Silicon NPN transistors like BC108	*0·60
U26	30 Fast switching silicon diodes like 1N914 Micro-Min.	0·60
U29	10 1 Amp SCR's TO-5 can. up to 600 CRS/25-600	*£1·20
U32	25 Zener diodes 400mW DO-7 case 3-18 volts mixed	0·60
U36	20 Silicon planar NPN transistors TO-5 BFY50/51/52	*0·60
U45	7 3A SCR. TO66 up to 600 PIV	*£1·20
U46	20 Unijunction transistors similar to TIS43	*0·60
U48	9 NPN Sil. Power transistors like 2N3055	*£1·20

Code No's mentioned above are given as a guide to the type of device in the Pak. The devices themselves are normally unmarked.

DIODES

Type	Price
BA100	*0·10
BA116	*0·21
BA126	*0·22
BA143	*0·15
BA154	*0·12
BA156	*0·14
BA173	*0·15
BB104	*0·15
BY100	*0·16
BY126	*0·15
BY127	*0·16
BY128	*0·16
BY164	*0·51
BYX3830	*0·43
OA10	*0·14
OA47	*0·07
OA70	*0·07
OA79	*0·07
OA81	*0·07
OA85	*0·09
OA90	*0·07
OA91	*0·97
OA95	*0·07
OA200	*0·07
OA202	*0·07
1N914	*0·06
1N916	*0·06
1N4148	*0·06

THYRISTORS

PIV	0·6A TO18	0·8A TO92	1A TO5	3A TO66	5A TO66	5A TO64	7A TO48	10A TO48	16A TO48	30A TO48
10	*0·13	*0·15	—	—	—	—	—	—	—	—
20	*0·15	*0·13	—	—	—	—	—	—	—	—
30	*0·19	*0·22	—	—	—	—	—	—	—	—
50	*0·22	*0·28	*0·20	*0·25	*0·36	*0·36	*0·48	*0·51	*0·54	*1·18
100	*0·25	*0·30	*0·25	*0·25	*0·48	*0·48	*0·51	*0·57	*0·58	*1·43
150	*0·31	*0·38	—	—	—	—	—	—	—	—
200	*0·38	*0·44	*0·25	*0·30	*0·50	*0·50	*0·57	*0·62	*0·62	*1·63
400	—	—	*0·30	*0·39	*0·55	*0·57	*0·62	*0·71	*0·77	*1·79
600	—	—	*0·39	*0·48	*0·69	*0·69	*0·78	*0·89	*0·90	—
800	—	—	*0·58	*0·65	*0·81	*0·81	*0·92	*1·22	*1·39	*4·07

SILICON RECTIFIERS

PIV	300mA (DO 7)	750mA (SO 16)		1 Amp Plastic	1·5 Amp (SO 10)	3 Amp (SO 10)	10 Amp (SO 10)	30 Amp (TO 48)
50	0·05	0·06	IN4001	0·05	0·07	0·14	0·19*	0·56*
100	0·05	0·07	IN4002	0·06	0·09	0·16	0·21*	0·69*
200	0·06	0·09	IN4003	0·07	0·12	0·20	0·23*	0·93*
400	0·07	0·14	IN4004	0·08	0·14	0·28	0·35*	1·25*
600	0·08	0·16	IN4005	0·09	0·18	0·33	0·42*	1·76*
800	0·11	0·18	IN4006	0·10	0·18	0·35	0·51*	1·94*
1000	0·13	0·28	IN4007	0·11	0·23	0·44	0·60*	2·31*
1200	—	0·32			0·28	0·54	0·69*	2·88*

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6 Amp	TO66	*0·51	*0·61	*0·77
10 Amp	TD48	*0·77	*0·92	*1·12

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72709	0·23	0·21	0·19
72709P	0·19	0·18	0·17
72710	0·32	0·31	0·28
72741	0·28	0·27	0·26
72741C	0·26	0·25	0·24
72741P	0·28	0·27	0·26
72747	0·79	0·74	0·61
72748P	0·35	0·33	0·31
SL201C	0·46	0·42	0·37

Type	Quantities		
	1	25	100+
SL701C	0·46	0·42	0·37
SL702C	0·46	0·42	0·37
TAA263	0·74	0·65	0·56
TAA293	0·93	0·88	0·83
TAA350	£1·71	£1·67	£1·57
µA703C	0·26	0·24	0·22
µA709C	0·19	0·18	0·17
µA711C	0·32	0·31	0·28
µA712C	0·32	0·31	0·28
µA723C	0·45	0·43	0·40

Type	Quantities		
	1	25	100+
76003	£1·39	£1·34	£1·30
76023	£1·39	£1·34	£1·30
76660	0·88	0·86	0·83
LM380	0·93	0·90	0·88
*NE555	0·45	0·43	0·40
*NE556	0·88	0·86	0·83
TBA800	£1·39	£1·34	£1·30
ZN414	£1·11	—	—

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Type	1	25	100+
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7401	0·10	0·09	0·08
7402	0·11	0·10	0·09
7403	0·11	0·10	0·09
7404	0·13	0·12	0·11
7405	0·13	0·12	0·11
7406	0·25	0·24	0·23
7407	0·25	0·24	0·23
7408	0·15	0·14	0·13
7409	0·15	0·14	0·13
7410	0·09	0·09	0·08
7411	0·23	0·22	0·21
7412	0·26	0·25	0·24
7413	0·26	0·26	0·25
7416	0·28	0·27	0·26
7417	0·28	0·27	0·26
7420	0·12	0·11	0·10
7422	0·28	0·27	0·26
7423	0·30	0·28	0·26
7425	0·30	0·28	0·26
7426	0·30	0·28	0·26
7427	0·30	0·28	0·26
7428	0·42	0·38	0·36
7430	0·12	0·11	0·10
7432	0·30	0·28	0·26
7433	0·38	0·37	0·35
7437	0·30	0·28	0·26
7438	0·30	0·28	0·26
7440	0·12	0·11	0·10
7441	0·64	0·62	0·60
7442	0·65	0·63	0·61
7443	£1·10	£1·05	£1·00
7444	£1·10	£1·05	£1·00
7445	0·95	0·80	0·85
7446	£1·10	£1·05	£1·00
7447	0·87	0·85	0·83

Type	1	25	100+
7448	0·80	0·78	0·76
7450	0·12	0·11	0·10
7451	0·12	0·11	0·10
7453	0·12	0·11	0·10
7454	0·12	0·11	0·10
7460	0·12	0·11	0·10
7470	0·25	0·24	0·23
7472	0·22	0·21	0·20
7473	0·26	0·24	0·22
7474	0·27	0·25	0·23
7475	0·48	0·46	0·44
7476	0·25	0·24	0·23
7480	0·50	0·48	0·46
7481	£1·02	£1·00	0·98
7482	0·83	0·81	0·79
7483	0·98	0·96	0·94
7484	0·90	0·88	0·86
7485	£1·25	£1·20	£1·15
7486	0·32	0·30	0·29
7489	£2·90	£2·80	£2·70
7490	0·37	0·35	0·33
7491	0·60	0·58	0·56
7492	0·43	0·42	0·41
7493	0·43	0·42	0·41
7494	0·43	0·42	0·41
7495	0·70	0·65	0·60
7496	0·68	0·66	0·64
74100	£1·00	0·98	0·96
74104	0·40	0·38	0·36
74105	0·40	0·38	0·36
74107	0·36	0·34	0·32
74110	0·56	0·54	0·52
74111	0·83	0·81	0·78
74118	0·90	0·88	0·86
74119	£1·25	£1·20	£1·15
74121	0·26	0·26	0·25

Type	1	25	100+
74122	0·50	0·48	0·46
74123	0·58	0·56	0·54
74141	0·60	0·56	0·56
74145	0·96	0·94	0·92
74150	£1·30	£1·25	£1·20
74151	0·76	0·74	0·72
74153	0·95	0·93	0·91
74154	£1·50	£1·45	£1·40
74155	0·80	0·78	0·78
74156	0·80	0·78	0·76
74157	0·95	0·83	0·91
74160	£1·00	0·98	0·96
74161	£1·00	0·98	0·96
74162	£1·00	0·98	0·96
74163	£1·00	0·98	0·96
74164	£1·25	£1·20	£1·15
74165	£1·25	£1·20	£1·15
74166	£1·48	£1·44	£1·39
74174	£1·00	0·95	0·90
74175	0·95	0·93	0·81
74176	£1·16	£1·11	£1·06
74177	£1·16	£1·11	£1·06
74180	£1·18	£1·11	£1·06
74181	£2·00	£1·90	£1·80
74182	0·90	0·88	0·86
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Type	Quantities		
	1	25	100+
BP930	0·14	0·13	0·13
BP932	0·15	0·14	0·13
BP933	0·15	0·14	0·13
BP935	0·15	0·14	0·13
BP936	0·15	0·14	0·13

Type	Quantities		
	1	25	100+
BP944	0·15	0·14	0·13
BP945	0·28	0·26	0·23
BP946	0·14	0·13	0·12
BP948	0·28	0·26	0·23
BP951	0·65	0·60	0·56

Type	Quantities		
	1	25	100+
BP962	0·14	0·13	0·12
BP9083	0·42	0·40	0·38
BP9094	0·42	0·40	0·38
BP9097	0·42	0·40	0·38
BP9099	0·42	0·40	0·38

★ DIL Sockets

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TSO16 16 pin type	0·35	0·32	0·30
TSO24 24 pin type	0·69	0·64	0·62
BPS8 8 pin type (low cost)	0·14	0·12	0·10
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UIC06 —	8 × 7406	0·60
UIC07 —	8 × 7407	0·60
UIC10 —	12 × 7410	0·60
UIC13 —	8 × 7413	0·60
UIC20 —	12 × 7420	0·60
UIC30 —	12 × 7430	0·60
UIC40 —	12 × 7440	0·60
UIC41 —	5 × 7441	0·60
UIC42 —	5 × 7442	0·60
UIC43 —	5 × 7443	0·60
UIC44 —	5 × 7444	0·60
UIC45 —	5 × 7445	0·60
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UIC83 —	5 × 7483	0·60
UIC86 —	5 × 7486	0·60
UIC90 —	5 × 7490	0·60
UIC91 —	5 × 7491	0·60
UIC92 —	5 × 7492	0·60
UIC93 —	5 × 7493	0·60
UIC94 —	5 × 7494	0·60
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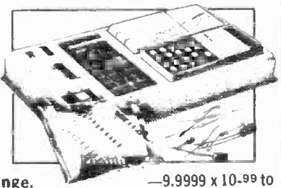

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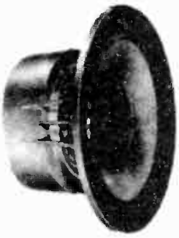

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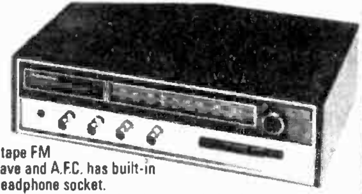

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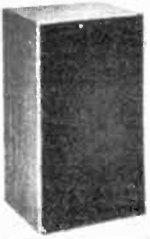

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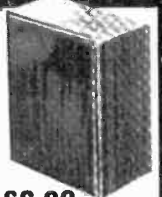

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The professional finish can be obtained with the minimum of tools, the infinite baffle type enclosures come ready mitred and professionally finished, and fix together with masking tape till glue dries.
The cabinet measures 12" x 9" x 5" deep approx finished in simulated teak, incorporating a quality 7"x 4" elliptical speaker, power handling 4 watts, flux density 30,000 maxwells, impedance 8-15 ohms nominal, voice coil dia ¾ magnet size 2⅞" approx.

£6.00 + p&p £1.70
PAIR INCLUSIVE

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.)

VISCOUNT IV STEREO AMP

NOW AVAILABLE IN KIT FORM! 30x30 WATTS RMS

£27.50
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COMPLETE 20x20 SYSTEMS

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 at 10 watts better than 0.2%. Six switched inputs: 1. Magnetic P.U. – 3 millivolts at 47 K ohms (R.I.A.A.); 2. Crystal/ceramic P.U. – 50 millivolts at 50 K ohms (R.I.A.A.); 3, 4, 6. Tape Tuner/Aux. – 140 millivolts at 50 K ohms (flat frequency response); 5. Microphone – 3 millivolts at 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 at full rated output. **Signal to noise ratio:** better than –50 dB on all inputs. **Tone control range:** Bass ±15 dB at 50 Hz; Treble ±12 dB at 10 KHz. **Power requirements:** 250V A.C. mains at 60 watts.
Approx size: 15¼" x 3" x 10." **MP60 type deck** with magnetic cartridge, de luxe plinth and cover. **Two Duo Type 11a matched speakers** – Enclosure size approx. 19½" x 10¾" x 7¾" in 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 IIa 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
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PRICES: SYSTEM 2

Viscount IV R103 amplifier	£27.50 + £1.90 p & p
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System 1a £1.75 System 2 £3.50

Note: 30 x 30 kit available only as a separate item.

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SPECIAL OFFER

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* This is an advanced kit not suitable for those without electrical knowledge and those unable to solder.

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or send SAE for complete details.

*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"×6"×3½" **£20.00** +£1.35 p & p.

8 TRACK HOME CARTRIDGE PLAYER

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.

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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

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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.

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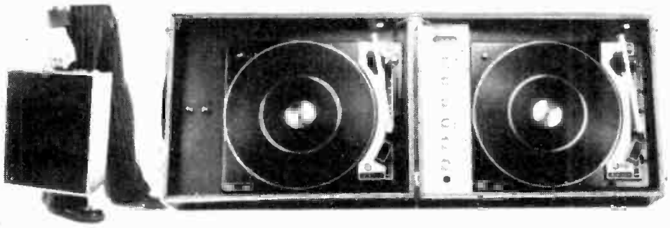
Also available with the 'Compact' (see opposite page) easy build speaker kit £13.50 + £2 p & p

PORTABLE DISCO CONSOLE*

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.



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 — 17¾"×13¾"×8¾" (app.)
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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.

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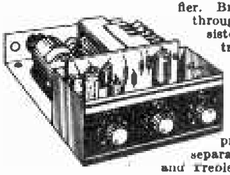

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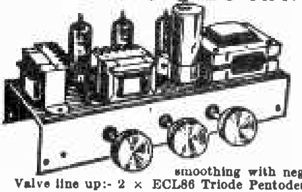
DE LUXE STEREO AMPLIFIER



A.C. mains 200-240 v. Using heavy duty fully isolated mains transformer with full wave rectification giving adequate smoothing with negligible hum. Valve line up:- 2 × ECL86 Triode Pentodes. 1 × EZ80 as rectifier. Two dual potentiometers are provided for bass and treble control, giving bass and treble boost and cut. A dual volume control is used. Balance of the left and right hand channels can be adjusted by means of a separate 'Balance' control fitted at the rear of the chassis. Input sensitivity is approximately 300m/v for full peak output of 4 watts per channel (8 watts mono), into 3 ohm speakers. Full negative feedback in a carefully calculated circuit, allows high volume levels to be used with negligible distortion. Supplied complete with knobs, chassis size 11"w × 4"d. Overall height including valves 5". Ready built & tested to a high standard. **£12·50.** P.&P. 95p.

ALL-PURPOSE POWER SUPPLY UNIT 200/240v. A.C. input. Four switched fully smoothed D.C. outputs giving 6v. and 7½v. and 9v. and 12v. at 1 amp on load. Fitted insulated output terminals and pilot lamp indicator. Hammer finish metal case overall size 6" × 3½" × 2½". Ready built and tested. **PRICE £6·35** P. & P. 85p.

VYNAIR & REXINE SPEAKERS & CABINET FABRICS app. 54 in. wide. Our price £1·50 yd. length. P. & P. 35p per yd. (min. 1 yd.). S.A.E. for samples.

HARVERSON'S SUPER MONO AMPLIFIER

A super quality gram amplifier using a double wound fully isolated mains transformer, rectifier and ECL82 triode pentode valve as audio amplifier and power output stage. Impedance 3 ohms. Output approx. 3·5 watts. Volume and tone controls. Chassis size only 7in. wide × 3in. deep × 6in. high overall. AC mains 200/240v. Supplied absolutely Brand New completely wired and tested with good quality output transformer. P. & P. 85p BARGAIN PRICE **£5·00**

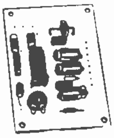
BRAND NEW MULTI-RATIO MAINS TRANSFORMERS. Giving 13 alternatives. Primary: 0–210–240v. Secondary combinations 0–5–10–15–20–25–30–35–40–60v. half wave at 1 amp. or 10–0–10, 20–0–20, 30–0–30v. at 2 amps full wave. Size 3in. long × 3½in. wide × 3in. deep. Price £2·90 P. & P. 75p.

MAINS TRANSFORMER. For power supplies.
Pri. 200/240v. Sec. 9–0–9 at 500 mA. £1·50. P. & P. 35p.
Pri. 200/240v. Sec. 12–0–12 at 1 amp. £1·65. P. & P. 55p.
Pri. 200/240v. Sec. 10–0–10 at 2 amp. £2·35. P. & P. 70p.

GENERAL PURPOSE HIGH STABILITY TRANSISTOR PRE-AMPLIFIER

For P.U. Tape, Mike, Guitar, etc. and suitable for use with valve or transistor equipment. 9-18v. battery or from H.T. line 200/300v. Frequency response 15Hz—25KHz. Gain 26dB. Solid encapsulation size 1⅝" x 1½" x ⅝". Brand new complete with instructions. Price £1·60. P. & P. 15p.

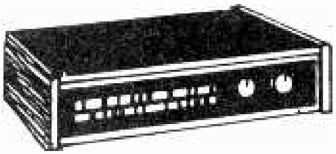
STEREO-DECODER



SIZE 2" x 3" x ½" ready built. Pre-aligned and tested. Sens. 20-560 mV for 9-16V neg. earth operation. Can be fitted to almost any FM VHF radio or tuner. Stereo beacon light can be fitted if required. Full details and instructions (inclusive of hints and tips) supplied. £6·25 plus 20p. P. & P. Stereo beacon light if required 45p extra.

QUALITY RECORD PLAYER AMPLIFIER MK. II A top quality record player amplifier employing heavy duty double wound mains transformer, ECC83, EL84, and rectifier. Separate Bass, Treble and Volume controls. Complete with output transformer matched for 3 ohm speaker. Size 7in. wide × 3in. deep × 6in. high. Ready built and tested. PRICE £6·50, P. & P. 90p.
ALSO AVAILABLE mounted ou board with output transformer and speaker. PRICE £7·75, P. & P. £1.

HARVERSONIC MAINS OPERATED SOLID STATE STEREO FM TUNER



Enjoy fabulous stereo radio at this low introductory price!

Designed and styled to match our 10 + 10 amplifier but will suit any other standard stereo amplifier. The design incorporates the very latest circuitry techniques with high-grain, low noise IF stages. Automatic frequency control to "lock-on" station and prevent drift. IC stereo decoder for maximum stereo separation. L.E.D. for stereo beacon indicator. Nominal output of tuner 100mV. Approximate size 12½" wide × 8" deep by 2⅝" high. Supplied ready built, fully tested and fully guaranteed. A/C Mains 200/240V (not available in kit form).

SPECIAL OFFER for 1 month only £25 + £1·20 p. & p.

LATEST ACOS GP91/1SC mono compatible cartridge with t/o stylus for LP/EP/78. Universal mounting bracket. £1·75 P. & P. 18p.

CERAMIC STEREO CARTRIDGE. Universal Mounting brackets and turnover stylus. 70mV per channel output. ONLY £2·06 + 18p P. and P.

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LATEST CRYSTAL T/O STEREO / COMPATIBLE CARTRIDGE for EP/LP/Stereo/78. £1·98 P. & P. 18p.

LATEST T/O MONO COMPATIBLE CARTRIDGE for playing EP/LP/78 mono or stereo records on mono equipment. Only £1·75, P. & P. 18p.

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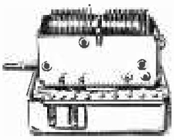
SPECIAL OFFERS

Mullard LP1159 R.F.–I.F. Double Tuned Amplifier Module for nominal 470 KHz. Size approx. 2¾" × 1½" × ⅜" 7·6 Volt + earth. Brand new pre-aligned. Full specification and connection details supplied. £2·50. P. & P. 12p



Pye VHF/FM Tuner Head covering 88-108 M/Hz. 10·7 M/Hz I.F. output 7-8 Volt + earth. Supplied pre-aligned, with gang full circuit diagram and connection details supplied. Beautifully made with precision-geared FM and 323 Pf + 323Pf A.M. Tuning Gauge only £3·50 + P. & P. 35p.

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Push Button Switch bank. 8 Buttons giving 16 S/P C/O interlocked switches plus 1 Cancel Button Plus 3 d/p c/o. Overall size 5" × 2½" × 1". Supplied complete with chrome finished switch buttons. 2 for £1·50 + 10p P & P.

HI-FI LOUDSPEAKER SYSTEM MK II

Beautifully made, simulated teak finish enclosure with atttactive slatted front. Size 16½" high × 10½" wide × 9" deep (approx.). Fitted with E.M.I. Ceramic Magnet 13" × 8" bass unit, H.F. tweeter unit and crossover. **AVAILABLE IN NOMINAL** 4 Ohm, 8 Ohm or 16 Ohm impedance (state which).

OUR PRICE £12·50 each Carr. £1·60.

Cabinet Available Separately £7·50, Carr. £1·20.
Also available in 8 ohms with EMI 13" × 8" bass speaker with parasitic tweeter £11·00, Carr. £1·60.

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5in. 3 ohm £1·45, P. & P. 35p. 7 × 4in. 3 ohm £1·69, P. & P. 48p. 10 × 6in. 3 or 15 ohm £2·50, P. & P. 75p. E.M.I. 8 × 5in. 3 ohm with high flux magnet £2·06, P. & P. 50p. E.M.I. tweeter. Approx. 3½". Available 3 or 8 or 15 ohms, £2·00 + 25p, P. & P.

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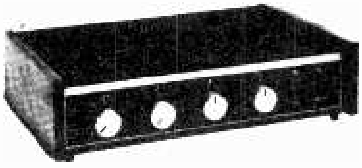
Size 11⅝" × 14 11/16" × 1 1/16" deep. Weight 19oz. Power handling 20W r.m.s. (40W peak). Impedance 8 ohm only. Response 40Hz–20kHz. Can be mounted on ceilings, walls, doors, under tables, etc., and used with or without baffle. Send S.A.E. for full details. Only £7·68 each. P. & P. 70p.

Now also available 8". – 8 ohm 10 watts, r.m.s. 20 watt peak 40 Hz–20,000 Hz. Overall depth 1". Ideal for Hi-Fi or for use in cars £5·18 + 40p p. & p.

HARVERSONIC SUPERSOUND 10 + 10 STEREO AMPLIFIER KIT



A really first-class Hi-Fi Stereo Amplifier Kit. Uses 14 transistors including Silicon Transistors in the first five stages on each channel resulting in even lower noise, level with improved sensitivity. Integrated pre-amp with Bass, Treble and two Volume Controls. Suitable for use with Ceramic or Crystal cartridges. Very simple to modify to suit magnetic cartridge—instructions included. Output stage for any speakers from 8 to 15 ohms. Compact design, all parts supplied including drilled metalwork high quality ready drilled printed circuit board with component identification clearly marked, smart brushed anodised aluminium front panel with matching knobs, wire, solder, nuts, bolts—no extras to buy. Simple step by step instructions enable any constructor to build an amplifier to be proud of. Brief specification; Power output: 14 watts r.m.s. per channel into 5 ohms. Frequency response ±3dB 12·30,000 Hz Sensitivity: better than 80mV into 1MΩ. Full power bandwidth: ±3dB 12-15,000 Hz. Bass boost approx. to ±12dB. Treble cut approx. to –16dB. Negative feedback 18dB over main amp. Power requirements 35v. at 1·0 amp. Overall Size 12"w. × 8"d. × 2⅝"h.

Fully detailed 7 page construction manual and parts list free with kit or send 25p plus large S.A.E.

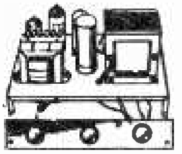
AMPLIFIER KIT .. .. £15·00 P. & P. 55p
(Magnetic input components 33p extra)
POWER PACK KIT .. .. £5·35 P. & P. 85p
CABINET .. .. .. £5·35 P. & P. 75p

SPECIAL OFFER—only £24 if all 3 items ordered at one time including p. & p.

Full after sales service

Also available ready built and tested £32·50. P. & P. £1.

Note: The above amplifier is suitable for feeding two mono sources into inputs (e.g. mike, radio, twin record decks, etc, and will then provide mixing and fading facilities for medium powered Hi-Fi Discotheque use, etc.

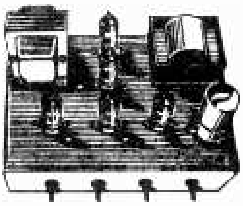


3-VALVE AUDIO AMPLIFIER HA34 MK II

Designed for Hi-Fi reproduction of records. A.C. Mains operation. Ready built on plated heavy gauge metal chassis, size 7½"w. × 4"d. × 4¾"h. Incorporates ECC83, EL84, EZ80 valves. Heavy duty, double wound mains transformer and output transformer matched for 3 ohm speaker. Separate volume control and now with improved wide range tone controls giving bass and treble lift and cut. Negative feedback line. Output 4½ watts. Front panel can be detached and leads extended for remote mounting of controls. Complete with knobs, valves, etc., wired and tested for only £8·75. P. & P. 85p.

HSL "FOUR" AMPLIFIER KIT. Similar in appearance to HA34 above but employs entirely different and advanced circuitry. Complete set of parts, etc £7·75 P. & P. 85p.

10/14 WATT HI-FI AMPLIFIER KIT



A stylishly finished monaural amplifier with an output of 14 watts from 2 EL84s in push-pull. Super reproduction of both music and speech, with negligible hum. Separate inputs for mike and gram allow records and announcements to follow each other. Fully shrouded section wound output transformer to match 3–15 Ω speaker and 2 independent volume controls, and separate bass and treble controls are provided giving good lift and cut. Valve line-up 2 EL84s, ECC83, EF86 and EZ80 rectifier. Simple instruction booklet 25p + SAE (Free with parts)' All parts sold separately. ONLY £12·50 P. & P. £1·25. Also available ready built and tested £16·87 P. & P. £1·20.

SPECIAL OFFER Limited number of the latest BSR C141RI Auto/Manual changer de-luxe. Lightweight tubular arm, cue-ing lever bias compensator £14·00 + £1·10 p. & p.

Prices include VAT at Current Rate

Open 9.30–5.30 Monday to Friday, 9.30–5 Saturday Closed Wednesday.

All prices and specifications correct at time of press and subject to alteration without notice.

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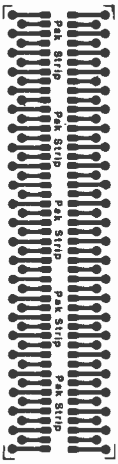
(Pat. applied for)



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·1 pitch for
D.I.L. IC's etc.

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
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- ★ 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
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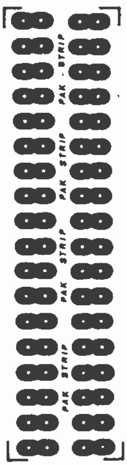
- ★ No need to drill holes for nuts and bolts . . . just stick down . . .

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



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General purpose
group board

One Type A PACK 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 ....£1·80 VAT & Postage inc.
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ECC83	37p	PC88	70p	PL83	51p	6BW7	75p
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ECH83	90p	PCC88	69p	PL509	£2·00	20L1	92p
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ECL83	75p	PCF82	55p	PY81/3	45p	30C17	88p
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EF80	33p	PCF200	£1·05	PY800	45p	30F5	86p
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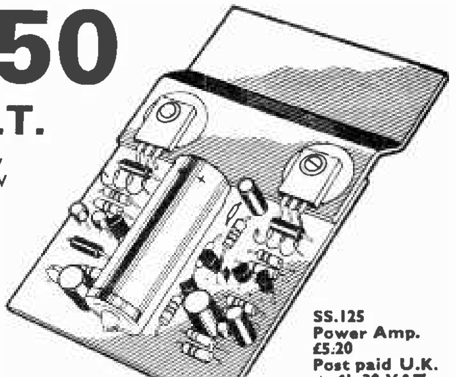
OUTPUT	25 watts R.M.S. into 8 Ω using 50V 22 watts R.M.S. into 4 Ω using 33V *(Low imp. not less than 4 Ω)*
★ DISTORTION ★	Less than 0·05% at all power levels (From 10Hz to 10KHz)
FREQUENCY RESPONSE	± 1dB 15 Hz to 30 KHz (4 Ω) ± 1dB 10 Hz to 30 HKz (8 Ω)
HIGH Z INPUT	100 Kohms (40dB gain/100x)
INPUT SENSITIVITY	150mV for 25W. R.M.S. out
SIZE	(Inc. built on heat sink type mounting bracket) 4¾" x 3" x ⅞" high



SS.125
Power Amp.
£5.20
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SS.105	5 watt amplifier to run from 12V. (3½" x 2" x ¾")	£2·25
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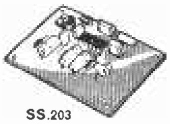
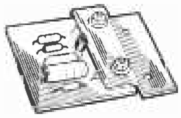
SS.140	Delivers 40 watts R.M.S. into 4 ohms using a 45V/2A supply such as our SS.345 the power and quality of this unit are superb—Size 4" x 3" x ¾".	£3·75
SS.100	Active tone control stereo. ±15dB lift-cut bass/treble	£1·60
SS.102	Pre-amp for ceramic	£1·60
SS.103	Active pre-amp (stereo) inc. R.I.A.A. and line feed back	£2·25

SS 202



SS.203



SS.105

SS.140

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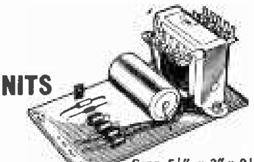
. . . And 5 NEW Stirling Sounds POWER SUPPLY UNITS



Robustly designed units in each of which is a stabilised take-off point to provide for tuner, pre-amp and control stages.

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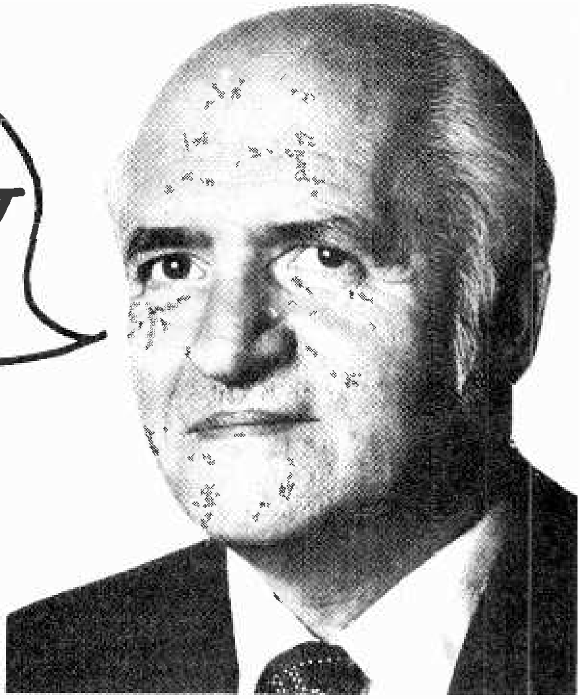

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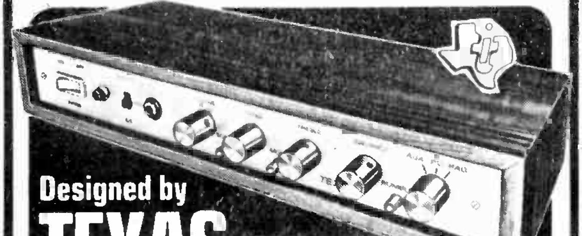

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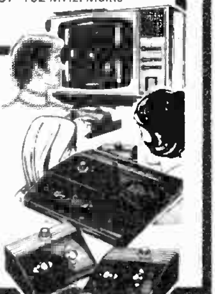

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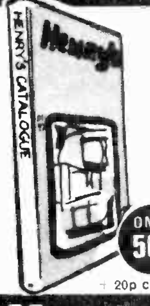

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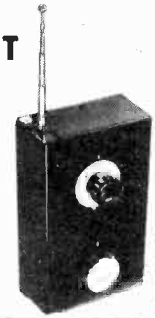

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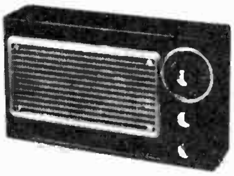

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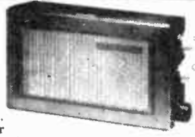

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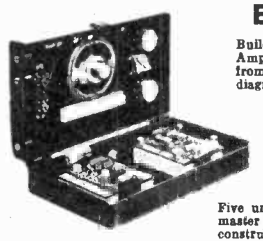

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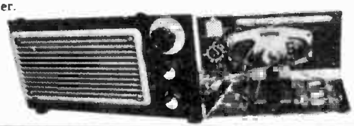

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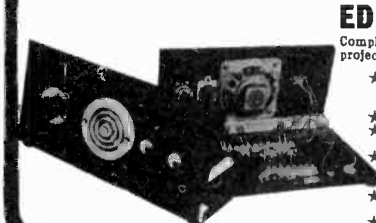

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PW576

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

SUBSCRIPTIONS – PRACTICAL WIRELESS AND TELEVISION MAGAZINES

WE are still receiving numerous letters requesting subscriptions to *Practical Wireless* and *Television* magazines. For those readers who are not aware, we regret that our magazines can no longer be supplied on direct subscription by IPC Limited due to escalating costs.

This action is very much regretted, but it should not mean that any reader is deprived of his/her regular copies of *Practical Wireless* or *Television*. Readers should order direct from their local newsagents. Any readers outside the UK who have difficulty in locating a supplier should write to the Editor and he will advise them of their local agent.

Grimsby A.R.S.

THE Grimsby Amateur Radio Society has moved to a new QTH. The address is now the New Alexandra Social Club, Alexandra Road, Cleethorpes.

The meetings are held fortnightly on Thursday evenings at 8 p.m. Old and new members are always made welcome as is anybody with an interest in short wave listening, amateur radio, electronics etc.

If anyone would like further details, please contact *George Smith, G4EBK, Hon. Sec., 6 Fenby Close, Grimsby, South Humberside, DN37 9QJ.*

RNARS events

THE following is the 1976 calendar of events of the Royal Naval Amateur Radio Society, the headquarters of which, G3BZU, are located at HMS Mercury, Leydene, Hampshire. If you would like any further information, contact Mike Matthews, G3JFF at the above address.

16-24th April
HMS Belfast activity period. GB3RN all bands. 24 hour day operation. Further details G3HZL QTHR.

20th June
HMS Mercury Mobile Rally.

28-30th August
Portsmouth Dockyard—Navy Days. GB3RN and displays in conjunction with HMS Mercury Communications Exhibit.

16-17th October
JOTA scout camp and Amateur radio teach-in at HMS Mercury/G3BZU.

Fuse Standards

THE British Standards Institution has published a revision of BS 88 now entitled *Cartridge fuses for voltages up to and including 1,000V a.c. and 1,500V d.c.* There are two parts: Part 1 *General requirements*, and Part 2 *Supplementary requirements for fuses of standardised dimensions and performance for industrial purposes*.

Part 1 specifies general requirements, including characteristics, construction, performance, and proving tests for all types of cartridge fuses. Subsequent parts will give supplementary requirements in different applications. Part 2 is for industrial purposes, and specifies fuses most commonly used in the United Kingdom. These two parts of BS 88 substantially agree with IEC publication 269. The earlier edition of the standard has been withdrawn.

