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7405	0.15	7414	0.58	7448	0.80	7489	2.90	74110	0.50	74181	2.00
7406	0.30	7416	0.28	7475	0.48	7490	0.42	74118	0.90	74190	1.50
7407	0.30	7417	0.28	7480	0.50	7491	0.75	74119	1.85	74198	2.00
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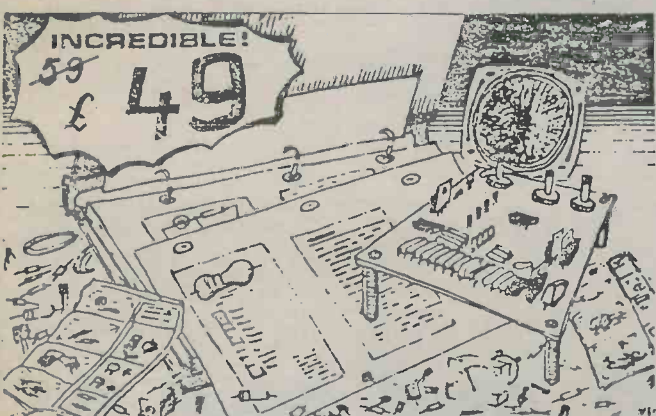

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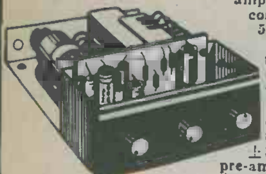

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Pri. 200/240v. Sec. 9-0-9 at 500 mA. £1.60 P. & P. 65p.
Pri. 200/240v. Sec. 12-0-12 at 1 amp. £1.85 P. & P. 65p.
Pri. 200/240v. Sec. 10-0-10 at 2 amp. £2.50 P. & P. 90p.
Pri. 200/240v. Sec. 23v. at 1.5 amp, 6v at ·6 amp, 8v. at 50 mA. £2.25 + 65p P. & P.

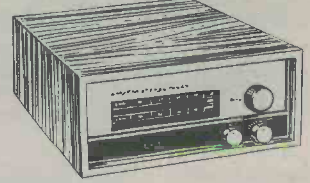
ALL PURPOSE POWER SUPPLY UNIT 200/240v. A.C. input. Four switched fully smoothed D.C. outputs giving 6v. and 7½v. and 9v. and 12v. at 1 amp on load. Fitted insulated output terminals and pilot lamp indicator. Hammer finish metal case overall size 6" × 3½" × 2¾". Ready built and tested. Price £6.75. P. & P. 95p

STEREO-DECODER SIZE 2"×3"×½"

Ready built. Pre-aligned and tested. Sens. 20-560mV for 9-16V neg. earth operation. Can be fitted to almost any FM VHF radio or tuner. Stereo beacon light can be fitted if required. Full details and instructions (inclusive of hints and tips) supplied. £6.00 plus 20p P. & P.
Stereo beacon light if required 40p extra.

QUALITY RECORD PLAYER AMPLIFIER MK. II A top quality record player amplifier employing heavy duty double wound mains transformer, ECC83, EL84, and rectifier. Separate Bass, Treble and Volume controls. Complete with output transformer matched for 3 ohm speaker. Size 7in wide × 3in deep × 6in high. Ready built and tested. PRICE £7.00. P. & P. £1.25
ALSO AVAILABLE mounted on board with output transformer and speaker. PRICE £8.00. P. & P. £1.30.

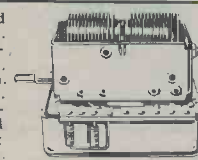
MAINS OPERATED SOLID STATE AM/FM STEREO TUNER



200/240V Mains operated Solid State A/M F/M Stereo Tuner. Covering M.W. A.M. 540-1605 KHZ, VHF/FM 88-108 MHZ. Built-in Ferrite rod aerial for M.W. Full AFC and AGC on AM and FM. Stereo Beacon Lamp Indicator. Built-in Pre-amps with variable output voltage adjustable by pre-set control. Max o/p Voltage 600 m/v RMS into 20K. Simulated teak finish cabinet. Will match almost any amplifier. Size 8½" w. 4" h. × 9½" d. approx. LIMITED NUMBER ONLY at £28.00 + £1.50 P. & P.

SPECIAL OFFERS

Mullard LP1159 RF-IF Double Tuned Amplifier Module for nominal 470kHz. Size approx. 2¼" × 1¼" × ¾" 7·6V + earth. Brand new pre-aligned. Full specification and connection details supplied. £2·25 + P. & P. 20p.



Pye VHF/FM Tuner Head covering 88-108M/Hz. 10·7M/Hz IF output 7·6V + earth. Supplied pre-aligned, with full circuit diagram. Connection details supplied. Beautifully made with precision-geared FM Gang and 323 Pf + 323 Pf AM Tuning Gang only £3·15 + P. & P. 35p.

PRECISION MADE
Push Button Switch bank. 8 Buttons giving 16 S/P C/O interlocked switches plus 1 Cancel Button Plus 3 d/p c/o. Overall size 5" × 2½" × 1". Supplied complete with chrome finished switch buttons 2 for £1.80 + 20p, P. & P.

HI-FI LOUDSPEAKER SYSTEM MkII

Beautifully made simulated teak finish enclosure now with most attractive slatted front. Size 16½" high × 10½" wide × 9" deep (approx.). Fitted with E.M.I. Ceramic Magnet 13" × 8" bass unit, H.F. tweeter unit and crossover. AVAILABLE IN NOMINAL 4 ohm, 8 ohm or 16 ohm impedance (state which). Handling power 10 watts R.M.S.

OUR PRICE £14.00 each. Carr. £3

Cabinet Available Separately £8.00 each. Carr. £2.00
Also available in 8 ohms with EMI 13" × 8" bass speaker with parasitic tweeter £12.50 each. Carr. £3.00

LOUDSPEAKER BARGAINS
5in. 3 ohm £2·00, P. & P. 35p. 7 × 4in. 3 ohm £2·35, P. & P. 48p. 10 × 6in. 3 or 15 ohm £3·20. P. & P. 75p. 8 × 5in. 3 ohm with high flux magnet £3·00, P. & P. 60p. Tweeter. Approx. 3½". Available 3 or 8 or 15 ohms, £2.00 + 30p P. & P.

2" PLASTIC CONE HF TWEETER 4 ohm, £3·50 per matched pair + 50p P. & P.

HIGH POWER HI-FI 8 ohm Dome Tweeter. 1" voice coil. Magnet size 3" dia. Suitable for use in up to 50 watt systems. £4·50 each + 60p P. & P.

VYNAIR & REXINE SPEAKERS & CABINET FABRICS app. 54 in. wide. Our price £2.00 yd. length. P. & P. 50p per yd. (min. 1 yd.). S.A.E. for samples.

"POLY PLANAR" WAFER-TYPE, WIDE RANGE ELECTRO-DYNAMIC SPEAKER
Size 11¾" × 14¾" × 1⅛" deep. Weight 19oz. Power handling 20W r.m.s. (40W peak). Impedance 8 ohm only. Response 40Hz–20kHz. Can be mounted on ceilings, walls, etc. and used with or without baffle. Send S.A.E. for details. Only £8·40 each. P. & P. 90p for one, £1.10 for two.

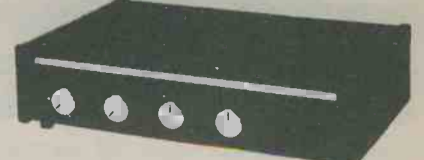
Now also available 8"-8 ohm. 10 watts r.m.s. 20 watt peak 40 Hz-20,000 Hz. Overall depth 1". Ideal for Hi-Fi or for use in cars £5.25 + P. & P. (one 65p, two 75p).

SONOTONE 9TAHC COMPATIBLE STEREO CARTRIDGE T/O stylus Diamond Stereo LP and Sapphire 78.
ONLY £2.50 P. & P. 20p. Also available fitted with twin Diamond T/O stylus for Stereo LP. £3.00 P. & P. 20p.

LATEST CRYSTAL T/O STEREO/COMPATIBLE CARTRIDGE for EP/LP/Stereo 78. £2.00 P. & P. 20p

LATEST T/O MONO COMPATIBLE CARTRIDGE for playing EP/LP/78 mono or stereo records on mono equipment. Only £2.00 P. & P. 20p

HARVERSONIC SUPER SOUND 10 + 10 STEREO AMPLIFIER KIT

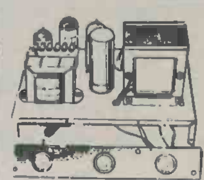


A really first-class Hi-Fi Stereo Amplifier Kit. Uses 14 transistors including Silicon Transistors in the first five stages on each channel resulting in even lower noise level with improved sensitivity. Integrated pre-amp with Bass, Treble and two Volume Controls. Suitable for use with Ceramic or Crystal cartridges. Very simple to modify to suit magnetic cartridge—instructions included. Output stage for any speakers from 8 to 15 ohms. Compact design, all parts supplied including drilled metal work, high quality ready drilled printed circuit board with component identification clearly marked, smart brushed anodised aluminium front panel with matching knobs, wire, solder, nuts, bolts—no extras to buy. Simple step by step instructions enable any constructor to build an amplifier to be proud of. Brief specifications: Power output: 14 watts r.m.s. per channel into 5 ohms. Frequency response ±3dB 12–30,000 Hz Sensitivity: better than 80mV into 1MΩ. Full power bandwidth: ±3dB 12–15,000 Hz. Bass, boost approx. to ±12dB. Treble cut approx. to —16dB. Negative feedback 18dB over main amp. Power requirements 35v. at 1·0 amp.
Overall Size 12"w. × 8"d. × 2½"h.
Fully detailed 7 page construction manual and parts list free with kit or send 25p plus large S.A.E.

AMPLIFIER KIT	£13·50	P. & P. 80p
(Magnetic input components 33p extra)		
POWER PACK KIT	£5·50	P. & P. 95p
CABINET	£5·50	P. & P. 95p

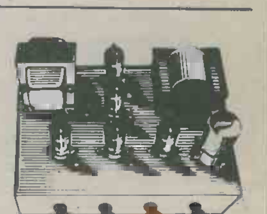
Special offer—only £23.75 if all 3 units ordered at one time plus £1.25 P. & P.

Full after sales service
Also available ready built and tested £31·25. P. & P. £1.50.



3-VALVE AUDIO AMPLIFIER HA34 MK II. Designed for Hi-Fi reproduction of records. A.C. Mains operation. Ready built on plated heavy gauge metal chassis, size 7½"w. × 4"d. × 4¾"h. Incorporates ECC83, EL84, EZ80 valves. Heavy duty, double wound mains transformer and output transformer matched for 3 ohm speaker. Separate volume control and now with improved wide range tone controls giving bass and treble lift and cut. Negative feedback line. Output 4½ watts. Front panel can be detached and leads extended for remote mounting of controls. Complete with knobs, valves, etc., wired and tested for only £8.50. P. & P. £1.40.

HSL "FOUR" AMPLIFIER KIT. Similar in appearance to HA34 above but employs entirely different and advanced circuitry. Complete set of parts, etc. £8.00. P. & P. £1.40.



10/14 WATT HI-FI AMPLIFIER KIT
A stylishly finished monaural amplifier with an output of 14 watts from 2 EL84s in push-pull. Super reproduction of both music and speech, with negligible hum. Separate inputs for mike and gram allow records and announcements to follow each other. Fully shrouded section wound output transformer to match 3-15Ω speaker and 2 independent volume controls, and separate bass and treble controls are provided giving good lift and cut. Valve line-up 2 EL84s, ECC83, EF86 and EZ80 rectifier. Simple instruction booklet 25p × SAE (Free with parts). All parts sold separately. ONLY £13.50. P. & P. £1.40. Also available ready built and tested £18.00. P. & P. £1.40.

SPECIAL LINES OFFERED SUBJECT TO STOCK AVAILABILITY

Limited number of British Manufacturer's Surplus professional 100 watt RMS Slave amplifiers. Special features: 2 separate power modules, 1 for Bass response, and 1 for mid. range/tweeter. 5 stage LED display for power o/p indication. A/c mains i/p switchable for 110 or 240V. Can easily be converted to stereo.

AVAILABLE TO PERSONAL CALLERS ONLY—PLEASE PHONE TO CONFIRM AVAILABILITY.
Brand new and tested only £33·75.

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SEND SAE WITH ALL ENQUIRIES. FOR PERSONAL CALLERS ONLY: WE CAN NOW OFFER A FULL REPAIR SERVICE ON ALL HI-FI EQUIPMENT, DISCO, CASSETTES, CAR RADIO, ETC.

(Please write clearly)

PLEASE NOTE: P. & P. CHARGES QUOTED APPLY TO U.K. ONLY. P. & P. ON OVERSEAS ORDERS CHARGED EXTRA.

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MODULES DESIGNED AND MADE IN OUR OWN UK (Essex) FACTORY

Sold direct to you the customer at genuine money saving prices. All goods shown here guaranteed and sent post free in UK with V.A.T. included

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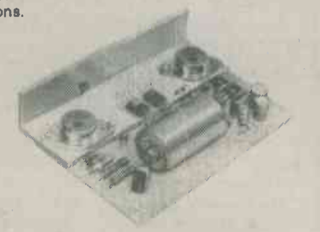
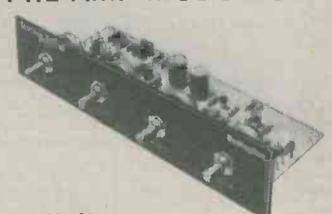
AMPLIFIERS 3 to 100 WATTS R.M.S.

Ready assembled on P.C.Bs., tested and guaranteed. Easy to connect. With instructions. Output ratings ±1dB.



SS.103	I.C. amp. 3 watts R.M.S. using 20V/8Ω or 14V/4Ω. Input 100mV.	£2.85
SS.103-3	Stereo version of above, 21.C.s	£5.00
SS.105	5 watts R.M.S. into 3Ω using 13.5V. Sensitivity — 30mV. THD — 0.3%. 3½" x 2" x 1".	£3.95
SS.110	10 watts R.M.S. into 4Ω using 24V. Sensitivity — 80mV. THD — 0.3%. 3½" x 2" x 1".	£4.65
SS.120	20 watts R.M.S. into 4Ω using 34V. Sensitivity — 80mV. THD — 0.3%. 3½" x 2" x 1".	£5.15
SS.125	25 watts R.M.S. into 8Ω using 50V. Sensitivity — 140mV. Distortion — Less than 0.05% into 8Ω S/N better than 70dB.	£7.25
SS.140	40 watts R.M.S. into 4Ω using 45V. Sensitivity — 300mV. Distortion typically 0.1% 5" x 3½" x 1½".	£6.50
SS.160	64 watts R.M.S. into 4Ω using 50V. Sensitivity — 350mV. Distortion typically 0.1% 5" x 3½" x 1½".	£8.50
SS.1100	100 watts R.M.S. into 4Ω using 70V/2A. Input sensitivity — 500mV. Distortion at half-power, typically 0.1%. 5" x 3½" x 1½".	£10.50
HS.160	Multi-finned heatsink for SS.140 or SS.160.	75p
HS.1100	Ditto for SS.1100.	£1.50

THE CONTROL AND PRE-AMP MODULES



UNIT ONE
Stereo pre-amp & active tone control unit 50mV in for 200mV out, 10 16V operation. Bass ± 15dB at 30Hz; Treble ± 15dB at 10KHz; Balance control; Volume control. For ceramic P.U., radio or tape inputs. WITH FREE CONTROL PANEL FASCIA £9.00

UNIT TWO
Similar to UNIT ONE but for magnetic cartridge input. R.I.A.A. corrected. Sensitivity — 5mV for 200mV out (can be varied). WITH FREE CONTROL PANEL FASCIA. £12.43

CONTROL PANEL FASCIA available separately. 50p

SS.100
Basic active stereo tone control module to provide ± 15dB on bass at 30Hz and on treble at 10KHz. £3.00

SS.101
Stereo pre-amp suitable for ceramics, tape, radio, etc. £2.75

SS.102
Stereo pre-amp for mag. pick-ups. R.I.A.A. corrected £4.45

POWER SUPPLY UNITS

Every Stirling Sound Power Unit is tested and guaranteed under working conditions before despatch. All units except SS.312 include a stabilised low voltage take-off point (13-15V) for pre-amp, tone control, radio tuner, etc. Outputs quoted minimal unloaded ratings.

SS.312	12V/1A	£6.60
SS.318	18V/1A	£6.95
SS.324	24V/1A	£7.65
SS.334	34V/2A	£8.75
SS.345	45V/2A	£10.75
SS.350	50V/2A	£11.75
SS.360	60V/2A	£12.75
SS.370	70V/2A	£14.75

SS.310/50 Stabilised power supply unit with variable output from 10V to 50V/2A. Short circuit protected. £17.75

SS.300 Power stabilising unit variable from 10 to 50V/8A for adding to unstabilised supply units. £5.50

ACCESS OR BARCLAYCARD CUSTOMERS — JUST TELL US YOUR NUMBER
ALL GOODS POST FREE IN U.K. ALL PRICES SHOWN HERE INCLUDE V.A.T. Prices subject to alteration without notice. Order to Dept. RC4.

STIRLING SOUND
37 VANGUARD WAY
SHOEBURYNESS ESSEX
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Shop & Showroom 222-224 West Road, Westcliff-on-Sea. Phone Southend (0702) 351048.

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Please send ....
(or as attached list) for which I enclose £....................
NAME ....
ADDRESS RC5

TIME PEACE £9·45*

Not a spelling mistake, but another descriptive term for the National MA1012 *complete* clock & display module.
Featuring sleep and snooze timers, 24 hour alarm format, fast and slow setting, alarm output switch.

Display area 76 x 20 mm. Total size 3½x8x2 cm.
The MA1012 is non-strobed, with direct drive to the display LEDs, thus causing none of wideband RFI noise associated with earlier clock IC designs. It is suitable for any tuner or radio timing applications, plus all the usual clock applications. Help reduce noise pollution with our MA1012 clock module! The module requires only switches and mains transformer. A suitable 240v AC input transformer is available for £1.50 + 8%vat
Two modules, with two transformers, for £20.00 + 8% VAT.

REFERENCE SERIES TUNER MODULES

EF5803	2 MOSFET AGC RF stages, with low noise selected MOSFETs, MOS mixer, Buffered local oscillator output for counter and synthesizer purposes, 6 tracked tuned circuits, IF and Image <100dB down.	£19.75
Ref. FMIF	Selectable 2 or 3,6 pole linear phase IF filters, two MOS IF preamps, twin detector coil for 0.07% THD Δf 22.5kHz. Noise mute, deviation mute, adjustable range AFC, meter output.	£16.25
Ref. MPX	With the incomparable HA1196 PLL low noise, wide range decoder IC, preamp and LC low pass filter on input, twin LC pilot and base-bandpass filters on the output. With 2 x LM380N ICs for monitor amp purposes available on the board.	£16.45

Our other ranges of FM and AM tuner modules available as before.

EF5801	17.45	EF5600	12.95	7252	26.50	7122	13.22
7030	10.95	EC3302U	7.50	7253	26.50	*Most also available in kits:*	
91196	12.99	8319	11.45	91197	11.35	*details in catalogue & price list*	

COILS FOR LW, MW, SW 1,2, and 3 now listed in catalogue 30 & 33p ea
TOKO 10k series coils now for 1.5 to 30MHz, giving a total coverage in osc and rf coils

Low cost meters: Internally illuminated edgewise meters 200uA, and back lit flat face meters 200uA. A wide choice of scales · or material to DIY.

Equipment boxes: These must be the best value in ABS (black) equipment boxes with close fitting (flanged) lids. 8x6x4 (cms) 54p ea*, 10x7.5x4 (cms) 66p ea*, and 12x10x4.5 (cms) 76p ea*. Also new stackable component storage boxes and trays.

DETECKNOWLEDGEY: theory and practise of metal locator principles including BFO IB, phase angle, pulse induction. A unique reference for users and constructors. £1.00

Our usual unique range of coils, filters etc for radio: from TOKO; 350,000 in stock. The best in linear ICs for RF, HA1137:£2.20; HA1196:£4.20; HA1197:£1.40, plus all common radio and multiplex devices, audio ICs (TBA810AS £1.09), MOSFETs, a unique line in varicap diodes for AM tuning :: see the latest catalogue for details. 45p

Postage 25p per order, VAT 12.5% except where otherwise indicated (*8%). Send to: 2 Gresham Road, Brentwood, Essex. tel (0277) 216029. Only 200m from station!

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TRADE COMPONENTS

JUST A FEW BARGAINS ARE LISTED — SEND STAMPED ADDRESSED ENVELOPE FOR A QUOTE ON OTHER REQUIREMENTS. PAY A VISIT. OVER 90% OF STOCK BELOW QUANTITY WHOLESALE PRICE. ALL PRICES INCLUDE THE ADDITIONAL DISCOUNT IN LIEU OF GUARANTEE. MINIMUM ORDER GOODS VALUE £1.00 BEFORE P/P & VAT.

Goods sent at customer's risk unless sufficient payment for registration (1st class letter post) or compensation fee (parcel post) included.

VALVE BASE

Printed circuit B9A–B7G 5p*
Chassis B7–B7G 9p*
Shrouded chassis B7G–B8A 10p*
B12A tube. Chassis B9A 10p*

Car type panel lock and key 50p
18 volt 4 amp charger, bridge rectifier 79p
GC10/4B £3.00

Speaker 6" x 4" 5 ohm ideal for car radio £1.00*

Aluminium Knobs for ¼" shaft. Approx. ⅝" x ⅞" with indicator Pack of 5 50p*

TAG STRIP – 6 way 3p
9 way 5p Single 1p

5 x 50pF or 2 x 220pF trimmers 20p

BOXES — Grey polystyrene 61 x 112 x 31mm, top secured by 4 self tapping screws 32½p
Clear perspex sliding lid, 46 x 39 x 24mm 10p
ABS, ribbed inside 5mm centres for P.C.B., brass corner inserts, screw down lid, 50 x 100 x 25mm orange **48p**; 80 x 150 x 50mm black **70p**; 109 x 185 x 60mm black **£1.10**

Used 999 ALARM UNIT. 12 volt includes loop cassette tape player, 2 x d.p.t.d., 1 x 4 p.d.t. miniature relay. Reed relay, solenoid, 35 marked semiconductors, caps, resistors, pots, terminal strip etc.
£2.00 plus £1.40 p&p

SWITCHES

Pole	Way	Type	
1	2	Slide	12p*
6	2	Slide	20p*
2	1	Rotary Mains	20p*
2	1	(or 1p 2W) Micro with roller	20p
2	3	Miniature Slide	16p*
1	2	Toggle	12p*

S.P.S.T. 10 amp 240v. white rocker switch with neon. 1" square flush panel fitting 30p
S.P.S.T. dot 13 amp, oblong, push-fit, rocker 15p

Sidleen/AFA Very High Security barrel Key Switch. 2 tubular keys £2.50

AUDIO LEADS

3 pin din to open end, 1½yd, twin screened 35p*
3 pole jack both ends 4ft 80p
3 pole jack plug to tag ends, 4 ft 35p

COMPUTER & AUDIO BOARDS/ASSEMBLIES

VARYING CONTENTS INCLUDE ZENER, GOLD BOND, SILICON, GERMANIUM, LOW AND HIGH POWER TRANSISTORS AND DIODES, HI STAB RESISTORS, CAPACITORS, ELECTROLYTICS, TRIMPOTS, POT CORES, CHOKES ETC.
3lb for **85p** + **£1.00** post and packing
7lb for **£1.95** + **£1.40** post and packing

1k horizontal preset with knob 10 for 30p*

3" Tape Spools 3p
1" Terry Clips 4p
12 Volt Solenoid 30p

TV KNOB

Dark grey plastic for recessed shaft (quarter inch) with free shaft extension 5p*

ENM Ltd. cased 7-digit counter 2¼ x 1¾ x 1¼" approx. 12V d.c. (48 a.c.) or mains 75p

ZM1162A INDICATOR TUBE

0-9 Inline End View. Rectangular Envelope 170V 2·5M/A £1

GRUNDIG REGULATED TAPE MOTOR

6V nominal approx. 3 x 1½". Incl. shock absorbing carrier 70p

3.5mm metal stereo plug 20p*

Ferric Chloride, Anhydrous mil. spec. 1lb bag **40p**

RESISTORS

⅛–¼–½ watt 1p*
1 watt 2p*
Up to 15 watt wire wound 8p
1 or 2% five times price.

Cinch 8 way std 0.15 pitch edge connector 20p

Diode Equivalent Book, 172 pages, AA111 to ZY200, 1N34 to 1S3200, also outline and connection data
£1.50 NO VAT

POTS*

Log. or Lin., carbon or wirewound, rotary or slide. Single 20p*
With switch 30p*
Dual 36p*
Dual switch 45p*
1.5m Edgetype 10 for 30p
Skeleton Presets*
Slider, horizontal or vertical standard or subminn. 6p

THERMISTORS and V.D.R's

CZ1/2/6/11/14, E23, E299D4P230, ITT116-121-40, K813, KR22, KT150, VA1005/6/8/1010/1033/4/7/8/9/1040/1053/5/1066/7/1074/6/7/1082/6/1091/6/7/8/1100/3/8. Rod with spot blue/fawn/greeen.
All 17p each

RELAYS

P.O. 3000 type, 1,000 OHM coil. 4 pole c/o 50p
12v d.p.c.o. heavy duty octal 80p
700 ohm 11-31 volt miniature sealed d.p.c.o. 80p
185 ohm 6/12V miniature sealed, 4 p.c.o. £1.20

JAP 4 gang min. sealed tuning condensers 30p*

ELECTROLYTICS* Many others in stock

MFD	Up to 10V	25V	50V	70–75V	100V	200–250V	300–350V	450–500V
10	4p	5p	6p	8p	10p	12p	16p	20p
25	4p	5p	6p	8p	10p	15p	18p	20p
50	4p	5p	6p	9p	13p	18p	25p	—
100	5p	6p	10p	12p	19p	20p	—	—
250	9p	10p	11p	17p	28p	—	85p	£1
500	10p	11p	17p	24p	45p	—	—	—
1000	13p	22p	40p	75p	—	£1.50	—	—
2000	23p	37p	45p	—	—	(all are*)	—	—

As total values are too numerous to list, use this price guide to work out your actual requirements 8/20, 10/20, 12/20, 22/50, 47/25.
Tubular tantalum 20p each. 16-32/275V, 100-150V, 100-100/275V **30p*** 50-50/385V, 12,000/12V, 32-32-50/300V, 20-20-20/350V **60p*** 700 mfd/200V **£1.00**; 100-100-100-150-150/320V **£2.00***

RS 100–0–100 micro amp null indicator Approx. 2" x ¾" x ¾" £1.50

INDICATORS

Bulgin D676 red, takes M.E.S. bulb 30p
12 volt, or Mains neon, red pushfit 18p
R.S. Scale Print, pressure transfer sheet 10p

CAPACITOR GUIDE – maximum 500V

Up to .01 ceramic 3p*. Up to .01 poly 4p*. .013 up to .1 poly etc. **5p***. 12 up to .68 poly etc. **6p***. Silver mica up to 360pF **8p**, then to 2,200pF **11p**, then to .01 mfd **18p**.
10p .1/750. **12p**. .01/1000, 8/20. .1/900 .22/900, 4/16. .25/250 AC (600vDC) **40p.** 5/150, 10/150, 40/150.
Many others and high voltage in stock.

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240 volt A.C./D.C. Will hold relay, etc., for approx. 15 secs after power off. Ideal for alarm circuits, etc. £1

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Belling Lee L1469, 4 way polythene. **6p each**

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Bulgin, 5mm Jack plug and switched socket (pair) 30p

Reed Switch 28mm. body length 9p

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5 assorted multiple units for 50p*

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2 Amp Suppression Choke 8p
3 x 2½ x $\frac{1}{16}$" } **PAXOLINE** 5 for 20p
4⅞ x ½ x ⅛" } 10 for 10p
PCV or metal clip on MES bulb Holder 5 for 20p
VALVE RETAINER CLIP, adjustable 5 for 10p

OUTPUT TRANSFORMERS*

Sub-miniature Transistor Type 25p
Valve type, 40p

POT CORES with adjuster
LA2508-519 30p pair

STYLII 20p*

ER5SB/5MX/HC2/ER2. Compact X2/X/C/SX. Garrard GCM21T/22T/GKM24T/GKS25/GP59. B.S.R. C1/SX1M/ST3/CS80/TC8/OP and T, and many other sapphire types. Send sample required with payment and s.a.e. if in doubt.

