PRACTICAL WIRELESS

OCTOBER 1971

20p

EXTRA INSIDE

8 PAGE SUPPLEMENT

SMALL WORKSHOP TOOLS

plus

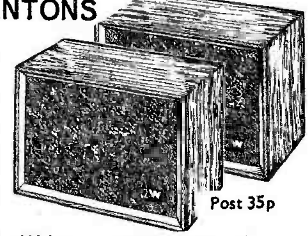
Wall Chart

CIRCUIT BUILDING BRICKS

MODULAR AUDIO MIXING SYSTEM

SUPER SPEAKER BARGAINS

WHARFEDALE DENTONS

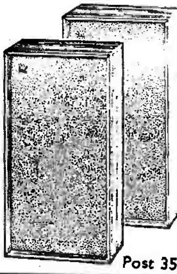


A compact system sold in matched pairs for a perfectly balanced stereo system. Each Denton contains an 8in. bass unit with 3in. pressure unit, coupled by a Wharfedale crossover network. Rated input: 15 watts maximum. Frequency response: 65–17,000Hz. Impedance: 4/8 ohms. Cabinet 9¾in. x 14in. x 8¾in. These most attractive units are available in oiled teak, white or matt walnut and are small enough to blend in with most surroundings.

Post 35p

LIST PRICE £39·00 **£28·00** Walnut White **£27·00** Teak

WHARFEDALE TRITONS



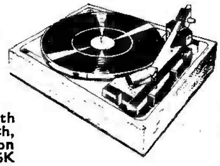
A new and exciting addition to the Wharfedale range, this three speaker system will satisfy the most ardent Hi-Fi enthusiast. Shelf or floor standing—hand finished in oiled teak or polished walnut. Frequency response 55–22,000Hz. C.A.B. Dome pressure unit. Bass unit 8in. Mid-range unit 5in. Treble unit 2in. Impedance 8 ohms. Size 21¾in. x 9¾in. x 9in.

LIST PRICE £59·90

LASKY'S PRICE **£36·00** Teak **£38·00** Walnut White

Post 35p.

BSR McDONALD MP60



High precision low-mass counterbalanced pick-up arm, heavy balanced turntable, simple to operate controls, viscous cueing device, slide in cartridge carrier, 4 pole motor.

LASKY'S PRICE **£12·50** Post 35p

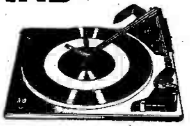
BSR McDONALD UNITS & PACKAGES

A. Chassis only. **B.** Complete with Lasky's plinth and cover. **C.** Complete with Lasky's plinth, cover and AD76K cartridge. **D.** Comp. wired on BSR plinth with cover. **E.** As D plus AD76K cartridge.

MODEL	A	B	C	D	E
610	£15·45	£18·75	£22·50	£24·50	£28·50
510	£13·45	£16·95	£20·75	£22·00	£26·00
310	£9·95	£13·45	£17·25	£21·00	£23·50
MP60	£12·50	£15·75	£19·50	£21·50	£25·50

GARRARD UNITS AND PACKAGES

GARRARD SL 55B



Four speed autochanger

LASKY'S PRICE **£10·50** Post 35p

Garrard SP25 Mk. III	£11·50
Garrard SP25, Mk. III wired	£12·00
Garrard SP25 Mk. III with 9TA cart.	£13·95
Garrard SL40B	£9·95
Garrard AP76 without cart.	£20·95
Garrard 3000 with 9TA cart.	£10·50
Garrard 2025TC with 9TA cart.	£9·85

GARRARD PACKAGES

Post on packages 50p

Garrard AP76 with AD76K cart. and Lasky's plinth and cover	£35
Garrard AP76 with Shure M44E cart. and Lasky's plinth and cover ...	£40
Garrard SP25 Mk. III, AD76K cart. and Lasky's plinth and cover... ...	£20
Garrard SP25 Mk. III, Micro M2100/e cart. and Lasky's plinth and cover	£25

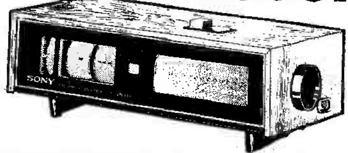
LASKY'S NEW LOW NOISE CASSETTES FROM THE USA

Type	Singles	5	10	20
C-60	41p	£1·82	£3·41	£6·55
C-90	63p	£3·04	£5·78	£10·89
C-120	96p	£4·13	£7·43	£13·41

Post Each 5p. 5-20p. 10-25. 20-50p.

SONY 8FC 59W SCOOP

DIGITAL AM/FM CLOCK RADIO



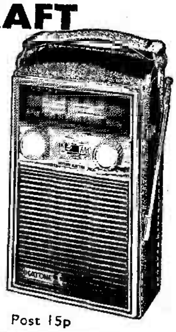
Digital Alarm Clock Radio. The digital clock shows you the time minute by minute with matchless accuracy and once set the Digimatic will wake you up at the same time every morning without having to be re-set. The radio section eatures Sony's unique sleep button, you fall gently to sleep lulled by the sweet tone of the radio, which switches itself off at a predetermined time. Available in either black, white or red (8FC-59W). Frequency range 530-1,605KHz (AM); 87-108MHz (FM). Uses 8 transistors and 8 semi-conductors, built-in ferrite aerial and 3¼in loudspeaker. Power requirements: 230V AC 50Hz. Dimensions: 12⅞in x 3⅞in. x 5⅛in.

LIST PRICE £30·00

LASKY'S PRICE **£22·50** Post free in U.K.

KATONE AM/AIRCRAFT PORTABLE RADIO

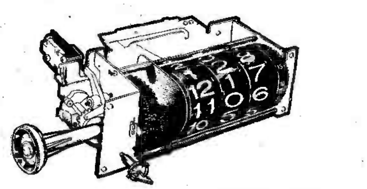
BATTERY/MAINS



A combined battery and mains portable of exceptionally attractive design. Housed in a leatherette covered case, size 8½in. x 5½in. x 3¼in., fitted with an 8-section external telescopic aerial for FM and internal ferrite rod for MW wave bands, and clear easy-to-read dial with logging scale. Wave band coverage is FM 88-108MHz, AM 535-1,600KHz. A highly selective circuit using 9 transistors and 9 semi-conductors operating from either 4 x 1·5 volt torch batteries or direct from 230 volts 50Hz AC house mains, from a built-in mains unit. A socket is fitted for a personal earphone. Easy-to-use silver colour knobs, with "woodgrain" panel enhances the appearance of this fine radio.

LASKY'S PRICE **£9·95** Post 15p

DIGITAL CLOCK SCOOP



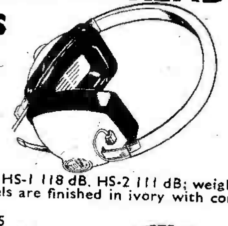
- MADE ESPECIALLY FOR LASKY'S BY FAMOUS MAKER
- MAINS OPERATION
- 12-HOUR ALARM
- AUTO "SLEEP" SWITCH
- HOURS, MINUTES AND SECONDS READ-OFF
- FORWARD AND BACKWARD TIME ADJUSTMENT
- SILENT OPERATION SYNCHRONOUS MOTOR
- SHOCK AND VIBRATION PROOF
- BUILT IN ALARM BUZZER

EXCLUSIVELY FROM LASKY'S for you to mount into any housing. The clock measures 4¾ W x 1¾ H x 3¾ D (overall from front of drum to back of switch). SPEC.: 210/240V a.c., 50Hz operation; switch rating 250V, 3A. Complete with instructions. **HUNDREDS OF APPLICATIONS. COMPLETE WITH KNOBS.**

SPECIAL QUOTES FOR QUANTITES

LASKY'S PRICE **£6·95** Post 18p

TRIO HS.1 & HS.2 STEREO HEADPHONE BARGAINS



Models HS-1 and HS-2. Both these sets by TRIO offer really superb stereo reproduction in a lightweight, fully adjustable headset designed for optimum comfort. Listening fatigue is unknown with TRIO headphones. Brief spec. both models: Input imp. 8Ω nominal (matching 4 to 8Ω); max. input 0·5W; frequency response 20–19 kHz; output sensitivity at 1mW input; HS-1 118 dB. HS-2 111 dB; weight 0·66lbs. Identical in appearance—both models are finished in ivory with contrasting foam filled ear pads and head band.

LIST PRICE £8·40 HS.1 **£5·20p** LIST PRICE £6·75 HS.2 **£4·15p** Post 18p

Lasky's Radio Limited

LASKY'S RADIO LTD. OVER 38 YEARS ESTABLISHED

Branches

207 EDGWARE ROAD, LONDON, W.2 Tel: 01-723 3271
33 TOTTENHAM CT. RD., LONDON, W.1 Tel: 01-636 2605
Open all day, 9 a.m.–6 p.m. Monday to Saturday
152/3 FLEET STREET, LONDON, E.C4 Tel: 01-353 2833
Open all day Thursday, early closing 1 p.m. Saturday

The Home of High Fidelity

42-45 TOTTENHAM CT. RD., LONDON, W.1 Tel: 01-580 2573
Open all day, 9 a.m.–6 p.m. Monday to Saturday

NEW CITY BRANCH NOW OPEN

109 FLEET STREET, LONDON, E.C4 Tel: 01-353 5812
Open all day Thursday, early closing 1 p.m. Saturday

ALL MAIL ORDERS AND CORRESPONDENCE TO: 3-15 CAVELL ST., TOWER HAMLETS, LONDON, E.1 Tel.: 01-790 4821

BI-PRE-PAK LIMITED

FULLY TESTED AND MARKED

	£p		£p
AC107	0·15	OC170	0·23
AC126	0·13	OC171	0·23
AC127	0·17	OC200	0·25
AC128	0·13	OC201	0·25
AC176	0·25	2G301	0·13
ACY17	0·15	2G303	0·13
AF239	0·37	2N711	0·50
AF186	0·50	2N1302-3	0·20
AF139	0·37	2N1304-5	0·25
BC154	0·25	2N1306-7	0·30
BC171 = BC107	0·13	2N1308-9	0·35
BC172 = BC108	0·13	2N3819FET	0·45
BF194	0·15	**Power Transistors**	
BF274	0·15		
BFY50	0·20	OC20	0·50
BSY25	0·57	OC23	0·30
BSY26	0·13	OC25	0·25
BSY27	0·13	OC26	0·25
BSY28	0·13	OC28	0·30
BSY29	0·13	OC35	0·25
BSY95A	0·15	OC36	0·37
OC41	0·13	AD149	0·30
OC44	0·13	AUY10	1·25
OC45	0·13	2S034	0·25
OC71	0·13	2N3055	0·63
OC72	0·13		
OC73	0·17	**Diodes**	
OC81	0·13	AAY42	0·10
OC81D	0·13	OA95	0·19
OC83	0·20	OA79	0·09
OC139	0·13	OA81	0·09
OC140	0·17	IN9114	0·07

FREE!

PACKS OF YOUR OWN CHOICE UP TO THE VALUE OF **50p** WITH ORDERS OVER £4

CLEARANCE LINES

	1.10	*10.50*	*50+*
SL403D Audio Amp.	2·00	1·95	1·80
IC 709C Linear Opp. Amp.	50p	40p	35p
A.E.I. Fully marked & tested Gates	25p	22p	20p
A.E.I. Fully marked & tested Flipflops	50p	40p	30p
OC71/72 Fully tested, unmarked	5p	5p	4p
Matched Sets 1-OC44, 2-OC45 Per set	25 p	20p	15p
Matched Sets, OC45, 1st & 2nd I.F. Per set	15p	12p	10p
TIC45 Thyristors, 6A, 60V Texas	15p	15p	12p
OA47 Gold bonded Diodes, marked & tested	3p	3p	2p
1W Zener Diodes 6·8V, 7·5V, 24V, 27V, 30V & 43V	5p	4p	3p
10W Zener Diodes: 7·5V, 11V, 13V, 20V & 100V	20p	17p	15p
Micro Switches, S/P, C/O Popular size	25p	20p	15p
1 Amp Bridge Rectifiers 25V, RMS	25p	22p	20p

1 Amp Plastic Rectifiers. These are voltage. reverse Polarity and other rejects from the BY 127 range. Ideal for low voltage Power Units etc. Price £1 per 100.

COLOUR T.V. LINE OUTPUT TRANSFORMERS

Designed to give 25kV when used with PL509 and PY500 valves. As removed from colour receivers at the factory.

ONLY £1 each
Post and packing 23p.

BUMPER BUNDLES

These parcels contain all types of surplus electronic components, printed panels, switches, potentiometers, transistors and diodes, etc.

2 LBS IN WEIGHT FOR £1

Post and packing 25p.

NEW TESTED AND GUARANTEED PAKS

B2	4	Photo Cells, Sun Batteries. 0·3 to 0·5V, 0·5 to 2mA.	50p
B79	4	IN4007 Sil. Rec. diodes, 1,000 PIV lamp plastic	50p
B81	10	Reed Switches, mixed types large and small	50p
B99	200	Mixed Capacitors. Postage 13p Approx. quantity, counted by weight	50p
H4	250	Mixed Resistors. Postage 10p. Approx. quantity counted by weight	50p
H7	40	Wirewound Resistors. Mixed types and values. Postage 8p.	50p
H8	4	BY127 Sil. Recs. 1000 PIV. 1 amp. plastic	50p
H9	2	OCP71 Light Sensitive Photo Transistor	50p
H12	20	NKT155/259 Germ. diodes, brand new stock clearance	50p
H18	10	OC71/75 uncoded black glass type PNP Germ.	50p
H19	10	OC81/81D uncoded white glass type PNP Germ.	50p
H28	20	OC200/1/2/3 PNP Silicon uncoded TO-5 can	50p
H29	20	OA47 gold bonded diodes coded MCS2	50p

F.E.T. PRICE BREAKTHROUGH!!

This field effect transistor is the 2N3823 in a plastic encapsulation, coded as 3823E. It is also an excellent replacement for the 2N3819.

Data sheet supplied with device.

1-10 **30p** each, 10-50 **25p** each, 50+ **20p** each.

OUR VERY POPULAR 3p TRANSISTORS

FULLY TESTED & GUARANTEED

TYPE "A" PNP Silicon alloy, metal TO-5 can. 2S300 type, direct replacement for the OC200/203 range.

TYPE "B" PNP Silicon, plastic encapsulation, low voltage but good gain, these are of the 2N3702/3 and 2N4059/62 range.

TYPE "E" PNP Germanium AF or RF—please state on order. Fully marked and tested.

TYPE "F" NPN Silicon plastic encapsulation, low noise amplifier of the 2N3708, 9, 10, 11.

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. **£1 each**

BULK BUYING CORNER

NPN/PNP Silicon Planar Transistors TO-18 mixed untested similar to 2N706-6A-8, BSY26-7A9-95A and BCY70 etc. **£4·25** per 500. **£8** per 1000.

NPN Silicon Planar transistors plastic encapsulation untested similar to 2N3707 to 3711. **£4·25** per 500. **£8** per 1000.

Silicon planat diodes do-7 glass similar to OA200-202, BAY31-36. **£4·50** per 1000.

NPN/PNP Silicon planar transistors plastic TO-18 similar to BC113-4, BC153-4, BF153-160, etc. **£4·25** per 500. **£8** per 1000.

NPN Silicon planar transistors TO-5 can similar to BC142/3, BFY50-2-3. **£5·25** per 500, **£10** per 1000.

OC44, OC45 transistors fully marked and tested 500 to 999, **8p** each, 1000+ **6p** each.

OC71 transistors fully marked and tested, 500 to 999, **6** each, 1000+ **5p** each.

A amp minature plastic diodes IN4001 at 500 to 999, **4p** each, 1000+ **3p** each.
IN4004 at 500 to 999, **5p** each, 1000+ **4p** each.
IN4006 at 500 to 999, **6p** each, 1000+ **5p** each.
IN4007 at 500 to 999, **8p** each, 1000+ **7p** each.

NEW UNMARKED UNTESTED PAKS

B66	150	Germanium Diodes Min. glass type	50p
B83	200	Trans. manufacturers' rejects all types NPN, PNP, Sil. and Germ.	50p
B84	100	Silicon Diodes DO-7 glass equiv. to OA200, OA202	50p
B86	50	Sil. Diodes sub. min. IN914 and IN916 types	50p
B88	50	Sil. Trans. NPN, PNP equiv. to OC200/1, 2N706A, BSY95A, etc.	50p
B60	10	7 Watt Zener Diodes Mixed Voltages	50p
H6	40	250mW. Zener Diodes DO-7 Min. Glass Type	50p
H10	25	Mixed volts. 1½ watt Zeners. Top hat type	50p
H11	30	MAT Series "alloy" pnp Transistors	50p
H15	30	Top Hat Silicon Rectifiers, 750mA. Mixed volts	50p
H16	8	Experimenters' Pak of Integrated Circuits. Data supplied	50p
H20	20	BY126/7 Type Silicon Rectifiers, 1 amp plastic. Mixed volts.	50p

FREE CATALOGUE AND LISTS for:—

ZENER DIODES
TRANSISTORS, RECTIFIERS
FULL PRE-PAK LISTS
& SUBSTITUTION CHART

MINIMUM ORDER **50p** CASH WITH ORDER PLEASE. Add 10p post and packing per order. OVERSEAS ADD EXTRA FOR AIRMAIL.

P.O. RELAYS

Various Contacts and Coil Resistances. No individual selection. Post & Packing **25p**

8 FOR £1

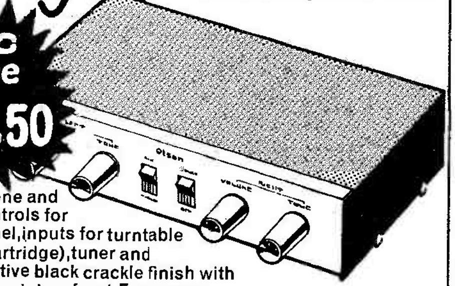
FREE! A WRITTEN GUARANTEE WITH ALL OUR SEMICONDUCTORS

BI-PRE-PAK LTD DEPT. D, 222-224 WEST ROAD, WESTCLIFF-ON-SEA, ESSEX
TELEPHONE: SOUTHEND (0702) 46344

JUST BEGINNING?

Then try out **8-Watt, 10-Transistor Stereo Amplifier R.137**

ROC price £10.50



Separate tone and volume controls for each channel, inputs for turntable (ceramic cartridge), tuner and tape. Attractive black crackle finish with brushed aluminium front. Frequency response: 70-20,000 Hz ±3dB. Output: 4 watts per channel @ 8 ohms. Inputs: Phono 80mV; tuner/aux 80mV.

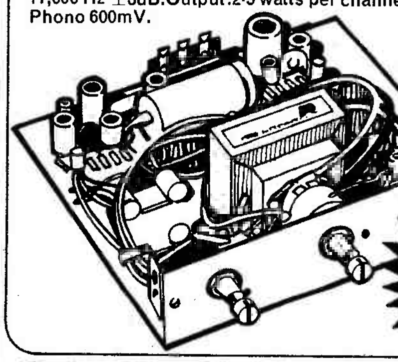
Normal retail price: £14·70

FIRST STEP TO STEREO!

5-Watt Transistor Stereo Amplifier Chassis R.123

Completely self-contained, fully transistorised, mains-powered (240vAC) amplifier, needing only cabinet and knobs. Ideal for adapting mono players to stereo. Frequency response: 40-17,000 Hz ±3dB. Output: 2·5 watts per channel @ 8 ohms. Input: Phono 600mV.

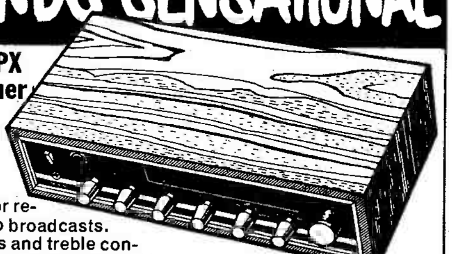
Normal retail price: £7·30



ROC price £4.95

SOUNDS SENSATIONAL

AM/FM/MPX Stereo Tuner Amplifier R.124



A top quality amplifier with facility for receiving stereo broadcasts. Separate bass and treble controls, automatic frequency response, stereo headphone socket, output power: 8 watts. FM frequency range 88-108 M Hz; AM frequency range 535-1605 K Hz. Inputs for turntable (ceramic cartridge) and tape. Frequency response: 50-10,000 Hz ±3dB. Output: 4 watts per channel @ 8 ohms. Inputs: Phono 200mV, tape 100mV. FM: Sensitivity 20µV, stereo separation 26dB, image rejection 55dB. AM: Sensitivity 300µV.

Normal retail price: £42·00 **ROC price: £29.95**

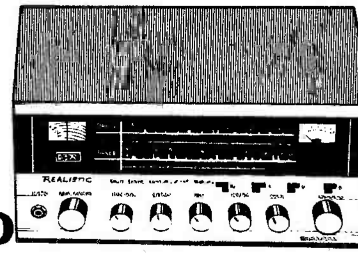
World wide reception

Professional Solid-state, Four-band Communications Receiver R.135

Fully transistorised with continuous coverage from 555K Hz to 30 M Hz in four bands (with illuminated bandspread for 160-10 metres). Incorporates internal speaker, automatic noise limiter, SSB/AM/CW switch, AVC switch, S Meter, Receive and Standby switch, external socket for headphone or speaker, bandspread control, BFO control, on/off/AF gain, band selector, antenna trimmer and RF gain. Runs off 240 v AC, batteries or any 12 v DC negative ground source. Frequency ranges (in mHz): Band A, 535-1·6; B, 1·55-4·5; C, 4·5-13; D, 13-30. Sensitivity: 0·5µV @ 30mHz. Bandspread: 10-160 metres.

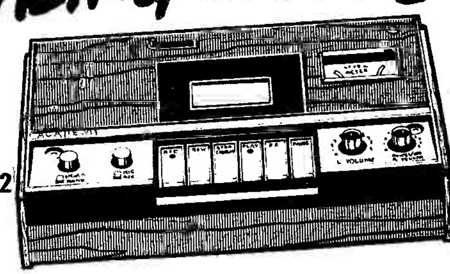
Normal retail price: £65·00

ROC price: £45.00



AMAZING OFFER!

Stereo Cassette Tape Unit R.142



Complete stereo record and playback unit with line and microphone inputs. Fitted with tape counter, separate pause control, recording level metres for each channel, pop-up cassette ejection. Supplied complete with two pencil microphones. Wow & flutter better than 0·3%, frequency response 100-10,000 Hz. Tape speed: 1⅞ IPS, 4·75 CMS. Rewind time: Better than 60 sec (C.60 cassette).

Normal retail price: £65·00

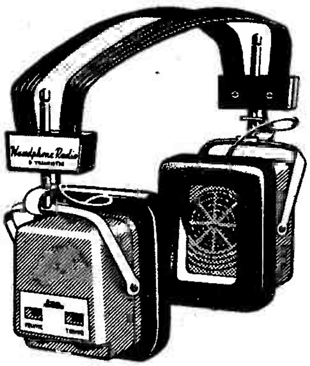
ROC Price £49.50

We don't want you to

Every piece of electronic or audio-equipment we sell is built to our specifications. It comes complete with a Guarantee. And it's tested before it leaves us.

We bend over backwards in our advertising to make sure everything we say is factually accurate. But, buying mail-order, even though you're buying from us, we accept you could still end up with a piece of equipment that's not exactly what you wanted. And we think that's unfair.

FANTASTIC BARGAIN



Headphone Radio R.143

For completely private listening without the distortion of the ordinary earphone adaptor. Battery operated; PP3. Fully transistorised. Frequency range: 535-1600 K Hz, Medium Wave Band. Maximum output: 300mW.

ROC price £6.90

Normal retail price: £9·40

STEREO headphones

only £2.40

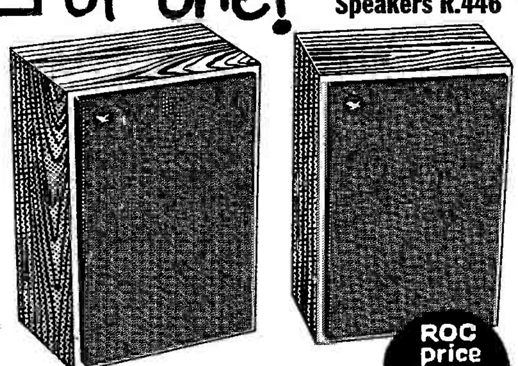
Stereo Headphones R.328

Light and comfortable, with a frequency response of 30-15,000 Hz for real listening pleasure. Complete with jack plug. Impedance 8-16 ohms.

Normal retail price: £2·95

2 for the price of one!

Matched Stereo Speakers R.446



ROC price £16.40

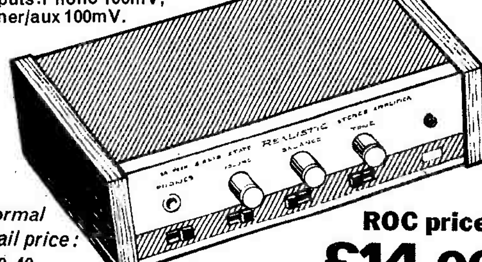
Heavily lagged teak finish cabinets each with large dual cone base unit and separate tweeter. Power handling: 10 watts peak; frequency range: 40-18,000 Hz, impedance: 8 ohms. Size: 14 x 8¾ x 6½.

Normal retail price: £19·60

Don't read this!

10-watt Transistor Stereo Amplifier R.136

Ganged volume, balance and tone controls. Inputs for turntable (ceramic cartridge), tuner (see R.134) or tape. Oiled walnut case with satin finish aluminium front panel. Frequency response 50-10,000 Hz ±3dB. Output: 5 watts per channel @ 8 ohms. Inputs: Phono 100mV, tuner/aux 100mV.



Normal retail price: £20·40

ROC price: £14.00

The Perfect match!

AM/FM/MPX Stereo Tuner R.134

Matching unit to the R.136 amplifier. Covers AM and FM tuning bands with automatic stereo signal light. FM frequency range: 88-108mHz; AM frequency range: 535-1605kHz. FM: Sensitivity 5µV, stereo separation 25dB@1kHz, image rejection 50dB. AM: Sensitivity 250µV.

ROC price £22

Normal retail price: £28·60

pay for your mistakes

So we've got a proposition for you.
If you buy a piece of Roc equipment, and it's not quite what you expected, send it back within seven days, and as long as it's as good as new we'll give you your money back. O.K?

Return of post mail-order service; orders over £10 post free, (U.K. only) add 25p for p & p to orders under £10. HP terms available.

ROC ELECTRONICS LIMITED

B. Jory Esq 193 Edgware Rd., London W2 1ET. *01-723 6211.*
Callers at Shop welcome 9-6 Mon to Sat (Thurs 1pm)

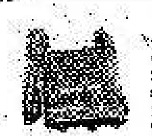
LOW PRICE, HIGH QUALITY SPEAKER SYSTEMS

All cabinets are new and carefully designed acoustically with speakers mounted on ½in. chipboard baffles. All speakers are ex-TV high quality with hi-flux magnets carefully matched and tested.

We still do the well known Shelley and Caxton column speaker systems.

SPEAKER MATCHING TRANSFORMERS

3, 7, 15 ohms, 8 watt, **70np.** P. & P. 17np.



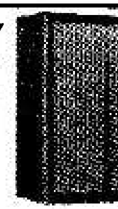
STEREO HEADPHONE JUNCTION BOX

Simple unit connects direct to amplifier and speakers to give attenuated headphone output, has 2 position switch to give headphones only—speakers only.
Only **£1·37** each P & P 12½.

VYNAIR

Widths from 50 to 54 in., **75np** yd. off roll. P. & P. 10np, ½ yard **40np**. P. & P. 10np. Send 5np stamps for samples.

FARRADAY



5¾" x 11" x 4¾" covered in White, Green or Black rexine or Teak cloth with Silver coloured metal front
£2·90 P & P 25p.

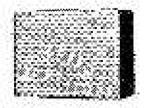
IMP

Wedge shaped extension speaker 7½ x 6½ x 4in. (max.). Covered in walnut wood grain cloth with mottled Vynair front. Keyhole slot at back. Fitted with 3 ohm speaker unit. Only **£1.25.** P. & P. 36np each

CARTRIDGES-Stereo

Sonotone 9TA H/C Diamond **£2.40.** Ronette S105 Medium Output, **£1.40.** S106 High Output **£1.40.** Acos GP93/1 Sapphire, **£1.90.** GP94 1 Sapphire, **£2.** TA700 equivalent to B.S.R. SX1M, **£1.75.** Japanese equivalent to B.S.R. TC8s, **£1.75.** P. & P. 7np on each.

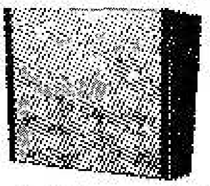
CLARENCE



11" wide x 8½" x 4½" deep with volume control covered in Black rexine and Mottled Vynair.
£2·25 P & P 25p.

CARTRIDGES-Mono

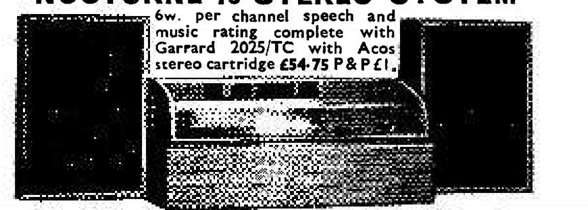
GP.91 Stereo Compatible **£1.25.** Acos GP67/2 will replace Collaro and Garrard Mono cartridges, **95np.** T.T.C. Crystal High Gain, **75np.** B.S.R. TC8H Jap. equivalent **£1.25.** P. & P. 7np.



DUDLEY

11" x 9½" x 5" deep, tapering to 3½" deep covered in Black reseine and Mottled fawn Vynair **£2·10** P & P 25p.

NOCTURNE 73 STEREO SYSTEM



6w. per channel speech and music rating complete with Garrard 2025/TC with Acos stereo cartridge **£54·75** P & P £1.

SPEAKERS

E.M.I. 13½ x 8in, 3 ohm **£2.50,** 15 ohm. P. & P. 30np. E.M.I. 13½ x 8in. fitted two 2½in. tweeters, 15 ohm **£4.50.** P. & P. 30np. E.M.I. 13½ x 8in. (15 ohm) Hi-Fi quality **£6.25.** P. & P. 30np. Bakers 12in. 25 watt 8 and 15 ohms **£7.** P. & P. 30np. Eagle Crossover **86np.** P. & P. 5np.

BROADWAY ELECTRONICS 82 MITCHAM ROAD, TOOTING BROADWAY, LONDON S.W.17 01-672 3984 (Nr. Tooting Broadway Underground Station) (Closed all Wednesday)

M. & B. COMPONENTS (LEEDS) LTD.

(INCORPORATING M. & B. RADIO)

PO Box 125, 38 BRIDGE END, LEEDS 1 Telephone 0532-35649

MB2/20A TWO METRE TRANSCEIVER. Rx Tuneable over 2 metre band, 20 watts RF output AM modulated. Ideal for mobile or fixed station. Only requires connection to speaker, aerial and 12v DC supply to become fully operational. (Full details on list.)
£50 inc. carr. U.K.

AD 108D MARCONI COMMUNICATION RECEIVERS. 9 miniature valves plus Xtal filter and tuneable BFO covering 260 to 510 Kc/s and 2 to 18·5 Mc/s in 4 switched bands. Slow motion dial with logging scale. Originally intended for 24v DC operation but supplied with details for converting to mains operation. In very clean, tested condition. **£15·50 inc. carr. U.K.**

EX-ARMY 88 WALKIE TALKIES. 3 channel, less handset. Untested but complete and in clean condition. With circuit.
ONLY £4·75 or £8 for 2 inc. carr. U.K.

6 TO 12 VOLTS DC TRANSISTOR CONVERTOR. Brand new 6v DC input, 12v DC output at 4 amps conservatively rated. Ideal VW owners. **£5·40 inc. carr. U.K.**

9 TRANSISTOR 455 KC/S IF STRIPS. Ideal basis for receiver.
BARGAIN. Only £1·20 inc. carr. U.K.

GEIGER COUNTERS. Well known contamination meter comprised of main unit fitted with meter marked in Milli Rontgens/hour, probe lead and carrying case. Audio output available from socket on front panel. Supplied new or as-new condition. Model 1 fitted with vibrator PSU using 5 pen cell batteries. **£4·85 inc. carr. U.K.**

12v INVERTER TRANSFORMERS. Complete with circuit to build inverter to give 350v output at 300 m/a. **£2·20 inc. carr. U.K.**

Send S.A.E. for complete list of items in stock.

VALVES

SAME DAY SERVICE
NEW! TESTED! GUARANTEED!

SETS 1R5, 1S5, 1T4, 3S4, 3V4, DAF91, DF91, DK91, DL92, DL94. Set of 4 for £1·02. DAF96, DF96, DK96, DL96, 4 for £1·48.

1R5	·28	25U4GT	·57	DY86	·26	EL500	·62	PCL82	·33	UABC80	·33
1S5	·22	30C1	·29	DY87	·26	EM80	·41	PCL83	·59	UAF42	·51
1T4	·16	30C15	·63	DY802	·40	EM81	·41	PCL84	·35	UBC41	·52
3S4	·26	30C17	·80	EABC80	·32	EM84	·32	PCL85	·42	UBF80	·34
3V4	·37	30C18	·63	EAF42	·50	EM87	·36	PCL86	·40	UBF89	·33
5U4G	·26	30F5	·70	EB41	·40	EY51	·38	PCL88	·72	UCC84	·33
5V4G	·35	30FL1	·63	EB91	·11	EY86	·31	PCL800	·77	UCC85	·36
5Y3GT	·28	30FL12	·70	EBC33	·40	EZ40	·43	PENA4	·77	UCF80	·34
5Z4G	·35	30FL14	·70	EBC41	·54	EZ41	·48	PEN36C	·70	UCH42	·62
6/30L2	·58	30L1	·30	EBC90	·22	EZ80	·22	PFL200	·53	UCH81	·32
6AL5	·11	30L15	·59	EBF80	·32	EZ81	·23	PL36	·49	UCL82	·34
6AM6	·13	30L17	·71	EBF89	·31	GZ30	·35	PL81	·46	UCL83	·55
6AQ5	·26	30P4	·65	ECC81	·17	GZ32	·42	PL81A	·49	UF41	·56
6AT6	·22	30P12	·77	ECC82	·20	GZ34	·50	PL82	·31	UF89	·31
6AU6	·21	30P19	·65	ECC83	·35	KT41	·77	PL83	·33	UL41	·60
6BA6	·21	30PL1	·63	ECC85	·26	KT61	·55	PL84	·30	UL44	£1·00
6BE6	·22	30PL13	·78	ECC804	·57	KT66	·81	PL500	·64	UL84	·33
6BJ6	·41	30PL14	·67	ECF80	·30	LN319	·63	PL504	·64	UM84	·22
6BW7	·55	30PL15	·90	ECF82	·26	LN329	·72	PM84	·35	UY41	·40
6CD6G	£1·07	35L6GT	·45	ECH35	·30	LN339	·63	PX25	£1·00	UY85	·28
6F14	·42	35W4	·25	ECH42	·61	N78	·87	PY32	·55	VP4B	·77
6F23	·70	35Z4GT	·25	ECH81	·29	P61	·45	PY33	·55	Z77	·22
6F25	·60	807	·45	ECH83	·40	PABC80	·34	PY81	·27	Transistors	
6K7G	·12	6063	·62	ECH84	·36	PC86	·48	PY82	·25	AC107	·17
6K8G	·17	AC/VP2	·77	ECL80	·32	PC88	·48	PY83	·28	AC127	·18
6Q7G	·28	B349	·65	ECL82	·31	PC96	·42	PY88	·33	AD140	·37
6SN7GT	·30	B729	·62	ECL86	·36	PC97	·40	PY800	·34	AF115	·20
6V6G	·23	CCH35	·67	EF39	·38	PC900	·33	PY801	·34	AF116	·20
6V6GT	·31	CY31	·32	EF41	·60	PCC84	·30	R19	·30	AF117	·20
6X4	·23	DAF91	·22	EF80	·23	PCC85	·27	R20	·59	AF118	·48
6X5GT	·28	DAF96	·36	EF85	·28	PCC88	·42	U25	·65	AF125	·17
7B7	·33	DF33	·38	EF86	·31	PCC89	·46	U26	·59	AF127	·17
10P13	·58	DF91	·16	EF89	·26	PCC189	·48	U47	·65	OC26	·25
12AH8	£2·25	DF96	·36	EF91	·18	PCC805	·59	U49	·59	OC44	·12
12AT7	·17	DH77	·22	EF183	·28	PCF80	·29	U50	·39	OC45	·12
12AU6	·22	DK32	·37	EF184	·31	PCF82	·31	U52	·31	OC71	·12
12AU7	·20	DK91	·28	EH90	·37	PCF86	·45	U78	·24	OC72	·12
12AX7	·23	DK92	·42	EL33	·55	PCF800	·67	U191	·60	OC75	·12
19BG6G	·87	DK96	·38	EL34	·45	PCF801	·31	U193	·42	OC81	·12
20F2	·67	DL35	·40	EL41	·54	PCF802	·44	U251	·66	OC81D	·12
20P3	·80	DL92	·26	EL84	·23	PCF805	·63	U301	·45	OC82	·12
20P4	·92	DL94	·37	EL90	·26	PCF806	·58	U329	·66	OC82D	·12
25L6GT	·20	DL96	·38	EL95	·33	PCF808	·70	U801	·98	OC170	·22

READERS RADIO

85 TORQUAY GARDENS, REDBRIDGE, ILFORD, ESSEX. Tel. 01-550 7441.

Postage on 1 valve 5p, on 2 or more valves 3p per valve extra. Any parcel insured against damage in transit 3p extra.

Build yourself a TRANSISTOR RADIO

NEW! ROAMER 10 WITH VHF INCLUDING AIRCRAFT

10 TRANSISTORS. 9 TUNABLE WAVEBANDS, MW1, MW2, LW, SW1, SW2, SW3, TRAWLER, BAND, VHF AND AIRCRAFT BAND

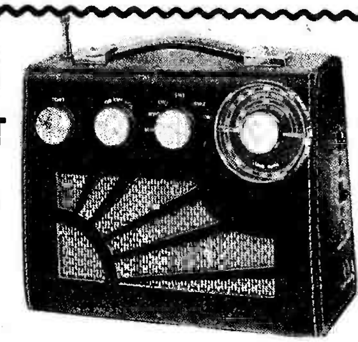
Built in Ferrite Rod Aerial for MW/LW. Retractable, chrome plated 7 section Telescopic Aerial, can be angled and rotated for peak short wave and VHF listening. Push Pull output using 600mw Transistors. Car Aerial and Tape Record Sockets. Switched Earpiece Socket complete with Earpiece. 10 Transistors plus 3 Diodes. 7in × 4in Speaker. Air Spaced ganged Tuning Condenser with VHF section. Volume on/off, Wave Change and Tone Control. Attractive Case in black with silver blocking. Size 9" × 7" × 4". Easy to follow instructions and diagrams. Parts price list and easy build plans 30p (FREE with parts).

Total building cost

£8·50

P. P. & Ins. 50p

(Overseas P. & P. £1)



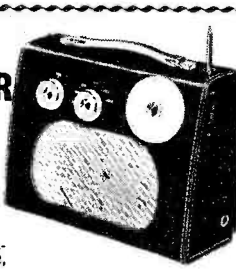
ROAMER EIGHT Mk I

NOW WITH SWITCHED TONE CONTROL

7 Tunable Wavebands: MW1, MW2, LW, SW1, SW2, SW3 and Trawler Band. Built in Ferrite Rod Aerial for MW and LW. Retractable chrome plated Telescopic aerial for Short Waves. Push pull output using 600mW transistors. Car aerial and Tape record sockets. Selectivity switch. Switched earpiece socket complete with earpiece. 8 transistors plus 3 diodes. 7in. × 4in. Speaker. Air spaced ganged tuning condenser. Volume/on/off, tuning, wave change and tone controls. Attractive case in rich chestnut shade with gold blocking. Size 9 × 7 × 4in. approx. Easy to follow instructions and diagrams. Parts Price List and Easy Build Plans 25p (FREE with parts).

Total building cost £6·98 P. P. & Ins. 41p.
(Overseas P. & P. £1)

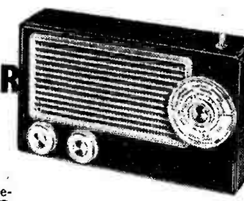
ROAMER SEVEN MK IV



7 Tunable Wavebands: MW1, MW2, LW, SW1, SW2, SW3 and Trawler Band. Extra Medium waveband provides easier tuning of Radio Luxembourg, etc. Built in ferrite rod aerial for MW and LW. Retractable 4 section 24in. chrome plated telescopic aerial for SW. Socket for Car Aerial. Powerful push-pull output. 7 transistors and 2 diodes, including Micro-Alloy R.F. Transistors. 7 × 4in. P.M. speaker. Air spaced ganged tuning condenser. Volume/on/off, tuning and wave change controls. Attractive case with carrying handle. Size 9 × 7 × 4in. approx. Easy to follow instructions and diagrams. Parts price list and easy build plans 15p (FREE with parts). Earpiece with plug and switched socket for private listening, 30p extra.

Total building costs £5·98 P. P. & Ins. 41p.
(Overseas P. & P. £1)

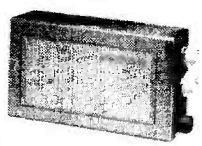
ROAMER SIX



6 Tunable Wavebands: MW, LW, SW1, SW2, Trawler band plus an extra M.W. band for easier tuning of Luxembourg, etc. Sensitive ferrite rod aerial and telescopic aerial for Short Waves. 3in. Speaker. 8 stages—6 transistors and 2 diodes including Micro-Alloy R.F. Transistors, etc. Attractive black case with red grille, dial and black knobs with polished metal inserts. Size 9 × 5½ × 2½in. approx. Easy build plans and parts price list 15p (FREE with parts). Earpiece with plug and switched socket for private listening 30p extra.

Total building costs £3·98 P. P. & Ins. 26p
(Overseas P. & P. £1)

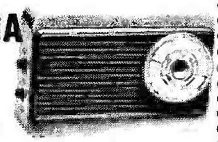
POCKET FIVE



3 Tunable Wavebands: MW, LW, Trawler Band with extended M.W. band for easier tuning of Luxembourg, etc. 7 stages—5 transistors and 2 diodes, supersensitive ferrite rod aerial, fine tone moving coil speaker. Attractive black and gold case. Size 5¼ × 1¼ × 3¼in. Easy build plans and parts price list 10p (FREE with parts). Earpiece with plug and switched socket for private listening 30p extra.

Total building costs £2·23 P. P. & Ins. 21p
(Overseas P. & P. 63p)

TRANSONA FIVE

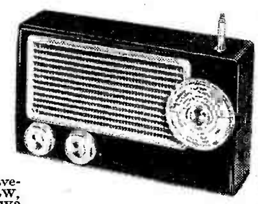


NOW WITH 3in SPEAKER

3 Tunable Wavebands: MW, LW and Trawler Band. 7 stage—5 transistors and 2 diodes, ferrite rod aerial. tuning condenser volume control, fine tone 3in. moving coil speaker. Attractive case with red speaker grille. Size 6¼ × 4¼ × 1½in. Easy build plans and parts price list 10p (FREE with parts). Earpiece with plug and switched socket for private listening 30p extra.

Total building costs £2·50 P. P. & Ins. 22p
(Overseas P. & P. 63p)

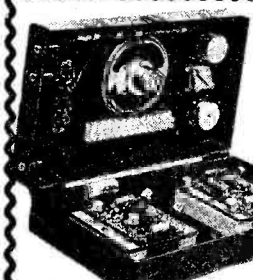
TRANS EIGHT



6 Tunable Wavebands: MW, LW, SW1, SW2, SW3 and Trawler Band. Sensitive ferrite rod aerial for M.W. and L.W. Telescopic aerial for Short Waves. 3in. Speaker. 8 improved type transistors plus 3 diodes. Attractive case in black with red grille, dial and black knobs with polished metal inserts. Size 9 × 5½ × 2½in. approx. Push pull output. Battery economiser switch for extended battery life. Ample power to drive a larger speaker. Parts price list and easy build plans 25p (FREE with parts). Earpiece with plug and switched socket for private listening 30p extra.

Total building costs £4·48 P. P. & Ins. 31p
(Overseas P. & P. £1)

NEW! "EDU-KIT"



BUILD RADIOS, AMPLIFIERS, ETC., FROM EASY STAGE DIAGRAMS. FIVE UNITS INCLUDING MASTER UNIT TO CONSTRUCT.

COMPONENTS INCLUDE:
Tuning Condenser: 2 Volume Controls: 2 Slider Switches: 4"×2½" Speaker: Terminal Strip: Ferrite Rod Aerial: 3 Plugs and Sockets: Battery Clips: 4 Tag Boards: Balanced Armature Unit: 10 Transistors: 4 Diodes: Resistors: Capacitors: Three ½" Knobs. Units once constructed are detachable from Master Unit, enabling them to be stored for future use. Ideal for Schools, Educational Authorities and all those interested in radio construction.

All parts including Case and Plans £5·50 P. P. & Ins. 31p
(Overseas P. & P. £1)

FULL AFTER SALES SERVICE

- Callers side entrance Barratts Shoe Shop
- Open 10–1, 2.30–4.30 Mon.–Fri. 9–12 Sat.

RADIO EXCHANGE CO

61 HIGH STREET, BEDFORD. Tel. 0234 52367

I enclose £.................. please send items marked

ROAMER TEN	☐	ROAMER SEVEN	☐
ROAMER EIGHT	☐	TRANS EIGHT	☐
TRANSONA FIVE	☐	ROAMER SIX	☐
POCKET FIVE	☐	EDU-KIT	☐

Parts price list and plans for ....

Name ....

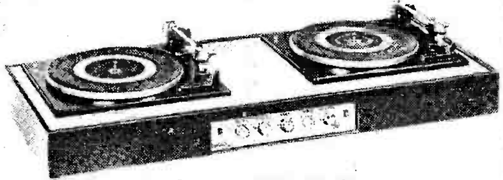
Address ....

.... PW.34

DISCOTHEQUE EQUIPMENT PACKAGE OFFERS

F.A.L. PHASE 50 MK.II AMPLIFIER	£33.50	PACKAGE PRICE
PR. FANE POP 25/2 25W L/SPEAKERS	£13.50	**£44** carr. £1
Terms: Deposit £5.50 and 9 monthly payments of £4.72 (Total £47.98)	£47.00	
F.A.L. PHASE 50 MK.II AMPLIFIER	£33.50	PACKAGE PRICE
PR. FANE POP 50 L/SPEAKERS	£21	**£49·50** carr. £1
Terms: Deposit £10.50 and 9 monthly payments of £5 (Total £55.50)	£54.50	
F.A.L. PHASE 100 AMPLIFIER	£61.95	PACKAGE PRICE
PR. L125 50W L/S in cabinets	£59.80	**£110** carr. £1.50
Terms: Deposit £22 and 9 monthly payments of £11 (Total £121)	£121.75	
F.A.L. PHASE 100 AMPLIFIER	£61.95	PACKAGE PRICE
4 FANE POP 50 L/SPEAKERS	£42	**£94** carr. £1.50
Terms: Deposit £14 and 9 monthly payments of £10 (Total £104)	£103.95	

F.A.L. DISCOTHEQUE CONSOLE



Incorporating twin Garrard SP25 Mk.III turntables and Goldring CS90 Ceramic Cartridges with diamond stylii. Separate Vol. Bass and Treble controls for each turntable plus MONITORING FACILITIES. Black Rexine covered Cabinet with lid.

£65 Carr. £1·25

Terms: Deposit £11 and 9 monthly payments of £6·70 (Total £71·30)

AUDIOTRINE HI-FI SPEAKER SYSTEMS

Consisting of matched 12in. 11,000 line 15 Watt 15 ohm high quality speaker, cross-over unit and tweeter. Smooth response and extended frequency range ensure surprisingly realistic reproduction. **£5·75**

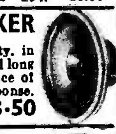
OR SENIOR 15 WATT INC. **£6·75** Carr. 30p
HF126 15,000 LINE SPEAKER carr. 35p

AUDIOTRINE HIGH FIDELITY LOUDSPEAKERS

Heavy construction. Latest high efficiency ceramic magnets. Treated Cone surround. "D" indicates Tweeter Cone providing extended frequency range up to 15,000 c.p.s. Impedance 3 or 8–15 ohms. Please state choice. Exceptional performance at low cost.

HF801D	8"	8W	£2.71	HF120D	12"	15W	£4.75
HF102D	10"	10W	£3.40	HF126	12"	15W	£5.50
HF120	12"	15W	£4.25	HF126D	12"	15W	£5.90

FANE 807 HIGH FIDELITY LOUDSPEAKER



A full range 8in. 10 watt unit for excellent sound quality. in suitable enclosure. Cast chassis Roll P.V.C. cone surround and long throw voice coil to achieve very low fundamental resonance of 80 c.p.s. Tweeter cone is fitted to extend high note response. Frequency range 25 Hz to 15 KHz. Impedance 3 or 8–15 Ω. Gauss 10,000. Remarkable value. **£3·50**

HI-FI SPEAKER ENCLOSURES

Modern design. Teak veneer finish. Acoustically lined. All sizes approx. Carr. 30p. per enclosure

JE8 Size 16 x 11 x 9in. Pressurised. Gives pleasing results with any 8in. Hi-Fi 'speaker. **£5·35**

SE8 For optimum performance with any 8in. Hi-Fi 'speaker. Size 22 x 15 x 9in. Ported **£6·47**

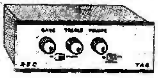
SE10 For outstanding results with 10in. Hi-Fi 'spkr Size 24x15x10in. P'td. **£6·74**

SE12 For exclnt prfmnce with 12in. Hi-Fi speaker and Tweeter. Size 25 x 16 x 10½in. **£7·87**

R.S.C. BATTERY/MAINS CONVERSION UNITS

TYPE BM1. An all-dry battery eliminator. Size 5½ x 4½ x 2in. approx. Completely replaces batteries supplying 1·5v and 90v, where A.C. mains 200/250v. 50c/s is available. Complete kit with diagram **£3** Assembled ready for use **£3·50**

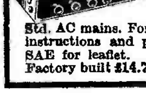
R.S.C. TA6 6 Watt HI-FI SOLID STATE AMPLIFIER



200-250v. AC mains operated. Frequency Response 30-20,000 c.p.s. —2dB. Harmonic Distortion 0.3% at 1,000 c.p.s. Separate Bass and Treble 'lift' and 'cut' controls. 3 input sockets for Mike, Gram, Radio or Tape. Input selector switch. Output for 3-15 ohm spkrs. Max. sensitivity 5mV. Output rating I.H.F.M. Fully enclosed enamelled case, 9½ × 2½ × 5½in. Attractive brushed silver finish facia plate 10½ × 3½in. and matching knobs. Complete kit of parts with full wiring diagrams and instructions. **£7·50** Carr. 40p

OR FACTORY BUILT WITH 12 MONTHS' GUARANTEE **£9·75**

R.S.C. A11 HI-FI 12-14 WATT AMPLIFIER



PUSH-PULL OUTPUT. Two input sockets with sep. vol. controls for mixing. High sensitivity, 5 valves. Bass and treble controls. Response ± 3dB 30-20,000 c/s. Hum level −60dB. Sensitivity 40 millivolts. For Crystal or Ceramic PUs. High Impedance "mikes". For Musical Instruments etc. Std. AC mains. For 3 & 15 ohm spkrs. Complete kit. Full instructions and point-to-point wiring diagrams. Carr. 60p **£10·50**

SAE for leaflet. Twin handled metal cover £1.75

Factory built £14.75 or Dep. £3 and 9 mthly pymnts of £1.60 (Total £17.40.)

R.S.C. COLUMN SPEAKERS

R·S·C HI-FI CENTRES LTD.

IDEAL FOR VOCALISTS AND PUBLIC ADDRESS

All types 15 Ohms covered in Rexine Vynair
TYPE C4100 IS ALSO SUITABLE FOR BASS GUITAR OR ELECTRONIC ORGAN

TYPE C48S 25-30 WATTS
Fitted four 8" high flux 8 watt speakers. Overall size approx 48 x 10 x 5 in. Carr 50p
Terms: Dep £3 and 9 monthly payments £2 (Total £21) **£17·75**

TYPE C412S 50 WATTS
Fitted four 12" 11,000 line 15 watt speakers: Overall size approx 56 x 14 x 9 in. Carr 75p
Terms: Dep. £4 and 9 monthly payments £3 (Total £31) **£27·50**

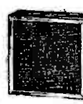
TYPE C4100 100 WATTS inc. four 12" 50 watt speakers for conservative rating. Extra heavy construction. Size approx 58 × 16 × 10" Acoustically filled and pressurised. Terms: Dep. £7·50 and 9 mthly. pyts. £5·45 (Total £56·55). Carr. £1 **£50·50**

30 WATT HI-FI AMPLIFIER FOR GUITAR, VOCAL OR INSTRUMENTAL GROUP.

A 2 or 4 input, 2 vol. control Hi-Fi unit with Separate Bass and Treble controls. Current valves. Peak output rating. Strong Rexine covered cabinet with handles. Attractive black/gold P.V.C. facia. Neon indicator. For 200-250v. A.C. mains. For 3 or 15 ohm speakers. Send S.A.E. for leaflet.
Terms: Deposit £3.70 and 9 monthly payments of £2.10 (Total £22.60) **£19·95** Carr. 65p

HIGH QUALITY LOUDSPEAKER UNITS

IN TEAK VENEERED CABINETS

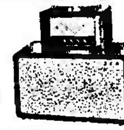


L13 13" × 8" 10 Watt 10,000 lines 3 or 15 ohms. State impedance required. **£5·25** carr. 40p

L12 12" 25 WATT 10,000 lines 15 ohms. Also supplied Rexine covered **£10·50** carr. 45p

L125 50 WATT
Two tone Rexine and vynair finish. Fitted pair of 12" 50 watt high flux speakers for conservative rating. Impedance 8-15 ohms. Or deposit £4 and 9 monthly payments of £3·85. Total £34·15 **£31** Carr. 75p

R.S.C. BASS REGENT 50 WATT AMPLIFIER



A powerful high quality all-purpose unit for lead, rhythm, bass guitar, vocalists. gram, radio, tape, Peak Output rating.
Loudspeaker unit optional horizontal or vertical mounting. **£60**
★ Two extra heavy duty 12in. Loudspeakers.
★ Four Jack inputs and two Volume Controls for simultaneous use of up to four pick-ups or "mikes". Carr. £1.50
Bass and Treble controls. Send S.A.E. for leaflet.
Credit Terms Deposit £16 and 9 monthly payments of £5.75 (Total £67.75)

FAL PHASE 50 MkII AMPLIFIER 50W

Solid state 4 Separately controlled inputs. Plus master vol. control. Ind. Bass and Treble Controls. Protective circuit to guard against damage from accidental shorts. Output for Speaker/s 3·30 ohms. Size 17" × 7" × 7½" 200-250v. A.C. mains. Output 60 watts music rating
Or deposit £6 & 9 monthly payments £3·50. Total £37·50. **£33·50** Carr. 65p

FAL PHASE 100 AMPLIFIER 100W

Solid State. 4 Separately controlled inputs Plus master volume control. Ind. Bass and Treble Controls. Output for speaker/s 3·30 ohms. Protective circuit to guard against damage from accidental shorts. I.H.F.M. Output rating.
Or deposit £12 & 9 monthly payments £6·25. Total £68·25. **£61·95** Carr. 75p
Send S.A.E. for leaflets.

FANE ULTRA HIGH POWER LOUDSPEAKERS

All power ratings are R.M.S. continuous. 2 YEARS' GUARANTEE
High flux ceramic magnets. Heavy cast chassis. All carr. free.

'POP' 100 18" 100 Watt 14,000 gauss 8/15Ω **£22·05**
Dep: £6 and 9 monthly payments £2·10 (Total £24·90)

'POP' 60 15" 60 Watt 14,000 gauss 8/15Ω **£12·90**
Dep. £3.30 and 9 monthly payments. £1.30 (Total £15).

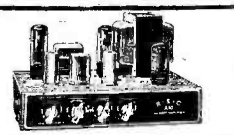
'POP' 50 12" 50 Watt 13,000 gauss 15Ω **£10·50**
Dep £2 and 9 monthly payments £1.15 (Total £12.35) Pair suitable all purposes

FOR BASS GUITAR, ELECT. ORGAN. ETC.

FANE LOUDSPEAKERS 'POP' 25/2

12in. 25 WATT
Dual Cone 15 Ω (for uses other than Bass Guitar or Electronic Organ). **£6·75** Carr. free
or Dep. £1 and 9 mthly payments 75p (Total £7.75).

R.S.C A10 30 WATT ULTRA LINEAR HI-FI AMPLIFIER



Highly sensitive. Push-Pull high output, Hum level—70dB. Response ±3dB 30-20,000 c/s. All high grade components. Valves EF86, EF86, ECC83, 807, 807, GZ34. Separate Bass and Treble Controls. Sensitivity 36 millivolts. For High Impedance microphones. For Clubs, Schools, Theatres. Dance Halls Outdoor Functions, etc. For Electronic Organ, Guitar, String Bass, etc. Gram, Radio or Tape. Two separate inputs with vol. controls permit such as "mike" and Pick-up etc. to be used for mixing purposes, 200-250 v. 50 c/s A.C mains. For 3 and 15 ohm speakers. Complete Kit of parts with wiring diagram and instructions. Twin-handled perforated cover £1.75 Or factory built with EL34 output valves and 12 months' guarantee for £19.75 **£15·75** Carr. 65p
TERMS: Deposit £4 and 9 monthly payments of £2·10 (Total £22·90). Send S.A.E. for leaflet.

RSC TRANSFORMERS, L.F. CHOKES & RECTIFIERS

FULLY GUARANTEED. Impregnated and Interleaved where necessary

Primaries 200-250v. 50c/s. Screened

MIDGET CLAMPED TYPE 2½ × 2¾ × 2½in.

250v., 60mA, 6.3v. 2a	99p
250-0-250v., 60mA 6.3v 2a	£1·05

FULLY SHROUDED UPRIGHT MOUNTING

250-0-250v. 60mA, 6.3v. 2a., 0-5-6.3v. 2a.	£1.40
250-0-250v. 100mA, 6.3v. 4a., 0-5-6.3v. 3a.	£2.20
300-0-300v. 100mA, 6.3v. 4a., 0-5-6.3v. 3a.	£2.20
300-0-300v. 130mA, 6.3v. 4a., c.t., 6.3v. 1a. For Mullard 510 Amplifier	£2.45
350-0-350v. 100mA, 6.3v. 4a., 0.5-6.3v. 3a.	£2.20
350-0-350v. 150mA, 6.3v. 4a., 0-5-6.3v. 3a.	£2.65
425-0-425v. 200mA, 6.3v. 4a., c.t., 5v. 3a.	£4.95
425-0-425v. 200mA, 6.3v. 4a., 6.3v. 3a., 5v. 3a	£5.10
450-0-450v. 250mA, 6.3v. 4a., c.t., 5v. 3a.	£5.50

TOP SHROUDED DROP-THRO' TYPE

250-0-250v. 70mA, 6.3v. 2a., 0-5-6.3v. 2a.	£1.35
250-0-250v. 100mA. 6.3v. 3.5a.	£1.55
250-0-250v. 100mA, 6.3v. 2a., 6.3v. 1a.	£1.60
350-0-350v. 80mA, 6.3v. 2a., 0-5-6.3v. 2a.	£1.65
250-0-250v. 100mA, 6.3v. 4a., 0-5-6.3v. 3a.	£2.20
300-0-300v. 100mA, 6.3v. 4a., 0-5-6.3v. 3a.	£2.20
300-0-300v. 130mA, 6.3v. 4a., 0-5-6.3v. 1a. Suitable for Mullard 510 Amplifier	£2.60
350-0-350v. 100mA, 6.3v. 4a., 0-5-6.3v. 3a.	£2.20
[illegible] 1[illegible]0mA, 6.3v. 4a., 0-5-6.3v. 3a.	£2.60

FILAMENT or TRANSISTOR POWER PACK
Types 6.3v. 1.5a. 49p; 6.3v. 2a. 54p; 6.3v. 3a. 76p; 6.3v. 6a. £1.30; 12v. 1a. 55p; 12v. 3a. or 24v. 1.5a £1.35; 0.9-18v. 1½a. £1.10; 0-12-25-42v. 2a. £1.76

CHARGER TRANSFORMERS 0-9-15v. 1½a. 99p; 2½a. £1.10; 3a. £1.25; 5a. £1.45; 6a. £1.65; 8a. £2.00

AUTO (Step UP/step DOWN) TRANSFORMERS
0-110/120v. 200-230-250v., 50-80 watts £1·10; 150 watts, £1.90 250 watts £2.75; 500 watts £5.75.

