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JANUARY
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VOL. 51 NO. 9

ISSUE 827

JANUARY 1976

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

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BACK NUMBERS

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

● NEWS & COMMENT

- 743, 758 NEWS . . . NEWS . . . NEWS . . .
- 754 TELEVISION—What's in the January issue
- 767 NEXT MONTH IN PRACTICAL WIRELESS
- 780 PRODUCTION LINES—product reports—*Colin Riches*
- 787 ON THE AIR
- 787 Amateur Bands—*Eric Dowdeswell, G4AR*
- 788 Broadcast Bands, SW—*Derek Bell*
- 789 Broadcast Bands, MW—*Charles Molloy*
- 790 HOTLINES on recent developments—*Ginsberg*
- 793 CQ! CQ! CQ! CQ! CQ!

● CONSTRUCTIONAL

- 744 EMERGENCY LIGHT UNIT—*Alan Ainslie*
- 748 IC REV COUNTER—*J. B. Dance, M.Sc.*
- 757 TAKE 20, No. 73—Touch Switch—*David Andrews*
- 768 P.W. 'EASYBUILD' MUSIC BOX—*M. J. Hughes, M.A., C.Eng., MIERE*
- 782 P.W. 'EASYBUILD' STEREO DISCO SYSTEM, Part 2—*A. C. Ainslie & C. Toms*

● OTHER FEATURES

- 753 SPECIAL PRODUCT REPORT—RT-VC Viscount IV Stereo Amplifier
- 761 IC OF THE MONTH—No. 55—SGS-ATES Audio Power Amplifiers
- 766 GOING BACK, Wireless of yesteryear—*Colin Riches*
- 773 WANT SOME LOLLY?—How about writing for Practical Wireless?

PCB SERVICE — ANNOUNCEMENT — Page 742

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RTVC

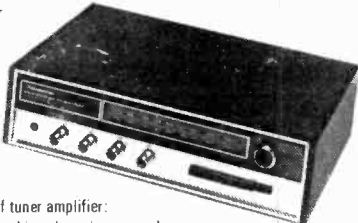
FOR SPEAKERS AT FANTASTIC REDUCTIONS

ELIZABETHAN STEREO TUNER AMPLIFIER

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

Technical Specifications
15 transistors, 11 diodes, integrated circuit.

Power output 8 watts. Size of tuner amplifier: 4" x 10" x 15 1/2" approx. Finished in selected rosewood veneer with brushed aluminium front panel and matching controls.



£29.00
+p & p £1.50

STEREO CASSETTE TAPE DECK

This compact stereo cassette deck is designed to link up with your stereo system. It incorporates features normally found in machines costing far more, these include large illuminated recording level meters, slider level controls, Chromium Dioxide (CrO₂) selector switch, pause control, and autostop, tape/digit counter, Din or Phono connections, twin mic. inputs and outputs for your stereo headphones.

Technical Specifications - Input level Mic - 65dB into 10KΩ. Line in - 20dB into 1MΩ. DIN - 47dB into 100KΩ. Output levels Line out - 500mV 10KΩ. OIN - 500mV 10KΩ. Frequency response - Normal 50-10KHz, Chrome 50-14KHz, Signal noise ratio - better than 40dB.



£35.00
+p & p £1.50

THE 'COMPACT'

EASY BUILD SPEAKER KIT

A compact bookshelf speaker system giving a high electro acoustic efficiency for the low powered amplifier.

The professional finish can be obtained with the minimum of tools, the infinite baffle type enclosures come ready mitred and professionally finished, simply apply glue, fold up around baffle board, and fix together with masking tape till glue dries.

The cabinet measures 12"x9"x5" deep approx finished in simulated teak, incorporating a quality 7"x4" elliptical speaker, power handling 4 watts, flux density 30,000 maxwells, impedance 8-15 ohms nominal, voice coil dia 3/4" magnet size 2 1/2" approx.



£6.00
pair inclusive. P & P £1.70

EASY TO BUILD SPEAKER KITS

These superb simulated teak-finished speaker kits have been specially designed by RT-VC for the cost-conscious hi-fi enthusiast who wants top quality speakers but doesn't want to spend the earth. Built to EMI's exacting specification, these new RT-VC speaker kits (350 type kit) incorporate 13" x 8" woofer, 3 1/4" tweeter and matching crossover.

Easily put together with just a few basic tools.
Specification (each speaker): Impedance 8 ohms. Power handling 15 watts RMS (30 watts peak). Response 20-20,000 Hz. Size 20" x 11" x 9 1/2" approx. Comparable built units (EMI LE3) sold elsewhere for over £45 pair.

£22.00 pair complete +£5.20 p & p.

Complete with crossover Components and circuit diagram



RTVC*

VISCOUNT IV STEREO SYSTEM

System 1a. **£69.00**

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

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

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

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

CONTROLS: Push button ON/OFF, stereo/mono, scratch filter, 6 position rotary selector. Individual rotary controls for treble, bass, balance and volume. Headphone socket, tape out socket, Aux. mains output. Frequency response: 25 Hz to 25 KHz @ full rated output. **Signal to noise ratio:** better than -50 dB on all inputs. **Tone control range:** Bass ±15 dB @ 50 Hz; Treble ±12 dB @ 10 KHz. Power requirements: 200-250V A.C. mains @ 60 watts. Approx. size: 15 1/4" x 3" x 10".

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

Two Duo Type IIa matched speakers - enclosure size approx. 19 1/2" x 10 1/2" x 7 1/4" 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 11 1/2". 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** +£6.50 p & p.

PRICES: SYSTEM 2
Viscount IV R103 amplifier £27.50 +£1.90 p & p
2 Duo Type III speakers £46.00 +£7.50 p & p
MP60 type deck with Mag. cartridge de luxe plinth and cover £22.00 +£3.30 p & p
Total if purchased separately: £95.50
Available complete for only **£85.00** +£7.60 p & p.

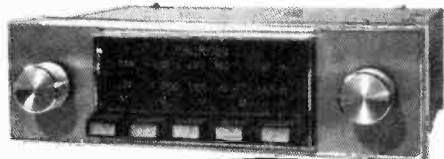


NEW!

20x20 SYSTEM

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System 1a £1.75 System 2 £3.50

PUSH BUTTON CAR RADIO KIT— THE TOURIST TT*



NO SOLDERING REQUIRED

NOW BUILD YOUR OWN PUSH BUTTON CAR RADIO

Easy to assemble construction kit comprising fully completed and tested printed circuit board on which no soldering is required. All connections are simple push fit type making for easy assembly. Fine tuning push button mechanism is fully built and tested to mate with printed circuit board.

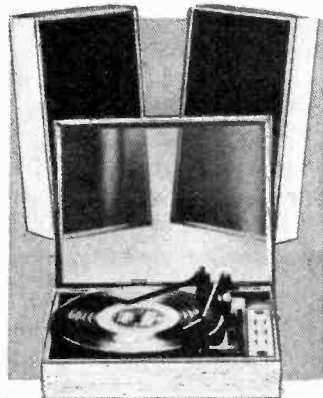
TECHNICAL SPECIFICATION: (1) Output 4 watts RMS output. For 12 volt operation on negative or positive earth. (2) Integrated circuit output stage, pre-built three stage IF Module.

Controls volume manual tuning and five push buttons for station selection, illuminated tuning scale covering full, medium and long wave bands.

Size chassis 7" wide 2" high and 4 1/2" deep approx. **£9.50** +£1.05 p & p. Speaker including baffle and fixing strip **£2.00** +45p p & p. Car Aerial Recommended — fully retractable **£1.60** +40p p & p.

The Tourist I Kit for the experienced constructor. If you can solder on a printed circuit board you can build this model. Same technical specification as Tourist TT. **Price £8.20** +£1.05 p & p.

*STEREO 21 QUALITY SOUND FOR LESS THAN £24.00



Stereo 21, easy to assemble audio system kit. No soldering required.

The unit is finished in white P.V.C. and the acrylic top presents an unusually interesting variation on the modern deck plinth. Includes — BSR 3 speed deck, automatic, manual facilities together with stereo cartridge.

Two speakers with cabinets.

Amplifier module. Ready built with control panel, speaker leads and full, easy to follow assembly instructions.

Specifications — For the technically minded:

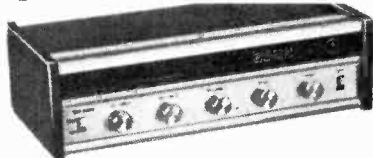
Input sensitivity 600mV. Aux. input sensitivity 120mV. Power output 2.7 watts per channel. Output impedance 8—15 ohms. Stereo headphone socket with automatic speaker cutout. Provision for auxiliary inputs — radio, tape, etc., and outputs for taping discs.

Overall Dimensions. Speakers approx 15 1/2" x 8" x 4". Complete deck and cover in closed position approx 15 1/2" x 12" x 6".

Complete only £23.20 +£3.00 p & p.

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

*DISCO AMPLIFIER



Reliant Mk IV Mono Amplifier, ideal for the small disco or house parties. Output 20 watts RMS into 8 ohms (suitable for 15 ohms).

Inputs * 4 electrically mixed inputs. * 3 individual mixing controls. * Separate bass and treble controls common to all 4 inputs. * Mixer employing F.E.T. (Field Effect Transistors). * Solid State circuitry. * Attractive styling.

INPUT SENSITIVITIES — Input — 1). Crystal mic, guitar or moving coil mic, 2 and 10mV. (Selector switch for desired sensitivity.) — Inputs — 2), 3), 4). Medium output equipment — ceramic cartridge, tuner, tape recorder, organs, etc. — all 250mV sensitivity. AC Mains, 240V operation. Size approx: 12 1/2" x 6" x 3 1/2".

£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.

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

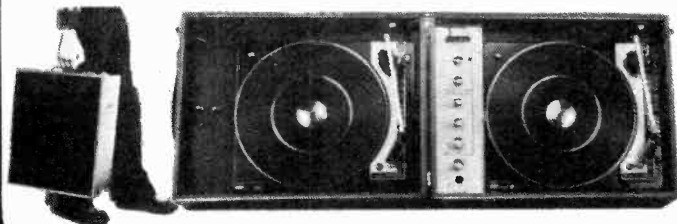
BUILD YOUR OWN STEREO AMPLIFIER*



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

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

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. MP6D 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 — 17 1/2" x 13 1/2" x 8 1/2" (app.)
Unit Open — 35 1/2" x 13 1/2" x 4 1/2" (app.)
This disco console is ideally matched for the Reliant IV and Disco 50 or any other quality amplifier.

The unit is finished in black PVC with contrasting simulated teak edging, diamond spun control knobs with matching control panel.

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

All prices include VAT at current rates



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- 7252** Tunerset. 1uV for 26db S/N; .1% THD, with varicap tuning, full scan/lock facility. £24.
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- 7500** Teak cabinet and chassis/front panel for our various am/fm tuner modules and kits. With provision for 3 meters, long slider, 6 preset unit, 5 push button switches, LED etc. £10.00 (carriage £2.50 extra.)
- 7501** The International (see ETI Sept 75) FM tuner. Complete kit & cabinet. £40.00.
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PCF802	40.0
PCL82	39.0
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PCL86	41.0
PFL200	59.5
PL36	55.5
PL84	25.0
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AC154	18
AC155	18
AC156	20
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AC187	19
AC187K	24
AC188	17
AC188K	26
AD142	45
AD149	40
AD161	38
AD162	38
AF114	24
AF115	21
AF116	22
AF117	19
AF118	50
AF139	35
AF178	45
AF180	45
AF181	45
AF239	40
AF240	60
BC107	11
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BC132	25
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BC149	10
BC153	15
BC154	15
BC157	14
BC158	10
BC159	12
BC173	18
BC178B	20
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BC183L	12
BC187	25
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BC337	19
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BF178	20
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BF181	32
BF184	25
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BA148	19
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8Y199	27
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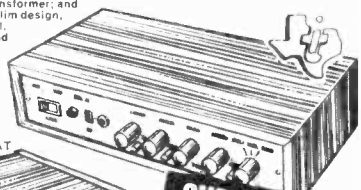
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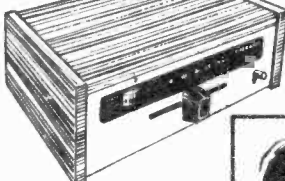
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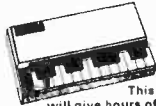
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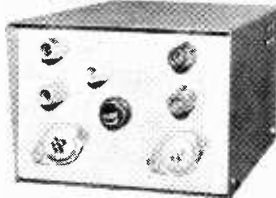
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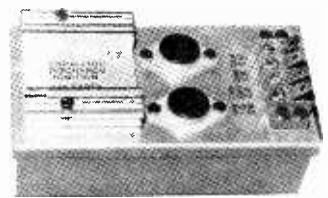
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0-5 mA	0-5 mA	200	200
0-10 mA	0-10 mA	6	6
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0-100 mA	0-100 mA	0.5	0.5
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VA (watts)	Ref. No.	Price Cased	Price Plugs 2 Pin + 1 Earth
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120	150	9.37	0.98
200	151	12.29	0.98
250	152	13.81	0.98
350	153	16.54	0.98
500	154	18.38	0.98
750	155	28.72	1.25
1000	156	37.44	1.25
1500	157	44.37	1.25
2000	158	52.45	2.95
3000	159	77.18	2.95

12 & 24 Volts Prim. 200-240V.

Amps	24V	Ref. No.	Price	Post
12V	0.15	242	1.88	0.34
0.5	0.25	111	1.80	0.46
1	0.5	213	1.90	0.61
2	1	71	2.47	0.61
4	2	18	3.07	0.62
6	3	70	4.50	0.72
8	4	108	5.11	0.85
10	5	72	5.83	0.85
12	6	116	5.90	0.85
16	8	17	7.28	0.97
20	10	115	10.98	1.18
30	15	187	14.06	1.36
40	20	232	15.83	0.84
60	30	226	17.70	0.84

30 Volts

Amps	Ref. No.	Price	Post
0.5	112	2.04	0.61
1	79	2.87	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

AUTO TRANSFORMERS

VA Watts	Ref. No.	Price Cased	Price Plugs 2 & 3 pin	Open	Post
Tapped at 115, 220, 240 Volts	20	113	4.31	0.25	1.88 0.61
Tapped at 115, 200, 220, 240 Volts	150	4	6.99	0.25	4.28 0.72
	200	65	7.87	0.25	5.21 0.78
	300	66	8.67	0.25	6.11 0.85
	500	67	11.82	0.25	9.48 1.18
	750	83	14.81	0.95	11.30 1.28
	1000	84	18.38	0.95	14.35 1.44
	1500	93	23.28	0.95	19.22 O.A.
	2000	95	35.07	1.80	25.49 O.A.
	3000	78	50.81	2.35	34.87 O.A.

50 Volts

Prim. 200-240V. Sec. 19, 25, 33, 40, 50V.

Amps	Ref. No.	Price £	Post £
0.5	102	2.71	0.61
1	103	3.58	0.76
2	104	5.30	0.85
3	105	6.10	0.85
4	106	7.97	1.08
6	107	12.93	1.18
8	118	13.75	1.44
10	119	17.79	1.86

60 Volts

Prim. 280-240V. Sec. 24, 30, 40, 48, 60V.

Amps	Ref. No.	Price £	Post £
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1	125	3.75	0.85
2	127	5.38	0.85
3	125	7.91	0.97
4	123	9.20	1.18
5	40	10.22	1.18
6	130	12.10	1.36
8	121	15.74	0.84
10	122	20.10	0.84
12	189	18.87	0.84

MINIATURE AND EQUIPMENT

Prim. 240V with screen.

Volts		Milliamps		Ref. No.	Price	Post
Sec. 1	Sec. 2	Sec. 1	Sec. 2			
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
0-9-0	—	100	—	13	1.50	0.34
0-9	0-9	330	330	235	1.82	0.34
0-8-9	0-8-9	500	500	207	1.69	0.46
0-8-9	0-8-9	1000	1000	208	2.79	0.46
15-0-15	—	40	—	240	1.55	0.34
0-15-0	0-15	200	200	236	1.55	0.34
20-0-20	—	30	—	241	1.55	0.34
0-20	0-20	150	150	237	1.56	0.34
0-15-20	0-15-20	500	500	205	2.88	0.58
0-20	0-20	300	300	214	2.03	0.61
0-20	—	3500	NO SCREEN	1116	3.45	0.97
0-12-0-12-20	—	700 (D/C)	—	321	2.50	0.61
0-15-20	0-15-20	1000	1000	206	2.55	0.72
0-15-27	0-15-27	500	500	203	3.12	0.58
0-15-27	0-15-27	1000	1000	204	4.55	0.72

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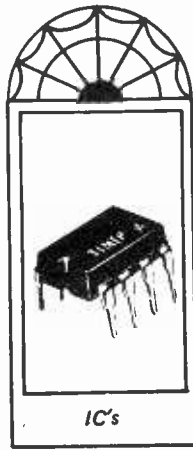
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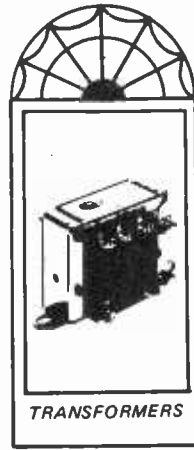
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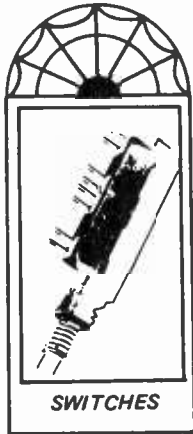


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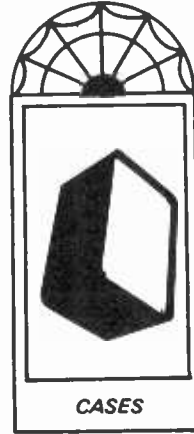
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U 5	80 200mA sub-min. silicon diodes	0-60
U 6	30 Sil. Planar trans. NPN like BSY95A, 2N706	0-60
U 7	18 Sil. rect. TOP-HAT 750mA VLTG. RANGE up to 100	0-60
U 8	50 Sil. planar diodes DO-7 glass 250mA like OA200/202	0-60
U 9	20 Mixed voltages, 1 Watt Zener Diodes	0-60
U10	20 BAY60 charge storage diodes DO-7 glass	0-60
U11	20 PNP Sil. planar trans. TO-5 like 2N1132, 2N2904	0-60
U13	30 PNP-NPN Sil. transistors OC290 & 28104	0-60
U14	160 Mixed silicon and germanium diodes	0-60
U15	20 NPN Sil. planar trans. TO-5 like 2N696, 2N697	0-60
U16	10 3Amp sil. rectifiers stud type up to 1000 PIV	0-60
U17	30 Germanium PNP AF transistors TO-5 like ACY 17-22	0-60
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U25	20 300 MHz NPN silicon transistors 2N708, BSY27	0-60
U26	30 Fast switching silicon diodes like IN914 Micro-Min	0-60
U29	10 1 Amp SCR's TO-5 can. up to 600 PIV CRS1/25-600	\$1-20*
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U34	30 Silicon PNP alloy trans. TO-5 BCY26 28302/4	0-60
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U36	20 Silicon planar NPN transistors TO-5 BSY50/51/52	0-60
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U49	12 NPN Sil. plastic power trans. 60W like 2N5294/0296	\$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.

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U.A.7818 18V	(Equiv. to MVR18V) \$1-25p

THYRISTORS

PIV	0-6A	0-8A	1A	3A	5A	5A	7A	10A	16A	30A
	TO15	TO92	TO5	TO66	TO66	TO64	TO48	TO48	TO48	TO48
10	0-13	0-15	—	—	—	—	—	—	—	—
20	0-15	0-18	—	—	—	—	—	—	—	—
30	0-19	0-22	—	—	—	—	—	—	—	—
50	0-22	0-28	0-30	0-35	0-38	0-38	0-48	0-51	0-54	\$1-18
100	0-26	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	\$1-18
300	—	—	0-30	0-39	0-55	0-57	0-62	0-71	0-77	\$1-79
400	—	—	0-39	0-48	0-69	0-69	0-78	0-89	0-90	—
600	—	—	0-58	0-65	0-81	0-81	0-92	\$1-22	\$1-39	\$4-07

DIODES

Type	Price	Type	Price	Type	Price		
AA119	0-08	BY101	0-12	BY216	0-41		
AA120	0-09	BY105	0-18	BY217	0-38		
AA129	0-08	BY114	0-18	BY218	0-26		
AA130	0-09	BY124	0-12	BY219	0-28		
AA213	0-10	BY126	0-15	CG82	0-20		
BA100	0-10	BY127	0-18	(OA91Eq) OA202	0-07		
BA116	0-21	BY128	0-16	CG851 (OA70)	0-06		
BA128	0-32	BY130	0-17	OA79	0-07		
BA148	0-15	BY133	0-21	OA5 Short	1N34	0-07	
BA154	0-12	BY164	0-51	Leads	0-21	1N34A	0-07
BA155	0-15	BYX38/300-43	0A10	0-14	1N914	0-08	
BA166	0-14	BYZ10	0-36	0A47	0-07	1N918	0-08
BA173	0-15	BYZ11	0-31	0A70	0-07	1N4148	0-06
BB104	0-15	BYZ12	0-31	0A79	0-07	18021	0-10
BY100	0-16	BYZ13	0-28	0A41	0-07	18951	0-70

QUALITY TESTED PAKS

Pak No.	Quality Tested Paks	Price
Q 1	20 Red spot transistors PNP	0-60
Q 2	16 White spot R.F. transistors PNP	0-60
Q 3	4 OC 77 type transistors	0-60
Q 4	6 Matched transistors OC44/45/81/81D	0-60
Q 5	4 OC 75 transistors	0-60
Q 6	5 OC 72 transistors	0-60
Q 7	4 AC 128 transistors PNP high gain	0-60
Q 8	4 AC 126 transistors PNP	0-60
Q 9	7 OC 81 type transistors	0-60
Q10	7 OC 71 type transistors	0-60
Q11	2 AC 127/128 Complementary pairs PNP/NPN	0-60
Q12	3 AF 116 type transistors	0-60
Q13	3 AF 117 type transistors	0-60
Q14	3 OC 171 H.F. type transistors	0-60
Q15	7 2N2926 Sil. Epoxy transistors mixed colours	0-60
Q17	5 NPN 2 x ST.141. & 3 x ST.140	0-60
Q18	4 MADT'S 2 x MAT 100 & 2 x MAT 120	0-60
Q19	3 MADT'S 2 x MAT 101 & 1 x MAT 121	0-60
Q20	4 OC 44 Germanium transistors A.F.	0-60
Q21	4 AC 127 NPN Germanium transistors	0-60
Q22	20 NKT transistors A.F. R.F. coded	0-60
Q23	10 OA 202 Silicon diodes sub-min	0-60
Q24	8 OA 81 diodes	0-60
Q25	16 IN 914 Silicon diodes 75PIV 75mA	0-60
Q26	8 OA95 Germanium diodes sub-min-1N69	0-60
Q27	2 10A 600 PIV Silicon rectifiers IS425B	0-60*
Q28	2 Silicon power rectifiers BYZ 13	0-60
Q29	4 Sil. transistors 2 x 2N696, 1 x 2N697, 1 x 2N698	0-60
Q30	7 Silicon switch transistors 2N708 NPN	0-60
Q31	6 Silicon switch transistors 2N708 NPN	0-60
Q32	3 PNP Sil. trans. 2 x 2N1131, 1 x 2N1132	0-60
Q33	3 Silicon NPN transistors 2N1711	0-60
Q34	7 Sil. NPN trans. 2N2989, 500MHz (code P397)	0-60
Q35	3 Silicon PNP TO-5 2 x 2N2904 & 1 x 2N2095	0-60
Q36	7 2N3948 TO-18 plastic 300 MHz NPN	0-60
Q37	3 2N3053 NPN Silicon transistors	0-60
Q38	5 PNP transistors 3 x 2N3703, 2 x 2N3702	0-60
Q39	5 NPN transistors 3 x 2N3704, 2 x 2N3705	0-60
Q40	5 NPN transistors 3 x 2N3707, 2 x 2N3708	0-60
Q41	3 Plastic NPN TO18 2N3904	0-60
Q43	5 BC 107 NPN transistors	0-60
Q44	5 NPN transistors 3 x BC108, 2 x BC109	0-60
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Q46	3 BC 115 NPN TO-5 transistors	0-60
Q47	4 NPN high gain transistors 2 x BC 157, 2 x BC 168	0-60
Q48	3 BCY 70 PNP transistors TO-18	0-60
Q49	3 NPN transistors 2 x BFY 51, 1 x BFY 52	0-60
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Q51	7 BSY 95A NPN transistors 300MHz	0-60
Q52	8 BY 100 type silicon rectifiers	\$1-20
Q53	25 Sil. & Germ. trans. mixed all marked new	\$1-50
Q54	6 TIL 209 Red LED	\$1-20*

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UIC03	12 x 7403	0-60	UIC75	8 x 7475	0-60
UIC04	12 x 7404	0-60	UIC76	8 x 7476	0-60
UIC05	12 x 7405	0-60	UIC77	8 x 7477	0-60
UIC06	8 x 7406	0-60	UIC78	8 x 7478	0-60
UIC07	8 x 7407	0-60	UIC79	5 x 7481	0-60
UIC10	12 x 7410	0-60	UIC82	5 x 7482	0-60
UIC13	8 x 7413	0-60	UIC83	5 x 7483	0-60
UIC20	12 x 7420	0-60	UIC86	5 x 7486	0-60
UIC40	12 x 7440	0-60	UIC90	5 x 7490	0-60
UIC41	5 x 7441	0-60	UIC91	5 x 7491	0-60
UIC42	5 x 7442	0-60	UIC92	5 x 7492	0-60
UIC43	5 x 7443	0-60	UIC93	5 x 7493	0-60
UIC44	5 x 7444	0-60	UIC94	5 x 7494	0-60
UIC45	5 x 7445	0-60	UIC95	5 x 7495	0-60
UIC46	5 x 7446	0-60	UIC96	5 x 7496	0-60
UIC47	5 x 7447	0-60	UIC100	5 x 74100	0-60
UIC48	5 x 7448	0-60	UIC121	5 x 74121	0-60
UIC50	12 x 7450	0-60	UIC141	5 x 74141	0-60
UIC51	12 x 7451	0-60	UIC151	5 x 74151	0-60
UIC53	12 x 7453	0-60	UIC154	5 x 74154	0-60
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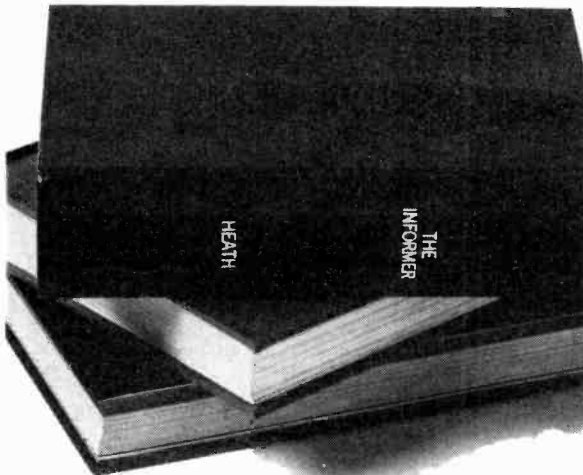
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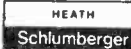
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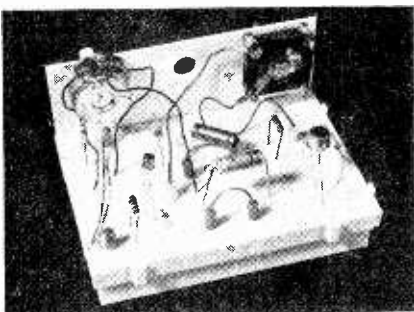
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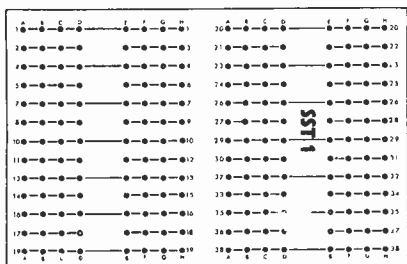
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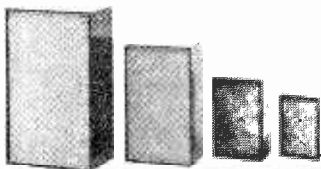
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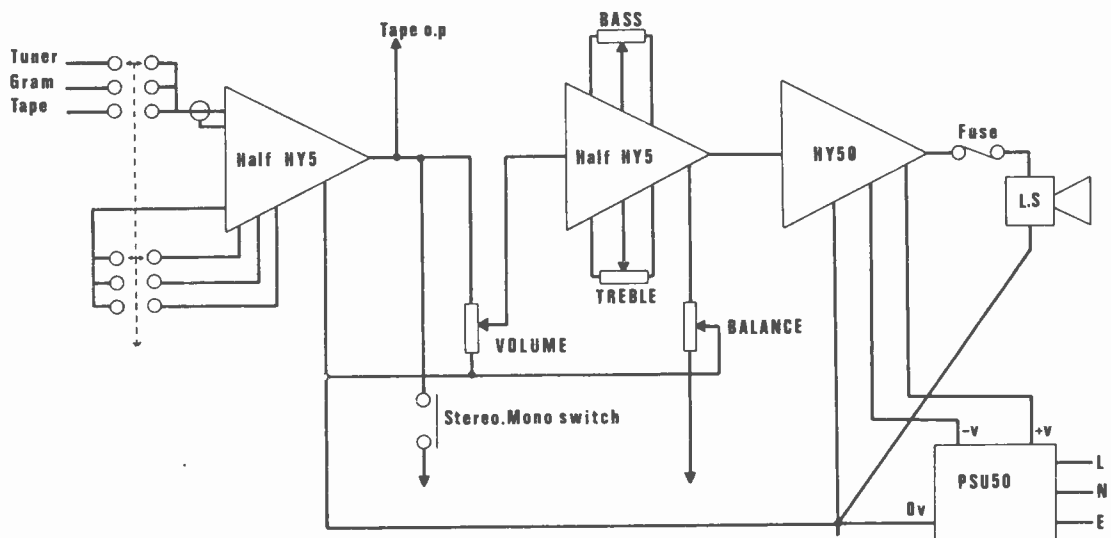
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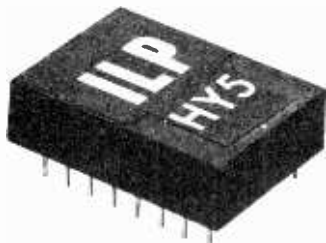


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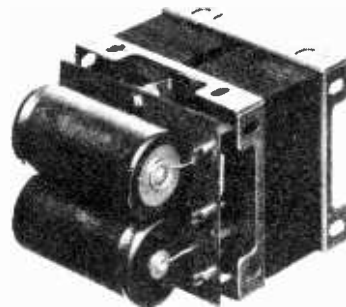


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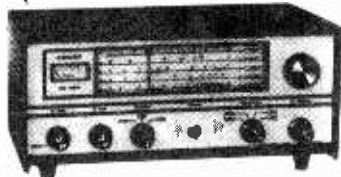
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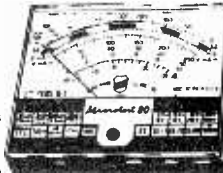
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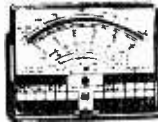
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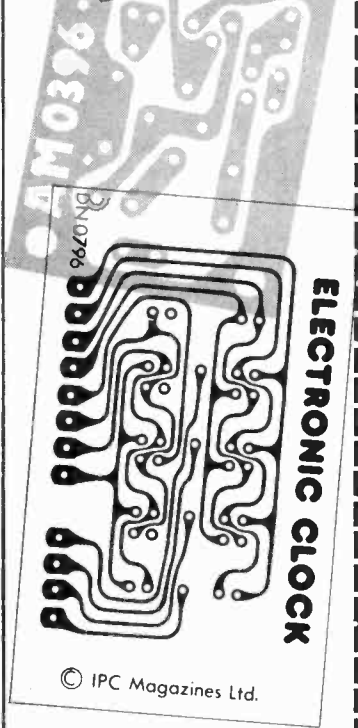
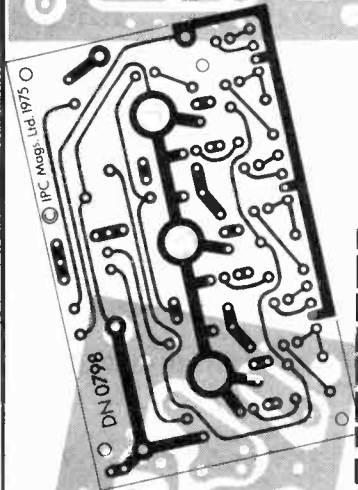
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As a result of continued requests from readers we are happy to announce the start of a printed circuit board service for projects published in Practical Wireless. A list of PCBs now available, plus ordering coupon, will be found below. The list will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



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Sinclair digital watch

THE watch is controlled by a quartz crystal and on command displays either hours and minutes or minutes and seconds, depending on the switch that is operated. The display is internally timed for one second or will stay on as long as the switch is closed. The two operating switches are located on the watch front beneath the LED display. There is a third switch on the rear which permits setting of the watch and holding of the time to which it has been set. Closing the read hours and minutes switch and then depressing the set switch will clock hours round at the rate of one per second and similarly depressing the minutes and seconds switch followed by the set switch will clock minutes round at one per second. Seconds are automatically reset to zero. Depressing the set switch only will stop the watch and hold the set time.

Sinclair guarantee an accuracy of better than one second per day and typically several times better than that will be obtained. The accuracy is fundamentally determined by the quartz crystal and the precision to which this is trimmed. The watch is powered by two small mercury cells and will give a life of typically one year dependent on the frequency with which the display is used.