RS neg. volt regulator T03, 306-099 (equiv. MPC900) 10A, 100 watt 4-30 volt. Adjustable short circuit protection. Normally £12.50. **£6.00**

Miniature 0 to 5mA d.c. meter approx. ⅞" diameter £1
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AF139	20p
AF178/80/81	30p
AF239	30p
ASY27/73	30p
AU110/113	£2.20
BC107/8/9 + A/B/C	6p
BC147/8/9 + A/B/C/S	6p*
BC157/8/9 + A/B/C	6p*
BC178A/B, 179B	12p
BC184C/LC	9p*
BC186/7	20p
BC213L/214B	10p*
BC261B	8p
BC327/8, 337/8	8p*
BC547/8+A/B/C	10p*
BC556/7/7B/8/9	9p*
BCX32/36	12p*
BCY31	80p
BCY40	50p
BCY70/1/2	12p
BCZ11	28p
BD113	50p
BD115	31p
BD116(BRC116T)	£1
BD131/2/3	35p
BD135/6/7/8/9	30p
BD137/138 match pr	70p
BD140/142	30p
BD201/2/3/4	80p
BD232/3/4/5/8	49p
BDX77	£1
BD437	50p
BF115/167/173	15p
BF178/9	20p
BF180/1/2/3/4/5	15p
BF194/5/6/7	6p*
BF194A, 195C	6p*
BF200, 258, 324	20p
BF262/3	30p
BF336	27p
BFS28 Dual Mosfet	£1
BFW10/11 F.E.T.	40p
BFW30	£1
BFW57/58	17p*
BFX12/29/30	20p
BFX84/88/89	17p
BFY52	13p
BFY90	50p
BR101	30p
BRY39/56	26p
BSV64	30p
BSV79/80 F.E.T.s	80p
BSV81 Mosfet	90p
BSX20/21	14p
BSY40	27p
BSY95A	12p
BU204+Mount Kit	£1.60
BU208	£2
CV7042 (OC41/44 ASY63)	5p
GET111	40p
ON222	20p
TIP30/3055	45p
TIS88A F.E.T.	23p
μA7805	£1.60
ZT1486	£1
ZTX300/341	7p*
2N393 (MA393)	30p
2N456A	50p
2N706A	15p
2N929	14p
2N987	40p
2N1484	£1
2N1507/2219	15p
2N2401	30p
2N2412	70p
2N2483	23p
2N2904/5/6/7/7A	15p
2N3053	14p
2N3055 R.C.A.	50p
2N3704	8p*
2N3133	20p
2N3553	50p
2N4037	34p
2N5484 FET	34p
2SA141/2/360	31p
2SB135/6/457	20p
40250 (2N3054)	30p

BRIDGE RECTIFIERS

Amp	Volt		
½	1,600	BYX10	30p
1	140	OSH01-200	26p
1.4	42	BY164	40p
0.6	110	EC433	6p
5	400	Texas	90p
2½	100	I.R.	40p

RECTIFIERS

	Amp	Volt	
1N4005/6	1	6/800	5p
IN4007/BYX94	1	1250	5p
BY103	1	1,500	18½p
SR100	1.5	100	7p
SR400	1.5	400	8p
REC53A	1.5	1,250	14p
LT102	2	30	10p
BYX22-200	1½	300	20p
BYX38-300R	2.5	300	40p
BYX38-600	2.5	600	45p
BYX38-900	2.5	900	50p
BYX38-1200	2.5	1,200	55p
BYX48 300R	2.5	300	26p
BYX49-600	3	600	35p
BYX49-900	3	900	40p
BYX49-1200	3	1,200	52p
BYX48-300R	6	300	40p
BYX48-600	6	600	50p
BYX48-900	6	900	60p
BYX48-1200R	6	1,200	80p
BYX72-150R	10	150	35p
BYX72-300R	10	300	45p
BYX72-500R	10	500	55p
BYX42-300	10	300	30p
BYX42-900	10	900	80p
BYX42-1200	10	1,200	95p
BYX46-300R*	15	300	£1.00
BYX46-400R*	15	400	£1.50
BYX46-500R*	15	500	£1.75
BYX46-600*	15	600	£2.00
BYX20-200	25	200	60p
BYX52 300	40	300	£1.75
BYX52-1200	40	1,200	£2.50
RAS310AF*	1.25	1,250	40p

*Avalanche type

TRIACS

Amp	Volt		
6	800	Plastic RCA	£1.20
25	900	BTX94-900	£4.00
25	1200	BTX94-1200	£6.00

RS 2mm Terminals Blue & Black 5 for 40p
Chrome Car Radio facia 15p
Rubber Car Radio gasket 5p
DLI Pal Delayline 50p*
Relay Socket miniature 2PCO 15p
28 pin d.i.l. socket low profile 33p

TIE CLIPS

Nylon self locking, 3½" 2p
B9A valve can 5p
0-30, or 0-15, black pvc, 360° dial, silver digits, self adhesive, 4½" dia. 10p
Mullard Semiconductor, Valve & Component Data Book 1976-8 40p

OPTO ELECTRONICS

Diodes		Photo transistor	
TIL209 Red	12p	BPX29	80p
BPX40	50p	OCP71	45p
BPX42	80p		
BPY10	80p		

(VOLTIAC) BPY68, BPY69, BPY77 80p

BIG L.E.D. 0.2" 2v 50m/A max. RED 14p
Wire end neons 7p

PHOTO SILICON CONTROLLED SWITCH BPX66 PNPN 10 amp £1.00

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RS 0.6in green £2.00
Minitron 0.3in 3015F filament £1.10

CQY11B L.E.D. Infra red transmitter £1
One fifth of trade
Plastic, Transistor or Diode Holder 1p
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BC186	11p	2G401	5p
BCY30-34	20p	2N711	25p
BCY70/1/2	8p	2N2926	4p*
BY126/7	4p	2N598/9	6p
HG1005	10p	2N1091	8p
HG5009	3p	2N1302	8p
HG5079	3p	2N1907	£1
L78/9	3p	Germ. diode	1p
M3	10p	2N3055 Motorola	30p
OA81	3p	GET120 (AC128 in 1" sq. heat sink	15p
OA47	3p		
OA200-2	3p		
OC23	20p	GET872	12p
OC200-5	20p	2S3230	30p

MINIATURE EDGE METERS

100μA f.s.d., scaled 0.5, 12V. Illuminated, blue perspex front, 35mm x 14mm £3.00
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Ferromag C core. Screen-95-105-115-125-200-220-240v input: output 17v ¾A x 2 + 24-0-24v 1.04A + 20v 1mA. These current ratings can be safely exceeded by 50%. £3.50 + £1.00 p&p.

WOODS 240V A.C. Approx. 2,500 r.p.m. continuous rated 5In FAN (ex-computer) **£3.60 plus £1 p&p**

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1	400	BTX18-300	35p
1	240	BTX30-200	30p
15	500	BT107	£1
6.5	500	BT101-500R	90p
6.5	500	BT109-500R	£1.00
20	600	BTW92-600RM	£3.00
15	800	BTX95-800R Pulse Modulated	£8.00
30	1000	28T10 (Less Nut)	£3.00

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0.25MFD	800 volt	60p
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Car Aerial 9p, Coax 6p, 5 pin 180° 9p, 5 or 6 pin 240° din 6p, speaker din switched 10p, 3.5 mm switched 5p, stereo ¼" jack enclosed 15p.

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6800 mfd. 10v 5 for 30p*
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8+8 mfd. 350v 5 for 40p*
1 mfd. non-polar 350v 10 for 30p
25000 mfd. 25v 20p
12000 mfd. 12v 12p
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Philips Head Cleaner Tape 25p
BC548B 500 for £25*
BC556 500 for £25*
BCY71 500 for £40
BD437 50 for £12.50
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Vero card handle 10 for 50p
62Ω ½W Resistor £5* for 2,000 p/p £1.00
ON222 (superior matched BF181) 10 for £1.00

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1N4148	3p
BA145	14p*
Centercel	24p*
BZY61/BA148/OA81	10p
BB103/110 Varicap	20p*
BB113 Triple Varicap	37p*
BA182	13p
OA5/7/10	15p
BZY88 Up to 33 volt	8p
BZX61 11 volt	15p*
BR100 Diac.	15p
BZY96C 10V	30p
BZY95C 33V	30p

RS *Irravin* high temperature wire, 19/0·16, minus 55° to 105°C, 600V, 3A, white, black or red. Half trade price at 30p 10M coil.
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μA702 Op Amp	46p
723	50p
(72) 709	45p
SN76013N	£1.20*
SN76228N	£1.75*
SN76131N	£1.30*
SN74017N	30p
TAD100 AMRF	£1.00*
CA3001 R.F. Amp	50p
CA3132	£1.90*
CD4013 CMOS	36p
CD4069	20p
TAA300 1wt Amp	£1.00
TAA550 Y or G	22p
TAA263 Amp	65p
7400/7401	14p
7402/4/10/20/30	14p
7414	56p
7438/74/86	24p
7414	56p
7483	69p
LM300, 2-20V reg	£1.00
LM1303N	£1.00
74154	90p
TBA550Q	£1.50*
ZN414 Radio Chip	£1.20

HANDLES

Rigid light blue nylon 6¼" with secret fitting screws 5p

Belling Lee white plastic surface coax outlet box 20p

Miniature Axial Lead Ferrite Choke formers 5 for 10p

RS 10 Turn pot 1% 250, 500 Ω, 1K, 50K £1.50

Copper coated board 10" x 9" approx. 35p

Geared Knob 8-1 ratio, 1¾" diam., black 70p

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Strip of 4 40A 440V 12p

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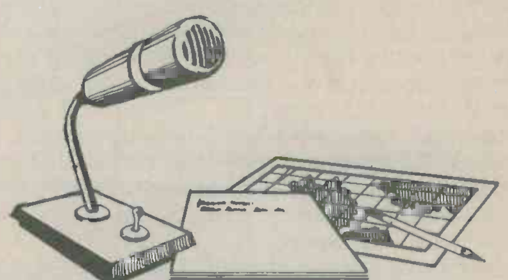

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REC5

REGENERATIVE

The regenerative v.h.f. receiver is assembled in a ready-made case, with a consequent easing of constructional difficulties

By R. A. Penfold

This simple receiver uses three transistors (including one f.e.t.) and provides full coverage of the normal 88 to 108MHz f.m. broadcast band. The set is completely self-contained as it incorporates a 9 volt battery supply and a telescopic aerial. The output is intended to feed a crystal earphone, but in practice it seems to work into any normal type of headphones perfectly satisfactorily.

The circuit is rather unusual in that it uses a regenerative detector which demodulates the received f.m. signal using slope detection. While it is possible to resolve quite weak stations with this receiver, it is only really intended for use in areas where f.m. reception is reasonably good. Adjustment of the set is then not too critical, and a high signal-to-noise ratio with good volume should be obtained. With weak stations it is rather difficult to get optimum results and what are normally only slight hand-capacitance effects become considerably more apparent.

The output quality of the set is very acceptable, and is better than that which is normally produced by a simple a.m. receiver, or by more complicated ones for that matter. This is due to the relatively wide bandwidth which can be used at v.h.f., and which enables a good treble response to be obtained. Also, except under exceptional conditions, reception will be of a fairly local nature and so interference from foreign stations is virtually non-existent. On the deficit side, it is obviously impossible to receive foreign stations on a receiver such as this.

CIRCUIT DETAILS

Fig. 1 shows the complete circuit diagram of the receiver. The aerial is coupled to the detector stage by C1, this capacitor being needed to reduce the loading effect of the aerial on the detector. Without this low value series capacitance the detector would be so heavily damped that it would be prevented from functioning at all.

TR1 is in the detector stage and is connected in the common gate Colpitts oscillator mode, with feedback being provided by C12. The operating frequency of the circuit is determined by the tuned circuit given by L1, C11 and VC1. The last component is the tuning capacitor of the receiver. L2 is an r.f. choke which ensures that there is a fairly high impedance at v.h.f. in the source circuit, whilst maintaining a low impedance at audio frequencies. R1 is the source bias resistor as well as the source load, and C4 bypasses this at v.h.f. The audio output is developed across R1. C2 and C3 are decoupling capacitors.

Although, as was just stated, the detector transistor is connected in the Colpitts oscillator mode, the circuit is adjusted in practice such that there is just not quite enough feedback to cause oscillation. This is normal practice with a regenerative a.m. detector, and the feedback level causes the circuit to offer maximum gain and selectivity. In consequence the tuning response curve of the receiver features a sharp peak with steeply falling skirts on either side. When a frequency modulated signal is

V.H.F. RECEIVER

Employing slope detection, this 3-transistor f.m. radio requires no alignment.

applied to one of these tuning response skirts the result is a detected signal whose amplitide varies with the frequency modulation. The closer the detector is brought to the oscillation point the greater is the detected a.f. output for a given frequency modulated signal. Since the background noise level does not vary greatly with different levels of regeneration, there is an increase also in signal-to-noise ratio. The linearity of the detector is found, in addition, to be at its best when it is adjusted just below the threshold of oscillation.

VR1 provides the regeneration control by varying the supply voltage applied to the drain of TR1, and hence the gain offered by this transistor. It can therefore be adjusted to a point where the gain of TR1 is just insufficient to cause oscillation. This is a more convenient method of regeneration control than would be given by varying the value of the feedback capacitor, C12, and the control is in practice smooth and relatively easy to set up.

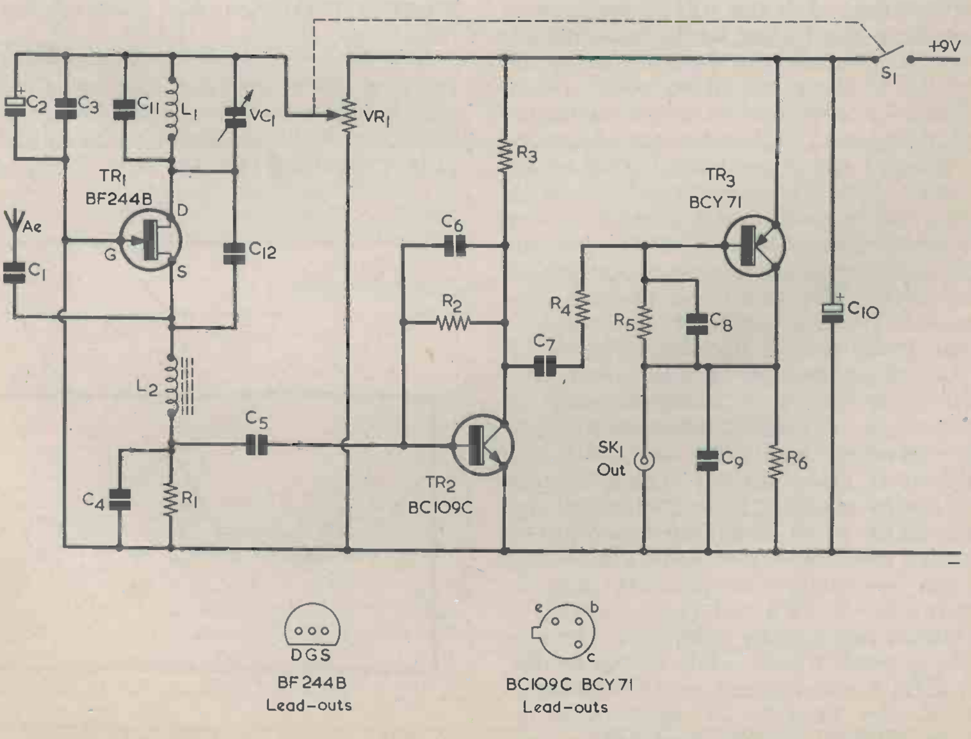


Fig. 1. The circuit of the regenerative v.h.f. receiver. The use of slope detection makes this a very simple receiver which requires no alignment

COMPONENTS

Resistors
(All fixed values ¼ watt 10%)
R1 1kΩ
R2 1.8MΩ
R3 5.6kΩ
R4 1kΩ
R5 1.2MΩ
R6 4.7kΩ
VR1 5kΩ potentiometer, log, with switch S1

Capacitors
C1 3.9pF ceramic
C2 10μF electrolytic, 10V. Wkg.
C3 0.022μF disc ceramic
C4 0.01μF disc ceramic
C5 0.22μF type C280 (Mullard)
C6 330pF ceramic plate
C7 0.22μF type C280 (Mullard)
C8 270pF ceramic plate
C9 0.047μF disc ceramic
C10 100μF electrolytic, 10V. Wkg.
C11 6.8pF polystyrene or silvered mica
C12 6.8pF ceramic
VC1 25pF variable, type C804 (Jackson)

Inductors
L1, L2 see text

Semiconductors
TR1 BF244B
TR2 BC109C
TR3 BCY71

Switch
S1 s.p.s.t., part of VR1

Socket
SK1 3.5mm. jack socket

Miscellaneous
Verobox type 65-2520J
Telescopic aerial (see text)
2 control knobs
Plain perforated s.r.b.p. board, 0.1in. matrix
Iron dust core, 17 x 8mm. (see text)
Enammelled copper wire, 0.9mm. dia. (20 s.w.g.)
9 volt battery type PP3 (Ever Ready)
Battery connector
Wire, solder, etc.

A.F. STAGES

TR2 and TR3 are both high gain low noise common emitter a.f. amplifiers, and they provide by far the majority of the receiver's overall gain. Both stages are quite conventional. C5 couples the a.f. signal across R1 to the base of the n.p.n. TR2, and C7 couples the output of TR2 to the base of the p.n.p. TR3.

It is important that both the a.f. stages have a reduced response at the higher audio frequencies, since the two transistors are both capable of operating at v.h.f. If any v.h.f. signal were to find its way into the a.f. section and be amplified there, the result would be instability and a loss of performance. The reduced response at the higher audio frequencies also provides de-emphasis, which counteracts the treble premphasis present on the transmitted signal. The combined effect of pre-emphasis and de-emphasis is to give an improved signal-to-noise ratio. The reduction in high frequency response is effected by C6, R4, C8 and C9.

The receiver audio output is taken from TR3 collector by way of jack socket SK1. A direct connection without a series d.c. blocking capacitor is employed here, since a crystal earphone has an extremely high resistance and does not upset the voltage conditions at TR3 collector. The earphone is not affected by the standing direct voltage at the output socket. Even when magnetic headphones are used it is still unnecessary to have a blocking capacitor, as the headphones simply form a load, in parallel with R6, for TR3 collector.

C10 is the supply decoupling capacitor. The on-off switch, S1, is ganged with VR1. Power is obtained from a PP3 9 volt battery, and the current consumption of the receiver is approximately 3.5mA only. The battery will thus have quite a long life, even if the set is used frequently.

The BF244B specified for TR1 is available from several suppliers, including Electrovalue Limited.

BUILDING THE SET

The receiver is housed in a plastic Verobox type 65-2520J, which has dimensions of 150 by 80 by 50mm. The two controls and the 3.5mm. jack socket, SK1, are mounted on the lid of the case, which now becomes the front panel for this particular application. Details of the drilling required are given in Fig. 2. The diameter of the hole required for SK1 should be checked from the component itself.

The telescopic aerial is mounted vertically at the extreme left of the case, looking at the front of the set. As can be seen in the photograph of the interior, it is right against the plastic mounting pillars moulded into the case. The type employed

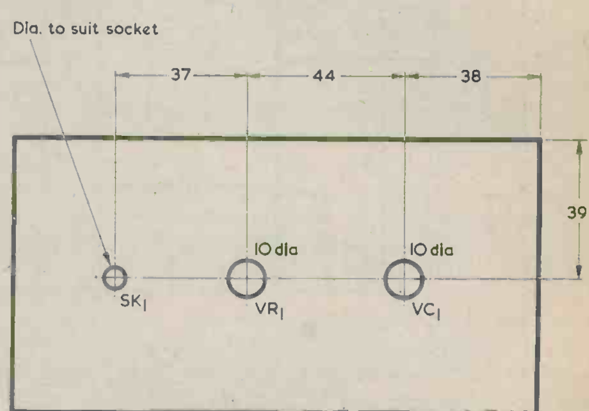


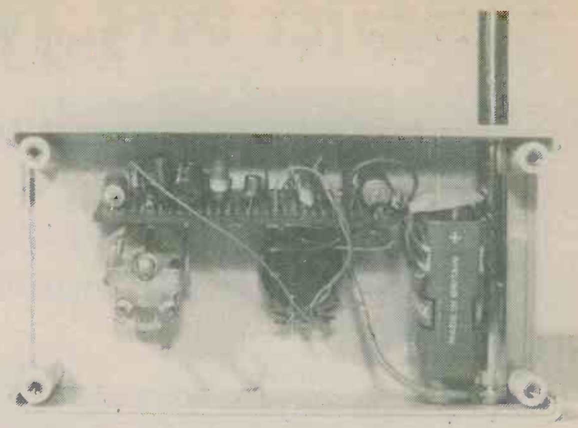
Fig. 2. Three holes are required in the front panel of the plastic case. These are positioned as shown here

in the prototype has an extended length of 975mm. and a hinged base section, and is available from Doram Electronics. A 9mm. diameter hole is drilled in what is now the top of the case, and a 4BA clear countersunk hole exactly below it in the case bottom. The body of the aerial passes through the 9mm. hole and it is secured at the bottom with a 4BA countersunk screw. A 4BA solder tag is fitted over this screw between the bottom of the aerial and the case inside surface, and connection to the aerial is made by way of this tag.

COMPONENT PANEL

With the exception of C11, all the small components are assembled on a plain perforated s.r.b.p. panel of 0.1in. matrix and having 31 by 13 holes. The component layout and the underside wiring on this panel are illustrated in Fig. 3.

First, the panel has to be carefully cut out from a



The battery is positioned between the end of the component panel and the telescopic aerial. A piece of foam plastic glued to the inside of the case rear is sufficient to keep it in place

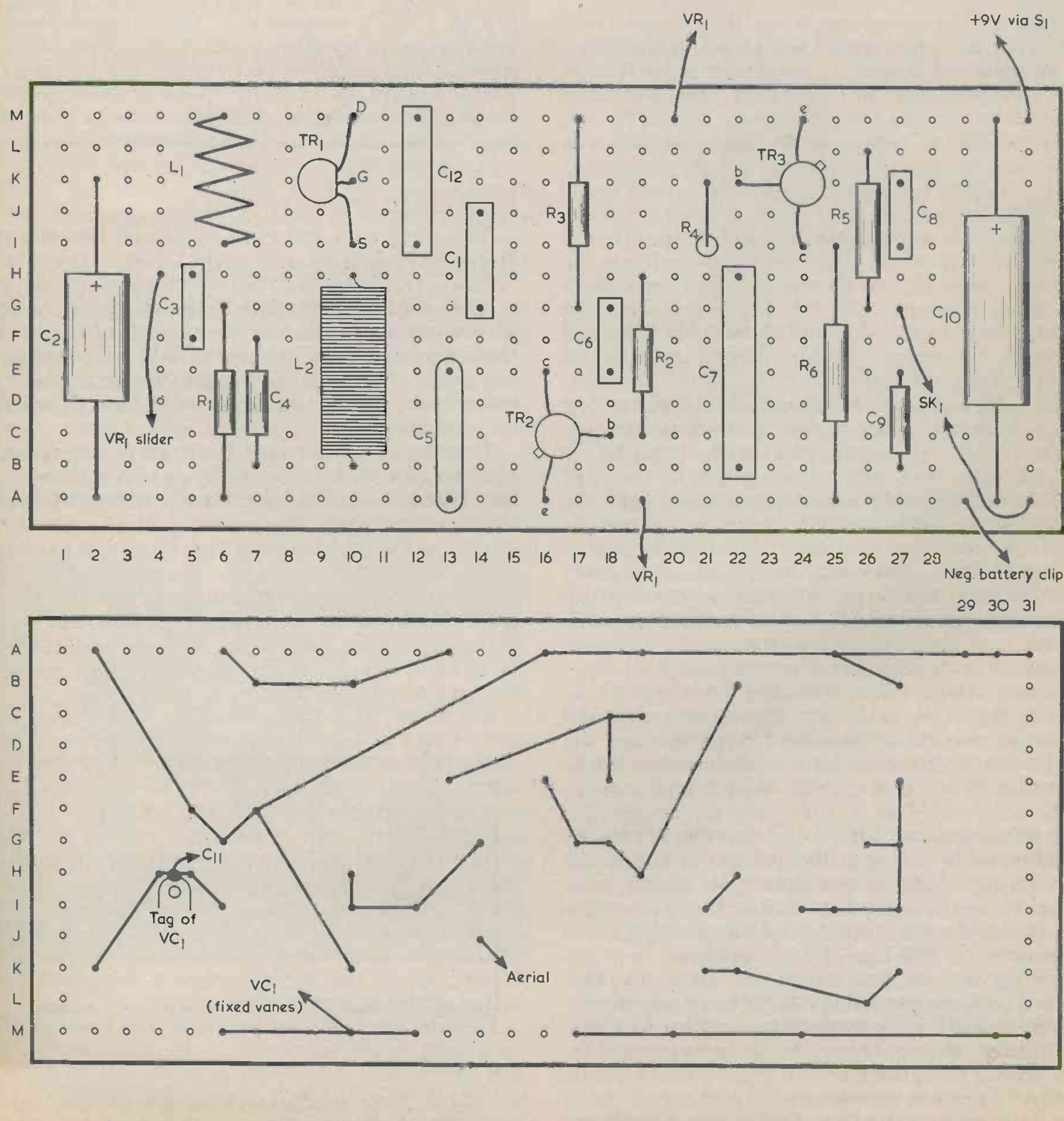
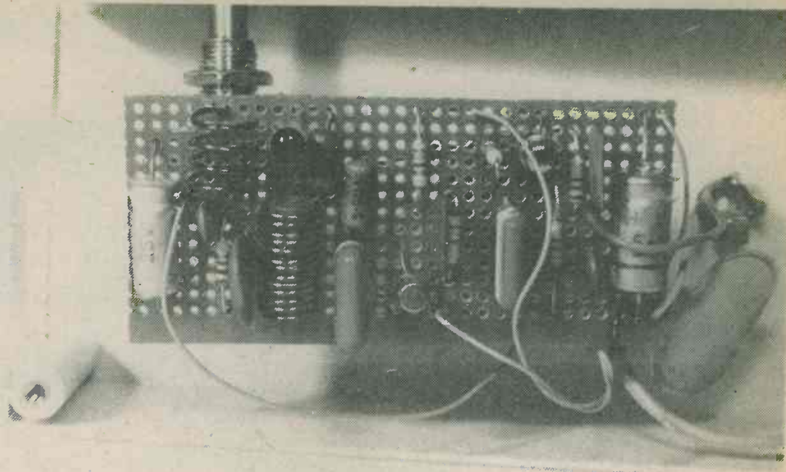


Fig. 3. Wiring of the components on the perforated s.r.b.p. panel



The perforated s.r.b.p. panel with components mounted and external leads attached

larger piece. The components are then fitted, their leads being bent flat under the panel so that they may be soldered together in the wiring pattern of Fig. 3. In some cases the component lead-outs may be too short for the required connections, whereupon tinned copper wire of around 22 s.w.g. can be used to extend any wires where necessary.

Both coils are home-made and are wound using enamelled copper wire of 0.9mm. diameter (about 20 s.w.g.). L1 is self-supporting and is wound on a temporary former of $\frac{5}{16}$in. diameter such as the shank of a twist drill of this size. It has precisely 4 turns equally spaced and its length is 0.4in. The lead-out wires project downwards and are trimmed to a length of about 5 to 10mm. The enamel insulation is then scraped off and the lead-outs are tinned with solder. These operations should be carried out before the coil is removed from its temporary former. When the coil has been completely prepared, its lead-outs pass through the appropriate holes in the component panel and are connected into circuit.

L2 is wound on a dust iron core having a diameter of 8mm. and a length of 17mm., this component being available as "Dust Core type 8" from Maplin Electronic Supplies. The winding consists of 13 turns of the same 0.9mm. enamelled copper wire wound in a single layer around the dust core; these turns will cover most if not all of the core. As with L1, the wire ends are bent down, scraped clean and tinned, before being passed through the holes in the component panel. L2 is not a tuned winding, and its inductance is not particularly critical.

The moving vanes tag of VC1 is soldered to the panel underside wiring at the position indicated in Fig. 3, using a generous amount of solder. This joint provides the actual mounting for the component panel and causes it to be held in position when VC1 is fitted in the case. C11 is soldered between the moving vane tag and one of the fixed vane tags of VC1. The few remaining connections external to the panel may next be completed, employing flexible insulated wires. These connections should be fairly short and direct, as long leads trailing around in the case could cause hand-capacitance effects and may also affect performance in other ways. The lead from hole A19 connects to the track tag of VR1 corresponding to full anti-clockwise rotation of its control knob. If the lead from the panel to the negative terminal of the battery connector is kept fairly short, this will assist in maintaining the battery in position between the end of the board and the telescopic aerial.