OUTPUT TRANSFORMERS

Standard Pentode 5,000 Ω or 7,000 Ω to 3 Ω	50p
Push-Pull 8 watts EL84 to 3 Ω or 15 Ω	83p
Push-Pull 10 watts 6V6, ECL86 to 3, 5, 8 or 15 Ω	£1.37
Push-Pull EL84 to 3 or 15 Ω 10-12 watts	£1.35
Push-Pull Ultra Linear for Mullard 510, etc.	£2.20
Push-Pull 15-18 watts, sectionally wound 6L6, KT66, etc., for 3 or 15 Ω	£1.99
Push-Pull 20 watt high quality sectionally wound EL34, 6L6, KT66 etc. to 3 or 15 Ω	£3.30

SMOOTHING CHOKES 150mA, 7-10H, 250 Ω 70p; 100mA, 10H, 200 Ω 60p; 80mA, 10H, 350 Ω 50p; 60mA, 10H, 400 Ω 25p.

SELENIUM RECTIFIERS F. W. (Bridged)
All 6/12v. D.C. output. Max. A.C. input 18v.
1a. 25p. 2a. 35p. 3a. 50p. 4a. 65p. 6a. 80p.

Introducing R.S.C. MkIII SUPER 30 HI-FI STEREO AMPLIFIER

A COMPLETELY NEW DESIGN FURTHER IMPROVED IN BOTH APPEARANCE and PERFORMANCE. REPRESENTING VALUE FAR HIGHER THAN THE PRICES SUGGEST.
Only high grade components by leading manufacturers.
COMPLETE KIT OF PARTS £25 Carr. 65p

Or **FACTORY BUILT** with 12 months guarantee Dep. £5·75 and 9 monthly payments £3·50 (Total £37·25) **£33·75**
Or **FACTORY BUILT** in cabinet as illustrated Dep. £6 and 9 monthly payments £3·86 (Total £40·74) **£36·75**

PRINTED CIRCUITRY, TWENTY SILICON TRANSISTORS. FOUR DIODES, FOUR RECTIFIERS.
TECHNICAL DETAILS (Applying to each channel where appropriate)
CONTROLS: PUSH-BUTTON SELECTOR (1) Disc (2) Radio (3) Tape (4) Mono L (5) Mono R (6) SPEAKER DIS. (7) Mains on/off. Bass, Treble, and Balance. Plus Ceramic/Mag P.U. Switch.

★ **SATIN SILVER METAL FACIA** with black lettering. Black edged knobs with bright silver centres.
★ **PUSH-BUTTON SELECTOR SWITCHING**
★ **NEON INDICATOR**
★ **JACK SOCKET FOR HEADPHONES**
★ **CABINETED MODEL VENEERED IN SATIN TEAK. SUITABLE FOR ANY MODERN PICK-UP CARTRIDGE CERAMIC or MAGNETIC, REGARDLESS OF PRICE. WE RECOMMEND USE WITH THE BEST ANCILLARY EQUIPMENT THAT CAN BE AFFORDED.**

OUTPUT: 15 watts R.M.S. (Continuous) into 8 ohms. 10 watts R.M.S. (Continuous) into 15 ohms.
HUM & NOISE—75dB Min. Vol. —65dB Full Vol. **HARMONIC DISTORTION** 0·1% at 1000 Hz 10 Watts
FREQUENCY RESPONSE: —3dB 7Hz to 70KHz
TREBLE CONTROL: +16dB to —12dB at 14KHz
BASS CONTROL: +17dB to —16dB at 40Hz **CROSS TALK**—58dB
SENSITIVITIES: Disc Mag. 2·5mV. Ceramic 35mV. Radio 120mV. Tape 120mV.
REAR PANEL SOCKETS ARE FOR 3 PAIRS OF INPUTS (1) P.U. (2) Radio. (3) Tape Amp. Plus pair for tape recorder signal take off and 2 pairs for speaker connections.

R·S·C HIGH FIDELITY STEREO 'PACKAGE' OFFERS

Four fully wired units ready to 'plug in.'
★ SUPER 30 AMPLIFIER (15 + 15 watt) in veneered housing
★ GARRARD SP25 MKIII Turntable on Plinth with cover
★ GOLDRING CS90 Ceramic Pick up Cartridge with diamond stylus
★ PAIR OF STANWAY II Speaker Units
Special Total Price **£79·80** Carr. £1·50

★ Super 30 Amplifier (15 + 15 watt) in veneered housing
★ Goldring GL69 II Transcription Turntable on Plinth as illustrated
★ Goldring Magnetic P.U. Cartridge.
★ Pair of Stanway II speaker units
Special Total Price Carr. £1·50 **£96·75**

Matching as recommended for optimum performance. Send S.A.E for coloured brochure showing other money-saving offers.

Package prices apply providing all individual units are purchased from any branch within 3 months. See leaflet.

Stanway II

ATTRACTIVE TEAK or AFRORMOSIA VENEERED CABINETS and PLINTHS

TERMS AVAILABLE ON ALL PACKAGE OFFERS

★ TA12 AMPLIFIER 6·5 + 6·5 watt in veneered housing
★ GARRARD SP25 MK III Player unit on Plinth
★ GOLDRING CS90 Ceramic P.U. Cartridge with diamond stylus
★ PAIR OF DORCHESTER Loudspeaker Units
Special Total Price **£58** Carr. £1·25
Or Deposit £7·15 and 9 monthly payments £6·35 (Total £64·30).
Trans. Plastic Cover £3·15 extra.

Package as above but with Garrard 3000 Autochanger and Sonotone 9TA Ceramic Cartridge in lieu of SP25 and CS90 **£51·75** Carr. £1·25
Or Deposit £6 and 9 monthly payments £5·70 (Total £57·30)
Trans. Plastic cover £3·15 extra.

'YORK' HIGH-FIDELITY 3 SPEAKER SYSTEM

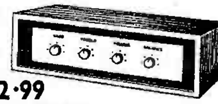
★ Moderate size only 25 × 14 × 10in.
★ Response 30-20,000 c.p.s. Impedance 15 ohms
COMPLETE KIT Carr. 63p **£22**
★ Performance comparable with units costing considerably more.
Consists of (1) 12in. 15 watt Bass unit with cast chassis, Roll rubber cone surround for ultra low resonance, and ceramic magnet. (2) 3-way quarter section series cross-over system (3) 8 × 5in. high flux middle range speaker. (4) High efficiency tweeter. (5) Appropriate quantity acoustic damping material. (6) Handsome Teak veneered cabinet. (7) Circuit and full instructions. Terms: Dep. £4·50 and 9 monthly payments £2·25 (Total £24·75).
DEMONSTRATIONS AT ALL BRANCHES

HIGH FIDELITY LOUDSPEAKER UNITS

Cabinets latest style Satin Teak veneer. Acoustically lined or filled acoustic damping. Ported where appropriate. Credit terms available.
DORCHESTER (Illustrated) Size 16 × 11 × 9in. appr. Range 45-15,000 c.p.s. Rating 8-10 watts. Fitted High flux 13 × 8in. Dual Cone speaker. Imp. 3 or 15 ohms. **£9·45** Carr. 40p
STANWAY II Size 20 × 10½ × 9½in. approx. Rating 10 watts. Inc. 13 × 8in. speaker with highly flexible cone surround, long throw voice coil and 10,000 line magnet. High flux tweeter. Handsome Scandinavian design cabinet. Range 35-20,000 c.p.s. Imp. 15 ohms. Gives smooth realistic sound output. See 'package offers' for illustration **£17·85**

RSC G66 6+6 WATT high quality STEREO AMPLIFIER

Individual Ganged controls: Bass, Treble, Volume and Balance. Printed circuit construction employing 10 Transistors plus Diodes. Output rating I.H.F.M. Frequency range 20-20,000 c.p.s. Suitable for Crystal Pick-ups, etc., and for loudspeaker output impedances of 3 to 15 ohms. For standard 200—250v A.C. mains operation. Attractive silver finished metal facia plate & matching control knobs.
COMPLETE KIT of PARTS INCLUDING FULLY WIRED PRINTED CIRCUIT and comprehensive wiring diagram and instructions **£9·99** carr. 40p.
Or **FACTORY BUILT IN TEAK VENEERED CABINET** as illustrated **£12·99** or dep £2·50 and 9 mthly pymnts. £1·45 (Total £15·55).



R.S.C. TA12 MKIII 6·5 + 6·5 WATT STEREO AMPLIFIER

FULLY TRANSISTORISED, SOLID STATE CONSTRUCTION HIGH FIDELITY OUTPUT OF 6.5 WATTS PER CHANNEL

Designed for optimum performance with any crystal or ceramic Gram. P.U. cartridge, Radio tuner, Tape recorder etc. ★ 3 separate switched input sockets on each channel ★ Separate Bass and Treble controls ★ Slide Switch for mono use ★ Speaker Output 3-15 ohms ★ For 200-250v. A.C. mains ★ Frequency Response 20-20,000 c.p.s. —2dB ★ Harmonic Distortion 0.3% at 1,000 c.p.s. Hum and Noise — 70dB ★ Sensitivities (1) 50mV (2) 400mV (3) 100mV. Output rating I.H.F.M. ★Handsome finish Facia plate & Knobs.
COMPLETE KIT OF PARTS WITH FULL WIRING DIAGRAMS & INSTRUCTIONS. £15·50 Carr. 40p.
Factory built with 12 months guarantee **£19·50** or Deposit £3 and 9 mthly pymts £2·15 (Total £22·35). Or in Teak veneer housing **£23** Dep. £3 & 9 mthly payments £2.55 (Total £25·95). Send S.A.E. for leaflet

R.S.C. PLINTHS

Superior Solid Natural Wood Construction for Record Playing units, cut for Garrard 1025, 2025, 3000, AT60, SP25 etc. **£3·15**

WITH TRANSPARENT PLASTIC COVER **£6·30**

SPECIAL HI-FI OFFERS

All carriage paid. Mail orders only.

WHARFEDALE/F.A.L.
1 pr Wharfedale Super Linton Speakers, 1 F.A.L. Phase 32 15 + 15 watt Stereo Amplifier Total Rec. Retail Price £87·70
PACKAGE PRICE £66·50

Above brand new goods. Following have been unpacked for display purposes only:-
LEAK MINI-SANDWICH (Teak finish) £18
ROGERS RAVENSBROOK STEREO AMPLIFIER £39
TANDBERG 62X TAPE RECORDER (Stereo) £88
GOLDRING GL68 Transcription Turntable and Pick-up £14·50
GOODMANS AUDIOM 91 £19·95

LOW DEPOSIT CREDIT TERMS

AVAILABLE ON PURCHASES OVER £8 (KITS OF PARTS EXCEPTED)

INTEREST CHARGES REFUNDED

ON CREDIT SALES SETTLED IN 3 MONTHS

BRADFORD 10 North Parade. (Half-day Wed.) Tel. 25349
BLACKPOOL (Agent) O. & C. Electronics, 227 Church Street
BIRMINGHAM 30/31 Gt. Western Arcade (Half-day Wed.) 021-236-1279
DERBY 26 Osmaston Rd., The Spot (Half-day Wed.) Tel. 41361
DARLINGTON 18 Priestgate (Half-day Wed.) Tel. 68043
EDINBURGH 133 Leith St. (Half-day Wed.) Tel. 556 5766
GLASGOW 326 Argyle St. (Half-day Tues.) Tel. CITy 4158
HULL 91 Paragon Street (Half-day Thursday) Tel. 20505

R·S·C HI-FI CENTRES LTD.

MAIL ORDERS TO: Audio House, Henconner Lane, Leeds 13.
Terms C.W.O. or C.O.D. No C.O.D. under £1. Postage 25p extra under £2. 30p extra over £2 or as quoted. Trade supplied. S.A.E. please with enquiries
Branches open all day Sats.
MAIL ORDERS MUST NOT BE SENT TO SHOPS

32 High Street (Half-day Thurs.) Tel. 56420 **LEICESTER**
5-7 County(Mecca) Arcade, Briggate (Half-day Wed.) Tel. 28252 **LEEDS**
73 Dale St. (Half-day Wed.) Tel. CENtral 3573 **LIVERPOOL**
238 Edgware Road, W2 (Half-day Thurs.) Tel. PAD 1629 **LONDON**
60A Oldham Street (Half-day Wed.) Tel. CENtral 2778 **MANCHESTER**
106 Newport Rd. (Half-day Wed.) Tel. 47096 **MIDDLESBROUGH**
41 Blackett Street (Opp Fenwicks Store) (Half-day Wed.) Tel. 21469 **NEWCASTLE UPON TYNE**
13 Exchange Street (Castle Market Bldgs.) (Half-day Thursday) Tel. 20716 **SHEFFIELD**

BC221 MAINS POWER UNITS

200/250v I/P, O/Ps 135v at 20 mA from electronic stabiliser also 6·3v AC for heaters. Uses 4 valves made to fit in battery compartment of unit with small control box with swt and fuses. Supplied new with circ and mains lead.
Price **£6·00** plus 60p carr.
Spares for above, set of 4 new valves **£1·00**
New mains trans **£1·50** both post paid.

R.F. 26 TUNING UNITS

These tune 50 to 65 Mc/s use 3 valves I.F. O/P 7 Mc/s will mod up to 100 Mc/s fitted slow motion dial etc. Supplied in good cond. with circ. Price **£2.10** plus 40p post.
Rx unit 3645 for use with above **£2·25** carr. paid

METER UNITS

Radio altimeter units 6·5 mA F.S.D. 270° scale size front 3¼″ sq. fitted on/off and range swt ideal for use as rev. counters; good condition.
Price **80p** plus 15p post

AMPLIFIER UNIT 115v 50c/s I/P

These are a small self contained unit, uses 3 valves 6X4 Rect, 6AK6 O/P and 12AX7 Amp; these are low impedance I/P & 500 ohm O/P, fully enclosed size 10 x 3½ x 3½″. Supplied with circ. & mods. for 3 ohm O/P, ideal unit for beginner, Ex USAF surplus good cond. Price **£2·50** plus 25p post.
Small 230/110 trans for above 75p post paid.

HEAVY DUTY MAINS TRANS.

Pria 200/220/240v 50c/s Sec 500-0-500 at 400 mA or can be connected to give 1 kV at 200 mA; varnish finish tag connections; size overall 5½ x 5½ x 4¼; supplied in new condition ex service.
Price **£2·25** plus 40p post.

POWER UNITS

These are a transistorised power unit high cycle I/P and contain 8 type 2S012A Silicon NPN pow transis (Texas); these are Vc 70v 1c 2a good to 2 Mc/s also 18 Silicon diodes 200 P.I.V. 5a to 8a large Ledex swt, large board with transistors, etc. misc potted trans supplied new crated, modern Guided Missile equip.
Price **£4·50** plus 75p carr.

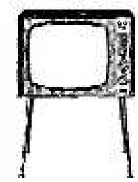
MISC. ITEMS

Scope tube 3BPI 3″ green screen with base and Mu Met shield and base connections **£2·50.** Crystal units 100 Kc high grade with base **£1·40.** Relays coil 14K 1p c/o sealed new ex equip also 24v 700 ohm 2p c/o sealed both 2 for **30p.** Block conds 8µf 1Kv 2 for **90p.** 8µf 750v 2 for **60p.** Valves 6SN7 or 6SL7 5 for **50p.** Relay panel with 4x min 2p c/o relays coil 1K new ex equip **55p.** Diodes type GJ5M 300 P.I.V. 1 amp mounted on small h/s 8 for **40p.** Miniature plug and sk 18 way with clamp and cover good quality **15p** pair. L.V. Smoothing Conds 4000µf 50v 5 x 2″ **50p.** 2500µf 75v 4 x 2″ **50p.** 800µf 50v 5 x 1½ **30p** all with fully insulated cases and fix brackets, good quality. I.F. strips 30 Mc/s wide band 10 valves miniatures, size 18 x 4 x4″. USAF surplus **£1·80.** Pre Amp for I.F. strip **90p.** Relays coil 6/12v D.C. 1p N.O. rated 20a **40p.** Control knobs to fit ¼ shafts assorted 12 for **50p.** Pot Cores LA66 4 for **50p.** LA2503 Vinkors 4 for **50p.** American 73 Radio Mag new back issues 8 for **£1·15.** Speaker units portable 8″ unit in case 18 x 18 x 8″ 3 ohm with 600 to 3 ohm trans new **£2·90.** Test unit with 2x LA2503 Vinkors 4 Sil Transis 4 min relays min valves etc. new boxed **85p.** T.S.210 (test osc) covers 20 to 85 M/cs in 4 bands with xtal check noise gen etc. reqs 250v ht and 6·3v with charts good cond. **£3·90.** Swt unit yax type 4p 4w 4b with 12 7/45pf trimmers **35p** Tuning Cond air spaced 60pf with small drive **35p.** EHT Cond. 1 x ·5µf 2kV wk size 4 x 2 x 2″ inc term **50p.** Group board with 7x 400 P.I.V. 500 mA diodes, min relay II tant conds etc. new ex equip. **50p.** OC16 med pwr transis P.N.P. type 2 for **25p.** Transformers Pria 115/120v sec 850-0-850v at 600 mA or 1700v 300 mA potted type new Amer supplied in pairs **£4·60.** Circuit diagrams, 1392 Rx, 1155Rx, 1475 (88) Rx all **30p.** Scopes CD513.2 **£1·50.** 13A, CD518 (CT316), Os-8, **50p** ea. CT38 later series **50p.**

All above prices include post or carr. All goods ex equipment unless stated otherwise. S.A.E. with enquiry

A. H. SUPPLIES

57 MAIN ROAD, SHEFFIELD S9 5HL



EX RENTAL TV's

19″ — £29·95
23″ — £39·95
All Channels 405/625
2 Years Guarantee.
Free List by return.

17″ Slim line TV's £11·95, 19″ Slim line TV's £15·95. Guaranteed 2 years. Send for List. Carr. & ins. all sets £1·95. Daily demonstrations to personal shoppers.

• TEAK HI-FI STEREO CABINETS £14·95

Brand New 44″ wide × 16″ deep × 18″ high with Legs. A superb piece of furniture. Carr. £1·00.

TRANSISTOR GANG CONDENSERS 30p. Minature AM precision Tape Motors £1·95 famous German manufacturer. 200/250V. Post 20p.

Transistor Radio Cases: 25p each. Size 9½″ × 6½″ × 3½″. P. & P. 15p.
SPEAKERS 50p 2½″ 8Ω BRAND NEW. P. & P. 5p.

TRANSISTORS Post Free

AC 126	AF 179	OC 81
AC 128	OC 44	OC 81D
AF 114	OC 45	
AF 117	OC 71	15p each

POTENTIONMETERS 23p each

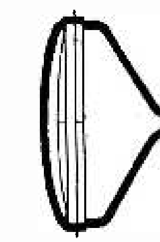
Double & Switched	500 KΩ/500 KΩ	3½″ shaft
Double & Switched	500 KΩ/100 KΩ	2″ shaft
Double & Switched	1 MEG/100 KΩ	1½″ shaft

Post. & Pack. 5p.—4 for 10p

KNOBS 100,000 to clear (Brand New)

100 assorted Radio & T.V. knobs 50p. Postage 10p. (If you require sets 2 to 6 just ask)

TV TUBES REBUILT GUARANTEED 2 YEARS



14″—£3·95, 17″ & 19″—£5·95, 21″ & 23″—£6·45.
Exchanged Bowls. Carr. 53p.

DUKE & CO. (LONDON) LTD.

621/3 Romford Road, Manor Park, E.12
Phone 01-478 6001-2-3 Stamp for Free List

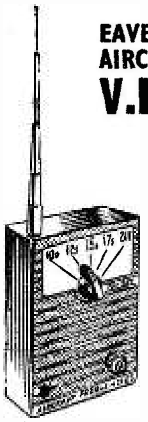
Selections from FELSTEAD ELECTRONICS' List

(Sent free for stamped addressed envelope to address below)
Transistors etc. AC126 **12½p.** AF115 **20p.** AF116 **15p.** AF117 **20p.** OA5 **7½p.** OA10 **7½p.** OA81 **7½p.** OA85 **7½p.** OC23 **32½p.** OC25 **30p.** OC26 **37½p.** OC28 **42½p.** OC35 **42½p.** OC44 **14p.** OC45 **12½p.** OC71 **12½p.** OC72 **12½p.** OC75 **12½p.** OC81 **12½p.** OC81D **12½p.** OC82D **12½p.** OC170 **20p.** OC171 **12½p.** Many more in list. **S.D.R.** BY100 800piv **14p. 6 amp series:** BYZ13 300piv **20p.** BYZ12 600piv **25p.** BYZ11 900piv **30p.** BYZ10 1200piv **35p.** **(Charges 6½p up to 11, paid for 12 and over). Sub-Min Transformers: OUTPUT 3 Ω** for OC72 etc.) 14p (up to 6, 6½p). **SOLDERING IRON.** Slim, modern, British highspeed 8¼″, all parts replaceable, highest quality, full guarantee: **£1·07½** (10p). **DIAMOND STYLII** Replacements for **BSR TC8/LP, TC8/S, TC8LP/STEREO: COLLARO 'O' : RONETTE** BF 40LP: Garrard GC2/LP and GC8/LP: ACOS GP65/67, all at **40p** (6p). ACOS GP73, GP91, GP91SC, GP104: BSR ST4 (ST3, ST5), ST8 (ST9); SONOTONE 8TA. 9TA, 9TAHC; **PHILIPS** AG3306, 3060 (3063, 3066, 3301, 3302, 3304); Garrard GKS25, GCM21, GCS23 and many more 'Garrard' etc. types. All at **75p.** (6p). All are of the very highest quality. **DOUBLE DIAMOND**: ST4 (ST3, ST5); ST10 (ST9, ST8); 9TA, 9TAHC, 3306, GP91 (For, GP92, GP93, GP94 cartridges); GP91-SC for all GP91-SC Cartridges. All at **£1·50** each (6p). **SAPPHIRE STYLII.** All those types shown above under 'Diamond Stylii at 40p' also GP37 at **17½p** each (5p) and GP91 and GP91SC at **40p** (5p). No others. **PICK-UP CARTRIDGES.** All Standard fittings and stylii. Mono GP67/2 **80p.** STEREO-COMPATIBLE (MONO) GP91/SC **£1·10** STEREO GP93 **£1·30** STEREO CERAMIC GP94 **£1·95** SONOTONE STEREO 9TAHC (DIA.) **£2·40. RECORDING TAPE.** Still the finest quality British Mylar available: Standard 5″ 600ft. **36p.** 5¾″ 900ft. **50p.** 7″ 1200ft **56p.** LONG PLAY 5″ 900ft. **50p.** 5¾″ 1200ft. **56p.** 7″ 1800ft. **90p.** (7½p on 5″ and 5¾″, 9p on 7″). Other sizes of Tapes, also Cassettes in list. **MICROPHONES.** Crystal Mic 91, hand/desk **81p.** MIC45. Curved metal hand-grip **£1·00.** CM21 Grey hand desk **62½p.** Stick '60' **£1·02½.** CM70 "Planet" machined metal tapered stick type with neck cord, adaptor to fit floor stands **£1·47½** (all 9p). LAPEL (or hand) with clip **32½p** (6p). All are fitted with leads. **Dynamic MS10** 50K Ω for desk, tapered with base and slide-out adaptor **£1·97½. MS11.** Similar, but fixed on swivel swan neck to switch-fitted base, **£2·22½** (Either 15p). **Type 209 Cardioid ball.** 50K/600 Ω, omni-dir., built-in vol. control, on/off switch, special lead, handle (as good as money can buy) **£6·30. UD130** Uni-Dir. Ball., mesh, 50K/600 Ω, Adap., cable, jack plug **£4·80.** (20p). **DM160.** omni-dir., Ball, 50K Cable adaptor **£3·87½** (all at **27½p**). **MICROPHONE INSERTS.** Dia., 1·75″ OR 0·9″ either size **27½p** (6p). **EARPIECES** with lead and min. jack plug (2·5 or 3·5 mm., state which). Magnetic 9p Crystal (3.5 only) **24p** (Up to 3 for 6p on any). **HEADPHONES** De-luxe STEREO 8-16 Ohms **£2·47½.** Same, fitted vol. control each earpiece **£4·20.** Both have lead and stereo jack plug (17½p.) High Res. 2000 ohm. Adjustable **92½p** (7½p). **SPEAKERS** 12″ ROUND fitted tweeter, 3 or 15 Ω (state which) **£1·87½** (27½p) or for Stereo **£4·25** pair, carr. paid. 2½″, 3 OR 8 Ω (state which) **37½p** (6p). **EMI** 13″ × 8″, 3, 8 or 15 Ω (state which) **£2·12½** (25p): with two tweeters and crossover network 15 Ω **£3·75** (25p). **VIBRATORS.** 12V 4-pin non-synch. 121HD4, 2¾″ ex. pins. **27½p.** 12V 7-pin Synch. (12SR7) **62½p.** (Both types 6½p per vibrator). **CONNECTING WIRE.** Packs of 5 coils asstd. cols. ea. coil 5yds. Solid core **14p** (6p). Flexible **16p** (7½p). **Super thin for transistor wiring 16p (6p). PICK-UP WIRE.** Super thin twin flex, screened and sheathed **6p** yd. (6p up to 6yds.—over free). **RETRACTABLE Flex. Leads.** (Curlies) Phonoplug each end 12ft. **39p.** 6ft phono plug/phono socket other end **25p.** 12ft **42½p** (6p per lead all types). SEND S.A.E. for full free list of mains eliminators, amplifiers, extension aerials (car and portable), electrolytics, vol. controls, more micröphones, transistors, thyristors and SDRs and other devices, switches of many types, rotary, toggle min. and sub-min. slide types, multitest meters, panel meters, all types of British and continental plugs and sockets, croc. clips, terminals, valve holders also Goldring G800 series cartridges etc. etc. 'Special Offer' lines at very low prices.

FELSTEAD ELECTRONICS (PW 49)

LONGLEY LANE, GATLEY, CHEADLE, CHES. SK8 4EE

Cash with order only. No COD or Caller Service. Charges (Min. 6p) in brackets after all items. **Regret Orders under 25p excluding postage, unacceptable. SAE please for enquiries** or cannot be replied to. Charges apply G.B. and Eire only. Overseas orders welcomed (lists free overseas).



EAVESDROP ON THE EXCITING WORLD OF AIRCRAFT COMMUNICATIONS—JUST OUT

V.H.F. AIRCRAFT BAND CONVERTER

Many thousands of v.h.f. Aircraft Band Converters now selling in U.S.A. *Listen in to* **AIRLINES, PRIVATE PLANES, JETPLANES.** *Eavesdrop on exciting crosstalk between pilots, ground approach control, airport tower. Hear for yourself the disciplined voices hiding tenseness on talk downs.* Be with them when they have to take nerve rippling decisions in emergencies—Tune into the international distress frequency. Covers the aircraft frequency band including **HEATHROW, GATWICK, LUTON, RINGWAY, PRESTWICK ETC., ETC. CLEAR AS A BELL.** This fantastic fully transistorised instrument *can be built by anyone nine to ninety in under two hours.* (Our design team built four—everyone worked first time). *No knowledge of radio or electronics required.* No soldering necessary. Fully illustrated simply worded instructions take you step-by-step. Uses standard PP3 battery. Size only 4½" x 3" x 1½". All you do is extend rod aerial, place close to any ordinary medium-wave radio- (even tiny portables) **NO CONNECTIONS WHATEVER NEEDED.** Use indoors or outdoors. **THERE WILL BE ENORMOUS DEMAND FOR THIS NEW DESIGN, SEND NOW, ONLY £2·37** (47/6) + 23p (4/6) p. & p. for all parts, including case nuts, screws, wire, etc., etc. (Parts available separately).

ONLY **£2·37** (47/6)

Only **£4·95** (99/-)

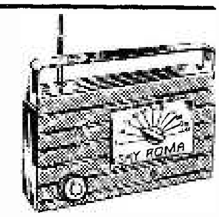
FIND BURIED TREASURE WITH THIS READY BUILT & TESTED

Treasure Locator Module

BRAND NEW FULLY TRANSISTORISED PRINTED CIRCUIT METAL DETECTOR MODULE. *Ready built and tested*—just plug in a PP3 battery and 'phones and it's working. Put it in a case, screw a handle on and **YOU HAVE A PORTABLE TREASURE LOCATOR EASILY WORTH ABOUT £20!** Extremely sensitive—penetrates through earth, sand, rock, wood, dirt, water, etc.—**EASILY LOCATES COINS, GOLD, SILVER, WATCHES, JEWELLERY, NUGGETS, METALLIC ORE, HISTORICAL RELICS, BURIED PIPES, KEYS, NAIL-IN-TREES, ETC., ETC.** Signals exact location by "beep" pitch increasing as you near buried metallic objects. **PRINTED CIRCUIT SEARCH COIL** *so stable and sensitive it will detect certain objects buried* **SEVERAL FEET BELOW GROUND! GIVES CLEAR SIGNAL ON ONE COIN!** *You could even pay for your holidays with two or three days electronic beachcombing—it's almost like having a licence to print money!* Unclaimed treasure now exceeds the combined wealth of all nations. **ORDER NOW WHILE PRESENT STOCKS LAST—TREMENDOUS DEMAND EXPECTED AT THIS REMARKABLY LOW PRICE. DEMONSTRATIONS DAILY. ORDERS DESPATCHED IN STRICT ROTATION. SEND NOW £4·95 + 30p carr.** (99/- + 6/-) etc. (High quality Danish Stethoscope headphones £2·75 (55/-) extra if required).

SHORTWAVE TRANSISTOR RADIO

ONLY **£2·25** (45/-)



Can be built in one evening

At last! After trying countless circuits searching for easy build, work first-time short waver. Giving advanced world-wide performance, we chose this 'Sky Roma'. Anyone from 9 years up can follow the step-by-step, easy-as-ABC, fully illustrated instructions. (We built ten prototypes and everyone worked first time) no soldering necessary. 76 stations logged on rod aerial in 30 mins.—**Russia, Africa, USA, Switzerland, etc.** Experience thrills of world wide news, sport, music, etc. **Eavesdrop on unusual broadcasts.** Uses PP3 battery. Transistorised (no valves!). Size only 3" x 4½" x 1½". As tremendous demand anticipated price held to only **£2·25** (45/-) + 17p (3/6) p. & p. for all parts incl. Cabinet, screws, instructions etc. (Parts available separately).

FIND BURIED TREASURE!

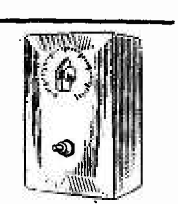
TREASURE LOCATOR TRANSISTORISED

NOW IT'S HERE AT LAST, after experimenting for four and a half months with a multitude of different circuits and carrying **out actual field tests** with prototypes, our design team have come up with this real winner. This fully portable transistorized metal locator detects and tracks down buried metal objects—it signals **exact location** with loud audible sound (no phones used)—uses any transistor radio which fits inside—no connections needed. **FINDS GOLD, SILVER, LOST COINS, JEWELLERY, KEYS, WAR SOUVENIRS, ARCHAEOLOGICAL PIECES, METALLIC ORE, NUGGETS ETC. ETC.** Outdoors or indoors. *Extremely sensitive, will signal presence of certain objects buried several feet below ground!* No knowledge of radio or electronics required. *Can be built with ease in one short evening by anybody from nine years of age upwards,* with the wonderfully clear, easy to follow, step-by-step, fully illustrated instructions—it really is easy as A.B.C. transistorized — no valves. Uses standard PP3 battery. No soldering necessary. Size of detector head 13½" x 10" x 2½". **Great demand expected at this remarkably low price—ORDER WHILE PRESENT STOCKS LAST.** All parts including detector head case, nuts, screws, wire, simple instructions etc. etc. **ONLY £2·37** (47/6) + 27p (5/6) p. & p. (**Sectional handle** as illustrated **75p** (15/- extra). Parts available separately. Made up looks worth £15 !

ONLY **£2·37** (47/6)

SOOTHE YOUR NERVES, RELAX WITH THIS AMAZING

RELAXATRON



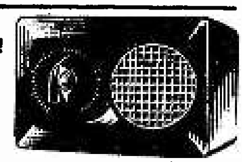
only **£2·25** (45/-)

CUTS OUT NOISE POLLUTION—SOOTHES YOUR NERVES! Don't underestimate the uses of this fantastic new design—the **RELAXATRON** is basically a pink noise generator based on avalanche operated transistors. Besides being able to mask out extraneous unwanted sounds, it has other very interesting properties. For instance, many people find a rainstorm mysteriously relaxing, a large part of this feeling of well-being can be directly traced to the sound of falling raindrops!—a well known type of pink noise. *A group of Dentists have experimented on patients with this pink noise*—**NO ANESTHETICS WERE USED!** The noise ostensibly created a most definite reaction on these patients' nervous systems with the results that their pain systems were blocked. **IF YOU WORK IN NOISY OR DISTRACTING SURROUNDINGS, IF YOU HAVE TROUBLE CONCENTRATING, IF YOU FEEL TENSED, UNABLE TO RELAX**—then build this fantastic Relaxatron. Once used you will never want to be without it—use this amazing pink noise generator whenever you feel uneasy, can't relax or wish to concentrate. **TAKE IT ANYWHERE,** pocket sized. Uses standard PP3 batteries (current used so small that battery life is almost shelf-life) **CAN BE EASILY BUILT BY ANYONE OVER 12 YEARS OF AGE** using our unique, step-by-step, fully illustated plans. No soldering necessary. All parts including case, a pair of crystal phones, Components, Nuts, Screws, Wire, etc. etc. no soldering. **Send only £2·25 + 25p (45/- + 5/-)** p. & p. parts available separately.)

GET A GOOD NIGHT'S SLEEP—EVERY NIGHT! INGENIOUS ELECTRONIC

SLEEP INDUCER

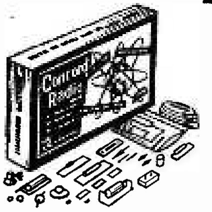
only **£2·75** (55/-)



CAN'T SLEEP AT NIGHTS? DO YOU WAKE UP IN THE NIGHT AND CAN'T GET OFF TO SLEEP AGAIN? WOULD YOU LIKE TO BE GENTLY SOOTHED OFF TO SATISFYING SLEEP EVERY NIGHT? Then build this ingenious electronic sleep inducer. *It even stops by itself so you don't have to worry about it being on all night!* The loudspeaker produces soothing audio-frequency sounds, continuously repeated—but as time goes on the sounds gradually become less and less—until they eventually cease altogether, *the effect it has on people is amazingly very similar to hypnosis.* A control is provided for adjusting the length of times etc., all transistor, can be built by anyone over 12 years of age in about two hours. No knowledge of electronics or radio needed. Extremely simple, easy-to-follow, step-by-step, fully illustrated instructions included. *No soldering necessary.* Works off standard batteries—extremely economical. Size only 3" x 4½" x 1½"—take it anywhere. **All parts** including case, loudspeaker, components, nuts, wire, screws, etc. etc. **THERE WILL BE A GREAT DEMAND FOR THIS UNIQUE NEW DESIGN—SEND NOW £2·75 + 25p (55/- + 5/-)** p. & p. (parts available separately).

BUILD 5 RADIO AND ELECTRONIC PROJECTS

TOTAL BUILDING PRICE **£1·97** (39/6)



Amazing Radio Construction set! Become a radio expert for **£1·97** (39/6). A complete Home Radio Course. No experience needed. Parts including simple instructions for each design. Illustrated Step-by-step plans, all Transistors, loudspeaker, personal phone, knobs, screws, etc., all you need. Presentation Box **37p** (7/6) **extra as illus.** (if required) (extra parts available separately) no soldering necessary. Send only **£1·97** (39/6) + **23p** (4/6) p. & p.

REAL WORKING ELECTRONIC ORGAN

ONLY **£2·75** (55/-)

Don't confuse with ordinary electric organs that simply blow air over mouth-organ type reeds etc. Eight months were spent in creating and testing this superb, revolutionary electronic organ. Fully transistorized—no valves. **Proper self-contained loudspeaker.** *Fifteen separate keys span two full octaves*—play the *"Yellow Rose of Texas"*, play *"Silent Night"*, play *"Auld Lang Syne"*, play *lots and lots of similar tunes* on this **real working electronic organ.** Although it's no theatre organ it's certainly no tiny thing, it measures 13½ x 10 x 2½". You have the thrill and excitement of building it together with the pleasure of playing a real, live, throbbing electronic organ. *Take it anywhere—play it anywhere,* **NO PREVIOUS KNOWLEDGE OF ELECTRONICS NEEDED—NONE WHATEVER.** No soldering necessary. it really is as simple as a.b.c. to make. **Anyone from nine years upwards can build it easily in one short evening** following the fully illustrated, step-by-step, simply worded instructions. **BIG DEMAND ANTICIPATED FOR THIS UNIQUE INSTRUMENT** at our low, low building price. **ONLY £2·75** (55/-) + 23p (4/6) p. & p. for all parts, including case, loudspeaker, transistors, condensers, resistors, knobs, transformer, volume control, wire, nuts, screws, simple (but full) instructions, etc. etc. Uses standard battery (parts available separately). Have all the pleasure of making it yourself, finish with an exciting gift for someone.

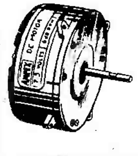
EXAMINE AT HOME FOR 7 DAYS. YOUR MONEY REFUNDED IN FULL IF NOT 100% DELIGHTED.

CONCORD ELECTRONICS LTD (Dept. PW24)

8 Westbourne Grove, London W.2.
(Nr Bayswater & Queensway Tubes. 1 minute ABC Cinema)
Callers Welcome 9 a.m.-6 p.m. inc. Saturday

(STAFF WANTED FOR ALL DEPARTMENTS)

AMPEX 7·5v. D.C. MOTOR. This is an ultra-precision tape motor designed for use in the AMPEX model AG20 portable recorder. Torque 450GM/CM. Stall load at 500ma. Draws 60 ma on run. 600rpm +5% speed adjustment, internal AF/RF suppression $\frac{1}{4}$" dia. 1" spindle, motor 3" dia. $1\frac{3}{4}$". Original cost £16·50. **Our** price **£4·25.** P. & P. 25p. Mu-metal enclosure available **75p** each.



SYNCHRONOUS MOTORS. 220/380 v. 50/60 Hz. 250-300 rpm. **75p** each.

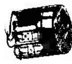
MYCALEX MAINS. Shaded pole, 1425 rpm, $\frac{3}{16}$" spindle. 2 for **£1·25.** Carriage Paid.

MAINS INDUCTION MOTOR. Open frame, $\frac{3}{16}$" spindle, weight $\frac{3}{4}$ lb. Powerful. **88p** each. P. & P. 12p.

GEARED MOTORS

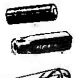
ELECTRO CONTROL (CHICAGO). Shaded pole 240v. 50 Hz. 200 rpm. 10lb. in. **£2·50,** P. & P. 25p.

MYCALEX. Open frame, shaded pole motors, 240v, 50 Hz. 7 rpm. 28 lb. in. 80 rpm. 12 lb. in, **£2.25** each. P. & P. 25p.

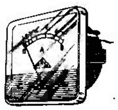


"CROUZET" TYPE 965. 115/240v. 50 Hz. 47/68 watts. 50 rpm. Stoutly constructed. Size: $2\frac{1}{16}$" dia. x $3\frac{1}{4}$" long plus spindle 1" x $\frac{1}{4}$" dia. Anti-clock. **£2·75.** P. & P. 25p.

TYPE 955. Same as above, but 3 rpm. **£3·00.** P. & P. 25p.



"MALLORY" LONG LIFE BATTERIES. Type A. RM12 cell 1·35v. 3,600 ma/H. CAP. 250/300 ma cont. current. Size: 2" x $\frac{5}{8}$". 5 for **£1·00** or **£2·00** per doz. Carr. Paid. Type B. Comprises 8 x RM 625 cells. Nom. volts. 1·35 each 10·5v. Overall, 350ma/H CAP. 20/25 ma cont. current. Size: $2\frac{1}{16}$"x$\frac{1}{2}$"x$\frac{3}{4}$". 3 for **£1·00** or **£3·00** per doz. Carr. Paid.



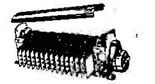
A.C./D.C. M/IRON AMMETERS. 0-5 amps or 0-8 amps (suitable battery chargers etc.). Perspex front. Size: $1\frac{3}{4}$" x $1\frac{3}{4}$". Any 2 for **£1·10.** Carr. Paid.

ERNEST TURNER 800μa METER. 160Ω movement, 2" case elliptic, plastic front, Green-Red-Green uncalibrated scale **£1·50** each. Carriage paid.

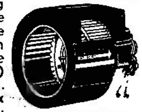
PAINTON BOURNS TRIMPOTS. 1k, 2k, 2·5k, 5k, 10k, 20k, 50k, 500k. Other Trimmer pots in stock. RIL 10k. MORGANITE 1k. MEC 200 Ω (tubular) 50Ω. Any 3 for **£1 10** carr. paid.

PROGRAMME TIMER BY HONEYWELL

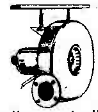
A bank of 15 micro-switches are each independently operated by 15 pairs of cams which in turn are individually adjustable to give switching periods of zero to 12 seconds with infinitely variable combinations. A mains synchronous motor drives the cam shaft at 1 rev. per 12 seconds (5 R.P.M.). Originally cost **£15·00** plus. Many applications such as lighting effects etc. New in original makers cartons. First class value at **£5·75** plus 25p. P. & P.



PRECISION FAN CO. (SMITHS INDUSTRIES) DOUBLE ENTRY CENTRIFUGAL FAN/BLOWER. This is a beautifully balanced, particularly quiet running unit giving approx. 90 cubic ft./min. The motor is a 2 pole shaded pole Mycalex, drawing only 240ma on run. Weight $2\frac{1}{2}$ lbs. Sizes: case dia. 3·1 ins. width (case only) 3·125 ins. Width overall (inc. 5·25 ins. Aperture 3·125 ins x 1·85 ins. Offered well below makers price at **£2·95.** P. & P. 25p.

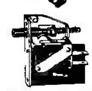


Brand New "DISCUS" Centrifugal Blower by Watkins & Watson. 240v. 50 Hz. Powered by A.E.I. continuous rating 2850 rpm motor. Cowl diameter 10". Outlet flange 2" I.D. Coupling flange supplied. These superb precision units are ideally suited for **Organ construction.** Offered at approx. half makers price **£12·50.** Carriage £1·50.



PLUNGER SWITCHES. Spring return 3 P.D.T. 1 amp. Single action. Size: $\frac{7}{8}$" x $\frac{9}{16}$" plus plunger. **£1·50** per doz. Carr. Paid

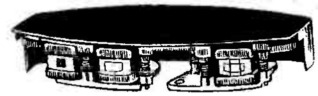
"HONEYWELL" TYPE 23AC-NE.—15 amp. change-over micro switch is fitted on angled metal mount with spring-loaded plastic rod operating cam. **50p.** each.



VINKOR POT CORE ASS. TYPE LA. 2103 (core LA. 2100). Normal price £1·48. Our price **75p** each. Special quote for quantity.

UNISELECTORS. 8 Bank 25-way, 24 volt Double sweep. Brand new in maker's boxes **£5·25** P. & P. 25p.

Special offer of AMPEX professional tape heads. mu-metal shrouded. (Designed for model AG20). Full track record, or playback, **£3·00.** Erase head **£2·00.** Set of 3 with mounting bracket and cover **£7·50.** Half track record only, **£3·00** each. Carriage paid.



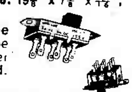
"BENSON BROS." 12v. **D.C. HEAVY DUTY SOLENOID.** Size: 3" overall x $1\frac{1}{4}$" x 1". Very powerful, with secondary low current hold coil. Cont. rated **£1·00** each. P. & P. 15p.

"DECCO" MAINS SOLENOID. Compact and very powerful. 16 lb. pull. $\frac{3}{8}$" travel which can be increased to 1" by removing captive-end-plate. Overall size 2" x $2\frac{1}{4}$" x $2\frac{3}{4}$" high. **£1·50.** P. & P. 25p.

"MAGNETIC DEVICES" Mains Solenoid:—2" x $1\frac{1}{2}$" x $1\frac{1}{2}$" approx. 2lb. pull. Plunger Travel $1\frac{1}{4}$". New in makers boxes; offered at half original cost. **75p.** P. & P. 25p.

"FIBRE GLASS" COPPER CLAD. Top grade. One size only, $7\frac{1}{2}$" x $4\frac{3}{4}$" x $\frac{1}{16}$". 3 panels **£1·00.** 12 panels **£3·50.** P. & P. 15p.

"SRBP" COPPER CLAD. Sizes: $7\frac{1}{4}$" x $4\frac{3}{16}$" x $\frac{1}{8}$", 16 for **£1·00.** $14\frac{1}{2}$" x $5\frac{1}{4}$" x $\frac{1}{16}$", 8 for **£1·00.** $19\frac{1}{2}$" x $7\frac{1}{2}$" x $\frac{1}{16}$", 4 for **£1·00.**



SLIDER SWITCHES. 3 amp. type D.P.D.T. 1" x $\frac{5}{16}$" x $\frac{3}{8}$" deep. 1 amp. type 3 P.D.T. $\frac{1}{2}$" x $\frac{5}{16}$" x $\frac{1}{16}$" deep. **£1·25** per doz. Either type or mixed as required. Carr. Paid.

L.T. TRANSFORMERS. Prim. 0-110-240v. Sec. 4 5–0–4·5v. at 1 amp. Size: $1\frac{3}{4}$" x $1\frac{1}{2}$" x $1\frac{5}{16}$". **60p.** P. & P. 15p

Prim. 220/240 v. Sec. 0-5-10-15-20 v. at 2 amps. **£1·25.** P. & P. 15p.

Prim 200/240v Sec **0-1-56-58-60** at 3·5 amps plus 0–90 at 100 ma. wax impregnated with screw term blocks. Weight 10 lbs **£3·60** plus 40p P. & P.

CURRENT FLOW INDICATOR. Ideal for all types of battery operated equipment (portable machines, tape recorders etc.). Four white segments appear when current flows. Coil is 600Ω 6/12v. Drawing only 8 ma on function. Neat in appearance. Size: dia. $\frac{13}{16}$" x $\frac{13}{16}$" deep. Fixing centres $1\frac{1}{4}$". **£1·25** each. Carr. Paid.

ELECTRO-TECH SALES

BUSINESS HOURS: 9.30-6 (1 p.m. Sat.) **264 PENTONVILLE ROAD, LONDON, N.1** P.W.10 (ONE MIN. FROM KINGS X STATION) Tel. 01-837 74012

YOUR CAREER in *RADIO & ELECTRONICS ?*

Big opportunities and big money await the qualified man in every field of Electronics today—both in the U.K. and throughout the world. We offer the finest home study training for all subjects in radio, television, etc., especially for the **CITY & GUILDS EXAMS** (Technicians' Certificates); the Grad. Brit. I.E.R. Exam.; the **RADIO AMATEUR'S LICENCE;** P.M.G. Certificates; the R.T.E.B. Servicing Certificates; etc. Also courses in Television; Transistors; Radar; Computers; Servo-mechanisms; Mathematics and Practical Transistor Radio course with equipment. We have **OVER 20 YEARS'** experience in teaching radio subjects and an unbroken record of exam. successes. We are the only privately run British home study College specialising in electronics subjects only. Fullest details will be gladly sent without any obligation.

To: British National Radio School, Reading, Berks.

Please send FREE BROCHURE *to*

NAME .... Block

ADDRESS .... Caps.

.... Please

10/71

BRITISH NATIONAL RADIO SCHOOL

UNBEATABLE RUSSIAN VALUE

PERFORMANCE CAN BE COMPARED WITH £65 RADIOS!

Sockets for tape recorder, record player, extension speaker, earphone, external power supply (12v DC), external line and dipole aerials. Battery life approx. 300 hours.

At last, the Astrad Solar Radio combining quality with value and a specification not before available from Russia. Designed for the man who appreciates the extras necessary for quality performance. This 6 waveband Radio has twin speakers for quality. Fully independent Treble and Bass tone controls for ultimate performance and twin separate tuning controls for AM & FM broadcasts. 12 push buttons for waveband selection including automatic frequency control on VHF. This is the big set from Russia, overall dimensions—14" x $9\frac{1}{4}$" x $4\frac{1}{2}$". Included in this incredible specification is an inbuilt tuning meter to ensure that you are spot-on the station you select. Telescopic aerial on universal joint and a push-button dial light. All presented in a luxurious padded case with carrying handle. **This fabulous Radio is fully guaranteed for 1 year.** Only limited supplies available at a never to be repeated price.

TECHNICAL DATA :
Waveband (frequency)
LW 2000—735·5m.
MW 571·4—186·9m
SW3 53·1—40·54m
SW2 31·91—24·79m
SW1 19·87—16·76m
VHF 3·43—288m
(5—104 mc/s)
17 transistors, 8 diodes

NEW BUDGET PRICES

£22·97 Earphones 25p. P. & P. 75p

SEBA ELECTRONICS, Dept. M/O, 104 Uxbridge Road, Hanwell, London, W7. Phone: 01-579 5644

A CASE FOR "IMPEX"

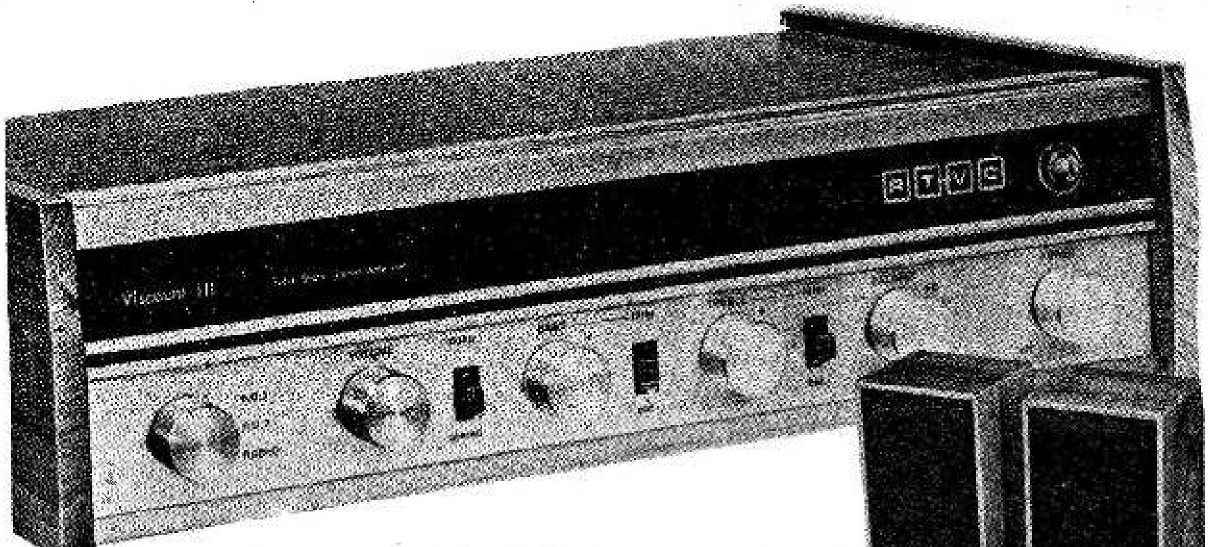
PROBLEM : I have a tuner, timer, mixer and digital clock for which I require suitable cases.
ANSWER : "IMPEX" Instrument Cases.
PROBLEM : All the instruments are different sizes.
ANSWER : "IMPEX" have a standard range of 36 sizes.
PROBLEM : I want them to be robust and stylish.
ANSWER : "IMPEX" cases are both functional and attractive.
PROBLEM : My budget is strictly limited.
FINAL ANSWER : "IMPEX" cases are very competitively priced.

Find out how they answer many problems. Details from:

"IMPEX"

P.O. Box 2BB, Newcastle-upon-Tyne. NE99 2BB.
(Makers of the M.S.7 Magnetic Pickup Pre-amplifier)

28watts, r.m.s. 40Hz to 40kHz ± 3dB



Viscount III Audio Suite complete £49

There are two stereo amplifiers—the R100 for ceramic cartridges, the R101 for magnetic. Both incorporate FETs (FIELD EFFECT TRANSISTORS), just like top-priced units. FETs give you more of the signal you want, and almost none of the background hiss you don't. Both units have a jack socket to plug in headphones and there's a separate output for tape recorder. Filters (an unusual feature in this price range) and tone controls give a wide range of bass and treble adjustment which compensate for input deficiencies and domestic acoustic conditions.

PRICES SYSTEM 1

Viscount III R101 amplifier	£22·00+90p p&p
2 x Duo Type II speakers,	£14·00+£2 p&p
Garrard SP25 Mk. III with MAG. cart ridge plinth and cover	£23·00+£1·50 p&p
Total	£59·00

Available complete for only £52·00+£3·50 p&p

SYSTEM 2

Viscount R101 amplifier	£22·00+90p p&p
2 x Duo Type III speakers	£32·00+ £3 p&p
Garrard SP25 Mk. III with MAG. cartridge, plinth and cover	£23·00+£1·50 p&p
Total	£77·00

Available complete for £69+£4 p&p

SYSTEM 3

Viscount III Amplifier R100	£17·00+90p p&p
2 x Duo Type II speakers, pair	£14·00+£2 p&p
Garrard SP25 Mk. III with CER. diamond cartridge, plinth and cover	£21·00+£1·50 p&p
Total	£52·00

Available complete for only £49·00+£3·50 p&p

SPEAKERS Duo Type II
Size 17″ x 10¾″ x 6¾″. Drive unit 13″ x 8″ with parasitic tweeter. Max. power 10 watts. 3 ohms. Simulated Teak cabinet. **£14 pair**+£2 p&p.

Duo Type III Size 23½″ x 11½″ x 9½″. Drive unit 13½″ x 8¼″ with H.F. speaker. Max. power 20 watts at 3 ohms. Freq. range 20Hz to 20kHz. Teak veneer cabinet. **£32 pair**+£3 p&p.

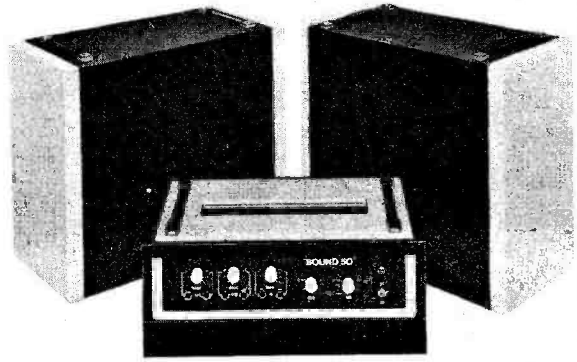
SPECIFICATION R100/101
14 watts per channel into 3 to 4 ohms. Total distortion @ 10W @ 1kHz 0·1%. *P.U.1* (for ceramic cartridges) 150mV into 3 Meg. *P.U.2* (for magnetic cartridges) 4mV @ 1kHz into 47K. equalised within ± 1dB R.I.A.A. *Radio* 150mV into 220K. (Sensitivities given at full power). Tape out facilities; headphone socket, power out 250mW per channel. *Tone controls and filter characteristics.* Bass: +12dB to −17dB @ 60Hz. Bass filter: 6dB per octave cut. Treble control: treble +12dB to −12dB @ 15kHz. Treble filter: 12dB per octave. *Signal to noise ratio:* (all controls at max) R101—P.U.1 and radio—65dB. P.U.2. −58dB. **R100** same as R101 but P.U.2 (for crystal cartridges) 450mV into 3 Meg. *Cross talk* better than −35dB on all inputs. *Overload characteristics* better than 26dB on all inputs. Size 13¾″ x 9″ x 3¾″.

R+TV

Radio and TV Components (Acton) Ltd. 21c High Street, Acton, London W3 6NG
323 Edgware Road, London, W.2. Mail orders to Acton. Terms C.W.O. *All enquiries S.A.E.*
Goods not despatched outside U.K.

SOUND 50

50 WATT AMPLIFIER & SPEAKER SYSTEM



The Sound Fifty valve amplifier and speakers are sturdily constructed with smart housings and thoroughly tested electronics. They are designed to last—to withstand the knocks and bumps of life on the road. Built for the small and medium sized gig, they are easy to handle and quick to set up and can be relied upon to come over with all the quality and power you need.

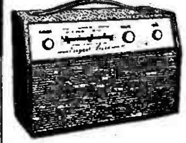
Output Power: 45 watts R.M.S. (Sine wave drive). **Frequency response:** −3dB points 30Hz at 18KHz. **Total distortion:** less than 2% at rated output. **Signal to noise ratio:** better than 60dB.
Speaker Impedance: 3, 8 or 15 ohms. **Bass Control Range:** ± 13dB at 60Hz. **Treble Control Range:** ± 12dB at 10 KHz. **Inputs:** 4 inputs at 5mV into 470K. Each pair of inputs controlled by separate volume control. 2 inputs at 200mV into 470K.
To protect the output valves, the incorporated fail safe circuit will enable the amplifier to be used at half power.
SPEAKERS! Size 20″ × 20″ × 10″ incorporating 12″ heavy duty 25 watt high flux, quality loudspeaker with cast frame. Cabinets attractively finished in two tone colour scheme—Black and grey.

COMPLETE SYSTEM £50 Plus £6 P. & P.
Sound 50 amp and 2 speakers

or available separately. Amplifier £28.50 plus £1.50 P. & P.
Speakers £12.50 each plus £2.25 P. & P.

THE ELEGANT SEVEN Mk. III

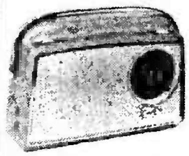
(350mW Output)



7 transistor fully-tunable M.W.—L.W. superhet portable. Set of parts. Complete with all components, including ready etched and drilled printed circuit board—back printed for foolproof construction.
MAINS POWER PACK KIT: 75p extra.

Price **£5.25** plus 50p. P. & P.
Circuit 13p FREE WITH PARTS.

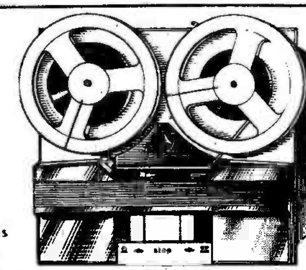
THE DORSET (600mW Output)



7-transistor fully tunable M.W.—L.W. superhet portable. Set of parts. The latest modulised and pre-alignment techniques make this simple to build. Sizes: 12 x 8 x 3in.

Price **£5.25** plus 50p P. & P.
Circuit 13p FREE WITH PARTS

CONTINENTAL 4 TRACK, 3 SPEED TAPE DECK

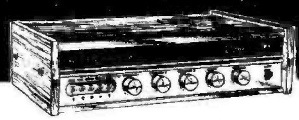


with high impedance heads

R.C. 74 tape deck. Three speeds—$7\frac{1}{2}$, $3\frac{3}{4}$ and $1\frac{7}{8}$ ips.
4-track record/playback head. Plus 4-track erase head. Positive pressure pad system. Takes any tape spool up to and including 7″. The R.C. 74 is driven by a powerful 200/250V 50-cycle A.C. motor. A heavy, accurately balanced, flywheel brings wow and flutter levels down to approx. 0.3% total at $3\frac{3}{4}$ and $7\frac{1}{2}$ ips. Fast rewind in both directions.
Controls couldn't be simpler! Just five push buttons that interlock to cut out accidental tape damage. Efficient servo-action type braking. Easy drop-in tape loading.
The R.C. 74 comes with an attractive moulded deck cover, which has positions for tone and volume controls. The unit is built into a rigid die-cast frame, and overall size of the whole unit is $12\frac{3}{4} \times 11\frac{1}{4} \times 6$ inches. Every single deck fully tested before dispatch. Spools not supplied.

Price complete **£15·00.** Plus 75p P. & P.

RELIANT mk. IV



The Reliant Mk. IV
provides a high standard of sound reproduction, with full mixing facilities. It's versatility makes it suitable for: Discotheque, P.A., Home Entertainment Applications, etc.

* **Five Electronically Mixed Inputs**
* **Three Individual Mixing Controls**
* **Separate bass and treble controls common to all five inputs**
* **Mixer employing F.E.T. (Field Effect Transistor)**
* **Solid State Circultry**
* **Attractive Styling**

£9.50 PRICE
plus P. & P. 60p.

SPECIFICATIONS

INPUTS:—1. Crystal Mic or Guitar 9mV. 2. Moving coil Mic or Guitar 8mV. Inputs 3, 4 & 5 are suitable for a wide range of medium output equipment (Gram, Tuner, Monitor, Organ, etc.) All 250mV sensitivity.

CONTROLS:—3 Volume controls. Bass control range ±13db @ 60 Hz. Treble control range ±12db @ 15KHz. Separate ON/OFF Switch, Neon Indicator.

POWER OUTPUT:—12 Watts R.M.S. into 3 to 4 ohms speaker.

SIGNAL/NOISE:—Better than —60db on inputs 3, 4 and 5 & —50db on 1 & 2.

SUPPLY:—220 — 250 AC. Mains.