The electronic circuitry to control the watch is all contained on a single integrated circuit which Sinclair Radionics have designed using injection logic technology. The chip requires only a quartz crystal, a trimmer capacitor, an LED display and batteries to complete the electrical line-up.

Three years ago, having spent a considerable time reviewing and analysing various technologies appropriate to electronic watches, Sinclair realised that the process which was gradually emerging from the research laboratories of Philips and IBM had both electrical parameters and cost potentials well-suited to a watch. The process is now known as PL and is capable of very low power consumption, having a speed power product of less than 1pJ, combined with an ability to supply



high peak currents without using excessively large output devices. The process is intrinsically capable of low voltage operation without needing tight parameter control.

A study carried out by the company showed that without recourse to fine geometries a chip area saving of 1.5:1 could be achieved compared with ion implanted CMOS devices and at

the same time both segment and digit drive components could be incorporated on the chip. With one exception presently available CMOS chips require separate bipolar digit drivers. The process required careful development with an able semiconductor company, but it had a good start as it was based on a well-established bipolar process with a considerable amount of knowledge already to hand. The development lay in optimising a different range of parameters.

Close analysis of chip size, slice processing cost and yield showed that the balance should weigh considerably in favour of the bipolar technology and therefore a major design programme was undertaken.

The whole design was carried out by Sinclair engineers to the extent of producing an actual circuit layout, which was diffused and refined in conjunction with ITT in England. During all stages of both circuit and process development, close contact was maintained between the two companies to ensure that circuit parameters married up to process requirements and vice versa.

Part Exchange Scheme

HENRY'S-LINDAIR hi-fi and audio retail group is operating a new Part Exchange Department.

The firm states that customers who bring their old equipment into any Henry's-Lindair store will be given a reasonable 'trade-in' allowance which they may then use against the purchase of new equipment from that particular store. The trade-in equipment will then be passed to the Service Department, if necessary, where it will be tested and overhauled. It will then be sold through one of the group's newly established Bargain Centres in Edgeware Road and Tottenham Court Road, London, with a three month guarantee.

**MORE NEWS... ON
PAGE 758**

Arrow Stock Sheet

AROW Electronics Ltd., recently sent us a copy of their latest stock sheet and price list. Included in it are their special low price specialities of COS-MOS logic devices and items ranging from a metal detector and S-Dec products to opto-electronic devices and jack plugs. A very useful list of available components and prices to have by the workbench.

If you would like a free copy of the Arrow list, send a stamped, self-addressed envelope to *Arrow Electronics Ltd., Mail Order Dept., P. W., 7 Coptfold Road, Brentwood, Essex, CM14 4BW.*

Aerialite

AERIALITE Aerials have transferred their sales, production and technical departments from Congleton in Cheshire, to Whitegate, Broadway, Chadderton, Oldham, Lancs, OL9 9QC. Telephone: 061-652 1111.

to sense the voltage drop across R1, which is about 2.5V when the cells are charging normally. Should a cell become open circuit or a fault develop in the charger circuit then the voltage drop across R1 will fall to zero and the LED will go out, as proposed in the above recommendation. In practice the LED must be arranged so as to be visible at all times, easily arranged by placing the LED behind, but close to, the diffuser giving a patch of red light during normal charging.

The 'mains-on' reference voltage is produced by D2 and D4 which give -6V from the transformer relative to the positive side of the battery when the mains is applied. The reference voltage is smoothed by C1, to prevent 100Hz triggering of the lamp, and fed to Tr2 base which biases this transistor off by making its base more negative than its emitter. However, when the mains fail C1 discharges into R3 and Tr2 is no longer cut off. Base current through R3 turns on the transistor which in turn turns on Tr1 by effectively connecting R2 between its base and the positive supply.

Transistor Tr1 is supplied with such heavy base current through R2 and Tr2 that it saturates and behaves as a simple diode of low voltage drop in series with the cells and the bulbs. In practice a saturation voltage of 650mV is typical, corresponding to a power dissipation in Tr1 of only 600mW. With Tr1 saturated the bulbs receive about 3.3V and pass a little under 1A if three 0.3A bulbs are used. Higher current bulbs should not be used in an effort to increase the light output as Tr1 will fail to saturate and will overheat. It is possible to use a lower current load (3x0.15A bulbs, for instance) which will lengthen the maximum discharge time for the unit.

The Emergency Light Unit is equipped with two fuses, one of 0.1A on the primary side of the mains transformer and one of 0.5A on the secondary, designed to offer protection against a fire hazard in the event of any components failing. Only the specified types should be used otherwise the unit may be dangerous under fault conditions.

Construction

There are two possible ways of constructing the Emergency Light Unit; either as a self-contained lamp or as a 'control box' driving a separate decorative lamp. In the latter case the PCB is constructed as will be described and housed in a suitable cabinet, with any metalwork connected to mains earth. The LED to indicate cell charging should be mounted on the front of the control box and a small socket provided for connection to the bulb(s), which can be concealed in an ornamental oil lamp or something similar.

Self-contained 'luminaires' are most popular commercially and this unit was primarily designed to be both self-contained and attractive in appearance. A rather pleasing case for the unit is available in a choice of colours from British Home Stores as an interior light fitting. It is a simple matter to remove the reflector and lampholder fitted in the bottom of the case, as well as all metal attachments, to leave an empty shell into which the PCB and lampholder board can be fitted.

To ensure long term reliability a PCB, Fig. 2, has been designed to accommodate all the electronics. The board is octagonal as it has to fit in the bottom of the round case. It is convenient to mount the transformer first. The specified one is for PCB mounting.

★ components list

Resistors

R1 10Ω 2W, R2 33Ω, R3 100Ω, R4 100Ω
(R2/3/4 are ½W 5 or 10%)

Semiconductors

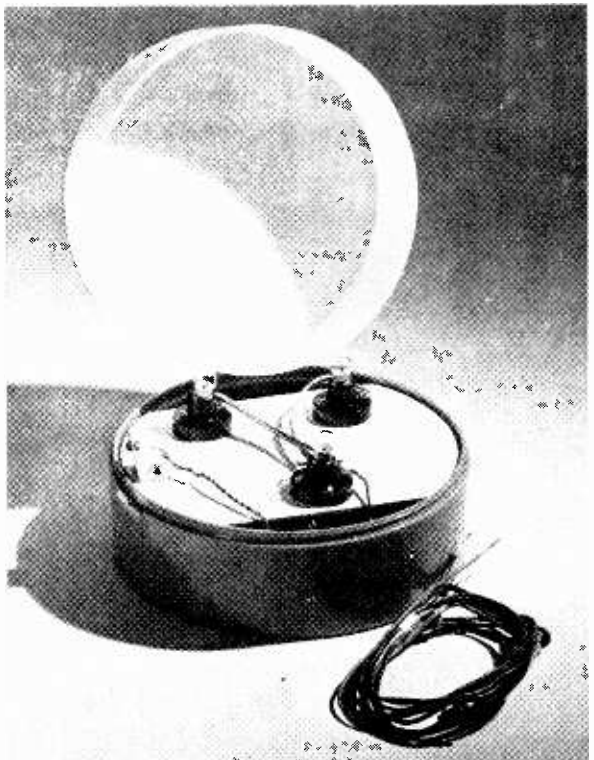
Tr1	BFY50	Tr2	BC108 or 109
D1/4	1N4002	LED	TIL209

Miscellaneous

C1, 100μF 10V. T1, 240V primary, 6-0-6V 250mA secondary (B.B. Electronics, 1 Windsor Walk, South Anston, Nr. Sheffield, Yorks. Type EL3/6A £1.86 + 25p P/P). B1/3, Ever Ready NCC400 Style HB, or similar, 3 off. F1, 100mA 20mm fuse. F2, 500mA 20mm fuse. Fuse holders, for PCB, 2 off. Lamps, 3.5V 0.3A with holders, 3 off. Case, British Home Stores type 1914. TO5 heatsink for Tr1.

Alternatives can be used but mounting holes will have to be drilled in the board and the transformer connected with flexible leads.

All the other components, except the cells, can then be mounted as in the PCB layout drawing Fig. 3. The fuse holders are easier to mount if they are clipped on to a fuse before insertion into the board. Tr1 is fitted with a TO5 finned heatsink to keep it cool during discharge. Solder tags are inserted for the six external connections to the board. **The cells are inserted last** because, as received, they are partially charged and could damage partially completed



The completed 'luminaire'. The PCB is mounted in the bottom of the case, the lamp board resting on a rim inside the case. Both boards should be a tight fit in the case.

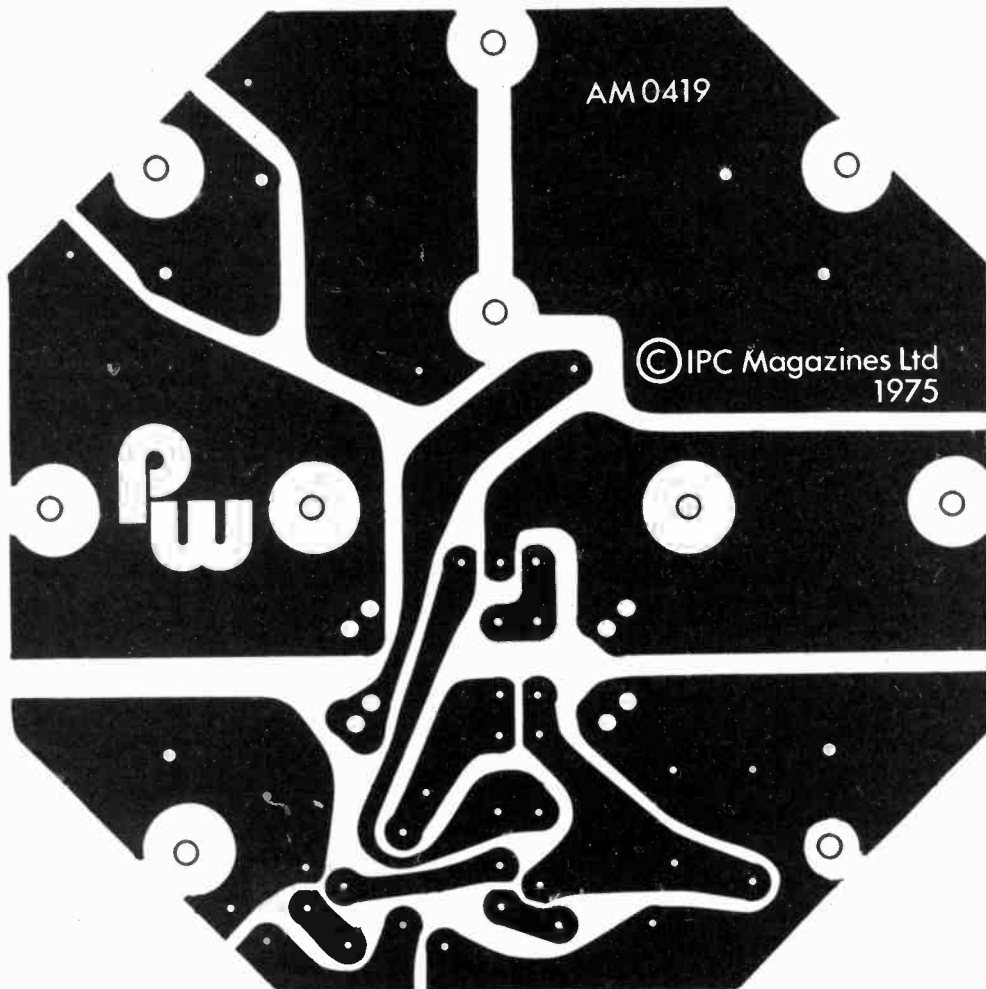


Fig. 2: Full-size layout of the PCB. Fig. 3: next page, shows the component layout. The cell retaining straps have been removed in this view.

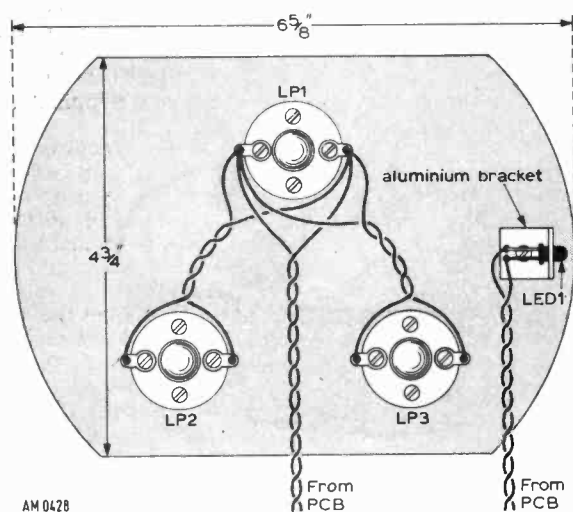


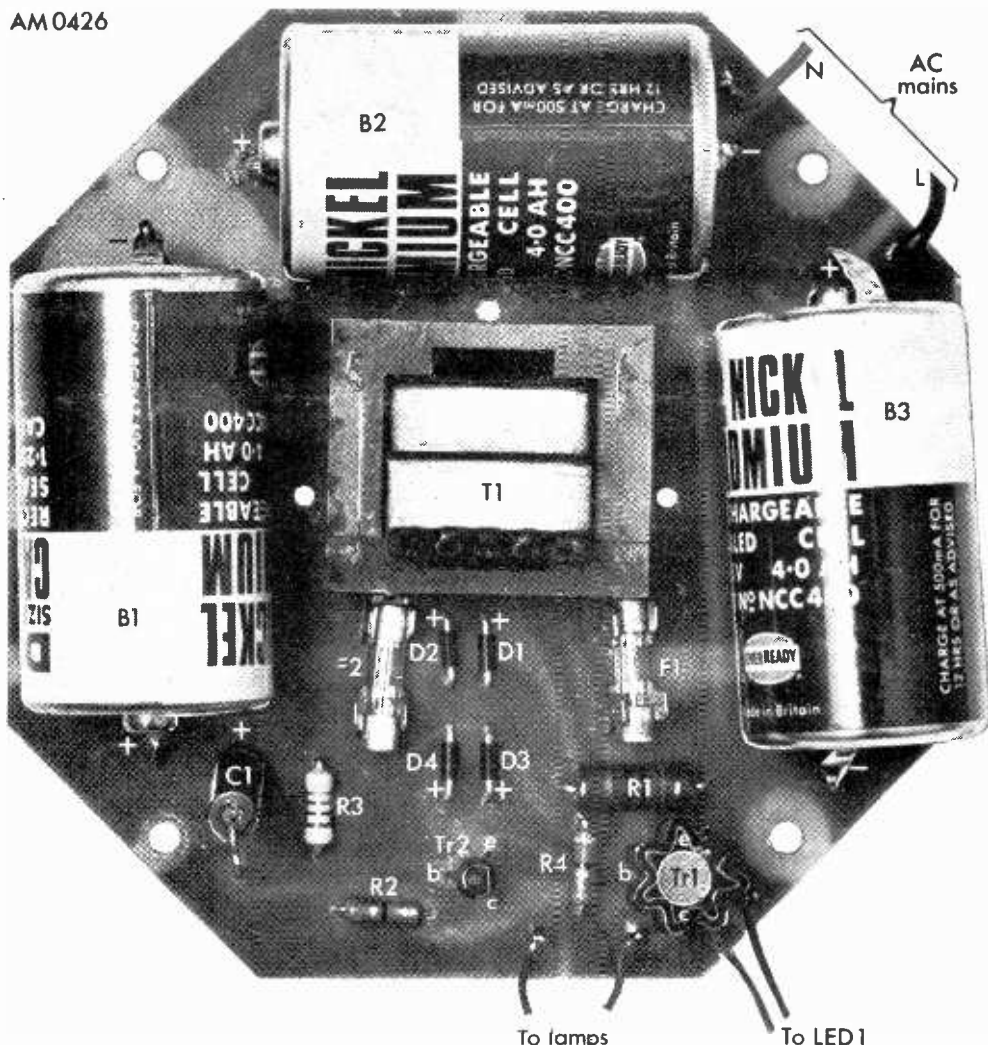
Fig. 4: The lamp board also carries the LED which should be bright enough to be visible through the translucent part of the case when the cells are charging normally. Diameter of the board will depend upon the actual case used by the constructor.

circuitry. Short lengths of tinned copper wire are used to connect the cells to the board and give some support. Small straps are then made from sheet tinfoil, one for each cell held down on either side using the 6BA holes in the PCB. Alternatively, simple straps can be formed from thick copper wire passed through the holes, twisted and soldered under the board.

Three bulbs are used in the prototype and the three MES lampholders are mounted on a piece of perspex, fixed to the top of the bottom half of the case, and painted white to act as a reflector. The perspex is a tight push fit in the case and needs no mounting screws. A small bracket is made from aluminium to hold the LED against the translucent dome. All three lampholders are wired in parallel with a short length of flex left for connection to the PCB. Similarly a length of flex is soldered to the LED, Fig. 4.

(N.B. On no account should wood be used to make the lampholder board or any other part of the luminaire as this would present a fire hazard.)

The PCB is placed in the bottom of the case and a felt pen used to mark the position of the four mounting bolts. The base is then drilled to accept 4BA bolts which are held captive with nuts. This is necessary because the PCB has to be removed prior to installation to reveal the holes for the wall screws.



When the board has been mounted, the wires to the lampholder panel are soldered to the tags and the panel fixed in place.

After thoroughly checking all connections the mains can be connected to the input of the unit. The LED should glow indicating that the cells are being charged. A voltmeter across R1 should indicate a voltage drop of about 2.5V showing that the charging current is of the right order. After a period of ten minutes or so the cells should be sufficiently charged to run the lamps for a couple of minutes when the mains is switched off.

Installation

The unit can be mounted in any position as the cells are held by their straps. Should the unit be mounted on a ceiling it is important to check that the lampholder panel is a tight fit.

There are three mounting holes for woodscrews, in the bottom of the case, together with a central hole for the mains cable. With the PCB removed the bottom of the case is screwed to the wall or ceiling with a short length of mains cable left floating. The PCB is replaced and the mains input soldered in. Alternatively a short fly-lead with a terminal block can be used to save soldering at the installation

To lamps

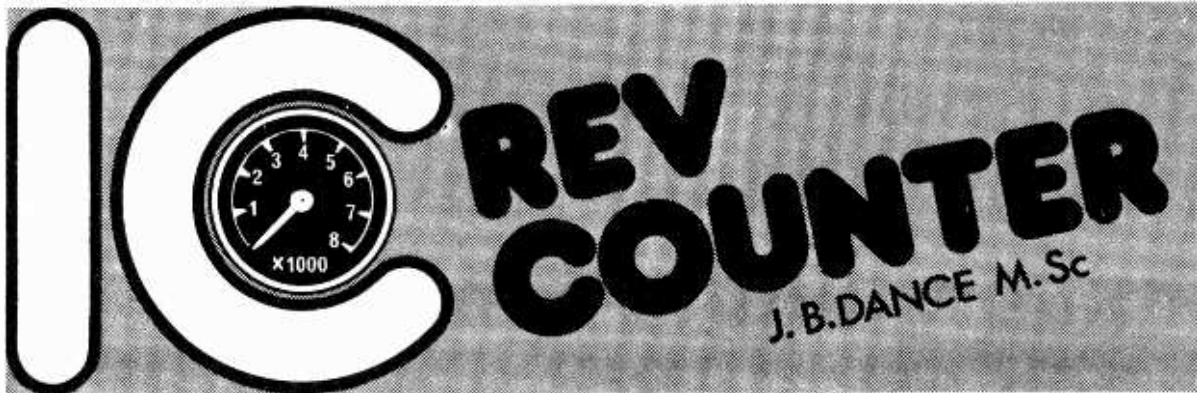
To LED 1

stage. The lampholder board is pushed into position and the three bulbs tightened. At this stage, if the cells are charged, the bulbs will light because there is no mains input. With mains on the bulbs should extinguish and the LED will come on. Snapping the dome on completes the installation.

In use the Emergency Light Unit requires no maintenance other than a regular check, by switching the mains off, to ensure that it is operating correctly. The cells have an operating life of several years and providing that no extremes of temperature are encountered the need for replacement would be unlikely. Should the unit be used outside or where the temperature could drop below 10°C then the cell manufacturers recommend that precautions be taken to prevent damaging the cells by over-voltage during charging. Protection can be provided by connecting a 4.7V 2W zener diode across the cells, the cathode to the positive end of C1 and the anode to the emitter of Tr1.

Finally, a warning about the nickel cadmium cells used in this project. This type of sintered plate cell has an internal resistance of only a few milliohms which means that dangerously high currents will flow if a cell is accidentally short-circuited. They should therefore be treated with respect and kept in their packing until needed.

P.W.



IN this article it will be shown how an integrated circuit especially designed for use in the automobile field can be employed as the heart of a simple engine 'rev counter'. These are much used in sports cars for rally driving to enable maximum performance to be obtained. They show the driver the optimum moment at which to change gear in order to obtain the best possible performance without the risk of damaging the engine by 'over-revving'. Rev counters can also be most instructive to the learner driver, whilst some car owners feel that they confer a prestige value on their vehicle.

The SAK115

The integrated circuit used in this project is the SAK115 which is manufactured by ITT Semiconductors. The device is encapsulated in a plastic dual-in-line case which has a metal tab on each side of the device and eight connecting pins.

The device has been designed for vehicles having negative earth since almost all modern cars are of this type. However, it will be shown that the same device can also be used with an extra transistor in a slightly more complex circuit for vehicles which have positive earth systems.

Negative earth

The use of the SAK115 in the simpler negative earth circuit of Fig. 1 will be considered first. Each time the contact breaker points on the car open, a voltage pulse is developed across them. Each pulse occurs at the same time as a spark in the engine. The number of pulses per minute (ppm) is thus proportional (but not equal) to the engine revolution rate. The pulses can therefore be used to drive the rev counter provided that each pulse causes a constant amount of charge to flow through the meter.

The input to the circuit of Fig. 1 is fed by the fairly high voltage pulses from the contact breaker which are then fed to the potential divider R1 and R2. Consequently, only about one-tenth of the original pulse amplitude is fed to pin 1 of the IC. The SAK115 is monostable and of the flip-flop type. Each pulse fed to pin 1 switches the circuit, so that the output voltage at pin 6 changes for a short time, during which

time a current flows through the meter M1. At the end of the timed period the circuit automatically returns to its former stable state. The circuit remains in the latter state until the next pulse arrives.

The duration of the current pulse to the meter is determined by the product of C1, R3 and VR1. If the value of VR1 is increased, the length of the current pulse increases and so does the deflection of the meter. The trimmer VR1 can thus be employed to calibrate the circuit so that the correct readings are provided by the instrument. If the meter is to indicate the correct rpm under all conditions, the current which passes through the meter during any pulse must always have the same value. It must not, for example, vary with the battery supply voltage or the readings of the meter would depend on the charge/discharge battery current and on the state of charge of the battery.

In order to keep the amplitude of the current pulses through the meter fairly constant, a zener diode is incorporated to provide a relatively constant voltage supply to the IC. As the car battery voltage

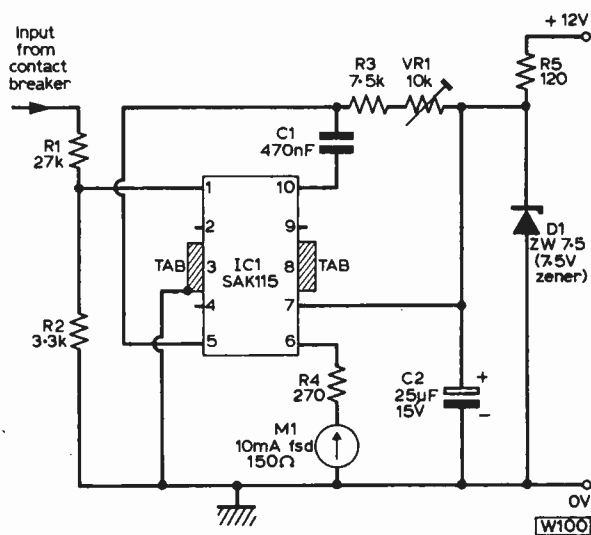


Fig. 1: Basic circuit of the rev counter utilising the SAK115 integrated circuit. The above circuit is only suitable for vehicles having a negative earth system.

changes, the voltage across the zener diode D1 remains virtually constant and the whole of the change of voltage appears across R5. The capacitor C2 smooths the supply to the IC and removes any stray pulses.

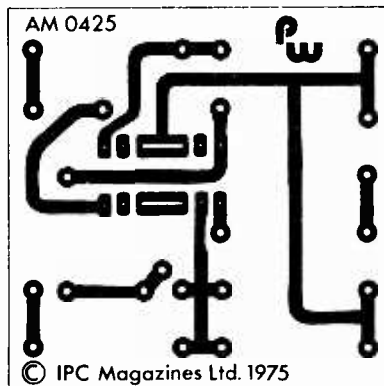
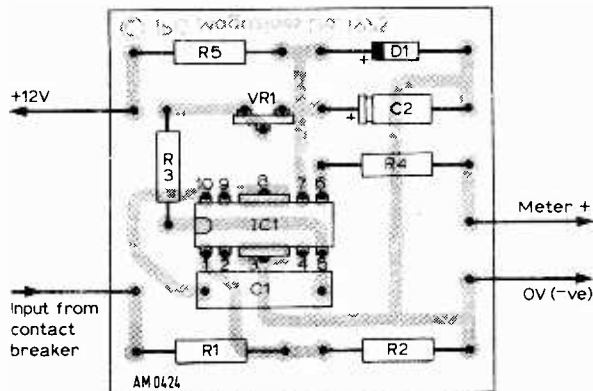
The duration and amplitude of each current pulse is fixed by the circuit component values, so each pulse from the contact breaker causes the same amount of charge to flow through the meter. The meter deflection is therefore proportional to the rate of revolution of the engine. Although the current through the meter actually consists of individual short pulses (each of a few thousandths of a second in duration), the mechanical inertia of the meter smooths out these pulses to give a virtually steady reading.

Noise pulses

The electrical system of a vehicle is notoriously noisy, consisting of transient changes in voltages at various points in the circuit, which would normally trigger a conventional monostable circuit and cause a high reading to be obtained. However, the SAK115 has been specifically designed for use in such noisy environments and cannot be triggered by pulses which have an amplitude of less than about 8V at pin 1.

The potential divider resistors R1 and R2 reduce any spurious input pulses still further and the circuit is therefore insensitive to pulses of less than about 80V at the contact breaker itself. In negative earth cars, a positive pulse considerably greater than this value is developed at the contact which is not earthed, each time the current ceases to flow through the ignition coil when the contacts open. It is the inductance of the coil which is responsible for the generation of these pulses.

The SAK115, being specifically designed for negative earth vehicles, is insensitive to negative-going pulses. This again greatly reduces the likelihood of incorrect readings being obtained due to triggering of the circuit by spurious pulses. Any negative pulses



The suggested printed circuit board and component layout are shown actual size, and for negative earth systems only. It is also suggested that the board be suitably drilled, and mounted directly on the back of the meter.

which reach pin 1 are shorted to earth by a diode inside the IC connected between pins 1 and 3.

A further advantage of the use of a purpose built IC is that the internal push-pull output stage of the device is specially designed to drive a moving-coil meter. It provides adequate drive even when the meter coil has a relatively high inductance and when the revolution rate is high.

The meter

The meter should be calibrated over the range required. For a small car, 6,000 rpm is about the maximum one should ever use, but in some sports cars a value up to about 8,000 rpm is permissible. One therefore requires a meter scaled from zero up to about seven or eight for a typical small car, or possibly up to ten for a sports car. This allows an adequate margin at the top end of the scale. Unfortunately meters calibrated from zero up to about eight are not normally available.

The simplest solution is to employ a 10mA fsd meter, where each milliamp of the scale can be made to correspond to 1000 rpm. The uppermost part of the scale will not then be used. Constructors who are good at artwork will be able to make a scale marked

★ components list

Resistors

R1 27k Ω	R5 120 Ω
R2 3.3k Ω	R6 270 Ω
R3 7.5k Ω	VR1 10k Ω vert preset, miniature
R4 270 Ω (see text)	

All resistors 10% \pm w

Capacitors

C1 470nF 25V	C2 25 μ F 15V
--------------	-------------------

Semiconductors

IC1 SAK115—Available from Phoenix Electronics (Portsmouth) Ltd., 139-141 Havant Rd., Drayton, Portsmouth, Hants. PO6 2AA. Priced £1.14 each plus 48p VAT and p&p.

D1 ZW7.5 zener diode

T1 2N2904 or similar npn transistor

Miscellaneous

M1, 0-10mA fsd moving coil meter. 50 x 50mm piece of veroboard, or pcb. T1, mains transformer with secondary 80 to 200V RMS. Br1, bridge rectifier or 4 rectifier diodes.

0-8,000 rpm from transfers (such as 'Letraset'). The top part of the scale could then be marked with a red band to show that the engine should not be taken to such a high rpm.

The current which flows through the meter under any conditions is inversely proportional to the sum of R4 and the meter resistance. The circuits shown are suitable for use with meters which have an fsd of about 10mA and a resistance of about 150Ω. If the meter resistance is much less than 150Ω, the value of R4 should be increased to make up the difference. Similarly, if a more sensitive meter is used, the total resistance of the meter circuit must be increased to reduce the current which flows under any specified pulse rate. The total resistance of the meter circuit of Fig. 1 is about 420Ω. If a meter with an fsd of 2mA is used, one-fifth of the current is required to obtain a given deflection, and therefore the total resistance in the meter circuit should be about 1.6kΩ.

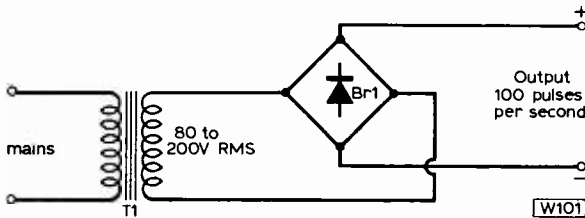


Fig. 2: The circuit shown here provides a simple method for obtaining an output of 6,000 pulses per minute. This is for the calibration of the circuits shown in Figs. 1 & 3.

Calibration

One can, of course, calibrate the circuit by driving the car at a known speed in a specified gear and getting a colleague to adjust VR1 so that the meter indicates the correct rpm for the speed and gear concerned, calculated from the vehicle manufacturer's data. This procedure is somewhat tedious and requires a constant speed to be kept up for at least a minute or so; in addition, it relies on the accuracy of the speedometer. It is more accurate however to make at least a preliminary bench adjustment of VR1 by feeding pulses at a known frequency into the circuit. The 50Hz mains supply is the obvious source, since it is easy to obtain 3,000 or 6,000 ppm by half-wave or full-wave rectification of the supply.

Most small cars are four cylinder, four stroke types, whose camshaft rotates at half the engine revolution rate, giving four sparks per revolution of this shaft. Thus the contact breaker provides two pulses to the rev-counter circuit per revolution of the engine. If 6,000 ppm are fed to the circuit, the trimmer VR1 must be adjusted so that the meter indicates 3,000 rpm.

The very simple circuit of Fig. 2 can be employed as a source of 6,000 ppm.

An AC output from the transformer of not less than about 80V is fed to the bridge rectifier circuit shown. This circuit inverts each alternative half cycle of the 50Hz mains voltage and thus produces 100Hz output of 6,000 ppm. The output from Fig. 2 must be connected with the correct polarity to the input of Fig. 1 or no meter reading will be obtained. The negative output line from Fig. 2 is connected to the

OV line of Fig. 1, whilst the positive output is connected to the upper end of R1 of Fig. 1.

Although it is possible to feed the mains directly to the bridge rectifier of Fig. 2, this can be very dangerous in the hands of the inexperienced experimenter. It is far safer to use a transformer.

If a transformer with a secondary winding providing 80 to 200V RMS output is not available, a transformer providing a somewhat lower voltage may be used for the calibration, but R1 of Fig. 1 must be reduced during the calibration only, so that an adequate pulse reaches the IC.

6/8 cylinder vehicles

In the case of a six cylinder, four stroke vehicle, the cam shaft again rotates at half engine speed, but there will be six pulses per rotation of the cam shaft instead of four. The contacts therefore provide three pulses per engine revolution. Thus when the bridge circuit of Fig. 2 is used to provide 6,000 ppm VR1 should be adjusted so that the meter indicates 2,000 rpm.

In the case of an eight cylinder, four stroke vehicle, each engine revolution produces four pulses from the contact breaker. When the circuit of Fig. 2 is used, VR1 should be adjusted so that the meter shows 1,500 rpm. In the case of six and eight cylinder vehicles, it may be necessary to increase R4 somewhat in order to achieve correct readings. A value of 390Ω for six cylinder cars and 560Ω for eight cylinder cars should be suitable, but these values are not critical and it is only necessary to ensure that VR1 can be adjusted to give the correct reading.

Once the circuit has been calibrated using the mains frequency it can be fitted into the vehicle and should require no further attention. However, recalibration will be necessary if a meter of different internal resistance is employed or the zener diode is changed.