USING THE SET

The set has purposely been designed to cover somewhat more than the normal f.m. Band II so that stray capacitances and small errors in the construction of L1 will not result in part of the band being lost from the coverage of the set. Therefore, no alignment of any kind is necessary.

In order to obtain good results it is essential that VR1 be adjusted properly. By gradually advancing this control while adjusting the tuning control it should eventually be possible to receive a few stations. Further advancing VR1 should result in an increase in quality and volume, but care must be taken not to adjust the detector beyond the threshold of oscillation. This will result in signals being unintelligible, with the set radiating interference which could upset reception on other f.m. receivers nearby.

For those who are unfamiliar with slope detection of an f.m. signal, it should perhaps be explained that the receiver is not tuned to the centre of the signal's bandwidth, as it would be for normal a.m. or f.m. reception. Instead, the tuning is adjusted just off-centre, and it does not matter on which side of the centre the tuning is off-set. In practice, the effect is not excessively noticeable as there is quite a wide range of tuning settings which will produce a satisfactory output with any given signal, and there is only an extremely narrow range of settings at the centre where a completely distorted audio signal is given.

In order to obtain best results it will probably be necessary to tilt the aerial at 45 degrees. Also, the strength of f.m. broadcast signals often varies considerably from one part of a room to another, and it might be necessary to change the position of the set itself in order to obtain optimum reception. ■

NEW REPLACEMENT FOR QUARTZ

By Michael Lorant

High Q frequency control crystals are now being produced in lithium tantalate

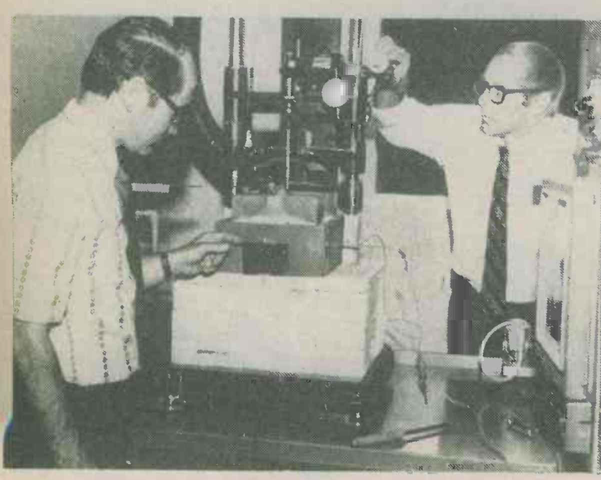
A man-made crystal has become the first practical alternative to quartz for use in communications equipment engineering. The crystal, lithium tantalate, has been custom designed by Bell Systems scientists in U.S.A., and is now being produced at the Merrimack Valley Works of the Western Electric Company, manufacturing and supply unit of Bell Systems. Usage of lithium tantalate is expected to require a production level approaching the present in-house production level for quartz crystal units.

PIEZOELECTRIC

Lithium tantalate has the piezoelectric property of converting mechanical pressure into electric energy and vice versa. In the first planned application of the new material, a frequency-selective filter assembly having two lithium tantalate crystals and five other components will replace an equivalent quartz filter circuit which uses four quartz crystals and fourteen other components.

The development of lithium tantalate has required a background of research and engineering to provide an understanding of the properties of the material, optimum methods of growing and processing it and the circuit designs in which it can best be used.

Lithium tantalate has to be grown at high temperature from a melt of lithium oxide and tantalum pentoxide. The crystal boule, about three inches by three-quarters of an inch in size, is cut into small rod-shaped crystals. Many individual experiments were required to learn more about the properties of lithium tantalate, including how to handle it, polish it, control its qualities and cut it into device-size crystals.



David W. Rudd of Western Electric's Quartz Crystal Unit Design and Engineering Department, and Albert A. Ballam of Bell Systems' Crystal Chemistry Research Department, developers of lithium tantalate, adjust the crystal pulling machine in which the new man-made crystals are grown

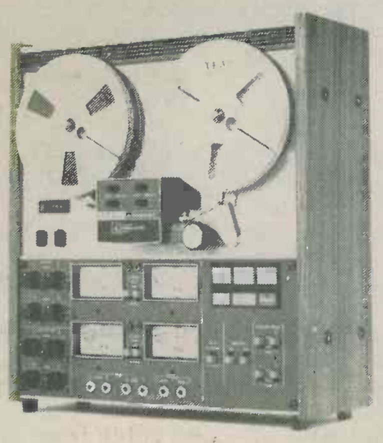
Here, Albert A. Ballam holds a lithium tantalate crystal with David W. Rudd looking on. Lithium tantalate crystals have Q factors which enable them to supersede traditional quartz crystal units

The communications industry has a high demand for precise filters and oscillators for frequency selection, rejection and control, this demand largely arising from the economic need to multiplex many information-carrying signals into a single channel. In Bell Systems equipment, quartz crystal resonators are widely used to provide the precise frequency-sensitive elements in oscillators, inductance-capacitance (LC) filter circuits and monolithic filters.

Although quartz occurs in nature, most quartz for commercial use is produced synthetically to ensure a dependable quality and supply of material. Synthetic quartz, also a Bell Systems development, is produced by the hydrothermal process, in which it is crystallised from a water solution at temperatures as high as 1,300°F, and at pressures up to 50,000 pounds per square inch.

Lithium tantalate, like some grades of quartz, has a low temperature coefficient of frequency. This means that its frequency of resonance is relatively unaffected by temperature changes in its environment. Lithium tantalate also exhibits a low impedance, a high Q, minimum regression to unwanted modes of oscillation, good machinability, low water solubility and an acceptable degree of hardness. ■

RECORDING ROLE IN "STAR WARS"



TEAC equipment played a major recording role in the production of "Star Wars", the classic space fantasy that has captured the imagination of the American public and is well on its way to becoming the most successful motion picture ever made.

All the special dialogue and sound effects were recorded and mixed on TEAC equipment under the direction of Ben Burtt. He used an A-7300 and a 2300 open reel deck with a 2340 four-channel open reel deck and a TEAC Tascam Model 5 mixer to create the sound effects for the galactic languages and creature sounds, planetary vehicles, robots, weapons, and starship battle scenes in space.

The final elaborate stereo sound track was mixed at Samuel Goldwyn Studios in Los Angeles using Dolby noise reduction.

"Star Wars" is a Lucasfilm Ltd. Production, written and directed by George Lucas. He points out that the special photographic work involved as many as 75 people working on two full shifts to execute the 360 separate special effects shots in the film.

AWARD TO BLIND RADIO AMATEUR

Mr. Ted John of Wallasey, who lost his sight on service with the Royal Navy in the Second World War, has been honoured for his service to war-blinded radio amateurs. His award, a two feet tall silver cup, was presented to him at the 2nd Annual General Meeting of St. Dunstan's Amateur Radio Society held at Ian Fraser House, Ovingdean, near Brighton.

The cup was given to St. Dunstan's by friends of the late Wally Wardrop, whose contribution to disabled and handicapped radio amateurs was considerable. In its turn, the St. Dunstan's Amateur Radio Society presents the award to the member whose contribution and participation in the club is deemed to have been outstanding. Because of its size, the cup will remain at Ian Fraser House and Ted has an inscribed shield which he will keep.

Ted John, who works for the Merseyside Police, had already lost his sight when he obtained his transmitting licence, G3SEJ, in 1959, and he is a member of the Wirral Amateur Radio Club.

Nearly thirty licensed amateurs, and short wave listeners — including one lady of 90! — meet three times a year at Ian Fraser House. St. Dunstan's is, of course, the organisation which looks after men and women blinded in the services.

ELECTRONIC DIGITAL STOPWATCH HAS BUILT-IN CALCULATOR

ST-1 is a new type of one-tenth second stopwatch from Casio Electronics Co. It has four timing modes: standard stop/start with automatic reset to zero at every start; time-out or net timing where each restart carries on from the previous stop time; normal lap timing with each stop indicating the total time elapsed from original start; and split lap timing where each stop gives an indication of time elapsed since the preceding stop.

In addition Casio ST-1 has a totaliser. In standard stop timing it tells you of the total of, say, a series of heats (from which an average can be calculated on the same machine). In the time-out mode it can be used to indicate time lost during stoppages. And in split timing, it adds the splits to give an overall time.

As an extra, the ST-1 is also a calculator. One that can add, subtract, multiply and divide — both in ordinary decimal arithmetic and in hours, minutes and seconds. It has an independent memory and handles percentages and square roots.

Timing capacity is one-tenth of a second short of ten hours, calculation capacity eight digits, or one second short of 100 hours.

Measuring approximately 5 x 3 x 1 inches and weighing under 5 ounces complete with its AA size battery, Casio ST-1 sits neatly in the hand. Supplied with a security wrist strap, this versatile little instrument has a recommended retail price of only £29.95.

. . . COMMENT

THE ULTIMATE IN TAPE RECORDERS?

The BBC and the 3M Company, of St Paul, Minnesota, U.S.A., have collaborated in the development of a digital audio recording system which promises to revolutionise professional sound recording. The use of digital techniques derived from computer technology has resulted in a system which is virtually distortionless and noise free — a performance unattainable with conventional analogue techniques.

The system is the result of research conducted by the BBC and 3M. The BBC has pioneered the use of digital techniques. The 3M Company has been a pioneer in the US in the development of magnetic tapes for computer, video and audio applications and is a leading manufacturer of professional audio equipment and tape. This technological achievement is particularly significant because earlier attempts at digital audio recording required huge quantities of magnetic tape and too many recording tracks.

The advantages of the new system include the absence of tape noise, modulation noise, distortion and flutter. The highest grade of ordinary (analogue) recording system now available has a signal-to-noise ratio of some 68dB. This can be improved only by expensive techniques which entail some loss of fidelity. Figures released by 3M show that the new digital system is achieving better than 90dB, that is it can handle at least a greater range of sound intensity.

CABLE STRIPPER

The photograph shows the new MK02 cable stripping tool which has been developed by AB Engineering Co. from their well established range of hand tools and cable strippers. The new tool has an additional facility for longitudinal slitting of power cables.

Suitable for all sizes of round cable from 4.5 to 28.5mm. diameter, the MK02 features an adjustable cutting blade which can be set by turning a knurled screw to match the thickness of insulation to be stripped. The cable is retained by a spring loaded gripping clamp, and simple rotation of the tool round the cable cuts cleanly through the insulation. The cutting blade is then turned through 90 degrees by depressing a knob on the side of the tool, this allowing the insulation to be cut along its length and simply peeled away from the core.

Further details can be obtained from AB Engineering Co., Apem Works, St. Albans Road, Watford. WD2 4AN.

FRESH BOOK ON MICROWAVES

The Microwave Division of Marconi Instruments Ltd, has recently published a book entitled 'Experimental Microwaves', by A. W. Cross. Aimed at HNC students, it avoids a highly theoretical treatment and concentrates on experimental techniques for measuring phenomena in waveguides.

The book begins with a fundamental description of what is happening in a wave-guide, including basic theory, but mathematics is kept to a minimum. The second part covers the purpose and operation of each instrument on the test bench and is followed by a series of experiments which can be performed to demonstrate the various measuring techniques. The final section contains logarithmic and other tables.

"Experimental Microwaves' is a 147 page large format book with many diagrams and tables. Copies, price £8.50, are available from the Publicity Department of Marconi Instruments, Longacres, St. Albans, Herts, AL4 0JN.

EVENT FOR THE NEW BANK HOLIDAY

Frank Osborn, G2CV0, who is Town Mayor of Mersea, Mersea Island, Essex, and also a Vice President of the Mersea Island Museum, is, with the help of members of the Colchester Radio Club, setting up a station within the museum covering the new Bank Holiday weekend April 29th, 30th and May 1st.

Any readers wishing to visit the station would be very welcome. The museum is adjacent to West Mersea Church, is close to the beach, and there is free parking near at hand.

RADIO 3 EXCLUSIVE

The Test and County Cricket Board have agreed terms with the BBC on a new contract, giving BBC Radio exclusive 'live' coverage of cricket for the next three years.

"No, Mrs. Scroggins, it's not convenient for a Brain Washing just now!"

SUGGESTED CIRCUIT

ON-OFF SEQUENCE SWITCH

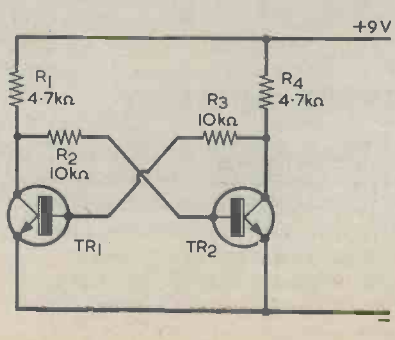
By G. A. French

One of the simplest latching circuits incorporating discrete transistors is that shown in Fig. 1. Each transistor is a silicon type, which means that bias current can only flow into its base to turn the transistor on when the base-emitter potential is about 0.6 volt. When the transistor is turned on close to saturation the collector-emitter voltage is typically about 0.1 volt, and in practice may be anywhere between nearly zero and 0.2 volt.

Let us assume that TR1 is on. In this condition its collector is 0.2 volt or less positive of the negative rail, whereupon base current cannot flow into TR2 via R2. TR2 is therefore turned off. It passes no collector current and base current can flow into TR1 via R4 and R3. If on the other hand it is TR2 which is on, its collector is at 0.2 volt or less positive of the negative rail and this prevents base current flowing into TR1 by way of R3. TR2 is then held turned on by the base current flowing through R1 and R2.

After switch-on either TR1 or TR2 may turn on in random manner, with the transistor having the higher gain probably being that which is turned on more frequently. The transistor which is turned on can be turned off by momentarily short-circuiting its base to the negative rail. The other transistor will then turn on and stay on. The circuit is stable and remains latched with either transistor on.

Fig. 1. A simple latch circuit incorporating two small silicon transistors. The circuit is stable with either transistor turned on and the other turned off



SEQUENCE SWITCH

By the addition of a few components it is possible to employ the circuit as an on-off sequence switch which changes state after each closure of the contacts of a push-button. The modified circuit is shown in Fig. 2. In this diagram C1 is a plastic foil capacitor, either polyester or polycarbonate, and is not electrolytic. For the time being we shall ignore the presence of R6 and C2.

Let us start an examination of the circuit when, with S2 closed and the 9 volt supply applied, TR1 is on and TR2 is off. C1 is charged, via R5, to the same low potential as that on TR1 collector. When push-button S1 is pressed, its contacts close and cause the low voltage on the upper plate of C1 to be applied to the base of TR1. Since this voltage is well below 0.6 volt above the negative rail, TR1 at once turns off and TR2 turns on. The circuit remains completely stable under these conditions, because the upper plate of the capacitor couples via R3 to the low voltage which is now present at the collector of TR2. Because R3 is one-hundredth the value of R5, the voltage across the capacitor is only fractionally higher than that at TR2 collector despite the fact that R5 now couples to a relatively high voltage (of about 6 volts) at the junction of R1 and R2.

When S1 is released the circuit stays in the same condition, but C1 now charges, via R5, to the voltage at the junction of R1 and R2.

If S1 is pressed again the high voltage which is now present on the upper plate of C1 is applied to the base of TR1, causing it to turn on abruptly with, in consequence, TR2 turning off. Again, the circuit is stable in this condition whilst the button is pressed because C1 is maintained charged to 0.6 volt by way of the current flowing into TR1 base via R4 and R3. When S1 is released, C1 is disconnected from the base of TR1 and C1 discharges, via R5, to reach the low voltage at TR1 collector.

Should S1 be pressed again, the base of TR1 will be taken to this low potential, TR1 will turn off, and the first switching operation described earlier will once more take place.

Thus, pressing S1 first turns TR1 off and TR2 on, whilst the second closure of its contacts turns TR1 on and TR2 off. The third operation of S1 will turn TR1 off again, and the circuit continues to function successively in this manner.

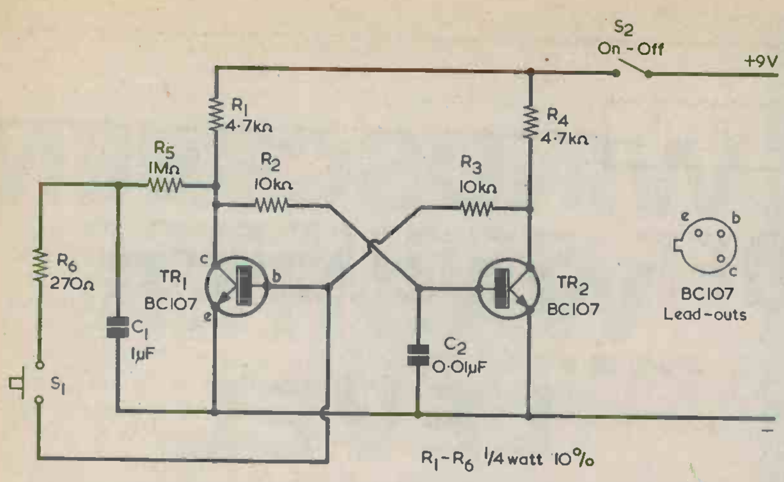


Fig. 2. Adding two resistors, a capacitor and a push-button allows the circuit to function as a sequence switch. The transistors change state each time the push-button is pressed

ASYMMETRIC OPERATION

The operation of the circuit is asymmetric in terms of time because the effective discharge of C1, when S1 is released after TR1 has turned on, is slower than the effective charge of C1 when S1 is released after TR1 has turned off. The terms "effective discharge" and "effective charge" here mean the amounts of discharge and charge which are necessary to allow C1 to initiate the following changeover of state when S1 is next pressed. As a result, it is necessary to wait longer before pressing the button when TR1 has turned on than it is when TR1 has turned off. However, both periods of time are considerably less than one second and the asymmetry will normally not even be noticed. There is, in practice, little point in complicating the very simple circuit of Fig. 2 by adding components which will remove the asymmetry.

We have not yet considered R6 or C2. R6 is merely a current limiting resistor, and it limits to about 22mA the initial current from C1 into the base of TR1 when S1 is pressed with TR1 turned off. The value of R6 is much lower than those of the other resistors in the circuit and it has no effect on circuit operation.

The purpose of C2 is to ensure that TR2 is always the transistor which is turned off when the supply is applied. Its presence very slightly delays the rise in TR2 base voltage when S2 is closed, and it thereby allows TR1 to be the transistor which turns on first. C2 is fully effective when the supply is turned on abruptly, as with the on-off switch of Fig. 2, but it may be less effective if the supply voltage rises at a much slower level at switch-on, as can occur if the 9 volts is provided by a mains power supply having a large value of reservoir and smoothing capacitance following the rectifier circuit. In this instance, C2 can control conditions after switch-on if its value is increased but, should its value be raised significantly higher than some 0.02μF, it may start to upset the sequential action given by pressing S1. Thus, the circuit may not be suitable for applications in which the supply voltage, after switching on, rises only slowly to its full value.

If it is unimportant whether either TR1 or TR2 is off after switch-on, then C2 can be omitted and the circuit can be powered by any type of supply offering 9 volts. The circuit will function, incidentally, at supply voltages well below 9 volts and down to 6 volts or less.

The current drawn from a 9 volt supply is of the order of 2.5mA.

EXTERNAL CIRCUIT

The on-off sequence switch will normally be required to control an external circuit, and in quite a few instances where only low currents are involved it may be possible to simply work from the voltage which is present at the collector of TR1 or TR2.

Where high currents are to be controlled an added transistor operating a relay can be employed, and a suitable circuit is shown in Fig. 3. No current flows into the base of the added transistor when TR2 is turned on, and the relay is de-energised. When TR2 turns off, a current of around 0.4mA flows into the base of the added transistor via the series 10kΩ resistor, and the transistor then causes the relay to be energised. The usual diode is connected across the relay coil to prevent the appearance of a high back-e.m.f. when the relay de-energises, and this can be a 1N4002, as shown, or any other small silicon rectifier.

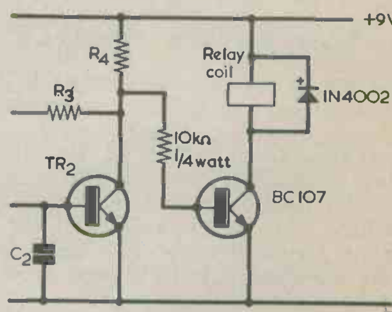
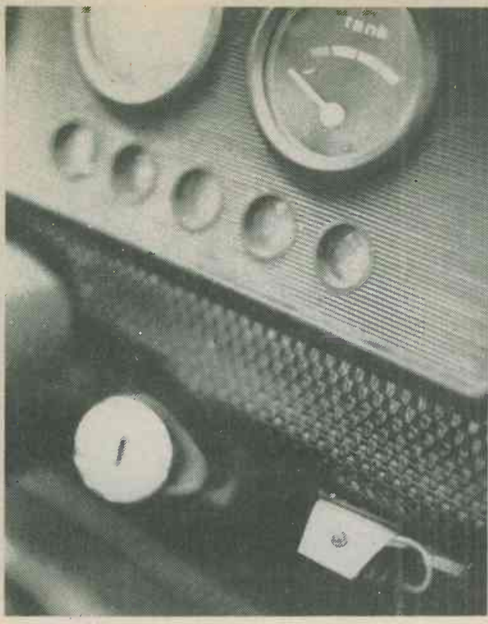


Fig. 3. An external circuit can be controlled by means of an added transistor and a relay

The relay can be any type having a coil resistance of 300Ω or more, and which is capable of energising reliably at a coil voltage somewhat below the supply voltage. ■



WINDSCREEN WASHER LEVEL MONITOR

Single i.c. CMOS circuit keeps constant check on windscreen washer water level

by J. H. Telford

This device was designed to ease the burden on the inveterate non-checker of car fluid levels, the driver who discovers his windscreen washer bottle empty half-way along the M1 or in the wilds of the Scottish Highlands. The main requirement is that the car should have a semi-rigid insulated washer bottle, such as are found on Minis and Cortinas. The car supply should be 12 volts nominal, and can be either negative or positive earth.

The circuit gives a two-fold warning of reduction in the water level of the car windscreen washer bottle. An l.e.d. glows steadily to indicate a drop of level below, say, half-full. Should the level be allowed to fall further the same l.e.d. will flash at a constant rate when the bottle is nearly empty. The unit, which takes approximately 40 to 50mA of current at maximum, may be switched via the ignition switch. The device will reset itself should the washer bottle be refilled.

NEGATIVE EARTH CIRCUIT

The level monitor circuit for a negative earth system is shown in Fig. 1. In this, IC1 is a CD4011 quad 2-input NAND gate, and it will be remembered that the output of a NAND gate is at logic 0 (negative) only when all its inputs are at logic 1 (positive). The NAND gate output is at logic 1 for all other input conditions. In the diagram the negative rail is shown above the positive supply rail. The negative rail corresponds to the potential of logic 0 whilst the lower positive rail corresponds to the potential of logic 1.

Gates 1 and 2 of the CD4011 form an astable multivibrator which, with the values specified for R1, R2, C1 and C2, has a rate of pulsing at about 2

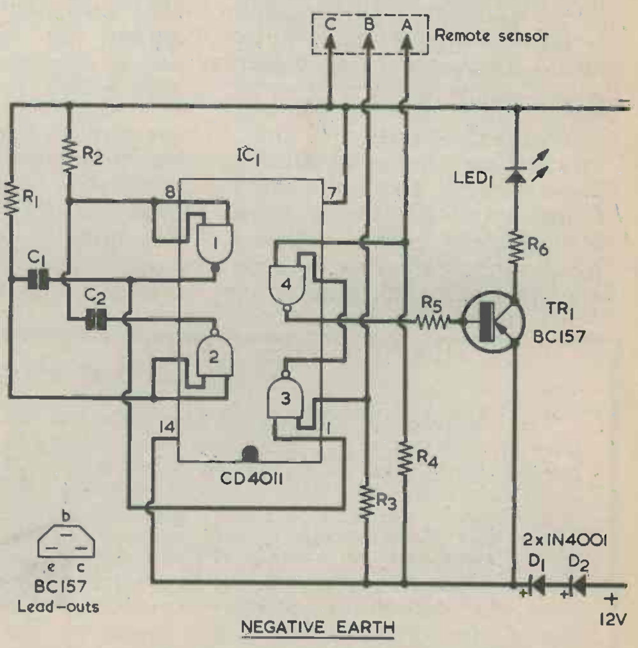


Fig. 1. The water level monitor circuit for use in cars having a negative earth

flashes per second. A faster flashing rate can be obtained by using 0.33μF capacitors for C1 and C2, and a slower flashing rate by using 0.68μF capacitors. The output of the multivibrator is applied to an input of gate 3. The multivibrator runs continuously as soon as the supply is applied.

Terminals A, B and C connect to the water level sensing probes, these being in actual contact with the water in the washer bottle. When the water is at an adequate level it completes the circuit between terminals C, B and A, causing one input of gate 3 and one input of gate 4 to be held negative at logic O. Both gates therefore have a logic 1 (positive) at their output. The logic 1 at the output of gate 4 is passed via R5 to the base of TR1 whereupon, since this is a p.n.p. transistor, it remains cut off. In consequence it passes no collector current and the l.e.d. is not alight.

As the water is used its level falls until the circuit between terminals C and A is broken. The input from the sensor to gate 4 is then pulled by R4 to a logic 1. Since the other input of gate 4 is also at logic 1, its output falls to logic O (negative). This negative voltage causes base current to flow in TR1 via R5 and the transistor turns on, causing the l.e.d. to be lit.

When the water level falls further, towards the washer bottle being nearly empty, the circuit breaks between terminals C and B. R3 pulls the associated input of gate 3 to a logic 1, so that its output can fall to a logic O when its other input is also at logic 1. However, this other input is connected to the output of the multivibrator given by gates 1 and 2, and this output is changing continually from logic O to logic 1 as the multivibrator oscillates. Thus, the output of gate 3 is at logic 1 when the multivibrator output is at logic O, and vice versa. This continuously changing output is fed into gate 4, the output of which correspondingly changes continually from logic O to logic 1 and back again. As a result, transistor TR1 is turned on and off at the multivibrator frequency and the l.e.d. flashes accordingly.

Refilling the washer bottle will first cause the flashing to stop and then, when there is sufficient water to complete the circuit between terminals C and A, cause the l.e.d. to extinguish.

COMPONENTS

The l.e.d. can be any 0.2in. red type with a maximum current rating of 50mA or more. Very nearly all small l.e.d.'s fall into this category, and a particularly suitable type is the red FLV117 available from Bi-Pak Semiconductors. TR1 must be a p.n.p. type, preferably the type specified which has adequate gain. R6 could be increased up to about 820Ω, to dim the l.e.d., but it was found that the value of 360Ω gives sufficient brightness to be seen in daylight. A lower value for R6 is not recommended as it could destroy the l.e.d. by allowing too much current to pass. Diodes D1 and D2 give 1.2 volts extra protection to the i.c. by raising the safe supply voltage maximum to 16.2 volts. This point applies to the CD4011AE, with its maximum supply voltage rating of 15 volts. If a CD4011BE is employed, the diodes can be left out as the BE suffix indicates an operating voltage up to 18 volts recommended. CD4011BE i.c.'s are becoming more readily available, but check the actual type number of the i.c. itself before deciding whether or not to omit the diodes.

To avoid possible damage to the i.c., a 14-way i.c. holder is wired into the circuit. The i.c. is then plugged into this holder when all wiring is completed.

As will become apparent later, the probes connected to terminals A, B and C are in an environment where the insulating between them may be reduced by dirt, grease or moisture. Should this occur, the values of R3 and R4 may be too high to pull the appropriate gate inputs to a logic 1 when the water level falls. If this effect occurs or seems

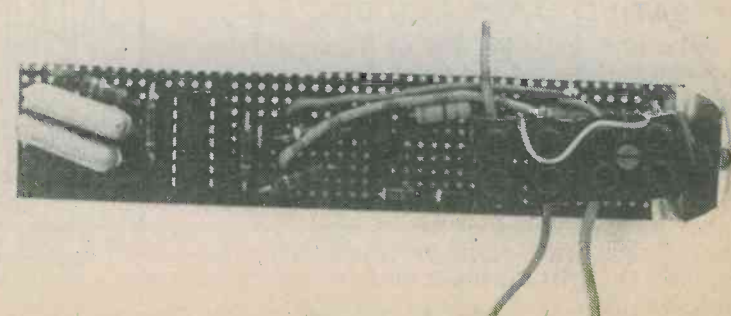
COMPONENTS

Resistors
(All ¼ watt 10% unless otherwise stated)
R1 1MΩ
R2 1MΩ
R3 1MΩ
R4 1MΩ
R5 8.2kΩ
R6 360Ω ½ watt

Capacitors
C1 0.47μF type C280 (Mullard)
C2 0.47μF type C280 (Mullard)

Semiconductors
IC1 CD4011 (negative earth)
CD4001 (positive earth)
TR1 BC157 (negative earth)
BC108 (positive earth)
D1 1N4001
D2 1N4001
LED1 red l.e.d. (see text)

Miscellaneous
Veroboard, 0.1in. matrix
Aluminium sheet (for l.e.d. panel)
14-pin i.c. holder, d.i.l.
3 brass or stainless steel pins (see text)
4-way terminal block (see text)
6BA bolt, 1in., and nut
Connecting wire, etc.