SIZE:—$12\frac{1}{2}$″ x 6″ x $3\frac{1}{2}$″.

TOURIST

MARK 3

CAR RADIO

ALL TRANSISTOR

Beautifully designed to blend with the interiors of all cars. Permeability tuning and long wave loading coils ensure excellent tracking, sensitivity and selectivity on both wave bands. R.F. sensitivity at 1MHz is better than 8 micro volts. Power output into 3 ohm speaker is 3 watts. Pre-aligned I.F. module and tuner together with comprehensive instructions guarantees success first time. 12 volts negative or positive earth. Size 7in x 2in x $4\frac{1}{2}$in deep.

SET OF PARTS £6.30
plus P. & P. 50p.

Circuit diagram 13p. Free with parts
Speaker, baffle and fixing kit **£1·25** extra plus 25p. p. & p. Postage free when ordered with parts.

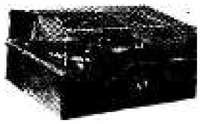
See previous page for address

RADIO & TV COMPONENTS
R+TV
(ACTON) LIMITED

AUDIO SUPPLIES

SLASH PRICES! UP TO 60%

SUPERB Plinths & Covers



ONLY

£3·25 P. & P. 30p

for GARRARD and B.S.R. SP25, SL65B, 3500, 3000 2025TC, 2000, 1025, 5100, AT6, AT60, 40B, B.S.R. McDonald range. All decks are finished in teak polish and will blend in any modern home. The covers are of tinted Perspex (please state deck when ordering).

SUPERIOR PLINTHS AND COVERS FOR GARRARD AP75, AP76, SL72B, SL75B and SL95B.
£4·99. P.P. 60p (R.R.P. £9·50)

STEREO AMPLIFIERS p.p. 50p

ARMSTRONG 521	£40·00
AMSTRAD 8000	£15·00
H.L. SA707	£18·00
TELETON SAQ206	£16·00
VICEROY VAS70	£42·00
VICEROY 55	£16·00
SANSUI full range in stock P.O.A.	
METROSOUND ST20	£24·00
SINCLAIR 2000 MkII	£22·00
SINCLAIR 3000	£32·00
SINCLAIR NEOTERIC	£46·00
SINCLAIR A.F.U.	£4·50
SINCLAIR S60 + 2 Z30/PZ5	£15·00
SINCLAIR S60 + 2 Z30/PZ6	£17·50
SINCLAIR S60 + 2 Z50 + PZ8 and Mains trans.	£23·00

Sonab special offer for personal callers only

TUNER AMPLIFIERS p.p. 50p

ARMSTRONG 526	£80·00
ARMSTRONG 525	£70·00
RODGERS RAVENSBROOK	P.O.A.
TELETON CR10T with speakers	£25·50
TELETON F2100	£30·00
WHARFEDALE 100·1	£103·00
PHILIPS RH781	£53·00
GOODMANS MODULE 80	£72·00
TELETON R8000 with speakers	£35·00
TOSHIBA range P.O.A.	

Sonab special offer for personal callers only

TUNERS p.p. 50p

ARMSTRONG M8	£7·75
ARMSTRONG 523	£40·00
ARMSTRONG 524	£31·00
TELETON GT101	£32·00
SINCLAIR Pro. 60	£19·50
RODGERS RAVENSBOURNE FET2 Chassis	£45·00
LEEK STEREO STETIC Chassis	£48·00

Easy to find—50 yards from (B.R.) Stoke Newington Stn.
67, 149, 247, 73, 76, 243 Buses Pass our door.

STEREO LPs of the great musicians

3 for £1.15 free p. &. p.

Send S.A.E. for lists

WHY PAY MORE?

Post Budget Purchase Tax Reductions.

Send S.A.E. for quote on equipment you require.

Most good manufacturers products available.

GOODMANS MAGISTERS
£80·00 per pair, p. & p. £2·50

PICK-UP ARMS p.p. 45p

SME 3009/S2	£25·00
SME 3012/S2	£26·50
GOLDRING L75	£10·00
GOLDRING L69	£8·00
AUDIO TECHNICA AT1005	£16·25

VISIT OUR 3-STOREY WAREHOUSE PACKED WITH HI-FI & STEREO EQUIPMENT. 1000's OF ITEMS ALWAYS AVAILABLE TO SELECT FROM.

FOR ALL YOUR NEEDS IN HI-FI EQUIPMENT SEND A LARGE S.A.E. or PAY A VISIT

2 SHOWROOMS DEVOTED TO DEMONSTRATING SPECIALLY SELECTED SYSTEMS

SPECIAL OFFERS

GARRARD SP25 Mk. III GOLDRING G800 Superb Plinth and Cover.
SINCLAIR Project 60—Stereo 60 Pre-Amplifier and Control Unit. 2 Z30's and PZ5. 2 WHARFEDALE Unit 3. List Price £84·00. OUR PRICE £55. P. & P. £1·75.

GARRARD SP25 Mk III
GOLDRING G800 H
Plinth and Cover complete
OUR PRICE £18·00. P. & P. 75p.

ARMSTRONG 526
GARRARD AP76
SHURE M55E
Plinth & Cover complete
STE-MA 400 speakers
OUR PRICE £148·00. P. & P. £1·25

CARTRIDGES p.p. 3p

GOLDRING G850	£3·50
GOLDRING G800H	£5·00
GOLDRING G800	£7·00
GOLDRING G800/E	£10·75
GOLDRING G800/SE	£16·00
SHURE M3D	£4·75
SHURE M44/5/7/C	£7·00
SHURE M55E	£9·00
SHURE M75E type 2	£15·00
SHURE V15 type 2	£30·00
SHURE 44E	£8·50
SHURE 31E	£9·00
SHURE 32E	£8·25
SONATONE 9TAHCD	£1·50
AUDIO TECHNICA AT66	£4·00
ADC 10/E MkII	£25.00

GARRARD 0/100 IN STOCK SPECIAL PRICE ON APPLICATION

TURNTABLES p.p. 60p

GARRARD SP25/Mk. III	£10·00
GARRARD 2025TC with Sonotone 9TAHC Diamond Cartridge	£8·00
GARRARD A70 Mk. II	£10·97
GARRARD SL65B	£12·75
GARRARD AP76	£18·00
GARRARD SL72B	£25
GARRARD SL75B	£27·00
GARRARD 401	£27·00
GARRARD SL95B	£34
GOLDRING GL75P	£35
GOLDRING GL75	£28·50
GOLDRING GL69	£21
THORENS TD125	£62
THORENS TD150AB/2	£38
PIONEER PL11AC complete	£39
Dual 1219	£49
DUAL 1209	£34
PHILIPS 202A	£54

OPEN
Monday – Wednesday 9.30 a.m.–6 p.m.
Half day Thursday until 1 p.m.
Late night Friday until 8 p.m.
SATURDAY 9.30 a.m.–6 p.m.

All prices subject to change without notice

SEND CHEQUES, P.O., MONEY ORDER, etc. to—

AUDIO SUPPLIES PW10. 50 STAMFORD HILL, LONDON, N.16.
Telephone: 01-806 3611/7311

PERSONAL CALLERS PLEASE NOTE—Cheques are only accepted when accompanied by a Bank Cheque Card (not Barclay Card).

The largest selection

NEW LOW PRICE TESTED S.C.R.'s

PIV	1A TO-5	3A TO-66	7A TO-66	10A	16A TO-48	30A TO-48
	£p	£p	£p	£p	£p	£p
50	0·23	0·25	0·47	0·50	0·53	1·15
100	0·25	0·33	0·53	0·58	0·63	1·40
200	0·35	0·37	0·57	0·61	0·75	1·60
400	0·43	0·47	0·67	0·75	0·93	1·75
600	0·53	0·57	0·77	0·97	1·25	—
800	0·63	0·70	0·90	1·20	1·50	4·00

SIL. RECTS. TESTED

PIV	300mA	750mA	1A	1·5A	3A	10A	30A
	£p	£p	£p	£p	£p	£p	£p
50	0·04	0·05	0·05	0·07	0·14	0·21	0·47
100	0·04	0·06	0·05	0·13	0·16	0·23	0·75
200	0·05	0·09	0·06	0·14	0·20	0·24	1·00
400	0·06	0·13	0·07	0·20	0·27	0·37	1·25
600	0·07	0·16	0·10	0·23	0·34	0·45	1·85
800	0·10	0·17	0·13	0·25	0·37	0·55	2·00
1000	0·11	0·25	0·15	0·30	0·46	0·63	2·50
1200	—	0·33	—	0·33	0·57	0·75	—

TRIACS

VBOM	2A TO-1	6A TO-66	10A TO-88
	£p	£p	£p
100	0·50	0·63	1·00
200	0·70	0·90	1·25
400	0·90	1·00	1·60

SILICON HIGH VOLTAGE RECTIFIERS
10-Amp 3-K.V. (3000 P.I.V.) Stud Type with Flying Leads, 80p each.

DIACS
FOR USE WITH TRIACS
BR100 .. .. 37p each

2A POTTED BRIDGE RECTIFIERS 200V 50p

UNIJUNCTION
UT46. Eqvt. 2N2646, Eqvt. TIS43. BEN3000 27p each, 25–99 25p 100 UP 20p.

AD161 *NPN*
AD162 *PNP*
MATCHED COMPLEMENTARY PAIRS OF GERM. POWER TRANSISTORS.
For mains driven output stage of Amplifiers and Radio receivers.
OUR LOWEST PRICE OF 63p *PER PAIR*

NPN SILICON PLANAR BC107/8/9, 10p each; 50–99, 9p; 100 up, 8p each; 1,000 off, 7p each. Fully tested and coded TO-18 case.

FREE

One 50p Pak of your own choice free with orders valued £4 or over.

2N3055 115 WATT SIL. POWER NPN
OUR PRICE 63p EACH

AF239 PNP GERM, SIEMENS VHF TRANSISTORS. RF MIXER & OSC. UP TO 900 MHZ. USE AS REPLACEMENT FOR AF139-AF186 & 100's OF OTHER USES IN VHF. OUR SPECIAL LOW PRICE:—1–24 37p each, 25–99 34p each 100 + 30p each.

FULL RANGE OF ZENER DIODES VOLTAGE RANGE 2-33V. 400mV (DO-7 Case) 13p ea. 1½W (Top-Hat) 18p ea. 10W (SO-10 Stud) 25p ea. All fully tested 5% tol. and marked. State voltage required.

FET'S

2N 3819 .... 35p
2N 3820 .... 93p
MPF105 .... 40p

BRAND NEW TEXAS GERM. TRANSISTORS
Coded and Guaranteed

Pak No.			EQVT
T1	8	2G371A	OC71
T2	8	2G374	OC75
T3	8	2G3744A	OC81D
T4	8	2G381A	OC81
T5	8	2G382T	OC82
T6	8	2G344A	OC44
T7	8	2G345A	OC45
T8	8	2G378	OC78
T9	8	2G399A	2N1302
T10	8	2G417	AF117

All 50p each pak

CADMIUM CELLS

ORP12 43p
ORP60, ORP61 40p each

PHOTO TRANS.

OCP71 Type. 43p

2N2060 NPN SIL. DUAL TRANS. CODE D1699 TEXAS. Our price 25p each.

SIL. G.P. DIODES £p
300mW 30 .. 0·50
40PIV (Min.) 100 .. 1·50
Sub-Min. 500 .. 5·00
Full Tested 1,000 .. 9·00
Ideal for Organ Builders.

120 VCB NIXIE DRIVER TRANSISTOR. Sim. BSX21 & C407, 2N1893 FULLY TESTED AND CODED ND120. 1–24 17p each. TO-5 N.P.N. 25 up 15p each.

D13D1 Silicon Unilateral switch 50p each.
A Silicon Planar, monolithic integrated circuit having thyristor electrical characteristics, but with an anode gate and a built-in "Zener" diode between gate and cathode. Full data and application circuits available on request.

Sil. trans. suitable for P.E. Organ. Metal TO-18 Eqvt. ZTX300 5p each. Any Qty.

EX-EQUIPMENT MULLARD
AF117 transistors. Large can 4 leads type. Leads cut short but still usable, real value at 15 for 50p.

KING OF THE PAKS Unequalled Value and Quality

SUPER PAKS

NEW BI-PAK UNTESTED SEMICONDUCTORS

Satisfaction GUARANTEED in Every Pak, or money back.

Pak No.		£p
U1	120 Glass sub-min. general purpose germanium diodes	0·50
U2	60 Mixed germanium transistors AF/RF	0·50
U3	75 Germanium gold bonded diodes sim. OA5, OA47	0·50
U4	40 Germanium transistors like OC81, AC128	0·50
U5	60 200mA sub-min. Sil. diodes	0·50
U6	30 Silicon planar transistors NPN sim. BSY95A, 2N706	0·50
U7	16 Silicon rectifiers Top-Hat 750mA up to 1,000V	0·50
U8	50 Sil. planar diodes 250mA, OA/200/202	0·50
U9	20 Mixed volts 1 watt Zener diodes	0·50
U11	30 PNP silicon planar transistors TO-5 sim. 2N1132	0·50
U13	30 PNP-NPN sil. transistors OC200 & 2S104	0·50
U14	150 Mixed silicon and germanium diodes	0·50
U15	25 NPN Silicon planar transistors TO-5 sim. 2N697	0·50
U16	10 3-Amp silicon rectifiers stud type up to 1000 PIV	0·50
U17	30 Germanium PNP AF transistors TO-5 like ACY 17-22	0·50
U18	8 6-Amp silicon rectifiers BYZ13 type up to 600 PIV	0·50
U19	25 Silicon NPN transistors like BC108	0·50
U20	12 1·5-Amp silicon rectifiers Top-Hat up to 1,000 PIV	0·50
U21	30 A.F. germanium alloy transistors 2G300 series & OC71	0·50
U23	30 Madt's like MAT series PNP transistors	0·50
U24	20 Germanium 1-Amp rectifiers GJM up to 300 PIV	0·50
U25	25 300Mc/s NPN silicon transistors 2N708, BSY27	0·50
U26	30 Fast switching silicon diodes like IN914 micro-min	0·50
U28	Experimenters' assortment of integrated circuits, untested. Gates, flip-flops, registers, etc., 8 assorted pieces	1·00
U29	10 1-Amp SCR's TO-5 can up to 600 PIV CRS1/25-600	1·00
U31	20 Sil. Planar NPN trans. low noise amp 2N3707	0·50
U32	25 Zener diodes 400mW D07 case mixed volts, 3–18	0·50
U33	15 Plastic case 1 amp silicon rectifiers IN4000 series	0·50
U34	30 Sil. PNP alloy trans. TO-5 BCY26, 2S302/4	0·50
U35	25 Sil. planar trans. PNP TO-18 2N2906	0·50
U36	25 Sil. planar NPN trans. TO-5 BFY50/51/52	0·50
U37	30 Sil. alloy trans. SO-2 PNP, OC200 2S322	0·50
U38	20 Fast switching sil. trans. NPN, 400Mc/s 2N3011	0·50
U39	30 RF germ. PNP trans. 2N1303/5 TO-5	0·50
U40	10 Dual trans. 6 lead TO-5 2N2060	0·50
U41	25 RF germ. trans. TO-1 OC45 NKT72	0·50
U42	10 VHF germ. PNP trans. TO-1 NKT667 AF117	0·50

Code Nos. mentioned above are given as a guide to the type of device in the Pak. The devices themselves are normally unmarked.

NEW QUALITY TESTED PAKS

Pak	Description	Price £p
Q1	20 Red spot trans. PNP AF	0·50
Q2	16 White spot R.F. trans. PNP	0·50
Q3	4 OC77 type trans.	0·50
Q4	6 Matched trans. OC44/45/81/81D	0·50
Q5	4 OC75 transistors	0·50
Q6	4 OC72 transistors	0·50
Q7	4 AC128 trans. PNP high gain	0·50
Q8	4 AC126 trans. PNP	0·50
Q9	7 OC81 type trans.	0·50
Q10	7 OC71 type trans.	0·50
Q11	2 AC127/128 comp. pairs PNP/NPN	0·50
Q12	3 AF116 type trans.	0·50
Q13	3 AF117 type trans.	0·50
Q14	3 OC171 H.F. type trans.	0·50
Q15	5 2N2926 sil. epoxy trans.	0·50
Q16	2 GET880 low noise germ. trans.	0·50
Q17	3 NPN 1 ST141 & 2 ST140	0·50
Q18	4 Madt's 2 MAT 100 & 2 MAT 120	0·50
Q19	3 Madt's 2 MAT 101 & 1 MAT 121	0·50
Q20	4 OC44 germ. trans. A.F.	0·50
Q21	3 AC127 NPN germ. trans.	0·50
Q22	20 NKT trans. A.F. R.F. coded	0·50
Q23	10 OA202 sil. diodes sub-min.	0·50
Q24	8 OA81 diodes	0·50
Q25	6 IN914 sil. diodes 75PIV 75mA	0·50
Q26	8 OA95 germ. diodes sub-min. 1N69	0·50
Q27	2 10A 600PIV sil. rects. IS45R	0·50
Q28	2 Sil. power rects. BYZ13	0·50
Q29	4 Sil. trans. 2 × 2N696, 1 × 2N697, 1 × 2N698	0·50
Q30	7 Sil. switch trans. 2N706 NPN	0·50
Q31	6 Sil. switch trans. 2N708 NPN	0·50
Q32	3 PNP sil. trans. 2 × 2N1131, 1 × 2N1132	0·50
Q33	3 Sil. NPN trans. 2N1711	0·50
Q34	7 Sil. NPN trans. 2N2369, 500MHZ	0·50
Q35	3 Sil. PNP TO-5 2 × 2N2904 & 1 × 2905	0·50
Q36	7 2N3646 TO-18 plastic 300MHZ NPN	0·50
Q37	3 2N3053 NPN sil. trans.	0·50
Q38	7 PNP trans. 4×2N3703, 3×2N3702	0·50
Q39	7 NPN trans. 4×2N3704, 3×2N3705	0·50
Q40	7 NPN amp. 4×2N3707, 3×3N3708.	0·50
Q41	3 Plastic NPN TO-18 2N3904	0·50
Q42	6 NPN trans. 2N5172	0·50
Q43	7 BC107 NPN trans.	0·50
Q44	7 NPN trans. 4×BC108, 3×BC109	0·50
Q45	3 BC113 NPN TO-18 trans.	0·50
Q46	3 BC115 NPN TO-5 trans.	0·50
Q47	6 NPN high gain 3×BC167, 3×BC168	0·50
Q48	4 BCY70 NPN trans. TO-18	0·50
Q49	4 NPN trans. 2×BFY51, 2×BFY52	0·50
Q50	7 BSY28 NPN switch TO-18	0·50
Q51	7 BSY95A NPN trans. 300MHZ	0·50
Q52	8 BY100 type sil. rect.	1·00
Q53	25 Sil. & germ. trans. mixed all marked new	1·50

PRINTED CIRCUITS—EX-COMPUTER

Packed with semiconductors and components, 10 boards give a guaranteed 30 trans and 30 diodes. Our price 10 boards, 50p. Plus 10p P. & P. 100 Boards £3, P. & P. 30p.

GENERAL PURPOSE GERM. PNP POWER TRANSISTORS

Coded GP100. BRAND NEW TO-3 CASE. POSS. REPLACEMENTS FOR:—OC25-28-29-30-35-36. NKT 401-403-404-405-406-430-451-452-453. TI3027-3028, 2N250A, 2N456A-457A-458A, 2N511 A & B. 2G220-222, ETC.
SPECIFICATION
VCBO 80V VCEO 50V IC 10A PT. 30 WATTS Hfe 30–170.

PRICE	1–24	25–99	100 up
	43p each	40p each	36p each

GENERAL PURPOSE SILICON NPN POWER TRANSISTORS

Coded GP300. BRAND NEW TO-3 CASE. POSSIBLE REPLACEMENT FOR:—2N3055, BDY20, BDY11.
SPECIFICATION
VCBO 100V, VCEO 60V, IC 15AMPS, PT. 115 WATTS. Hfe 20–100. FTI MHZ

PRICE	1–24	25–99	100 up
	55p each	50p each	47p each

JUMBO COMPONENT PAKS

MIXED ELECTRONIC COMPONENTS

Exceptionally good value (no rubbish)

Resistors, capacitors, pots, electrolytics and coils plus many other useful items. Approximately 3lbs in weight. Price incl. P. & P

£1·50 only

Plus our satisfaction or money back guarantee.

NEW EDITION 1971

TRANSISTOR EQUIVALENTS BOOK. A complete cross reference and equivalents book for European, American and Japanese Transistors. Exclusive to BI-PAK 90p each.

GERM. POWER TRANS.

Type	Price each	Type	Price each
OC20	50p	OC29	40p
OC22	30p	OC35	33p
OC23	33p	OC36	40p
OC25	25p	AD140	40p
OC26	25p	AD142	40p
OC28	40p	AD149	43p

GENERAL PURPOSE NPN SILICON SWITCHING TRANS. TO-18 SIM. TO 2N706/8, BSY27/28/95A. All usable devices no open or short circuits. ALSO AVAILABLE in PNP Sim. to 2N2906, BCY70. When ordering please state preference NPN or PNP.

		£p			
			100	For	1·75
20	For	0·50	500	For	7·50
50	For	1·00	1000	For	13·00

OUR STOCKS of individual devices are now too numerous to mention in this Advertisement. Send S.A.E. for our listing of over **1,000 Semiconductors.** All available **Ex-Stock** at very competitive prices.

SILICON PHOTO TRANSISTOR. TO-18 Lens end. NPN Sim. to BP×25 and P21. BRAND NEW. Full data available. Fully guaranteed.

Qty.	1-24	25-99	100 up
Price each	45p	40p	35p

RTL MICROLOGIC CIRCUITS

Epoxy TO-5 case	Price each 1–24	25–99	100 up
uL900 Buffer	35p	33p	27p
uL914 Dual 2i/p gate	35p	33p	27p
uL923 J-K flip-flop	50p	47p	45p

Data and Circuits Booklet for I.C's Price 7p.

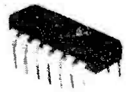
Dual-in-Line Low Profile Sockets
14 and 16 Lead Sockets for use with Dual-in-Line Integrated Circuits

Order No.	Price each 1–24	25–99	100 up
TSO 14 pin type	30p	27p	25p
TSO 16 pin type	35p	32p	30p

-the lowest prices!

74 series T.T.L. I.C's

DOWN AGAIN IN PRICE



Check our 74 Series List before you buy any I.C's. **Our prices are the lowest possible.** All devices ex-stock.
Full spec. guaranteed.

BI-PAK Order No.	Similar Types to:—Description	Price and qty. prices 1–24 £p	25–99 £p	100 up £p
BP00 = 7400	Quad 2-input NAND gate	0·15	0·14	0·12
BP01 = 7401	Quad 2-input pos. NAND gate (with open collector output)	0·15	0·14	0·12
BP02 = 7402	Quad 2-input pos. NOR gates	0·15	0·14	0·12
BP03 = 7403	Quad 2-input pos. NAND gates (with open collector output)	0·15	0·14	0·12
BP04 = 7404	Hex Inverters	0·15	0·14	0·12
BP05 = 7405	Hex Inverter (with open-collector output)	0·15	0·14	0·12
BP10 = 7410	Triple 3-input pos. NAND gates	0·15	0·14	0·12
BP13 = 7413	Dual 4-input Schmitt trigger	0·29	0·26	0·24
BP20 = 7420	Dual 4-input pos. NAND gates	0·15	0·14	0·12
BP30 = 7430	8-input pos. NAND gates	0·15	0·14	0·12
BP40 = 7440	Dual 4-input pos. NAND buffers	0·15	0·14	0·12
BP41 = 7441	BCD to decimal nixie driver	0·67	0·64	0·58
BP42 = 7442	BCD to decimal decoder (4–10 lines, 1 of 10)	0·67	0·64	0·58
BP46 = 7446	BCD-to-seven-segment decoder/driver	2·00	1·75	1·50
BP47 = 7447	BCD-seven-segment decoder/drivers (15V outputs)	0·97	0·94	0·88
BP48 = 7448	BCD-to-seven-segment decoder/driver	0·97	0·94	0·88
BP50 = 7450	Expandable dual 2-input and-or-invert	0·15	0·14	0·12
BP51 = 7451	Dual 2-wide 2-input and-or-invert gates	0·15	0·14	0·12
BP53 = 7453	Quad 2-input expandable and-or-invert	0·15	0·14	0·12
BP54 = 7454	4-wide 2-input and-or-invert gates	0·15	0·14	0·12
BP60 = 7460	Dual 4-input expander	0·15	0·14	0·12
BP70 = 7470	Single-phase J-K flip-flop	0·29	0·26	0·24
BP72 = 7472	Master slave J-K flip-flop	0·29	0·26	0·24
BP73 = 7473	Dual Master slave J-K flip-flop	0·37	0·35	0·32
BP74 = 7474	Dual D type flip-flop	0·37	0·35	0·32
BP75 = 7475	Quad latch	0·47	0·45	0·42
BP76 = 7476	Dual J-K with pre-set and clear	0·43	0·40	0·38
BP80 = 7480	Gated full adders	0·67	0·64	0·58
BP81 = 7481	16-bit read/write memory	0·97	0·94	0·88
BP82 = 7482	2-bit binary full adders	0·97	0·94	0·88
BP83 = 7483	Quad full adder	1·10	1·05	0·95
BP86 = 7486	Quad 2-input exclusive NOR gates	0·32	0·30	0·28
BP90 = 7490	BCD decade counter	0·67	0·64	0·58
BP91 = 7491	8-bit shift registers	0·87	0·84	0·78
BP92 = 7492	Divide-by-twelve counters	0·67	0·64	0·58
BP93 = 7493	4-bit binary counters	0·67	0·64	0·58
BP94 = 7494	Dual entry 4-bit shift register	0·77	0·74	0·68
BP95 = 7495	4-bit up-down shift register	0·77	0·74	0·68
BP96 = 7496	5-bit parallel in parallel out shift-register	0·77	0·74	0·68
BP100 = 74100	8-bit bistable latches	1·75	1·65	1·55
BP104 = 74104	Single J-K flip-flop equivalent 9000 series	0·97	9·94	0·88
BP105 = 74105	Single J-K flip flop equivalent 9001 series	0·97	0·94	0·88
BP107 = 74107	Dual Master slave flip-flops	0·40	0·38	0·36
BP110 = 74110	Gates master-slave flip-flops	0·55	0·53	0·50
BP111 = 74111	Dual data lock-out flip-flop	1·25	1·15	1·00
BP118 = 74118	Hex set-reset latches	1·00	0·95	0·90
BP119 = 74119	Hex set-reset latches. 24-pin	1·35	1·25	1·10
BP121 = 74121	Monostable multivibrators	0·67	0·64	0·58
BP141 = 74141	BCD-to-decimal decoder/driver	0·67	0·64	0·58
BP145 = 74145	BCD-to-decimal decoder/driver O/C	1·50	1·40	1·30
BP150 = 74150	16-bit data selector	1·80	1·70	1·60
BP151 = 74151	8-bit data selectors (with strobe)	1·00	0·95	0·90
BP153 = 74153	Dual 4-line-to-1-line data	1·20	1·10	0·95
BP154 = 74154	4- to 16-line decoder	1·80	1·70	1·60
BP155 = 74155	Dual 2- to 4-line decoder	1·40	1·30	1·20
BP156 = 74156	Dual 2- to 4-line decoder O/C	1·40	1·30	1·20
BP160 = 74160	Sync. decade counter	1·80	1·70	1·60
BP161 = 74161	Sync. 4-bit binary counter	1·80	1·70	1·60
BP190 = 74190	Sync. up-down BCD counter	3·50	3·25	3·00
BP191 = 74191	Sync. binary up-down counter (single clock line)	3·50	3·25	3·00
BP192 = 74192	Sync. up-down decade counter	2·10	1·95	1·75
BP193 = 74193	Sync. binary up-down counter (tow clock lines)	2·10	1·95	1·75
BP196 = 74196	Pre-setable 50MHz decade counter	1·80	1·70	1·60
BP197 = 74197	Pre-setable 50MHz binary counter	1·80	1·70	1·60
BP198 = 74198	8-bit parallel L-R shift register	5·50	5·00	4·00
BP199 = 74199	8-bit parallel access shift register	5·50	5·00	4·00

Devices may be mixed to qualify for quantity price. Larger quantities—prices on application (TTL 74 Series only).
Data is available for the above series of I.C's in booklet form. Price **13p.**

TTL INTEGRATED CIRCUITS

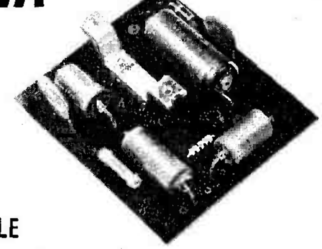
Manufacturers' "Fall outs"—out of spec. devices including functional units and part function but classed as out of spec. from the manufacturers' very rigid specifications. Ideal for learning about I.C's and experimental work.

PAK No.		PAK No.		PAK No.	
UIC00 = 12 × 7400N	50p	UIC42 = 5 × 7450N	50p	UIC80 = 5 × 7480N	50p
UIC01 = 12 × 7401N	50p	UIC50 = 12 × 7450N	50p	UIC82 = 5 × 7482N	50p
UIC02 = 12 × 7402N	50p	UIC51 = 12 × 7451N	50p	UIC83 = 5 × 7483N	50p
UIC03 = 12 × 7403N	50p	UIC60 = 12 × 7460N	50p	UIC86 = 5 × 7486N	50p
UIC04 = 12 × 7404N	50p	UIC70 = 8 × 7470N	50p	UIC90 = 5 × 7490N	50p
UIC05 = 12 × 7495N	50p	UIC72 = 8 × 7472N	50p	UIC92 = 5 × 7492N	50p
UIC10 = 12 × 7410N	50p	UIC73 = 8 × 7473N	50p	UIC93 = 5 × 7493N	50p
UIC20 = 12 × 7420N	50p	UIC74 = 8 × 7474N	50p	UIC94 = 5 × 7494N	50p
UIC40 = 12 × 7440N	50p	UIC75 = 8 × 7475N	50p	UIC95 = 5 × 7495N	50p
UIC41 = 5 × 7441AN	50p	UIC76 = 8 × 7476N	50p	UIC96 = 5 × 7496N	50p

UICX1 = 25 × Asst'd 74's £1·50

Paks cannot be split but 20 assorted pieces (our mix) is available as PAK UICX1
Every PAK carries out BI-PAK Satisfaction or money back GUARANTEE.

ANOTHER BI-PAK FIRST!



THE NEW **S.G.S.** EA 1000 AUDIO AMPLIFIER MODULE

***GUARANTEED NOT LESS THAN 3 WATTS RMS**

Especially designed by S.G.S. incorporating their proven Linear I.C. Audio Amp. TA/621 providing unlimited applications for the enthusiast in the construction of radios, record players, Audio and Stereo units. Also ideal for intercom systems, monitoring applications and phone answering machines. OTHER USES: *portable applications where supply rails as low as 9V are of prime importance.*

- Sensitivity 40 mV for 1 watt VOLTAGE GAIN 40dB but can be varied up to 73dB for some applications.
- Signal to Noise Ratio 86dB.
- Frequency response better than 50 Hz to 25 KHz for −3dB.
- Normal supply Voltage 9-24V.
- Suitable for 8-16 OHM Loads.
- Overall Size 2″ × 3″ × ¾″.
- Typical Total Harmonic distortion at 1 watt less than 1%.

****Supply voltage (Vs) = 24V 15ohm load.***

Module Tested and Guaranteed

Quantity	1-9	10-25
Price each	£2·63	£2·28

Larger quantities quoted on request

Full hook-up diagrams and complete technical data supplied free with each module or available separately at 10p each.

ROCK BOTTOM PRICES—CAN'T BE BEATEN!

LOGIC — DTL 930 SERIES — IC's

Type No.	Function	Price 1–24	25–99	100 up
BP930	Expandable dual 4-input NAND	12p	11p	10p
BP932	Expandable dual 4-input NAND buffer	13p	12p	11p
BP933	Dual 4-input expander	13p	12p	11p
BP935	Expandable Hex Inverter	13p	12p	11p
BP936	Hex Inverter	13p	12p	11p
BP944	Dual 4-input NAND expandable buffer without pull-up	13p	12p	11p
BP945	Master-slave JK or RS	25p	24p	22p
BP946	Quad, 2-input NAND	12p	11p	10p
BP948	Master-slave JK or RS	25p	24p	22p
BP951	Monostable	65p	60p	55p
BP962	Triple 3-input NAND	12p	11p	10p
BP9093	Dual Master-slave JK with separate clock	40p	38p	35p
BP9094	Dual Master-slave JK with separate clock	40p	38p	35p
BP9097	Dual Master-slave JK with Common Clock	40p	38p	35p
BP9099	Dual Master-slave JK Common Clock	40p	38p	35p

Devices may be mixed to qualify for quantity price. Larger quantity prices on application. (DTL 930 Series only).

BRAND NEW LINEAR I.C's—FULL SPEC.

Type No.	Case	Leads	Description	Price 1–24	25–99	100 up
BP 201C—SL201C	TO-5	8	G.P. Amp	63p	53p	45p
BP 701C—SL701C	TO-5	8	OP Amp	63p	50p	45p
BP 702C—SL702C	TO-5	8	OP Amp Direct OP	63p	50p	45p
BP 702—72702	D.I.L.	14	G.P. OP Amp (Wide Band)	53p	45p	40p
BP 709 —72709	D.I.L.	14	High OP Amp	53p	45p	40p
BP 709P—μA709C	TO-5	8	High Gain OP Amp	53p	45p	40p
BP 711—μA711	TO-5	10	Dual comparator	58p	50p	45p
BP 741 —72741	D.I.L.	14	High Gain OP Amp (Protected)	75p	60p	50p
μA 703C—μA703C	TO-5	6	R.F.-I.F. Amp	43p	35p	27p
TAA 263—	TO-72	4	A.F. Amp	70p	60p	55p
TAA 293—	TO-74	10	G.P. Amp	90p	75p	70p

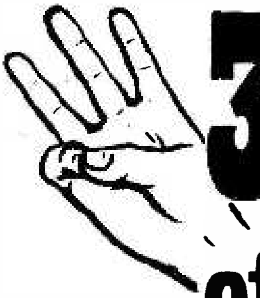
All prices quoted in new pence Giro No. 388-7006
Please send all orders direct to warehouse and despatch department

BI-PAK

P.O. BOX 6, WARE · HERTS

Postage and packing add 7p. Overseas add extra for airmail. Minimum order 50p. Cash with order please.

Guaranteed Satisfaction or Money Back



3 WAYS

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

# of obtaining components *quickly & easily*

1 CALL AT No. 240 London Rd., Mitcham

If you live within easy reach of Mitcham or are in the area at any time do call on us. We are almost opposite Mitcham Baths. We open 9 a.m. every weekday. On Wednesdays we close 1 p.m. and all other days, including Saturdays, 5.30 p.m. On Saturdays we have extra staff to deal with queries. We carry a vast stock of components, and 999 times out of a 1,000 we can immediately lay our hands on the particular item required.

2 JOIN OUR CREDIT ACCOUNT SERVICE

We began our Credit Account Service about 18 months ago and it has proved extremely popular. Little wonder! Our customers find it a very simple and convenient way of purchasing all their radio and electronic needs. We supply pre-paid envelopes and order forms and no matter how many orders you send us you make only one payment per month. There are several other advantages with our Credit Account Service. Please write or phone for details.

3 and ORDER BY MAIL OR TELEPHONE

Although we are kept busy selling "over the counter" we supply even more by Mail Order. You can telephone any time of day or night, Sundays included. If you ring out of office hours a recording machine takes your message for us to deal with as soon as we open shop again. Our number is 01-648 8422. If you wish to order by post our address is in the panel at the top of the page. We deal with all orders promptly.

WHICHEVER WAY YOU CHOOSE you need the Home Radio Catalogue

In its 315 pages are listed over 8,000 components, over 1,500 of them illustrated. Each copy contains 10 Vouchers, each worth 5p when used as instructed. Free Supplements are supplied regularly to keep you up-to-date. The Catalogue costs 50p over the counter, or 70p including postage and packing.

Post this Coupon with Cheque or PO for 70p

Please write Name and Address in block capitals.

Name ....

Address ....

....

....

HOME RADIO (Components) LTD.
Dept. PW, 234-240 London Rd., Mitcham, CR4 3HD

The price of 70p applies only to catalogues purchased by customers in the U.K. and to BFPO addresses.

PRACTICAL WIRELESS

VOL 47 NO 6
Issue 776

OCTOBER 1971

Who makes what?

WELL, of course, that's easy! When you buy a radio set, hi-fi amplifier or piece of electrical equipment, the trade mark tells you that. Or if the mark is an unfamiliar one you can find the piece moulded on the cabinet or printed on the carton which says 'Made in Outer Mongolia' or whatever.

People are interested in where products are made for a variety of reasons. The possible standard of workmanship, value-for-money, reputation, reliability, the position of after-sales service, availability of spare parts—or even personal political motives—are all valid reasons why a purchaser would want to know who makes what, and where.

From November 30th, however, the Merchandise Marks Act comes to an end and from that date it will no longer be obligatory for imported goods to bear a 'country-of-origin' mark. The casual customer will therefore not be sure if he is buying a radio set made in Birmingham or Baluchistan, or an amplifier which is a Chinese-copy of an American design made in Hong Kong or Japan.

Of course, there will still be trade marks which proclaim that the goods are true-blue British or come from well-respected foreign companies. Sadly, though, things are not always what they seem for many tape recorders, radio and TV receivers, bearing the names of old-established British manufacturers have for some time been made overseas and imported for the home market.

From November 30th, protection of the consumer has been thown at the retailer who, when asked, will be expected to disclose where a particular product is made. Unfortunately in may cases he will have no way of giving the required information. For instance, 'household-name' UK companies are none too keen to admit that some of their goods are being made in low-cost labour countries. Moreover, if a retailer does not know the country of origin, or (even inadvertently) gives the wrong answer, he will be at risk under the Trade Descriptions Act!

Apart from the factors mentioned earlier, which allow a customer to assess the advisability or otherwise of making a purchase, a particularly disturbing aspect of electrical goods (notably electric blankets and appliances) is that safety specifications may fall far short of those imposed on British-made goods and expose the user to potential hazards.

So, together with the British Radio Equipment Manufacturers' Association, the Radio and Television Retailers' Association and the Association of Manufacturers of Domestic Appliances, we beg the Secretary for Trade and Industry to think again. And to would-be purchasers after November 30th we can only say, most emphatically *caveat emptor!*

W. N. STEVENS—*Editor.*

NEWS AND COMMENT

CONSTRUCTIONAL

OTHER FEATURES

SPECIAL FEATURES

NOVEMBER ISSUE WILL BE PUBLISHED ON OCTOBER 8th

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

Viscount value

The Viscount III Audio System is the first of a range of audio equipment marketed in the UK by R+TV Components (Acton) Ltd. under the Viscount brand name.

The complete system includes a choice of two amplifiers, a Garrard SP25 Mk III turntable and two Duo type II or type III speakers.

Amplifier RT100 is for ceramic cartridges and model RT101 which has an additional input stage accepts magnetic types. Both amplifiers incorporate f.e.t.'s giving excellent signal to noise ratios.

Prices are: RT100, £17; RT101, £22; Garrard SP25 with ceramic cartridge, £21 or with magnetic cartridge, £23. Duo type II speakers cost £14 the pair and Duo type III, £32.

Savings can be made by buying complete systems.

Impex cases

In last month's issue we stated the following about Impex instrument cases:

"At no additional cost, Impex cases can be supplied with all or some of these specifications: alternative colours of blue or bronze; no hood; no ventilating slots or back/front anodised front/rear panels".

What we should have mentioned is that these additions can only be supplied free of charge for quantities over 24.

NHK's anniversary

June 1 saw the anniversary of the Radio Japan Service. Thirty-six years ago NHK commenced this service in commemoration of the 10th anniversary of radio broadcasting in Japan and the attainment of 2 million licensed subscribers.

From June 1934 to 1945, NHK broadcast its domestic programmes to Korea, Taiwan and Manchuria, then Japan's outlying territories, utilising telephone channels of the International Telephone Company. Shortwave broadcasts were received in various parts other than the areas directed, and reception reports began to come to NHK from Japanese residing abroad and from large numbers of overseas people. In those days, Japanese living in various parts of the world totalled nearly two million. These people raised their voices requesting the establishment of an overseas broadcasting service. In Japan, too, commencement of an overseas broadcasting service was also strongly desired, since this country had been isolated after her withdrawal from the League of Nations and was in need of reinforcing its public relations abroad. At first the service was known as Radio Tokyo (Radio Japan was first used in 1952).

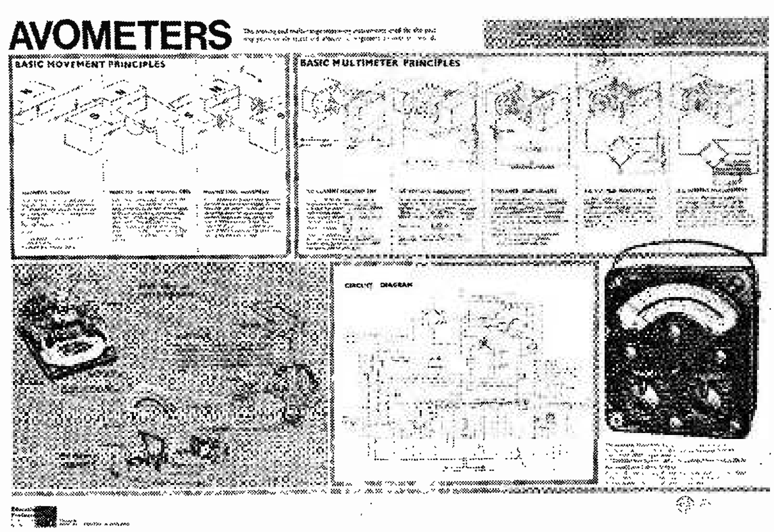
Avo wall chart

Avo Limited (Thorn Group) announce a new wall chart featuring the latest Mark 4 version of the Avometer Model 8. The design and layout is such that it will prove of great interest not only to Avometer users but also to technical schools and general education establishments as a teaching aid.

Information is presented in a clear, logical manner and the theoretical and practical information is both concise and easy to understand. Magnetic theory is developed pictorially to outline the operation of the moving coil movement whilst a mathematical treatment is used to derive the various ranges of a multimeter.

Illustrations of the interior of the instrument include an exploded view of the movement to simplify the constructional detail and a circuit diagram provides an introduction to standard symbols and references.

The Avometer chart (size 20×30in., 508×762mm.) is ideal for blackboard or wall presentation and is available from *Spares Dept., Avo Limited, Avocet House, Dover*, at 75p per copy, including post and packing.



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

Windermere VHF

The v.h.f. radio services from the Windermere relay station started on August 7. Radio 2 is on 88·6MHz, Radio 3 on 90·8MHz and Radio 4 on 93·0MHz, all with horizontal polarization.

The v.h.f. radio transmissions from this new relay station, which is situated on Claife Heights, above the western shore of Lake Windermere, will serve Ambleside, Windermere town, Bowness-on-Windermere, and an area around the northern shores of the lake.

Stereo from Rowbridge

The necessary equipment has now been installed at Rowridge to enable the Radio 3 transmitter (90·7MHz) to broadcast stereophony. This is being brought into use immediately, so that listeners can hear the Promenade Concerts in stereo—all except four of the concerts will be broadcast stereophonically in Radio 3. The stereo transmissions from Rowridge will initially be on an engineering test basis; every effort will be made to maintain them, but there may be occasions when it will be necessary to revert to monophonic transmissions. The date for the start of the full stereophonic service will be announced later.

Miniature Electric Tools

A range of battery-operated miniature tools has been introduced by Expo (Drills) Ltd., 62 Neal Street, London, W.C.2.

Two basic models are available. The 'Reliant' is designed for lighter work such as model making, and has a full load current of 1·5A. Its rated torque is 1·38oz. in. (100 gm.cm.). For jobs requiring a more powerful tool and for professional applications the 'Titan Super' is rated at 3·5A on full load. It has a rated torque of 350cmp operating at 4000-9000rpm. An extremely large range of accessories is also available for both models. Various collets and accessories are supplied with the different models, which range in price from £3 to £5·50.

Lectures

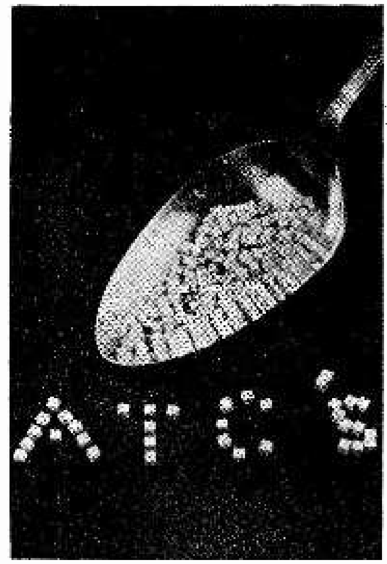
THE Polytechnic of North London Department of Electronic and Communications Engineering is running a course on Audio and Acoustic Measurements on Thursdays 6.30-8.30 p.m. 1971/2. 1971: Oct., 28, Parameters and Standards of Measurement R. N. Baldock, B.Sc., F.B.K.S.T.S. Nov. 4, Measurement of Microphone Performance, H. D. Harwood, B.Sc., B.B.C. Research; 11, Electrical and Mechanical Measurements in Tape Recording, R. L. West, B.Sc., C.Eng., F.I.E.R.E.; 18, Measurements in Professional Recording, Angus McKensie; 25, Electrical and Mechanical Measurements on Disc, Pickups and Accelerometers, S. Kelly, C.Eng., F.I.E.R.E. Dec. 2, Measurement of Loudspeaker Performance I, R. L. West; 9, Measurement of Loudspeaker Performance II, R. C. Driscoll, M.Sc.; 16, Measurement of Studio Characteristics, R. C. Driscoll, M.Sc. 1972: Jan. 13, Measurement of Noise Transmission, J. Moir C.Eng., F.I.E.E.; 20, Assessment of Noise Nuisance, J. Moir, C.Eng., F.I.E.E.; 27, Visit to A.I.R.O. Laboratories, Hemel Hempstead, G. Berry, B.Sc., C.Eng., M.I.Mech.E. and Assocs.

Grand Junk Sale

The Star Short Wave Club, G3ZWA, is holding a "Grand Junk Sale" in aid of Radio Amateur Invalid Bedfast Club funds. It is to be held at the New Inn Hotel, Bramley Town Street, Bramley, Leeds 13. The date is Wednesday September 15th and time 7.30.

If any readers have any junk, the Star Club will collect within a radius of 25 miles from Leeds. Please contact Mr. T. Leeman, G8BUU, 115 Asket Drive, Seacroft, Leeds, LS14 1HX.

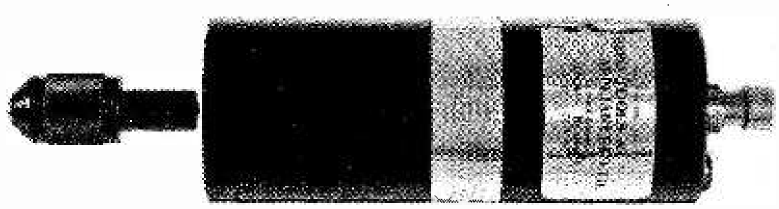
Chip "C's"

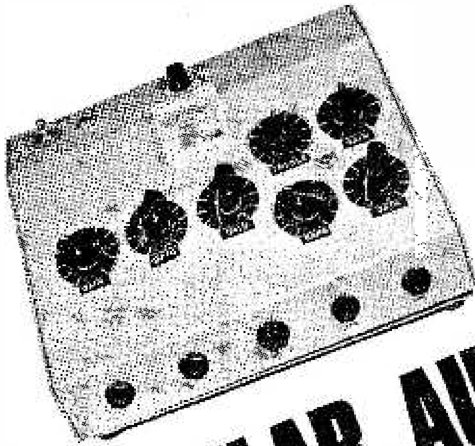


Featuring a very low insertion loss, a very high Q and high capacitance-to-volume ratios, a new range of ceramic and porcelain chip capacitors from Guest International Limited is ideal for u.h.f. and microwave applications. Apart from the basic pellet and chip, there is a wide choice of lead variations: stripline, axial and radial wire, axial and radial ribbon.

ATC 100 series are porcelain chips with an insertion loss of 0·03dB, a Q of over 10,000 and a capacitance range of 0·1 to 1000pF. In a case size of only 0·110in.square, the working voltage is up to 500V d.c.

ATC 200 series are ceramic chips with an insertion loss of 0·05dB. The capacitance range is 10pF to 1·2μF and chips are available in case sizes 0·050, 0·110 and 0·250in.square, depending on the value and the working voltage.





MODULAR AUDIO MIXING SYSTEM

F. C. JUDD

So many audio sources are now in common use that an article describing a specific design would meet the needs of only a few. This problem is overcome here by giving circuits for virtually all sources and care in design has made possible a large number of permutations so that a custom built audio mixer is possible even for those readers unable to design their own. The clever constructional method employed also allows for rapid modification to meet any mixing need.

A STUDY of the four block diagrams in Fig. 1 will show how the various signal preamplifiers, the tone control unit and line amplifier etc. can be used to build audio signal mixing systems to cater for tape recording, public address, discotheque and even Hi-Fi applications. The combinations given are but a few of the permutations which can be extended for stereo use simply by duplication.

Each signal preamp has the same output level, 100mV, and will match directly into either the tone control unit or the line amplifier, both of which are designed to accept a signal level of 100mV. The tone control has unity gain so this provides 100mV output to match into the line amplifier. Any group of signal preamplifiers can therefore be coupled directly to the line amplifier or via the tone control unit and then to the line amplifier. This allows any of the signal preamplifiers to be used with or without the tone control unit.

The line amplifier has a nominal output of 1V r.m.s. at a fairly low impedance and can be used to drive a power amplifier module requiring between 500mV to 1V input, or it can be coupled to a tape recorder or radio input, or to a public address or music amplifier with inputs rated for 500mV to 1V. Groups of the preamplifiers and line amplifier can be run from batteries or from an 18V mains power supply.

COMBINATIONS

A fairly simple arrangement is shown in Fig. 1a and is intended for use as a general purpose signal mixer as shown on the front cover. This would be suitable for tape recording, as it has two microphone inputs, one input for low impedance pick-up (with R.I.A.A. correction), and two line level (200mV to over 1V) inputs. The tone control operates for the mic. and pickup inputs, whilst the line inputs go directly to the line amplifier. The system also includes a VU meter with variable control so that the meter can be set to read with the level meter on a tape recorder.

The combination shown in Fig. 1b has the same input channels but no tone control unit. The arrangement in Fig. 1c might be suitable for a small discotheque with one mic. input, two pickup inputs both via a tone control unit and one line input, suitable for the output from a tape recorder. For music application, Fig. 1d provides two mic. and two guitar inputs with separate tone control units for each guitar input. In each case the VU meter is optional but can be used as an overload indicator as will be shown later.

PERFORMANCE SPECIFICATIONS

Seven preamplifiers will be described, each catering for specific signal sources as follows:—

1. LOW IMPEDANCE MICS. (25 to 600Ω). Direct input, no transformer required. Input sensitivity 50μV. Output 100mV. Frequency response ±1dB. 30 to 30,000Hz. Signal-to-noise −50dB. (Code: **Mic. Lo-Z**).
2. FOR MICROPHONES WITH BUILT-IN TRANSFORMERS. Medium to high impedance. Input sensitivity 1mV. Output 100mV. Frequency response ±1dB 20 to 30,000Hz. Signal-to-noise −60dB. (Code: **Mic. Hi-ZT**).
3. FOR CRYSTAL MICS. High impendance. Input sensitivity 2mV. Output 100mV. Frequency response ±1dB 30 to 12,000Hz. Signal-to-noise −50dB. (Code: **Mic. Hi-ZX**).
4. MAGNETIC PICKUP. Impedance 56kΩ. Input sensitivity 5mV. Output 100mV. Frequency response to R.I.A.A. as shown in Fig. 2. Signal-to-noise −60dB. (Code: **PU Mag.**)

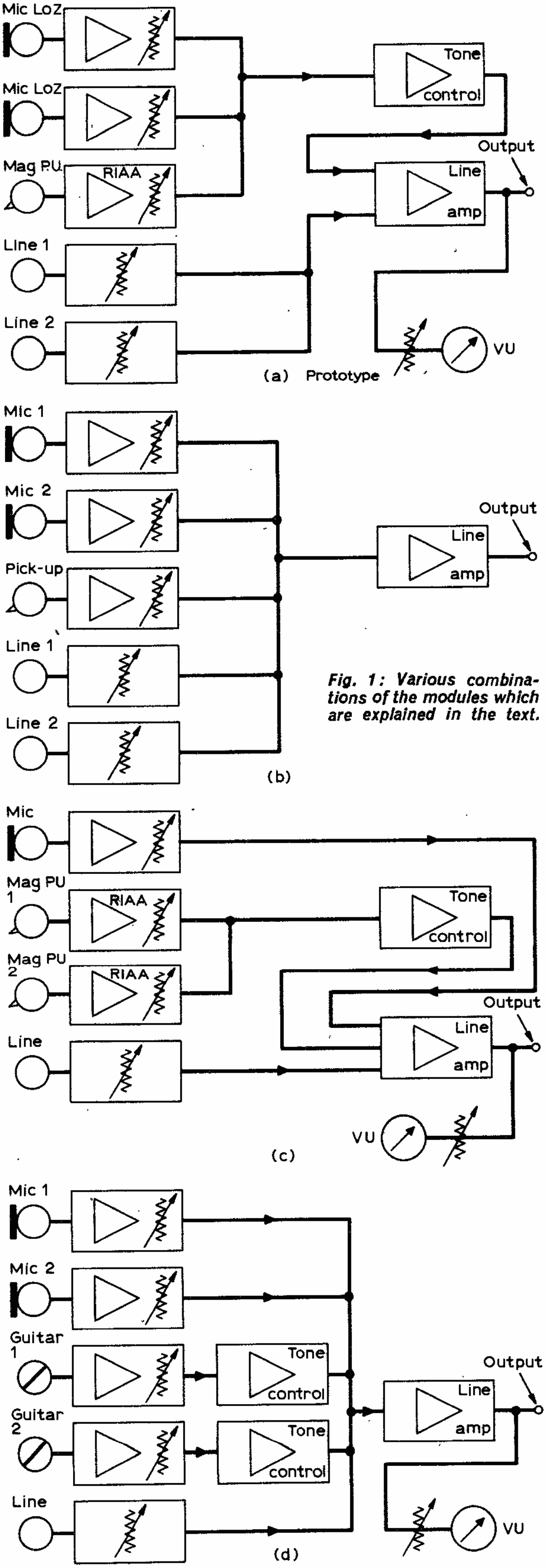


Fig. 1: Various combinations of the modules which are explained in the text.

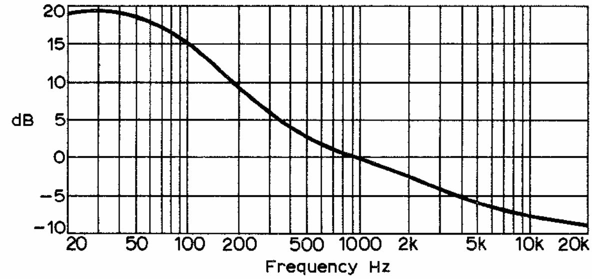


Fig. 2: The RIAA response curve incorporated in the magnetic pickup module.

5. CERAMIC PICKUP. Input impedance 2MΩ. Input sensitivity 60mV. Output 100mV. Frequency response approximately 20 to 20,000Hz ±1dB. Equalisation automatic due to high input impedance. Signal-to-noise −50dB. (Code: **PU Cer.**)
6. CRYSTAL PICKUP. Input impedance about 1MΩ. Input sensitivity 850mV. Output 100mV. Frequency response approximately 20 to 20,000Hz ±1dB. Equalisation automatic due to high input impedance. Signal-to-noise −60dB. (Code: **PU Xtal.**)
7. GUITAR PREAMP. Input impedance medium, 10 to 100kΩ. Input sensitivity variable. 50 to 100mV. Output 100mV. Frequency response ±1dB 20 to 30,000Hz. Signal-to-noise −50 to −60dB. (Code: **G.**)

The tone control unit will take the output from any of the preamps and provides 100mV output so that it can be coupled directly to the line amplifier. Its performance is as follows:— With tone controls neutral the flat response is 10 to 80,000Hz ±1dB. The response of the bass and treble controls is shown in Fig. 3 providing 15dB lift and 12dB cut at 40Hz and 15dB lift to 12dB cut at 20,000Hz The signal to noise performance is better than −90dB. (Code: **TC**).

The line amplifier unit will accept the output from any of the preamps or the tone control unit and therefore has an input sensitivity of 100mV. The output signal level available is 1V r.m.s at an impedance of approximately 600Ω. The frequency response is flat from 10 to nearly 100,000Hz and the signal-to-noise performance −80dB. The output can be fed simultaneously to one or more tape recorders and/or amplifiers via series output resistors as will be shown. The overall gain of the line amplifier is adjustable i.e., the input sensitivity can be increased. (Code: **LA.**)

The line inputs do not require separate preamplifiers as these are arranged in passive network coupling directly to the line amplifier. The input sensitivity will be 200mV to over 1V r.m.s. at approximately 10kΩ impedance. (Code: **L input.**)

CONSTRUCTION

The construction of each of the preamplifier modules is such that the circuit board is mounted on a small screen this, in turn, being secured to the fixing bush of the gain control (VR1 in each circuit). The complete preamp can therefore be secured to a front panel by the lock nut of the gain control. The tone control unit is similar except that there are two potentiometers and both are mounted on the small screen and then secured to the panel. The line amplifier can be simply mounted on a piece of aluminium angle ($^3/_8 \times {}^3/_8$in) or on stand-off pillars as convenient. It need not be fixed to a panel but must

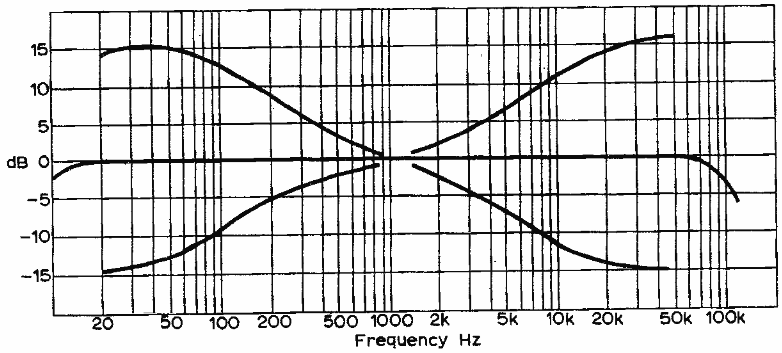


Fig. 3: Response curves of the tone control module.

be fairly well clear of mains power supply components. The input sockets for all inputs must be insulated from the front panel and earthed only at the common earthing point on the preamplifier board. *If the mixing unit is to be mains powered, the components for the power supply must be kept as far away from the amplifier boards as possible and preferably with a screen around them.*

The seven preamplifier boards are exactly the same and details for construction are given in Fig. 4. In each case the gain control (VR1) is fitted as shown

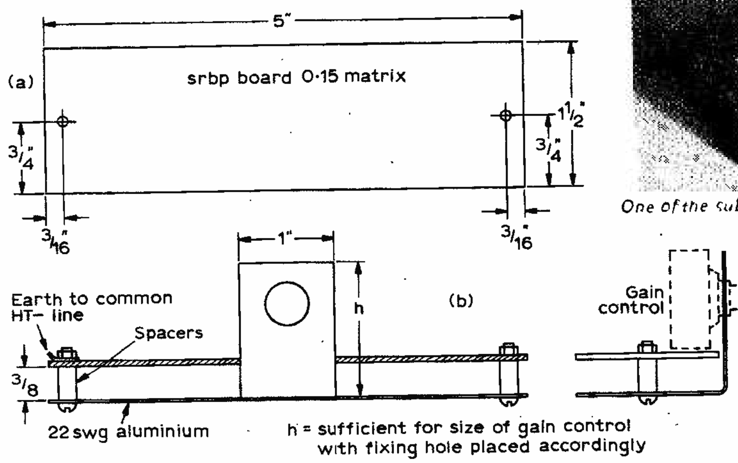


Fig. 4: Details of the sub-chassis used for each module.

in Fig. 4c. The construction of the tone control board is similar except that two controls have to be fitted so the screen has two flaps as shown in Fig. 5. The height of each flap and the position of the fixing hole will depend on the physical size of the potentiometers used.