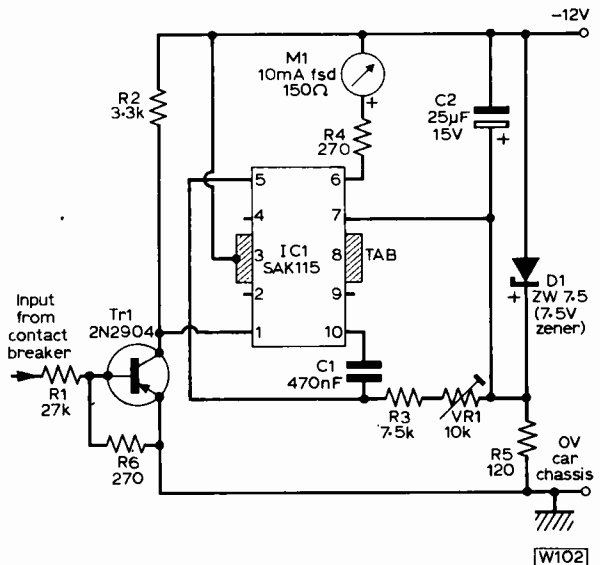


Fig. 3: The above circuit is similar in design to that shown in Fig. 1, but is only suitable for vehicles having a positive earth. The purpose of the transistor is to amplify and reverse the polarity of the pulses.

continued on page 765.



I can just imagine the old chap bawling at Rudolph "Here's another nice mess you've landed us in!" And there's Rudolph smirking all over his face, fondly imagining he's another Biggles. They've certainly a lot of ground to cover to deliver all those toys, not to mention all those gorgeous Home Radio Components Catalogues!

Don't worry . . . they'll soon carry out some make-shift repairs and your catalogue will arrive on time. That is, assuming you have ordered one! You *have* ordered one . . . haven't you? If not, please order right away. It certainly is the most useful present you could give the electronics enthusiast. So, if you have a son, grandson or nephew who's

been bitten by the electronics bug, just send them one, and then every time they use it (which will be often) they'll think "what a clever feller you are!"

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I showed this advert to my grand-daughter and she asked "Is a victory roll something you eat?" It therefore occurred to me that the point of the cartoon might escape our younger readers, so here is the explanation. During World War Two, if one of our fighter pilots shot down an enemy aircraft, when he returned to base he did a slow roll over the aerodrome before landing; hence the term "Victory Roll."



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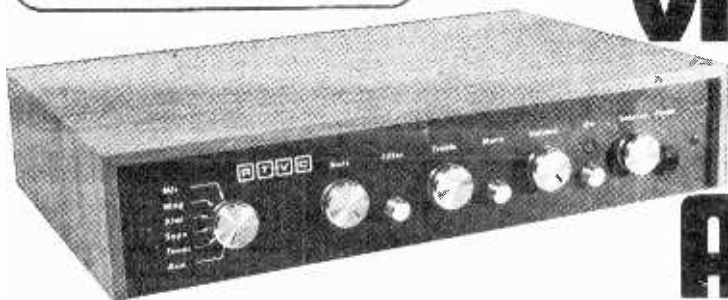
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SPECIAL PRODUCT REPORT

RTVC VISCOUNT IV STEREO AMPLIFIER



YOU may have noticed in the sparkling advertisements for sparkling amplification gear that when it comes to output wattage there is usually more sparkle than watts-per-pound sterling. For some time RT-VC have specialized in offering concrete value-for-money in their range of products. From my experience of the range one can find very useful equipment performance without the fancy treatment that characterises goods offered by the 'Big Boys'. This does not mean that looks are placed second; indeed the result a happy compromise of both appearance and performance. For those of us on a restricted budget it is surely good that such firms can still hold their head above water. Quite obviously there is a strong market for watts without frills.

FIRST LOOK

I have just been living with the new Viscount IV stereo amplifier and find the unit most suitable for inclusion within a stereo system where that difficult combination of power and price seem to get out of balance.

The quoted specifications are given below and were borne out in practice. Laboratory data does not always check out with practical realisation (theory into practice and all that) thus more time was spent in the subjective appraisal of this unit. However, under lab conditions I am glad to report that the unit was able to provide 20W RMS of true-blue power from each channel at 1kHz! With both channels driven simultaneously nigh-on 16W was throbbing into each load resistor.

Frankly, I do not know of any other equipment available that is completely built, ready for connection to the mains, looks good and offering this solid output power at the price. The Viscount IV is compact and features a slimline appearance within its real teak veneered case. No plastic 'simulation'!

FACILITIES

The front panel incorporates the bright aluminium and matt black of more costly units. No less than six varieties of input signal can be selected by the switch seen at the left side of the fascia. Next along are two rotary wide-range tone controls affording adjustment of the bass and treble ends of the audio spectrum. Between these is a pushbutton activating the low-pass filter so attenuating HF scratch from carelessly kept records.

A stereo-mono pushbutton offers useful flexibility and some devious minds may even care to indulge in a little mono-mixing or perhaps have different sounds in different rooms.

The volume control is conventional in that both channels are affected equally while the balance control enables either channel to be reduced to zero level without disturbing its partner.

Two remaining features at the front are the on-off push-button with flush mounted indicator lamp and a $\frac{1}{2}$ in. diameter stereo headphone socket. Clear labelling is a feature of both front and rear, right down to the pinning of the DIN input sockets. Certainly this avoids the confusion in referring to drawings where the artist has forgotten to mention whether the diagram refers to a plug or a socket!

Four such sockets are provided on the rear panel to allow signals from magnetic cartridge, crystal cartridge, microphone, tuner, tape machine and one other auxiliary source to be coupled in to the audio system. The tape facility has in-out pinning to permit the single cord connection that eases the lot of the tape enthusiast. Outputs to speakers sees use of DIN sockets again for convenience. Also of sure convenience is the provision of two mains outlets in the US twin flatpin configuration that has been common on much imported audio apparatus. These outputs are activated with the amplifier itself. Unit protection is by a single 'slo-blo' fuse accessible from outside the case.

Well, that's the unit. Simple, yet incorporating many features not found on amplifiers costing more. Back in the lab for a second I'm glad to report that no sign of crossover distortion was evident at any output level. Traces seen on the scope screen were always clean, right up to the unit's clipping point where evidence of the latter was observed to be symmetrical.

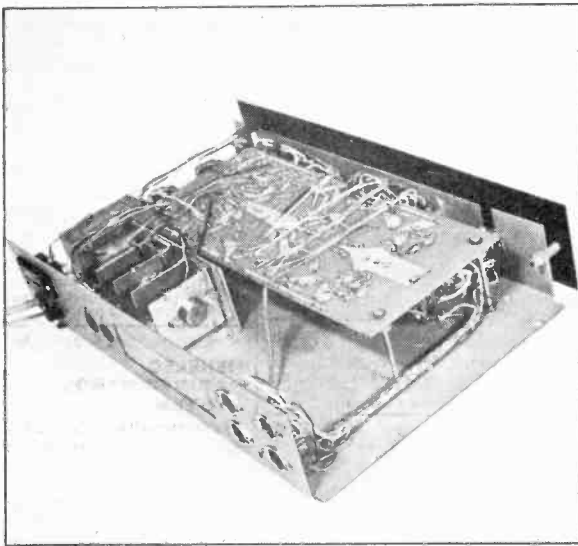
SPECIFICATION

Power Output	20 + 20W RMS into 8 Ω
Speakers	8 to 15 Ω
Total Distortion	Better than 0.2% @ 10W
Six Switched Inputs	1. Mag PU 3mV @ 47k Ω 2. Crystal/Ceramic PU 50mV @ 50k Ω 3. Tape 140mV @ 50k Ω 4. Tuner as 3. 5. Microphone 3mV @ 50k Ω 6. Auxiliary as 3.
Frequency Response	25Hz to 25kHz @ full rated output
Signal/Noise Ratio	Better than -50dB at all inputs
Tone Control	Bass \pm 15dB @ 50Hz Treble \pm 12dB @ 10kHz
Supply	200/250V AC 60W
Dimensions	15 $\frac{1}{2}$ " wide, 3" high, 10" deep (388 x 77 x 254mm)

CONCLUSIONS

Wired up to the normal components of my audio system the amplifier certainly gave a good account of itself. Amazingly so in view of the price, especially compared to the price of my normal amplifier! I tried many types of signal source and all were processed by the Viscount IV in a very satisfactory manner. Using a pair of inelegant and not very expensive loudspeakers I found that the wide range of tone control available from the unit was able to replace what was obviously lacking in the speakers. Coupled with a significantly more expensive pair of speakers the range of control available from those controls marked 'bass' and 'treble' was very marked. Some 'disco-bass' sounds were recreated right in my living room! With more natural settings of these controls and in conjunction with a broad range of listening material, extending from rock to the classics, I was able to enjoy a pleasingly smooth performance. Distortion, especially that ugly crossover type, was indiscernible.

The range of output powers employed in the listening tests extended from the 'normal' background levels used when guests are present right up to fruity power levels I sometimes like to indulge in when alone (I think my neighbours have either become used to me or fled the district).



Plenty of room inside, with the output transistors well clear of the rest of the circuitry.

I found myself constantly referring back to the price of the amplifier the more it seemed to please me in sheer performance. The only peculiarity that bothered me, and I must say that I did become used to it, was the unorthodox positions of the knob datum lines. These appear to have a middle position at five o'clock and while unnatural at first it could even be a fresh novelty in these days of style-oneupmanship by the manufacturers. In all then a very versatile amplifier with power enough for most domestic installations. I would recommend it highly where funds are particularly tight, where kit-building is 'out', and where upgrading of an existing installation is called for without breaking the bank. Altogether extremely good value for money.

The RT-VC Viscount IV Stereo Amplifier retails at £27.50 including VAT and is available separately or as part of a complete Hi-Fi system. Many permutations are available for the Hi-Fi enthusiast with an eye on cost and good performance. For further information on the complete RT-VC Viscount IV Stereo System, please refer to their advertisement in this issue. **RT-VC 21C High Street, Acton, London, W3, and 323 Edgware Road, London, W2.**

TELEVISION

JANUARY 1976

SERVICING THE THORN 8000/8500 COLOUR CHASSIS

The Thorn 8000 and 8500 chassis have been produced in very large quantities and are thus amongst the most commonly encountered colour chassis. They are all solid-state sets with some interesting features that could confuse those not familiar with the basic design. This month we start a series which will provide a detailed circuit description and deal with faults experienced.

UHF PREAMPLIFIER

The addition of a preamplifier can significantly improve the noise performance in low-signal areas or enable extra distant TV transmissions to be received. The design to be presented this month is simple and very stable. It is based on the BF272 transistor.

SOLID-STATE MONO CHASSIS FAULTS

There have been only two large-screen UK produced solid-state monochrome TV chassis, the Philips 320 and RBM A816. John Coombes describes faults experienced with these.

TRANSISTOR LINE TIMEBASES

In Part 2 of his series E. J. Hoare describes the exacting requirements for correct line output transistor operation and how these are met in practical designs, and provides a clear account of the complexities of line output transformer tuning.

N1500 VCR SERVICING GUIDE

Regular maintenance is essential if the performance of a videocassette recorder is to be kept up to scratch. What this involves in mainly careful lubrication and cleaning. Michael Gladwell sets out what is required with the Philips Model N1500.

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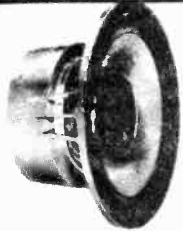
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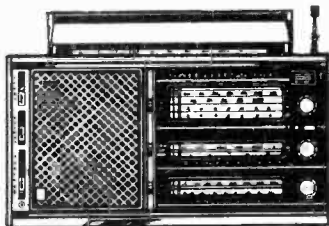
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No. 73 TOUCH SWITCH

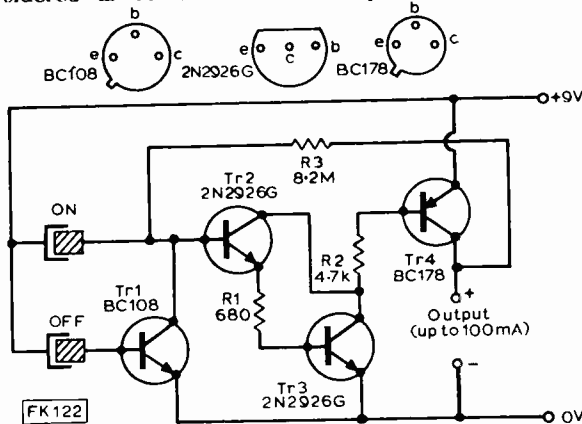
A series of simple transistor projects, using not more than twenty components.

IN an increasing number of applications ordinary mechanical switches are being superseded by touch activated switches. These are operated by body resistance between two electrodes, rather than by mechanical pressure or movement. Apart from the obvious novelty value, these have the practical advantage of having no moving parts to wear out, giving them the reliability of the main electronic part that they are switching.

This article describes a simple touch switch which provides the ON/OFF switching of any small piece of battery-powered equipment which has a current consumption of between a few micro-amps and 100mA, such as portable receivers, signal generators and other test equipment.

The Circuit

The device uses only four transistors, three resistors, and when initially connected to the supply is in the off state; no current flowing except for leakage currents. As the transistors are all silicon types, the total leakage current is only a fraction of 1 μ A and for all practical purposes can be considered as zero. This is an important feature as



Circuit diagram of touch switch. Current consumption of the unit is 1.3mA when in the ON state, and less than 1 μ A when in the OFF state.

otherwise the unit would be drawing power even when the main equipment was turned off.

When the ON plate is touched a small bias current flows from the positive supply into the base of Tr2. This is wired as the first transistor of a Darlington pair, Tr3 being the second transistor. This bias current will begin to turn on Tr2 and Tr3 and cause a base current to be supplied to Tr4 via Tr3 and R2.

As Tr4 turns on, the voltage at its oscillator will

★ components list

Resistors

R1 680 Ω
R2 4.7k Ω

R3 8.2M Ω
All $\frac{1}{4}$ W 5% or 10% tolerance

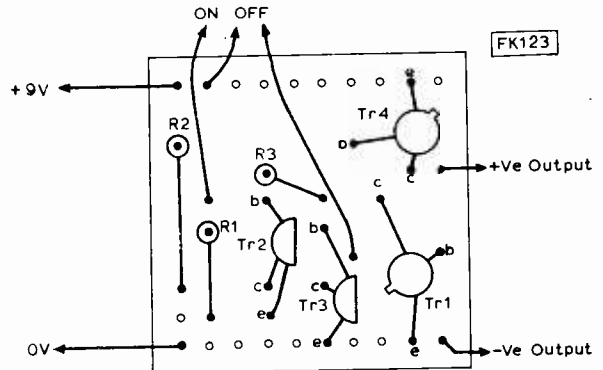
Semiconductors

Tr1 BC108
Tr2 2N2926G

Tr3 2N2926G
Tr4 BC178

Miscellaneous

Veroboard 35 x 35mm, 0.1in. matrix. 9V Battery and clips. Piece of copperclad board for touch plate.



The circuit is constructed on 0.1in matrix Veroboard, with flying leads to the touch plates.

begin to rise, and this will cause further base current to flow into Tr2. This is supplied from Tr4 collector via R3. This extra base current will cause Tr2, Tr3 and Tr4 to conduct more heavily, which in turn causes an even greater current flow through R3. This regenerative action results in Tr4 being switched quickly to saturation. The equipment connected in its collector circuit will thus be turned on, and as the circuit is self latching, it will remain on, even when the operator's finger is removed from the touch plate.

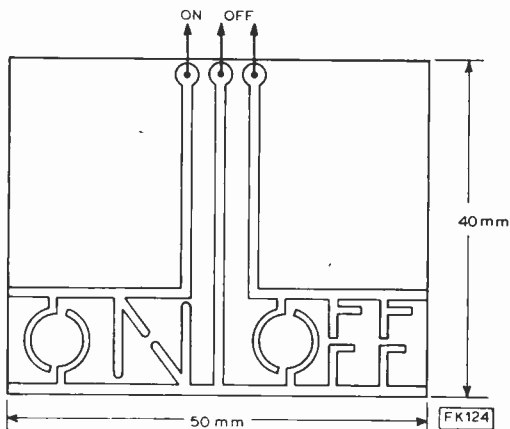
When the OFF plate is touched, Tr1 receives a base current from the positive supply, turning it on. In doing so, it shunts the base current of Tr2 to earth, and so turns Tr2, Tr3 and Tr4 off. The circuit is thus returned to its original condition. R1 and R2 are current limiting resistors included to prevent Tr3 and Tr4 from passing an excessive current. The current consumption of the unit when it is in the ON state is about 1.3mA, and it is a secondary function of R1 and R2 to limit this current to an economic level.

Construction

Construction of the unit is very straightforward being built on a piece of 0.1in Veroboard. The touch plate can be made to conventional designs from PCB or Veroboard, or the novel printed circuit design employed by the author can be copied.

This is perhaps a little less sensitive than conventional designs, but it still provides adequate sensitivity when used with this circuit.

For practical use on a piece of equipment an aperture should be cut in the front panel of the equipment, or any other convenient point, then the touch plate glued or bolted in place behind the cutout. In use it should be found that the touch plates only need to be touched momentarily to initiate the switching action. The only exception to this will be if the controlled equipment has a fairly high value decoupling capacitor connected across the supply lines (such as in a transistor radio). In this case it will be necessary to touch the OFF plate fractionally longer than normal, so that the



Although any shape can be used for the touch plates the above design was used by the author.

decoupling capacitor has a chance to discharge. Otherwise the unit may turn on again as the finger of the operator is removed from the plate. **PW**

NEWS...

NEWS...

NEWS...

Greenweld Meter Catalogue

GREENWELD Electronics tell us that they have now compiled a catalogue detailing the various types of multimeter that they have in stock.

If anyone would like a free copy, together with price list, they can get one by sending a 9in x 4in stamped addressed envelope to: *Peter Green, Greenweld Electronics, 51 Shirley Park Road, Southampton.*

Sound & Vision '76

SOUND & Vision '76 will be the title of next year's TV and audio show to be held at the National Exhibition Centre, Birmingham (May 28th to 31st).

The show follows on from HEDA—the first International Home Electronics and Domestic Appliances Exhibition—a five day trade show sponsored by the Association of Manufacturers of Domestic Electrical Appliances (AMDEA) and the British Radio Equipment Manufacturers' Association (BREMA) which opens on May 23rd.

With the exception of the first day of the public show, when the doors will open at noon, the TV and audio show will be open from 10 a.m. to 10 p.m. daily including the Spring Bank Holiday Monday.

GB2RS News Broadcasts

THE R.S.G.B. has operated these broadcasts on 80m and 2m for many years now and the service for Region 1 has been improved by the addition of two more news readers.

They would appreciate any information on the coverage obtained and the number of readers listening on each of the two bands. It would also interest the R.S.G.B. to know how many non-members are listeners to these broadcasts. Also, if you have any suggestions for material to be included in these weekly bulletins, the R.S.G.B. would be pleased to hear from you.

VHF-UHF Manual (3rd edition)

THIS completely revised and enlarged edition is also available from the R.S.G.B. All the existing chapters have been up-dated and expanded. In addition, chapters on Space Communication and Microwaves have been included for the first time.

The volume, which has an increased page size and a lot more pages, is case-bound to overcome the binding problems that existed with earlier editions. Price had not been decided at the time of our going to press.

Woollies own

IT'S the Wonder of Good Old Woollies — that's what the adverts tell us—and the latest wonder may well be Winfield-brand audio equipment.

Woolworths are setting up audio centres in 170 of their larger stores. Initially, the departments will concentrate on branded goods (HMV, Ultra, Ferguson, Pye, Philips, Fidelity, etc.) with prices ranging from £40 to £400, but if these items go down well with the public, the Winfield brand may soon be available.

Each department is headed by a manager who has been given training organised by various manufacturers and Woolworths will set up their own network of manufacturer - approved service agents.

1976 Amateur Radio Callbook

THE new edition of the R.S.G.B. Callbook is available from the *Radio Society of Great Britain, 35 Doughty Street, London, WC1N 2AE.*

The price of £1.47, although higher than for the 1975 edition includes the cost of postage and packing.

**MORE NEWS ON
PAGE 743**

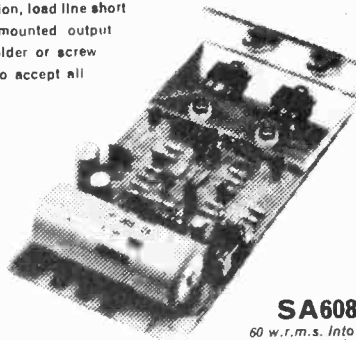
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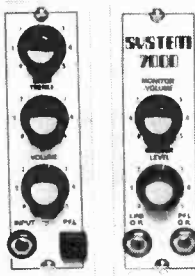
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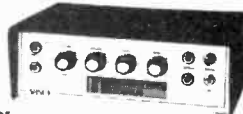
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I.C. OF THE MONTH

Number 55

SGS-ATES AUDIO POWER AMPLIFIERS

A NUMBER of medium power IC audio amplifiers are produced by SGS-ATES Ltd. in quad-in-line packages. Here we consider the TBA810 and TCA830 which incorporate thermal shut-down circuits and the TCA940 which has output short-circuit protection in addition to the thermal shut-down circuit.

If any of these devices become so hot (about 130°C) that a further rise in temperature might damage them, the drive currents to the bases of the output transistors are automatically diverted. The current in the output stages is thus greatly reduced so that the internal power dissipation remains small until the device becomes cool. It is therefore most unlikely that the experimenter will accidentally destroy any of these devices provided that the maximum permissible power supply voltage is not exceeded. Thermal runaway cannot occur.

TYPES

The TBA810S can provide 7W into a 4Ω loudspeaker when fed from a 16V line or 6W into 4Ω from a 14V supply. Thus it is very suitable for use in car radio receivers. This device is encapsulated in the 'Findip' package which has two cooling fins fitted to the sides of the device. The TBA810AS is electrically identical with the TBA810S but has two short horizontal cooling tabs with a hole for attaching a heat-sink to each tab.

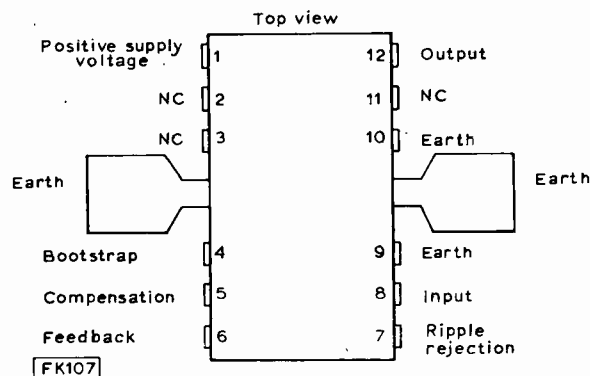


Fig. 1: Connections of all the devices discussed.

zontal cooling tabs with a hole for attaching a heat-sink to each tab.

The TCA830S has the Findip encapsulation of the TBA810S but provides up to 4.2W into a 4Ω speaker when fed from a 14V supply line or 3.7W into 8Ω from a 16V supply.

The TCA940 is supplied in the same package as the TBA810AS and it can provide up to 10W into a 4Ω speaker when a 20V supply is used or 6.5W into 8Ω with the same supply voltage. The TCA940E has the same internal circuit as the TCA940, but the package of the TBA810S is used. It is wise to limit the maximum continuous power delivered by this device to about 7W into a 4Ω speaker or it will get very warm. However, it can supply up to 10W for a moment. The protective circuits will prevent it from overheating to the point of damage. The pin connections of all the devices are identical, shown in Fig. 1.

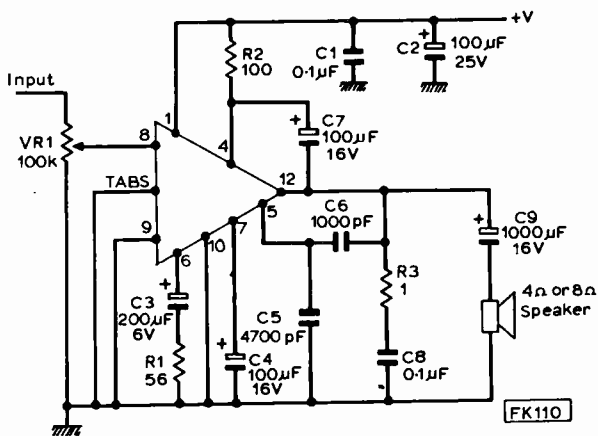


Fig. 2: A typical circuit.

TYPICAL CIRCUIT

A typical circuit for any of the devices under discussion is shown in Fig. 2. Volume control VR1 may be replaced by a 100kΩ resistor.

Capacitor C1 should be soldered close to pin 1 of the device to prevent the possibility of high frequency oscillations, but C2 may be in the power

unit. Feedback for the bootstrap circuit at pin 4 is provided by C7 and R2, whilst C9 prevents a steady current from flowing through the loudspeaker speech coil. If the value of C9 is reduced, the bass response will be affected, since this capacitor sets the low frequency cut off.

GAIN

The gain of Fig. 2 is equal to the ratio of the value of an internal 4kΩ feedback resistor divided by the value of R1, and is between 34 and 40dB. This corresponds to a voltage gain of between 50 and 100 times.

If the value of R1 is reduced, the fraction of the voltage fed back through the internal 4kΩ resistor

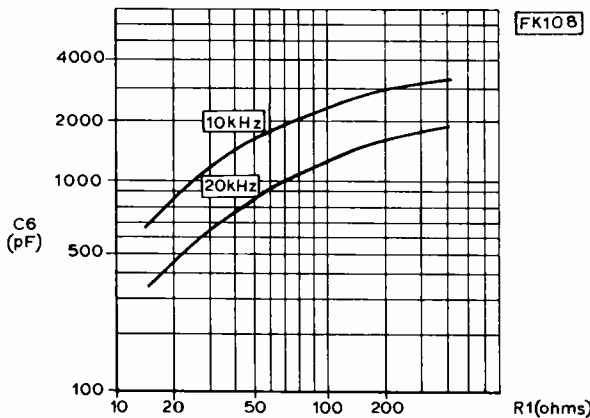


Fig. 3: The values of C6 for various values of R1 for the upper cut-off frequencies of 10kHz and 20kHz.

to pin 6 will be reduced and the gain will be increased. For example, if R1 is 15Ω, the voltage gain will be about 270, whilst if R1 is 150Ω the gain will be about 27. It is recommended that R1 should have a value between these limits, although R1 can have a value of up to 220Ω with a 12V supply before saturation occurs in the input stage.

The variation of gain in these devices arises from the tolerance of the internal feedback resistor ($\pm 30\%$) and from the tolerance in the value of R1. This variation can be reduced by connecting a resistor of less than 4kΩ and 5% tolerance from the lower end of C9 in Fig. 2 to the upper end of R1.

Capacitors C5 and C6 control the frequency response but the values required are also affected by the value of the gain controlling resistor R1, so Fig. 3 shows the value of C6 required with various values of R1 for upper cut-off frequencies (3dB down) of 10kHz and 20kHz. A value of C5 about five times that of C6 produces optimum stability. The values shown in Fig. 2 provide an upper cut off frequency of about 17kHz.

In the case of the TCA830S, C5 may be omitted and the value of C6 can be 390pF. This gives a response to 10kHz with a 56Ω resistor for R1, but the value of C6 should be selected in proportion to the value of R1.

The components R3 and C8 form a 'Boucherot cell' or 'Zobel' network. These components, in parallel with the speaker inductance and capacitance, present a load to the output of the amplifier

which approximates to a pure resistance (without any inductive or capacitive components) at all frequencies. This greatly reduces any tendency to instability at high frequencies.

SUPPLY VOLTAGE

The absolute maximum supply voltage to the TCA940 is 24V. However, it is wise to regard 20V as the maximum voltage to leave a reasonable margin of safety. The TBA810 devices and the TCA830S have the lower absolute maximum voltage rating of 20V so the maximum working voltage should be regarded as being about 16V. The TBA810 devices can deliver more current than the TCA830S.

The minimum recommended supply voltage for the TBA810 and the TCA830S is 4V, but the power output at this voltage is only a fraction of a watt. The minimum recommended operating voltage for the TCA940 is 6V, at which the device will deliver about 1W into a 4Ω speaker or ½W into 8Ω.

DISTORTION

The maximum output power levels quoted are for 10% total harmonic distortion. In actual practice such a peak distortion level is reached only occasionally. The typical distortion is about 0.3% for power levels of up to 2W (TCA830S), up to 3W (TBA810 devices) and up to 5W (TCA940 devices).

However, the distortion rises very rapidly indeed with the onset of waveform clipping, as shown in Fig. 4 for the TCA940 with an 18V supply. The capacitor C4 of Fig. 2 attenuates any hum on the power supply line by about 45dB, but the attenuation falls to about 40dB if R1 is reduced to 20Ω.

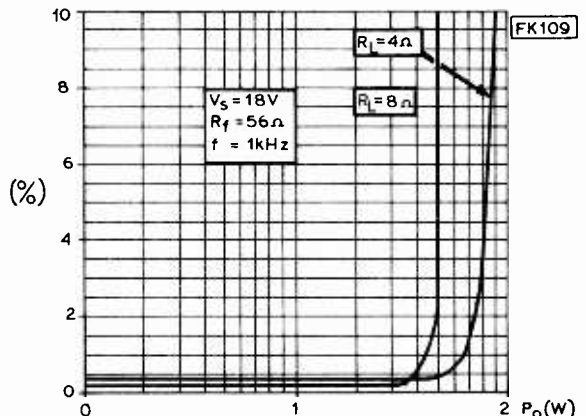


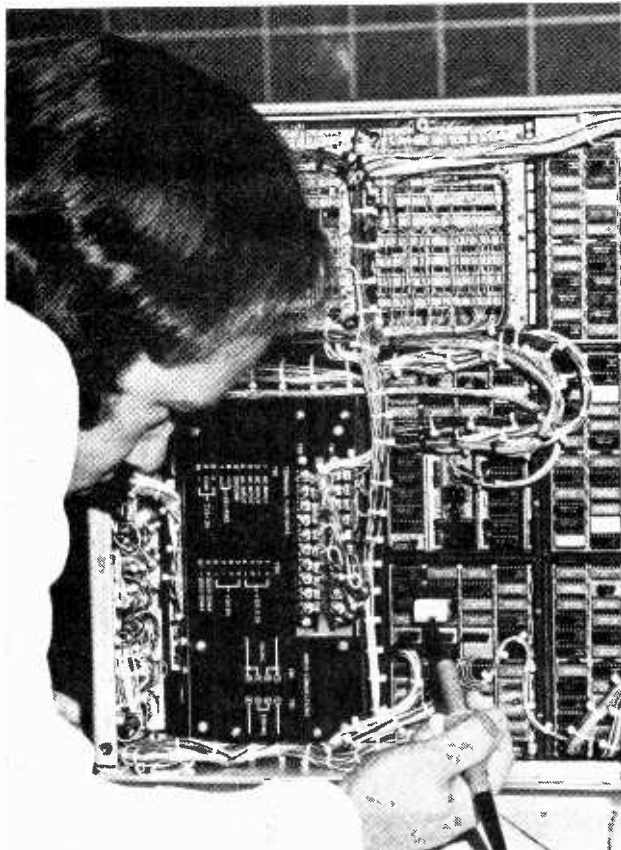
Fig. 4: Distortion plotted against output power for a typical TCA940 device for an 18V supply.

SIMPLER CIRCUIT

An alternative circuit which is somewhat simpler than that of Fig. 2 is shown in Fig. 5. Neither side of the speaker can be connected to the negative (earth) line, but the capacitor C6 of Fig. 5 replaces both C7 and C9 of Fig. 2.

The remainder of Fig. 5 is similar to Fig. 2, except

continued on page 765



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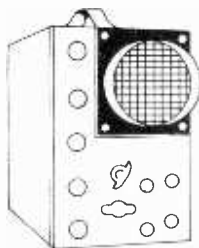
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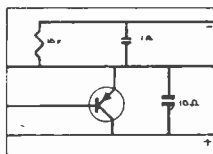
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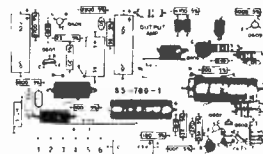
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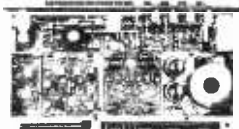


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that the hum attenuating capacitor on pin 7 has been omitted, since Fig. 5 is often used in portable receivers. If desired, tone control circuits can be incorporated in the input circuit of an amplifier or in an external feedback loop.

MOUNTING

The Findip package of the TBA810S type may be mounted on a printed circuit board, the cooling tabs each being soldered to copper foil of about 20 to 30mm square depending on the maximum power output required. Mounting of the TBA810AS package should present few problems since the device can be soldered into a printed circuit board with small metal heat sinks bolted to each of the tabs of the device.

AVAILABILITY

The devices are available from Chromasonic Electronics, 56 Fortis Green Road, Muswell Hill, London N10 3HN and from The Radio Shop, 16 Cherry Lane, Bristol BS1 3NG. The prices are in the region of £1 to £2. DW

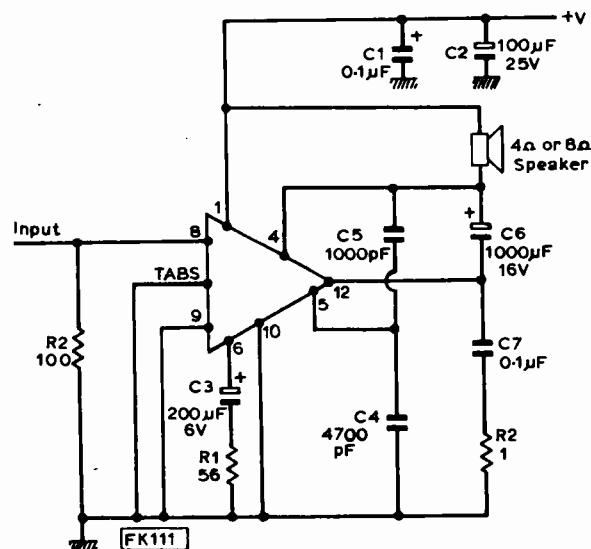


Fig. 5: A simple circuit in which neither side of the loudspeaker can be earthed.