The components are assembled on a piece of Veroboard measuring approximately 1in. by 5in.

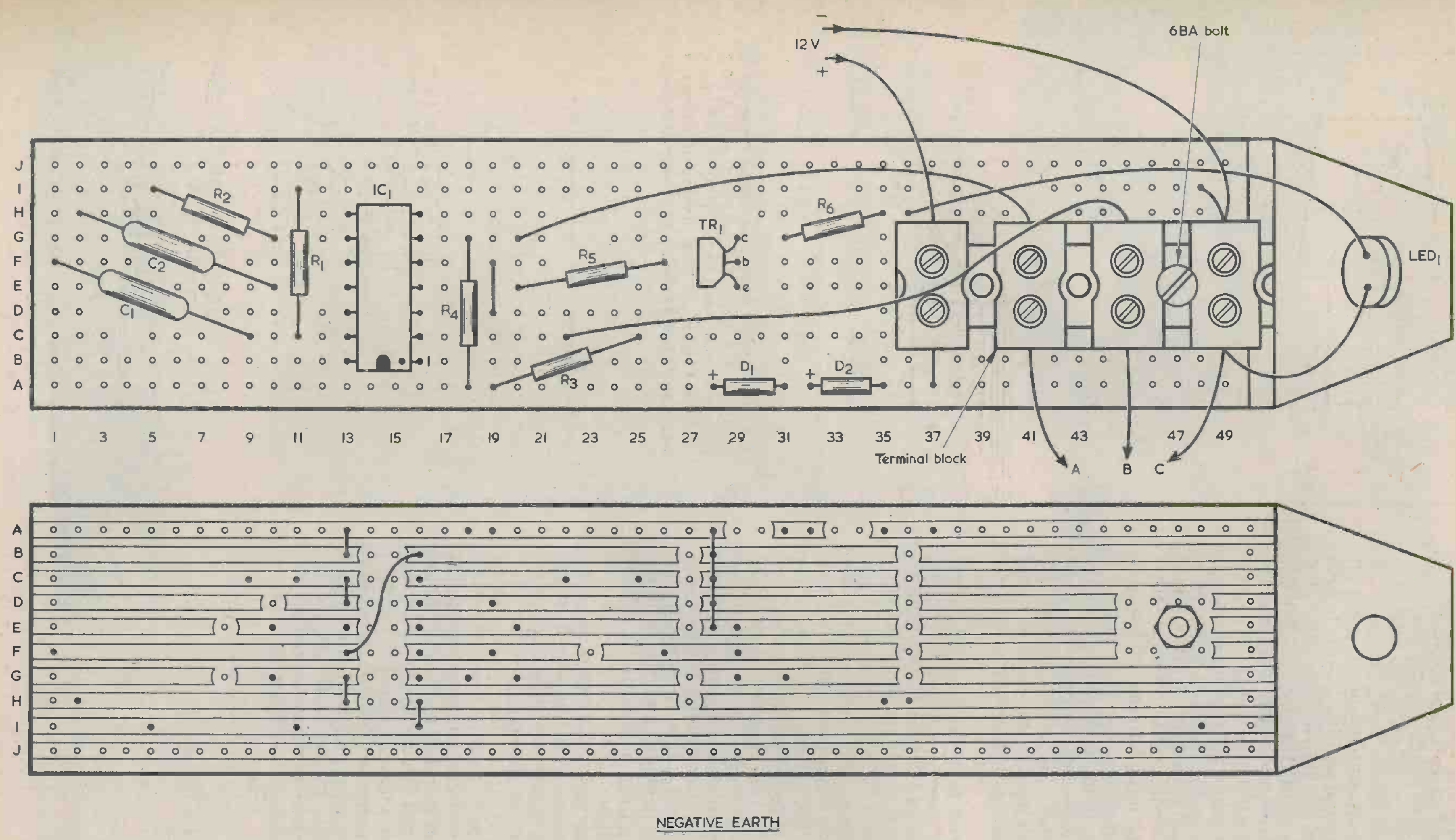


Fig. 2. Component and copper sides of the negative earth version Veroboard

possible the values of R3 and R4 may be reduced to 100kΩ. However, the author has experienced no trouble on this score with the prototype, and with R3 and R4 at the specified value of 1MΩ.

CONSTRUCTION

The electronics are assembled on a piece of 0.1in. Veroboard, the component and copper sides of which are illustrated in Fig. 2. This is for the negative earth version of the level monitor. Connections to the positive and negative supply inputs and to the sensor are made via a 4-way terminal block. The latter is a plastic block of the type which can be cut out from a longer length. It is secured to the Veroboard by a single 6BA bolt and nut, as indicated. (This bolt and nut are also used for the l.e.d. front panel and for fixing the board to the car dashboard.)

First make the cuts in the copper strips as indicated. In some places, as for example under the i.c., the copper is removed over an area of two holes or more instead of relying on the more conventional single hole breaks. This approach is not essential, but it ensures a high level of insulation across the breaks. The i.c. socket is next fitted, after which bridges between adjacent tracks are made on the copper side of the board. An insulated lead on the copper side also bridges together pins 1 and 10 of the i.c.

On the component side of the board, connecting wires, resistors, capacitors, diodes and the transistor are soldered, in that order, into place.

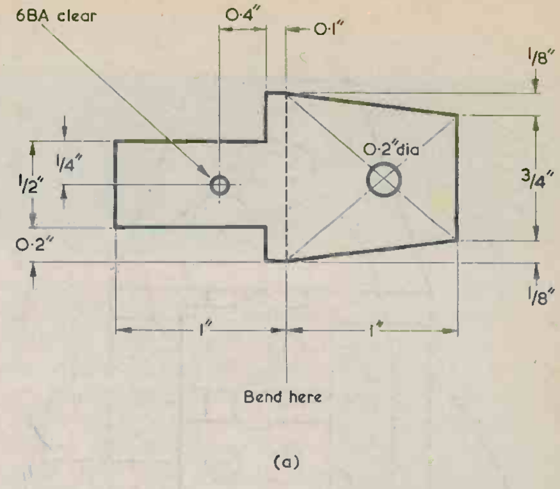
Next, make up the front plate for the l.e.d., as illustrated in Fig. 3(a). This can be made from aluminium sheet. The position shown for the 6BA clear hole is that applicable to the particular terminal strip employed by the author, and may vary slightly with other terminal strips. In consequence, the front plate may be passed under the terminal strip and the position of the hole marked up with its aid. Fig. 3(b) shows how the Veroboard assembly was mounted under the car dashboard, using the same 6BA screw and nut which secure the l.e.d. front plate and terminal block. In practice, the board will not be fitted in the car until later, and some constructors may prefer to use alternative fixing methods to that illustrated.

At the present stage of construction, secure the terminal strip, front plate and Veroboard together with the 6BA bolt and nut. Mount the l.e.d. in place with a dab of glue. The anode lead-out connecting to R6 may need to be extended. Be sure to connect the l.e.d. the correct way round by following the data on it, if available. If the lead-outs are not known, connect the l.e.d. experimentally to a 3 volt battery with a 1kΩ resistor in series with one of its leads. When the l.e.d. lights up, it is the anode lead-out which connects to the positive terminal of the battery.

Finally, fit the i.c. into its holder, making sure that it is correct way round.

SENSOR

Fig. 4 shows the construction of the sensor. The probe pins are fitted at the levels required for monitoring, and the wires from points A, B and C are taken to the terminal block on the Veroboard panel. The terminal block and pin assembly is fitted to the wall of the washer bottle by simply pushing the pins through the plastic. A rigid or



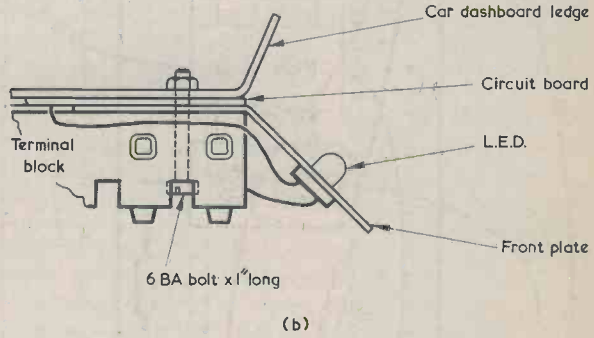


Fig. 3(a). Details of the front plate, on which is mounted the l.e.d. The position of the 6BA clear hole may need to be varied to suit some terminal blocks. (b). One method of fitting the board and l.e.d. assembly to the car dashboard

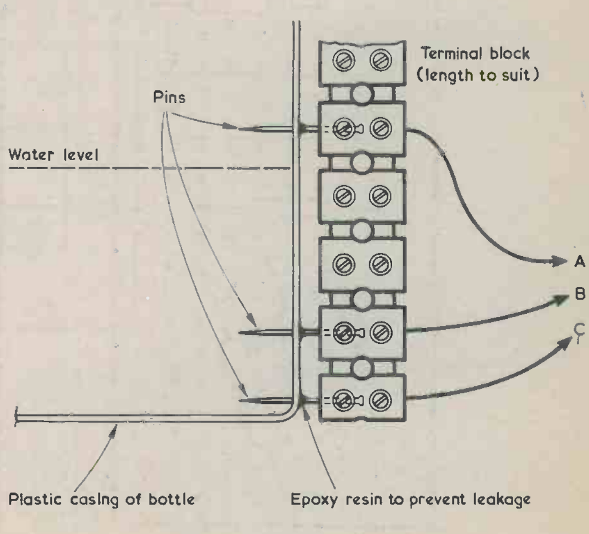
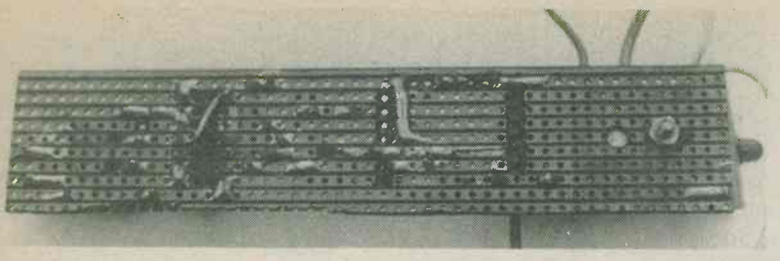


Fig. 4. The water level sensor head. The pins detect the level of the water



The underside of the Veroboard

semi-rigid bottle is best for this. To prevent leakage, the joins between pins and plastic can be coated with epoxy resin. The bottle may then be fitted to the car and the three leads taken into the driver's compartment via a suitable grommet.

The material of which the pins are made is important. In one version of the sensor the author used so-called "stainless steel" pins but these rusted after some 4 or 5 months. The pins should therefore be real stainless steel or brass. The author's original version, with brass pins, is still going strong after about a year's use.

FITTING INTO THE CAR

To prevent spurious operation the underside of the board should be varnished with two coats of lacquer, and if the underside will touch bare metal than it should be protected by a layer of insulating material. Now fit the leads A, B and C, and attach the unit to a suitable ledge, as indicated in Fig. 3(b) or employing any other mean of mounting which may be favoured. When firmly fastened, connect the power leads, running one through the ignition switch if required. The water bottle should be empty or nearly empty. On turning the ignition key the l.e.d. will commence flashing. Filling the washer bottle will first make the l.e.d. glow steadily and then turn it out. The unit is now operational.

Should no light appear at first switch-on, check the l.e.d. connections and then the joints around gates 3 and 4 of IC1. Should these seem satisfactory, cover the lower sensor contacts with water and re-examine the l.e.d. If it is alight the fault lies with the multivibrator. Check its connections, especially those around the capacitors. If the l.e.d. is not alight then check the connections at TR1. No light at this point would indicate a failure in the l.e.d., TR1 or IC1. While checking any CMOS circuit it is imperative that the power be disconnected and the i.c. removed. It is preferable also that the i.c. be out of its socket whilst the unit is being wired up and fitted into the car. The i.c. leads should not be handled, and when not in its socket the i.c. leads should always be inserted in the conductive foam or foil with which it is supplied. (The author's approach with CMOS i.c.'s is to hold them with a bulldog clip before removing the i.c. from the foam or foil so that the pins are all short-circuited together. It is then fitted into its socket with the clip attached, after which the clip is removed. In the present application the clip could be retained until after the unit has been installed and wired up in the car).

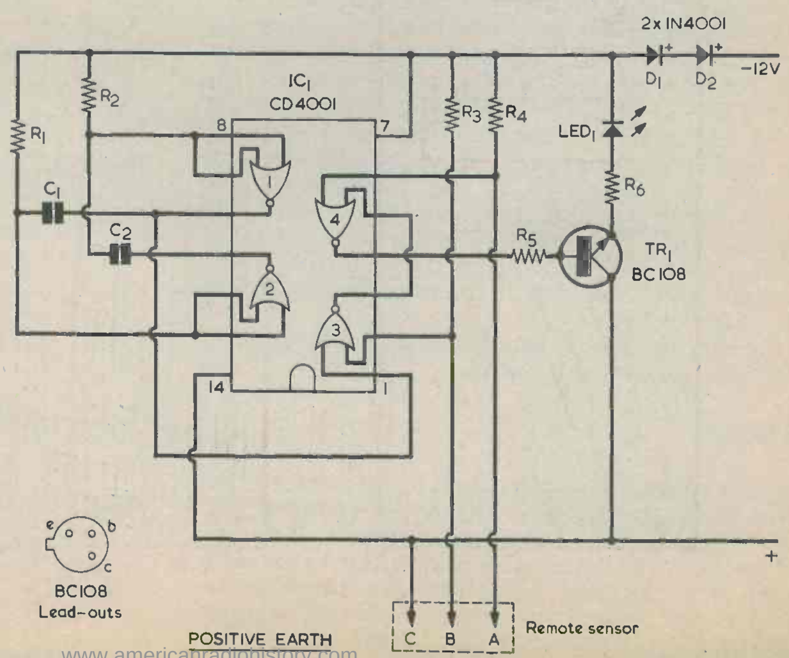
Although the prototype has operated perfectly since its installation, one point has arisen. When the water level is just at the sensor points in the bottle, driving over bumpy ground or around corners can cause the l.e.d. to flicker on and off. Should this be found disconcerting then all you have to do is refill the bottle, which after all is the reason for building the device.

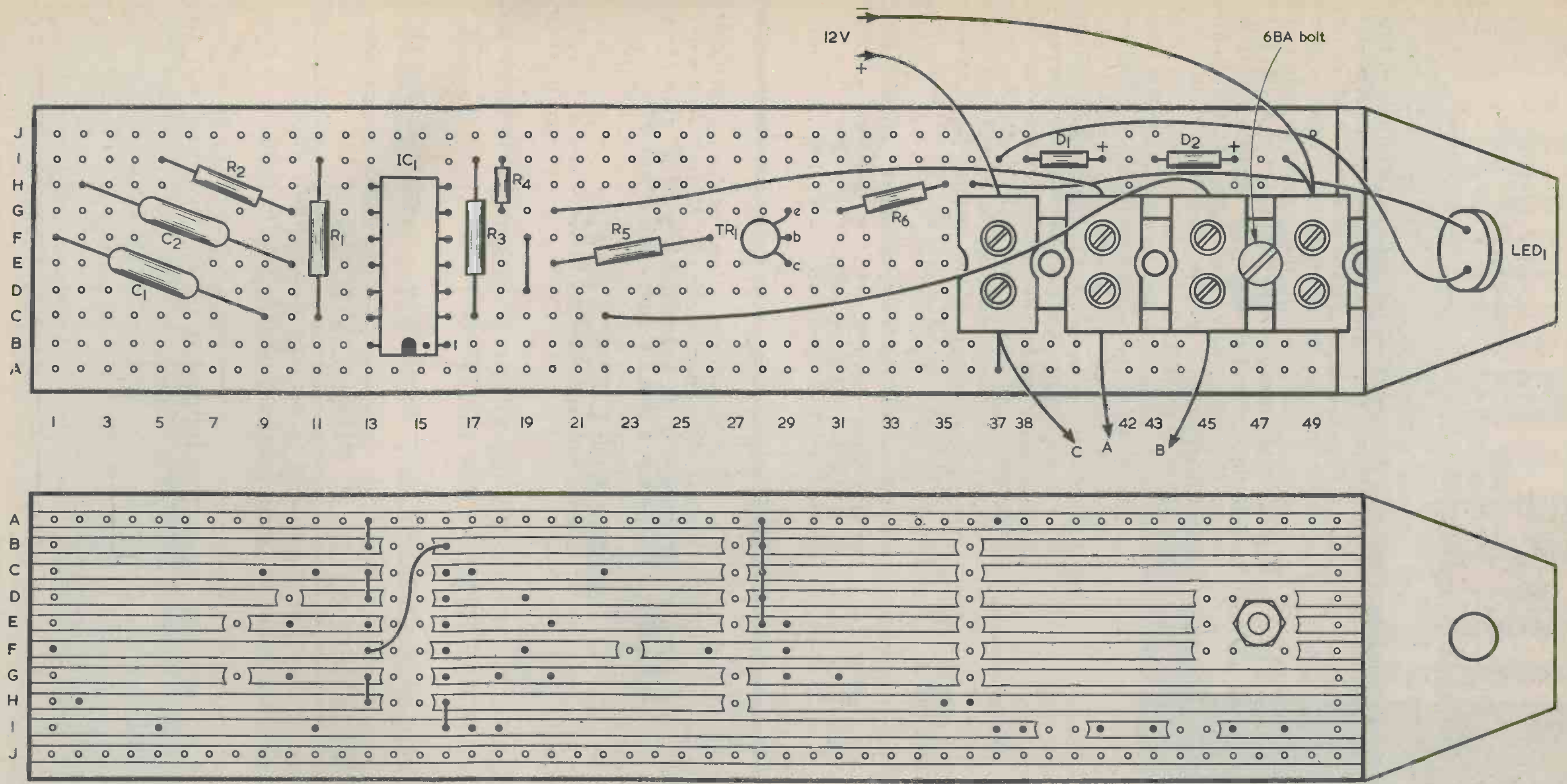
POSITIVE EARTH VERSION

The level monitor as so far described is intended for a car with a negative earth. With this the water in contact with sensing pin C is also at the same potential as the car earth.

It is simple to devise a modification which allows sensing pin C to be at the same potential as a positive car earth, and a suitable circuit is shown in Fig. 5. This time the i.c. is a quad 2-input NOR

Fig. 5. The circuit required for the positive earth version of the level monitor





POSITIVE EARTH

Fig. 6. A somewhat different Veroboard layout is required for the positive earth version

The attachment at the water bottle. The particular installation shown here has relatively close spacing of the sensor pins

gate type CD4001. The output of a 2-input NOR gate is only at logic 1 when both its inputs are at logic 0, so that it acts as a NAND gate for negative logic.

In Fig. 5, gates 1 and 2 function as a multivibrator in the same way as did gates 1 and 2 in the negative earth circuit. When the water in the washer bottle connects together terminals C, B and A, a logic 1 is applied to gates 3 and 4, so that their outputs are both at logic 0. TR1 is now an emitter follower and, since its base is held at the same potential as the negative rail by gate 4 output, the l.e.d. does not light. As the water falls below sensing pin A, R4 pulls the appropriate input of gate 4 to logic 0, whereupon its output goes to logic 1 and TR1 causes the l.e.d. to light.

When the water falls below sensing pin B, R3 takes the appropriate input of gate 3 to logic 0, with the result that its output changes from logic 0 to logic 1 according to its input from the multivibrator. As before, this causes the l.e.d. to flash.

The two diodes in the negative supply lead permit the use of a CD4001AE for IC1. If a CD4001BE i.c. is used the diodes may be omitted.

Fig. 6 illustrates the component and copper sides of the Veroboard for the positive earth version. The comments concerning this and its installation in the car which were made for the negative earth circuit apply similarly to the positive earth version. ■

BACK NUMBERS

For the benefit of new readers we would draw attention to our back number service.

We retain past issues for a period of two years and we can, occasionally, supply copies more than two years old. The cost is 58p, inclusive of postage and packing.

Before undertaking any constructional project described in a back issue, it must be borne in mind that components readily available at the time of publication may no longer be so.

HIGH GAIN DISC TV ANTENNA

By Ivor N. Nathan

Low-cost homely materials are all that are needed for this u.h.f. indoor TV aerial.

This u.h.f. antenna is similar in design and performance to a parabola antenna; a flat disc is used in this instance only because it is more convenient for the amateur constructor to either make or obtain. In the author's case, the body of the disc consisted of a long discarded 78 r.p.m. 10in. record, the hole in the centre being an ideal entry point and anchor for the coaxial cable feeder. The 10in. diameter is correct for the u.h.f. television band, and all that is required to convert the disc into a metallic reflector is a sheet of household aluminium foil (i.e. baking foil) sufficient to cover both sides of the disc in one piece. Accordingly, a sheet of aluminium foil approximately 2ft. square should be neatly folded around the disc to completely enclose it, having first applied a liberal amount of adhesive to both sides of the disc. The foil should be unbroken on the disc surface behind the dipole. Strips of Sellotape are used to seal the edges of the foil that show on the other side.

HALF WAVE DIPOLE

The energised element of the antenna is a half wave dipole, and this is made by opening out the end of a length of low-loss u.h.f. coaxial cable, as in Fig. 1. Sufficient cable should be used so that the dipole and feeder consists of one continuous length of cable; this avoids the need for any joins and ensures good matching and minimum signal losses.

Feed one end of the cable through the hole in the disc's centre, having first carefully punctured the aluminium foil on both sides of the hole. Ensure that sufficient cable has been fed through to provide easy access to the cable end so that the dipole can be cut. The dipole is made by first cutting away $4\frac{1}{2}$in. of outer insulation from the end of the cable. If the inner conductor and its insulation are carefully drawn through a gap in the braiding so as not to damage the braiding, and as close as possible to the outer covering of the cable, the two halves of the half wave dipole can then be bent into shape. The half that is formed from the inner conductor, still carrying its own insulation, is completely self-supporting but the half that is formed from the braiding will probably not be. This can be remedied by completely sleeving both halves of the dipole with spare lengths of cable outer insulation.

The aerial input socket of the television receiver should be fully isolated, by its manufacturer, from mains voltages. Nevertheless, it is preferable to ensure that there is no exposed metal in the dipole, and the sleeving over the dipole halves provides insulation in addition to stiffness. Ensure that all metallic parts of the dipole are completely covered by sleeving; any doubtful gaps can be covered with a liberal coating of Araldite, which will also add strength to the dipole's construction.

Each piece of sleeving should actually be approximately 1in. oversize. A piece of insulating material, such as a spare piece of coaxial inner cable insulation with the inner conductor removed, can then be inserted to plug each of the two dipole ends. The dipole is then bent approximately into the shape shown in Fig. 2, and a coaxial plug fitted to the remote end of the cable.

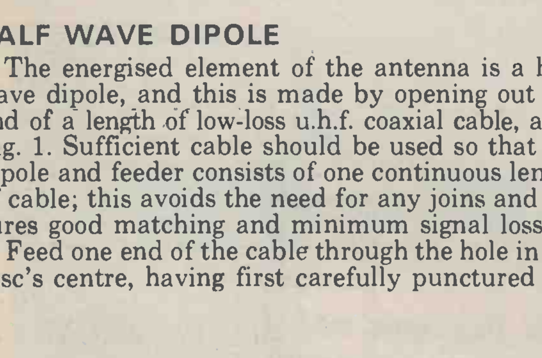


Fig. 1. Preparing the end of a coaxial cable so that the inner conductor and the braiding form the two halves of a dipole

DIPOLE ADJUSTMENT

Because the distance between the dipole and the disc reflector is quite critical, it is best to adjust this distance with the television receiver operating in order to obtain optimum results. Observing the correct propagation polarity for the group of channels to be received, tune the receiver to a mid-band channel then adjust the distance between the dipole and disc reflector for maximum signal. The position of the dipole is now made permanent by spreading a ring of Araldite at the junction of the cable and the disc on both sides of the disc; when set hard the rings form a cable support and also prevent the dipole from moving. Using this method of obtaining maximum gain and optimum matching obviates the need for any balun device. The dipole ends are then cemented to the disc with

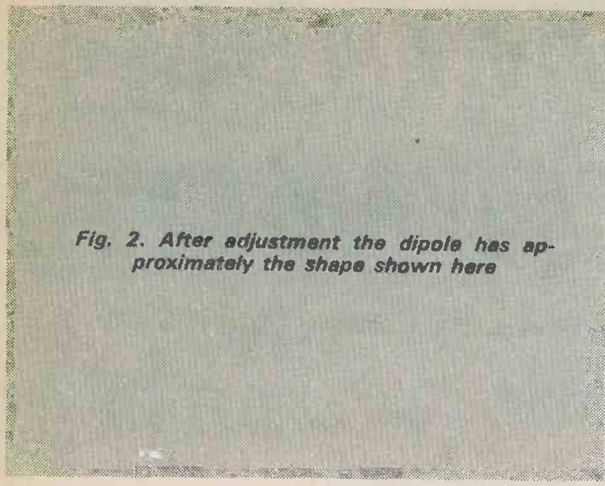
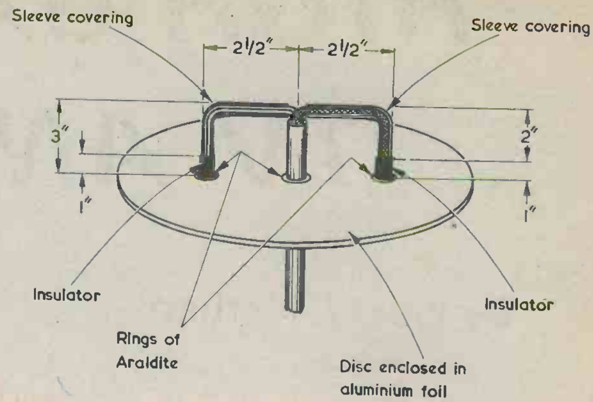


Fig. 2. After adjustment the dipole has approximately the shape shown here



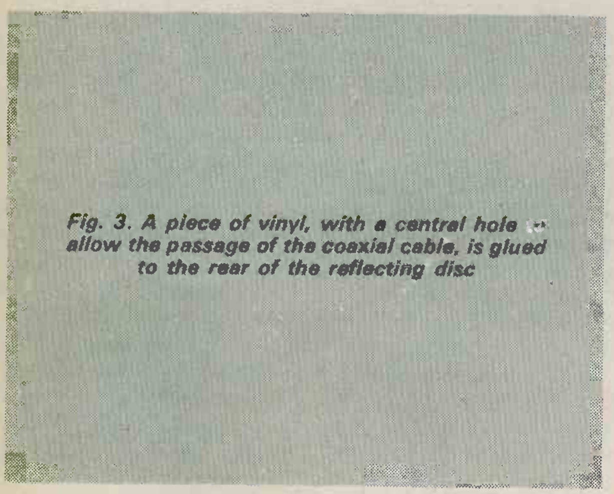
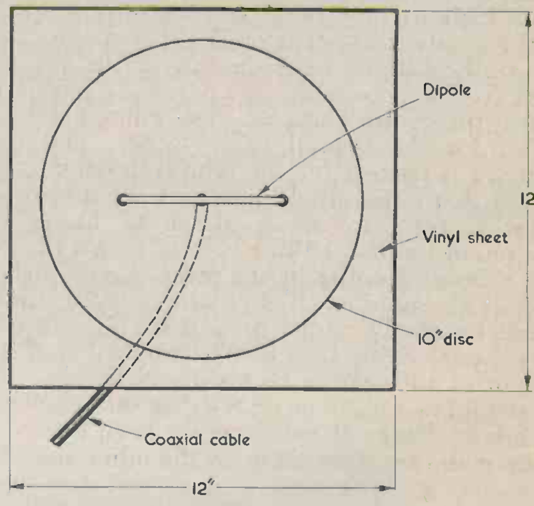


Fig. 3. A piece of vinyl, with a central hole to allow the passage of the coaxial cable, is glued to the rear of the reflecting disc



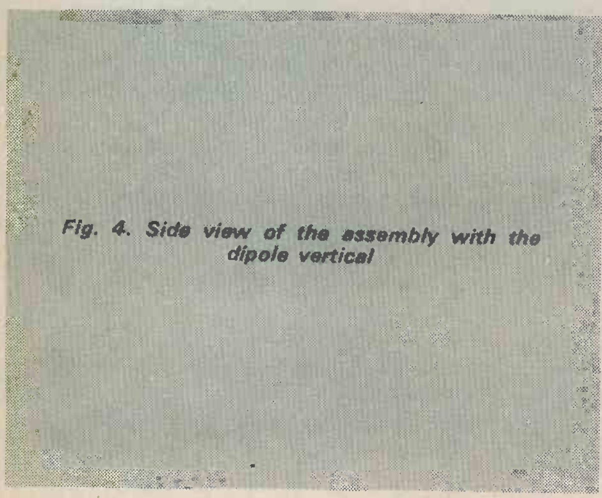
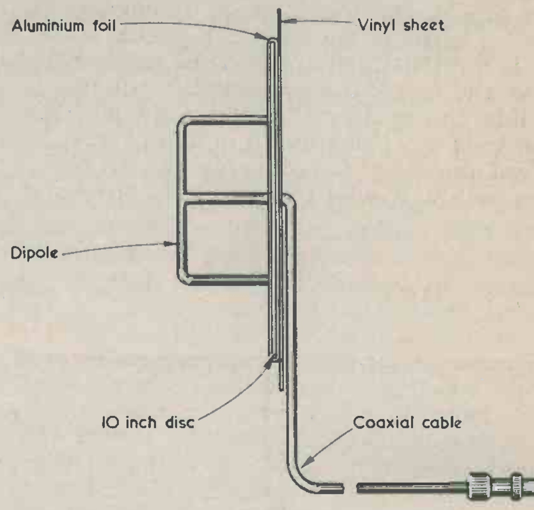


Fig. 4. Side view of the assembly with the dipole vertical



Araldite.