CIRCUITS AND ASSEMBLY OF THE MODULES

Each of the amplifier modules and the tone control

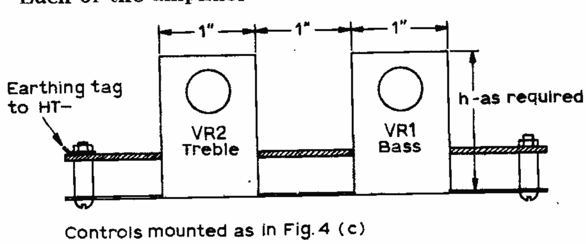
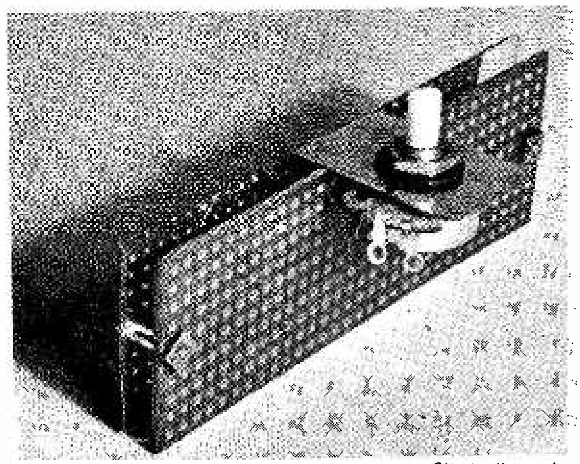


Fig. 5: Modified sub-chassis for the tone control module.

can be tested separately by operating them from an 18V battery (two 9V units) and by checking each one with an audio signal generator and audio voltmeter or by connecting an appropriate input signal source and feeding the output to an amplifier.

LINE AMPLIFIER

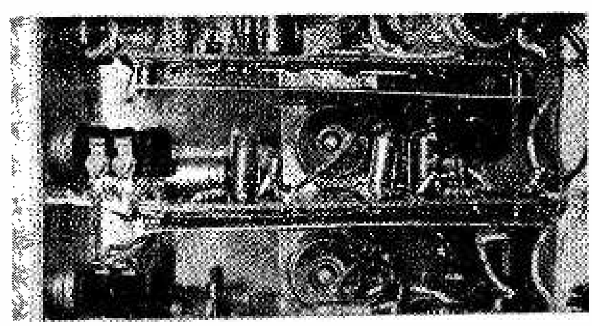
The best order of construction is to build the line amplifier (code: LA) first so that the preamps can be tested with it as each is completed. The circuit is given in Fig. 6 and the board layout in Fig. 7. As



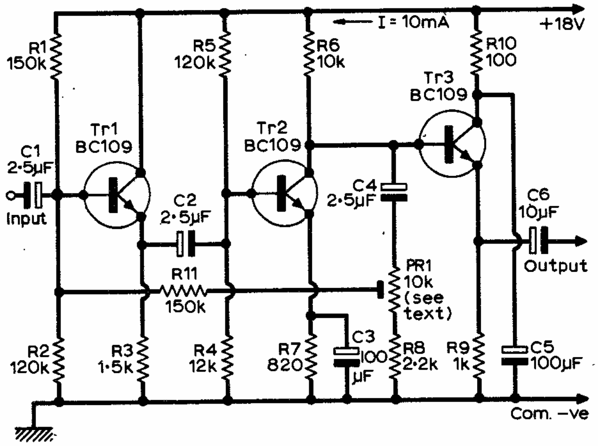
One of the sub-chassis before the components are fitted; dimensions are given in Fig. 4.

with all the circuits except the tone control unit only one type of transistor is used—the BC109 silicon NPN—which is readily available and inexpensive. The line amplifier employs three of these beginning with Tr1 as an emitter follower input stage with Tr2 as the amplifier.

Negative feedback between Tr2 and Tr1 via the pre-set PR1 ensures a linear response and some adjustment over total gain. The pre-set should be adjusted so that with a 100mV input signal the output at C6 is exactly IV. If a signal generator and audio voltmeter are unavailable, set PR1 to midway position. The output transistor Tr3 operates as an emitter follower and provides a low impedance



An internal view of the prototype showing one of the modules. The input jack is on the left with the common wiring on the right.



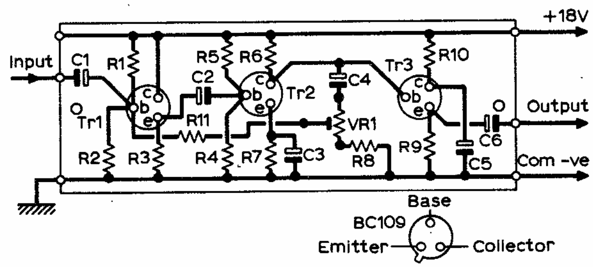
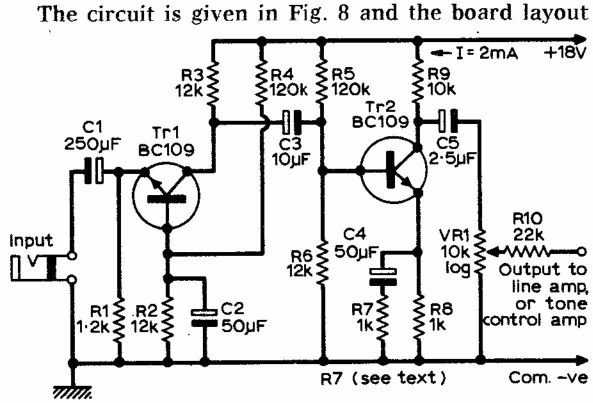


Fig. 6: (above) and Fig. 7 (below): The circuit and layout of the line amplifier module.

output. Details for feeding more than one power amplifier and/or tape recorder from the line amplifier output will be given later.

MICROPHONE PREAMP (Mic Lo-Z)

The circuit is given in Fig. 8 and the board layout



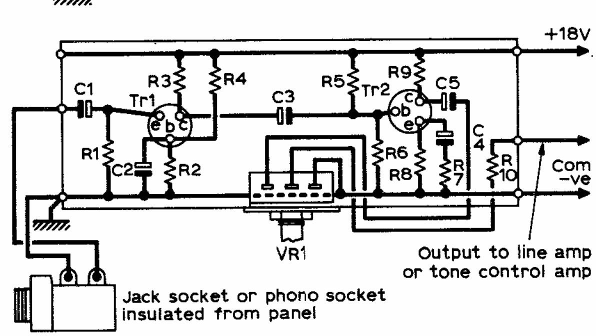


Fig. 8 (above) and Fig. 9 (below): The circuit and layout of the low impedance microphone preamplifier module.

★ components list

Amplifier Modules Circuit Boards

0.15 matrix s.r.b.p. board to sizes given. 22 s.w.g. aluminium for module screens to sizes given.

Line Amplifier (LA)

Tr1, Tr2, Tr3		BC109
PR1	10kΩ	Miniature carbon pre-set

Resistors

R1	150kΩ	R6	10kΩ
R2	120kΩ	R7	820Ω
R3	1.5kΩ	R8	2.2kΩ
R4	12kΩ	R9	1kΩ
R5	120kΩ	R10	100Ω

All ¼W, 10% types

Capacitors

C1	2.5μF	25V	C4	2.5μF	25V
C2	2.5μF	25V	C5	100μF	25V
C3	100μF	25V	C6	10μF	25V

Microphone Pre-amplifier (Mic. Lo-Z)

Tr1, Tr2		BC109
VR1	10kΩ	Log. Potentiometer

Resistors

R1	1.2kΩ	R6	12kΩ
R2	12kΩ	R7	1kΩ
R3	12kΩ	R8	1kΩ
R4	120kΩ	R9	10kΩ
R5	120kΩ	R10	22kΩ

All ¼W, 10% types

Capacitors

C1	250μF	25V	C4	50μF	25V
C2	50μF	25V	C5	2.5μF	25V
C3	10μF	25V			

Power Supply

Transformer T1	18V Secondary	Henry's Radio Type MT95
Bridge Rectifier MR1		Henry's Radio Type LT119
C1	2500μF	25-30V
C2	5000μF	25-30V
R	¼W—see text	

On/Off mains toggle switch

Panel neon indicator

All electrolytics used in the amplifier circuits should be rated for at least 25V working.

Each pre-amplifier will require an input jack socket or phono socket of the type that can be insulated from the panel on which they are mounted.

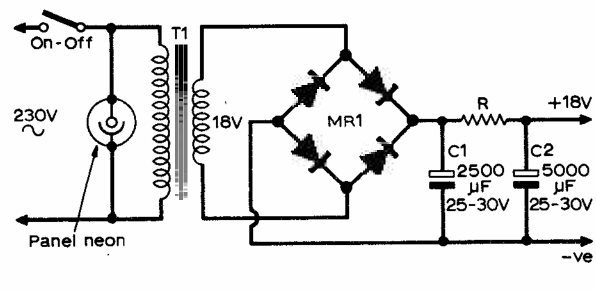
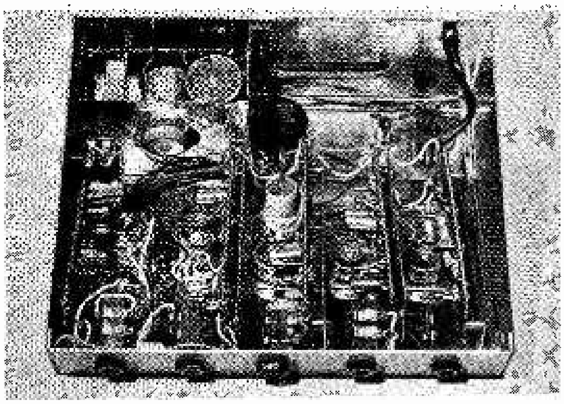


Fig. 10: Suggested circuit for a mains power supply to power the mixer.

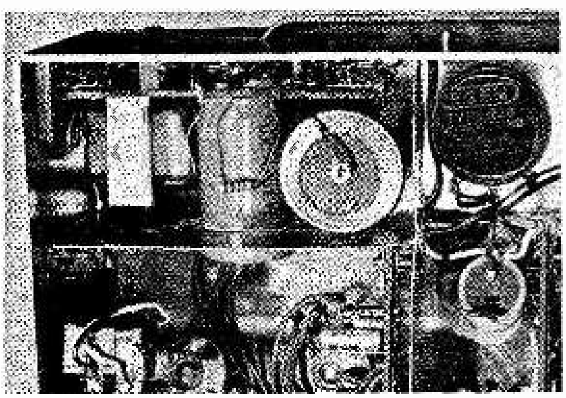
in Fig. 9. The input transistor Tr1 operates as a grounded base amplifier and provides a very low impedance input. Tr2 is a signal amplifier with negative feedback introduced by R7 in series with the emitter by-pass capacitor C4. This resistor can be reduced a little in value to obtain more gain for very low output microphones, although it should not be less than 680Ω otherwise the noise level will rise excessively. As with all the preamplifiers the output is taken to the gain control VR1 and thence via the series resistor (R10) which becomes part of the passive mixing network common to all the preamps.

MAINS POWER SUPPLY

The current consumption of the preamplifiers at



Internal view of the completed prototype.



The power supply should be properly screened as shown.

18V varies between about 2 and 5mA. The line amplifier takes 10mA and the tone control unit 5mA. Four preamplifiers, a line amplifier and say one tone control unit, would require about 25mA which could be drawn from an 18V battery with reasonable economy. Two PP9 batteries would be ideal. Larger mixing units, particularly if built for stereo use and requiring duplication of preamps etc. are best operated from a mains power supply. One that will provide well over 100mA is given in Fig. 10 (see components list for transformer and rectifier details). The resistor R will be around 1kΩ for low current drain and of lower value for higher current drain. With the mixing circuits running, adjust R to obtain 18V across C2.

Part 2 next month, will deal with the rest of the preamplifier modules.

TO BE CONTINUED

CHARLES MOLLOY

THE Medium Wave Column

A NEW 1000kW station on 1457kHz located near Tirana in Albania is being heard in this country as a background to BBC Radio 4, (South and West). It relays Radio Peking and has been heard at 2100hrs GMT with the identification 'Govarit Pekin' followed by programmes in Russian. An increasing number of superpower broadcasters are appearing on the medium waves. Urumchi in Western China (2000kW) is audible all evening on 1525kHz; listen between Prague 1520kHz and Vatican Radio 1529kHz for Russian speech plus jamming. Libya has two megawatters—El Beida on 1124kHz and Tripoli on 1250kHz. El Beida is the stronger of the two; it is heard with EAJ15 Barcelona on the same frequency throughout the evening. Tripoli suffers from interference from Dublin/Cork until 2245hrs when the latter close down, leaving the channel clear. Further east, Riyadh (1200kW) in Saudi Arabia is on 587kHz and has been logged before midnight with Arabic programming.

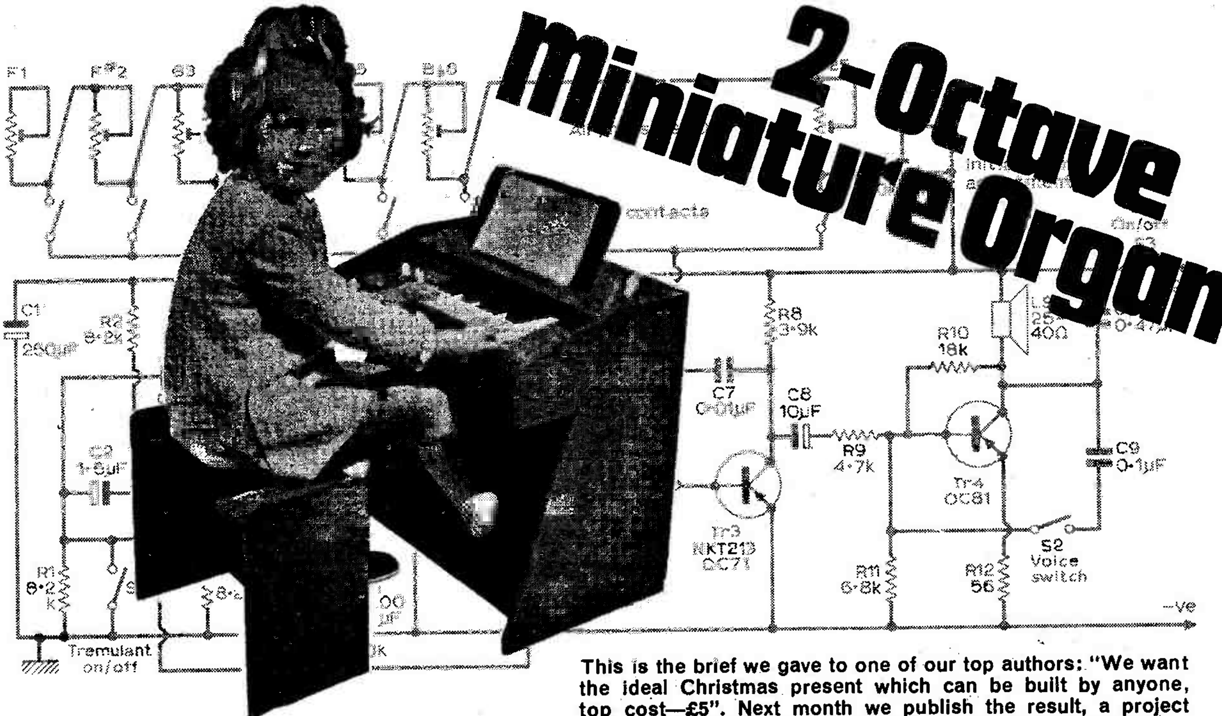
Calcutta 1130kHz (1000kW) was heard frequently last winter before sign-off at 1700hrs. It is now on extended schedule and has been several times during the summer at 2230hrs GMT, as it changes from Chinese to Indian programming. There are three Voice of America stations in the Far East, each with 1000kW, all of which have been heard in the U.K. Bangkok, Thailand 1580kHz was logged at the end of September last year at 2200hrs GMT while Poro 1140kHz in the Phillipines and Okinawa 1178kHz in the Ryuku Islands are both heard in winter before sign-off at 1700hrs.

'Book of the World 1971' is the title of an unusual paperback now on sale in the bookshops. Sections deal with 181 different countries, each with a map plus details of the type of government, languages spoken, religions and currency. As well as providing the DXer with a valuable aid to station identification, this book gives background information on countries logged and adds interest to the hobby.

Broadcasts in English on the medium waves can be heard from a number of unexpected places during the late evening. Timisoara, Rumania on 755kHz has a programme in English, French and German at 2230hrs GMT, which should not be confused with the Voice of the West, in Portugal, also on 755, which starts its English programmes at 2245hrs. The Voice of America in Rhodes is 1259kHz is heard regularly in English between 2100hrs and midnight, with some interference from Wroclaw in Poland. Rhodes is one of the Dodecanese Islands situated near the coast of Turkey, which are usually counted as a separate country by DXers. The VOA is also heard in English from Thessalonika, Greece 791kHz between 2100hrs and 2130hrs. Enugu, Nigeria 1320kHz, although only 10kW, is a weak but consistent signal at 2300hrs GMT when it carries it's final news in English before closing down. ELBC Monrovia, Liberia on 629kHz has English programming and is usually logged between 2330hrs and sign-off at 0045hrs.

* IN NEXT MONTH'S PRACTICAL WIRELESS

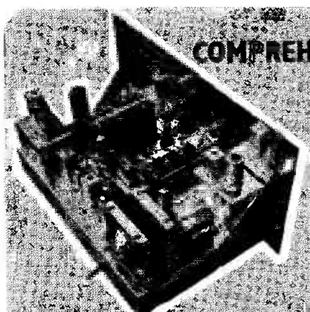
2-Octave Miniature Organ



This is the brief we gave to one of our top authors: "We want the ideal Christmas present which can be built by anyone, top cost—£5". Next month we publish the result, a project which will go down as one of the all-time 'greats', a **2-Octave Miniature Organ**—complete with voicing and tremulant. The electronics is dead simple (just look at the circuit sketch above!) and the cabinet woodwork can be built by anyone who can use a saw. The £5 cost includes everything—just as you see it.

Special Feature

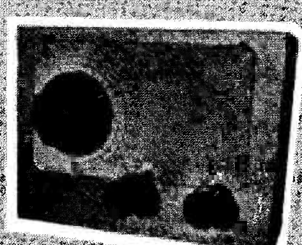
* What to look for at the AUDIO FAIR *



COMPREHENSIVE MULTI-BAND RECEIVER

Do you want to build a communications receiver in easy stages? This design initially provides a basic 3 valve receiver, complete in itself, covering 550kHz to 30MHz with full bandspread. At your leisure add an RF stage, a simple crystal filter, a carrier oscillator/product detector for receiving SSB/CW and finally a crystal marker. Full constructional details.

BASIC SIGNAL GENERATOR

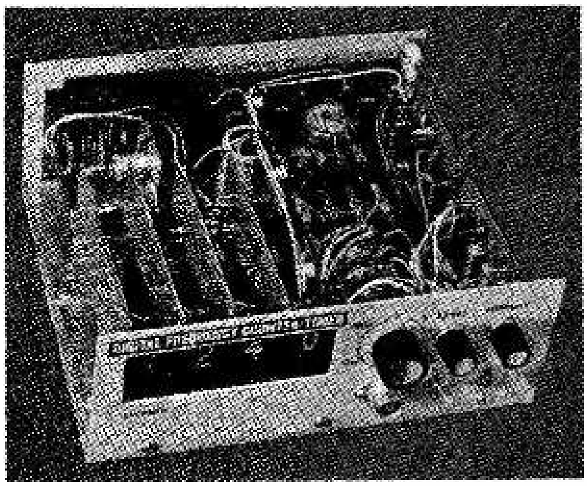


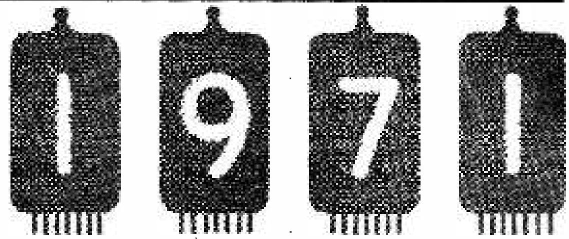
A signal generator is essential for the testing, alignment and calibration of receivers and for quick tests of audio circuits. For the beginner or occasional dabbler, this basic design should prove ideal, with modulated or unmodulated outputs from 150kHz to 1·6MHz plus a direct audio source; all outputs are fed via a variable attenuator.

ALL IN THE NOVEMBER ISSUE ON SALE OCTOBER 8th

Plus many other constructional articles and all the regular features. Be certain not to miss the next issue, price 20p.

DIGITAL FREQUENCY COUNTER/TIMER





J. THORNTON-LAWRENCE GW3JGA

NOTE

Several wiring connections were omitted from figure 6 in the September issue. Pin 10, on IC's 3, 4, 5, 6 and 7, should be shown connected to the OV rail. Pins 1 and 12 on IC's 9, 11, 13 and 15, should be shown joined.

On IC1, pin 4 is the +5V supply rail and pin 11 is OV supply rail. On IC2, pin 14 is +5V supply rail and pin 7 OV supply rail. These latter connections were omitted from figure 6 for clarity.

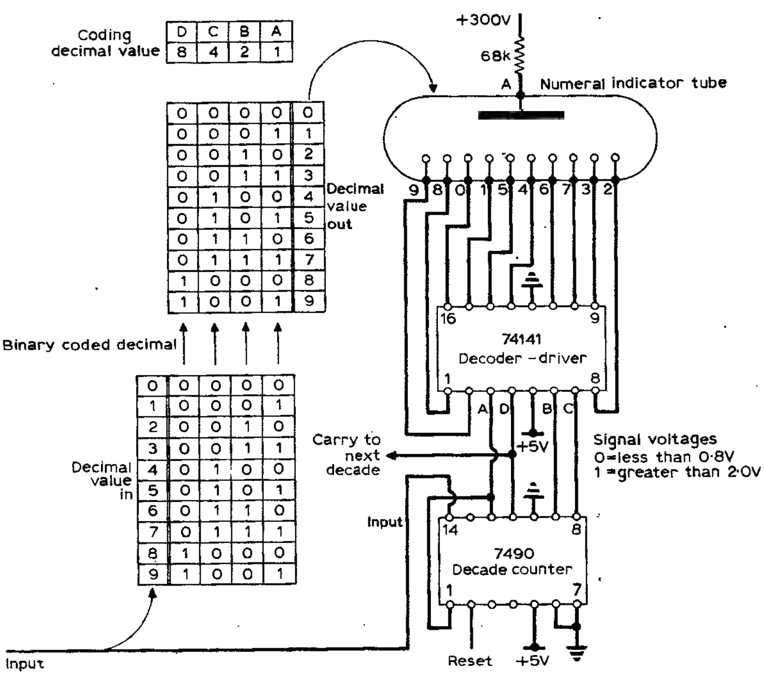
PART 2 *(continued from the September issue)*

This negative going step is passed by C5 to Tr7 base which moves by −5 volts thus cutting off Tr7 and allowing the collector of Tr7 to rise to +5V.

The current through VR2 and R14 discharges C5 so that the negative voltage on Tr7 base rises exponentially until Tr7 conducts. The rate is determined by the setting of VR2, the DISPLAY control.

When Tr7 conducts, its collector voltage starts to fall, turning off Tr6 and thus increasing the base current to Tr7 and producing a fast negative going voltage at Tr7 collector. This voltage step is differentiated by C7, R16 and R17 and inverted by IC2d to give a positive pulse of 200μS duration.

The positive going edge of this pulse resets the counter to zero and the negative going edge sets the JK flip-flop IC1a and causes the cycle of operation to be repeated. The time for which the reading is displayed is controlled by the DISPLAY control and this is adjustable from about 0·5 second to 2 seconds.



Coding decimal value	D	C	B	A	
	8	4	2	1	Decimal value out
	0	0	0	0	0
	0	0	0	1	1
	0	0	1	0	2
	0	0	1	1	3
	0	1	0	0	4
	0	1	0	1	5
	0	1	1	0	6
	0	1	1	1	7
	1	0	0	0	8
	1	0	0	1	9

Decimal value in				
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1

Fig. 9: Table showing the operation of the decade counter and decoder-driver.

Counter and Display

The counter and display has four decades, each decade operates in the same way. The output of one decade is linked to the input of the next higher decade to perform the 'carry' operation and a reset connection is common to all decades.

The input to the counter is a series of pulses. The counting has to be carried out in binary form and then decoded into decimal form for display.

This is done using a decade counter I.C. type SN7490N, which consists of 4 master-slave flip-flops forming a ÷2 counter and a ÷5 counter.

The input signal goes to the input of the ÷2 counter (pin 14) and the output of this (pin 12) is linked externally to the input of the ÷5 counter (pin 1).

The outputs of the four flip-flops are called A, B, C, D and have a decimal value of 1, 2, 4, 8 respectively. The table showing the operation of the decade counter is included in Fig. 9.

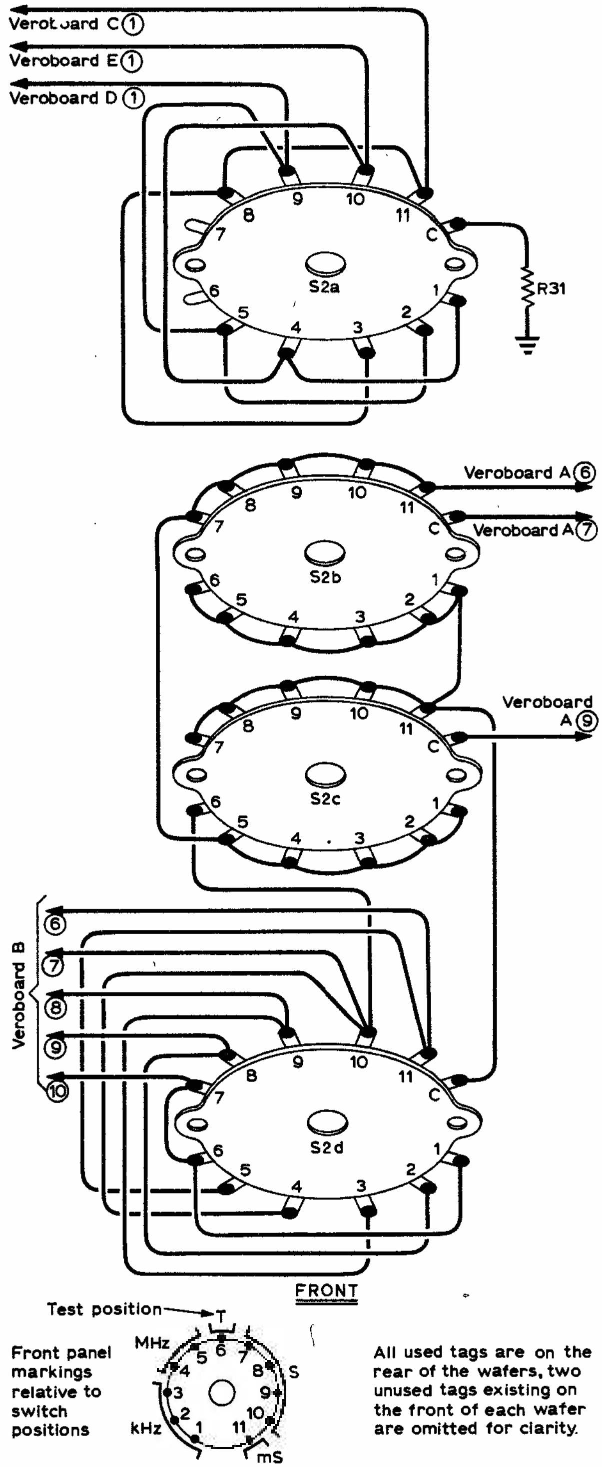


Fig. 10: Exploded view of the function switch S2, viewed from the front.

The counter can be reset to zero at any time by the application of a positive pulse to pin 2.

The binary coded decimal output from the counter, A, B, C, D is connected directly to the inputs of the decoder/numeral tube driver I.C. type SN74141N. Here the inputs are decoded back into decimal form for driving the numeral tube (Hivac Type XN13).

The numeral tube contains neon gas at low pressure and has an anode and 10 wire cathodes in the form of numerals, 0-9.

With the anode connected to HT+ through a current limiting resistor, any cathode which is connected to 0V will be surrounded by a glow showing up the shape of the number.

The outputs of the decoder-driver are collector circuits of high voltage transistors which, when made to conduct, effectively connect the appropriate cathode to 0V. For example, suppose the input to the decade counter receives 5 pulses or cycles of input signal. The output will be D low, C high, B low, A high, representating a binary number of 0101. This number is decoded in the decoder/driver to figure 5 and the figure 5 output (pin 14) becomes switched to 0V causing the figure 5 to be displayed in the numeral tube.

Each counter, decoder/driver and tube is built on a Veroboard panel and the inter connection of these panels is shown in the main diagram Fig. 6.

The decimal indication is provided by miniature wire ended neon indicator lamps mounted between two numeral tubes and these are switched by the function switch S2a.

Function Switch

The function switch S2 is made up from Radiospares Miniature 'Maka Switch' parts and consists of a shafting unit and 4 break-before-make 1 pole 12 way wafers. The wafers are spaced by 2 spacers on each side. Only 11 positions are used and the stop on the indexing mechanism is adjusted accordingly.

The wafers are lettered a, b, c and d, starting at the rear and working towards the indexing mechanism. Wafer 'a' controls the decimal point neon lamps, wafer 'b' the clock period input to the gate, wafer 'c' the signal input to the gate and wafer 'd' the output from the clock divider.

In the frequency positions 1 to 5, the output from the input stage is fed to the 'Signal Input' of the gate and the appropriate clock signal is fed to the 'Clock Period Input' of the gate. In the time positions, 7 to 11 of the switch, the output from the input stage is fed to the 'Clock Period Input' of the gate and the appropriate clock signal is fed to the 'Signal Input' of the gate.

A test position is provided in position 6 where the 1kHz clock output is counted for a period of 1 second to give a reading of 1,000. The test position only serves to check that the gate, counter and display are functioning, it does not provide a check of the crystal oscillator frequency.

The wiring and connections to the switch are shown in Fig. 10. The method of assembly is as follows:

1. On the shafting unit, check that the lengths of studding are screwed fully into the indexing mechanism plate and remove the end nuts and washers.

2. Rotate the switch spindle to the fully anti-clockwise position (as viewed from the front). The flats on the wafer end of the spindle should be in line with the studding. This is position "1".

3. The switch should now be held so that the lengths

of studding are at each side and the control knob end of the spindle is towards you, as shown in Fig. 10.

4. Take a 1 pole 12-way wafer and hold this with the side having the majority of tags, away from you and with the two tags that are facing you positioned in the top right hand segment. Rotate the rotor section until the common or rotor contact is making contact with tag 1. The slot in the rotor should now be horizontal.

5. Assemble the wafer on to the shafting assembly, keeping the side with the majority of tags facing away from the indexing mechanism. This wafer is now wafer "d" in Fig. 10.

6. Fit 2 spacers on each piece of studding.

7. Fit another wafer as described in operation 4 and 5 (wafer "c").

8. Repeat operations 6 and 7 until four wafers have been fitted (wafers "b" and "a").

9. Fit washers and fixing nuts to the studding.

10. The rotation of the switch should now be checked to see that all parts operate smoothly.

11. The rotatable stop plate, which is located on the face of the indexing mechanism, should now be set to give 11 positions, working clockwise and commencing from the maximum anti-clockwise position. This is the position at which all the wafers have been set. The stop plate may be held in place temporarily by the mounting nut, ready for assembly to the front panel.

12. The wiring of the switch may now be carried out as shown in Fig. 10. 22 s.w.g. tinned copper wire is used for wiring from tag to tag, sleeving being necessary only when crossing between wafers.

13. The correctness of the wiring can be checked by using an ohm or continuity meter and measuring between the appropriate tags whilst the switch is rotated, e.g. S2b/C is connected to S2d/C in positions 1, 2, 3, 4, 5 and 6.

Power Supply

The power supply consists of a Radiospares Midget Mains transformer which with its associated rectifiers smoothing and regulators provides

+300V	at 10mA	Unregulated
+5V	at 350mA	Regulated
−5V	at 5mA	Regulated

The output from the 250 volt secondary winding is rectified by D7 and smoothed by C12 to give about +300V output. The negative return is through R24 and D9 to 0V. The negative supply derived in this way is smoothed by C13 and regulated by the zener diode D9 to give −5V. The I.C. logic requires about 350mA at +5V and this is provided by the 6·3 volt filament winding on the transformer.

The 6·3 volt output is full wave bridge rectified to give about +7·5 volt across the reservoir capacitor C14. This feeds the zener diode D6 and the power emitter follower Tr11 to give the required 5V output.

Veroboard Panels

The layout drawings of the 0·1×0·1in matrix Veroboard show the copper strip side of the panel the components on the reverse side being "seen through" the copper strips.

Each copper strip is given a letter code and each

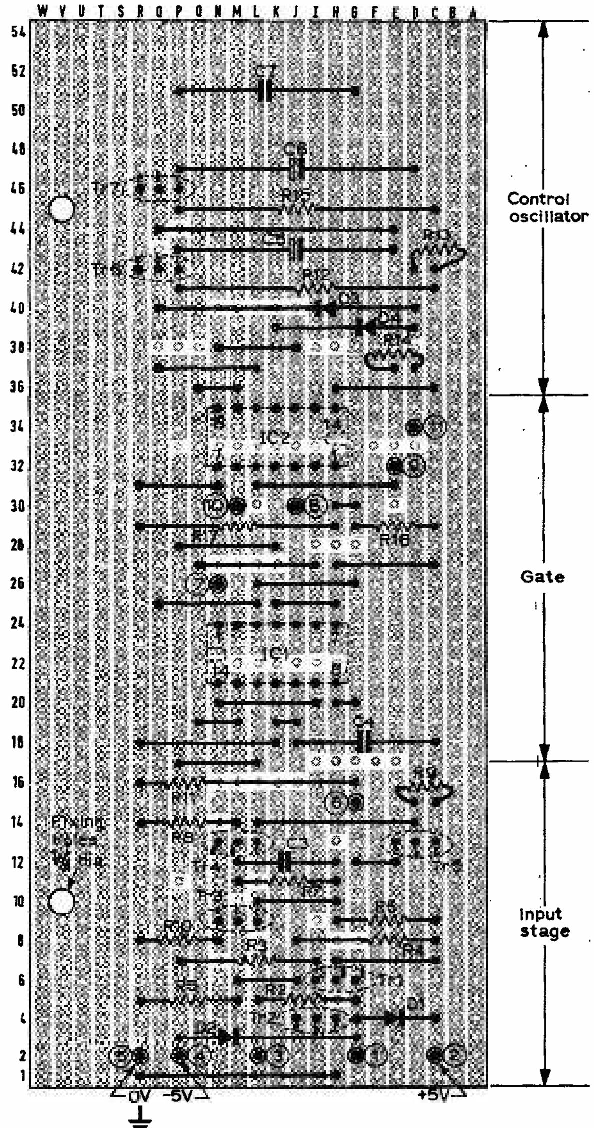


Fig. 11. Veroboard panel A. Input stage, gate and control oscillator. Viewed from copper side. Note correct orientation of integrated circuits when fitting. The integrated circuits and their holders are indented at one end to assist orientation.

horizontal row of holes, a number.

All solid horizontal lines represent wire links which connect one strip to another.

The orientation of integrated circuits and transistors should be noted carefully, some transistors may have unusual lead positions and these may have to be crossed over for the connections to be correct. Assembly of the components, etc., must be carried out in a systematic manner or errors will result. A suggested method is as follows:

1. Cut the Veroboard to the correct dimensions using a fine toothed saw and working from the copper side. Apart from checking the physical dimensions, also check that the correct number of holes appear in each direction.

2. Fix strips of masking tape on all four edges of the Veroboard panels. Also fix masking tape to the same edges on the reverse (copper) side of the board.

DISCOUNTS UP TO 60% ON BRANDED GOODS

ALL BRAND NEW in manufacturer's sealed cartons. GUARANTEED 12 MONTHS.

SONY · LEAK · SINCLAIR · TELETON · ARMSTRONG · THORENS · PHILIPS · K.E.F. · TEAC · ROGERS · PIONEER

SPECIAL OFFER

Garrard SP25 Mk.III.

Goldring G800H

Teak plinth and tinted cover. Ready wired for immediate use.

£18·50

Please add £1·15 for post & packing

TURNTABLES

Please add 50p for post and packing

*Garrard SP25 MkIII	£10·75
*Garrard 2025TC with stereo cart.	£8·00
*Garrard 2025TC with Sonotone 9TAHC	£8·95
*Garrard 3000 with Sonotone 9TAHC	£10'25
*Garrard SL65B	£13·25
*Garrard AP76	£18·75
*Garrard SL72B	£24·00
*Garrard SL75B	£26·00
*Garrard SL95B	£35·50
Garrard 401	£27·00
*B.S.R. MP60	£11·00
Pioneer PL12AC	£39·00
Thorens TD 125	£62·50
Thorens TD 125AB	£98·50
Thorens 150 AB11	£42·50
Goldring GL69/2	£21·50
Goldring GL69 P2	£29·50

* *Items marked can be mounted in plinth and cover, ready wired for £4·50 extra plus 25p for post & packing.*

AMPLIFIERS

Please add 50p for post and packing

Armstrong 521 (cased)	£41·95
Amstrad 8000	£17·70
Dulci 207	£15·95
Dulci 207M	£21·00
Europhon 10+10	£14·50
H.L. Audio 707	£17·75
Metrosound ST20E	£29·00
Philips R580	£20·50
Pioneer SA500	£41·50
Pioneer SA700	£68·00
Pioneer SA900	£94·50
Rogers Ravensbrook Chassis	£36·00
Rogers Ravensbrook Cased	£41·00
Rogers Ravensbourne Chassis	£45·00
Rogers Ravensbourne Cased	£48·50
Sinclair 2000·MkI	£21·00
Sinclair 2000 MkII	£28·25
Sinclair 3000	£32·50
Sinclair PRO 60/2×Z30/PZ5	£15·75
Sinclair PRO 60/2×Z30/PZ6	£18·00
Sinclair PRO 60/2×Z50/PZ8/Trans	£22·95
Teleton SAQ206	£18·00

TUNERS

Please add 50p for post and packing

Armstrong 523 AM/FM	£40·00
Armstrong 524 FM	£31·00
Dulci FMT7	£19·50
Dulci FMT7 Stereo	£27·00
Teleton GT101 MPLX	£30·50
Rogers Ravensbourne FET 2 Chassis	£45·50
Rogers Ravensbourne FET 2 Cased	£49·00
Rogers Ravensbrook FET 4 Chassis	£37·50
Rogers Ravensbrook FET 4 cased	£38·00

PICK-UP ARMS

Please add 35p for post and packing

SME 3009/S2	£23·95
SME 3012/S2	£25·75
Goldring L75	£9·50
Goldring L69	£7·50
Audio-Technica AT1005	£14·95

TUNER AMPLIFIERS

Please add 75p for post and packing

Armstrong 525FM	£68·75
Armstrong 526 AM/FM	£78·75
Teleton CR10T with speakers	£26·25
Teleton F2300 (new product)	£38·50
Teleton CR55	£87·00
Teleton TSF50	£51·75
Teleton F2000	£31·00
Wharfedale 100-1	£103·00
Teleton TFS50LA	£60·00
Teleton 2100	£34·00

SPEAKERS

Please add £1·25 for post and packing

(PRICE PER PAIR)

Wharfedale Denton	£29·75
Wharfedale Melton	£49·90
Wharfedale Triton	£45·75
Wharfedale S/Linton	£40·75
Keletron KN500	£15·00
Keletron KN700	£18·00
Keletron KN123/3	£31·50
Keletron KN1000	£27·50
Keletron KN1500	£37·00
Keletron KN2000	£41·50
K.E.F.	by letter
Celestion Ditton 120	£35·50
Celestion Ditton 15	£49·50
Celestion Ditton 25	£101·00
Celestion Ditton 10	£67·50
Ste-Ma 400	£34·00
Ste-Ma 300	£48·50
Ste-Ma Hi-Fi 4	£78·00
Ste-Ma Hi-Fi 115	£17·50
Ste-Ma Hi-Fi 3	£63·50

GLOBAL CONTRACT SERIES

Contract 8 3-way 7 watts R.M.S.	£16·00
Contract 6 3-way 5 watts R.M.S.	£10·75

SPEAKER KITS

Wharfedale Unit 3	£20·50
Wharfedale Unit 4	£27·00
Wharfedale Unit 5	£39·00

CARTRIDGES

Please add 10p for post and packing

Goldring G850	£3·75
Goldring G800H	£5·50
Goldring G800	£6·75
Goldring G800E	£10·50
Goldring G800SE	£15·25
Sonotone 9TAHC Diamond	£1·75
Shure M3DM	£4·75
Shure M44S/7/C	£7·00
Shure M55	£9·00
Shure M75E	£14·00
Shure V15 Type 2	£28·00
Shure M44E	£8·00
Shure M31E	£8·50
Shure M32E	£8·00
Audio-Technica AT66	£4·95
Audio-Technica AT35	£14·25
SMC 101	£2·79
MC15	£4·50

TAPE DECKS & RECORDERS

Please add 75p for post and packing

Teleton FXB 510D	£44·75
Teleton TCR130	£22·90

PERSONAL CALLERS VERY WELCOME!

Come and browse through our multi 1,000 foot warehouse/showroom.

NO PARKING PROBLEM

PURCHASE TAX CUT!!

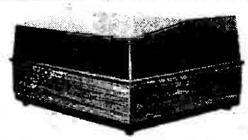
—we pass these reductions to you

The following branded names are not allowed to be advertised at Discount Rates—SONY, SANYO, BANG & OLUFSEN, TRIO, RADFORD, SONAB, NIKKO, CHILTON, FERROGRAPH, LUXOR, CELESTION, AKAI, TANNOY, TANDBERG, TEAC, CAMBRIDGE, ARENA, ROTEL. Send a stamped addressed envelope for a GUARANTEED DISCOUNT PRICE.

PLINTHS & COVERS

(as illustrated)

£3·20



plus 35p post and packing

Finished in real teak veneer with tinted dustcover. Ready to use (fully assembled). Suitable for Garrard SP25; 2025TC; 3000; AT60; 2000; 2500; 3500; 5100; 1025; SL65B.

ALSO FOR B.S.R. McDONALD MP60 AND OTHERS

Plinths and Covers for AP76; AP75; SL72B; SL75B; SL95B. £4·20 plus 35p post and packing.

Also finished in walnut to match Japanese equipment—no extra charge.

GLOBAL TRANSEUROPEAN COMBO

Made by world famous European manufacturer

COMPLETE HI-FI STEREO SYSTEM

VHF/MEDIUM/LONG WAVE Tuner Amplifier

4 watt per channel, separate tone and balance controls. Two neat speakers with wooden slatted front. Single play deck in plinth and cover. Finished in teak. Fully guaranteed 12 months. On constant demonstration.

£37·50

plus £1·25 carriage

GLOBAL AUDIO DISCOUNT WAREHOUSES

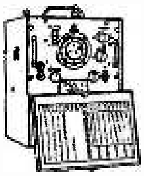
Dept. (P.W.2.) 174 Pentonville Road, London, N1. Telephone 01-278 1769

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

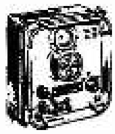
2 minutes from KING'S CROSS, EUSTON & ST. PANCRAS on main road leading to the East and West Country

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).

BETTER GET 'SET'

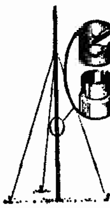


BEST OFFER YET! FAMOUS BC.221 FREQUENCY METER
125 KHz—20 MHz. Complete with valves, crystal and charts. ONLY £13·50. Carr. £1·50. LIMITED NUMBER — ORDER NOW!



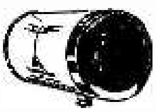
CRYSTAL CALIBRATOR No. 10 Crystal controlled heterodyne wave-meter covering 500 KHz—10 MHz (Harmonics up to 30 MHz). Power required 300V. D.C. 15mA. 12v. 0·3A. D.C. Test equipment for 62TM/RC.
ONLY £4·25. P. & p. 50p.
FEW ONLY—No. 62 TM/RC 1·5—10 MHz £17·50. Carr. £2.

MARCONI 801A SIGNAL GENERATOR
10—310 MHz. In original transit case. £45. Carr. £2·50.



AERIAL MAST EQUIPMENT
20' TELESCOPIC MASTS £3·75. Carr. £1.
5' 2" Extension Sections to fit bottom of above mast to increase height. £1·25 each (any number supplied).
35' MAST (7—5' 2" interlocking sections) with base plate and 12 nylon guys with semi-auto tensioner. £22·50. Carr. £2·50.
70' MAST. Ditto.16 guys, block and tackle. £45. Carr. £2·75.

AERIAL RODS 3ft.
Screw-in 1" dia. sections. Brand New, green finish. Suitable for many other uses. 10 for £2. Carr. 50p. 25 for £5. Carr. Paid.



R.F. ANTENNA TUNER (A.T.U.)
Cylinder design 10" x 4½". Precision calibrated scale. Suitable for tuning most aerials for increased signal strength. A must for serious operators for RC or TM. Full instructions.
ONLY £1·75. P. & p. 25p.

R.F. ANTENNA TUNER (A.T.U.) OPEN TYPE
Mounted on ceramic former and feet.

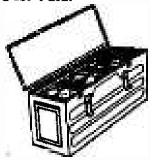
"Roller Coaster" design 16 G silver or silver plated wheel traversing on wire on ceramic former. Will handle considerable R.F.
In original packing. As used with No. 53 Transmitter. ONLY £2·50. P. & P. 50p.

No. 19 SET TRANSMITTER RECEIVER
Rebuilt. Complete station with PSU, Cables, Mic, Aerial, etc. £22·50. Carr. £3.

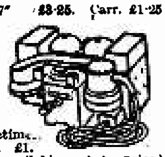
No. 19 SET 500uA METERS
Scaled 0—600 and 0—15V. Brand new, boxed £1·25 Post Paid. (Quantity prices on request.)

R.F. AMPLIFIER. To increase output of No. 19 Set. ONLY £3·75. Carr. £1·25. Instruction Book for RF Amp. 37½p Post Paid.

ALL No. 19 SPARES IN STOCK
Complete instruction book with circuits for No. 19 Equipment. 37½p Post Paid.



HEAVY DUTY BATTERIES
New in metal cases with carrying handles.
6v. 85 AH 13" x 9½" x 7" £3·25. Carr. £1·25



FAMOUS TELE 'F' FIELD TELEPHONES
Suitable for Farms, Building Sites etc. Communication up to 5 miles or more. Rugged construction, will last a lifetime.
ONLY £5·75 PAIR. Carr. £1.
(Twin telephone wire for above available—ask for price.)
Many other Ex-Govt. Surplus Equipment items in stock. Receivers etc. in small quantities too numerous to mention. Enquiries invited. LIST 25p Post Paid. (Refundable against purchases over £3.)
C.W.O. Carriage charges apply to Mainland only.

Surplus Electronic Trading

DRIVERS END LANE, CODICOTE, HITCHIN, HERTS, SG4 8TP
Hours of business: 8–5 Mon.–Fri., 8–12 Sat. Telephone: Codicote 242 for appointment

NEW 8in. SPEAKERS 15 ohms 75p, p. & p. 10p.

BARGAIN PARCELS 14lb at £1·45 plus 32½p p.p.; 28lb at £2·75 plus 52½p p.p.; 56lb at £4·50 plus £1·25 p.p. Contain pots, Res, Valves, Diodes, Tagboards, Chassis, Valve-holders, etc. Good value save £££s. Lucky Dip Service.

NEW 6 ft. VHF AERIALS. Freq. 75-78 Mc/s. 70 ohms. £2·50p, p. & p. 50p.

VHF Receiver, Type 715, less crystal 60-100 Mc/s can be operated on 2 or 4 meters or made tunable 12 volt input, not tested; complete with valves and speaker.
£3 plus £1 p.p.

VHF AERIAL TUNING UNITS consisting of the following: 1–1½" 500 micro/ampmeter. 1 small 2-gang 75 PF capacitor. 1 various large wattage resistors for dummy load. Pair gears B.N.C. type sockets. Will tune 10 mtrs with 25/30 watts R.F. input. Size only 5½" x 4½" x 5" Sealed. Price £1·37½ p.p. 25p

CRYSTALS AS NEW: Hc 6u, 5.345; 5.030; 5.005; 4,945; 4,875; 4,840; 4,795; 4,580; 4,660; 4,520; 4,510; 2,300; 2,295 Kc/s. 50p each plus 8p. p.p.

SCOOP PURCHASE OF BRAND NEW CARBON RESISTORS. 10% tolerance ½ & ¼ watt. Preferred values in packets of 10. Our price 50p per 100. 50p per 200, £1·35 per 300, 500 at £2·12½. Our selection. p.p. 8p per 100 and 2½p per extra 100.

TRIMMER BARGAINS. These are 10PF sub-min. air-spaced trimmers on board with min. wire ended Xtal. Brand new. No details: Contents 12 trimmers, some ceramic caps. Xtal frequency 3RD overtone 249 mc/s—250 Mc/s, 255 Mc/s. No choice.
Trimmers without Xtal—60p per doz. plus 17½p p.p.
Trimmers with Xtal—75p per doz. plus 17½p p.p.
Also 20 PF min. brand new air spaced.
50p per doz. plus 17½p p.p.

ANY HEIGHT AERIAL TUBULAR SECTIONS ½" dia x 3 ft. long. Brass screw in type, copper coated and painted. New 20p each. p.p. 5p. each. Minimum order 6.

BRAND NEW HARTLEY OSCILLOSCOPES CT316 in original packing. Band width up to 5 Mc/s. Mains supply. Price £40, p. & p. £1·50p.

AERIALS NEW CONDITION. Whip type 4ft 25p, 14ft. 77½p. Used condition 4ft. 20p, 14ft. 62½p. All collapsible type p. and p. 4ft. 10p, rest at 17½p. Bases for above 25p. p.p. 12½p. New matching unit coax connection for above 30p. p.p. 5p.

Huge release of valves for the 62 set TX/RX. in original rubber packing consisting of QV04/7 x 6lM, ARP12 etc. 10 valves in all at the bargain price as seen
87½p plus 17½p p.p.

R209. Set of valves 62½p. p.p. 25p.

New Headphone and Mike rubber muff type. Low impedance. 97½p. p. & p. 17½p.

NEW AERIAL WIRE ON BOARDS 7/22 UNCOVERED. 75ft, 40p, 90ft, 47½p. 100ft 55p, 150ft, 75p. 180ft, 95p. 250ft, £1·30p, p & p 12½p.

Headphones, ex Gov. DLR No. 5 high impedance. New 87½p 17½p p.p. Used condition 62½p 17½p p.p.

MUIRHEAD DECADE A.F. SIGNAL GENERATOR.
This precision instrument can be used:
1. To Measure Gain up to 50 dbs.
2. To Measure Loss up to 45 dbs.
3. To compare Power levels (A.F.).
4. As an Audio Frequency Generator covering 100 Hz to 41 kHz. With a dial setting accuracy of ±0·5 Hz. Output :—1 M/W into 600 SL. Complete with mains power unit. Tested. Good Condition. £12, p & p. 75p.

Heavy New Coax Cable 75OHM will handle at least 1KW 50ft lengths, Plug on end, £1·70p + 30p.p.

Also ¼" 75 ohm Coax in 50ft coils with BNC plugs good condition. price £1 + 30p. p.p.

2 BNC plugs on short length coax cable large size low loss plugs 30p + 5p, p.p.

Block Type capacitor TCC 8UF + 15% 350 VDC WKG 60°C. 250 VDC WK9 70°C Type 62 CIM Price 40p + 13p p.p. New.

C.W.O. CARRIAGE CHARGES MAINLAND ONLY

A. H. THACKER,
Radio Dept.,
HIGH STREET, CHESLYN HAY, Nr. Walsall. Staffs.

STROBE! · STROBE!

Build a Strobe Unit, using the latest type Xenon white light flash tube. Solid state timing and triggering circuit. 230/240V a.c. operation.

EXPERIMENTERS' ECONOMY KIT
Speed adjustable 1 to 36 Flash per sec. All electronic components including Veroboard S.C.R. Unijunction Xenon Tube and instructions £6·30 plus 25p P. & P.

NEW INDUSTRIAL KIT
Ideally suitable for schools, laboratories, etc. Roller tin printed circuit. New trigger coil, plastic thyristor. Speed adjustable 1—80 f.p.s. Price £10·50. P. & P. 50p.

HY-LYGHT STROBE MK III
This strobe has been designed and produced for use in large rooms, halls and the photographic field, and utilizes a silica plug-in tube for longer life expectancy, printed circuit for easy assembly, also a special trigger coil and output capacitor. Speed adjustable 0—30 f.p.s. Light output approx. 4 joules. Price £12·00 P. & P. 50p. Suitable metal case £3·50 extra.

AND NOW!
THE 'SUPER' HY-LIGHT KIT
Approx. four times the light output of our well proven Hy-Lyght strobe.
Incorporating:
- Heavy duty power supply.
- Variable speed from 1—23 flash per sec.
- Fantastic Octal based tube with massive electrodes.
- Reactor control circuit producing an intense white light.

The brilliant light output of the SUPER" HY-LYGHT gives fabulous effects with colour filters.
Never before a Strobe Kit with so HIGH an output at so LOW a price. ONLY £20 plus. 75p P. & P. Suitable metal case £6·50 extra.

7-inch POLISHED REFLECTOR
Ideally suited for above Strobe kits. Price 53p. P. & P. 13p or post paid with kits.

LIGHT SENSITIVE SWITCHES

All parts incl. ORP.12, relay, transistor and circuit. 6 or 12v. operation Price £1·25 plus 12p P. & P.
120/240 AC MAINS MODEL
Transformer, rectifier, special relay 1 make, 1 break. £2·38. P. & P. 20p inc. circuit.

INSULATED TERMINALS
In black, red, white, yellow, blue and green. New, 10p eacg post paid.

VENNER ELECTRIC TIME SWITCH
200/250V Ex. GPO. Tested. Manually set 2 on, 2 off every 24h. Override switch: 10A £2·75, 15A £3·25, 20A £3·75. P. & P. 20p.
Also available with solar dial ON dusk, OFF dawn. Price as above.

200-250V A.C. NEON INDICATOR

Available in red or amber at 20p each. Or in green at 32p each. Minimum order 3 units. P. & P. 5p.

ELECTRONIC ORGAN KIT
Easy to build, Solid State. Two full octave (less sharps and flats). Fitted hardwood case. Powered by two penlite 1½V batteries. Complete set of parts including speaker etc., together with full instructions and 10 tunes. Price £3·00. P. & P. 22p.

50 in 1 ELECTRONIC PROJECT KIT
50 easy to build Projects. No soldering, no special tools required. The kit includes Speaker, Meter, Relay, Transformer, plus a host of other components and a 56-page instruction leaflet. Some examples of the 50 possible Projects are: Sound Level Meter, 2 Transistor Radio, Amplifier, etc. Price £7·75. P. & P. 30p.

CRYSTAL RADIO KIT
Complete set of parts, including Crystal Diode, Ferrite Aerial, Drilled Chassis, and Personal Ear Piece. No soldering, easy to build, full step by step instructions. £1·75 inc. post.

12 VOLT DC MOTOR
Powerful 1 amp. REVERSIBLE motor. Speed 3,750 RPM complete with external gear train (removable) giving final speed of 125 RPM. Size: 4½" x 2½" dia. Price 95p inc. p

SERVICE TRADING CO

All Mail Orders, Also Callers, Parking Space.
Dept. PW10. 57 BRIDGMAN ROAD, LONDON, W4 5BB. Phone 01-995 1560.
Showrooms now open, Mon.—Fri.

Personal Callers only. Open SAT.
9 LITTLE NEWPORT ST. LONDON. WC2H 7JJ 01-437 0576.

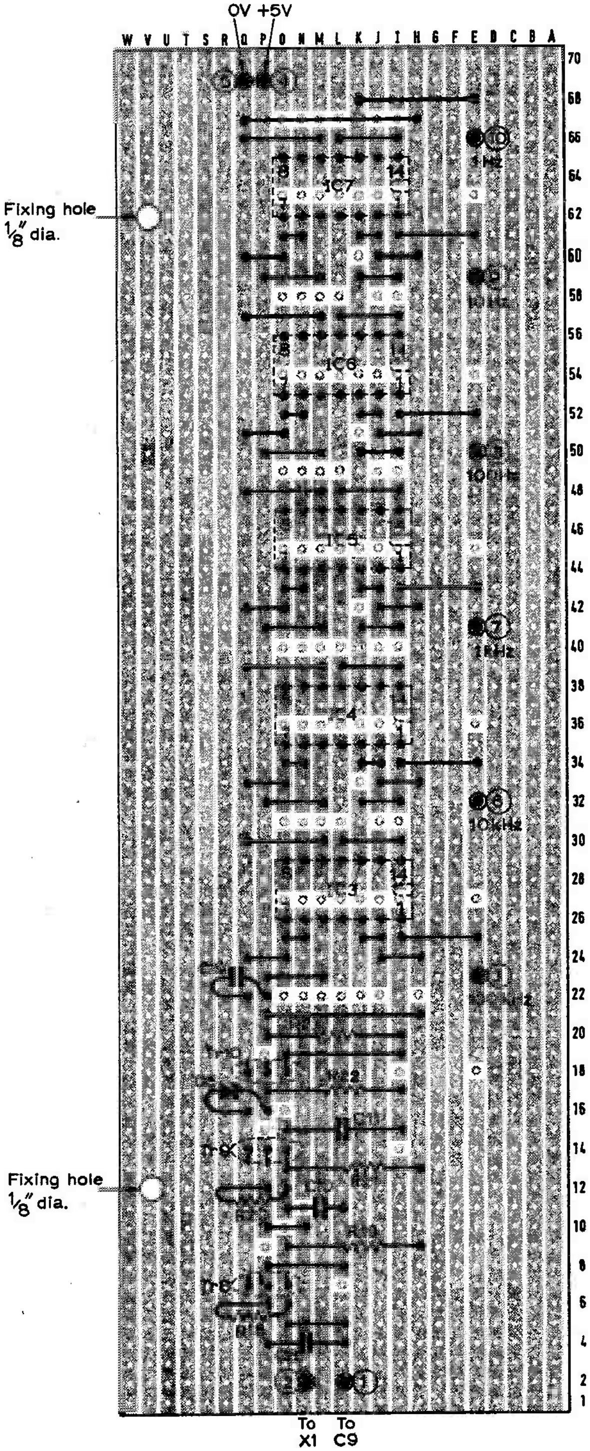


Fig. 12. Veroboard panel B. Crystal clock and divider. Viewed from copper side

3. By writing on the masking tape, letter all the vertical strips and number all the horizontal rows of holes on both sides of the board.

4. The breaks in the copper may be made using the appropriate Vero tool, part No. 2022 or by using a $\frac{5}{16}$in. drill held in a pin vice. Each copper break on the layout drawing should be identified by its co-

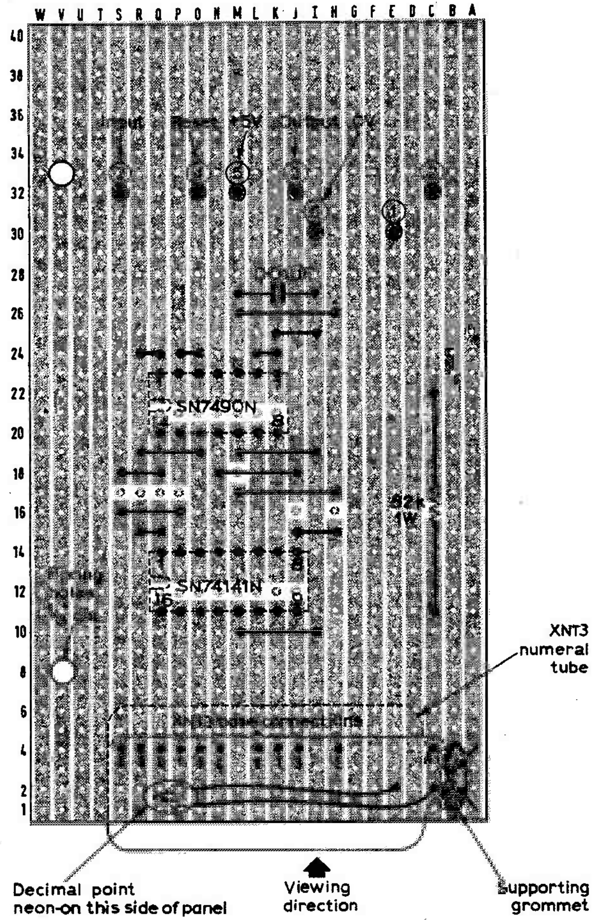


Fig. 13: Counter and display panels C. D. E. F. Panel F. does not require a neon "decimal".

ordinates, e.g. D38 and the copper strip removed by carefully rotating the tool or drill by hand using the identified hole as a guide.

Experience has shown that just counting the position of a hole is not reliable and errors are very likely to result.

5. Wire links are formed from pre-stretched 22 s.w.g. tinned copper wire. A length of about 3ft of 22 s.w.g. TC wire is stretched slightly by using a pair of pliers at each end, until it becomes stiff. All wire links are fitted on the components side.