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Positive earth cars

The circuit of Fig. 3 may be employed with vehicles having positive earth, where the input pulses from the contact breaker have a negative polarity. They are fed into the potential divider consisting of R1 and R6. Where only about one hundredth of the initial pulse amplitude is fed to the base of Tr1. It has been found experimentally that, with the values of R1 and R6 shown in this circuit, the input pulse amplitude required to just trigger this circuit is about the same as that required to trigger the circuit of Fig. 1.

Smaller pulses are obtained from the junction of the potential divider resistors in Fig. 3 than in Fig. 1, but the transistor amplifies the pulses. The amplification provided by various transistors differs somewhat, but is in no way critical. The amplified pulses appear across the resistors R2 and are positive going, since the transistor circuit changes the pulse polarity. These pulses are used to drive the IC connected in the same type of circuit as in Fig. 1.

Positive earth calibration

The positive earth circuit of Fig. 3 may be calibrated in exactly the same way as the circuit of Fig. 1, but requires negative pulses to trigger it. The negative output line from Fig. 2 is therefore connected to R1 in Fig. 3, whilst the positive line from Fig. 2 may be connected to either of the power supply lines in Fig. 3. No meter reading will be obtained if these connections are made the wrong way around.

Power supply

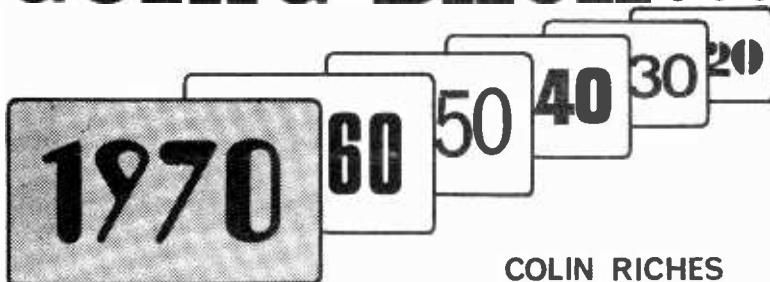
The power supply to the IC should be obtained in the following way so that no current will be drawn when the car's ignition is switched off. In addition, protection is then provided by the car's ignition fuse. The negative power supply line in Fig. 1 or the positive supply line in Fig. 3 should be connected to a good chassis earth on the vehicle, such as the one on the control box. The other power supply line should be connected to the output from the fuse controlled by the ignition switch. Constructors will probably find it most convenient to clamp the meter to the steering column by means of a bracket and a suitable clip. The circuit board itself can be placed in any convenient place, for example, behind the meter.

IC information

The following information is included for those readers who wish to have more information on the SAK115 itself. The power supply (that is, the zener voltage in Figs. 1 and 3) must not exceed 9V or the device may be damaged. It is therefore recommended that the actual supply should lie between 7.5V and 8V at pin 7. The power supply current required is about 12 to 22mA.

The input frequency from the contact breaker should not exceed 10kHz, but this is well above that obtainable from any vehicle. It is also recommended that the resistance between pins 7 and 10 should be between 5k and 20kΩ. DW

GOING BACK...



COLIN RICHES

THIS month we do not go back quite so far in time with a piece of equipment kindly loaned to us by Mr. T. C. McCulley, 31 Cleveland Road, New Malden, Surrey. As far as we know, it is of about 1947 vintage and was an American development made under licence in this country.

Basically the machine is a very sophisticated version of the disc record used by BBC correspondents in the last war to make recordings at the front line so that the people back home could hear the real sounds of war.

Our machine is called a "Recordon" and was to be used on a.c. only 200/250V or 100/130V. To make a recording, one had to turn the volume control-power supply switch clockwise and turn the 'record' switch to the 'on' position. The recording disc was then placed on the turntable lining it up with positioning pins so that it would not slip round. A grooved disc or 'scroll' was then placed on the recording disc and the tonearm placed against the knob in the centre of the

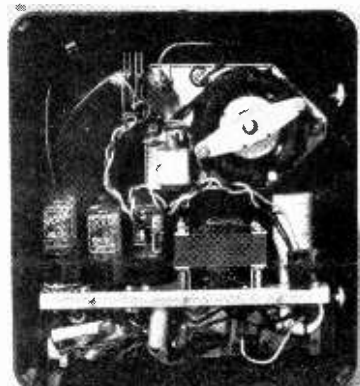


Top view showing disc in position.

scroll. All that remained was then to speak into the microphone.

To hear the recording, the 'play' switch was operated and the tonearm placed against the knob in the centre of the scroll. The volume was adjusted to suit and if the playback became muffled, one could rotate the tuner knob to restore clarity.

This machine was used as some form of office dictating device and it had amongst its features, a button for the erasing of dictation errors, a footswitch control and a push-button 'executive' type microphone.



Rear view showing valves and motor.

An inscription on the case tells us that the suppliers were Thermionic Products Ltd., of London, S.E.11 and the machine was manufactured under agreement with the Brush Development Co., the Brush Crystal Co., Magnetone Inc. and Thermionic Products Ltd. Patent Nos. 454595 and 599751 applied.

If anyone has further information on the Recordon, please would they contact Mr. McCulley direct.

Vintage vision

SOUND is closely allied to vision and this brings us to an interesting note to make for your diaries if you are keen on vintage sound projectors and audio equipment. It's the first ever British Film Collectors' Convention and it will be held on Saturday 24th January 1976 at the Holborn Central Library Theatre, High Holborn, London, WC2.

There will be an exhibition of vintage cine equipment, some of which will actually be working, plus displays of photographs of the old times. There will also be continuous shows of the latest package films released on Super 8mm and some interesting sound projectors in use.

Anyone interested in attending, please send a stamped, addressed envelope to Paul Van Someren, 145 New Kings Road, London, SW6 4SL.

Vintage News-sheet

If anyone would like a free copy of the Antique Wireless News-sheet, send a stamped, self-addressed envelope to Tudor Rees (Vintage Services), 64 Broad St., Staple Hill, Bristol, BS16 5NL.



The accessories that go with Mr. McCulley's recorder.

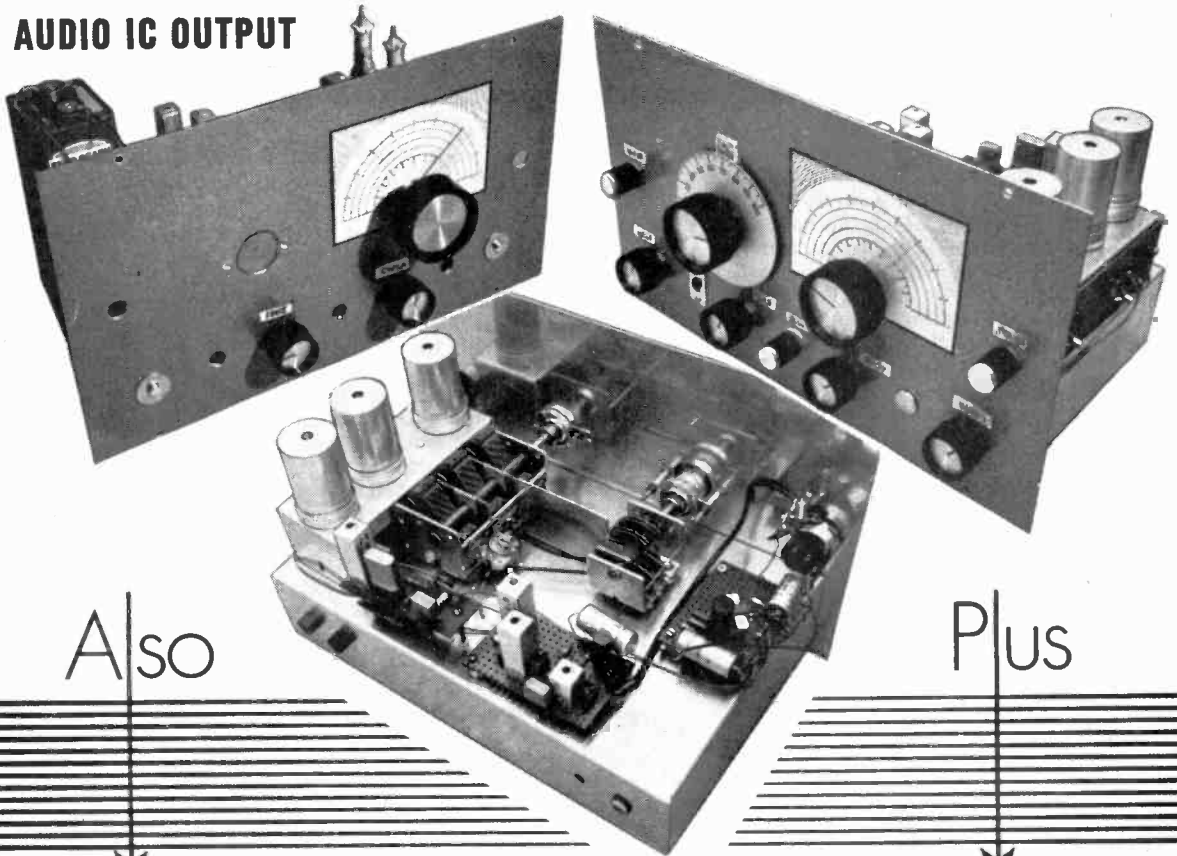
**GENERAL
COVERAGE**

STEP BY STEP RECEIVER

IN NEXT MONTH'S PRACTICAL WIRELESS

- **COVERS MEDIUM WAVES & 3 SHORT WAVE BANDS 1.7 to 30 MHz**
- **DUAL-GATE FETs in RF and MIXER STAGES**
- **AUDIO IC OUTPUT**

The multi-stage receiver is an ideal subject for step-by-step construction. The basic set can be built, tested and operated before further stages are added. These optional extras include an RF amplifier stage, IF stage with crystal filter, beat frequency oscillator permitting reception of Morse and single sideband telephony, and an extra audio stage.



Also

Plus

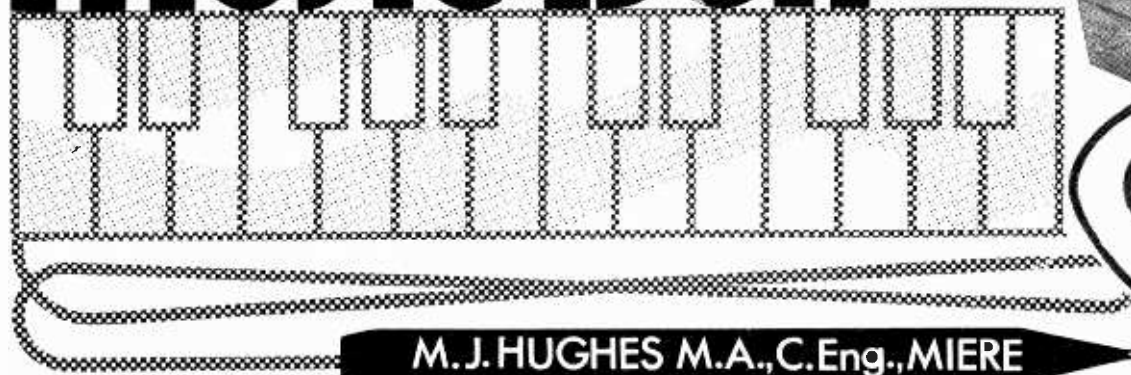
STEREO MIXER UNIT

Mix your microphones output with music from the radio or tape deck to make your own stereo recordings. Mains powered thus eliminating expensive batteries. Simple construction on plain veroboard.

**ALL THE
REGULAR
FEATURES**

**ON SALE IN
JANUARY**

PW 'Easybuild' Music Box



M. J. HUGHES M.A., C.Eng., MIERE

THIS is a comparatively simple project which most beginners could easily undertake. It is a monophonic organ (i.e. only one note can be played at a time) in which the note is selected by touching a key-shaped electrical contact on the printed circuit board with a probe. In that respect it does not differ greatly from other designs already published but a few features have been added which make the project novel in some respects. It was a temptation to add a number of other refinements but it was felt that one of the big attractions of this project would be its absolute simplicity.

PERFORMANCE

A 25 note keyboard spanning two octaves (from C to C) is used and each note is individually tuned with its own preset potentiometer. A master preset allows the pitch of the organ to be shifted over several octaves without altering any other component values. The individual notes will need a slight amount of retuning after this operation because the

voltage control effect of the master preset is not linear. In practice this is no hardship, because once having made the instrument and decided whether to have bass, tenor, alto or soprano pitch simply adjust the presets and leave them.

The advantage of being able to set the pitch of the organ is useful if the project were to be used in school because there need be no variance from one organ to another and later an "Ensemble" of several of the organs could be used to form the basis of a band, similar to a recorder group.

A switch allows vibrato to be selected and a preset control determines the depth of the vibrato. There is no tone control nor volume control; they could be fitted but were left out, with a very good motive. Because a printed circuit board is used there is virtually no free wiring, which sometimes causes problems for beginners and certainly, in this case, would detract from the neat mechanical assembly. The only free wires are those to the battery and probe.

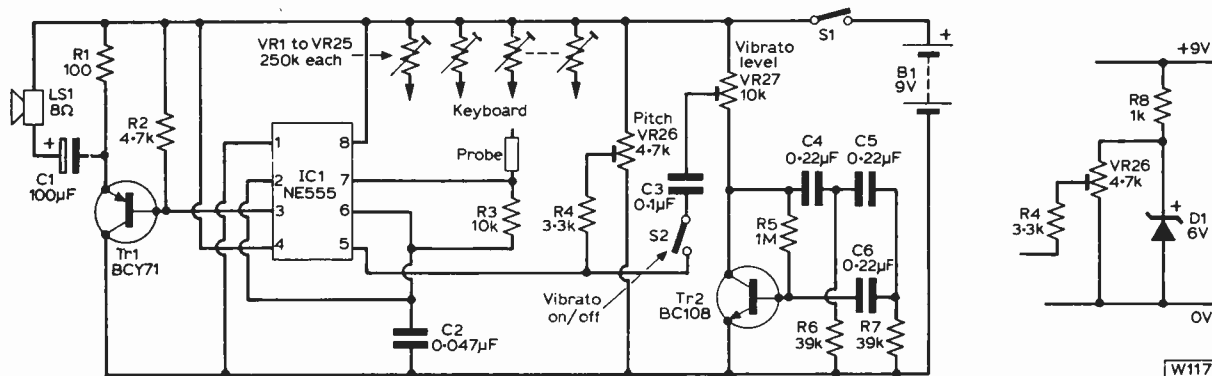
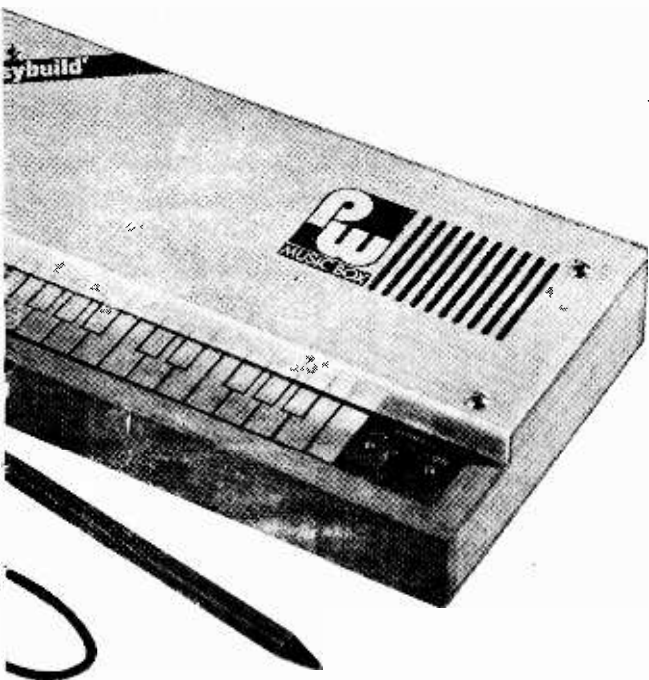


Fig. 1: Full circuit of the Music Box with, inset right, optional circuit for improved stability of the tuning voltage.



CIRCUIT

The circuit is shown in Fig. 1 and the heart of it is an NE555 IC timer operating in astable mode. The frequency of oscillation is set by the value of C2 together with R3 and the selected preset potentiometer from VR1 to VR25. It is the probe, connected to the top end of R3 which is used to select the potentiometer and, hence, the note. The output of IC1 is a square wave which has an amplitude of several volts and it is only necessary to take this from pin 3 and provide a degree of current amplification with the emitter follower Tr1 before it is used to drive a small loudspeaker.

A PNP emitter-follower stage is used so that when no note is being played Tr1 is not conducting, reducing battery consumption. By using an NE555 one can make use of its voltage control capability. A DC voltage at pin 5 will shift the frequency of operation altering the pitch of the instrument over a wide range without changing C2 or any of the other potentiometers. The control voltage is produced by VR26. As the battery voltage falls this control voltage will change slightly affecting the tuning of the instrument but in the majority of cases where the instrument is used as a toy this is not likely to present problems.

If very stable tuning is required this control voltage can be obtained using a zener diode and an extra resistor as shown in the inset to Fig. 1. This modification would require a slight change to the PCB but it is felt that few would want to do this, keeping to the simpler version.

A low frequency signal on top of the DC control voltage will frequency modulate the signal from IC1 which provides perfect vibrato. Tr2 and its associated components form a simple phase shift oscillator which produces a pure 6Hz sinewave output. A controllable portion of this is selected by VR27 and fed via C3 and the vibrato switch to the voltage control input of the main oscillator. Adjustment of VR27 sets the depth of vibrato. It is important that a branded

★ components list

Resistors

R1 100Ω	R4 3.3kΩ	R7 39kΩ
R2 4.7kΩ	R5 1MΩ	R8 1kΩ
R3 10kΩ	R6 39kΩ	

All 10% $\frac{1}{4}$ or $\frac{1}{2}$ W

VR1-25 250kΩ (25 off) vertical sub-miniature preset pots.

VR26 4.7kΩ ditto

VR27 10kΩ ditto

Capacitors

C1 100μF 12V	C3 0.1μF	C5 0.22μF
C2 0.047μF	C4 0.22μF	C6 0.22μF

All polyester except C1.

Semiconductors

Tr1 BCY71	Tr2 BC108
IC1 NE555	D1 6V 400mW zener

Miscellaneous

Miniature slide switch, on-off, 2 off. Speaker, 8 to 35Ω, not more than 2½in. overall diameter. PCB (see page 742). PP3 battery and press-stud connector. Cabinet, probe and material for cover.

A solid mahogany cabinet with plywood base can be obtained from Birch & Ridley, Watson Road, Worksop, Notts. for £3.50 plus 40p p/p. An aluminium top plate with circular speaker hole can be obtained from H. L. Smith Ltd., 287 Edgware Road, London W2 for 33p plus 17p p/p.

BC108 is used for Tr2 as some general purpose NPN transistors will not have sufficient gain to get the vibrato circuit oscillating. For the same reason use good quality polyester capacitors for C4, C5 and C6 and avoid ceramic types.

The circuit will work with just about any speaker having an impedance of 8Ω or greater but the crucial factor is its diameter so that it will fit on the printed circuit board. An 8Ω speaker will give the largest output but a 35Ω one still gives quite an appreciable output.

CONSTRUCTION

For assembly of the printed circuit board refer to Fig. 2/3. Start by inserting and soldering in all the preset potentiometers. This is a bit monotonous but it gives plenty of practice at soldering before coming to the semiconductors! Next glue the loudspeaker into position with a fast-setting epoxy resin, and avoid getting the resin on the cone of the speaker. Before going on to the rest of the components fix the two slide switches S1 and S2 into position. These switches and the loudspeaker should be mounted on the plain side of the board.

Go on to solder in all the fixed resistors and then the capacitors. The only polarised component so far is C1 so make sure this is inserted the right way round, the positive end of the capacitor should go into the hole nearer to the loudspeaker connection. Insert and solder the two transistors into their correct position and the leads the right way round. The emitter is the wire nearest the spigot on the can, the collector is the wire diametrically opposite the emitter and the base lead is midway between the two but offset to one side. Finally insert the integrated circuit making sure that its orientation mark is in the position shown on the layout drawing.

The only wiring left goes to the battery switch, the loudspeaker and the vibrato switch. A single wire goes to the probe.

TESTING

Before testing, set all the potentiometers to the middle of their range. Connect the battery, switch on and try touching the end of the flying lead on any of the keys, when a strong note should come from the loud-speaker but the tuning will be meaningless at this point. While touching a single key check the vibrato by switching it on and altering the depth by adjustment of VR27. Check, also that adjustment of VR26 will change the note you are holding.

Now decide how you wish to pitch the instrument. Holding the probe lead on the central "C" of the keyboard, adjust VR26 until the note heard corresponds to the middle "C" of the two octave span required. (A piano is a great help here). From there on it is only necessary to touch each note in turn and adjust the corresponding potentiometer until the instrument is accurately tuned over the entire two octaves in question. It is much easier to tune if the vibrato is switched off.

FINISHING OFF

Make the wooden cabinet and the bent aluminium lid as shown in the drawings. If it is not possible to use aluminium then make the lid out of thin plywood or plastic. In fact some readers might prefer to make the whole box from plastic. The printed circuit board should just be a snug fit inside the case.

Place the printed circuit board inside the box and put some temporary packing under the front edge to keep the board level. Mark the holes for mounting the board to the underside of the lid, one in each corner. Make sure that the holes are clear of the printed wiring.

Use long 4BA screws with nuts to bolt the PCB to the underside of the lid and make sure that it stands off sufficiently to leave a small gap between the bottom edge of the front drop and the keys, otherwise a short circuit might occur.

Before completing assembly glue a card strap inside the front edge of the box to hold the battery. Position the battery and thread the probe lead through the hole in the front. A knot in this lead will take the

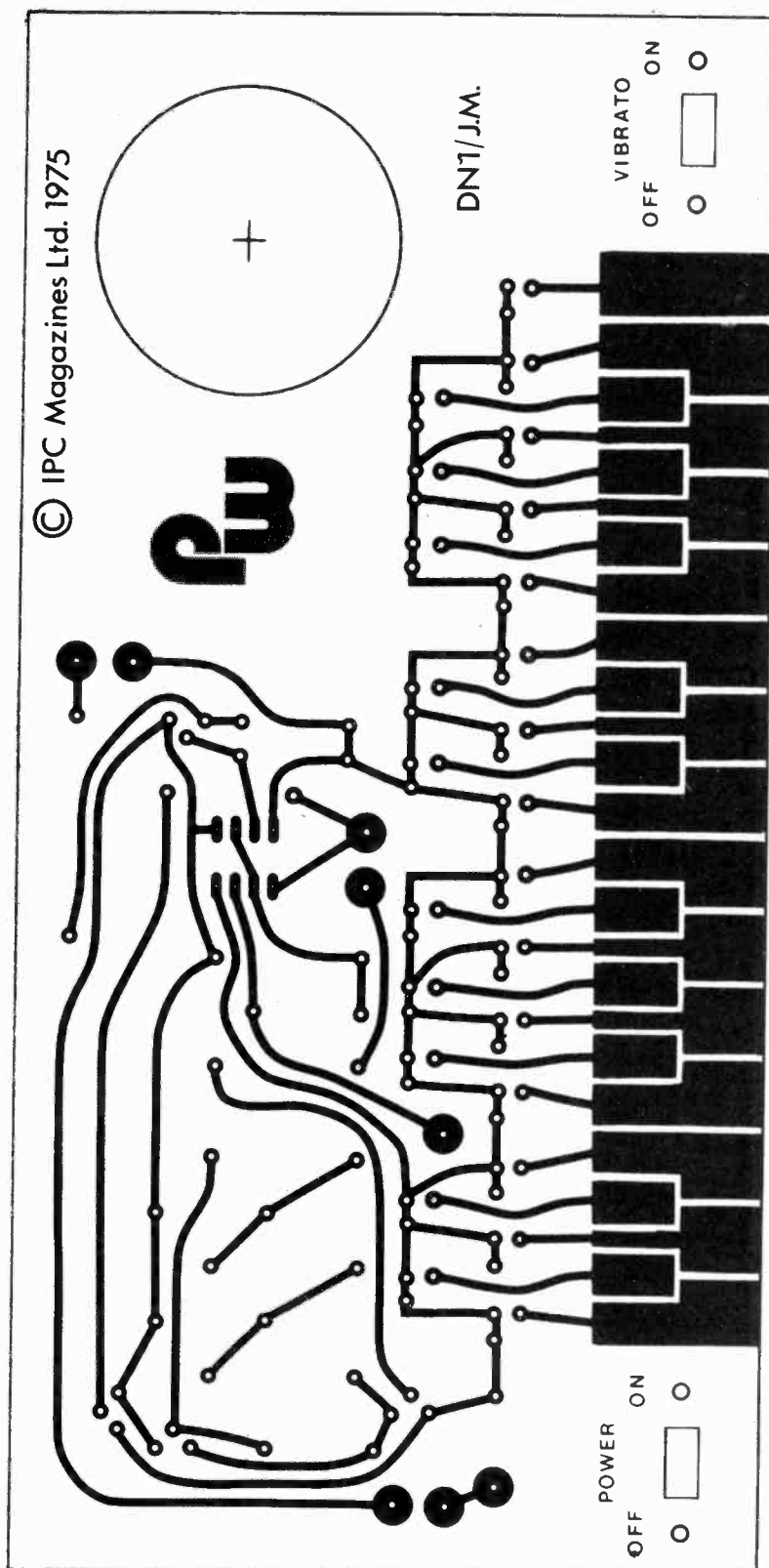


Fig. 2: above, shows the PCB for the Music Box, drawn actual size. Fig. 3: next page, is a guide to the layout of the components on the PCB. The voltage stabilising circuit shown in Fig. 1 is not included on this board. The two switches and the speaker are glued to the plain side of the PCB.

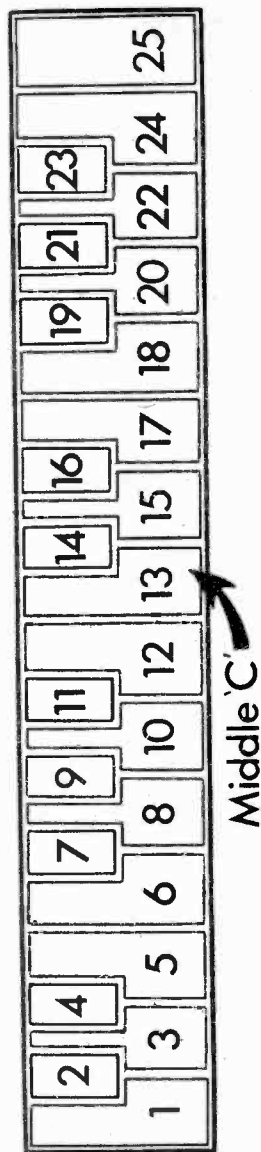
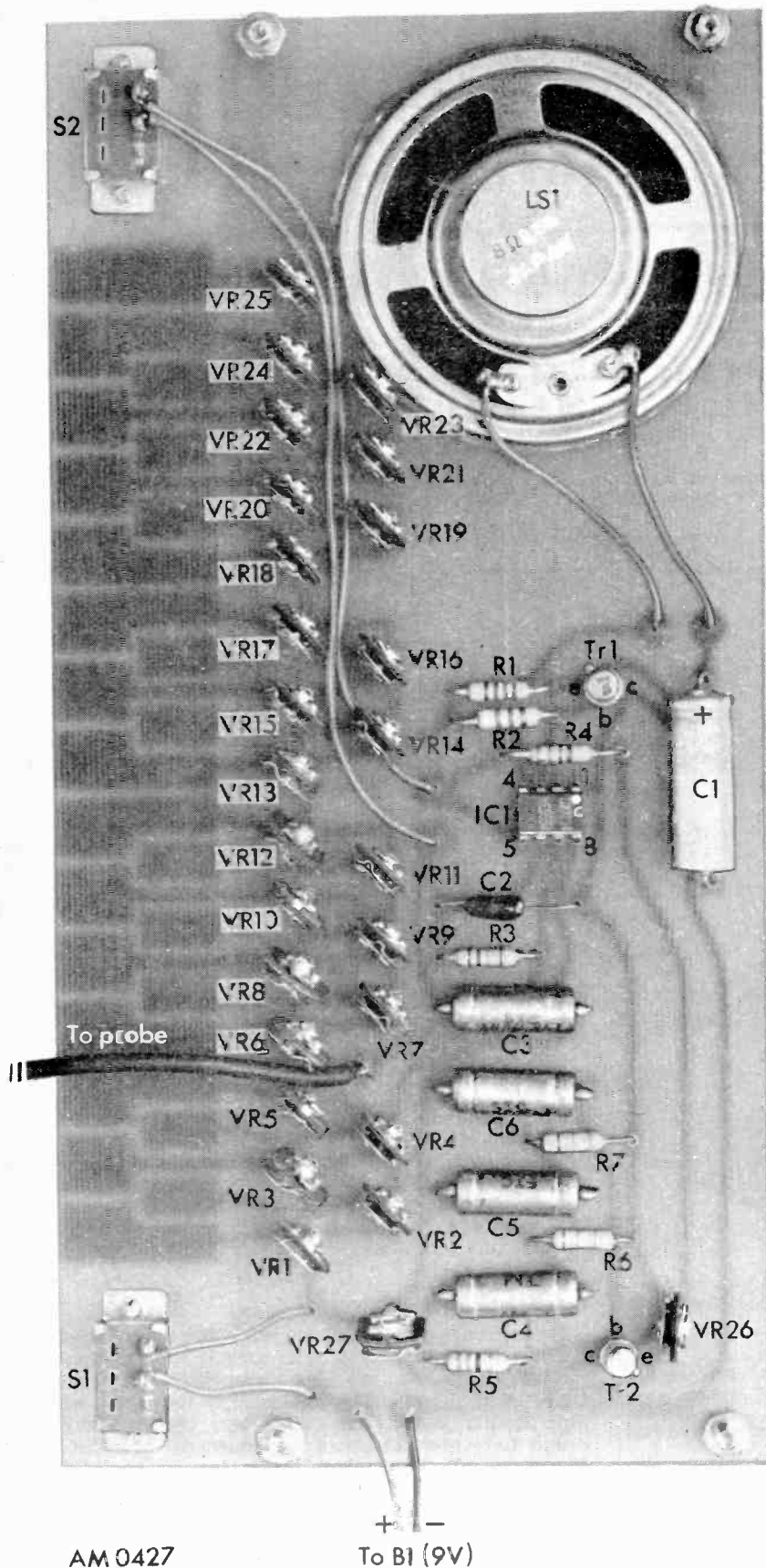


Fig. 4: 'Keyboard' layout with the 'keys' numbered to enable tunes to be played using the notation shown on the next page.

strain and prevent pulling of the lead from its solder pad. Make a final check on the tuning and then screw the PCB into position in the box.

To make the probe use the body of a felt-tipped pen having first removed the tip and the internals. The flying lead should be threaded through the body, if necessary drill out the back end and through the tip. Strip off a bit of insulation and fold the wire back on itself and apply a smooth blob of solder.

'COME ALL YE FAITHFUL'

8 8 — 3 8 10 — 3 — 12 10 12 13 12 10 — 8 8 — 7 5 7 8 10 12 7 5 — 3 3.

'CAMPTOWN RACES'

11 11 11 8 11 13 11 8 — 8 6 — 8 6 11 11 11 8 11 13 11 8 — 8 6 — 8 6 — 4.

'COCKLES AND MUSSELS'

1 6 — 6 6 6 10 — 6 8 8 8 8 11 8 8 10 13 11 10 13 11 10 6 8 — 6.

'JINGLE BELLS'

13 13 13 — 13 13 13 — 13 16 9 11 13 — 14 14 14 — 14 14 13 13 13 13 13 11
 13 11 16 — 13 13 13 — 13 13 13 — 13 16 9 11 13 — 14 14 14 — 14 14 — 13
 13 — 13 13 16 14 13 11 9.

To assist the non-musical the notes of some well-known tunes are numbered as shown here to correspond with the 'keyboard' of Fig. 4.

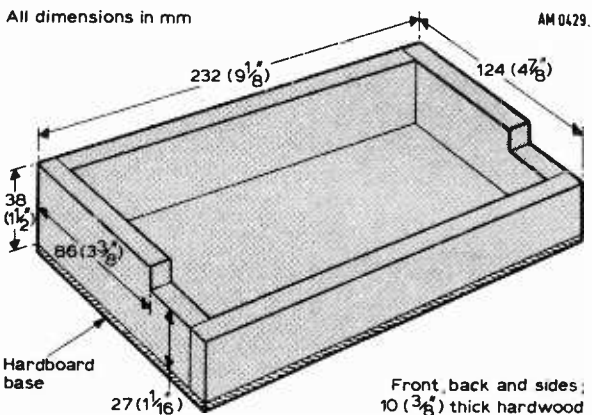
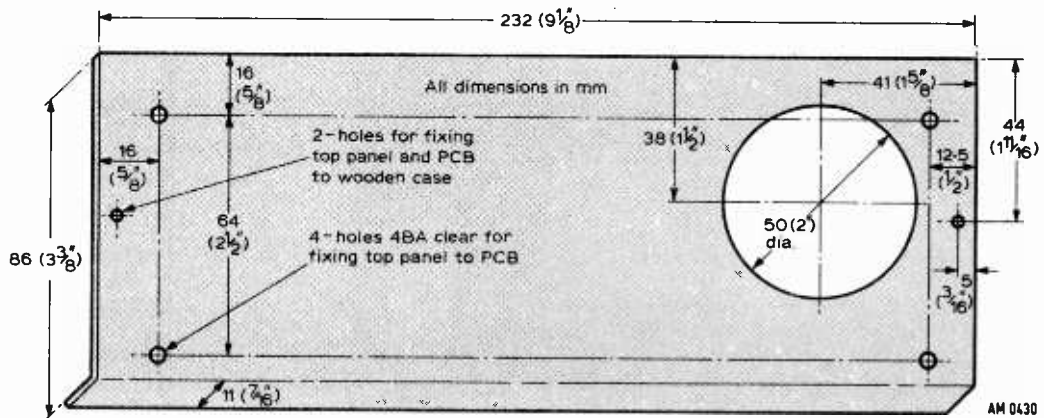


Fig. 5: Dimensions of the top cover of the Music Box. The speaker aperture can be backed with a small piece of cloth or the cutout can be made ornamental as in the author's model.

