Practical projects to build at home

everyday electronics

DEC. 73
15p

ALL INEXPENSIVE AND EASY TO BUILD

HOME RADIO (Components) LTD, Dept. EE, 234-240 London Road, Mitcham, CR4 3HD. Phone 01-648 8422

The Catalogue you MUST have!

250 pages 11¾" x 8¼"

6,785 electronic components clearly listed and indexed

1,750 pictures

10 free Vouchers each worth 5p.

Price list regularly updated

Bookmark with useful list of technical abbreviations

Details of our popular Credit Account Service and our Easy Ordering System are included in the catalogue.

Only 55p. plus 22p POST AND PACKING

POST THIS COUPON
with cheque or P.O. for 77p.

The price of 77p applies only to customers in the U.K. and to BFPO addresses

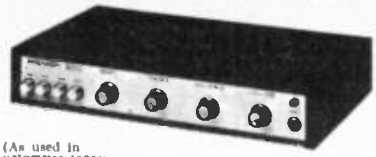
Name ______________________

Address ______________________

____

HOME RADIO (Components) LTD. (Regn. No. London 912966)
Dept. EE, 234-240 London Road, Mitcham CR4 3HD

PREMIER 800 STEREO AMPLIFIER

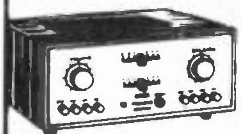


(As used in SYSTEM '800')

A truly high quality stereo amplifier—compare the specification, compare the price. Output: 5 watts per channel. Frequency response: 30–20,000 Hz — 2 db. Distortion: 1% Output Impedance 8 ohms nom. Inputs equalised to R.I.A.A. Magnetic 4mV. Ceramic 100mV. Tuner 100mV. Tape 100mV. Tape out 150mV. Din sockets for inputs and outputs. Controls: Bass, Treble, Volume, Balance, Selector. Mono / Stereo switch. Stereo headphone socket. Attractive slim line design teak cabinet with aluminium front panel. Size 12¼" × 6¼" × 2¼"

ONLY **£17·85** Carr. 50p.

PREMIER PARAGON STEREO HI-FI AMPLIFIER



Gives the best possible reproduction of records, radio and tape at a reasonable price. Fitted with all the controls and facilities you're ever likely to want, the Paragon gives you a degree of sophistication that is usually only found with amplifiers costing twice its price. It has bass and treble slide controls, volume and balance knobs, and eight push-buttons. There's also a standard stereo jack socket on the front panel, plus a ceramic/magnetic cartridge switch and a mains outlet socket on the back panel.

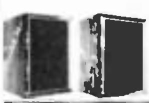
Specification: 10 + 10 watts into 8 ohms. Power/frequency response: 0dB 10 watts into 8 ohms - 3dB 20Hz - 25KHz. Distortion typically less than 0·25%. Inputs for Magnetic phono (4mV) Ceramic phono (66mV) Radio/Tape(100mV). High and low filters. Teak finish cabinet. Size: 12¼" × 5¼" × 10¼".

£27·50 P. & P. 50p.

PREMIER STEREO SYSTEM '64'

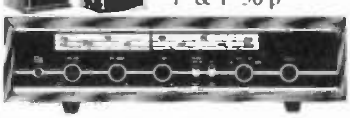
Consists of the Premier Paragon Stereo Amplifier, Garrard SP25 III in teak finish plinth with cover and fitted Goldring G800 stereo magnetic cartridge plus a pair of Marsden Hall Annex 100 Loudspeaker Systems. Complete with Free leads and plugs. **£64** Carr. & Insurance £1·75

MSB-3002 Stereo Tuner Amplifier



£29·50

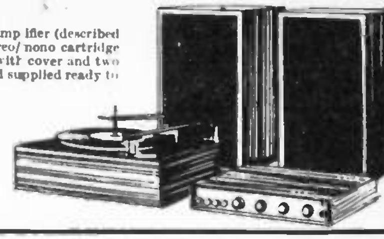
P & P 50p



Fantastically low-priced stereo tuner amplifier covering LW, MW & VHF with built-in decoder for stereo reception. Output 2 x 4 watts RMS. Input for ceramic or crystal pick-up. Output for tape recorder. Switched A.F.C. Stereo headphone socket. Controls—volume, tone, balance, selectors and tuning. Attractive walnut finish cabinet with 2 matching speakers.

PREMIER HI-FI STEREO SYSTEMS

SYSTEM 'ONE'



Consists of the Premier 800 Mk II all transistor stereo amplifier (described left) Garrard auto/manual record player unit fitted stereo/mono cartridge with diamond stylus and mounted in teak finish plinth with cover and two cloth front loudspeaker systems. Absolutely complete and supplied ready to plug in and play. The 800 Mk II amplifier has an output of 5 watts per channel with inputs for ceramic and magnetic pick-up, tape and tuner also tape output socket and headphone socket. Controls: Bass, Treble, Volume, Balance, Selector, Mono/Stereo switch. Headphone socket. Power on/off. Teak finish cabinet with aluminium front panel. Size: 12¾in. × 6¾in. × 2-in.

£43·00

Carr. £1·75

SYSTEM 'TWO'

As above but with slotted front teak finish loudspeakers. Garrard SP25 Mk. III and magnetic cartridge.

£49·50

Carr. £1·75

FREE STEREO HEADPHONES AND ALL LEADS AND PLUGS WITH ABOVE SYSTEMS

NEW PREMIER COMPACT STEREO SYSTEM

All transistor stereo amplifier mounted into teak finish plinth with cover and Garrard 2025 T/C autochanger and a pair of matching teak finish cloth front speaker systems.

★ Output 4 watts rms per channel.
★ Separate volume, bass, treble and balance controls.
★ Stereo/Mono ceramic cartridge.
★ Tape/Tuner input and Tape output sockets.
★ Complete with all leads ready to use.

£31·00 Carr. & Ins. £1·50

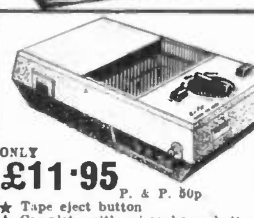
STEREO HEADPHONE EXTENSION LEAD

15 foot curly cord. £1·50. P. & P. 10p.

GARRARD SP25 MK III SINGLE RECORD PLAYER FITTED GOLDRING 800 MAGNETIC STEREO CARTRIDGE. COMPLETE IN TEAK PLINTH WITH COVER.

PREMIER PRICE **£16·50** P. & P. £1

"LIFE" AC/DC CASSETTE RECORDER



★ Battery/Mains operation
★ Single knob operation

ONLY **£11·95** P. & P. 50p

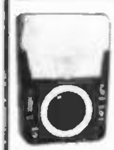
★ Tape eject button
★ Complete with microphone, batteries and handle

MODEL CT-330 MULTITESTER

The Model CT-330 Multitester is a de-luxe, accurate and high sensitivity instrument having many features which are desirable and required in testing modern electronic equipment. The Model CT-330 is very compact and of sturdy construction. Only the finest parts are used —1% resistors, low-resistance selector switch, clear scales and rugged meter movement. Ranges: DC Voltages: 0, 0·6, 6, 30, 120, 600, 1,200, 3,000, 6,000V (20,000ohms/V). AC Voltages: 0, 6, 30, 120, 600, 1,200V (10,000 ohms/V). DC Current: 0, 0·6, 6, 60, 600mA. Resistance: 0, 6k, 600k, 6M, 60M (30, 3k, 30k, 300k ohms at centre scale). Capacity: 0·00005–0·01μF, 0·001–0·2μF. Decibels: —20 to +63db.

£8·25 P. & P. 25p

MODEL 630 MULTITESTER



Ranges: DC Voltages: 0, 3, 15, 60, 300, 600, 1,200V (30,000 ohms/V). AC Voltages: 0, 6, 30, 120, 600, 1,200V (15,000 ohms/V). DC Current: 0, 0·03, 3, 30, 300mA. Resistance: 0, 16k, 160k, 1·6M, 16M ohms (10, 100, 10k, 100k ohms at centre scale). Decibels: —20 to +63db.

£8·50 P. & P. 25p

MULTIMETER 20,000 O.P.V.

Compares with meters costing double its price. Features large easy-to-read meter, unusually high sensitivity—wide choice of ranges. With test leads, batteries and manual. Size: 4¼" × 3¼" × 1". Ranges: DC Voltages: 5, 25, 50, 500, 2,500V, (20,000 O.P.V.). AC Voltages: 10, 50, 100; 500, 1,000V (10,000 O.P.V.). DC Current: 50μA, 2·5, 250mA. Resistance: 6k, 6M ohms. Decibels. —20 to +22 db. Capacitance: 10μF to 0·100μF, 0·100μF to 0·1μF. Optional leather case.

£5.90 P. & P. 25p

HI-FI STEREO HEADPHONES

Designed to the highest possible standard. Fitted 2¼". speaker units with soft padded ear muffs. Adjustable headband. 8 ohms impedance. Complete with 6ft lead and stereo jack plug.

£2·25 P. & P. 25p.

COMPACT CASSETTES LOW-NOISE

Screw Fixing. Fully Guaranteed. In Library Cases.

	EACH	3 for	6 for	10 for
C60	31p	89p	£1·72	£2·75
C90	44p	£1·22	£2·38	£3·85
C120	57p	£1·54	£3·04	£4·95

P. & P. 10p each (3 and over 15p)

EMI LOW NOISE CASSETTES

Brand New in Library Cases

C60	C90	C120
(List 71p)	(List 98p)	(List £1·48)
48p	70p	92p

P. & P. 15p

PREMIER RADIO

56 GEORGE STREET, LONDON W1H 5RH. TEL: 01-935 7917

ALL PRICES INCLUDE VAT

Also at: 23 Tottenham Court Road, London W1P 9RA Tel: 01-636 3451

BI-PRE-PAK

SUPPLIERS OF SEMI-CONDUCTORS TO THE WORLD

COMPLETE TELEPHONES

EX. G.P.O. NORMAL HOUSEHOLD TYPE

ONLY £1·05

POST & PACKING 45p EACH

TELEPHONE DIALS

Standard Post Office type. Guaranteed in working order.

ONLY 27½p

POST & PACKING 16½p

TESTED AND GUARANTEED PAKS

B79	4	IN4007 Sil. Rec. diodes. 1,000 PIV lamp plastic	55p
B81	10	Reed Switches, 1" long. ⅛" dia. High Speed P.O. type	55p
B99	200	Mixed Capacitors. Approx. quantity, counted by weight	55p P & P 15p
H4	250	Mixed Resistors. Approx. quantity counted by weight	55p P & P 15p
H7	40	Wirewound Resistors. Mixed types and values.	55p
H9	2	OCP71 Light Sensitive Photo Transistor	55p
H28	20	OC200/1/2/3 PNP Silicon uncoded TO-5 can	55p
H30	20	1 Watt Zener Diodes. Mixed Voltages 6.8 – 43V.	55p
H35	100	Mixed Diodes. Germ. Gold bonded, etc. Marked and Unmarked.	55p
H38	30	Short lead Transistors, NPN Silicon Planar types.	55p
H39	6	Integrated Circuits. 4 Gates BMC 962, 2 Flip Flops BMC 945	55p
H40	20	BFY50/2, 2N696, 2N1613 NPN Silicon uncoded TO-5	55p
H41	2	Sil Power transistors comp pair BD131/132	55p

UNMARKED UNTESTED PACKS

B1	50	Germanium Transistors PNP, AF and RF	55p
B66	150	Germanium Diodes Min. glass type	55p
B83	200	Trans. manufacturers' rejects all types NPN, PNP, Sil. and Germ.	55p
B84	100	Silicon Diodes DO-7 glass equiv. to OA200, OA202	55p
B86	100	Sil. Diodes sub. min. IN914 and IN916 types	55p
H6	40	250mW. Zener Diodes DO-7 Min. Glass Type	55p
H15	30	Top Hat Silicon Rectifiers, 750mA. Mixed volts	55p
H16	15	Experimenters' Pak of Integrated Circuits. Data supplied	55p
H17	20	3 amp. Silicon Stud Rectifiers, mixed volts	55p
H20	20	BY126/7 Type Silicon Rectifiers 1 amp plastic. Mixed volts.	55p
H34	15	Power Transistors, PNP, Germ. NPN Silicon TO-3 Can.	55p

MAKE A REV COUNTER FOR YOUR CAR

The 'TACHO BLOCK'. This encapsulated block will turn any 0-1mA meter into a linear and accurate rev. counter for any car with normal coil ignition system.

£1·10 each

OVER

1,000,000

TRANSISTORS IN STOCK

We hold a very large range of fully marked, tested and guaranteed transistors, power transistors, diodes and rectifiers at very competitive prices. Please send for free catalogue.

Silicon planar plastic transistors.

Unmarked, untested factory clearance. A random sampling showed these to be of remarkably high quality.

Audio PNP, similar to ZTX500, 2N3702/3, BCY70 etc.
Audio NPN, similar to ZTX300, 2N3708/9, BC107/8/9, BC168/9 etc.
Please state Audio NPN or Audio PNP when ordering.
ALL AT 500 for £3·30, 1,000 for £5·50, 10,000 for £44 P. & P. 11p/1,000.

OUR VERY POPULAR 4p TRANSISTORS

TYPE "A" PNP Silicon alloy, TO-5 can.
TYPE "B" PNP Silicon, plastic encapsulation.
TYPE "E" PNP Germanium AF or RF.
TYPE "F" NPN Silicon plastic encapsulation.
TYPE "G" NPN silicon similar ZTX 300 range
TYPE "H" PNP silicon similar ZTX 500 range

8 RELAYS FOR VARIOUS TYPES P & P 27½ £1·10

Our famous PI Pak is still leading in value for money.

Full of Short Lead Semiconductors & Electronic Components, approx. 170. We guarantee at least 30 really high quality factory marked Transistors PNP & NPN, and a host of Diodes & Rectifiers mounted on Printed Circuit Panels. Identification Chart supplied to give some information on the Transistors. Please ask for Pak P.I. Only 55p. 11p P & P on this Pak.

A CROSS HATCH GENERATOR FOR £3.85 ! ! !

YES, a complete kit of parts including Printed Circuit Board. A four position switch gives X-hatch, Dots, Vertical or Horizontal lines. Integrated Circuit design for easy construction and reliability. This was a project in the September 1972 edition of Television.

This complete kit of parts costs £3·85, post paid.

A MUST for Colour T.V. Alignment.

ELECTRONIC TRANSISTOR IGNITION

Now in kit form, we offer this "up to the minute" electronic ignition system. Simple to make, full instructions supplied with these outstanding features:—
Transistor and conventional switchability, burglar proof lock up and automatic alarm, negative and positive compatability. This project is a "star" feature in the September edition of "Electronics Today International" magazine. Our kit is recommended by the ETI magazine.

Complete kit including p & p £7·92
Ready built and tested unit £3·02 extra.

FREE CATALOGUE FOR

TRANSISTORS, RECTIFIERS, DIODES, INTEGRATED CIRCUITS, FULL PRE-PAK LISTS

PLASTIC POWER TRANSISTORS

NOW IN TWO RANGES

These are 40W and 90W Silicon Plastic Power Transistors of the very latest design, available in NPN or PNP at the most shatteringly low prices of all time. We have been selling these successfully in quantity to all parts of the world and we are proud to offer them under our Tested and Guaranteed terms.

Range 1. VCE. Min 15. HFE Min 15.

	1–12	13–25	26–50
40 Watt	22p	20p	18p
90 Watt	26½p	24½p	22p

Range 2. VCE. Min 40. HFE Min 40.

	1–12	13–25	26–50
40 Watt	33p	31p	29p
90 Watt	38½p	36½p	33p

Complementary pairs matched for gain at 3 amps. 11p extra per pair. Please state NPN or PNP on order.

INTEGRATED CIRCUITS

We stock a large range of I.Cs at very competitive prices (from 11p each). These are all listed in our FREE Catalogue, see coupon below.

METRICATION CHARTS now available

This fantastically detailed conversion calculator carries thousands of classified references between metric and British (and U.S.A.) measurements of length, area, volume, liquid measure, weights etc.
Pocket Size 15p. Wall Chart 18p.

LOW COST DUAL IN LINE I.C. SOCKETS

14 pin type at 16½p each } Now new low profile
16 pin type at 18p each } type

BOOKS

We have a large selection of Reference and Technical Books in stock.
These are just two of our popular lines:

B.P.1 Transistor Equivalents and Substitutes; 40p
This includes many thousands of British U.S.A., European and C.V. equivalents.

The Iliffe Radio Valve & Transistor Data Book 9th Edition; p. & p. 23½p. 75p
Characteristics of 3,000 valves and tubes, 4,500 Transistors, Diodes, Rectifiers and Integrated Circuits.

Send for lists of publications
N.B. Books are void of V.A.T.

Please send me the FREE Bi-Pre-Pak Catalogue.

NAME..

ADDRESS..

....

ALL PRICES INCLUDE 10% VAT
MINIMUM ORDER 50p. CASH WITH ORDER PLEASE. Add 11p post and packing per order
OVERSEAS ADD EXTRA FOR POSTAGE
BUY THESE GOODS WITH ACCESS.

BI-PRE-PAK LTD
CO. REG. No. 820919
DEPT. E, 222-224 WEST ROAD, WESTCLIFF-ON-SEA, ESSEX SS0 9DF
TELEPHONE: SOUTHEND (0702) 46344

Henry's

PANEL METERS · TRANSFORMERS · CONTROLS · RELAYS
IRONS · TOOLS · VALVES · POT CORES MOST TYPES OF COMPONENTS
You need a catalogue! 55p post paid complete with Discount Vouchers

UK's LARGEST RANGE OF KITS & GADGETS

TEST EQUIPMENT

MULTIMETERS

(carr. etc. 30p)

200H (M210)	20K/Volt Slimline with case	4·95
TLH33D	2K/Volt Robust with case	4·95
U437	10K/Volt Steel case. AC up to 40 KHz	4·95
U4324	20K/Volt with AC current ranges	8·00
AF105	50K/Volt with Leather case	6·50
U4313	20K/Volt AC current. Steel case	10·50
U4341	Plus Built in transistor tester	10·50
Model 500	30K/Volt	9·95

OTHER EQUIPMENT

SE250B	Pocket Signal Injector	1·90 carr. 15p
SE500	Pocket Signal Tracer	1·50 carr. 15p
TE15	Grid Dip meter 440kHz–280mHz	13·45 carr. 30p
TE40	AC Millivoltmeter 1·2mHz	18·75 carr. 35p
TE65	28 Range valve voltmeter	19·25 carr. 40p
TE20D	120kHz–500mHz RF Generator	16·95 carr. 40p
TE22D	20Hz–200kHz Audio Generator	18·75 carr. 40p
SE350A	Deluxe Signal Tracer	9·95 carr. 20p
SE400	Volts/ohms/R-C sub./RF field/RF gen.	11·25 carr. 20p

New Revolutionary Supertester 680R

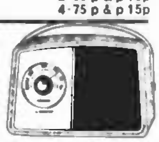
Accessories

680R Multi-tester	18·50
Transistor tester	11·00
Electronic voltmeter	18·00
Ampclamp	11·95
Temperature probe	11·95
Guass meter	11·95
Signal Injector	5·95
Phase Sequence	5·95
EHT Probe	5·95
Shunts 25/50/100A	4·50 each

A SELECTION OF INTERESTING ITEMS

C3025	Compact transistor tester	5·50 p & p 15p
E1300	Mono mag. cart. preamp.	1·95 p & p 15p
E1310	Stereo mag. cart. preamp.	4·95 p & p 25p
Easiphone telephone amplifier		6·15 p & p 25p
D1203	Teleamp. with PU coil	3·60 p & p 20p
LL1	Door Intercomm. and chime	11·95 p & p 25p
Chattalite (lights as you talk)		13·90 p & p 20p
1 Kw Dimmer/controller		3·00 p & p 10p
9" Twin spring unit For		2·75 p & p 15p
16" Twin spring unit Reverbs		6·50 p & p 25p
Car Tachometer Electronic		7·50 p & p 15p
VHF 105 Aircraft Band Corrector		3·95 p & p 15p
B2005 4 Ch. mic. mixer		2·95 p & p 15p
B2004 2 ch. Stereo mixer		4·75 p & p 15p

BUILD THIS RADIO



Portable MW / LW radio kit using Mullard RF/IF module. Features MW — bandspread for extra selectivity. Slow motion tuning. Fibre glass PVC cabinet. 600MW output. All parts £7·98 (battery 22p), carr. etc. 32p.

EXCLUSIVE: SPECIAL OFFERS

MW/LW CAR RADIO + or — Earth with speaker and fixings. £6·50 carr./packg. 30p.

8 TRACK CAR STEREO (— Earth) with speakers in Pods & fixings. £12·50 carr/packg. 40p.

HANIMAX HC1000 Battery cassette recorder. £10·50 carr/packg. 25p.

HANIMAX HC2000 Battery/Mains cassette recorder. £13·50 carr/packg. 30p

AKAI GXC40 Stereo cassette recorder. £59·95 carr/packg. 50p. Pair Akai ADM microphones. £6·95 carr/packg. 20p.

5 WAVEBAND PORTABLE TWIN SPEAKER RADIO. FM/MW/SW/AIRCRAFT—PUBLIC SERVICES. £10·45 carr/packg. 30p.

PORTABLE CASSETTE TAPE PLAYER— for car or carry around. £7·25 carr/packg. 20p.

HANIMAX POCKET CALCULATOR WITH % KEY. £33·50.

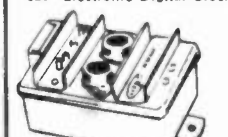
SPECIAL PURCHASES

AVOMETER MOVEMENTS AVO 8 or 9 50mA MOVEMENTS. Ex Brand New AVO's £3·50 Post 20p.

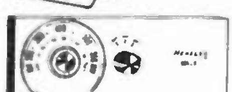
UHF TV TUNERS CHANNELS 21 TO 64 Brand new transistorised geared tuners for 625 Line Receiver IF output. £2·50, Post 20p.

EASY TO BUILD KITS BY AMTRON—EVERYTHING SUPPLIED

Model No.		
310	Radio control receiver	2·98
300	4-channel R/C transmitter	5·95
345	Superhet R/C receiver	5·95
455	AM signal generator	12·33
65	Simple transistor tester	1·40
115	8 watt Amplifier	3·90
120	12 watt amplifier	4·70
125	Stereo control unit	5·70
130	Mono control unit	3·60
605	Power supply for 115	4·55
610	Power supply for 120	4·55
615	Power supply for 2 x 120	5·73
230	AM/FM aerial amplifier	2·93
240	Auto packing light	5·90
275	Mic. preamplifier	6·08
570	LF generator 10Hz–1mHz	15·80
575	Sq. wave generator 20Hz–20Khz	14·60
590	SWR meter	12·85
620	Ni-CAD Charger 1·2–12v	8·00
630	STAB Power supply 6-12v 0·25-0·1A	8·15
690	DC motor speed Gov.	2·87
700	Electronic Chaffinch	7·00
705	Windscreen wiper timer	6·80
760	Acoustic switch	10·75
780	Metal Detector (electronics only)	9·65
790	Capacitive Burglar alarm	6·85
835	Guitar preamp.	4·25
840	Delay car alarm	6·15
875	CAP. Discharge ignition for car engine (-Ve Earth)	13·15
80	Scope Calibrator	2·25
255	Level Indicator	6·15
525	120–160mHz VHF timer	11·30
715	Photo cell switch	7·70
795	Electronic continuity tester	4·30
860	Photo timer	13·25
871	Slide projector auto feed control	7·15
235	Acoustic Alarm for driver	7·60
465	Quartz XTAL checker	8·75
220	Signal Injector	2·30
390	VOX	15·50
432	Testakit	19·30
670	Buffer Battery Charger	6·55
885	Capacitive Contact Alarm	6·25
850	Electronic Keyer	18·75
820	Electronic Digital Clock	58·50



ALL KITS OFFERED SUBJECT TO STOCK AVAILABILITY



BUILD THIS TUNER

MW/LW Radio Turner to use with any amplifier. Features Mullard RF/IF module Ferrite aerial, built in battery. Excellent results. Size 7" x 2¼" x 3¾". All parts £4·85, carr. 15p.

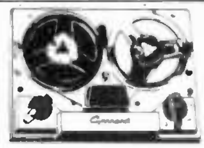
MULTI-USE & RADIONIC KITS

10–1	10 Projects	3·60
50–1	10 Projects	6·00
150–1	150 Projects	13·20
Telephone Communicator		7·20
X20	20 (Elec.) Projects	4·95
X40	40 (radio) Projects	9·45

(carr./packing 40p)

All transistor circuits with hand books

All types offered subject to availability. Prices correct at time of press E & OE. **10% VAT TO BE ADDED TO ALL ORDERS.** UK post etc. 15p per order unless stated.



GARRARD BATTERY TAPE DECK

GARRARD 2 speed 9 volt tape decks. Fitted record/play and oscillator/Erase heads. Wind and rewind controls. Takes up to 4" spools. Brand new complete with head circuits. £9·50 carr. 30p

TOP QUALITY SLIDER CONTROLS

60mm stroke high quality controls complete with knobs (post, etc. 15p any quantity).

Singles Log and Lin 5K, 10K, 22K, 50K, 100K, 250K, 500K, 1 Meg. 45p each.

Ganged Log and Lin 10K, 22K, 50K, 100K, 250K, 65p each. (Quantity discounts available)

Complete with knobs.

MARRIOT TAPE HEADS

4 TRACK MONO or 2 TRACK STEREO

'17' High Impedance £2·00

'18' Med. Impedance £2·00

R730/E73 2 track mono Record/Erase low imp. 75p pair.

Erase Heads for '17' and '18' 75p

'63' 2 track mono. Hi Imp. £1·75

'43' Erase Head for '63' 75p

(Post, etc. 15p any quantity).

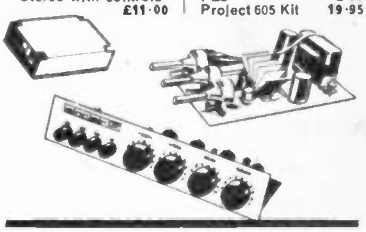
SINCLAIR, MINIATURE AMPLIFIERS & TUNER/DECODER

AMPLIFIERS (carr., etc. 20p)

4-300, 0·3 watt 9 volt	1·75
104, 1 watt 9 volt	2·20
304, 3watt 9 volt	2·50
555, 3 watt 12 volt	2·85
E1208, 5 watt 12 volt	4·50
608, 10 watt 24 volt	4·10
410, 10 watt 28 volt	4·95
Z30, 15 watt 30 volt	3·57
E1206, 30 watt 45 volt	9·75
Z50, 30 watt 50 volt	4·37
E1210, 2½ + 2½ watts 12 volt	5·25
RE500, 5 watt IC mains operated Amplifier with controls	£6·30
SAC14, 7 + 7 watt Stereo with controls	£8·00
SAC13, 15 + 15 watt Stereo with controls	£11·00

SINCLAIR PROJECT 60 (carr. 20p)

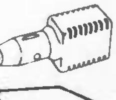
Z30 3·57	Z50 4·37
Stereo 60 Preamp.	7·97
PZ5 £3·97, PZ6	£6·37
PZ8 (for Z50) £4·77 (TRANS £2·95)	
AFU £4·45	
New **SINCLAIR PROJECT 80**	
Stereo Preamp.	9·50
Audio Filter Unit	5·50
Z40 15 Watt Amp.	4·30
Z60 25 Watt Amp.	5·50
PZ5 Mod. for 1 on 2 Z40	3·98
PZ6 Mod. (S Tab) 1 on 2 Z40	6·25
PZ8 Mod. (S Tab) 1 on 2 Z60	6·30
TRANSFORMER FOR PZ8	2·95
Project 605 Kit	19·95



POWER SUPPLIES FOR EVERY PURPOSE

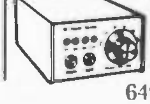
(All cased unless stated chassis)

470C 6/7½/9 volt 300 MA (includes Multi-Adaptor for Tape Recorders, etc.)	1·95 post 20p
Car Lighter Voltage Adaptors 300mA (State voltage 6v, 7½v, 9v)	1·95 ea. post 25p
SC202 3/6/7½/9 volt 400mA	3·25 carr. 30p
HC244R Stabilised version	4·25 carr. 30p
P500 9 volt 500mA	2·80 post 20p
P11 24 volt 500mA (chassis)	2·80 post 20p
P15 26/28 volt 1 amp (chassis)	2·70 post 20p
P1080 12v 1 amp (chassis)	3·25 post 20p
P1081 45v 0·9 amp (chassis)	4·40 post 20p
P12 4½–12 volt 0·4–1 amp	6·75 post 30p
SE101A 3/6/9/12 volt 1 amp (Stab.)	9·15 post 25p
RP164 6/7½/9/12 1 amp (Stab.)	9·95 post 30p



FIBRE OPTICS

0·01 Diam. Mono Filament £1·50 per 25 metre reel
0·13 Diam. 64 Fibres Sheathed. £1·00 per metre
SPRAYS 15mm Diam. Mares Tails £9·50.