A length, in excess of the length of the link required, is cut off and two right angled bends are made in the appropriate places to form the required "U" shaped link. A pair of pointed nosed pliers is useful for this and the span of the link can be checked by holding it against the panel in the appropriate place. When the link is inserted, the end wires may be bent outwards slightly to hold the link in place while it is soldered.

6. Components should be fixed starting at one end of the panel and the position and value checked before soldering.

7. The soldering should be carried out using a soldering iron with a small chisel shaped bit, no wider than $\frac{1}{16}$in. The cored solder used should be no larger than 20 s.w.g.

Check each soldered joint using a magnifying glass as it takes only a very small piece of swarf or solder to bridge the 0·025in gap between the copper strips.

8. Connections to the Veroboard panel are made to pins inserted in the appropriate places and soldered to the copper strip. These pins are Vero type TP 11032 or similar.

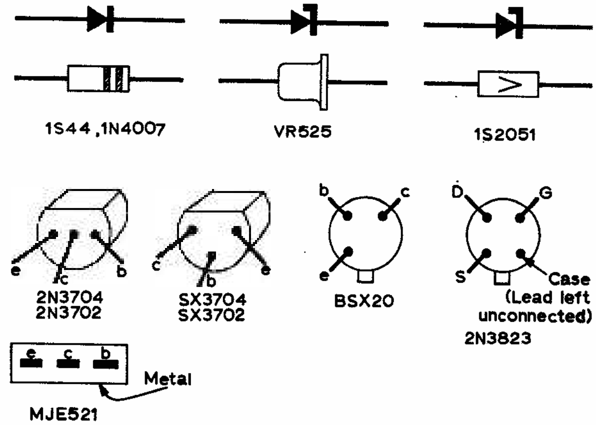
An insertion tool for this pin is Vero part No. IT 2151.

9. Tick off each break, link, component and pin on the drawings as they are fitted, this will identify any items which otherwise might be missed.

Semiconductors

The 3702 and 3704 transistors are specified in the components list as being the '2N' types, these are the most popular version and are readily available.

The 3702 and 3704 transistors are also available in an 'SX' version. The lead connections for these types are all different from each other and are shown in the diagram above.



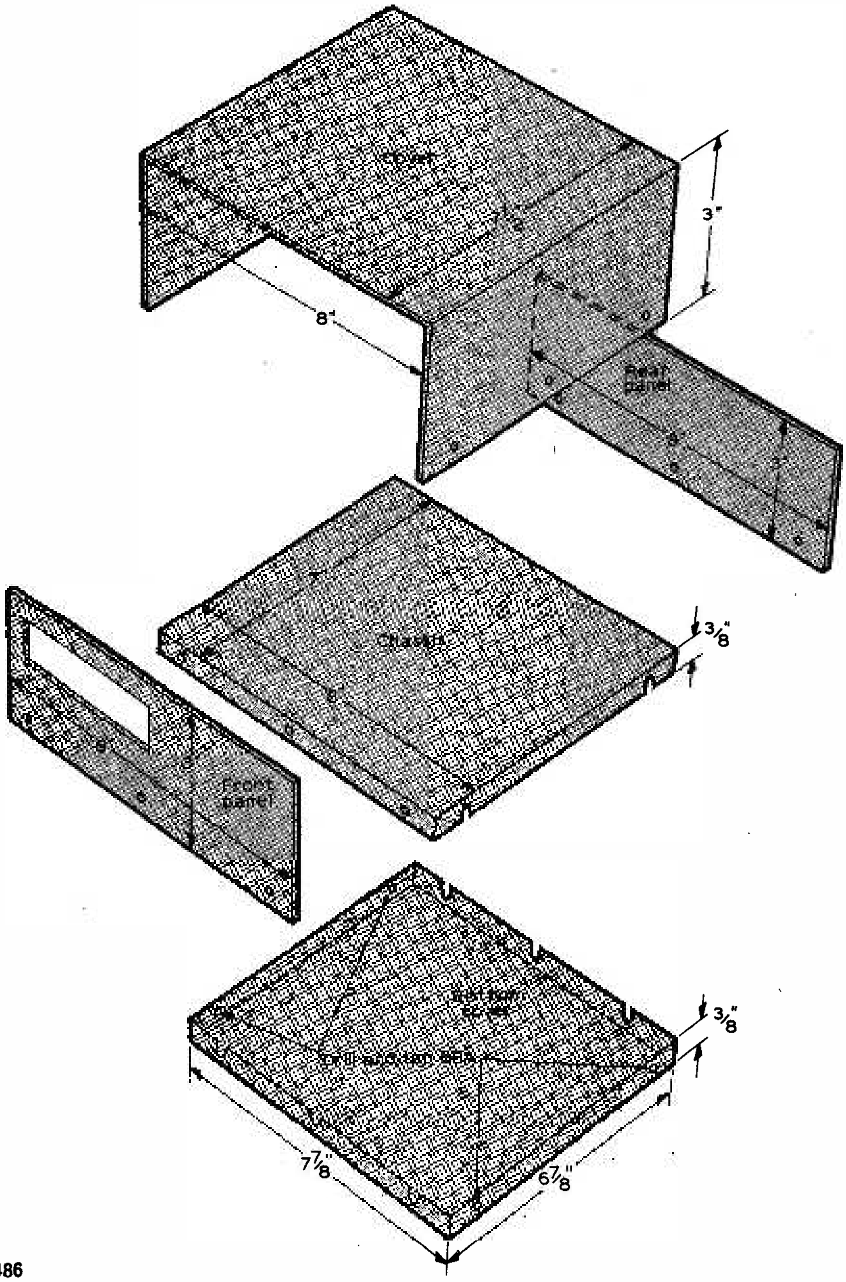


Fig. 14 (left) Cabinet and chassis construction.

It should be noted that on the Veroboard panels, the connections run e.b.c. and when the '2N' version is used, the collector and base leads will have to be crossed over to line up with the appropriate holes in the Veroboard panel.

Sockets for Integrated Circuits

Sockets are used for all the integrated circuits and although this increases the overall cost and is not essential for the operation of the instrument, it does provide the facility for disconnecting or changing an I.C. should a fault condition exist, also it does allow various parts of the instrument to be tested without incurring the expense of buying all the I.C's at once, 16-way sockets are required for I.C.8, 10, 12 and 14 and 14-way sockets for all the others.

The instrument is built using a simple aluminium chassis, panel and cover type of construction, as shown in Fig. 14. The finished chassis size is $8 \times 7 \times {}^3\!/_8$in deep and has a front and rear panel, each size 8×3in, fastened to the front and rear edges with 6BA screws and nuts.

(To be continued)

ATTRACTIVE DISCOUNTS at all times

ELECTROVALUE

Electronic Component Specialists

EVERYTHING BRAND NEW & TO SPEC • LARGE STOCKS • NO SURPLUS

BARGAINS IN NEW SEMI-CONDUCTORS

MANY AT NEW REDUCED PRICES · ALL POWER TYPES WITH FREE INSULATING SETS

40361	55p	2N2905	44p	2N4291	15p	BC148	9p	BFX87	29p
40362	68p	2N2905A	47p	2N4292	15p	BC149	10p	BFX88	26p
2N696	17p	2N2924	20p	AC107	46p	BC153	19p	BFY50	23p
2N697	18p	2N2925	22p	AC126	20p	BC154	20p	BFY51	20p
2N706	12p	2N2926	11p	AC127	20p	BC157	12p	BFY52	23p
2N930	29p	2N3053	27p	AC128	20p	BC158	11p	BSX20	16p
2N1131	29p	2N3055	60p.	AC153K	22p	BC159	12p	C407	17p
2N132	29p	2N3702	13p	AC176	16p	BC167	11p	MC140	25p
2N1302	19p	2N3703	13p	ACY20	20p	BC168	10p	MPS6531	35p
2N1303	19p	2N3704	13p	ACY22	16p	BC169	11p	MPS6534	30p
2N1304	26p	2N3705	13p	AD140	63p	BC177	14p	NKT211	25p
2N1305	26p	2N3706	13p	AD142	50p	BC178	13p	NKT212	25p
2N1306	33p	2N3707	13p	AD149	58p	BC179	14p	NKT214	23p
2N1307	33p	2N3708	10p	AD161	33p	BC182L	11p	NKT274	18p
2N1308	36p	2N3709	11p	AD162	36p	BC183L	10p	NKT403	65p
2N1309	36p	2N3710	13p	AF114	24p	BC184L	11p	NKT405	79p
2N1613	23p	2N3711	13p	AF115	24p	BC212L	16p	OC71	38p
2N1711	26p	2N3819	23p	AF117	22p	BC213L	16p	OC81	25p
2N1893	54p	2N3904	35p	AF124	24p	BC214L	16p	OC81D	25p
2N2147	95p	2N3906	35p	AF127	22p	BCY70	18p	ZTX300	14p
2N2218	34p	2N4058	13p	AF139	33p	BCY71	33p	ZTX301	16p
2N2218A	44p	2N4059	10p	AF239	36p	BCY72	15p	ZTX302	22p
2N2219	38p	2N4060	11p	ASY26	27p	BF115	23p	ZTX303	22p
2N2219A	53p	2N4061	11p	ASY28	27p	BF167	18p	ZTX304	27p
2N2270	62p	2N4062	12p	BC107	12p	BF173	19p	ZTX500	18p
2N2369A	19p	2N4124	18p	BC108	11p	BF194	14p	ZTX501	21p
2N2483	35p	2N4126	27p	BC109	12p	BF195	15p	ZTX502	25p
2N2484	42p	2N4284	15p	BC125	15p	BFX29	31p	ZTX503	22p
2N2646	47p	2N4286	15p	BC126	22p	BFX84	25p	ZTX504	52p
2N2904A	42p	2N4289	15p	BC147	10p	BFX85	32p		

RESISTORS 10% — 5% — 2%

Code	Power	Tolerance	Range	Values available	1 to 9	10 to 99 (see note below)	100 up
C	1/20W	5%	82 Ω–220K Ω	E12	9	8	7
C	1/8W	5%	4·7 Ω–470K Ω	E24	1	0·8	0·7
C	1/4W	10%	4·7 Ω–10M Ω	E12	1	0·8	0·7
C	1/2W	5%	4·7 Ω–10M Ω	E24	1·2	1	0·9
C	1W	10%	4·7 Ω–10M Ω	E12	2·5	2	1·9
MO	1/2W	2%	10 Ω–1M Ω	E24	4	3·5	3
WW	1W	10% ± 1/20 Ω	0·22 Ω–3·9 Ω	E12	7	7	6
WW	3W	5%	12 Ω–10K Ω	E12	7	7	6
WW	7W	5%	12 Ω–10K Ω	E12	9	9	8

Codes: C = carbon film high stability low noise
MO = metal oxide Electrosil TR5 ultra low noise
WW = wire wound Plessey.

Prices are in pence each for same ohmic value and power rating, NOT mixed values. (Ignore fractions of 1p. on total value of resistor order)

Values:
E12 denotes series: 10, 12, 15, 18, 22, 27, 33, 39, 47, 56, 68, 82 and their decades.
E24 denotes series: as E12 plus 11, 13, 16, 20, 24, 30, 36, 43, 51, 62, 75, 91 and their decades.

ZENER DIODES

5% full range E24 values; 400mW: 2·7V to 30V **15p** each 1W: 6·8V to 82V **27p** each 1·5W: 4·7V to 75V **60p** each Clip to increase 1·5W rating to 3 watts (type 266F) **4p.**

CARBON TRACK POTENTIOMETERS, long spindles

Double wiper ensures minimum noise level.

Single gang linear	220 Ω, to 2·2M Ω	12p
Single gang log	4·7K Ω to 2·2M Ω	12p
Dual gang linear	4·7K Ω to 2·2M Ω	42p
Dual gang log	4·7K Ω to 2·2M Ω	42p
Log/antilog	10K, 47K, 1M Ω only	42p
Any type with ½A D.P. mains switch, extra		12p

Please note: only decades of 10. 22 and 47 are available within ranges quoted.

CARBON SKELETON PRE-SETS

Small high quality, type PR, linear only 100 Ω, 220 Ω 470 Ω, 1K, 2K2, 4K7, 10K, 22K, 47K, 100K, 220K, 470K, 1M, 2M2, 5M, 10M Ω Vertical or horizontal mounting **5p** each.

ENAMELLED COPPER WIRE even No S.W.G. only. 2oz reels 16.22 S.W.G. **25p**; 24-30 S.W.G. **30p**; 32-34 S.W.G. **33p**; 36-40 S.W.G. **35p**; 4oz reels 16·22 S.W.G. only **41p.**

MULLARD polyester C280 series

250V 20% 0·01; 0·022; 0·033, 0·047 **3p** ea. 0·068; 0·1, 0·15 **4p**, 0·22 **5p**, 10%: 0·33 **7p**, 0·47 **8p**, 0·68 **11p**, 1μF **14p**. 1·5μF **21p**, 2·2μF **24p.**

MULLARD SUB-MIN ELECTROLYTIC

C426 range axial lead **6p** each
Values (μF/V): 0·64/64; 1/40; 1·6/25; 2·5/16; 2·5/64; 4/10; 4/40; 5/64; 6·4/6·4; 6·4/25; 8/4; 8/40; 10/2·5; 10/16; 10/64; 12·5/25; 16/40; 20/16; 20/64; 25/6·4; 25/25; 32/4; 32/10; 32/40; 32/64; 40/16; 40/2·5; 50/6·4; 50/25; 50/40; 64/4; 64/10; 80/2·5; 80/16; 80/25; 100/6·4; 125/4; 125/10; 125/16; 160/2·5; 200/6·4; 200/10; 250/4; 320/2·5; 320/6·4; 400/4; 500/2·5.

LARGE CAPACITORS

High ripple current types: 1000/25 **28p**; 1000/50 **41p**; 1000/100 **82p**; 2000/25 **37p**; 2000/50 **57p**; 2000/100 **£1·44**; 2500/64 **77p**; 2500/70 **98p**; 5000/25 **62p**; 5000/50 **£1·10**; 5000/100 **£2·91**; 10000/50 **£2·40.**

COMPONENT DISCOUNTS

10% on orders for components for £5 or more. 15% on orders for components for £15 or more (No discount on nett items).

POSTAGE AND PACKING

Free on orders over **£2**. Please add **10p** if orders under £2. Overseas orders welcome: carriage and insurance charged at cost. *Prices subject to alteration without notice.*
U.S.A. CUSTOMERS. U.S.A. orders charged at prices as advertised by ELECTROVALUE AMERICA, P.O. Box 27, Swarthmore, PA 19081.

Appointed distributors for
SIEMENS (U.K.) LTD.
Appointed stockists for
NEWMARKET TRANSISTORS
RADIOHM POTENTIOMETERS

SAVE £6·25 ON THE NEW ENGLEFIELD 840 AMPLIFIER

This latest Peak Sound high fidelity amplifier incorporates many strikingly original features including facility for adding in stereo FM tuner. Superb performance characteristics and luxurious styling Electrovalue choice of simulated soft leather covering in black, blue, red or dark green. As now advertised at £49·50. Our price **£38·75** nett

MAINLINE AMPLIFIER KITS

70W. **£12·60** nett. (main amplifier module).

30 WATT BAILEY AMPLIFIER PARTS

Transistors and PCB for one channel **£6·46**
Capacitors, resistors (metal oxide), and transistors, one channel. **£8·41.**
Complete unregulated power supply pack, **£4·75.**
Suitable heatsink 10DN 400C. **55p.**

SIEMENS' TTL INTEGRATED

We stock a large range of all types for very wide range of applications. For full details, see our latest catalogue.

S-DeC RANGE

S-DeC **£1·44**; DeCSTOR **£2·88**; S-DeC 4 Pack **£5·10**; T-DeC **£2·88**; μDeC 'A' **£3·18**; μDeC 'B' **£5·91.**
Accessory prices increased approx. 20% since publication of our 1971 catalogue (pages 51-53). Guide prices unchanged.

INDICATOR LAMPS

NEON chrome bezel, round red NR/R, **24p**; chrome bezel, round amber NR/A, **24p**; chrome bezel, round clear NR/C, **24p.** Neon, square red type LS5C/P, **18p**; amber type LS5C/A, **18p**; clear type LS5C/C, **18p.** All above are for 240V mains operation. **Filament types:** 6V, 0·04A square red type LS5C/R-6V, **30p**, 6V 0·04A amber type LS5C/A-6V, **30p**; 6V 0·04A clear type LS5C/C-6V, **30p**; 6V 0·04A green type LS5C/G-6V, **30p**; 12V 0·04A LS5C/R-12V, **34p**; 34V 0·04A LS5C/R-28V, **45p.**

SIEMENS' POLYCARBONATE CAPACITORS

5% tolerance
250V up to 0·1mF. 100V 0·1mF and above.

0·01, 0·012, 0·015, 0·018, 0·022, 0·027, **5p**; 0·033, 0·039, 0·047, 0·056, 0·068, 0·082, 0·1, 0·12, 0·15, 0·18, 0·22, **6p**; 0·27, **7p**; 0·33, **9p**; 0·39, **9p**; 0·47, **10p**; 0·56, **13p**; 0·68, **15p**

DIN CONNECTORS

		plug	socket
Loudspeaker ..	.. 2-pole	12p	10p
Audio ..	.. 3-pole	13p	10p
Audio ..	.. 4-pole	14p	12p
Audio ..	.. 5-pole 180 deg.	15p	12p
Audio ..	.. 5-pole 240 deg.	15p	12p
Audio ..	.. 6-pole	15p	13p

Handbook of transistor equivalent and substitutes, 40p. (Postage 3p if ordered alone).

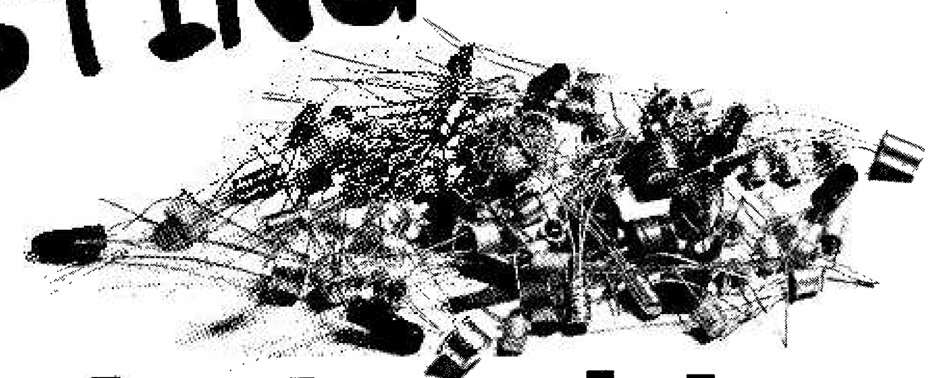
ELECTROVALUE 1971 CATALOGUE. 64 pages and covers. Packed with items and information. Post free **10p**

ELECTROVALUE

(Dept. PW.1071) 28 ST. JUDES ROAD, ENGLEFIELD GREEN, EGHAM, SURREY
Hours: 9—5.30: Sat. 1 p.m. Tel.: Egham 5533 & 4757 (STD 0784-3) Telex 264475

TESTING surplus transistors

R A BUTTERWORTH



THE technical press offer so many transistor projects that many of us have bought and acquired a fair stock of transistors gathered from bargain packs or labouriously removed them from surplus computer boards. We then go through them only to find that many are un-marked, indecipherable, or have some queer markings not contained in any lists. The manufacturers are reluctant to supply data because they have been made to *"customer requirements"*. A few hours spent in sorting these into NPN or PNP and grading them into four categories will save a lot of time, patience and money on the next project development. The methods of grading are only approximate and there are only four grades:—

1. RF types.
2. Low gain types.
3. High gain types.
4. All others which do not pass the tests described.

PRELIMINARY TESTING

First do a thorough visual examination and sort the transistors into *known* and *unknown*. The *knowns*, however, should be put through the tests since they may be blown or below spec. If your collection contains transistors removed from computer boards, the leads will be short. Fortunately when these boards are assembled, small plastic spacers are fitted, in most cases to comply with manufacturer's recommendations as to bending and heat dissipation. The makers also usually bend over about ⅛in on the solder side with the result that the lead lengths are in a safe condition. Any that are too short should be thrown away. Figure 1 shows the bases of seven categories into which these recovered units fall. Some may have a coloured dot, usually red or white, indicating the collector lead, also some are internally connected collector-to-can. Do not be fooled however by coloured sleeving on the leads; not all manufacturers use the same code. Of course a really good transistor checker can make things very easy but this will cost a good deal of money.

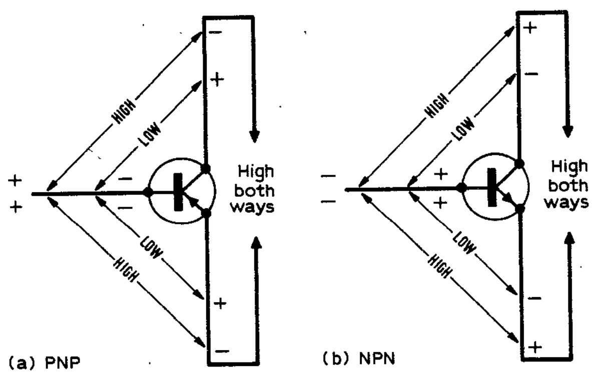
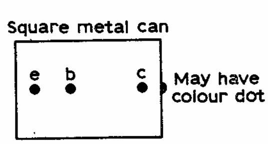
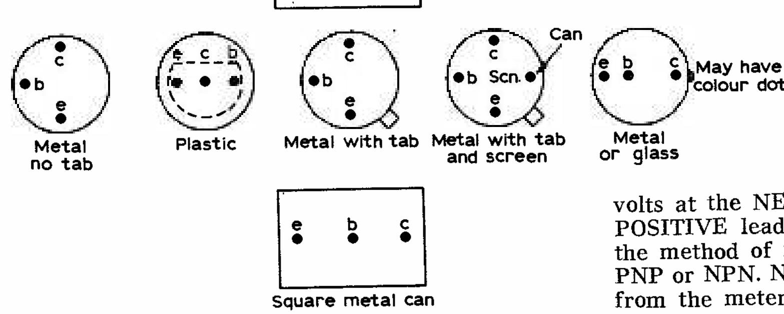


Fig. 2 : Resistance readings found on a good transistor—see text for details.

Fig. 1: Some transistor lead connections. These are only the most common arrangements and variations do exist.





IDENTIFYING THE LEADS

The first checks, sorting the PNP and NPN types and the leads are done with a multimeter on its low ohms range. *A word of warning first* about that multimeter. Most meters on the ohms range give positive volts at the NEGATIVE LEAD and negative at the POSITIVE lead, so check first. Figure 2 illustrates the method of finding out whether the transistor is PNP or NPN. Never be scared of reversing the leads from the meter; with about 1·5V, which is usually available from the meter on low ohms ranges, you won't do any harm. Should you get a low resistance reading both ways between base and either of the other connections you can be fairly certain that there is an internal short. If you get a low reading between the base and one lead and a high at the other it is either bad or you are not on the base. It is probable that you will meet with marginal readings at times, so make tests as follows with reference to Fig. 3.

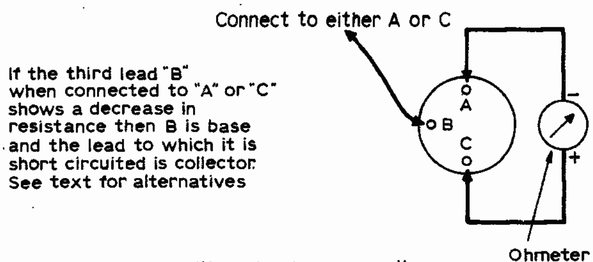


Fig. 3: Tests for identifying the base connections.

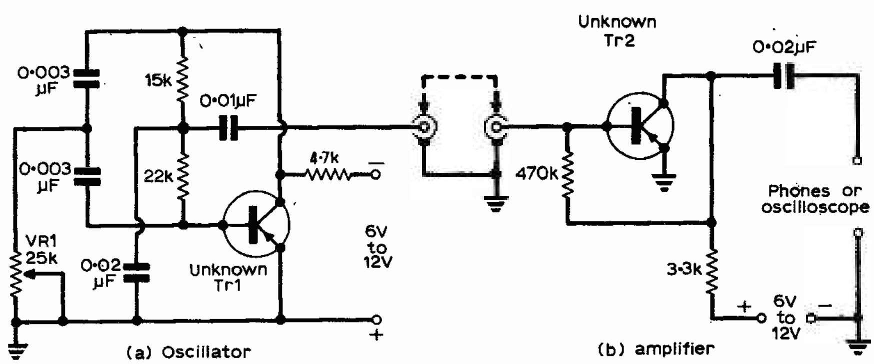


Fig. 4: The circuit used for the gain and amplification tests. Note that for NPN devices the battery polarity must be reversed.

Draw a base diagram of the base of the transistor and mark them 'A', 'B', 'C'; you are now faced with three permutations, of pairs 'AB', 'AC' 'BC'. Now take any pair and connect to the ohmmeter on low ohms range, then connect the other lead to each lead in turn: if the resistance falls the unpaired lead is the base lead and the lead to which the base was shorted is the collector. Check to see if this lead is connected to the metal can, this could confirm that it is the collector. If you do not get these results then check each of the three pairs using the same procedure. If the base cannot be identified for certain and there is high resistance both ways it is most probable that the third lead is base. To check, assume this is base and check with the meter whether it is a PNP or NPN in Fig. 1. You should then have established the base connection; the emitter and collector connections will be identified by reversing the leads in the grading test.

TESTING FOR GAIN

To test for gain two simple circuits are required as shown in Fig. 4. Good quality transistor sockets are essential since we are most likely dealing with short leaded transistors and soldering in and out will become tedious. The assembly of the the circuits is an individual choice, though the author used 'S-Dec' and found it ideal. When the test rig is assembled, put in two good known transistors, say an OC44 or OC45 for Tr1 and an OC70 or OC72 for Tr2, connect up the battery and headphones. If you can use a 'scope, all the better. Now adjust VR1 until a tone (or trace) is observed, then start to substitute the unknowns for Tr1. If a tone is present the gain will be more than 30, if no oscillation occurs then it is less than 30. At this point those transistors which have connections which are difficult to identify can be checked and identified by insertion, keeping the assumed base connection and reversing the other two unknown leads in the socket. If no oscillation occurs, keep it for the two further tests. Do not be afraid to reverse leads even at this higher voltage; if it blows then it was probably useless anyway.

AMPLIFICATION TEST

Now replace the original test transistor i.e. the OC44/45 (or one of the good ones known to oscillate) and then one by one test all those which failed the high gain test by substitution in the Tr2 position. The note heard in the headphones will tell you if it will amplify at all. If it is possible to use an oscilloscope, a little more information will be gained on this last test which is for low gain. By means of the trace shown on the 'scope, you can classify some transistors in the large signal class because the waveform will be distorted or clipped. The assumption in the tests up to now has been that the surplus transistors are in the small signal group.

R.F. TESTS

All the transistors available should be put through the r.f. test, irrespective of whether they have passed the previous tests. The r.f. test circuit is shown in Fig. 5. Here the reader will have to arrange for the crystal, Tr1, L1 and C1, according to what he has available, to check frequency. As a guide, with a 20MHz overtone crystal, an OC170, L1 being eight turns of 18s.w.g. on a $\frac{1}{2}$in former, tuned with a 50pF capacitor, the circuit will cover the range up to

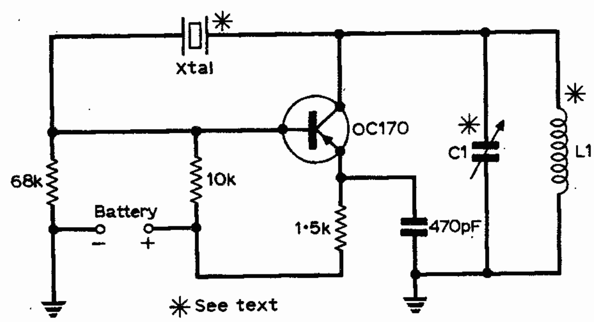


Fig. 5: The r.f. test circuit. For NPN devices the battery polarity must be reversed.

30MHz. Here a receiver or G.D.O. is necessary to detect the oscillation. Once oscillation is established it is merely a matter of substituting as before.

With your collection graded, as outlined, it is simply a matter of substitution of various types within that grade for optimum results in a particular project. The methods described are by no means comprehensive but at least you will have got a little order out of chaos and the building of many projects will be made much easier. ■

GENERAL PURPOSE power supply

M. WALLIS

IN the "good old days" of valves, power supplies were simple. Some 90 per cent of equipment operated with an h.t. supply of about 300V and the heaters were nearly all 6·3V. A single power supply would operate the vast majority of equipment that one was experimenting with. Today the semiconductor rules the day and power supplies are very much less standardised. Checking through a recent copy of *Practical Wireless* showed that there were six circuits given—and five different supply voltages were specified, ranging from 6V to 30V. Batteries can cope with a number of these, especially the most common 9V supply, but even the most half-hearted experimenter needs quite a range of batteries to pursue his hobby—even for quick lash-ups.

One can of course build a sophisticated, stabilised power supply with variable output covering quite a large range but such circuits are expensive, are by no means simple in their construction and most of the time the sophistication is not required.

By incorporating a simple two-pole, six-way rotary switch into the circuit of a standard power supply, it is possible to build a power unit with six different outputs—all with low internal impedance—and which will simulate exactly the supply that you finally build into the equipment.

A few refinements can be incorporated into such a power supply such as an indicator neon and fuse protected output which are not always necessary on the final supply which is fitted permanently but which make life simpler (and cheaper!) while experimenting.

the circuit

The wide proliferation of supply voltages needed for semiconductor designs has brought about the introduction of mains transformers with a wide range of secondary tappings and it is simply by selecting the appropriate ones of these that various output voltages can be obtained.

The transformer specified in the components list is a good one to use but other types with multiple secondaries can be adopted.

This one is fitted with 12, 15, 20, 24 and 30V tappings (these of course refer to a.c. r.m.s. volts) and a total of 13 different voltages can be selected from this as shown in the table. Those shown in the drawings, and for which the wiring is done, tend to be the higher voltages as batteries are still the best bet up to about 9V but it is a matter of personal choice which are selected.

Note that the d.c. voltages are those which should be read with no loading and are only approximate. In any case it has been found by

TABLE 1

VOLTS (d.c.)	VOLTS (a.c.)	Connections from which derived
4·5	3	12—15
6	4	20—24
7·5	5	15—20
9	6	24—30
12	8	12—20
13·5	9	15—24
15	10	20—30
18	12	0—12 or 12—24
22·5	15	0—15 or 15—30
27	18	12—30
30	20	0—20
37·5	24	0—24
45	30	0—30

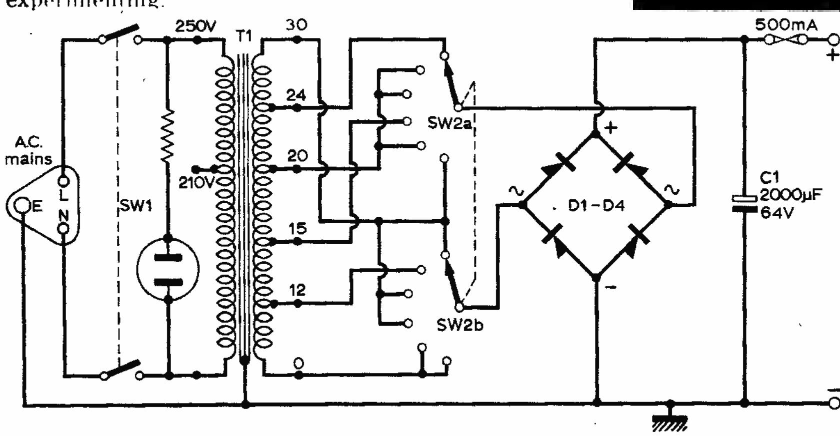


Fig. 1: The circuit of the general purpose power supply.

★ components list

T1 Mains transformer 250V primary with multiple secondaries as shown, 500mA. Douglas Type MT112AT or similar.
D1-D4 Silicon Bridge Rectifier BY164 or similar.
C1 2000μF 64V
SW1 Double pole on-off switch.
SW2 2-pole 6-way rotary switch.
Neon panel with built-in resistor.
500mA fuse and fuse holder.
Red and Black insulated terminals.
Tag strip for rectifier.
Capacitor clamp.
Aluminium chassis, 6×4×2in. H. L. Smith Ltd., 287 Edgware Rd., London W2.

experience that the secondary taps are by no means always accurate and quite large differences have been measured from the theoretical voltage but as exact voltages are rarely needed, variations are allowable.

The output voltage from the prototype, which can be seen marked on the chassis, are those measured, not those calculated, and these discrepancies can only be due to winding inaccuracies as it is wired up exactly as in Fig. 1.

The current rating required from a general purpose power supply will depend on the uses to which it is put. Only power amplifiers at peaks take more than about 500mA and that was the rating chosen; it is sufficient for nearly all experimental work.

More than one company makes transformers with the voltage taps used here, but the most widely available is possibly the Douglas MT112AT. The same transformer with a 2A rating is coded MT3AT and although it will just fit into the chassis shown, it is a tight fit and a larger one is recommended.

The mains supply is connected to the correct primary (either 210V or 250V) of the transformer via a double-pole switch. A panel neon, connected

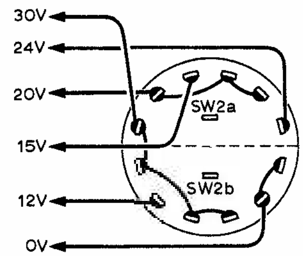


Fig. 3: The switch wiring used on the prototype.

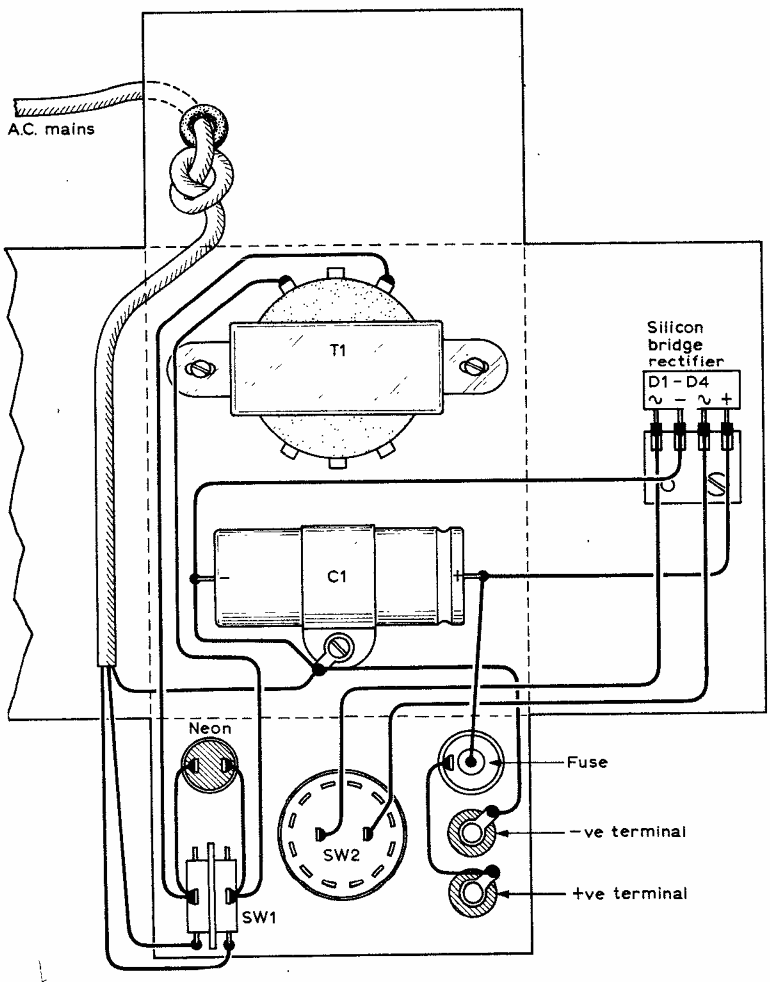


Fig. 2: The component layout and wiring details.

across the primary is very useful. Today most neons are supplied with a built-in resistor but if one is not fitted, a 220kΩ should be wired in series as shown in the circuit.

The earth line is shown connected to the negative line but may equally well go the positive if used in conjunction with PNP type equipment which is earthed by some other means. Whatever happens the aluminium chassis should be earthed for safety reasons.

The various connections to the voltage selector switch are taken from the appropriate tappings and the switch wipers are connected directly to the bridge rectifier a.c. contacts. Plastic encapsulated silicon bridge rectifiers are widely available at reasonable prices and come under a variety of codings. The ratings must be 50V peak, 1A. The Mullard BY164 is suitable here.

Adequate smoothing for all purposes is provided by the 2000μF capacitor; the voltage rating of this should be well above the 45V or so applied and a 64V type was used in the prototype.

To provide a measure of protection, a 500mA fuse should be connected in the supply as shown.

construction

The prototype was built in a

small aluminium chassis size 5 x 4 x 2½ inches, fitted with a drop-in lid. These chassis are available from H. L. Smith Ltd., the address is given in the components list.

The layout of the components is shown in Fig. 2 and can be seen in the photograph.

The bridge rectifier can be mounted on a small tag strip on one long side, the transformer and the capacitor on the base, with the remaining components on the front panel.

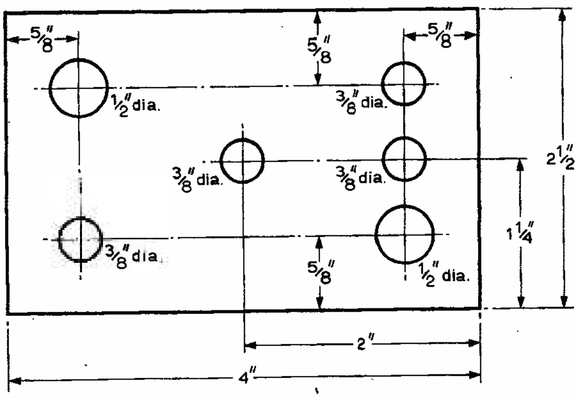
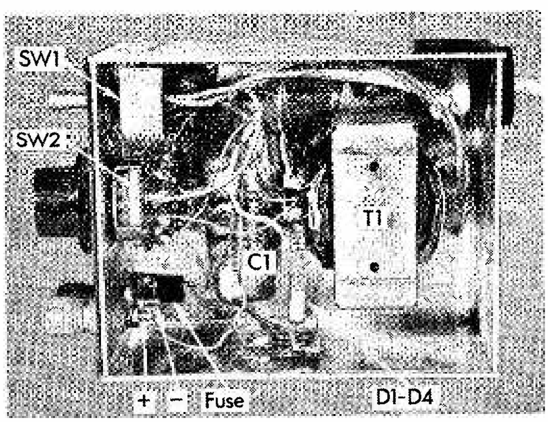


Fig. 4: The front panel drilling details.

The switch wiring needs quite a lot of planning unless that used in the prototype is copied exactly, this is shown in Fig. 3. If other voltages, selected from the table, are required, the wiring should be planned carefully first of all. It is far easier to do the wiring on the switch leaving a few inches of wire which will finally be wired to the transformer.

When all wiring is completed a thorough check should be made to see that there is no possibility of mains being applied to the case and that no bare wires can touch each other.



Internal view of the prototype showing component siting. Compare this with Fig. 2.

Connect a voltmeter to the terminal sockets and switch on, ensuring that a voltage reading is obtained in each switch position. Wrong wiring on a switch of this sort can lead to a direct short of the secondary and—unless noted very quickly—unpleasant things can happen to both the transformer and the switch.

There may be a very small amount of sparking while switching but this does no harm. The prototype has been in use continuously for several months with no ill effects.

There is just one point that must be made. The charge stored in a smoothing capacitor of this size lasts for a long while and if the power supply has been on a high range the capacitor should be shorted out (with the mains switch off) before being applied to a circuit where a high voltage could cause damage. This should be done through a resistor, not directly, as the fuse may blow otherwise.

If, due to the nature of the experimenting, a considerable amount of switching is envisaged, a resistor can be wired permanently between the output terminals so that a small current is drawn at all times and the capacitor will then settle down very quickly to the applied voltage. A 4·7kΩ resistor with a ½W rating will serve this purpose. ■

CROSSWORD No.2
WINNERS and SOLUTION

The Practical Wireless Crossword Competition No. 2, published in the June 1971 issue, has now closed and the prizes of £10 vouchers, exchangeable with any advertiser in Practical Wireless have been awarded to:

Mr. J. Rutter
Newcastle-upon-Tyne

Mr. D. Bell
Silvertown, London E.16

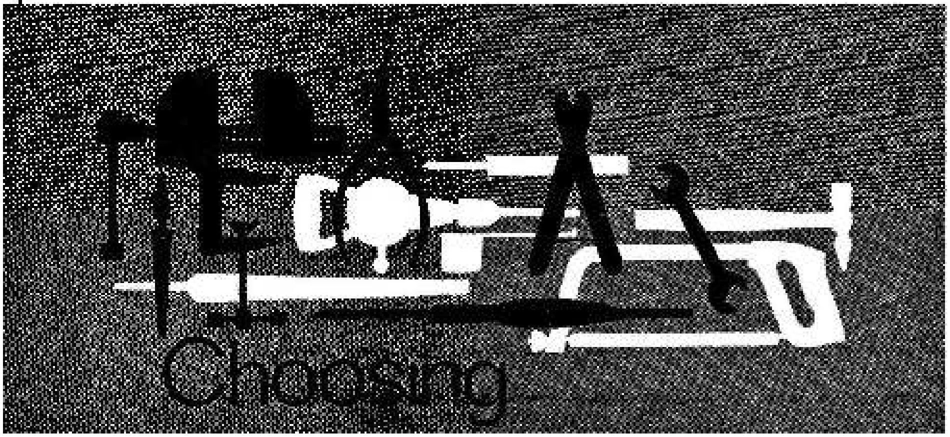
Mr. R. W. Clarke
Bedfont, Middx.

Mr. W. Easton
Whitby, Yorks

Mr. M. R. Edmunds
Southampton, Hants

SOLUTION TO COMPETITION NO. 2

	1 S		2 R	E	3 S	I	4 S	T	5 S		6 G	
7 F	I	N	E		O		T		8 T	R	A	P
	N		L		L		Y		R		T	
9 D	E	M	A	N	D		10 L	E	A	D	E	11 D
A			Y		E		I		Y			U
12 S	E	13 N	S	O	R		14 I	N	S	15 E	R	T
H		U				16 D				N		Y
		17 M	I	18 C	R	O	W	19 A	V	E		
		B		O		T		R		R		
	20 N	E	O	N				21 C	A	G	E	
		R		22 E	M	I	T	S		Y		



PRACTICAL WIRELESS
SUPPLEMENT
OCTOBER 1971

Choosing SMALL WORKSHOP TOOLS

S. YEATMAN

SINCE YOU ARE reading Practical Wireless the chances are that you have already tried your hand at constructing one of our projects. If you are already well fitted out with tools or have access to workshop facilities the bending up of a piece of aluminium to make a chassis or the punching and drilling of various holes would not have presented you with much of a problem. But if you are a newcomer to home electronics you have probably employed 'knife and fork' techniques, utilising kitchen knives and similar tools!

This really is doing things the hard way and the effort involved can put a considerable damper on anyone's enthusiasm for home construction, apart from any ensuing domestic problems when the lady of the kitchen discovers that her best kitchen knife now looks like a hacksaw blade!

If you are really taken with the idea of constructing electronic gear then be prepared to start off properly by buying a few good essential tools designed for the job in hand. Forget Dad's woodworking screwdriver with its $\frac{1}{2}$" wide blade filed so thin that it seems to fit any screw head from 8BA upwards! Very convenient, of course, but what a mess it makes of screw heads! Dad's pliers, too, are very handy—they 'fit' any size of nut you like to mention but by the time they have slipped a couple of times that nut looks pretty sorry for itself.

When you find out what fun these electronic projects can be you will begin to take pride in the finished job and Mum's knives and Dad's tools just won't be good enough. So, start off on the right foot by getting the proper tools and remember that, like most 'bargains', cheap tools can turn out to be expensive in the long run. Spend a little more on tools from manufacturers of repute and scorn imported tools made of inferior materials.

The following review lists small workshop tools more or less in the order of necessity bearing in mind the requirements of the home constructor. The soldering iron takes precedence since even the simplest bought kit of parts needs the odd soldered joint or two.

In a review of this kind only general reference can be made to the great variety and range of tools that are available today. Specific recommendations are impossible without some knowledge of the amount of money it is intended to spend and the precise nature of the work to be undertaken in the workshop.

Workshops tend to 'just grow' from a few simple tools. As the limitations of these tools become apparent so more tools are bought to fill the gaps, thus it can be seen that a large initial outlay is not necessary.

Spreading the cost over a period allows emphasis to be made here on the requirement to buy quality, a policy which, if followed, will not be regretted.

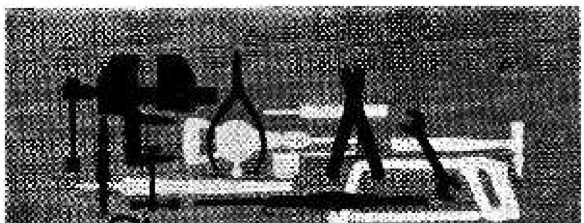
SOLDERING IRONS. There is a wide variety of electric soldering irons available today, the main problem being the selection of one of a suitable wattage for the home constructor of radio gear. For the average Practical Wireless project a 25 watt iron should prove satisfactory but if a lot of work is likely to be done on printed circuit boards a 15 watt iron would be more appropriate. These circuit boards often contain many small components fitted quite close together and thus vulnerable to the heat of a soldering iron. Excessive heat can also damage the copper strips of the board itself.

With these irons goes a wide range of copper bits of differing diameters, some straight and some angled. Initially a straight bit $\frac{1}{8}$" or $\frac{3}{16}$" in diameter can be chosen for general purpose work with an angled bit for the awkward spots. At a little extra cost special bits are available which contain additives to the copper designed to prolong the life of the bit.

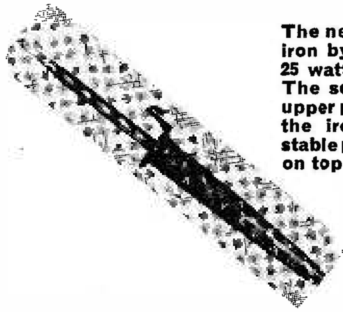
For home use a soldering iron operating directly from the 230 volt mains supply is usual but, for anyone who might feel a little happier with a lower working voltage, irons are available to work from as low as 6 volts via a mains isolating transformer.

When wiring an electric iron to its mains plug ensure that the instructions supplied with the iron are strictly adhered to so that the iron is properly earthed. This is a very important point for the builder of electronic equipment when wiring in transistors and other solid-state devices. Irreparable damage can be caused to these devices by stray earth currents if the soldering iron is not properly earthed.

Advancing rapidly in popularity are the soldering guns or 'heat guns', as they are sometimes known. The copper bit is, in fact, part of a low voltage secondary winding of the built-in transformer. Exaggerated claims are sometimes made concerning the short heat-up time for these guns,



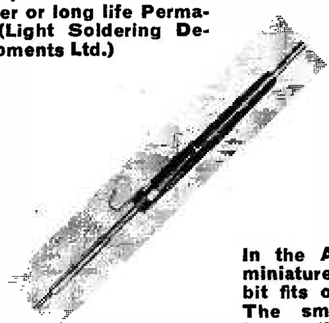
Choosing SMALL WORKSHOP TOOLS



The new Invader soldering iron by Adcola is rated at 25 watts and has a $\frac{3}{16}$" bit. The square styling of the upper part of handle causes the iron to remain in a stable position when placed on top of the workbench.

One of the Litesold range of irons available in ratings from 10 to 60 watts, covering all requirements in

electronic soldering. Various tips are obtainable in copper or long life Permatip. (Light Soldering Developments Ltd.)



In the Adamin series of miniature irons the copper bit fits over the element. The smallest, Model 6, has a rating of only 6 watts at 6 volts. (L.S.D. Ltd.)

This soldering iron bench stand guards against accidental burns or even fires. The iron maintains its normal operating temperature while in the stand. A bit cleaning pad is fixed to the front of the stand. (L.S.D. Ltd.)

typically 10 seconds, but the better known makes can be relied upon in this respect.

The trigger style on-off switch on these guns often has two positions, for fast heat-up and for running heat, thus giving a dual-heat facility. Sometimes other types of bit are available which can be used to cut sheet plastics or to weld plastic sheet and so on.

Solder today, as used on electronic work, invariably has several cores of flux to ensure better distribution of the flux around the joint and consequently a better joint. The solder contains tin and lead in varying proportions which affect the temperature at which the solder will melt. The usual ratio of tin to lead is 60/40 for radio work and the diameter of the solder can be between 18 and 22 s.w.g. depending upon the fineness of the work being done.

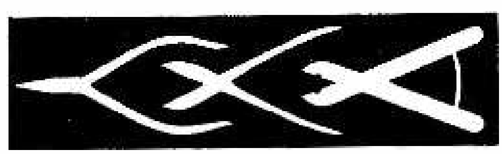
While short lengths of solder can be bought for a few pence the ½ or 1lb. reel will be found to be more economical for the home constructor. If however he wishes to experiment with various solders he will find many easy-to-use dispensers and handy-packs available with different types of solder such as 40/60 or 60/40 tin-lead alloys as well as solders containing a small amount of copper which is calculated to reduce the amount of wear on the copper soldering bit.

Although soldering irons are usually fitted with a hook of some kind so that they can be hooked onto a convenient point it is a good policy to provide some kind of metal stand for use on top of the bench. Such a stand can be easily made out of an odd piece of aluminium or tinplate.

Soldering iron manufacturers naturally produce their own stands or 'protective shields' for their irons and these are designed to ensure that the iron does not overheat when the iron is not being used but is still switched on. For convenience a cleaning pad for the bit may be incorporated and possibly a holder for a reel of solder.

A 'must' in soldering is a sharp pick or long needle for clearing out holes in soldering tags and removing surplus solder. Commercial versions are usually made of aluminium, to prevent the solder sticking to the needle, and with a plastic handle or covering. One end may be pointed and the other end split to enable wires to be unravelled from tags etc., while the solder is molten.

Another de-soldering aid available is in the form of copper wire braid. When the end of the braid is touched on a hot soldered joint surplus solder travels up the braid by capillary action. The end of the braid is snipped off ready for the next joint.



PLIERS AND CUTTERS. Again a very large field of choice and again the rejoinder to pay a bit extra to get quality. Two pairs of pliers will suffice for most constructional work, a long-nosed pair with tapered jaws coming to a reasonable fine point and a heavier pair with stocky jaws, maybe ½" wide, and probably incorporating a pair of sidecutters.

The long-nosed pliers will always be in the hand of the electronics constructor, for twisting wires round tags and forming the wire ends of components before soldering them into position. Don't forget that a wiring joint should always be mechanically sound before it is finally soldered, although the true experimenter will not go along with this principle because he will want to use the same components time and again!

Variations on the pliers theme include those with angled jaws of various lengths, round jaws and flat narrow jaws rather than pointed ones. When buying pliers see that the opening and closing action is not too loose or the jaw tips will not close together properly and it will be difficult to get hold of fine wires when wiring up.

Wirecutters will be used as often as the pliers so, again, only the best must be chosen. They should be about the same size as the long-nosed pliers with the cutting edges at an angle to the body. Other types have the cutting edges across the top or parallel with the body.

When buying sidecutters hold them up to the light and see that the cutting edges come together cleanly and evenly throughout their length. Try this test with a cheap imported pair of cutters and see the difference! The previous remarks concerning the action of pliers applies just as much to sidecutters. A loose action and the cutting action will be greatly impaired. On the other hand, there is nothing more annoying than a pair of cutters or pliers that need two hands to open them!

WIRESTRIPPERS. Different people have different ways of stripping the insulation from wire, varying from the use of the front teeth to an old kitchen knife! If the wire is nicked, and it often is, it will eventually break if it is subject to vibration or flexing. The ordinary sidecutters are frequently pressed into service as wirestrippers mainly because they will have just been used to cut off a piece of wire and are still in the hand! However there are plenty of wirestrippers on the market designed for the job so there is no excuse for improvisation.

Wirestrippers usually have some means of adjustment to cater for different size wires. It is important not to try to strip wires of a larger gauge than that for which the wirestripper has been set, or the wire will be nicked. One of the latest style wirestrippers on the market has a four position cam that can be adjusted immediately to another gauge of wire, while still held in the hand. Incidentally, this model also has wire cutters which have ground edges, a great improvement.

A feature on some types of wirestrippers, which the author considers of great importance, is the provision of a spring that keeps the cutters normally open, the cutting action taking place against the spring.

SCREWDRIVERS. Strictly speaking, every different sized screw needs its own screwdriver, if the blade is to fit the screw slot properly, but not many of us are likely to go to that extreme. The width of the blade should be about the diameter of the screw head or wider, rather than narrower. For electronic construction work it is best to buy a set of screwdrivers with blade widths from about $\frac{1}{8}''$ up to $\frac{1}{4}''$ or $\frac{5}{16}''$. Three screwdrivers should be sufficient. A useful addition is one for the Philips style screws, that is the screws with crossed slots.

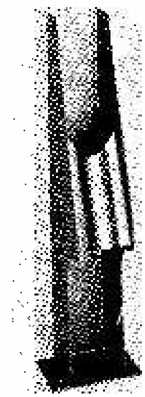
Screwdriver sets are available consisting of several blades that can be fitted to a common handle. Although these may be cheaper than individual screwdrivers they are less convenient in practice.

The screwdriver blade itself should be about 6″ or so long depending upon the blade width. One very useful size of blade is one about $\frac{3}{32}''$ wide for use with knob setscrews. The blade should be as long as possible so as to reach a knob in spite of the clutter of other knobs, dials etc. on a panel.

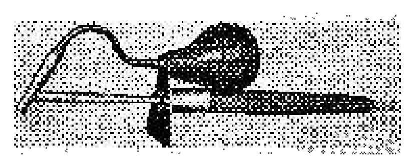
Don't take any notice of the markings on some screwdrivers that seem to indicate that one can use them with safety on 10000 volt circuits! Anyone having that sort of voltage around should know the precautions he should take. They would not include the use of a screwdriver on 10000 volts!

Variations on the basic screwdriver include the ratchet

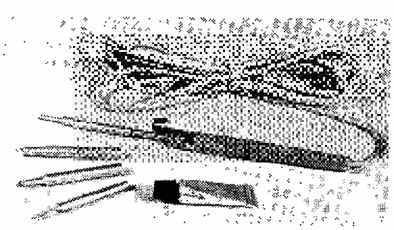
A most useful de-soldering aid is a reel of specially treated copper braid which will completely remove unwanted solder from a joint by capillary action.



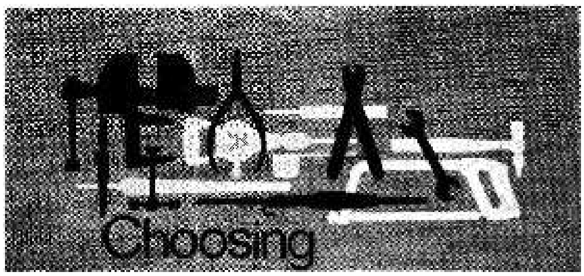
The Adcola protective shield is intended for wall or bench mounting and has slots for a spindle carrying a reel of solder.



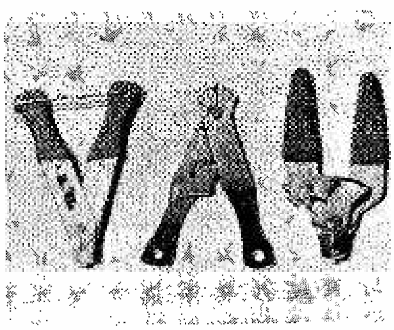
This de-soldering tool (L.S.D. Ltd.) could be invaluable when stripping components from surplus equipment. It is self-contained and simple to operate and may be used as a conventional soldering iron.



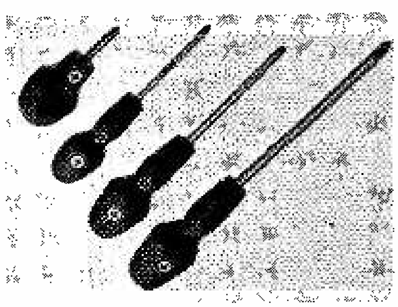
The Adamin miniature iron, Model 15, can be obtained complete with a set of four bits of differing size. The tube of special lubricant is used to prevent the bits from sticking to the heating element.



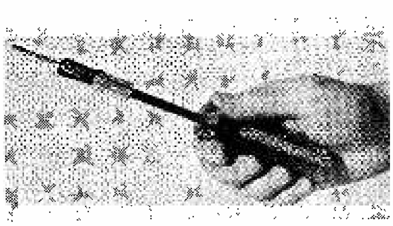
Choosing SMALL WORKSHOP TOOLS



Three of the Bib range of wirecutter/ strippers by Multicore Solders Ltd. The latest, centre, is the Model 3A with an instantly adjustable cam enabling the strippers to deal with most wire sizes. The cutters have ground cutting edges. The ends of the arms are, in fact, flat spanners for 4 and 6BA nuts, a most unusual feature.



A set of Stanley 'Pozidrive' screwdrivers enabling Philips type screws to be reached in the most awkward corners.



The Stanley range of 'Spee-D-Grip' screwdrivers incorporating a spring clip which holds screws in position for starting in inaccessible places.

types which remove the necessity of continually lifting the screwdriver from a screwhead thus, incidentally, reducing the risk of the blade slipping and doing damage. Of course, if one used a screwdriver properly, the blade should never leave the slot, but this seldom happens!

A most valuable addition to a set of screwdrivers is one having a spring attachment at the tip of the blade to firmly hold a screw while it is being inserted into place. Its value in awkward spots is inestimable. Such an attachment can sometimes be bought separately for use on almost any screwdriver.

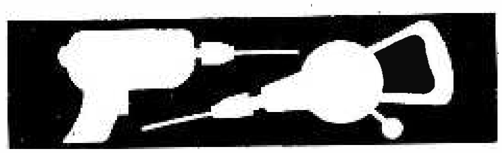
SPANNERS. There is always a temptation to use a pair of pliers on any nut that needs tightening, usually because the pliers are ready to hand. It should be remembered that the opposite faces of a nut are parallel to each other where-as the jaws of a pair of pliers are only parallel when they are closed. That's why the pliers always slip off the nut and cause damage.

First of all, get a set of box spanners covering 0 to 8BA either single or double ended. The single ended ones with a wooden or plastic handle are recommended. Just two, for 4 and 6BA, are worth their weight in gold in a workshop. Having long stems they are invaluable for placing nuts into odd corners where fingers or pliers cannot reach.

It is always good practice, wherever possible, to tighten a nut on to a screw rather than use a screwdriver on the screwhead. This is particularly important where the screwhead is visible such as on the front panel of a piece of equipment where a damaged slot on a screw would be an eyesore.

Another requirement in the spanner line is a set of flat spanners, again covering the BA sizes, possibly 0 to 8BA. These can very well be double ended ones since the length of the spanners is not of much importance.

Some sets are single ended but bolted together at one end so that one can be selected and the others swung out of the way, rather like a set of feeler gauges.



DRILLS. In the past a hand drill would have been a first acquisition in a workshop, followed by an electric drill when the money was available. Today the cost of electric drills is such as to justify buying one from the outset.

The simple electric drill will have a single speed and accommodate drills up to $\frac{1}{4}''$ in diameter, ('twist drill' is really the proper name for the bit that does the cutting). This model will perform just about all the routine drilling jobs in a workship where electronic projects predominate. A chuck adaptor to take drills up to $\frac{3}{8}''$ in diameter is highly desirable, enabling the usual holes for mounting potentiometers etc. to be drilled without having to resort to files or reamers.

If the drill is likely to be used for other duties around the house then the two speed drill with a chuck taking drills up to $\frac{1}{2}''$ in diameter can be considered. A popular accessory for the electric drill is the speed controller which is an electronic device enabling the speed to be varied continuously from a few r.p.m. to maximum speed. Such controllers are available in kit form or ready assembled.

If a lot of drilling is anticipated, particularly on chassis work, a drill stand will prove a boon. Most electric drill manufacturers have such stands but their design is such that they will accommodate most makes of drill. Such stands ensure that holes are drilled vertically, which may not be very important on sheet metal work but could be critical with a deep hole. Holes will be more accurate both in size and positioning when drilled on a stand rather than with a hand held electric drill.

When using drill adaptors enabling, say, a $\frac{3}{8}''$ drill to be used in a chuck of nominal $\frac{1}{4}''$ capacity, remember not to overload the motor by exerting excessive pressure on the drill especially in hard materials.