BS 88 Part 1 price £5·50 and Part 2 £3·50 may be obtained from *BSI Sales Department, 101 Pentonville Road, London N1 9ND.*

BBC Radio Leicester

BBC Radio Leicester's medium-wave service is transmitting from a new, improved aerial at Freemen's Common.

The medium-wave service, on 188 metres (1594kHz), can be received at distances of twenty miles or so from the transmitter in daytime, but after dark the coverage is restricted by interference from other transmitters. The vhf programme is transmitted on 95·1MHz.

N. Radio Societies Association

THE Annual Convention and Exhibition of the N.R.S.A., which is sponsored by radio societies in the North of England, will take place at Belle Vue, Manchester on Sunday 25th April 1976.

The doors will open at 11am and there will be a large number of trade exhibitors, as well as club display stands. A trophy will be awarded for the best club stand and there will also be a variety of demonstrations connected with different aspects of amateur radio.

Other attractions will include a Grand Raffle, an Inter-Club Quiz and a Construction Contest.

Comprehensive talk-in facilities will be provided on 2 metres 145·5MHz (FM), 145MHz (AM), and on 144·290MHz (SSB); also on 4 metres 70·26MHz (AM & FM). There will be a GB3NRS HF bands station operating from the exhibition.

For long distance travellers it is hoped to offer talk-in through the local repeaters GB3MP (ChR6) and GB3RF (ChR7). Both these repeaters are scheduled to be on the air before the event, and there is considerable interest in mobile operation throughout the North West.

The N.R.S.A. is a non-profit making body which relies on the income from this convention and the small subscription from member societies in order to organize the following year's event. Further information can be obtained from the Publicity Officer:—*Mr. Gordon Adams, 2 Ash Grove, Knutsford, Cheshire, WA16 8BB. Telephone:—Knutsford 4040.*

BBC Radio Medway—Hoo

BBC Radio Medway's medium-wave service on 290 metres (1034kHz) is now transmitted from a new aerial at Hoo and the old station at Gillingham has closed down.

The vhf service from Wrotham, on 96·7MHz, is unaffected by this change.

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

RTTY news

THE British Amateur Radio Teleprinter Group announced the start on 7th March, 1976, of its RTTY News Bulletin service for radio amateurs.

Initially, the transmissions are made every Sunday according to the schedule below; later it is expected that more transmitting stations will be added to those listed.

The material transmitted will include test tapes for machines and systems plus news of specific RTTY interest.

The licence for GB2ATG is a broadcast, not a communications licence so transmitting stations will not be able to reply to any calls using this callsign.

Time	Frequency	Signal Characteristics	Transmitting Stations
1. 1200 hrs	3590kHz	45·45 bauds FSK 170Hz shift	G3IIR, G3OZF, GW3IGG
2. 1230 hrs	144·60MHz	(i) 45·45 bauds FSK, 850Hz shift (ii) 45·45 bauds AFSK, 170Hz shift, 2125/2295Hz tones	G3IIR, G3OUF, G3OZF

Summer School

THE Department of Electrical Engineering Science at Essex University will be holding its annual Electronics Summer School for teachers during the week July 12-16 this year. Three courses will be run simultaneously. The "Linear Circuit Design" course is concerned with the use of transistors and operational amplifiers in analogue applications and the basic circuits of a hi-fi amplifier are investigated in detail. The "Digital Circuit Design" course concentrates on the use of the transistor as a switch and develops design using integrated logic circuits; a digital patchboard is used to introduce the concepts of combinational and sequential logic design.

"Small Computer Systems" is a new course which should be of interest to mathematics teachers as well as those interested in electronics; the aims of the course are to introduce a typical small computer, the PDP-8, to investigate how it is used and to discuss its function in schools.

Further information on the Summer School can be obtained from *R. J. Mack, Department of Electrical Engineering Science, University of Essex, Wivenhoe Park, Colchester CO4 3SQ, telephone Colchester (0206) 44144, extension 2408 or 2299.*

Amateur Computer Club

IF you would like to find out more about the Amateur Computer Club, send a stamped, addressed envelope to J. T. C. Aslen, Club Secretary, 7 Doordells, Basildon, Essex. Telephone: Basildon 411125 or 0484-56712.

They have recently published a design for a low-cost computer and they think they will have working models by the middle of this year.

Longleat Rally

THE 19th Longleat Mobile Rally will take place at Longleat House, Longleat Park, near Warminster, Wiltshire, on Sunday June 27, 1976.

As in previous years, the trade stands will be housed in large marquees. The rally is to start at 10 a.m. and talk-in stations will be operational on 160m (1920kHz), 80m (3775kHz) and 2m (145·50-kHz +VFO). Callsigns will be announced nearer the date. There will be a walking DF hunt at 3 p.m. on Top Band and there will be a Grand Raffle. Overnight camping will be allowed from 6 p.m. on Saturday 26th. Further gen from *Brian Crocker, G3ULJ, Organiser, 36 Portland Street, Staple Hill, Bristol, BS16 4PT.*

Hot news from Heathkit

HEATHKIT announce their "Modulus" system of audio units. The range comprises a digital AM/FM tuner/2-4 channel preamp/control centre; a stereo receiver of "medium" or "high" power; and a 4-channel receiver "medium" or "high" power. You build in to your system what you want. Optionals include FM Dolby CD-4 Demodulator and SQ Decoder. All these items and more feature in the April/May 1976 Heathkit Catalogue supplement.—*Heath (Gloucester) Limited, Dept. PW46, Gloucester, GL2 6EE.*

Barking Society

THE Barking Radio and Electronics Society G3XBF/G8GPK, have recently started a new activity dealing with all aspects of closed circuit television. This section is attempting to build its own studio, but is hampered by a lack of members and may be forced to close. They feel there must be a need for a Video club in their area and have asked us to mention its formation in the News section of P.W. The society also runs a Morse Class on Tuesday evenings. Further details of any of their activities can be obtained from *J. R. Wiles at Society HQ, Westbury Recreation Centre, Westbury School, Ripple Road, Barking, Essex, IG11 7PT. (Telephone: 01-594 4009.)*

3-BAND RF MINI-AMPLIFIER

F. G. RAYER

THIS tuned RF amplifier will be found to provide quite substantial gain, and is of great help in bringing weak signals up to a level where they can be received properly. Even with a sensitive receiver having two RF amplifiers and a number of IF stages, it can result in the satisfactory reception of signals which are otherwise virtually impossible to copy.

With stronger signals, which would in any case be received satisfactorily, the unit helps to reduce second channel intereference, which can be troublesome with some receivers. However, its main use is in improving reception where a poor aerial, or the low signal strength of the wanted transmissions, makes adequate reception otherwise impossible.

CIRCUIT DETAILS

Three coils are used, L1, L2 and L3, Fig. 1. Switch S1 selects the required coil. One section of VC2 (208pF) is used for L2 and L3. For the lowest frequency range L1, VC1 is also in circuit, giving 384pF in all. As a result, three ranges as follows are obtained:—

Range 1—15—32MHz
Range 2—5·5—15MHz
Range 3—1·6—5·5MHz

It is of course not essential to provide tuning in this way. But if a value of about 365pF is used for all bands, Ranges 1 and 2 will overlap considerably, while the use of 200pF or so for each band will curtail the coverage of L3 at the low frequency end.

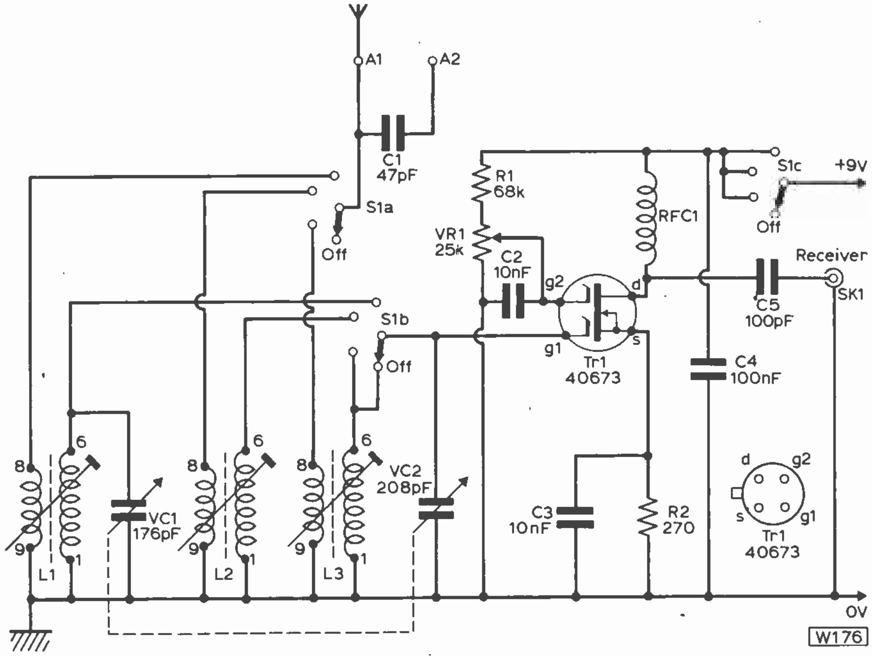


Fig. 1: Complete circuit diagram of the amplifier, showing the method of switching the coils to obtain a frequency coverage of 1·6MHz to 32MHz.

★ component list

Resistors

R1 68kΩ R2 270Ω

VR1 25kΩ Lin. potentiometer

All resistors ¼W 10%

Capacitors

C1 47pF C4 100nF

C2 10nF C5 100pF

C3 10nF

VC1/VC2 Jackson type 00, 176/208pF gang.

Semiconductors

Tr1 40673

Miscellaneous

L1, 'Blue' valve type Range 3. L2, 'Blue' valve type Range 4. L3, 'Blue' valve type Range 5 (All coils Denco miniature dual purpose). RFC1, RF choke type Denco RFC5. Jackson type 4832 two speed drive with knobs. S1a, b, c, 3-pole 4-way rotary switch. 127 x 101 x 51 mm Universal chassis, with extra 127 x 101mm plate. (Home Radio). Four 12mm high rubber feet. Two insulated aerial sockets. Coax socket. Tag strip comprising 8 tags. Battery clip. Two matching control knobs.

Results would be the same, but it is felt that having three ranges which include all bands from 1·6MHz to 32MHz in this way is probably better.

Switch section S1a/b Fig. 2 is for coil coupling windings while the third section of the switch, S1c, is for on-off purposes. An alternative aerial socket A2 is fitted for use instead of A1, when the unit is required to tune fairly sharply. Any end-connected aerial can be used.

Potentiometer VR1 allows amplification to be reduced when strong signals are present, as these might overload the receiver. This control however does not reduce gain to the level where no signals can be received.

Coupling to the receiver is from the RF choke RFC1 and capacitor C5. This will work satisfactorily with receivers having a high nominal aerial input impedance. With receivers having a low impedance, overall gain can be increased by using an impedance matching coil, but this would either have to be tuned in addition to the aerial coils, or be a broad-band device.

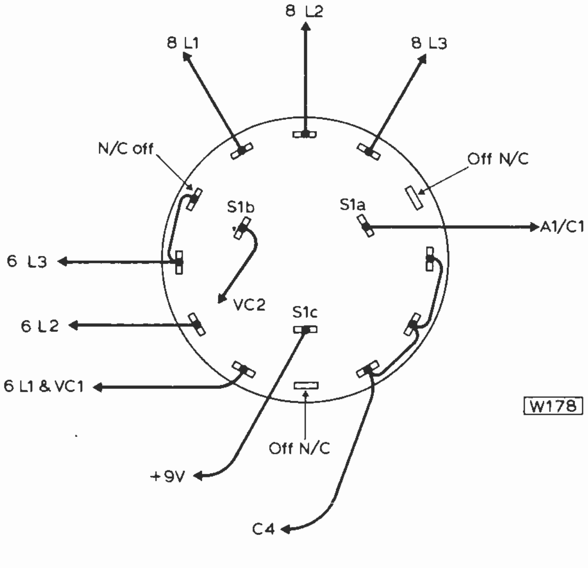


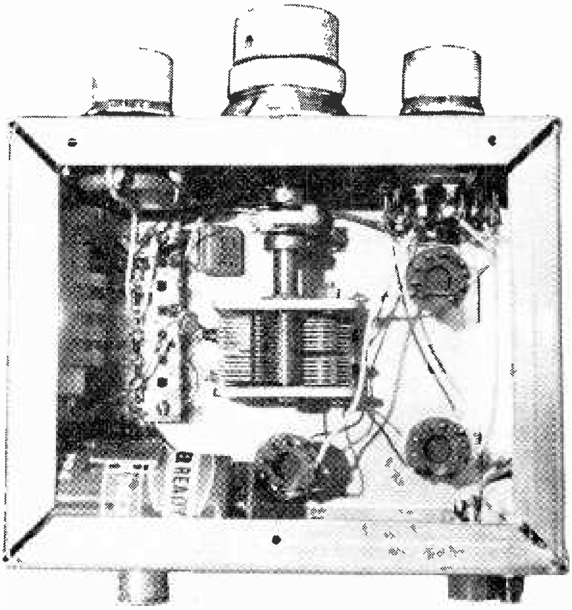
Fig 2: The three-pole four-way switch S1 is of the rotary type, and front panel mounted.

When using the unit with communications type and similar receivers, it was found necessary to employ a screened co-axial lead to the receiver. The power supply is a small internal battery, the drain being only a few milliamps, depending on the setting of VR1.

CABINET

A low-cost and effective screening box and case can be made easily from a 127×102×51mm "universal chassis" with an extra 127×101mm flat plate, which is later attached with self-tapping screws for the top.

As the coil fixing bushes and core-adjusting screws of the coils project through the bottom of the case, four plastic feet are required to raise it about 13mm. First drill one 127×51mm member for the front, and fit the switch, VR1, and drive. The bottom 127×51mm flat plate is screwed on, and can be drilled to take VC1/2, which is held with one or two 4BA bolts. Washers or other distance pieces are necessary to raise the gang slightly, to get it level with the drive coupling. The capacitor fixing screws must not be too long, or they will short circuit or damage the capacitor. A final lining-up of drive and capacitor is easy if the drive fixing holes are on the large side.



Plan view of the amplifier with the top plate removed. The ganged capacitor VC1/2 is driven via reduction gearing to provide precision tuning.

Nearly all wiring is completed before the sides and back of the case are fitted. The back is prepared by drilling it for the aerial sockets and co-axial outlet and a clip is made to hold a PP4 battery. When the back is fitted, one 4BA bolt is used for an earth connection.

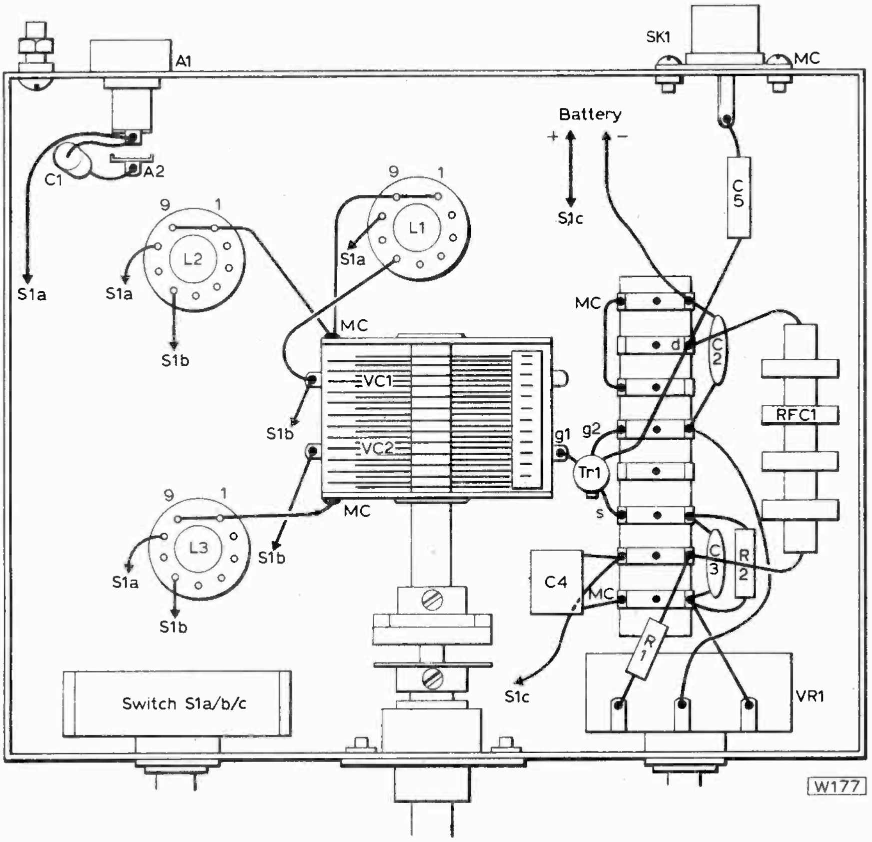
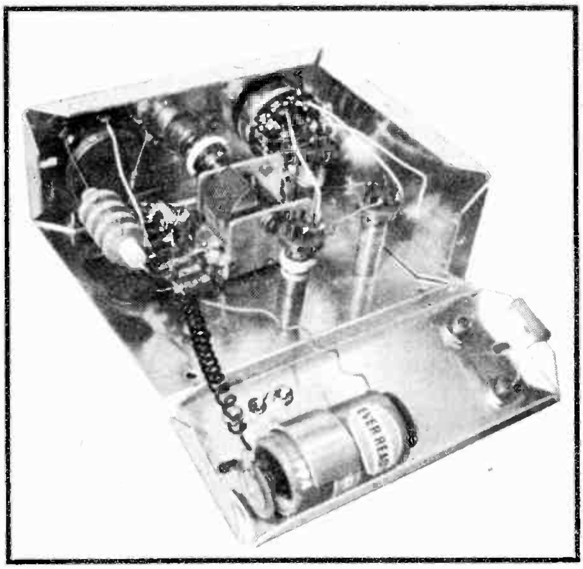


Fig. 3: The schematic shown here gives the location of all components, and the wiring between components and controls.

WIRING DETAILS

Leads are run approximately as in Fig. 3. The tagstrip is raised on 12mm long bolts. As unnecessary coupling between gate 1 and drain circuits is likely to cause instability, G1 is connected directly to VC2. For the same reason, the drain lead is lengthened and taken to the tag holding C5 and the RFC, both adjacent tags being earthed as in Fig. 2. Tr1 is gate-protected, and no special precautions need be taken when fitting it, provided the soldering iron is earthed and overheating is avoided.



The case is constructed from a single Universal Chassis with an extra plate. Size is approximately 101 × 127 × 51mm.

The coil pins may need scraping, before soldering. Lengthy heating should also be avoided here, or the pins may move. Connections to the switch can be seen from Figs. 2 and 3. All these leads must be reasonably short and direct.

When the sides and back are fitted, connections can be made to A1, A2 and the co-axial socket. The battery is placed with its positive end toward L1.

Earthing is provided by a terminal, or by the co-axial lead to the receiver. Having the latter unnecessarily long may reduce signal strength in some cases.

A frequency scale for the tuning need not be provided, as the amplifier is simply tuned to bring about an improvement in signal strength. With the unit switched to the Range needed for the receiver frequency, tuning should be found to peak up signals considerably. This will be most apparent with weak signals, or with the receiver AGC off. If the receiver has a tuning meter, this will show correct tuning. The coil cores are set to give coverage approximately as described. Exact coverage is not important, provided the ranges overlap slightly.

Should whistles accompany reception, especially with VR1 at maximum gain, Tr1 is oscillating. This is most likely when using an unscreened receiver aerial lead, especially if this is near the aerial connection to the unit. Tuning the booster should be found to peak up signals or aerial noise but not cause heterodynes or oscillation.

TAKE 20

DAVID ANDREWS

No. 74 SNAP MACHINE

A series of simple transistor projects, using not more than twenty components.

★ components list

R1	22kΩ	R6	4·7kΩ
R2	22kΩ	R7	22kΩ
R3	100kΩ	R8	100kΩ
R4	470Ω	R9	470Ω
R5	4·7kΩ	R10	22kΩ

All ¼W 10%

LED1/2	MV5025 (or general purpose LED)
Tr1	BSY95A
Tr2	BCY71
Tr3	BCY71
Tr4	BSY95A
S1/2	push-to-make buttons
S3	push-to-break button
S4	single pole on-off

Veroboard, PP3 battery and connectors. Suitable case, about 130 x 65 x 40mm.

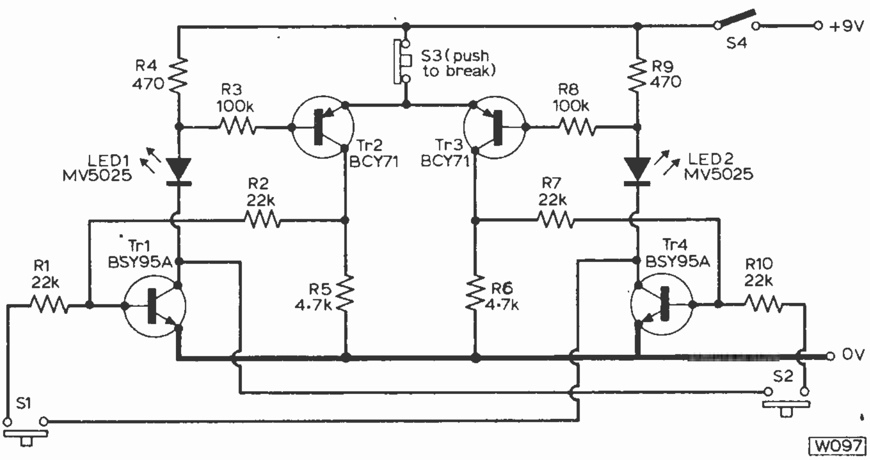
THERE have been lots of designs for simple Snap indicators published. Most, however, suffer from the problem that indication of the winner only lasts as long as the competitor presses his button. For that reason the following design has a built-in memory which ensures that the winner is indicated for an indefinite period until a reset button is pressed.

For the benefit of those who have not come across a Snap indicator before let's briefly explain the object and principle of operation. For games of skill involving two people it is sometimes desirable to find out who answers the question first. Before attempting to answer, the person has to commit himself to answering by pressing a button which lights a lamp and inhibits the opponent's button and lamp from operating.

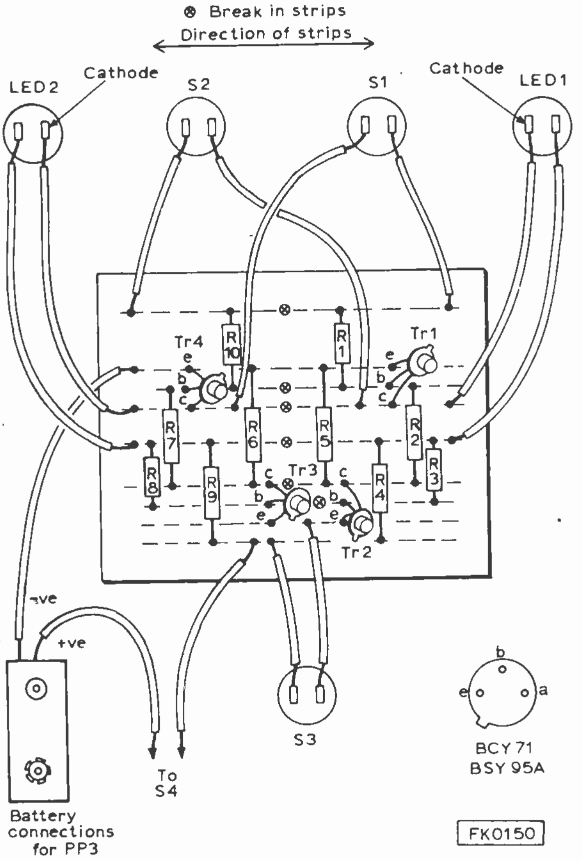
The psychological impact of the Snap indicator enhances a game's excitement considerably. The indicator could equally well be used in conjunction with the classical "Snap" card game.

Flip-flop circuit

Inspection of the circuit will show that Tr1 and Tr4 form a simple flip-flop which becomes cross-coupled when either of the push-buttons S1 or S2 is closed. This action illuminates the LED on the side of the push-button in question and prevents the opponent's LED operating. This circuit differs from many others by the inclusion of Tr2 and Tr3 which respectively act as "latches" to Tr1 and Tr4. If S1 is depressed Tr1 switches on and LED1 lights up. The collector potential of Tr1 falls to zero thus preventing any base current drive to Tr4 inhibiting the other player's



Complete circuit diagram of the Snap Machine, showing flip-flop Tr1 and Tr4, and latches Tr2 and Tr3.



Component layout of the Veroboard panel and wiring to the switches and LED'S. The size of the board is for guidance only.

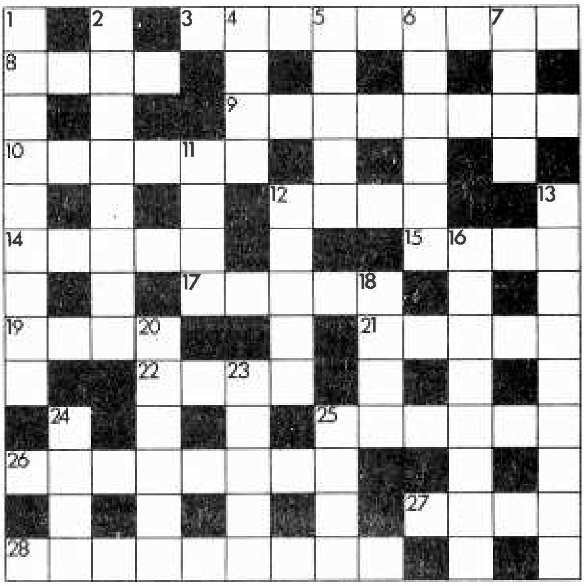
circuit. The potential at the positive end of LED1 also falls towards zero and this provides a source of base current for Tr2 which is a PNP device. The collector voltage of Tr2 rises towards the positive supply rail providing an alternative source of base current to Tr1 through R2.

If the player's finger is removed from the push-button this alternative supply of base current keeps Tr1 switched on and LED1 illuminated. At the same time the circuitry around Tr4 and LED2 is still inhibited, the only way to switch LED1 out and reset the circuit for another attempt is to break the circuit between the emitters of Tr2 and Tr3 and the positive rail, with the normally closed pushbutton S3.

Board layout

Provided the layout is carefully followed there should be no problems in the assembly of this circuit. Use normally open push-buttons for S1 and S2 and a NORMALLY CLOSED one for S3. It is important to connect the LEDs with the right polarity. The CATHODE of the device should be connected to the collector of its driving transistor. Using the specified devices the cathode end can be identified by a very small indent on the base of the red plastic or by the fact that there is a wider shoulder on the top of the cathode lead-out wire. When using other LEDs check the polarity carefully. PW

PW TECHNICROSS PUZZLE No.13



ACROSS

3 Grateful for this lack of fidelity? (9)
8 Spoken part chorally introduced? (4)
9 Steamiest form of radio? (8)
10 Untrue of Dylan's radio play? (6)
12 Drily cut off but I shall shortly be heard! (4)
14 Gets the message and sticks to the script! (5)
15 Cine movement in southern France? (4)
17 Demand precision in complex acting? (5)
19 Coverage of the first garden programme? (4)
21 I love her broadcasting manner (5)
22 River said to be in slow motion (4)
25 Set off because of the French component? (6)
26 A tuner in civil aviation? (8)
27 One piece heard from the deepest bass? (4)
28 He sings of a drink and a lake (5, 4)

DOWN

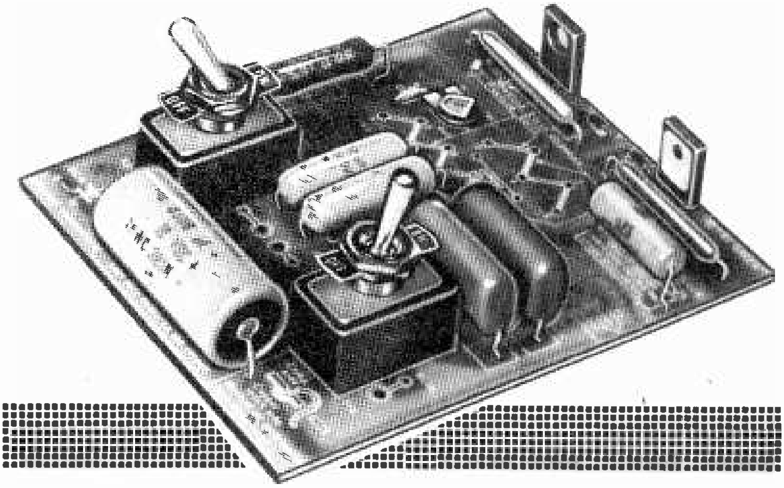
1 How to get on without feedback? (9)
2 Programme that takes the broader view? (8)
4 Toy with this in Children's Hour? (4)
5 A giant in Welsh programmes? (5)
6 & 20 Down She's on the air fitfully (6, 6)
7 Actors gloomy over this? (4)
11 The language you hear on Irish radio! (4)
12 Its creation may be quite a project? (5)
13 Welcome the end of transmission? (9)
16 An impressionable comic? (8)
18 Pitch of an oscillating note? (4)
20 See 6 Down
23 Kind of breakthrough the talkies made? (5)
24 He mustn't miss a word! (4)
25 A bit of percussion in our hearing? (4)

FOR AMUSEMENT ONLY
ANSWERS NEXT MONTH

SPECIAL PRODUCT REPORT

BI-PRE-PAK

'Super Spark' CAPACITY DISCHARGE IGNITION KIT



The photograph in the heading shows the printed circuit board which is fitted to the lid of the die-cast box by the locknuts on the switches. As can be seen the PCB is well annotated. The zig-zag lines are the alternative links for positive or negative chassis connections. The two transistors are mounted vertically at the extreme righthand end of the board.

IN case you do not feel like wading through this review to the very end we will have the conclusions first! This kit is easy to assemble and to fit to a car. It worked first time and starting the car is much easier now, especially in cold weather. Is it a good buy? At £7·96+8% VAT it certainly is!

The circuit employed is similar to that which appeared in PW in June 1971, repeated in June and July 1972. However there are a few refinements which are very much worthwhile, all concerned with extra reliability. A two-transistor oscillator working at an audio frequency uses the primary winding of a transformer, the secondary feeds a bridge rectifier producing around 350V DC output. This is applied to a thyristor, the gate of which is triggered by the car's contact breaker on the distributor. The 350V pulse is fed via a $1\mu F$ capacitor to the primary of the coil. In case you are worried about 350V being applied to the 12V coil it should be pointed out that 350V is roughly the back voltage developed by the primary winding when the 12V supply is broken by the contact breaker, the basis of the ordinary ignition system.

INFO

The general information sheet supplied with the kit tells me that a Mr. Kettering was responsible for the original system some 60 years ago, so I've learned something! This sheet is full or useful information but unfortunately it is poorly reproduced in a very small type face, the explanatory diagrams being almost unreadable. Bi-Pre-Pak are not alone in this sad habit of neglecting the all-important "gen" accompanying electronic equipment generally and kits in particular. It may seem to the seller to be an economy, saving a few pence in this manner, but I can assure all those guilty that they are making a big mistake. The second information sheet supplied deals with the assembly of the kit and installation instructions. This is better produced but even so the circuit diagram was broken up in parts due to poor reproduction. Mr. Davis of B-P-P has assured me that this matter and a few spelling errors are being attended to.

However, it must be said that the printed circuit board is one of the best ever seen. The amount of information printed on the board makes the aforesaid circuit diagram almost superfluous! The PCB was assembled in a couple of hours, without going mad. The ends of all component leads were scraped clean whether they needed it or not. An old habit, but it pays off, ensuring a good soldered joint every time. Little sketches of the transistors, diodes and the thyristor on the circuit diagram and the PCB eliminate any possible error here when it comes to wiring them in.

During assembly the PCB was laid across the open top of the die-cast aluminium box, a great help. This box may seem to be rather extravagant, representing a fair part of the cost of the kit, but it does have an excellent seal all round, rather important considering the muck that can be found in the engine compartment of the average car! To aid the sealing a piece of thin plastic sheet was interposed when the lid of the box was finally screwed down.

ANTI-THEFT

To my mind the biggest feature of the kit, not sufficiently underlined by B-P-P, is the ability to switch back to normal ignition at any time thus eliminating that fear in the back of the mind that the electronic ignition might let you down one day! It is important to note that if the switches are placed in opposite positions the car is totally immobilised, which is much easier than removing the rotor from the distributor! These two switches are mounted on the PCB and used to mount the board on the lid of the box. The neon lamp protruding through the lid is one of those little "extras" that instil confidence, indicating that the unit is producing the 350V required, further confirmed by the high pitched whistle from the oscillator indicating that all is well.

INSTALLATION

On applying 12V from a car battery in the workshop, nothing happened! No current was being drawn by the unit. A check revealed that the fuse had been omitted! This is a piece of fuse wire soldered across two points on the PCB, thus saving a fuseholder. The fuse duly fitted, the unit worked at once producing the 350V output at the rectifier. The PCB can be wired for positive or negative chassis but it should be noted that the black wire goes to the chassis regardless of the chassis polarity. The PCB is **not** electrically connected to the box so this lead must not be omitted.

The unit was fitted to a Triumph Herald 12/50 of 1965 vintage and tested during the very cold spell in February when temperatures were below freezing for several days on end. The box was bolted to the left-hand vertical panel

continued on page 60

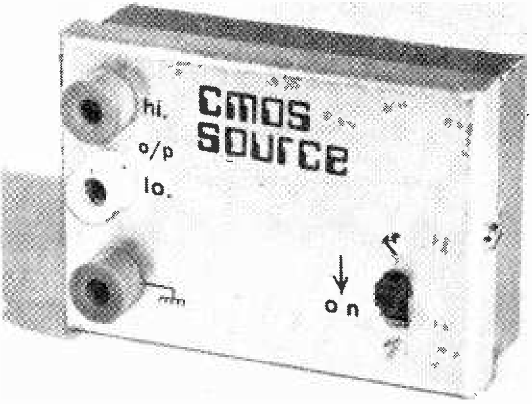
AF Signal Source

W. MOONEY

THE rapid decrease in the price of CMOS (4000 series) digital integrated circuits, and the amazing reduction in quiescent power consumption compared to the popular 74 series, makes experiment with these devices a tempting proposition. Quiescent power consumption is of the order of 10nW per gate for the 4000 series and is therefore negligible, whereas consumption by the 74 series is about 10mW per gate. Despite conflicting requirements of fast switching speed and low power consumption, these devices will still work well up to 10MHz.

The signal source described here, uses only one IC which contains two 3-input NOR gates and an inverter. The source provides a square-wave of about 1kHz at a voltage of 99% of the battery voltage. Two outputs are provided, one via a 1μF capacitor which should give a good square wave into high impedance loads, and a second output via a 100pF capacitor, picking off the RF harmonics for signal injection.

The current drawn from the battery is less than 30μA and increases with the application of a load to the output. The device will continue to work until the supply voltage drops to below 3V, when the off load current will be about 10μA.

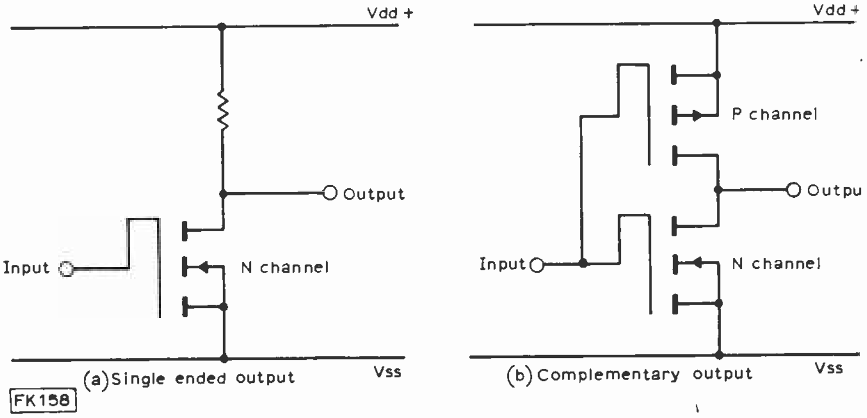


Power consumption

In a normal N or P channel MOS gate as in Fig. 1a the quiescent power consumption is high because a load resistor is used. Therefore in this instance when the output is in the low state a current must flow through the resistor in order to decrease the output voltage. This resistor must be fairly low so as to drive the following stage when a low output is required. But if too low, the current required to produce a low state will be too high. A compromise is therefore arrived at. If the load resistor is replaced by a MOSFET of opposite polarity (Complementary) to the lower MOSFET as in Fig. 1b the need for such a compromise is obviated as this load fulfils both requirements.