Henry's RADIO LIMITED

EDGWARE ROAD, W2

SEE FACING PAGE FOR ADDRESSES

The Sinclair Cambridge... no other calculator is so powerful and so compact.

Complete kit-£24·95! (PLUS VAT)

The Cambridge – new from Sinclair
The Cambridge is a new electronic calculator from Sinclair, Europe's largest calculator manufacturer. It offers the power to handle the most complex calculations, in a compact, reliable package. No other calculator can approach the specification below at anything like the price – and by building it yourself you can save a further £5·50!

Truly pocket-sized
With all its calculating capability, the Cambridge still measures just $4\frac{1}{2}$" x 2" x $\frac{11}{16}$". That means you can carry the Cambridge wherever you go without inconvenience – it fits in your pocket with barely a bulge. It runs on ordinary U16-type batteries which give weeks of life before replacement.

Easy to assemble
All parts are supplied – all you need provide is a soldering iron and a pair of cutters. Complete step-by-step instructions are provided, and our service department will back you throughout if you've any queries or problems.

The cost? Just £27·45!
The Sinclair Cambridge kit is supplied to you direct from the manufacturer. Ready assembled, it costs £32·95 – so you're saving £5·50! Of course we'll be happy to supply you with one ready-assembled if you prefer – it's still far and away the best calculator value on the market.

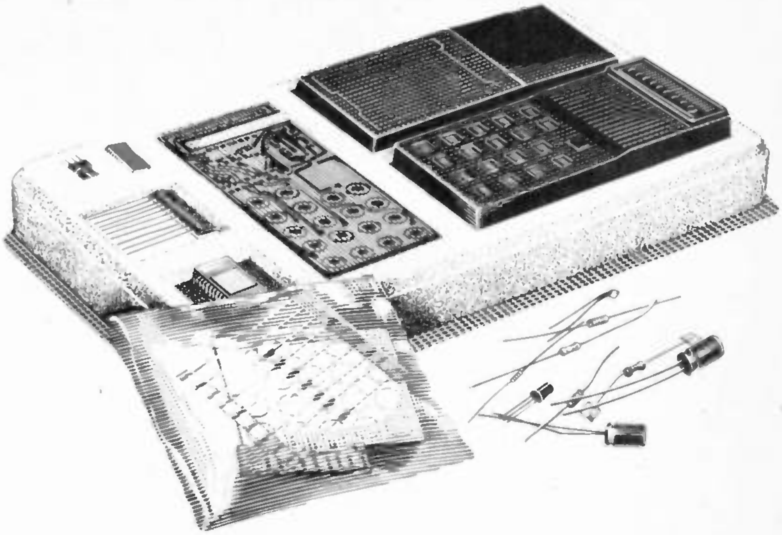
Features of the Sinclair Cambridge
- *Uniquely handy package. $4\frac{1}{2}$" x 2" x $\frac{11}{16}$", weight $3\frac{1}{2}$ oz.
- *Standard keyboard. All you need for complex calculations.
- *Clear-last-entry feature.
- *Fully-floating decimal point.
- *Algebraic logic.
- *Four operators (+, –, x, ÷), with constant on all four.
- *Constant acts as last entry in a calculation.
- *Constant and algebraic logic combine to act as a limited memory, allowing complex calculations on a calculator costing less than £30.
- *Calculates to 8 significant digits, with exponent range from 10^{-20} to 10^{79}.
- *Clear, bright 8-digit display.
- *Operates for weeks on four U16-type batteries. (MN 2400 recommended.)

A complete kit!

The kit comes to you packaged in a heavy-duty polystyrene container. It contains all you need to assemble your Sinclair Cambridge.
Assembly time is about 3 hours.

Contents:

1. Coil.
2. Large-scale integrated circuit.
3. Interface chip.
4. Thick-film resistor pack.
5. Case mouldings, with buttons, window and light-up display in position.
6. Printed circuit board.
7. Keyboard panel.
8. Electronic components pack (diodes, resistors, capacitors, transistor).
9. Battery clips and on/off switch.
10. Soft wallet.



This valuable book – free!
If you just use your Sinclair Cambridge for routine arithmetic – for shopping, conversions, percentages, accounting, tallying, and so on – then you'll get more than your money's worth.

But if you want to get even more out of it, you can go one step further and learn how to unlock the full potential of this piece of electronic technology.

How? It's all explained in this unique booklet, written by a leading calculator design consultant. In its fact-packed 32 pages it explains, step by step, how you can use the Sinclair Cambridge to carry out complex calculations like:

Logs	Sines	Cosines
Tangents	Reciprocals	nth roots
Currency conversion	Compound interest	

and many others...

sinclair

Sinclair Radionics Ltd, London Road,
St Ives, Huntingdonshire
Reg. no: 699483 England
VAT Reg. no: 213 8170 88

Why only Sinclair can make you this offer
The reason's simple: only Sinclair – Europe's largest electronic calculator manufacturer – have the necessary combination of skills and scale.

Sinclair Radionics are the makers of the Executive – the smallest electronic calculator in the world. In spite of being one of the more expensive of the small calculators, it was a runaway best-seller. The experience gained on the Executive has enabled us to design and produce the Cambridge at this remarkably low price.

But that in itself wouldn't be enough. Sinclair also have a very long experience of producing and marketing electronic kits. You may have used one, and you've almost certainly heard of them – the Sinclair Project 60 stereo modules.

It seemed only logical to combine the knowledge of do-it-yourself kits with the knowledge of small calculator technology.
And *you* benefit!

Take advantage of this money-back, no-risks offer today
The Sinclair Cambridge is fully guaranteed. Return your kit within 10 days, and we'll refund your money without question. All parts are tested and checked before despatch – and we guarantee a correctly-assembled calculator for one year.

Simply fill in the preferential order form below and slip it in the post today.

Price in kit form: £24·95 + £2·50 VAT. (Total: £27·45)
Price fully built: £29·95 + £3·00 VAT. (Total: £32·95)

EE 12 73

To: Sinclair Radionics Ltd, London Road,
St Ives, Huntingdonshire, PE17 4HJ

Please send me

☐ a Sinclair Cambridge calculator kit at £24·95 + £2·50 VAT (Total: £27·45)

☐ a Sinclair Cambridge calculator ready built at £29·95 + £3·00 VAT (Total: £32·95)

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

*Please debit my *Barclaycard/Access account. Account number

Name

Address

*Delete as required.

PLEASE PRINT

everyday electronics

PROJECTS...
THEORY......

PREVENTIVE MEASURES

The electronics enthusiast has frequent opportunities to provide good service for others, apart from satisfying his own personal interests and needs. This is because of the varied nature of the end-products of his hobby. In this context, a rather special case arises this month, which we feel merits the attention of all constructors.

We are all very familiar with the phrase "prevention is better than cure". The old adage is one of the first things to be implanted in our minds when quite young. This logic becomes part of our subconsciousness, though often we fail to heed this sound advice in our day-to-day affairs until damage or loss has been suffered.

True the increase in house break-ins and car thefts has brought attention to the need for security devices and systems that, if they do not actually prevent unauthorised entry, will at any rate give prompt indication immediately such a felony is attempted.

The basis of all modern intruder alarms is electronics, though systems may differ widely in the kind of sensing techniques employed. Many designs have been published for simple alarm systems suitable for protecting premises and motor vehicles. This month we publish another security system, but one that has been designed to counter the threat and danger of a baby or young child being unlawfully taken from a pram or other baby carriage.

Incidents of baby snatching from unattended prams and pushchairs have been headline news during the last few months. Although this inexplicable crime has not reached epidemic proportions, like other well-publicised offences, it could become "catching". The best way to discourage further incidents is to provide protection that frustrates an attempt to baby snatch by giving out a strident warning to alert passers-by.

The *Baby Snatch Alarm* described in this issue will take little in time, effort, or money to assemble. In use, it will give peace of mind to the busy mother when she has to leave a baby unattended, if for but a few moments, while she goes about her shopping.

Remember, electronics is our servant, and we constructors should be prepared at all times to use it whenever feasible to help solve everyday problems. Here is an excellent example of circuitry put to worthwhile use as a preventative measure. Why not make this project *your* good turn?

Fred Bennett

Our January issue will be published on Wednesday, December 19

Everyday Electronics, Fleetway House, Farringdon Street, London, E.C.4. Phone: *Editorial* 01-634-4452; *Advertisements* 01-634-4202.

..EASY TO CONSTRUCT
..SIMPLY EXPLAINED

VOL. 2 NO. 12 DECEMBER 1973

CONSTRUCTIONAL PROJECTS

GENERAL FEATURES

Publisher's Annual Subscription Rate, including postage to any part of the world, £2·35. International Giro facilities Account No. 5122007. State reason for payment "message to payee". Address to Everyday Electronics, Subscription Department, Carlton House, Great Queen Street, London, WC2E 9PR. Binders for volumes 1 and 2 (state which) and indexes for volume 1 available for 97p and 11p respectively, including postage, from Binding Department, at the above address.

We are unable to supply back copies of Everyday Electronics or reprints of articles and cannot undertake to answer readers' letters requesting designs, modifications or information on commercial equipment or subjects not published by us. An s.a.e. should be enclosed for a personal reply. Letters concerning published articles should be addressed to: The Editor, those concerning advertisements to: The Advertisement Manager, both at the address shown opposite.

NEXT MONTH

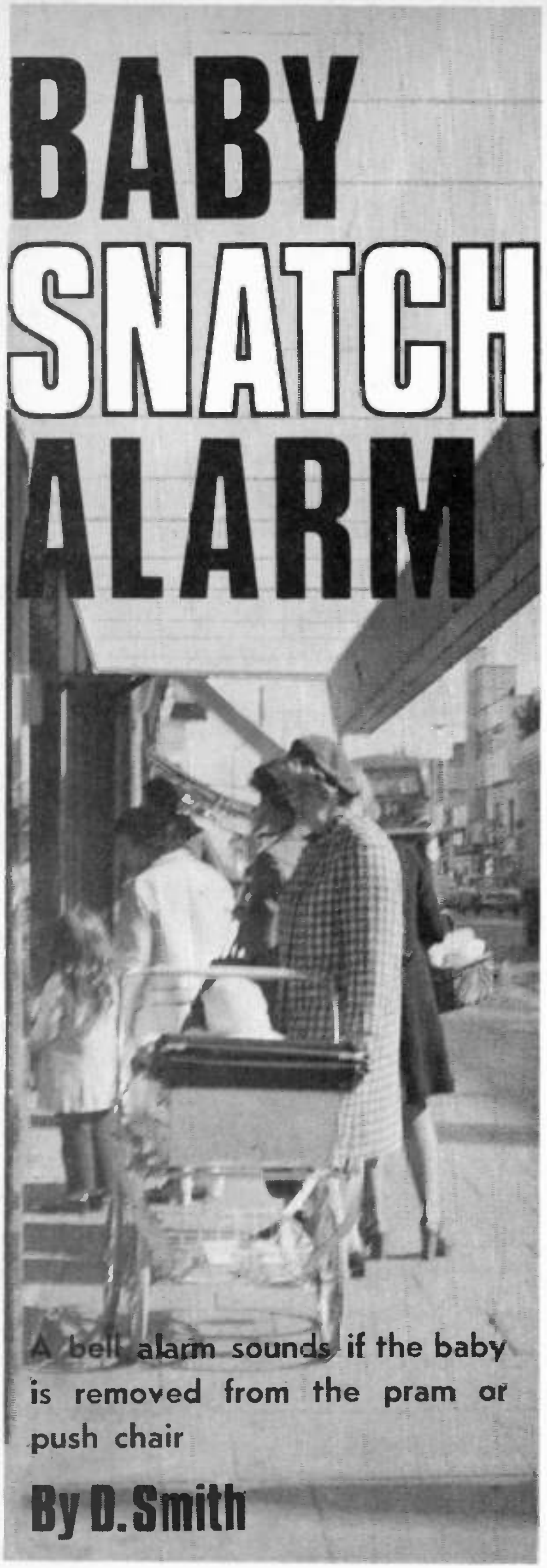
V.C.O. Effects Unit
Sewing Machine Speed Control
Fetset Receiver

PLUS

Semiconductor Primer No. 1

More details on page 685

BABY SNATCH ALARM



A bell alarm sounds if the baby is removed from the pram or push chair

By D. Smith

THIS alarm has been designed to fit easily on any pram or push chair, to sense the baby without actual contact, and to be virtually foolproof in operation. When the unit is connected and switched on, the baby cannot be removed, the pram cannot be pushed away, and the unit cannot be disconnected or opened without the alarm sounding.

There are ways of preventing the alarm sounding but without studying the actual operation of the unit a would-be snatcher would not be able to take the baby.

BABY SYSTEM

The sensing element used is a pressure mat that is virtually waterproof and is placed under the sheet or mattress to sense when the baby is actually in the pram. This mat is connected to the main unit, which is hung on the side or end of the pram, by a twin lead and a jack plug.

If the jack plug is removed, the lead cut, or the pressure taken off the mat, the alarm sounds. To prevent the pram being taken away the lead is passed through one of the wheels before being plugged into the main unit, thus the wheel cannot turn unless the wire is unplugged—sounding the alarm.

The whole system is controlled by a switch operated by a key—in the same way as a car's ignition switch—and is supplied by a 6 volt lantern battery so it is safe even if it gets wet.

THE CIRCUIT

The circuit diagram of the alarm is shown in Fig. 1, SK1 is the socket into which the pressure mat is plugged, S1 is a microswitch fitted under the front panel of the case so that should the unit be opened while turned on, the alarm bell WD1 will sound. Switch S2 is the master, key operated on/off switch and LP1 and LP2 provide visual indication of the alarm condition and light a small sign reading "Baby Snatch."

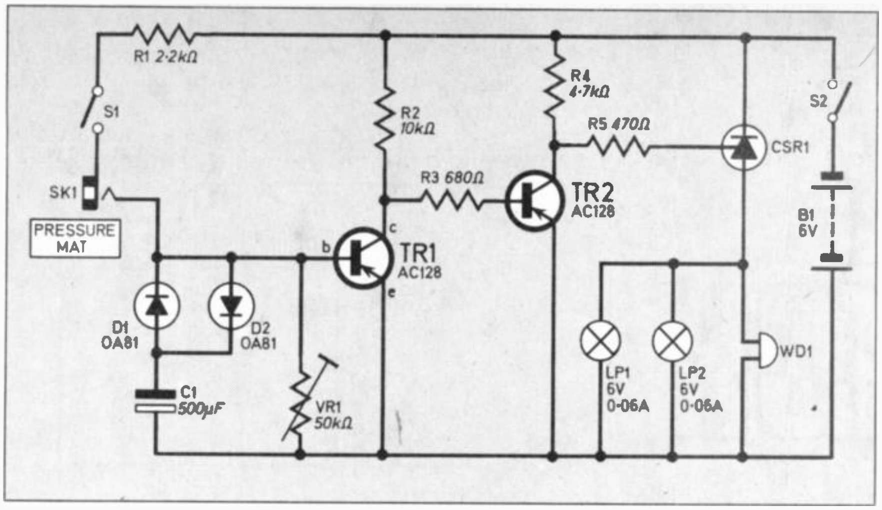


Fig. 1. The complete circuit diagram of the Baby Snatch Alarm.

With the pressure mat connected and the unit closed and turned on, capacitor C1 will charge through the mat, S1, R1 and D1, thus holding TR1 on. Diodes D1 and D2 prevent TR1 from being turned off when the unit is first switched on and C1 is discharged.

With TR1 on, TR2 is off and the thyristor CSR1 will not be fired and thus no current will flow to LP1, LP2 and WD1. If the circuit from TR1 base to the the negative line is broken—by removing the pressure from the mat, unplugging the mat or opening S1, capacitor C1 will discharge through D2 and VR1 at a rate determined by VR1 and, after a short delay TR1 will turn off, TR2 will turn on and hence fire CSR1 which will pass current to the warning devices LP1, LP2 and WD1.

Once CSR1 is passing current it cannot turn off until the current falls to nearly zero or the voltage is removed. Although the bell only requires intermittent current, LP1 and LP2 pass enough continuous current to keep CSR1 conducting and thus the lights will show and the bell will continue to ring until the unit is turned off by the key switch.

Capacitor C1 and VR1 provide a short delay —up to about 10 seconds depending on the setting of VR1—so that should the baby jump up and down or in some way temporarily remove its weight from the mat, the alarm will not sound. Only if the weight remains off the mat for longer than the set time will the alarm sound.

Power for the unit is from a 6V SP996 battery which, on standby will last a very long time (probably at least six months to a year with normal use) and would certainly be capable of sounding the bell for about half an hour continuously. Hopefully the alarm will only be operated for test purposes.

Approximate cost of components including V.A.T.

£8:00 plus case

Components....

Resistors
R1 2·2kΩ
R2 10kΩ
R3 680Ω
R4 4·7kΩ
R5 470Ω
All ¼W ± 10% carbon

SEE **SHOP TALK**

Capacitor
C1 500µF elect. 12V

Semiconductors
TR1 AC128 germanium *pnp*
TR2 AC128 germanium *pnp*
CSR1 1A 50 p.i.v. thyristor
D1, 2 OA81 or similar diodes (2 off)

Miscellaneous
SK1 jack socket with plug
S1 s.p.s.t. micro switch
VR1 50kΩ skeleton preset
LP1, 2 6V 0·06A bulbs in double holder with motif plate
WD1 4·5V or 6V bell (Friedland type)
S2, key operated s.p.s.t. switch
B1 SP996 6V battery
Veroboard 23 holes x 13 strips x 0·15 matrix, small brackets to fix Veroboard, case (see text) metal for pram mounting brackets, wire, 4BA fixings, Pressure mat.

BABY SNATCH ALARM

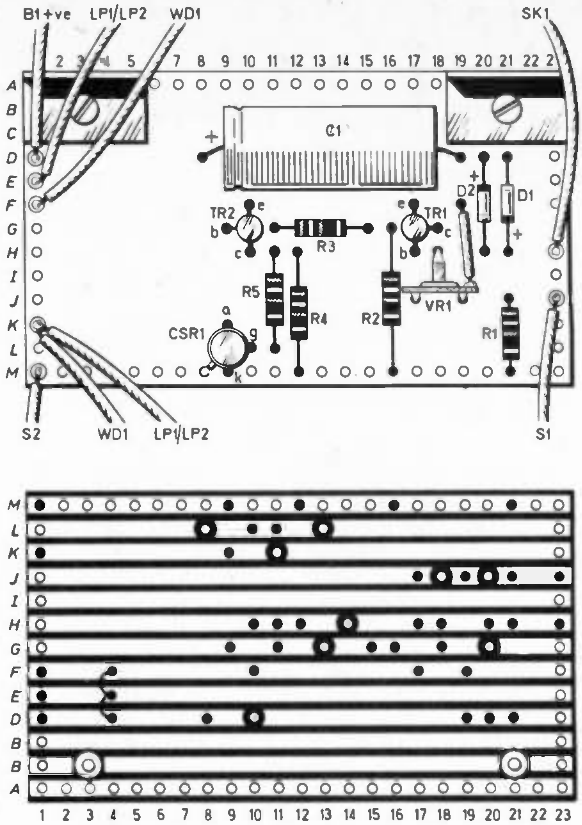
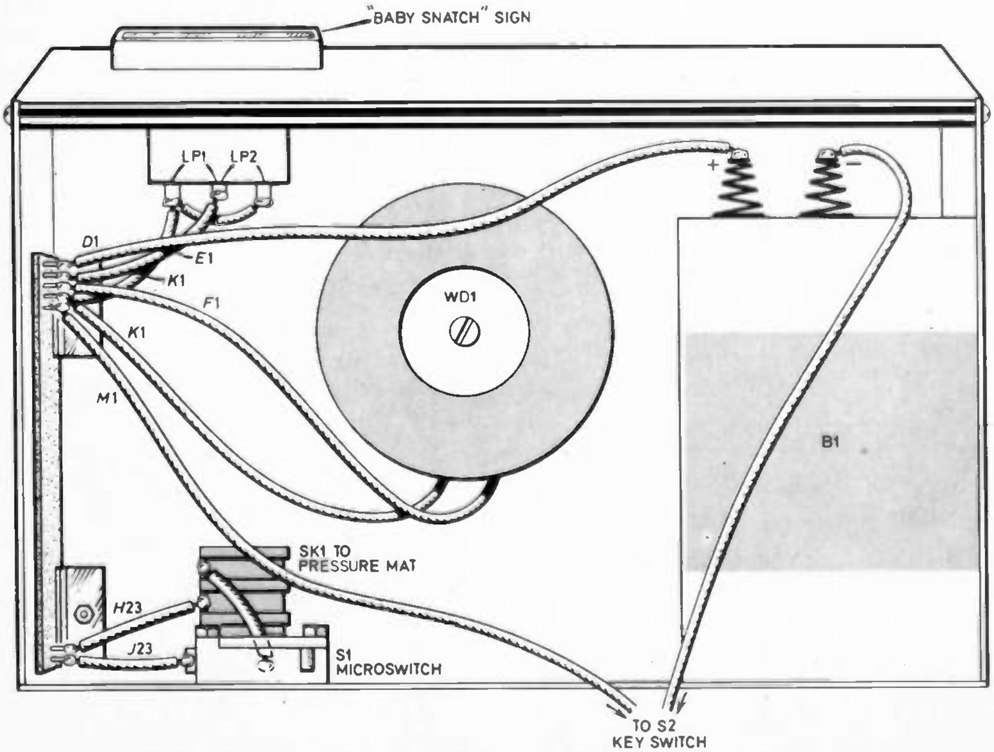


Fig. 2 (right) Veroboard layout and wiring for the alarm circuit.

Fig. 3 (below) Layout and wiring of the complete alarm unit.



CONSTRUCTION

The main circuit is built on a piece of Veroboard. The strips must be cut and separated as shown in Fig. 2. Larger holes in the board are drilled for VR1, also two more holes are drilled to take the two fixing brackets. Make sure that you remember to strap together strips *D*, *E* and *F*. All the external connections are made by using terminal pins, these are fitted to each end of the board as shown. Mount all the components on the board, soldering the transistors in last using a heat shunt on each wire as it is soldered.

The cabinet can be to your own personal choice but the one used on the prototype is a standard chassis size 205 x 150 x 75mm. The sloping front was produced by measuring down 25mm on each side of the chassis and then cutting two pieces out, one each side. The lid of the chassis was also cut down to match.

The chassis is then drilled and finally covered in Contact or a similar covering. Advertise what the unit is on the front using Letraset, this will deter would-be baby snatchers and also warn other mothers not to pick the baby up, however innocent the motive is. Some holes are cut in the bottom of the box to allow the sound from the bell to be heard and to take SK1. The lamp indicator hole should be cut in the top. The micro-switch is fitted inside and to the front of the box so that it operates (opens) when the lid is removed.

The key switch is fitted to the front of the box on the lid. The unit can be then wired up as shown in Fig. 3. Two brackets are made up to fit onto the pram and are fastened to the rear by fixing screws. Two of these screws also serve to fix into position the Veroboard assembly.

The battery is soldered in as it should be quite a while before this needs replacing; also the battery is difficult to connect using other methods and as reliability is required, soldering seems to be best. The lid is fastened on making sure that the microswitch operates correctly.

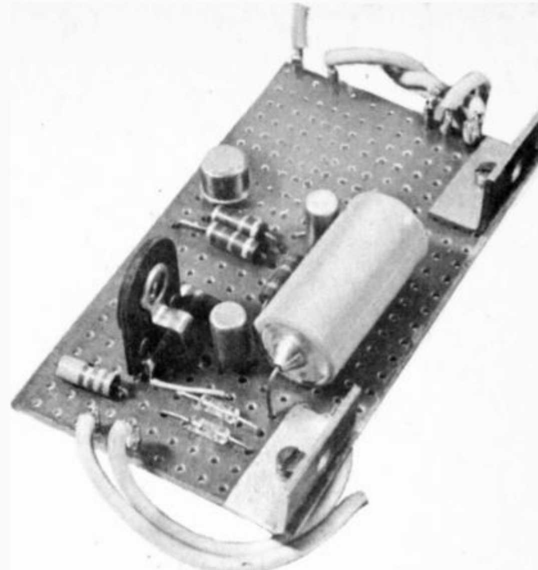
FITTING AND TESTING

The pressure pad is fitted underneath the baby. If extra pressure is required (because the baby is very light) either place some extra weight on the mat to "bias" it, double the mat or place under the mat a piece of hardboard with indentations in it. The mat seems to operate better sometimes by point pressure rather than overall pressure. The pressure mat wires should be long enough to pass through a pram wheel and join the main unit via a jack plug.

TESTING

When testing the unit allow it to be turned on for some time before triggering it, this enables C1 to charge fully and thus provides a check on the delay time. Adjust VR1 to provide the required time delay before the alarm sounds—possibly one or two seconds.

In use the mat can be left in the pram and connected to the unit by passing the lead through the wheel and plugging in the jack plug when needed. The unit is then turned on by operation of the key switch and the key removed. When the mother returns, she turns off the unit with the key, unplugs the mat and pushes the pram away. ▣



Photograph of the circuit board for the Baby Snatch Alarm.

TEACH-IN '74

FOR BEGINNERS IN ELECTRONICS... THEORY AND EXPERIMENTS

TUTOR: PHIL ALLCOCK*

LESSON 3 Zener diode and the Capacitor

IN addition to the IN4001, the shopping list includes a second diode known as a Zener diode. This component is very similar to the IN4001 diode except that the maximum current is less and the breakdown voltage is carefully controlled during manufacture to be close to a specified level, in this case 4·7 volts ±5 per cent. Diodes such as this are sometimes called breakdown diodes and they are specifically designed to be used in the reverse direction at the breakdown voltage.

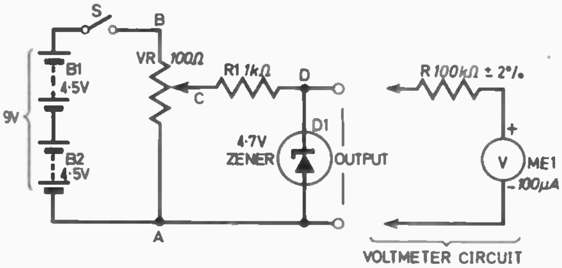
In Fig. 2.8 the diode voltage in the breakdown region is almost constant and independent of the reverse breakdown current. Providing the current and power dissipation are restricted the diode can be operated in this manner to give an almost constant voltage difference of approximately 4·7 volts without harmful effects. The dissipation limit for the diode specified is 400mW (0·4 watt) and since the voltage is 4·7 volts the reverse breakdown current must be limited to a maximum value of

$$I_{max}\ (\text{mA}) = \frac{400}{4\cdot7} \quad \left(\text{mA} = \frac{\text{mW}}{\text{volts}}\right)$$

$$\simeq 85\text{mA}$$

Figure 3.1 shows a circuit using the Zener diode. Notice the different symbol for the Zener diode and also the direction in which it is connected relative to the battery polarity.

Fig. 3.1. Circuit using a Zener diode.



With the switch closed the full 9 volts is applied to the 100 ohm potentiometer but only a fraction of this voltage is fed to the Zener diode via the 1 kilohm current-limiting resistor. As the potentiometer slider moves from A towards B the fraction of this 9 volts passed to the diode increases until a point is reached, about mid-way along the 100 Ω potentiometer, at which the voltage equals the Zener breakdown voltage of 4·7V. Up to this point no current can flow via the 1 kilohm resistor but once the breakdown voltage is reached, or exceeded, current can flow via the 1 kilohm and the Zener diode.