A sheet of stiff vinyl 12in. square is next glued to the back of the disc, partly to protect the aluminium foil but mainly to help anchor the cable and also to provide a means of suspending the antenna in its operating position. Small screws can be driven through the vinyl, clear of the disc, into any suitable supporting surface, such as the wooden beams within a roof space. Figs. 3 and 4 show the final assembly. An alternative to the vinyl sheet is plywood.

The antenna was compared with a 7-element Yagi and gave roughly equivalent results. Experimenters may wish to construct a ruggedised externally mounted version of this antenna, using a solid metal disc reflector. ■

TELEPHONE AMPLI[...]

By A. P.

The purpose of this unit is to amplify the output from a telephone so that it is at loudspeaker volume. The main advantage provided is that this enables more than one person to hear the conversation, but it can also be useful in noisy environments where the low volume sound from a telephone handset can be difficult to understand. Sometimes a poorly connected call can be hard to comprehend due to a lack of volume, and the additional gain of a telephone amplifier can be very helpful under these circumstances.

A subscriber is not allowed to make a direct connection to a telephone, and so some indirect means of picking up the telephone signal must be used. Telephones contain inductors which radiate the signal in the form of a stray magnetic field, and it is from this field that the signal for the present unit is derived. Such a process is the conventional method for obtaining an input signal for an amplifier of this type.

Bring your conversations loudspeaker le[...] battery opera[...]

THE CIRCUIT

The circuit diagram of the telephone amplifier is shown in Fig. 1. L1 is the pick-up coil, and this is simply a 10mH ferrite cored r.f. choke. Special telephone pick-up coils were readily available some years ago, but appear difficult to obtain at the present time. However, the r.f. choke operates perfectly well in this application.

Only a very small output signal, of less than a millivolt, is produced by the pick-up coil, and this signal is at a fairly low impedance. TR1, which is used as the pre-amplifier, is therefore connected in the common base configuration. The common base mode of operation provides a low input impedance and a high voltage gain. R2 is the collector load resistor and R1 provides base biasing, whilst C2 bypasses the base of TR1 to the negative supply rail. L1 completes the emitter circuit of TR1 at d.c., as well as injecting the input signal.

C3 rolls off the upper frequency response of the circuit, and this is done for two reasons. First, the circuit has quite a high level of gain and a frequency response which would otherwise extend well into the radio frequency spectrum. Without treble roll-off the gain at high frequencies could lead to instability. Second, the higher audio frequencies contribute very little to the intelligibility of telephone speech, and so an improved signal-to-noise ratio is produced by the treble cut.

Similarly, bass frequencies do not serve any useful purpose as far as telephone transmission of speech is concerned, and it is usually considered beneficial to roll them off also. This is achieved by employing interstage coupling capacitors having rather low values.

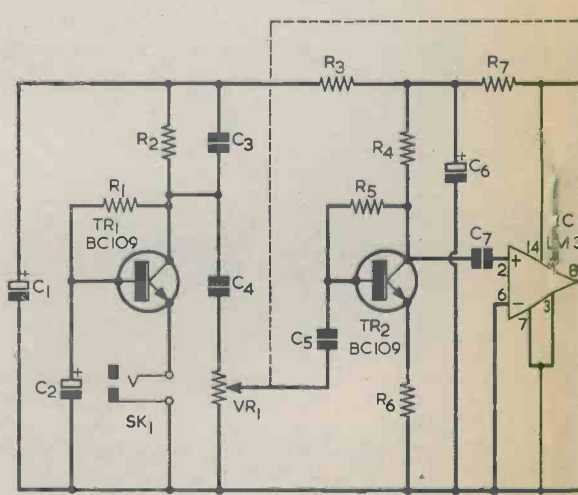


Fig. 1. The circuit of the telephone amplifier. In use t[...]

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PHONE AMPLIFIER

By A. P. Roberts

Bring your telephone conversations up to loudspeaker level with this battery operated amplifier

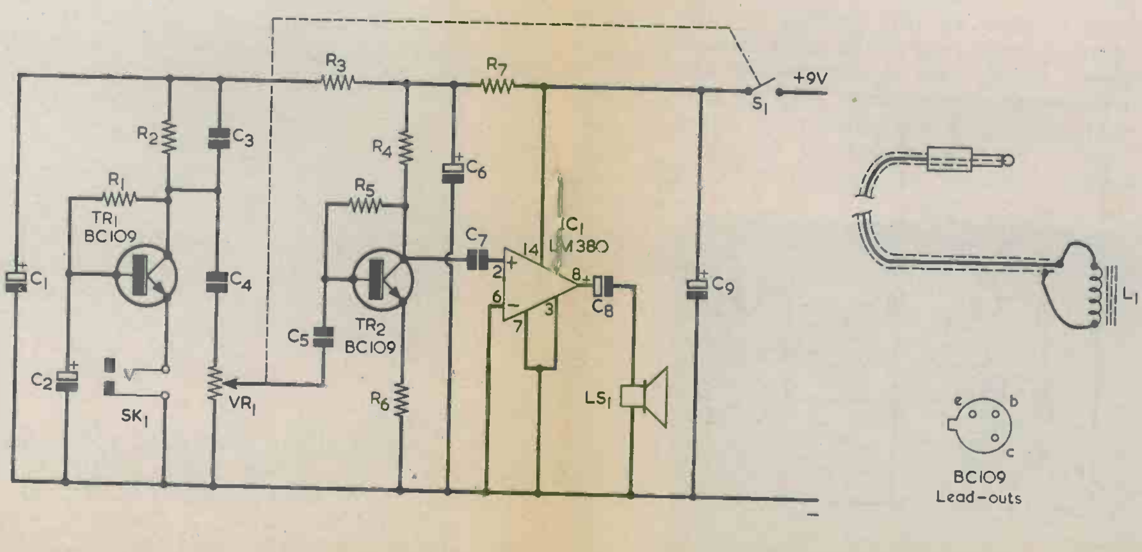
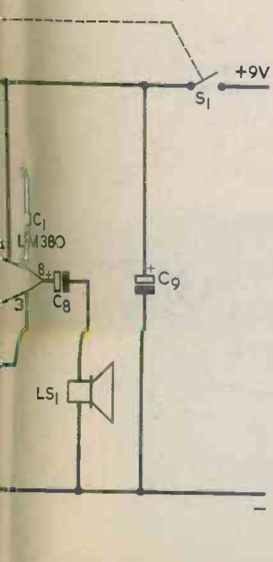


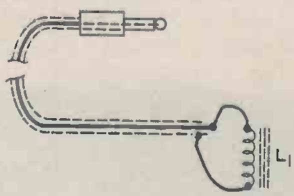
Fig. 1. The circuit of the telephone amplifier. In use the jack plug connecting to L1 is inserted in SK1

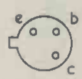
FIER

. Roberts

r telephone s up to level with this ated amplifier







BC109
Lead–outs

se the jack plug connecting to L1 is inserted in SK1

COMPONENTS

Resistors
(All fixed values ¼ watt 10%)
- R1 2.2MΩ
- R2 5.6kΩ
- R3 1kΩ
- R4 4.7kΩ
- R5 2.2MΩ
- R6 680Ω
- R7 470Ω
- VR1 10kΩ potentiometer, log, with switch S1

Capacitors
- C1 100μF electrolytic, 10 V. Wkg.
- C2 2.2μF electrolytic, 10 V. Wkg.
- C3 0.01μF type C280 (Mullard)
- C4 0.1μF type C280 (Mullard)
- C5 0.01μF type C280 (Mullard)
- C6 100μF electrolytic, 10 V. Wkg.
- C7 0.047μF type C280 (Mullard)
- C8 100μF electrolytic, 10 V. Wkg.
- C9 100μF electrolytic, 10 V. Wkg.

Inductor
- L1 10mH r.f. choke type CH4 (Repanco)

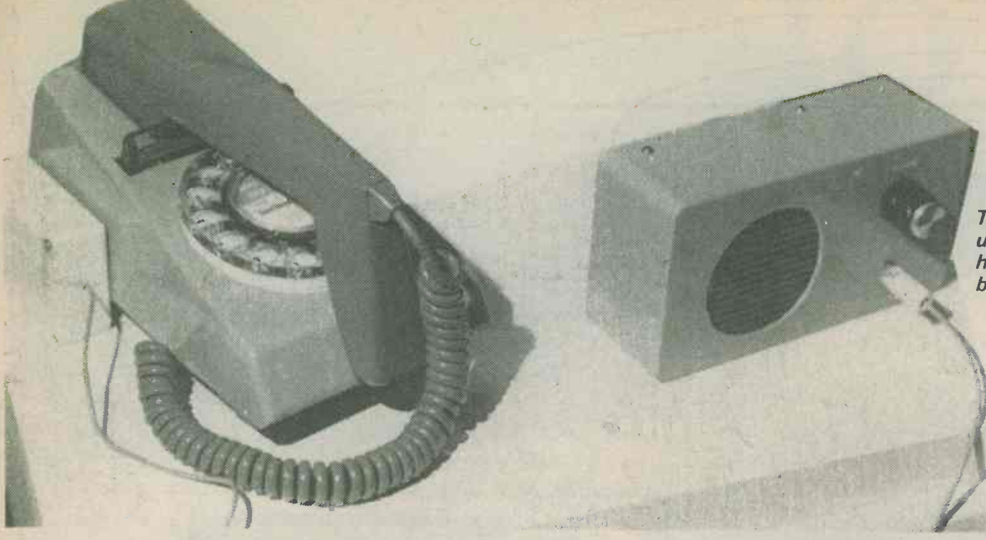
Semiconductors
- TR1 BC109
- TR2 BC109
- IC1 LM380

Socket
- SK1 3.5mm. jack socket

Speaker
- LS1 approx. 2.5in. diameter, 8Ω to 35Ω

Switch
- S1 s.p.s.t., part of VR1

Miscellaneous
- Plastic case, approx. 150 x 80 x 50mm.
- Plastic case, approx. 71.5 x 49 x 24.5mm., Verobox type 75-1469 or similar
- 9 volt battery type PP6 (Ever Ready)
- Battery connector
- Veroboard, 0.1in. matrix
- Control knob
- 3.5mm. jack plug
- Screened cable
- Speaker fabric
- Wire, screws, nuts, etc.



The telephone amplifier in use. The pick-up coil is housed in the small plastic box at the left of the telephone base

The output from TR1 is fed to volume control VR1 via the d.c. blocking capacitor, C4. From here the signal is coupled to another amplifier stage by way of C5. This second stage of amplification incorporates TR2, wired in the common emitter mode. The stage is quite conventional except for the inclusion of the unbypassed emitter resistor, R6. R6 introduces a large amount of negative feedback to the stage and reduces its gain, which would otherwise be excessive.

An LM380 i.c. is used as the output amplifier, and this device requires very few external discrete components. C7 provides d.c. blocking at the input while C8 provides the same function at the output. The voltage gain of the amplifier is set at 50 by an internal feedback circuit. The i.c. has both inverting and non-inverting inputs, and in this application it is the latter which is used. The inverting input is connected to the negative supply rail so that it cannot pick up noise due to stray couplings.

An output power of a few hundred milliwatts can be provided by the LM380 under these circumstances, which means that the device is being used well within its capabilities. The i.c. cannot, in any case, be damaged by overloading as it has both thermal shutdown and output short-circuit protection. The prototype is used with an 8 Ω impedance speaker. However, a wide range of speaker impedances will prove satisfactory, and any speaker impedance between 8 Ω and 35 Ω will be suitable.

As the LM380 has a Class B output and the overall gain of the circuit is very high, it is absolutely essential that the supply lines be very well decoupled. This function is performed more than adequately by C1, R3, C6, R7 and C9. S1 is the on-off switch, and is ganged with VR1. The quiescent current consumption of the amplifier is about 10mA, but this figure is considerably exceeded at high volume levels.

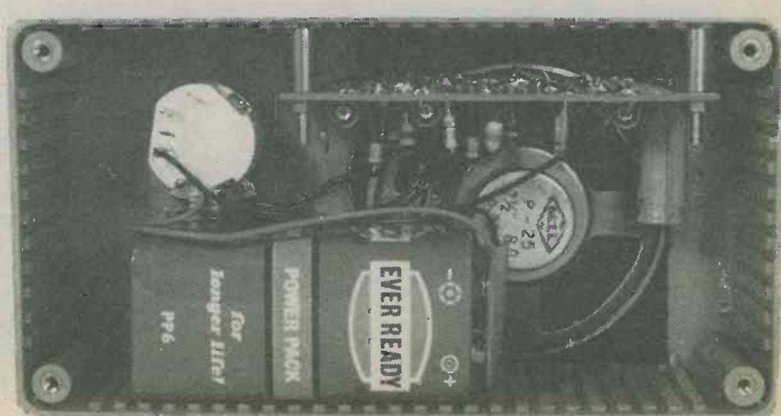
The 2.2μF electrolytic capacitor, C2, is shown in the Components List as having a working voltage of 10 volts. In practice this capacitor can have a working voltage well in excess of this figure, a typical value being 63 volts.

CONSTRUCTION

All the small components are assembled on a piece of 0.1in. matrix Veroboard having 14 strips by 33 holes. Both sides of this panel are illustrated in Fig. 2, which also shows the other wiring of the unit. After a panel of the correct size has been cut out with a hacksaw the 16 breaks in the copper strips are made, following which the two 6BA clear mounting holes are drilled. The various components can then be soldered into position, as well as the four link wires. The LM380 has its central pins, 3, 4, 5, 10, 11 and 12, at the same potential as the negative rail. All these pins are soldered to the copper strips at the holes through which they pass.

A plastic box which measures about 150 by 80 by 50mm. deep is used as the housing for the prototype, but any plastic case of the same size, or somewhat larger, which can accommodate the components will be equally suitable. The speaker is mounted on the left hand side of the front panel of the box, and it requires a cut-out of about 50mm. in diameter. This can be made with the aid

There is adequate space inside the plastic case for the components and the battery



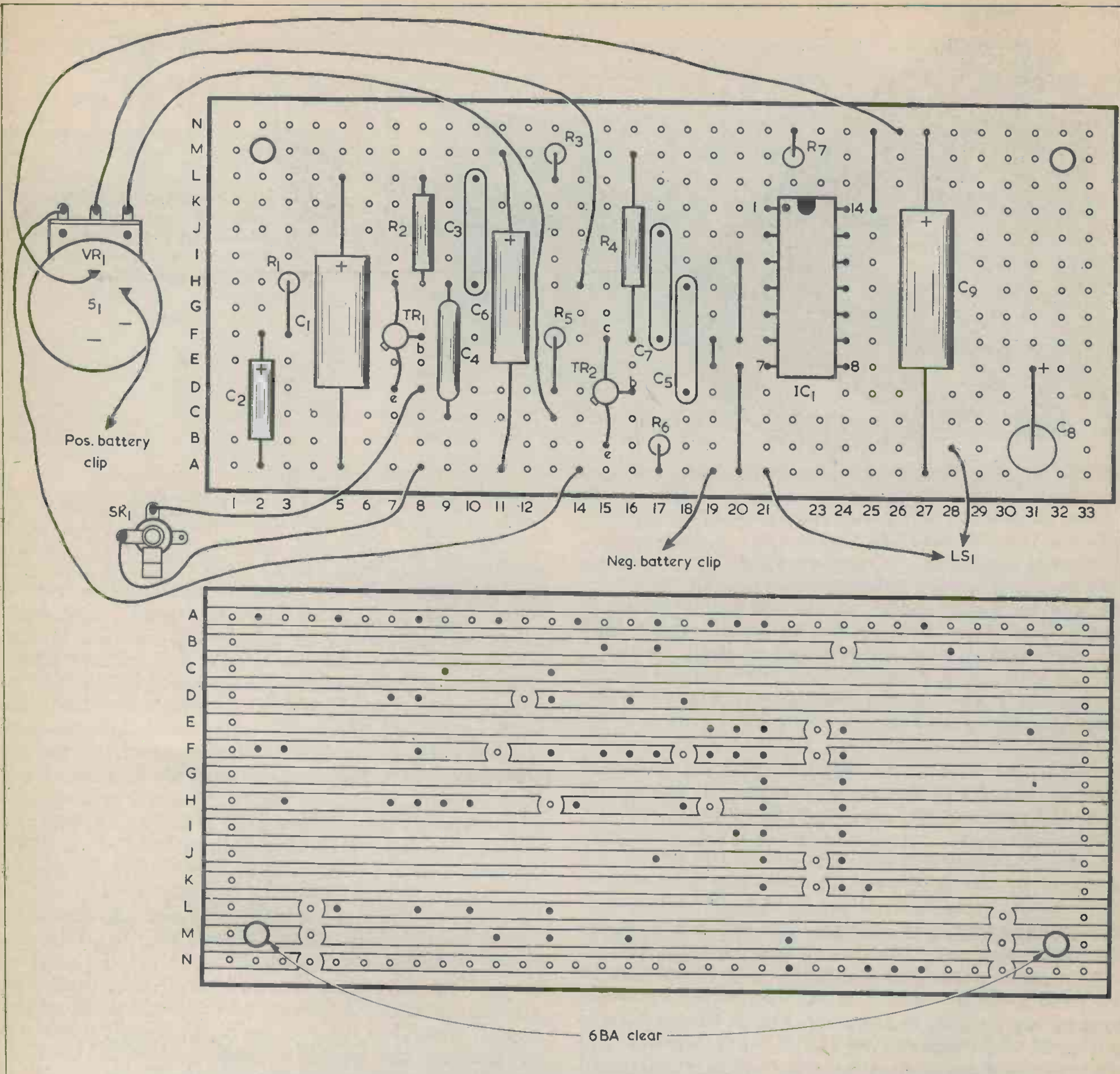
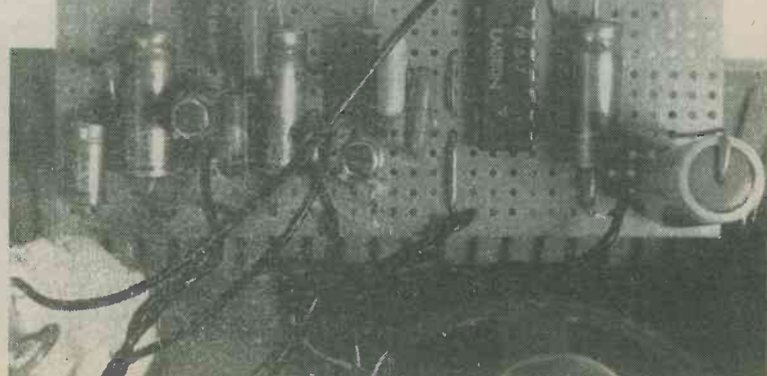
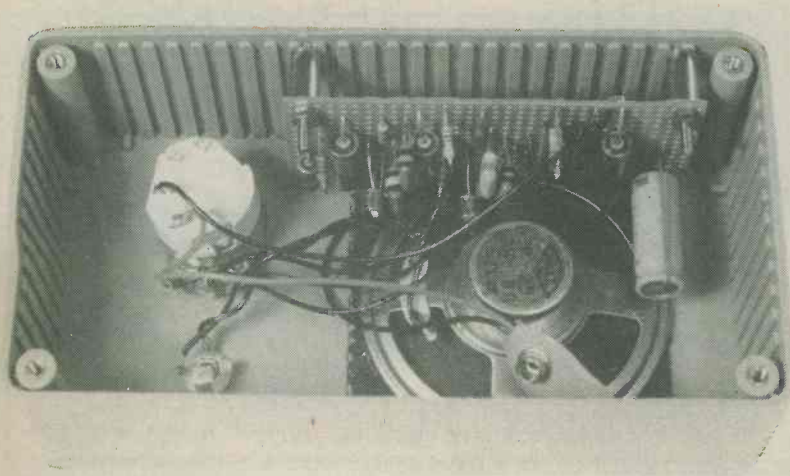


Fig. 2. All the small components are assembled on a 0.1in. Veroboard. The component and copper sides are illustrated here

Close-up of the Veroboard panel. When mounted, this is secured to the top of the case by two 6BA screws and nuts





An angled view inside the case with the battery removed

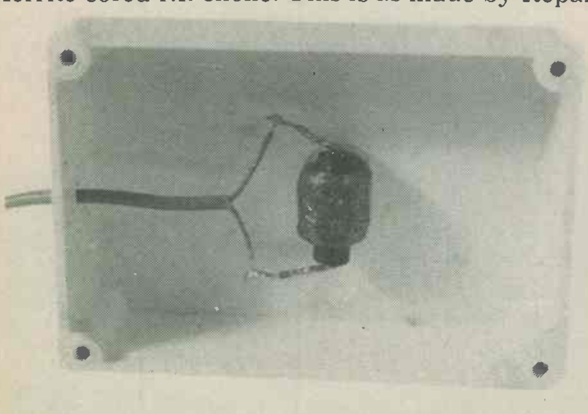
of a fretsaw or a miniature round file. A piece of speaker fabric is then glued in position at the rear of the cut-out, and the speaker is then carefully glued onto this. Use only a small amount of adhesive, so that none comes into contact with the speaker cone or surround. Also, use a good quality adhesive, such as an epoxy type.

VR1/S1 and SK1 are mounted on the right hand side of the front panel, with VR1/S1 above the socket as can be seen from the photographs of the prototype.

The component panel is fitted at the top of the case above the loudspeaker, using two 6BA screws with nuts. Spacers are fitted to the screws between the panel and the case; these are necessary as the component panel could otherwise be damaged as the mounting nuts are tightened. The panel cannot be finally mounted until it has been wired up to the rest of the circuit, as shown in Fig. 2. This wiring is all quite straightforward, and it is not necessary to use screened leads at the input or for the wiring to the volume control.

PICK-UP COIL

As mentioned earlier, the pick-up coil is a 10mH ferrite cored r.f. choke. This is as made by Repanco, or equivalent. It is housed in a small Verobox with dimensions of 71.5 by 49 by 24.5mm. Any other small plastic case which will take the choke could also be employed. The coil is connected to the telephone amplifier by a screened lead which is about 1 metre long, and a small hole for this lead must be drilled in one side of the case. The cable is then threaded through this hole and connected to the choke. The other end of the cable is terminated in a 3.5mm. jack plug which connects with SK1.



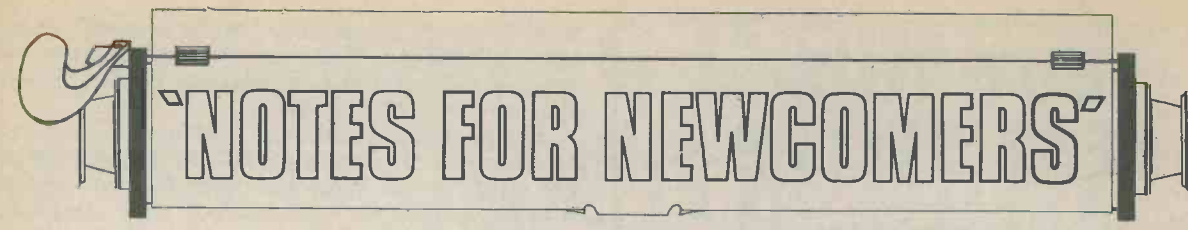
The pick-up coil is a ferrite cored r.f. choke. The centre wire of the screened cable connects to one of its leads and the braiding connects to the other lead

Eventually the choke will be glued in position inside the case, but before this can be done it is necessary to find the correct orientation for it. In order to do this the pick-up coil is placed near the base of a telephone which is reproducing an audio signal (which can be provided by the "Dial-A-Disc" facility, or some similar service). The coil is then tried in various positions and orientations in an attempt to find the one which provides the best signal. Note that the process is not merely a matter of finding the position and orientation which provides the greatest audio output. The coil will be sensitive to any stray magnetic field in its vicinity, and it therefore tends to pick up a certain amount of mains hum. It should be possible to adjust the coil both to obtain a strong audio output signal and to null any interfering mains hum.

When the optimum location has been found, the pick-up coil is glued into its case in such a way that it will have the correct position and orientation when the case is suitably placed alongside the telephone base.

With a standard Post Office telephone of the type which is currently being issued the maximum pick-up seems to occur with the coil at the centre of the right hand side of the telephone base. With a Trimphone, maximum signal pick-up appears to be with the coil at the rear of the left hand side of the base, and the output here is comparatively strong.

When using the amplifier unit it is necessary to ensure that the speaker is not too close to the microphone in the telephone handset, and that the volume control is not advanced too far. If these precautions are not observed acoustic feedback will occur, with the characteristic loud howl being produced in consequence. ■



RESISTOR TOLERANCES

By R. Webber

A little tolerance eases many problems.

All quantities in engineering are subject to tolerances. For instance, in a design for an electric motor the optimum diameter for its rotating shaft may be, say, $1\frac{1}{2}$ inches. However, the engineer working out the motor design cannot simply turn round to the people who are to make the spindle and say: "Please manufacture spindles for this motor which are exactly $1\frac{1}{2}$ inches in diameter", because they will reply that, in engineering terms, this is impossible. Quite properly they will need minimum and maximum limits to work to. So the engineer has to consider how much on either side of $1\frac{1}{2}$ inches the spindle diameter will be satisfactory, and he may then say: "Okay, make up the spindles so that the diameter never exceeds 1.505 inch and is never less than 1.495 inch." In other words, he is stating that the spindles should all have a nominal diameter of 1.55 inch with a tolerance on this value of plus or minus 0.005 inch.

A tolerance of plus or minus 0.005 inch, or its near equivalent in millimetres, is quite a standard mechanical engineering tolerance. In fact, many mechanical dimensional tolerances are quite a lot tighter (i.e smaller) than such a figure.

ELECTRONIC TOLERANCES

When we move to electronic engineering, two of the important quantities we meet are resistance and capacitance. It can come as a surprise to those with previous mechanical experience to find that very many electronic circuits incorporating resistance and capacitance are capable of working quite happily with some resistors having values whose tolerances are as high as plus or minus 20% on nominal value and some capacitors with tolerances on value which are even higher than this. In some cases, where a more accurate overall performance is required, electronic circuits may incorporate a pre-set variable resistor (or potentiometer) or pre-set variable capacitor (or trimmer) fitted at one or more strategic positions. The pre-set component can then be adjusted to overcome the small differences in performance which are introduced by the relatively wide tolerance resistors or capacitors elsewhere in the circuit.

So far as the newcomer to electronics as a hobby is concerned, fixed resistors (i.e. those not intended to have their values adjusted) are quite easy to get used to. In this short article we will deal with small fixed resistors having wattage ratings from around $\frac{1}{8}$ to 1 watt.

Until the late 1950's most fixed resistors in this category were carbon composition types in which the resistive element was a stick consisting of a mixture of carbon particles suspended in a hard-setting plastic material. These were available with a tolerance of plus or minus 20% in values of 10, 15, 22, 33, 47, 68 and their decades, and in 10% and 5% in the values shown in the Table. These "preferred value" series of numbers are still in use, and those in the Table are known as the E12 and E24 series respectively.

The preferred value system was introduced because, until he had actually made his resistors, the manufacturer of carbon composition resistors wasn't at all certain what values would turn up at the end of his production line! If he aimed at a run of, say, 10kΩ resistors, those which fell below this value could conveniently enter a preferred value

Preferred values for 10% and 5% fixed resistors.