In the high output state the lower MOSFET switches off becoming, in effect, a high resistance of about $10^{13}\Omega$ and the top MOSFET becomes a low resistance of about 300Ω. When a low output is required the resistors effectively change place, the upper MOSFET switching off and the lower MOSFET switching on. In the complementary MOSFET circuit (CMOS) the power consumed in the high or low state is therefore negligible and the great majority of the power is consumed during switching.

For a brief period during the switching action both MOSFETS will be equally on and will have a relatively low resistance. At this instant the current peaks to typically 1·5mA with a 10V supply rail. When the CMOS gate is in a normal digital environment carrying step pulses, the power consumed due to this effect is practically zero. The consumption is then purely due to the capacitance of the load, typically 5pF per gate.



(a) Single ended output

(b) Complementary output

Fig. 1a: A normal N channel MOS gate with a single ended output. Fig. 1b: A similar device to that shown in Fig. 1a, but with the load resistor replaced with a P channel gate. This now forms a complementary output.

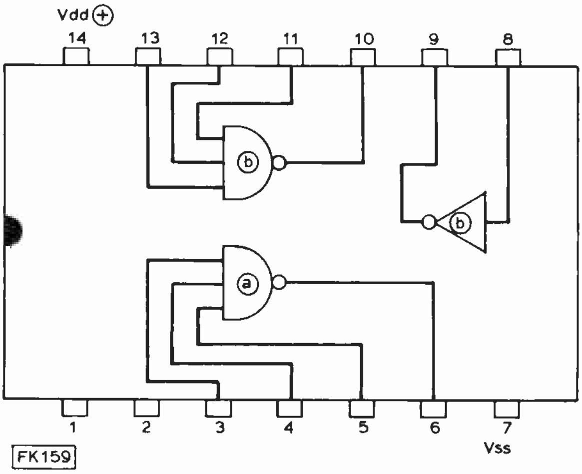


Fig. 2: Internal configuration of the CD4000. Gates 'a' and 'b' are NOR gates and 'c' is an inverter.

Total power

The total power consumed (Pt) by a particular gate carrying regular step pulses is therefore the sum of the quiescent power (Pq) in the high or low state, and the switching power. The switching power is dependent on the frequency (f), the voltage difference between the high and low states (approx. the supply voltage Vdd) and the capacitance of the load (C). Bringing these together we get:

$$Pt = Pq + CVdd^2f$$

This is arrived at from the familiar expression for the energy stored in a capacitor $\frac{1}{2}CV^2$.

In the source described here the conditions are somewhat different as the inputs to both gates are part of a timing circuit. This circuit slows down the transition through the high current portion of the transfer characteristic, giving a higher current drain than would be expected from the above expression. However at a maximum of 30μA it still compares very favourably with an equivalent circuit using discrete bipolar devices.

Circuit operation

The internal layout of the CD4000 IC used in this circuit is shown in Fig. 2, the parts marked (a) and (b) are the NOR gates and (c) the inverter. The circuit of the oscillator is shown in Fig. 3, all inputs to each gate are strapped together, the operation now being the same as that of the inverter where a low input produces a high output and vice versa. The circuit will be recognised as a multivibrator type of oscillator, the frequency determining components being C1/R1 and C2/R2. In this circuit C1=C2 and R1=R2, thus giving a squarewave of equal mark/space ratio.

★ components list

Resistors

R1 10MΩ R3 1MΩ
R2 10MΩ R4 see text
All resistors 10% ¼W

Capacitors

C1 100pF SM C3 100pF SM
C2 100pF SM C4 1uF 50V elect.

Semiconductors

IC1 CD4000

Miscellaneous

S1, miniature slide switch. Aluminium box 76 x 50 x 25mm type AB12, available from Home Radio. Printed circuit board 45 x 25mm. Three 3mm plugs and sockets. Three 1·5V cells, type D23.

Circuit operation is best understood by freezing the cycle at a point in time when the output of gate (a) has just jumped from zero up to nearly the supply voltage. The voltage on the input to (b) will follow this rise since C1 is discharged and the output of (b) will now be zero. The voltage on the input to (b) will slowly drop towards zero as C2 charges up, and at some point (about 40% of the supply voltage) will cause the output of (b) to jump quite rapidly to the high state. As C1 is discharged, the input to (a) will follow this increase causing the output of (a) to drop. It will now remain low until C1 charges through R1 to the point where the output of (a) goes high once more and the cycle repeats. At the times of the cycle when the output of (a) or (b) drops to a low state the associated capacitor will be charged up and this charge results in a negative voltage appearing on the following input. A lucky spin-off of the input protection circuitry now occurs as this negative potential forward biases certain diodes thus quickly discharging the relevant capacitor.

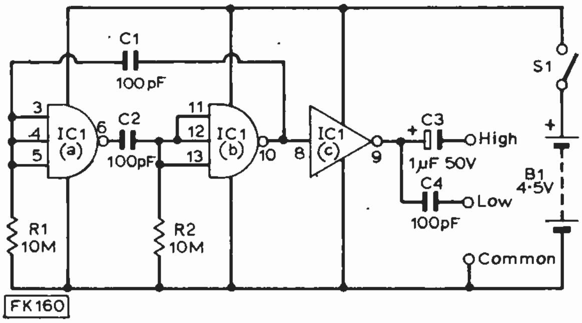


Fig. 3: The above drawing shows the complete circuit of the oscillator. With the component values shown, the output frequency is about 700Hz.

The output from gate (b) is passed through the inverter which isolates the oscillator from the load and squares up the waveform. The supply line is not decoupled as it is quite unnecessary and tends to make starting difficult by removing the switch-on kick. No specific arrangements have been made for starting but should the oscillator stop for any reason, simply switching off for a few moments, and then on again, will usually start the oscillator running.

Construction

The device is constructed in a ready made aluminium box measuring 76×50×25mm. The PCB, Fig 4 switch and terminals were attached to the lid of the box as is the power source which consists of three 1·5V cells, type D23, connected to give over

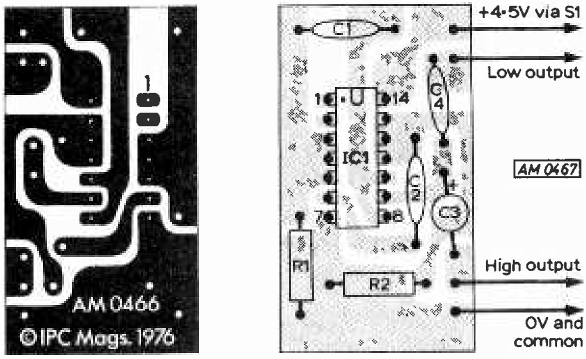


Fig. 4: PCB showing foil side to the left, and component overlay to the right. The board is shown full size.

4·5V when new. These small cells are not very popular but a little searching is worth while as they offer a considerable saving in space, being only about 10mm in dia. and 30mm long. A long life is expected of these batteries and they are therefore glued together and then to the case, making the connecttions by direct soldering. If it is decided to use mercury cells, direct soldering should be avoided for safety reasons.

The IC was found to be remarkably robust as the inputs are protected by an array of zener diodes to prevent static build up. However in the interests of good practice the soldering iron should be earthed and precautions taken to prevent personal static build up. The timing capacitors are silvered mica but any low leakage type will do. The output capacitors should have a suitably high working voltage if work with valve or high voltage transistor equipment is envisaged.

The source in use

The output frequency of the device with the component values given here is about 700Hz. The square-wave is quite good with harmonics extending well into the short wave region. The output voltage is dependent on the supply voltage and the device will work well down to below 3V. Under 3V, however, starting becomes increasingly difficult. The quiescent current consumption at 3V is less than 10μA.

The device has been used for fault finding in AM receivers and audio amplifiers, although the use of a square-wave generator does not end here, especially if an oscilloscope is to hand. For example, the action of tone controls and various filters can then be observed directly. One fundamental property of a symmetrical square-wave is that the RMS and average voltage are equal. This property was demonstrated with a prototype when the battery voltage was found to be 4·8V (20k ohm/Volt meter), the output indicated on the AC range was exactly 2·4V RMS.

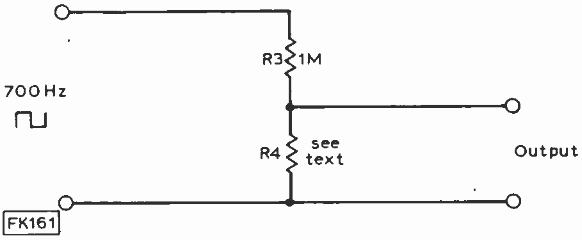


Fig. 5: The output amplitude of the Signal Source may be a little high for some purposes, and this simple attenuator should be used when necessary.

Some form of potential divider should therefore be used before injecting the signal into the more sensitive stages of audio amplifiers, otherwise serious overload will occur giving misleading results. A simple attenuator as shown in Fig. 5 will be adequate, the value of R4 being altered as required. For example with 2·4V input and R4=1kΩ the output will be 2·4mV. Some levels to expect when dealing with AF stages are as follows:

Output from magnetic cartridge	3mV
Output from ceramic cartridge	80mV
Output from crystal cartridge	300mV
Output from cassette replay head	0·5mV
Input from, tape, tuner, or aux	100mV

Although it should be remembered that the battery life will be reduced by applying heavy loads to the source, it is possible to drive an 8Ω loudspeaker directly although this hasn't been tried for more than a few seconds.

BOOKS RECEIVED

RADIO CONSTRUCTION FOR AMATEURS

By R. H. Warring
Published by Pitman Publishing Limited,
Pitman House, 39 Parker Street, London WC2B 5PB
120 pages 21·5cms x 14cms.
Price £2·50

THIS book caters for both beginner and the enthusiast with some electronics experience. It sets out the theory of radio transmission, describes working components and circuit construction and provides over 30 working circuits. Chapter headings included are: Crystal Sets, More about Tuned Circuits, Transistors, Bias and Stabilisation, Regenerative and Reflex Receivers, FET's and IC's. etc.

PRINCIPLES OF TRANSISTOR CIRCUITS (Fifth Edition)

By S.W. Amos
Published by Newnes-Butterworths,
The Butterworth Group, 88 Kingsway,
London, WC2B 6AB
320 pages 21cms × 14cms
Price £3·20

THIS Wireless World book has been updated quite extensively from the 4th edition by the inclusion of information on field-effect transistors and the expansion of the treatment of switching circuits. Chapter 1, Semiconductors and Junction Diodes deals with the basics of semiconductor physics and the principles of transistor operation. Following chapters include such subjects as Common-base and Common-gate Amplifiers, Bias and DC Stabilisation, Large Signal AF Amplifiers, IF Amplifiers, Pulse Generators and Further Applications of Transistors and other Semiconductor Devices.

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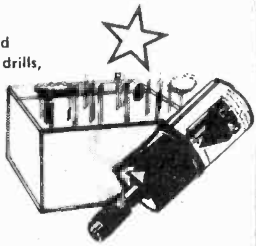

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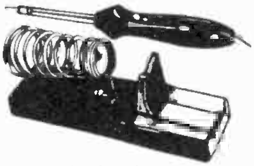

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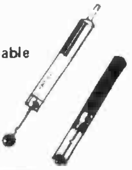

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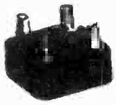

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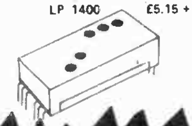

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BC 237B	11p H
BC 238C	10p H
BC 239C	12p H
ZTX 107	10p H
ZTX 108	9p H
ZTX 109	12p H
ZTX 300	13p H
ZTX 500	14p H
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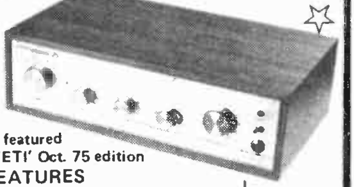

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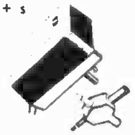

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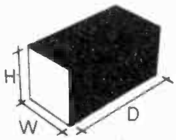

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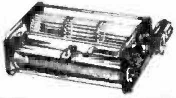

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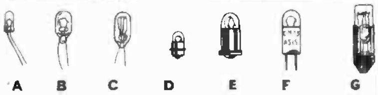

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		12V 40 MA			6·3 200 MA
		12V 100 MA			14V 40 MA
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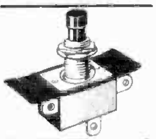

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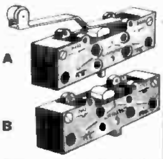

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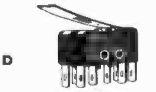
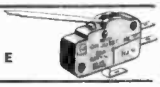


Type D similar to Type C, but with tags underneath, uses same lever as Type C or can be banked horizontally and double lever (as shown) supplied at **12p**. Prices as type C.



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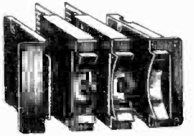

(Plessey) ten position 0–9 (single pole ten way) modular, any number may be banked. Contact rating 2a. A.C. or D.C., colour black, size overall 52·58 high x 12 wide x 49 mm deep. P.C. pitch 156. Price **£1·50** per unit, end mounting cheeks **£1·00** per pair, p. & p. 30p any order.

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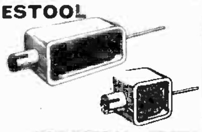

240 a.c. type MM6 3lb pull. 2¾" x 1" x 1¼". Travel 1". **£1·50** each, plus p. & p. 25p.
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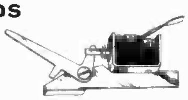

This little unit gives vertical lift of approximately 1in. through hinged "elbow". Bracket incorporates 2 fixing screws. Length of arm, 2¼" 240V. a.c. Pull at coil is approximately 1lb. Price **£1·25** plus p. & p. 20p.

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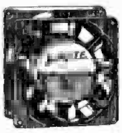

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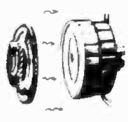

A superb example of Electro-mechanics! The main body is in two sections. The coil section is fixed and has a ⅜in sleeve. The drive section rotating on the outer perimeters. The uniting plate has ⅜in ID bearing concentric with main section and 18-tooth cog wheel. When energized transmission is extremely powerful, 24V d.c. at 240 MA. **Our price just £2·70** plus 30p p. & p.

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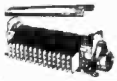

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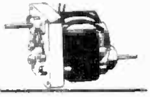

240 a.c., high Torque, approximate overall size 3½" x 3½" x 2¾" and spindle dia. ⅛". Price **£3·50** plus p. & p. 50p.

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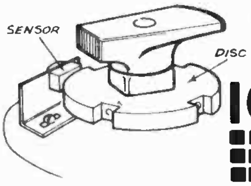

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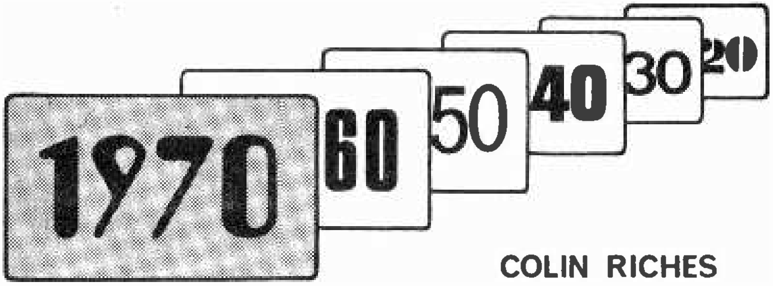
GOING BACK...



COLIN RICHES

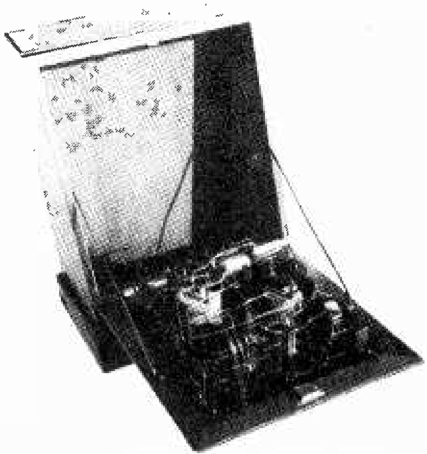
'Mystery' Receiver

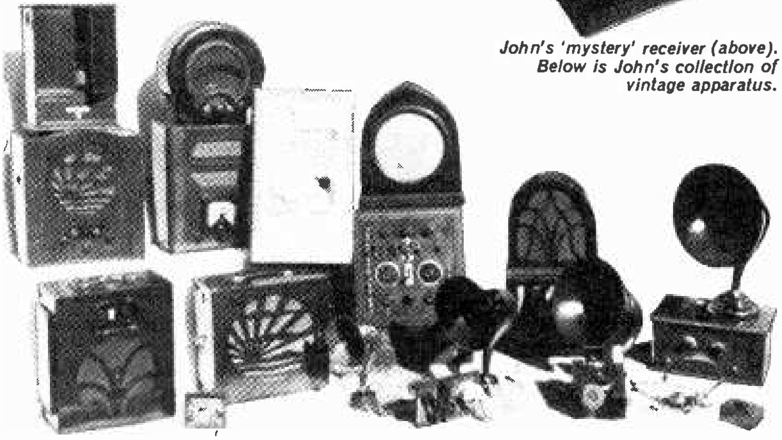
I HAVE received a letter from one of our younger Going Back enthusiasts—John Narborough, aged 16, from Uckfield in Sussex.

He tells me that he has quite a collection of vintage radio equipment and during his three or four years of being a PW reader, prompted by reminiscences from his dear old dad who used to dabble in radio in the '20s he has become extremely interested in the earlier days of wireless.

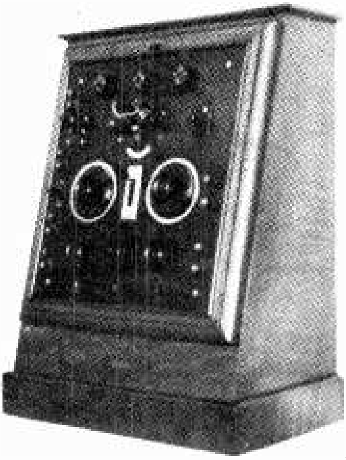
He says he is finding—much to his mother's delight—that it is becoming increasingly hard to find items of equipment (that do not have misguidedly high price tags) with which to "clutter" up the home. Nevertheless, John considers that he has one or two prizes in his collection.

John would like to know if any other Going Back readers could help him concerning the item in the two smaller photographs. The set is built into an oak cabinet which has a drop-down front. Three valveholders are mounted at the top with filament rheostats below. Also included are the usual tuning and reaction controls, three sets of coil terminals and a reaction control for some external piece of equipment—possibly a frame aerial—even though there are AE and E terminals on the panel. The wiring (it's a pity but a few of the components are missing) indicates that the set is probably an early '20s' design and there is a transformer wound "like a coil in cylinder form", the core of which comprises individual iron wires. Under the detector valve socket (centre) there is a screw-in variable grid leak and coil changing system of plugs and sockets. An engraved "wiper" type switch gives ranges from 200 to 3000 metres. Each valve holder has switches for its individual power supply.





John's 'mystery' receiver (above). Below is John's collection of vintage apparatus.



External view of the 'mystery' receiver.

John passes on a useful tip here—he only managed to decipher the wording on the controls by rubbing the ebonite panel with a cloth dipped in turps. This reveals the mark where the lettering used to be—but only while it is drying.

What John would like to know, if anyone would care to drop him a line is: who was the manufacturer and where do coils/frame aerial fit?

The set does not look home-brewed but could be a "limited quantity" set. The DPDT switches are made from a commercial front knob and a home-machined contact system of brass strip.

The larger picture shows some of John's collection. Creeping off. the picture at bottom right is a Brown Microphone Amplifier which he has had working—even though the tone is rather shrill.

Anyone interested can contact John Narborough at *The Orchard, Rocks Lane, High Hurstwood, Uckfield, Sussex, TN22 4BN.*

Vintage CQ!

INFORMATION WANTED

. . . Circuit diagram or the Works Publication WP 137 (mentioned on label giving valve details) of a Burndept Screened Portable. Valves are PM1HF, PM1A, PM12 and PM252. The set requires a 2V accumulator, 108V HT with 66V tapping and 18V (tapped every 1·5V) grid battery.—*John Hein, 13 Blane Avenue, Blanefield, via Glasgow, G63 9HU.*

Dear Sir,

letters

Early morning maths

While thumbing through my husband's *PW* (February), I noticed the Editors comments on digital watches. We have had a digital clock for over a year now, and although I can cope with the 24 hour system on it, I am still sometimes frustrated by having to mentally subtract numbers from 60 to find out how long it is to the next 'o'clock'.

My suggestion (I know nothing about the electronic practicability of it) is that we return to the 12 hour system, and that the display reads the minutes first, with 'to' or 'past' in the middle, i.e. 27 past 7 or 29 to 8. This would abolish the need for mental arithmetic early in the morning as the time to get up approaches! **Mrs F R Tasker** (Hardwicke)

PS. What happened to the crossword?

This is fitted in when space permits—Ed.

Crystal controlled pendulum

Your editorial in the February issue of *Practical Wireless* caused me a little quiet amusement.

As a retired airline captain, I am used to learning to accept new instrument faces, hence the digital presentation causes me no pain. However, this does not deafen me to the complaints of the female side of my family ever since I constructed a digital clock. I am sure that quite a lot of people have to make a distinct effort to convert mere numbers to a more conventional mental picture of time.

A few months ago, I wrote to another journal making such a point and asking if they would publish a circuit which would marry the accuracy of a crystal timer to a balance wheel or pendulum clock. This could be achieved by comparison perhaps, plus suitable correcting impulses. I said I was sure that this would please hobbyists and horologists not to mention their womenfolk! The editor did not agree, hence my amusement.

You, of course, refer only to wrist watches. In this case could not a miniature stepping motor drive conventional hands, as employed, I believe, in certain makes of watch?—**E Rodley** (Guildford).

IC DFM

Is it not time to revisit the subject of the Digital frequency meter?

Surely, amongst the readership of *PW* there is someone capable of contributing a device of sound economic sense, from the vast array of ICs now available?—**B A Martin** (Solihull)

We hope to be satisfying people, such as Mr Martin, very shortly —Ed.

Heavy duty charge

As a reader of PW for many years and also a keen motorist (DIY), I submit a humble request for an article on a battery charger, something a little more sophisticated than the straight forward trickle charger. I would suggest a charging rate from about 2A to 8A (for rapid charge), and using full wave rectification. Suitable also for 6V or 12V batteries. I'm sure one could be built much cheaper than a commercially bought one.—**C. Law** (Blackburn)

(*Potential contributors—please note*)

The price of stock

Reading Mr B. A. Pearson's letter of complaint re transistor prices in the March issue, stirs me from my customary lethargy (and it takes a lot to do that) and prompts me to put another view which may not be popular with all your readers.

In the first place, the correct price for an OC71 of reputable make should have been 74p plus VAT. In the second place the dealer should be thanked for keeping this type of transistor in stock, bearing in mind the fact that these are not exactly the most sought-after transistors and in any case can be obtained in bulk at give away prices as seconds or surplus which the average dealer would not care to keep or sell.

The third item is this. The average man in the street knows nothing of the pitfalls involved in running a business (be it small or large). He knows he needs an OC71 and for convenience pops into his local dealer trusting that he will have some in stock. It could have been any one of hundreds of different types held in stock against the time they are needed (if they are) together with hundreds of valves, resistors, capacitors etc. Who pays for the stock which just lies there as a convenience? There is no way of knowing what will be asked for. If Mr Pearson thinks it is so lucrative I suggest he draws up an imaginary stock list, pays for it all (mentally that is, I doubt if he would be so bold as to do it) and then tries to sell it at 25p per go, that is if he has thought to stock the item required.—**Les Lawry-Johns** (Gravesend, Kent)

Very puzzling

I have taken PW for some years now, and whenever possible attempt to complete the 'Technicross' puzzle. However, after many frustrating months, I feel that it would be beneficial to those taking part if the answers were published in the same issue as the puzzle. Waiting a month for the correct answers tends to lessen the enjoyment of the game.

Perhaps I may also suggest, that on the whole, the questions are a little obscure for the general readership of PW, including myself! Am I just a little thick or is this a generally held thought amongst the readership? —**A W Bunting** (Kent)

We would be pleased to hear from other readers about their views on this feature.

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EF91	1·35
EF92	1·51
EF95	1·63
EF183	0·69
EF184	0·69
EH90	0·91
EL34	1·21
EL36	1·15
EL84	0·53
EL86	1·21
EL95	0·89
EM81	1·24
EY51	0·89
EY86	0·50
EY86/87	0·53
EY88	0·81
EZ80	0·63
EZ81	0·53
GY501	1·30
GZ34	1·06
OC83	0·60
PC86	1·05
PC88	1·05
PC97	0·53
PC900	0·65
PCC84	0·63
PCC85	0·90
PCC88	0·98
PCC89	0·73
PCC189	0·91
PCF80	0·63
PCF82	1·37
PCF86	0·73
PCF200	1·30
PCF201	1·30
PCF801	0·73
PCF802	0·78
PCF806	0·73
PCH200	1·30
PCL82	0·63
PCL83	0·73
PCL84	0·69
PCL85	0·72
PCL86	0·73
PCL805/850	·73
PD500	2·11
PFL200	0·91
PL36	1·06
PL81	0·91
PL81A	1·08
PL82	0·48
PL83	1·50
PL84	0·78
PL500	1·02
PL504	1·02
PL508	1·30
PL509	1·77
PL802	2·03
PY33	0·73
PY81/800	0·56
PY82	0·70
PY88	0·63
PY500A	1·15
PY800	0·56
PY801	0·56
U26	1·22
U191	1·17
U193	0·56
UABC80	1·01
UBC81	0·80
UBF89	0·65
UCC85	0·66
UCH81	1·30
UCL82	0·78
UCL83	0·78
UL84	1·06
UY85	0·73
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30C17	1·29
30C18/ PCF805	1·29
30F5/PF818	1·35
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30FL12	1·44
30FL14	1·20
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DL92	0·50
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EBF89	0·32
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ECC83	0·38
ECC84	0·35
ECC85	0·45
ECC88	0·50
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ECH42	0·85
ECH81	0·35
ECH83	0·50
ECL80	0·60
ECL82	0·42
ECL83	0·75
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EF80	0·35
EF85	0·45
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EF89	0·35
EF91	0·40
EF92	0·50
EF95	0·45
EF98	0·80
EF183	0·40
EF184	0·40
EL32	0·60
EL33	3·00
EL34	0·70
EL36	0·60
EL37	3·40
EL41	0·90
EL42	1·65
EL84	0·35
EL95	0·60
EM80	0·55
EM81	0·60
EM84	0·40
EM85	1·00
EM87	1·00
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EZ40	0·60
EZ41	0·75
EZ80	0·30
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PCF86	0·65
PCF801	0·60
PCF802	0·55
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PCF806	0·80
PCF808	1·00
PCL82	0·45
PCL83	0·70
PCL84	0·50
PCL85	0·60
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PL81	0·55
PL82	0·50
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PL84	0·50
PL500	0·35
PL504	0·85
PL508	0·90
PL509	1·55
PL802	2·00
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PY33	0·63
PY81	0·50
PY82	0·45
PY83	0·50
PY88	0·63
PY500	1·10
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PY801	0·55
SP41	3·00
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U25	1·00
U26	0·85
U191	0·75
UABC80	0·40
UAF42	0·75
UBC41	0·60
UBC81	0·50
UBF80	0·50
UBF89	0·50
UCC85	0·50
UCH42	0·80
UCH81	0·50
UCL82	0·40
UCL83	0·70
UF41	0·75
UF89	0·50
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UL84	0·50
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VR150/30	0·45
1R5	0·50
1S5	0·40
1T4	0·40
3S4	0·50
3V4	0·85
5R4GY	1·20
5U4G	1·25
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5Y3GT	0·65
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6AU6	0·40
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6BQ7A	0·55
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6BW7	1·00
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6CH6	2·20
6CW4	3·00
6F23	0·90
6F25	1·00
6F28	0·75
6J5M	0·65
6J5G	0·45
6J6	0·35
6J7G	0·30
6J7M	0·65
6K6GT	0·80
6K7G	0·35
6K7M	0·45
6K8G	0·45
6K8M	0·70
6K25	1·00
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6L6GC	0·60
6Q7G	0·40
6Q7M	0·60
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7C6	1·00
7H7	0·80
7R7	0·30
7S7	2·25
7Y4	0·80
12AT6	0·45
12AT7	0·45
12AU6	0·50
12AU7	0·38
12AX7	0·32
12BA6	0·50
12BE6	0·60
30C1	0·40
30C15	1·00
30C17	1·00
30C18	0·90
30F5	1·00
30FL1	1·00
30FL2	1·00
30FL14	1·00
30L15	0·95
30L17	0·95
30P4MR	1·30
30P12	1·00
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1N914	0·06
IN4001	0·06
IN4002	0·07
IN4003	0·08
IN4004	0·08
IN4005	0·10
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1N4009	0·06
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1S921	0·07
IS2033	0·20
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IS2100A	0·20
1S3010	0·25
2N696	0·15
2N697	0·16
2N706	0·10
2N706A	0·12
2N1131	0·25
2N1132	0·24
2N1302	0·16
2N1303	0·18
2N1304	0·33
2N1305	0·33
2N1306	0·33
2N1307	0·33
2N1308	0·33
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2N1614	0·45
2N2147	0·78
2N2160	0·78
2N2369A	0·16
2N2646	0·50
2N2904	0·20
2N2904A	0·25
2N2905	0·22
2N2905A	0·25
2N2906	0·20
2N2926	0·12
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2N3711	0·11
2N3819	0·38
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2N4059	0·10
2N4060	0·13
2N4061	0·13
2N4062	0·14
2N4289	0·30
3N125	1·75
3N141	0·81
40360	0·40
40361	0·45
40362	0·40
40430	0·85

SN7400	0·16
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SN7402	0·16
SN7403	0·16
SN7404	0·26
SN7405	0·22
SN7406	0·42
SN7407	0·42
SN7408	0·28
SN7409	0·28
SN7410	0·16
SN7411	0·25
SN7412	0·30
SN7413	0·36
SN7416	0·36
SN7417	0·36
SN7420	0·16
SN7422	0·25
SN7423	0·37
SN7428	0·40
SN7430	0·16
SN7433	0·37
SN7437	0·37
SN7438	0·37
SN7440	0·22
SN7441AN	0·92
SN7442	0·79
SN7450	0·16
SN7451	0·16
SN7453	0·16
SN7454	0·16
SN7460	0·16
SN7470	0·36
SN7473	0·41
SN7474	0·42
SN7480	0·60
SN7483	1·10
SN7486	0·47
SN7490	0·55
SN7491AN	1·00
SN7492	0·70
SN7493	0·70
SN7494	0·80
SN7495	0·80
SN7496	0·95
SN7497	3·87
SN74100	1·89
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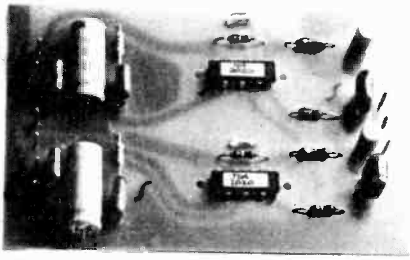

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3-VALVE RADIOS

Valved radios are still great favourites with many people. The main reason is economy, as a mains operated transistorised set large enough to provide the same bass response tends to be expensive whilst battery operated sets are either too small to sound good or are too expensive to run, bearing in mind the fact that a PP9 battery, for example, is now over 50p. In addition to this, some people have a sentimental attachment to their valve radios. We are quite fond of an old couple in their nineties, who have a 1933 Ultra! We will not go into the servicing of this type of set, however! Suffice to say that we have kept it going for them for more years than we care to mention.

Transformerless

Valved radios generally fall into two types, the heavier type having a mains transformer and parallel-fed valve heaters and the lighter ones with no transformer and series heaters. The latter is more commonly encountered and we will consider this type first.

With no transformer to provide low voltage supplies, the normal 240V mains has to be adapted to provide the HT and heater requirements. If we accept that one of the mains supply leads, preferably the neutral, can be connected directly to the chassis or metalwork, the design can be simplified so that all that is necessary is a means of reducing the mains voltage to that required by the total number of valve heaters in series. This is usually done by inserting a wirewound resistor in the top end of the series chain to drop the voltage to that required. A tapping on this resistor can be used to supply the HT rectifier, which is usually a valve, and the current drawn by the HT must be added to that drawn by the valve heaters when calculating the value of the dropping resistor. The arrangement is shown in Fig. 1 except that a dial lamp and shunt resistor have been inserted into the chassis return to neutral (or one side of the mains at any rate).

The advantage of using a valve rectifier is twofold. First, the valve warms up slowly with the rest and therefore the HT builds up slowly as the rest begin to draw current. Therefore the HT is rarely more than, say, 200V. This takes the strain off all the capacitors on the HT line and leads to greater reliability. Secondly, the voltage drop across the rectifier heater in addition to that of the other valves reduces the rating of the dropper so that the heat concentration is reduced in this area. Obviously the higher the total voltage of the valve heaters the lower the value of the dropper. This is why nearly all European radios of this type used 100mA valves of the "U" series (UY85, UL84, UCL82 etc.). Countries with a low mains voltage (say the US) of about 110V used a different range of valves taking more current and dropping less voltage. Some years ago it was quite common to find a series chain of 0·3A valves (25Z4, 25L6 etc.), or a 0·2A chain (CY31, CL33 etc.), a 0·15A chain or even a 0·16A would you believe! Also a 0·1A chain which is the most likely line-up to be found in sets of more recent origin.

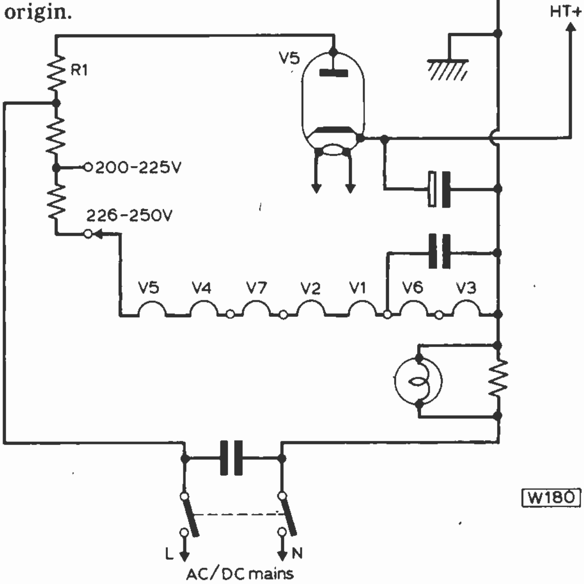


Fig. 1 In AC/DC receivers the heater chain and HT supply were generally of this type.

The number of valves used could vary but the minimum was usually four including the rectifier, this line-up being, for example, UCH81 frequency changer, UBF89 IF amp, detector and AGC, UCL82 audio amplifier and output, and a UY85 rectifier. A variation on this theme was a UCH81 as above with another UCH81 as an IF amplifier and audio amplifier with a UL84 output, using two crystal diodes for detection and AGC. The one advantage with this system was the possibility of changing over the two UCH81s if the one in the FC stage was reluctant to oscillate (which is something they often did, or didn't!).