Fig. 6: left, shows the simple case for the Music Box.

Fig 7: below left, illustrates the way in which the PCB is fitted to the top cover. It is very important to see that the gap shown is adequate to prevent the top cover shorting the 'keys'.

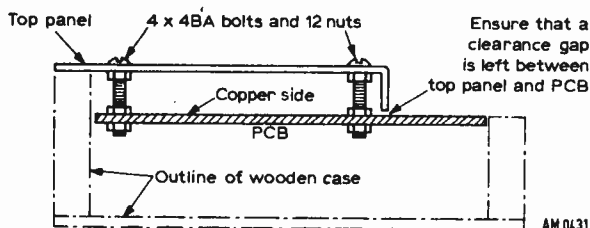
Finally, carefully glue the wire and the tip into place with epoxy resin.

An overlay, Fig. 4, can be cut out and stuck on the lid to match up with the keys. This is for the benefit of those who cannot read music but would like to practice playing music such as the selection of seasonal tunes shown.

MAKING MUSIC

Having built and tested the Music Box the natural desire will be to play a tune on it! For the non-musical constructor we have reproduced the 'keyboard' with numbers, together with the notes of four popular ditties given as numbers, thus enabling a tune to be played without any knowledge of music. The dash indicates a short pause.

To carry the idea further and to make the playing of a tune even easier by this method, the 'keys' can be marked with the numbers by means of small sticky labels or even with a felt-tipped pen. DW



Now...the most exciting Sinclair kit ever

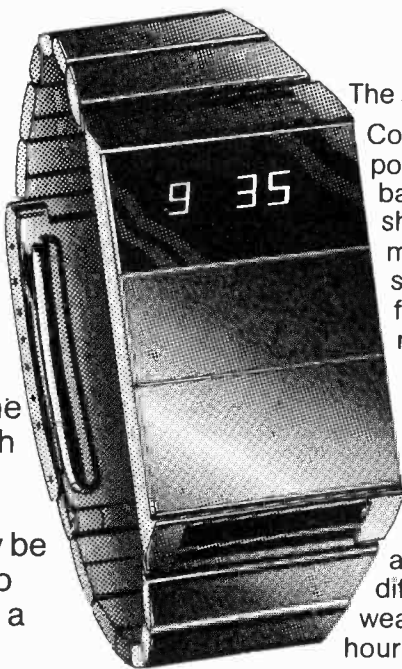
The Black Watch kit

At £17.95, it's

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

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

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



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

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

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

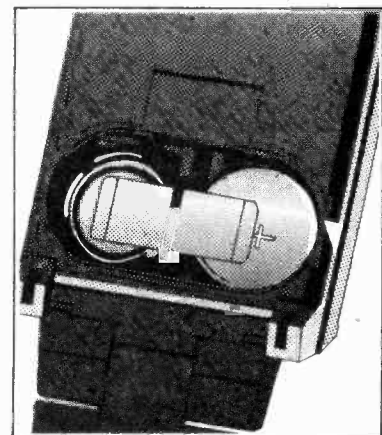
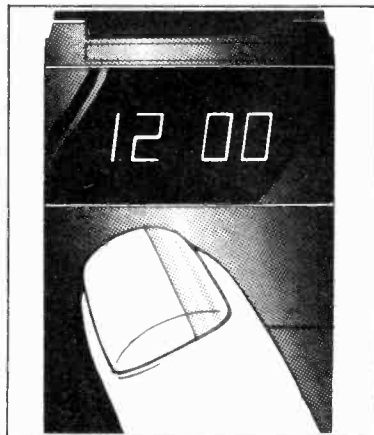
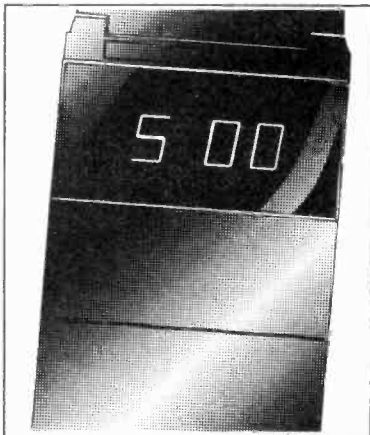
The special features of The Black Watch

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

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

Touch-and-see case – no unprofessional buttons.

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



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

The chip...

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

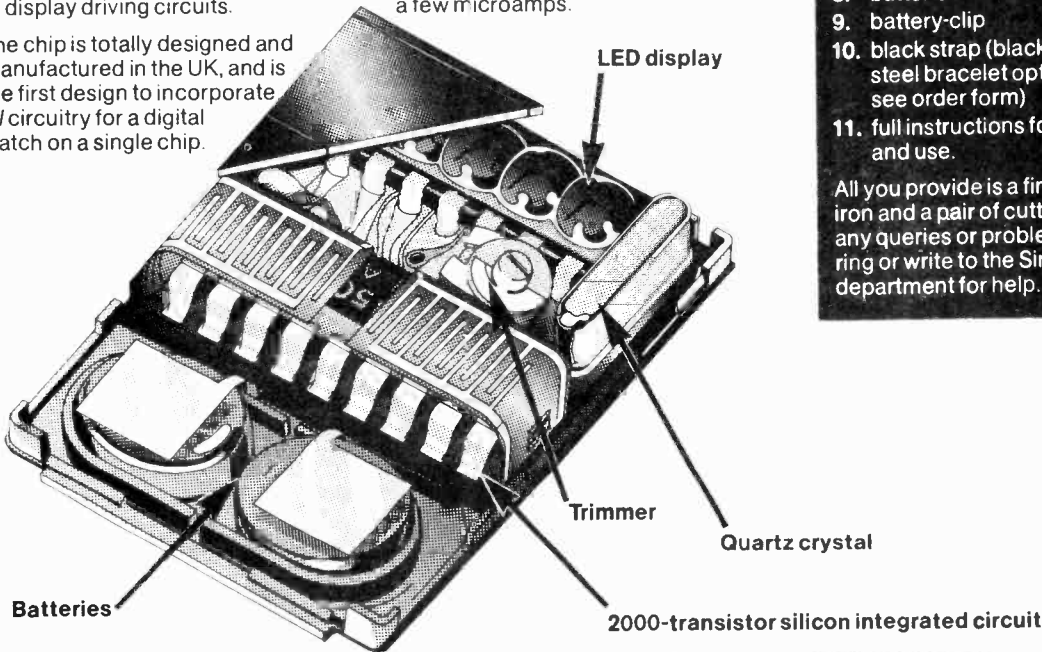
This chip of silicon measures only 3 mm x 3 mm and contains over 2000 transistors. The circuit includes

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

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

...and how it works

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



Complete kit £17.95!

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 you provide is a fine soldering iron and a pair of cutters. If you've any queries or problems in building, ring or write to the 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 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: £17.95 (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 £17.95 (inc. black strap, VAT, p&p).	* I enclose cheque for £..... made out to Sinclair Radionics Ltd and crossed.
..... (qty) black stainless-steel bracelet(s) at £2.00 (inc. VAT, p&p).	* Please debit my *Barclaycard/Access/American Express account number
.....

Name _____

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PW1

Please print. FREEPOST—no stamp required.

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GENERAL SERVICING

An occasional series by LES LAWRY-JOHNS

chatting this time on—

1-UNIT AUDIO EQUIPMENT

THE units referred to in this article are mainly those of the cheaper variety costing, say, under £100. Such a unit could have an auto-changer of the cheaper BSR type with a simple amplifier system using a single audio chip for each channel or perhaps an audio pair, a driver and a preamplifier for each channel. Several examples of such units have been produced by various firms, some with radio, some without, and they all tend to follow a similar pattern of a basic design with limited output and few frills.

Auto-changers

We shall start by taking a quick look at the auto-changer which does tend to give one or two troubles which occur so often that they can be predicted, within reason. The most common trouble which we have experienced of late is due to lack of lubrication on the centre post, the friction sometimes becoming so great that it is difficult to spin the turntable by hand. Normally things do not get to this stage as the user is concerned by the slow and varying speed of the turntable and either does something about it or gets something done.

A variation on the same theme is noisy rotation, causing the pick-up arm to vibrate. The answer is to remove the centre trim and circlip, ease off the turntable and oil the centre post. Check for any roughness and do the same with the turntable centre bearing. Whilst doing this it is worthwhile checking the motor and idler. Whilst the bottom bearing of the motor rarely needs attention, although it does happen, the top bearing loses its lubrication, understandably enough, much earlier. So a few drops in the top bearing do not come amiss. The screeching of a dry bearing is not an uncommon noise to issue from the average type of motor.

Another cause of speed variation is lack of friction between the motor spindle and the rubber of the idler wheel. The rubber tends to become shiny and requires roughening with a piece of fine sandpaper or the like. Make sure that no oil gets on this rubber and that it spins easily on its post. It is often thought that wear on this rubber idler will cause the speed to vary, due to its smaller diameter. This is not so. The size of the idler wheel has no influence on the speed of the turntable at all, unless of course it has an irregularity on its surface when it will produce a bumping effect. The speed is controlled by the motor and its drive spindle and the size of the turntable driven surface.

Having got that off our chest we should now have a smoothly running motor, an evenly spinning idler driving a turntable which is freely rotating about the centre pillar. Belt driven and direct drive turntables need not concern us here as they are found only in more expensive assemblies.

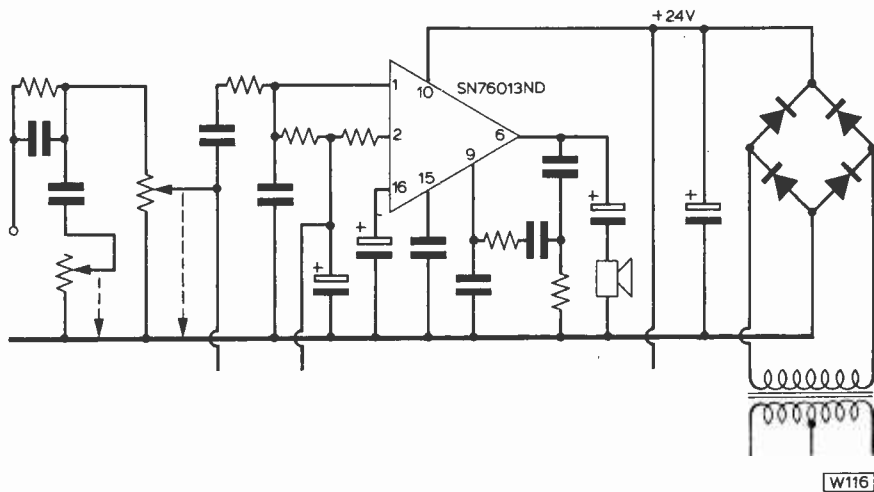
The Amplifier

Before considering any specific faults we should first consider external factors which can cause them. The most common fault is failure of the output transistors or ICs (chips). Such failure can be caused by the use of unsuitable loudspeakers or a fault in the cable to them, including the possibility of the leads in the plug touching. It pays to check the plug and lead, plus any joins in it, and the loudspeaker itself. If the amplifier output is specified for 8Ω working, ensure that the loudspeaker is an 8Ω one and that no other loudspeaker has been wired across it.

A good number of loudspeakers clearly marked 8Ω have been found to be 3Ω , and usually of unknown origin, and this has meant that the equipment to which they have been fitted has been over-run, dissipating excessive current and thereby excess heat. This has meant the early demise of the ICs



—with suspicion of the driver—



This is the basic circuit of many stereo amplifiers found in domestic audio equipment and serves to illustrate the text.

or output transistors operated beyond their rated power. Quite often the loudspeakers are fixed in a position, together with their wiring, which makes removal inconvenient so that when the amplifier fails it is only this which is taken for repair. With new components fitted and tested upon correct speakers, the equipment is once more coupled up and the overrunning is repeated.

A permutation of this state of affairs is often that one speaker is incorrect, one correct. One channel fails due to overrunning and the owner changes over the speaker plugs to "check the speakers". This means that the wrong speaker is now connected to the good channel and the correct speaker to the failed one. The equipment can be operated like this for some time on the basis that "some sound is better than none" with the resultant destruction of the good channel.

Another consideration here; if one channel fails and the supply is not regulated, the remaining channel will operate at a higher supply voltage and thus

may fail due to this factor. The only moral which can be drawn is that if one channel fails, for whatever reason, the equipment should not be used until the fault(s) is rectified and the system checked.

Before leaving the subject of loudspeakers let us make one or two points, probably elementary to most, quite clear. If loudspeakers are to be added to an existing system and there is no provision for this on the amplifier, add them in series (cut one wire and insert the speaker), never loop off in parallel. Parallel working decreases the impedance and thus increases the load on the amplifier. Series working increases the impedance and decreases the load; not so much power but the amplifier will last longer! If an amplifier is designed to work into 8Ω, use an 8Ω load, or more, but not less. If leads have to be joined, make sure they cannot touch accidentally. If plugs are to be soldered, bring the insulation right up to the tags and leave no whiskers which can rotate and touch if the leads are twisted. These simple precautions can avoid annoying and costly repairs. If space permits, put a short length of insulating sleeving over the insulation of the wire and slide it over the joint when it has been soldered.



—leave no whiskers which can rotate—

Servicing Amplifiers

The rather simple stereo amplifier which is likely to be fitted in our unit under discussion, will have a pair of audio chips or two pairs of output transistors with driver(s) and a preamplifier. An example of one channel a unit, with the bare necessities, is shown in the circuit.

Undoubtedly the most common fault in these units is the failure of one or both of the ICs, usually SN76013ND or SN76013N. The main difference is that the ND lies flat on the panel with two pieces of metal soldered to the print earth as a heat sink. The N series differs by having these pieces of metal bent up to form a larger finned heat sink.

If one is lucky, and things have not gone too far, the unit can be connected to the speakers and switched on to produce sound from one speaker and nothing (or a hum) from the other. If there is no sound at all from one channel this chip will be quite cold and a voltage check will show a reading on pin 10 only. If there is a hum from one side the chip will be overheating and again is easily identified.

Replacement of a defective chip is not at all difficult provided one has an efficient means of removing the solder to leave the chip loose in the holes so that it can be lifted out and the new one popped in, soldered on all active pins, and any flux removed from between the joints. Removing the solder in the first place is the major part of the battle. A soldering bit which fits over all pins at once and sucks up the solder in one go is a luxury which not everyone has available. Most are content to use a simple vacuum pump or perhaps the more efficient desoldering braid. On occasions this is all that is required but, more often than not, things are not that simple.



—many engineers are climbing Mount Everest—

For example, both channels may be inoperative but only one chip need be at fault (check voltages for this one) because one chip can turn the other off. Again, one channel may be working when tested and the other is defective. When the latter is replaced the unit may work fine for a time and then one channel fails, quickly followed by the other. Investigation may show that the new chip has failed but the other is now functioning just to add to the confusion. The answer is that one has been intermittent causing the voltage to rise, in turn causing the otherwise good one to short internally. The answer is to replace both chips when there is the slightest hint of "one channel went first, and then the other". Such hanky panky can also cause trouble elsewhere. For example, a shorted chip (or output pair of transistors) can cause a heavy flow of current sufficient to cause the bridge rectifier to short out before the fuse fails. Hence one can be faced with a blown fuse, apparently caused by a defective rectifier. Replacement of these parts should be followed by a careful check on the supply line to ascertain whether there is still a contributory short.

It is alarming just how much time, money and patience can be expended on a seemingly simple job if one is not aware of the pitfalls that await the unwary or unwarned.

This is one of the reasons why audio unit repairs are not exactly sought after by workshops, often

engaged in the usually more straightforward servicing of TV receivers. The fact that these latter devices are being served up with ever-increasing numbers of chips probably explains why many engineers are leaving the trade and taking up the less arduous pursuit of climbing Mount Everest or deep-sea diving. Those remaining hope that replacement panels will save them in the field whilst the faulty panel can be put on a test rig under test for diagnosis by someone else during the day or by himself in the wee small hours!

In all cases the rule is to know what the voltages should be at various points or at least be able to compare a working stage with a non-working one, and to take these voltages without damaging the item under test. An ordinary voltmeter test prod is a pretty clumsy affair and can easily slip between adjacent pins of a chip. Either sharpen the probe or bind a needle to it. If there is doubt, check all relevant components. A leaky capacitor or a faulty resistor is often found after a chip has been needlessly replaced.

AC or DC Coupling

Whilst most up-to-date inexpensive amplifiers use chips, some modern and all older ones use a balanced pair in the output stage of each channel with their drivers and pre-amplifiers. The very early amplifiers used transformer coupling from the driver to the output pair and this made fault diagnosis very easy as the output stage was, from a supply point of view, bias, etc., independent of the earlier stages. Thus if one transistor's voltages were high it was a comparatively easy matter to cold test each transistor and associated resistors to ascertain where the short or open circuit was occurring.

It hasn't been that easy for some considerable time now, as transformers are a thing of the past; stages are DC coupled and thus interdependent. A fault in an early stage can easily switch off all succeeding stages so that wildly wrong voltages in the output stage need not denote a fault here, or in the driver stage(s). The rule is therefore to regard the amplifier as a whole and start from the beginning, say from where the preamplifier is isolated from the preceding stage by a capacitor. The snag, once again, is that the pre-amplifier may depend for its bias on the output stage, then where are you?

Quite often the job is less tedious than it could be by virtue of the fact that certain types of transistor are more prone to fail than others. For example, if we know that AC128 transistors are used, these are tested first, together with the associated emitter resistors. This has saved time, again and again. The method of cold testing transistors with an ohmmeter has been described on many occasions and will not be repeated here. Quite apart from this, if the emitter resistors appear scorched or otherwise distressed, these usually being about $2 \cdot 2\Omega$, it is a pretty safe bet that the output pair need replacement together with suspicion of the driver.

If in doubt it is far better to replace all suspects in one go rather than try to pinpoint one particular transistor. Low and medium power audio transistors are cheap and easy to replace (as a rule, but there are always exceptions) but it is not always easy to gain access. So once the panel or unit is out for repair, do what is necessary plus anything else remotely suspect before reassembling.



—the answer is to replace both chips—

Noise

We have so far considered the causes of inoperative stages, but, all too often, the fault is the annoying one of excessive background noise. Usually the suspect items are capacitors or transistors, the latter being the main culprits, with electrolytic capacitors following close behind. Sometimes the responsible component is heat conscious and can be identified by a judicious squirt of cooling solution (Freezit) but more often the trouble is due to an internal defect which no amount of freezing or disturbing will alter. Operation of the volume control will immediately identify the rough position in the circuit (before or after the control, always assuming the control itself is not responsible) and this is a starting point.

Bearing in mind the fact that the whole circuit is probably DC coupled and that shorting the base to emitter of an early stage would probably shut down the whole circuit and thus do very little to identify the actual culprit, a fairly high value capacitor can be used (depending upon the circuit values) to short out the signal and eventually the noise when the faulty stage is reached.

Distortion

Distortion is usually due to transistors working under improper conditions, sometimes caused by leaky capacitors, sometimes by faulty transistors, very occasionally by incorrect value resistors. The action taken depends very much upon the experience of the repairer. Very often a short-cut can be taken if the type of capacitors fitted are those which are well-known to be likely to break down. If, for example, some small electrolytic capacitors are fitted which are coloured black with silver writing denoting their value, etc., it is prudent to check the voltages of the associated stages and if these are suspect, remove the capacitor and test again. If the voltages are now right, and a meter check reveals heavy leakage through the capacitor, the short cut is well justified. Quite often the output transistors are unmatched or one is defective, this showing in

a voltage check followed by a cold resistance test. If the voltages are wrong but the cold test appears about right, check the driver stages where a high reading may be found both ways, base to emitter or base to collector, or perhaps a low reading in the reverse (when it should be high, taking into consideration the circuit values) direction.

Dry Joints, and the like

It is often the case that incorrect working is not due to component failure at all and it is always worthwhile spending a little time gently rocking various components to ensure that they are properly soldered to the panel. It is surprising how long a piece of equipment will function with a component not being soldered at all in the first place! It doesn't usually show up until, as a rule, the equipment is disturbed. Since this is usually due to a fault developing in another section, the repairer is faced with two faults instead of one although he probably only realises this when the more obvious fault has been located and cleared. This is irritating, to put it as mildly as possible.

A variation of this is a crack in a copper track which may not show up until the panel is flexed. This again is a great time waster and a combination of signal injection, voltage reading and continuity testing may be required to locate the break if it cannot be seen.

Checking the Cartridge

One of the more common faults is that the output of one channel is normal but the output of the other is low or absent. It is prudent to check the cartridge on the pick-up head before taking any other action. This is done quite easily by disconnecting the leads from the cartridge, with the amplifier on and the balance control at centre, when hum, equal from each channel, should be obtained, picked up by the active lead to each channel, usually the red for one channel and white for the other, the black and green leads being earthed and common. If the red clip provides a reasonable hum when touched as does the green for the other channel, the amplifier is likely to be in order and the cartridge at fault. A replacement cartridge is probably the only attention required. If there is hum from one side but not the other, follow the leads underneath to the tag strip and repeat the hum test. If equal hum is obtained, the continuity of the relevant lead to the pick-up head should be checked. If no hum is received on one side follow through to the amplifier and check the input to this with the lead connected and with it off; to check for the rather unlikely possibility of a short in the cable, from inner to screening.

Having said this we hasten to add that if phono plugs are used for the connection to the amplifier or to the tag strip the possibility of such a short becomes a probability and will be found where the screening is soldered to the plug body, the heat used having melted the insulation between the inner and the outer. If this is so, cut back the cable and make the connection with a longer pigtail on the screen. It may not look so nice but a short is less likely.

TO BE CONTINUED

PRODUCTION LINES

colin riches

THE LOCKABINET

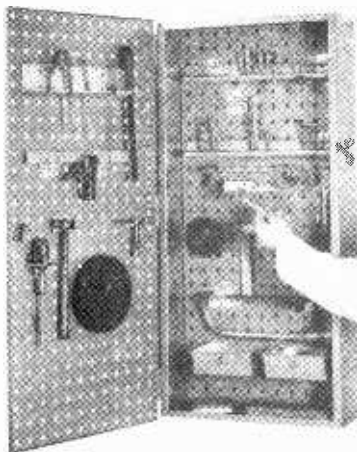
As tools of all types become increasingly expensive Lockpanel Ltd. have introduced a "Lockabinet".

The photograph illustrates the all British-made cabinet which is ruggedly constructed from 1.25mm (18G) metal panels. The cabinet has overall dimensions of 1000 mm (39") x 460 mm (18½") x 200 mm (8"). The back panel and door are perforated with a regular pattern of square holes into which can be hooked a wide range of tool holding accessories suitable for storing virtually any type of hand tool, engineers or electrician's tools.

The Lockabinet is wall mounted, with access to the fixing brackets from inside the cabinet. Thus, when locked it offers security for its contents whilst providing an orderly and visually effective storage method—each tool being easily located when required.

Finished in anti-chip epoxy stove enamel of light green colour the Lockabinet is provided with a chromium plated integral lock.

All the accessories can be purchased separately from the cabinet



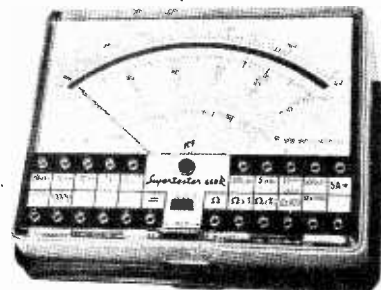
but the firm offers a complete kit which includes a cabinet plus a selection of the most generally useful accessories at £37.48. The price includes packing, carriage and VAT.

Lockpanel would be pleased to send full details of the Lockabinet to any readers on application. *The Lockpanel Company Limited, Marjorie Street, Leicester, LE4 5GZ.*

THE SUPERTESTER

The Supertester 680R is an 80-range test meter with a 20,000 ohm/V sensitivity.

Technical data—Volts A.C. 11 ranges: 2-10-50-250-1000-2500 Volts and 4-20-100-500 and 2000 Volts. Volts D.C. 13 ranges: 100mV-2V-10-50-200-500-1000 Volts 200mV-4V-20-100-400 and 2000 Volts. Amp. D.C. 12 ranges: 50 μA-500 μA-5 mA-50 mA-500mA-5 Amp and 100 μA-1 mA-



10mA-100mA-1 Amp and 10 Amp. Amp. A.C. 10 ranges: 250 μA-2.5mA-25mA-250mA-2.5A and 500μA-5mA-50mA-500mA-5A. Ohms 6 ranges: x1-x10-x100-x1000-x10,000 and Low Ohms. Detector Reactance 1 range: from 0 to 10 Megohms. Frequency Output 2 ranges: from 0 to 500 and from 0 to 5000Hz. Voltage Output 9 ranges: 10-50-250-1000-2500V and 20-100-500-2000 Volts. Decibels 10 ranges from -24 to +70dB. Capacity 6 ranges: from 0 to 50,000 and from 0 to 500,000pF using the mains and from 0 to 20, from 0 to 200, from 0 to 2,000 and from 0 to 20,000 microfarad using the incorporated 3 Volts battery. **Bold figures indicate A — V x 2.** Price complete with case and probes is around £18.50. Further information from: *Electronic Brokers Ltd., 49-53 Pancras Road, London, NW1.*

KNOBBS, ETC.

A broad range of collet knobs and accessories is now available from Roxburgh Electronics Ltd.

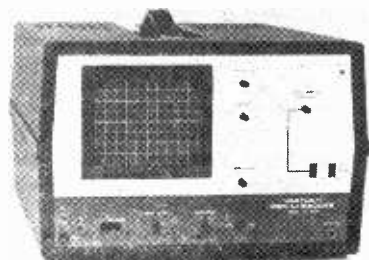
Designed for ease of handling and simplicity of assembly, they are produced to fit shaft diameters of 3mm., 4mm. or 6mm., and ¼ in. or ½ in. The diameters of the knobs, at 10, 11, 15, 21 and 29mm., are such that they will fit into the cap recess of the next largest size, enabling double knobs to be formed.

The knobs and nut covers are available in winged and plain styles, with or without line, in matt finished black, red or grey nylon; the caps and pointers, which are also of matt finished nylon, are additionally available in green, blue or yellow. The captioned dials, which can be supplied with a variety of standard legends and symbols, are of polycarbonate. *Roxburgh Electronics Ltd., 22 Winchelsea Road, Rye, Sussex. Telephone: Rye 3777.*

DC-5MHz, 100mV SCOPE

The new Heathkit IO-4560 'scope's sweep speed is continuously adjustable from 20 ms/cm to 200 ns/cm. Maximum vertical sensitivity is 100mV with a front panel switch for X1, X10 and X100 attenuation, AC or DC. Vertical input impedance is 1 megohm for low circuit loading. Up to 400 VDC can be applied directly without circuit damage, making it a great 'scope for students' use. For phase and frequency measurements, an external horizontal input can be applied directly through the front panel input jack. It has 250mV sensitivity with DC to 100kHz bandwidth. Display stability is excellent because the low voltage supplies for the amplifiers and sweep circuit are zener regulated. The primary circuit of the power transformer is fused for protection from over-load.

Kit K/IO-4560 costs £69.90 including VAT and delivery within the United Kingdom. Full details available upon request from: *Heath (Gloucester) Ltd., Bristol Road, Gloucester GL2 6EE or The London Heathkit Centre, 233 Tottenham Court Road, London W1P 9AE.*



AERIAL TUNER UNIT

The Codar RQ-80 A.T.U. has been designed to match the random lengths of single wire often employed as aerials on short wave receivers, and to provide an efficient coupling to the receiver input with appreciable increase in signal level. It is particularly effective where short or indoor aerials have to be used because of space limitations.

The RQ-80 employs an air spaced Hi-Q low-loss "Codarcoil" inductor in a tuned input/output PI-network with a very wide range of matching obtainable with 10 switch positions of inductance taps. An additional switch position transfers the aerial direct to the receiver.

The nominal range covered is 1.5-30MHz continuous, the L.F. end limit being dependent on the type and length of aerial in use, and can be lower than quoted.

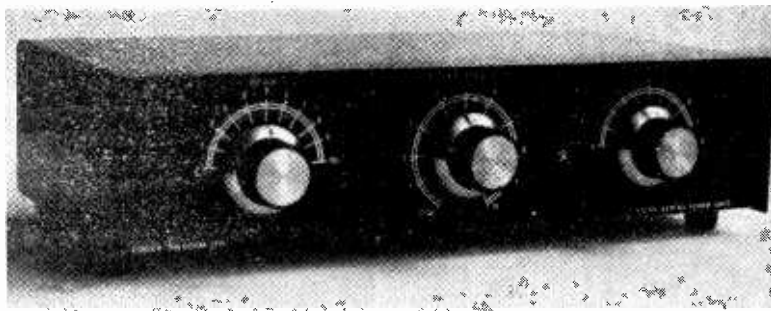
It is fully screened in a metal cabinet 23cm x 12cm x 5cm (9" x 4 $\frac{3}{4}$ " x 2") and finished in charcoal grey and black with white legends. Co-ax output socket to receiver is provided. 12 months guarantee. Price is £12.50 posted. Codar, Valcon Works, Burrell Buildings, Churchill Industrial Estate, Lancing, Sussex, BN15 8TZ. Tel. Lancing 61901.

VEROBXES

Vero Electronics Limited announce the introduction of a new range of Plastic Veroboxes® which have been designed to house the smaller type of instrument or control unit.

The boxes are constructed of two mouldings in light grey high impact A.B.S. and contain built-in guide slots for vertical mounting of P.C. boards or metal plates. The base panel is also fitted with threaded inserts for the attachment of a horizontal P.C. board or chassis. The boxes include, anodized aluminium front and rear panels for the mounting of switches, knobs, meters or plugs and sockets. These panels are held in position by the mouldings so that no panel fixing screws are required. The two mouldings themselves are screwed together by four screws which enter through the base moulding and are hidden from view by the plastic feet used with the boxes.

The illustration shows the various sizes of Verobox® which are available together with examples of the fixing of P.C. boards. A new full colour brochure is now available describing these latest additions to the Vero range of small enclosures. Vero Electronics Limited, Industrial Estate, Chandlers Ford, Eastleigh, Hants.



CAPACITANCE METER

Electronic Services & Products Limited, have introduced a new linear capacitance meter to meet a requirement for fast accurate

measurement of a wide range of capacitors.

The instrument incorporates integrated circuits with a reliable linear scale meter producing accuracies usually reserved for manually balanced instruments.

Measurements as low as 1pF and up to 10 μ F are easily obtained by the simple selection of the appropriate range and NO balancing is required at any stage of the operation. The correct value is simply read direct from the meter.

Power is provided by two 9 volt (PP3) batteries whose condition is continuously monitored by a Light Emitting Diode. Should the batteries fall below the voltage required for accurate measurement then the LED will not light. Price £35.00. Electronic Services & Products Ltd., Braunston, Daventry, Northants. NN11 7HH. Tel. Rugby 890672.



SINCLAIR'S DIGITAL WATCH

Sinclair recently announced their new digital watch (see News . . .) The electronic circuitry which controls the watch is all contained on a Sinclair-designed IC measuring 117 x 123 thou.—developed using injection logic technology— I^2L .

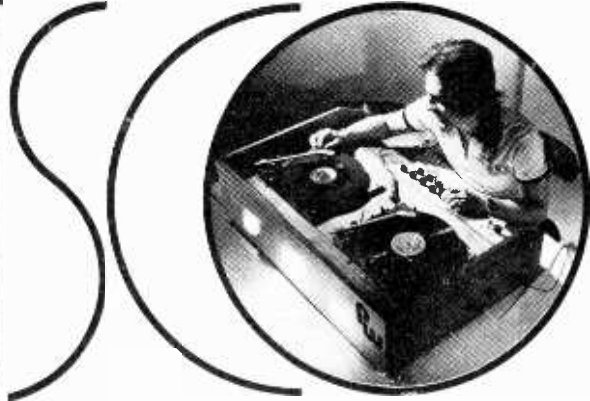
Sinclair believes that this original watch chip design, containing over 2,000 active devices is the sole

production watch chip, using injection logic, available in the world today. The chip requires only a quartz crystal, trimmer capacitor, a LED display and mercury cells to complete the watch circuit.

The three-function watch employs a 32.768kHz flexural bar crystal as the frequency control element for the oscillator and this is trimmed in production to a precise frequency.



STEREO SYSTEM



PART 2 A.C. AINSLIE* & C. TOMS†

Continued from last month

Heavy feedback around the power amplifiers has produced a design very tolerant of supply voltage fluctuations. This has saved the expense of a stabilised power supply and allows a reserve of power in the smoothing capacitors to give a transient music power output exceeding 100W.

Current consumption for one channel at full power is in the order of 2A. Ample safety margins are therefore provided by specifying a 6.6A bridge rectifier to power a stereo console. Smoothing is provided by two separate 1000 μ F capacitors since a single 2000 μ F capacitor to handle the necessary ripple current and high voltage is not generally available.