Since the voltage across the Zener has to remain almost constant the excess voltage supplied by the potentiometer must appear across the 1 kilohm resistor. It is this resistor which limits the diode current to a safe value when the potentiometer slider is at point B. Under these conditions the Zener current will be approximately

$$\frac{(9 - 4\cdot7)}{1\cdot0} = 4\cdot3\text{mA} \quad \left(\frac{\text{volts}}{\text{k}\Omega} = \text{mA}\right)$$

If the 1 kilohm resistor was changed to 100 ohm the maximum current would be approximately ten times greater i.e. 43mA.

CAPACITOR ACTION

This month we are introducing another very useful component, the capacitor. Like resistors, capacitors are made in a wide range of values and there are several distinct types, but before considering these in detail we will examine the behaviour of the basic capacitor illustrated in Fig. 3.2. This is simply a pair of metal plates arranged close together but not in actual contact. The space between the plates can be filled with air or some other insulating material

* North Staffordshire Polytechnic (Any communications arising from the Teach-In '74 series must be addressed to Everyday Electronics, Fleetway House, Farringdon Street, London E.C.4)

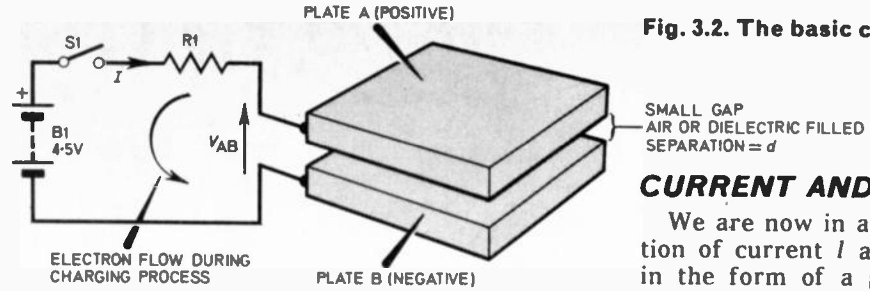


Fig. 3.2. The basic capacitor and charging circuit.

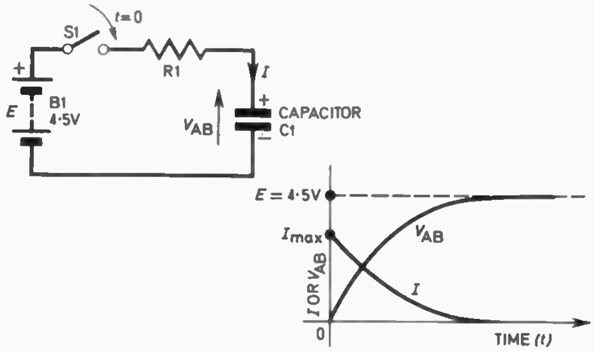


Fig. 3.3. Variation of current and voltage in circuit shown.

such as dry paper or plastic.

Now we already know that the metal plate is a good electrical conductor because it has "free" electrons in its structure and these can be made to move under the influence of an e.m.f. provided, by say, a battery. However, in the circuit of Fig. 3.2 the path for current flow is different to that previously considered since the capacitor plates are not in contact.

When the switch is closed electrons leave plate *A* and accumulate on plate *B* and a current *I* flows in the metallic parts of the circuit due to the applied e.m.f. Each electron "carries" a fixed negative electric charge and initially the metal plates are electrically neutral (i.e. they have their correct quota of electrons). Consequently this movement of electrons causes plate *A* to become positively charged with respect to plate *B*, since *B* now has an excess whilst *A* has a deficiency of electrons.

This charge transfer, around the circuit, causes a voltage difference V_{AB} between the capacitor plates which is in opposition to the battery e.m.f. Because of this opposition, the rate of charge movement (which is simply the circuit current *I*) decreases as the voltage V_{AB} increases.

An equilibrium condition is eventually reached and the capacitor is then said to be fully charged. In this state the voltage V_{AB} would be equal to the battery voltage of 4·5 volts and the current *I* would be zero. The resistor R1 is included to limit the initial level of the current when the switch is closed. The process is similar to the flow of water from a full to an empty container. The flow stops when the water levels are equal.

CURRENT AND VOLTAGE VARIATION

We are now in a position to sketch the variation of current *I* and voltage V_{AB} against time in the form of a graph, as shown in Fig. 3.3. Since the capacitor is initially uncharged, V_{AB} is zero and the current is limited to

$$I_{max} = \frac{E}{R1} \text{ (from Ohm's law).}$$

At all times the circuit voltages must obey our previous rules and so we can also write $E = I\,R1 + V_{AB}$ (Kirchhoff's law).

This equation states that the sum of the voltage across the resistor (*I*R1) and the capacitor (V_{AB}) is always equal to *E* and since *E* is constant (in this case) any increase in V_{AB} must occur simultaneously with a decrease in current *I* (R1 is also constant). Clearly, when *I* is zero V_{AB} and *E* are equal as already discussed. The rate at which the charging process occurs depends on the values of both the resistor R1 and the capacitor C1.

The basic unit of capacitance is the farad but as this is a fairly large unit it is usual to deal with sub-divisions such as microfarads (μF), nanofarads (nF) and picofarads (pF). The wall chart gives the values of these sub-divisions and should be consulted as necessary until the terms and their meanings are thoroughly familiar.

CAPACITANCE VALUE

At this stage the reader may be wondering how the capacitance value is related to the basic parallel plate system of Fig. 3.2, and the answer lies in the relationship between the charge transferred and the voltage V_{AB}. The capacitance of a given capacitor, or system of plates, is in fact a measure of the amount of charge transfer necessary to produce a voltage difference (V_{AB}) across the capacitor, of 1 volt.

The greater the charge that has to be moved to produce one volt difference, the larger the capacitance of the system considered. In practice the capacitance is determined by the dimensions and separation of the two plates and also the type of material used to fill the space between them. This material is known as the dielectric. Increasing the plate area and/or reducing the plate separation, lead to an increase in capacitance. The above relationships are conveniently summarised:

(a) charge (in coulombs) = capacitance (in farads) x voltage (in volts) or $Q = CV_{AB}$

(b) capacitance of parallel plate capacitor =

$$\text{constant} \times \frac{\text{plate area}}{\text{plate separation}}$$

The constant in (b) depends on the material used for the dielectric.

DISCHARGED AND STORED ENERGY

If the capacitor C1 in Fig. 3.3 was ideal it would remain charged, with a voltage difference E, even if removed from the rest of circuit. providing no external connection is made between the plates. If such a connection is made, say with a resistor R1 and a switch S1 as shown in Fig. 3.4, the charge would be "restored" when the switch closes and a current would flow during this process. The new equilibrium condition would be when V_{AB} and I are both zero. The energy lost as heat in the resistor represents the energy that was stored in the previously charged capacitor and it can be shown that this energy is given by:

$$\text{energy} = \tfrac{1}{2}C(V_{AB})^2 \text{ joules.}$$

In this equation C is in farads and V_{AB} is in volts. For a given capacitance the energy stored rises as the square of the voltage, so doubling the voltage increases the energy by four times. The resistor R1 limits the initial discharge current and the curves in Fig. 3.4 illustrate the variation of I and V_{AB} during the discharge period.

TIME CONSTANT

The time to fully charge or discharge an ideal capacitor is theoretically infinite but in practice the process can be considered complete when the voltage or current change is within 1 per cent of the final equilibrium value. The rate at which a given capacitor can alter its state of charge is determined by the circuit "time constant" which is given by the product C x R.

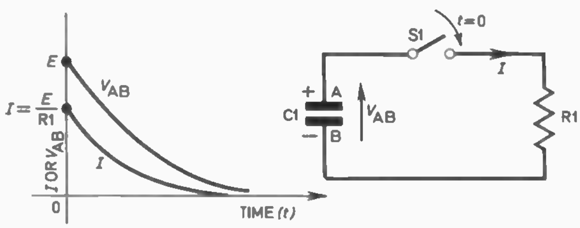


Fig. 3.4. Discharge of the capacitor.

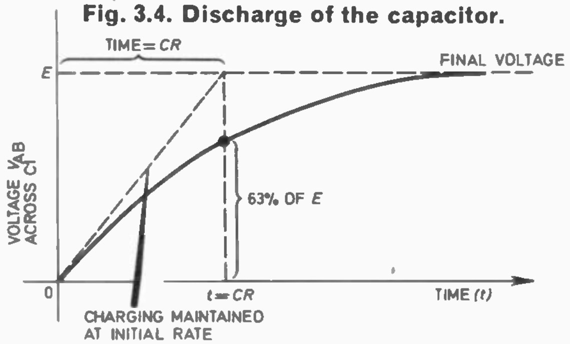


Fig. 3.5. Time constant graph.

If C is in farads and R is in ohms the product CR gives the time constant in seconds.

Two interpretations of the meaning of "time constant" are possible: If the capacitor charge (or discharge) rate is maintained constant at the initial value then the process would be complete in a time equal to the circuit time constant. Alternatively the time constant is the time required for approximately 63 per cent of the full change to actually take place. Both interpretations are illustrated in Fig. 3.5.

To reach the point at which the charging is 99 per cent complete a time equal to approximately $5CR$ is required. The charge and discharge curves are often called "exponential" and are very important—many changes that occur in nature follow the same law of variation. A large number of electronic circuits employ capacitor/resistor combinations for timing and pulse generation and we shall come across these later in the series.

CAPACITOR TYPES

A wide choice of different types of capacitor exists and the circuit symbols used are shown on the wall chart. In addition to the capacitance value and associated percentage tolerance, it is normal to quote a maximum working voltage rating. The use of very thin dielectrics allows large capacitance values to be achieved within a reasonable volume but the voltage rating falls as the plate separation is reduced.

Some dielectrics can yield high capacitance values but are not perfect insulators and this introduces an internal leakage path between the plates which allows the charge to leak away within the capacitor itself. A further point is that the larger values of capacitance may only be available with a polarised type of capacitor, which implies operation with one voltage polarity only. Many so called electrolytic capacitors are of this form and these components often have very wide tolerances, typically +100 per cent and −50 per cent.

In some applications the temperature variation of capacitance may also be of interest. The common capacitor types and their main characteristics are listed in Table 3.1. For general circuit applications the polyester and polycarbonate types wil be quite suitable. Electrolytic types are invariably used for power supplies, decoupling and similar applications requiring large values, say 10μF or more.

When a particular type of capacitor is specified it is unwise to use another type without first considering its suitability in the given application. This is especially true when operation at high frequencies is involved.

SERIES AND PARALLEL

Capacitors of similar voltage rating can be connected in parallel and this gives a total

Table 3.1 Capacitors

Type of Dielectric	Typical Range of Capacitance Values	Typical Voltage Rating	Main Characteristics
Silver Mica	1 pF to 10,000 pF	300V	Close tolerance ±1%. Stable, low loss. Low leakage. Used at high frequencies.
Polystyrene	50 to 10,000 pF	30–500V	± 2% or better if required. Relatively bulky. Low loss. Good insulation.
Ceramic	1·0–10,000 pF	30–1500V or more for special "suppressor" types.	Tolerance ± 20%. R.F. applications, decoupling. Some types have controlled temperature characteristics.
Polyester Polycarbonate	0·01–1·0μF 0·01–10μF	50–250V	± 20% or better. General purpose applications. Larger values relatively expensive.
Tantalum	0·1–500μF	5–100V (Observe polarity)	Low leakage; polarised; stable; low voltage ratings, small size.
Electrolytic	Up to 10,000μF or more.	5–500V (Observe polarity)	High values, mainly polarised. Wide tolerance +100%−50% Poor stability.
Variable Types	500 or 1000 pF max. (10 : 1 max/min ratio.) Low values available for trimmers e.g.: 0·5/5 pF.	500V or more	Air insulation types—low loss, stable. Silvered ceramic, P.T.F.E. or mica compression types for low value trimmers.

capacitance equal to the sum of the separate components. Thus a 250μF and a 500μF capacitor will give 750μF when joined in parallel (like polarity ends together—positive to positive, negative to negative when electrolytics are involved). Connection in parallel gives an effective increase in plate area, hence the increase in capacitance.

Series connection is also possible but this gives a capacitance less than the smallest value used. The rule for calculating the effective capacitance is simply

$$\frac{1}{C_{\text{effective}}} = \frac{1}{C1} + \frac{1}{C2} + \frac{1}{C3} + \text{etc.}$$

A 1μF in series with a 0·5μF would give an effective value of 0·33μF. If the capacitors are polarised the positive of one capacitor must be joined to the negative of the next and the individual voltage ratings must be adequate, since high leakage in one component will affect the voltage distribution across all elements.

It is also possible to series connect electrolytics, back to back, to simulate a non-polarised (i.e. reversible) electrolytic but the effective value may be somewhat indeterminate as one capacitor is always effectively the wrong way round and may not yield its specified capacitance under these conditions. The voltage rating is also ill-defined with this connection.

LEAKAGE CURRENT

The leakage current of electrolytic capacitors can be a nuisance if not allowed for in the circuit design stage. When these types are subjected to normal voltage levels, after periods "out of service", the leakage current may initially rise well above the normal leakage current level. The current eventually decreases as the electro-chemical action rebuilds the dielectric barrier.

In general the leakage current depends on the capacitance and voltage and is sometimes specified as a certain maximum current level per unit *CV* product (farad x volt). For low leakage applications tantalum types are extremely useful but usually have a very low reverse voltage limit above which current flow increases rapidly.

COLOUR CODES

Some capacitors, usually below 1μF, have the capacitance, tolerance and voltage rating given by a colour code. The illustrations on the chart give details of two fairly common codes. Ceramic, tantalum bead and polyester types are often colour coded.

Next month we shall begin our study of the behaviour of the BC107 transistor and introduce some experiments using this device.

Test No. 7

Devise a suitable layout for the circuit shown in Fig. 3.1 and wire up the components on the Tutor Board in a neat manner. Connect the voltmeter across points *A* and *D* and with the switch open turn the 100 ohm potentiometer to point *A*. Close the switch and check that the voltmeter reads zero. Slowly turn the potentiometer whilst observing the meter. The voltage rises at first and then remains almost constant at about 4·7 volts even though the potentiometer is turned fully towards point *B*.

Repeat the procedure with the voltmeter connected across the 1 kilohm resistor (point *C* and *D*). In this case the meter will only begin to show an appreciable reading when the diode begins to break down. By studying the circuit and the test results, show that when connected across the 1 kilohm resistor, the voltmeter behaves as though it was a 0-10mA meter in series with the diode.

Test No. 8

This test illustrates the charge-discharge mechanism covered in this month's part. Build the circuit shown in Fig. 3.6 with the capacitor C1=250μF. Observe correct polarity. With the switch initially in position *A* connect the 0 to 10V voltmeter circuit across the capacitor and check that the capacitor is uncharged.

Operate the switch to position *B* whilst still observing the meter. Satisfy yourself that the operation of the circuit is correct and that the discharge occurs more quickly than the charge. Why is this so? (A charged capacitor can be discharged by returning the switch to position *A*.)

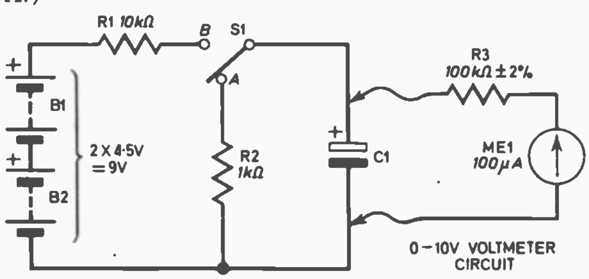


Fig. 3.6. Circuit for use with Test No. 8.

Test No. 9

Repeat Test No. 8 using the 1000μF capacitor. Using the "seconds hand" of a clock or wristwatch measure the time taken for the capacitor to charge to 63 per cent of its final voltage. To perform this test it is necessary first to determine the voltage across the 1000μF capacitor when fully charged. This reading should be approximately 8 volts, which is less than the total battery voltage. (If you have remembered your earlier tests you will know why this is so—if not, go back over the earlier work to find the answer!)

Work out the voltage equivalent to the 63 per cent point which should come somewhere near to five volts. This is half full scale deflection on the meter. The timing is best done with the help of a friend who can note the time elapsed when you call out that the 63 per cent point has been reached. It helps if the switch is moved to position *B* when the seconds hand is at a convenient point on the clock face.

Use the results to estimate the actual capacitance value, which has a wide tolerance on the 1000μF nominal value. Due to the shunting effect of the voltmeter the effective charging resistance is about 9 per cent less than the 10 kilohm resistor i.e. about 9·1 kilohm.

To help check your results note that a capacitor of exactly 1000μF would take 9·1 seconds to charge to 63 per cent of its final voltage, irrespective of the actual battery voltage in use.

Test No. 10

Modify the circuit wiring on the Tutor Board to match the schematic circuit of Fig. 3.7. This is very similar to the previous circuit but allows for rapid charging of the 1000μF when the switch is in position *B*. With the switch in position *A* the only discharge path is via the 100 kilohm and meter and the time constant is now much greater than before (100 seconds for a nominal capacitor value of 1000μF).

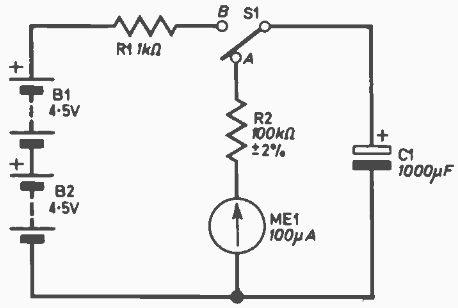


Fig. 3.7. Circuit for use with Test No. 10

Using this arrangement try to plot a discharge curve by taking meter readings every 10 seconds after switching to position *A*. Don't forget that the rate of fall of voltage (or current) will become less as discharge takes place. Several minutes will be needed for a complete discharge with the given values, as using the 5*CR* factor, mentioned earlier, 99 per cent discharge will take 500 seconds!

After recording all the important points, dismantle the circuit and reconnect the protective meter shorting lead.

See page 686 for a progress check.

PICKUPS & TURNTABLES

By GORDON J. KING

For record reproduction three main items besides amplifiers and speakers are involved, (i) the pickup cartridge (ii) the pickup arm and (iii) the turntable unit. The complete unit is usually finished off nowadays with a wooden plinth and tinted Perspex dust cover.

Sometimes the plinth is made sufficiently large to carry the amplifier, it then being necessary to connect a couple of loudspeaker systems and the mains supply to this. The alternative is for the amplifier to be a separate unit designed to accept the signals from the gramophone pickup.

One would rarely nowadays expect to see the loudspeakers in the same cabinet as the record playing equipment and amplifier—at least not when good quality stereo reproduction is the order of the day.

The encased three items are often referred to collectively as the record playing unit which, from a spinning stereo record, yields left and right audio signals for applying to the pickup sockets of the amplifier; this in turn driving the left and right loudspeaker systems to reproduce the two-channel stereo information.

The Pioneer PL61 stereo turntable with Hall effect motor, belt drive deck, tone arm and strobe light.

The Toshiba SR-870 stereo deck with belt drive turntable and electret condenser cartridge.

The left and right channels are called respectively the *A* and *B* channels in some quarters and are colour-coded white and red.

The turntable is commonly driven by mains supply power, the drive motor having synchronous characteristics which tend to "lock" the speed to the mains frequency, thereby ensuring (with the spinning mass of the turntable) rotational speed constancy which is absolutely essential for faithfull reproduction.

Fluctuations of speed below about 10Hz cause a waver of pitch called *wow*, while a similar effect above 10 hertz, is called *flutter*.

Some turntable drive motors are powered from electronic oscillators which means that by changing the oscillator frequency the speed can be regulated; moreover, and more important, a servo control arrangement can be engineered into this in a manner where any speed change produces a control parameter change in the direction required to correct the speed—a sort of feedback system.

V-SHAPED GROOVE

An ordinary stereo disc carries the left and right signals on the two walls of a common V-shaped groove, which means that the two lots of information are recorded mutually perpendicular and each in a plane 45 degrees to the surface of the record. The wall nearest to the centre of the disc carries the left channel signals and the other wall the right channel signals.

It is the job of the pickup cartridge to extract the signals and to present them in isolation to the left and right channels of the amplifier. For the best stereo effect it is important for the signal "leakage" from one channel to the other channel, to be as small as possible. This *channel separation* is given in terms of a decibel ratio, the higher the decibel value the better. The reciprocal term is *crosstalk*, also presented as a decibel ratio, indicating how much signal in one channel is getting into the other channel.

Any pick-up cartridge is thus expected to "trace" the modulation on the two walls and to present it in two isolated channels in an electrical form corresponding to the left and right signals which originated the modulation from the microphone system.

A pick-up cartridge, therefore, can be regarded as a generator which is powered by the mechanical energy coupled from the moving, modulated groove via the vibrating stylus assembly.

The Toshiba SR-510 stereo deck featuring direct drive turntable and condenser cartridge. Suitable for playing CD4 four channel discs.

GENERATING SYSTEMS

The two main generating systems are *piezoelectric* and *electromagnetic*. The former is based on the fact that an electric charge is produced when certain kinds of natural and man-made crystals are bent or stressed. The amount of electricity so yielded depends on the degree of stress.

It is noteworthy that gas and cigarette lighters are now using this principle, whereby the lighting action is arranged to bend a crystal sufficiently to produce enough electricity to cause a spark to ignite the gas!

Piezoelectric pick-ups, though, only produce a low output—often less than 1V. This is because only relatively small stresses occur from the deflection of the stylus coupling under the control of the groove modulation. Generally, the better the overall quality of the cartridge the smaller the electric output.

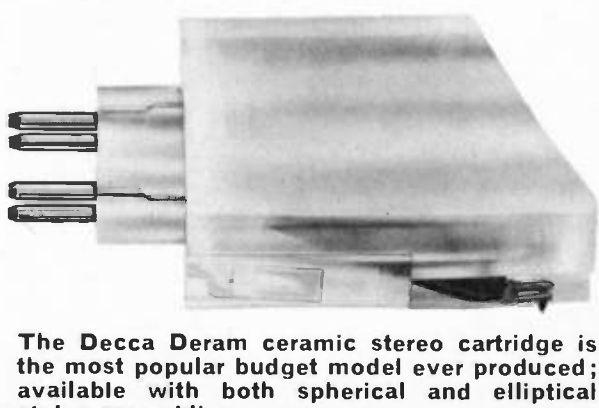
As piezoelectric crystals are not very resilient it is necessary to "gear-down", so to speak, the stylus-to-crystal coupling, which means that the effective deflection at the crystal is less than that at the stylus.

The majority of early piezoelectric cartridges and pickups employed the crystal, Rochelle salt. This is rather fragile and is sensitive to temperature and humidity changes.

Recent years have seen a change from this sort of crystal to a man-made crystal based on a ceramic material. The piezoelectric effect is introduced during manufacture by an electrostatic polarizing process which orientates the crystalline structure of the ceramic so that it exhibits similar characteristics to Rochelle salt. However, the crystal is harder, chemically inert and immune to humidity and other atmospheric conditions.

It produces less output than Rochelle salt and is used mostly in the better quality piezoelectric cartridges which would normally be connected to an amplifier having sufficient input stage (pre-amplifier) gain to step-up the weak signals to operate the power amplifier.

A couple of well known ceramic species among the many available are the Decca Deram and the Goldring CS91E, yielding respective per-channel outputs of some 35 millivolts and 20 millivolts into 2 megohm loads.

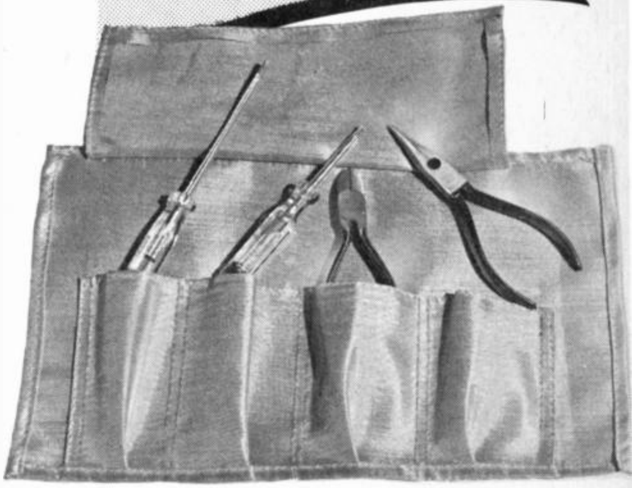


The Decca Deram ceramic stereo cartridge is the most popular budget model ever produced; available with both spherical and elliptical stylus assemblies.

..SPECIAL OFFER!

A HIGH QUALITY TOOL KIT

AT A SPECIAL PRICE £2·99



The tools in the roll are as follows:

1 pair 5½ inch "telephone" pliers
1 pair 4 inch side cutters
1 4-inch insulated screw driver
1 2-inch mains tester (100 to 500 V) screw-driver

Please complete both parts of the coupon below
Allow 28 days for delivery

To: EVERYDAY ELECTRONICS
DEPT. E.E.1. ROCHESTER X
KENT, ME99 1AA

Please send me the Tool Kit(s) as indicated at £2·99 per kit.

I enclose cheque/P.O. No. ....
Value ....

No. OF KITS REQUIRED
NAME ....
ADDRESS ....
....
Tel. No. ....

No. OF KITS REQUIRED
NAME ....
ADDRESS ....
....
....

From: EVERYDAY ELECTRONICS
DEPT. E.E.1., ROCHESTER X, KENT
ME99 1AA

(Please cut around dotted line)

Remittance must be by cheque or postal order (name and address on back of cheques please), crossed and made payable to IPC Magazines Ltd. This offer is open to readers in Northern Ireland, England, Scotland, Wales and Channel Islands only. It is not available in Eire or overseas.

The Kit

To help new readers and established constructors, the staff of E.E. in conjunction with a leading supplier of tools, have put together four tools of high quality that form the basis of any constructor's tool kit. The tools are not cheap but, together with a strong, woven, greaseproof nylon "roll" are offered to readers at a saving of approximately 80p on the recommended retail price.

The kit would make an excellent Christmas present for anyone just starting electronic construction—but be sure to order immediately to avoid disappointment.

Batteries

I recently bought a transistor radio that needed 9 volts to run it. As I did not have the right physical sized batteries I temporarily wired up six HP7s to give the right voltage and the radio did not work. Eventually when I got the right batteries (HP11s) all was well. The original smaller batteries were new and gave the right voltage so why wouldn't they run the radio?

Assuming you did not make a mistake in wiring up the batteries we suspect that the small HP7s were current limiting. This means in simple terms that they did not have enough guts to do the job properly. Because of their small size there is not a very large area of chemically active surface within them; when you draw current from a battery, gases are generated at one of the electrodes and there is a material put in the battery especially to absorb these gases—called a depolariser.

Probably you were trying to draw a high current from the battery and the depolariser was not able to keep up with the gas generation — consequently the battery would cease to pass current. As soon as you switched off and removed the batteries the depolariser would start to have an effect and the battery would appear perfectly normal again.

CSRs

What are the differences between a thyristor, triac and diac?

The thyristor and triac are both used to control high power alternating currents in applications such as light dimmers and motor speed controllers. The thyristor will never let more than half the total mains energy pass through it because it has rectifier properties; the triac, on the other hand, will control both positive and negative going mains excursions.

You can seldom substitute one for another in circuits because the driving circuits usually have to be different. The diac is sometimes called a trigger diode because it is a device that will not conduct current in either direction until a certain voltage is developed across it; when that voltage has been reached the device goes into conduction (in either direction) until the current that is flowing falls below a certain level and then it drops back out of conduction until it is triggered by another high voltage.

...Counter Intelligence

BY PAUL YOUNG

A retailer discusses component supply matters.

I suppose in other trades with the approach of Christmas the retailer has a fairly clear idea what stock he must lay in. Whether it be Teddy Bears, Socks, or Light Ale, he can judge on past experience his probable needs. The component dealer has no such yardstick. True he may sell a few more soldering irons, or multi-meters but on the whole it will depend, on what the projects are in the magazines and also whether they "catch on". Alas the line—hold on, my crystal ball is slipping so I can only cross my fingers and hope!

Width or Depth

In addition one of the major difficulties facing the retailer is the proliferation of all types of electronic components, and he is faced with the invidious choice of stocking in width (i.e. a large variety) or depth (i.e. a smaller variety but greater quantity) and it is becoming more and more obvious that in order to give his customers good service he will have to settle for the latter! We must trust that between all of us everything will be covered.