The main disadvantage of series-heated valves is the fact that rectifier and output valves are well up the live mains end with only the dropper and perhaps the dial lamps (some designs) at a higher potential. This means that there is increased stress between the heater and the cathode of the valve with the consequent risk of breakdown, and induced hum in the case of the output valve. It comes as no surprise therefore to find the fault of "no valves glowing" is often due to the heater of the rectifier being open circuit. It is not that the heater just feels like failing, it is most often blown due to the failure of insulation, the high potential AC on the heater suddenly finding itself provided with a short cut via the main electrolytic capacitor and chassis. The rectifier heater is thus treated to an extremely gay life of somewhat short duration. If there are dial lamps in the way, these will probably fail also. A similar short in the output valve may or may not blow the heaters, only cause them (rectifier and output only) to glow brightly.

Common faults

Now let us consider a few of the more common complaints and their cures. One of the most common is hum. Tackling this in a set with series heated valves is a little different from a set with parallel heaters. In the latter case one tends to reach for an electrolytic capacitor of adequate voltage rating, usually 350V or more, and connect this across the HT line in one of two places, reservoir section to chassis or smoothing section to chassis, to see which section is at fault. The series heated chain does add the probability of heater-cathode leakage so that although the test electrolytic capacitor can still be tried, one is not surprised if there is no difference. The next step is to see if the hum continues with the volume turned down. If it does, it is reasonable to suspect that the output valve (probably a UL84 or UCL82) has heater-cathode leakage or is drawing grid current, the net result being the same. So change the valve.

If the receiver uses a printed panel, there is the added possibility of leakage across the surface of the panel or through it. The affected area will usually be blackened and a little cutting away of the plastic, perhaps combined with replacing the affected tracks with wire, may have to be resorted to. Set manufacturers seem often more concerned with appearance than efficiency and mount resistors close up to the panel with the leads cut short. Replacements should be made with longer leads so that the resistors stand well up off the panel, however ugly this may appear. Resistors, like politicians, should be open and above board!

—one common complaint is hum—

—set manufacturers often seem more concerned with appearances—

Do not omit to check the grid resistor of the output valve which sometimes goes high particularly if the valve has been drawing grid current. A grid leak resistor of say 1MΩ or 470kΩ can often rise to many megohms leaving the grid floating and humming away to itself. Quite often the hum varies with the volume control setting and this means we have to look back to the preceding stages. Usually either the IF amplifier, say UF89, or the frequency changer (UCH81) is at fault and the latter, being more expensive of course, is usually the culprit!

No results

One of the most common complaints is that the valves light up but there is precious little other activity. The usual reason is that the smoothing resistor has failed but one must not assume this. The output transformer could have an open circuit primary or there may be no supply to the rectifier due to an open circuit surge resistor (R1 in Fig. 1), perhaps little Johnny has moved or unscrewed the internal loudspeaker muting devices on the external speaker panel (you did it, but blame Johnny anyway).

So we must proceed logically. If there is a fine upstanding dropper it is no trouble to check all sections with a neon when the set is on or an ohmmeter when the set is off (if you're too lazy to switch the meter to the AC range and check the voltages on the dropper tags with the set on). Many sets did not use a single dropper however and the surge limiter may be a separate wirewound resistor mounted in a more inaccessible position. If the value cannot be read it can be assumed to be in the region of 100Ω. If a printed panel is used, the resistor may be intact but it could have parted company with its print beneath.

Assuming the rectifier is receiving its supply however, there should be HT on at least one of the main electrolytic capacitor tags. If there is a good voltage on one but not the other the smoothing resistor (or choke if it's an older set) could well be open circuit. The value of this will depend upon whether it has to pass the total HT current. Quite often, the output transformer primary is directly connected to the rectifier and therefore the anode current of the output valve does not pass through the smoothing resistor. In this case the value may be quite high, say about 3kΩ. If the voltages are ok at both the smoothing tags, check the voltage at the anode of the output valve. If output transformers have a bad habit it is that they go open circuit on the winding which feeds the anode! This means a new transformer. If an exact replacement is not to hand an alternative can be used, the important thing being that the correct impedance matching is maintained. Very generally speaking, a small battery output valve requires a high impedance, the normal type of valve encountered in mains operated sets a medium impedance, whilst a low impedance is only required for more high powered amplifier type valves (and output triodes if you can remember that far back).

—a hefty charge which can tickle you pink—

Don't forget that if there is no discharge path through the HT line, the reservoir capacitor can be left with a hefty charge which can tickle you pink if you let it! The capacity is not that used in TV receivers (about 100 to 300μF) which can really cause a spark but even a 32μF on a 300V line can pack a punch which is not to be sneezed at!

The Thorn group made a large number of models with the "U" series of valves on a printed panel where not only the smoothing resistor had a habit of becoming O/C but also parted company with its print, as did the surge resistor to the UY85 anode. These were fairly small wirewound resistors and serve as an illustration of what we have been going on about in the above text.

The audio amplifier

Having checked the HT supply and output stage, and ensured the latter is operating under the correct conditions, with the cathode bias components in order (resistor the right value and the capacitor doing its job) check the output grid to ensure there is no positive reading. If there is such a reading, the valve could be drawing grid current, highly likely, or the coupling capacitor from the audio amplifier anode could be leaking, less likely but still a strong possibility. We then turn to the preceding stage which is normally either a separate triode section in the output valve or the triode section in a valve like a UABC80 (three diodes and a triode in one envelope). The only component likely to require attention is the anode load resistor which is normally about 220kΩ. This does tend to "go high" producing loss of volume and a peculiar form of distortion (stressing the sibilants, you could say). This is no trouble as the voltage at the anode will be very low and this itself suggests the resistor is the primary subject.

A low voltage need not be due to the resistor and if this proves to be of correct value, attention should be directed to the control grid. This is normally biased by a high value resistor of up to 10MΩ. If the coupling capacitor (the charge on this determines the bias with the resistor) is leaky, the bias is cancelled and the valve draws too much current. The voltage drop across the anode load is therefore excessive and is responsible for the condition. Some receivers do use cathode bias, and where this is so the cathode capacitor could be shorted, or the grid coupler could still be leaky, but most receivers have the cathode directly coupled to chassis as this simplifies the design.

Most sets have the volume control feeding the control grid and if the coupling capacitor is leaky the position of the control will vary the distortion to an extent. Which of course brings us to the vexed subject of noisy controls. Usually a squirt of cleaning fluid into a convenient gap in the housing will bring the control to heel but it is sometimes difficult to find or make a gap. The construction of the control either makes this operation very easy or very difficult and it is sometimes necessary to partially strip it or replace it completely. The control itself is not always responsible however and associated capacitors should be checked for leakage as control tracks do not take kindly to the passage of DC current. This is particularly so in the case of some makes of unit audios and radiograms of more recent origin but since these are transistorised this thorny subject will not be pursued further.

The IF stage

The detector and AGC circuitry in valved receivers very rarely gives trouble so we may be forgiven for nipping smartly past these and delving into the IF stage. Once again this can be quite simple, with the cathode chassis connected and the control grid biased from the AGC line. Note that valves are always reversed biased, i.e. the control voltage pushing the valve toward cut-off and is therefore negative-going. The HT supply to the anode and screen is via a decoupling resistor of some 1kΩ with a capacitor to chassis of from 0·047 to 0·1μF. This decoupling point can be the screen pin of the valve base with a short lead to the IF transformer primary, or to the latter point with a short connection to the screen pin.

Separate supplies are often used so that the screen grid of the IF amplifier can be connected to the same electrode on the frequency changer base and two resistors are often used as a potentiometer to hold the screens steady, typical values being say 22kΩ from HT to the valve base with a 47kΩ to chassis. As the majority of the current passes through the upper resistor, 22kΩ, this is often the one to change value and thus drop the applied voltage. This is sometimes the cause of the complaint, "My radio has been getting weaker and weaker and now you can hardly hear it".

Instability is another common disorder and this can vary from whistles and screeches to non-operation due to the paralysing effect of the AGC being overloaded by the instability. This can be a trifle tedious to overcome and the normal remedies are not always effective. The usual first step is to try bridging the decoupling capacitors with a test 0·05μF or similar. Bridging from screen to chassis may stop all complaints right away and you then go on your way rejoicing. But more extensive checking around may have to be resorted to, bridging other capacitors associated with the IF and frequency changer stages, the AGC line and the HT line. If none of these efforts produce results, check the alignment of the IF transformers, the valves, earth contacts (especially if these are riveted) and the main electrolytics.

Frequency changer stage

For AM reception this is usually a conventional triode heptode such as a UCH81. The complaint of no normal reception with, perhaps, some background mush is often the result of the valve becoming defective and refusing to oscillate (triode section). When it is oscillating there should be a negative voltage on the triode grid. If this is absent a new valve will usually put things right. If it doesn't, a general check up on the capacitors and resistors, comparatively few in number, associated with the section will usually restore signals. A defective coil is sometimes difficult to locate if it is suffering from shorted turns but with a bit of luck the trouble may be the result of a badly soldered lead-out or even an open circuited lead-out which can be repaired.

The mixer section is similarly wired to the IF amplifier and the same remarks apply regarding resistors changing value, leaky decoupling capacitors and the like. It varies in the arrangement of the control grid which is blocked from the aerial coils as a rule with a fairly low value capacitor, say 100pF, and with a fairly high value resistor connecting to the AGC line.

The aerial circuit may consist of a ferrite rod on which is mounted the tuning coils with leads to the tuning gang, the wavechange switch and chassis, but there are infinite variations on this theme. If there is no ferrite rod (the design is older) there is usually a cluster of coils around the wavechange switch and an open circuit on one may result in the others being put out of action. They are probably slug tuned for padding with separate trimmers for lining up the high frequency end of the scale. Where ferrite rods are fitted the actual rod is the slug and the position of the coils on the rod is varied for padding on the low frequency end of the scale.

VHF-FM

Receivers with these facilities have a separate section due to the higher frequencies involved. The aerial input can conveniently be a half-wave dipole made simply by opening up a piece of twin flex to the required length and stapling this in the cabinet. This is all very well in some areas but if serious listening is demanded a more elaborate system is needed with the correctly matched down lead, 75Ω coaxial on most UK stuff, 300Ω balanced twin on imported, as a rule. We will not go into the pros and cons of these different inputs here as they are pretty well known and have been discussed at length in previous issues.

The aerial input is taken to the tuning coils and thence to the first section of a double triode, as a rule, say a UCC85. The second half functions as an oscillator. Nine times out of ten replacement of this valve will restore normal signals if these fail suddenly, the tenth time being the result of defective resistors or capacitors. The actual tuning may be carried out by separate sections on the gang capacitor or by varying the position of the slugs in the aerial and oscillator coils. The output of this usually small section is fed to the IF stages, there may be more than one, through separate transformers to a ratio detector. The two diodes involved in this latter operation may be in a valve envelope (as in the UABC80 for example) or separate germanium or silicon diodes if the valve line-up does not include such a valve.

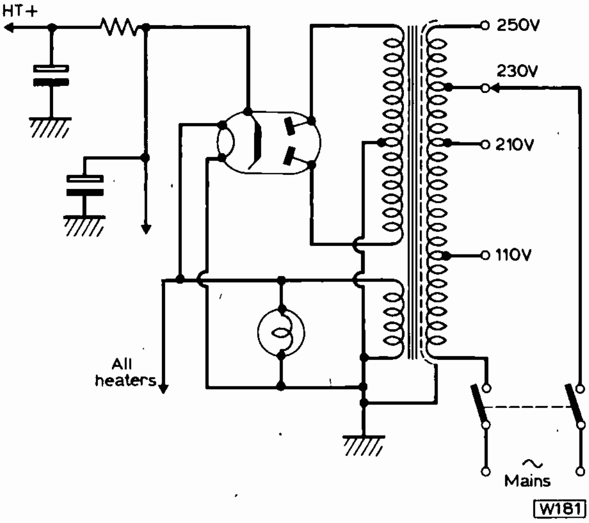


Fig. 2. AC-only sets have the conventional mains transformer with the valve heaters in parallel.

AC-only sets

The advantage of using a mains transformer is that the valve heaters can be wired in parallel (all at the same low potential) so that the stress between the cathode and heater is largely removed, and that the chassis can be isolated from the mains. Note we said, "can be." Some receivers sacrifice this advantage on the grounds of economy. Some transformer supplied sets use a series chain of heaters but this is all a matter of design considerations.

Some pretty weird and wonderful sets were imported some years ago using difficult valves which did tax one's resources but this is a story of its own which we may relate on another occasion. The average type of AC mains set which is likely to be encountered and which is probably worth renovating will have a transformer supplying a full wave rectifier and valves having 6·3V heaters (possibly 5V for the rectifier heater). The rectifier may have between 250 and 350V applied to its anodes from a centre tapped winding, the centre tap being chassis connected. The output of the rectifier is taken to the reservoir capacitor which may have a value of between 8 and 32μF. The circuit is then much the same as that previously described, using a smoothing resistor, a choke or part of the output transformer before the smoothing capacitor. The rectifier valve may be directly heated (cathode is the heater) which has a very fast warm up or indirectly heated (separate cathode) which warms up and becomes operative with the other valves. The latter imposes less stress on the capacitors, Fig.2.

—old timers which really need tracking down—

If a rectifier valve is difficult to obtain and it is decided to wire a couple of silicon diodes across the base, this stress must be recognised as the switch-on surge may be greater than the rating of the capacitors, To avoid this the inclusion of a thermistor between the rectifier output and the reservoir capacitor will add to the long term reliability of the receiver.

Valves such as the EZ80 and EZ81 are still generally available and should be used whenever possible. Older types such as the EZ40 and the like need a bit more finding but it is the old timers like the 5Z4 and 5Y3 which really need tracking down and it is here that the diodes may have to be used.

Little need be said about the other stages. They follow the lines already discussed but one is more likely to find different output stages in higher priced radiograms etc. For example, a cheaper type may use a single EL84 (or ECL86, for example) for each channel if the instrument is stereo whilst higher quality grams which are more likely to be worth saving may have four such valves, two in push-pull for each channel. The complication arises not only in the output transformers but in the drive from the audio stage to the output pair. An output transformer primary may have five lead outs, HT to the centre tap, a tap for each screen (this provides a degree of feedback) and the outer taps for the anodes.

Valves in push-pull need differing grid drives so that some form of phase splitter is necessary. A common method is to use a triode suspended midway between the HT line and chassis with one output valve driven from the anode and the other from the cathode (when the anode is positive going, the cathode is negative thus providing the "I push, you pull" requirement). This in turn means that the grid of the triode is returned to cathode at a fairly high potential. There are so many variations on this theme that detailed description is impractical, at least in this article, so that one should not be surprised if the voltages in the driver stages appear abnormal. Stereo does at least supply us with a ready made comparison circuit so that if one side is working well we know what to expect in the side which isn't. Get the voltages right and most else falls in line. Where they are wrong, check the resistors for correct value and the capacitors for leakage. Then suspect the valves.

HOTLINES

ON RECENT DEVELOPMENTS

NOSEY!

Electronic noses have been around on the Amateur construction scene ever since suitable sensors became available. These, however, have found most use in such applications as fire/smoke detection etc.

A Watford company has managed some success with an explosives detector. It's called the unassuming name PD2, weighs a mere 22lbs and lives in an innocent-looking suitcase. The unit gives a positive response when explosives are detected. An audible alert sounds immediately after taking an air sample containing explosive vapour. The unit is so sensitive that it is able to detect the tiniest traces of explosives such as those which might be found on a persons hands after handling explosives—or on their clothing. The photograph shows a security officer checking a bag. If you want one of these units the UK price is around **£2,150**. Probably not a high price for something that nose what it's about.

THE 'CHIT'

The NRDC (National Research Development Corporation) has encouraged many good ideas and another has just found its way into my hands. It's called CHIT, standing for CHeap Input Terminal and was developed at the National Physical Laboratory. The approach used is quite ingenious. Two oblong lengths of resistive material are laid one on top of the other.

When a point (a pencil) is used to draw or write on the top oblong, the pressure causes the air gap between the two resistive surfaces to decrease and the two oblongs make contact at the point of impact. Electrodes are connected to each of the oblongs at their ends and when a current is passed through one of the oblongs, a uniform voltage gradient is developed along its entire length. The voltage at the exact point of contact i.e.: wherever the pencil tip happens to be pressing at any given instant in time, will be proportional to the pencil point's position on the x axis. The other oblong is used as a sort of wiper of a potentiometer and will attain this voltage. The two oblongs are switched, electronically, so that first one oblong is acting as a position indicator and the other the wiper of a pot, then the roles are reversed due to the electronic switching. Thus the point can be monitored in both x and y axis.

Using this method as an input terminal, handwritten characters can be transmitted, signatures verified, line drawings, circuits etc can be transmitted. Perhaps it won't be too long before you will write a letter on such a device and it will be transmitted at the same instant and received immediately. We seem to have come a long way since the Penny Black back in 1840. If it comes, it could mean that many postmen will be looking for a new post—do you see?

The electronic sniffer type PD2

FLAT TV SCREENS

From time to time I have made comments about flat screen television "tubes". Research and development has been going on in this area for some time and the latest effort to come to my attention looks very promising. First, the US Airforce is going to try out the idea—and believe you me the American military do not waste time on impractical ideas no matter how clever they might be. The device is the brainchild of Hughes Aircraft who have vast expertise in many areas not the least of which is electronics. Some 18 months ago Hughes brought out a 1in^2 liquid crystal display which was capable of showing a television picture. The company successfully deposited a number of liquid crystal picture elements on a piece of silicon which also contained the excitation circuitry. Manufacturing defects caused problems but once these were overcome Hughes steamed ahead. Now, four on the lin. miniature "tv screens" have been butted up together to form a 2 x 2in. display comprising a 100 x 100 cell array.

It has been rumoured that the US Airforce has shown great interest in using the new approach for things like scan-converted radar, forward-looking infrared and possibly in head-up displays for gun aiming. In sunlight, it's difficult to see the cathode ray tube type of display whereas the LCD component is reflective and thus thrives in such conditions. Another distinct advantage is that crts commonly required high voltages—often thousands of volts. The LCD array requires only 25V. Plans are already afoot to produce a larger array and it is easily technically feasible.

Ginsberg

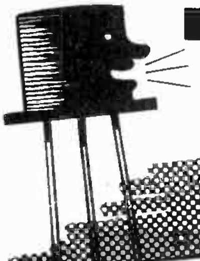
MORE HOTLINES ON PAGE 57

IN NEXT MONTH'S PRACTICAL WIRELESS

A versatile instrument you'll enjoy to nake-no difficult components!

DIGITAL FREQUENCY METER

You'll probably find that you have a lot of the components already! An interesting constructional project which will give much satisfaction when it's completed. Readout to, typically, 27MHz or more depending upon the IC's used. Gate times of 100μs to 1s. Input 60mV to 10V and time intervals 1ms to 9999s.



Talking Transistors

-getting to know how they work

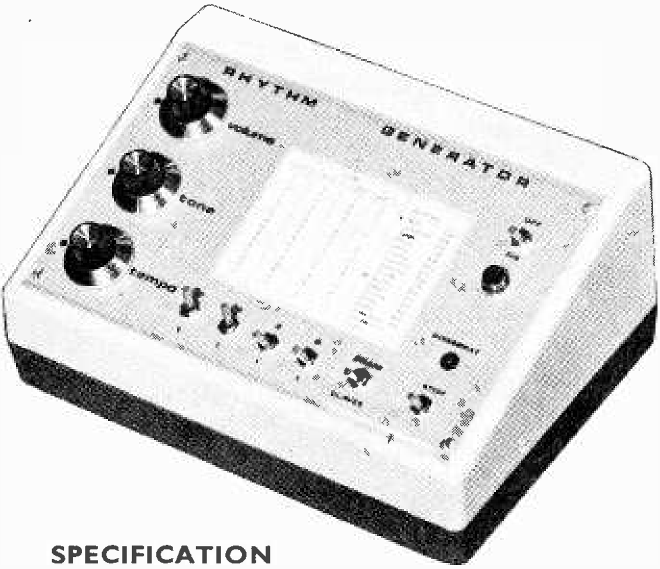
ONTINUED FROM THE SUPPLEMENT IN THE APRIL ISSUE

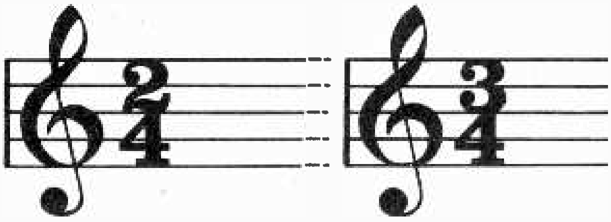
AULT~FINDING GUIDE

TYPICAL SERVICING PROCEDURES

HINTS & TIPS~WHAT TO LOOK FOR

ON SALE IN MAY





RHYTHM

PART 1

SPECIFICATION

Output to external amplifier	500mV max. Variable
Number of rhythms	15
Number of percussion instruments	9
Tempo (useful range)	15 to 100 bars/min.
Number of elementary times per rhythm pattern	24 or 32
Number of bars per rhythm pattern	2 or 4
Supply voltages from internal power supply	+12V +5V −12V
Down-beat indication	LED
External stop and reset	Foot-switch socket
Rhythm selection	4-bit binary code

MORE and more people these days are taking an interest in making their own music and to that end electronics is playing an ever-increasing part. Witness the number of constructional articles that have appeared for synthesisers, organs, electronic pianos, musical boxes, guitars etc. An essential part of most music is rhythm and what

CODE				Snare/ Claves	RHYTHM	
Input 8	Input 4	Input 2	Input 1			
1	1	1	0	S	Waltz	3/4
1	1	0	1	S	Jazz Waltz	3/4
1	1	0	0	S	Tango	2/4
1	0	1	1	S	March	2/4
1	0	1	0	S	Swing	4/4
1	0	0	1	S	Foxtrot	4/4
1	0	0	0	S	Slow Rock	6/8
0	1	1	1	S	Pop Rock	4/4
0	1	1	0	S	Shuffle	2/4
0	1	0	1	C	Mambo	4/4
0	1	0	0	C	Beguine	4/4
0	0	1	1	C	Cha Cha	4/4
0	0	1	0	C	Bajon	4/4
0	0	0	1	C	Samba	4/4
0	0	0	0	C	Bossa Nova	4/4
1	1	1	1	—	No selected rhythm	

Fig. 2: Table of Rhythm selection input codes. This table may be cut out and stuck on the facia of the unit.

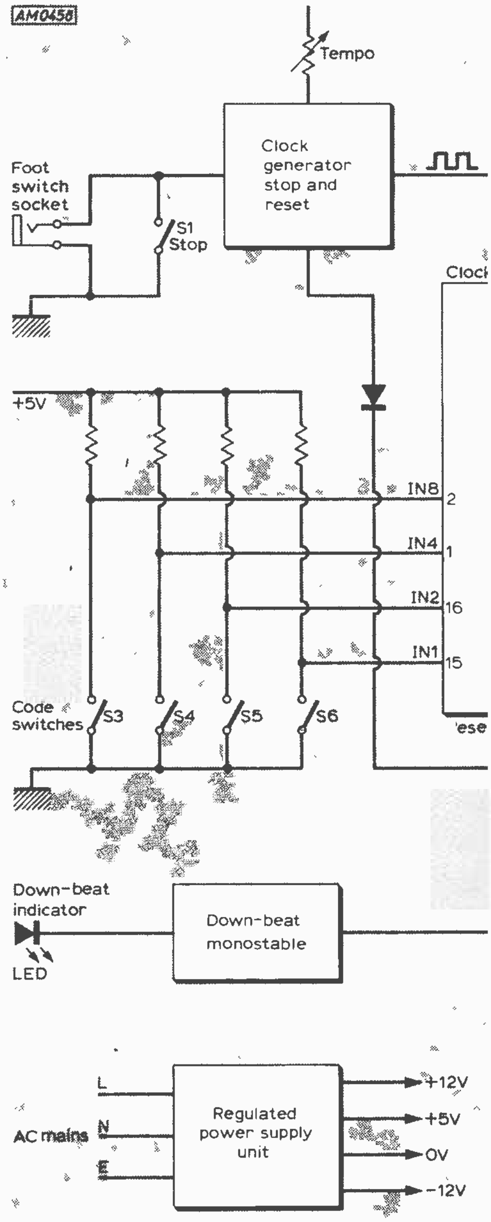
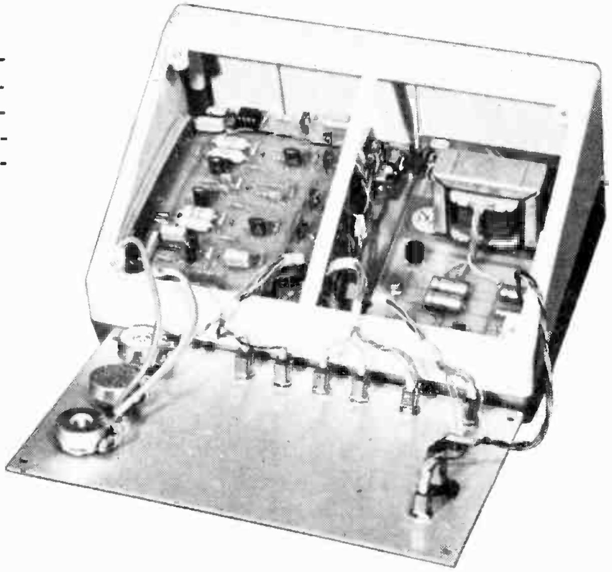
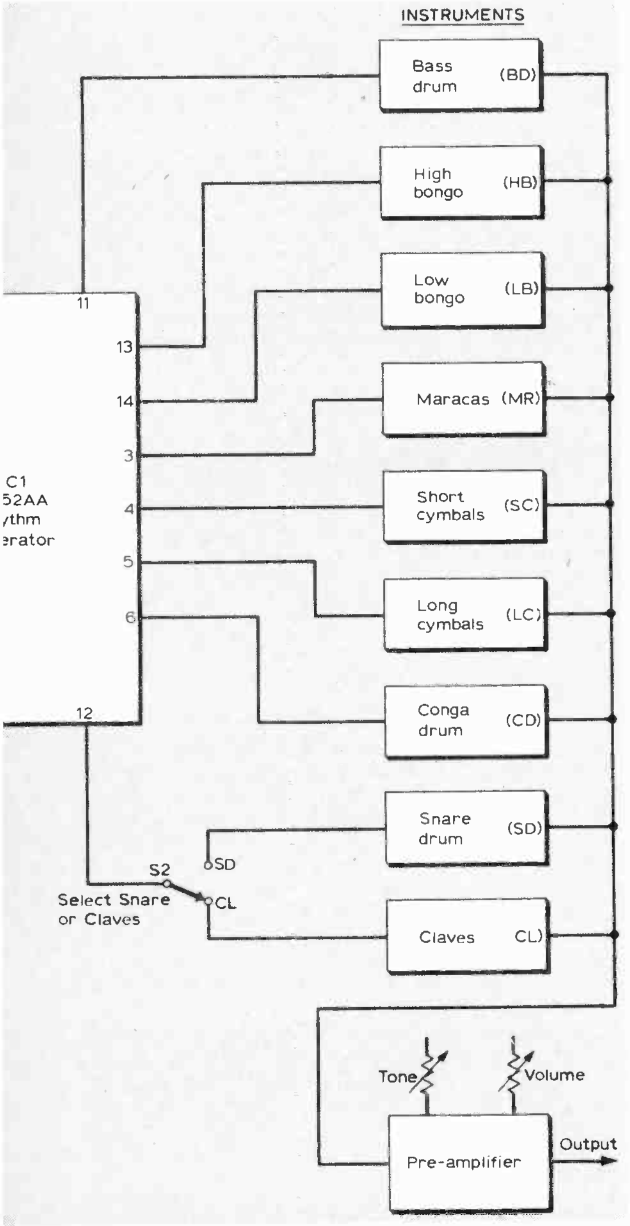


Fig. 1: Basic block diagram of the Rhythm Ger

ENERATOR

A.S.WEBB B.Sc





showing the M252AA integrated circuit as the heart of the system.

better method of turning a solo performance into a duo than with the addition of a drummer and full drum kit all contained in a box measuring little more than 205 x 152 x 102mm (8 x 6 x 4in)! In addition such a portable unit could well provide the rhythm section for a small group or a novel gimmick on the disco scene.

This article describes the construction of a Rhythm Generator containing **nine** percussion instruments which can be programmed to play any one of **fifteen** different rhythms. Emphasis has been placed on simplicity of construction and low cost without sacrificing the faithful reproduction of the sound of each instrument. Anyone who has had some experience of soldering and knows one end of a diode or electrolytic capacitor from the other, should, with a little care and patience, be able to make this unit. Several MOS (Metal Oxide Semiconductor) integrated circuits are used but for those who are not familiar with the handling of this type of device full instructions will be given. **In the meantime do not be tempted to remove them from the protective conducting foam packing.**

Generator block diagram

Fig.1 shows the block diagram for the Rhythm Generator. The heart of the generator is the M252AA MOS integrated circuit manufactured by SGS-ATES. This device incorporates a memory programmed with fifteen different rhythm patterns which are selected by a 4-bit binary code. The four code inputs are designated IN8, IN4, IN2 and IN1 each one capable of being switched to '0' (i.e. '0'V, switch closed) or '1' (i.e. +5V, switch open) by S3, S4, S5, S6 respectively. Thus $16(2^4)$ combinations are possible, fifteen of which are used to programme the following rhythms:— Waltz, Jazz Waltz, Tango, March, Swing, Foxtrot, Slow Rock, Pop Rock, Shuffle, Mambo, Beguine, Cha Cha, Bajon, Samba and Bossa Nova. Details of the particular codes are given in Fig. 2 with code 1-1-1-1 having no selected rhythm.

The chip is driven by a square wave from the

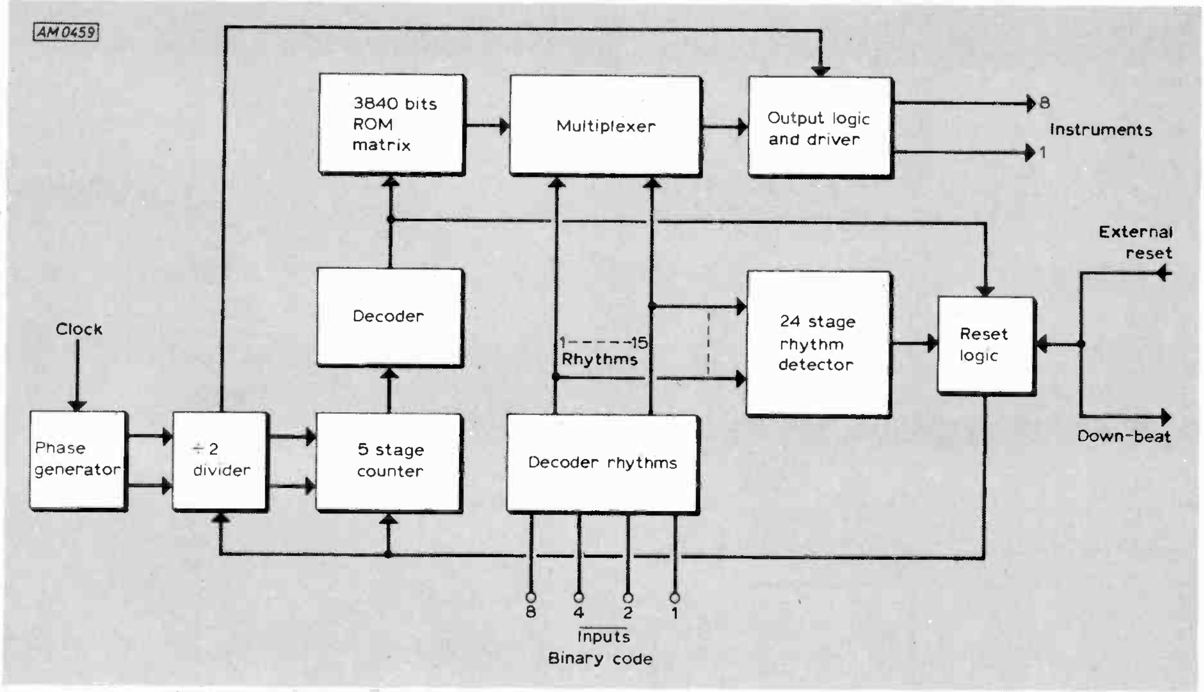


Fig. 3: Block diagram of the M252AA Rhythm Generator. Rhythms are selected by applying either a logic '1' or '0' to the input gates of the IC.

clock generator, the frequency of which determines the tempo of the rhythm. Once a code has been selected the various instruments are triggered in the correct sequence to provide the particular rhythm pattern. Only eight of the nine instruments are used at any one time, the snare drum being manually selected by S2 for the Waltz, Jazz Waltz, Tango, March, Swing, Foxtrot, Slow Rock, Pop Rock and Shuffle whilst the claves are used for the remaining South American rhythms. The outputs from the instrument simulators are combined and fed to a pre-amplifier incorporating volume and tone controls.

A down-beat indicator in the form of an LED is included to mark the beginning of each rhythm pattern. A combined stop and reset facility (S1) allows the generator to be stopped and restarted at the beginning of a bar. This feature permits the rhythm to be brought in on the down-beat after the introduction to a piece of music has been played. To make this easier while playing, a socket has been provided wired in parallel with the stop switch S1 on the panel, so that a foot operated switch may be connected.

The M252 Rhythm Generator

The internal operation of the M252 IC is shown in Fig. 3. The clock input is first divided by two and this output drives a 5-stage counter which resets every 32 pulses for rhythms of 4/4 time and after every 24 pulses for 3/4 time. The counter states are then decoded to drive the ROM (Read Only Memory) matrix which has been pre-programmed with the fifteen different rhythms. The binary code that has been entered to select a rhythm is decoded and used to determine the reset point of the counter and to programme the multiplexer to select that particular rhythm from the output of the memory matrix This output is then fed to the driver circuit which modifies the pulses to make them suitable for triggering the percussion instruments. The output section also includes logic circuitry to reset the memory outputs to zero after each reading so that the output will always be able to provide the correct trigger edge during the following beat.

The internal reset pulse of the counter is routed to an output connection (pin 7) which, with the addition of a blocking diode to separate the signals, can furnish the down-beat indication as well as allowing the external resetting of the rhythm.

Clock Generator

The clock generator circuit, see Fig. 4, is a simple astable multivibrator utilising two 2-input NAND gates (IC2b and IC2c) together with the timing components R3, VR1 and C1 to provide a square wave output to drive the M252 chip. By closing the STOP switch (S1) the clock is inhibited with its output remaining at "1" and at the same time the M252 is reset via IC2a and D1. Upon opening the switch the output immediately goes to '0' thus generating the first command pulse and the rhythm commences with the first beat of the bar i.e. the down-beat.