THE LIGHT MODULATOR

As there is sufficient audio signal voltage available from powerful amplifiers, a passive selective network is used for channel separation. The crossover frequencies are 3kHz and 7kHz giving better results than the more usual low frequency crossover networks. Fig. 5 shows the circuit diagram.

The level of each channel is controlled by VR16 (HF) VR15 (MID) and VR14 (LF). Overall display brightness is controlled by VR13 with R53 as a limiting resistor. Trigger transformers T2, T3 and T4 drive the gates of the thyristors and isolate the input circuitry from the mains. To reduce any mains borne interference, a capacitive suppression filter is provided (C33-39).

CONSTRUCTION

Ease of assembly and repeatability of results are ensured by assembling all the electronics on printed circuit boards with the exception of the mixer which is so simple that a p.c.b. is not needed.

Each sub-assembly is completed and preferably bench tested before being mounted into the console. The power supply is assembled in the console as it acts as a structural support and would need to be built before the other units could be tested.

STEREO/MONO OPTIONS

A mono disco console comprises a single pre-amp/power amp board, mono mixer and a power supply. Mono cartridges would be used in the turntables or stereo cartridges wired for mono (both channels paralleled).

LIGHT MODULATOR (OPTIONAL)

Resistors

- R52 39 Ω 5W wirewound
- VR13 250 Ω 1W wirewound
- VR14 100 Ω
- VR15 100 Ω
- VR16 100 Ω } horiz. skeleton presets

Capacitors

- C30 0.47 μ F 100V working
- C31, C32 8 μ F bipolar (B. B. Atkin) (2 off)
- C33-C39 0.1 μ F 1000VDC (7 off)

Inductors

- L1 1mH Type WK05/3K
- L2 0.5mH Type WK1/B3K } (B. B. Atkin)
- T2-T4 High frequency pulse transformer (ITT) (3 off) (B. B. Atkin)

Thyristors

- SCR1-SCR3 BTY79-400R (for 1kW per channel) or BT106 for console lights only (3 off)

Bulbs

- LP2-LP4 100W spot bulbs (B. B. Atkin) (3 off)

Miscellaneous

- Brass/ceramic bulb holders (3 off) (B. B. Atkin)
- S4-S6 S.P.S.T. miniature toggle switches (3 off)
- S7 S.P.S.T. illuminated rocker switch
- F3 2A 20mm fuse and panel mounting holder
- Terminal pins (10 off), printed circuit board (1 off)

*Consultant †W.K.F. Electronics

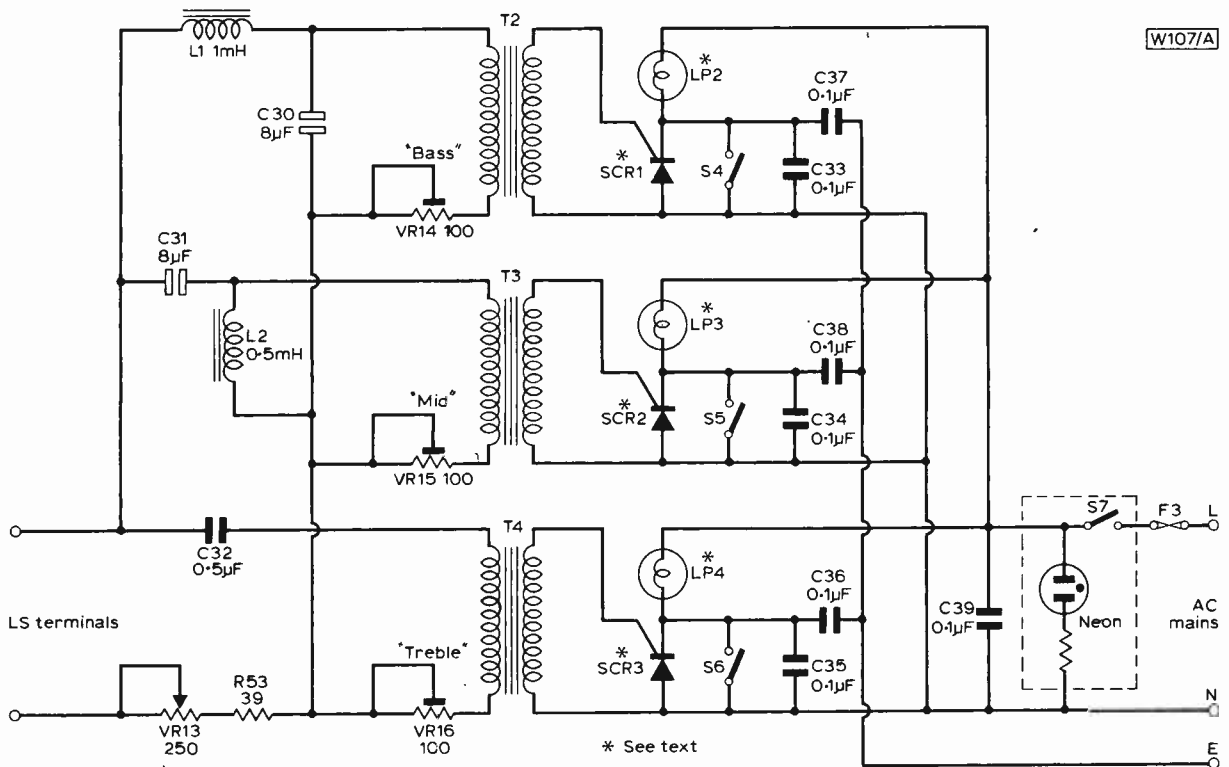


Fig. 5: Circuit diagram of the Light Modulator for use with the Disco system. The thyristors may be either BT106 for console lights only or BTY79-400R for up to 1000W of external lighting.

A stereo console would have a pair of pre-amp/power amp boards (one for each channel), as well as a stereo mixer using tandem controls and incorporating a balance control. A single power supply of adequate current rating is used, this being the same as for the mono version.

To allow for future conversion to stereo, a mono system could be built using a single pre-amp/power amp board but with a stereo mixer. To convert to stereo all that would be involved would be the construction of a second amplifier board and the removal of the cross-channel shorting link on the pickup cartridges.

AMPLIFIER BOARDS

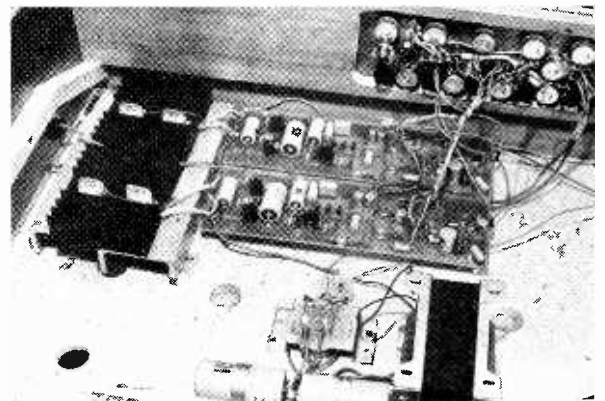
The p.c.b. design and component layout are shown in Figs. 6 and 7. Component mounting is quite straightforward and should follow normal practice. Attention should be paid particularly to capacitor and transistor polarities. Some of the transistor numbers are rather similar and particular care has to be taken not to confuse them. Close tolerance resistors have been specified to ensure consistent performance and all capacitor voltages have been chosen to allow a wide safety margin. C23 must be a low leakage component of adequate voltage rating. Polyester or tantalum capacitors are satisfactory but an electrolytic should not be used as the leakage currents upset the amplifier balance.

Small terminal pins (Veropins) are soldered to the board to take external connections.

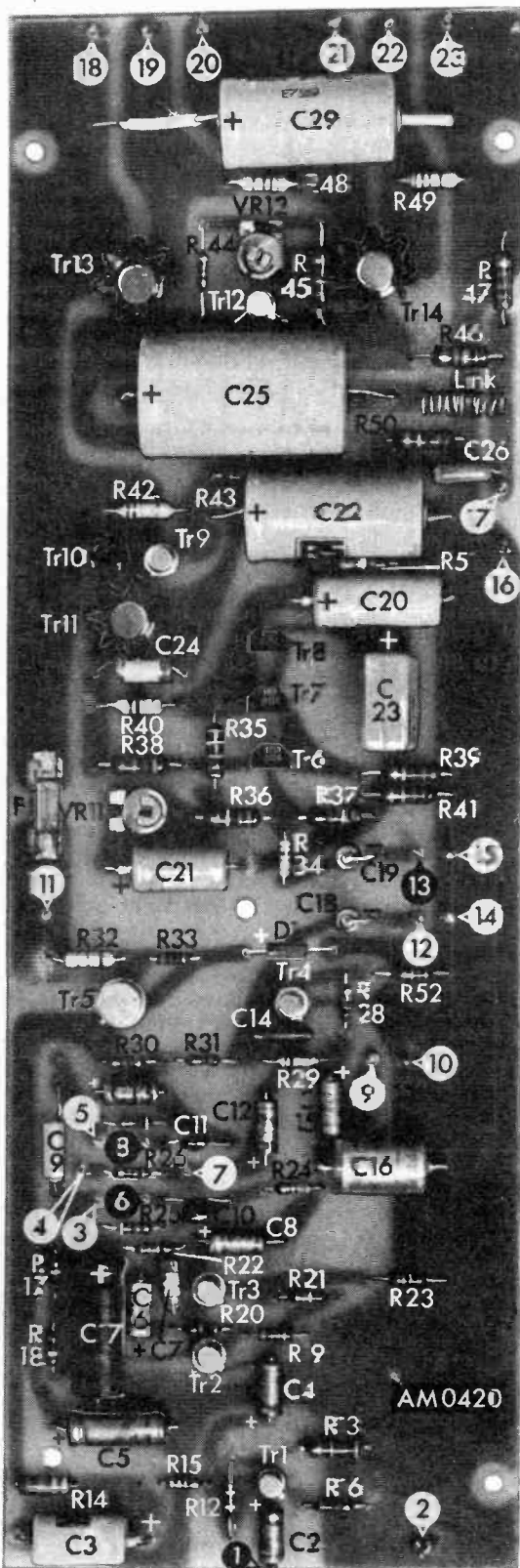
All three driver transistors in the power amplifier dissipate quite high powers and need heatsinks. Simple black anodised clip-ons are perfectly satisfactory giving a thermal resistance of 50°C/W in free air.

The output transistors Tr15 and Tr16 are TO3-cased devices which require an insulating mounting kit on account of their "live" cases. A 150mm (6in) length of black anodised extruded heatsink which gives a thermal resistance of little more than 1°C/W and is adequate for both output transistors.

Silicone grease or special heatsink compound should be lightly smeared over the insulating washers prior to mounting the transistors. Shake-proof washers should be used on the mounting nuts and a solder tag placed under one nut of each transistor as the collector connection. A simple ohmmeter check should be made to ensure that none of the transistor connections is shorting to the heatsink. Two bundles of three colour coded wires connect the output transistors to the p.c.b. terminal pins.



Layout of the amplifier boards, power transistors on heatsinks and power supply components on the wooden cabinet described in detail next month.



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AM 0421

Fig. 6 and 7: Layout of the components on the amplifier board p.c.b. and printed circuit design (not to scale). The link to the right of C25 is coiled to aid high frequency stability (about ten turns).



Front view of the completed Disco Unit

POWER SUPPLY

The power supply transformer is mounted centrally on the bottom of the console. In this way it offers some support to the centre of the deck board which rests directly on top. If the recommended transformer is not used additional packing may be required to bring the overall height to 123mm. A transformer of low leakage flux should be used to reduce the possibility of hum pickup.

The bridge rectifier is mounted on a small heat-sink which, together with a clip for the smoothing capacitor is screwed directly on to the wooden base-board (see photo).

A terminal block is fixed to the bottom of the console to supply mains from the on/off switch to the transformer. When the decks are installed they will also draw their mains from this terminal block.

SETTING UP THE POWER AMPLIFIER

Before power is applied to the board, VR12 (quiescent current preset) must be set fully clockwise and VR11 (common mode voltage) set to midway to avoid damaging the pre-amplifier on switch on. No connections need be made to the pre-amp and the power amp input (negative end of C19) is temporarily shorted to earth.

With 80V applied to the power amplifier, VR12 is adjusted to bring the positive end of C25 to exactly 40V.

Should an oscilloscope and signal generator be available, VR11 can be adjusted for symmetrical clipping of a 1kHz sine wave applied to the power amplifier input. There is no need to have a load connected for this adjustment which is just as well as few loudspeakers would safely handle a 100W plus sine wave.

In the event of no equipment being available, VR11 should be replaced with a two per cent 60k Ω resistor which would give near to optimum performance.

Adjustment of the quiescent current preset VR12 is made with amplifier at operating temperature preferably installed in the plinth. Before VR12 is moved from its fully clockwise position, the amplifier is used to deliver a medium power (20 or 30W) into a load for a quarter of an hour or so to give sufficient time for the temperature to stabilise. With the input short circuit removed, the power ampli-

fier will accept the output signal from most radio tuners or tape recorders and will drive a loud-speaker or dummy load (four 15 Ω 10W resistors in parallel). The input signal is connected between earth and the negative end of C19, a suitable amplitude being 100mV or so.

When the temperature has stabilised the supply should be switched off, the input short circuit replaced and the supply fuse on the p.c.b. removed. The collector connection to Tr15 (pin 18 on the p.c.b.) is then removed and a 50mA meter placed in series. The load is removed from the output as the surge of current charging the output capacitor would damage the meter.

Having checked that the meter connections are secure the fuse is replaced and power applied. VR12 is adjusted carefully for a reading of 8 to 10mA, this quiescent current being sufficient to virtually eliminate crossover effects.

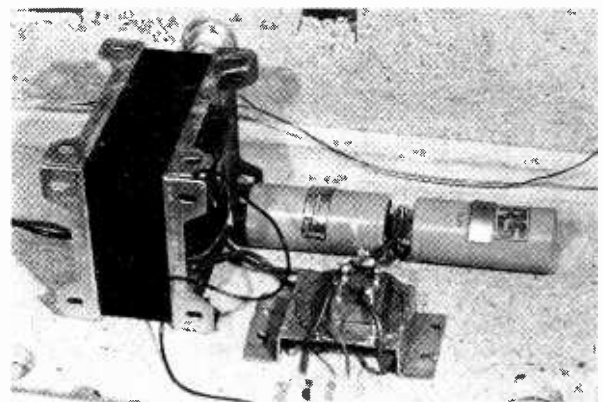
It is necessary to carry out this adjustment fairly rapidly so that the transistors do not cool down significantly from their operating temperature. When the complete Disco system has been assembled in the console, it is as well to reset the quiescent current after an evening's use. Readers without the equipment necessary for this setting-up procedure should turn the preset 20° from the fully clockwise position. This will result in a low but adequate standing current.

Under no circumstances should power be applied to the amplifier without the milliammeter or Tr15 collector connected otherwise most of the transistors will be destroyed.

LIGHT MODULATOR CONSTRUCTION

The three-channel light modulator is assembled completely on a single p.c.b. (see Figs. 8 and 9).

Three amp stud-mounting thyristors are specified which are capable of driving up to about 300W of lighting for each channel. The devices need to be considerably over-rated because of the low resistance of filament lamps when cold, i.e. on switch-on. The 3A devices are simply cooled by an excess of copper on the p.c.b. but additional heatsinks would be advisable should higher current devices be employed to drive larger light columns. Such heatsinks could take the form of a simple aluminium "U"



View of the power supply components which are mounted on the base board. The power supply can be built temporarily, in order to test the amplifier boards.

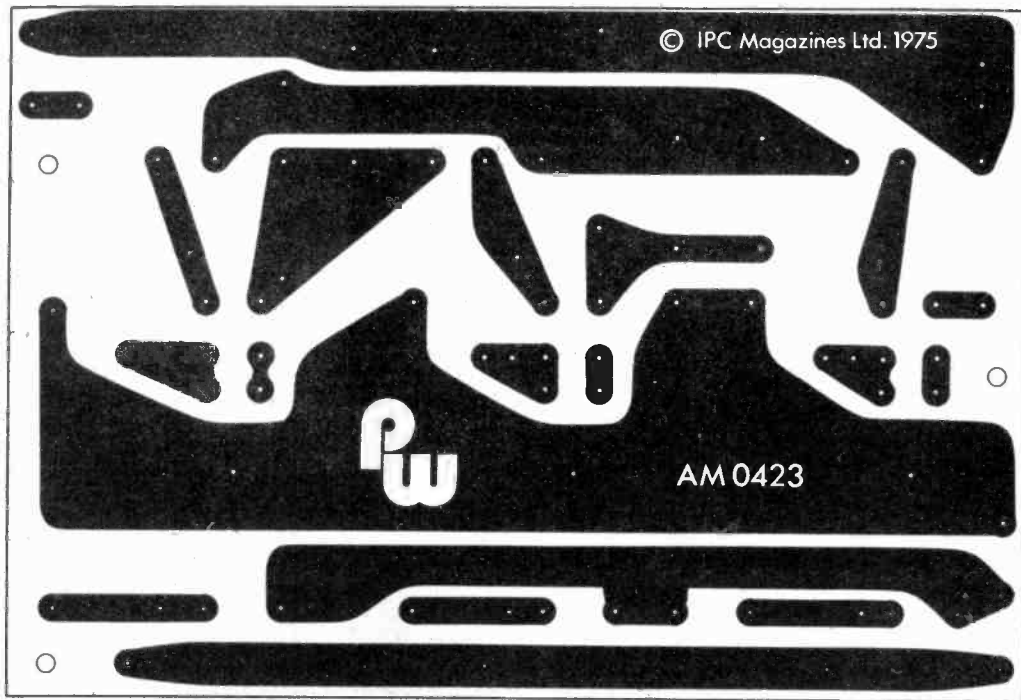
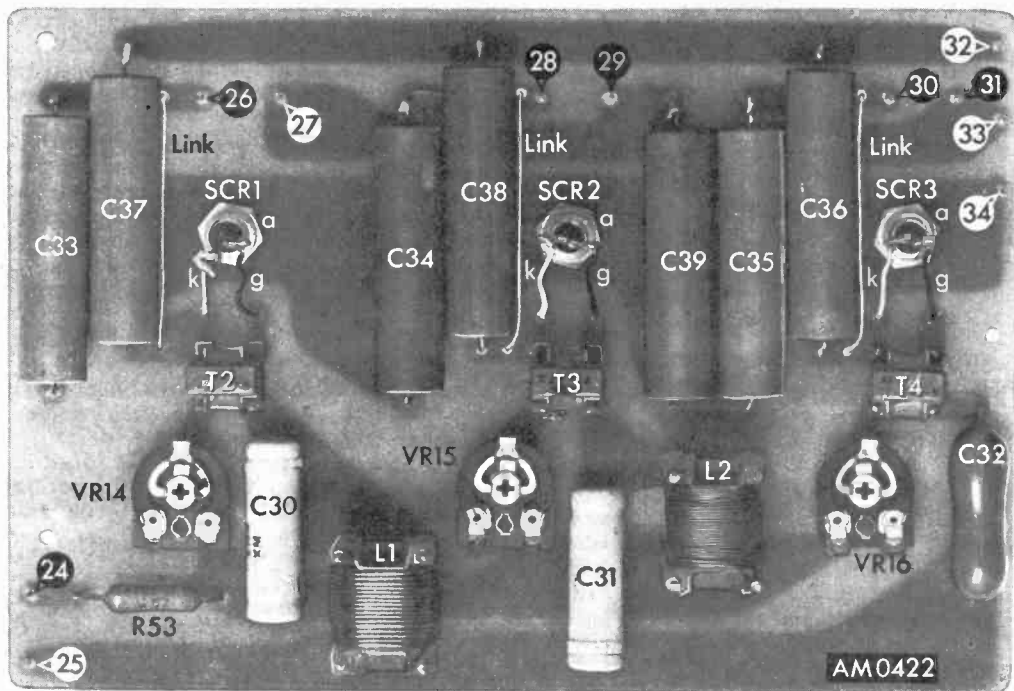


Fig. 8 and 9: Construction of the Light Modulator board showing layout of components and printed circuit layout.

sandwiched between the device and the board of two or three inches area or a commercial stud package cooler could be used.

The trigger transformers must be of good quality as the safety of the whole Disco system depends on the interwinding insulation of these components. The amplifier side of the electronics and the turntable metalwork should be properly earthed through the three-core mains lead to ensure operator safety

even in the event of a breakdown of these transformers.

VR13 adjusts the overall sensitivity of the modulator and is set to produce a satisfactory display after installation.

In Part 3 cabinet construction and interwiring of the complete unit will be described.



AMATEUR BANDS

by Eric Dowdeswell G4AR

A REMINDER of the winter comes with the No. 1 edition of the 160m DX Bulletin from "Stew" Perry W1BB for the 75/76 season. If you once listened to Top Band in the daytime and found nothing, you could not be blamed if you wrote-off the band for good! However, you would be very pleasantly surprised if you tried again after dark! Last season was the best yet for Stew, working 62 countries and all the signs are that he will do even better this season. Prefixes already active include VK, KH6, ZL, JA, VS6, PY and many others, with promise of activity from KC4, VR1, VP2 and HB0.

Once again W1BB has organised Transatlantic Tests especially for Europeans who have not so far been able to work a W station, and vice versa. Dates are December 21, January 11 and February 8 from 0500 to 0730 GMT. Even if you are only listening it is still a thrill to realise that your local G station with his 10W is probably making it across the "pond" for the first time! Remember, the W/VE's can be found between 1800 and 1807kHz and the Europeans around the so-called "DX window" 1825 to 1830kHz. Considering the chaos on some other bands this gentleman's agreement works very well indeed. Any European calling W's on their own frequency soon gets told the facts of life!

W. C. Johnson, 72 Estcourt Street, Newbridge Road, Hull is a newcomer to the short wave bands and after refurbishing an old CR45 with new valves etc has been pleasantly surprised at its performance. However he would be very glad to get hold of a manual for this set and naturally will be only too pleased to reimburse anyone who can help.

Dennis Anderson (London SE11) kindly relieved my ignorance of his Realistic DX150 receiver by sending in the handbook, duly statted for reference. Made in Japan and handled by the Radio Shack Co. in the States it is general coverage with band-spread and resembles a solid-state 9R59DS! But I imagine its performance is rather better especially at the higher frequencies. For £30 Dennis certainly got a bargain!

Tim Charles (Colchester) finds that 15 and 20m are beginning to die down for the winter but he is compensated by the ZL's on 80m nowadays. He says 'not to be worried' if you hear ZL4ZLV, permitted

to use the amateur bands but normally the commercial station at the works of ZL4AV, producing marine radio equipment. Home one morning after visiting his dentist Tim found YJ8CS on 20m for a new one, in the New Hebrides. **Martin Kessel** A9016 (Stoke-on-Trent) reports getting cards from KS6ET and KS6FF, proof of the efficiency of his HMV 5-valver or at least his handling of it! **Neil Whiteside** A8859 (Hitchin) got his Microwaves Module working on 2m with a longwire as a start but found things much better with a proper yagi for the band.

Seems my note on the Pioneer Radio Club in Edinburgh, in the September issue, produced a few new faces. Co-founder **Bob Henderson** GM4DTJ reports that they now have a room of their very own, a basic requirement of any successful club, and a programme of equipment construction is already under way, with the club transmitter active on the HF bands and on 2m. **Paul Barker** BRS34898 (Sunderland) was very happy to 'see' 9K2D0, on his SSTV setup on 20m. Paul discovered that XJ6UM was really VE6UM in a different hat! Won't be long before we are allowed to pick our own prefixes in celebration of a birthday or something equally daft!

Stephen Budd A8713 (Worthing) seems to have been on the 'A' prefix hunt copying A2CJP, A4XGC, A6XB and A9XBB from Botswana, Oman, United Arab Emirates and Bahrein respectively. Those envious of the KS6's mentioned previously might like to know, via Stephen, that several KS6's hang around 14284kHz on SSB. **Andrew Swiffin** A8603 (Cheadle) may have to mortgage his receiver, he says, to be able to pay the postage for his reports to this column! He too, found the two KS6's, around 0845 GMT.

Back to **Tim Charles** again, reporting some of the repeaters he has been hearing on 2m, including OZ3REI on channel R5. According to Tim, a North Essex Raynet (RSGB's emergency network) group exercise was being repeated all over Denmark by an unidentified repeater on R8 recently! Being an anti-repeater man myself I think the day is not far off when the amateur community will be sorry that it ever went in for repeaters. The behaviour of many operators on these frequencies has to be heard to be believed!

Mike Green A8088 (Northwich) found seven LU's, six PY's and three ZP's on 10m which can't be bad on a band often accused of being dead.

Although this is being compiled in October for the January issue which will be out on 5 December it is appropriate to wish you all a VERY HAPPY CHRISTMAS and to hope that Father Christmas will bring along all that nice new gear that we have all been waiting for!



NOTE:— Please ensure logs are posted in time to reach me by 25th of each month.

Log extracts

M. Kessel:— 80m EA6BG VU2GDG 20m DU6EG KL7BJW MID VK5WD VK9KK ZL1AH

J. Hinton:— 20m FC9UK YS1AE 8P6CC 15m HZ1KE 7Q7RM 9G1LZ 9J2BO

M. Bennett:— 80m 4W1AF 9K6OG 20m HB0AIC HL9UF KG6JES ZS1AMB (Queen Maud Land ITU Zone 67) 15m CM6AI FL8AC VK9XX 9N1MM 10m DU3ON HK3LT ZP5JN 7Q7RM

D. Anderson:— 20m KL7HFQ PZ1DR 15m 9J2BO PY1AZ

P. Barker:— 20m EA9EX JY9JM ZL4PD 20m SSTV EA3AUM I2PET OH5RM OK2OI 9K2DO 15m ZS1E 9L1JM (QSL W4BAA)

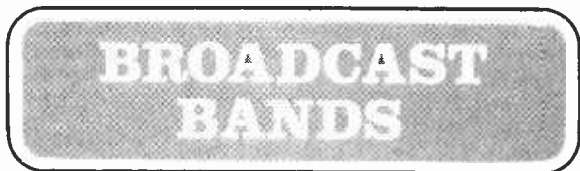
T. Charles:— 160m OE5NT OH2BO OH3VV 80m JY3ZH W6CXQ ZLIJX ZL4ZLV 5V7WT 40m **HV3SJ WAOKXJ/OY** 20m YJ8CS ZL1BN ZL1TY 15m **JE3NB KZ5EK LU7EY ZS6BR 9H1EN** 2m DM3WCB OZ3REI (repeater, FM)

A. Swiffin:— 80m CX9BT 20m KS6ET KS6FF YB0PG 15m TU2FH 5L2FM

S. Budd:— 20m AP2KS A2CJP A4XGC A6XB A9XBB C5AN WA6LRG/KB6 KJ6CF KM6EB KS6DV KS6ET KS6FF P29CW VP8NP VS5DB XP1AA (Greenland) 3B9DA (Rodriguez Is) 4S7BR -5T5CJ 5V7WT 7P8AC (Lesotho)

M. Green:— 40m TR8SS 20m C5AN HI8REL YN8GTG 15m CX3VR VU2DK 5L7F 9J2AB HP7XJS (DXpedition) 10m LU4DSZ PY4KL ZP5RS 2m via Oscar 7 from 10m VP9GE

All SSB except those in bold which are CW.



SHORT WAVE BROADCASTS

by Derek Bell

MR. R. CORBETT of Kettering recently picked up a copy of PW during his teabreak at work, and upon reading this column became converted to DXing, and, pausing only to finish his sandwiches, dashed out to trade his portable for one with short wave coverage. "I am amazed at the results obtained" says Mr. Corbett, and I am flattered at the results of this column, says I! Our friend then asks several questions on how to get the best from his new purchase which I will do my best to answer.

The first one is that, setting aside ex-service sets, there are not many sets under £50 that have complete short wave coverage. The Codar CR70A is within your price range and adding on the PR40

pre-selector will improve reception. Otherwise you will have to have the medium wave plus the SW coverage. I must say that I have heard of some strange shacks but under the stairs is a new one on me! I would think that this situation is prone to all the interference that comes from domestic appliances.

The second question posed was the one that puzzles a lot of DXers. If, in the SINPO code, 5 is the strongest then how does one estimate the propagation? The simple answer is that for a 5 rating one looks for perfect propagation, free from all fading, in fact, of local radio quality. In propagation measurement all sorts of factors must be taken into consideration, notably, fading, audio quality and the noise that accompanies the signal. There is an alternative system that uses only the letters SIO, Strength Interference and Overall readability, lumping noise and propagation under the one heading.

From Long Eaton, Notts, **H. A. Mead** writes about a map that Radio Prague has sent him showing the ITU zones. He comments that the zone numbers on the map are different from those on the map in the Radio Amateurs Handbook. I would suspect that the ITU number were drawn up by the International Telecommunications Union for the use and benefit of the broadcasters while amateurs have a zoning system of their own making. (And in use many years before the ITU one was thought of. Again, change for changes sake. Eric G4AR.)

An information-packed letter arrived chez Bell recently from **John McLeod** of Inverness. Firstly, he tells us that Radio Kiev has announced a new English service on 7390, 6045, 6020 at 1930 to 2000 Mondays, Thursdays and Saturdays. Further on the DX scene a fault in one of Radio Sweden's aerials has resulted in the closedown of some of the services from the Horby and Karlsborg transmitters. John then goes on to nominate RBI as producing the most boring QSL card! It has a decibel table overprinted RBI in red. There are also a few harsh words from John on the way some secretaries address cards to him using "England" or, in one case, "Scotland, England, GB!"

Station address lists seem to be popular for the avid QSLer so here are a few that have been requested:—

Radio Kuwait, PO Box 397, Kuwait.

Radio Cairo, PO Box 795, Cairo, Egypt.

Radio Finland, PO Box 528, Helsinki, Finland.

A rarely reported station comes from **Robert Hill** at school in Colwyn Bay, Wales This is Radio Athens on 7250 at 1915. The set in use is an Invicta 8027 with an internal aerial and on the high ground of that part of the country pulled in the skywaves from the following:—

9755 AWR Malta relay, 2030 Saturdays only, in English.

11940 Radio Kuwait, at 1730.

11642 Radio Israel, at 2050, sign off time.

Robert then asks for details of the Malta relay since he logged not only AWR but IBRA at 2100 to 2115. The transmitters in question are run by Deutsche Welle and leased to other broadcasters. They comprise one 600kW for MW and three 250kW on the short waves. They also own the transmitter in Portugal used by AWR.

Recently this column featured a vintage SW receiver, so **C. H. Wood**, of Sunbury-on-Thames, comes along with a 1936 Murphy A36, this set is certainly pre-April 1937 since that is the month it was



reviewed in (dare we mention it?) *Wireless World!* The set has had little done to it except for a new valve and transformer and a couple of switches, C.H. mentions that he has had to paint some of the insulation to protect it and some of the stations printed on the dial have long since vanished!

Congratulations are in order for the American folk music show "Grand old 'opry" heard on the AFRTS air waves. The show is fifty years old this year and was the subject of a "happy birthday" piece on BBC recently. Another BBC curiosity is a recently issued record in praise of radio, by an outfit calling themselves "The Medium Wave Band", friends of Charles Molloy?

Finally, an official statement from Radio Canada has reached me regarding the sad demise of the RCI Short Wave Club. The reason for this is said to be "the need for stringent budgetary controls". It is stated that they need listeners cooperation in giving their views on programme content rather than just QSLing, and in this area what they describe as an "unsatisfactory result" came out of their recent QSL policy. Therefore they have decided that no more QSLs will be issued until Spring 1976. When the new schedules are issued for the 1976 short wave season then listeners on the mailing list will get a QSL. If the collector wishes to make it an "official" QSL he must return it to RCI having filled in the details in order that it may be stamped. The new card will have an Olympic Games motif and it seems that RCI are set fair to continue this policy since they say that a card will be sent automatically each year.

Well, that seems to wind things up for this month so I will wish you and yours a Very Happy Christmas and, although we are coming up to the sunspot minimum, the best of DX for 1976.

MEDIUM WAVE DX by CHARLES MOLLOY

MEDIUM wave transmitters in Europe operate on channels which, over the greater part of the band, are spaced 9kHz apart. In other parts of the world, channels are multiples of 10kHz and occasionally 5kHz and the two systems coincide at intervals of 90kHz, for example 620, 710 and 800. DXing on those frequencies can be difficult for the listener in Europe. Fortunately there are other parts of the band where the DX channels are 4kHz away from the nearest European broadcast and the DXer who hunts in these areas is often well rewarded.

During the evening search for Baghdad on 760kHz; Isfahan in Iran on 1100kHz; Kabul in Afghanistan on 1280kHz; Kuwait on 1345kHz; Ahwaz, Iran on 1390kHz; Dubai, United Arab Emirates on 1480kHz and Sharjah on 1575kHz. After midnight listen for Surinam on 725kHz; Georgetown, Guyana on 760kHz; CJON St John's, Newfoundland on 930kHz; Hofei, China on 940kHz; Hyderabad, Pakistan on 1010kHz; St John's Antigua on 1100kHz; Radio Globo, Rio de Janeiro on 1180kHz and Radio Tupi, also in Rio, on 1280kHz. All of these stations have been logged

recently in the UK by DXers using communications type receivers and a MW loop or longwire aerial.

Alfred Johnson, of Barnet, has been active on the band between 0200 and 0300 GMT. The highlights of his North American log include the following from the USA; WOR in New York City on 710kHz; WABC also in NYC on 770kHz; WGY in Schenectady, NY on 810kHz; WHAS Louisville, Kentucky on 840kHz; WCFL Chicago on 1000kHz; KDKA Pittsburg on 1020kHz and WHN in NYC on 1050kHz.