To accentuate the problem the manufacturers themselves are dictating terms which rule out any alternative. Only recently we had a notification from Repanco stating that in future in their "transistor coil" range not less than 100 of any type of coil could be supplied at one time. They do not supply through wholesalers and there are 16 different varieties of coil. On a quick calculation, it meant an outlay of nearly £600 in order to sell a few dozen coils. I have no doubt they can justify their decision on economic grounds, but I am sure the sober truth is that they have been wooed by the colour T.V. manufacturers.

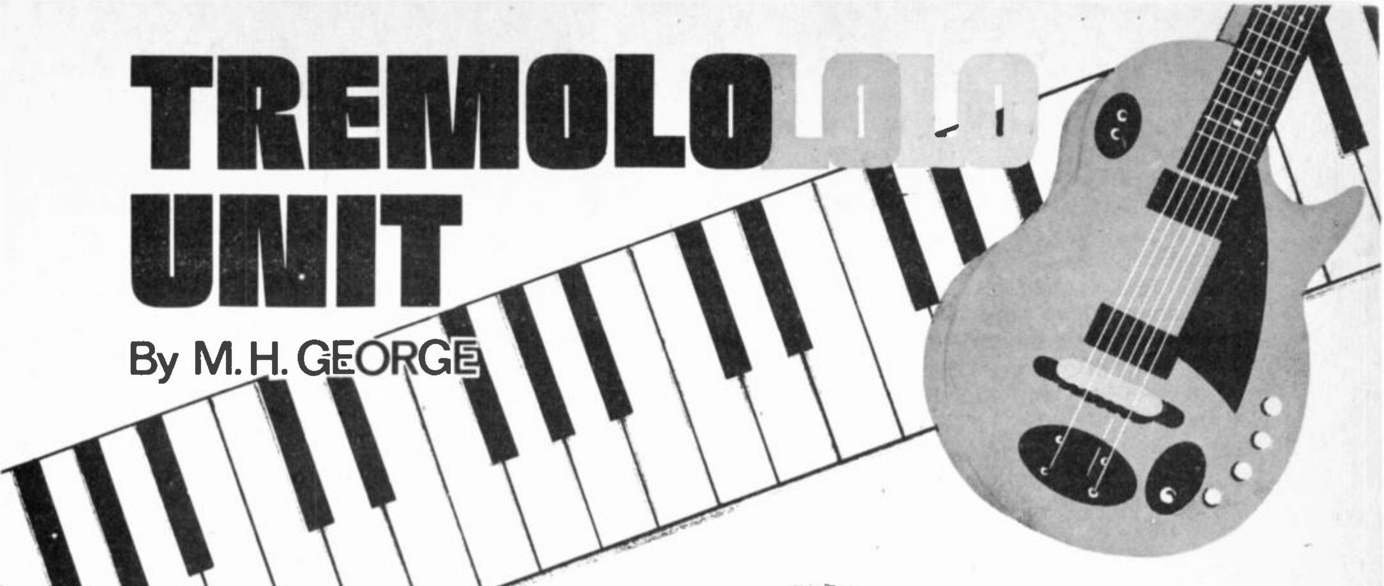
We joined a buying group several years ago and it was hoped that between all the members we might buy them, each member buying one range but there was insufficient interest, and so one more component bites the dust. I would like to be able to tell you that this is an isolated case, but unfortunately I cannot. I could quote probably another six examples at least. So when you ask your supplier for an XYZ coil and he tells you he has not got one, do not think he is too lazy to pick up the phone and order some!

Asides

Being near Christmas I was hoping to tell you about the Indian who walked into our shop one day and asked us to make him a talking kettle, and about the Russian chauffeur who used to come down to our shop once a week in an embassy car, complete with a hammer and sickle flag on the front. He would enter and stand stiffly to attention and say "Me Sokolov, me want 7 lamp Philips"! but this would be deviating too far from the straight and narrow, so you will have to read my memoirs. Good Christmas shopping.

TREMOLO UNIT

By M. H. GEORGE



An effects unit for use with electric guitar or organ.

Approximate cost of components including V.A.T.
£2.10 plus case

THE tremolo effect is one electronic musical effect which has become extremely popular with electric guitar and organ players, but for the average amateur user, the drawback is that commercial units are very expensive to buy. The effect of tremolo is to vary the amplitude of the input signal at a rate determined by the setting of the speed control.

CIRCUIT ACTION

The "electronics" part of the circuit is simply an oscillator producing a sine wave voltage variation of frequency between about 3Hz and 15Hz. This varying signal is then used to modulate the signal input from the instrument. The oscillator configuration used is known as a twin T bridge (Fig. 1), which gives a 180

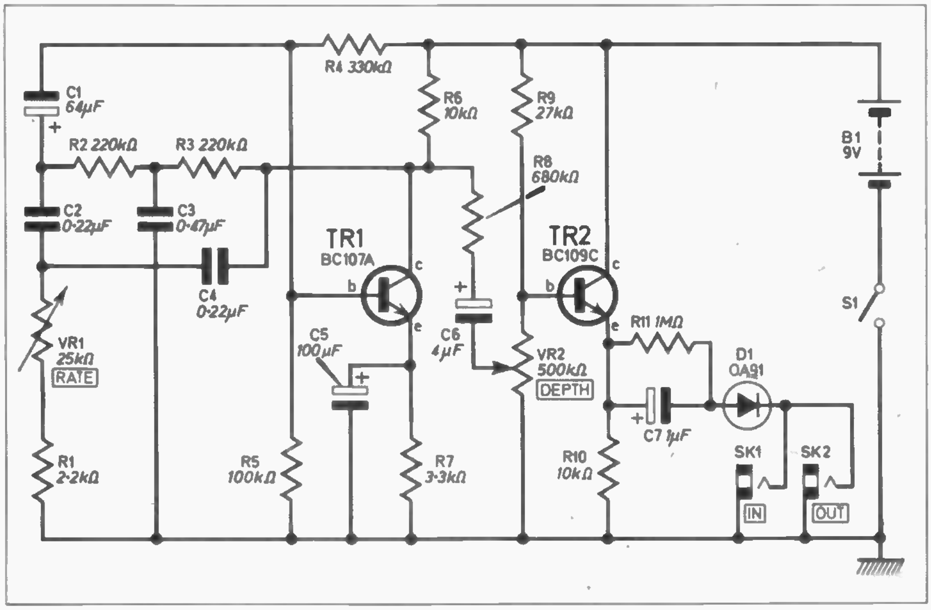


Fig. 1. Complete circuit diagram of the Tremolo Unit.

degrees phase shift at a frequency set by the values of C2, C3, C4 and R2, R3, R1 and VR1. This shift, when added to the 180 degrees phase shift produced by TR1, connected as a common emitter amplifier, gives a total 360 degrees shift, or positive feedback, which results in oscillation.

The slowly varying signal appearing at TR1 collector is taken via C6 and R8 to the "depth" control, VR2, which determines how much of this alternating voltage is fed to the base of TR2, connected as an emitter follower to buffer the relatively high impedance output from TR1 against possible low impedances at the input jack sockets.

The values of C1 and C5 are not critical, and may be anything between 40µF and 200µF, the main consideration probably being the physical size of the components. Also D1 may be any **germanium** diode, TR2 should be one of the higher gain groupings of the BC109, i.e. BC109B or C, while TR1 should be a lower gain grouping of BC107, i.e. unclassified or BC107A.

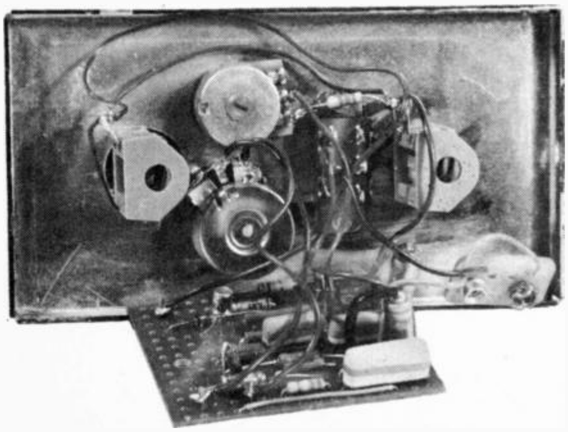
VEROBOARD WIRING

The piece of Veroboard may be cut from a standard strip of 65mm width (16 holes). Capacitors and resistors should be mounted first after making the necessary breaks in the strip and mounting holes of 4BA or 6BA clearance to preference, see Fig. 2. The transistors may be mounted next, and the diode last, using a heat-sink on the leads of these components, especially the germanium diode.

The best way of connecting the wires, which run between the front panel and the board, to the Veroboard is to use Veropins or short pieces of stiff wire at these points, and then make the connections later, soldering the wires to the pins.

CASE CONSTRUCTION

The front panel lid should be drilled first, as indicated in Fig. 3—the round holes are most easily and neatly made with chassis punches. A 6mm hole should be drilled and the remainder



filed out to form the 12mm by 6mm rectangular hole for S1. The switch, controls and sockets can now be mounted and interwired.

The box part of the case is drilled to take the Veroboard, and in one corner, to take a Terry clip or similar for the battery mounting. When positioning these holes, make sure, of course, that none of the top panel components are fouled in any way by components on the Veroboard or by the battery.

The circuit board is mounted on spacers which are of sufficient height to ensure that the copper side of the board is clear of the metal case. The board and clip are best secured using countersunk screws, so that the base of the unit is left fairly flat. The final assembly is completed by wiring the front panel to the Veroboard. Wires between the lid and the board should be of reasonable length to facilitate removal of the lid for battery changing, etc.

THE UNIT IN USE

As the circuit diagram shows, it does not matter which way round the amplifier and instrument are connected to the unit, which is connected between the instrument and the amplifier. It is suitable for use with guitar or organ ▣

Components....

Resistors

R1	2·2kΩ	R6	10kΩ
R2	220kΩ	R7	3·3kΩ
R3	220kΩ	R8	680kΩ
R4	330kΩ	R9	27kΩ
R5	100kΩ	R10	10kΩ
All ¼W ± 10% carbon		R11	1MΩ

Capacitors

C1 64µF elect. 9V
C2 0·22µF } polyester
C3 0·47µF } polyester
C4 0·22µF } polyester
C5 100µF elect. 9V
C6 4µF elect. 9V
C7 1µF elect. 9V

Potentiometers

VR1 25kΩ carbon log.
VR2 500kΩ carbon lin.

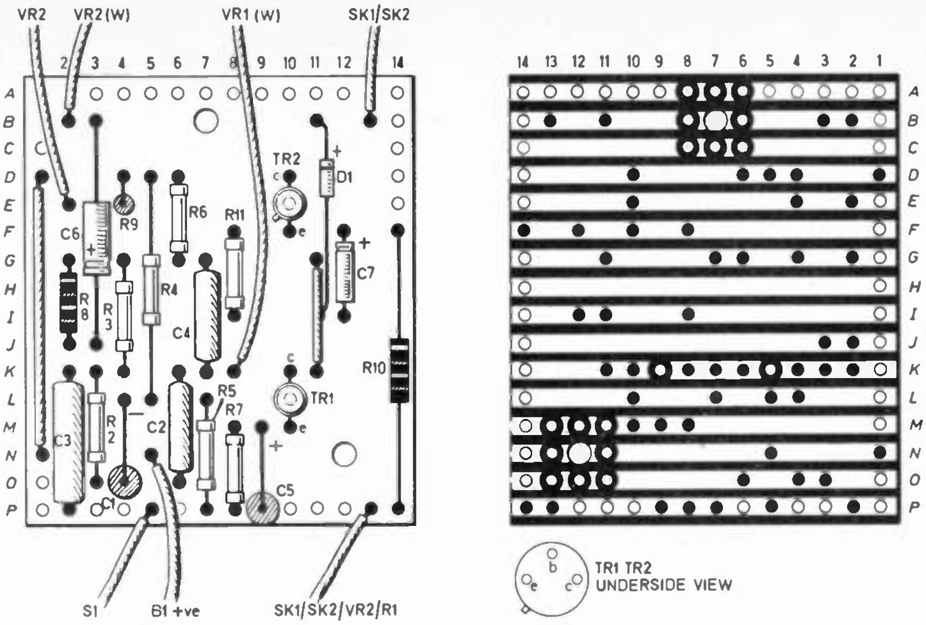
SEE SHOP TALK

Semiconductors

TR1 BC107 or BC107A silicon *npn*
TR2 BC109B or BC109C silicon *npn*
D1 OA91 germanium diode

Miscellaneous

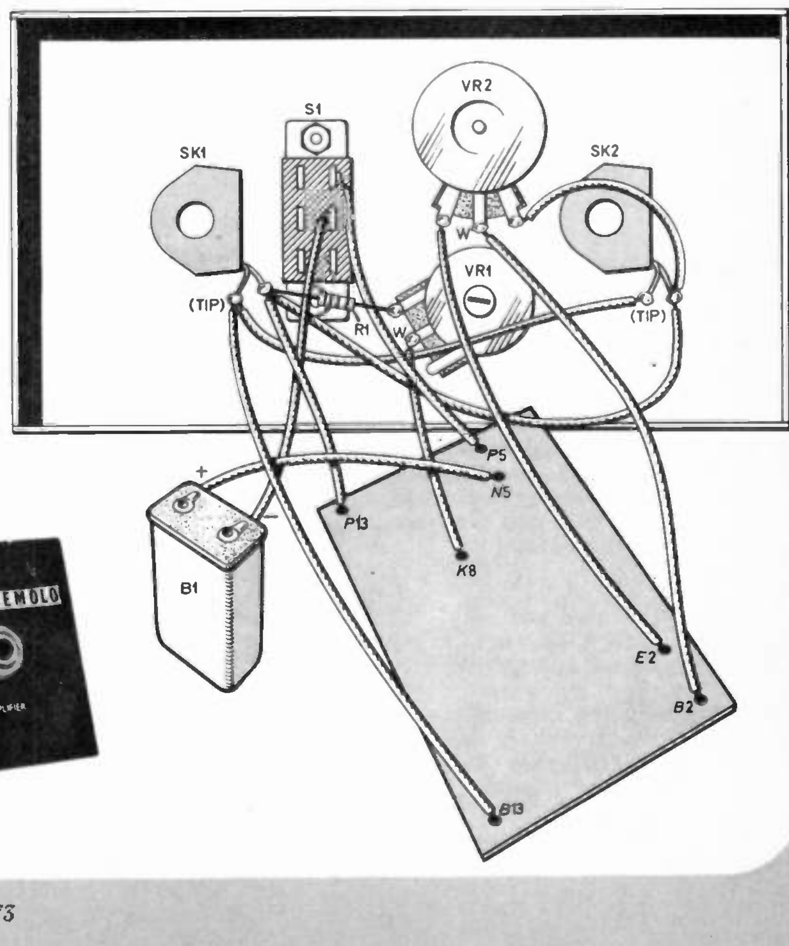
SK1 standard jack socket
SK2 standard jack socket
S1 s.p.s.t. slide or toggle switch
B1 9V PP3 battery
Battery connectors, Veroboard 14 holes by 16 strips x 0·15 inch matrix, aluminium case 138mm x 74mm x 40mm (approx), knobs for VR1 and VR2.

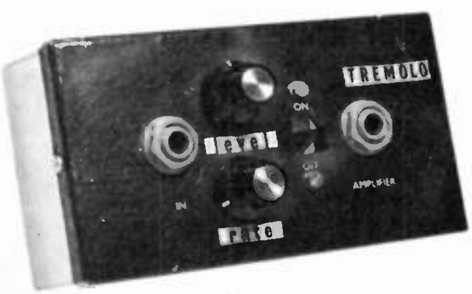


TREMOLO UNIT

Fig. 2 (above) Layout and wiring of the components mounted on the Veroboard.

Fig. 3 (right) Layout and wiring of the complete unit.





DOWN TO EARTH

By GEORGE HYLTON

"How is it that carbon resistors, all about the same size, can have quite different power ratings?"

Traditionally, carbon resistors come in standard wattage ratings such as $\frac{1}{2}$W, $\frac{1}{4}$W, $\frac{1}{8}$W and so on. In recent times, however, resistor makers have taken to quoting power ratings which take into account the ambient temperature in which the resistor has to work. The basis of power ratings for resistors is temperature.

There is always some temperature which is high enough to damage the materials from which a resistor is made. One source of heat is the power dissipated in the resistor when current flows through it. Even if there were no other source of heat, this self-heating would impose a limit to the power which could safely be dissipated in the resistor.

In practice, the resistor has to operate in surroundings which may raise its temperature even when no power is being dissipated. This explains those puzzling differences in power ratings.

AMBIENT TEMPERATURE

To illustrate the point, let's conduct an imaginary experiment with a resistor. This resistor has a maximum safe operating temperature of exactly 100 degrees centigrade. Anything higher will destroy it. We now pop it into the oven with the thermostat set to 100 degrees centigrade. Our resistor is kept at its upper temperature limit by the ambient temperature inside the oven alone. Any more heat and it will die.

If, keeping it in the oven, we pass any current through it at all, its temperature will pass the safe limit and the resulting chemical changes will destroy it. Our resistor may, in ordinary circumstances, be $\frac{1}{2}$ watt type, but in the oven, to all intents and purposes, it's a zero-watt type.

If we relent a little, and turn the oven down to 90 degrees C, we can pass a little current through the resistor without damaging it. But only enough to raise its temperature by 10 degrees C, that is, from 90 degrees C back to 100 degrees C again. Any more, and it's finished. So it's still far from being a $\frac{1}{2}$ watt resistor.

If we go on turning down the oven, to 80 degrees C, 70 degrees C, 60 degrees C and so on, at each new lower temperature we can safely put more electrical power into the resistor. Eventually we shall have reduced the temperature so much that our "$\frac{1}{2}$ watt" resistor will really be able to dissipate $\frac{1}{2}$ watt of electrical power without coming to grief.

ACTUAL DISSIPATION

How do you know what temperature allows the full power rating to be achieved? You don't, without consulting the maker's data on the particular type of resistor you are using. If the resistor happens to be a type made for military use the rated ambient temperature may be quite high, say 70 degrees C.

It will be obvious from our oven experiment that such a resistor, if rated at $\frac{1}{2}$ watt at 70 degrees C, will safely dissipate more than $\frac{1}{2}$ watt at room temperatures of 20-25 degrees C. By the same token, a resistor intended for use in domestic equipment and rated to dissipate $\frac{1}{2}$ watt at 25 degrees C will certainly not stand up to $\frac{1}{2}$ watt at 70 degrees C. On the other hand, it will probably be much smaller than its military, high-temperature counterpart, of the same apparent power rating.

Our "resistor-in-the-oven" example was highly artificial and unrealistic in one respect. We assumed for the purpose of the argument that a sharp dividing line could be drawn between a safe operating temperature and a lethal one. Real life isn't like that, and the dividing line is blurred. As the temperature is raised, the destructive chemical reactions are speeded up, but they still go on, slowly, at lower temperatures, gradually destroying the resistive "track" and so altering the resistance. If your particular application can tolerate a 10 per cent change of resistance over the lifetime of your equipment, then you can work your resistors harder than if only a one per cent change can be tolerated.

SPECIFICATIONS

This idea of the allowable change of resistance over a period of time is built into some makers' specifications. The Mullard CR25 resistor is an example. Graphs are published which enable the user to select an operating power which ensures that the resistance stays within known limits.

You can now see why some makers quote several ratings for the same resistance. A resistor with, say, 0·5 per cent tolerance may be expected to stay within, say, one per cent of its nominal value for 1000 hours at one dissipation, within five per cent at another, higher dissipation, and within 10 per cent at a still higher one—all at a specified maximum ambient temperature, of course.

"Can't you be satisfied with a transistor radio glued to your ear like everyone else!"

This Christmas

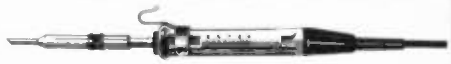
if your imagination stops at cigars...

...give Antex

MODEL X25 Soldering Iron
220-240 Volts or 100-120 Volts. The leakage current of the NEW X25 is only a few microamps and cannot harm the most delicate equipment even when soldered "live". Tested at 1500v. A.C. This 25 watt iron with its truly remarkable heat-capacity will easily "out-solder" any conventionally-made 40 and 60 watt soldering irons, due to its unique construction advantages. Fitted long-life iron-coated bit 1/8". 2 other bits available 3/32" and 3/16". Totally enclosed element ceramic and steel shaft. Bits do not "freeze" and can easily be removed. **PRICE £1·93** (rec. retail) P & P 8p. Suitable for production work and as a general purpose iron.

MODEL CCN
220 volts or 240 volts. The 15 watt miniature model CCN also has negligible leakage. Test voltage 4000v. A.C. Totally enclosed element in ceramic shaft. Fitted long-life iron-coated bit 3/32". 4 other bits available 1/8", 3/16", 1/4" and 3/64". **PRICE £2·15** (rec. retail) P & P 5p.

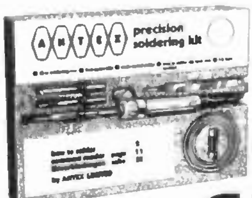
MODEL G 18 watt miniature iron, fitted with long-life iron-coated bit 3/32". Voltage 240, 220 or 110. **PRICE £2·15.** (rec. retail) P & P 5p.



MODEL CN Miniature 15 watt soldering iron fitted 3/32" iron-coated bit. Many other bits available from 3/64", to 3/16". Voltages 240, 220, 110, 50 or 24. **PRICE £1·93.** (rec. retail) P & P 5p.

all prices include VAT at 10%

MODEL SK.2 KIT
Contains 15 watt miniature iron fitted with 3/16" bit, 2 spare bits 5/32" and 3/32" heat sink, solder, stand and "How to Solder" booklet.
PRICE: £2·87. (rec. retail) P & P 8p.



MODEL MLX KIT
Battery operated 12v. 25 watt iron fitted with 15' lead and 2 heavy clips for connection to car battery. Packed in strong plastic wallet with booklet "How to Solder".
PRICE £2·27 (rec. retail) P & P 12p.

MODEL SK.1 KIT
Contains 15 watt miniature iron fitted with 3/16" bit, 2 spare bits 5/32" and 3/32", heat sink, solder, stand and "How to Solder" booklet. **PRICE £3·25** (rec. retail) P & P 12p.

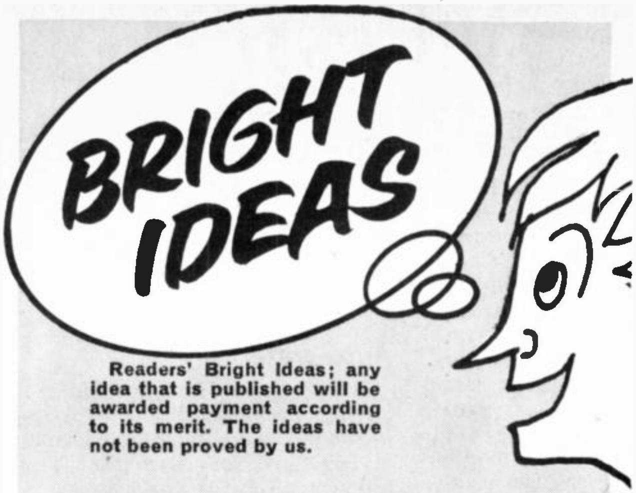
A N T E X

From radio or electrical dealers, car accessory shops or in case of difficulty direct from:— **ANTEX LTD. FREEPOST** (no stamp required) **PLYMOUTH PL1 1BR** Tel: 0752 67377.

Please send the following:
. . . .
. . . .

I enclose cheque/P.O./Cash (Giro No. 2581000)
. . . .

NAME . . . .
ADDRESS . . . .
EE 12
. . . .



Readers' Bright Ideas; any idea that is published will be awarded payment according to its merit. The ideas have not been proved by us.

When desoldering printed circuit boards one frequently comes across multi-terminal components such as integrated circuits and transformers which defy desoldering owing to the small size of the average soldering iron bit. To effectively increase the area of the bit a few turns of heavy gauge wire round the soldering iron bit will allow such components to be desoldered. A similar extension, with a protruding wire, can be used for cutting through thermo-plastics, which tend to mess-up a soldering iron bit if used directly.

N. Howard,
Rutland.

This idea came to me while I was trying to find my solder reel in amongst the pile of "junk" accumulating on my workshop bench. At that time my components were stored in plastic interlocking storage drawers often advertised in this magazine. My solder reel fits neatly in the smallest of these drawers. To make the solder run freely a hole must be drilled slightly larger than the diameter of the solder in the middle of one side of the drawer and the case. I have since made a wire feed based on this same principle.

A. Freed,
Bucks.

I have found a useful and inexpensive way of making microphone or earpiece holders. A plastic, one ounce ground pepper container obtainable from nearly all food stores is ideal from the point of view of size and the perforations in the lid avoid the necessity of making further holes. The microphone or earpiece is easily mounted with adhesive, in the lid behind these holes and the flex can be brought through the bottom of the container which, although quite strong, is light and very easy to cut.

S. M. Poultney,
Bath, Somerset.

Please Note: this column is intended for constructional ideas and ideas relating to electronic construction. It is not our intention to publish circuits of any description.
All items submitted should be original and not previously published. If similar ideas are submitted by two or more readers the first received will be published.

Next Month...

VCO EFFECTS UNIT

A voltage controlled oscillator that can be used as an effects unit with drums or other instruments. The oscillator can also be used with an amplifier to form a simple instrument.

RECEIVER

An f.e.t. m.w. receiver, the "Fetset" is simple to build using only two transistors in a pocket size case. A good design for the new constructor.

SEWING MACHINE SPEED CONTROL

A power controller that provides easier slow speed control of electric sewing machines.

All in the January issue of

Everyday Electronics

On sale Wednesday December 19

SHOP TALK

By Mike Kenward

IT was interesting to see one reader commenting in a recent letter that if we published any more audio effects units he would go mad and start pulling his hair out—I hope he does not as we don't like losing regular readers. The comment is of course a valid one but with fantastic interest in audio and special effects it is difficult for us not to publish such items regularly. A case of providing designs for the majority. Anyway there are always one or two other items in each issue that are aimed at different fields and this one is no exception.

Baby Snatch Alarm

Although basically simple the *Baby Snatch Alarm* does incorporate one or two rather unusual components such as the pressure mat, key operated switch and the illuminated sign, apart from these three items the components are quite straight forward.

Taking the switch first, a basic switch is available from Home Radio or Henry's Radio but the ignition switches in cars are rather better as they use a better type of key and are thus less easily "picked". A breakers yard should be able to provide the switch but you may need to get the key from a garage. The pressure mat is only available from J. Bull as far as we know.

The lamp has proved rather more difficult to get—a suitable one is available from Home Radio but can only be supplied with the wording engraved and these are thus rather expensive (about £1·25). Various types are available from smaller suppliers—particularly ex-equipment types. If you cannot get a similar one it is possible to mount a piece of opaque Perspex on the front panel and use two "L" bracket type lamp holders behind it to illuminate the lettering.

Incidentally, the lettering is best added using Letraset and spraying over with clear varnish to protect it.

Tremolo

The *Tremolo* can be dealt with very quickly by saying that all the components should be readily available. If necessary a footswitch may be added in parallel with the on/off switch, so that the unit can be foot operated when required.

The values of the electrolytic capacitors are not critical.

Auto-water

Once again few component buying problems for the *Autowater* but some comment on one or two parts may be useful. The integrated circuit used is available in two types of case; this project uses the 14 pin dual in line (d.i.l.) type and, if the wiring diagrams are to be followed this type should be obtained—it is also a good idea to get a socket for the i.c. to prevent damage when soldering.

The relay must work mechanically and must possess at least two sets of contacts—so that it operates correctly—the contacts are not used for electrical connections and can thus be of any type.

Finally an unusual item, the drainpipe, this should be available from most d.i.y. shops—the diameter will need to be about 6 inches, we think this is more correctly called sewer pipe.

TEACH-IN '74 QUESTION TIME

IF you wish to test your progress in the *Teach-In '74* series so far, why not have a go at answering the following questions. The questions are based on the material presented in the first three parts. Answers next month.

1. Are electrons positive or negative?
2. How are current and charge related?
3. What does Ohm's law state?
4. What is the effective value of 10kΩ in parallel with 22kΩ?
5. What is the maximum current allowable for a 1 watt, 1kΩ resistor?
6. What colours represent ±1%, ±5% and ±10% in the resistor code?
7. What resistance value is coded Red, Violet, Yellow, Gold?
8. If the negative terminals of two 4·5V batteries are connected together what is the voltage difference between the remaining two terminals?
9. If the dielectric of a capacitor is made thinner what happens to the capacitance?
10. What is the time constant for R=10kΩ and C=22μF in series?
11. What energy can be stored in a 1000μF, 100V working voltage, capacitor?
12. When constructing the 0–10V voltmeter must the resistor always be connected in the positive lead?
13. Does the band marking on a diode indicate the anode or the cathode connection.
14. A battery, resistor and diode are connected in series. The voltage across the diode is approximately the same as the battery. Is the diode (a) forward biased, (b) reverse biased, (c) damaged?
15. What is the maximum current allowable via a 10V, 400mW Zener diode?
16. What value results from 1μF in series with 5μF?
17. Does a lamp bulb have a constant resistance?