The frequency of the clock may be continuously varied from approximately 5Hz to 50Hz by the tempo control VR1. The relationship between the clock frequency and the rhythm tempo is given by the following formula:—

$$\text{No. of bars/min} = \frac{\text{Clock frequency} \times \text{No. of bars per rhythm pattern} \times 60}{\text{No. of counts per rhythm} \times 2}$$

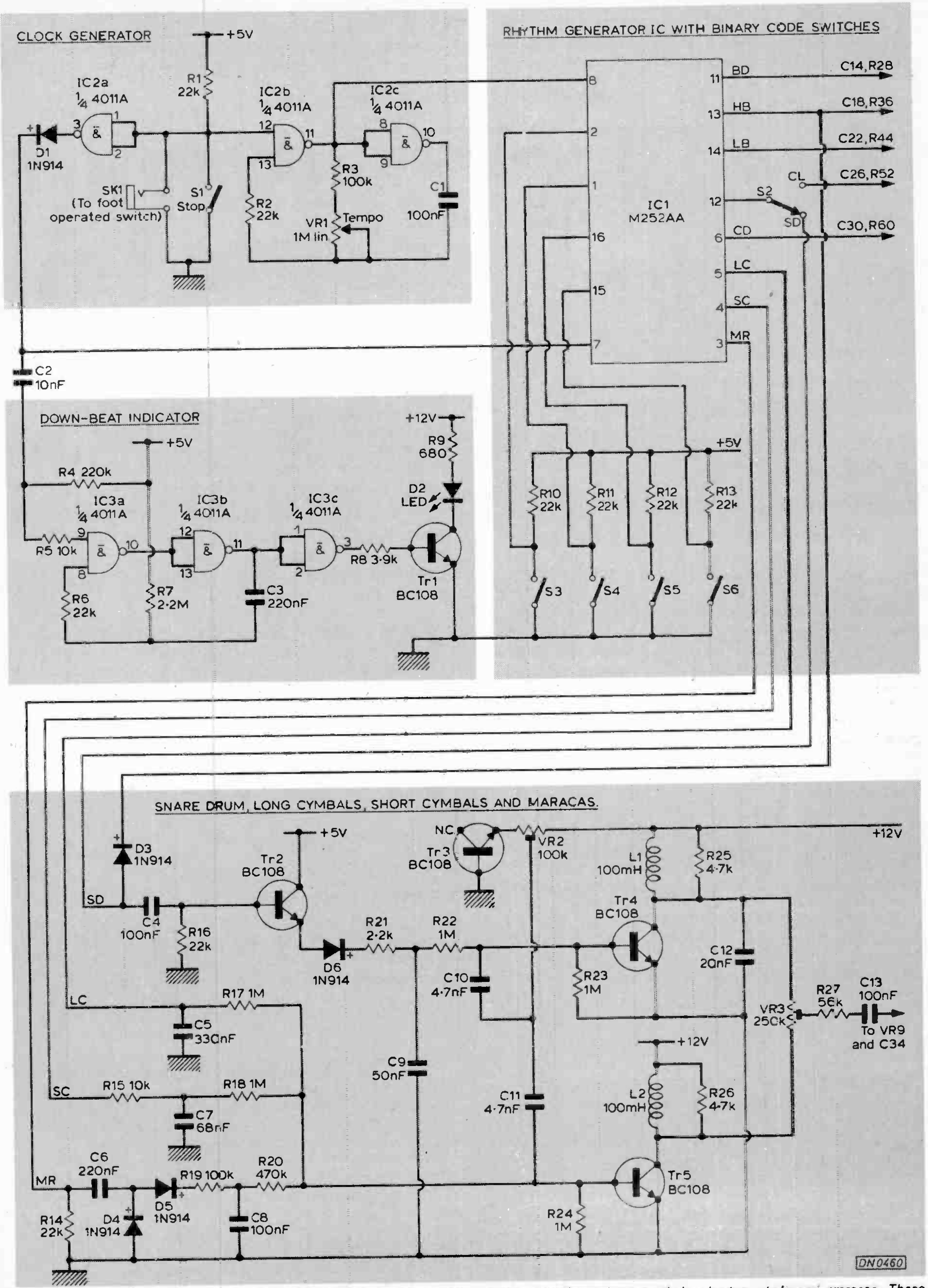
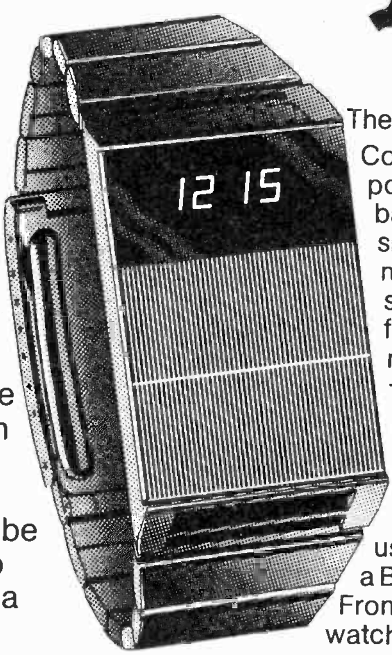


Fig. 4: Part of the circuit containing the clock generator, downbeat indicator, snare drum, long cymbals, short cymbals and maracas. These particular circuits are all housed on one PCB.

The Black Watch kit £14.95!



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

★ Complete–right down to strap and batteries.

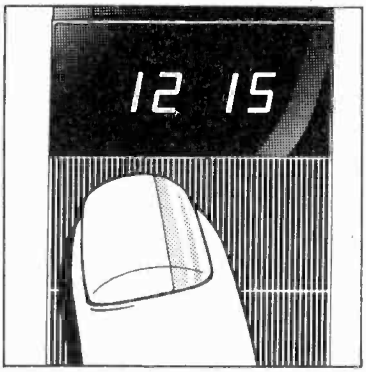
★ Guaranteed. A correctly-assembled watch is guaranteed for a year. It works as soon as you put the batteries in. On a built watch we guarantee an accuracy within a second a day–but building it yourself you may be able to adjust the trimmer to achieve an accuracy within a second a week.

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

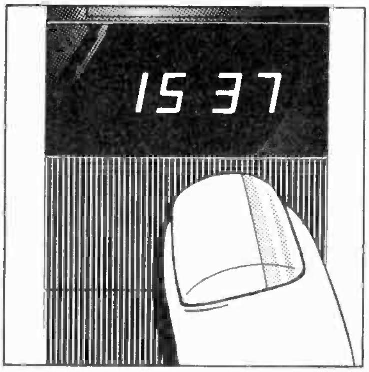
The Black Watch kit is unique, too. It's rational – Sinclair have reduced the separate components to just four–and it's simple: anybody who can use a soldering iron can assemble a Black Watch without difficulty. From opening the kit to wearing the watch is a couple of hours' work.

Touch and tell

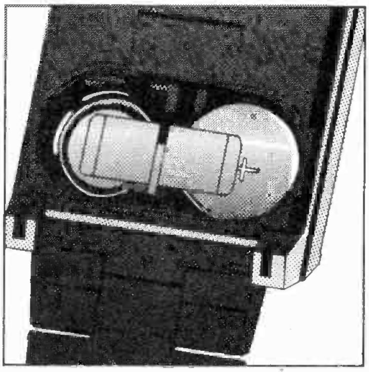
Press here for hours and minutes...



here for minutes and seconds.



Batteries easily replaced at home.



The specialist 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). Easily re-set using special button–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.

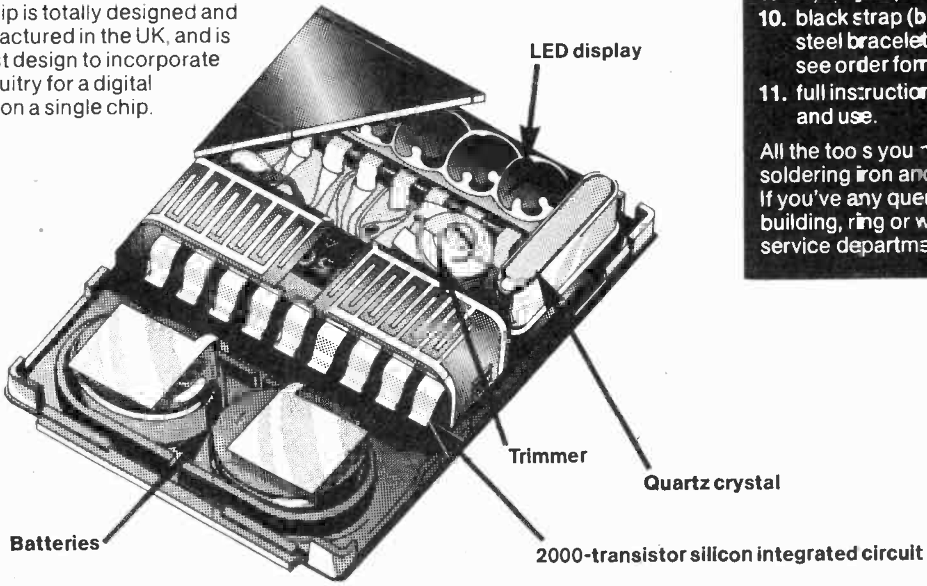
...and how it works
A crystal-controlled reference is used to drive a chain of 15 binary dividers which reduce the frequency from 32,768 Hz to 1 Hz. This accurate signal is then counted into units of seconds, minutes, and hours, and on request the stored information is processed by the decoders and display 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!

Price in kit form: £14.95 (inc. black strap, VAT, p & p).

Price in built form: £24.95 (inc. black strap, VAT, p&p).

sinclair

Sinclair Radionics Ltd,
London Road, St Ives,
Huntingdon, Cambs., PE17 4HJ.
Tel: St Ives (0480) 64646.
Reg. no: 699483 England. VAT Reg. no: 213 8170 88.

To: Sinclair Radionics Ltd, FREEPOST, St Ives, Huntingdon, Cambs., PE17 4BR.

Please send me ...... Total £

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

.... (qty) Sinclair Black Watch(es) built at £24.95 (inc. black strap, VAT, p&p). ....

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

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

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

....

Name (please print) ____________________

Address ____________________

____

____

Signature ____________________ PW/5

FREEPOST – no stamp required. *Delete as required

★ components list

Resistors

R1	22kΩ	R38	27kΩ
R2	22kΩ	R39	150kΩ
R3	100kΩ	R40	68kΩ
R4	22kΩ	R41	10kΩ
R5	10kΩ	R42	68kΩ
R6	22kΩ	R43	390kΩ
R7	2·2MΩ	R44	12kΩ
R8	3·9kΩ	R45	47kΩ
R9	680	R46	27kΩ
R10	22kΩ	R47	150kΩ
R11	22kΩ	R48	68kΩ
R12	22kΩ	R49	10kΩ
R13	22kΩ	R50	68kΩ
R14	22kΩ	R51	390kΩ
R15	10kΩ	R52	12kΩ
R16	22kΩ	R53	47kΩ
R17	1MΩ	R54	27kΩ
R18	1MΩ	R55	150kΩ
R19	100kΩ	R56	68kΩ
R20	470kΩ	R57	10kΩ
R21	2·2kΩ	R58	68kΩ
R22	1MΩ	R59	1MΩ
R23	1MΩ	R60	12kΩ
R24	1MΩ	R61	47kΩ
R25	4·7kΩ	R62	27kΩ
R26	4·7kΩ	R63	150kΩ
R27	56kΩ	R64	68kΩ
R28	12kΩ	R65	10kΩ
R29	47kΩ	R66	68kΩ
R30	27kΩ	R67	390kΩ
R31	150kΩ	R68	10kΩ
R32	68kΩ	R69	390kΩ
R33	10kΩ	R70	10kΩ
R34	68kΩ	R71	2·2kΩ
R35	100kΩ	R72	2·2kΩ
R36	12kΩ	R73	22kΩ
R37	47kΩ	R74	22kΩ

All ¼ watt 5%

VR1	1MΩ linear	VR7	500kΩ
VR2	100kΩ	VR8	500kΩ
VR3	250kΩ	VR9	10kΩ
VR4	500kΩ	VR10	25kΩ linear
VR5	500kΩ	VR11	10kΩ log
VR6	500kΩ		

VR2 to 9 Skeleton Preset Subminiature Vertical

Capacitors

C1	100nF	Polyester	C23	12nF	Polyester
C2	10nF	Mylar 10%	C24	40nF	Mylar 10%
C3	220nF	Polyester	C25	12nF	Polyester
C4	100nF	Polyester	C26	4·7nF	Ceramic
C5	330nF	Polyester	C27	1·5nF	Ceramic
C6	220nF	Polyester	C28	4·7nF	Ceramic
C7	68nF	Polyester	C29	1·5nF	Ceramic
C8	100nF	Polyester	C30	50nF	Mylar 10%
C9	50nF	Mylar 10%	C31	18nF	Polyester
C10	4·7nF	Ceramic	C32	50nF	Mylar 10%
C11	4·7nF	Ceramic	C33	18nF	Polyester
C12	20nF	Mylar 10%	C34	220nF	Polyester
C13	100nF	Polyester	C35	100nF	Polyester
C14	150nF	Polyester	C36	220nF	Polyester
C15	47nF	Polyester	C37	100µF	25 V
C16	150nF	Polyester	C38	100µF	25 V
C17	47nF	Polyester	C39	100µF	25 V
C18	33nF	Polyester	C40	10µF	25 V
C19	10nF	Mylar 10%	C41	10µF	25 V
C20	33nF	Polyester	C42	100µF	25 V
C21	10nF	Mylar 10%	C43	100µF	25 V
C22	40nF	Mylar 10%			

Capacitors C19, C20, C21, C23, C24 and C25 are the most important and 5% types could be used if available (see text).

Polyester are Mullard C280 except C23, 25, 31 and 33 which are C296A.

Semiconductors

Tr1	BC108B
Tr2	BC108B
Tr3	BC108B
Tr4	BC108B
Tr5	BC108B
Tr6	2N1132 or equivalent
Tr7	BFY51 or equivalent
IC1	M252AA
IC2	CD4011A
IC3	CD4011A
IC4	CD4011A
IC5	741 Op Amp
IC6	Regulator 12V 100mA TBA 625B

D1	1N914	D10	1N914
D2	LED 0·2"	D11	1N914
D3	1N914	D12	Bridge Rectifier 100 PIV 1A
D4	1N914	D13	
D5	1N914	D14	
D6	1N914	D15	
D7	1N914	D16	5V6 zener 400mW
D8	1N914	D17	12V zener 400mW
D9	1N914	D18	1N914

Miscellaneous

T1	Mains Transformer 15-0-15 V 100mA
S1, S3, S4, S5, S6	SPST miniature toggle switch
S2	SPDT miniature toggle switch
S7	SPST miniature mains toggle switch
L1, L2	SC60 miniature Choke 100mH
F1	20mm Fuse 250mA anti-surge plus panel mounting fuseholder (12mm hole fixing)
SK1	2 way jack socket 6·5mm
LP1	Mains neon indicator
3	Printed circuit boards
1	16 pin DIL socket
3	14 pin DIL socket
1	8 pin DIL socket
1	Case type 65-2523E (Veroboard)
3	Knobs with graduated skirt dia. 30mm
4	Vero Stand-offs type B. 19mm long (22-1419H)

Length single screened wire. Length 3-core mains lead. Rubber grommets. Vero half pins type 18-0223 K

The author acknowledges the assistance of Watford Electronics with this project.

COLLATED LIST FOR RESISTORS AND CAPACITORS

Resistors		Capacitors	
1	680Ω	2	1·5nF Ceramic
3	2·2kΩ	4	4·7nF Ceramic
1	3·9kΩ	3	10nF Mylar 10%
2	4·7kΩ	2	12nF Polyester (Mullard C296A)
9	10kΩ	2	18nF Polyester ,,
5	12kΩ	1	20nF Mylar 10%
12	22kΩ	2	33nF Polyester (Mullard C280)
5	27kΩ	2	40nF Polyester ,,
5	47kΩ	2	47nF Polyester ,,
1	56kΩ	3	50nF Mylar 10%
10	68kΩ	1	68nF Polyester ,,
3	100kΩ	5	100nF Polyester ,,
5	150kΩ	2	150nF Polyester ,,
4	390kΩ	4	220nF Polyester ,,
1	470kΩ	1	330nF Polyester ,,
6	1MΩ	2	10µF 25V
1	2·2MΩ	5	100µF 25V

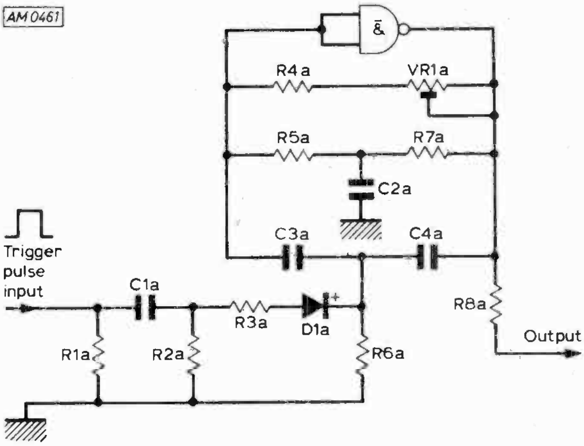


Fig. 5: Basic circuit of a damped sinusoidal oscillator, comprising a 'Twin-T' ringing oscillator utilising a NAND gate.

For rhythms of 4/4 time and for the March and Tango the number of counts per rhythm pattern is 32, each rhythm pattern covering two bars. The tempo is thus variable from approximately 9 to 94 bars/min. In the case of rhythms of 3/4 and 6/8 time the counter resets after 24 pulses and there are two bars per rhythm pattern giving a tempo from 13 to 125 bars/min.

The Shuffle, 2/4 time, has four bars per rhythm pattern and resets after 24 pulses giving a variation of 25 bars/min to 250 bars/min which is twice the tempo of the Waltz and over 2½ times that of the 4/4 rhythms, for the same setting of VR1. It is for this reason that the tempo control covers such a wide range and will need adjustment especially when

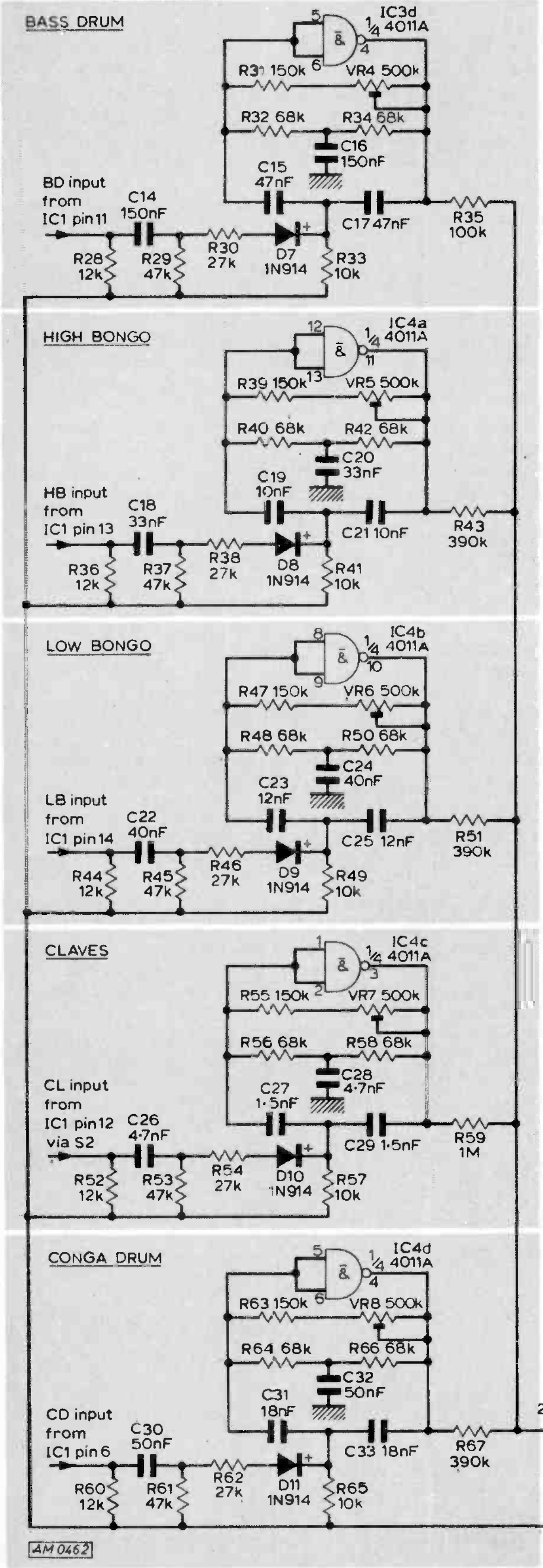
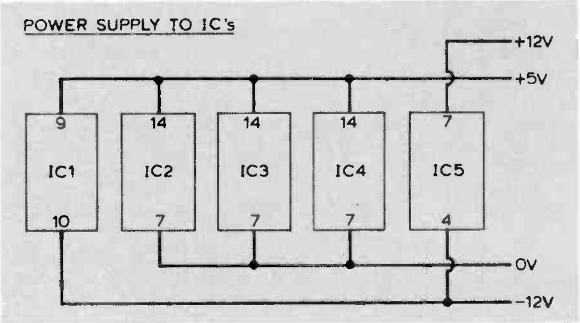
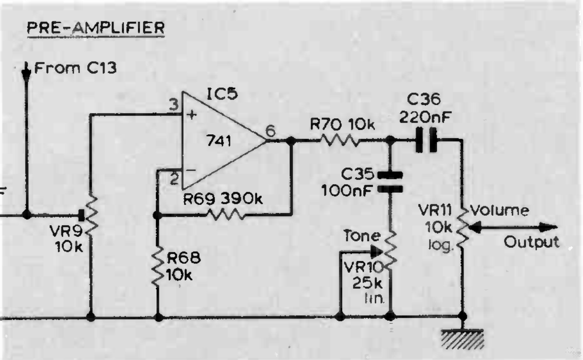


Fig. 6: Circuit diagram left shows the five ringing oscillators for bass drum, high and low bongos, claves and conga drum. All five circuits feed into a common pre-amplifier.
The circuit below shows the various power requirements for the IC's





changing to the Shuffle. To facilitate the exact setting of the tempo, control knobs of the type with a graduated skirt are recommended.

The internal reset pulse of the generator chip is only 2 to 3μS long so it is too short to light a lamp. It is also necessary that the lamp should light on the negative edge of the reset pulse which occurs at the beginning of the bar. The down-beat monostable circuit, see Fig. 4, comprises C2, C3, R4, R5, R6, R7, IC3a and IC3b. It lengthens the short down-beat trigger pulse to around 350mS by latching the output of IC3b to '0' until C3 has charged up to above the "1" input trigger level of IC3a. It operates on negative-going pulses only and the resulting '0' output from IC3b is inverted by the NAND gate IC3c to switch on Tr1 thus lighting the LED.

Percussion Instruments

The percussion instruments may be divided into two categories, those that consist of damped sinusoidal oscillations and those consisting of damped filtered white noise. In the first category are included the bass drum, high bongo, low bongo, conga drum and claves. The general circuit shown in Fig. 5 consists of a simple twin-T ringing oscillator utilising a NAND gate which is adjusted to a point slightly below oscillation by VR1a. The different sound of each instrument is achieved by choosing the correct values of C2a and C3a to determine the required frequency of operation and by regulating its decay time (damping) by VR1a to obtain longer or shorter sounds.

The trigger pulse from the M252 is a square wave which must be differentiated by C1a and R2a and allowed one-way entry by diode D1a to produce a short pulse which is sufficient to set the oscillator ringing but not to interefere with the damping of the oscillation. Resistor R1a is necessary to keep the input at earth in the absence of a command pulse since the outputs of the M252 are open drain types.

Fig. 6 shows the circuit of the five ringing oscillators used and gives values for the three frequency determining capacitors for each instrument. The tolerance of these capacitors is not too critical but it should be kept within 20%, which is reflected in the types specified in the component list. However, a problem does exist in the case of the high and low bongos. The frequency of operation and therefore the capacitor values of these two instruments is very close and 10% tolerance has been specified in this instance. This still means it is possible in an extreme case that the frequencies of operation could be identical and if this does occur 5% types may be substituted to overcome the problem.

In the second category falls the long cymbals, short cymbals and maracas, for which the basic type of circuit is shown in Fig. 7. Transistor Tr1b is switched on during the short trigger pulse from the M252 chip and charges C2b. This capacitor then discharges through R4b to the base of Tr3b. The white noise produced by Tr2b by the zener effect of the reverse biased base-emitter junction is also applied to the base of Tr3b via C3b. During the discharge of C2b, Tr3b can amplify this noise. The degree of amplification, however, follows the discharge curve of C2b and therefore a damping of a variable length is obtained depending on the values of C2b and R4b. The inductor L1b and the capacitor C4b allow selective amplification of certain frequencies to obtain a more realistic sound of the instrument being simulated.

The distinctive metallic sound of the snare drum caused in the real intrument by catgut snares stretched across the drum-head is realistically simulated by combining filtered white noise from this circuit with high bongo. The long cymbal and short cymbal circuits dispense with Tr1b and differ only in decay time. The maracas simulator is unusual in that it is the only instrument in which the sound increases gradually and then decays. This effect is achieved by means of an integrator-differentiator circuit D4, D5, R19, R20 and C8, see Fig. 4.

Pre-amplifier

The outputs of the nine instruments are mixed and fed to the input of the pre-amplifier through the preset potentiometer VR9, Fig. 6. The active element of the amplifier is the ubiquitous 741 op.amp used in the non-inverting mode. A simple variable low-pass filter, C35 VR10, acts as a tone control and the output level is adjustable by means of the potentiometer VR11.

PART 2, to be published next month, will cover details of the power supply, PCB's, construction and setting-up.

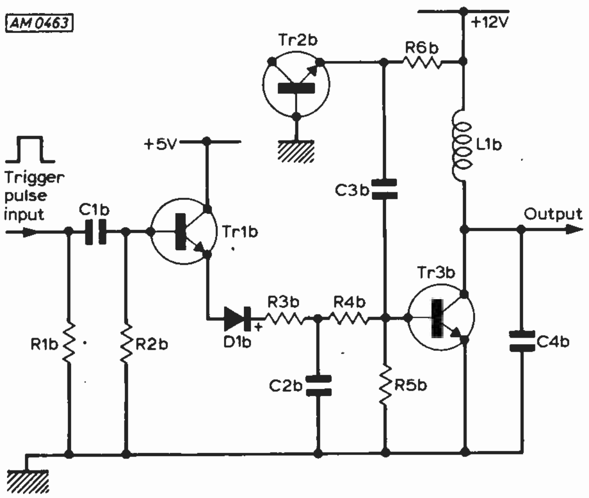


Fig. 7: Basic circuit of the 'white noise' instrument simulator.

MORE HOTLINES ON RECENT DEVELOPMENTS

THE FLASHER

If it's escaped your attention, the LM3909 chip is well worth looking at if you need some form of flashing light. In its simplest form the IC needs only a 1·5V battery and a suitable capacitor to make a flashing light which will keep going for a very long time—like two years with an akaline cell. One useful circuit suggested by the manufacturers is to mount the chip, l.e.d. and capacitor into the base of a torch. The tiny flashing light can be seen in the dark making it easy to always find your torch. Ideas for toys, models etc. come readily to mind and I reckon that this IC will fast become a favourite with amateur constructors.

LIQUID CRYSTAL PICS.

Electronics and photography have always been close allies for the hobbyist. Of interest to both will be the work being carried out at the Hughes Aircraft Company. Researchers there are working on what they call a light cell. The idea is to enhance the image being reproduced. To do this photographically is not so easy, and present electronic solutions are not ideal.

The Hughes approach is quite ingenious. The light from the desired image (i.e. the varying tones formed by the brightness of the light in the various parts of the image) is allowed to strike a cadmium-sulphide layer which modulates the resistivity of the photoconductive layer. This in turn varies the voltage which is applied to a liquid crystal layer. The characteristics of the liquid crystal can be altered thus giving control over the image which is finally transmitted. Resolution is presently 60 lines/millimetre and the device requires only 6V.

COMPUTER-FACILITY FOR £7·50

A new general-purpose microprocessor shortly to be introduced by National Semiconductor, and priced around £7·50 in quantity lots, is expected to generate keen interest in present users of Random Logic.

SC/MP is an 8-bit PMOS microprocessor operating at 2 microsec cycle time and requiring only a single 12V supply with a useful margin of ±2V. It generates its own timing on the chip, and will be ideally suited to simple control and timing functions.

Designers working with appliance controls, building monitors, fuel-injection units, traffic signal control, word-processing systems, electronic toys, etc. will find the SC/MP right in both design and cost, claims N.S.

Multiple SC/MP can communicate with each other when they share a common bus. Logic on each chip senses when the bus is in use, so when one SC/MP ceases transmission (or reception) the next can take over. If it declines, the next but one is invited.

A simple control system can be developed using one SC/MP and a programme memory—which can be selected from a wide range of standard memory parts. Such a system could access up to 4 kilobits of memory and could provide the control logic for simple industrial systems, TV games, small traffic-control systems, etc.

I.R. HEADSETS

A recent development in the West German colour television market has caused quite a stir among other europeans. Apparently infrared audio headsets are now becoming increasingly common as a standard fitment to the receivers. Another application of the infrared audio system is to teach children whose hearing is impaired. The infrared is transmitted to a minute IR receiver which is an integral part of the headphones thus leaving one free to move about anywhere within the range of the IR beam. One German company is readying a two-channel stereo transmission system. The signals for each of the two channels is modulated onto two separate carriers. These are set at 200kHz and 280kHz. These frequencies are then transmitted via the infrared beams.

VIDEO DISCS

The video home-player scene has taken on a new look. A large French company recently confessed that it is going into production with an inexpensive optical video disc-player. What is interesting is that the company, looking some years ahead, sees the distinct possibility of cheap throw-away video discs which will be sold at newsagents just like magazines.

GAMING CHIPS

In a previous issue (Hotlines, *Practical Wireless*, March 1976) I mentioned tv games. US semiconductor giant Fairchild has announced that it is going into this area in a big way. Plans haven't been completely revealed as yet but it would seem promising for the home constructor if this company were to start manufacturing chips specifically designed for things like tele-tennis, tele-football etc. Please note; they haven't started making them so don't look for ICs yet a while.

Ginsberg

OUR CQ "COLUMN"

If you wish to have a "CQ" request in *Practical Wireless*, we would be grateful if you could write it out in the same style we print it. This helps us to help you by saving time trying to take extracts from long letters and deciphering names and addresses.

Thank you.

PRODUCTION LINES

colin riches

ITT SOUNDERS

ITT are marketing a range of piezo ceramic sounders. The smaller ones shown in the picture comprise a thin piezo-electric vibrator and solid-state oscillator. One very special feature of the units is their exceedingly low power consumption with high sound pressure level.

The circular device at the top left of the photograph is Model U2-50RDID2H which gives a continuous short pulsed or long pulsed tone facility from 24V. Operating voltage is 5-35V at 10mA with an oscillating frequency of 2·7kHz. Sound level is over 90dB. The small black sounder (centre)—the U5-35R runs at 4mA with a continuous tone only. Output is over 70dB. The bottom left unit (U1-50RD2) has continuous or long pulsed tones and runs on 12V at 10mA. The bottom right unit (U3-5DR) is a 24V continuous tone sounder which draws 8mA.

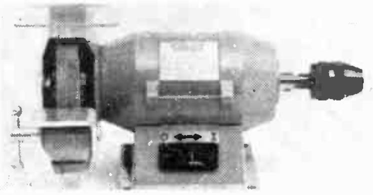
The sounders make very good alarms for use inside the home i.e. they could be wired to fire alarms, smoke detectors, mains failure alarms for freezers etc. etc. and their very low current consumption makes them ideal for this purpose.

The horn-type sounder RHA 102 (top right) is a real "ear-splitter" which incorporates a sensitive drive unit and solid-state oscillator amplifier. Two separate tones are provided—warble at 1200Hz-1700Hz at 180 c.p. minute, and continuous 1000Hz, and these can be used individually by connecting the appropriate pair of wires to the 12V d.c. supply. Current consumption of this model is 400mA and it pushes out 98dB of noise making it eminently suitable for applications where warning signals are required e.g. fire and intruder systems, factories, hotels, vehicle alarms and so on. Prices, not yet fixed are believed to be quite reasonable. Further gen by sending a stamped addressed envelope to *Mr. K. W. Stanton, ITT Components Group Europe, Standard Telephones and Cables Ltd., Materials Division, (Dept. P.W.) Edinburgh Way, Harlow, Essex SM20 2DE. Phone Harlow 26811.*

BENCH GRINDERS

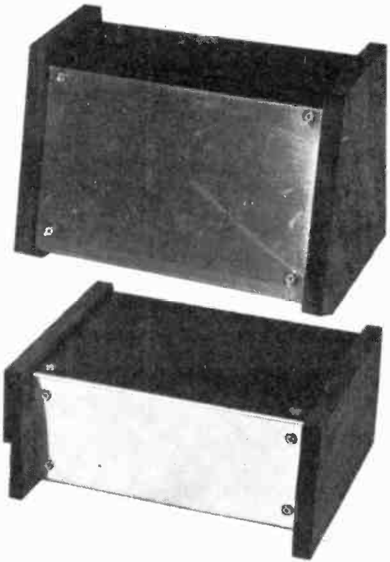
Industrial power tool manufacturers, Wolf Electric Tools Ltd., have introduced two new 5in (125mm) Bench Grinders to complement their 6in. and 8in. industrial model range. The new machines are designed for light industrial and home workshop use and those of you who are still of the "Chassis bashing fraternity".

Model 8252 is fitted with an 80 grit fine grinding wheel and a 60 grit coarse wheel while the more versatile model 8159 is fitted with a 80 grit grinding wheel and an 8mm chuck, enabling its use with small accessories for polishing, sanding etc.

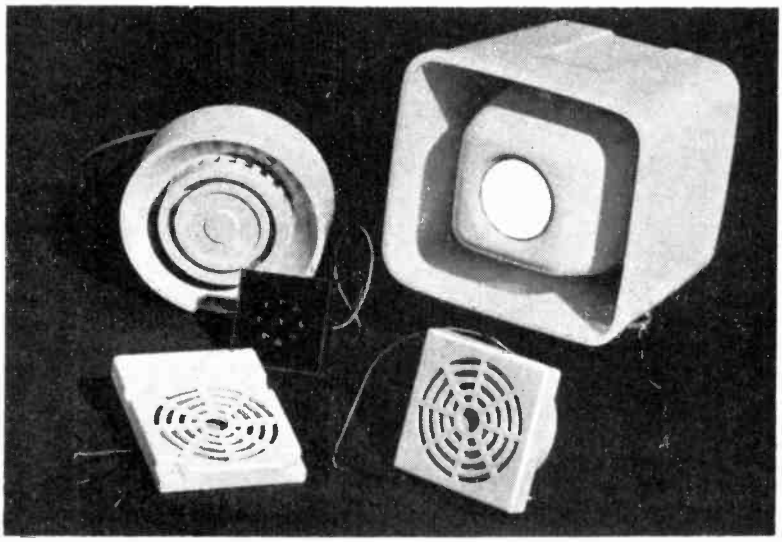


Both models are supplied with adjustable tool rests and eye protection for grinding work. Recommended price of either model is, £41·95, excluding V.A.T. *Wolf Electric Tools Ltd., (Dept. P.W.) Station House, Harrow Road, Wembley HA9 6TJ.*

EQUIPMENT CASES



H.M. Electronics have announced two rather attractive equipment cases. Model DC.1 (with the sloping front) which, say the makers, was designed with digital clocks in mind, can also be used for mixer units, electronic dice or some of the many projects published in our pages. The second case is the Mini-bec case which measures 7in x 3in. (or the decimal 178mm x 76mm). Both units would give home-built equipment a really professional finish for they are well-made in aluminium with black crackle tops with teak end sections. In addition, the DC.1 has a green front panel. Prices: the DC.1 costs £3·75 + 75p post and packing incl. VAT and the Mini-bec is priced at £2·99+ 75p post and packing incl. VAT. Further information from *H.M. Electronics, (Dept. P.W.) 275a Fulwood Road, Sheffield S10 3BD.*



ADC ACCUTRAC

A unique electronic turntable—the "Accutrac"—operated by remote control—has been introduced by Audio Dynamics Corporation, a subsidiary of BSR Ltd.