Hand operated drills suitable for the small workshop range from the simplest single speed ones with a $\frac{1}{4}''$ capacity to those taking drills up to $\frac{1}{2}''$ and having an integral gearbox providing either a low speed or a high speed at the chuck. A little extra spent on a good hand drill will be a worthwhile investment. In particular the gears will run more smoothly and require less energy and the chuck will be of a better quality.

Now, what about the twist drills themselves? These are bought singly, as required, or, if starting more or less from scratch, then in a set complete with a stand for use on top of the bench. They may be had in sizes from about $\frac{1}{32}''$ to $\frac{1}{4}''$ in diameter or in a numbered range from No. 80 (0·0135") to No. 1 (0·228"). Letter drills carry the range on upwards from 'A' (0·234") to 'Z' (0·413").

For many years the author has had just four drills always to hand, No's 12, 24, 32 and 43. These will cover the drilling of holes for tapping or clearing for 2, 4 and 6BA screws.

As far as the quality of twist drills is concerned, it is necessary to take a little more care over their selection than with other tools since there are a lot of drills on the market that seem to be made of little more than soft iron! So once again beware of cheap imitations and if the pocket will stand it, buy a small set of genuine high speed drills. These will last for ever and seldom need sharpening if not abused.

PUNCHES. Whenever it is required to drill a hole in a chassis, or anywhere else for that matter, it is essential to use a centre punch to mark the spot where the hole is required. Otherwise it is almost certain that the drill will wander off the spot, scratching or damaging the surface being drilled. This particularly applies to hard surfaces and when using a hand held electric drill especially if care is not taken to keep the drill vertical.

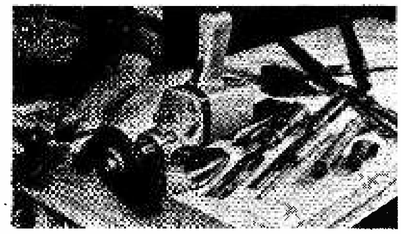
There's not much to say about centre punches. A good one will be of tempered steel with a sharp round point, usually machine ground. Spring loaded punches are available which obviate the need for a hammer, so these punches are very convenient and the extra cost well justified.

Chassis punches are a necessity although the number bought for a small workshop will probably depend upon the funds available. These punches will cut holes ranging from $\frac{3}{8}''$ to 3" in diameter but it is recommended that at least two be obtained, $\frac{5}{8}''$ diameter for B7G valveholders and $\frac{3}{4}''$ diameter for B9A valveholders. These punches require a suitable Allen key to operate them and their cutting limit is about 16 s.w.g. mild steel. They will cut through the usual 16 s.w.g. aluminium sheet like the proverbial knife through butter, thus saving a great deal of time and energy.

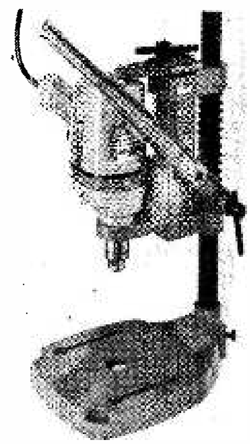
A useful tip . . . the resulting hole will have a burr on one side so place the cutting part of the punch on the side of the panel or chassis that might be of some importance from the point of view of appearance.

Other chassis cutters are available that will cut square or rectangular shaped holes but the infrequent need for such cutters does not justify their purchase.

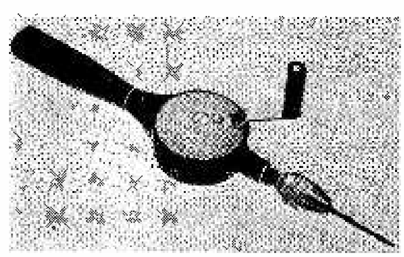
The predecessor of the chassis cutter was the tank cutter. This had an adjustable cutting bar for different diameters of hole, but unless used in a lathe or drill press,



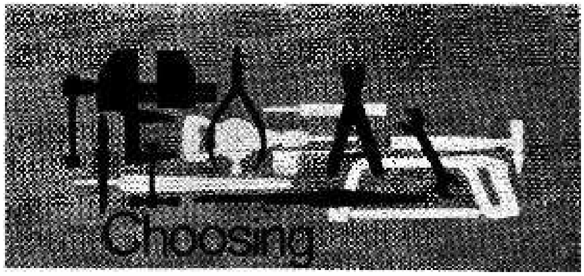
This bench clamp enables a portable electric drill to be used with grinding, polishing or other attachments (Wolf). The drill is a Wolf Sapphire 73.



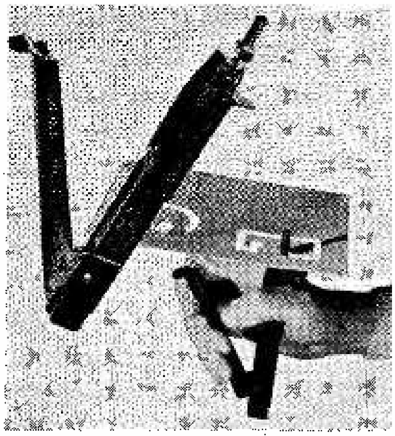
For precision drilling a bench drill stand is essential. The spring loaded press magnifies the hand pressure some ten times. (Wolf)



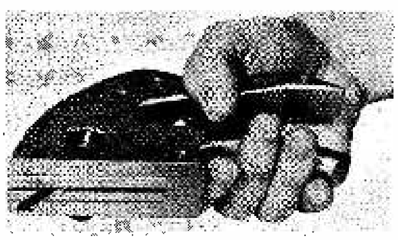
The old-fashioned hand drill now has a streamlined appearance. In this Stanley drill the gears are completely enclosed protecting them from dirt, swarf etc. and obviating nipped fingers!



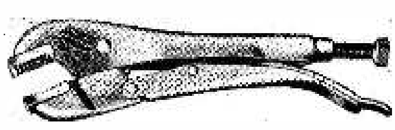
SMALL WORKSHOP TOOLS



Requiring only a $\frac{7}{16}$" hole to begin operations this Adel nibbling tool will cut a hole of any shape or size in sheet steel up to 18 gauge steel or aluminium up to 16 gauge. (West Hyde Developments Ltd.) The punch and die action cuts without distorting the metal.



This precision made Mole 'Supercut' tool has a powerful action capable of cutting long straight lengths, curves or angles in sheet materials such as steel, aluminium, plastic laminates etc. A replacement blade can be fitted very easily.



The standard Mole wrench has many uses in the small workshop. In spite of its immense gripping power it can be opened at a touch on the release lever.

the resulting hole could be a little rough in appearance. A slow cutting speed was essential and for this a carpenter's brace was ideal.

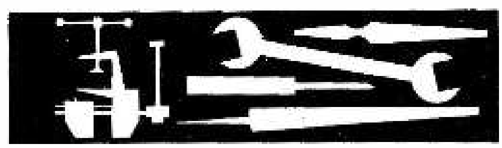
Other hand tools for cutting holes in sheet metal include the family of "nibblers'. A small hole is first drilled in the sheet metal, the nibbler inserted and the action of the tool nibbles the material away to form a hole of almost any shape desired. The hole can be finished off with the usual files.

Shears, or tinsnips, will be needed for cutting sheet metal and a 10" pair with straight jaws should suffice for general work. The will make a straight cut in sheet metal for a limited distance although the 'goosebill' type will usually prove better for this work.

TAPS. Now and again the necessity will arise to tap a thread in a hole and for this two taps for each size thread are required, together with a tap wrench. The first tap is tapered, to start the thread, and the second tap is full size. Sometimes a third tap of intermediate taper is used but this is not really required for small threads.

The tap sizes most likely to be required are the usual 2, 4 and 6BA. Taps can be broken off relatively easily and for this reason a proper tap wrench is strongly recommended.

The simplest and probably the best tap wrench is the bar type with a screw grip on to the tap. The chuck model is more expensive but it does enable the tap to reach positions that would be inaccessible with the bar type wrench.



FILES. For finishing off the edges of metalwork and suchlike a 10" flat file will be quite adequate. That known as 'second cut' will prove best being neither too coarse nor too fine for work on soft metals. A similar sized half round file is very useful for finishing off large holes such as those required for meters. While smaller holes, for valveholders etc., can be cut with chassis punches the cost of similar punches for large meter holes tends to be prohibitive, especially as they are used relatively infrequently. Such large holes can be made by drilling a circle of small holes, then knocking out the disc of metal and finishing the work with a half round file.

A $\frac{1}{4}$" round file completes the essential complement of files. This will find most use in enlarging small holes in the absence of a reamer or for 'drifting' holes that are not quite where they ought to be! Perhaps the spot was not properly spotted with a centre punch before drilling!

With the advent into common use of slide switches on electronic equipment the need has arisen for a couple of small needle files, one round and the other square, for finishing off the rectangular holes required in panels for these switches. If a set of needle files can be managed then so much the better as these sets contain files of circular, triangular and flat sections as well as those already recommended.

When buying files get suitable wooden handles for them at the same time. Don't try to use a file without a handle or there will be a grave risk of the tang of the file entering the wrist if the file should jam or stick in the work.

HAMMERS. As far as hammers are concerned the small workshop should have one with a plastic or rubber head for bending sheet metal, without causing undue marking of the metal. A second hammer should be a light one of the 'ball-pein' variety for general work around the place. A good make is advisable to ensure that the hammerhead is properly attached to the shaft as a hammerhead in orbit around the workshop is not funny!

REAMERS. During the construction of a piece of electronic equipment one always seems to need to drill a hole that is between the sizes of the drills available. In such a case a tapered reamer can be invaluable, as an alternative to filing out the hole with a round file, a process that does not endear one to one's family, if they are within earshot!

A pair of reamers can deal with holes between $\frac{1}{8}$" and 1" in diameter producing a clean circular hole with little or no burr. They are usually intended for use in a hand brace but can on occasion be held in the hand.

VICES. If a bench or table is permanently available for constructional work then a vice of some sort will prove to be a great boon especially when fabricating metal work. While smaller sizes are obtainable, an engineer's vice with 4" wide jaws should be the smallest size to be considered. Such a vice is extremely rugged and will take a lot of punishment, including using it as an anvil!

Since the vice jaws are made of hardened steel, and serrated at that, it is essential to make up a pair of soft jaws to protect work held in the vice. These jaws can be made from pieces of aluminium or other soft metal. Other vices have clip-on jaws which are plain, serrated or slotted to hold tubing or round material more securely. Another model of vice has a separate mounting plate that can be attached to almost any flat surface by means of a suction pad.

A carpenter's vice with 6" or 8" jaws is even better for sheet metal work since the jaws can be opened to a far greater extent than those of an engineer's vice. However the space needed to permanently mount a carpenter's vice, especially below and behind the vice, is considerably more than that needed for an engineer's vice. However, there are some portable vices on the market that seem to combine the best points of both types.

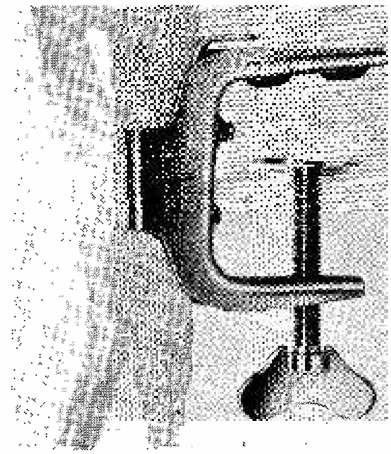
Although one may possess a bench vice there is always a need for a portable clamping or holding device and this is where the wrench comes in very handy.

The modern version of the wrench has an easily operated lever that allows the wrench to be locked on to the work and just as easily released. A clamp to hold the wrench is also available, which can be fitted to a table or bench top with a single clamping screw, thus providing a fixed vice if necessary. The jaw opening of the wrench can be adjusted over a wide range by a single screw fitting.

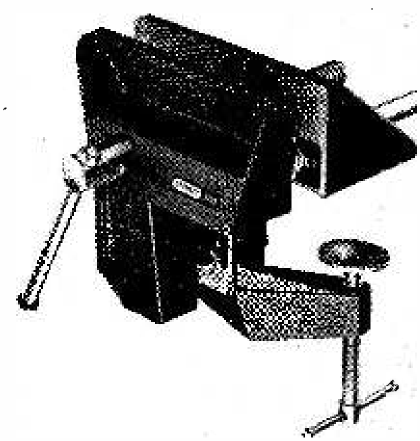
RULES. For marking out on sheet metal a rule and a square (trysquare) will be required, if an accurate job is to be done. A 12" rule is good enough and although it would seem that choosing such a simple tool would be no problem, the choice is, in fact, very wide indeed, ranging from rather inaccurate wooden rules, with printed graduations, to engraved steel ones.

Although a 6" square can be bought separately it really pays to buy a combination square since this incorporates a rule and square, usually of reasonable quality.

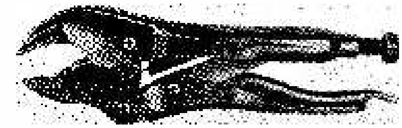
HACKSAWS. The hacksaw will come in for quite a bit of use in the small workshop, mainly for cutting sheet metal to size before forming into a chassis. Some of the cheaper hacksaw frames will be found to twist when the blade is tightened up, so a good quality frame will be a sound buy. The adjusting nuts, too, can be difficult to turn owing to poorly formed threads.



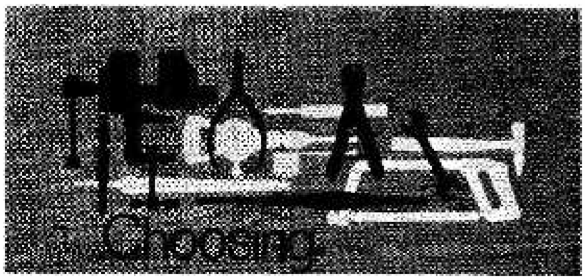
The versatility of the Mole wrench can be greatly increased by the use of this table or bench clamp, converting the wrench into a portable vice.



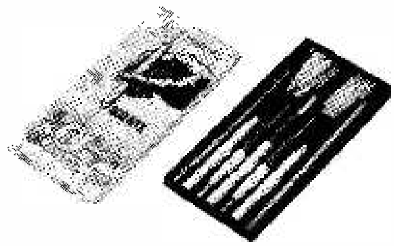
This Stanley aluminium portable vice has 5" jaws and can be clamped to any convenient surface. It is eminently suitable for bending sheet metal into chassis etc.



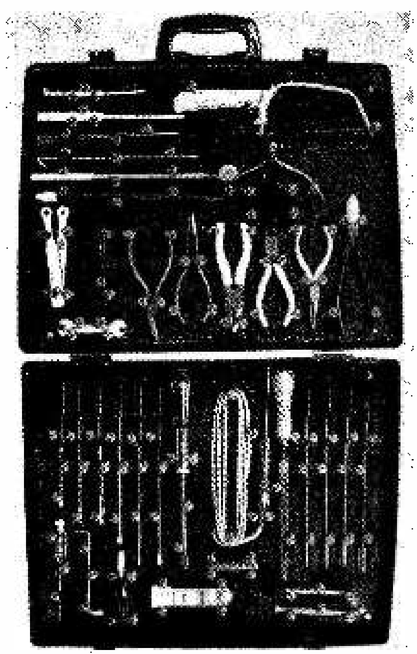
The Mini-Mole is just 5" long and very useful for getting into those tight corners, inaccessible to its 'big brother'. The curved jaws provide maximum contact with round or irregular shapes.



SMALL WORKSHOP TOOLS



This set of Philips trimming tools and adaptors will cover every conceivable requirement when aligning electronic equipment. The compact packaging makes the set particularly useful to the service engineer. (Combined Electronic Services Ltd.)



If you don't feel like tramping around the tool shops to gather together your collection of small workshop tools then this very comprehensive tool kit may be the answer. It has a wide variety of spanners, screwdrivers, pliers, cutters, a soldering iron and solder, and even an angled mirror for viewing components tucked away in tight corners. (C.E.S Ltd.)

A frame to take 10″ or 12″ blades is big enough and the blades themselves can be of the low tungsten flexible type. These will deal with general cutting of mild steel, brass and aluminium etc. and absorb a lot of misuse without breaking. For maximum performance high speed flexible blades are to be preferred although they are a little more expensive.

For maximum efficiency the size of the teeth on the blade must be related to the material being cut. For soft metals, such as aluminium, a coarse blade is desirable to prevent the teeth from clogging, but on harder metals such as brass or on thin sheet metal a finer toothed blade is required. The number of teeth per inch of blade normally runs from 14 to 32 for hand held saws.

A very useful addition to the standard hacksaw is the 'junior' or bow-frame saw in which the blade is held under tension by the bow. The standard blade is 6″ long with fine teeth. This saw is very handy for the smaller, finer jobs where the standard hacksaw would prove clumsy. In the electronic workshop the bow saw will be used a great deal for shortening the spindles of potentiometers, capacitors etc. Remember to hold the unwanted end of the spindle in the vice while cutting, rather than the component itself.

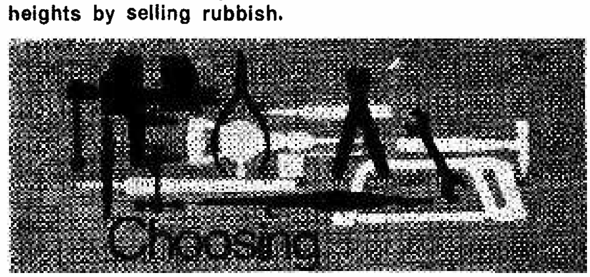
TRIMMING TOOLS. Although perhaps it is wandering into the realms of servicing it is not inappropriate in this review to mention trimming tools for electronic equipment. After all, having built a lovely radio set in our nice new workshop, it won't be of much use unless the tools to align it are to hand.

These trimming tools can be bought individually, as needed, but preferably they ought to be obtained as a kit. This will prevent the use of ordinary screwdrivers for adjusting iron cores which can only cause damage in the long run.

A kit may consist of one basic tool holder with several types of trimming tool that can be fitted into the holder or, in the more expensive kits, a complete trimmer for each purpose, such as adjusting iron cores, capacitors and special types of capacitors, such as the Philips pre-set beehive capacitors, which are met with quite frequently.

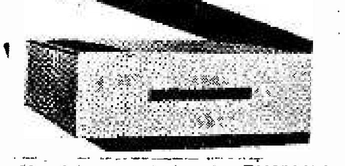
In conclusion it should be pointed out that for every basic tool mentioned in this review there are a dozen or more variations on the market. Like women, there are short ones, tall ones, thin ones and fat ones! Each one to his own fancy! The average D.I.Y. or tool shop is sated with gadgets that promise to relieve us of the tedium and work required to do a particular job. Few succeed, and those that do probably take twice as long to set up to do the job as one would take using basic tools alone.

It's surprising how often one resorts to basic methods and tools in the workshop. If funds are limited then put them to good use by buying only the best in tools from reliable manufacturers. If their names happen to be a household words they would not have reached those dizzy heights by selling rubbish.



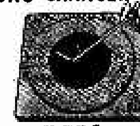
SMALL WORKSHOP TOOLS

PHILIPS PORTABLE PLAYER CABINET



Size 18 × 15¼ × 7¼in. Cut for B.S.R. UA12/14/15/16/25 deck. Amplifier space 14 × 5 × 3¼in. Satin aluminium front grille. Really smart appearance. Black/White. Chrome fittings. **£4** Post 25p

BSR C.109 SUPERSLIM
STEREO AND MONO CHANGER



Plays 12", 10" or 7" records. Auto or Manual. A high quality unit backed by BSR reliability with 12 months' guarantee. AC 200/250v. Size 13¼ × 11¼in. Above motor board 3¼in. below motor board 2¼in. with STEREO and MONO XTAL **£7.75** Post 25p.

GARRARD PLAYERS with Sonotone 9TA Cartridges. Stereo Diamond and Mono Sapphire. SP25 Mk II £15 Model 3500 Stereo and Mono Autochanger £14. Post 25p.

RECORD PLAYER PORTABLE CABINET Space for amplifier and autochanger. Post 25p. **£3.75**

RCS DE-LUXE 3 WATT AMPLIFIER. Ready made with 2-stage triode pentode valve, 3 watts output. Tone and volume controls. Isolated mains transformer, knobs, loudspeaker valves ECL82, EZ80. Response 50-12,000 cps. Sensitivity 200mV. Post 25p. **£4**

RSC 2 WATT AMPLIFIER with loudspeaker and valves UCL82 and UY85 Post 25p **£3**

R.C.S. TEAKWOOD BASE. Ready cut out for mounting (State player make and model) **£2.75**

R.C.S. PLASTIC COVERS FOR ABOVE BASE. Durable tinted plastic, attractive appearance. **£2.75**

EMI PICK-UP ARM with mono xtal and stylus £1·25. HI-FI PICK-UP CARTRIDGES. Diamond Stereo/Mono 9TA £2·90; GP94 £2·75; GP93 £2·25; Mono GP91 £1·50; GC8 £1·25; ACOS L.P. only 50p. All standard fixing complete with stylus.

PHILIPS TRANSISTOR FM STEREO MULTIPLEX DECODER

As used in LEAK Troughline Tuner. Brand New. Pre-aligned with 9 semi conductors. 24v. D.C. at 6mA. Complete with circuit and connections 3¼ × 2 × 1in. **£4** Post Free

WEYRAD P50—TRANSISTOR COILS

RA2W Ferrite Aerial	65p	Spare Cores	3p
Osc. P50/1AC	30p	Driver Trans. LFDT4	50p
I.F. P50/2CC 470 kc/s.	33p	Printed Circuit, PCA1	50p
3rd I.F. P50/3CC	33p	J.B. Tuning Gang	65p
P51/1 or P51/2	33p	Weyrad Booklet	10p
P50/3V	33p	OPT1	55p

Mullard Ferrite Rod 8 × ⅜in. 20p, 6 × ¼in. 25p.

VOLUME CONTROLS

Long spindles. Midget Size 5 K. ohms to 2 Meg. LOG or LIN. L/S 15p. D.P. 25p. STEREO L/S 55p. D.P. 75p. Edge 5K. S.P. Transistor 25p

80ohm Coax 4p. yd.

BRITISH AERIALITE AERAXIAL-AIR SPACED 40 yd. £1·40; 60 yd. £2. FRINGE LOW LOSS Ideal 625 and colour. **10p** yd.

WIRE-WOUND 3-WATT POTS. Small type with small knob. Values 10Ω to 30 K., Carbon 30 K to 2 meg. **25p**

WIRE-WOUND 3-WATT STANDARD SIZE POTS. LONG SPINDLE 10 OHMS to 100 K. **40p**

VEROBOARD 0·15 MATRIX
2½ × 5in. 19p. 2½ × 3¾un. 16p. 3¾ × 3¾in. 19p. 3¾ × 5in. 26p.
EDGE CONNECTORS 16 way 25p; 24 way 38p.
PINS 36 per packet 17p. FACE CUTTERS 38p.
S.R.B.P. Board 0·15 MATRIX 2½in. wide 3p per 1in., 3¾in. wide 4p per 1 in.; 5in. side 5p per 1in. (up to 17in.).
S.R.B.P. undrilled $\frac{1}{16}$in, Board 10 × 8in. 15p.

BLANK ALUMINIUM CHASSIS. 18 s.w.g. 2½in. sides. 6 × 4in. 45p; 8 × 6in. 50p; 10 × 7in. 70p; 14 × 9in. 90p; 16 × 6in. 90p; 12 × 3in. 50p.
ALUMINIUM PANELS 18 s.w.g. 6 × 4in. 8p; 8 × 6in. 15p; 10 × 7in. 17p; 12 × 8in. 23p; 14 × 9in. 27p; 12 × 12in. 32p.

1¼ inch DIAMETER WAVE-CHANGE SWITCHES 25p. 2 p. 2-way, or 2 p. 6-way or 3 p. 4-way 25p each. 1 p. 12-way, or 4 p. 2-way, or 4 p. 3-way 25p.
1 inch DIAMETER Wavechange "MAKITS" 1 p. 12-way, 2 p. 6-way, 3 p. 4-way, 4 p. 3-way, 6 p. 2-way, 1 wafer 60p, 2 wafer 90p. Extra wafers up to six 30p each.
TOGGLE SWITCHES, sp. 14p; dp. 18p; dp. dt. 23p.

ALL PURPOSE HEADPHONES

H.R. HEADPHONES 2000 ohms Super Sensitive	£1·75
LOW RESISTANCE HEADPHONES 3-5 ohms ..	£2·00
DE LUXE STEREO HEADPHONES 8 ohms ..	£3·25

"THE INSTANT" BULK TAPE ERASER AND RECORDING HEAD DEMAGNETISER

200/250 v. A.C. Leaflet S.A.E. **£2.35** Post 15p

GENERAL PURPOSE TRANSISTOR PRE-AMPLIFIER BRITISH MADE

for Mike, Tape, P.U., Guitar, etc.
Battery 9–12v or H.T. line 200–300v D.C. operation. Size 1⅜" x 1¼" x ¾". Response 25 c.p.s. to 25 Kc/s. 26db gain. For use with valve or transistor equipment. Full instructions supplied. Brand new. Guaranteed. Details S.A.E. **90p** Post 10p

NEW TUBULAR	ELECTROLYTICS			CAN TYPES	
2/350V ..	14p	100/25V ..	10p	16+16/500V ..	55p
4/350V ..	14p	250/25V ..	14p	50+50/350V ..	35p
8/450V ..	14p	500/25V ..	20p	60+100/350V ..	58p
16/450V	15p	8+8/450V	18p	32+32/250V ..	18p
32/450V	20p	8+16/450V	20p	32+32/450V ..	33p
25/25V	10p	16+16/450V	25p	32+32+32/350V	43p
50/50V ..	10p	32+32/350V	25p	100+50+50/350V	48p

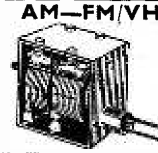
SUB-MIN. ELECTROLYTICS, 1, 2, 4, 5, 8, 16, 25, 30, 50, 100, 200mF 15V 10p; 500, 1000mF 12V 18p; 2000mF 25V 35p.
CERAMIC 1pF to 0·01 mF, 4p. Silver Mica 2 to 5000pF, 4p.
PAPER 350V-0·1 4p, 0·5 18p; 1mF 15p; 2mF 150V 15p. 500V-0·001 to 0·05 4p; 0·1 5p; 0·25 8p; 0·47 25p. 1,000V-0·001, 0·0022, 0·0047, 8p; 0·01, 0·02, 12p; 0·047, 0·1, 16p.
SILVER MICA. Close tolerance 1% 2·2-500pF 8p; 500-2·200 pF 10p; 2,700-5,600pF 20p; 6,800pF-0·01, mfd 30p; each.
TWIN GANG. "0-0" 208pF+176pF, 65p; Slow motion drive 365+365 with 25+25pF, 50p 500pF slow motion, standard 45p; small 3-gang 500pF £1·10. SHORT WAVE. Single 25pF 55p
CHROME TELESCOPIC AERIAL, swivel base, 28in. 20p.
TUNING. Solid dielectric. 100pF. 500pF, 35p each.
TRIMMERS. Compression 30, 50, 70pF, 5p; 100pF, 150pF, 8p; 250pF, 10p; 600pF, 10p; 750pF 10p; 1250pF 10p.
RECTIFIERS CONTACT COOLED ½ wave 60mA 38p; 85mA 48p. SILICON BYZ13 80p; BY100 30p; BY127 30p.
EX-GOVERNMENT RECTIFIERS 250v. 200mA, 30p.
NEON PANEL INDICATORS 250V AC/DC Red or Amber 20p.
RESISTORS. ¼ w., ½ w., 20% 1p; 2 w. 5p.
HIGH STABILITY. ½ w. 2% 10 ohms to 1 meg., 10p.
Ditto 5% Preferred values 10 ohms to 10 meg., 4p.
WIRE-WOUND RESISTORS 5 watt, 10 watt, 15 watt 10 ohms to 100K, 10p each; 2½ watt, 1 ohm to 8·2 ohms 10p.

Q MAX CHASSIS CUTTER

Complete: a die, a punch, an Allen screw and key

⅜in. 83p	⅝in.	88p	1⅛in.	98p	1½in. £1·20	2⅜in. £2·21
½in. 83p	1in.	98p	1¼in. £1·03	1¾in. £1·45	2½in. £2·86
⅞in. 84p	1$\frac{3}{16}$in. 98p	1⅜in. £1·08	2in.	£1·99	1in.sq. £1·88

AM—FM/VHF TUNING GANG



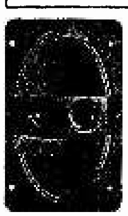
Super quality small size 1¼ × 1¼ × 1⅛in.. plus spindle 1¼ × ¼in. 365 + 365 pF with 25 + 25 pF. British made. Geared slow motion drive 6:1. Plastic dust cover. 6BA tapped front fixing. Cast aluminium frame **50p** Post Free

MAINS TRANSFORMERS

ALL POST 25p each

250-0-250 50 mA. 6·3 v. 2 amps, centre tapped ..	£1·10
250-0-250 80 mA. 6·3 v. 4 amp.	£1·40
250-0-250 80 mA. 6·3 v. 3·5 a. 6·3 v. 1 a. or 5 v. 2 a.	£2·00
350-0-350 80 mA. 6·3 v. 3·5 a. 6·3 v. 1 a. or 5 v. 2 a.	£2·00
300-0-300 v. 120 mA., 6·3 v. 4 a. C.T.; 6·3 v. 2 a...	£2·50
MINIATURE 200 v. 20mA., 6·3 v. 1 a. 2½ × 2½ × 2in.	75p
MIDGET 220 v. 45 mA., 6·3 v. 2 a. 2¾ × 2¼ × 2in.	90p
P.E. AURORA TRANS. 12 + 12v., 500mA	£1·50
MINI-MAINS 20v, 100mA. 1¼ × 1¼ × 1¼in.....	50p
HEATER TRANS. 6·3v. 3 a.	60p
Ditto tapped sec. 1.4 v., 2, 3, 4, 5, 6·3 v. 1½ amp...	80p

GENERAL PURPOSE LOW VOLTAGE. Tapped Outputs at 2 amp. 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 24 and 30 v. £2·00 1 amp., 6, 8, 10, 12, 16, 18, 20, 24, 30, 36, 40, 48, 60. £2·00 2 amp. 6, 8, 10, 12, 16, 18, 20, 24, 30, 36, 40, 48, 60. £3·00
AUTO TRANSFORMERS 115v. to 230v. or 230v. to 115v. Input/Output. 150w. £2·00; 500w. £5; 1000w. £12.
CHARGER TRANSFORMERS. Input 200/250v. for 6 or 12v., 1½ amp., £1·20; 2 amp £1·50; 4 amp. £2·00.
FULL WAVE BRIDGE CHARGER RECTIFIERS: 6 or 12 v. outputs, 1½ amp. 40p; 2 amp. 55p; 4 amp. 85p.
All transformers Postage 25p extra.



E.M.I. 13½ × 8in. LOUDSPEAKERS

With flared tweeter cone and ceramic magnet. 10 watts. Bass res. 45-60 cps. Flux 10,000 gauss. State 3 or 8 or 15 ohm. **£2.25** Post 15p
Also with twin tweeters and crossover. 10 watt. State 3 or 8 or 15 ohm. (As illustrated) **£4** Post 15p
Recommended Teak Cabinet Size 16 × 10 × 9in. Post 25p **£5**

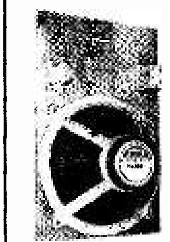
10W MINI-MODULE LOUDSPEAKER KIT £3.25

Post 25p

Triple speaker system combining on ready cut baffle. ½ in. chipboard 15 in. × 8½ in. Separate Bass, Middle and Treble loudspeakers and crossover condenser. The heavy duty 5 in. Bass Woofer unit has a low resonance cone. The mid-Range unit is specially designed to add drive to the middle register and the tweeter recreates the top end of the musical spectrum. Total response 20-15,000 cps. Full instructions for 3 or 15 ohm.
TEAK VENEERED BOOKSHELF ENCLOSURE. 16½ × 10½ × 6in. Modern Design, dark grey Tygan covered baffle **£5** Post 25p

ALL MODELS "BAKER SPEAKERS" IN STOCK

BAKER 12in. MAJOR £9



30-14,500 c.p.s., 12in. double cone, woofer and tweeter cone together with a BAKER ceramic magnet assembly having a flux density of 14,000 gauss and a total flux of 145,000 Maxwells. Bass resonance 40 c.p.s. Rated 20 watts. Voice coils 3 or 8 or 15 ohms. Post Free
Module kit, 30-17,000 c.p.s. with tweeter, crossover, baffle and instructions. **£11.50**

BAKER "BIG—SOUND" SPEAKERS

'Group 25'	'Group 35'	'Group 50'
12 inch 25 watt **£7**	12 inch 35 watt **£9**	15 inch 50 watt **£19**
3 or 8 or 15 ohm	3 or 8 or 15 ohm	8 or 15 ohm

TEAK HI-FI SPEAKER CABINETS. Fluted wood front
For 12in. round Loudspeaker .... £9. Post 25p
For 13 × 8in. Loudspeaker .... £5. Post 25p
For 10 × 6in. round Loudspeaker ...... £4. Post 25p
LOUDSPEAKER CABINET WADDING 18in. wide, 15p ft.

THIS ELAC CONE TWEETER IS OF THE VERY LATEST DESIGN AND GIVES A HIGHER STANDARD OF PERFORMANCE THAN MORE EXPENSIVE UNITS.

The moving coil diaphragm gives a good radiation pattern to the higher frequencies and a smooth extension of total response from 1,000 cps to 18,000 cps. Size 3½ × 3½ × 2in. deep. Rating 10 watts. 3 ohm or 15 ohm models. **£1.90** Post 10p

TWO-WAY XOVER NETWORK 3000 c/s.

With variable tweeter attenuator giving accurate high/low frequency balance. Mounted on panel 5½in. × 4in. with control knob, tweeter and woofer leads and input terminals. Suitable for 3 to 8 ohm imp. **£1.90** Post 10p

GOODMANS HEAVY DUTY 10in. WOOFER 15 OHM

10w. Large ceramic magnet. 30–12,000 cps. Ideal P.A., Systems, Columns, Hi Fi, Enclosures etc. **£4**

Horn Tweeters 2-16kc/s, 10W 8 ohm or 15 ohm £1·50.
De Luxe Horn Tweeters 2-18 Kc/s, 15W, 8 ohm £3.
TWO-WAY 3000cps CROSSOVERS 3 or 8 or 15 ohm 95p.
SPECIAL OFFER! 80 ohm, 2¾in. dia.; 35 ohm. 3in.
25 ohm, 3in. dia.; 6 × 4in.; 8 × 5in.
15 ohm 3¾in. dia; 7 × 4in.; 8 × 5in.
3 ohm, 2¾in, 3in. 5in. 5 × 3in. 7 × 4in. **£1** EACH TYPE
LOUDSPEAKERS P.M. 3 OHMS. 6½in. £1.10; 8 × 5in. £1·25; 8 × 2½in. 90p; 8in. £1.75; 10 × 6in. £1.90.
5in. WOOFER 8 watts max. 20-10,000 cps. 8 or 15 ohm. £1·80.
ELAC 8 in. De Luxe Ceramic 3 ohm or 15 ohm £2·50.
RICHARD ALLAN TWIN CONE LOUDSPEAKERS. 8in. dia. 4 watt; 10in. dia. 5 watt; 12in. dia. 6 watt 3 or 8 or 15 ohm models £1.95 each. Post 15p.
OUTPUT TRANS. EL84 etc. 25p; MIKE TRANS. 50:1 25p.
SPEAKER COVERING MATERIALS. Samples Large S.A.E.
GOODMAN'S OUTPUT TRANSFORMER 5 watt push-pull for valves EL84 etc., 3, 8 and 15 ohms 85p. Post 20p.

100 WATT ALL PURPOSE POWER AMPLIFIER

4 inputs speech and music. Response 10–30,000 cps Matches all loudspeakers. A.C. 200/250V. Treble and Bass Controls Details. S.A.E. **£36** Post Free

ALL EAGLE PRODUCTS

SUPPLIED AT LOWEST PRICES
ILLUSTRATED EAGLE CATALOGUE 20p. Post Free.

BARGAIN AM TUNER. Medium Wave. Transistor Superhet. Ferrite aerial. 9 volt. **£4**

BARGAIN 4 CHANNEL TRANSISTOR MIXER Add musical highlights and sound effects to recordings. Will mix Microphone. records, tape and tuner with separate controls into single output. 9 volt. **£3**

BARGAIN FM TUNER 88-108 Mc/s Six Transistor. 9 volt Printed Circuit. Calibrated slide dial tuning. Walnut Cabinet. Size 7 × 5 × 4inch **£10**

BARGAIN FM TUNER as above less cabinet **£7.50**

BARGAIN 3 WATT AMPLIFIER. 4 Transistor Push-Pull Ready built, with volume control. 9v. **£3.50**

COAXIAL PLUG 6p. PANEL SOCKETS 6p. LINE 18p. OUTLET BOXES, SURFACE OR FLUSH 25p.
BALANCED TWIN FEEDERS 5p yd. 80 ohms or 300 ohms.
JACK SOCKET Std. open-circuit 14p, closed circuit 23p; Chrome Lead Socket 45p. Phono Plugs 5p. Phono Socket 5p.
JACK PLUGS Std. Chrome 15p; 3·5mm Chrome 14p. DIN SOCKETS Chassis 3-pin 10p; 5-pin 10p. DIN SOCKETS Lead 3-pin 18p; 5-pin 25p. DIN PLUGS 3-pin 18p; 5-pin 25p.
VALVE HOLDERS, 5p; CERAMIC 8p; CANS 5p.

E.M.I. TAPE MOTORS

120v. or 240v. AC. 1,200 r.p.m. 4 pole 135mA. Spindle 0·187 × 0·75in. Size 3½ × 2½ × 2¼in. (illustrated). Post 15p. **£1.25**

BALFOUR GRAM MOTORS

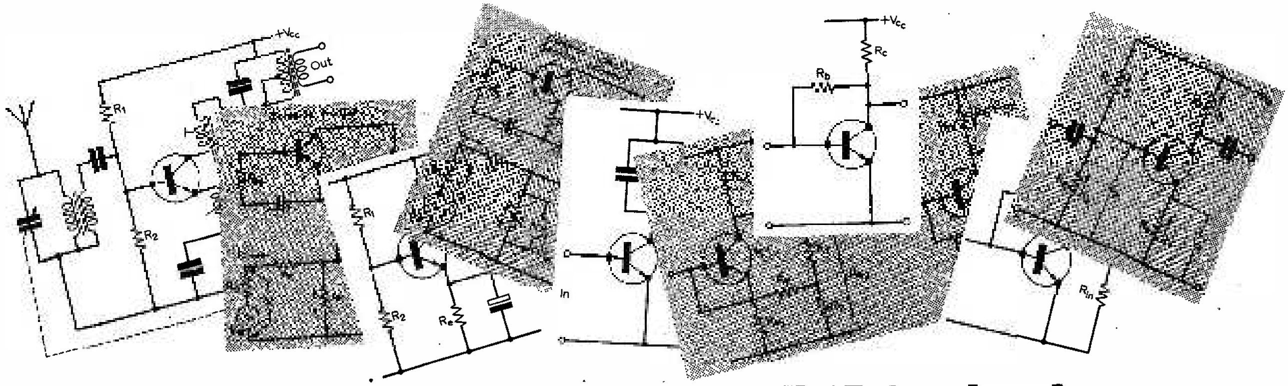
120v. or 240v. A.C. 1,200 r.p.m. 4 pole 50mA. Spindle ¾ × 3/20. Size 2½ × 2¼. × 1½in. Post 15p **85p**

Minimum Post and Packing 15p RETURN OF POST DESPATCH. HI-FI STOCKISTS. CUSTOMERS FREE CAR PARK. CALLERS WELCOME

RADIO COMPONENT SPECIALISTS

337 WHITEHORSE ROAD, CROYDON
Open 9–6 p.m. (Wednesdays 9–1 p.m., Saturdays 9–5 p.m.)

List 5p. **Written guarantee with every purchase.** *(Export: Remit cash and extra postage.) Buses 133, 68 pass door. S.R. Stn. Selhurst.* **Tel. 01-684-1665**



TRANSISTOR CIRCUITRY for beginners'

PART 1

H.W.HELLYER

SPECIAL SERIES-READ IN CONJUCTION WITH OUR FREE WALL CHART!

WHEN the idea for this series was first broached, everything seemed straightforward and simple. We would entitle the wallchart 'Building Bricks,' said the Editor, in an inspired moment, and the articles would take up each 'brick' and develop it so that newcomers to transistor circuitry could understand what was happening inside those inscrutable black boxes.

Which was all very fine—but it completely overlooked the fact that any beginner worth his salt is going to say 'But Why???'

No good my declaring '. . . an input signal to the base of Tr1 turns it on, which causes Tr2 to turn off and Tr3 and Tr4 to return to the stable mode, releasing Tr5, which now bottoms and allows . . . etc.' It would sound like a paragraph from Henry!

To understand transistor action, it is imperative that we begin by understanding what makes the darned things tick, That means going back to pure physics, not too deeply, preferably without mathematics, and then progressing to the methods of construction and the reasons why there are essential parameters—rules of operation, if you like—and this is what we shall begin with.

Semiconduction

As the name implies, the semiconductor is neither pure insulator nor electrical conductor, but something in between. Its resistivity lies roughly midway between that of conductors and insulators. This resistivity, moreover, decreases with increase of temperature (the resistance of a conductor increases slightly as the temperature is raised). This is one important difference between semiconductors and conductors.

Next, perhaps more important, is the way in which current flows in a semiconductor. There can be two processes; either a flow of negative electrons, as in the case of a conductor, or a flow in the opposite direction of positive 'holes'. The concept of hole flow is so vital to the understanding of transistor operation that we must begin with a simple discussion of atomic structure in order to get a grasp of it.

Atomic Structure

An atom consists of a central nucleus containing positively charged protons with a number of negatively charged electrons orbiting around it. The negative charge carried by an electron is equal to, and exactly opposite to, the positive charge of a proton. In a neutral atom, the numbers of each are equal.

Different elements have atoms containing different numbers of electrons, orbiting at different distances from the nucleus. The electrons close to the nucleus are tightly bound to the nucleus, but those circling in the outer orbits are more loosely bound, and are easier to dislodge from the parent atom. The outer ring is called the **valence ring,** and the valence electrons are those with which we are mainly concerned in this work. The looser they are bound to the atom—in any material—the better a conductor a piece of that material will make. This is because loosely bound valence electrons are free to be attracted by a positive charge, such as a voltage applied across a conductor by means of a battery.

Electrons flow out of the conductor into the battery at the positive connection, but an equal number pass from the negative connection of the battery into the conductor at the negative terminal, keeping the overall total of electrons the same.

Conversely, an insulator is a material in which all electrons are tightly bound to the nucleus, so that a large amount of energy is needed to break any loose to make a current flow.

Crystal Structure

The structure of a crystal of germanium or silicon is depicted in Fig. 1. It can be seen that there are four valence electrons in the outer ring and these are balanced in the nucleus by four positively charged protons, as indicated. In the three-dimensional structure that exists in reality, every atom is equi-distant from four other atoms and each valence electron forms a pair with one from an adjacent atom.

In two-dimensional form this can be shown as in Fig. 1, with pairs of electrons forming co-valent

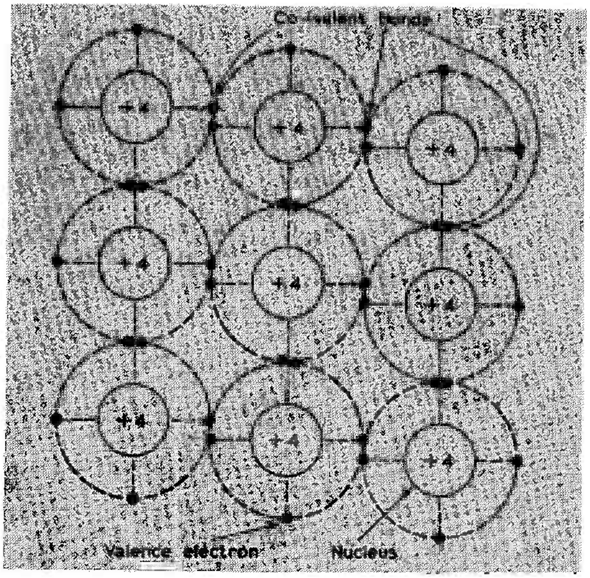


Fig. 1: Illustrating the structure of a germanium or silicon crystal.

bonds. This is a perfect crystal, with no impurities; and no electrons are dislodged from their atoms. This is, in fact, the basic structure of a perfect insulator, at absolute zero temperature, but as temperature increases, the energy of each atom is increased and some electrons can break away. If a voltage is applied, these free electrons are attracted to the positive pole and a current flow results. The space left in the crystal structure by a dislodged electron is termed a 'hole' and this represents a net positive charge.

We can therefore think of a movement of negative electrons toward the positive voltage terminal and a virtual movement of positive 'holes' (as successive electrons move to fill the vacant spaces) toward the negative pole.

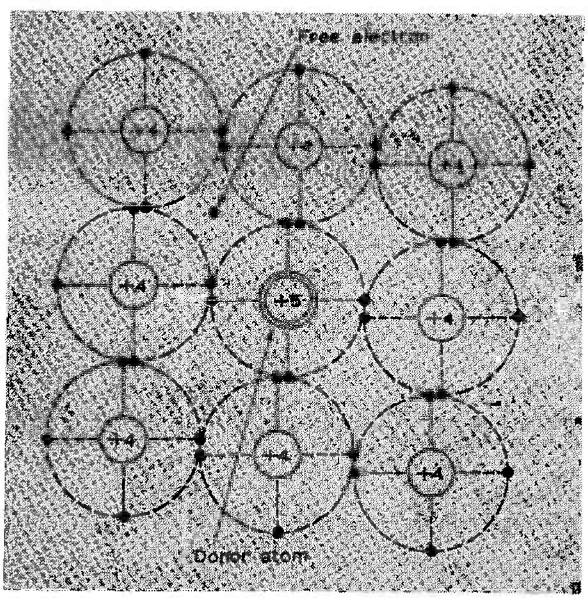


Fig. 2: Adding a 'donor' atom producing an excess free electron. N-type crystal.

N- and P-Type Semiconductor

This is a simplified explanation, but suffices to show the principle of hole movement. In a pure semiconductor there must be one hole for each free electron. Such a pure semiconductor is termed an **intrinsic material**. However, if an element of impurity is added to the intrinsic material an imbalance is obtained. If, for example, a "donor atom" having five valence electrons is added to the crystal, as in Fig. 2, there is an excess free electron. Four of the donor atom's valence electrons form co-valent bonds, in the manner previously described, but the free atom cannot do so and orbits loosely.

Some materials with a valency of five are antimony, arsenic and phosphorus. These can be added to the germanium or silicon crystal in proportions of as little as one part in a hundred million and reduce the resistivity of the germanium from 70 ohms/cm to 1 ohm/cm. Because the donor atoms in such a material contribute free electrons, which carry a negative electric charge, a material "doped" in this

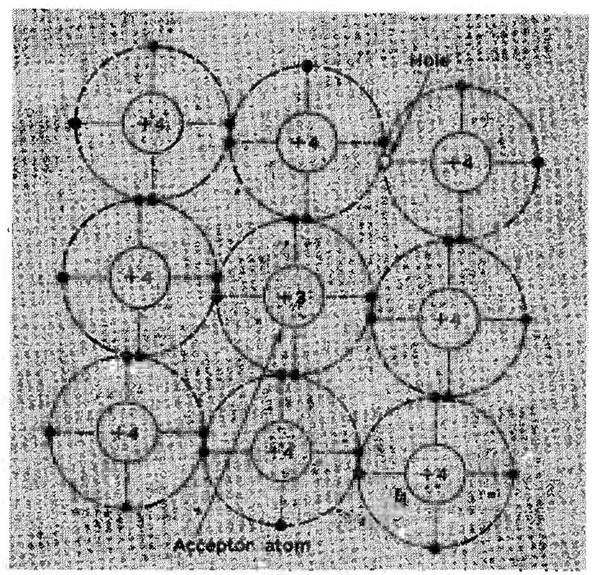


Fig. 3: In this case, an 'acceptor' atom creates a 'hole'. P-type crystal.

way is called an **n-type** semiconductor (i.e. it possesses an excess of negative current carriers).

The opposite process takes place if indium, borium or aluminium atoms are added to the basic semiconductor material, germanium or silicon. These materials have three valence electrons, and the addition of them creates holes in the semiconductor material, as shown in Fig. 3. The resultant semiconductor material has an excess of positively charged holes and is termed **p-type**.

Minority Carriers

Minority carriers are another important factor of semiconductor physics. If a few electrons are injected into p-type material they are called minority carriers (the majority of current carriers in p-type material being, as we have seen, holes). Recombination takes place as the electrons move to fill the holes.

Similarly, holes injected into an n-type material form minority carriers in this type of material, and small currents arise as recombination takes place. The time this takes to happen, termed the minority carrier lifetime, is an important property of a semiconductor material and the operation of most transistors depends on the movement of minority carriers.

PN Junction

A single piece of p-type or n-type semiconductor material is purely resistive: reversing the applied voltage does not alter the current flow. But if p-type and n-type regions are formed in a piece of semiconductor material, with the regions adjoining each other, a rectifying device is formed: when voltage is applied in one direction, current flows, but in the other direction little or no current flows. Such an arrangement is termed a pn junction.

In Fig. 4, the region to the right of the centre line is n-type, possessing a certain density of free electrons. To the left of the line is a region of p-type material possessing a number of positively charged holes. When the junction is first formed, it becomes an area of activity for a short period as free electrons tend to cross into the p-type region and holes move over to the n-type region.

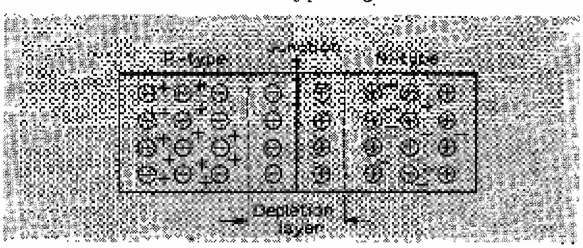


Fig. 4: Showing the charges existing in an unbiased PN junction.

This process of diffusion results in a potential building up across the junction, as the p-region gains a net negative charge with respect to the n region in the vicinity of the junction, and vice-versa, and this potential prevents further diffusion. This potential is termed the barrier potential and the region in the immediate vicinity of the junction, where there are very few free current carriers remaining after the initial diffusion, is termed the depletion layer or region, as shown in Fig. 4.

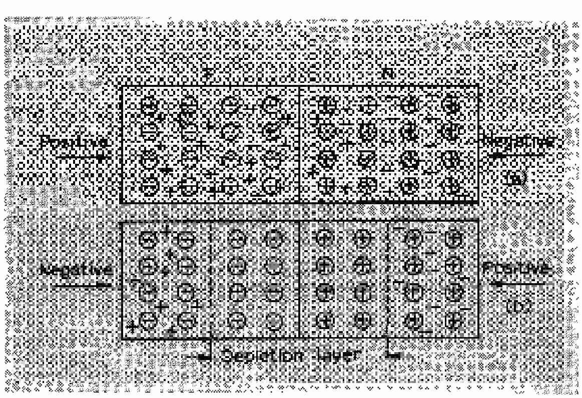


Fig. 5(a): Position of the charges with forward biasing and Fig. 5(b): with reverse biasing.

Forward and Reverse Biasing

We now have a piece of material with pronounced non-linear characteristics: when an external voltage is applied, current will flow in one direction only. If the p-type side is made positive with respect to the n-type (see Fig. 5(a), forward biasing), the effect is that the barrier potential is reduced. Majority carrier holes will diffuse across to the n-type (where they become minority carriers), and majority carrier electrons will move in to the p-type region. A relatively large current can flow across the junction in this way.

Reversing the bias, i.e. applying it as shown in Fig. 5(b), increases the barrier potential (since the external voltage adds to that across the depletion layer already) so that current flow is made very low —in fact virtually nil. However, due to the effect of temperature a number of holes and free electrons will be generated on either side of the junction—this happens even at room temperatures—and this will give the effect of a small reverse current flowing across the junction. The forward current may be quoted in milliamps but the reverse current only in microamps.

Characteristics of PN Junction

Fig. 6 shows the characteristics of a pn junction. As the forward voltage is increased from zero, the forward current increases slowly at first until the junction barrier is overcome, then rises rapidly. (In alternative terms, it can be said that the resistance of the forward biased junction is low.) In the reverse direction, the current remains low and practically

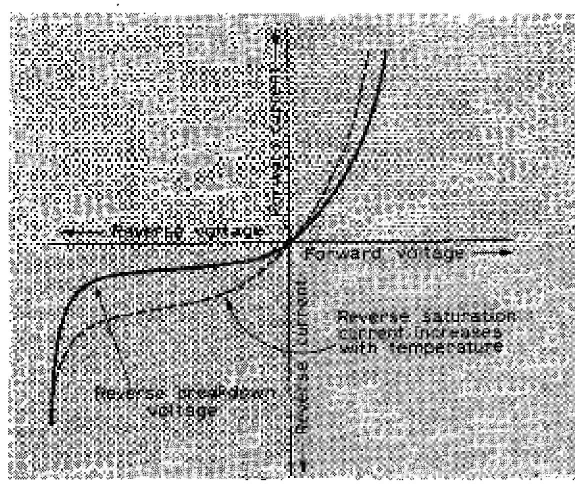


Fig. 6: The electrical characteristics of a PN junction.

constant as voltage is increased, i.e. reverse resistance is very high. Eventually, however, a point is reached where the reverse voltage accelerates the reverse current carriers to such a speed that they break down covalent bonds in the crystal structure, thereby releasing more carriers and producing an avalanche breakdown (when the junction may be destroyed). The value of voltage at which this occurs depends on the resistivity of the material.

As the reverse saturation current is due to the effect of heat, it increases with temperature, giving

—continued on page 512

I.C. OF THE MONTH

L.A.J. IRELAND

Number 24 — **LM373 Multiple-mode Detector**

SOME months ago these notes described the Motorola MC1596 balanced mixer integrated circuit and outlined its operation as a multiple-mode detector in receiver circuits. The unit discussed now goes further; full i.f. amplification facilities, at any chosen frequency up to 12MHz., are incorporated, as well as multiple-mode detection. It is the National Semiconductors (U.S.A.) type LM373, available in the U.K. from: Athena Semiconductor Marketing Co. Ltd., 140 High Street, Egham, Surrey: or Rastra Electronics Ltd., 275 King Street, Hammersmith, London W.6.

Uses

The unit is intended, not just to operate in each mode, but to make it possible to design a receiver in which intermode switching would be simple without reduction of performance. As well as the standard a.m. and f.m. modes, as used for broadcast entertainment in the m.f. and v.h.f. bands, the LM373

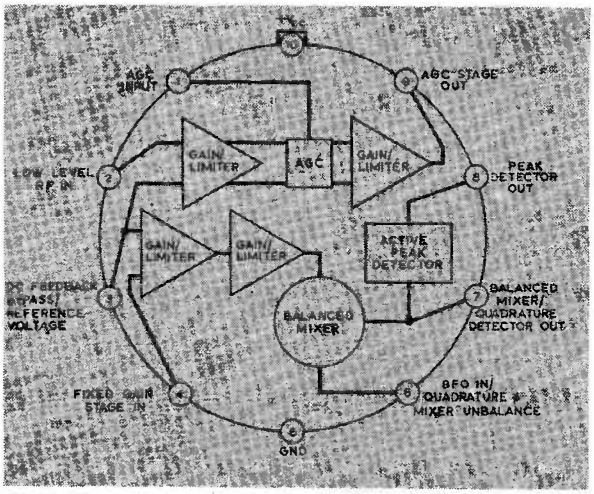
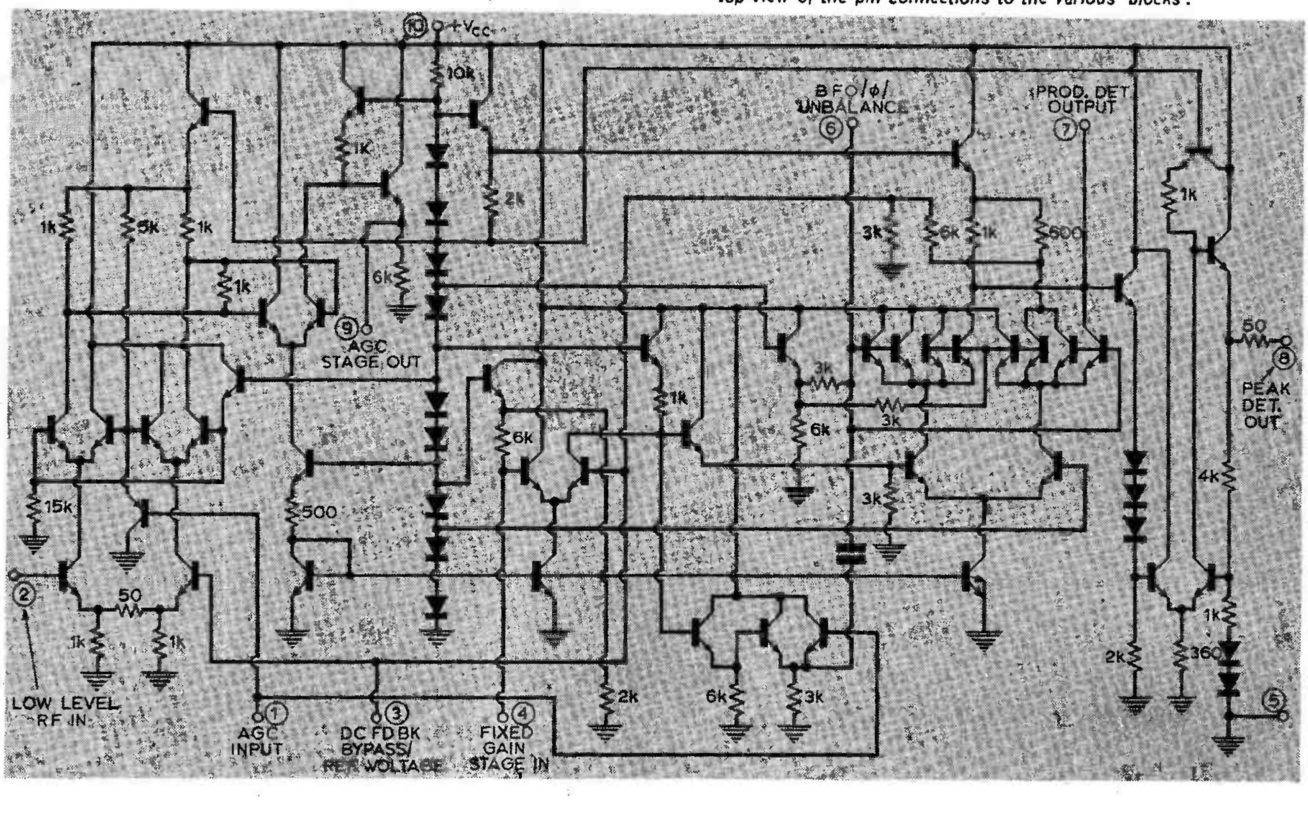


Fig. 1: The equivalent circuit of the LM373 (below) with (above) the top view of the pin connections to the various 'blocks'.



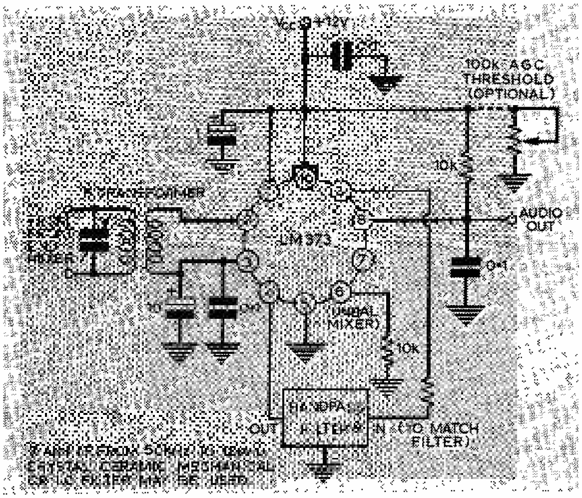


Fig. 2: External circuitry required for the LM373 when used as an AM IF strip.

can handle n.b.f.m. (narrow-band frequency modulation) increasingly used in mobile radiotelephone systems, and s.s.b. (single sideband suppressed carrier) transmissions of commercial or amateur origin.

Design

Considerable ingenuity is exercised in the design of the i.c. to reconcile the conflicting demands of each transmission system with the minimum of inter-mode switching in the receiver. A.M. and s.s.b. receivers must have a linear amplitude response, maintained, despite the wide range of signal strength received off the air, by an automatic gain control subcircuit. An f.m. i.f. amplifier strip, on the other hand, is essentially nonlinear, in that any input signal is amplified to a limiting level before application to the detector stage. It follows that automatic gain control has no place in such a system.