DEMO CIRCUITS

11

By MIKE HUGHES

The Hartley Oscillator

To look at the conventional way a **Hartley oscillator** circuit is drawn it is rather difficult, at first, to grasp what is going on. In an attempt to simplify the explanation of how it works we have started off with a circuit that is more in keeping with the type of transistor stage we have come across so far. In actual fact there is no difference whatsoever between the circuits of Figs 11.1 and 11.2

BASIS OF OPERATION

Anyway, look at Fig 11.1 for a start! Transistor TR1 is basically a grounded emitter amplifier stage but instead of a resistor as a collector load we are using the primary winding of a transformer T1. Resistors R1, R2, and R3 are the normal biasing resistors we have come across before and C3—if we were to use it—would be the emitter decoupling capacitor to prevent negative feedback between emitter and base. More about C3 later.

Notice that T1 is wound so that the signal at point *B* is out of phase with that at point *A* (relative to the common point *C*). You can tell that there is a phase reversal between primary and secondary of the transformer by noting the dots that show the starts of the respective windings.

Forgetting C1 for a moment, consider what is happening if we assume that the transistor is working as an amplifier that has its output signal fed back (in phase) to the input. When the circuit is switched on for the first time the bias current into the base of TR1 will make the voltage at *A* fall slightly; this induces a rising voltage at *B* and this is fed back to the input via C2 to point *D*. The effect of this rising voltage across C2 injects extra base current and the transistor conducts more making the voltage at A fall further.

If this argument is continued it can be seen that there is a form of positive feedback which continues until the transistor is fully conducting. When this happens there will be no further change in voltage at *A* and hence no induced voltage at *B*; consequently the feedback signal falls and this makes the transistor cease conducting and the voltage at *A* rises. Again positive feedback assists because the rise in potential at *A* makes the voltage at *B* fall—this reverses the direction of the feedback current which now opposes the bias current; this process continues until the transistor is turned off.

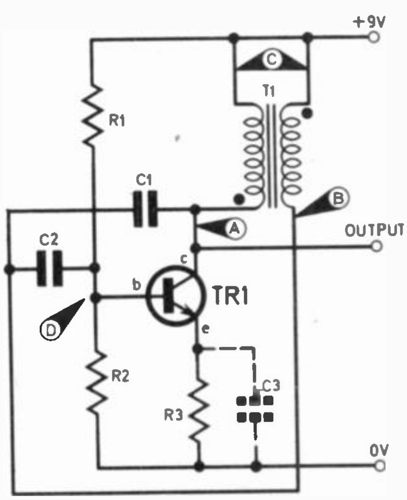


Fig. 11. 1. A basic Hartley circuit with the circuit layout slightly modified to ease the explanation.

WAVESHAPE

One of the features of the Hartley oscillator is that it produces a very stable sinusoidal waveform but to achieve this end there are two points to consider. Firstly how do we prevent the transistor going from fully conducting to totally cut off (to get a pure sinewave we must not clip the waveform); secondly how do we control the frequency?

We will deal with the waveshape first as it is the simplest problem. The answer is to control the amount of positive feedback so that it is sufficient to maintain oscillation but not so high that clipping occurs. This can be done in one of two ways; either by reducing the turns ratio between primary and secondary of T1 or by deliberately introducing an amount of *negative* feedback that will negate the positive feedback to some degree. The latter technique is preferable because by its very nature it is self compensating to a fair degree.

In our example we are going to use a transformer with a 1 to 1 turns ratio, so we have ample feedback signal, and to keep this in bounds we can inject a considerable amount of negative feedback by totally removing the normal emitter decoupling capacitor C3 (that is why it is shown dotted). Later on if you make the circuit you can experiment with fewer turns on the secondary and you may have to reduce the amount of negative feedback to maintain oscillation; this is done by introducing progressively larger values of capacitance for C3.

FREQUENCY CONTROL

To see how the frequency is controlled it might be better to look at Fig 11.2. First, assure yourself that it is identical to Fig 11.1 except that instead of a symbol for a transformer we have used a single winding inductor, centre tapped. Don't worry though, this is identical to T1 of Fig 11.1. Point *C* is the same common point which is connected to the positive rail and you can, if you like, consider the single winding as being two adjacent windings on the same core having the start at *A* for the winding between *A* and *C* and the start at *C* for the winding between *C* and *B*. The reason for using a single winding is that in this instance we can dispense with one of the four lead out wires shown in Fig 11.1 (it is easier to make!).

Having sorted out the circuit now look at the position of our C1; it is across the terminals of inductor L1. This forms a tuned circuit that has maximum impedance when the reactance of C1 equals the reactance of L1 and this can only occur at one frequency,

i.e. when $2\pi fL = \dfrac{1}{2\pi fC}$

where f is in Hz, L in henries and C in farads.

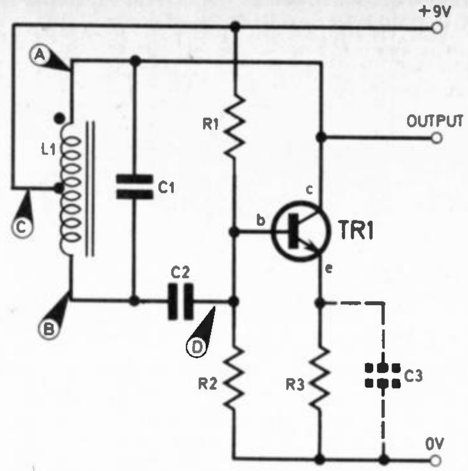


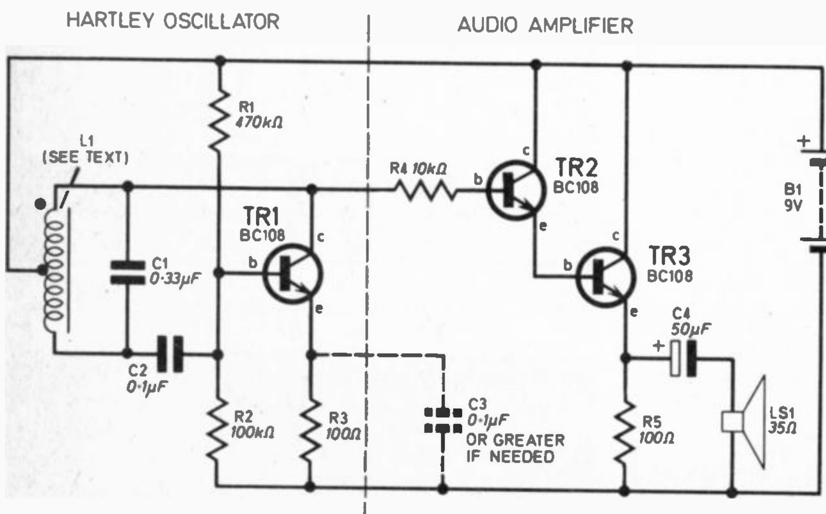
Fig. 11. 2. A more conventional schematic for a Hartley Oscillator.

By doing a little algebra it can then be shown that maximum impedance is obtained at a frequency given by:

$$f = \frac{1}{2\pi\sqrt{LC}}$$

When the tuned circuit L1 C1 shows maximum impedance maximum voltage drop across it will be obtained. Thus, in simple terms, it can be seen that the feedback signal amplitude at *B* will be maximum for only one frequency and it is at this frequency that the circuit will prefer to oscillate. If, however the amount of positive feedback is too great, not only will this distort the waveshape but also incite the circuit to oscillate at other frequencies—it is quite common to encounter a phenomenum called "squegging" when the circuit tries to oscillate at two frequencies at the same time. In audio circuits this sometimes sounds like an outboard motor ticking over (depending on the frequencies involved) and is known as "motor boating".

Fig. 11. 3. A practical Hartley Oscillator.

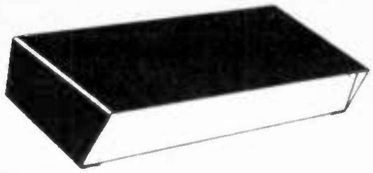


PRACTICAL CIRCUIT

A practical demonstration circuit is shown in Fig 11.3, this will oscillate quite happily in the upper audio frequencies. L1 has an inductance of about 1·5mH and can be made by winding 350 turns of 32 to 36 s.w.g. enamelled wire onto about 75mm of ⅜inch diameter ferrite aerial rod. At 175 turns, a length of the wire should be looped out of the windings to form the centre tap.

Next part: The diode gate

PSYCHEDELIC LIGHTING UNIT IN KIT FORM
Make this fascinating three-channel unit from a kit which contains all components needed to produce a reliable and entertaining display. Takes its drive from the speaker terminals of a record player, tape recorder or portable radio. Will provide a brilliant 2kW of light, using normal 240 volt coloured lamps. Price per kit, £10·40



METAL CABINETS
These attractive steel cabinets are PVC covered in a range of colours, and offer an economically priced unit for the home constructor. The chassis, which has a white satin PVC finish, provides an easily accessible building area, with an integral fascia panel. The cabinet is supplied complete with stick-on feet.
Colours available include Green, Grey Black, White and Blue. Every effort will be made to supply a selected colour, but please give alternatives if possible.

Approximate size in inches l.	w.	d.	Price
8	6	3	£1·60
11	6½	3	£2·04

Other sizes to special order. HOLES PUNCHED in front or back panels to your own requirements. Please send S.A.E. for quotation.

FIXED VOLTAGE REGULATORS
TO3 case. Gives stabilised supply. MVR 5 V, MVR 12 V, MVR 15 V. All priced at £1·65

VEROBOARD

	0·1	0·15
2½ × 1in	7p	7p
2½ × 3¾in	27p	20p
2½ × 5in	29p	29p
3¾ × 3¾in	29p	29p
3¾ × 5in	31p	32p

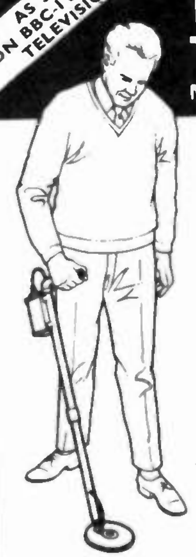
PRINTED CIRCUIT CAPACITORS
Electrolytic, low voltage, small size. Available in the following uF/V. 0·47/63, 1/63, 2·2/63, 4·7/40, 10/63, 22/40, 100/10, 9p each; 47/40, 100/63, 220/40, 470/16, 15p each; 1,000/16, 18p each.

Our CATALOGUE, priced at 25p post free, shows the majority of the R.S. range of professional components. Most are available by return of post. Prices include VAT. All orders over 50p POST FREE. S.A.E. with all queries please.

CELECTRON-E
P.O. Box No. 1, Llantwit Major, Glamorgan, Wales GF6 9YN

AS SEEN ON BBC-1 & BBC-2 TELEVISION

BUILD THE
TREASURE TRACER Mk III
METAL LOCATOR



- Genuine 5-silicon transistor circuit, does not need a transistor radio to operate.
- Incorporates unique varicap tuning for extra stability.
- Search head fitted with Faraday screen to eliminate capacitive effects.
- Loudspeaker or earphone operation (both supplied).
- Britain's best selling metal locator kit.
- Kit can be built in two hours using only soldering iron, screwdriver, pliers and wire snips.
- Excellent sensitivity and stability.
- Kit absolutely complete including drilled, tinned, fibreglass p.c. board with component siting printed on.
- Complete after sales service facilities.
- Weighs only 22oz; handle knocks down to 17" for transport.

Send s.a.e. for leaflet.

Complete kit with prebuilt search head	£9·80 Post etc. 35p (Inc VAT)	Built, tested and Guaranteed	£13·75 Post etc. 35p (inc VAT)

MINIKITS ELECTRONICS, 35b Langley Drive, Wanstead, LONDON E11 2LN. (Mail order only)

DISCOUNTS UP TO 60%

Global's GOLDEN Guarantee
WE GUARANTEE THAT WITHIN 7 DAYS OF PURCHASE IF ANY ITEM OF GOODS IS FOUND TO BE GENUINELY DEFECTIVE WE WILL REPLACE THE SAID GOODS WITHOUT QUESTION. AFTER 7 DAYS GOODS ARE COVERED BY MANUFACTURERS 12 MONTHS GUARANTEE

ALL PRICES ARE INCLUSIVE OF V.A.T.

FANTASTIC OFFER
GARRARD SP25 Mk III
Goldring G800. Teak finish, plinth and tinted cover with mains lead and DIN plug and screened lead. All fully wired.
Please add £1·75 for P. & P. and Ins. **£14·50**

TURNTABLES
Please add 95p P & P and Ins.

BSR MP60	£9·05
Garrard SP25 Mk III	£9·25
Garrard SL65B	£12·75
Garrard AP76	£16·75
Garrard 401	£25·95
Garrard Zero 100 (sgle)	£30·63
Garrard Zero 100 (Auto)	£34·95
Goldring GL85/P. P & C	£59·30
Goldring G101/P. P & C	£19·75
Goldring GL72	£21·90
Goldring GL72/P	£28·50
Goldring GL75	£27·35
Goldring GL75/P	£34·90
Goldring GL Lid	£3·55
Goodmans TD100 P & C G800 Cart	£47·15
Thorens TD125	£59·95
Thorens TD125 AB Mk II	£92·50
Thorens TD160 AB & C	£44·95
Thorens TD165 AB & C	£51·50
Condor Auto Cleaner (Star Value)	£1·40 P & P 15p

TUNERS
Please add 95p P & P and Ins.

Alpha Highgate FT150	£32·95
Amstrad Multiplex 3000	£23·90
Lowther FM Mk 8 N/P	£42·75
Lowther FM Mk 9 N/P	£72·50
Metrosound FMS 20 Mk II	£37·75
Rogers R/brook FET 4 (Cha)	£32·95
Rogers R/brook FET 4 (Cased)	£36·50
Sinclair cased tuner	£25·30
Teleton GT202 (N/P)	£30·55

TUNER/AMPLIFIERS
Please add £1·10 P & P and Ins.

Alpha FR 3000	£61·35
Goodmans Module 80	£59·90
Goodmans Mod 80 Com	£106·50
Goodmans Mod. 90	£74·75
Goodmans One-Ten	£86·50
Rogers R/brook (Cha)	£61·95
Rotel 150A	£45·25
Rotel 200A	£57·95
Status STA160	£89·95

AMPLIFIERS
Please add 95p P & P and Ins.

Amstrad 8000 Mk II	£15·85
Amstrad IC2000 Mk II	£34·85
Amstrad Integra 4000	£22·95
Alpha Highgate FA400	£32·25
Global 10 + 10	£19·75
Global 20 + 20	£25·95
Keletron 700	£19·25

Keletron 1500	£24 95
Metrosound ST20E Mk II	£29·45
Metrosound ST60	£49·70
Rogers R/brook (Ch)	£41·15
Rogers R/brook Mk III (Ca)	£44 35
Rogers R/bourne (Ch)	£54·25
Rogers R/bourne (Ca)	£56 75
Sinclair 2000	£24·00
Sinclair 3000	£30·50
Sinclair 605	£21·45
Sinclair PRO 60 2 x Z30/PZ5	£16·40
Sinclair PRO 60 2 x Z30/PZ6	£19·45
Sinclair PRO 60 2 x Z50/PZ8 Trans	£25·25
Sinclair AFU (Filter Unit)	£4·95
Sinclair Stereo 60 Pre-amp	£7·35
Sinclair Z30 Amp	£3·85
Sinclair Z50 Amp	£4·50
Sinclair PZ5 Power Supp.	£4·20
Sinclair PZ6 Power Supp.	£6·15
Sinclair PZ8 Mains Trans.	£4·95
Sinclair PZ8 Power Supp.	£6·15

SPEAKERS
£1·65 for P & P (Per Pair)

Amstrad Acoustra 1500	£26·90
Amstrad Acoustra 2500	£30·75
B & W DM5	£38·50
Celestion Ditton 15	£50·75
Celestion Ditton 44	£79·95
Goodmans D/Maxim	£39·70
Goodmans Mezo 3	£49·95
Goodmans Havant	£34·95
Keletron KS4	£13·95
Keletron KS8	£22·50
Sinclair Q16	£10·95
Sinclair Q30	£30·95
Wharfedale Denton II	£26·80

SPEAKER UNITS

Wharfedale Linton Kit	£16·85
Wharfedale Glendale Kit	£29·95
Goodmans Din 20 Kit	£14·75
Wharfedale Dovedale Kit	£44·95

PLINTH & COVERS
£3·20

For Garrard SP 25, 2025 TC, 3000, BSR McDonald MP60 £3·08, P. & P. 71p.
For AP76, SL72B, SL95B, etc. £4·75, + 71p P. & P.

CARTRIDGES
Please add 11p P & P and Ins.

Goldring G850	£2·75
Goldring G800	£3·75
Goldring G800E	£6·70
Goldring G800SE	£10·90
Shure M3D	£3·25
Shure M44E	£4·55
Shure M55E	£5·00
Shure 75ED Type 2	£9·25
Shure V15	£25 95
Shure M75EJ Type 2	£7 95

All prices correct at time of press (E. & O. E.) and are subject to alterations

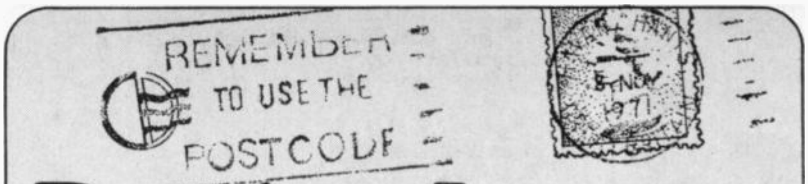
GLOBAL AUDIO DISCOUNT WAREHOUSES

Dept. (EE12), 174 Pentonville Road, London N.1. Tel. 01-278 1769
Or: 4 High View Parade, Redbridge Lane East, Woodford Avenue, Ilford, Essex. Tel. 01-550 1086

Open Monday to Saturday 9.30 a.m. to 6 p.m. LATE NIGHT FRIDAY 7 p.m.

MAIL ORDERS: Order with confidence. Send Postal Order, Cheque, Money Order, Bank Draft, Giro or Cash by Registered Mail. **CALLERS.** Please note that cheques can only be accepted together with cheque cards (not Barclay Card)

2 minutes from KING'S CROSS, EUSTON & ST. PANCRAS on main road leading to the East and West Country



Readers Letters

Beta Down Under

Having been interested in electronics for only a short while, I have found EVERYDAY ELECTRONICS and more especially the *Teach-In '74* series, to be most useful and informative for beginners like myself, and without it I probably would have given up long ago. Thank you.

For quite some time now I have wanted an electric guitar, but could never find sufficient finance to buy one commercially, so I was highly delighted when the project on the *Beta Electronic Guitar* was announced. I waited until I had all three issues concerning the *Beta* before embarking on my first electronic project.

I realised I would have trouble obtaining the transformer type M218 and probably the jack socket without sending to England for them, but decided to go ahead anyway and make as many of the parts as I could, including the pick-ups.

The materials and components were gathered together from three different states of Australia, and with the help of friends and an understanding wife, the guitar was manufactured on the kitchen bench.

All was completed and ready to go except for the transformer, and all enquiries for a 5 ohm to 50 kilohm matching transformer turned up zero, so with the help of a very good friend and technician, a single transistor pre-amp circuit was developed to take its place, which, with a few modifications to original circuits, has done the job very well.

I am so pleased with the performance and sound of the guitar, plus the big saving in cost, that if anyone else in Australia is building or wanting to build the same, and is having the same difficulties as I had, I would be only too pleased to be of any assistance with information if they care to write to me.

Thank you once again for helping me get started in electronics through your magazine.

T Holmes,
152 Heber St.,
Moree, 2400
N.S.W.
Australia.

Battleground

I was interested in Mr. R. Macdonnell's letter, EVERYDAY ELECTRONICS July 1973, which mentioned various kits. He seems to have enjoyed a great deal of success with his equipment which functions correctly after being assembled and wired. My own experience however is that correct assembly and wiring with good soldered joints does not guarantee satisfactory operation of electronic equipment.

Some years ago I caught the radio bug and decided to put together a t.r.f. radio or "straight" set as it is sometimes called. This receiver was a three valve plus rectifier set in a cream plastic case, and it produced a mains hum when switched on.

I then went to work on it by removing the metal rectifier and fitting a double-diode valve in its place. My joy was short lived however, because having removed the mains hum I now had a modulation hum from the loudspeaker.

Two 0·02 microfarad 1000V capacitors connected to each anode of the rectifier cured this trouble. Then transistor radio's appeared and I simply had to have a shot at these not knowing what lay in wait for me.

The first attempt was a complete failure and it was sent back from whence it came, my own fault of course, printed circuit soldering had defeated me (incorrect soldering iron—too large) produced many dry joints.

At present I have a transistor radio waiting for a new volume control because the one sent had faulty switch contacts. Has any other reader found it a battleground of electronics.

W. J. Mitchell
Lancs.

Price

As a schoolboy, I would like to thank you for putting your magazine and your projects within both the scope and pocket-money of the schoolboy enthusiast; I have already constructed quite a few of your ideas, and still find money for more!

N. D. Tyrrell,
Nr. Bristol.

COMPETITION WINNER

The first prize-winner of EVERYDAY ELECTRONICS soldering competition Mr. David Riley (right of our picture) with the Viscount Audio System donated by Radio and T.V. Components (Acton) Ltd. On the left are Editor Fred Bennett who made the presentation, and Assistant Editor Mike Kenward. Mr. David Riley whose home is at Orpington, Kent, has just entered University to study medicine.

One hundred runners-up have been awarded prizes consisting of soldering equipment donated by Adcola Products Ltd., Antex (Electronics) Ltd., and Multicore Solders Ltd.

EVERYDAY ELECTRONICS thanks all firms concerned for their valuable support for this contest.

KITS FOR PREVIOUS PROJECTS

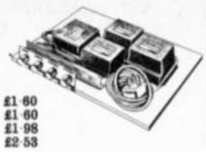
Unless otherwise stated, kits contain electronic parts only. The case and special items can be obtained locally. Also batteries are not included. Kits may be returned for refund if construction has not been started. We reserve the right to substitute components should deliveries be protracted so as to avoid undue delay.

If reprint of data is required add 10p

HOME SENTINEL. "Ward off the unwanted intruder"—No elaborate setting up or wiring required. Kit of parts £4·35.
"SNAP" INDICATOR. Press your button first and your opponent is blocked also suitable for Quiz games and reaction testing. Kit of parts £1·10.
RECORD PLAYER. Good quality at a reasonable price—good enough for classical records and pop. Kit of parts £6·10.
WINDSCREEN WIPER CONTROL. Wet dirty road—Drizzle—Fog—Smeared screen—Scraping wipers—combat these with add-on wiper control. Kit of parts £3·50.
FUZZ BOX. Add weird and interesting effects to guitar playing with this solid state Fuzz box. Kit of parts £3·50.
PHOTOGRAPHIC COLOUR TEMPERATURE METER. Must for colour photographer get the colours right gives quick indication of filters necessary for correction in any light. Can be used with natural or Studio lighting. Kit of parts £3·58.
ASTRON M.W. RADIO. A simple M.W. reflex circuit receiver—easy to build £3·30.
REMOTE TEMPERATURE COMPARATOR. Measures small temperature changes in liquids or gasses—fish tank, photographic solution—thermostatically controlled rooms etc. Kit £5·25.
RAIN WARNING ALARM. Keep your washing dry with this automatic alarm device. Kit £2·20.
WAA WAA PEDAL. Add excitement and sound vibration to your music. Kit £3·50.
ELECTRO LAUGH. Laughter simulator also useful electronic alarm. Kit of parts £2·20.
SOIL MOISTURE METER. Many plants are killed through over-watering—this meter measures soil moisture at root depth—probes can be left permanently beside the plant—indicator remotely housed could monitor several plants. Kit £3·90.
SIGNAL INJECTOR. A useful pocket instrument for fault finding in radios and amplifiers. Kit £1·10.
BABY ALARM. Keep a check on the kids—this device will give you peace of mind as you watch T.V. Kit £4·40.
SIMPLE CALCULATOR. Teaching aid for multiplication—can be used for quick checks. Kit £3·10.
POWER SUPPLY UNIT. Just right for testing low voltage circuits—a simple stabilised supply providing 0-16 volts D.C. continuously variable. Kit £5·90.
METAL LOCATOR. A simple easy to construct self-contained metal locator giving a meter indication of buried metal. Kit £5·00.
AUDIO TONE GENERATOR. Makes electronic music—covers range from 50—2000 hz. Specifically designed for use with tape recorder. Kit £3·25.
LIGHT TO SOUND CONVERTER. Produces an audio tone—the frequency of which is dependent on the light level. Kit £3·15.
SHAVER INVERTER. Provides 240v 50hz from 12 volt car battery—gives approx. 10 watts which is enough for most shavers. Kit £4·35.
ELECTRONOME. Electronic Metronome with pulse frequency continuously variable from 40—225 beats per minute. Kit £3·15.
THROUGH LENS LIGHT METER. A simple light meter for use with single lens reflex camera. Kit £4·25.
MEDIUM AND LONG WAVE RADIO TUNER. A simple radio tuner for use with almost any amplifier. Kit £3·25.
INFRA RED BURGLAR ALARM. Uses an invisible, reflected beam to detect intruders when beam is intercepted—a power output is switched on for up to one minute. Kit £4·35.
CASSETTE TAPE POWER SUPPLIES. Two units to power a cassette tape player or recorder one from the mains. Price £2·50. Two from the car battery—price £1·40.
REACTOMATIC. A reaction testing game that can also be a quiz answering indicator. Kit £3·30.
ELECTRONIC MOUSE TRAP. A humane mouse trap—catches them alive so that you can release them in the park. Kit £3·25.
TRANSISTOR TESTER. A rapid tester for checking most transistors—tests transistors in an oscillator circuit and gives audible indication of goodness. Kit £3·15.
BIT SAVER. Prolongs life of soldering iron bit—prevents pitting. Kit £1·95.
ICE WARNING DEVICE. A device that can be set to indicate 'ice' conditions or similar temperature levels. Kit £1·55.
AUDIO COLOUR UNIT. Add a colour dimension to your audio equipment. This unit will modulate three lamps in accord with Bass—middle and treble notes of any music. Kit of parts £7·20.
U.H.F. T.V. AERIAL. A simple aerial for U.H.F. to reception on your band could improve your reception immensely. Kit £1·85.
DAMP LOCATOR. Easily carried in your pocket this little unit gives visible indication of damp. Kit £1·25.
ENLARGER & EXPOSURE METER. For D.I.Y. photographer £5·00.
EGG TIMER. Simple timer with audible warning. £4·15.

TERMS:—10% discount if ten of an item ordered, spad postage where quoted—other items, post free if order for these over £5·00 otherwise add 20p.

MULLARD UNILEX STEREO SYSTEM

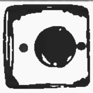


There is no doubt that it is a good system, we believe that for the money it is without comparison. We demonstrate gladly at our Tamworth Road depot. Prices of the individual items for this:—

1 Unilex Amplifier	Ref. EP.9000 ..	£1·60
1 Unilex Amplifier	Ref. EP.9000 ..	£1·60
1 Unilex Pre-Amp	Ref. EP.9001 ..	£1·98
1 Unilex Power Unit	Ref. EP.9002 ..	£2·53
1 Control panel kit with spun aluminium faced knobs		£3·30

Or the complete outfit—£11·30 post paid.
Pair of 15 ohm speakers made by E.M.I. are also available if required, price £3·30 the pair. No extra postage if ordered with the above, otherwise add 25p.

THYRISTOR LIGHT DIMMER



Domestic model for any lamp up to 250 watt. Mounted on switch plate to fit in place of standard switch. Virtually no radio interferences. Price £2·95. Industrial model 5 amp module with control knob not on switch plate £3·30.