The Accutrac 4000, the first of three units on the market comprises three separate but interrelated component pieces; the automatic direct drive electronic turntable, a remote receiver and a hand-held cordless transmitter. From the comfort of an easy chair, listeners can programme exactly what they want to hear on a given album by selecting tracks indicated numerically on the transmitter. The message is then transmitted to the receiver, which is located in convenient proximity to the turntable and the receiver in turn activates the turntable's arm, which places the stylus precisely at the beginning of the track selected by the listener. The receiver's L.E.D. (Light Emitting Diode) winking "eye" lets the listener know that the information has been received and held in total memory.

Up to twenty-four commands can be programmed in any order required. The transmitter can also be programmed to reject, cue, repeat and clear, as well as play, in fact virtually all you have to do is to place a record on the turntable. Track selection can be determined by a quick look at the album jacket and favourite selections can be repeated over and over again without the listener even having to move an inch.

How does the Accutrac actually work? The Accutrac process begins with the logic circuitry built into the turntable, a direct drive unit. In the Accutrac system, there are electronic speed-sensing circuits within the motor itself, constantly monitoring the turntable's speed accuracy and instantaneously correcting the speed.

In a sense, Accutrac has eyes. A tiny solid-state infra-red generator and detector is built into the special ADC LMA-1 cartridge (an advanced version of the XLM). The generator focuses a tiny beam of infra-red light onto the record and senses the surface of the disc. Although the arm is raised, lowered and moved automatically by its own servo-motor, it always tracks the groove with perfect freedom because from the instant the stylus touches the record, the arm is totally decoupled from the servo-motor and controls.

Separate control circuits for each speed allow individual adjustment and switching from 33 to 45 rpm now involves just a simple reliable switch—no mechanisms. In order to prevent floor shake, footsteps or acoustic feedback from reaching the stylus in the groove, the arm and motorboard are suspended on springs that have been computer-calibrated to provide maximum isolation and security. Price is about £300. *BSR Limited (Dept. P.W.), Powke Lane, Cradley Heath, Warley, West Midlands, B64 5QH, England.*

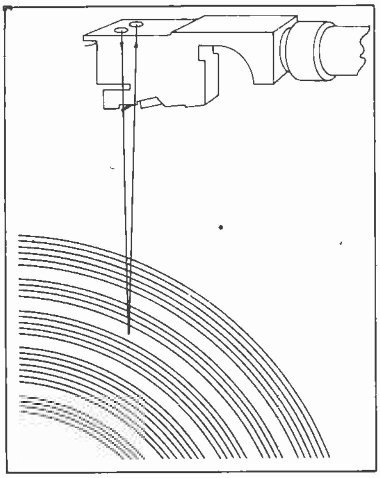
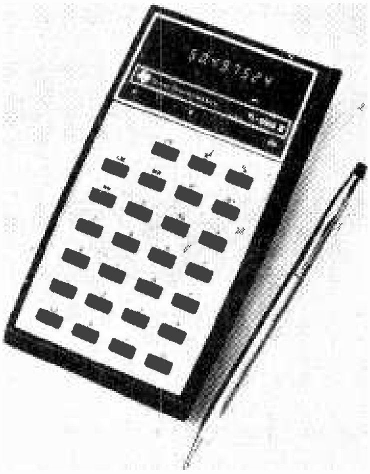


Diagram showing the infra-red Tx/Rx (left). The Accutrac deck with remote control Tx/Rx (below).

8-FUNCTION CALCULATOR WITH CONSTANT AND MEMORY ANNOUNCED BY T.I.



A new 8-function electronic calculator recently launched by the European Calculator Division of Texas Instruments Limited is designated the TI-2550-II. The new calculator features the basic five functions—add, subtract, multiply, divide, and percent—with an automatic constant on all five functions plus a full four-key memory (memory plus, memory minus, memory recall, and. clear memory). In addition it features the widely used slide rule calculator functions of square root, square and reciprocal. Recommended retail price of this new calculator is £29·95 inc. V.A.T. and accessories.

The "reverse key" is especially useful to divide the quantity in the memory by the quantity in the display. The square root, square, and reciprocal keys operate only on the displayed quantity; they do not complete any pending operation. Thus, the calculator can easily solve problems such as the square root of the sum of squares without using the memory.

For maximum readability, the negative sign is always displayed immediately to the left of the first displayed digit. A ninth character on the extreme left of the display is used to indicate a quantity stored in the memory as an error and overflow indication.

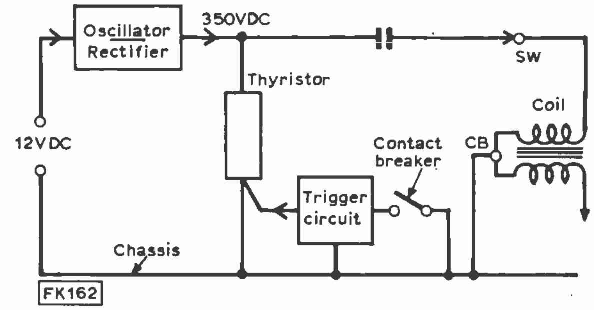
Packaged in a 5·8 by 3·2 by 1·25in. (14·7 x 8·1 x 3·2cm) case and weighing less than 8 ounces (230 grammes), the TI-2550-II comes with battery pack containing two fast-charge nickel-cadmium batteries, the AC9900 adapter/charger and owner's manual. *Texas Instruments Ltd., (Dept. P.W.) 165 Bath Road, Slough SL1 4AD Berkshire. Telephone Slough 35544.*

SPECIAL PRODUCT REPORT—*continued from page 31*

adjacent to the coil, keeping the connecting leads as short as possible, thinking that these new "electrics" might cause interference to the car's radio. In the event it was possible to switch from normal to electronic ignition without any difference being noted to the general noise level on the radio. The holes in the box were drilled out to take ¼in. bolts, one fitted with a soldering tag to take the black chassis lead from the unit. All existing push-on tags were retained, spade tags being fitted to the leads from the unit. At any time the unit can be removed and the wiring replaced in a couple of minutes.

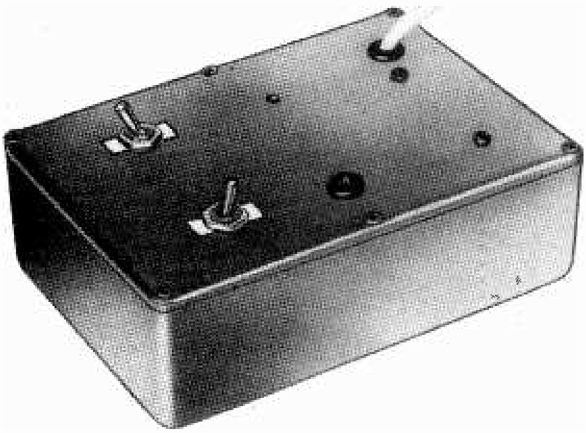
ON THE ROAD

The installation instructions are very good. If more than one wire is found on the "SW" terminal of the coil all should be removed and connected to the blue wire from the unit. A short piece of insulating sleeving was fitted over each exposed connection and the wires taped together neatly. Some slack was left in the wires to allow for movement of the engine on its mountings.



Basic circuit of a capacity discharge ignition system. There are many variations of this theme to be found.

The Herald, normally driven by the daughter of the family, was left out in the open during the cold spell and the engine started every morning after the second go on the starter plus half the usual amount of choke. This was a distinct improvement on the normal performance in average temperatures. To the reviewer this aspect of electronic ignition is most important with the consequent saving in wear and tear on the battery and the starter. Performance at speed was noticeably better, the car seeming to have more power and to run more smoothly in the 60 to 70mph range, no doubt due to the virtual elimination of the contact breaker bounce problem at high engine speeds. There was a certain amount of rough running at low speeds especially when the foot was lifted from the accelerator. At this point no attention had been paid to the sparking plugs or contact breaker which had been in use for several thousand miles without attention other than checking the gaps from time to time.



The completed unit, ready for installation in the car. The switches are shown in their 'anti-thief' positions. Electronic ignition is operative with both switches to the right and normal ignition when they are to the left. A small neon lamp protrudes through the grommet, bottom centre, lighting when the unit is functioning properly.

CONCLUSIONS

New plugs and contact breaker set were fitted and the rough running disappeared, gaps being set at the usual 25 and 15 thou respectively. Increased gap on the plugs is usually recommended with electronic ignition but this has not been tried yet. Daughter normally keeps a record of petrol bought and miles run so this was very useful in trying to assess whether there was an improvement in petrol consumption. It is unfortunate that a lot of rubbish is written about sensational improvements in this field with electronic ignition but it is seldom borne out in practice. An improvement of about two miles a gallon was found but a lot more mileage will have to be run before a definite figure could be given.

No doubt if the Herald were kept in tip-top order with frequent checks on engine performance with test equipment the electronic ignition would not make so much difference to its performance, except at high speeds, but the Herald was an ordinary car, receiving less care than it really deserves, yet it benefited considerably from the electronic ignition. Considering the price of the Bi-Pre-Pak kit it is a very good investment indeed.

The Super Spark Ignition Kit is available from Bi-Pre-Pak for £9·09 including VAT and post and packing from 222 West Road, Westcliff-on-Sea, Essex SS0 9DE. *A.E.D.*

CQ!CQ!CQ!CQ!

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..issues of P.W. containing details of mods to the 19 set (? 1960).—D. Collings, c/o Glossop School, Talbot Road, Glossop SK13, Derbyshire.

..P.W. March and April 1971. Also P.W. May 1972. S. Brown, 12 Waverley Road, Middleton, Manchester, M24 3JG.

..P.W. July 1961 and August 1961—G. Farrer, 16 Duncan Road, Gillingham, Kent.

INFORMATION WANTED

..manual and circuit diagram for Pye Ranger 2207V.—C. Sedgwick, 38 Eaton Road, Kempton, Beds., MK42 7RP.

..on Pamphonic type 601A, 601B (or Cossor 601A and 601B) amplifiers.—D. Evans, 29 Malton Road, Liverpool, L25 8QU.

EQUIPMENT FOR DISPOSAL

..60 Practical Wireless's from 1971 to 1975, resistors, capacitors, (fixed and variable), transistors, (PNP and NPN with long leads), speakers (3 ohms to 35 ohms), valves (DL96, DAF types). Please send a stamped addressed envelope for a list.—J. Owens, 26 Ardd Fawr, Dolgellau, N. Wales.

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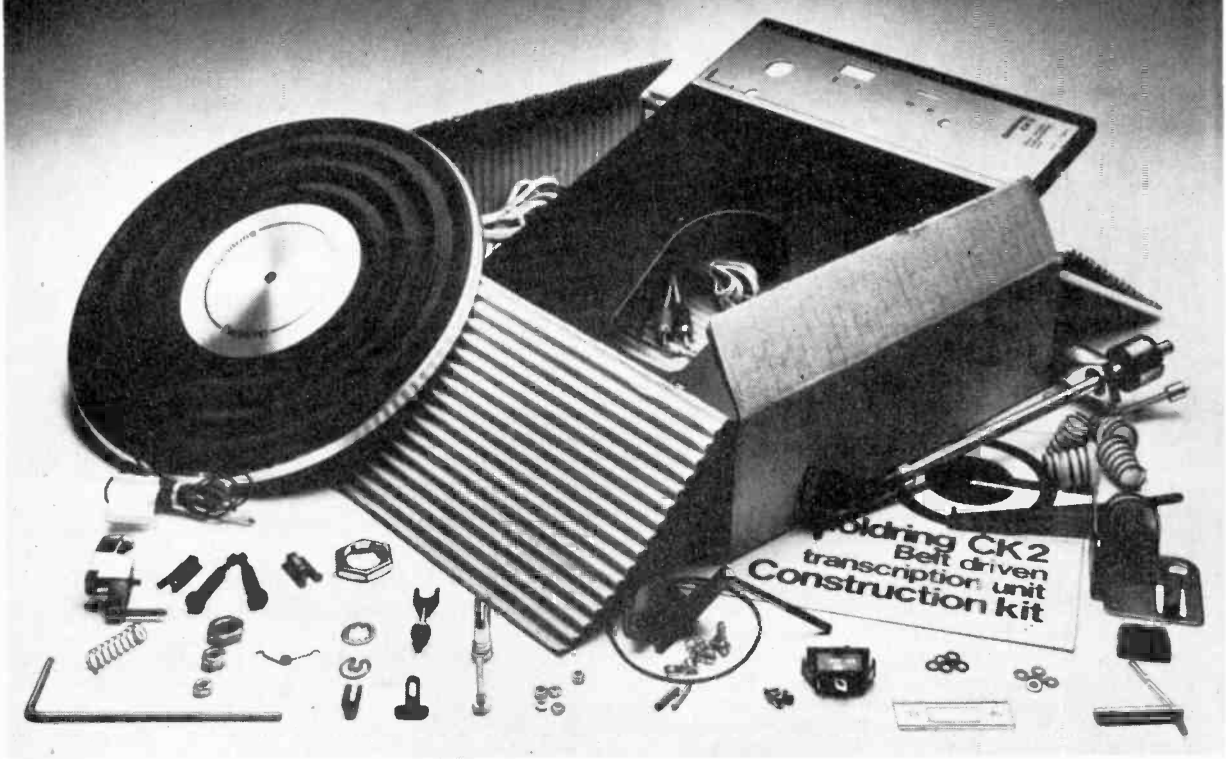

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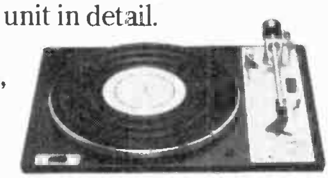

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PW 576

Goldring

Battery Economy in Transistor Radios

B.B.RAFTER

Some of those hardest hit by the general heavy increases in dry battery prices over the last few years are the "senior citizens" who live on a tightish budget and rely to such a great extent for news, entertainment and especially "company" on their transistor portables, sometimes themselves quite senior! It is, of course, possible in many cases, though not in all, to replace batteries by a small mains unit and this will soon repay its cost by savings in replacements at anything between 52p and 85p a time. Perhaps the easiest sets to convert in this way are the portables of any vintage using the PP9 or equivalent battery, as this can usually be replaced by a mains unit of identical size, either bought complete, made up from data published, or from kits advertised or from the spares box.

Many portables, however, dating from the days before complementary symmetry in output stages, have a split secondary "single-ended" push-pull power stage requiring a double 4·5V battery, and since the PP11 or similar now costs 85p, replacement is a big item in a modest budget. Here again, it is possible to buy a ready-made mains unit giving two 4·5V outputs, but they are more expensive than the single 9V units, not so easy to make up from the spares box, and I have never seen a kit for one.

The solution is, really, to convert the output stage of such a set from double 4·5V to single 9V working. Even if the user then continues to use batteries, this will bring down his replacement costs by over 30% from 85p to 52p and of course there are cheaper 9V mains units available and they are much simpler to make up. I recently came across an OAP faced with the problem of the expense of the P11 and I managed to convert his set from double 4·5V to single 9V working in what proved to be an extremely simple manner, once the PCB had been extracted from the case and examined. The set proved to have a fairly common split battery, push-pull output stage, as in Fig. 1. This had to be converted to single battery working with as little disturbance as possible of the existing PCB and the controls. In fact, it proved possible by re-soldering only two connections:—

> Lead A from the speaker in Fig. 1 was cut where it entered the 4-pin battery plug and re-soldered to point X on the double pole switch at the back of the volume control.
>
> Lead B from the speaker was transferred, on the PCB, from the negative side of the capacitor (100uF) to the positive side, at point C.

These changes thus produced the standard single 9V output stage, as in Fig. 2. All that remained was to change the battery plug from the original 4-pin (for two 4·5V outlets) to an ordinary 9V type, using the cut-away top from a defunct PP9 battery. The conversion was then complete, much to the pleasure of our old friend, for whom it will now be possible, if he so wishes, for me to make up a small 9V mains unit to enable him to use his beloved portable at minimum cost. PW

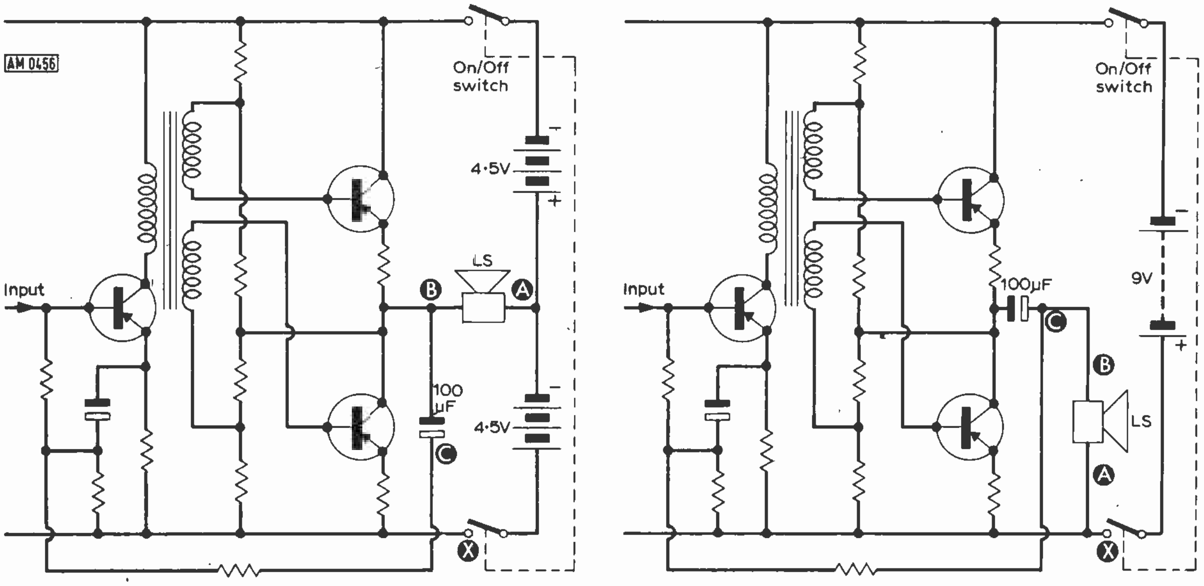

Fig. 1, left, shows a typical output stage using two 4·5V batteries. Fig. 2, right, is the same circuit converted to operate from a single 9V battery.

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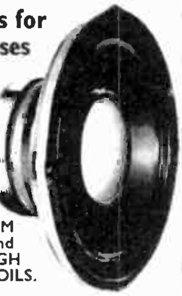

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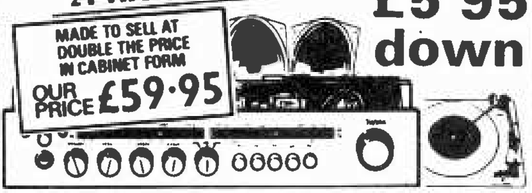

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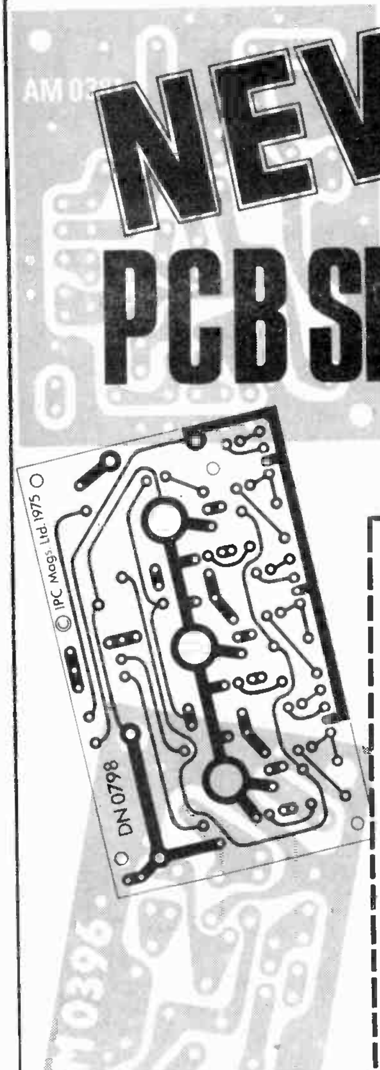

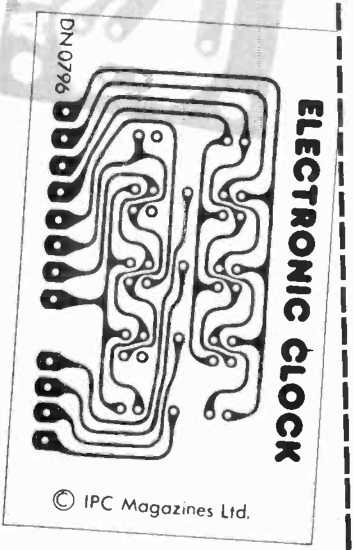

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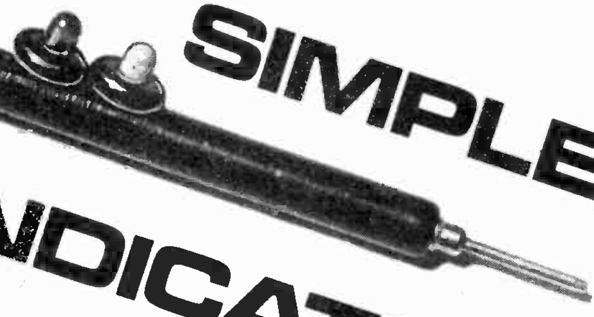


Peter HEMINGWAY

THIS device was designed as a result of reading an article in PW some 3 years ago (Logiprobe, by L. Cook, October 1972). The device described there was somewhat cumbersome, and prompted me to design a unit which was simpler, cheaper and more compact. The fact that this device is so simple means that it can be built into a small and very handy body, such as a felt-tip pen or as the prototype was, built into a discarded test probe.

Circuit Details

The circuit is basically a potential divider with two LED's to indicate the current flow through their respective resistors. The value of the resistors is not too critical and can be of any value from 330Ω to 1kΩ. However, if resistors of less than 330Ω are used, damage to the LED's may result, and if too high a value, the LED's will be too dim. As R1 and R2 must be of the same value, they should also be of 10% tolerance, and $\frac{1}{8}$W so that they are able to fit into the case.

The LED's used in the prototype are 5mm types, one green to indicate logic 0 (or 0V) and the other, red, to indicate logic 1 (or +1V). To cut the cost even more, 3mm diameter LED's could be used.

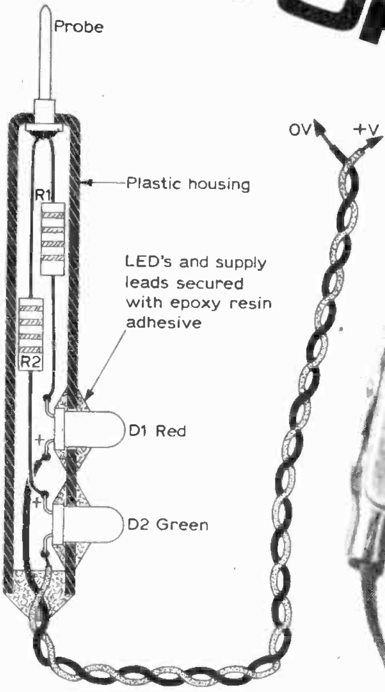
As previously stated the prototype was built into a test probe of slightly smaller dimensions than a felt-tip pen. The drawing opposite illustrates a cross section of the unit showing the internal wiring and components. The supply leads to the probe should be terminated in a pair of crocodile clips in order that the probe can be connected to the same power supply as that used by the TTL circuitry under test.

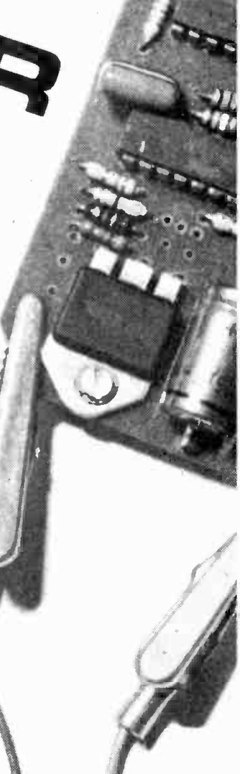
After the probe has been tested and found to be working satisfactorily, the wires and LED's are fixed in place with a glue such as polystyrene cement or Araldite.

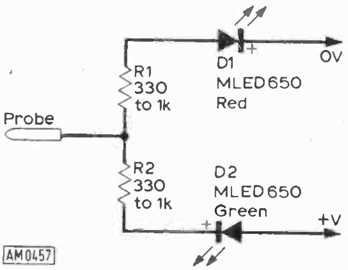
Testing

A quick method of testing the probe, is to connect the supply leads to their respective terminals of a 6V battery. If all is well, both LED's should light at half brightness (half brightness will also be displayed when the probe is connected to a point that is either floating or at an inadmissible voltage (e.g. 2·1V). When the probe is touched to a positive terminal, D1 (red) should light, and similarly when the probe is touched to the 0V terminal, D2 (green) should light.

If these results are not obtained it is probably due to the fact that one or both diodes are connected the wrong way round.







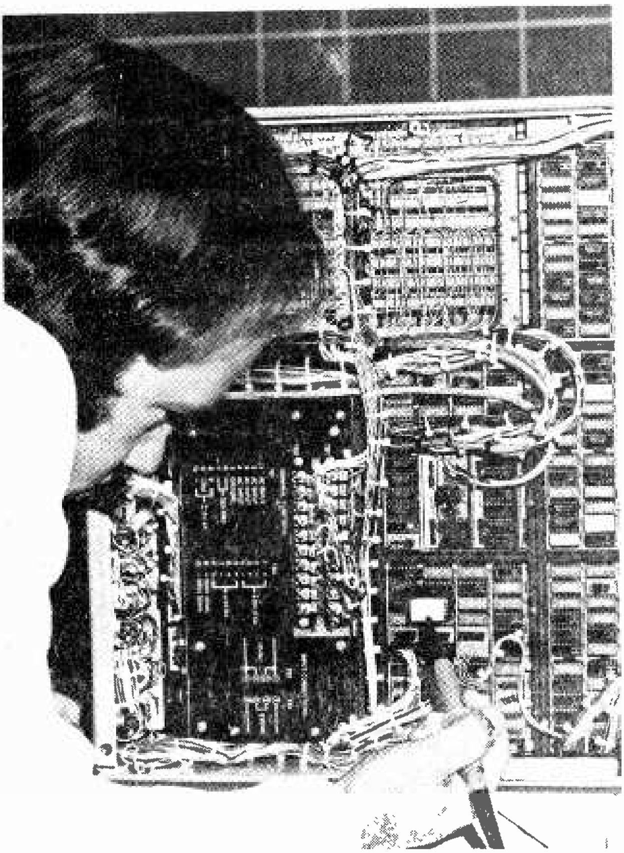
AM0457

★ components list

Resistors
R1* 330Ω–1kΩ R2* 330Ω–1kΩ
*see text.

Semiconductors
D1 MLED 650(red) D2 MLED 650(green)

Miscellaneous
Felt-tip pen body or spare test probe. Two crocodile clips.
Lengths of wire (two colours).



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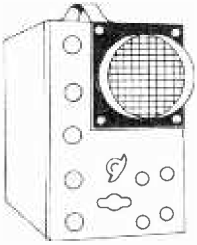

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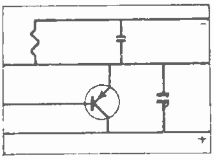

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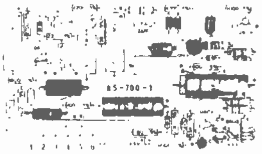

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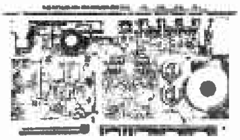

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- suitability for both open-reel and cassette tape machines
- check tape switch for encoded monitoring in three-head machines

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Signal-to-noise ratio: 75dB (20Hz to 20kHz, signal at Dolby level) at Monitor output
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30mV sensitivity

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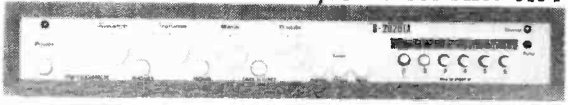

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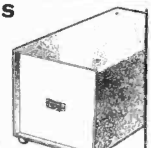

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200	151	12·29	0·98	8·61	0·97
250	152	13·81	0·98	10·31	1·18

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See catalogue for full range.

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Primary 240V with screen. See catalogue for full range.

VOLTS		MILLIAMPS		REF.	PRICE	POST
Sec. 1	Sec. 2	Sec. 1	Sec. 2	NO.	£	£
3-0-3	—	200	—	238	1·56	0·34
0-6	0-6	500	500	234	1·56	0·34
0-6	0-6	1000	1000	212	2·12	0·46
9-0-9	—	100	—	13	1·60	0·34
0-9	0-9	330	330	235	1·62	0·34

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4	2	18	3·07	0·62
6	3	70	4·50	0·72
8	4	108	5·11	0·85

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Secondary 12, 15, 20, 24, 30V

AMPS	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	51	6·75	0·95
6	117	7·52	0·97
8	88	9·93	1·18
10	89	10·27	1·18

50 VOLTS

Primary 200/240V
Secondary 19, 25, 33, 40, 50V

AMPS	REF. NO.	PRICE £	POST £
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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
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60 VOLTS

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Secondary 24, 30, 48, 60V

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1	126	3·75	0·72
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3	125	7·91	0·97
4	123	9·20	1·18
5	40	10·22	1·18
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10	122	20·10	O/A
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0–5 mA	170	0–5 mA	200
0–10 mA	6	0–10 mA	6
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
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I.C. OF THE MONTH

Number 58

Motorola MC1312P Quadraphonic decoder

THE Motorola MC1312P and MC1313P are 14-pin dual-in-line devices which have been especially designed for decoding the two composite signals from quadraphonic records into the four separate audio channels. The matrix system used in these devices is suitable for use with inputs encoded on the "SQ" system which was developed by the Columbia Broadcasting System and which is now used by most of the large recording companies. It is also suitable for the decoding of SQ quadraphonic broadcast programmes, but it remains to be seen whether such material will be transmitted in the UK.

THE TWO DEVICES

The MC1312P is designed for home entertainment applications and introduces less harmonic distortion, typically 0·1%, than the MC1313P, typically 0·25%. The MC1313P is intended for use in quadraphonic vehicle systems where it provides an excellent performance at supply voltages as low as 8V.

The MC1312P has a higher typical input impedance, 3MΩ, than the MC1313P, 1·8MΩ. In addition, the MC1312P can provide outputs of up to at least 2V RMS whilst the MC1313P provides at least 0·8V RMS before the total harmonic distortion rises to 1%. The MC1313P has the advantage that it can operate in a cold vehicle at temperatures down to −40°C whilst the MC1312P characteristics are specified down to 0°C. The MC1312P has a lower signal to noise ratio, 80dB, with the input shorted, as opposed to 74dB for the MC1313P under certain conditions.

TYPICAL CIRCUIT

A typical circuit for the use of either of these devices is shown in Fig.1. It is recommended that the component values shown should have a tolerance of ±5% for optimum performance in this circuit. The absolute maximum permissible power supply voltage is 25V, but the MC1312P is usually operated from a 20V supply and the MC1313P from a 12V vehicle supply. The current consumption of the MC1312P is in the range 11 to 21mA and that of the MC1313P 6·5 to 12·5mA at their respective normal operating voltages.

The SQ encoded right hand channel signal is labelled R_T (for total right signal) in Fig.1, whilst L_T is the total left hand signal. The device essentially separates the total right hand signal into two separate audio signals, namely the right hand front signal (R_F) at pin 11 and the right hand back signal (R_B) at pin 14. These two output signals are fed to separate power amplifiers which feed the appropriate

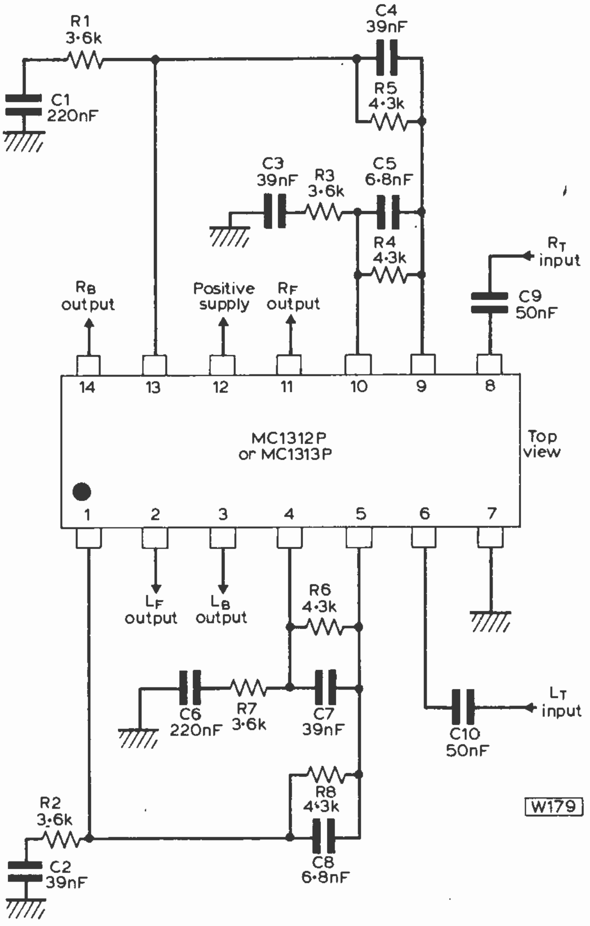

Fig. 1: Typical circuit utilizing the MC1312P or MC1313P. The devices are similar in application except for the supply voltage which is about 20V for the former and 12V for the latter.

loudspeakers. Similarly, the total left hand signal is separated to produce two audio output signals at pin 2 (L_F) and at pin 3 (L_B). The impedance at each of the four outputs is typically 5kΩ.

The two output voltages are about the same as the input voltage for that side, the tolerance in the signal amplitude ratios L_F/L_T and R_F/R_T being ±1dB. The balance between the two forward channels also has a tolerance of ±1dB. The amplitudes of the output signals to the two rear amplifiers are at a level of typically −3dB relative to those to the two front amplifiers.

Internally these devices contain two preamplifiers which are respectively fed with the input R_T and L_T signals via the blocking capacitors C9 and C10. These preamplifiers each feed two "all pass" networks, shown in Fig.1, which produce phase shifts of 90° without amplitude variations. Each phase shifted signal is fed into an internal resistor matrix together with the original output from the preamplifier, the two outputs from each matrix forming the required front and back signals.

It is generally desirable to enhance the centre front and the centre back separation. This is effected by connecting a resistor between pins 2 and 11 (front outputs) and between pins 3 and 14 (back outputs). For 10% front channel blending, a 47kΩ resistor may be connected between pins 2 and 11 and for 40% back channel blending a 7·5kΩ resistor between pins 3 and 14.

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TELEVISION

IN THE MAY ISSUE

DIRECT-READING CAPACITANCE METER
This simple battery-powered design, based on the use of an NE555 timer i.c., gives direct indication of capacitance values from a few picofarads up to 10μF. A d.c. test voltage is used, allowing the measurement of polarised capacitors and the capacitance of reverse-biased semiconductor junctions.

SERVICING THE TANDBERG CTV2-2 CHASSIS
The Tandberg CTV2-2 chassis is in many ways typical of the latest generation of large-screen, 110° deflection continental colour receivers, with a switch-mode power supply and making extensive use of i.c.s. W. S. J. Brice decribes the various faults he has encountered.

AERIAL PERFORMANCE
Roger Bunney and Ian Beckett have been investigating the relative performance of various well-known u.h.f. aerials. Their results form an interesting follow-up to Pat Hawker's recent articles.

SMALL PICTURE AND RELATED FAULTS
Lack of height, bottom cramping and other forms of non-linearity, and field sync problems are common faults with older TV sets. John Law provides a comprehensive guide to the causes of such faults.

FIELD TB CIRCUIT FOR THE PIL TUBE
Recent solid-state chassis use a wide variety of field timebase circuits. As an example of some of the latest techniques S. George investigates the circuit used in the Korting 55636 chassis, which is fitted with a PIL colour tube.