To provide the facilities indicated, the LM373 incorporates four gain blocks, which can be operated in a limiting mode, as well as an automatic gain

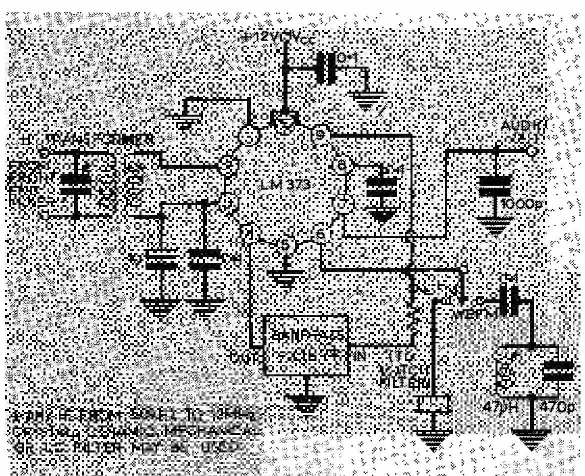


Fig. 3: The LM373 in its role of an FM IF strip suitable for narrow or wideband reception.

control system and two detectors, one a balanced mixer similar to that in the Motorola circuit already mentioned, and the other a peak detector for a.m. operation. The equivalent circuit and pin diagram given in Fig. 1 allows these sections to be identified.

Operation

Some discussion of the circuit would appear necessary. Each gain block is essentially the familiar differential amplifier, which can be operated in its linear region when the circuit is used for a.m. or s.s.b. reception, or driven to full gain as a limiter for f.m.

The automatic gain control characteristic is secured through a pair of transistors shunting the differential interstage coupling components. When no a.g.c. voltage is applied, these transistors are cut off, but as the control voltage is increased, they draw off an increasing fraction of the signal current; finally the point is reached where the signal from

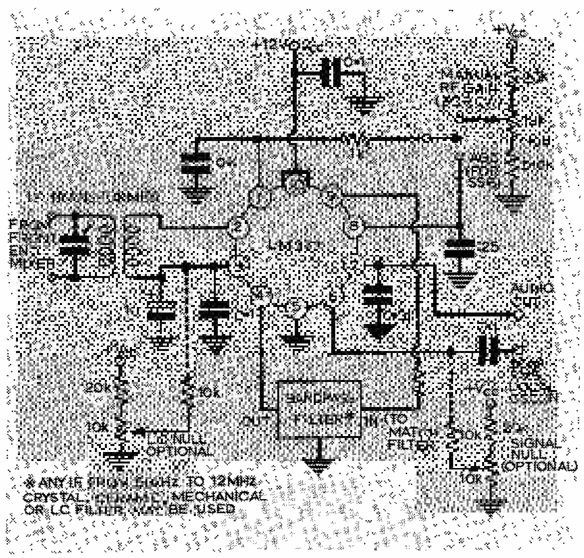


Fig. 4: The SSB/CW IF strip shown here further demonstrates the versatility of the LM373.

the first gain block is shorted out, and coupling to the second is merely through stray capacitance.

This approach secures the unusual a.g.c. range of over 70dB., enabling linear a.m. detection to be attained with input signals from 40 microvolts up to 200 millivolts. The string of reference diodes and emitter follower transistors from the d.c. +ve. line provide power supplies with decoupling to each stage of the amplifier strip, together with appropriate bias voltages to set the operating point of each element. As well as simplifying the external decoupling requirements of the circuit, these imply that each stage essentially has its own regulated supply, so minimising the effects of power line variations.

The balanced mixer stage is easily identified by the cross-coupling of its component transistors. For f.m. it operates as a quadrature detector, a system outlined when describing the MC1496, as was the product detector system used for s.s.b. In a.m. operation, this section is deliberately unbalanced by an externally applied bias, leaving only one side of the differential system connected to its load effectively.

N.b.f.m. demodulation requires a quadrature element of a higher Q factor, i.e. more rapid change of phase with frequency, and therefore a quartz crystal is substituted for the more familiar l.c. circuit. The final section is the peak detector, acting as a.m. detector and a.g.c. voltage source for linear a.m. and s.s.b. operation.

A few precautions are necessary for successful operation. The a.g.c. stage output at pin 9 has a very low impedance, being taken from an emitter follower. A value of 70 ohms is quoted, so that if a high Q crystal filter is employed here a series resistor is advocated, so that the resonance peak of the component will not be damped. The manufacturer of the crystal in question will quote a recommended source impedance, allowing selection of an appropiate resistor.

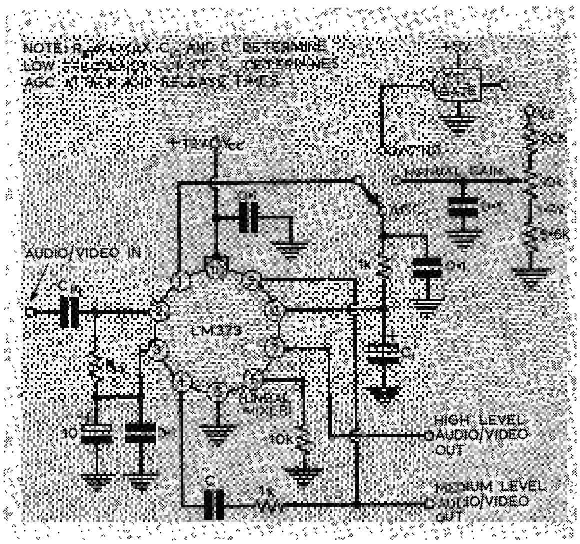


Fig. 5: In TV circuitry the LM373 can be used as an audio/video amplifier with a.g.c., manual gain control or gating.

The d.c. feedback loop at pin 3 must be carefully bypassed, since the decoupling must be effective throughout the passband of the LM373; an electrolytic or tantalum capacitor, as used for a.f. decoupling, has too high a reactance at high frequencies to be effective alone, so a small disc ceramic or silver mica is added.

For s.s.b., bypassing of r.f. at pin 7 is particularly important, as any local oscillator component reaching the peak detector would increase the a.g.c. voltage generated, and lead to an unnecessary reduction of system gain. The optional nulling circuits may be used to maximise gain should that prove necessary (an unlikely event).

Figs. 2-5 indicate the circuitry in which the LM373 may be employed, and it should be noted that the communications receiver applications for which it was designed do not exhaust the potential of this versatile unit, as is indicated by the circuit for a wideband amplifier indicated in Fig.5. Other reported applications have included use as an amplitude-modulated r.f. oscillator, an s.s.b. generator, or indeed any of the applications open to the balanced mixer circuit in which extra wideband gain is useful. So presumably more will be heard of the LM373!

TRANSISTOR CIRCUITRY FOR BEGINNERS

—continued from page 509

the effect shown by the dotted line in Fig. 6.

Junction devices of this type are known as diodes, and widely used in radio, television and other electronic applications. The diode is essentially a one-way valve, as we have seen from the forward and reverse bias characteristics.

Germanium diodes were the first types developed for commercial use, but the current-handling capacity of these devices was limited, and it was not until research provided a means of treating silicon that power rectifier semiconductors became a practical proposition. Silicon is more difficult to melt and purify than germanium, but can be doped with donor and acceptor impurities in the same way as germanium, is less sensitive to temperature, and will handle higher powers more efficiently. Common types pass currents of half-an-ampere and more with a practically negligible forward resistance. Silicon diodes have a high reverse voltage rating. (On the other hand, a germanium has greater efficiency at low voltages and at higher frequencies, and is thus retained for signal circuits.)

The pn junction forms the basis of most forms of semiconductor diode and transistor. One other form of construction is important in connection with diodes—the point contact type. In this the rectifying property is possessed by a contact between a thin metal wire and a piece of semi-conductor material. Though junction devices predominate today, point contact diodes are still much used as detectors in radio equipment. Their characteristic is similar to that of the pn junction, shown in Fig. 6, except that as the reverse current increases beyond the reverse breakdown point, reverse voltage tends to fall.

TO BE CONTINUED

SERVICING

AN INTRODUCTION TO FAULT-FINDING

PART 6

G. J. KING

THIS MONTH G. J. KING RETURNS TO THE SERIES TO ELABORATE ON AUDIO MATTERS, DEALING WITH CONVENTIONAL VALVE AMPLIFIERS AS WELL AS TRANSISTORISED HI-FI EQUIPMENT.

NOW that colleague Hellyer has cleared the decks on alignment, superhet theory and f.m. stereo, it is my turn to have a go on audio equipment.

GRAM AUDIO STAGES

An ordinary radiogram differs little at the pre-audio stages from a radio receiver, so much of the information presented earlier will also be applicable here. However, most contemporary radiograms are equipped for f.m reception, possibly with a decoder to abstract the stereo information and to direct the left and right channel signals separately to the corresponding audio channels. Thus, many radiograms and record reproducers feature a pair of audio channels and speaker systems. These are very much twin partners, the design of one following very closely the design of the other.

A mono radiogram has just the single audio channel and speaker system (though some designs employ more than one speaker unit, the mono signal being applied to them all in suitable frequency division). Whether mono or stereo, the f.m. front-end is a fairly common factor, the demodulator these days usually being the ratio detector in unbalanced or (in better quality equipment) balanced mode.

However, while the f.m. detector in a mono receiver feeds the audio channel direct (via the 50μS de-emphasis), the f.m. detector in a stereo receiver delivers the multiplex signal to the stereo decoder, the function of which is to process the sidebands of the stereo information (the difference signal) in conjunction with the mono information and the 38kHz reference signal (derived by frequency multiplication from the 19kHz pilot tone) to retrieve the left and right transmitted audio signals in the best isolation (e.g., with the least crosstalk).

De-emphasis and sometimes subchannel suppression (deleting the residual 19kHz and 38kHz multiplex components which can interfere with the audio section and add whistles to tape recordings) are engineered into the left and right audio channels, prior to the power amplifiers.

I shall be having something to say about f.m. front-ends, i.f. channels and stereo decoders later, but for now let us concentrate on the audio channels.

The simplest audio channel is designed round the triode-pentode valve, the triode receiving the detector's signal, amplifying it and then passing it to the control grid of the pentode for power amplification, Fig.1. Quite a lot of valve radiograms are equipped with this kind of audio section, as also are the inexpensive species of record reproducers. These were in fashion when stereo started, so early stereo models boast two such audio sections.

The advent of stereo was concurrent with the development of transistor equipment, which was fortunate for the receiver designers, so the audio channels we now find in stereo eqipument are mostly transistorised.

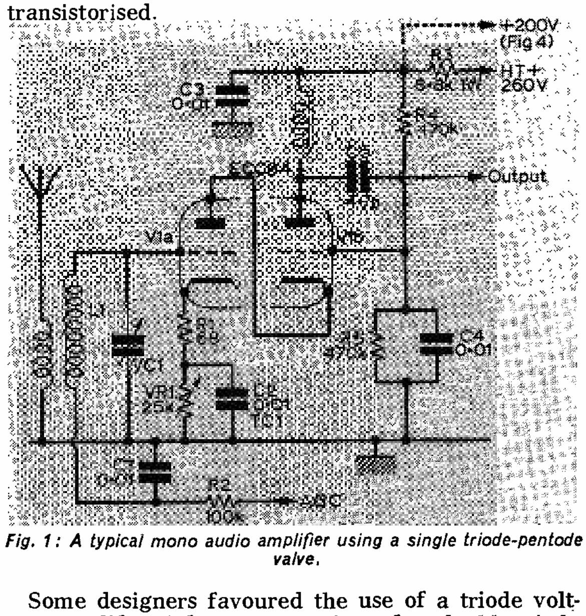


Fig. 1: A typical mono audio amplifier using a single triode-pentode valve.

Some designers favoured the use of a triode voltage amplifier (often one section of a double-triode valve) followed by a separate power pentode. This allows for greater audio power than generally possible from the pentode section of a triode-pentode valve, particularly so far as the early triode-pentode valves are concerned. Such a circuit is shown in Fig. 2, which will be seen to have much in common with that in Fig. 1.

Better quality receivers have been made with a pair of triode-pentodes in each channel to provide push-pull working. In this type of circuit the two pentodes are the push-pull output valves, while the two triodes are arranged as phase splitters supplying the anti-phase drives to the pentodes. However, since few receivers like this are in the field, there is not much point in detailing the circuit, but it is worth bearing in mind.

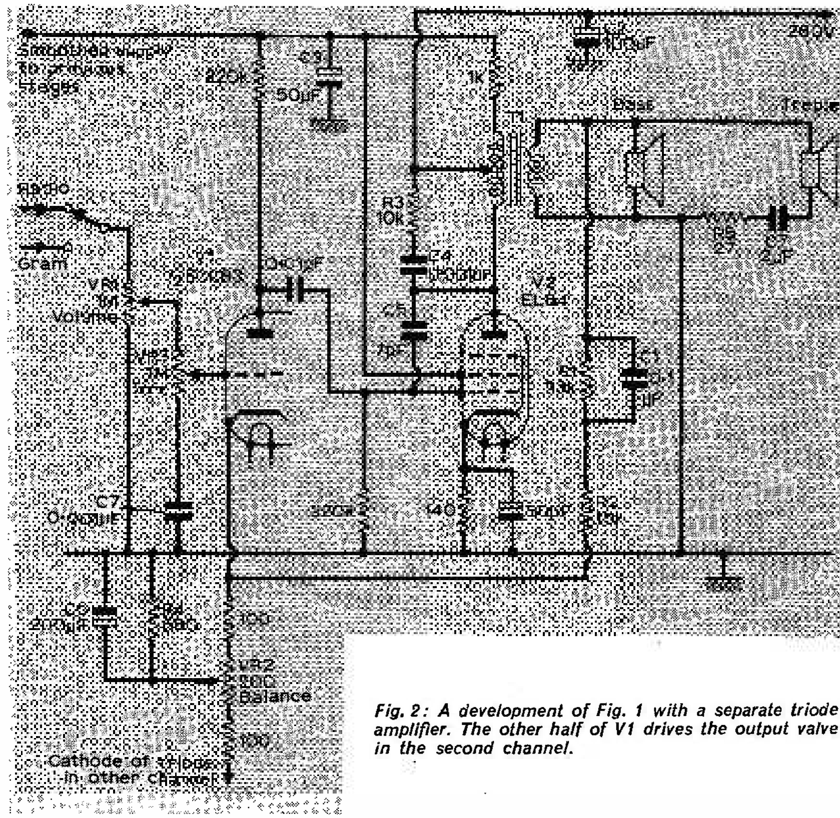


Fig. 2: A development of Fig. 1 with a separate triode amplifier. The other half of V1 drives the output valve in the second channel.

Let us return to Fig. 1. The audio signal from pickup or radio detector is coupled by C1 to the top of the volume control VR1, the selected level of signal then being applied via C2 to the triode grid. Note that the grid is returned to chassis through R1 (10MΩ) and that the cathode of the triode is returned direct to chassis. This is a common trick to secure grid bias for the triode. Contact potential in the valve causes a minute current to flow through R1, and because of the high value of this resistor a small potential developed across it, and since it is negative at the grid it serves as grid bias. It requires an electronic testmeter to measure this bias (since a normal meter would swamp the 10MΩ with its own resistance).

A common cause of distortion in this kind of circuit stems from a faulty triode, the fault resulting in excessive grid current and hence a potential across R1 in opposite polarity to that of the bias. The triode anode current rises, and often the valve tends to overheat.

R2 is the triode anode load, with R3 and C3 the decoupling components. The signal across R2 is coupled by C4 to g1 of the pentode, which is biased by the voltage drop across the cathode resistor R4, the grid being returned to chassis through R5. C5 is the cathode bypass capacitor (always an electrolytic in audio output stages).

The anode of the pentode is loaded by the low impedance speaker via the output transformer T1. C6 across the primary attentuates high-order harmonic distortion and makes the reproduction more palatable, as there is no negative feedback and no cancellation of second-harmonic distortion by any push-pull action.

FAULTS

Owing to the simplicity of this circuit, (Fig. 1) faults are not generally very difficult to define or locate. A cause of bad distortion is poor insulation of the coupling capacitor C4. This would permit a positive potential to exist at the control grid of the pentode with a consequent counteracting of the negative bias. It would be accompanied by excessive positive voltage at the cathode of the pentode, which could result in the failure of C5. The valve would also run very hot, possibly with the pentode anode glowing red.

Complete failure (e.g., audio drive at the top of the volume control VR1, but no speaker output) should first lead to a valve test, followed, if necessary, by voltage checks on the appropriate electrodes. C6 is subjected to audio voltage peaks which sometimes result in it shorting. This would cut the output completely, of course, but without affecting the pentode anode voltage much, so look out for this if the valve and electrode voltages seem to be normal.

Open-circuit of T1 primary deletes the pentode anode voltage, a fault condition which is often revealed by the screen grid (g2) of the pentode glowing red hot.

Low gain or volume at maximum volume control setting, assuming normal audio drive from the detector or gram pickup, is not uncommonly caused by C5 going open-circuit or low in value. This results in negative current feedback from the audio then developed across R4. The quickest way of checking this is by shunting an electrolytic across C5.

The symptom can also be caused (possibly accompanied by distortion) by the triode anode load R2 going high. If R3 goes high or C3 becomes electrically 'leaky,' the voltage at the top of R2, and hence the triode anode voltage, will drop, which again will cause low gain and possible distortion.

Before going on to more modern transistor circuits, let us have a look at some possible fault conditions in the valve circuit in Fig. 2. The faults described for Fig. 1 circuit would also be applicable here, with one or two qualifications. First, there are two separate valves involved, the triode voltage amplifier in this case being one section of a double-triode, the other triode serving as the voltage amplifier of the partnering stereo channel (not shown).

If one channel only is in trouble one can easily compare the voltages, etc. with those at the same points in the active channel, which is a quick way of bringing the fault to light. It is also possible to substitute the same type of valves (V2, for example) between the two channels, which would tell conclusively whether the valve is responsible.

There are refinements in Fig. 2, not found in Fig. 1 circuit. For example, voltage negative feedback is applied from the secondary of the output transformer T1 to the cathode of the voltage amplifier V1, and for this to happen one side of the secondary has to be connected to chassis. The amount of feedback is determined by R1 and R2, while C1 in parallel with R1 corrects the phase of the feedback signal, ensuring that it remains substantially negative over the audio spectrum. Thus, if there is a significant rise in gain (e.g., full output at a low setting of the volume control VR1) and abnormally high distortion, then R1 and R2 should be checked for value.

C1 open-circuit could encourage instability at certain frequencies, and this is sometimes 'triggered' by transients of the music. The oscillation could be at a frequency above audio, and the only way to prove this is by connecting an oscilloscope across the secondary of the output transformer T1, preferably when the amplifier is driven by a sinewave signal from an audio generator. The oscillogram in Fig. 3 gives some idea of what the spurious signal could look like on the sinewave. The audio generator would be coupled to the grid of the triode, of course.

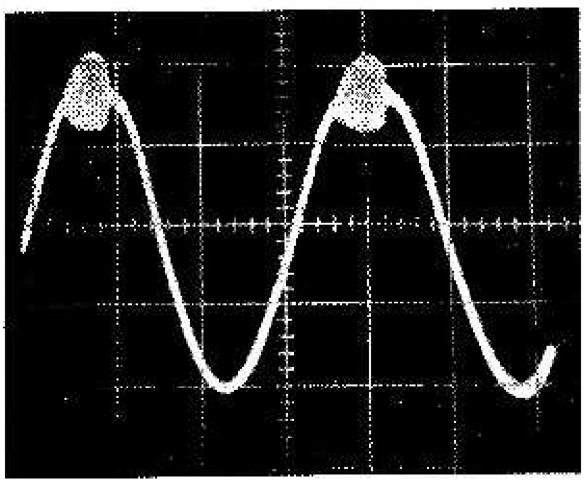


Fig. 3: This oscillogram shows spurious oscillation triggered off by transients in the signal

If the earth and feedback connections are reversed on the transformer the feedback would be positive and the amplifier would turn into a violent oscillator! Take care, therefore, when fitting a replacement transformer! Moreover, designs like this are geared to an output transformer of specific characteristics, so if it becomes necessary to replace the transformer, and the exact type is not available, then it might be necessary to alter the feedback resistors and the phase-correcting capacitor so that the values provide the correct conditions of feedback.

An interesting feature of the circuit is the tap on T1 primary. An output transformer of this kind serves both for speaker coupling and for 'smoothing' the h.t. supply fed to the earlier stages. In fact, it acts in part rather like a smoothing choke. In the circuit, C2 is the reservoir capacitor across the power supply output and C3 is the main smoothing electrolytic.

R3 and C4 series combination across the signal part of T1 primary attenuates the higher-frequency distortion components while, with C5, providing a degree of corrective phase shift.

The triode V1 in this circuit is cathode-biased, the main cathode resistor being R4, decoupled by C6. VR2 is the stereo balance control, which feeds either side the 100-ohm resistors (one to the cathode circuit of the partnering channel). The 100-ohm resistors provide a small degree of negative current feedback since they are out of the decoupling influence of C6. The voltage developed either side of VR2 relative to the slider also contributes to the feedback. Thus it will be appreciated that by adjusting VR2 from its centre setting, the feedback on one channel will decrease, while increasing on the other channel. This, therefore, allows the gains of the two channels to be adjusted relatively for the most desirable stereo effect.

VR3 is a simple 'tone' control which works as a reactive potential-divider in conjunction with C7. With increasing frequency the reactance of C7 falls, which means that as the slider of VR3 is turned towards this end of the track the bass is lifted and the treble diminished.

It will also be seen that two speaker units are employed. That for bass is connected directly across the secondary of T1, while the treble unit receives drive via R5 and C7. R5 reduces the power, while C7 passes only the higher frequency signals. This is a very simple frequency-divider, which cannot be regarded as 'hi-fi.'

HI-FI CIRCUIT

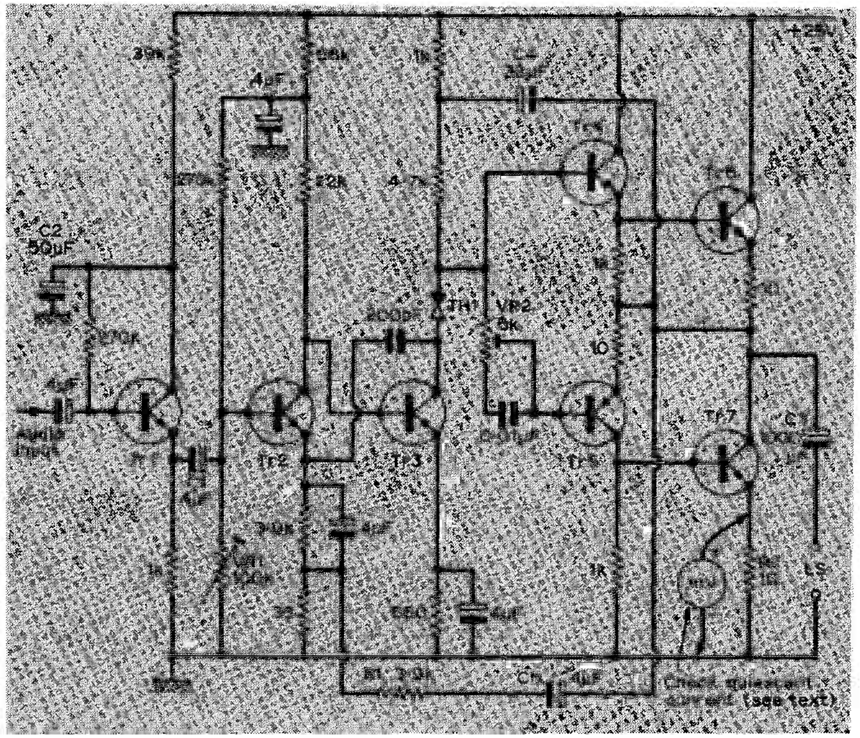
One channel of a slightly different circuit which, possibly differing in detail, is found in some hi-fi equipment. This is the power amplifier department only, Fig. 4, where Tr1 is the input transistor, coupling to the d.c.-coupled pair Tr2/Tr3 via C1. The coupling is from Tr1 **emitter** (the collector 'earthed' to signal through C2). The stage is thus an emitter-follower, which has a relatively high base input impedance, giving the correct match from the control section.

Tr4/Tr5 constitute a complementary driver pair (complementary because one is n.p.n and the other p.n.p.). These drive the push-pull output transistors Tr6/Tr7 alternatively into conduction and cut-off on each half-cycle of signal. It will be noted that the base of Tr4 is fed from the same source (e.g., Tr3 collector) as the base of Tr5. Thus on a positive half-cycle Tr4 conducts and pushes a positive half-cycle into Tr6 base. At the same time Tr5 is driven downwards and since Tr7 base is connected this time to Tr5 collector a negative half-cycle appears at Tr7 base, pushing this transistor into cut-off. On a negative half-cycle of drive the conditions reverse, so that Tr6 is driven into cut-off and Tr7 into conduction.

The two half-cycles are reconstituted as a complete waveform in the load comprising the speaker, coupled through C3.

C4 is a bootstrapping capacitor which applies feedback in such a way as to increase the driver input impedance. A.C. negative voltage feedback is applied to Tr2 emitter circuit from the push-pull pair, via C5

Fig. 4: Circuit of one channel of a transistorised hi-fi stereo amplifier.



and R1. Feedback of 60dB is a common hi-fi value, which reduces the output impedance to a fraction of one ohm.

D.C. coupling exists right through to the output transistors from Tr2, so by adjusting the d.c. conditions, both the drive 'balancing' and the quiescent current of the output transistors are affected. Some circuits have no means of adjusting these parameters, so if the value of a critical component alters, so might the quiescent current and balancing.

However, in Fig. 4 VR1 adjusts the balancing and VR2 the quiescent current, which leads us neatly to hi-fi equipment fault-finding and tests. But before going on to this it is noteworthy that temperature stabilisation is often provided in or around VR2 circuit to hold the quiescent current steady with increase in temperature of the transistors. The 'thermal element,' TH1 in Fig. 4 provides this function.

AMPLIFIER TESTS AND FAULT FINDING

For detailed testing in audio circuits, especially high quality circuits in which transistors are employed, we require an audio signal generator, audio millivoltmeter and an oscilloscope, at least. For distortion tests, we require in addition a distortion factor meter or similar instrument.

If it is assumed that the radio or pickup source signal is reaching the input of the amplifier and there is no output from the speaker, then we should check as far as possible into the amplifier with a signal tracer (e.g., pair of headphones, etc.—see Part 3, PW July 1971). In Fig. 4, for example, we could get to the base of Tr2, but possibly not any further owing to the d.c. couplings of the subsequent stages. Indeed, it is often necessary to consider the power amplifier proper as a complete circuit from the testing point of view. This is because a faulty transistor or component in one stage could reflect fault conditions into the other stages as a result of the d.c. couplings. This possibility is often overlooked when testing in circuits of this kind.

When we reach the point where the signal disappears, therefore, we may have to continue the exercise in terms of voltage measurements at the electrodes of the various transistors, comparing them with the correct values given in the service manual or on the circuit. Complete failure commonly implies significant change in the d.c. conditions, so the fault area should soon be revealed by voltage testing. If a coupling capacitor has failed, then signal tracing should reveal this without much trouble.

More difficult faults to locate are those resulting in low gain, intermittent crackling and distortion at all powers or only at high power. Starting first with distortion, a preliminary test should be that of quiescent current (assuming the amplifier to be 'Class B,' which it usually is in these days of transistors).

If possible, one should avoid connecting a milliammeter in series with the output pair for this test, owing to the resistance of the meter movement. In a circuit like that in Fig 4, the voltage across the emitter resistor (R2) of Tr7 should be measured on a d.c. millivoltmeter. The voltage will be very low because R2 is only 1 ohm! Anyway, suppose we measure 25mV, then by Ohm's law be can calculate that the current is 25mA (1 ohm resistor, since $I=V/R$, where I is in mA when V is in mV). A current of 25mA is, in fact, a common quiescent current value, and it can be adjusted accurately by a preset such as VR2.

If there is no preset and the current is way out, the values of the resistors associated with this part of the circuit should be measured (also the thermistor, etc., if used). Excessive quiescent current will cause the output transistors to run hot and limit the output

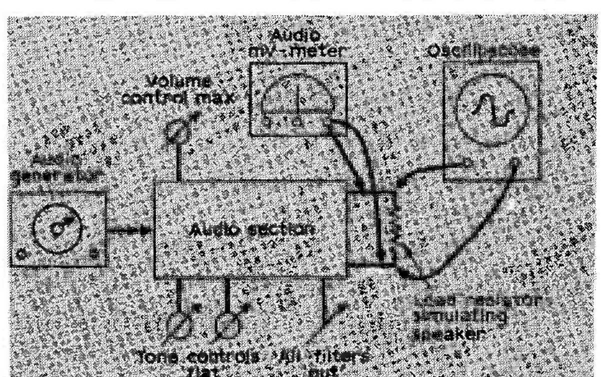


Fig. 5: Equipment set-up required to check the balance of output transistors.

power, while too low a value will precipitate high distortion (crossover distortion) at low volume.

Balancing requires an oscilloscope to monitor the output sinewave fed in from an audio generator. The setup is shown in Fig. 5 where is will be seen that the speaker is replaced by a load resistor of suitable power rating (to match the steady-state power of the amplifier). The volume control should be fully advanced, and the generator signal increased until the tips of the displayed waveform commence to clip. When the balancing is correct both tips will clip together. If one clips before the other then the balancing preset (such as VR1 in Fig. 4) should be adjusted for symmetrical clipping. The waveforms are shown in Fig. 6.

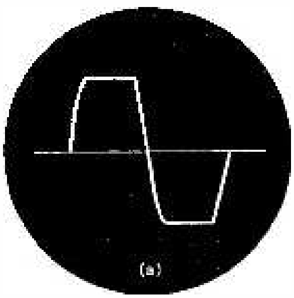


Fig. 6(a) Symmetrical clipping of the waveform when the gain is advanced indicates correct balance.

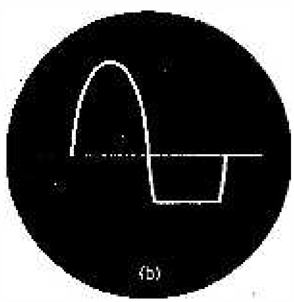


Fig. 6(b) Output waveform with an unbalanced stage.

We can use the setup in Fig. 5 to measure the steady-state power of the amplifier. For this test the oscilloscope should either be accurately calibrated in peak-to-peak voltage (so that the r.m.s. voltage of the waveform can be determined by multiplying the peak voltage—i.e., half p-p voltage-by 0·7) or an r.m.s.-reading audio millivoltmeter should also be connected across the load, as shown in Fig. 5.

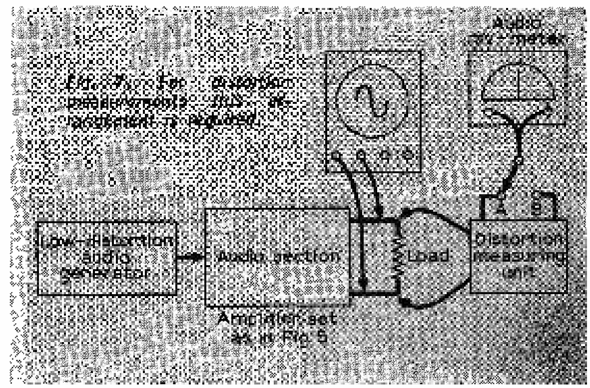
The load voltage just prior to the clipping point should be noted, and the steady-state power in watts is equal to the load voltage squared divided by the load value in ohms (i.e., $W = V^2/R$). The power is usually taken at 1kHz, but the power bandwidth can be appraised by noting the reduction in power at the low and high frequency ends of the spectrum.

Low power, but good waveshape often signifies low supply rail voltage, and this can result from low mains voltage or incorrect mains voltage tapping.

DISTORTION TEST

Finally, total harmonic distortion testing. For this we require either a complete distortion factor meter or the set-up in Fig. 5 with a distortion measuring unit which, as was noted in the Test Instrument supplement, April 1971, is a 'notch filter' which tunes out the fundamental frequency of the output signal, leaving only the harmonic components, the voltage sum of which is compared in ratio with the voltage of the fundamental frequency across the load, to give the dB or percentage total harmonic distortion.

The complete set-up is shown in Fig. 7. The voltage across the load is first measured at the required power (use the oscilloscope for maximum power test to indicate the clipping level) with the switch in postion A, then switching to position B, allowing the audio millivoltmeter to read the voltage of the summed harmonics. For this to happen, however, the distortion measuring unit needs to be very accurately tuned and balanced for the **least** indication on the audio millivoltmeter, which requires the range of the millivoltmeter progressively to be stepped down. The total harmonic distortion is the voltage ratio between the readings at switch postions A and B.



For example, if voltage A is 9V (which across 8 ohms would correspond to about 10W) and voltage B is 90mV, the ratio would be 100:1 or 40dB, corresponding to 1% t.h.d. With 9mV at B it would represent a ratio of 1000:1 or 60dB, corresponding to 0·1% t.h.d.

Remember, though, that a simple distortion measuring set 'notches out' only the fundamental, leaving wideband noise as well as t.h.d. components, so the distortion readout will include noise. Residual hum is generally removed by a high-pass filter in the test set-up, but such filtering, of course, cannot be used for distortion measurements at low-frequency for obvious reasons.

END OF PART SIX

Back Numbers Important Announcement

We regret to inform readers that owing to the closure by the Company of the department concerned it will no longer be possible to supply back numbers of **Practical Wireless** and **Television**.

To ensure obtaining regular copies of these magazines readers are strongly urged to place a regular order with their local newsagent, or to take out an annual postal subscription.

Reference to past issues of the magazines may sometimes be obtained at certain public libraries who may hold bound volumes. A few libraries are said to offer a photostat service. Alternatively, we are always willing to insert a free request for specific back numbers in our "CQ" column which appears in most issues.

practically wireless commentary by HENRY

No. 84

Ted and Lid

NO, not *that* Ted. Henry is not taking the lid off political chicanery—leave that to out-of-office politicians. TED, or, more properly, T.E.D., is a beautiful phrase I heard during a broadcast interview recently. That ubiquitous character, A. Spokesman, was defending the Post Office in the face of polite but relentless attacks from the BBC, who were following up listeners' complaints about crossed lines.

'How does it happen,' came the suave question, *'that we pick up our telephone and find our conversation interrupted by a pair of drooling lovers or an irate customer who has lost his laundry?'*

Ah, well, our indefatigable spokesman countered, that is probably caused by a Transient Equipment Defect. Isn't that lovely? Imagine, Joe, when wifey grumbles about the birdies that chirp unwantedly during her 'Housewives' Choice', being able to say airily: *"Can't do much about that, I'm afraid. That's TED."*

The point is that the faults are not just short-lived, ephemeral, unidentified phenomena—giving them a name has fixed them, preserved them for posterity, entered them on the list of recognisable bugbears.

Wireless work is full of such instances; for example, the intermittently blowing fuse. We pursue diligent tests before replacing the offending glass tube. We measure resistance, cheer when we get a half-scale reading, then remember that we intended to change the battery of the meter last time we used it.

We cheer when we get a half-scale reading . . .

Baffled by the lack of short-circuits we decide to beat the brute by checking the current. Meter in series—ah, which way round? Switch on. No, the other way around: *is* that pointer bent? But the reading is no greater than expected, and certainly less than the rating of the fuse, which we refit. Perhaps it is the result of overheating. We cover the now smug-looking set with our jacket and wait.

It is a bad habit of some manufacturers to let dirty great heat-sinks jut out at the back, and the fallacy about cool-running transistors is shattered as we smell singeing Harris Tweed and realise we have a Class A output to contend with.

Touching the fins to confirm our nose, we snatch fingers back with a howl and, sucking them, muse that the problem could not have been temperature at all. And the fuse still holds.

Obviously, TED has been at work. He is only waiting for us to settle comfortably with a book and a glass at our elbow before blowing the fuse again. Or, more likely, lulling us into a false sense of security, will allow us the whole evening's listening, then, while we sleep through the small CQ hours, will sneakily contract that vulnerable thread of wire again so that rising betimes, we gaily throw the switch and get: silence!

TED is no fool. That Post Office bloke urged 'sweet reasonableness' upon subscribers when their lines were crossed. The inference was that if we pretended not to notice the fault it would go away. Any *PW* reader could have told him that is the wrong approach.

. . . and we snatch our fingers back with a howl.

How many times have you had a piece of equipment propped up on the bench, festooned with test leads, bedizened with warning lights, burbling away in the corner of your mind, and leaped into the breach as the expected fault occurs, only to be greeted with a return to normality the moment you touch the chassis?

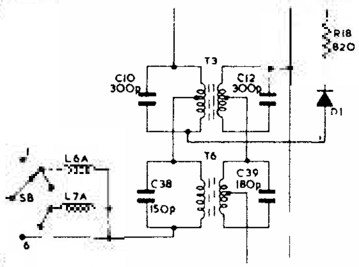
Tracking down TED is the work of an expert. One tests piecemeal. One uses not sweet reasonableness, but bitter reason. Diagnosis, as our soon-to-finish series on Servicing has emphasised, is the secret of success. And for *diagnosis*, where TED is concerned, read *inspired guesswork*. This is where LID comes in. LID is one of those contractions I am no longer likely to forget, since talking to Bob Stockwell, publicity manager of Bang & Olufsen, the day after an exhausting exhibition.

'How do you manage to organise it?'

'It's not easy,' he said, *'but we begin by catering for the Largest Imaginable Disaster and take it from there. . . .'*

That is the secret of dealing with TED. Put the LID on him: when the fuse blows, imagine the worst that could happen and assume that it has! But don't try to telephone the repairman—you will probably get the laundry company again.

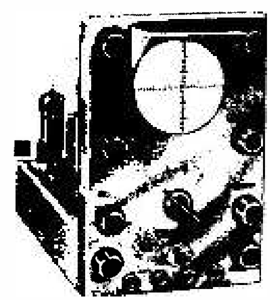
electronics mastered!*



by our highly practical
BUILD, SEE & LEARN system

Step by step we take you through the apparent intricacies of electronics and show you how easily you can master the subject. Write for the brochure which shows, in full detail, how you can do it.

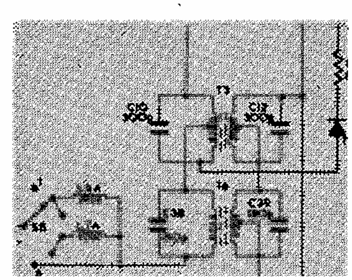
1 *We provide a full range of components and sub-assemblies, with details of what they do, so that you learn to recognise all the 'bits and pieces'. Using some of these you are instructed in how to build this oscilloscope, simply and quickly.*



2 *You are shown how to read and understand circuit diagrams so that you can later build more advanced equipment or draw your own diagrams.*

3 *You can construct over 40 kits, including:—*

- *Valve experiments*
- *Transistor experiments*
- *Amplifiers*
- *Oscillators*
- *Signal tracer*
- *Photo electric circuit*
- *Computer circuit*
- *Basic radio receiver*
- *Electronic switch*
- *Simple transmitter*
- *a.c. experiments*
- *d.c. experiments*
- *Simple counter*
- *Time delay circuit*
- *Servicing procedures*



*** This course has been designed to help even those who are complete newcomers to electronics. No Maths needed !**

POST NOW
FOR
FREE BROCHURE
BLOCK CAPITALS PLEASE

To: British National Radio School, Reading, Berks.
Please send your free Brochure, without obligation, to:

NAME

ADDRESS

P10/71

FREE SPECIAL ELECTRONIC GIFT to all our Students POST COUPON NOW!

ELECTRONIC VALVES

OA2	0·38
OA3	0·45
OB2	0·35
OB3	0·60
OC3	0·38
OD3	0·35
1B3GT	0·38
1CP31	6·00
1L4	0·20
1R4	0·35
1R5	0·35
1S4	0·27
1S5	0·25
1T4	0·25
1U4	0·27
1U5	0·50
1V2	0·45
1X2B	0·40
2D21	0·35
3A4	0·35
3B28	2·15
3BP1	2·75
3Q4	0·40
3S4	0·35
3V4	0·45
5R4GY	0·60
5Y4G	0·33
5U4GB	0·42
5V4G	0·42
5Y3GT	0·32
5Z3	0·50
5Z4G	0·40
6/30L2	0·75
6AB4	0·35
6AF4A	0·50
6AG7	0·40
6AH6	0·50
6AJ8	0·30
6AK5	0·30
6AK6	0·57
6AL3	0·43
6AL5	0·20
6AM5	0·32
6AM6	0·33
6AQ5	0·35
6AQ6	0·55
6AR5	0·35
6AR6	1·50
6AR11	1·25
6AS5	0·35
6AS7G	0·80
6AT6	0·30
6AU6	0·25
6AV6	0·30
6AW8A	0·55
6BA6	0·25
6BE6	0·30
6BF5	0·80
6BF6	0·50
6BH5	0·45
6BJ6	0·45
6BK7A	0·55
6BN5	0·43
6BN6	0·40
6BQ5	0·25
6BR8	0·65
6BS7	1·30
6BW6	0·55
6BW7	0·70
6BX6	0·25
6BZ6	0·35
6C4	0·33
6C5GT	0·40
6CB6	0·30
6CD6GA	1·15
6CG7	0·50
6CH6	0·55
6CL6	0·50
6CW4	0·63
6CY5	0·43
6CY7	0·65
6D3	0·45
6DC6	0·75
6DK6	0·48
6DQ6B	0·63
6DS4	0·75
6EA8	0·58
6EH7	0·30
6EJ7	0·35
6EW6	0·65
6F1	0·70
6F5	0·50
6F6G	0·30
6F11	0·38
6F13	0·38
6F14	0·65
6F15	0·65
6F18	0·45
6F23	0·80
6F24	0·75
6F25	0·75
6F26	0·35
6F28	0·60
6J4	0·50
6J5GT	0·30
6J7	0·45
6K6GT	0·55
6K7	0·35
6K8G	0·35
6K25	0·75
6L6GT	0·45
6L7	0·40
6L18	0·45
6LD20	0·40
6N7GT	0·40
6P1	0·60
6P25	1·25
6P28	0·65
6Q7	0·40
6SA7	0·40
6SG7	0·35
6SK7	0·35
6BL7GT	0·85
6SN7GT	0·35
6SQ7	0·40
6SR7	0·40
6T8	0·35
6U4GT	0·60
6U8A	0·40
6V6GT	0·38
6X4	0·30
6X5GT	0·35
6X8	0·55
6Y6G	0·65
7Y4	0·60
9BW6	0·50
10C2	0·50
10D1	0·50
10D2	0·40
10F1	0·90
10F9	0·50
10F18	0·45
10L1	0·45
10LD11	0·60
10P13	0·55
10P14	1·10
12AB5	0·60
12AC6	0·40
12AL5	0·45
12AQ5	0·43
12AT6	0·30
12AT7	0·33
12AU6	0·30
12AU7	0·30
12AV6	0·33
12AV7	0·50
12AX7	0·30
12AY7	0·70
12B44A	0·55
12BA6	0·35
12BA7	0·35
12BE6	0·35
12BH7	0·40
12BY7	0·55
12K5	0·55
12K7GT	0·35
12Q7G	0·30
12SR7	0·35
14S7	0·80
20D1	0·45
20L1	1·10
20P1	0·50
20P4	1·10
20P5	1·20
25C5	0·50
25L6GT	0·45
25Z4G	0·30
25Z6GT	0·65
30A5	0·45
30AE3	0·40
30C1	0·30
30C15	0·80
30C17	0·85
30C18	0·75
30F5	0·85
30FL1	0·70
30FL12	0·93
30FL14	0·75
30L1	0·40
30L15	0·85
30L17	0·80
30P12	0·80
30P19	0·80
30PL1	0·70
30PL13	0·93
30PL14	0·90
35A3	0·55
35A5	0·75
35B5	0·65
35C5	0·40
35D5	0·70
35L6GT	0·50
35W4	0·30
35Z3	0·60
35Z4G	0·30
35Z5GT	0·40
50A5	0·70
50B5	0·45
50C5	0·40
50CD6G	1·65
50L6GT	0·50
85A2	0·40
90AG	2·40
90AV	2·50
90C1	0·60
90CV	1·25
807	0·50
813	3·75
866A	0·75
5642	0·65
6080	1·50
6146	1·50
6360	1·25
6870	2·50
6939	2·15
7199	0·75
7360	1·80
7586	1·25
7895	1·25
9002	0·35
9003	0·50
AZ1	0·48
AZ31	0·55
CBL1	0·80
CBL31	0·90
CY31	0·35
DAF96	0·42
DF96	0·42
DK40	0·55
DK92	0·50
DK96	0·42
DL96	0·42
DM160	0·65
DY86	0·33
DY87	0·35
DY802	0·50
E88CC	0·65
E180F	0·95
E810F	2·90
EABC80	0·35
EAF42	0·55
EBC33	0·50
EBC41	0·55
EBC81	0·30
EBF80	0·40
EBF83	0·40
EBF89	0·30
EC53	0·50
EC86	0·60
EC88	0·60
EC90	0·33
EC91	0·50
EC92	0·35
EC93	0·50
EC8010	2·25
ECC40	0·60
ECC81	0·33
ECC82	0·30
ECC83	0·30
ECC84	0·30
ECC85	0·40
ECC88	0·40
ECC89	0·50
ECC91	0·20
ECC189	0·60
ECF80	0·35
ECF82	0·35
ECF86	0·65
ECF804	1·50
ECH42	0·70
ECH81	0·30
ECH83	0·40
ECH84	0·45
ECL80	0·40
ECL81	0·45
ECL82	0·35
ECL83	0·65
ECL84	0·55
ECL85	0·55
ECL86	0·40
ECLL800	1·50
EF37A	0·60
EF39	0·40
EF40	0·50
EF41	0·65
EF42	0·70
EF80	0·25
EF83	0·55
EF85	0·35
EF86	0·30
EF89	0·28
EF91	0·33
EF92	0·40
EF95	0·30
EF97	0·65
EF98	0·65
EF183	0·30
EF184	0·35
EF800	1·00
EF804	1·25
EK90	0·30
EL33	1·25
EL34	0·50
EL36	0·50
EL37	1·25
EL41	0·55
EL42	0·58
EL81	0·55
EL83	0·42
EL84	0·25
EL85	0·43
EL86	0·40
EL90	0·35
EL95	0·35
EL803	1.00
EL821	0·55
EL822	0·90
ELL80	0·75
EM34	0·90
EM71	0·75
EM80	0·40
EM81	0·60
EM84	0·35
EM85	1·00
EM87	0·55
EN91	0·35
EY51	0·40
EY80	0·45
EY81	0·40
EY83	0·55
EY86	0·40
EY87	0·43
EY88	0·43
EZ40	0·45
EZ41	0·45
EZ80	0·25
EZ81	0·28
GY501	0·80
GZ30	0·40
GZ31	0·33
GZ32	0·48
GZ33	0·70
GZ34	0·60
HABC80	0·40
HK90	0·35
KT66	2·05
KT88	2·00
N78	1·45
PABC80	0·40
PC86	0·60
PC88	0·60
PC97	0·50
PC900	0·48
PCC84	0·40
PCC85	0·40
PCC88	0·55
PCC89	0·50
PCC189	0·55
PCC805	0·85
PCC806	0·80
PCF80	0·30
PCF82	0·35
PCF84	0·50
PCF86	0·60
PCF87	0·85
PCF801	0·50
PCF802	0·50
PCF805	0·75
PCF806	0·70
PCF808	0·75
PCH200	0·70
PCL81	0·50
PCL82	0·35
PCL83	0·65
PCL84	0·45
PCL85	0·40
PCL86	0·45
PCL88	0·90
PCL800	0·93
PCL801	0·70
PD500	1·50
PF86	0·60
PF818	0·85
PFL200	0·70
PL33	0·35
PL36	0·55
PL81	0·50
PL82	0·45
PL83	0·45
PL84	0·40
PL302	0·80
PL504	0·80
PL508	0·90
PL509	1·30
PL801	0·80
PM84	0·50
PY31	0·80
PY33	0·63
PY80	0·35
PY81	0·30
PY82	0·30
PY83	0·38
PY88	0·40
PY500	1·00
PY800	0·50
PY801	0·50
PZ30	0·35
QQV2-6	2·15
QQVO3-10	1·25
QQV03-20A	5·25
QQV06-4A	5·50
TT21	2·65
TT22	2·80
U18/20	0·75
U25	0·75
U26	0·75
U31	0·45
U37	1·50
U52	0·33
U76	0·30
U78	0·30
U191	0·75
U201	0·35
U281	0·40
U282	0·40
U301	0·40
U403	0·50
U404	0·40
U801	1·00
UABC80	0·35
UAF41	0·50
UAF42	0·55
UBC41	0·50
UBC81	0·40
UBF80	0·40
UBF89	0·35
UBL1	0·50
UBL21	0·60
UC92	0·35
UCC85	0·40
UCF80	0·55
UCH21	0·60
UCH42	0·70
UCH43	0·75
UCH81	0·35
UCL81	0·60
UCL82	0·35
UCL83	0·60
UF41	0·60
UF42	0·60
UF43	0·60
UF80	0·35
UF85	0·40
UF89	0·35
UL41	0·65
UL84	0·30
UM84	0·20
UY1N	0·50
UY11	0·65
UY41	0·45
UY82	0·50
UY85	0·30
W729	0·60
Z759	1·85
Z803U	0·90

STEPHENS

ELECTRONICS
P.O. BOX 26
AYLESBURY, BUCKS.

SEND S.A.E. FOR LISTS
GUARANTEE:—
TERMS CASH WITH ORDER ONLY.
POST AND PACKING PAYABLE ON ORDERS UP TO £6, AFTER THAT FREE, EXCEPT C.R.T's

Satifaction or money refunded.

ALL ITEMS ADVERTISED IN LAST MONTH'S ISSUE ALWAYS IN STOCK FOR SAME DAY DISPATCH

SEMICONDUCTORS BRAND NEW MANUFACTURERS MARKINGS NO REMARKED DEVICES

2N388A	62½p	2N3702	17½p	ACY18	25p	AF127	17½p	BC184	22½p	BFY52	22½p
2N614	30p	2N3704	22½p	ACY19	25p	AF139	37½p	BC187	28½p	BSX21	37½p
2N697	20p	2N3705	20p	ACY20	25p	AF178	45p	BC213L	26½p	OC25	50p
2N698	25p	2N3711	20p	ACY21	25p	AF179	45p	BCY32	37½p	OC26	32½p
2N706	12½p	2N3819	35	ACY22	20p	AF180	52½p	BCY58	22½p	OC28	62½p
2N706A	12½p	2N3826	30p	ACY28	20p	AF181	42½p	BCY70	20p	OC29	75p
2N930	27½p	2N3905	37p	ACY40	20p	AF186	66½p	BD115	78p	OC35	40p
2N1132	32½p	2N3914	P.A.	ACY41	25p	AF239	42½p	BD121	65p	OC36	62½p
2N1303	17½p	R.C.A.		ACY44	40p	ASY28	28p	BD123	82½p	OC42	25p
2N1305	25½p	40253	P.A.	AD140	40p	BC107	15p	BD124	62½p	OC44	20p
2N1306	25p	40398	P.A.	AD142	58p	BC108	15p	BD131	97½p	OC45	12½p
2N1307	25p	40458	P.A.	AD149	57½p	BC109	15p	BD132	97½p	OC46	15p
2N1711	25p	2N4061	22½p	AD150	62½p	BC113	27½p	BF115	25p	OC70	15p
2N2147	72½p	2N4062	22½p	AD161	37½p	BC114	37½p	BF117	47½p	OC71	12½p
2N2160	57½p	2N4286	17½p	AD162	37½p	BC115	32½p	BF160	P.A.	OC72	12½p
2N2614	30p	2N4291	17½p	AF102	58p	BC116	62½p	BF162	P.A.	OC74	32½p
2N2646	57½p	AC107	30p	AF106	42½p	BC116A	37½p	BF163	35p	OC75	22½p
2N2905	40p	AC117	60p	AF114	25p	BC117	39p	BF167	25p	OC76	22½p
2N2926		AC126	20p	AF115	30p	BC118	32½p	RF173	32½p	OC77	27½p
Green	14p	AC127	25p	AF116	25p	BC134	57½p	BF178	35p	OC78	25p
Yellow	12½p	AC128	20p	AF117	25p	BC135	P.A.	BF179	72½p	OC81	20p
Orange	12½p	AC154	22½p	AF118	60p	BC136	P.A.	BF180	35p	OC81D	20p
2N3053	27½p	AC176	25p	AF119	20p	BC137	P.A.	BF181	32½p	OC83	25p
2N3055	75p	AC187	62½p	AF124	22½p	BC138	P.A.	BF184	25p	OC84	25p
2N3391	20p	AC188	37½p	AF125	20p	BC142	30p	BF194	22½p	OC139	32½p
2N3392	20p	ACY17	27½p	AF126	20p	BC143	P.A.	BF195	27½p	OC140	32½p
						BC147	17½p	BF196	42½p	OC170	30p
						BC148	15p	BF197	31½p	OC171	20p
						BC149	17½p	BF198	42½p	OC200	32½p
						BC152	17½p	BF200	36½p	OC202	47½p
						BC157	20p	BF224	30p	OCP71	42½p
						BC158	17½p	BF225	30p	P346A	25p
						BC169B	14p	BF257	47½p	TI8	40p
						BC169C	15p	BFX84	30p		
						BC171	17½p	BFY19	33p		
						BC175	27½p	BFY50	22½p	P.A. Price on application	
						BC183	22½p	BFY51	22½p		

DIODES & RECTIFIERS

IN914	7½p	BZY88 (Series)	32½p	OA91	7½p
AA119	10p	OA5	12½p	OA202	10p
BA102	22½p	OA47	7½p	BA144	12½p
BA115	7½p	OA70	7½p	BA145	20p
BA114	12½p	OA79	9p	BA148	23p
BY100	22½p	OA81	7½p	BA155	P.A.
BY126	20p	OA90	7½p	BA156	P.A.
BY127	22½p				

CARTRIDGES

		Inc. P.T. each			Inc. P.T. each			Inc. P.T. each
ACOS			X3H	S/S	£1·39	**RONETTE**		
GP79		63p	X5M	S/S	£1·39	105	S/S	99p
GP91—18c		£1·05	X5H	S/S	£1·39	106	S/S	99p
GP91—28c		£1·05	SX5M	S/S	£1·81	DC400	S/S	70p
GP91—38c (TC8)		£1·05	SX5H	S/S	£1·81	DC400SC	S/S	70p
GP92		£1·32	SX5M	D/S	£2·00	105	D/S	£1·12
GP93—1		£1·24	SX5H	D/S	£2·00	106	D/S	£1·12
GP94—1		£1·55	X4N	D/S	£1·36	DC400	D/S	84p
GP94—5		£1·80				DC400SC	D/S	84p
GP95		£1·24	**GOLDRING**					
GP96		£1·57	850		£5·25	**SONOTONE**		
Acos 104 1—10		£2·09	G800		£7·35	8TA	D/S	£1·25
B.S.R.			G800E		£15·00	9TS	D/S	£1·79
X3M	S/S	£1·39	G800 Super E		£19·50	9TAHC	D/S	£1·79

BEST QUALITY CAPACITORS WIMA DUROLIT

Capacitance	Working Voltage	
1000 pF	630	25p
1500 pF	630	25p
2200 pF	630	25p
3300 pF	630	25p
4700 pF	630	25p
6800 pF	630	25p
0·01 μF	630	27p
0·015 μF	630	29p
0·022 μF	630	29p
0·033 μF	630	33p
0·047 μF	630	40p
0·068 μF	630	42p
0·1 μF	630	50p
0·15 μF	630	56p
0·22 μF	630	67p
470 pF	1000	29p
680 pF	1000	29p
1000 pF	1000	25p
1500 pF	1000	25p
2200 pF	1000	27p

WIMA TROPYFOL

Capacitance	Working Voltage		Capacitance	Working Voltage	
47 pF	400	21p	0·022 μF	630	27p
68 pF	400	21p	0·033 μF	630	31p
100 pF	400	21p	0·047 μF	630	36p
150 pF	400	21p	1000 pF	1000	21p
220 pF	400	21p	1500 pF	1000	21p
330 pF	400	21p	2200 pF	1000	23p
470 pF	400	21p	3300 pF	1000	23p
0·01 μF	400	19p	4700 pF	1000	25p
0·015 μF	400	21p	6800 pF	1000	27p
0·022 μF	400	23p	0·01 μF	1000	27p
0·033 μF	400	23p	0·015 μF	1000	31p
0·047 μF	400	25p			
0·068 μF	400	27p			
0·1 μF	400	33p			
0·22 μF	400	46p			
1500 pF	630	21p			
2200 pF	630	21p			
3300 pF	630	21p			
4700 pF	630	21p			
6800 pF	630	23p	0·022 μF	1000	36p pack of 5
0·01 μF	630	25p			
0·015 μF	630	25p			

ADD 5p PER ITEM POST AND PACKING

MAGNETIC RECORDING TAPES by a leading manufacturer

POLYESTER			POLYESTER		
Length	Spool Size in.	Price	Length	Spool Size in.	Price
Standard Play			900ft	5	70p
600ft	5	50p	1200ft	5¾	85p
850ft	5¾	63p	1800ft	7	£1·00
1200ft	7	70p	Double Play		
Long Play			1200ft	5	87p
210ft	3	27p	1800ft	5¾	£1·10
450ft	4	43p	2400ft	7	£1·30

EMPTY TAPE REELS

3in	7p
4in	9p
5in	11p
5¾in	13p
7in	13p

CASSETTES
Boxed in Plastic Library Packs

C60	53p
C90	63p
C120	87p

P. & P. 7p on all orders.

ON THE SHORT WAVES

MONTHLY NEWS FOR DX LISTENERS

THE BROADCAST BANDS

Malcolm Connah

Frequencies in kHz • Times in GMT

THE first report this month comes from a new reporter D. A. Hairon from Jersey in the Channel Islands. The equipment used was a Codar CR70A receiver, a 50ft long wire and a 19 metre band dipole. This combination enabled him to hear the following stations:—

9480 Radio Peking in English at 0130.
9625 CBC, Canada in English at 0200.
11710 R. Nacional de Espana in Spanish at 0130.
11720 CBC, Canada in English at 0200.
11730 R. Nederland, Bonaire, English at 0200.
11745 HCJB, Quito, Ecuador, English at 0000.
11775 TWR, Bonaire in Spanish at 0215.
11810 RAI, Rome in English at 0100.
15195 R. Ankara, Turkey, Turkish at 1600.
15250 RSA, South Africa in French at 1856.
15300 HCJB, Quito, Ecuador in Spanish at 2145, and in Portuguese at 0000.
15305 SBC, Switzerland in English at 1315.
15345 Radio Kuwait in English at 1630.
15355 ABC, Australia in English at 0530.
17655 R. Cairo, U.A.R. in English at 1730.
17715 ABC, Australia in French at 2315.
17810 R. Nederland, Bonaire in Spanish at 2130.
17830 R. Lebanon in English at 1830.
17825 NHK, Japan in English at 0800.
21525 WNYW, U.S.A. in English at 1800.
21640 R. Nederland, Bonaire, English at 1830.
25730 R. Norway in English at 1200.

Ray Warren of Bury St. Edmunds has used his Koyo 1661 receiver to good effect and heard the following:—

3980 Voice of America in English at 1720.
5970 R. Free Europe, Germany at 1450.
6075 WNBC, New York, news at 1630.
6085 R. Nederland in English at 0930.
9030 R. Peking in English at 2050.
9390 R. Tirana, Albania in English at 1530.
9750 SBC, Switzerland, news in English, 1540.
15300 HCJB, Quito, Ecuador, English news, 1410.

Peter Hall of Pocklington, Yorkshire, has a Meridian 10 transistor superhet and a 50 foot aerial which enabled him to hear:—

6070 R. Sofia, Bulgaria in English at 1930.
6130 HCJB, Quito, Ecuador in English at 0800.
7275 RAI, Rome in English at 1940.
9550 Radio Finland in English at 1815.
9580 BBC, Ascension Island relay at 2115.
9620 R. Belgrade, Yugoslavia at 1800.
9625 Israel B.C. in English at 2045.
9630 R. Trans Europe, Portugal at 2100.
9700 R. Sofia, Bulgaria in English at 2140.
11620 AIR, Delhi in English at 2010.
11672 R. Pakistan in English at 2030.
11755 R. Finland in English at 0930.
11915 BBC, Cyprus relay at 1645.
11965 TWR, Monaco in English at 1700.

Ross Pullen of Crawley used his Murphy A72 communications receiver and a 100 foot long-wire to hear some interesting stations:—

6015 VOA, Rhodes, music and talk at 2200.
6145 R. Nacional, Brazil in Spanish at 2245.
9510 R. Noumea, New Caledonia, French at 0910.
9605 HCJB, Quito, Ecuador, English at 0730.
9745 R. Baghdad, Iraq in English at 2015.
9775 R. Diffusion-Television Nationale Congolaise, African music at 2200.
11672 R. Pakistan, English at 2002.
11965 Rwanda relay of Deutsche Welle at 2037.
17705 R. Havana, Cuba, Spanish news at 2015.