DISTRIBUTION PANELS

Just what you need for work bench or lab. 4 × 13 amp sockets in metal box to take standard 13 amp fused plugs and on/off switch with neon warning light. Supplied complete with 6 feet of flex cable. Wired up ready to work. £3·50 plus 23p P. & I

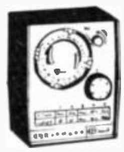
CD CAR IGNITION

This system which has proved to be amazingly efficient. We offer kit of parts as P.W Circule £6·55 plus 20p p. & p. Deluxe model with prepared circuit board £7·95. When ordering pleast state whether for positive or negative systems.

CENTRIFUGAL BLOWER

Miniature mains driven blower centrifugal type blower unit by Woods. Powerful but specially built for quiet running—driven by cushioned induction motor with specially built low noise bearings. Overall size 4½" × 4½" × 4". When mounted by flange, air is blown into the equipment but to suck air out, mount it from centre using clamp. Ideal for cooling electrical equipment or fitting into a cooker hood, film drying cabinet or for removing flux smoke when soldering etc. etc. A real bargain at £2·05.

HORTSMAN 24 HOUR TIME SWITCH



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

Programme	Hot Water	Central Heating
0	Off	Off
1	Twice daily	Off
2	All day	Off
2	Twice daily	Twice daily
4	All day	All day
5	Continuously	Continuously

Suitable of course, to programme other than central heating and hot water, for instance, programme upstairs and downstairs electric heating or heating and cooling or taped music and radio. In fact there is no limit to the versatility of this Programmer. Mains operated—Size 3" × 3" × 2" deep as illustrated but less case. Price £3·50 each.

GOOD COMPANION

We can now offer these again in i.c. version using Ferranti ZN414 and Mullard AF Modules 1172. Excellent tone wood cabinet. Cabinet size approx. 11in wide × 8in. high × 3in. deep. Complete assembly instructions £5·75 plus 25p post and ins.

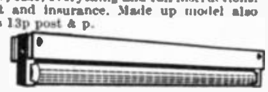
MIGHTY MIDGET

Probably the tiniest possible radio, as described in Practical Wireless, January '73. All electronic parts £2·20 post paid.

DRILL CONTROLLER
NEW IKW MODEL

Electronically changes speed from approximately 10 revs. to maximum. Full power at all speeds by finger-tip control. Kit includes all parts, case, everything and full instructions. £1·65 plus 13p post and insurance. Made up model also available. £2·50 plus 13p post & p.

THE TWENTYLITE



Flourescent lighting units with polyester choke and finished white enamel. 24" model. Ideal kitchen, bedroom, hallway, porch, lift, etc., with tube. Assembled ready to install. Price £2·90 + 35p p. & p.

RADIO STETHOSCOPE

Easiest way to fault find—traces signal from aerial to speaker—when signal stops you've found the fault. Use it on Radio, TV amplifier, anything — complete kit comprises two special transistors and all parts including probe tube and crystal earpiece. £2·20—twin stetho-set instead of earpiece 83p extra—post and ins. 20p.

1 HOUR MINUTE TIMER

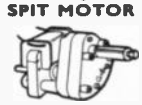
Made by famous Smiths company, these have a large clear dial, size 4¼in. × 3½in., which can be set in minutes up to 1 hour. After preset period the bel rings. Ideal for processing a memory jogger or, by adding simple lever, would operate micro-switch. £1·26

KITS FOR PREVIOUS PROJECTS CONT. FROM LEFT HAND COL.

NEON NOVELTY. Interesting modern ornamental device £1·65.
INDICATOR AUDIBLE WARNING. Add this audible warning device to car indicators or dash panel warning lights and your attention will be instantly drawn to the warning lamp kit. £1·20.
NIGHT LIGHT SWITCH. A simple control to dim a lamp. Kit £1·10.
GENERAL PURPOSE AMPLIFIER. An audio amplifier of reasonable quality for use with radio tuners—audio oscillators, record decks—electric guitars, etc. Kit £4·90.
HOME INTERCOM. Keep in touch with this simple, easily connected good quality two way intercom. Kit £4·00
FLASHING LIGHT METRONOME. For use in the musical field and the laboratory—where an audible not on click could get lost or become annoying. Kit £1·40.
MINI ORGAN. A three octave, stylus operated organ—neatly and simply constructed on a printed circuit board. Kit £4·75.
RAIN ALARM II. Sounds an audible alarm as soon as the first rain drops fall. Kit £2·00.
CASSETTE AMPLIFIER. Boosts the output from cassette tape recorders and transistor radios. Kit £4·50.
AUDIO SIGNAL MIXER. Where you want to mix speech and music, and to fade them in and out—no tape enthusiast should be without this. Kit £3·90
AUTO FAN. A thermostatic control for car engine fan, gives quicker warming up time, etc. Kit £3·35.
SLAVE FLASH. Photos taken with a single flash have a "flat" appearance—a second flash correctly positioned overcomes this. This unit enables a second (or third) flash to be automatically triggered. Kit £1·85.
ELECTRONIC DOORBELL. Not in fact a bell but an electronic circuit that produces an unusual sound when the button is pressed. Kit £4·00.
WAA WAA. Add another sound dimension to your guitar or organ. Kit £1·50.
I.C. RADIO. A fantastic personal radio uses a special I.E., is small, easy to build, yet gives excellent results. Kit £3·10.
AQUARIUM THERMOSTAT. A very sensitive electronic thermostat. Can also be used for other applications requiring fine control of temperature. Kit £3·85.
TRAIN CONTROLLER. With most control there is considerable loss of power on low speeds—this unit overcomes this problem and makes slow speed realistic. Kit £3·15.
STEREO HEADPHONE ADAPTER. Enables one or two sets of stereo headphones to be used with an amplifier. £1·85.
4 BAND TRF RECEIVER. Receives amateur, shipping and normal medium wavebands. £8
GAS ALARM. A simple alarm detects gases, vapours and smoke. £5·99

8 GANG TUNING CONDENSERS. 500pf each section ideal for transmitter or communications receiver. 61p.

SPIT MOTOR



200-250V induction motor, driving a Carter gearbox with a 1¼" output drive shaft running at 5 revs p.m. Intended for roasting chickens, also for driving models—windmills, coloured disc lighting effects, etc. £2·05 plus 20p post and ins.

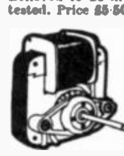
RECORD PLAYBACK HEADS (TRUVOX)

Individual prices of these are:—
2 track record playback heads 50p each.
4 track record playback heads 72p each.
Erase heads are also available separately—
2 track 33p—4 track 55p

TINIEST AUDIO UNIT

Although only the same size as an Oxo cube these are completely self contained and comprise microphone, 3 transistor amplifier with volume control and battery compartment and finally a dynamic earpiece. All in a plastic case. Made by Ardent (Sold, we believe at over £50 each). These are really hearing aids complete except for the ear tube but we are not selling these as hearing aids only for the micro midget parts they contain. Believed to be in perfect working order but not tested. Price £5·50 each.

MAINS MOTOR



Precision made—as used in record decks and tape recorders—ideal also for extractor fan, blower, heaters, etc. New and perfect. Snip at 85p. Postage 20p for first one then 10p for each one ordered.
1" stackmotor 94p.
1½" stackmotor £1·10.

NEED A SPECIAL SWITCH

Double Leaf Contact. Very slight pressure closes both contacts. 8p each 10 for 60p. Plastic push rod suitable for operating. 6p each. 10 for 54p.

RESETTABLE FUSE

How long does it take you to renew a fuse? Time yourself when next one blows. Then reckoning your time at £1 per hour see how quickly our resettable fuse (auto circuit breaker) will pay for itself. Price only £1·10 each or £12 per dozen, specify 5, 10 or 15 amp—*simply fit in place of switch.*

J. BULL (ELECTRICAL) LTD.

(Dept. E.E.), 7 Park Street, Croydon CRO 1YD

Callers to: 102/3 Tamworth Road, CROYDON.

MAINS OPERATED CONTACTOR

220/240v. 50 cycle solenoid with laminated core so very silent in operation. Closes 4 circuits each rated at 10 amps. Extremely well made by a German Electrical Company. Overall size 2½ × 2 × 2in. £2·20 each.

1 REV. PER MINUTE MOTOR WITH GEAR-BOX

Made by the famous Chamberlain & Hookham Ltd. These could be made to drive clock or similar. Really robust reliable unit. Price £1·10 each.

AUTO—ELECTRIC CAR AERIAL

with dashboard control switch—fully extendable to 40in or fully retractable. Suitable for 12V positive or negative earth. Supplied complete with fitting instructions and ready wired dashboard switch. £6·35 plus 25p post and insurance.

MAINS TRANSISTOR POWER PACK

Designed to operate transistor sets and amplifiers. Adjustable output 6v., 9v., 12 volts for up to 500mA (class B working). Takes the place of any of the following batteries: PP1, PP3, PP4, PP6, PP7, PP9 and others. Kit comprises: mains transformer rectifier, smoothing and load resistor, condensers and instructions. Real snip at only £1·10, plus 20p postage.

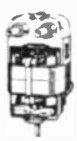
MINIATURE WAFER SWITCHES

2 pole, 2 way—4 pole, 2 way—3 pole, 3 way—4 pole, 3 way—2 pole ,4 way—3 pole, 4 way—2 pole 6 way—1 pole, 12 way. All at 25p each.

DRY FILM LUBRICANT

Dry Film Lubricant. In aerosol can for easy application and for putting lubricant into places where the normal oil can cannot reach. Home and everyday uses. We have purchased a large quantity of these from the Liquidator and are able to offer them to you for about half of the original list price. 88p per (8 oz.) can or 12 cans for £8 post paid. The lubricant is I.C.I. fluon L169.

MULTI-SPEED MOTOR

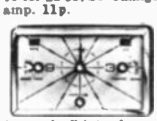


Six speeds are available 500, 850 and 1,100 r.p.m. and 8,000, 12,000 & 15,500 r.p.m. Shaft is ¼ in. diameter and approximately 1 in. long. 230/240v. Its speed may be further controlled with the use of our Thryrister controller. Very powerful and useful motor size approx. 2 in. dia. × 5 in. long. Price 97p plus 23p postage and insurance.

SLIDE SWITCHES

Slide Switch. 2-pole changeover panel mounting by two 6B.A. screws. Size approx. 1in × ⅝in rated 250V lamp. 8p each. 10 for 75p. Ditto as above but for printed circuit 6p each, 10 for 65p Sub Miniature Slide Switch. DPDT 19mm (⅞in approx.) between fixing centres. 20p each or 10 for £1·90. SP Change over spring return 250v 1 amp. 11p.

15A ELECTRICAL PROGRAMMER



Learn in your sleep: Have radio playing and kettle boiling as you awake—switch on lights to ward off intruders—have warm house to come home to. All these and many other things you can do if you invest in an electrical programmer Clock by famous maker with 15 amp. on/off switch. Switch-on time can be set anywhere to stay on up to 6 hours. Independent 60 minute memory jogger. A beautiful unit. Price £2·15 + 20p p & p or with glass front chrome bezel 83p extra.

1 CHIP RADIO

Ferranti's latest device ZN414—gives results better than superhet. Supplied complete with technical notes and circuits. £1·35 each. 10 for £12.

Hi-Q TUNER COMPONENTS

For experimenting with the ZN414.

KIT NO. 1. Plessey Miniature Tuning Condenser with built in LW switch and 3" ferrit slab and litz wound MW coil and wave change switch, 72p

KIT NO. 2. Air spaced tuning condenser 6" ferrite rod litz wound MW and LW coils and wave change switch, 94p.

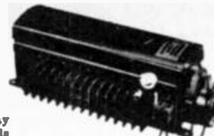
KIT NO. 3. Air spaced TC with slow motion drive 8" ferrit rod, with litz wound LW and MW coils and wave change switch, £1·10.

KIT NO. 4. Permeability tuner with fast and slow motion drive and LW loading coils and wave change switch, 50p.

HOUR MINUTE TIMER

Made by Smiths. Complete with control knob and calibrated dial. Useful in kitchen, office, dark-room, etc. Bargain at 55p.

HONEYWELL PROGRAMMER



This is a drum type timing device, the drum being callibrated in equal divisions for switch setting purposes with trips which are infinitely adjustable for position. They are also arranged to allow 2 operations per switch per rotation. There are 15 changeover micro switches each of 10 amp type operated by the trips thus 15 circuits may be changed per revolution. Drive motor is mains operated 5 revs per min. Some of the many uses of this timer are Machinery control, Boiler firing, Dispensing and Vending machines, Display lighting animated and signs, Signalling, etc. Price from makers probably over £10 each. Special snip price £6·33 plus 25p post and insurance. Don't miss this terrific bargain.

THIS MONTH'S SNIP

WALL THERMOSTATS. Made by the famous Smiths Instrument Co. called Colourstat. Wall mounting and in a handsome plastic case. (Cream and beige). Adjustable by slider (lockable) and may be set to control temperatures from around freezing through to 50°C. The slide panel is engraved and indicates (frost) (warm) (very warm), etc. The thermostat will control heaters, etc. up to 15 amp at normal mains voltage and is ideal for living room, bedroom and greenhouse, etc. Price £1·65. Don't miss this.

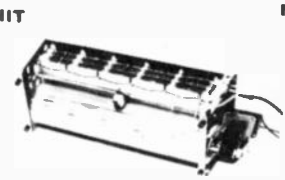
TEACH IN '74

A new beginners series started with the October issue of this magazine, we will be supplying all the parts for this. The initial kit covering all components required for the first 6 months is available post and VAT included—price £7. A special feature about our version of this kit is the 4½" × 3" meter 0-100uA meter. As the author says, a large meter is so much easier to read than a small one.

BABY SNATCH ALARM
AUTO-WATER FOR PLANTS
TREMELO UNIT

To receive parts for these and other feature projects, send the quoted approximate amounts and any cash adjustment can be made later.

TANGENTIAL HEATER UNIT



This heater unit is the very latest type, most efficient, and quiet running. Is as fitted in Hoover and blower heaters costing £15 and more. We have a few only. Comprises motor, impeller, 2kW. element and 1kW. element allowing switching 1, 2 and 3kW. and with thermal safety cut-out. Can be fitted into any metal line case or cabinet. Only needs control switch, £3·85. 2kW. Model as above except 2kW. £2·75. Don't miss this. Control Switch, 44p plus VAT P. & P. 40p.

PORTABLE RADIO CASE DE-LUXE

A similar size to the above but a more expensive design. Used with the Good Companion de-luxe model. £2·20 plus 50p post and insurance.

24hr. REPEATING TIME SWITCH

Made by Smiths these are A.C. mains operated. NOT CLOCKWORK. Ideal for mounting on rack or shelf or can be built into box with 13A socket. 2 completely adjustable time periods per 24 hours. 5 amp change-over contacts will switch circuit on or off during these periods £2·75 post and ins. 23p. Additional time contacts 55p pair.

SWITCH TRIGGER MATS

So thin is undetectable under carpet but will switch on with slightest pressure. For burglar alarms, shop doors, etc. 24in × 18in £1·69. 13in × 10in £1·21.

HORSTMANN "TIME & SET" SWITCH

(A30 Amp Switch.) Just the thing if you want to come home to a warm house without it costing you a fortune. You can delay the switch on time of your electric fires, etc. up to 14 hours from setting time or you can use the switch to give a boost on period of up to 3 hours. Equally suitable to control processing. Regular price probably around £5. Special snip price £1·65 Post and ins. 23p.

KETTLE ELEMENTS

Made by the famous A.E.I. Co. Complete with washers and combined fixing ring and plug shroud. Normal 2 round pin and flat pin earth connection and overload reset push button. 2 Models—1⅛in (approx.) suitable for Swan and other similar models—1⅝in (approx.) suitable for G.E.C., Hotpoint, etc. All quick boil 2½kW elements at 240V. Price £1·33.

BATTERY CONDITION TESTER

Made by Mallory but suitable for all batteries made by Ever Ready and others, most of which are zinc carbon types but also mercury manganese—nicad—silver oxide and alkaline batteries may be tested. The tester puts a dummy load on the battery and the meter scale indicates the condition depending upon which section the pointer rests. The section reads "replace" "weak" or "good". The tester is complete in its case, size 3¾" x 6¾" 2" x with leads and prods. Price £2·50 plus 20p postage.

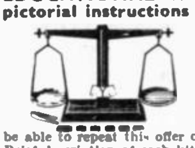
12 WAY SUB-MINIATURE MULTI-CORE CABLE

7·0076 copper cores each core P.V.C. insulated and of different colour. P.V.C. covered overall and approx. 3/16in. thick. Price 22p per yard.

SNAP ACTION SLIDE SWITCH

Rated 5a. 240v. Made by Arrow. Type fitted in the handles of electric drills, vacuums, etc. 5p each. 10 for 54p.

EDUCATIONAL KITS — all with pictorial instructions



THIS BALANCE KIT FREE. Eagle educational kits. Japanese made, these are excellent value for money. We do not expect to be able to repeat this offer once stocks are sold. Brief description of each kit is given below and with 3 kits or more we give FREE an accurate 11 piece balance kit. Price of kits 44p each post paid. Special price for all 7 kits £3·00 with free balance kit.

KA2 Lens Kit. Eleven parts, including candle, one concave lens, one convex lens, stage and slit frame, etc. Watch light rays bend as they pass through different lenses.

KA3 Water Pump Kit. Thirteen parts. Top of pump is transparent so that operating parts may be observed. Small parts are brightly coloured to be seen easily while working. Three types of pump may be made: Lift Pump, Force Pump and Force Pump with reservoir and nozzle.

KA4 Buzzer Kit. Eleven parts. Transparent covers allow the operation of buzzer to be seen. Illustrates and teaches how electromagnetism with an automatic switch results in an operating buzzer.

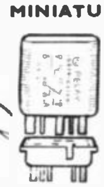
KA7 Electro-Magnet Kit. Fifteen parts, includes compass. Makes two electro-magnets, one with one layer of wire and one with several layers of wire. Picks up tacks, nails and any small parts showing how magnetism works.

KA8 Current and Resistance Kit. Twenty-nine parts, including bench and light bulb. Conduct interesting and educational projects to learn the application of "OHMS LAW" and see the difference in current and resistance with different types and lengths of wire.

KA9 Bell Kit. Eight parts, including bell and push button switch. Build a complete electric bell and see how the hammer is triggered to make the bell ring.

KA10 Morse Key Buzzer and Bell Kit. 25 part kit, easy to construct, simple to operate.

MINIATURE SEALED RELAY



American made. Our Ref. No. REL A1. Measures only ⅞" wide × ½" thick and ⅞" high and it's a double change over, we don't know the contact rating but estimate this at 3/5 amps. The coil resistance is 600 ohms and 9-12 volt will close it. Ideal for models and miniaturised equipment. It's a plug in relay but we supply complete with base. Price 28p including base.

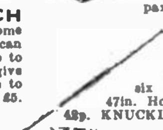
TELEPHONES

Complete as illustrated. Save your legs, time and temper, simply by putting in some telephones. Ex. G.P.O. not new— but guaranteed in good condition and serviceable. Supplied with diagram and instructions showing how to connect. 3 types available as illustrated less internal bell £1 each. Ditto with bell but less dial £1·25 each. As illustrated with dial and bell £1·50 each. Post etc. 50p each.

BAKELITE INSTRUMENT CASE

Size approx. 6¼" × 3¾" × 2" deep with brass inserts in four corners and bakelite panel. This is a very strong case suitable to house instruments and special rigs, etc. Price 54p each. pax lid 11p extra.

TELESCOPIC AERIAL



for portable, car radio or transmitter. Chrome plated—six sections, extends from 7½ to 47in. Hole in bottom for 6BA screw. 42p. KNUCKLED MODEL FOR F.M. 55p

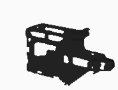
TREASURE TRACER

Complete Kit (except wooden battens) to make the metal detector as the circuit in Practical Wireless, August issue. £2·30 plus 20p post and insurance

IMMERSION HEATERS BY REMPLOY

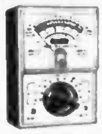
Standard fitting for domestic water tanks, made by the famous Remploy Company. Complete with sealing washers suitable for 200–240 volts A.C. Depth into tank 11". 2kw or 3kw £1·65 plus 20p each post and insurance.

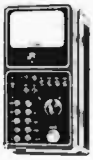
MAINS OPERATED SOLENOIDS



Model TT2—small but powerful 1" pull—approx. size 1¼" x 1½" x 1¾". 66p. Model 400/1 ½" pull. Size 2¾" x 2" x 1¾". 83p. Model TT10 1½" pull. Size 3" x 2¾" x 2½". £1·98 plus 20p post and insurance.

GWS G.W.SMITH & CO (RADIO) LTD

AUDIOTRONIC MODEL ATM.1

Top value 1000 o.p.v. pocket multimeter. Ranges: 0/10/50/250/1000v. AC and DC. DC Current 0·1mA/100mA. Resistance 0/150k ohms. Decibels −10 to +22dB. Size 90 × 60 × 28mm. Complete with test leads. £2·95. Post 15p.

RUSSIAN 22 RANGE MULTIMETER

Model U437 10,000 o.p.v. A first class versatile instrument manufactured in U.S.S.R. to the highest standards. Ranges: 2·5/10/50/250/500/1000v D.C. 2·5/10/50/250/500/1000v A.C. DC Current 100wA/1/10/100mA/1A. Resistance 300 ohms/3/30/300K/3m Ω. Complete with batteries, test leads, instructions and sturdy steel carrying case. £4·95. P. & P. 25p

MODEL TE-200

20,000 O.P.V. Mirror scale, overload protection. 0/5/25/125/1,000V. D.C. 0/10/50/250/1,000V. A.C. 0/50 µA/250 mA. 0/60K/6 meg Ω. −20 to +62db. £4·95. P. & P. 15p.

MODEL TE-300

30,000 O.P.V. Mirror scale, overload protection 0/·6/3/15/60/300/1,200V. D.C. 0/6/30/120/600/1,200V. A.C. 0/30µA/6mA/60mA/300mA/600mA. 0/8K/80K/800K/8 meg. ohm −20 to +63 db. £7·50. P. & P. 15p.

U4312 MULTIMETER

Extremely sturdy instrument for general electrical use. 667 o.p.v. 0/·3/1·5/7·5/30/60/150/300/600/900 VDC and 75mV. 0/·3/1·5/7·5/30/60/150/300/600/900 VAC. 0/300µA/1·5/6/15/60/150/600mA/1·5/6 AMP. D.C. 0/1·5/6/15/60/150/600mA/1·5/6 AMP. AC. 0/200 Ω/3K/30K Ω. Accuracy DC 1%. AC 1·5%. Knife edge pointer, mirror scale. Complete with sturdy metal carrying case, leads and instructions. £9·75. P. & P. 25p.

MODEL 500

30,000 O.P.V. with overload protection, mirror scale, 0/·5/2·5/10/25/100/250/500/1,000v. D.C. 0/2·5/10/25/100/250/500/1,000V. A.C. 0/50µA/5/50/500mA. 12 amp. D.C. 0/60/K/6 Meg./60 Meg Ω. £10·50. Post paid. Leather Case £1·75

MODEL C-7080 EN

Giant 6" mirror scale. 20,000 o.p.v. 0 / ·25 / 1 / 2·5 / 10 / 50 / 250 / 1000 / 5000V. D.C. 0 / 2·5 / 10 / 50 / 250 / 1000 / 5000V. A.C. 0 / 50µA / 1 / 10 / 100 / 500mA / 10 amp. D.C. 0 / 2K / 200K / 20 meg − 20 to + 50 dB. £13·95. Post 35p.

Model S-100TR MULTIMETER/TRANSISTOR TESTER

100,000 o.p.v. mirror scale/overload protection. 0/·12/·6/3/12/30/120/600 V DC. 0/6/30/120/600. V AC. 0/12/600µA/ 12/300mA/12 AMP DC. 0/10 K/1 MEG/100MEG. −20 to +50db. 0·01−2 MFD. Transistor tester measures Alpha, beta and Ico. Complete with batteries, instructions and leads. £14·95. P/P 25p.

KAMODEN 72.200 MULTITESTER

High sensitivity tester. 200,000 o.p.v. Overload protection. Mirror scale. Ranges: 0 / ·06 / ·3 / 3 / 30 / 120 / 600 / 1200V. D.C. 0 / 3 / 12 / 60 / 300 / 11,200V. A.C. 0 / 6µA / 1·2mA / 120mA / 600mA / 12A. D.C. 0 / 12A. A.C. −20 to +63dB. 0 / 2K / 200K / 2 meg / 200 meg ohms. £16·95. Post 30p.

ALL PRICES ARE SUBJECT TO 10% VAT

TMK LAB TESTER.

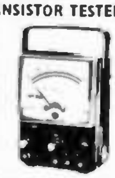
100,000 O.P.V. 6½in. Scale Buzzer Short Circuit Check. Sensitivity: 100,000 O.P.V. D.C. 5K/Volt A.C. D.C. Volts: ·5, 2·5, 10, 50, 250, 1,000 V. A.C. Volts: 3, 10, 50, 250, 500, 1,000V. D.C. Current: 10, 100µA, 10, 100, 500mA, 2·5, 10 amp. Resistance: 1K, 10K, 100K, 10MEG, 100MEG Ω. Decibels: −10 to +49 db. Plastic Case with Carrying Handle. Size: 7½in. × 6½in. × 3¼in. £19·95. P. & P. 25p.

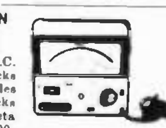
HIDKI MODEL 700X

100,000 O.P.V. Overload protection. Mirror scale. ·3/·6/1·2/1·5/3/6/12/30/60/120/300/600/1200V DC 1·5/3/6/12/30/60/150/300/600 1200 V. A.C. 15/30µA/3/6/30/60/150/300mA 6/12 AMP. DC. 2K/200K/2 Meg/20 Meg ohm −20 to +63dB. £14·95. P. & P. 20p

370 WTR MULTI-METER

Features A.C. current ranges. 20,000 o.p.v. 0/·5/2·5/10/50/250/500 1000 V. D.C. 0/2·5/10/50/250/500/1000V AC 0/50µA/1/10/100mA/1/10 Amp D.C. 0/100mA/1/10 Amp AC 0/5K/50K/500K/5 meg/ 50 meg. −20 +62db. £17·50. P. & P. 25p.

KAMODEN HM.350 TRANSISTOR TESTER

High quality instrument to test Reverse Leak current and DC current. Amplification factor of NPN, PNP, transistors, diodes, SCR's etc. 4" × 4¼" clear scale meter. Operates from internal batteries. Complete with instructions, leads and carrying handle. £12·50. Post 30p.

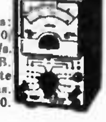
MODEL 449A IN CIRCUIT TRANSISTOR TESTER

Checks true A.C. beta in / out. Checks Ico. Checks diodes in / out. Checks SCR, etc. Beta HI 10 − 500, LO 2 − 50. Icbo 0−5000µA. 220/240 V A.C. operation £17·50. Post 25p.

LB3 TRANSISTOR TESTER

Tests ICO and B. PNP / NPN. Operates from 9v battery. Complete with all instructions, etc. £3·95. P. & P. 20p.

LB4 TRANSISTOR TESTER

Tests PNP or NPN transistors. Audio indication. Operates on two 1·5v batteries. Complete with all instructions, etc. £4·50. P. & P. 20p.

TE-40 HIGH SENSITIVITY A.C. VOLTMETER

10 meg. input 10 ranges: ·001/·03/·1/·3/1/3/10/30/100/300V. R.M.S. 5cps.-1·2 Mc/s. Decibels −40 to +50dB. Supplied brand new complete with leads and instructions. Operation 230V. A.C. £17·50. Carr. 25p.

TE-65 VALVE VOLTMETER

28 ranges D.C. volts 1·5−1,500v. A.C. volts 1·5−1,500v. Resistance up to 1,000 megohms. 200/240v. A.C. operation. Complete with probe and instructions. £17·50. P. & P. 30p. Additional probes available: R.F. £2·12; H.V. £2·50.

MODEL AT201 DECADE ATTENUATOR

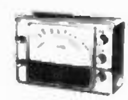
Frequency range 0−200KHz. Attenuator 0−111db, 0·1db step. Impedance 600 ohms. Max. input power 30dbm. Size 180 × 90 × 55mm. £12·50. Post 37p.

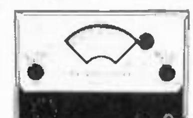
KAMODEN HM. 720B F.E.T. V.O.M.