WHICH PATTERN?
E. Trundle's test equipment survey next takes a look at the various patterns available to the service engineer.

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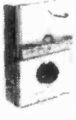

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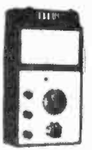

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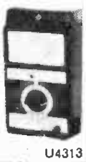

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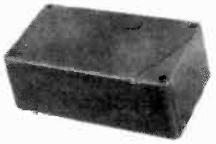

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ON THE AIR

AMATEUR BANDS

by Eric Dowdeswell G4AR

IT has always amazed me to realise that the act of sitting down and taking a written examination, successfully, should enable anyone to go on the air with 150 watts DC input, or the equivalent in SSB, without ever having touched a piece of radio equipment in their life! The results of the misuse of such a transmitter on the neighbouring TV's are not hard to imagine! Even if the transmission is 'clean' and up to the standards required by the Home Office the newcomer will not have the faintest idea on how to tackle TVI problems. Unfortunately, it is only after the 'black box' has been bought, at some expense, that these troubles come to light, which accounts for the number of commercial transceivers one sees for sale in our magazines, by newly licensed amateurs. And some other hobby gets another newcomer!

But it is no good carping about the problem if one is not prepared to suggest an alternative. The answer must be to return to the days when one could start with an 'artificial aerial' licence enabling experiments with transmitters to be made on a dummy load, followed by a minimum period on CW only with low power, say 25 watts and then on to the full licence. In this way a tremendous amount of experience can be gained and, above all, interest is continuously stimulated. Now, pushing buttons on the 'black box' soon palls, because one is learning precisely nothing other than the procedure of talking to another amateur and that's just as simple as talking on the telephone!

Nothing new in all this of course, so what's the snag? Just that the licensing authority would not be prepared to undertake the additional work involved. But in the interests of amateur radio could not the RSGB undertake to administer such a scheme? With official approval, of course, with the Home Office just issuing the bits of paper. Oh, well, just a thought!

Stephen Budd A8713 of Worthing reckons that since the sunspot numbers seem pretty constant now we could be at the bottom of the cycle so he's looking forward to better times. Well, I think we have been at the bottom for some time and in spite of the fact that new spots have already been seen for the new cycle it will be a year or so before any significant improvement is noticeable. **Paul Turner** in Bishops Stortford turned his spell in bed with flu to good use by extending his aerial and putting his new QR666 close to hand. He likes this Trio model except that he feels he'd like a higher ratio drive on the bandspread to assist with resolving SSB on the higher frequency bands.

Now for the good news! **Jeremy Hinton** of Newcastle, Staffs., is now ex-A8962, thank goodness, and proud owner of G8LIZ for the moment but could have his G4+3 by this time, as he was about to take his Morse test any day. He couldn't wait to get on the air and so popped round to G8KTW's shack for a quick QSO with his new call.

Plenty of useful info in the latest Bulletin from Stew Perry W1BB for the 160m addicts. Like W8LRL who made WAC in two hours in the CQ 160m competition in January! As Stew says, 'WOW'! Seems OK1ATP write about his 160m beam in the Oct 75 QST. Anyone have any info on this? Depends whether it goes up or outwards before I could try it out! Stew worked EA8CR/9 for his No. 127 country on the band. **Paul Barker** in Sunderland zoomed in on the SSTV contest but bad conditions limited his results in Europe. The ARRL contest the same weekend didn't help either as no-one seemed to respect the accepted SSTV frequencies.

Peter Readings, not too far away from me, in Woking, was taken by my remarks on newcomers to amateur radio, in the March issue. He started in 1935 with a one-valve PW design for the short waves and getting back again now is brushing up for the RAE, in due course. **Martin Chapple** A9090 in Leamington Spa writes in for the first time. Aged 14, he was 'converted', as he puts it, to amateur radio when he visited a local special events amateur station. He progressed rapidly to a Trio 9R59DS and a 100ft wire and now contemplates a Microwave Module for 2m and 8-element yagi plus the same again for 70cm. He queries the many odd prefixes to be heard these days. The best way to find out where they are is to look at the ITU block allocations rather than the usual prefix list, which is obviously going to be out of date the moment it is printed. **R. Berry** of Colne thought he was interested in the VHF bands until he got his 9R59DS going on 20m and now has the DX bug. He heard TG9TI helping in the earthquake disaster which hit Guatemala.

Alan Doherty in Portrush, Co. Antrim found plenty on 80m in the early hours with 3D2KG pushing his total of countries heard on that band to 172. He has an FR400SDX and FR50B for keeping an ear on two bands at once! I wouldn't mind the FR400SDX by itself! His inverted-V on 80m is likely to be changed to a delta loop before long. More info, please! **Peter**

ON THE AIR

Allen A8677 was pleased with the improved results from using a 132ft wire and found ZL3NR/C on 80m, which can't be bad!

A most interesting letter from **Jim Durrant** G4CEX of Solihull, in which he supports my views on the lack of encouragement being offered to the newcomer by the RSGB. He plodded on alone "the only English book I found of help was the one by Frank Rayer" (well-known PW contributor). "When I got my ticket I joined the RSGB automatically but gave them up after a couple of years as a bad job . . . . don't think I have seen one article in Radcom that would be of any use to a beginner". Need I say more? He continues "I wish the powers-that-be in the RSGB would take notice of your remarks and really do something for the novice!" Congrats Jim on sticking to it and I know you will not regret getting your ticket, in spite of the obstacles.

A letter in a similar vein from **A. J. Lees** of Bournemouth, copy to the RSGB, says he always recommends beginners to take PW "as this magazine has done more for beginners than any other magazine". He says "the newcomer eagerly scans Radcom to no avail and becomes disillusioned and thinks he has wasted his money". If you are listening regularly how about some reports OM?? **Alan Dixon** A9037 of Kingston sympathises with Steve Cottis who had trouble getting on an RAE course. Alan was only 14 when he started his course last September and has just heard that he has passed his RAE in the December exam! Fantastic! So cheer up, Steve, it can be done.

Finally, a note from **Les Light** G3KDL, Hon. Sec. of the Radio Society of Harrow, club calls G3EFX and G8JMR. Meetings every Friday at 8pm at the Harrow Sea Cadets HQ, Woodlands Road, Harrow. Features during April are a debate on HF and VHF propagation and a talk on mobile operation by Fred Barnes G3AGP. Two evenings a month are kept for practical work and construction. So flock along folks, nothing to lose but your bus fare!

I have been asked to dispose of a Hallicrafters S108 receiver. Valves, thank goodness, MW to to 32MHz continuous, with amateur bands 10 to 80m on main dial, BFO, noise limiter and excellent manual. Condition is very good and has been checked out by yours truly. Sorry, but must be inspect and collect, which a buyer would probably prefer anyway!

Log extracts

S. Budd:— 80m A4XGC CO2JA C31LC EA9FC FG7AR/FS7 HZ1SH PJ0USA OE6DK/YK ZL3GG ZL3NR/C 9Y4NP **40m** VK3ZL 6W8FP **15m** A4XGC ZD8AR 9V1SH **20m** FG7AR/FS7 ST2SA (14250 0700 Fridays) VS6BL YB1HF 9N1MM

P. Barker:— 20m SSTV CT1JI F9XY I1SU I0PCB OZ5FG SM5EEP **20m** A6XP EA8CR/9 OE6DK/YK OE7XBI (Olympic Games, Innsbruck)

A. Doherty:— 80m EA8CR/9 FL8DJ HK1CHL HP3XWB HR3JJR KL7HFQ PJ8CO VP2DQ 5Z4LW 3D2KG **20m** YN7NHW

P. Allen:— 80m WB9AJF/6Y5 ZL3NR/C **15m** TU2EI 5N2ESH OE6DK/YK (Golan Heights) C9MJO (Mozambique) 3B8CV

All stations are SSB except those of P. Barker, all SSTV.

BROADCAST BANDS

SHORT WAVE BROADCASTS

by Derek Bell

A "defector", if I may call him that, from the ranks of the licensed amateurs is **Allan King** G4BKM of London who forwards a sample of the duplicated report forms he sends out in search of QSL cards. These forms give all the relevant information in neatly spaced sections with the largest space devoted to the ten minutes of programme content that stations usually require. Despite this, Allan complains that Radio Pakistan turned down a request and on checking the tape recording of the broadcast all details were found to be correct. It seems to me to be a case of the station log being at fault!

Two more newcomers to the hobby ask questions that I must deal with in two sections, **A. B. Towler** of Newcastle on Tyne would like to know what to put into reception reports to gain QSL cards. This should comprise the following: time in GMT, frequency, your set and aerial type, the SINPO rating of the signal, ten minutes verbatim of the programme content and your name and address. It also helps to say a few kind words and say "please"! Information on types of set, aerial systems etc can be obtained from the many very good leaflets issued by Radio Nederland, PO Box 222, Hilversum, Holland. I do not know of any duplicated report forms for sale but the Post Office air letter form should suffice provided that one does not have to send IRCs to the station.

Sylvia Wood of Godalming is our second newcomer although she is seeking help to get her RAE "ticket" so we may seen loose her. Ah well! win some, lose some! The path to this side of our hobby starts by getting the Guide to Amateur Radio from the RSGB. Meantime, Sylvia, you will have to be content with joining we mere DX fanatics. The log you were asking about is usually a tattered notebook that the DXer keeps of the time, date, frequency and station name in order to jog his memory or give him a guide as to what was heard and at what time of year, since not only does reception vary with the season but we are now in the sunspot minimum of the solar cycle and it will be 1978 before we can expect the beginning of any improvement.

Midst all the gloom however, **David Sewell** sends us a selection of his best and these are Latin American stations. This aspect of our hobby attracts many listeners who like to specialise in these stations. since there are many differing styles and programme content is equally varied. Look forward

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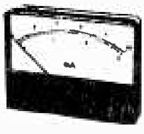
ME13=0 to 100 m/a Full Scale
ME14=0 to 500 m/a Full Scale
ME15=0 to 1 amp Full Scale
ME16=0 to 50 volts
ME17=0 to 300 volts A.C. Full Scale
ME18="S" Meter
ME19="VU" Meter



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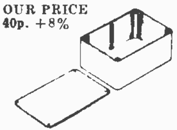

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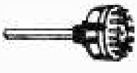

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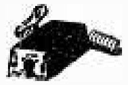

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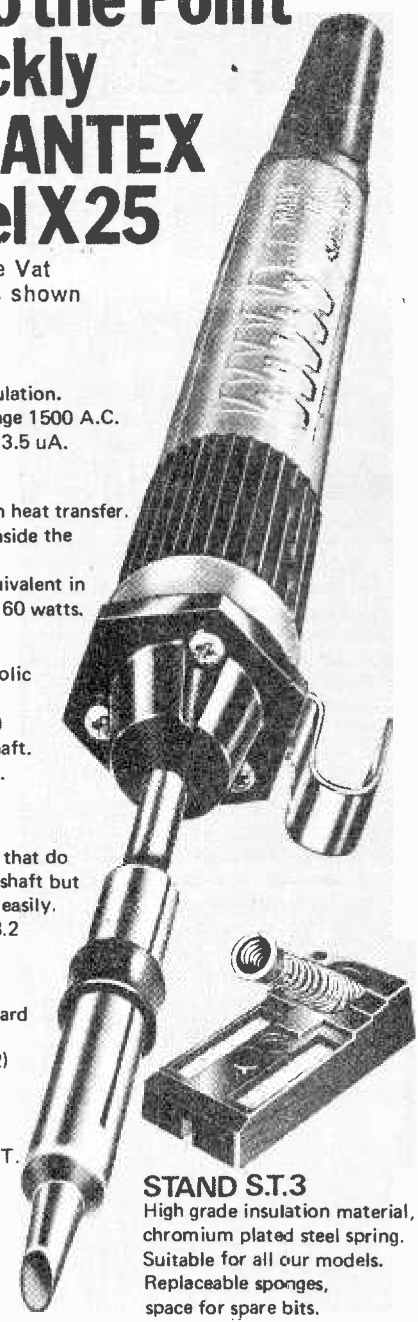

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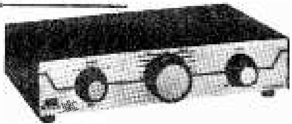

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CD4056	1·08
CD4057	20·35
CD4059	3·64
CD4060	0·92
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CD4062	7·33
CD4063	0·90
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CD4089	1·27
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ON THE AIR

to Lara Venezuela on 4800 at 0220, Juventud Venezuela on 4900 at 0050, Barquisimeto Venezuela on 4990 at 0135. These were all pulled in on Dave's Trio 9R59DS with a trap dipole 25 feet high, but all the same, undoubtedly and verily, only for night-owls!

Ian Walker of Crouch End, London is baffled by a station he heard on 2300 and 2750 simultaneously. This came in on Ian's Sony ICF5500M via the set's telescopic aerial. The clue to the ident of this station is its claim to be "The voice of Soviet public opinion"! The station is Radio Peace and Progress and very little is known of its staff or its aims for that matter. Ian describes the programme content as documentary on political topics.

Just a short while ago the latest edition of the Radio RSA bulletin plopped on to the mat at chez Bell. This leaflet, a mere shadow of its former self, covers the period of the summer schedules starting in March and indicates that RSA will use 5980, 7270, 11900, 11970, 17780, 15155, 15220 and 21535kHz. Their signals are radiated, with short breaks, twenty four hours a day to various target areas and in different tongues, but, strangely, while they have English transmissions they only specify North America as an English target area while the other area is just designated "Europe".

Robin Bayley of Kingswood School, Wolverhampton reports the 15155 RSA service in German at 1800, on a Marconi R1475 with a long wire, plus NHK Tokyo on 15430 at 0805, TWR Bonaire on 11920 at 0030, Radio Nacional de Brazil on 11780 at 2100. Another youngster is **Stewart Fenwick** of Clackmannan in Scotland, who reports that Radio Pyongyang recently sent him a QSL after 106 days and I use this to mention that reports have been noticed of late that the station in Fukien, China has re-emerged after a long period, on 2430. This station is very rarely reported and I can remember at a European DX Council conference a German DXer showing me one of their QSLs, written on rice paper in Chinese, which he had waited a donkeys age to get. At this time he claimed the station was a small transmitter working mobile so if any one chances on them please let us know all the details.

Ken Smith of Ross-on-Wye has some enquiries to make about the Voice of America transmitter at Rhodes. He thinks that the frequency has changed for the 2100 session and asks for any information of new frequencies. As I have said above, it is about this time of year that the schedules change and so it is possible that this station has disappeared from its usual part of the spectrum. A reader who just wants to be known as "SS" suggests that the Radio Australia signal on 9745 mentioned recently, in fact comes from Melbourne as he monitored it over Christmas. This may well be since stations, through many causes, have to depart from the published schedules and the poor old scribe slaving over a hot tripe-writer can only rely on his friends who write in to keep him up to date. SS also craves info on "what to do with aerials", well, one thing not to do is to fasten them rigidly to trees, since, as happened to a friend of mine in the recent gales, the tree swayed and down came the lot! The answer to this is to secure the long wire with one of those rubber "ropes" that are used on motor cycle panniers and car roof racks. If it is an inverted "L" longwire have the foot of the "L" running down from the support post and not down the house wall, and feed into the house via a wire run from the far end of the aerial. That brings this session to a close so I will wish you and yours best 73s.

BROADCAST BANDS

MEDIUM WAVE DX

by CHARLES MOLLOY

THIS MONTH **Alan Crookes** reports from his new QTH in Sheffield. He had to rebuild his loop after moving house but his 'shack' is now fully operational and he is using a Murphy B40A communications receiver to pull-in his medium wave DX. Stations logged include WINS, the all-news station in New York City, which transmits on 1010kHz with a power of 50kW and three locals in Newfoundland, CBN in St John's on 640kHz, CKVO in Clarenville on 710kHz and CJON St John's on 930kHz. Alan points out that the announcement "VOCM Radio Service" from CKVO is misleading since CKVO is not mentioned in many station listings, including the 1975 World Radio and TV Handbook, as it came on the air as recently as December 1974. The VOCM Radio Service is a local network in Newfoundland with VOCM on 590kHz in St John's as the key station. Other members of the network, in addition to CKVO, are CHCM in Marystown on 560kHz, CKCM in Grand Falls on 620kHz, CKGA in Gander on 730kHz and CKIM Baie Vert on 1240kHz, all of which have been heard recently in the UK. VOCM is one of the few medium wave stations in Canada to use the prefix V in its callsign; the majority start with the letter C. Newfoundland became the 10th province of Canada in 1949 but VOCM and four other well established broadcasters managed to hold on to their original call letters that were issued when the territory was still a Crown colony.

The World Radio and TV Handbook, generally regarded as the DXers 'bible' is published annually in Denmark and distributed in the UK by Billboard Publications. It is printed in English and can be ordered through bookshops. It costs £5. The WRTVH lists all known broadcasting stations (and TV stations) with the exception of low power locals in the USA and low power relays elsewhere. AM broadcasting stations are listed by frequency and there is a section for each country which gives the hours of transmission, addresses and QSL information. The less pretentious "Guide to Broadcasting Stations" at 80p is produced in the UK by Butterworth and is on sale in many bookshops. AM broadcasters in Europe and North Africa are listed along with a selection of the more powerful medium wave transmissions from other parts of the world.

ON THE AIR

This is a very useful book for the beginner. A similar publication "World Radio TV Listings" is available for 60p.

The Foreign Broadcasting Information Service of the United States Government produces "Broadcasting Stations of the World Part 2" at intervals of about two years. All broadcasting stations located outside the United States and in the frequency range 150kHz to 26MHz are listed. This bulky paperback can be obtained for $2·50 postpaid from the Superintendant of Documents, Government Printing Office, Washington, DC 20402, USA. Quote Pr.Ex-7.9:972 Part 2 and be prepared for a wait of several weeks!

Steve Whitt (London) refers to a wavetrap which he inserted between his loop aerial and the input to his communications receiver, in order to reduce local interference on 1546kHz. It is a parrailel tuned circuit which can be tuned across the medium wave band. It offers a high impedance at its resonant frequency and a low inpedance at all others and when it is placed in series with the aerial lead, it will reduce the strength of an unwanted station, leaving others unaffected. A medium wave tuning coil and appropriate variable capacitor, or pre-set, to tune across the medium wave band, are the only components required. The coupling winding is not used. Tune the receiver to the unwanted signal, adjust the wavetrap for minimum signal strength and the receiver can be used normally.

S. Lydon (Kingston-on-Thames) has been trying, without success, to tune-in to the Irish Speaking Radio (Radio na Gaeltachta), a network of VHF and MW transmitters in the Republic of Ireland. There are three outlets on the medium waves; Connemara on 539kHz with a power of 2kW, Kerry on 962kHz with 1kW and Donegal on 1250kHz with 10kW. In spite of their proximity to England these stations are rather difficult to pick-up, mainly on account of co-channel interference. The writer, from his QTH in North West England, can hear Connemara during the evening after dark, using a Marconi Mercury receiver and a medium wave loop. The station is on the air from 1800 to 2100 approximately and with a bit of luck might just be audible in the London area. Radio na Gaeltachta is an example where DX means Difficult rather than Distant. Torshavn in the Faroe Islands on 584kHz is another 'Difficult' station. Some DXers, including the writer, have had to wait for years before receiving a rather attractive QSL card as a reward for persistance.

D. R. Mayhew reports hearing Kinshasa in Zaire on 692kHz and Dakar in Senegal on 764kHz, using a Philips receiver and medium wave loop aerial. Medium wave stations in Africa are often heard well in the UK at this time of year. A loop is very useful for listening to this continent since the DX lies to the south and the interference from Europe, in general, comes from the east so it is not difficult to null-out the QRM. Stations to look for during the evening are Tenerife in the Canary Islands which broadcasts in Spanish on 620kHz; ELBC in Monrovia, Liberia which has English programming on 629kHz; Enugu, Nigeria which is a weak signal clear of interference on 1320kHz at 2300; Nouakchott, Mauretania on 1349kHz and, from the Republic of Guinea, Conakry which is a strong signal on 1403kHz after 2300hrs. There are two long wave stations in Africa, both coming in at good strength in the UK. From the top of a mountain near Azilal in Morocco the home service in Arabic is transmitted with 800kW on 209kHz, while from nearby Algeria the French programme comes from Tipaza with a power of 1500kW on 245kHz.

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

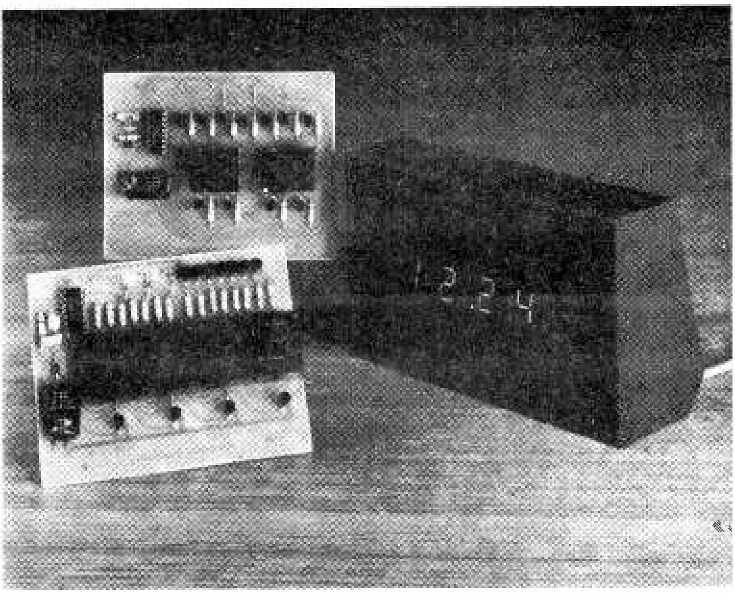
Logs covering any Amateur band/s in band/alphabetical order by the 25th of the month to Eric Dowdeswell G4AR, Silver Firs, Leatherhead Road, Ashtead, Surrey, KT21 2TW.

KINDLY NOTE!

TELE TENNIS SCORING UNIT
September 75

Some readers have queried the origin of the timing signals used for this unit. The signal Q3 originates at pin 13 of IC53, signal SP2 at pin 3 of IC56 and signal SP6 at pin 8 of IC57. Note also that IC32 is shown as a 7410 which should read 7400, as in circuit diagram.

Greenbank Electronics Established 1970



The illustration shows the two P.C.B. module kits already assembled, one has 8mm high digits, the other has 16mm high digits. Also shown is an example of a completed clock.
Free on request: Data on AY-5-1224 and MK50253 clock chips, 4 and 6 digit alarm clock suggested circuits, quartz crystal timebase, and L.E.D. displays, (If you can send an S.A.E., it makes things a little easier for us).

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(ex. VAT, p&p)

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Features:—

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4001/14001	0·15	4024/14024	0·60	4044/14044	0·75	4067/ —	2·95	4097/ —	2·95	14516/4516	1·10	14549/ —	2·95
4002/14002	0·15	4025/14025	0·15	4045/ —	1·15	4068/14068	0·15	4099/ —	1·50	14517/ —	5·40	14552/ —	8·05
4006/14006	0·95	4026/ —	1·40	4046/14046	1·10	4069/14069	0·15			14518/4518	1·00	14553/ —	3·50
4007/14007	0·15	4027/14027	0·45	4047/ —	0·70	4070/14070	0·15			14520/4520	1·00	14554/ —	1·20
4008/14008	0·75	4028/14028	0·70	4048/ —	0·45	4071/14071	0·15			14521/ —	2·00	14555/4555	0·70
4009/14009	N/S	4029/ —	0·90	4049/14049	0·45	4072/14072	0·15	4700/ —	1·50	14522/ —	1·50	14556/4556	0·70
4010/14010	N/S	4030/14507	0·45	4050/14050	0·45	4073/14073	0·15	7083/ —	4·25	14524/ —	N/S	14557/ —	3·20
4011/14011	0·15	4031/ —	1·80	4051/14051	0·75	4075/14075	0·15			14526/ —	1·50	14558/ —	0·90
4012/14012	0·15	4032/14032	0·85	4052/14052	0·75	4076/14076	1·25			14527/4527	1·20	14559/ —	2·95
4013/14013	0·45	4033/ —	1·10	4053/14053	0·75	4077/14077	0·15			14528/4098	0·85	14560/ —	1·55
4014/14014	0·80	4034/14034	1·55	4054/ —	0·95	4078/14078	0·15	14501/ —	0·15	14529/ —	1·30	14561/ —	0·45
4015/14015	0·80	4035/14035	0·95	4055/ —	1·05	4081/14081	0·15	14502/4502	1·00	14530/ —	0·65	14562/ —	5·25
4016/14016	0·45	4036/ —	1·80	4056/ —	1·05	4082/14082	0·15	14505/ —	3·30	14531/ —	1·25	14566/ —	1·20
4017/14017	0·80	4037/ —	0·75	4057/ —	20·35	4085/ —	0·55	14506/ —	0·35	14532/4532	1·60	14572/ —	0·35
4018/ —	0·80	4038/14038	0·85	4059/ —	10·60	4086/ —	0·55	14508/4508	2·35	14534/ —	6·00	14580/40108	6·00
4019/14519	0·45	4039/ —	2·85	4060/ —	0·90	4089/ —	0·65	14510/4510	1·10	14536/ —	2·85	14581/40181	3·05
4020/14020	0·90	4040/14040	0·85	4061/ —	16·40	4093/14093	0·65	14511/4511	1·25	14537/ —	15·25	14582/40182	1·15
4021/14021	0·80	4041/ —	0·65	4062/ —	N/S	4094/ —	1·50	14512/ —	1·05	14539/ —	1·05	14583/ —	0·71
4022/14022	0·75	4042/14042	0·65	4063/ —	0·90	4095/ —	0·85	14514/4514	2·55	14541/ —	1·80	14585/ —	1·45

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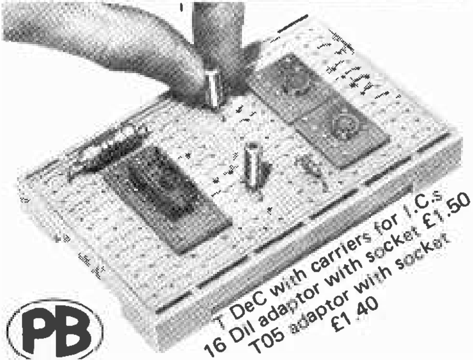

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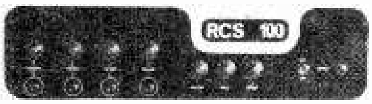

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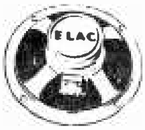

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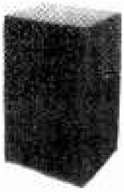

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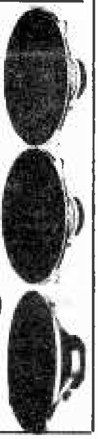

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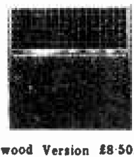

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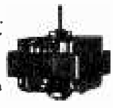

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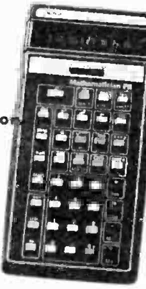

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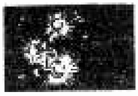

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6v and 12v	3 amp	2·25
6v and 12v	5 amp	3·50

Add 30p per £1 to cover postage and VAT

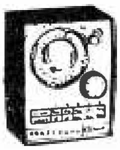
HONEYWELL PROGRAMMER

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 15 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 £9·96. £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, 68 resistors, mostly ¼ 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 5" x 7". Only 75p (the 66 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	All Day
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 3in × 3in × 2in deep. Price £4·25. 80p Post and VAT. as illustrated but less case.

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.

THIS MONTH'S SNIP

HIGH POWERED TRANSFORMER

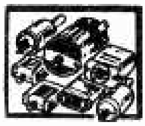
Rated at 250 Watts, upright mounting varnish impregnated. Its primary is for 230/240 volts 50 cycles, it has four secondaries éach 10v very high current windings. Just a few of the circuits it can power are: 10-0-10v at up to 12 amps; 20-0-20v at up to 6 amps; single 10v at 25 amps; single 20v at 12½ amps; single 30v at 9 amps; single 40v at 6·5 amps. This can be used for charging or for amplifiers, etc., there being an earth screen between primary and secondaries. A transformer like this to-day would cost at least £15 from the makers; however, we are making a special offer at £3·50 + 28p, post £1 + 8p each. Grab some while you can, our stock may not last long.

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 one 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—thee core mains lead—terminal output—when ordering please state output voltage 4½v, 6v. 7½v, 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 1½-12v 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.

175 Watt model £6·50 + 92p Post and VAT.

MULTIPLE CONTACT PANEL

Size approx. 4½ × 2½" have 200 contacts each across referenced for easy identification. Contacts are spring loaded and gold "pip". Ideal for the circuit breadboarding (resistors, etc., plug straight in) or for working out printed circuits, for electronic novelties, puzzles, combination locks, etc., ex-unused computer panels, price only £2 + 16p. IE. only 1p per contact, probably less than the value of the gold pip. Post + 11p.

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 CR0 1XX.

O.C.P. 70 photo transistor by Mullard, very popular for circuits such as infra-red burglar alarms, smoke detectors, etc. A big buy enables us to offer at the very favourable price of £25p each + 2p, or 5 for £1 + 8p.

Microswitch bargain, made by Pye, Honeywell, Burgess and similar first class makers originally for the Post Office, in fact they have been fitted to Post Office Equipment which was never put into use. They are a changeover microswitch with 10 amp contacts offered at the very low price of 20 for £1 + 8p. Post 40p + 3p.

Junction boxes free. We are coming to the time of the year when additional wiring and home alterations are usually carried out and as a special offer to all buying our cable to install immersion heaters, ring mains, etc., we are giving free this month six junction boxes with every 100 yard coil of 7/029 (4mm twin and earth cable). Our price for this cable, which is only approximately one half of the regular price anyway, is £8 + 64p. Carriage £2·50 + 20p—don't miss this bargain.

Super stick microphone. Japanese made, extremely good quality and performance. Impedance 50 Kohms. The microphone is intended for hand holding but stands ae available if required. Price £4·50 + £1·12p. Post 40p + 10p.

Tuner Cassette as described in March "Practical Wireless". Please note we can supply the ferrite slab and the Z.N. 414 1C. Price for these two items £2·25 including post and VAT. Copy of the circuit supplied on request.

Burglar Alarms. More and more burglars seem to be thriving on the properties of people who cannot be bothered to install burglar alarms. We can offer the intruder alarm as described in "Everyday Electronics" September issue. This is a good circuit and not too expensive. Price is £3·83 + 81p. Post 40p + 10p.

Thermally protected motor. American made 1" stack. This revs. at 2400 RPM, suitable for fan or similar application. Special feature is the trip which cuts off the mains should the motor overheat. Price £1·60 + 13p. Post 25p + 2p.

Amplifier in case with speaker, marketed by British Relay. This is in good quality cabinet with back and elliptical speaker. The amplifier is the Newmarket PC 4 module, together with volume control, size 9½" × 6" × 3½" deep, the amplifier can be powered by an internal 9v battery or from external mains source. Very useful amplifier for around the home or in the workshop for troubleshooting, or for testing out a quick lash up. Limited quantity of these, offered at bargain prices of £4 + £1. Post 40p + 10p.

Teak veneered double cabinet. We believe that this was made from one of the Leak systems. It is 25" × 4½" high × 8" deep made of thick board with sound/vent holes and should be ideal to house amplifier and tuner, or amplifier and one speaker. Very high quality cabinet which would cost £4 or £5 to make today. Price £2 + 50p + 80p + 20p.

Disco Dimmers made by Ultra Electronics, this is a variable controller which can be fitted behind a panel or into a standard switch box and it will control by 1250 watts along your similar non-inductive load. Very special price only £3 + 24p + 30p + 3p.

Disco Black Light Lamp 175 watts—230/240v pear-shaped back outer glass which obscures all visible radiation but emits long wave ultra violet (black light). This lamp provides a convenient way of fluorescing a discotheque, club, dance hall, party do, and being adirect plug in replacement of a tungsten lamp it is very convenient for temporary usage anywhere. Price £6·50+50p. Post 50p +4p.

Some more Relay bargains. Miniature plug-in type with perspex dust cover 700 ohm 12v DC working. 4 sets of gold-plated changeover contacts 1/2 amps. Normally an expensive relay. Our price £1 + 8p .

Mains Relays 230/240v. AC operated with 10 amp changeover contacts, open type, one screw fixing 3 sets changeover contacts £1 + 8p each.

Three Changeover perspex covered plug-in types £1·25 + 10p each, bases for same 30p + 2p each. Available with following coil voltages 12v AC. 50v AC 230/240 AC. Also still available the most **versatile type 600 relay** which, having a double wound coil, is suitable for working off 6, 12 or 24v. DC or mains through series resistor. This has multiple contacts and the price is 40p + 3p each.

Sound Transducer balanced armature type, 600 ohm imp. in capsule, size diameter 1¾" by ¾" thick. Useful in digital equipment or fo audio monitoring, or as a microphone or speaker, good quantities available. Basic price 50p + 4p less our usual quality discounts.

Venner Clock Replacements. 24 hour clock motor with threaded driving shaft. Standard replacements in many Venner time switches. Price £1·50 + 12p. Post 30p + 3p.

Stereo Pre amplifier, Mullard reference LP1182/2. This is a dual input hi-fi module, has a frequency response of 20 HZ to 50 KHZ. Its sensitivity 150mV at input 1 or 320mV at input 2. The bass and treble control ranges are plus or minus 14dB, distortion better than ·2%. All components are mounted on printed circuit wiring board, overall size of which is approx. 3" square. Connections are brought out to 22 tags which provide for high and low impedance inputs, stereo outputs, bass and treble lifts, volume and balance controls. We will supply complete with diagram of connections, price £1·50 + 37p. Post 30p + 7p.

Special Instrument offer is a Russian made Galvo, very sensitive precision instrument, full scale deflection 7-0-7μA. This is a bench mounting instrument of extremely high sensitivity (·3μA per division) size app ox. 6½" × 2½" × 2". Price £9·50 each + 78p. Post 50p + 4p.

Photo Multiplier Tubes. U.S. made, R.C.A. type No. 4555. These tubes have a gain of a million or more—regular price around £20 each, our price £6·75 + 54p each. Brand new in original maker's cartons.

VAT INCLUSIVE PRICES

Add 20p P & P—No other extras

Fully branded devices from RCA, TEXAS, MOTOROLA, MULLARD, etc.