10% (E12)	5% (E24)	10% (E12)	5% (E24)
10	10	33	33
	11		36
12	12	39	39
	13		43
15	15	47	47
	16		51
18	18	56	56
	20		62
22	22	68	68
	24		75
27	27	82	82
	30		91

with tolerance below 10kΩ, whilst those which were too high could enter a preferred value with tolerance above 10kΩ. The beauty of this system is that no resistors are wasted.

These older-fashioned carbon composition resistors, in tolerances nowadays of 10% and 5%, are still with us. They are perfectly good resistors for use in modern circuits, but they tend to introduce noise when employed in such applications as the pre-amplifier stages of a hi-fi amplifier. They are also rather liable to shift in value if they are overcooked during soldering.

At the present time, most retailers to the home-constructor market sell only the more modern carbon film, metal oxide film and similar types of resistor. These are high stability low-noise components which can be used virtually anywhere. Previously, 20% resistors were the cheapest, 10% resistors more expensive and 5% resistors more expensive again. With modern methods of manufacture, the 20% resistors have virtually disappeared from the scene as, indeed, so far as some mail-order retailers are concerned, have the 10% types in values under 1MΩ. There is no point in stocking 10% resistors if 5% resistors are available just as cheaply.

FIRST PUZZLE

And this is the point at which the newcomer to electronics bumps into his first little puzzle. A circuit design published in an electronics magazine may specify a particular resistor as having a value of 100kΩ plus or minus 10% (usually referred to as "100kΩ 10%"). He looks through his component catalogue and finds that he cannot get a 100kΩ 10% resistor anywhere because the widest tolerance resistors available are 100kΩ 5%! What does he do? To answer that question fully we go back to the person who designed the project.

When the designer came to that particular resistor in his circuit he checked out the probabilities and said to himself: "Ah now, the circuit will work perfectly well if this resistor has any value between 110kΩ and 90kΩ. In consequence, I'll call it up in the Components List as 100kΩ 10%." So, all that the "100kΩ 10%" expression means is that the resistor value must lie between these two outside limits of 110kΩ and 90kΩ. It will be perfectly in order to use a 100kΩ 5% resistor, because its value will lie between 105kΩ and 95kΩ. This is well within the bounds laid down by the designer.

To sum up, it is always correct to use a resistor having a narrower, or smaller, tolerance than that specified in a design.

Some of the more expensive small fixed resistors are available with tolerances of 2% or 1%. These are rather specialised close tolerance types which are mainly intended for circuits having fairly precise functioning, as are given by series meter resistor chains and the like. You *could* use a 2% or 1% resistor where a 10% or 5% resistor is specified, but you would probably find it too bulky. It will almost certainly be more costly than its wider tolerance brother.

We mentioned capacitor tolerances at the start, but our space is now at an end. Perhaps we will take up the subject of capacitor tolerances at a future date.

■

LOOKING INSIDE SEMICONDUCTOR DIODES

By Michael Lorant

Electron-probe techniques out-perform both optical and electron microscopes

Electronic research engineers of Bell Systems in the United States have developed a novel type of microscopy that uses a beam of electrons as a probe to investigate the structures of semiconductor crystals.

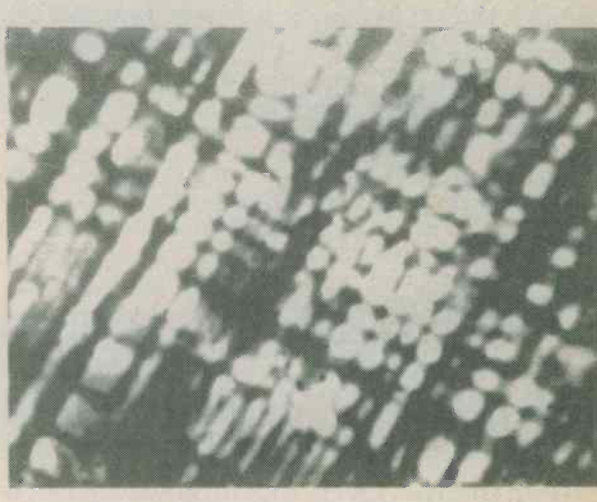
Unlike other electron-probe arrangements, or for that matter the electron miscroscope, which are limited to studies of surface or very thin layers, the Bell technique reveals features within the body of the semiconductor through photomicrographs.

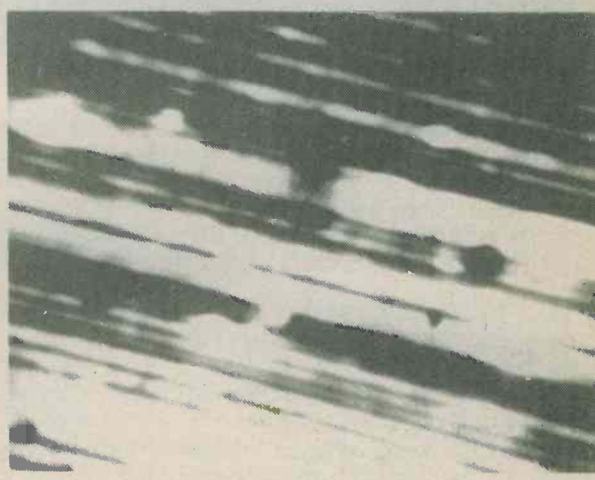
Crystal defects are not probed directly by the electron beam. Instead, the secondary charge carriers created by the beam are used, in effect, to project an image of each imperfection on to the plane of a p.n. junction. This image is then reproduced on a cathode ray tube.

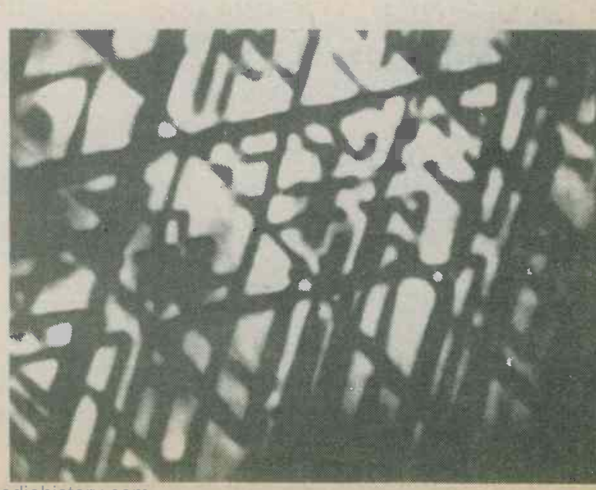
The process is non-destructive of the crystal, does not normally require special treatment of the crystal surfaces and has a resolving power higher than that of optical microscopes.

These new photomicrographs reveal both surface and internal structures and allow separate identification of each.

Electron-probes have proved useful in studying crystal defects that may degrade the performance of semiconductor diodes, and they are also leading to greater understanding of crystalline structures themselves. ■







Electron-probe photomicrographs showing internal views (perpendicular to three different crystal planes) of crystal imperfections in a silicon diode. Magnifications, from top to bottom, are 620, 710 and 800 times. The new electron-probe techniques permit scientists to look further inside semiconductor diodes in their studies of internal crystalline defects

SHORT WAVE NEWS
FOR DX LISTENERS

By Frank A. Baldwin

Times = GMT *Frequencies* = kHz

Turning aside from the Broadcast Bands to the Amateur Bands, just for a change of scenery, some stints on Top Band (1.8 to 2.0MHz) produced the following Dx — all on the key.

● TOP BAND (1.8-2.0MHz)

DJ2RE, DJ3XK, DK3AX, DK4FM, DL3RQ, EI1AA, EI2BB, EI9J, F3AT, F8EX, F8VJ, GD4BEG, GI3JEX, GI4ABZ, GM3ALK, GM3VPN, GM8CH, GU3HFN, GW3KOR, GW3XJC, GW4FDL/A, HB9BCI, HB9CM, HB9EP, K1PBW, K2GM, K2GNC, K4FU, K4IEX, K9ZUH, LA7Y/EA8, OE5KE, OK1ACB, OK1DCF, OK1DFR, OK2BJJ, OK2PGU, OK4ATQ, OK4ATY, OK5TLG/P, OK8CGS, OH1MA, OH2BG, OH2KA, OH3XZ, PAØHIP, VE1CD, VE2BPT, VE2FU, W1BB, W1MX, W2GM, W2PV, WA4SGF, W6MZW/1, W8JI, WB9QCP, YU1BCD, YU3TJA.

The other band tackled over the past few months has been Forty Metres (7.0 to 7.1MHz) where one has to contend with broadcast station QRM on the grand scale. One way around this (are they any others?) is to go on the band in the very early mornings — and I mean early!

● FORTY (7.0-7.1MHz)

CO2CM, FM7AV, HK1CHL, J3AAG, KP4RF, KP4WL, PT2WS, PY1WD, PY2XB/PP8, UF6FDJ, UI8LAG, VE3DP, VU2BK, YV4BE, ZD8TM, 4X4GD, 9K2DR.

Finally, a couple of short bursts on both Twenty (14.00 to 14.35MHz) and Twenty-One (21.00 to 21.45MHz) resulted in:

● TWENTY (14.00-14.35MHz)

CO2FR, JA1PIG/PZ, KV4AA, KV4CI, LU9CV, VE7ALR.

● TWENTY-ONE (21.00-21.45MHz)

CX8DT, HZ1HZ, OA4AHA, PJ9CG, VP2SZ, YN1FMQ, ZS2RE.

Now back to the Broadcast Bands.

CURRENT SCHEDULES

● TANZANIA

"Radio Tanzania", Dar-es-Salaam, operates an External Service carrying programmes in English to East, Central and Southern Africa. Some programmes however feature items in Afrikaans and vernaculars, these being those of the African National Congress, Pan African Congress and the "Voice of Namibia".

From 0330 to 0500 on **6105** and **15435**; from 0900 to 1030 (Saturdays and Sundays until 1530) on **9750** and from 1530 to 1915 on **6105** and on **15435**.

● ALBANIA

"Radio Tirana" lists programmes in English to **Europe from 0630 to 0700 on 7065** and **9500**; from 1630 to 1700 on **7065** and **9480**, from 1830 to 1900 on **7065** and **9485**; from 2030 to 2100 on **7065** and **9485** and from 2200 to 2230 on **7065** and **9480**.

● CHINA

"Radio Peking" operates a service in Amoy, Hakka and Standard Chinese directed to Taiwan on several channels, those of possible interest to the Dxer being listed here.

From 1000 to 1900 and from 2000 to 0130 on **3360**; from 1300 to 1900 and from 2000 to 2200 on **3830**; from 1115 to 1900 and from 2000 to 2200 on **4770** and from 0958 to 1900 and from 2000 to 2340 on **5125**.

The PLA Fukien Front Station radiates to Taiwan and other offshore islands, mostly in Standard Chinese, as follows (Dx interest channels only).

From 1151 to 2359 on 2490; from 1216 to 2310 on **3000**; from 1300 to 2240 on **3535**; from 1300 to 1930 on **3640**; from 1000 to 1800 and from 2240 to 0530 on **4045**; from 1000 to 1800 and from 2240 to 0530 on **4330**; from 1000 to 1259 and from 2241 to 0530 on **5240** and from 1000 to 1259 and from 2243 to 0530 on **5265**, all in Network One.

In Network Two from 1426 to 1900 on **2430**; from 1257 to 1900 on **2600**; from 1000 to 1900 on **3200**; from 1200 to 1900 on **3300**; from 1000 to 1900 on **3400**; from 1127 to 1700 on **3900**; from 1101 to 1900 on **4140**; from 0230 to 1700 on **4380**; from 0230 to 1600 on **4840**; from 0230 to 1425 on **5170** and from 0230 to 1100 on **5770**.

● MONGOLIA

The Domestic Service from Ulan Bator (First Programme) is on the air from 2200 to 0100 on **5055**; from 0100 to 1054 on **5055**, **7262** and on **11855**; from 1100 to 1500 on **4082**, **4763** and on **5055**. The Second Programme is transmitted from 0829 to 1050 on **5960** and on **6385**.

● **VIETNAM**
Radio Hanoi, the "Voice of Vietnam", has scheduled programmes in English for Europe from 1800 to 1900 and from 2030 to 2130 on **7290** and on **10040**. The Domestic Service in Vietnamese is broadcast from Ho Chi Min City from 2200 sign-on through to 1530 sign-off on **6165** and on **9620**.

● **ROMANIA**
"Radio Bucharest" in the External Service presents programmes in English to Europe from 1300 to 1330 on **9690, 11940** and on **15250**; from 1930 to 2030 on **6150** and on **7195** and from 2100 to 2130 on **5990** and on **7225**.

● **CZECHOSLOVAKIA**
"Radio Prague" is currently offering programmes in English to the U.K. from 1630 to 1700 on **5930** and on **7345**; from 1900 to 1930 on **5930, 7245** and on **7345**; from 2000 to 2030 on **5930** and on **7345** and from 2130 to 2200 on **6055**.

AROUND THE DIAL

In which are reported some of the interesting stations logged recently, the first being—

● **INDIA**
AIR (All India Radio) on **7225** at 1917, YL with songs, local-type music in the General Overseas Service programme in English (except for the songs) intended for East Africa, Western Europe and the U.K., scheduled from 1745 to 1945.

AIR Delhi on **3905** at 1509, local music, YL with songs in the Pushtu programme (Foreign Service) scheduled here from 1430 to 1530.

AIR Delhi on **3925** at 1511, OM with a talk in Hindi in the Home Service.

● **SOUTH KOREA**
Seoul on **3930** at 1552, OM in Korean announcing local music on records in the Home Service 1 programme, scheduled from 2000 to 1700.

● **AUSTRALIA**
ABC (Australian Broadcasting Commission) Brisbane on **9660** at 1235, OM in English with sports reports in the Domestic Programme.

● **CLANDESTINE**
"Voice of the People of Thailand" on a measured **9422.5** at 1431, military music at the opening of the Laotian transmission scheduled from 1430 to 1520. Controlled by the Thailand Communist Party, this transmitter was formerly thought to be located in the Kunming area of Yunnan Province in the People's Republic of China but is now believed to be sited in Ken Thao, opposite Nao Haeó district in the Laotian Province of Loei.

● **VIETNAM**
Hanoi on a measured **7512** at 1455, YL with songs, local-type music in the Cantonese programme, scheduled from 1430 to 1500 on this channel.

Hanoi on **9840** at 1500, YL introducing the Standard Chinese programme, scheduled from 1500 to 1600 daily.

● **SWEDEN**
"Radio Sweden", Stockholm, on **21555** at 1342, general discussion in Swedish in the Domestic 1st Programme radiated to embassies, ships and firms abroad in the SSB mode and scheduled on this channel from 0930 to 1600.

● **NORTH KOREA**
Pyongyang on a measured **6576.5** at 1925, OM in Korean to Europe, Near and Middle East and Africa, also heard in parallel on **9977**.

Pyongyang on **6600** at 2139, OM in Korean in the Domestic Service programme, scheduled here from 1500 to 1800 and from 2000 to 0830.

● **U.S.S.R.**
"Radio Kiev" on **5970** at 1945, station identification followed by a programme for Dxers and Radio Amateurs in the English programme for Europe, scheduled from 1930 to 2000.

● **POLAND**
Warsaw on **7285** at 1218, YL with the English programme for Europe, scheduled here from 1200 to 1230 and also in parallel on **6095**.

Warsaw on **9525** at 1237, OM with the programme "Inside Poland" in the English programme directed to Africa, scheduled from 1230 to 1300 on this frequency and in parallel on **9675, 11840** and on **15120**.

● **FINLAND**
Helsinki on **15260** at 1303, OM with the local news in English in the service to Europe, North America and the Far East, scheduled from 1300 to 1325 on this channel and in parallel on **11755** and **15105**.

● **AUSTRIA**
Vienna on **9770** at 1233, YL in English to Europe, South East Asia and Australia. Also to be heard in parallel on **6155, 11790** and on **17775**.

● **CHINA**
PLA (People's Liberation Army) Fukien Front on **3535** at 1925, discussion in Chinese in a Network 1 programme for Taiwan and Offshore Islands, scheduled from 1300 to 2240.

Radio Peking on **3920** at 1549, Chinese music, OM announcer in the Domestic 1st Programme, scheduled here from 1100 to 1735 and from 2000 to 0100.

Wuhan on **3940** at 1555, violin music local-style, YL announcer. Schedule is from 0300 to 0730, 0850 to 1605 and from 2100 to 0100.

Radio Peking on **6540** at 1439, OM with programme to Cambodia, scheduled from 1400 to 1500.

NOW HEAR THIS

FR3 Cayenne, French Guyana, on a measured **4972** at 0250, YL with announcements in French and off with National Anthem. The schedule is from 0900 to 0200 (variable sign-off) weekdays, 0900 to 0300 on Saturdays, Sundays 1000 to 0200 but can close anytime from 0100. The power is just 1kw.

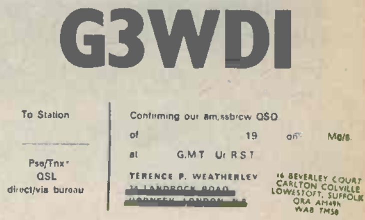
QSL CARD DISPLAYING

By T. F. Weatherley

I do it, you do it, even OA's in Peru do it. We QSL. In return we receive QSL cards. At first they are displayed as received, haphazardly, on the shack wall — then the door — then the ceiling and then — and then what do we do with them? We stick them in the drawer. Yes we mean to sort out the best, the most exotic, the rarest and display them well, but somehow old Bill's from the next street stays on the wall and the rare stuff stays in the drawer.

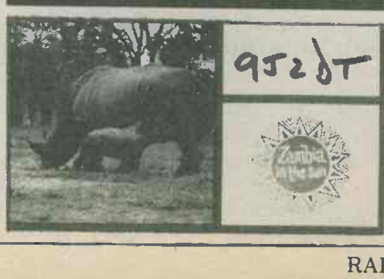
It was while wondering what to do with a stack of cards that the author decided to display the different styles of QSL. Some were purely functional, some artistic, some funny and some, well some were just QSL cards.

The functional cards like the author's own are just that — a large call sign and space for the contact and station details. Neat and tidy but scarcely art. Let's look now at some of the alternatives. The examples are all from the author's collection and lose something when reproduced in black and white.

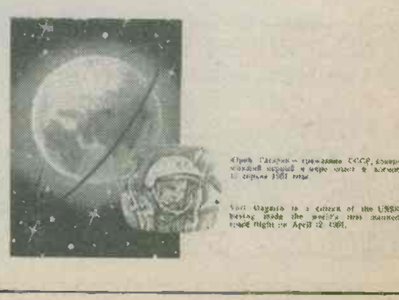


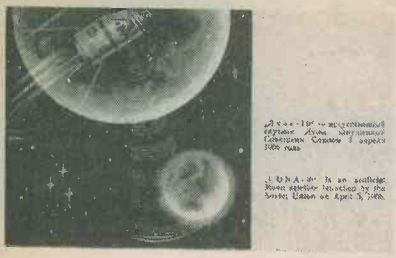
The view card, VE1TG's is an example, has the call and location printed over a view of the home state, town or village. Sometimes instead of the photograph there is a line drawing. The Hungarians have a series of 36 line drawings of castles to use as cards and the one from HA8VT is one such. The avid HA worker can collect the whole set of 36. This achievement is marked by the award of a 'Gold Degree.'

9J2DT card shows a variation of this style. An animal indigenous to the country is used. The card, supplied by the Zambia Tourist Board, carries 'Greetings from Zambia' on the back. Thus the QSL spreads goodwill and is an advertisement for the country of origin.

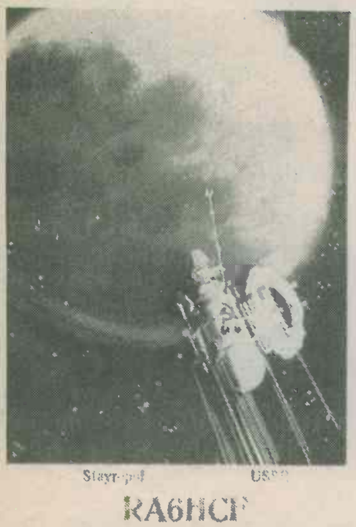


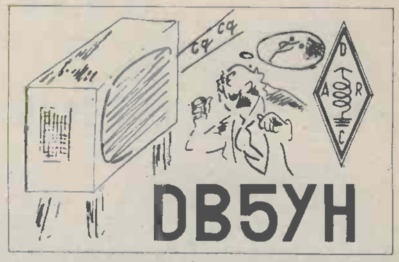
When the author was newly licensed, ten metres was wide open and contacts with UA's were 'ten a penny.' A large number of QSL's resulted. These cards form an interesting record of the Russian Space researches over the years from Gargarin in 1961 to Lunik 1966, Venura probe 1967, Soyoz 4 linking with Soyoz 5 in 1969, and the Luna 10. The only card showing the American moon mission was one from a DB station. Other Russian cards show 'heroic' scenes but one or two show 'folk' heroes. I am curious to know the origin of the character shown on one card as he looks most un-Russian, almost like an English squire.



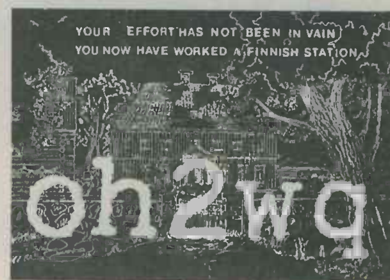


Cartoons showing the operator are uncommon but the two illustrated are both from Sweden.

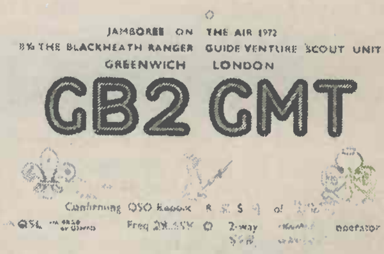


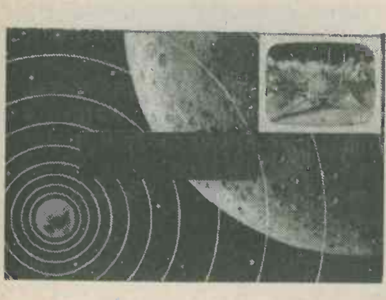


Other cards borrow well known cartoon characters. The author's favourite comic card is the one from DB5YH showing a TV set suffering from TVI with CQ on the sound channel. (A thinks balloon from the viewer shows a football game.) A card from Finland runs a close second. The caption reads: Your efforts have not been in vain you now have worked a Finnish station.



Special calls are marked by special cards. The one illustrated GB2GMT was a Jamboree of the air station on the Greenwich Meridian.





Blatant advertising is rare. Commercial organisations may supply 'hams' with cards but the advertising is muted. G3NTV's card carries the company name — Pye Telecommunications. The only card that is a pure ad is one from a short wave listener. This card is a reproduction of a famous Guinness ad (Guinness is . . . well Guinness!).

Thus QSLing may be an art but QSL card display is an art in itself. ■

THE "MAINS MICRO-AMP"

by Sir Douglas Hall, K.C.M.G. **Part 1 (2 parts)**

A really unique a.f. amplifier.

This little amplifier which, complete with speaker, is in a case measuring about $4\frac{1}{2}$ by $3\frac{3}{4}$ by $1\frac{1}{2}$ in., can be carried in a jacket pocket. The output is 100mW, and the input will match impedances of up to 1M Ω with full loading at less than 500mV at that impedance, whereupon good results can be obtained with a record player equipped with a high output crystal cartridge. Since the amplifier is essentially a mono type, a compatible cartridge is suggested, and an Acos GP91-3Sc will do nicely. For the cost of two extra components, a dual input version can be built giving an alternative input for impedances from 100 Ω or less up to about 2k Ω. Sensitivity, in terms of input voltage, is considerably higher at the low impedance because one of the extra components is a 1:25 step-up transformer.

The speaker is a 3 in. type and, obviously, hi-fi results cannot be expected. Nevertheless, a pleasing output at a volume sufficient for most ordinary rooms is given.

A STRANGE DEVICE

The circuit is shown in Fig. 1(a), and it will be seen that it incorporates what, to some readers, may well be a strange device — a pentode valve. The valve offers quite a number of advantages in the circuit, including a high input impedance at its control grid and a consistent amplification factor between valves of the same type number.

There is not the spread in gain that is offered by high input impedance semiconductor devices, and which has to be controlled by extra stages and negative feedback. The amplifier circuit is extremely simple, as is at once apparent, and all units built to the circuit will offer the same performance. The DL96 specified has a filament, whereupon there is no separate cathode to warm up after switching on. When connected as shown in the diagram, this filament requires 2.8 volts at 25mA.

There is a simple top-cut tone control at the input, this consisting of R1, VR1 and C1, and these components are followed by the volume control, VR2, the slider of which connects direct to the control grid of the valve. There is a similar direct connection between the anode of the valve and the base of the transistor, and the anode current of the valve is also the base current of the transistor. The transistor collector current heats the valve filament and then passes through R2 to provide grid bias, with C2 functioning as an a.f. bypass capacitor. There is a d.c. negative feedback stabilizing loop here: if the base current of the transistor tends to increase for any reason so does its collector current, the pentode bias voltage across R2 increases in consequence, thereby reducing the anode current and counteracting the increase in transistor base current.

The final output is taken from TR1 emitter, with the transistor functioning as an emitter follower. A high impedance speaker is used, which obviates the need for an output transformer.

Some readers will have already observed that the transistor cannot function without base current and that the valve cannot pass anode current until the filament is heated by the transistor collector current. How, therefore, does the amplifier start up? The answer is to be found in the zener diode D1. When the on-off switch S1 is closed, full-wave rectification takes place through D3 and D4, with C3 acting as a reservoir and smoothing capacitor. Despite the fact that the valve does not initially pass anode current, there is a direct current path across C3, this being given by the speaker speech coil, D1, the filament of V1 and R2. For the moment we will assume the use of an 80 Ω speaker. On first switching on, a direct voltage of 16 volts is formed across C3, and about 20mA of direct

COMPONENTS

Resistors
- R1 100k Ω ¼ watt 10%
- R2 22 Ω ¼ watt 10%
- VR1 1M Ω potentiometer, log (see text)
- VR2 1M Ω potentiometer, log, with switch S1 (see text)

Capacitors
- C1 3,300pF disc ceramic or ceramic plate
- C2 470μF electrolytic, 6V. Wkg. (see text)
- C3 1,000μF electrolytic, 25V. Wkg. (see text)

Transformers
- T1 mains transformer, secondary 20-0-20V at 30mA, type MT241CS (Douglas)
- T2 microphone transformer type TT53 (Repanco — see text)

Semiconductors
- TR1 BFR81
- D1 BZY88C12V
- D2 BZY88C2V7
- D3 1N4001
- D4 1N4001

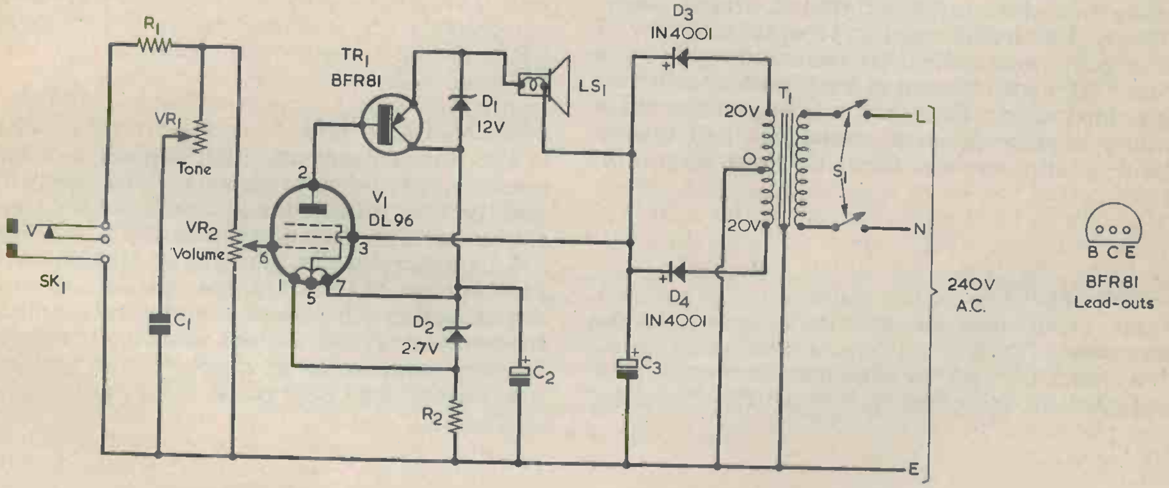
Valve
- V1 DL96

Switch
- S1 d.p.s.t. toggle, part of VR2

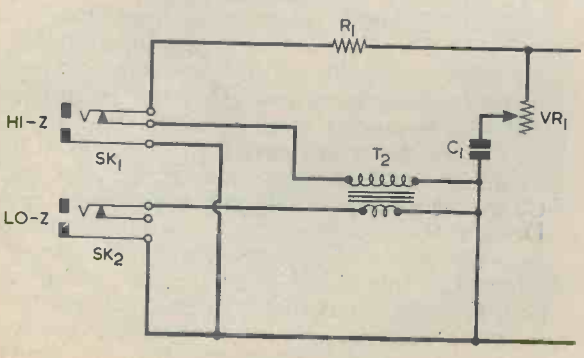
Sockets
- SK1 3.5mm. jack socket
- SK2 3.5mm. jack socket (see text)

Speaker
- LS1 120 Ω or 80 Ω, 3in. or 2¾in. (see text)

Miscellaneous
- B7G valveholder
- Spindle coupler (see text)
- 6 brackets, Lektrokit LK2331 (see text)
- 2 knobs
- 3-core mains lead
- Materials for case and "chassis" (see text)
- Wire, solder, etc.