Input impedance 10 meg ohms. Ranges: 0 / ·25 / 1 / 2·5 / 10 / 50 / 250 / 1000V. D.C. 0 / 2·5 / 10 / 50 / 250 1000V. A.C. 0 / 25µA / 2·5 / 25 / 250 mA D.C. − 20 to + 62dB 0 / 5K / 50K / 500K / 5meg 500meg ohms. £14·95. Post 30p

TMK MODEL 117 F.E.T. ELECTRONIC VOLTMETER

Battery operated, 11 meg input, 26 ranges. Large 4½" mirror scale. Size 5¼" × 4¼" × 2¼". DC VOLTS 0·3−1200V AC VOLTS 3−300V RMS. 8·0−800V P-P. DC CURRENT ·12−12mA. Resistance up to 2000M ohm. Decibels −20 to + 51dB. Complete with leads/instructions. £17·50. P. & P. 20p.

KAMODEN HMG-500 INSULATION RESISTANCE TESTER

Range 0−1000 Megohms, 500 Volt. Battery operated. Wide range clear meter 4½" × 4". Complete with deluxe carrying case, batteries, instructions. £19·95. Post 30p

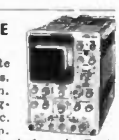
BELCO AF-5A SOLID STATE SINE SQUARE WAVE C.R. OSCILLATOR

Sine 18 × 200,000 Hz; Square 18 × 20,000 Hz Output max. + 10 dB. (10 K ohms) Operation internal batteries Attractive 2-tone case 7½" × 5" × 2". Price £17·50. Carr. 17p.

TO-3 PORTABLE OSCILLOSCOPE

3in. tube. Y amp. Sensitivity 0·1v p-p/CM. Bandwidth 1·5 cps−1·5 MHz. Input imp. 2 meg Ω 25pF X amp. sensitivity 0·9v. p-p/CM. Bandwidth 1·5cps−800kHz. Input imp. 2 meg Ω 20pF. Time base. 5 ranges 10 cps 300 kHz. Synchronization. Internal/external. Illuminated scale 140 × 215 × 330 mm. Weight 15½lb. 220/240V. A.C. Supplied brand new with handbook. £52·50. Carr. 50p.

CI-5 PULSE OSCILLOSCOPE

For display of pulsed and periodic waveforms in electronic circuits. VERT. AMP. Bandwidth 10MHz. Sensitivity at 100KHz VRMS/mm. ·1·25; HOR. AMP. Bandwidth 500KHz. Sensitivity at 100KHz, V RMS/mm. ·3·25; Preset triggered sweep 1−3,000µsec.; free running 20−200,000Hz in nine ranges. Calibrator pips. 220 × 360 × 430mm. 115−230V. AC operation. £39·00. Carr. paid.

RUSSIAN CI-16 DOUBLE BEAM OSCILLOSCOPE

5 Mc/s Pass Band. Separate Y1 and Y2 amplifiers. Rectangular 5in. × 4in. C.R.T. Calibrated triggered sweep from ·2 µ/sec. to 100 milli-sec. per cm. Free running time base 50 c/s−1 mc/s. Built-in time base calibrator and amplitude calibrator. Supplied complete with all accessories and instruction manual £87. Carr. Paid.

TE-16A TRANSISTORISED SIGNAL GENERATOR

5 ranges 400kHz−30mHz. An inexpensive instrument for the handyman. Operates on 9v battery Wide easy to read scale 800kHz modulation. 5¼ × 5¾ × 3¼in. Complete with instructions and leads. £8·97. Post 25p.

MODEL U4311 SUB-STANDARD MULTI-RANGE VOLT AMMETER

Sensitivity 330 ohms/Volt AC and DC. Accuracy 0·5% D.C. 1% AC. Scale length 165mm. 0/300/750µA/1·5 / 3 / 7·5 / 15 / 30 / 75 / 150 / 300 / 750mA / 1·5 / 3 / 7·5AMP DC 0 / 3 / 7·5 / 15 / 30 / 75 / 150 / 300 / 750mA / 1·5 / 3 / 7·5 AMP AC 0 / 75 / 150 / 300 / 750mV / 1·5 / 3 / 7·5 / 15 / 30 / 75 / 150 / 300 / 750V DC 0/750mV / 1·5 / 3 / 7·5 / 15 / 30 / 75 / 150 / 300 /750V AC. Automatic cut out. Supplied complete with test leads, manual and test certificates. £49·00. Post 50p.

TMK MODEL TW-50K

46 ranges, mirror scale, 50K/Vol. D.C. 5K/Volt A.C. D.C.: Volts ·125, ·25, 1·25, 2·5, 5, 10, 25, 50, 125, 250, 500, 1000V, A.C. Volts: 1·5, 3, 5, 10, 25, 50, 125, 250, 500, 1000V. D.C. Current: 25, 50µA, 2·5, 5, 25, 50, 250, 500mA, 5, 10amp. Resistance: 10K, 100K, 1 MEG, 10 MEG Ω. Decibels: −20 to +81·5db £8·50. P. & P. 17½p.

MODEL TE.15 GRID DIP METER

Transistorised. Operates as Grid Dip, Oscillator, Absorption Wave Meter and Oscillating Detector. Frequency range 440Kc/s−280Mc/s in 6 coils. 500µA Meter. 9V battery operation. Size 180 × 80 × 40mm. £15·00. Post 20p.

ARF-300 AF/RF SIGNAL GENERATOR

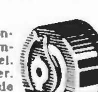
All transistorised, compact, fully portable. AF sine wave 18 Hz to 220 KHz. AF square wave 18 Hz to 100 KHz. Output sine / square 10v. P-P. RF 100 KHz to 200 MHz. Output 1v. maximum. Operation 220/240v. AC. Complete with instructions and leads. £29·95. Post 50p.

TE22 SINE SQUARE WAVE AUDIO GENERATORS

Sine: 20cps to 200 kc/s on 4 bands. Square: 20cps to 30 kc/s. Output impedance 5,000 ohms. 200/250V. A.C. operation. Supplied brand new and guaranteed with instruction manual and leads. £17·50. Carr. 37½p.

240° Wide Angle 1mA Meters

MW 1-6 60mm square £3·97
MW 1-8 80mm square £4·97
P. & P. 15p.

POWER RHEOSTATS

High quality ceramic construction. Windings embedded in vitreous enamel. Heavy duty brush wiper. Continuous rating. Wide range available ex-stock. Single hole fixing. ¼in. dia. shafts. Bulk quantities available.
25 WATT. 10/25/50/100/250/500/1000 ohms. £1·15 P. & P. 10p.
50 WATT. 10/25/50/100/250/500/1000/2500 or 5000 ohms. £1·62. P. & P. 10p.
100 WATT. 1/5/10/25/50/100/250/500/1000 or 2500 ohms. £2·34. P. & P. 15p.

AUTO TRANSFORMERS
0/115/250V. Step up or step down. Fully shrouded.

80 W	£2·35	P. & P. 18p
150 W	£3·00	P. & P. 18p
300 W	£4·00	P. & P. 23p
500 W	£5·80	P. & P. 33p
1000 W	£8·25	P. & P. 38p
1500 W	£11·25	P. & P. 43p
2250 W	£19·00	P. & P. 50p
5000 W	£40·00	P. & P. £1

HIGH QUALITY CONSTRUCTION KITS

JOSTY KIT

Appointed stockists at all branches

Complete with comprehensive, easy to follow instructions, and covered by full guarantee

Post and packing 15p per kit

AF20	Mono transistor amplifier	£4·80
AF30	Mono transistor pre amplifier	£2·61
AF310	Mono amplifier (use two for stereo	£5·91
AT5	Automatic light control	£2·58
AT30	Photo cell switching unit	£5·70
AT50	400W Triac light dimmer speed control	£4·80
AT55	1,300W Triac light dimmer speed control	£5·70
AT56	2,200W Triac light dimmer speed control	£6·90
AT60	Psychedelic light control single channel	£7·80
AT65	Psychedelic light control 3 channel	£14·55
HF61	Medium wave transistor radio	£3·33
HF75	FM transistor receiver	£2·88
HF310	FM tuner unit	£15·81
HF325	De luxe FM tuner unit	£24·12
HF330	Stereo decoder for HF310 HF325	£9·96
HF395	Aerial amplifier for AM FM bands	£1·77
GP310	Stereo pre amp for use with 2× AF310	£21·27
GU330	Tremolo unit for guitars etc	£7·50
NT10	Power supply 100 m/a 9V stab 12V unstab	£6·15
NT300	Professional stabilized power supply 2× 30 Volt 2.2 Amp	£12·51
NT305	Transistor converter 12 15V AC DC to 6V 7.5V or 9V DC	£4·50
NT310	Power supply 240V AC to 2× 18V DC at 2 Amps	£4·80
NT315	Power supply 240V AC to 4.5 15V DC 500	£9·57

NEW FROM JOSTY KIT!

'Amateur Electronics'—The professional book for the amateur—covers the subject from basic principles to advanced electronic techniques.

OUR PRICE £3·30, complete with circuit board for making the kits listed below.

AE1	100mW output stage	£1·65
AE2	Pre-amplifier	£1·26
AE3	Diode-receiver	£2·00
AE4	Flasher	£1·09
AE5	Astable multivibrator	£1·05
AE6	Monostable multivibrator	£1·02
AE7	RC generator	£1·06
AE8	Bass filter	99p
AE9	Treble filter	99p
AE10	CCIR filter	99p

230 VOLT A.C. 50 CYCLES RELAYS

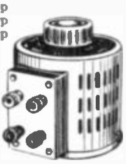
3 sets of changeover contacts at 5 amp rating, 40p each. P. & P. 12p (100 lots £30. Quantities available.

"YAMABISHI" VARIABLE VOLTAGE TRANSFORMERS

Excellent quality at low cost. All models—Input 230V. 50/60 c/s. Variable output 0-260V.

MODEL S-260 GENERAL PURPOSE BENCH MOUNTING

	£	P.&P.
1 Amp	8·75	30p
2·5 Amp	10·00	35p
5 Amp	14·70	37p
8 Amp	19·85	50p
10 Amp	23·10	75p
12 Amp	29·50	100p
20 Amp	61·25	125p
25 Amp	72·50	130p
40 Amp	103·10	150p



MODEL S-260B

Panel Mounting.

1 Amp	8·75	30p
2·5 Amp	10·00	35p

Carriage and Packing Extra

REFLEX HORN SPEAKER RUH.6

Built in driver unit. Impedance 16 ohm. Power rating 10 watt. Response 380–7000Hz. Approx. size 6" × 6". Weatherproof and shock proof.

OUR PRICE £4·97 P. & P. 30p.

SEW CLEAR PLASTIC PANEL METERS

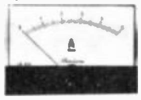
USED EXTENSIVELY BY INDUSTRY, GOVT. DEPTS., EDUCATIONAL AUTHORITIES, ETC.

Over 200 ranges in stock—other ranges to order. Quantity discounts available. Send for fully illustrated brochure.

Type SW.100 100 x 80 mm.

50μA	£4·15	5 amp. D.C.	£3·60
50–0–50μA	£3·95	300V. A.C.	£3·70
100μA	£3·95	VU Meter	£4·30
100–0–100μA	£3·90		
500μA	£3·70		
1mA	£3·60		
20V. D.C.	£3·60		
50V. D.C.	£3·60		
300V. D.C.	£3·60		
1 amp. D.C.	£3·60		

Type SD.830 82.5mm x 110mm Fronts



50μA	£3·40	10mA	£3·10
50–0–50μA	£3·40	50mA	£3·10
100μA	£3·35	100mA	£3·10
100–0–100μA	£3·35	500mA	£3·10
200μA	£3·30	1 amp.	£3·10
500μA	£3·15	5 amp.	£3·10
1mA	£3·10	10 amp.	£3·10
5mA	£3·10	5V. D.C.	£3·10
		10V. D.C.	£3·10
		20V. D.C.	£3·10
		50V. D.C.	£3·10
		300V. D.C.	£3·10
		15V. A.C.	£3·30
		300V. A.C.	£3·30
		VU Meter	£3·50

Type SD.640 63.5mm x 85mm Fronts

50μA	£3·05	500mA	£2·90
50–0–50μA	£3·05	1 amp.	£2·90
100μA	£3·00	5 amp.	£2·90
100–0–100μA	£3·00	10 amp	£2·90
200μA	£3·00	5V. D.C.	£2·90
500μA	£2·95	20V. D.C.	£2·90
1mA	£2·90	50V. D.C.	£2·90
5mA	£2·90	300V. D.C.	£2·90
10mA	£2·90	15V. A.C.	£3·00
50mA	£2·90	300V. A.C.	£3·00
100mA	£2·90	VU Meter	£3·15

Type MR.4SP. 2in. square fronts

50μA	£2·70	5 amp.	£2·40
50–0–50μA	£2·65	10V. D.C.	£2·40
100μA	£2·60	20V. D.C.	£2·40
100–0–100μA	£2·50	50V. D.C.	£2·40
200μA	£2·50	300V. D.C.	£2·40
500μA	£2·45	15V. A.C.	£2·40
500–0–500μA	£2·40	300V. A.C.	£2·40
1mA	£2·40	S Meter 1mA	£2·50
5mA	£2·40	VU Meter	£2·70
10mA	£2·40	1 amp. A.C. *	£2·40
50mA	£2·40	5 amp. A.C. *	£2·40
100mA	£2·40	10 amp. A.C. *	£2·40
500mA	£2·40	20 amp. A.C. *	£2·40
1 amp.	£2·40	30 amp. A.C. *	£2·40

"SEW" EDUCATIONAL METERS

Type ED.107. Size overall 100mm x 90mm x 108mm

A new range of high quality moving coil instruments ideal for school experiments and other bench applications. 3" mirror scale. The meter movement is easily accessible to demonstrate internal working. Available in the following ranges:

50μA	£6·90	15V d.c.	£5·95
100μA	£6·40	20V. d.c.	£5·95
50–0–50μA	£6·40	50V. d.c.	£5·95
1mA	£5·95	300V. d.c.	£5·95
1–0–1mA	£5·95	Dual range	
1A d.c.	£5·95	500mA/5A d.c.	£7·00
5A d.c.	£5·95	1/15A d.c.	£7·00
5V d.c.	£5·95	5V/50V d.c.	£7·00
10V d.c.	£5·95	5/15V d.c.	£7·00

Type MR.8SP. 4¼in. x 4¼in. fronts

50μA	£4·40	100mA	£3·90
50–0–50μA	£4·25	500mA	£3·90
100μA	£4·25	1 amp.	£3·90
100–0–100μA	£4·05	5 amp.	£3·90
200μA	£4·05	15 amp.	£3·90
500μA	£3·90	30 amp.	£3·95
500–0–500μA	£3·90	10V D.C.	£3·90
1mA	£3·90	20V. D.C.	£3·90
1–0–1mA	£3·90	50V. D.C.	£3·90
5mA	£3·90	150V. D.C.	£3·90
10mA	£3·90	300V. D.C.	£3·90
50mA	£3·90	15V. A.C.	£3·95
		300V. A.C.	£3·95
		S Meter 1mA	£3·90
		VU Meter	£4·55
		1 amp. A.C.*	£3·90
		5 amp A.C.*	£3·90
		10 amp. A.C.*	£3·90
		20 amp. A.C.*	£3·90
		30 amp. A.C.*	£3·90

Type MR.52P. 2½in. square fronts

50μA	£2·50	10V. D.C.	£2·50
50–0–50μA	£3·05	20V. D.C.	£2·50
100μA	£3·00	50V. D.C.	£2·50
100–0–100μA	£2·95	300V. D.C.	£2·50
500μA	£2·65	15V. A.C.	£2·60
1mA	£2·50	300V. A.C.	£2·60
5mA	£2·50	S Meter 1mA	£2·60
10mA	£2·50	VU Meter	£2·60
50mA	£2·50	1 amp. A.C. *	£2·50
100mA	£2·50	5 amp. A.C. *	£2·50
500mA	£2·50	10 amp. A.C. *	£2·50
1 amp	£2·50	20 amp. A.C. *	£2·50
5 amp	£2·50	30 amp. A.C. *	£2·50

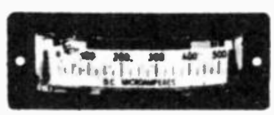
Type MR.6SP. 3½in. x 3½in. fronts

50μA	£2·70	10V. D.C.	£2·60
50–0–50μA	£3·15	20V. D.C.	£2·60
100μA	£3·15	50V. D.C.	£2·60
100–0–100μA	£3·10	150V. D.C.	£2·60
200μA	£3·05	300V. D.C.	£2·60
500μA	£2·75	15V. A.C.	£2·80
500–0–500μA	£2·60	50V. A.C.	£2·60
1mA	£2·60	150V. A.C.	£2·60
5mA	£2·60	300V. A.C.	£2·60
10mA	£2·60	500V. A.C.	£2·60
50mA	£2·60	S Meter 1mA	£2·65
100mA	£2·60	VU Meter	£3·70
500mA	£2·60	50mA A.C. *	£2·60
1 amp.	£2·60	100mA A.C. *	£2·60
5 amp.	£2·60	200mA A.C. *	£2·60
10 amp.	£2·60	500mA A.C. *	£2·60
15 amp.	£2·80	1 amp. A.C. *	£2·60
20 amp.	£2·60	5 amp. A.C. *	£2·60
30 amp.	£2·60	10 amp. A.C. *	£2·60
50 amp.	£2·90	20 amp. A.C. *	£2·60
5V. D.C.	£2·60	30 amp. A.C. *	£2·60

"SEW" EDGWISE METERS

Type PE.70. 3 17/32in. x 1 15/32in. x 2½in. deep

50μA	£2·75	500μA	£3·30
50–0–50μA	£2·60	1mA	£2·20
100μA	£2·60	300V. A.C.	£2·25
100–0–100μA	£3·50	VU Meter	£3·25
200μA	£3·40		



***MOVING IRON—ALL OTHERS MOVING COIL**

Please add postage

Type MR.38P. 1 21/32in. square fronts

50μA	£2·55	200mA	£2·25
50–0–50μA	£2·50	300mA	£2·25
100μA	£2·45	500mA	£2·25
100–0–100μA	£2·40	750mA	£2·25
200μA	£2·25	1 amp.	£2·25
500μA	£2·25	2 amp.	£2·25
500–0–500μA	£2·25	5 amp.	£2·25
1mA	£2·25	10 amp.	£2·25
1–0–1mA	£2·25	3V. D.C.	£2·25
2mA	£2·25	10V. D.C.	£2·25
5mA	£2·25	15V. D.C.	£2·25
10mA	£2·25	20V. D.C.	£2·25
20mA	£2·25	50V. D.C.	£2·25
50mA	£2·25	100V. D.C.	£2·25
100mA	£2·25	150V. D.C.	£2·25
150mA	£2·25	300V. D.C.	£2·25
		500V. D.C.	£2·25
		750V. D.C.	£2·25
		15V. A.C.	£2·30
		50V. A.C.	£2·30
		150V. A.C.	£2·30
		300V. A.C.	£2·30
		500V. A.C.	£2·30
		S Meter 1mA	£2·30
		VU Meter	£2·65

Type SD.460 46mm x 59.5mm Fronts

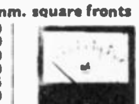
50μA	£2·60	1 amp.	£2·60
50–0–50μA	£3·30	5 amp.	£2·60
100μA	£2·75	10 amp.	£2·60
100–0–100μA	£2·75	5V. D.C.	£2·60
200μA	£2·70	10V. D.C.	£2·60
500μA	£2·55	20V. D.C.	£2·60
1mA	£2·60	50V. D.C.	£2·60
5mA	£2·60	300V. D.C.	£2·60
10mA	£2·60	15V. A.C.	£2·70
50mA	£2·60	300V. A.C.	£2·70
100mA	£2·60	VU Meter	£2·90
500mA	£2·60		

"SEW" BAKELITE PANEL METERS

Type MR.6S. 3½in. square fronts

25μA	£4·60	2 amp.	£2·60
50μA	£3·55	5 amp.	£2·60
50–0–50μA	£3·05	15 amp.	£2·60
100μA	£3·00	30 amp.	£2·60
100–0–100μA	£3·00	50 amp.	£2·60
500μA	£2·70	5V. D.C.	£2·60
500–0–500μA	£2·60	10V. D.C.	£2·60
1mA	£2·60	20V. D.C.	£2·60
1–0–1mA	£2·60	50V. D.C.	£2·60
5mA	£2·60	150V. D.C.	£2·60
10mA	£2·60	300V. D.C.	£2·60
50mA	£2·60	50mV. D.C.	£2·60
100mA	£2·60	100mV. D.C.	£2·60
500mA	£2·60	30V. A.C. *	£2·65
1 amp.	£2·60	50V. A.C. *	£2·65
		150V. A.C. *	£2·65
		300V. A.C. *	£2·65
		500V A.C.	£2·65
		500mA A.C. *	£2·60
		1 amp. A.C. *	£2·60
		5 amp. A.C. *	£2·60
		10 amp. A.C. *	£2·60
		20 amp. A.C. *	£2·60
		30 amp. A.C. *	£2·60
		50 amp. A.C. *	£2·60
		VU Meter	£3·65

Type S-80 80 mm. square fronts



50μA	£3·50	5 amp. D.C.	£3·00
50–0–50μA	£3·40	300V. A.C.	£3·00
100μA	£3·40	VU Meter	£3·70
100–0–100μA	£3·30		
500μA	£3·05		
1mA	£3·00		
20V. D.C.	£3·00		
50V. D.C.	£3·00		
300V. D.C.	£3·00		
1 amp. D.C.	£3·00		

BVD.S VERNIER TUNING DIAL

Approx. 7–1 ratio planetary drive vernier dials. Log scale 0–180 degrees. Blank scales 1 to 5. Scale width 4½". Dial size 5" × 3". Overall size 7¼" × 4¼" × 1¾" deep including knob and coupling. ¼" dia. shaft.

OUR PRICE £1·62 P. & P. 15p.

MP7 MIXER PREAMPLIFIER

5 microphone inputs each with individual gain controls enabling complete mixing facilities. Battery operated. 9½" × 5" × 3". Inputs Mics: 3 × 3mV 50K; 2 × 3mV 600 ohm. Phono meg. 4mV 50K. Phono ceramic 100mV 1 meg. Output 250mV 100K.

Our Price £8·97 P. & P. 20p

PS.1000B REGULATED POWER SUPPLY

Solid state. Output 6, 9 or 12 volt DC up to 3 amps. Meter to monitor current. Input 220/240v AC. Size 4" × 3½" × 6½". £11·97. P. & P. 25p.

EA.41 REVERBERATION AMPLIFIER

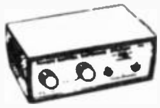
Self contained, transistorised, battery operated. Simply plug in microphone, guitar, etc. and output into your amplifier. Volume control, depth of reverberation control. Beautiful walnut cabinet. 7½ × 3 × 4½in.

Our Price £7·50 P. & P. 15p

PS.200 REGULATED P.S.U.

Solid state. Variable output 5-20 volt D.C. up to 2 amp. Independent meters to monitor voltage and current. Output 220/240 V. A.C. Size 7¼" × 5¾" × 3¼". £19·95. P. & P. 25p.

1021 STEREO LISTENING STATION



For balancing and gain selection of loudspeakers with additional facility for stereo headphone switching. 2 gain controls, speaker on-off slide switch, stereo headphone sockets. 6" × 3 × 2¼".

Our Price £2·25 P. & P. 15p

MCA. 200 AUTOMATIC VOLTAGE STABILISER

Input 88 125 VAC or 176, 250VAC. Output 120VAC or 240VAC. 200VA rating. £11·97. Carr. 50p.

SEND SAE FOR NEW 8 PAGE SEMI CONDUCTORS & VALVES LIST

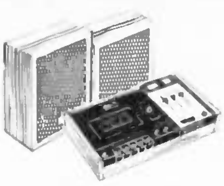
GWS

ALSO SEE FOLLOWING PAGES

ALL PRICES ARE SUBJECT TO 10% VAT

SAVE UP TO 33⅓% OR MORE! GWS

SUPER AKAI HI-FI BARGAINS
CS35 Stereo Cassette Recorder

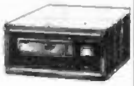


For conventional or Chromium Dioxide tape. 4 track record/playback. Volume and tone controls. Frequency response 40 - 16kHz (using CrO2 tape), distortion better than 2%, wow and flutter better than 0·2% RMS. Complete with pair of matching Akai CS88 speakers.

Rec. Price £96·10 **OUR PRICE £56·50** P.&P. 50p

MICROPHONES (P. & P. 50p)
ADM Dynamic (pair) £7·50

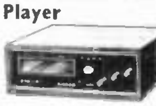
AUDIOTRONIC AHP-8D 8 Track Stereo Tape Deck



Can be used with most hi-fi amplifiers. Push button track selector and illuminated track indicators. Attractive cabinet with black and silver trim. Output level 750mV. AC 220/240v.

OUR PRICE £11·95 P. & P. 50p.

AUDIOTRONIC AHP-8A 8 Track Stereo Tape Player



Incorporates built in amplifiers giving 2½ + 2½ watts rms output. Push button track selector, illuminated track indicators, slider controls for volume, balance and tone. Attractive cabinet with black and silver trim. Output impedance 8 ohms. AC 220/240v.

OUR PRICE £17·25 P. & P. 50p.

SPECIAL PURCHASE! BSR 8 TRACK PLAYER CHASSIS

Famous BSR 8 track chassis as used in Model TD88 complete with silver and black escutcheon ready to fit into cabinet. Output 125mV. AC 240v. Overall size approx. 185 × 215 × 80mm.

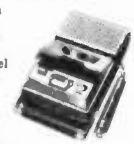
OUR PRICE £8·95 P. & P. 50p.

AUDIOTRONIC ACD.660 Stereo Cassette Deck

A beautifully styled 4 track stereo deck with an outstanding specification offered at a remarkably low price. Incorporates a host of features including switchable noise filter normal/chrome tape selector, twin VU meter, slider record/playback level controls, front panel headphone socket, recording indicator lamp, phono/Din line input sockets, 3.5mm mike input sockets etc. etc. Frequency response 100–8KHz (100–12KHz Cr02) S/N–45dB. Crosstalk 45dB. Separation–35dB. Noise limiter–6dB at 10KHz. Complete with phono connecting leads.

OUR PRICE £39·50 Carr. & Ins.50p

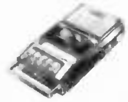
AUDIOTRONIC ACR.14 Battery Mains Cassette Recorder



Portable twin track mono recorder with automatic recording level control. Built in speaker. Earpiece socket. Input for radio or record player. Fast forward and rewind. Output 500mW. AC 220/240v or 6v DC operation. Complete with remote control microphone, mains lead, earpiece and batteries.

OUR PRICE £10·50 P. & P. 50p.

PORTABLE CASSETTE RECORDER CTS050



Instant recording and playing. Piano key controls. Automatic level control. Built in speaker. Complete with remote control microphone, carrying case and shoulder strap

OUR PRICE £8·50 P. & P. 50p.

AUDIOTRONIC LOW NOISE CASSETTES

Top Hi-Fi quality in library cases

TYPE	5	10	25
C60	£1·29	£2·53	£5·99
C90	£1·85	£3·62	£8·59
C120	£2·29	£4·48	£10·63

P. & P. 15p.
Cassette Tape Head Cleaner 30p

3-STATION INTERCOM KE.630

Master and two sub stations. Can be used on desk or wall mounted. Complete with cable and batteries.

Our Price £5·25 P & P 50p

MINUTEMAN MM3 POCKET CALCULATOR

Size only 4⅛" × 3" × 1". 8 digit display with overflow and error indicators. Floating decimal. Adds, subtracts, multiplies and divides. Chain and mixed calculations. Constant factor for series multiplication or division. Complete with batteries, instructions and case.

OUR PRICE £23·95 P. & P. 25p

MINUTEMAN MM3M

as above with addition of memory key, per cent key and a fixed or floating decimal. Complete with rechargeable batteries, AC adaptor, instructions and case.

OUR PRICE £28·50 P. & P. 25p

NEW! SINCLAIR CAMBRIDGE CALCULATOR

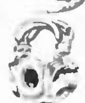
To build yourself. Complete kit of parts with step by step instructions to build a full specification pocket sized calculator.