Harold Emblem writes again from Mirfield in Yorkshire to report a good bag of North American outlets using his Eddystone 730 and MW loop. Canadians heard include four from Newfoundland; CBNA in St Anthony on 600kHz; CBN in St John's on 640kHz; CKVO in Clareville on 710kHz and CJON St John's on 930kHz plus a couple from Nova Scotia; CHER in Sydney on 960kHz and CKEC in New Glasgow on 1320kHz.

DX from the USA includes WINS in NYC on 1010kHz; WTIC Hartford on 1080kHz; WNEW in NYC on 1130kHz; WLOB Portland, Maine on 1310kHz and WOKO in Albany, NY on 1460kHz. Harold reports reception of Nouakchott in the African republic of Mauritania on 1349kHz at 2230 GMT, the time when the French stations on this channel usually sign off. A very good catch. Another to look for is Enugu in Nigeria on 1320kHz which can be heard with news in English at 2300 before signing-off for the night five minutes later.

Radio St Pierre which transmits with a power of 4kW on 1375kHz is the sole broadcasting station in the French islands of St Pierre and Miquelon which are located a few miles off the south coast of Newfoundland. Radio St Pierre is often heard in the UK during the winter. Listen after Lille on 1367kHz has closed down for the night, usually at 2300. Radio St Pierre is on the air until 0100, its local time is three hours behind GMT and the station will answer a correct reception report with a verification letter. Write to Radio St Pierre, BP7, St Pierre et Miquelon if you want to add this North American "country" to your list of countries verified.

BROADCAST BANDS

Short Wave reports by the 15th of the month to Derek Bell c/o Practical Wireless, Fleetway House, Farringdon Street, London, EC4A 4AD.
Medium Wave Logs to Charles Molloy, 132 Segars Lane, Southport, PR8 3JG.

AMATEUR BANDS

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

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HOTLINES

ON RECENT DEVELOPMENTS

HOT POT

It seems that component technology never stands still, and while the semiconductor manufacturers often hit the headlines with new devices, there are times when the more mundane components come to the forefront. Take the humble potentiometer as an example. Basically it might be thought of as a length of resistive material along which a small metallic wiper is moved. Thus by moving the finger along the material, the resistance between wiper and one end can be varied.

Two differing approaches have come to light and the first obvious difference is that there is no finger nor any wiper and thus no actual frictional contact of any sort!

The first approach employs two small ferrite cylinders with wire wound round them to form inductors. A permanent magnet also features and is used to vary the saturation of the ferrite as it is rotated. Of course, left to their own devices, the inductances across the ferrites are constant. But by passing a magnet over them a strange effect occurs; the inductance of the other decreases. A signal between the two ferrite cylinders thus provides an output which is proportional to the angular position of the magnet. Note that there is no actual physical contact between the elements. It is claimed that these potentiometers, which are no larger than conventional pots, can survive and operate happily at temperatures of 200°C which would seem to indicate applications in engine control and the like.

The second approach to potentiometer design is quite ingenious and delves into the realms of semiconductor resistors. The resultant devices are called field plate potentiometers and operate as follows.

Certain materials exhibit a marked change in resistance under the influence of a magnetic field. This is called the magneto-resistive phenomenon. The effect has been known for many decades but new advances in semiconductor materials have led to new crystalline structures, considerably increasing the range over which the resistance can be varied.

The technique employed is to embed minute needles of a conducting substance in a semicon-

ductor material. In the absence of a magnetic field the current passing through the structure passes through these regions via the shortest possible route. By applying a magnetic field, the current paths between the tiny needles become deflected causing the current to travel further and thus there is an increase in resistance due to this longer path effect.

TEMPERATURE

Perhaps one of the most popular and recurring circuit ideas in electronics construction journals is some form of temperature measurement and/or control. A common approach is to use an op amp (operational amplifier) since the two inputs offer a means of comparing one thing with another. The voltage on one input can be held constant and the variation in voltage applied to the other input (usually caused to vary by the sensor) gives a difference which shows up at the output.

Temperature tyros will be pleased to hear that a semiconductor manufacturer has brought out a chip (measuring 50 x 50mil) which has temperature sensor, zener diode stabilized voltage reference, and op amp all included. Designed for use in the range -25°C to 85°C it comes in an uncalibrated form to within $\pm 10^\circ\text{C}$. However, the user can calibrate it to within $\pm 0.5^\circ\text{C}$ with the simple addition of an external potentiometer. Price is not easy to guess but in the US the quoted cost for quantities of 100 to 999 are just a dollar each.

NEW DDM

Each time a new instrument is launched onto the market, it seems to have better and better specifications. A DMM (digital multimeter) marketed recently offered a capability of measuring resistance up to $2\text{G}\Omega$ (that's two million million Ohms). Not satisfied with this, the manufacturers built in the ability to resolve currents down to 100pA (picoamps—a million millionth of an Amp) and dc voltages down to 100 μV . It can also measure AC voltages up to 700MHz. Price in the US is under \$1,700 and it's the product of a Dutch company. My £3.50p Lisle Street special will never seem the same again.

FOOD FOR THOUGHT

If you want food for thought, how about the new induction heating for cookers. Not to be confused with microwave ovens, the approach is to employ fast turnoff thyristors operating at some 30kHz. The idea is to cause eddy currents in the base of a cooking utensil. This is done by a coil just beneath the cooker surface. Estimated to halve electricity usage, the system doesn't work until a utensil is placed above it since, with nothing there, there will be nothing in which to induce the eddy currents.

FAST-RECOVERY DIODE

A new fast-recovery diode (BD277) from RCA Solid State—Europe is available in a low-cost TO-220 Versawatt plastic package, giving excellent heat-sink capability and making the device particularly suitable for use in the deflection systems for 110° large-screen television tubes. Two of the diodes, used in conjunction with two thyristors, form the complete deflection circuitry, controlling the horizontal yoke current during the beam trace interval and acting as the commutating switch to initiate trace/retrace switching and controlling yoke current during retrace.

The diode is designed for operation from supply voltages between 150 and 270V (nominal), and can handle a maximum reverse voltage of 800V and an average current between 2A and 7A, depending on the heat sinking of the device. The diode can handle surges of more than 100A, and a low, 'soft' (low in harmonics) recovery characteristic.

Other applications in television sets include clamp and booster diodes, diode modulators and switching power supplies, and the diode can also be used in hammer drivers, invertors and convertors for induction heating systems, electronic ignition circuits, or speed controls for domestic appliances such as washing machines. Ban those wash-day blues with a BD277!

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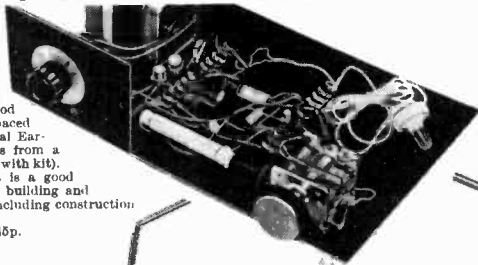
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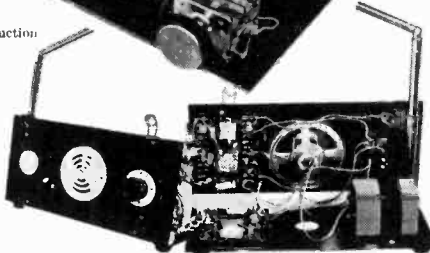
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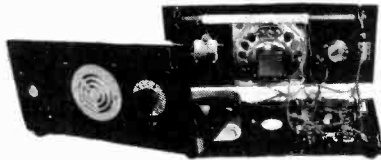
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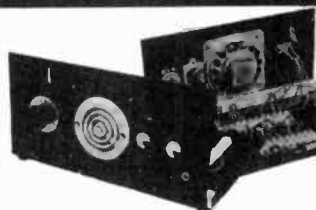
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ISSUES FOR DISPOSAL

..P.W. for April, May, August 1970 and June 1971.—D. Horrill, Mark House, Lindale, Grange-on-Sands, Cumbria.

..Television for Jan. 1972 to October 1974 excluding August 1972 to December 1972 inclusive.—B. C. Jackson, 28 High Street, Frodsham, Cheshire, WA6 7HE.

..P.W. 1970 to 1974.—M. Pedersen, 19 Belgrave Street, Brighton, BN2 2NS.

CORRESPONDENTS WANTED

..someone of my own age (14) who is interested in Amateur radio in general and electronics.—Andrew Sharpe, Hazel Dene, High Horse Close, Rowlands Gill, Tyne and Wear, NE39 1AW.

..anyone who has built the Galleon VHF kit advertised in P.W. I have found this kit extremely satisfying.—F. Ward, 2 Brookdown Terrace, Saltash, Cornwall, PL12 6HU.

..I am 17 and would like to correspond with readers, especially hams about my own age. Very interested in satellites.—G. Selvakumaran, 16 Jalan Batu Pahat (opp. Ban Ho Lee Shell), Kluang, Johore, West Malaysia.

BOOKS WANTED

..I want to collect older Mullard Data Book publications.—John B. Millin Jnr., 39 Dalgleish Avenue, Cumnock, Ayrshire, KA18 1QG.

..a copy of Practical Television Circuits. 1968 edition by Street.—S. H. Biggs, Bell Cottage, Bonfire Lane, Horsted Keynes, Sussex, RH17 7AJ.

EQUIPMENT WANTED

..active filter unit and stereo FM tuner for Sinclair Project 60.—M. Stanley, 9 Ormiston Gardens, Knock, Belfast, BT5 6JD.

..microphone transformer, ratio 100-1 or 150-1.—W. L. Brunson, 28 Meadfoot Road, Moreton, Merseyside.

..Telefunken radio valve type 199 for a c1938 TRF set made by Dr. Georg Seibt A.G. model VE 301 DYN. Also any gen on this equipment.—Sgt. J. Irvine REME, 1 Cheshire Regiment, Weeton, Lancs.

..Cossor valves 63 SPT and 61BT for 1035 oscilloscope.—Ian Ropper, 29 Wakefield Avenue, Edinburgh, EH7 6TN.

..receiver wanted for a 13-year old SWL.—P. Jeffries, 29 Walworth Grove, Acklam, Middlesborough, Teeside, TS5 8NN.

..the type of transistor used in Two Tone Door Bell (P.W. May 1973).—A. Fanzeres, P.O. Box 2483-ZC-00, Rio, Brazil.

..Sinclair Project 60 FM tuner.—C. Parkins, P.O. Box 10, Stanmore, Middlesex.

..an R107 receiver in working order.—J. King, 2 Delacerois Avenue, Lisburn, Co. Antrim, N. Ireland.

..power leads and headphones belonging to R209 receiver.—I. Simpson, 107 Derryhale Road, Portadown, Craigavon, Co. Armagh, N. Ireland, BT62 3SR.

..loan of CL33 valve required for old Bush receiver to see if any other faults present apart from this missing valve.—K. G. Bailey, 29 Anstruther Road, Norfolk Park, Edgbaston, Birmingham, B15 3NN.

..a balanced armature speaker unit.—J. Claxton, 6 Lloyd Park House, Forest Road, Walthamstow, London, E.17.

INFORMATION WANTED

..design for bias oscillator working at approximately 100kHz. Erase head must not be used and supply voltage must be around 6-12V.—R. Hill, 30 Queens Road, Bradford, West Yorks., BD8 7BT.

..manuals, circuit diagrams or any info. on Cossor 1052 D.B. scope, also C. F. Lord, FM3-3 frequency meter and Jason EM-10 valve voltmeter.—M. Roebuck, 16 Elizabeth Street, Newsome, Huddersfield, West Yorkshire.

..Schaub Lorenz Weekend T50L circuit diagram wanted. Will stat and return.—R. F. Nicholls, 11 Rue Dufreux, 44 St. Nazaire, France.

..good condition DX Data Chart (P.W. March '73 issue). Also issue of P.W. containing A.T.U.—R. Rooney, Roles-town, Kilsallaghan, Co. Dublin, Ireland.

..instruction manual/handbooks for the Trio JR310 and Trio 9R59DS communications receivers.—K. Arasu, School House, Brighton College, Brighton, BN2 2AL, Sussex.

..details, circuit, manual, etc. for STC B46 receiver, oscillator tuned, roller coaster coil, manufactured 1948 (STC No. 406).—T. D. Jackson, 60 Industrial Street, Todmorden, Lancs., OL14 5BT.

..instruction handbook and/or circuit diagram for a ex-WD scope 'Indicator CTR type 103'. Ref. 10Q/16208, part of 'Monitor type 101' and its associated power pack.—P. V. Hill, 25 Southern Crescent, Bramhill, Stockport, Cheshire, SK7 3AQ.

..borrow or buy circuit for Philips car radio N4G40T serial L21600. Version only has two windings on L6. Collector T2 goes to L4 via 350 ohms.—J. Palmer, 70 Westbury Road, Northwood, Middlesex, HA6 3BY.

..Schaub Lorenz T50L. Information on how to receive BBC MW with external aeriels. Circuit and alignment details also required.—R. Nicholls, 85 Avenue de Plaisance, 44 St. Nazaire, France.

..manual or circuit diagram for the TR1143 serial 11041 ex-WD Transceiver.—B. Bridges, 22 Bell Avenue, Harrow Crescent, Romford, Essex.

..circuit diagram for Ferranti 194 mains receiver.—J. Carver, 112 Merthyr Mawr Road, Bridgend, Glamorgan, CF31 3NY.

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0-0-8v	1 amp
0-0-18v	2 amp
20v	1 1/2 amp
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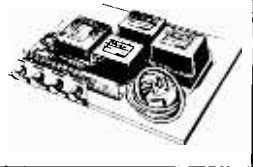
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12V DC motor made by Smiths, powerful, ideal for car blower; motor size 4" long x 3" diameter, 1" spindle; 1 1/2" long. £2 + 16p. Post 40p + 5p.

Plinth and cover for B&E plinth is teal colour and cover is smoky. Special offer £4 + £1. Post £1 + 25p. Covers available separately price £2 + 50p. Post £1 + 25p.

Plinth and cover for P25. This is a deeper, rather nicer plinth, unfortunately more expensive. Price £5.50 + £1.37. Post £1 + 25p.

Central heating controller, the Randall Mark 3, as fitted to Trianco and many other central heating systems. Has a two on/off per 24 hour clock switch and a position selector switch. Price £8.50 + 52p. Postage 50p + 10p.

Light for growing. Putting back the clock makes us realise how short daylight is during the months of November, December, January and February. As plants cannot grow without light, short days represent a loss of growing time which can be supplemented by using fluorescent lighting, especially in winter when that heating represents such an expensive item. We can offer a very cheap form of fluorescent lighting, (we do not think any other firm can beat our price), 50' of fluorescent light £10 + 80p if you can collect, or £13 + £1-04 if we have to despatch by British Road Services. For this you get 19 x 5" tubes, 20 tube ends, 10 metal chokes, 10 metal clips and 10 metal clips for mounting the tubes. You only have to supply the wooden battens and wiring up wire. Do not miss this offer—only 50 parcels now remain.

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8v Battery operated record player motors, on plate with turntable and mat. Price £4 + £1. Post 50p + 13p.

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

BARGAINS FOR CALLERS. We always have bargains for callers and now that the post charges are so high it is even more worthwhile for you to call. One item which we are offering at a very silly price this month is a wooden cabinet intended originally to be used for a music centre and offered at only a fraction of the cost of the wood alone, namely 50p each.

We have other cabinets including large stereogram types from £2 upwards, depending on condition, cabinets for portable players and radios from 50p upwards.

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

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220	16	9	
220	16	9	single end p/c fitting
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1000	16	20	
10	25	7	
22	25	7	
47	25	7	
100	25	7	
150	25	9	
200	25	11	
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5000	25	55	single end can
1000+1000	30	32	single end can
2500	30	40	single end can
	6-8	40	
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	100	40	
	1000	50	single end can
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LA7GT	60	6BJ6	84	6L18	64	12Q7GT	50	35W4	80	DK96	70	ECH83	32	EY88	60	PCF806	60	TP2620	1-00	W299	1-17	AF115	20	FX41A	89				
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LB5GT	60	6BQ7A	84	6L20	88	12B2G7	70	35Z4GT	88	DM70	80	ECL80	60	EZ41	55	PCL82	45	UBC41	60	Transistors		AF124	33	OAA7	18				
LL4	25	6B17	1-99	6N7GT	70	12B2H7	50	35Z5GT	90	DM71	1-76	ECL83	85	EZ90	35	PCL83	50	UBC81	60	& Diodes		AF125	82	OAA70	20				
LN5GT	70	6BR8	1-25	6Q7G	60	12B2J7	80	43	1-00	DY87/6	41	ECL84	70	EZ81	35	PCL84	50	UBC80	47	1N4744	18	AF126	22	OAA73	90				
LR5	50	6BS7	1-44	6Q7GT	60	12B2Q7	76	43	1-00	DY87/6	41	ECL85	70	GZ51	82	PCL86	55	UBP89	47	2N404	22	AF180	62	OAA79	12				
LR4	39	6BW6	1-00	6Q7(M)	64	12B2R7	75	50B5	1-00	E800C	2-87	ECL86	47	GZ33	48	PCL805	70	UBL21	2-34	2N966	63	AF115	20	OAA81	18				
LU4	70	6BW7	85	6R7G	70	141H7	74	50C5	70	E807	2-87	ECL87	40	GZ34	80	PEN45D	1-00	UC284	90	2N2147	1-10	BA116	23	OAA90	18				
LU5	88	6BZ6	87	6B87	85	1487	1-10	50C6GG		E808	2-87	ECL88	50	HZ37	1-20	PEN46	60	UCP80	90	2N2297	2-80	BA129	16	OAA91	18				
LD21	60	6C4	47	6BCTGT	50	19A05	65			E809	1-20	ECL89	50	HAB80	80	PEN45D	1-00	UCP80	90	2N2369	1-18	BA130	13	OAA92	18				
LD3	75	6C5G	50	6BG7	82	19G6	7-00	50H5	88	E180F	1-17	ECL90	47	EF43	85	PEN46D	1-00	UCP81	84	2N3053	42	BA163	20	OAA93	18				
LD4	70	6C6	47	6BH7	55	20D1	90	50L6GT	1-00	E180C	3-00	EF22	1-00	EF40	80			UC442	88	2N3121	3-22	BC108	16	OAA94	18				
LD5	60	6C9	2-00	6BS7	84	20F2	88	85A2	75	E1148	62	EF27	94	EF83	1-45			UC42	88	2N3121	3-22	BC108	16	OAA95	18				
LD6	47	6CD6G	1-00	6BK7GT	52	20L1	1-20	85A3	75	E1A0	40	EF30	94	EF84	50			UC42	88	2N3121	3-22	BC109	16	OAA96	18				
LD7	85	6CG8A	88	6BQ7GT	50	20P1	1-00	90A9	2-88	EAT6	1-40	EF35	40	EF85	40			PFL200	82	UC183	64	AA119	20	OC13	23				
LD8	30	6CG8A	88	6BQ7GT	50	20P1	1-00	90A9	2-88	EAT6	1-40	EF35	40	EF85	40			PL33	50	UC41	82	AA120	20	OC15	20				
LD9	30	6CG8A	88	6BQ7GT	50	20P1	1-00	90A9	2-88	EAT6	1-40	EF35	40	EF85	40			PL36	70	UF42	82	AA129	20	OC16	16				
LD10	30	6CG8A	88	6BQ7GT	50	20P1	1-00	90A9	2-88	EAT6	1-40	EF35	40	EF85	40			HN309	1-76	PL81	53	UF80	41	AA213	23	OC18	23		
LD11	30	6CG8A	88	6BQ7GT	50	20P1	1-00	90A9	2-88	EAT6	1-40	EF35	40	EF85	40			HVR2	1-00	PL81A	60	UF85	52	AC107	20	OC19	23		
LD12	30	6CG8A	88	6BQ7GT	50	20P1	1-00	90A9	2-88	EAT6	1-40	EF35	40	EF85	40			PL82	43	UF89	47	AC113	33	OCY12	64	OC75	14		
LD13	30	6CG8A	88	6BQ7GT	50	20P1	1-00	90A9	2-88	EAT6	1-40	EF35	40	EF85	40			PL83	1-17	PL83	50	UF85	52	AC126	26	OCY23	26		
LD14	30	6CG8A	88	6BQ7GT	50	20P1	1-00	90A9	2-88	EAT6	1-40	EF35	40	EF85	40			PL84	50	UL84	49	AC127	22	OCY34	29	OC77	25		
LD15	30	6CG8A	88	6BQ7GT	50	20P1	1-00	90A9	2-88	EAT6	1-40	EF35	40	EF85	40			PL84/500	50	UM80	60	AC128	22	OCY38	29	OC78	20		
LD16	30	6CG8A	88	6BQ7GT	50	20P1	1-00	90A9	2-88	EAT6	1-40	EF35	40	EF85	40			KT81	2-10	UY41	50	AC132	26	OCY39	33	OC79	20		
LD17	30	6CG8A	88	6BQ7GT	50	20P1	1-00	90A9	2-88	EAT6	1-40	EF35	40	EF85	40			KTW61	1-76	PL505	1-45	UY85	50	AC154	33	BF159	23	OC81	14
LD18	30	6CG8A	88	6BQ7GT	50	20P1	1-00	90A9	2-88	EAT6	1-40	EF35	40	EF85	40			KTW62	1-76	PL508	1-10	U10	1-17	AC166	33	BF159	23	OC81	14
LD19	30	6CG8A	88	6BQ7GT	50	20P1	1-00	90A9	2-88	EAT6	1-40	EF35	40	EF85	40			KTW63	1-17	PL509	1-45	U12/14	1-17	AC157	33	BF163	26	OC82	14
LD20	30	6CG8A	88	6BQ7GT	50	20P1	1-00	90A9	2-88	EAT6	1-40	EF35	40	EF85	40			MELD6	3-00	PY32	50	U19	4-00	AC165	33	BF173	49	OC82	14
LD21	30	6CG8A	88	6BQ7GT	50	20P1	1-00	90A9	2-88	EAT6	1-40	EF35	40	EF85	40			PL51	1-00	PY81	40	U25	7-00	AC166	33	BF180	33	OC63	26
LD22	30	6CG8A	88	6BQ7GT	50	20P1	1-00	90A9	2-88	EAT6	1-40	EF35	40	EF85	40			P61	1-00	PY82	40	U26	65	AC168	49	BF181	52	OC54	31
LD23	30	6CG8A	88	6BQ7GT	50	20P1	1-00	90A9	2-88	EAT6	1-40	EF35	40	EF85	40			PBC80	45	PY83	45	U33	1-75	AC176	71	BF185	55	OC123	29
LD24	30	6CG8A	88	6BQ7GT	50	20P1	1-00	90A9	2-88	EAT6	1-40	EF35	40	EF85	40			P82	70	PY88	47	U35	1-75	AC177	33	BF194	20	OC169	29
LD25	30	6CG8A	88	6BQ7GT	50	20P1	1-00	90A9	2-88	EAT6	1-40	EF35	40	EF85	40			HVR2A	1-00	PY88	47	U81	80	AC177	33	BF195	29	OC172	46
LD26	30	6CG8A	88	6BQ7GT	50	20P1	1-00	90A9	2-88	EAT6	1-40	EF35	40	EF85	40			EL66	60	PC95	70	PY600A		AC178	33	BF195	29	OC172	46
LD27	30	6CG8A	88	6BQ7GT	50	20P1	1-00	90A9	2-88	EAT6	1-40	EF35	40	EF85	40			EL66	60	PC95	70	U191	50	AC178	33	BF195	29	OC172	46
LD28	30	6CG8A	88	6BQ7GT	50	20P1	1-00	90A9	2-88	EAT6	1-40	EF35	40	EF85	40			EL66	60	PC95	70	U191	50	AC178	33	BF195	29	OC172	46
LD29	30	6CG8A	88	6BQ7GT	50	20P1	1-00	90A9	2-88	EAT6	1-40	EF35	40	EF85	40			EL66	60	PC95	70	U191	50	AC178	33	BF195	29	OC172	46
LD30	30	6CG8A	88	6BQ7GT	50	20P1	1-00	90A9	2-88	EAT6	1-40	EF35	40	EF85	40			EL66	60	PC95	70	U191	50	AC178	33	BF195	29	OC172	46
LD31	30	6CG8A	88	6BQ7GT	50	20P1	1-00	90A9	2-88	EAT6	1-40	EF35	40	EF85	40			EL66	60	PC95	70	U191	50	AC178	33	BF195	29	OC172	46
LD32	30	6CG8A	88	6BQ7GT	50	20P1	1-00	90A9	2-88	EAT6	1-40	EF35	40	EF85	40			EL66	60	PC95	70	U191	50	AC178	33	BF195	29	OC172	46
LD33	30	6CG8A	88	6BQ7GT	50	20P1	1-00	90A9	2-88	EAT6	1-40	EF35	40	EF85	40			EL66	60	PC95	70	U191	50	AC178	33	BF195	29	OC172	46
LD34	30	6CG8A	88	6BQ7GT	50	20P1	1-00	90A9	2-88	EAT6	1-40	EF35	40	EF85	40			EL66	60	PC95	70	U191	50	AC178	33	BF195	29	OC172	46
LD35	30	6CG8A	88	6BQ7GT	50	20P1	1-00	90A9	2-88	EAT6	1-40	EF35	40	EF85	40			EL66	60	PC95	70	U191	50	AC178	33	BF195	29	OC172	46
LD36	30	6CG8A	88	6BQ7GT	50	20P1	1-00	90A9	2-88	EAT6	1-40	EF35	40	EF85	40			EL66	60	PC95	70	U191	50	AC178	33	BF195	29	OC172	46
LD37	30	6CG8A	88	6BQ7GT	50	20P1	1-00	90A9	2-88	EAT6	1-40	EF35	40	EF85	40			EL66	60	PC95	70	U191	50	AC178	33	BF195	29	OC172	46
LD38	30	6CG8A	88	6BQ7GT	50	20P1	1-00	90A9	2-88	EAT6	1-40	EF35	40	EF85	40			EL66	60	PC95	70	U191	50	AC178	33	BF195	29	OC172	46
LD39	30	6CG8A	88	6BQ7GT	50	20P1	1-00	90A9	2-88	EAT6	1-40	EF35	40	EF85	40			EL66	60	PC95	70	U191	50	AC178	33	BF195	29	OC172	46
LD40	30	6CG8A	88	6BQ7GT	50	20P1	1-00	90A9	2-88	EAT6	1-40	EF35	40	EF85	40			EL66	60	PC95	70	U191	50	AC178	33	BF195	29	OC172	46
LD41	30	6CG8A	88	6BQ7GT	50	20P1	1-00	90A9	2-88	EAT6	1-40	EF35	40	EF85	40			EL66	60	PC95	70	U191	50	AC178	33	BF195	29	OC172	46
LD42	30	6CG8A	88	6BQ7GT	50	20P1	1-00	90A9	2-88	EAT6	1-40	EF35	40	EF85	40														

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16. Neon
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COMPLETE STEREO SYSTEM

Two full size loudspeakers 13 1/2" x 10" x 3 1/2". Player unit clips to loudspeakers making it extremely compact. Overall size only 13 1/2" x 10" x 8 1/2". 3 watts per channel, plays all records 33 rpm 45 rpm. Separate volume & tone controls 240V AC mains. Bargain Price £25 85p carriage. Attractive Teak finish Weight 13 1/2 lbs.



SPECIAL OFFER! SMITH'S CLOCKWORK 15 AMP TIME SWITCH 0-60 MINUTES

Single pole two-way surface mounting with fixing screws. Will replace existing well switch to give light for return home, garage, automatic anti-burglar lights etc. Variable knob Turn on or off at all or intermediate settings. Fully insulated. Makers last list price £4-50. Brand new and fully guaranteed. OUR PRICE £2-50 Post 35p.



CASSETTE RECORDER MOTOR ONLY. 6 Volt. Will replace many types. Ideal for models. £1-25.

BLANK ALUMINIUM CHASSIS. 18 s.w.g. 2 1/2" dia sides 6 x 4 in 55p; 8 x 6 in 68p; 10 x 7 in 75p; 12 x 8 in 81p; 14 x 9 in 81p; 16 x 10 in 81p; 18 x 11 in 81p; 20 x 12 in 81p.

ALUMINIUM PANELS 18 s.w.g. 6 x 4 in 15p; 8 x 6 in 25p; 10 x 8 in 25p; 12 x 10 in 30p; 14 x 12 in 30p; 16 x 14 in 35p; 18 x 16 in 35p.

ALUMINIUM BOXES. 18 SWG with lid. 3 x 3 x 3 in. = 75p. 4 x 4 x 4 in. = 90p. 6 x 4 x 4 in. = £1-10. 8 x 4 x 4 in. = £1-30. 12 x 4 x 4 in. = £1-50.

1 1/2" DIAMETER WAVELENGTH SWITCHES 45p. 2A. 3 p. 2-way, or 3 p. 6-way, or 3 p. 4-way. 1 p. 1 2-way, or 4 p. 2-way, or 4 p. 3-way.

TOGGLE SWITCHES. sp. 20p; dp. 25p; dp. dt. 30p.

R.C.S. GENERAL PURPOSE TRANSISTOR PRE-AMPLIFIER BRITISH MADE

Ideal for Mike, Tape P.U., Guitar, etc. Can be used with Battery 2-12V. or H.K. Line 200-300V. D.C. operation. Size 1 1/2" x 1 1/2" x 1 1/2". Resonance 25 cps. to 25 Kc/s. 28 db gain. For use with valve or transistor equipment. £1-45 Post 30p Full instructions supplied. Details S.A.E.

NEW TUBULAR ELECTROLYTICS CAN TYPES

2/350V 20p	250/85V 14p	16-16-16/875v 45p
4/350V 20p	500/85V 20p	50-50/300V 50p
8/350V 28p	100-100/275v 55p	32-32/450V 75p
16/350V 30p	150-200/275v 70p	100-50-50/850V 85p
32/500V 50p	8-8/450V 50p	32-32-32/850 75p
32/25V 19p	16-16/450V 50p	900MF/250V 95p
50/50V 10p	16-16/450V 50p	4700/68V 95p
100/25V 10p	32-32/850V 50p	

LOW VOLTAGE ELECTROLYTICS.

22, 25, 50, 68, 150, 470, 500, 680, 1500, 2200, 3300, mfd all 6 volt 10p. ea.
22, 25, 68, 100, 150, 200, 220, 330, 470, 680, 1000, 1500, 2200, mfd all 10 volt 10p. ea.
220, 330, 1000, 4700, mfd all 4v. 10p. ea.
1. 2, 4, 5, 8, 10, 25, 30, 50, 100 200 15V 10p.
5000µF 12V 15p; 25V 20p; 50V 20p;
1000µF 12V 20p; 25V 45p; 50V 47p; 100V 70p.
2000µF 6V 25p; 25V 42p; 50V 57p; 4700/68V 95p.
2500µF 6V 52p; 3000µF 25V 47p; 50V 85p.
5000µF 6V 25p; 12V 42p 25V 75p; 35V 85p; 50V 95p.
500V-0-001 to 0-05 4p; 0-1 10p; 0-25 12p; 0-47 25p.
CERAMIC 1pF to 0-01µF. 5p. Silver mica 2 to 5000pF. 5p.
PAPER 250V 7p. 25 15p; 1µF or 2µF 150V 15p.
MICRO SWITCH single pole changeover 20p
MICRO SWITCH sub min 25p.
TWIN GANG. "0-0" 208pF+178pF. 31-10.
Slow motion drive 365pF+285pF with 25pF+25pF, 50p;
500pF standard twin gang 75p. 120 pF twin gang 50p.

ELAC 9 x 5 in. HI-FI SPEAKER. TYPE 59RM. THIS FAMOUS AND WIDELY USED UNIT NOW AVAILABLE AT BARGAIN PRICE £3-45

NEON PANEL INDICATORS. 250V AC/DC Amber, 30p RESISTORS. 1/2 w. 1/4 w. 20%. 2p; 2 w. 5p. 10 Ω to 10M. HIGH STABILITY. 1/2 w. 2%. 10 ohms to 6 meg., 4p. Ditto 5%. Preferred values 10 ohms to 10 meg., 4p. WIRE-WOUND RESISTORS. 5 watt, 10 watt, 15 watt, 10 ohms to 100K, 15p each; 2w 0.5 ohm to 5 ohms 15p. TAP OSCILLATOR COIL. Valve type. 85p. FERRITE ROD 8" x 1/2" 20p; 6" x 1/2" 20p; 3" x 1/2" 10p.

MAINS TRANSFORMERS ALL POST 40p each

250-0-250V 80MA. 6-3-3A. 22-95.
250-0-250 80 mA. 6-3 v. 3-5 a. 6-3 v. 1 a. or 5 v. 2 a. 24-60
250-0-250 80 mA. 6-3 v. 3-5 a. 6-3 v. 1 a. or 5 v. 2 a. 25-80
300-0-300 v. 120 mA. 6-3 v. 4 a. C.T. 6-3 v. 2 a. 47-00
MINIATURE 200 v. 20 mA. 6-3 v. 1 a. 21 x 21 x 2 in. 95p
MIDGET 250 v. 45 mA. 6-3 v. 3 a. 21 x 21 x 2 in. 11-20
HEATER TRANS. 6-3 v. 3 amps. 21-45 1 amp. 95p
GENERAL PURPOSE LOW VOLTAGE. Tapped outputs at 2 amp., 3, 4, 5, 6, 8, 10, 12, 15, 18, 24 and 30 v. 44-80
1 amp., 6, 8, 10, 12, 15, 18, 20, 24, 30, 36, 40, 48, 50, 44-80
2 amp., 6, 8, 10, 12, 15, 18, 20, 24, 30, 36, 40, 48, 50, 44-80
3 amp., 6, 8, 10, 12, 15, 18, 20, 24, 30, 36, 40, 48, 50, 44-80
5 amp., 6, 8, 10, 12, 15, 18, 20, 24, 30, 36, 40, 48, 50, 44-80
5, 8, 10, 16 v. 1/2 A. 22. 6-0-6 v. 500 mA 90p. 0 v. 1 amp. 21. 12 v. 300 mA 21. 12 v. 500 mA 21. 12 v. 750 mA 21. 40 v. 2 amp. tapped 10 v. or 30 v. 22-50. 20V 3 amp. 22. 40V 3 a. 22-50. 22V-0-22V 4A D.C. 23-45
AUTO TRANSFORMERS. 115v to 230v or 230v to 115v. 150w. 45; 250w. 48; 400w. 47; 500w. 48.
CHARGER TRANSFORMERS. Input 200/250V. for 6 or 12v., 1 1/2 amp. 22-75; 4 amp. 24-80.
FULL WAVE BRIDGE CHARGER RECTIFIERS: 6 or 12v. outputs. 1 1/2 amp. 40p; 2 amp. 55p; 4 amp. 85p.