(a)



(b)

Fig. 1(a). The circuit of the "Micro-Amp" amplifier in its single input form (b). A second jack socket and a step-up transformer are incorporated at the input for the dual input version current flows, causing voltage drops of 1.6 volts across the speaker, 12 volts across D1, 2 volts across the filament and 0.4 volt across R2. The 2 volts across the filament is enough for this to commence emission and for anode current to flow. This current flows into TR1 base and TR1 collector current rises rapidly to its final value, causing increased current to be drawn from C3. The voltage across the valve filament increases until it is limited to about 2.7 volts by zener diode D2.

Under these conditions there is now a little in excess of 30mA drawn from C3 and the voltage across it falls to 14 volts. The voltage drops across the components are now about 2.6 volts across the speaker, 2.7 volts across the filament and 0.7 volt across R2, leaving 8 volts across the conductive transistor, TR1. Since D1 is rated at 12 volts it will offer virtually infinite impedance at 8 volts and it plays no further part in circuit operation, its only task having been to cause the circuit to start up after switching on.

If a speaker with a 120 Ω speech coil is used the currents will be slightly lower, but the same general effect will take place. Although the description of circuit start-up has been lengthy the actual process is short, there being only a slight delay due to the fraction of a second needed for the filament to heat up.

Fig. 1(b) shows the optional dual input circuit, which allows a second low impedance input to be applied. T2 is a 1:25 step-up transformer with its small winding connected to the low impedance input jack socket, SK2. Its large winding connects to the amplifier high impedance input via the break contact of SK1. Inserting a jack plug into the high impedance socket then automatically removes the transformer winding from circuit. Since colour coding of the transformer type employed for T2 seems to be inconsistent, its two windings have to be identified with the aid of a multimeter switched to an ohms range. The small winding connected to the low impedance input socket will, of course, have a much lower resistance than the large winding.

COMPONENTS

Some comments are required concerning the components. Apart from normal retail sources, the valve type DL96 can be obtained from mail order suppliers who specialise in valves. The transistor type BFR81 is also available from several suppliers, including Electrovalue Ltd. The two potentiometers need to be small in physical size and those used in the prototype were type P20 with a body diameter of 0.79in. The electrolytic capacitors employed for C2 and C3 were Siemens axial lead components. Both the capacitors and the P20 potentiometers can be obtained from Electrovalue Ltd.

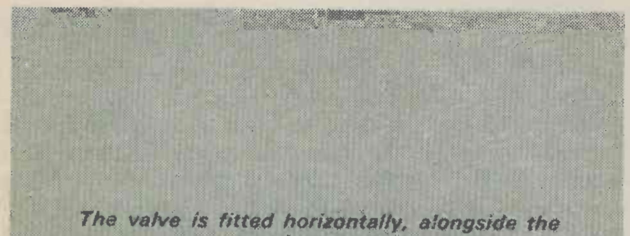
The author's amplifier employs a 120 Ω 3in. speaker obtained from Radio Component Specialists, 337 Whitehorse Road, Croydon, and this speaker is the preferred type. An alternative is the Eagle 80 Ω speaker type TP26G, which is available from a number of stockists. Whatever speaker is used it should be obtained before starting on the constructional work to ensure that there are no discrepancies in the dimensions of the "chassis" parts. The TT53 transformer specified for T2 can be obtained from Home Radio (Components) Ltd. It should be noted that this transformer is only required if it is intended to build the dual input version of the amplifier. Similarly, jack socket SK2 is only required for the dual input version.

Six angle brackets, Lektrokit Cat. No. LK-2331 are needed. A spindle coupler, which allows a $\frac{1}{4}$in. spindle to be extended by adding a further length of $\frac{1}{4}$in. spindle, is also required. A suitable type can be obtained from Home Radio.

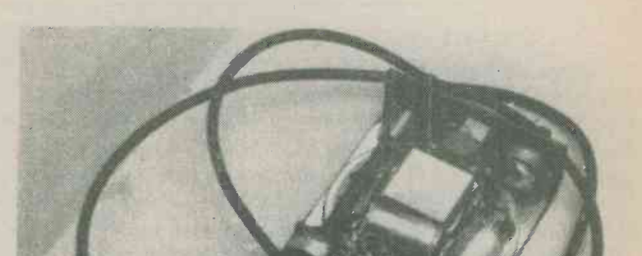
The mains transformer is a Douglas Code No. MT241CS and this can be obtained from stockists of Douglas transformers or direct from the manufacturer at Douglas Electronic Industries Ltd., Eastfield Road, Louth, Lincolnshire, LN11 7AL.

CONSTRUCTION

The components are mounted on a "chassis" consisting of the parts shown in Figs. 2(a), (b), (c) and (d). The material is $\frac{1}{8}$in. thick s.r.b.p. sheet or similar, and the two side pieces of Fig. 2(a) and (c) will be secured to the item of Fig. 2(b) by means of four of the Lektrokit angle brackets. The parts shown in Figs. 2(a), (b), (c) and (d) should now be cut out and drilled. All the holes A to L inclusive, together with holes Q, S and T, are drilled $\frac{1}{8}$in. diameter to take 6BA bolts. With the exception of



The valve is fitted horizontally, alongside the speaker magnet



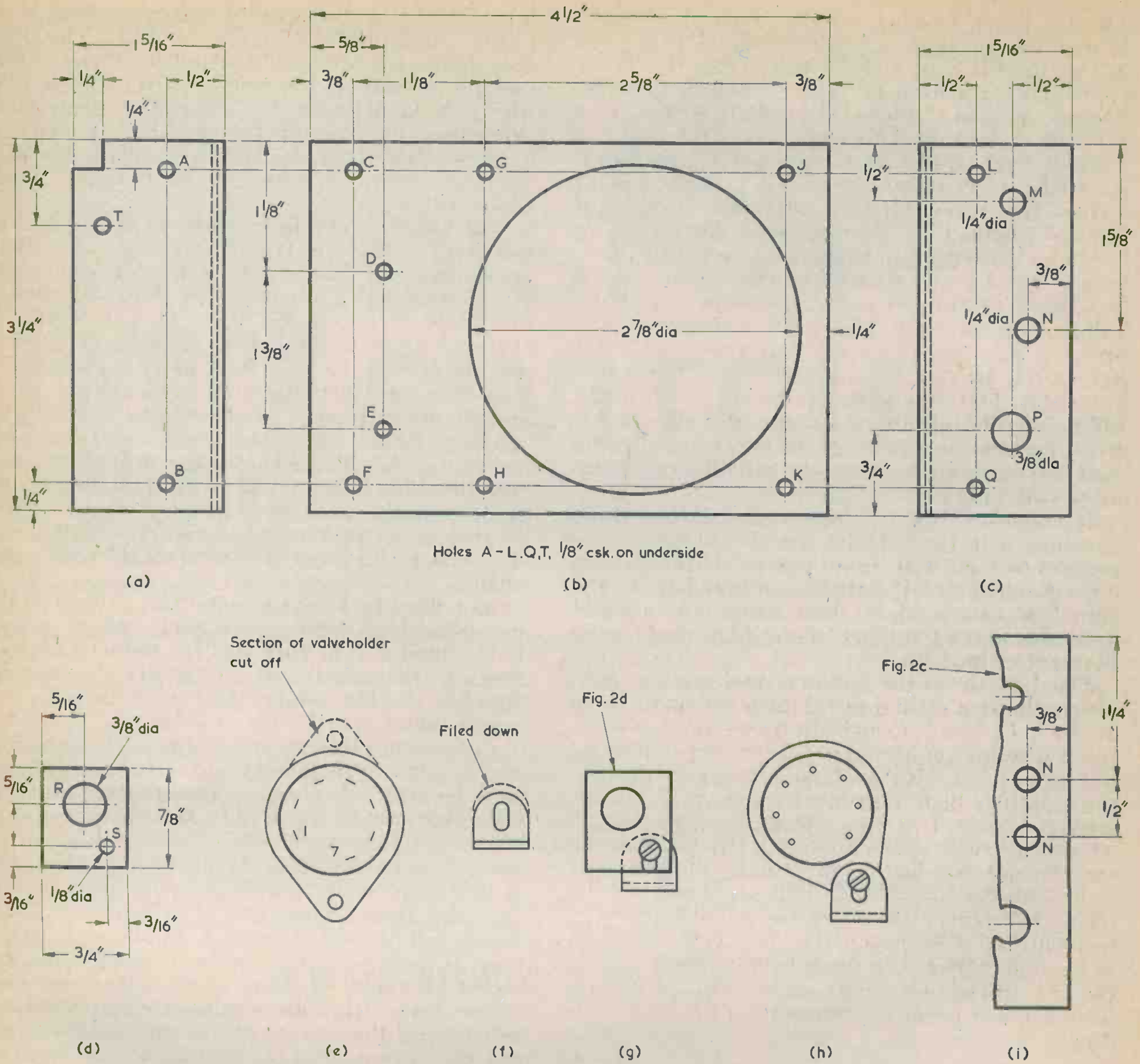
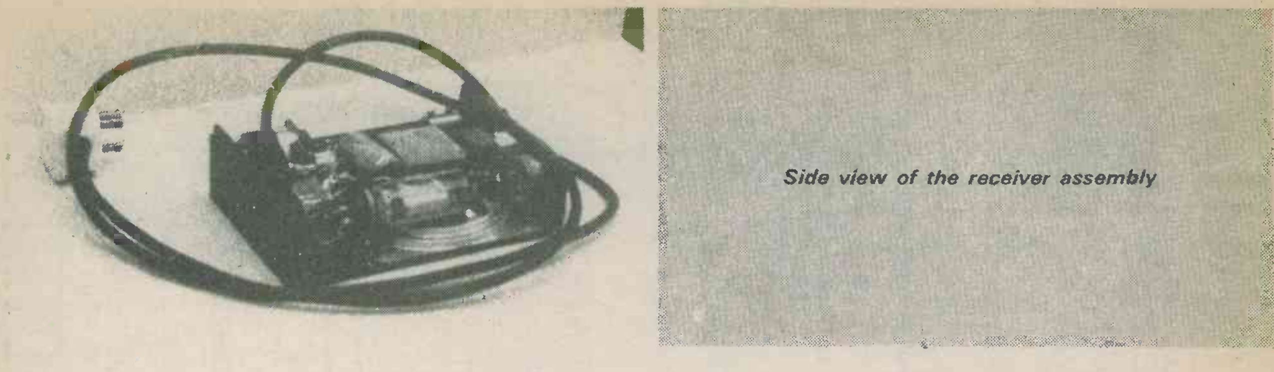


Fig. 2(a). One of the end panels of the amplifier "chassis" (b). The main panel, on which the speaker and mains transformer are mounted (c). The other end panel. The input jack socket is mounted at hole N, and VR1 at hole P. The extended shaft of VR2/S1 passes through hole M (d). The item on which VR2/S1 is mounted (e). Part of the B7G valveholder is cut away, as shown here (f). Three of the Lektrokit brackets are filed down (g). The part of Fig. 2(d) is fitted to one of the filed down brackets. After assembly, the height of the bracket is adjusted so that the large hole is approximately at the same level as hole M (h). The valveholder is secured to another of the filed down brackets (i). Two holes N are required for the dual input version

hole S, they are all countersunk on the underside (as presented in the diagrams, where what may be assumed to be the top side is shown). Holes D and E will be used for mounting the mains transformer, and they may be checked against the actual component before drilling. Holes G, H, J and K correspond to the four mounting holes of the R.C.S. 120 Ω speaker. The holes are still required if the Eagle 80 Ω speaker is used, but this speaker does not have mounting holes and is affixed to the section of Fig. 2(b) with adhesive. The round speaker aperture should also be smaller in diameter to suit the Eagle speaker when this is employed. Holes M and N are $\frac{1}{4}$in. in diameter and holes P and R are $\frac{3}{8}$in. in diameter. It should be noted that Fig. 2(c) shows what is required for the single input version of the amplifier; two holes N are needed for the dual input version, these being positioned as shown in Fig. 2(i).

The B7G valveholder is filed down to the appearance illustrated in Fig. 2(e), after which three of the Lektrokit brackets are filed down as shown in Fig. 2(f). The part of each bracket which is filed down is that having the elongated and not the round hole. The item of Fig. 2(d) is then bolted to one of the filed down brackets by means of a



Side view of the receiver assembly

6BA bolt and nut, in the manner shown in Fig. 2(g). It is on the outside of the bracket, i.e. on the side opposite the bracket section with the round hole. The bracket will later be secured at hole G, whereupon VR2/S1 can be mounted in hole R with its spindle (extended with the aid of the spindle coupler and a further length of ¼in. shaft) passing through hole M. This arrangement is shown in Fig. 3(b). The valveholder is next secured, with a 6BA bolt and nut, to another of the filed down angle brackets, as illustrated in Fig. 2(h). The valveholder is on the inside of the bracket. As is shown in Figs. 3(a) and (b), this bracket will be mounted at Hole H, allowing the valve to lie horizontally on the opposite side of the speaker magnet to the spindle of VR2/S1. The bolts securing these last two brackets pass also through the speaker frame when the 120 Ω speaker is used.

The remaining four angle brackets are employed to secure the sections of Figs. 2(a) and 2(c) to that of Fig. 2(b). The third filed down bracket is fitted at hole K, to give clearance for VR1 at hole P. The round holes of all four brackets are those secured to the item of Fig. 2(b), and the bolts which pass through the holes J and K also pass through the speaker frame when the 120 Ω speaker is employed.

Components may now be fitted as in Figs. 3(a) and (b). All 6BA mounting bolts should be countersunk types. A solder tag is secured under one of the mounting nuts for T1. If the 120 Ω speaker is used, a second solder tag is secured under its mounting nut at hole H. The valve is not inserted in its socket at this stage. Hole T, which has not been referred to, apart from stating that it is drilled ⅛in. diameter, will be used to secure a clamp for the mains lead. If the dual input version is being built, jack socket SK1 may be fitted at the hole N which is nearer VR1. VR1 also requires a slight modification for the dual input version, and details of this will be given in Part 2. The extra ¼in. shaft for VR2/S1 can conveniently be the excess which is cut off the spindle of VR1.

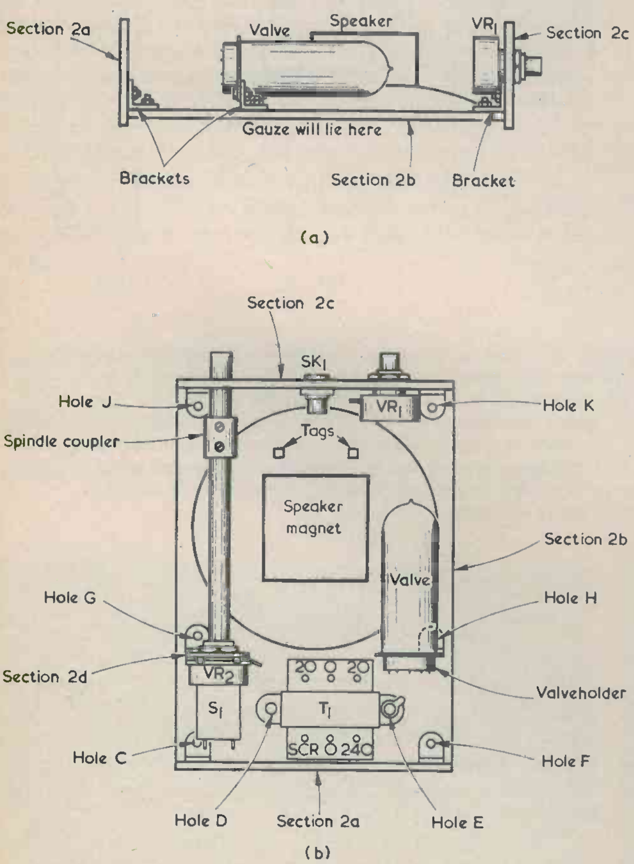


Fig. 3(a). Side view of the amplifier assembly
(b). Top view of the amplifier before wiring

NEXT MONTH

Constructional information will be completed in next month's concluding article, which will start by giving details of wiring up.

(To be concluded)

In your workshop

SINGLE-POLE DISPLAY SWITCH

An Exercise in diode logic

"It's this mate of mine," proffered Dick.

Smithy raised an eyebrow.

"Yes?"

"Well," continued Dick, "he's dead keen on short wave listening. And he's asked me to knock up an aerial tuning unit for him."

"That," commented Smithy, "shouldn't be too much of a problem. So far as I can remember there was a design for an aerial tuning unit recently in *Radio & Electronics Constructor.*"

"That's right," confirmed Dick. "In fact I'm basing the one I'm making for my mate on that design."

AERIAL TUNING UNIT

"Working from memory," stated Smithy thoughtfully, "all that you'll need for the aerial tuning unit is a tapped coil with two variable capacitors down to earth at either end. The aerial connects to one end of the coil and the receiver aerial input connects to the other end. Or, rather, to the portion of the coil which has been tapped into circuit." (Fig. 1.)

"Exactly," said Dick. "The *Radio & Electronics Constructor* design had eight taps into the coil but I've added another two to make it ten taps overall. Which fits in very nicely with a 2-pole 10-way rotary switch which my friend happens to have on hand. One of the poles switches the taps in the coil."

"And that," remarked Smithy, "leaves you with a second 10-way rotary switch section which has nothing to do."

"That's my problem."

Puzzled, Smithy reached for his tin mug and drank deeply. It was the Workshop lunch break and, as always, Dick had managed to direct the conversation to matters technical.

"How do you mean, that's your problem?" asked Smithy, turning to his assistant. "If you have a 1-pole 10-way switch section with nothing to do, you simply make no connections to it."

"That's what I intended doing at first," said Dick morosely. "Then I had what I thought at the time was a really bright idea. I decided to couple that switch section to a 7-segment l.e.d. display so that it would show a different number, from 1 through to 9 and then 0, for each switch position in order."

"Very good," commended Smithy. "Your aerial tuning unit would look really effective and technical if it had an l.e.d. display showing the coil tap switch positions. It will be a bit expensive, though, if you power the display from a battery."

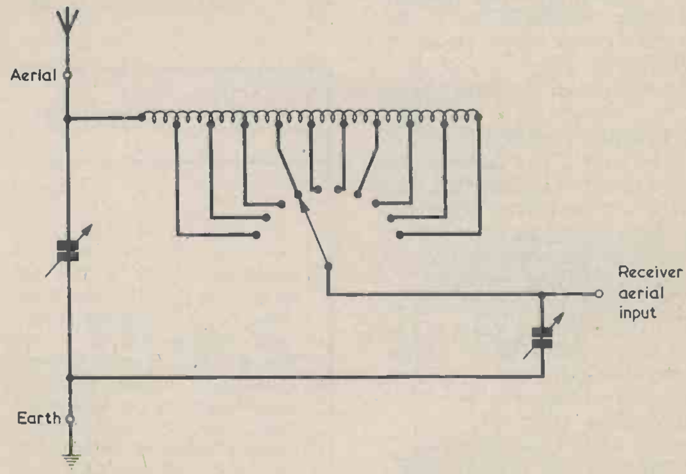


Fig. 1. Dick's short wave aerial tuning unit. He proposed to use a second pole of the 10-way rotary switch to light up a 7-segment l.e.d. display so as to form the numbers 1 through 9 to 0. (Constructional details of an aerial tuning unit — with 8 taps in the coil — were given in the January 1977 issue)

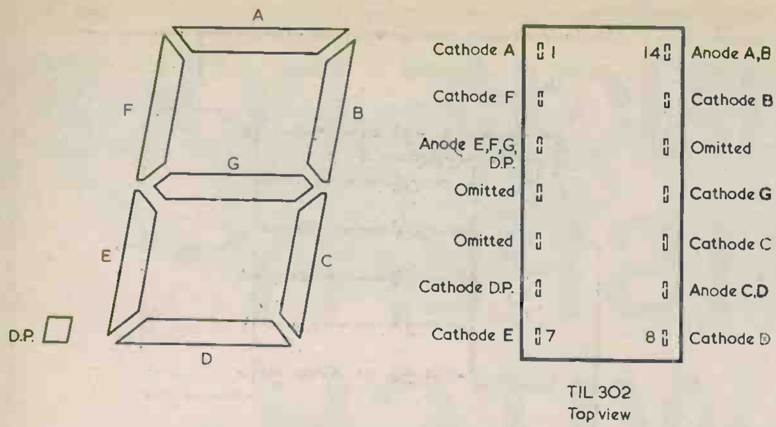


Fig. 2. The segments and decimal point for the TIL302, together with the pin connections. The pins point away from the reader

"The supply for the l.e.d. display raises no difficulties," said Dick. "I've fitted a little mains supply which gives about 9 volts d.c. at several hundred milliamps. What's got me baffled is the circuit that's needed between the switch and the display. So far as I can make out, it's impossible to control a 7-segment display from a single-pole 10-way switch!"

"Oh, come on," snorted Smithy. "It should be a piece of cake."

"Well, it isn't, and I'm beginning to think that it simply can't be done. Here, take a look at the circuit I've worked out up to now."

Dick rose from his stool, picked up several sheets of paper and walked over to Smithy's side.

"For starters," he went on, handing one of the pieces of paper to the Serviceman, "here's the data on the pinning for the display I'm going to use. It's a common anode display type TIL302, which is much the same as any other small common anode display."

Smithy examined the paper (Fig. 2.)

"This is quite a standard sort of display," he said. "You connect the anodes to a positive supply rail, and you switch on whatever segments you need for each figure by coupling the cathodes to the negative rail via series current limiting resistors."

"That's right," confirmed Dick. "In fact, I've made out a list of the segments which have to be lit for each of the numbers."

He handed a second piece of paper to Smithy. (Fig. 3.)

"All this is very straightforward," said Smithy as he looked down Dick's list of segments. "I see you've left yourself two options for the figures 6 and 9. They can be either with or without a tail at the top or the bottom."

"I'm beginning to wonder why I even bothered to think about numbers as high as 6 and 9," said Dick disconsolately, as he gave Smithy a third and final sheet of paper. "Here's my switching circuit so far, and it hasn't even got beyond figure 2!"

STEERING DIODES

Smithy glanced at Dick's attempted circuit, and a gleam of amusement crossed his face. (Fig. 4(a).)

"How," he asked gently, "is this supposed to work?"

"Well," explained Dick, "at first sight everything seemed very obvious. As you can see, I'm going to use 1kΩ series current limiting resistors for each segment cathode. Now, the general idea is that on position 1 of the switch the negative supply rail couples to segments B and C to give figure 1. Then on position 2 the negative rail couples to segments B, A, D, E and G. But, as soon as I'd drawn the circuit up to this stage I realised that it couldn't possibly work."

"Why not?"

"Because you'd switch on all the segments B. C. A. D. E and G with the switch either at position 1 *or* position 2. You'd be bound to, because all the negative ends of the 1kΩ limiting resistors join together at contacts 1 and 2 of the switch. For the life of me I just can't see how you can get over the problem. To switch the 7 segments you need a 7-pole switch!"

"Here, take it easy," chuckled Smithy. You *can* control the 7 segments fairly easily with a single-pole rotary switch, and all you have to do is to insert steering diodes in the feed to each segment. Like this."

Smithy took out his pen and added seven diodes to Dick's circuit (Fig. 4(b).)

"How," asked Dick suspiciously, "do those work?"

"They isolate the switched-on segments from the other segments," explained Smithy. "When the switch is in position 1, segments B and C are lit up via their series resistors and, now, via their series diodes. At the same time, the second diode down prevents the negative voltage applied to segment B being passed to segments A, D, E and G. So, only segments B and C light up."

"I don't quite get this," said Dick unhappily. "Also, does this steering diode business mean that you need a series diode for *every* connection to *every* segment?"

Smithy leaned over, pulled his note-pad towards him and commenced to sketch out a circuit.

Number Displayed	Segments Lit
1	B C
2	A B D E G
3	A B C D G
4	B C F G
5	A C D F G
6	C D E F G or A C D E F G
7	A B C
8	A B C D E F G
9	A B C F G or A B C D F G
0	A B C D E F

Fig. 3. The l.e.d. segments which are lit to display numbers from 1 through to 0. There are two options for 6 and 9 according to whether these numbers have a "tail" or not

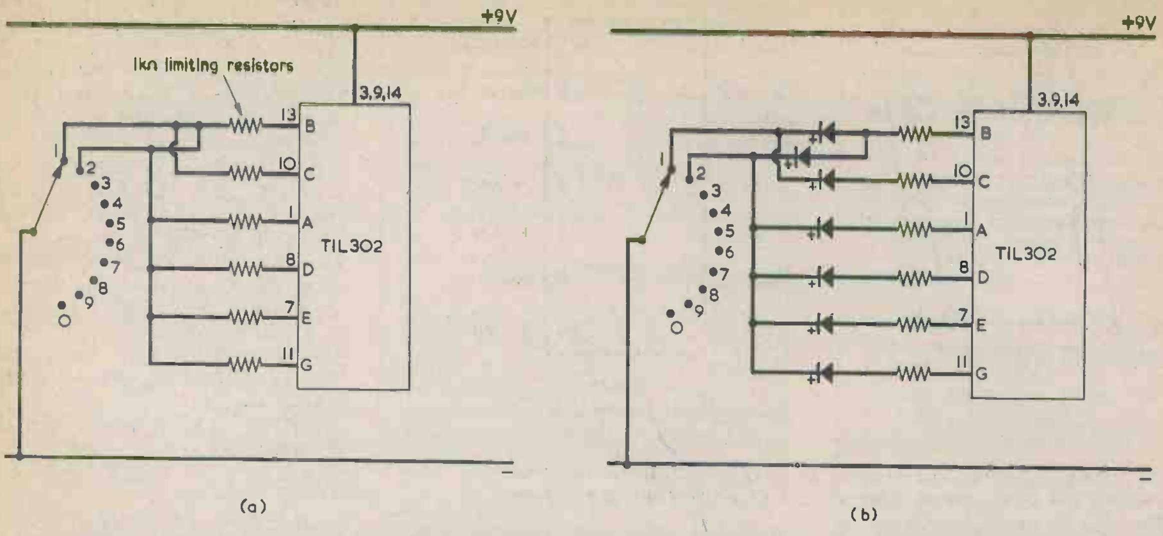


Fig. 4(a). Dick's first attempt at wiring the 10-way switch to select numbers 1 and 2. Naturally, all six segments light up at both the switch positions
(b). The segments can be isolated by inserting series steering diodes, as here

"In a practical circuit of this type," he stated, "you don't need a steering diode for every segment connection. If you use a few common-sense rules you can reduce the number of diodes required by selecting groups of segments which recur with different numbers. In a few instances you can even omit some of the diodes altogether. Let me give you a simple example of how the diodes work."

Smithy had now completed the circuit and he showed it to Dick. (Fig. 5(a).)

"Here's a little demonstration of what I mean," he continued. "Let's assume that we have a single-pole 3-way switch and that we want it to light up segment A at position 1, segment B at position 2 and both segments A and B at position 3. I've drawn out the circuit without diodes, in the same way that you draw up your circuit. Tell me what will happen with this circuit as it stands."

"The same sort of thing that would have happened with mine. Both segments will light up at switch positions 1, 2 and 3 because, if you trace the circuit through, the left hand ends of both the current limiting resistors are all joined together at these switch contacts."

"Very good. I'll now add a diode in series with each switch contact and the associated current limiting resistor. Like this."

Smithy redrew the circuit with the diodes incorporated. (Fig. 5(b).)

"I'm beginning to see what you're driving at, Smithy," said Dick intently, as he studied the circuit. "Now, when the switch is at position 1, segment A is lit up via D1 and the series resistor. But segment B can't light up because D3 is reverse-biased."

"You're getting the idea."