OUR PRICE £24·95 P. & P. 50p.
(Also available ready built Rec. Price £29·95)
OUR PRICE £27·20 P. & P. 25p

AUDIOTRONIC Stereo Headphones

LSH.20 Individual volume controls Stereo mono switch. 8 ohms. 40-19,000 Hz.
£3·50 P & P 30p

LSH.30 Open back type. Individual tone and volume controls. 8 ohms. 30–20,000 Hz.
£5·50 P & P 30p



LSH.40 Two way speaker system. Individual volume controls. 8 ohms. 20–20,000 Hz.
£6·95 P & P 30p

LSH.60 3" speaker units. 8 ohms. 20–20,000 Hz. Complete with zipped carrying case.
£8·50 P. & P. 30p

LQH.400 4-channel dynamic headphones. Each earpiece has 4 drive units. 4-32 ohms. 20-20,000 Hz.
£9·95 P. & P. 30p

LSH.50 Electrostatic with self powered energiser and control unit with headphone/speaker selector. 4-32 ohms. 20-24 000 Hz. £15·95 P. & P. 30p

RECORD DECKS

Carriage and Packing 50p

B.S.R. McDONALD

C114 Mini	£3·95
C129 Mono	£5·50
C137	£7·00
510/TPD1	£13·95
610	£10·55
610/TPD1	£15·45
710	£21·15
810	£26·30
MP60	£8·25
MP60/G800	£10·90
MP60/TPD1	£13·20
MP60/TPD2	£11·25
HT70	£11·60
HT70/G800	£14·25
HT70/TPDI	£16·55

CONNOISSEUR

BD1 Kit	£9·10
BD1 Chassis	£11·35
BD2/SAU2/Chassis	£22·70
BD2/SAU2/Plinth/Cover	£28·20

GARRARD

2025 T	£6·35
2025TC/K840A	£6·95
SP25 III	£9·25
SP25111/G800	£10·95
SP25/M75–6	£13·90
AP76	£18·00
868B	£18·50
SL65B	£11·15
SL72B	£17·75
SL95B	£31·15
401	£24·35
ZERO 100A	£34·10
ZERO 100S	£31·40
Zero 100 SB	£27·00

GOLDRING

G99	£22·50
G101P/C	£22·50
GL69/2	£15·75
GL72	£25·45
GL72/P	£33·75
GL75	£32·20
GL75P	£41·65
GL78P/C	£56·25
GL85P/C	£72·00

RECORD DECK PACKAGES

Complete units with Stereo cartridge ready wired in plinth cover.

GARRARD

2025 TC/9TAHCD	£11·35
SP25 111/G800	£16·50
SP25 111/M44E	£17·95
SP25 111/M44-7	£17·50
SP25 111/M55E	£18·50
SP25 111 Module/M75–6	£19·45
AP76/G800	£26·45
AP76/G800E	£28·65
AP76/M44E	£27·70
AP76/M44–7	£27·20
AP76/M55E	£28·30
AP76/M75ED	£34·90
AP76/M75EJ	£30·90
AP76 Module M75–6	£29·10
868B Module/M75-68M	£32·50
AP96 Module M75–6	£33·20
ZERO 1008 Module/M93E	£44·15
Zero 1008B Module M75-68M	£44·20

B.S.R. McDONALD

210/SC7M	£7·40
MP60/G800	£16·50
MP60/TPD1/G800	£15·80
MP60/M44–7	£17·50
HT70/TPD1/G800	£19·20

GOLDRING

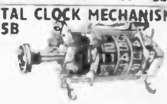
GL72/G800	£34·20
GL75/G800	£39·10
GL75/G800E	£41·55
GL78/G800	£42·45
GL78/G800E	£44·95

New Sinclair Hi-Fi Modules

PROJECT 80

Z40	£4·30
Z60	£5·50
STEREO 80	£9·50
AFU	£5·50
PZ5	£3·95
PZ6	£6·30
PZ8	£6·30
PZ8 Mains transformer	£4·05
Project 605	£20·97

DIGITAL CLOCK MECHANISM DT.55B



Features 24 hour alarm setting with built-in buzzer. On/off and auto alarm 'sleep' switch. Illuminated rotary dial with hours, minutes and seconds. Automatically turns off TV, radio, light, etc. and with autosetting will switch on again when required. AC 240v. operation. Switch rating 250v. 3A.

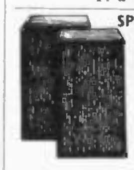
OUR PRICE £5·95 P. & P. 30p.

EMI LOUDSPEAKERS

Model 350. 13" × 8" with single tweeter/crossover. 20–20,000 Hz. 15 watt RMS. Available 8 or 15 ohms. £7·25 each. P. & P. 37p.

Model 450. 13" × 8" with twin tweeter/crossover. 55–13,000 Hz. 8 watt RMS. Available 8 or 15 ohms. £3·62 each. P. & P. 25p.

SPECIAL OFFER! STEREO SPEAKERS



Matched pair of stereo bookshelf speakers. Deluxe teak veneeredfinish. Size 14½" × 9" × 7½". 8 ohms. 8 watt RMS. 16 watt peak. Complete with DIN lead.

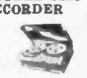
Our Price £12·95 Carr. 50p

SPECIAL OFFER! FRUSTRATED EXPORT ORDER
PHILCO FORD MODEL 5245 MAINS TAPE RECORDER

2 track BSR deck with push button controls for easy operation. Tape counter and volume control. Complete with hand microphone, Direct recording lead, 1200' reel of tape & spare spool. 200/250V AC operation. Fully guaranteed.

OUR PRICE £17·50. C & P 75p.

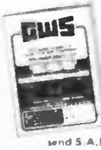
PHILCO FORD MODEL 5248 MAINS TAPE RECORDER



4 track, 2 speeds (3¾ i.p.s. & 1⅞ i.p.s.). Piano key type controls, tape counter, recording level meter, volume & tone controls etc. Complete with hand microphone, direct recording lead, 1800' of tape with spare spool. 200/250V AC operation fully guaranteed.

OUR PRICE £27·50. C & P 75p.

LONDON'S LARGEST STOCKS INCLUDING PRODUCTS BY—



ARMSTRONG
CAMBRIDGE
KEF·LUX·NIKKO
SANSUI·SANYO
SONY·TEAC
TRANSCRIPTORS
TRIO·UHER
YAMAHA

Prices on request or send S.A.E. for full Discount List

ALL EQUIPMENT IS FULLY GUARANTEED AND COVERED BY 12 MONTHS FREE SERVICE!

G.W.SMITH & CO (RADIO) LTD

PERSONAL CALLERS WELCOME AT ANY OF OUR RETAIL BRANCHES

CENTRAL LONDON		311, Edgware Road, W.2.	Tel: 01-262 0387
257/8, Tottenham Court Rd. W.1.	Tel: 01-580 0670	382, Edgware Road, W.2.	Tel: 01-723 4194
10, Tottenham Court Rd. W.1.	Tel: 01-637 2232	152/3, Fleet Street. E.C.4.	Tel: 01-353 2833
27, Tottenham Court Rd. W.1.	Tel: 01-636 3715	378, Harrow Road, W.9.	Tel: 01-286 9530
87, Tottenham Court Rd. W.1	Tel: 01-580 3739	**ESSEX**	
21, Old Compton Street, W.1	Tel: 01-437 9369	86, South Street, Romford	Tel: Romford 20218
3, Lisle Street, W.C.2.	Tel: 01-437 8204	**SURREY**	
34, Lisle Street, W.C.2.	Tel: 01-437 9155	1046, Whitgift Centre, Croydon.	Tel: 01-681 3027
118, Edgware Road, W.2.	Tel: 01-723 9789	27, Eden Street, Kingston.	Tel: 01-546 7845
193, Edgware Road, W.2.	Tel: 01-723 6211	32, Hill Street, Richmond.	Tel: 01-948 1441

ALL BRANCHES OPEN 9 a.m.-6 p.m. MONDAY TO SATURDAY

HEAD OFFICE and MAIL ORDER DEPARTMENT
UNIT 4, THE HYDE INDUSTRIAL ESTATE, THE HYDE, LONDON NW9 6JJ
TELEPHONE 01-205 3735

PRICES SUBJECT TO 10% VAT

Order with confidence by Post—but remember to add 10% VAT to total value of order including carriage and packing and send cash with order

PLEASE PRINT NAME & ADDRESS CLEARLY IN CAPITALS.

TELEPHONED ORDERS ACCEPTED FROM ACCESS and BARCLAYCARD HOLDERS

CREDIT TERMS FOR PERSONAL CALLERS (on sales of £50 and over).

All prices correct at 26-10-73 but subject to change without notice
E & OE

Everyday Electronics Classified Advertisements

RATES: 9p per word (minimum 12 words). Box No. 20p. extra. Semi-display—£6·00 per single column inch. Advertisements must be prepaid and addressed to Classified Advertisements Department, "EVERYDAY ELECTRONICS," I.P.C. Magazines Ltd., Fleetway House, Farringdon Street, London EC4A 4AD.

RECEIVERS and COMPONENTS

TUNBRIDGE WELLS, components from Teleservice, 108 Camden Road, Tunbridge Wells, Kent. Telephone 31803.

COMPONENTS GALORE. Pack of 500 mixed components manufacturers surplus plus once used. Pack includes Resistors, carbon and W.W., capacitors various, transistors, diodes, trimmers, potentiometers etc. Send £1+10p p. and p. c.w.o. to CALEDONIAN COMPONENTS, Strathore Road, Thornton, Fife.

MUST GO! Electronic components. Pots, resistors, capacitors, etc. Send large stamped, addressed envelope for list. P. FASOLI, 28 Middleham Street, Manchester M14 7NG.

MINIATURE HIGHSTAB RESISTORS
5% ¼W 22Ω to 2·2M E12 series 10 each value. Total 610, £3.

ANTEX X25 25W SOLDERING IRON
R.R.P. £1·92, Our Price £1·57.
BC107 10p. BC108 9p. BC109 10p. 1N914 4p. 8 pin 741 30p.

NEK ELECTRONICS (E3)
28, Carnegie Road, St. Albans, Herts.
Please add 10p P. & P. Mail order only.

MINI MAINS TRANSFORMER 30 x 30 x 37mm. Cool, quiet, British. Pri. 220/250V. Type MT3, 3-0-3V rms, 300mA, £1. MT7, 7-0-7V, 120mA, £1. VAT included. Use MT3 for 3V or 6V rectified d.c., MT7 for 9V or 18V. Circuits supplied. Mail order only, UK post 5p per order. Amatronix Ltd., 396 Selsdon Road, South Croydon, Surrey CR2 0DE.

COMPUTER PANELS 5-BC108; **DIODES** 4-55p (10p); **WIRE ENDED NEONS** 10-50p (8p); **SILICON DIODES** 650V 1½A 10-35p (5p); 3 **ASSORTED M.C. METERS** 2"-3" £1·15 (27p); **SILVER MICA CAPS** 100 assorted 55p c.p.; **POLYSTYRENE CAPS** 100 assorted 75p c.p., your choice 2p each. **FOUR WAY PIANO KEY SWITCH** with interlock 33p (7p); 7lb **ASSORTED COMPONENTS** £1·65 c.p.; 2lb **ASSORTED COMPUTER PANELS** £1·65 c.p.
J.W.B. RADIO
2 Barnfield Crescent, Sale, Cheshire M33 1NL.
Postage in brackets. Mail order only.

RESISTORS, $\frac{1}{4}$ watt 5% 1p each, 9p for 10, 80p for 100. Lists 5p, post 10p plus 10% VAT. Chris Smith Components, 31 Priory, Neston, Cheshire.

DESOLDERWICK
SOLDER-ABSORBING WICK
Approx 1 cm. completely desolders a P.C.B. joint. Use with any 20-40W soldering iron.
30cm. Pack 28p inc. P./P. etc.
Multipack. Four lengths of wick in various widths 80p inc. P./P. etc.
ORIENTATION LIMITED
Coverack, Cornwall.

EDUCATIONAL

TECHNICAL TRAINING in Radio, TV & Electronics thro' world-famous ICS. For details of proven home-study courses write ICS (Dept. 731A), Intertext House, London SW8.

SERVICE SHEETS

SERVICE SHEETS for Televisions, Radios, Transistors, Tape Recorders, Record Players, etc., from 5p with free Fault-Finding Guide, S.A.E. orders/enquiries. Catalogue 15p. Hamilton Radio, 47 Bohemia Road, St. Leonards, Sussex. Telephone Hastings 29066.

FOR SALE

TIMBER Plywood cut to your requirements. GENERAL WOODWORK SUPPLIES, 76-80, Stoke Newington High Street, N16 5BR.

EXPERIMENTERS! Hundreds of unusual items cheap. Catalogue $5\frac{1}{2}$p. Grimsby Electronics, 64 Tennyson Road, Cleethorpes, Lincs. (Mail Order Only).

PROFESSIONALLY made Tutor Board. Varnish insulation. All main holes drilled. £1 incl. p&p. B. H. Malme, 'Newhaven', Mill Lane, East Runton, Norfolk.

TIMBER & PLYWOOD for tutor board drilled, glued ready for assembly. £1 postage included. Mail order only. J. Lehane, Oristown, Ceanannus Mor, County Meath, Eire.

WANTED

NEWNES RADIO and TV Servicing books wanted. From 1960-1966, £2 paid per copy by return post, any quantity bought, Bells' Television Services, Albert Place, Harrogate, Yorks. Telephone 0423 86844.

BOOKS

WORLD RADIO TV HANDBOOK 1974 (published December), £3·15. Delivered direct from Denmark if ordered now. How to Listen to the World (late October), £2. Postage and VAT included. Every order acknowledged immediately. David McGarva, PO Box 114, Edinburgh EH1 1HP.

RADIO BOOK SERVICE

Handbk of Transistor Equiv & Substitutes	45p
Boys Bk of Crystal Sets and Simple Circuits	23p
How to make FM & TV Aerials, Bands 1,2,3	23p
Radio Servicing for Amateurs	25p
Transistor Test Equip & Servicing Manual	30p
Transis Circuits for Radio Controlled Models	45p
Modern Transistor Circuits for Beginners	45p
Electronic Novelties for the Motorist	55p
Manual of Electronic Circuits for the Home	55p

All prices include postage & packing
Dept E, 40 Elwill Way, Beckenham BR3 2RZ

MISCELLANEOUS

BEGINNERS, we exist for you. Instruction, components, constructional kits. Send S.A.E. to Electrolern, Lyburn Lodge, Nomansland, Wiltshire.

CONSTRUCTION AIDS. Screws, nuts, spacers, etc., in small quantities. Aluminium panels punched to spec. or plain sheet supplied. Fascia panels etched aluminium to individual requirements. Printed circuit boards-masters, negatives and boards, one-off or small numbers. Send 6p for list. RAMAR CONSTRUCTOR SERVICES, 29 Shelbourne Road, Stratford-on-Avon, Warks.

ALUMINIUM BOXES

For Veroboard				ADD 10% VAT
AD7	2¾"	5¼"	1½"	29p+P&P 8p
AD8	4"	4"	1½"	29p+P&P 8p
AD9	4"	2¾"	1½"	29p+P&P 8p
AD10	4"	5¼"	1½"	35p+P&P 8p

PROFESSIONAL CASES from £1·56.
ADFONIC,
18 Yew Lane, Ashley.
New Milton, HANTS BH25 5BA
CWO. Mail Order Only.
Component Catalogue FREE.

OMNI-DETECTORS

(Featured ★ TV ★ Radio ★ Nat. Press)
Ancient art of Dowsing in Modern Guise. Thrill to new discovery in this over-looked aspect of the Electro-Magnetic Spectrum. A LABORATORY IN A SINGLE PACK. Treasure Hunters! Use Omni-Dectectors to:—
- Locate ANY buried substance, ANY depth.
- Save hours of fruitless searching—MAP-DOWSING pinpoints search area before you leave home.
- Limitless other uses.

Dowsing used in World War 2 and by USA troops in Vietnam to locate underground springs, tunnels, mines.
Send only £2·80 + 15p p. & p. for unique pack of 4 dowsing instruments (non-electronic) and explicit 40-page manual to sole suppliers:—Omni-Detector Co., (Dept. EE), 27, Latham Road, Twickenham, Middx. TW1 1BN.

RADIO & TELEVISION AERIAL BOOSTERS £2·95p, five television valves 45p. 50p bargain transistor packs, bargain £1 resistor and capacitor packs. UHF-VHF televisions £7·50, carr. £1·50p. S.A.E. for 3 leaflets. ELECTRONIC MAIL ORDER (BURY) LTD., Bridge Street, Ramsbottom, Bury, Lancs.

P.E. SYNTHESISER KNOB KIT
Complete kit as Feb. issue 43 knobs, 7 calibrated discs. **£3·91** post free
DE LUXE KIT as above but calibrated for programming **£5·89** post free
Inclusive postage and V.A.T.
RE-AN PRODUCTS LTD.
Burnham Road, Dartford, Kent
Tel.: Dartford 20705

DON'T LOOK
unless you can resist the temptation to get these super 'attention-getters':
★ Pocket-sized **MAXI-VOLT** Big ½inch Spark Generator (instant 15,000 volts!). Ready-made, needs no batteries. Carry it around anywhere. Only weighs about 3 oz. (85g.) send £1·35 for your Maxi-Volt now!
★ Unique **TRANSMITTER/RECEIVER** Kit. No licence examinations or tests required to operate this transistorised equipment. Ease to build. Get transmitting. Send £5·90 for yours now!
★ Psychedelic **MINI-STROBE** Kit. Take a pocket-sized lightning storm to Disco's and parties. 'Brain-freeze' 'em with vari-speed stop-motion flashes. Includes super case too. Send £2·20 now!
(All prices include V.A.T., packing, and postage.)
Send remittance to:
BOFFIN PROJECTS,
4 CUNLIFFE ROAD,
STONELEIGH, EWELL, SURREY
(Mail order only)
Or for more details, send 15p for lists, plus free design project sheet.

If you have difficulty in obtaining

Everyday Electronics

Please place a regular order with your newsagent or send 1 year's subscription (£2·35) to:—

Subscription Department, Everyday Electronics, Tower House, Southampton Street, London, WC2E 9QX

Please mention

EVERYDAY ELECTRONICS

when replying to Advertising

Published approximately the third Friday of each month by IPC Magazines Ltd., Fleetway House, Farringdon Street, London, E.C.4 4AD. Printed in England by Index Printers Ltd., Dunstable, Beds. Sole Agents for Australia and New Zealand—Gordon & Gotch (A/Sia) Ltd. South Africa—Central News Agency Ltd. Publisher's Subscription Rate (including postage): For one year to any part of the world £2·35. Everyday Electronics is sold subject to the following conditions, namely that it shall not, without the written consent of the Publishers first given, be lent, resold, hired out or otherwise disposed of by way of Trade at more than the recommended selling price shown on the cover, and that it shall not be lent, resold or hired out or otherwise disposed of in a mutilated condition or in any unauthorised cover by way of Trade, or affixed to or as part of any publication or advertising, literary or pictorial matter whatsoever.

Henry's

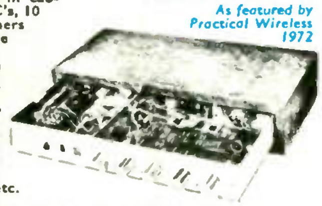
DONT RELY ON YOUR MEMORY
BUY NOW AT BARGAIN PRICES
Order your latest Henry's Catalogue Price 55p post paid complete with Discount Vouchers

BUILD THE TEXAN

20 + 20 WATT IC STEREO AMPLIFIER

As featured by Practical Wireless 1972

Now built and used by thousands of satisfied customers. Features slim design overall size in cabinet 15¼" x 2¾" x 6¾". 6-IC's, 10 transistors, stabilisers Gardners low field transformer. Fibre Glass PC Panel, complete chassis work. Now available built and tested as well as in kit form. HIGH QUALITY & STABILITY ARE PREDOMINATE FEATURES — DEVELOPED BY TEXAS ENGINEERS FOR PERFORMANCE, RELIABILITY AND EASE OF CONSTRUCTION. FACILITIES. On/off switch indicator, headphones socket, separate treble, bass, volume and balance controls, scratch and rumble filters, mono/stereo switch, input selector: Mag. P.U., Radio Tuner, Aux. Can be altered for Mic., Tape, Tape-head, etc. Constructional details Ref. No. 21 30p. Distributed L Henry's throughout UK. FREE—Teak cabinet with complete kit.



Kit price **£28·50** (+VAT+50p carr/packing) or built and tested **£35·00** (+ VAT + 50p carr/packing) as illustrated.

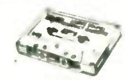
BUILD THE NEW HENELEC STEREO FM TUNER

A completely new high stability stereo FM tuner Features variable capacity diode tuning, stabiliser power supply, IC Decoder, high gain low noise. IF stages. LED indicators. Tuning meter, AFC, easy to construct and use. Mains operated. Slim modern design with fibre glass PC, teak cabinet, etc. Available as a kit to build or ready built. Overall size 8" x 2¾" x 6¾". Produced to give high performance with a realistic price. (Parts list and constructional details Ref. No. S 30p). Henry's are sole distributors UK and Europe.

KIT PRICE **£21·00** (+ VAT)
or built and tested **£24·95** (+ VAT)

LIVING SOUND LOW NOISE TOP QUALITY CASSETTES MADE BY EMI TAPES LTD. TO INTERNATIONAL STANDARDS ESPECIALLY FOR HENRY'S. ALL POST PAID LESS THAN ½ REC. PRICES COMPLETE WITH LIBRARY CASES

	3 for	6 for	10 for	25 for
C 60	£1·00	£1·80	£2·80	£6·75
C 90	£1·33	£2·57	£4·20	£10·25
C 120	£1·62	£3·15	£5·00	£12·25



Quantity and trade enquiries, invited

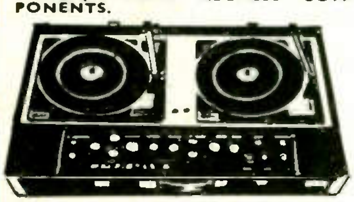
LEARN A LANGUAGE—complete with phrase book. German — French — Spanish — Italian £1·36 per course. £5 for any 4.

EARN YOURSELF EASY MONEY, WITH PORTABLE DISCO EQUIPMENT

DISCO MINI A complete portable disco, fitted mixer/preamp, 2 decks all facilities. £98·50
As above but with Slider Controls £118·50
100 watt amplifier for above £42·50
SL100 100 watt mixer/amplifier with slider controls £69·00
R50 50 watt mixer/amplifier £49·50
R100 100 watt mixer/amplifier £57·50
DISCO AMP 100 watt mixer/amplifier chassis unit. £69·50
DISCO MIXER/PREAMPLIFIERS (OP for up to 6-100 watt amplifiers)
SDLI (rotary controls) £49·50
SDLII (slider controls) £58·50
DISCO VOX (slider controls) the complete disco preamp £69·50
DJ100 100 watt power amplifier for above £42·50
DJ30L 3 channel 3kw sound to light £31·50
DJ40L as 30L plus built in microphone £41·95
DIMAMATIC 1 kW adjustable speed auto dimmer £25·00
Carlsboro Reverboration Unit £44·00
SCENE STROBE £19·00. ROAD STROBE £25·00. SUPER STROBE £45.
Disco anti-feedback microphone £11·95
Colt 150 watt liquid wheel projector £22·50
150 watt QI liquid wheel projector £50·00
150 watt QI cassette wheel projector £50·00
Spare Effects and liquid cassettes large range of patterns £6·00
6 Inch Liquid wheels £5·00
Mini spot bank fitted 3 lamps £12·95
Auto Trilite (mini with flashers) £17·00
Bubblemaster with 1 gall. liquid £41·15
Mixers/Mics/Speakers/Lighting

U.K.'s largest range of Disco Lighting. FREE STOCK LIST REF. No. 18 ON REQUEST.

AKG / RESLO / DJ / CARLSBRO / EAGLE MICS., STANDS, MIXERS, CABINETS. CHASSIS AND COMPLETE SPEAKER SYSTEMS, MEGAPHONES, TURNTABLES, PUBLIC ADDRESS COMPONENTS.



All prices carr. paid (UK) (VAT EXTRA)

Barclaycard/Access call, write or phone your order 01-723-6963—easy terms for callers.

TEXAN STEREO SYSTEM

PLUS PRICE SAVINGS

The Texan Stereo Systems include the high quality Texan Stereo amplifier assembled and ready to use. A pair of Type 200 20 watt Speaker-Tweeter systems size 21" x 12" x 10" and a choice of Garrard players built into a plinth with cover with Goldring G800 magnetic cartridge. System 25 uses Garrard SP25 Mk III and system 76 the Garrard AP76 de luxe turntable. All necessary leads are supplied.

System 25 (list approx. £109) **£79·50**
System 76 (list approx. £117) **£89·50**
(plus 10% VAT and plus £1·45 carr/packing)

Barclaycard/Access, call, write or phone, your order 01 402 4736 EASY TERMS FOR CALLERS

NEW **SINCLAIR PROJECT** 80

Stereo PreAmplifier	£11·95
Audio Filter Unit	£6·95
Z40 15 Watt Amplifier	£5·45
Z60 25 Watt Amplifier	£6·95
PZ5 Mod. for 1 on 2 Z40	£4·98
PZ6 Mod. (S Tab) 1 on 2 Z40	£7·98
PZ8 Mod. (S Tab) 1 on 2 Z60	£7·98
TRANSFORMER FOR PZ8	£2·95
NEW FM TUNER	£11·95
STEREO DECODER	£7·45

All items post paid.
Best price on request.

LOW COST HI-FI SPEAKERS

SPECIAL OFFERS

EMI 13" x 8"—full range speakers (post 20p each or 30p pair)
•150TC—8 ohms Twin Cone 10 watt £2·20 each or £4·00 pair.
•450 10 watt C/o Twin Tweeters 3, 8 or 15 ohms £3·50 each or £6·90 pair.
EW 15 watt 8 ohms C/o Tweeter £4·30 each or £7·90 pair.
350 20 watt C/o Tweeters 8 or 15 ohms £7·50 each or £14·20 pair.
• Polished wood cabinet £4·60 post 35p.

8 ohms full range (post 20p)				
FR4	4"	5 watt		£4·00
FR65	6½"	10 watt		£5·50
FR8	8"	15 watt		£7·60
FR23	9 x 6"	15 watt		£6·00
BASS & MID RANGE—8 ohms (post 20p)				
AA12	5"	15 watt		£3·20
B110	5½"	15 watt		£5·60
B200	8"	15 watt		£6·45
B139/2	13" x 8"	30 watt LF		£10·25
TWEETERS AND CROSSOVERS (post 20p)				
K2006	10 watt		8 or 15 ohms	£1·90
FHT6	15 watt		8 ohms	£3·20
K2011	30 watt		8 ohms	£3·75
T27	KEF			£4·25
Axcent 100	30 watt		8 ohms	£4·90
K4009	1kHz/5kHz C/o			£2·00
SN75	3kHz var. C/o			£1·75
SPEAKER KITS (carr. etc. 35p)				
20-2	8"	30 watt		£10·00 each
20-3	8"	40 watt		£15·00 each
LINTON 2		20 watt		£15·95 pair
GLENDALE 3		30 watt		£28·95 pair
DOVEDALE 3		50 watt		£42·00 pair
KEF KK2				£20·40 each
KEF KK3				£32·00 each

BUILO YOURSELF A POCKET CALCULATOR

A complete kit, packaged in a polystyrene container and taking about 3 hours to assemble—thats the Sinclair Cambridge pocket calculator from Henry's. Some of the many features include interface chip, thick-film resistor pack, printed circuit board, electronic components pack. Size 4⅜" long x 2" wide x ⅛" deep. Free of charge with the kit for the more advanced technologist is a 32-page booklet explaining how to calculate Logs. Tangents. Sines etc.

£24·95 + VAT. Also available assembled ready to use. **£27·22** + VAT.

10% VAT to be added to all orders. Prices and descriptions correct at time of press. E & OE.
Like a permanent job at Henry's? Experienced and trainee salesmen required. Tel. 01-402 8791.

See pages 648—650 of this magazine

Henry's RADIO LIMITED
EDGWARE ROAD, W2

404-406 Electronic Components and Equipment 01-402 8381
354-356 High Fidelity and Tape Equipment 01-402 5854/4736
309 PA-Disco-Lighting High Power Sound 01-723 6963
303 Special offers and bargains store
All mail to 303 Edgware Road, London W2 1BW

Open:- 9 am-6 pm 6 days a week All stores open all day Saturday