TTLs by TEXAS

7400	13p
74H00	20p
7401	15p
7402	15p
7403	17p
7404	17p
74H04	22p
7405	17p
7406	41p
7407	39p
7408	17p
7409	22p
7410	15p
74H10	20p
7411	24p
7412	25p
7413	34p
7414	65p
7416	32p
7417	32p
7420	15p
7421	43p
7422	19p
7423	36p
7425	33p
7427	40p
7428	39p
7430	15p
7432	28p
7437	28p
7440	15p
7441	70p
7442	64p
7443	116p
7444	116p
7445	81p
7446	75p
7447	81p
7448	75p
7450	16p
7451	17p
7453	17p
7454	18p
7460	16p
7470	29p
7472	27p
7473	32p
7474	32p
7475	48p
7476	32p
7480	54p
7481	103p
7482	75p
7483	85p
7484	103p
7485	130p
7486	32p
7489	291p
7490	43p
7491	81p
7492	48p
7493	43p
7494	81p
7495	70p
7496	84p
7497	291p
74100	116p
74107	32p
74118	90p
74121	32p
74122	52p
74123	73p
74126	75p
74132	75p
74136	81p
74141	70p
74145	75p
74148	173p
74150	135p
74151	77p
74153	92p
74154	164p
74155	82p
74156	82p
74160	107p
74161	107p
74162	107p
74163	107p
74164	130p
74166	136p
74174	131p
74175	92p
74176	131p
74177	108p
74180	108p
74181	322p
74182	89p
74185	146p
74190	155p
74191	156p
74192	130p
74193	130p
74194	116p
74195	83p
74196	99p
74197	108p
74198	214p
74199	197p

C-MOS ICs

4000	19p
4001	19p
4002	19p
4007	19p
4009	67p
4011	19p
4012	19p
4013	55p
4016	54p
4017	123p
4018	247p
4020	270p
4022	180p
4023	19p
4024	125p
4025	19p
4026	200p
4027	81p
4028	152p
4029	189p
4030	59p
4042	150p
4043	218p
4046	150p
4047	168p
4049	68p
4054	210p
4055	210p
4056	145p
4060	250p
4069	40p
4071	29p
4072	29p
4081	19p
4082	29p
4510	142p
4511	200p
4518	108p
4528	130p

MULLARD MODULE

LP1186 VARICAP FM TUNER 810p

LOW PROFILE DIL SOCKETS BY TEXAS

8 pin 13p, 14 pin 14p, 16 pin 15p, 24 pin 50p

INSULATORS: Mica + 2 Bushes for TO3 or TO66 5p

VOLTAGE REGULATORS

FIXED—Plastic 3 Terminals

1 Amp	Positive	
5V	7805	150p
12V	7812	150p
15V	7815	150p
18V	7818	150p
24V	7824	150p
1 Amp	Negative	
5V	7905	215p
12V	7912	215p
15V	7915	215p
18V	7918	215p
24V	7924	215p

LM309K (TO3) 5V 1 amp 150p

DUAL VOLTAGE REGULATOR

1468 ± 15V 100 mA 16 pin DIL 324p

Adjustable by resistors from ± 8V min to ± 20V max

VARIABLE VOLTAGE REGULATOR

723 2V to 37V 150 mA 14 Pin DIL 45p

TRANSISTORS

AC125	18p
AC126	13p
AC127	13p
AC128	12p
AC176	12p
AC187	14p
AC188	14p
AD149	46p
AD161	39p
AD162	39p
AF114	18p
AF115	18p
AF116	18p
AF117	18p
AF139	35p
AF239	43p
BC107	10p
BC108B	10p
BC109C	11p
BC147	9p
BC148	9p
BC149	10p
BC157	11p
BC158	13p
BC159	13p
BC169C	15p
BC171	12p
BC172	11p
BC173	13p
BC177	20p
BC178	17p
BC179	20p
BC182	12p
BC183	12p
BC184	14p
BC187	32p
BC212	14p
BC213	12p
BC214	17p
BC337	24p
BC478	32p
BCY70	20p
BCY71	24p
BD123	108p
BD124	70p
BD131	39p
BD132	43p
BD135	54p
BD136	55p
BD139	79p
BD140	87p
BF115	24p
BF167	25p
BF170	25p
BF173	27p
BF177	28p
BF178	30p
BF179	35p
BF180	35p
BF181	35p
BF182	35p
BF184	24p
BF185	24p
BF194	13p
BF195	11p
BF196	17p
BF197	19p
BF200	40p
BF257	34p
BF258	39p
BFR39	37p
BFR40	37p
BFR79	37p
BFR80	37p
BFR88	37p
BFX30	32p
BFX84	28p
BFX85	27p
BFX86	28p
BFX87	22p
BFX88	26p
BFY50	17p
BFY51	16p
BFY52	17p
BRY39	39p
BSX19	18p
BSX20	19p
BU105	175p
BU108	312p
MJE340	49p
MJ2955	81p
MJE2955	107p
MJE3055	70p
MPSA06	37p
MPSA12	62p
MPSU06	78p
MPSU56	98p
OC28	70p
OC35	70p
OC41	19p
OC42	19p
OC45	19p
OC71	25p
TIP29A	50p
TIP29C	62p
TIP30A	60p
TIP30C	72p
TIP31A	56p
TIP31C	68p
TIP32A	63p
TIP32C	85p
TIP33A	97p
TIP33C	120p
TIP34A	124p
TIP34C	160p
TIP35A	243p
TIP35C	290p
TIP36A	297p
TIP36C	360p
TIP41A	70p
TIP42A	76p
TIP2955	76p
ZTX108	11p
ZTX300	16p
ZTX500	19p
ZTX504	60p
2N697	14p
2N698	32p
2N706	13p
2N708	19p
2N918	43p
2N930	19p
2N1131	19p
2N1132	19p
2N1304	23p
2N1305	23p
2N1306	30p
2N1307	30p
2N1613	22p
2N1711	22p
2N1893	32p
2N2219	22p
2N2220	19p
2N2221	22p
2N2222	22p
2N2369	15p
2N2484	32p
2N2904	22p
2N2905	22p
2N2906	22p
2N2926RB	9p
2N2926OG	11p
2N3053	19p
2N3054	43p
2N3055	54p
2N3439	72p
2N3442	151p
2N3702	14p
2N3703	14p
2N3704	14p
2N3705	14p
2N3706	12p
2N3708	11p
2N3709	11p
2N3707	14p
2N3773	240p
2N3866	90p
2N3904	22p
2N3905	22p
2N3906	22p
2N4058	19p
2N4060	19p
2N4123	22p
2N4124	22p
2N4125	22p
2N4126	22p
2N4289	24p
2N4371	142p
2N4348	173p
2N4401	34p
2N4403	34p
2N5089	34p
2N5401	62p
40360	43p
40361	41p
40362	43p
40410	59p
40409	59p
40411	243p
40594	81p
40595	92p

FETs

BF244	45p
MPF102	37p
MPF103	37p
MPF104	37p
MPF105	37p
2N3819	27p
2N3820	50p
2N3823	54p
2N5457	32p
2N5458	32p
2N5459	32p
3N128	81p
3N140	92p
3N141	81p
40603	63p
40673	54p

UJTS

TIS43	34p
2N2160	86p
2N2646	38p
2N4871	37p

PUJT

2N6027 60p

DIODES

SIGNAL

OA47	9p
OA70	10p
OA81	10p
OA85	11p
OA90	7p
OA91	9p
OA95	9p
OA200	8p
OA202	10p
1N914	4p
1N916	11p
1N4148	4p

RECTIFIER

BY100	31p
BY126	15p
BY127	15p
1N4001	6p
1N4002	6p
1N4004	7p
1N4005	7p
1N4007	8p

ZENER

2·7 to 33V

400mW	11p
1W	22p

TUNNEL

AEY11 75p

VARICAP

BB105 33p

NOISE

Z5J 140p

BRIDGE RECTIFIERS

1A 50V	25p
1A 100V	27p
1A 400V	31p
1A 600V	37p
2A 50V	40p
2A 100V	48p
2A 400V	56p
4A 100V	75p
6A 50V	65p
6A 100V	70p

TRIACS

Amp	Volts	
3	400	130p
6	400	162p
6	500	194p
10	400	200p
10	500	270p
40430		108p
40486		108p
40669		105p

DIAC

BR100 27p

OP. AMPS

301A	Ext. Comp. 8 pin DIL	40p
536T	FET Op. Amp TO 99	300p
709	Ext. Comp. 8/14 pin DIL	30p
741	Int. Comp. 8/14 pin DIL	25p
747	Dual 741 14 pin DIL	76p
748	Ext. Comp. 8 pin DIL	40p
776	Prog. Op. Amp TO 99	153p
1458	Dual Op. Amp. 8 pin DIL	75p
3130	CMOS/Bipolar Mosfet 8 pin DIL	108p
3900	Quad. Op. Amp. 14 pin DIL	60p

LINEAR I.Cs.

CA 3028A	Diff. Cascade Amp. To 99	112p
CA 3046	5 Transistor Array 14 pin DIL	55p
CA 3048	Quad. Low Noise Amp. 16 pin DIL	250p
CA 3053	Diff. Cascade Amp. TO5/DIL	45p
CA 3089E	FM IF System 16 pin DIL	250p
CA 3090AQ	FM Stereo Decoder QIL	500p
ICL8038BC	VCO Function Generator 16 pin DIL	600p
ICL8038CC	VCO Function Generator 16 pin DIL	300p
LM 380N	2W Audio Amplifier 14 pin DIL	115p
LM 381N	Stereo Pre Amp 14 pin DIL	200p
MC1310	FM Stereo Decoder 14 pin DIL	220p
MC1312/3/5	SQ Quad Decoder	1375p
MFC4000B	¼W Audio Amplifier PCB	75p
MFC6040	Electronic Attenuator PCB	130p
NE555V	Timer 8 pin DIL	40p
NE556	Dual 555 14 pin DIL	108p
NE561B	PLL with AM Demod 16 pin DIL	350p
NE562B	PLL with VCO 16 pin DIL	350p
NE565	PLL 14 pin DIL	200p
NE566V	PLL Function Gen 8 pin DIL	165p
NE567V	PLL Tone Decoder 8 pin DIL	200p
2567	Dual 567 16 pin DIL	400p
SN72710	Diff. comparator 14 pin DIL	54p
SN72733	Video Amplifier 14 pin DIL	150p
SN76013N	Audio Pwr Amp with int HS	175p
SN76023N	Audio Pwr Amp with int HS	175p
TAA661B	FM IF Amp Lim/Detector QIL	150p
TBA641B	Audio Amp 14 pin DIL	300p
TBA800	5W Audio Amp QIL	112p
TBA810	7W Audio Amp QIL	125p
TBA820	2W Audio Amp QIL	100p
TDA2020	20W Audio Amp QIL	405p
XR2240	Prog Timer/Counter 16 pin DIL	400p
ZN414	TRF Radio Receiver TO18	140p

Basic data sheet on above ICs at 10p each + S.A.E.

OPTO-ELECTRONICS

PHOTO-TRANSISTORS

OCP70	33p
OCP71	120p
2N5777	43p

LDRs

ORP12	60p
ORP60	75p
ORP61	75p

LEDs

TIL209 Red	15p
TIL211 Green	32p
TIL32 Infrared	81p

0·2″

Red	17p
Green	29p
Yellow	32p

SEVEN SEGMENT DISPLAYS

3015F	Minitron 0·3″	130p
DL704	Com. Cathode 0·3″	160p
DL707	Com. Anode 0·3″	160p
DL747	Com. Anode 0·6″	250p

OPTO-ISOLATORS

Phototransistor TIL112 (IL 12) 6 Pin DIL	151p
Photodarlington ILCA55 6 Pin DIL	270p

DRIVERS

75491 Quad Segment Driver 14 Pin Dil	78p
75492 Hex Digit Driver 14 Pin DIL	97p

SCR THYRISTORS

1A 50V TO5	43p
1A 100V TO5	45p
1A 400V TO5	50p
3A 100V STUD	53p
3A 400V STUD	81p
7A 400V TO5 + HS	87p
7A 400V TO5 + HS	97p
8A 50V Plastic	142p
12A 400V Plastic	173p
16A 100V Plastic	173p
16A 400V Plastic	195p
16A 600V Plastic	238p

BT106	150p	2N3525	97p
C106D	59p	2N4444	200p
MCR101	27p	2N5064	43p

RHYTHM GENERATOR

Semiconductor Kit for current "PW" Project. Includes all I.Cs., Trs., Diodes and DIL sockets £14·00 inc. VAT and P & P.

MAIL ORDER ONLY - PROMPT DESPATCH

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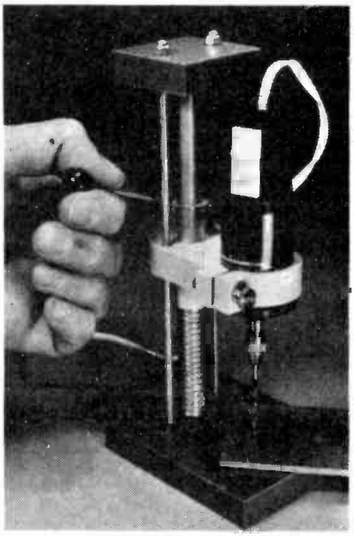
119A HIGH STREET,
TEDDINGTON TW11 8HG
Tel. 01-977-0878

INTRODUCING A MINIATURE PRECISION 12V. D.C. DRILL DESIGNED FOR THE ELECTRONIC ENGINEER



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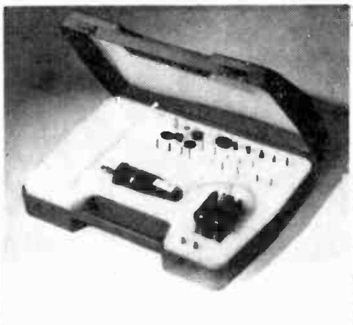

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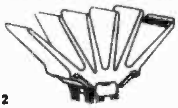

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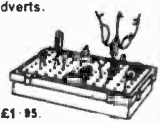

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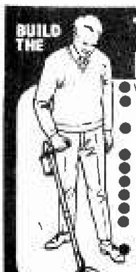

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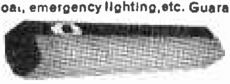

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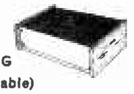

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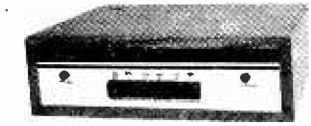

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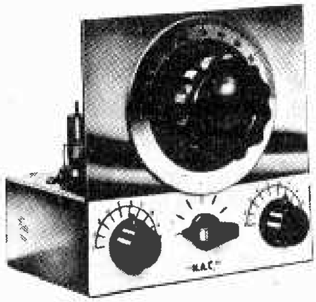

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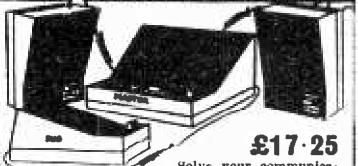

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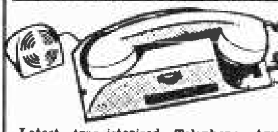
Solve your communication problems with this 4-Station **Transistor Intercom** system (1 **master** and 3 **Subs**), in robust plastic cabinets for desk or wall mounting. Call/talk/listen from **Master** to **Subs** and **Subs** to **Master**. Ideally suitable for Business, Surgery, Schools, Hospitals and Office. Operates on one 9V battery. On/off switch. Volume control Complete with 3 connecting wires each 66ft. and other accessories. P. & P. 75p.

MAINS INTERCOM NEW MODEL

No batteries—no wires. Just plug in the mains for instant two-way, loud and clear communication. On off switch and volume control. **Price £31·24** per pair P. & P. 75p.

NEW! AMERICAN TYPE CRADLE

TELEPHONE AMPLIFIER



ONLY **£12·95** + VAT £1·04

Latest transistorised Telephone Amplifier with detached plug-in speaker. Placing the receiver on to the cradle activates a switch for immediate two-way conversation without holding the handset. Many people can listen at a time. Increase efficiency in office, shop, workshop. Perfect for "conference" calls: leaves the user's hands free to make notes, consult files. No long waiting, saves time with long-distance calls. On/Off switch, volume. Direct tape recording model at £13·95 + VAT £1·12 P. & P. 70p, 10-day price refund guarantee.

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POLYESTER CAPACITORS: Axial lead type. (Values are in µf).
400V: 0·001, 0·0012, 0·0015, 0·0018, 0·0022, 0·0033 5p; 0·0047, 0·0068, 0·01, 0·015, 0·022 6p; 0·033, 0·047, 0·068 8p; 0·1, 0·15, 0·22, 10p; 0·33, 0·47, 18p.
160V: 0·1, 0·15 4p; 0·22 5p; 0·33 6p; 0·47 10p; 0·68 15p; 1·0 18p; 1·5 20p; 2·2 24p; 4·7 28p
DUBILIER: 1000V: 0·01, 14p; 0·022, 15p; 0·047, 16p; 0·1, 19p; 0·47 43p.

POLYESTER RADIAL LEAD P.C. TYPE (Values are in µf).
250V: 0·01, 0·015, 0·022 5p; 0·033, 0·047, 0·068, 0·1 6p; 0·15 7p; 0·22, 0·33 9p; 0·47 10p; 0·68 14p; 1·0 19p; 1·5 24p; 2·2 28p.

FEED THROUGH CAPACITORS
1000pF/350V 8p

ELECTROLYTIC CAPACITORS: Axial lead type (Values are in µF).
250V: 100µF, 40p; **100V**: 20, 6p; **63V**: 0·47, 1·0, 1·5, 2·2, 2·5, 3·3, 4·7, 6·8, 8, 10, 15, 22, 6p; 32, 47, 68, 10p; 100, 12p; **50V**: 1·0, 6p; 220, 15p; 1000, 42p; **40V**: 33, 100, 8p; 470, 22p; 2200 40p; **35V**: 1000, 38p; **30V**: 3500, 41p; **25V**: 8, 10, 22, 40 6p; 80, 100, 160 8p; 220, 13p; 470, 17p; 640, 21p; 1000, 27p; 2200, 34p; 3000, 39p; 4700, 47p; **16V**: 10, 40, 125, 250, 6p; 470, 11p; 1000, 1500, 18p; 4700, 46p; **10V**: 4, 100, 6p; 640, 10p; 1000, 14p; 2200, 18p. **TAG-END TYPE**: **70V**: 2500, 98p; 4700, 111p; **50V**: 2000, 72p; **25V**: 4700, 48p; **16V**: 4700, 36p.

TANTALUM BEAD CAPACITORS
35V: 0·1µF, 0·22, 0·33, 0·47, 0·68, 1·0, 2·2µF, 3·3, 4·7, 6·8. **25V**: 1·5, 10 **16V**: 10µF, 22. **10V**: 15µF, 33. **6V**: 47µF. **3V**: 100µF.
Price: 11p each.

MYLAR FILM CAPACITORS

100V: 0·001, 0·002, 0·005, 0·01µF	4p
0·015, 0·02, 0·04, 0·05µF, 0·1µF	5p
0·15, 0·2 50V: 0·47µF	6p

CERAMIC CAPACITORS
50V d.c. Plaquette body 25mm leads.

Range: 0·5pF to 10,000pF	3p
0·015µf, 0·022µf, 0·033µf, 0·047µf	4p

POTENTIOMETERS (AB or EGEN)
Carbon Track, 0·25W Log & 0·5W Linear values

1KΩ (LIN. ONLY) Single gang	17p
5KΩ–2MΩ single gang	17p
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SLIDER POTENTIOMETERS
0·25W log and linear values 60mm

5KΩ–500KΩ single gang	40p
10KΩ–500KΩ Dual gang	52p
50KΩ Lin 150mm WS 150	£3·00

PRESET POTENTIOMETERS

0·1W 50Ω–2·5MΩ Sub Min Vert. only	6p
0·25W 100Ω–3·3MΩ Horizontal	7p
0·25W 200Ω–4·7MΩ Vertical	7p

JACKSONS VARIABLE CAPS.

Dielectric	
100/300pF	86p
500pF	95p
'D' 2 speed Drive unit complete with knobs & coupling	322p
6:1 Ball Drive 4511/DAF	97p
Drum 54mm	30p
0-1-365pF	240p
00 2 365pF	240p
00 208/176	240p
,, with slow motion drv.	260p
C804 5, 10, 15, 20, 25 50pF	120p
100, 150pF	195p
'L' 3x310pF	372p
00-3x25pF	323p

RESISTORS—Erie make

Carbon, Miniature, High Stability, Low Noise

POWER	Tol.	RANGE	Val.	1–99	100+
0·25W	5%	2·2Ω–4·7M	E24	1p	0·8p
0·5W	5%	2·2Ω–4·7M	E12	1p	0·8p
1W	5%	2·2Ω–10M	E12	3p	2p

100 off price per value not mixed.

CERAMIC TRIMMER CAPACITORS
2–7pF; 4–15pF; 6–25pF; 8–30pF 17p each

MINIATURE

3–10pF; 3–30pF; 10–40pF	15p
60pf	34p

COMPRESSION TRIMMERS

3–40pF	18p
20–250pF	27p
100–500pF	32p
1250pf	45p

SILVER MICA
4·7, 6·8, 12, 18, 22, 33, 50, 82, 85, 100, 120, 150, 250pF 330pF 7p each

HEAT SINKS*

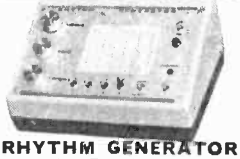
TO5/5F	8p
TO18/18F	8p
TO66/TV2	15p
TO3/TV3	15p
Insulation Kit (Mica & 2 washers)	6p

DIL SOCKETS*
Low profile

8 or 14 pin	13p
16 pin	14p
24 pin	36p
26 pin	58p

SOLDERCON PINS*

100 pins	65p



RHYTHM GENERATOR

Build this PW (May & June '76) Easy build Low cost Rhythm Generator. We are the sole suppliers of the complete Kit including the Case, predrilled printed front Panel and the three Fibre-glass P.C. Boards. Price *including* VAT
Complete Kit **£41·85**
(p.&p. and insur. £1·00)
Ready Built **£48·85** (available in limited quantity)
P&P 1·00
Send SAE for complete list. (Demonstration on at our retail shop)

DENCO COILS
Dual Purpose 'DP'

Rng. 1-5 B,Y,R,W	69p
6-7 B,Y,R	60p
1-5 Green	74p
Transistor Tuning coils 'T' Type	
Rng. 1-5 B,Y,R,W	78p
RFC 5 choke	76p
IFT 13/14/15/16/17	70p
IFT18/465 or 1·6m	80p
TOC 1	75p
MW 5F.R.	72p
MW/LW 5FR	94p

ALUM. BOXES with lid*

2¾x5¼x1½"	46p
4x4x1½"	46p
4x2¾x1½"	46p
4x5¼x1½"	58p
4x2¼x2"	46p
3x2x1"	40p
6x4x2"	78p
7x5x2½"	84p
8x6x3"	106p
10x7x3"	122p
10x4½x3"	110p
12x5x3"	120p
12x8x3"	180p

EARPHONES

Magnetic	
2·5mm plug	15p
3·5mm plug	15p
Crystal	
3·5mm plug	30p

SPEAKERS

8 0·3W	
2½"; 2¾"; 3"	56p
64 2½"	60p

DALO ETCH RESIST PEN* only 76p

COPPER CLAD SRBP LAMINATE*

Single Sided 8¾x9½"	48p
Double Sided 4¾x7"	35p

FIBREGLASS BOARD*

Single Sided 6x6"	64p
Single Sided 12x6"	115p

FERRIC CHLORIDE*
1lb Bag* 65p+ 30p (p & p)

VEROBOARD* Pitch

	0·1	0·15	0·15
	(copper clad)		(plain)
2½ x 3¾"	32p	24p	15p
2½ x 5"	35p	35p	20p
3¾ x 3¾"	35p	35p	—
3¾ x 5"	40p	41p	29p
2½ x 17"	105p	73p	60p
3¾ x 17"	145p	115p	75p
4¾ x 17"	185p	—	110p
Pkt of 36 pins			22p
Spot face cutter			52p
Pin insertion tool			72p

TRANSISTORS

	p
AC125*	28
AC126*	14
AC127*	14
AC128*	14
AC141*	24
AC142*	25
AC176*	14
AC187*	14
AC188*	15
ACY17	35
ACY18	28
ACY19	25
ACY20	24
ACY21	29
ACY22	16
ACY39	78
AD140*	48
AD149*	48
AD161*	35
AD162*	35
Mtch.pr.*	80
AF114*	18
AF115*	18
AF116*	18
AF117*	18
AF121*	33
AF124*	30
AF125*	30
AF126*	30
AF127*	30
AF139*	33
AF178	49
AF179	59
AF180	55
AF181*	48
AF185	60
AF186	48
AF239*	34
ASY26	31
ASY29	40
ASY50	17
BC107*	9
BC108*	9
BC108B*	12
BC108C*	12
BC109*	9
BC109B*	12
BC109C*	12
BC117	20
BC147	7

	p
BC148	7
BC149	9
BC154	20
BC157	10
BC158	12
BC159	13
BC167	12
BC168	12
BC169C	12
BC170	11
BC171	11
BC172	11
BC177*	16
BC178*	16
BC179*	20
BC182	11
BC182L	12
BC183	10
BC183L	11
BC184	11
BC184L	12
BC186	22
BC187*	28
BC212	12
BC212L	13
BC213	11
BC213L	13
BC214	14
BC214L	16
BC441*	30
BC461*	40
BC462*	30
BCY42	28
BCY43	28
BCY58	18
BCY59	18
BCY70*	18
BCY71*	18
BCY72*	18
BD115*	52
BD121*	115
BD123*	95
BD124*	75
BD131*	40
BD132*	40
Mtch.pr.*	85
BD135*	55
BD136*	50
BD137*	45
BD138*	45

BD139*	45
BD140	60
BD145*	55
BDY60	75
BDY61	65
BF115*	22
BF177	26
BF178*	28
BF179*	33
BF180	33
BF181	33
BF184	32
BF185	30
BF194	10
BF195	10
BF196	14
BF197	15
BF224A	12
BF244	17
BF256*	32
BF257*	32
BF258*	35
BF595	18
BFR39	30p
BFR40	30
BFR79	30
BFR80	30
BFX85*	25
BFX86*	24
BFX88*	22
BFY50*	15
BFY51*	15
BFY52*	15
BSX20*	20
BSY95A	14
MJ491	160
MJE370*	68
MJE371*	80
MJE520	65
MJE2955*	95
MJE3055*	65
MPF102	30
MPF103	30
MPF104	30
MPF105	30
MPSA06	30
MPSA56	30
MPSA70	32
OC23*	144
OC25*	48
OC26*	48
OC28*	58

OC29*	58
OC35*	54
OC36*	58
OC41	18
OC42	18
OC44	18
OC45	18
OC70	17
OC71	17
OC74	28
OC76	37
OC81	18
OC81D	24
OC82	18
OC83	28
OC139	94
OC140	100
OC141	157
OC170	30
OC171	32
OC201*	80
OC202*	90
TIC44*	30
TIP29	43
TIP29A	45
TIP29C	68
TIP30	52
TIP30A	54
TIP30B	64
TIP30C	76
TIP31*	54
TIP31A*	58
TIP31B*	70
TIP31C*	84
TIP32*	64
TIP32A*	68
TIP32B*	80
TIP32C*	99
TIP33*	95
TIP33B*	112
TIP33C*	130
TIP34*	110
TIP34A*	115
TIP34B*	167
TIP35*	259
TIP36A*	370
TIP41A*	68
TIP41B*	73
TIP42A*	78
TIP42B*	79
TIP2955*	65
TIP3055*	60

TIS43	25
TIS44	18
ZTX107	12
ZTX108	12
ZTX109	13
ZTX300	14
ZTX301	14
ZTX302	18
ZTX303	15
ZTX304	24
ZTX311	10
ZTX341	19
ZTX500	16
ZTX501	13
ZTX502	18
ZTX503	14
ZTX504	47
ZTX531	28
ZTX550	18
2N697*	13
2N698*	30
2N706*	12
2N708*	15
2N918*	40
2N920*	51
2N930*	18
2N1131	18
2N1132	18
2N1301*	20
2N1302*	17
2N1303*	20
2N1304*	24
2N1305*	28
2N1306*	28
2N1307*	28
2N1308*	35
2N1893*	30
2N1990*	48
2N2160*	55
2N2217*	23
2N2218A	20
2N2219A*	22
2N2220A*	18
2N2221A*	21
2N2222*	20
2N2303*	30
2N2369*	14
2N2483*	30
2N2484*	30
2N2846	38
2N2904*	20
2N2904A*	24

2N2906*
2N2907*
2N2907A
2N2926G
2N29260
2N2926R
2N2926Y
2N3011
2N3053*
2N3054*
2N3055*
2N3614*
2N3615*
2N3702
2N3703
2N3704
2N3705
2N3706
2N3707
2N3708
2N3709
2N3710
2N3711
2N3771*
2N3772*
2N3773*
2N3819
2N3820
2N3823
2N3824
2N3866*
2N3903
2N3904
2N3905
2N3906
2N4037
2N4058
2N4061
2N4062
2N4871
2N4922
2N5457
2N5458
2N5459
2N6027*
3N140*
3N141*
40361*
40362*
40430
40603*
40673*

CMOS*

4000AE	16p
4001AE	16p
4002AE	16p
4006AE	77p
4007AE	16p
4009AE	65p
4010AE	44p
4011AE	16p
4012AE	16p
4013AE	44p
4015AE	81p
4016AE	44p
4017AE	71p
4018AE	71p
4019AE	44p
4020AE	90p
4021AE	81p
4022AE	78p
4023AE	16p
4024AE	64p
4025AE	17p
4026AE	138p
4028AE	74p
4029AE	94p
4030AE	45p
4033AE	111p
4034AE	134p
4040AE	88p
4042AE	67p
4043AE	81p
4044AE	75p
4045AE	111p
4046AE	109p
4047AE	74p
4049AE	44p
4050AE	44p
4055AE	106p
4056AE	106p
4069AE	16p
4070AE	16p
4510AE	124p
4511AE	191p
4518AE	100p
4520AE	99p

LINEAR IC'S

709C 14 pin	29p
710	43p
741C	20p
747C	70p
748C	28p
AY-1-0212	550p
AY-1-5051	120p
AY-5-1224*	349p
AY-1-67216	175p
AY-5-3500*	610p
AY-5-3507*	610p
AY-5-4007*	735p
CA3018	72p
CA3020	145p
CA3028	90p
CA3046	59p
CA3048	210p
CA3075	150p
CA3081	150p
CA3089E	150p
CA3090AQ	250p
CA3123E	140p
ICL8038CC*	270p
LM300H	170p
LM301AM	38p
LM380	90p
LM381	160p
LM3900	65p
M252AA	750p
MC1303L	148p
MC1304P	360p
MC1310P	180p
MC1312PQ	150p
MC1458P	70p
MC1710CG	55p
MFC4000B	48p
MFC6040*	86p
MK50253*	550p
NE555*	45p
NE556DB*	99p
NE561*	325p
NE562B*	270p
NE565A*	200p
NE566*	150p
NE587V*	200p

SL403D
SL414A
SN72702
SN76033
SN76115
TAA550B
TAD100
TBA540Q
TBA800
TBA810S
TBA920Q
TDA2020
TCA270SQ
ZN414

REGULATOR

723C DIL
723C(TO5)
5V 1A(TO3)
12V 1A(TO3)
18V 1A(TO3)
MVR12(TO3)
TBA625B

TTL 74* Less 5% for 15 + mxd
Less 10% for 25 + mxd
DIGITAL ICs

7400	13p
7401	13p
7402	14p
7403	15p
7404	18p
7405	18p
7406	38p
7407	38p
7408	15p
7409	15p
7410	13p
7412	20p
7413	35p
7414	60p
7416	35p
7417	35p
7420	15p
7422	27p
7423	22p
7425	27p
7426	27p
7427	27p
7428	38p
7430	15p
7432	25p
7433	36p
7437	27p
7438	27p
7440	15p
7441	65p
7442	65p
7443	120p
7444	105p
7445	88p
7446	105p
7447	80p
7448	70p
7450	15p
7451	15p
7453	15p
7454	15p
7460	15p
7470	30p
7472	26p
7473	33p
7474	32p
7475	32p
7476	32p
7480	44p
7481	99p
7482	75p
7483	83p
7484	90p
7485	125p
7486	35p
7489	275p
7490	40p
7491	80p
7492	48p
7493	39p
7494	80p
7495	63p
7496	72p
74100	135p
74104	40p
74105	40p
74107	33p
74109	54p
74110	43p
74111	63p
74116	170p
74118	100p
74119	160p
74120	93p
74121	30p
74122	45p
74123	63p
74125	54p
74126	54p
74128	70p
74132	70p
74141	83p
74142	266p
74143	274p
74144	274p
74145	88p
74147	233p
74148	170p
74150	143p
74151	69p
74153	70p
74154	150p
74155	70p
74156	70p
74157	80p
74159	196p
74160	101p
74161	101p
74162	101p
74163	101p
74164	132p
74165	132p
74166	140p
74167	315p
74170	215p
74172	540p
74173	153p
74174	118p
74175	92p
74176	103p
74177	101p
74178	142p
74179	142p
74180	106p
74181	301p
74182	83p
74184	160p
74185	168p
74186	950p
74188	494p
74190	160p
74191	160p
74192	125p
74193	125p
74194	125p
74195	79p
74196	103p
74197	103p
74198	210p
74199	210p

DIODES

AA119	11p
AA120	10p
BA100	10p
BY126	12p
BY127	12p
OA5	39p
OA9	9p
OA10	40p
OA47	8p
OA70	8p
OA79	10p
OA81	8p
OA85	10p
OA90	6p
OA91	6p
OA95	8p
OA200	9p
OA202	6p
PL4001	6p
PL4004	8p
PL4006	12p
IN914	4p
IN4001/2	5p
IN4003	6p
IN4004/5	6p
IN4006/7	7p
IN4148	5p
IS920	7p
IS921	7p

BRIDGE RECTIFIERS (plastic case)

1A50V	20p
1A100V	24p
1A200V	26p
1A400V	27p
1A600V	29p
2A50V	30p
2A100V	38p
2A200V	44p
2A400V	48p
2A600V	54p
4A100V	53p
4A400V	60p
4A800V	90p
6A100V	64p
6A400V*	80p
BY122	54p
BY164	54p

ZENERS
Rng: 3·3V–33V

400mW	9p
1·3W	17p

VARICAPS

MVAM1	270p
MVAM2	105p

SMOKE* DETECTOR

TGS209	200p

SCR's* Thyristor

1A50V
1A100V
1A200V
1A400V
1A600V
3A50V
3A100V
3A200V
3A400V
3A600V
5A400V
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SPST on/off 40p
DPDT 6 tag 64p
DPDT Centre off 80p

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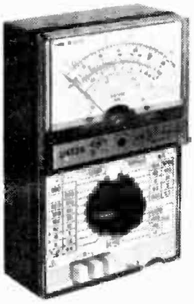

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CHROMASONIC electronics

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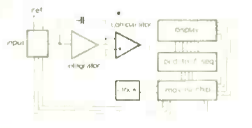
3½ DECADE DVM I.C.



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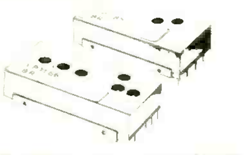

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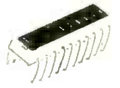
PHOTO-DARLINGTON

Vceo	25v	2N5777
Vcbo	25v	
Vebo	8v	
I1	250 mA	
Pd	200 mW	
Hfe	2500	

35p.

LINE-O-LIGHT



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7403	15p*	12½p*	10p *
7404	16p*	13p *	11p *
7408	16p*	13p*	11p *
7409	16p*	13p*	11p *
7410	16p*	13p*	11p *
7413	29p*	24p*	20p *
7417	27p*	22½p*	20p *
7420	16p*	13p*	11p *
7427	27p*	22½p*	18p *
7430	16p*	13p *	11p *
7432	27p*	22½p*	18p *
7437	27p*	22½p*	18p *
7441	75p*	62p*	50p *
7442	65p*	55p*	43p *
7445	85p*	71p*	57p *
7447	81p*	75p*	65p *
7448	75p*	62p*	50p *
7447A	95p*	83p*	67p *
7470	30p*	25p*	20p *
7472	25p*	21p*	17p *
7473	30p*	25p*	20p *
7474	32p*	26p*	21p *
7475	47p*	39p*	31p *
7476	32p*	26p*	21p *
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7485	£1.30 *	£1.09 *	87p *
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7491	65p*	55p*	45p *
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7493	45p*	40p*	32p *
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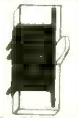

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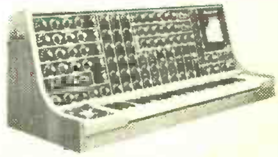

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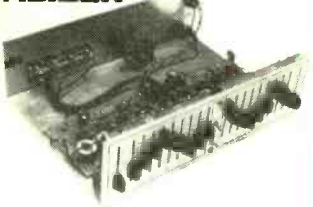

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