"Then," said Dick, his excitement rising, "if you put the switch to position 2, segment B lights up, but segment A doesn't because it's D4 which is now reverse-biased. And when you go to position 3, both segments A and B are lit up because D3 and D4 are now forward-biased and can pass current. Hey, Smithy, these steering diodes certainly clear up the common connection snags at the switch contacts!"

Dick's gloom had completely vanished as he considered the vistas opened up to him by the steering diodes.

"I haven't finished yet," grinned Smithy, drawing a further circuit. (Fig. 5(c).)

"You've taken out two of the diodes!"

"That's right," agreed Smithy. "In this particular switching

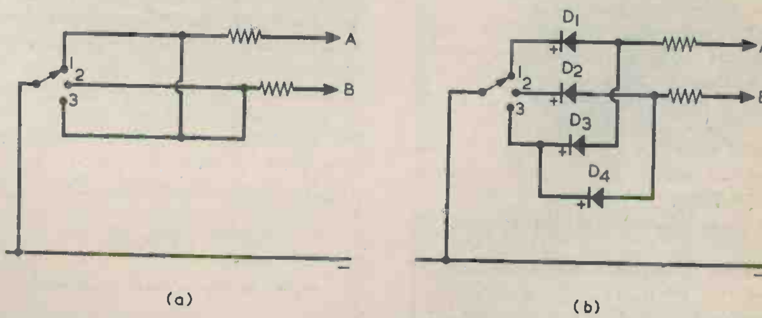
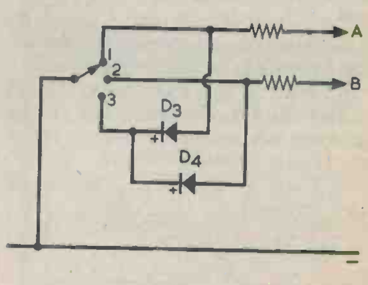


Fig. 5(a). First step in working out a simple steering diode circuit. It is desired to have segment A lit at position 1 of the switch, segment B lit at position 2 and both segments lit at position 3. As shown here the circuit cannot function correctly
(b). If four steering diodes are added, the circuit operates in the required manner
(c). A little thought reveals that two of the diodes are unnecessary and that they can be omitted from the circuit



application, D1 and D2 aren't needed. On position 1, segment A lights up as before, and D3 blocks any circuit through to segment B. It is segment B which lights up at position 2, with D4 blocking the circuit through to segment A. And on position 3 both segments are alight because D3 and D4 are now forward-biased and conducting."

REVERSE OPERATION

With a flourish of triumph, Smithy picked up his tin mug, drained it and handed it to Dick. Following the long-established Workshop custom, Dick took it over to the cracked teapot on the table alongside the Workshop sink for replenishment.

"Well," he said cheerfully, as he returned with the refilled mug, "you've certainly opened my eyes so far as this steering diode business is concerned. As you've shown me, you use the diodes to prevent segments other than those you've selected lighting up. And if you're only lighting one segment at any switch position you don't need a diode at all. Now let's have a look at that list of segments I made up which have to be alight for each number which is displayed."

Dick picked up the piece of paper he had previously handed over to the Serviceman. As he scanned it, his earlier gloom noticeably reasserted itself.

"What's up?"

"It's all those segments which have to be switched on," wailed Dick. "There must be at least 50 of them, and there are obviously no single segments for any number."

"That means," remarked Smithy, "that at the first attempt at the circuit you'd need about as many steering diodes as there are segments. However, these can be reduced by gating together groups of segments if these repeat sufficient times with different numbers. Even so you'd need, rough check, something like 30 to 40 diodes."

"Something like to 30 to 40 diodes!" gasped Dick incredulously. "Just to switch a 7-segment display!"

"You could, of course," suggested Smithy, "drop the idea of using a 7-segment display with this aerial tuning unit of yours."

"I can't drop it," moaned Dick. "I've already cut out the hole for it in the front panel!"

Smithy sipped contentedly at his tea.

"I must say," he remarked dispassionately, "that you're disappointing me quite a bit today."

"How come?"

"Well," said Smithy, "you're usually the guy with the bright ideas. And there's one particularly obvious idea sitting right under your nose and you haven't even thought of it yet."

"Am I? Is there? Where?"

"Just consider the situation. Here you are, going up and down the agony column and getting yourself all worked up over the number of segments you have to turn on to form the numbers. Why turn the segments on?"

"Why turn the segments on?" repeated Dick. "Dash it all, they've *got* to be turned on!"

"Start thinking in the reverse direction."

"I don't follow you."

"At the moment," stated Smithy, "you're starting with the premise that all the segments are turned off and you then make the further premise that the required ones have to be turned on."

"Hey, what are all these premises you're dragging in?"

"They're perfectly legitimate premises. Indeed, you could call them licensed premises!"

There was silence for some moments.

"Just," sighed Smithy, "concentrate on the argument."

"Okay then. What you're saying is that I shouldn't think of forming numbers by turning segments on."

"That's right."

A sudden light of comprehension shone in Dick's eyes.

"In other words, I should think of forming numbers by turning segments *off*."

"Exactly. Assume that all the segments are turned on and that each switch position causes some to be turned off."

"Blimey," said Dick, impressed. "That really is a new angle. Here, let's make up a new list which shows the extinguished segments for each number."

Eagerly, he picked up his earlier list and, with its aid, made up a second list of the segments which had to be extinguished for each number. (Fig. 6.)

"Do you see what I'm getting at?"

"Gosh Smithy, I'll say I do. The switching requirements are much simpler now. If I assume that the figures 6 and 9 are both to have a tail, I only need to extinguish one segment to get those two numbers. The same applies to 0. And I don't have to extinguish any segments at all for the figure 8!"

"Which means," chimed in Smithy, "much fewer steering diodes then would be needed when the switch turns segments on. I should imagine that, when we get down to working out the circuit in detail, we can save a few other diodes as well."

L.E.D. EXTINGUISHING

"One thing I'm not too sure about," said Dick uncertainly, "is how we extinguish the l.e.d. segments by means of the switch instead of turning them on."

"That bit's easy," replied

Number Displayed	Segments Extinguished
1	ADEFG
2	CF
3	EF
4	ADE
5	BE
6	B
7	DEFG
8	None
9	E
0	G

Fig. 6. An alternative approach towards displaying the numbers. Far fewer segments are involved when only those which are extinguished are considered. Figures 6 and 9 are both displayed with a "tail"

Smithy, taking up his pen again. "What we do is to connect all the segments permanently to the negative rail via their current limiting resistors. Like this."

Smithy completed a further circuit and pointed at it with his finger. (Fig. 7.)

"When you switch on the supply," commented Dick, "all the segments light up."

"They do," confirmed Smithy. "One way of extinguishing a segment is to short-circuit it, and this is what I do to segment A when, in my circuit, I close switch S1. The current which flows through S1 is still limited to a safely low value by the series current limiting resistor. I may alternatively want to short-circuit a segment via a forward-biased diode, and this is what happens with S2, D1 and segment B. Or the steering diode requirements may necessitate that I short-circuit a segment via two forward-biased diodes in series, and this state of affairs is given by S3, D2, D3 and segment C. Closing S3 causes segment C to turn off."

"What do you use for the diodes? Silicon rectifiers?"

"Yes, silicon rectifiers. Any small silicon rectifiers such as the 1N4001 or 1N4002 would be ideal in a circuit like this."

"That means, then," commented Dick, "that when S3 is closed there will be a voltage drop of about 1.2 volts in D2 and D3."

"True," agreed Smithy. "But the diodes will still allow segment C to be extinguished when S3 is closed. The segment needs something like 1.8 volts across it before it turns on."

"Fair enough," said Dick, satisfied with this explanation. "Now, how about a complete display circuit using the single-pole 10-way switch?"

"That will take a little longer to work out," pronounced Smithy, as he once more took up his tin mug. "Let me get a few calories aboard first, and then I'll get down to it."

Smithy drank with gusto, then proceeded to draw the complete switching circuit on a fresh page of his note-pad. Dick watched him as

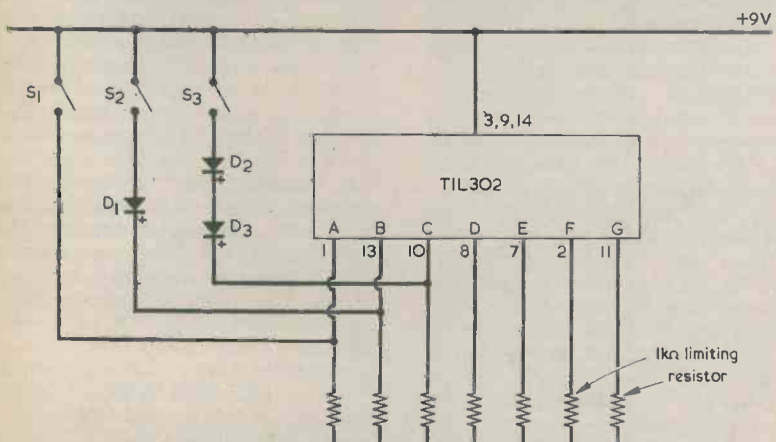


Fig. 7. How to extinguish segments by means of a switching circuit. When S1 is closed, segment A is short-circuited directly. Closing S2 short-circuits segment B via diode D1, and closing S3 short-circuits segment C via the two diodes D2 and D3

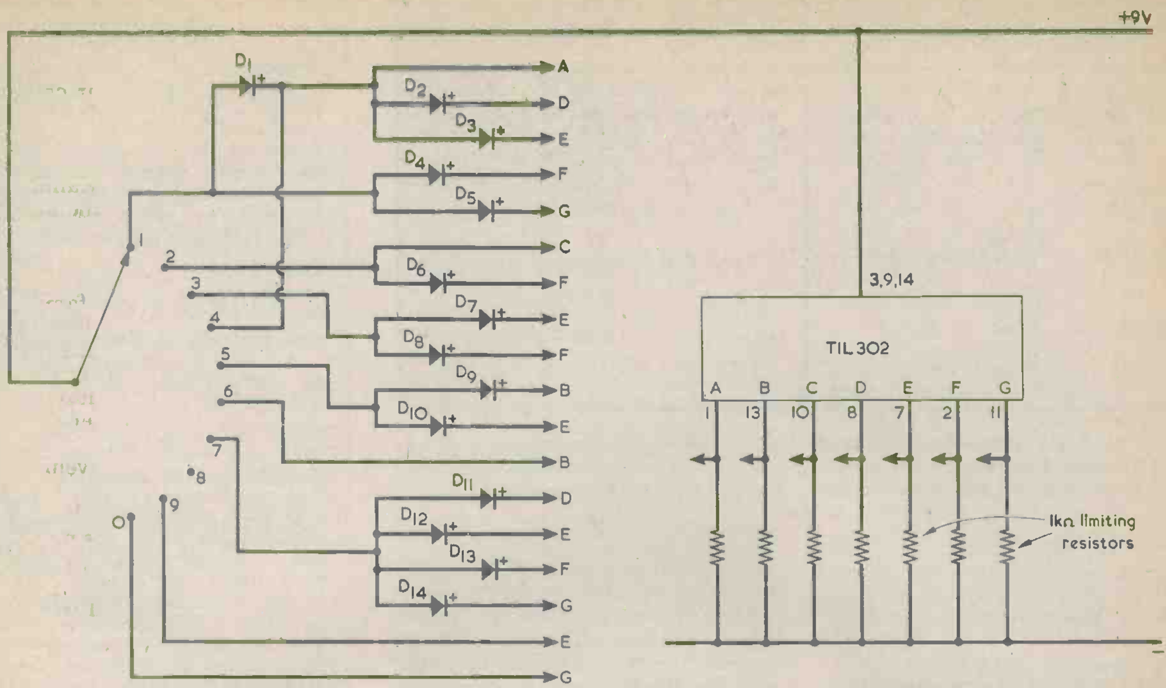


Fig. 8. Smithy's final circuit. The diodes can be any small silicon rectifiers, whilst the 1k Ω limiting resistors may be $\frac{1}{4}$ watt 10% types

the circuit gained shape.

"What did you mean just now," Dick broke in after a minute or so, "when you talked about 'premises'?"

"I was making a play on words," replied Smithy absently.

"Oh."

"You see 'premises' are things you assume at the start of an argument or dicussion."

"Are they?"

"And 'licensed premises' are places like pubs."

"Oh."

"It was," grated Smithy, "intended to be a joke."

"Blimey Smithy, you *never* make jokes."

"So," responded Smithy bitterly, "it would seem."

The Workshop fell silent again, as the now somewhat ruffled Smithy put the finishing touches to his circuit. (Fig. 8.)

"Here we are, then," he announced shortly. "One display switching circuit complete. And I've managed to prune down the number of diodes to 14 only."

"Gosh, that sounds good," replied Dick keenly. "I can see that you've left them out for 6, 9 and 0. Where are the other places where you've left out diodes?"

"The next is at segment C," said Smithy, his irritation disappearing as he regarded his circuit fondly. "Segment C only appears once in the whole list of numbers, and so it doesn't need a diode. I've also made a group of A, D and E, which appear both with number 1 and with number 4, so that saves another diode or two. Segment A only appears twice in the list, and on both occasions it is partnered with segments D and E. So it doesn't need a diode either."

"Stap me, that's crafty," said Dick enthusiastically. "Let's go through the switch positions from 1 right through to 0 at the bottom."

"You can do that yourself."

"Okay, let's start with position 1, then. At this position the positive supply connection goes through diode D1 to segments A, D and E, segment A being without a diode as you've just mentioned. It also goes through D4 and D5 to segments F and G. So that's got segments A, D, E, F and G extinguished, to give figure 1."

"That's the figure which requires more extinguished segments than any of the others," commented Smithy. "Position 2 is next."

"Okeydoke. Well, position 2 turns off segments C and F. After that, position 3 causes segments E and F to go out. On position 4, the positive connection goes to the same group, A, D and E, which were extinguished at position 1."

"Also," said Smithy, "diode D1 prevents this positive connection getting through to segments F and G. Position 5 causes segments B and E to turn off, whilst position 6 simply turns off segment B."

"Position 7 follows position 6, and it extinguishes segments D, E, F and G," stated Dick. "The next switch position, at 8, simply has no connections made to it because all the segments are lit for this number. So we end up with positions 9 and 0. Position 9 extinguishes segment E, and position 0 extinguishes segment G. And that's the lot!"

CURRENT DRAIN

"It is indeed," confirmed Smithy. "And the circuit isn't excessively complex, either. The current drain from the 9 volt supply will be between 70 and 90mA, varying a little according to the number of segments which are short-circuited. A current drain of this order is quite acceptable when the circuit is fed by a mains power supply."

"What about supply voltages other than 9 volts?"

"You merely change the values of the limiting resistors to allow the same segment current to flow. At 9 volts, the 1kΩ resistors allow a current of about 7mA to pass through each segment when it's lit. For other supply voltages, simply assume that about 2 volts is dropped in each segment and choose a value which causes about 7mA to flow. With a 12 volt supply, for instance, you want limiting resistors which cause 7mA to flow at 10 volts, whereupon these can be 1.3kΩ or 1.5kΩ. They can all be $\frac{1}{4}$ watt types, incidentally."

"Stap me," said Dick enthusiastically, taking up Smithy's final circuit and carrying it carefully over to his own bench, "you've certainly cleared up my 7-segment switching problem for me. That aerial tuning unit is going to look really natty when it's got the display in it indicating each switch position. Oh, and ha-ha!"

"What's that for?"

"I've just seen your gag about the 'lighting premises'!" ■

Radio Topics

By Recorder

★★★★★★★★★

DOG'S RADIO

Apart from the fact that if I repeated some of the jokes I hear on BBC radio in my local pub I'd probably get thrown out, I consider that the Beeb has done an excellent job over the years so far as sound broadcasting is concerned. The very strict foundations laid down in the early days by Lord Reith have provided a stabilizing factor which exists right through to the present day. Above all else, the BBC has acquired a world-wide reputation for accuracy and balanced presentation in all its news services including, in particular, those in the World Service which emanate from Bush House.

Thus it was that I greeted the news that we were to have an independent local station in our area a couple of years ago without a great deal of enthusiasm. Now that the station has become established I have changed my mind and am especially pleased with the parochial atmosphere which pervades much of its treatment of local affairs. One item, for instance, which occurs at a regular time each day, provides information on the stray dogs which have been rounded up during the preceding day and which are currently languishing in the local Dogs' Home. Details are given of each dog's approximate age, breed and colouring, together with the district in which it was found.

A broadcast service which can find room for events which may be mildly catastrophic for the dog-owner, and which are certainly catastrophic for the dog itself, deserves nothing but commendation.

PROTECTIVE DIODE

I recently knocked up a little a.f. oscillator for a few youngsters who wanted to get in some Morse practice. It was quite a basic affair employing what is now virtually the stock device for items of this nature, the 555 timer. The oscillator was powered by a PP6 battery which, as you doubtless know, accepts the same sort of 2-way connector clip as does the diminutive PP3. There wasn't an on-off switch and the oscillator was turned on by the simple process of connecting it to the battery.

So far so good. As I started working out the Veroboard layout it suddenly occurred to me that the oscillator would be used by some pretty boisterous characters who could quite conceivably touch the connector clip against the battery contacts the wrong way round, so that 9 volts with reversed polarity was applied to the oscillator circuit. The clip couldn't, of course, be properly plugged in wrong way round but even a temporary application of a reversed polarity supply could do quite a bit of damage to the 555 timer. It wouldn't do much good to the electrolytic bypass capacitor across the supply rails, either.

And so I inserted a 1N4002 silicon rectifier in series with the positive supply lead. When the battery is properly connected the positive supply current passes through the forward biased rectifier before it hits the electrolytic bypass capacitor and the remainder of the oscillator circuit. If the battery is connected wrong way round all that flows is a tiny and harmless leakage current through what is then a reverse biased silicon rectifier.

Inserting a silicon rectifier in one of the supply leads is an excellent dodge for any battery operated equipment where there is a risk of incorrect connection to the battery. This safety measure incurs a cost of only about 6p in money for the rectifier and only about 0.6V in voltage drop when the battery is connected right way round.

AS SHE IS SPOKE

Talking of jargon, there is certainly plenty of it around these days. I'm beginning to think that TV interviews of politicians and the like are not producing an increase in our vocabulary but are actually causing it to be more and more restricted. Let's take a look at a familiar story from our childhood.

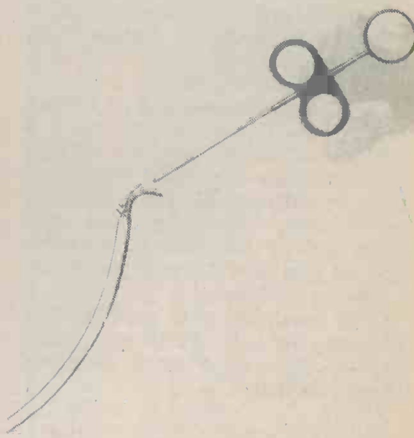
Little Red Riding Hood ventures into the woods to engage in meaningful dialogue with her senior citizen grandmother. Maintaining a low profile to escape the attentions of the wolf she finds what is apparently the old lady in her bed. But this proves to be a non-event because, despite the familiar environment, in no way is the grandmother there in physical presence since the old lady has been in dispute with the wolf before this moment in time. In real terms it is the wolf who, pausing only to state that he regrets any inconvenience, at once makes what is to him a viable attack on the little girl. Finding this counter-productive, she makes good her escape and, hopefully, finds her way into another ball-game.

Perhaps the original was better.

TERMINATING COAXIAL CABLES

One of the more fiddling jobs in television and electronic work is the terminating of coaxial cables. And so, this month, I'll lead in straight away to the first of my photographs, which illustrates one of the Mainliner Range of Lead Extractors, currently available from Eraser International Ltd.

These Lead Extractors automatically eject the centre insulated lead from braided coaxial cables, thereby eliminating the



One fiddling job eradicated. This tool is one of the Mainliner Range of Lead Extractors available from Eraser International Ltd., and it can remove the inner conductor at the end of a coaxial cable without having to manually unpick the braiding need to manually unpick the braiding. As you can see, the tool operates with a simple one-shot action, removing the inner conductor cleanly and neatly.

The Lead Extractors are made in a variety of colour coded sizes to process cables with outside diameters from 3.5 to 13.5mm. If you want further details, these can be obtained from Eraser International Ltd., 2/3 Hampton Court Parade, East Molesey, Surrey, KT8 9HB.

PULSE AND POWER

The second photograph shows the latest development in the Mechtric Engineering line of pulse generator and power supply instruments. This self-contained unit provides essential power supplies and digital signals for electronic circuit development, thereby eliminating the usual cluttered array of bench units.

The instrument is particularly suited for use in the general electronics laboratory, development and test area. It can also prove ideal for Colleges and Universities where, in company with an oscilloscope, it will get most projects under way. The instrument is already being used by a number of leading electronics companies.

Features of the Pulse Generator/Power Supply are a wide range continuously variable pulse generator, three power supplies for t.t.l., CMOS and op-amp circuits, square wave outputs in two phases, no limit to mark-space ratio, gated operation and trigger output, and short-circuit protection for all signal and power outputs.

The power supply outputs all have 0.1% regulation and consist of a 5 volt t.t.l. output at 2 amps maximum, a 4-16 volt CMOS output at 50mA maximum, and a 6-21 volt balanced op-amp output at 100mA maximum. The pulse rate range is 0.45Hz to 5MHz, and the square wave outputs are from 0.45Hz to 500kHz with one output leading by 90 degrees. The instrument runs from 240 or 120 volt 50 or 60Hz mains, and has dimensions of 435 by 90 by 260mm.

The manufacturers are Mechtric Engineering Ltd., 12 Brunel Road, Manor Trading Estate, Benfleet, Essex, SS7 4PS.

OLYMPIC GAMES

I see that Marconi Instruments Limited (a GEC-Marconi Electronics Company) has won a contract to supply television quality monitoring equipment for the new television centre being built in Moscow for the 1980 Olympic Games.

Under the contract Marconi Instruments will supply its Television Automatic Monitoring Equipment, TAME, to measure all the incoming signals from the competition areas together with 20 outgoing programme channels from the television centre which, the USSR has stated, will be the largest of its kind in the world.

Engineers from Marconi Instruments, the Soviet state committee for television and radio broadcasting (Gostelradio) and the Soviet Ministry for Communications Production will be co-operating to engineer and instal the complete system. Soviet engineers are visiting the Marconi Instruments factory at St. Albans in early 1978 to establish compatability between Soviet-made test generators and Marconi Instruments' analysis equipment.

Marconi Instruments first exhibited its TAME system in the USSR at a SIMA exhibition in 1973 and later loaned the equipment to Gostelradio for proving tests on the Soviet television system.

The decision to co-operate on this project was taken at a meeting between Deputy Minister Niemtsov of the Ministry for Communications Production and Richard Foxwell, now Managing Director of Marconi Instruments, in July 1975 following the signing of an "umbrella" agreement between GEC and the USSR state committee for Science and Technology. Since that time Marconi Instruments and Soviet engineers have been planning the system together.

The Marconi equipment is based on a BBC measurement concept and provides quality control by monitoring up to 24 parameters which define the quality of the picture during programme time. The equipment can report continuously or at predetermined intervals and will initiate alarms if quality falls below pre-set limits.

STEEL-CLAD BATTERIES

I was clearing out some junk from the attic the other day when I came across a little makeshift a.f. amplifier I knocked up at least 10 years ago. It was still assembled in a wooden case which just happened to be the right size to take the components and a small loudspeaker and, to be quite frank, I had completely forgotten about it. I was able to determine the time I made it because it was all-germanium except for one silicon diode. The latter was the old Lucas DD000 type, which was one of the first to become available on the home-constructor market.

Also in that wooden case, clamped to one of the sides, was s steel-clad PP7 battery. As a matter of interest I checked its voltage but this was quite definitely a steady zero. For those whose memories are as long as mine, the striking feature of that battery was that it looked just as smart and new as if it had been fitted in the amplifier case only a month rather than a decade ago. If it had been one of the earlier batteries with cardboard cases it would have been oozing no end of yukky gudge over all its surroundings.

The introduction of these steel-clad batteries has certainly paid off in improved performance so far as potential damage to equipment is concerned. Some time after they first became common I recall a report we had from a reader who stated that he had encountered a snag with a steel-clad battery which was secured by a metal clamp to a metal chassis. There was a small leakage current between the internals of the battery and the steel case, causing a current of around a tenth of a milliamp to flow to the chassis. I have never encountered this problem myself but it is something to bear in mind if you are constructing delicate equipment which requires a floating battery supply. It is no trouble at all to play safe and cover the latter with a piece of thin plastic sheet before clamping it to a metal chassis.

"Floating" is of course the jargon term for the battery supply when it is necessary that neither of its terminals should be connected directly to the chassis. ■

This versatile instrument combines the functions of power supply and pulse generator. Manufactured by Mechtric Engineering Ltd., it provides supplies for t.t.l., CMOS and op-amp circuits, and it has a very wide range of pulse and square wave outputs

Trade News

NEW MULTIPURPOSE HAND TOOL

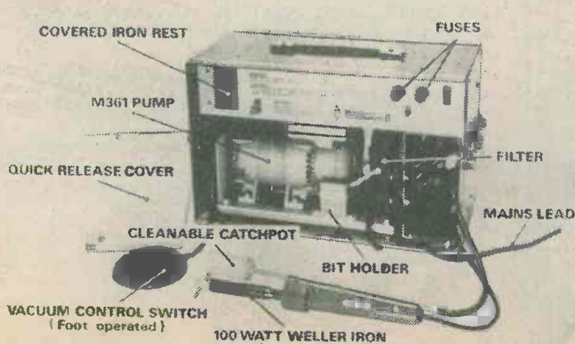
Designed for the amateur electronics constructor, service engineers or for use in the smaller workshops, the new 58-1908K hand tool from Vero Systems (Electronic) Ltd. can perform the complete wire wrapping function. In fact it is three tools in one; it will wrap 0.25mm (30 AWG) wire onto standard 0.6mm (0.025in) square DIP Socket posts, can also be used to unwrap and has a wire stripper. Price is £6.85 each.

LATEST IN DE-SOLDERING TOOL RANGE

The latest in the Soldermaster range of de-soldering tools from Charles Austen Pumps Ltd., 100 Royston Road, Byfleet, Weybridge, Surrey, is the Soldermaster Mk. 8. It has been developed to meet the requirements of Engineers who are now using the latest type of boards and components, the rapid advance of technology in this field has brought about many changes in circuit design over the last ten years and their experience with their Soldermaster Mk. 2, 3 and 5 has enabled them to develop the new unit permitting electronic engineers to make substantial savings in materials and time.

The Soldermaster Mk. 8 utilises the same proven vacuum system as earlier models in that the proven Weller 100 watt temperature-controlled iron heats a hollow bit, on which a vacuum is applied at the control of the operator via an air-operated foot switch. The solder is drawn through the bit into a catchpot where it cools and is later removed by removing an 'O' ring sealed cap. The Soldermaster Mk. 8's vacuum source is the Austen M.361 oil free diaphragm vacuum pump, this has a free flow rate of 15 litres per minute and can achieve a maximum vacuum of 500mm H.G.

The unit is housed in a blue and grey aluminium case 306mm wide x 235mm high x 180mm deep and weighs 8.2 kg. Removing the front panel reveals the iron rest, iron control, foot switch and holder with a range of five different hollow desoldering tips.



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(Continued on page 572)

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(Continued from page 571)

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COLLECTORS ITEMS. Disposing of early issues of radio magazines. *Wireless World:* 34 copies from 1943 to 1949. *Practical Wireless:* 33 copies from 1942 to 1949. *Short Wave Magazine:* 40 copies dating from 1937 to 1948. *Short Wave Listener:* 19 copies from 1947 to 1952. All in reasonable condition. Offers invited? Will sell as four separate lots but not individual copies. Box No. G352.

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(Continued on page 573)

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(Continued from page 572)

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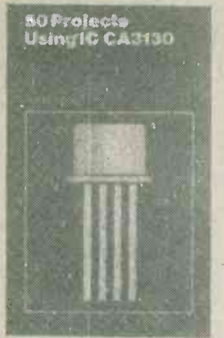

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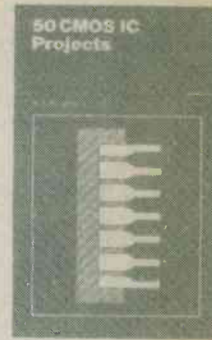

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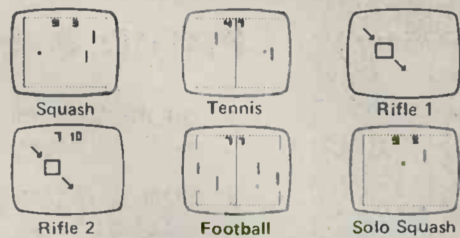

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