MAINS ISOLATING TRANSFORMER

Primary 0-110-240V. Secondary 0-240V. 3 amps. 750 watts. Insulated terminals. Varnish impregnated. Fully enclosed in steel case with fixing feet. Famous make. (Value £19) OUR PRICE £13-50 Carr. 95p. Suitable for outside use.

R.C.S. 3 WAY CROSSOVER

Complets with 12 ft. twin lead fitted with din speaker plug. Assembly with leads for speakers, bass, mid and tweeter. Crossover frequencies—950 cps and £2-20 3,000 cps. For systems up to 25 watts.

VOLUME CONTROLS 80 Ohm Coax 5p. yd.

5 K. ohms to 2 Meg. LOG or LIN. L/S 20p. D.P. 35p. STEREO L/S 55p. D.P. 75p. Edge SK. S.P. Transistor 25p

Wirewood controls 1 1/2 in. diam. 3 watts. 10 ohms to 100K British made with long spindles lin. dia 85p ea.

DUAL CONCENTRIC POT 500k Log + 500k LIN D.P. switch. Inner spindle 3 1/2 in; outer spindle 2 1/2 in. 75p.

CASH PRICES INCLUDE VAT MINIMUM POST AND PACKING 30p. CALLERS WELCOME

RADIO COMPONENT

Illustrated Radio Books & Component Lists 10p. Written guarantee.

E.M.I. 13 1/2 x 8 in. SPEAKER SALE!

With tweeter. £5-25
And crossover. 10 watt. Size 8 or 15 ohm. As Illustrated. Post 45p



With fared tweeter cone and ceramic magnet. 10 watt. 8 ohm. Bass res. 45-60 cps. Flux 10,000 gauss. 15 watts model 25. Post 45p £3-45

Bookshelf Cabinet £6-95

Fluted wood front 16 x 10 x 7 in. Teak Veneer Post 45p

GOODMANS 6 1/2 in. HI-FI SPEAKER

8 ohm, 10 watt. Large ceramic magnet Special Rubber cone surround. Frequency response 80-15,000 cps. Ideal P.A. Columns, Hi-Fi Enclosure Systems, etc. Suitable Tweeter £2-30. £4-60



B.S.R. SINGLE PLAYER DECK

3 speeds, cueing device, counter-balanced arm. Ideal disco deck Stereo cartridge fitted. £17-50 post 75p.



GOODMANS 8 in. WOOFER

8 ohm 15 watt. Deep cone. Heavy ceramic magnet. Bass resonance 35 cps. Frequency response 30-8,000 cps. Ideal bass unit for Hi-Fi systems £5-75



LOUDSPEAKERS P.M. 3 OHMS. 7 x 4 in. £1-25; 8 in. £1-50; 8 x 5 in. £1-80; 8 in. £1-75; 10 x 6 in. £1-90; 10 in. £2-00. SPECIAL OFFER LOUDSPEAKERS! All Brand New. 8 ohm. 2 1/2 in; 8 in; 8 1/2 in; 8 in. 8 ohm. 2 1/2 in; 8 in. 15 ohm. 3 1/2 in; 6 in; 8 x 4 in; 8 x 3 1/2 in; 7 x 4 in; 8 x 4 in. 25 ohm. 2 1/2 in; 8 in; 3 in; 5 x 3 in; 5 in. 25 ohm; 8 in; 5 in. 80 ohm. 2 1/2 in; 2 1/2 in. 120 ohm. 3 in. £1-25 EACH

LOUDSPEAKER VOLUME CONTROL 15 ohm 10 watt with 1 in. long threaded bush for wood panel mounting 75p.

RICHARD ALLAN TWIN CONE LOUDSPEAKERS. 8 in. diameter 4W £2-50, 10 in. diameter 6W £2-95; Post 25p. 1 1/2 in. diameter. 5W. £2-50; 5 or 8 or 15 ohm models. SPEAKER COVERING MATERIALS. Samples Large S.A.M. Horn Tweeters 2-16Kc/s. 10W 8 ohm or 16 ohm 44-80. De Luxe Horn Tweeters 2-16 Kc/s. 15W. 8 ohm 44-80. TWO-WAY 3,000 cps. CROSS OVERS 3, 6 or 15 ohm 21-60. 3-WAY CROSSOVER 850 cps and 8000 cps (25 watt) £2-20.

GOODMANS CONE TWEETER 18,000 cps. 25 watts. 8 ohm. Price £3-60.

ELECTRO MAGNETIC PENDULUM MECHANISM

1-5v d.c. operation over 250 hrs. continuous on 8P3 battery. Fully adjustable swing and speed. Ideal displays teaching electric magnetism or for metronome; stroke etc. 95p. Post 20p

WEYRAD TYPE COILS

P50/LAC-60p. RARW 85p. Twin Gang 81-20.
P50/SCC-40p. OPTI 65p. Printed Circuit 85p.
P50/SCC-40p. LFT4. 65p.

COAXIAL PLUG 10p. PANEL SOCKETS 10p. LINE 15p. OUTLET BOXES, SURFACE MOUNTING 25p. BALANCED TWIN RIPBON FEEDER 300 ohms. 7p. yd. JACK SOCKET Std. open-circuit 15p. closed circuit 25p; Chrome Lead Socket 45p. Phone Plugs 10p. Phone Socket by JACK PLUGS Std. Chrome 20p; 3-5mm Chrome 15p. DIN SOCKETS Chassis 2-pin 10p; 5-pin 10p; DIN SOCKETS Lead 2-pin 15p; 5-pin 15p. DIN PLUGS 2-pin 15p; 5-pin 25p. VALVE HOLDERS 5p; CERAMIC 10p; CANS 5p.

R.C.S. 100 WATT VALVE AMPLIFIER CHASSIS

Professional model. Four inputs. Treble, Bass, Master Volume Controls. Ideal disco P.A. or groups. Guitars, organs Suitable carrying case £10 £85 plus £1-60 carr.



RETURN OF POST MAIL ORDER SERVICE

R.C.S. 10 WATT AMPLIFIER KIT

This kit is suitable for record players, tape play back, guitars, electronic instruments or small P.A. systems. Two versions are available. A mono kit or a stereo kit. The mono kit uses 18 semiconductor. The stereo kit uses 22 semiconductor with printed front panel and volume, bass and treble controls. Spec. — 10 watts output into 8 ohm, 7 watts into 16 ohms. Response 20 CPS to 20 K/Cs. Input 100 M.V. high imp. Size 9 1/2" x 3 1/2" x 2 1/2".

Mono kit **£12-50** Stereo kit **£20** post 45p



ELAC 8in. or 10 x 6in. HI-FI SPEAKER

Dual cone plasticised roll surround. Large ceramic magnet. 50-16,000 cps. Bass resonance 65 cps. 8 ohm impedance. 8in. 10 watts **£4-35**

TEAK VENEER HI-FI SPEAKER CABINETS Fluted Wood Fronts

MODEL "A". 20 x 13 x 12in. For 12in. dia. **£12-50** Post 75p

MODEL "B". 16 x 10 x 7in. For 8 x 6in. or **£6-95** Post 45p

LOUDSPEAKER CABINET WADDING 18in. wide, 20p ft.

BAKER RECOMMENDED 18 inch Enclosure 4 cubic ft. HI-FI CABINET £21-50. Carr. £2 each. Few only. Size 20 x 20 x 12in. Teak Finished Fluted Front.

TEAKWOOD LOUDSPEAKER FRONT GRILLS Modernise your cabinets with the Grooved look. Sizes—18 1/2" x 10 1/2"—75p. 10 1/2" x 7 1/2"—45p.

BARGAIN 4 CHANNEL TRANSISTOR MONO MIXER. Add musical highlights and sound effects to recordings. Will mix Microphone, records, tape and tuner with separate controls into single output. 9 volt battery operated. **£5-20**

STEREO VERSION OF ABOVE £6-25.

R.C.S. STEREO FM TUNER BRITISH MADE



This completely cased mains powered Hi-Fi Tuner with brushed aluminium fascia is British made using the latest circuitry. Barga in **£30** Post 45p

BARGAIN 3 WATT AMPLIFIER. 4 Transistor Push-Pull Ready built with volume, treble and bass controls. 18 volt battery operated. **£3-95**

WAFFER HEATING ELEMENTS THIN OFFERING 1001 USES for every type of heating and drying applications in the home, garage, greenhouse, factory (available in manufacturing quantities). Approx. Size 10 1/2" x 8 1/2" x 1/4". Operating voltage 200/250V. a.c. 200 watts approx. Printed circuit element enclosed in asbestos fitted with connecting wires. Completely flexible providing safe Black heat. British-made for use in photocopiers and print drying equipment.

Ideal for home handymen and experimenters. Suitable for Heating Pads, Food Warmers, Convector Heaters, etc. Must be clamped between two sheets of metal or asbestos, etc., to make efficient clothes dryers, towel rails—Ideal for airing cupboards. Ideal for anti-frost device for the garage —preventing frozen radiators or acting as oil sump heater. Use in the greenhouse for seed raising and plant protection. Invaluable aid for bird houses, incubators, etc., etc. Can be used in series for lower heat. Or in parallel for higher heat applications.

ONLY 40p EACH (FOUR FOR £1-50) ALL POST PAID—Discounts for quantity.

BAKER MAJOR 12" £11-50



Post 50p
30-14,500 c/s. 12in. double cone, woofer and tweeter cone together with a BAKER ceramic magnet assembly having a flux density of 14,000 gauss and a total flux of 148,000 Maxwell. Bass resonance 40 cps Rated 25 watts. NOTE: 3 or 8 or 15 ohms must be stated.

Module kit, 30-17,000 c/s with tweeter, crossover, baffle and instructions. **£14-50**

Please state 3 or 8 or 15 ohms. Post 80p

"BIG SOUND" BAKER SPEAKERS

Robustly constructed to stand up to long periods of electronic power. As used by leading groups and discos

Useful response 30-13,000 cps. Bass Resonance 55 cps.

GROUP "25" **£8-95**
12in. 30 watt
3, 8 or 15 ohms. Post 40p

GROUP "35" **£10-50**
12in. 40 watt
3, 8 or 15 ohms. Post 40p

GROUP "50" **£19-50**
15in. 75 watt
8 or 15 ohms. Post 80p

GROUP 50/12in. **£14-50**
60 watt 8 or 15 ohms Post 80p

Group + PA Cabinets in stock Send for Leaflet.

BAKER 50 WATT ALL PURPOSE TRANSISTOR AMPLIFIER

All purpose transistorised. Ideal for Groups, Disco and P.A. 4 inputs speech and music. 2 way mixing. Output 8/15 ohm. a.c. Mains. Separate treble and bass controls. Guaranteed. Deluxe 100 watt model as illustrated £65. also available in Heavy Wooden case £75.



£49 Carr. £1-00

NEW DISCO 100 WATT **£59** Carr. £1.
ALL PURPOSE AMPLIFIER CHASSIS
2 inputs. 4 outputs separate volume treble and bass controls. Ideal disco amplifier chassis

R.C.S. SOUND TO LIGHT KIT

1000 watts per channel. Full instructions supplied. Kit price **£12-50**

THE "INSTANT" BULK TAPE ERASER & HEAD DEMAGNETISER. Suitable for cassettes, and all sizes of tape reels. A.C. mains 200/250V. Leaflet S.A.E. **£4-35** Post 80p



QUALITY LOUDSPEAKER ENCLOSURE

Teak veneered 1/2 inch thick wood cabinet. Size 18 1/2" x 18 1/2" x 8 1/2". Weight 23lbs. This cabinet features a wide mesh Silver Grill covering a separate compartment for mounting Tweeters or Mid-Range Horn. The fully sealed bass compartment is cut out for 6 1/2 inch Woofer. £2-50 Carr. 85p. Rosewood Version £2-50 Carr. 85p. Baffle could be cut to take larger speaker.



SPECIAL OFFERS
100 Ohm 20 watt Rheostat 2 1/2 in diam. Ceramic Former. Screw Terminals 1/2 in. diam. spindle. 95p. Post 25p.
AC mains relay 3 pole change over 75p.

E.M.I. GRAM MOTOR 120v. or 240v. A.C. 2,400 rpm. 2-pole 70mA. Size 2 1/2" x 2 1/2" in. **£1-25** Post 30p.

E.M.I. TAPE MOTOR 4 pole, 240 v. 135 mA. Size 3 1/2" x 2 1/2" x 2 1/2". **£2-00** Post 30p.
120v version £1.

BAKER HI-FI SPEAKERS HIGH QUALITY — BRITISH MADE

REGENT 12in. 20 watts

An inexpensive unit for the beginner in high fidelity and for general purposes. May be used to improve any Radio, Amplifier, Hi-Fi or Television receiver.

Bass Resonance 45cps
Flux Density 12,000gauss
Useful response 25-18,000cps
3 or 8 or 15 ohm models.

£10-50 Post 40p

DE-LUXE Mk II 12in 15 watts

Especially designed to provide full range reproduction at an economical cost. Suitable for use with any high fidelity system. Built-in concentric tweeter cone.
Bass Resonance 30cps
Flux Density 14,000gauss
Useful response 25-18,000cps
8 or 15 ohms models.

£13-50 Post 40p

SUPERB 12in. 25 watts

A high quality loudspeaker. Its remarkable low cone resonance ensures clear reproduction of the deepest bass. Fitted with a special copper drive and concentric tweeter cone resulting in full range reproduction with remarkable efficiency in the upper register.
Bass Resonance 25cps
Flux Density 16,500gauss
Useful response 20-17,000cps
8 or 15 ohms models.

£17-00 Post 80p

AUDITORIUM 12in. 35 watts

A full range reproducer for high power. Electric Guitars, public address, multi-speaker systems, electric organs. Ideal for Hi-Fi and Disco-theques.
Bass Resonance 35cps
Flux Density 15,000gauss
Useful response 25-16,000cps
8 or 15 ohms models.

£15-50 Post 80p

AUDITORIUM 15in. 45 watts

A high wattage loudspeaker of exceptional quality with a level response to above 3,000 cps. Ideal for Public Address, Discotheques, Electronic instruments and the home Hi-Fi.
Bass Resonance 35cps
Flux Density 15,000gauss
Useful response 20-14,000cps
8 or 15 ohms models.

£19-50 Post 80p

Hi-Fi Enclosure Manual containing plans, designs, crossover data and cubic tables. 60p. Post 5p.

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Practical Wireless, January 1976

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PLEASE ADD AN EXTRA 15% VAT EXCEPT ON TEST METERS, AND VEROBOARD please total 8% & 25% items separately ALL STOCK SUBJECT TO AVAILABILITY

SPECIAL RESISTOR KITS

10E12 1W KIT: 10 of each E12 value, 22 ohms—1M, a total of 570 (CARBON FILM 5%), £4.60 net
25E12 1W KIT: 25 of each E12 value, 22 ohms—1M, a total of 1425 (CARBON FILM 5%), £10.99 net
10E12 1W KIT: 10 of each E12 value, 22 ohms—1M, a total of 570 (CARBON FILM 5%), £4.60 net
25E12 1W KIT: 25 of each E12 value, 22 ohms—1M, a total of 1425 (CARBON FILM 5%), £10.99 net

MULLARD POLYESTER CAPACITORS C280 SERIES
250V P.C. Mounting: 0.01µF, 0.015µF, 0.022µF, 31p, 0.033µF, 0.047µF, 4p, 0.068µF, 0.1µF, 4p, 0.15µF, 5p, 0.22µF, 8p, 0.33µF, 8p, 0.47µF, 10p, 0.68µF, 13p 1µF, 17p, 1.5µF, 26p, 2.2µF, 28p.

MULLARD POLYESTER CAPACITORS C296 SERIES
400V: 0.001µF, 0.0015µF, 0.0022µF, 0.0033µF, 0.0047µF, 0.0068µF, 0.01µF, 0.015µF, 0.022µF, 0.033µF, 4p, 0.047µF, 0.068µF, 0.1µF, 5p, 0.15µF, 8p 0.22µF, 10p, 0.33µF, 8p, 0.47µF, 10p, 0.68µF, 14p, 1µF, 17p.
160V: 0.01µF, 0.15µF, 0.022µF, 0.047µF, 0.068µF, 4p, 0.1µF, 5p, 0.15µF, 6p, 0.22µF, 7p, 0.33µF, 8p, 0.47µF, 10p, 0.68µF, 14p, 1µF, 17p.

MINIATURE CERAMIC PLATE CAPACITORS
50V: (pF) 22, 27, 33, 39, 47, 56, 68, 82, 100, 120, 150, 180, 220, 270, 330, 390, 470, 560, 680, 820, 1K, 1K5, 2K2, 3K3, 4K7, 6K8, (µF) 0.01, 0.015, 0.022, 0.033, 0.047, 21p, each 0.1, 30p, 50p.

POLYSTYRENE CAPACITORS 160V 5%
(pF) 10, 15, 22, 33, 47, 68, 100, 150, 220, 330, 470, 680, 1000, 1500, 2200, 3300 4700, 6800, 10,000, 41p.

RESISTORS

CF—High Stab Carbon Film, 5%	MF—High Stab Metal Film, 5%		
W. Type Range	1-99	100-499	500-999
±	0.90	0.85	0.80
±	0.90	0.85	0.80
±	1.7	1.4	1.2
±	1.6	1.3	1.1
±	1.98	1.81	1.65
±	3.52	3.08	2.75

(Price in pence each).

VALUES AVAILABLE—E12 Series only. (Net prices above 100.)

PRESET SKELETON POTENTIOMETERS

MINIATURE 0.25W Vertical or horizontal 7p each 1K, 2K2, 4K7, 10K, etc. up to 1M Ω
SUB-MIN 0.05W Vertical, 100 Ω to 220K Ω 7p each.



B. H. COMPONENT FACTORS LTD. (P.W.) LEIGHTON ELECTRONICS CENTRE, 59 NORTH ST., LEIGHTON BUZZARD, BEDS. Tel.: LEIGHTON BUZZARD 2316 (STD. Code 05253)

Miniature Mullard Electrolytics

1.0µF 63V	7p	100µF 25V	7p
1.5µF 63V	7p	100µF 63V	17p
2.2µF 63V	7p	150µF 16V	7p
3.3µF 63V	7p	150µF 63V	17p
4.0µF 63V	7p	220µF 6.4V	7p
4.7µF 63V	7p	220µF 10V	7p
6.8µF 63V	7p	220µF 16V	8p
10µF 25V	7p	220µF 63V	25p
10µF 63V	7p	330µF 16V	14p
15µF 16V	7p	330µF 63V	28p
15µF 63V	7p	470µF 6.4V	8p
16µF 40V	7p	470µF 40V	25p
22µF 25V	7p	680µF 16V	17p
22µF 63V	7p	680µF 40V	28p
32µF 10V	7p	1000µF 16V	25p
33µF 16V	7p	1000µF 25V	28p
33µF 40V	7p	1500µF 6.4V	17p
47µF 10V	7p	1500µF 16V	28p
47µF 25V	7p	2200µF 10V	28p
47µF 63V	8p	3300µF 6.4V	28p
68µF 16V	7p		
68µF 63V	14p		
100µF 10V	7p		

VEROBOARD 0.1 0.15

21 x 5"	45p	45p
21 x 3 1/2"	17p	51p
21 x 5"	51p	53p
31 x 3 1/2"	45p	45p
21 x 1 1/2"	11p	10p
21 x 5" (Plain)	—	22p
5 x 3 1/2" (Plain)	—	20p
Inserts in tool	87p	87p
Track Cutter	86p	86p
Pins, Pkt. 50	25p	25p

TRANSISTORS

AC127	21p	BC212L	13p
AC128	22p	BC213L	13p
BC107	12p	BC214L	18p
BC108	12p	O C44	18p
BC109	13p	OC71	13p
BC148	13p	OC81	17p
BC149	13p	OC170	29p
BC182L	13p	2N2926	13p
BC183L	13p	2N3702	14p
BC184L	14p	T1543	45p

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CR52G	Green	Com. Anode	Left Dec.		£1.35
CR82Y	Yellow	Com. Anode	Left Dec.		£1.35
CR74R	Red	Com. Cathode	Right Dec.		£1.35
CR54G	Green	Com. Cathode	Right Dec.		£1.35
CR84Y	Yellow	Com. Cathode	Right Dec.		£1.35

For full information on low cost displays please send 15p.

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Singles
5K Log or 5K Dual
10K Lin Less 10K
25K Switch 25K Less
50K 17p each 50K 53p each
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250K Double 250K + 25%
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TR2 12-0-12 v 100 m/a
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3 1/2 x 3 1/2	41p	
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AB12	3	2	1	45p
AB13	6	4	2	69p
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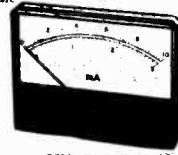
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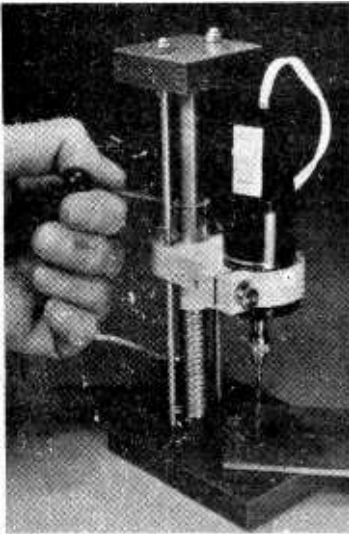
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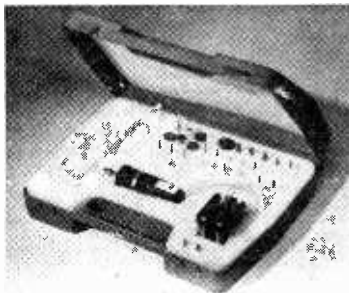
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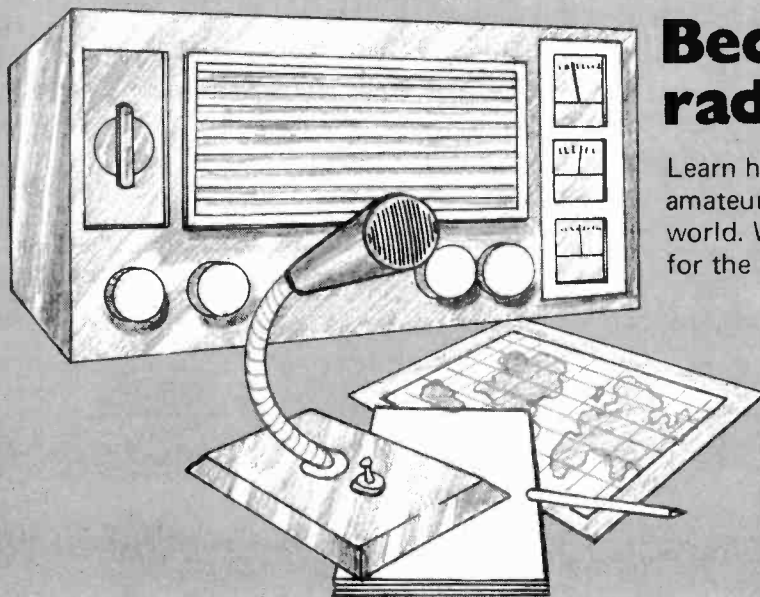
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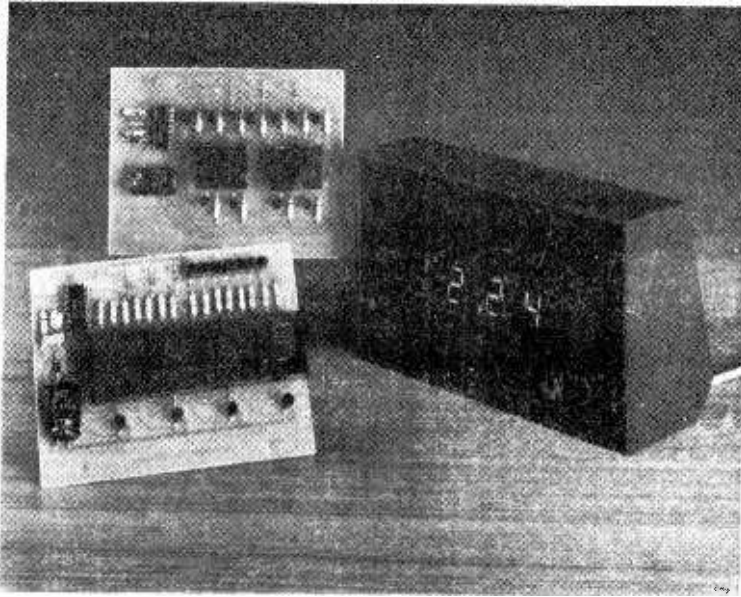
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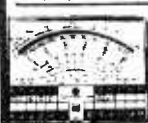
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7400	13p	7483	80p	*301A	Ext. Comp. 8 pin DIL	36p	AC126/7	11p	MJE2855	98p	2N3055	50p	7401	14p	7484	95p	*709	Ext. Comp. 8/14 pin DIL	30p	AC125	11p	MJE3055	65p	2N3442	140p	7402	14p	7485	120p	*710	Diff. Comp. 14 pin DIL	50p	AC141/2	18p	*MPSA06	30p	*2N3702/3	11p	7403	16p	7486	30p	*741	Int. Comp. 8/14 pin DIL	25p	AC176	11p	*MPSA12	50p	*2N3704/5	11p	7404	16p	7487	210p	*747	Dual 741 14 pin DIL	30p	AC187	12p	*MPSU56	62p	*2N3706	10p	7405	16p	7490	40p	*748	Ext. Comp. 8 pin DIL	70p	AC188	11p	*MPSU56	62p	*2N3707	11p	7406	38p	7491	75p	776	Prog. Op. Amp. TO5	140p	AD149	43p	OC28	81p	*2N3708/9	9p	7407	36p	7492	45p	3130S	COSMOS 8 pin DIL	100p	AD161/2	36p	OC33	48p	2N3773	220p	7408	16p	7493	40p	*LM3900	Quad Op. Amp 14 DIL	70p	AF114/5	16p	*OC4/5	18p	2N3866	70p	7409	20p	7494	75p	*MC1458	Dual Op. Amp. 8 pin DIL	70p	AF116/7	16p	*OCM4/5	18p	*2N3870/5	18p	7410	14p	7495	85p	NE5367	FET Op. Amp. TO99	275p	AF239	40p	*OC72	20p	*2N4058	15p	7412	23p	7496	75p	LINEAR I.C.s.		LEDS: TIL205 Red 14p; TIL211 Green 30p	AF239	40p	*OC83	28p	*2N4060	13p	7413	32p	74107	30p	*CA3028	Diff. Cascade Amp. TO5 90p	BT106	Stud	BC109/8	9p	*TIP2955	70p	*2N4289	20p	7414	60p	74121	30p	*CA3046	Transistor Array 14 DIL	50p	1A 50V TO5 40p	BC114/8	7p	*TIP29A	40p	40381	38p	7416	33p	74122	48p	*CA3048	4 Low Noise Amp. 4 Low Noise Amp. 16 DIL	200p	1A100V TO5 42p	*BC157	11p	*TIP31A	52p	40382	40p	7420	14p	74123	68p	*CA3089E	FM IF System 16 pin DIL	200p	1A400V TO5 52p	*BC158/9	10p	*TIP32A	58p	40384	120p	7422	18p	74151	65p	*CA3090	FM Stereo Dec. 16 DIL	160p	1A400V TO5 70p	BC178	18p	*TIP33A	58p	40410	55p	7423	34p	74152	72p	ICL8038CC	Fun. Gen. 14 pin DIL	275p	1A400V TO5 70p	*BC192/3	10p	*TIP33A	58p	40411	725p	7425	30p	74153	85p	LM380	2W Audio Amp. 14 DIL	90p	1A400V Stud 75p	*BC194	11p	*TIP34A	115p	40594	75p	7427	37p	74154	150p	*LM381	Stereo Preamp. 14 DIL	160p	7A400V TO5+HS 90p	*BC212	10p	*TIP35A	220p	40595	85p	7430	14p	74155	76p	*MC1310P	FM Stereo Dec. 14 DIL	175p	16A400V Plastic 180p	*BC213	10p	*TIP38A	290p	FTs		7432	25p	74156	76p	*MC1312	SQ Quad. Dec. 14 DIL	950p	M252 - 16 pin DIL	*BC217	30p	*ZTX108	5p	*BF244	36p	7437	25p	74161	99p	*MC1312	3W Audio Amp. PCB	70p	RHYTHM	*BC218	30p	*ZTX109	5p	*MPF102	30p	7440	14p	74161	99p	*MFC4008B	Electronic Attenuator	90p	GENERATOR	*BC219	14p	*ZTX504	15p	*MPF103	30p	7441	45p	74162	99p	MFC6040	Timer 8 pin DIL	45p	15 Prog. Rhynchms	*BCY71	12p	*2N697	13p	*MPF104	30p	7442	60p	74163	99p	NE555	Dual 555 14 pin DIL	100p	15 Amp P&P + 25%	*BCY72	20p	*2N820	30p	*MPF105	30p	7447	75p	74164	120p	NE561	PLL with AM Demod.	325p	VAT	*BD123	100p	*2N706	12p	*2N3820	57p	7448	70p	74166	126p	NE562	PLL with VCO 16 DIL	325p	Data 25p. + SAE.	*BD124	65p	*2N708	18p	*2N5457	30p	7450	15p	74175	85p	NE563	PLL FM/IF Demod	300p	TRIAcs	*BD131	36p	*2N930	18p	*2N5458	30p	7451	16p	74181	210p	NE565	PLL 14 pin DIL	200p	400V	*BD132	40p	*2N1131/2	21p	*2N5459	30p	7452	25p	74191	144p	NE567	PLL Fun. Gen. 8 DIL	150p	400V 95p	*BD133	55p	*2N1304/5	18p	MOSFETs	7453	16p	74182	82p	*557	Dual 557 14 pin DIL	370p	400V 95p	*BRF93/40	30p	*2N1306	28p	3N128	75p	7454	16p	74182	82p	*SN7233	Video Amp. 14 pin DIL	120p	400V 95p	*BRF98	30p	*2N1306	28p	3N140	85p	7456	15p	74185	135p	*TBA570	AM/FM Radio Receiver	160p	400V 95p	*BF115	22p	*2N1711	20p	3N141	75p	7460	15p	74195	75p	*TBA800	5W Audio Amp. OIL	90p	400V 95p	*BF167	23p	*2N1893	30p	40603	58p	7470	27p	74199	180p	*TBA810	7W Audio Amp. OIL	100p	400V 95p	*BF173	23p	*2N2219	20p	40673	59p	7472	25p	74191	144p	*TBA820	2W Audio Amp. OIL	80p	400V 95p	*BF257	32p	*2N221/2	20p	4073	30p	7473	30p	74192	120p	XR2240	Prog. Timer/Counter	370p	400V 95p	*BRFR9/80	30p	*2N2369	14p	4077A	27p	7474	45p	74194	180p	ZN414	TRF Radio Receiver	110p	400V 95p	*BRX84	25p	*2N2484	20p	*T1543	80p	7475	45p	74195	75p	Basic data sheets at 10p each + SAE.	400V 95p	*BRX85	25p	*2N2904/5	20p	2N2190	80p	7476	30p	74195	75p	CLOCK I.C.s.	400V 95p	*BRX86	25p	*2N2904/5	20p	2N2646	35p	7477	30p	74195	75p	MM 5314 24 pin DIL	430p	400V 95p	*BFY57	20p	*2N2926/B	7p	40673	59p	7478	50p	74198	180p	Data sheets 30p each + SAE	400V 95p	*BFY58	20p	*2N2926/Y	8p	*2N4871	30p	7482	70p	74199	180p	LOW PROFILE DIL SOCKETS BY TEXAS	400V 95p	*BFY59	16p	*2N3053	18p	PUJT	400V 95p	4028AE140p	4029AE196p	4046AE202p	4047AE137p	4049AE 63p	4054AE 21p	4055AE 135p	4056AE196p	4057AE163p	4058AE229p	4059AE 26p	4022AE169p	4023AE 21p	4024AE116p	4027AE 91p	4528AE120p	INSULATORS: Mica + 2 Bushes for TO3 & TO66 5p

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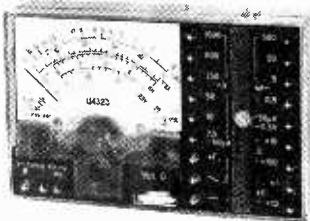
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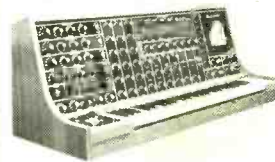
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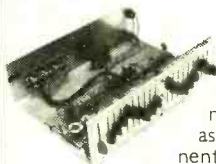
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