F. Wall of Walthamstow, London, E.17, has a homebrew 5-valve superhet and a 20 foot wire aerial, this equipment enabling him to hear:—

6035 R. Warsaw with Polish news at 1620.
6070 R. Sofia, Bulgaria in English at 1930.
9912 AIR, Delhi English news at 2000.
9630 R. Sweden 'Calling DXers' at 1230.
9660 R. Trans Europe in English at 1250.
9833 R. Budapest, Hungary, requests at 1945.
11735 R. Belgrade, Yugoslavia, English at 1530.
11740 ABC, Australia at 1530.
11755 R. Finland in English at 1500.
11765 ABC, Australia, sports programme at 0830.
11955 BBC, Malaysian relay at 1815.
15325 CBC, Canada, sports news at 1200.
21460 HCJB, Quito, Ecuador sign-on in French at 2015.
21535 RSA, South Africa, English news at 0930.
21595 CBC, Canada with news at 1910.
25790 RSA, South Africa, English news at 1500.

Stephen Mathews of Hull with his Bush 4-valve domestic receiver and 90 foot loft aerial heard the following:—

9660 YVLM Radio Rumbos, Venezuela at 0320.
9833 R. Espana Independiente, clandestine at 2230.
11765 ZYB8, R. Diffusion, Brazil at 0220.
11795 WINB, Red Lion, U.S.A. English at 2100.
11815 ZYW24, R. Brazil Central at 0045.
15260 FEBA, Seychelles testing at 1700.
17890 BED-40, Taiwan, weak at 0330.
21690 WIBS, Grenada in English at 1945.
21720 R. Ghana in English at 1445.

Reports should arrive by the 15th of the month and be addressed to the author at 5 Ranelagh Gardens, Cranbrook, Ilford, Essex.

THE AMATEUR BANDS

David Gibson, G3JDG

Frequencies in kHz • Times in GMT

HIGH noise levels have been the main complaint this past month with many people confessing to giving up and going off to watch television (sacrilege!). Despite these conditions there was still a large number of listeners who persisted, despite the noise, and managed to log some worthwhile DX as reward for their labours. Just goes to show, while you are busy moaning about the QRM and QRN, someone else is just getting on with it and working half the world.

News that G5ZT has received slow-scan television pictures from FG7XT in Guadeloupe makes you think. Many people would be only too pleased to hear an FG7 on c.w. **John Rimmer** (Deal) warns that VS9MF is on from Gan—a small island in the Maldive group of islands. Listen on 14 and 21MHz; sorry, no specific freqs given.

No activity reported on ten metres this month and it rather looks as though everyone has migrated to 14MHz. This latter band is an early morning/late night affair nowadays with everything dying out from mid-morning to late afternoon. On fifteen metres the same remarks apply, although occasionally South American stations appear during the daytime. For those who would like to persist on 28MHz, suggested time for a listen is from 1400 to 1600hrs.

Incidentally, this is one of the best bands on which to play with aerials since these normally work out to a very reasonable size. A quarter wave vertical is only around the 8ft. 6in. mark, exact size depending upon frequency since ten metres is one of the widest bands we have among those l.f. of 144MHz. If sunspot counts are any indication, then September would be a very good time for ten metres

A few contests this month just to get your ears in trim for the long winter evenings. September 11 and 12, WAE phone contest; 12, 3·5MHz Field Day; October 2 and 3, u.h.f./s.h.f. Field Day; 2 and 3, Oceania contest—a chance to bag a nice list of VK/ZL callsigns; 2 and 3, IARU Region 1 u.h.f./s.h.f. contest. Don't forget the Cumulative Activity on 70MHz from October 9 to December 30. This is our "use or lose" band and all support is very welcome, if not essential. You might try listening for some of the RAEN activity on four metres. The Radio Amateur Emergency Network has numerous "local" groups and the favourite band is 70MHz. How about listening out for your local group, or perhaps even joining them? Name and address of the Secretary of RAEN is; E. Bassett, 57 Upper St Helen's Road, Hedge End, Southampton, SO3 4LG.

Logs

A solitary log for two metres arrived this month from **David Sheekay** (Ashford). Gear is a super-regen using three transistors and an i.c. audio amplifier, homebrew, and antenna is described as "telescopic". Stations logged include; G2JF, G2VB, G3EFX/P, G3JXN, G3LTF, G3TDP/M, G3UNT, G4AAR, G4AAZ/M, G5OX, G8BYC, G8CCO, G8EBV, G8ELW and F0UJ. What about it all you converter and superhet types—you can't let a super-regen show you up, or can you?

Richard Mortimore (Cardiff), is now up to 20 w.p.m. at c.w. and says that he recommends all s.w.l.s to learn morse. Small sample from his list of c.w. pickings on 21MHz includes; CR6ID, JA3IL, KZ5BB, PY2EYE, PY4UK, W4NZK, WB4QVQ.

Mark Marsden (Ilford) uses a cassette tape recorder which has its input wired in parallel with the headphones. He claims this is very useful for checking calls heard against calls logged afterwards. Seems a very good idea. Calls heard, checked, recorded and logged on 14MHz include signals from; CE5ID, JA3JH, KV4HE, KZ5JF, PY2ZAC, PY4AEB, SV0WZ, VK3ART, VK4PJ, VP2AA, WA1DYR/MM, WB6YIY/MM, YV5CPA, YN2SC, ZL5ISJ, 4X4JU, 4X4OC, 9Q5IA.

"My uncle has given me all the PWs he can spare", writes **Kevin Davies.** Receiver is an R107 and the antenna 120ft. l.w. The following were in evidence on 14MHz s.s.b.; CT1ZE, EA3KO, EA4LM, EL2C, EL4A, HR3VSJ, JA1VK, K1WPS/CT1, LU4DMG, W1CMG/P1, W1MYA/MM, WA5KHM, WB6YIY, 4U1ITU, 4X4HT.

Paul Newman is at a new QTH which is some 680ft. a.s.l. Antenna at present is an 80ft. end fed and the receiver a modified BC348R ex G3HXS. With this gear, and from his lofty perch at Aylesbury, Paul bagged these on 14MHz; OD5BV, PY6AT, PY8LM, (Sao Luis Island), WA5STY/P/YV5 (Caracas) 4X4BL, 4X4GV, 5Z4KL, 9K2AL.

Jim Martin says that as it's the start of his holidays he thought he'd send in a report. (May the sun shine on your antenna, Sir.) His recently-purchased HA500 is nourished with an inverted V and rewards on 14MHz were; CR6EF, CR7IK, EL2CY, FP8CS, HC6CB, JA3IXL, JA4EDY, JA6FUV, JY9XL, KG4AN, KH6FP, KH6BB (Kure Island), KL7DIV, KR6US, KV4AD, KZ5AO, LG5LG, MP4MBC, PY1FN, PJ2MI, PZ1AD, PZ1AW, TG9GF, VK3JS, VP2MO, VQ9R, VS5CB, VS9MT, VU2BEZ, YV5EC, ZE1DO, ZP5GU.

On 3·5MHz c.w. it was UA1YUZ. Up on 7MHz, signals came from CX6CG, LX1BJ, PYCVX, PZ1AX, UW3NG, ZB2A, and ZP5AR. Gear is a JR500SE with 132ft. end fed. Operator's ears belong to **Julian Iredale** (Llandudno), and up on 14MHz s.s.b. Julian heard CR6GA, HV3SJ, OG5A, (Finnish Field Day prefix), PY2ZAC, PY4ATL, PZ1DL, TI2J, 5A4DL.

P. McKay advises that he never notices any logs for 7MHz in the Amateur Bands, and sends in a list of G-stations heard on this band. Well, the G's must have been working someone, so how about a listen this month?

Logs, in alphabetical order please, to arrive by the 15th of the month to:
12, Cross Way, Harpenden, Herts.

BUDGET HIGH-FIDELITY STEREO SYSTEMS

PREMIER STEREO SYSTEM "ONE" Consists of an all transistor stereo amplifier, Garrard 2025 T/C auto manual record player unit fitted stereo mono ceramic cartridge with diamond stylus and mounted in teak finish plinth with perspex cover and two matching teak finish loudspeaker systems. Absolutely complete and supplied ready to plug in and play. 2500 amplifier has an output of 5 watts per channel with inputs for pick-up, tape and tuner also tape output socket. Controls: Bass, Treble, Volume, Balance, Selector, Power on/off. Solid teak cabinet with aluminium front panel. Size 12½" × 4½" × 3½" high (Amplifier available separately if required £14·95 Carr. 40p).
PREMIER STEREO SYSTEM "TWO", as above but with Garrard SP25 MK III—ONLY £47. Carr. £1·75

ONLY £40·95 carr. £1·75

ONLY £57·75 carr. £1·75

PREMIER STEREO SYSTEM "THREE" This consists of KLINGER KC903 stereo amplifier giving 6 watts rms per channel with Bass, Treble, Volume and Balance Controls. Inputs for Magnetic and ceramic pickup, tuner, tape in and out. Stereo earphone socket. Garrard SP25 Mk III in teak finish plinth with cover and fitted Sonotone 9TAHCD diamond stereo cartridge. A pair of HMF Speakers size 16½" × 10½" × 9" fitted EMI units complete the matching system.
ONLY £57·75 Carr. £1·75

ALL SYSTEMS SUPPLIED WITH FREE LEADS AND PLUGS

PREMIER HI-FI OFFERS!

Rogers Ravensbrook II Stereo Amplifier in teak case (List £52·50)	£39·50
Rogers Ravensbourne Stereo Amplifier in teak case (List £64)	£49·00
Metrosound ST20 Stereo Amplifier in teak case (List £36)	£24·50
Garrard SP25 III less cartridge	£11·90
Garrard AP76 less cartridge	£19·50
Garrard 2025 T/C with Sonotone 9TAHC Diamond Cartridge	£8·97

SPECIAL BARGAINS!

Garrard 2025 T/C with Sonotone 9TAHC Diamond Cartridge ready wired in teak plinth with cover **£14**

Carriage and Insurance 50p extra any item.

SP25 MKIII SPECIAL!

GARRARD SP25 MK III SINGLE RECORD PLAYER FITTED AT66 MAGNETIC STEREO CARTRIDGE as available. COMPLETE IN TEAK PLINTH WITH RIGID PERSPEX COVER.
Total list price over £29.

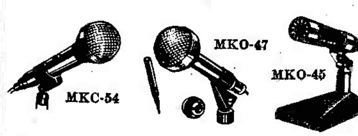
PREMIER PRICE **£19·90** P. & P. 50p.

HI-FI STEREO HEADPHONES

Designed to the highest possible standard. Fitted 2¼in speaker units with soft padded ear muffs. Adjustable headband. 8 ohms impedance. Complete with 6ft lead and stereo jack plug.
£2.47 P. & P. 25p.

STEREO STETHOSCOPE SET Low imp. £1.25 P. & P. 10p
MONO STETHOSCOPE SET Low imp. 52p. P. & P. 10p.

PREMIER QUALITY MICROPHONES



Precision made, beautifully designed and offering reliability at reasonable price.
FANON MKO-47 MINIATURE DYNAMIC
Frequency response 60–13,000 Hz. Impedance 50K ohms (−59 db). Can be used with stand, hand held or around neck. Diecast body satin chrome finish. Features removable windscreen. Complete with 8ft. cable, stand adaptor and Lavalier cord.
PREMIER PRICE £5·97, P. & P. 20p.
FANON MKO-46 3-WAY DYNAMIC
Frequency response 100–10,000 Hz. High impedance. Complete with 8ft. cable, and table stand.
PREMIER PRICE £2·87. P. & P. 20p.
FANON MKC-54 DYNAMIC
Frequency response 60–12,000 Hz. Impedance 50K ohms (−60 db) and 150 ohms (−71 db). On/Off switch. Complete with 20ft. cable and stand adaptor.
PREMIER PRICE £8·97. P. & P. 20p

TAPE CASSETTES

C60	(60 min.)	37p	3 for £1.05
C90	(90 min.)	62p	3 for £1.80
C120	(120 min.)	87p	3 for £2.55

P. & P. 5p.

FREE CASSETTE HEAD CLEANER with every 10 cassettes purchased.

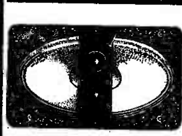
All cassettes can be supplied with library cases at 3p. extra each

VERITAS V-149 MIXER

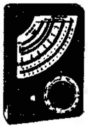
Battery operated 4-channel audio mixer providing four separate inputs. Size 6 × 3 × 2in. suitable for crystal microphone low impedance microphone, with transformer, radio, tape, etc. Max. input 1·5v. Max. output 2·5v. Gain 6 dB. Standard jack plug socket inputs, phonoplugs output. Attractive teak wood grain finish case.

MONO MODEL **£3** STEREO MODEL **£3.47** P. & P. 12p

E.M.I. 13×8in. HI-FI SPEAKERS



Fitted two 2½in tweeters and crossover network. Impedance 8 or 15 ohm. Handling capacity 10W. Brand new.
£3·47 P. & P. 40p



MULTIMETER 20,000 O.P.V.
Features large easy-to-read meter, wide choice of ranges. With test leads, batteries and manual. Size: 4½" x 3½" x 1". RANGES D.C. Voltages 0–5–25–50–250–500–2500v. A.C. Voltages 0–10–50–100–500–1000v. D.C. Current: 0–50μA–2·5mA–250mA. Resistance: 0–6000 ohms 0–6 megohms (300 ohms and 30 Kohms, at centre scale). Capacity: 10 μμf to ·001μf, ·001μf to ·1μf. Decibels −20 to +22dB. £4·90. P. & P. 17p.

"VERITONE" RECORDING TAPE

SPECIALLY MANUFACTURED IN U.S.A. FROM EXTRA STRONG PRE-STRETCHED MATERIAL. THE QUALITY IS UNEQUALLED. TENSILISED to ensure the most permanent base. Highly resistant to breakage, moisture, heat, cold or humidity. High polished splice free finish. Smooth output throughout the entire audio range. Double wrapped–attractively boxed

LP3	3"	250'	P.V.C.	28p
TT3	3"	450'	POLYESTER	37p
DT3	3½"	600'	POLYESTER	57p
SP5	5"	600'	P.V.C.	42p
LP5	5"	900'	P.V.C.	50p
DT5	5"	1200'	POLYESTER	75p
	5¾"	1200'	POLYESTER	75p
DT6	5¾"	1800'	POLYESTER	£1·12
TT6	5¾"	2400'	POLYESTER	£1·87
SP7	7"	1200'	P.V.C.	62p
LP7	7"	1800'	ACETATE	75p
DT7	7"	2400'	POLYESTER	£1·25
TT7	7"	3600'	POLYESTER	£2·50

TAPE SPOOLS 3" 5p, 5", 5¾", 7" 9p,
Post and Packing 3" 5p, 5". 5¾", 8p, 7" 10p. (3 reels and over Post Free).

PREMIER RADIO

10 & 23, TOTTENHAM COURT ROAD, LONDON, W.1 TEL: 01-636 3451/2639
HEAD OFFICE & MAIL ORDER DEPT. 23, TOTTENHAM CT. RD. TEL: 01-636 3451

TECHNICAL TRAINING

in radio television and electronics

Whether you are a newcomer to radio and electronics, or are engaged in the industry and wish to prepare for a recognized examination, ICS can further your technical knowledge and provide the specialized training so essential to success. ICS have helped thousands of ambitious men to move up into higher paid jobs—they can help you too! Why not fill in the coupon below and find out how?

Many diploma and examination courses available, including expert coaching for:

- **C. & G. Telecommunication Techns'. Certs.**
- **Radio Amateurs' Examination**
- **Radio Operator Certificates**
- **General Certificate of Education, etc.**

Now available Colour T.V. Servicing

Examination Students coached until successful

NEW SELF-BUILD RADIO COURSES

Learn as you build. You can learn both the theory and practice of valve and transistor circuits, and servicing work while building your own 5-valve receiver, transistor portable, and high-grade test instruments—all under expert tuition. Transistor Portable available as separate course.

POST THIS COUPON TODAY

for full details of ICS courses in Radio, T.V. and Electronics.

INTERNATIONAL CORRESPONDENCE SCHOOLS

EST. 1891

Dept. 171, Intertext House, Stewarts Road, London, S.W.8 4UJ

Please send me the ICS prospectus—free and without obligation.

(state Subject or Exam)..

NAME ....
(BLOCK CAPITALS PLEASE)

ADDRESS ....

....

AGE.........OCCUPATION.. 10/71

INTERNATIONAL CORRESPONDENCE SCHOOLS

OSCILLOSCOPES

E.M.I. WM16. Complete with Dual Trace Plug-in Amp/Differential Plug-in Amp. **£175**
SOLARTRON CD.1220. With Wide Band Unit .. **£190**
SOLARTRON CD.1220. With Dual Trace Unit .. **£220**
SOLARTRON CD.1220. With Differential Amp Unit .. **£240**
SOLARTRON CD.711S.2. Double Beam .. **£60**
CAWKELL REMSCOPE SO.1. Storage Oscilloscope .. **£200**
E.M.I. W.M.8. Complete with Amplifier Type 8 .. **£55**

TEST GEAR

WAYNE KERR. Universal Bridge Type B.221 .. **£65**
MARCONI. Q Meter Type TF 329G .. **£45**
MARCONI. Video Oscillator Type TF 885A 25HZ–5MHz .. **£45**
MARCONI. Vacuum Tube Voltmeter TF 1041A. .. **£60**
MARCONI. FM/AM Signal Generator TF995A/4 .. **£175**
POWER UNIT, 240V. a.c. 1/P.DC Output 400V 170mA/6·3V 3A .. **£10**
R.F. GENERATOR. 200 Mc/s. 275 Watts .. **£25**
R.F. GENERATOR. 25 Watts .. **£15**
SERVOMEX CONTROLS LTD. Motor Controller Type MC47 Complete with Motor .. **£65**

T.V. CAMERA LENSES

RANK TAYLOR HOBSON VIDITAL LENSES. Standard "C" Mounts. Focal lengths 2cm, 5cm, 8cm .. **£25** each
R.C.A. AR88. Receiver .. **£40**

MINIATURE GEARED MOTORS

1 R.P.M. HAYDEN. 240V a.c. Clockwise Rotation
1/5 R.P.M. CROUZET. 240V a.c. Anticlockwise Rotation
2 R.P.M. CROUZET. 20V a.c./12V d.c. Anticlockwise Rotation
.. **80p** each

RELAYS

SIENMENS/VARLEY PLUG-IN. Complete with Transparent Dust Cover 2 Pole C/0 **35p** each. 4 Pole C/o **50p** each
S.T.C. Miniature Sealed Relays. 6V, 12V, 24V, 48V. 2 Pole C/o .. **50p** each
G.P.O. Relays, 2000Ω. .. 2p C/o **50p**. 4p C/0 **60p** each
HEAVY DUTY. Relays 5A and 10A Contacts 12V, 24V, d.c. 110V, 240V a.c. 2p. C/o .. **90p** each
LATCHING RELAYS. B. & R. Type HO2/T498 2p. C/o .. **98p** each

SOLENOIDS

12V. d.c. 2½″×1¼″ Dia. .. **50p** each

WIRE WOUND POTENTIOMETERS

COLVERN, RELIANCE. All Values from 1 Ω–100K Ω. Brand New .. **19p** each
360° WIRE WOUND POTS. COLVERN CLR/6505/418 10K Ω, CLR/6605/ 18 100K Ω **£1.50** each
BOURNS. 10 Turn Pots. 10K Ω ± 5% LIN 0·25% .. **£1·98** each

ILLUMINATED PUSH BUTTON SWITCHES

Non-Locking Only. 2p C/o .. **35p** each

PUSH BUTTON SWITCHES

Multibank Push Button Switch assemblies now in Stock. Any combination, latching, non-latching, push-push, push to change over, push to hold etc.

2p. C/o **20p** per button.
4p. C/o **30p** per button.
6p. C/o **40p** per button.

MULTIPIN PLUGS AND SOCKETS

PAINTON/JONES 2/4/6/8/12/18/24/33 Way.
P.E.T., B.N.C., AMPHENOL, CANNON, D.I.N., Plus Complete Audio Range.

TRANSFORMERS

D. C. TIBBLES & CO. PRI. 0-100-110-220-240V. SEC. 12V. 20A .. **£6·50** each
MINIATURE TRANSFORMERS. 2″×1½″×1¼″ PRI. 240V SEC 12V 100mA
PRI. 240V SEC 0, 20V, 30V 100mA
PRI. 240V SEC 0, 18, 36, 0, 18, 36 100mA
All Types **65p** each
SHROUDED TRANSFORMERS. PRI. 0-120-240V SEC. 24V ½A .. **£1·25** each
PRI. 0-240V SEC 26V 1A .. **£1·60** each
C-CORE TRANSFORMERS. PRI. 240V SEC 0, 7½, 15V 1A .. **£1·20** each
HEATER TRANSFORMERS. PR. 0-110-200-220-240 SEC 6·3V 3A **£1·00** each

ALARM BELLS

Suitable for Burglar Alarms. AGRO Type 4145 200/250V a.c. .. **£3·50** each

PANEL METERS

SIFAM MOVING COIL 1mA Size 4¾″×4″ .. **£3·25** each
SIFAM MOVING COIL 100μA Size 3½″×3″ .. **£3·00** each
TAYLOR MOVING COIL 50-0-50μA Edgewise 2½″ scale .. **£4·25** each
ERNEST TURNER 270° Movement/Centre zero Circular 0-5-0-0·5 mA 2¾″ Dia. .. **£3·00** each
ERNEST TURNER 270° Movement/Centre zero Circular 1-0-1mA 3¾″ Dia. .. **£4·25** each
SANGAMO-WESTON ILLUMINATED METER 500μA F.S.D. 4¼″×3½″ **£3·90** each
SANGAMO WESTON. 50μA F.S.D. 4¼″×3½″ .. **£4·75** each

We also have a large number of assorted meters of different shapes/sizes/movements in stock.

SOUND-TO-LIGHT MODULES SUITABLE FOR DISCOTHEQUES ETC.
SINGLE CHANNEL 750 Watt Model .. **£6·00** each
THREE CHANNEL MODEL .. **£18·00** each
150W. LIQUID OIL WHEEL PROJECTORS COMPLETE WITH WHEEL .. **£35·00** each
EXTRA WHEELS 6″ Dia .. **£6·00** each

COMPONENTS

METAL OXIDE RESISTORS. 2% T.R.5 Complete Range always in Stock. 1 off **5p** each. 100 off **3½p** each.
MULLARD ELECTROLYTIC CAPACITORS. Complete Range always in stock.
MULLARD POLYESTER CAPACITORS. Complete Range always in Stock.
LEMCO SILVER MICA CAPACITORS. Complete Range always in Stock.
POLYSTYRENE CAPACITORS. Complete Range always in Stock.
WIREWOUND RESISTORS. 1W, 3W, 6W, 12W, 15W, 30W. Complete Range always in Stock.
SEMICONDUCTORS. Transistors, Diodes, Rectifier Blocks, Thyristors, U.J.T.'s Diacs, Triacs, F.E.T.'s, Zeners, Photocells etc.

10% DISCOUNT **10% DISCOUNT**
On any Cash Sale for Customers Presenting this Advertisement.

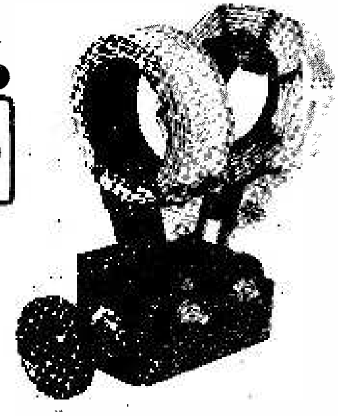
C. T. ELECTRONICS

267, ACTON LANE, LONDON, W.4 **01-994-6275**

Nearest Underground—Chiswick Park (District Line), Acton Town (Piccadilly Line). Bus Routes E3, 88, 207, 15, 7, 260.
(Please note: As yet we do not have a catalogue available. Any queries please phone or call at the above address).
BUSINESS HOURS: MON.–SAT. 9.30 a.m.–6 p.m. WED. 9.30 a.m.–1 p.m.
WANTED. SURPLUS OR REDUNDANT COMPONENTS AND TEST EQUIPMENT

GOING BACK...

1970 60 50 40 30 20



COLIN RICHES
ARTHUR DOW

MANY readers have written to ask us if we can suggest any gramophone records that may help them to bring alive even more vividly the days of vintage radio. After a certain amount of research we have discovered that Fountain Press, the book publishers, have now announced a new "Fountain" record label of Vintage Jazz music. The first 12in. LP releases feature historic jazz and blues recordings but future plans include Music Hall, Opera and other music of the "Good Old Days".

The records are housed in attractive double sleeves which open, displaying an authentically documented note section with accurate historical background information and photographs.

The first two releases are: "Original Dixieland Jazz Band and the Louisiana Five"—from the extremely rare Aeolian sessions of 1917 (catalogue number FJ-101). "Ladds Black Aces—Vol. 1"—the first 16 sides recorded by another pioneer white jazz band during 1921-1922 (Cat. No. FJ-102). Following soon are "Naylor's Seven Aces" (c 1923-4). "Jelly Roll Morton" 1923-4 piano solos. "Lovie Austin's Blues Serenaders" (1924-6), and "Annette Hanshawe. Vol. 1"—Miss Hanshawe enjoyed public acclaim as a singer of popular songs in the 1920's and 1930's and her records are great collectors' items today.

These records are available from record shops at £2·10 or direct at £2·25 which includes post and packing, from *Fountain Records, 46 Chancery Lane, London WC2A 1JU.*

If you have any questions or queries on these records or any other Vintage records or performers please write to us at Practical Wireless and we'll do our best to help you.

The Mystery of the ST.200

We would, at this point, like to thank the many enthusiasts who have been kind enough to write and help us try to clear up the mystery of the missing John Scott Taggart design "ST.200" mentioned in "Going Back", August 1971.

One theory put forward by **Mr. F. W. Snow,** Belper, Derby, is that there never was a design called the ST.200 but one called "The ST Twin"—a 2-valve reflex. It was published in *The Wireless Constructor* and not the *Popular Wireless* magazine during the late 1924's and early 1925's.

Mr. J. Crossley hailing from Failsworth, Manchester, also maintains that the ST.200 never existed. He says that J.S.T. visited the United States just after the advent of the ST.100. On his return, he was full of enthusiasm about a gentleman by the name of Armstrong, and *Popular Wireless* published a circuit by this man which J.S.T. had brought back with him. It was the "Armstrong Regenerative Circuit". J.S.T. then went on to publish the ST.300 design, so it appears that Armstrong's receiver may have taken the place of the missing ST.200.

Mr. A. H. Jenkins, Dringhouses, York, writes to say that as far as he recollects, the ST.200 may well have been just a mains-operated version of the ST.100 and therefore did not differ operationally from that design. It did however, need an extra valve. Mr. Jenkins also informs us that the S.T. series did not start at ST.100, although this was the most famous. He says that he used to have a limp covered book of J.S.T. circuits which started at crystal sets and worked up through one valvers. He seems to remember an ST.37 which was quite well-known at the time.

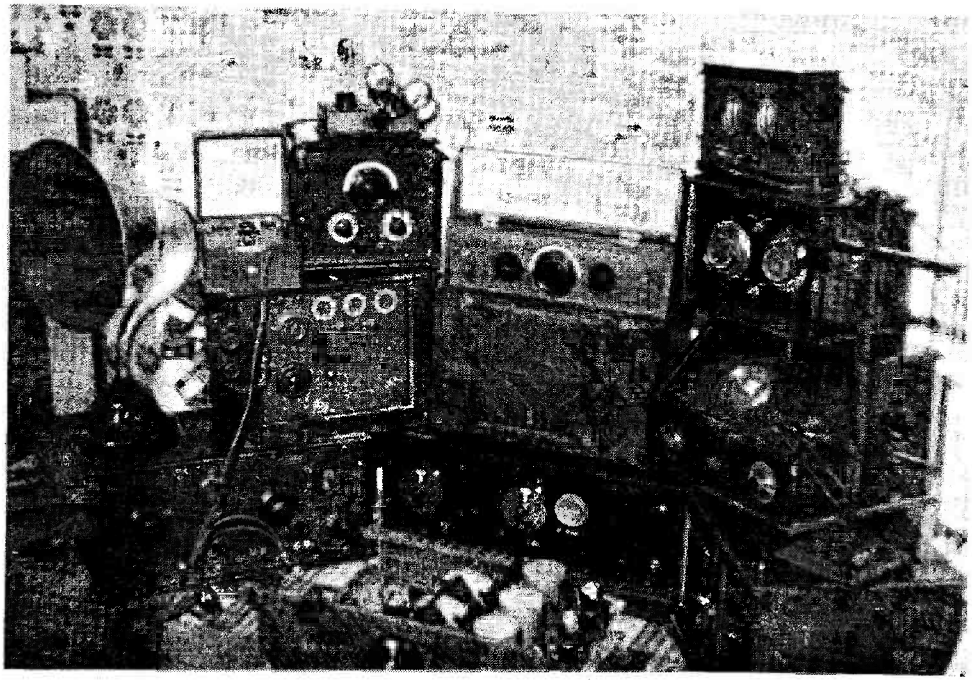
Vintage Sets

Mr. William Pozniak, from 37 Manley Road, Oldham, Lancashire, has loaned us some photographs. He says that for three years he has been routing through old cellars and derelict radio shops throughout the North (we hope you came out for food now and again, Mr. Pozniak) and has produced the collection of Vintage gear shown in the first picture. He says that it takes him most of his time to strip down and restore these sets to as near as possible their original condition. The sets he has are as follows: The Burndept Screened Four, The Burndept Portable Five, the Burndept Ethophone Five and the Burndept Ethophone Two.

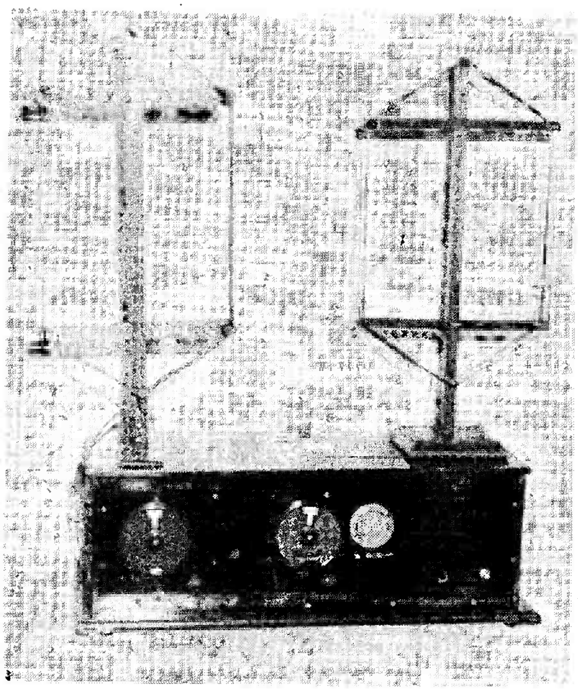
Mr. Pozniak believes there were about 20 Burndept receivers. This figure is agreed by Mr. Keith Lancaster who we mentioned some time ago as wanting to start a Vintage Radio Club. Incidentally, response has not been too good and if readers are interested in such a Club, would they please contact *Keith Lancaster, 40 Great Gardens Road, Hornchurch, Essex.*

The rest of Mr. Pozniak's collection contains a Marconiphone Type 32 three valver, a domestic Cossor two valver, a small set in a metal case named a GECoPHONE Victor 3 and a few home-constructed receivers.

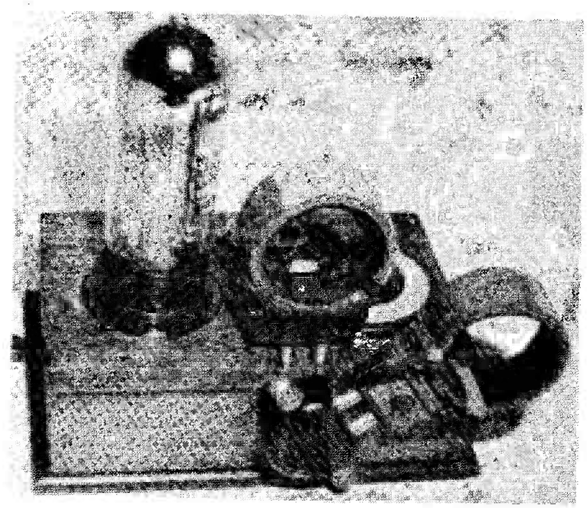
The receiver shown in the second picture is a



An overall view of Mr. Pozniak's collection of Burndept receivers. The small receiver shown at the top centre of the picture and the set in the centre of the picture together with frame aerials are shown enlarged below.



The James Super Six All Waver (c 1927).



Louwe receiver with encapsulated components.

1927 James Super Six All Waver (medium, long and short). The reader says that he purchased this set from an old radio shop which was a booming concern in the 1920's, together with a BTH horn speaker, and the person who sold it to him, told him, as he removed the set from the dusty shelf, that he was the first person to touch the set in 40 years.

The neat little receiver shown in the third photograph seems to Mr. Pozniak to be an unusual type, for he says that there appear to be two resistors and two capacitors encapsulated in glass tubes which have then been assembled inside the glass envelope of the valve. The make on the case reads "Louwe Radio Berlin" and on the valve it states "Louwe Radio British Made". This set is in working order on headphones although it was originally made to drive some sort of speaker. The reader would like to know the date and origin of this set if anyone can help him and he would also be interested if anyone could supply him with original Burndept valves for any of their makes of receivers.

TITANIC DISASTER

We would like to thank the many readers who have written to us about the Titanic Disaster. We are gradually answering all the letters and we hope you will bear with us.

SPECIAL PURCHASE!

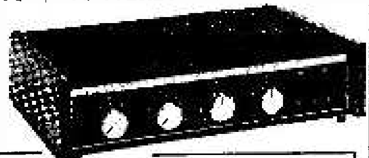
BRAND NEW FM MULTIPLEX STEREO DECODER UNITS.
Manufactured by **PHILIPS**. Size $2'' \times 3\frac{1}{4}'' \times 1''$. All transistor 24v. at 6 mA. Supplied pre-aligned with full circuit diagram and connection detials. **£4 each Post Free**

FEW ONLY—LEAK MK I TRANSCRIPTION PICK-UP ARMS
Using the world famous gimbal pivot system. Complete but less pick up head. **£2·50** P. & P. 20p

INPUT MATCHING TRANSFORMER
Beautifully made in heavy Mu-metal cylindrical case for minimum hum pick-up. Size $1\frac{1}{2}''$ high $\times 1\frac{1}{4}''$ dia. Ratio 150 : 1 approx. Especially suitable for matching dynamic or ribbon mikes or pick up from low to high impedance or vice versa. **75p each Post Free**

BLACK ANODISED 16g. ALUMINIUM HEAT SINKS
For TO3, complete with mica's & bushes. Size $2\frac{3}{8}'' \times 3''$ approx. **25p pair** P. & P. 5p.

HARVERSONIC SUPER SOUND 10 + 10 STEREO AMPLIFIER KIT



NEW IMPROVED MODEL WITH HIGHER OUTPUT AND INCORPORATING HIGH QUALITY READY DRILLED PRINTED CIRCUIT BOARD FOR EASY CONSTRUCTION

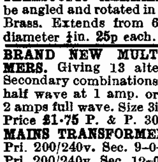
A really first-class Hi-Fi Stereo Amplifier Kit. Uses 14 transistors including Silicon Transistors in the first five stages on each channel resulting in even lower noise level with improved sensitivity. Integrated pre-amp with Bass, Treble and two Volume Controls. Suitable for use with Ceramic or Crystal cartridges. Output stage for any speakers from 5 to 15 ohms. Compact design, all parts supplied including drilled metal work, high quality ready drilled printed circuit board, attractive front panel, knobs, wire, solder, nuts, bolts—no extras to buy. Simple step by step instructions enable any constructor to build an amplifier to be proud of. Brief specification; Power output: 14 watts r.m.s. per channel into 5 ohms. Frequency response ±3dB 12–30,000 Hz Sensitivity: better than 80mV into 1MΩ. Full power bandwidth: ±3dB 12–15,000 Hz. Bass boost approx. to +12dB. Treble cut approx. to −16dB. Negative feedback 18dB over main amp. Power requirements 35v. at 1.0 amp.
Overall Size 12"w. x 8"d. x $2\frac{3}{4}$"h.
Fully detailed 7 page construction manual and parts list free with kit or send 18p plus large S.A.E.

PRICES

AMPLIFIER KIT	**£10·50**	P. & P. 15p
POWER PACK KIT ..	**£3·00**	P. & P. 30p
CABINET	**£3·00**	P. & P. 30p

(Post Free if all units purchased at same time)
Full after sales service
Also available ready built and tested **£20·50**. Post Free.
Note: The above amplifier is suitable for feeding two mono sources into inputs (e.g. mike, radio, twin record decks, etc.) and will then provide mixing and fading facilities for medium powered Hi Fi Discotheque use, etc.

SPECIAL PURCHASE OF MANUFACTURERS SURPLUS!
All Transistor F.M. tuner head with twin A.M. Gang incorporated. Beautifully engineered with precision geared reduction drive. FM RF Transistor, oscillator/Mixer and first I.F. stage (10.7 Mc/s output) with optional AFC connection. Built on printed circuit panel and fully screened. Extremely stable over range 88–108Mc/s. Brand new and pre-aligned. Size $2\frac{1}{8}$"h x $1\frac{1}{2}$"w x $2\frac{1}{2}$"d. For 6v D.C. at 2.8mA. A.M. Gang fitted with trimmers which can be connected to standard A.M. aerial and oscillator circuits if required. LIMITED NUMBER. Only **£2.25** post free. Connection details supplied.



HIGH GRADE COPPER LAMINATE BOARDS. $8 \times 6 \times \frac{1}{16}$in. FIVE for **50p**. P. & P. 13p.

TELESCOPIC AERIALS WITH SWIVEL JOINT. Can be angled and rotated in any direction. 6 section Lacquered Brass. Extends from 6in. to $22\frac{1}{2}$in. approx. Maximum diameter $\frac{1}{2}$in. **25p** each. P. & P. 5p.

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

MAINS TRANSFORMER. For transistor power supplies.
Pri. 200/240v. Sec. 9–0–9 at 500mA. **70p**. P. & P. 13p.
Pri. 200/240v. Sec. 12–0–12 at 1 amp. **88p**. P. & P 13p.
Pri. 200/240v. Sec. 10–0–10 at 2 amp. **£1·38**. P. & P. 30p.
Tapped Primary 200–220–240v. Sec. 21.5v. at 500mA. **63p**. P. & P. 13p.

SPECIAL OFFER !

HI-FI LOUDSPEAKER SYSTEMS

Beautifully made teak finish enclosure with most attractive Tygan-Uynair front. Size $16\frac{1}{2}''$ high x $10\frac{1}{2}''$ wide x $5\frac{1}{4}''$ deep. Fitter with E.M.I. Ceramic Magnet 13" x 8" bass unit, two H.F. tweeter units and crossover. Power handling 10 watts. Available 3 or 8 or 15 ohms impedance.

OUR PRICE £8.40 Carr. 65p
Cabinet Available Separately £4·50 Carr 60p
Also available in 8 ohms with EMI 13" x 8" bass speaker with parasitic tweeter **£6·50** Carr. 65p

LOUDSPEAKER BARGAINS
3" 4 ohm **50p**, P. & P. 8p. 5in. 3 ohm **80p**, P. & P. 15p. 7 × 4in. 3 ohm **£1·05**, P. & P. 20p, 10 × 6in. 3 or 15 ohm **£1·90**, P. & P. 30p, E.M.I. 8 × 5in. 3 ohm with high flux magnet **£1·62**. P. &. P. 20p E.M.I. $13\frac{1}{2} \times 8$in. 3 ohm with high flux ceramic magnet **£2·10** (15 ohm **£2·25**), P. & P. 30p. E.M.I. 13 × 8in. 3, 8 or 15 ohm with two inbuilt tweeters and crossover network **£4·20**, P. & P. 30p. E.M.I. 13" × 8" twin cone (parastatic tweeter) 8 ohm £2.25 P & P 30p.

BRAND NEW. 12in. 15w. H/D Speakers, 3 or 15 ohms. Current production b y well-known British maker. Now with Hiflux ceramic ferrobar magnet assembly **£5·50.** Guitar models: 25w. **£6·50**, 35w. **£8·50**. P. & P. 38p

E.M.I. $3\frac{1}{2}$in. HEAVY DUTY TWEETERS. Powerful ceramic magnet. Available in 3 or 8 or 15 ohms **93p** each. P. & P. 13p.

12in. "RA" TWIN CONE LOUDSPEAKER. 10 watts peak handling, 3 or 15 ohm £2·20, P. & P. 30p.

35 ohm SPEAKERS 3in. only **63p** P. & P. 13p.

VYNAIR & REXINE SPEAKERS & CABINET FABRICS app. 54 in. wide. Usually £1·75 yd., our price **75p** yd. length. P. & P. 15p (min 1 yd.) S.A.E. for samples.

HI-FI STEREO HEADPHONES

Adjustable headband with comfortable flexifoam ear-muffs. Wired and fitted with standard stereo $\frac{1}{4}$in jack plug. Frequency response 30–15.000Hz. Matching impedance 8–16 ohms. PRICE **£2·95.** P. & P. 15p.

SINGLE HEADPHONE. With aluminium headband. Approx. 200 ohm, **25p**. P. & P. 8p

CRYSTAL MIKES. High imp. for desk or hand use. High sensitivity, **93p**, P. & P. 8p

HIGH IMPEDANCE CRYSTAL STICK MIKES. OUR PRICE **£1·05**, P. & P. 8p

GENERAL PURPOSE HIGH STABILITY TRANSISTOR PRE-AMPLIFIER
For P.U. Tape, Mike, Guitar, etc. and suitable for use with valve or transistor equipment. 9-18v. battery or from H.T. line 200/300v. Frequency response 15Hz—25KHz. Gain 26dB. Solid encapsulation size $1\frac{3}{4}$" x $1\frac{1}{4}$" x $\frac{3}{4}$". Brand new complete with instructions. Price **88p**. P. & P. 13p.

BRAND NEW E.M.I. LIGHTWEIGHT PICK-UP ARM WITH ARM REST, Fitted mono t/o stylus and cartridge for LP/78. ONLY **£1**, P. & P. 13p.

QUALITY RECORD PLAYER AMPLIFIER MK II
A top quality record player amplifier employing heavy duty double wound mains transformer, ECC83, EL84, and rectifier. Separate Bass, Treble and Volume controls. Complete with output transformer matched for 3 ohm speaker. Size 7in. wide × 3in. deep × 6in. high. Ready built and tested. PRICE **£3·75** P. & P. 40p

ALSO AVAILABLE mounted on board with output transformer and speaker ready to fit into cabinet below. PRICE **£4·88** P. & P. 50p.

DELUXE QUALITY PORTABLE R/P CABINET MK II. Uncut motor board size $14\frac{1}{2}$ × 12in. clearance 2in. below, $5\frac{1}{2}$in. above. Will take above amplifier and any B.S.R. or GARRARD changer or Single Player (except AT60 and SP25). Size 18 × 15 × 8in. PRICE **£3·98**. P. & P. 50p.

10/14 WATT HI-FI AMPLIFIER KIT

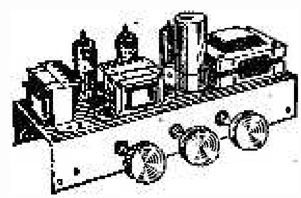
A stylishly finished monaural amplifier with an output of 14 watts from 2 EL84s in push-pull. Super reproduction of both music and speech, with negligible hum. Separate inputs for mike and gram allow records and announcements to follow each other Fully shrouded section wound output transformer to match 3–15 Ω speaker and 2 independent volume controls, and separate base and treble controls are provided giving good lift and cut. Valve line-up 2 EL84s, ECC83, EF86 and EZ80 rectifier. Simple instruction booklet 13p (Free with parts). All **parts sold separately**. ONLY **£7·97** P. & P. 55p. Also available ready built and tested complete with std. input sockets, **£9·97**. P. & P. 55p.

BRAND NEW TRANSISTOR BARGAINS. GET 15 (Matched pair) **75p**; V15/10p **50p**; OC71 **25p**; OC76 **30p**; AF117 **18p**; 2G339 (NPN) **15p**.
Set of Mullard 6 transistors OC44, 2—OC45, AC128D matched pair AC128 **£1·25**; ORP12 Cadmium Sulphide Cells **53p**. All post free.

SPECIAL PURCHASE! SPEAKER CABINET FROM FAMOUS MAKER!

Beautifully made all wooden construction cabinet with medium walnut finish front, gold anodised expanded aluminium grille and dark sides. Approx. size overall $11\frac{1}{2}''$ high x 5" deep x $13\frac{1}{2}''$ wide at base. Easily removable baffle cut out for 8" speaker. Fibre board back. Could accommodate amplifier or radio together with speaker. An expensively made cabinet at a give away price.
LIMITED NUMBER ONLY £1·38 Post Free.

DE LUXE STEREO AMPLIFIER



A.C. mains 200-240 v. Using heavy duty fully isolated mains transformer with full wave rectification giving adequate smoothing with negligible hum. Valve line up:—2 × ECL86 Triode Pentodes. 1 × EZ80 as rectifier. Two dual potentiometers are provided for bass and treble control, giving bass and treble boost and cut. A dual volume control is used. Balance of the left and right hand channels can be adjusted by means of a separate 'Balance' control fitted at the rear of the chassis. Input sensitivity is approxmately 300m/v for full peak output of 4 watts per channel (8 watts mono), into 3 ohm speakers. Full negative feedback in a carefully calculated circuit, allows high volume levels to be used with negligible distortion. Supplied complete with knobs, chassis size 11"w × 4"d. Overall height including valves 5". Ready built & tested to a high standard. **PRICE £8·92** P. &P. 45p

4-SPEED RECORD PLAYER BARGAINS
Mains models. All brand new in maker's packing.

LATEST B.S.R. C109/A21 4-SPEED AUTOCHANGER. With latest mono compatible cartridge **£6·97** Carr. 50p. With stereo cartridge **£7·97** Carr. 50p.

SUITABLE PLINTH UNIT FOR ABOVE with rigid plastic cover. **£5·75** complete P. & P. 50p.

LATEST GARRARD MODELS. All types available 1025, 2025, SP25, 3000, AT60 etc. S.A.E. for latest Prices!

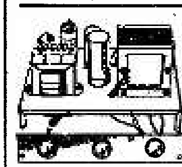
PLINTH UNITS cut out for Garrard Models, 1025, 2025, 2000, 3000, 3500 etc. With rigid transparent plastic cover. Special design enables above models to be used with cover in position. Also suitable for housing AT60 and SP25. **OUR PRICE £5.75** complete. P. & P. 50p.

LATEST ACOS GP91/1SC mono compatible cartridge with t/o stylus for LP/EP/78. Universal mounting bracket. **£1·50** P. & P. 8p.

SONOTONE 9TAHC COMPATIBLE STEREO CARTRIDGE T/O stylus Diamond Stereo LP and Sapphire 78.
ONLY £2·50 P. & P. 10p. Also available fitted with twin Diamond T/O stylus for Stereo LP. **£3.** P. & P. 10p.

LATEST RONETTE T/O STEREO/COMPATIBLE CARTRIDGE for EP/LP/Stereo/78. **£1·63** P. & P. 10p.
LATEST RONETTE T/O MONO COMPATIBLE CARTRIDGE for playing EP/LP/78 mono or stereo records on mono equipment. Only **£1·50** P. & P. 10p.

3-VALVE AUDIO AMPLIFIER HA34 MK II.



Designed for Hi-Fi reproduction of records. A.C. Mains operation. Ready built on plated heavy gauge metal chassis, size $7\frac{1}{2}$" w. × 4" d. × $4\frac{1}{2}$" h. Incorporates ECC83, EL84, EZ80 valves. Heavy duty, double wound mains transformer and output transformer matched for 3 ohm speaker. Separate volume control and now with improved wide range tone controls giving bass and treble lift and cut. Negative feedback line. Output $4\frac{1}{2}$ watts. Front panel can be detached and leads extended for remote mounting of controls. Complete with knobs, valves, etc., wired and tested for only **£4·75**. P. & P. 35p.

HSL "FOUR" AMPLIFIER KIT. Similar in appearance to HA34 above but employs entirely different and advanced circuitry. Complete set of parts, etc. **£3·98.** P. & P. 40p.

HARVERSON'S SUPER MONO AMPLIFIER
A super quality gram amplifier using a double wound fully isolated mains transformer, rectifier and ECL82 triode pentode valve as audio amplifier and power output stage. Impedance 3 ohms. Output approx. 3.5 watts. Volume and tone controls. Chassis size only 7in. wide × 3in. deep × 6in. high overall. AC mains 200/240v. Supplied absolutely Brand New completely wired and tested with good quality output transformer.
FEW ONLY.
BARGAIN PRICE **£2.75** P. & P. 35p

HANDBOOK OF TRANSISTOR EQUIVALENTS AND SUBSTITUTES
A must for servicemen and home constructors. 1971 edition including many 1000's of British, U.S.A., European and Japanese transistors. ONLY **40p** Post 5p.

Open 9–5.30 Monday to Saturday
Early closing Wed. 1 p.m.
A few minutes from South Wimbledon Tube Station.

HARVERSON SURPLUS CO. LTD.

170 HIGH ST., MERTON, LONDON, S.W.19 **Tel.: 01-540 3985**

SEND STAMPED ADDRESSED ENVELOPE WITH ALL ENQUIRIES

(Please write clearly)
PLEASE NOTE: P. & P. CHARGES QUOTED APPLY TO U.K. ONLY. P. & P. ON OVERSEAS ORDERS CHARGED EXTRA.

Fully guaranteed Individually packed VALVES

B12H	£1·75p
CY31	35p
DAF96	38p
DF96	37p
DK96	41p
DL92	32p
DL94	40p
DL96	41p
DM70	30p
DY86	45p
DY87	55p
DY802	48p
E88CC/01	£1·80p
E180CC	42p
E181CC	90p
E182CC	£1·05
EABC80	32p
EAF42	50p
EB91	15p
EBC33	50p
EBC41	52p
ECC81	30p
EBF80	42p
EBF83	42p
EBF89	30p
ECC81	30p
ECC82	28p
ECC83	30p
ECC84	20p
ECC85	40p
ECC86	50p
ECC88	37p
ECC189	52p
ECF80	35p
ECF82	35p
ECF83	75p
ECF801	62p
ECF802	62p
ECH35	60p
ECH42	65p
ECH81	28p
ECH83	42p
ECH84	45p
ECH200	62p
ECL80	45p
ECL82	32p
ECL83	65p
ECL86	42p
EF36	45p
EF37A	45p
EF39	40p
EF40	50p
EF41	62p
EF80	25p
EF83	55p
EF85	32p
EF86	31p
EF89	26p
EF91	15p
EF92	37p
EF95	30p
EF183	32p
EF184	35p
EFL200	75p
EL34	52p
EL41	57p
EL42	53p
EL84	23p
EL85	40p
EL86	40p
EL90	35p
EL95	35p
EL500	85p
EM31	25p
EM80	40p
EM84	35p
EM87	55p
EY51	40p
EY86	35p
EY81	35p
EY88	40p
EZ41	42p
EZ80	25p
EZ81	27p
GZ34	52p
KT66	£1·60p
KT88	£2·15p
N78	£1·25p
OA2	35p
OB2	35p
PABC80	37p
PC97	40p
PC900	47p
PCC84	37p
PCC89	45p
PCC189	55p
PCE800	75p
PCF80	30p
PCF82	33p
PCF84	46p
PCF86	57p
PCF200	77p
PCF201	77p
PCF801	48p
PCF802	48p
PCF805	72p
PCF806	65p
PCF808	72p
PCH200	70p
PCL81	47p
PCL82	37p
PCL83	65p
PCL84	42p
PCL85	42p
PCL86	42p
PFL200	57p
PL36	53p
PL81	50p
PL82	40p
PL83	42p
PL84	35p
PL500	73p
PL504	75p
PY33	60p
PY80	35p
PY81	27p
PY82	27p
PY83	35p
PY88	37p
PY800	52p
PY801	52p
QQVO3-10	£1·25p

29/41ft. AERIALS each consisting of ten 3ft. ⅞in. dia. tubular screw-in sections. 11ft. (6-section) whip aerial with adaptor to fit the 7in. rod, insulated base, stay plate and stay assemblies, pegs, reamer, hammer, etc. Absolutely brand new and complete ready to erect. In canvas bag £4. P. & P. 50p.

METERS Full List of our very large stock of meters on request.

TRANSISTORS, ZENER DIODES etc.

SPECIAL OFFER

O9J tube	£1·75
OA5	20p
OA10	25p
OA70	10p
OA71	10p
OA73	10p
OA74	10p
OA79	10p
OA81	10p
OA91	7p
OA200	7p
OA202	10p
OA210	25p
OA211	37p
OAZ200	55p
OAZ201	50p
OAZ202 to OAZ206	42p
OAZ207	47p
OAZ208 to OAZ213	32p
OAZ223 to OAZ225	50p
OC16	50p
OC22	50p
OC25	37p
OC26	25p
OC28	62p
OC29	62p
OC35	50p
OC38	42p
OC44	17p
OC45	15p
OC70	12p
OC71	15p
OC72	25p
OC73	30p
OC75	25p
OC76	25p
OC81	25p
OC81D	20p
OC81DM	20p
OC82	25p
OC82DM	30p
OC83	25p
OC83B	15p
OC84	25p
OC122	50p
OC139	25p
OC140	37p
OC170	25p
OC171	30p
OC172	37p
OC200	40p
OC201	60p
OC206	90p
IN21	17p
IN21B	25p
IN25	60p
IN43	10p
IN70	7p
IN702-725	36p
IN823A	£1·30
IZMT5	35p
IZMT10	33p
IZT5	67p
IZT10	63p
2G385	51p
2G403	15p
IN4785	50p
2N277	52p
2N918	37p
2N1304	25p
2N1306	25p
2N1307	25p
2N2147	75p
2N2904A	32p
2N3053	25p
2N3054	50p
2N3055	75p
2N3730	50p
2N3731	£2·75p
2N5109	£2·05p
40362	60p
82303	50p
3F100	67p
3FR5	32p
3N128	87p
3N139	£1·75p
3N140	95p
3N154	90p
3N159	£1·45p
6FR5	45p
12FR60	73p
10D1	16p
40594	£1·37p
40595	£1·37p
40636	£1·45p
40668	£1·35p
40669	£1·45p
AC126	25p
AC127	25p
AC128	25p
AC176	25p
ACY17	30p
ACY28	17p
AD149	50p
AD161	37p
AD162	37p
AF118	62p
AF127	17p
AF139	30p
AF178	48p
AF186	40p
AFY19	£1·13p
ASY26	25p
ASY28	25p
ASY67	48p
BAW19	28p
BC107	12p
BC108	12p
BC113	25p
BC118	38p
BCY72	15p
BF115	25p
BF173	30p
BFY51	20p
BFY52	23p
BSO5	38p
BS	45p
BS2	47p
BSY29	25p
BU100	£1·80p
BYZ13	25p
BYZ16	68p
CRS1/10	25p
CRS1/20	38p
CRS1/30	40p
CRS1/35	43p
CRS1/40	48p
CRS3/05	30p
CRS3/20	38p
CRS3/30	43p
CRS25/025	75p
CRS3/40	50p
GET103	23p
GET115	45p
GET116	50p
GEX66	£1·00
NKT222	20p
NKT304	50p
SD91S	26p
SD92S	31p
SD93S	32p
SD94	21p
SD98S	46p
V405A	40p

QQVO6-40A	£5·25p
R17	45p
R19	37p
STV280/40	£3·00p
STV280/80	£9·00p
TT21	£2·75p
U25	75p
U26	75p
U27	50p
U191	70p
U801	£1·00
UABC80	35p
UAF42	55p
UBC41	47p
UBF80	35p
UBF89	35p
UCC85	40p
UCF80	55p
UCH42	70p
UCH81	35p
UCL82	35p
UCL83	60p
UF41	50p
UF80	36p
UF89	35p
UL41	60p
UL84	30p
UU5	55p
UY41	45p
UY85	30p
VR105/30	35
VR150/30	35p
Z759	£1·65p
Z801U	£15·0p
Z803A	£1·25p
Z900T	75p
IL4	15p
IR5	35p
1S4	25p
1S5	24p
IT4	22p
1X2A	40p
1X2B	40p
3A4	30p
3D6	15p
3Q4	37p
3S4	35p
3V4	45p
5B254M	£2·20
5B/255M	£1·75
5R4GY	60p
5U4G	32p
5V4G	40p
5Y4G	40p
5Y3GT	35p
5Z4	75p
5Z4GT	40p
6AB7	30p
6AC7	15p
6AH6	50p
6AK5	30p
6AK8	32p
6AL5	15p
6AL5W	40p
6AM6	30p
6AN8	50p
6AQ5	35p
6AQ5W	50p
6AS6	37p
6AS7G	80p
6AT6	30p
6AU6	25p
6AX4GT	40p
6AX5GT	65p
6B7	40p
6BK7	40p
6BA6	25p
6BE6	30p
6BG6G	55p
6BJ6	45p
6BQ7A	35p
6BR7	80p
6BW6	80p
6BW7	70p
6C4	30p
6C6	25p
6CH6	55p
6CL6	49p
6D6	20p
6EA8	55p
6F23	75p
6F33	£1·50

MANY OTHERS IN STOCK include Cathode Ray Tubes and Special Valves. U.K. P. & P. Up to £1 12p, £1-£2 17p, £2-£3 22p. Over £3 post free. C.O.D. 20p extra.

INTERGRATED CIRCUITS— MANY OTHERS IN STOCK

RCA. CA 3005 wide band R.F. Ampl. 300mW diss £1·20
CA 3012 wide band ampl. 150m W diss .. .. £0·90
CA 3020 Audio power ampl. .. .. .. £1·37
CA 3036 Audio pre-ampl. .. .. £0·90
General Electric PA 230 £1·40; PA 234 £1; PA 237 £2·10
Mullard TAA 300 £1·75; TAA 320 73p

COLOMOR brand — ALL valves guaranteed

6H6	20p
6J4WA	75p
6J5	40p
6J5GT	25p
6J6	20p
6J7G	35p
6J7M	40p
6K6GT	50p
6K7	32p
6K7G	20p
6K8GT	45p
6K25	70p
6SA7	40p
6SA7GT	32p
6SC7GT	25p
6SG7	35p
6SJ7	37p
6SJ7GT	32p
6SK7	35p
6SL7GT	32p
6SN7GT	35p
6SQ7	39p
6SQ7GT	35p
6V6G	17p
6V6GT	38p
6X4	27p
6X5G	25p
6X5GT	32p
6Y6G	60p
6-30L2	70p
6Z4	32p
7B7	45p
7C5	85p
7C6	40p
7H7	32p
7Y4	60p
9D6	37p
11E2	£2·50p
12AT6	30p
12AT7	30p
12AU7	29p
12AV6	30p
12AX7	30p
12BA6	35p
12BE6	35p
12BH7	27p
12C8	32p
12E1	£1·25p
12K5	55p
12K7GT	40p
12K8GT	45p
12Q7GT	30p
12SG7	35p
14S7	75p
19AQ5	40p
19G3	£4·25p
19G6	£1·50p
19H4	£5·00p
20P4	£1·00p
25L6GT	40p
30C15	75p
30C17	80p
30C18	75p
30F5	84p
30FL1	70p
30FL12	92p
30FL13	50p
30FL14	75p
30L15	85p
30L17	80p
30P12	80p
30P19	80p
30PL1	70p
30PL13	92p
30PL14	85p
35L6GT	50p
35W4	30p
35Z4GT	45p
42	45p
50C5	40p
50CD6G30	£1·60p
50EH5	60p
75	40p
76	40p
78	40p
80	45p
803	£3·25p
805	£8·00p
807	50p
813	£3·75p
832A	£3·00p
866A	75p
954	40p
955	40p
956	20p
957	30p
991	40p
1622	£1·00p
2051	55p
5933	£1·12p
6057	50p
6060	50p
6064	45p
6065	65p
6080	£1·87p
6146	£1·50p
8020	£2·25p
9001	20p
9002	25p
9003	50p
9004	15p
9006	15p
C.R. Tubes	
VCR97	£4·50p
VCR517B	£3·50p
VCR517C	£7·50p
5FP7	£1·32p
88D	£9·00p
88J	£9·00p
88L	£9·00p
Photo Tubes	
CMG25	£2·75p
931A	£3·50p
6097C	£17·50p
Special Vlvs	
CV1031	£7·00p
CV2339	£20·00p
JP9/7D	£37·50p
K301	£5·00p
K305	£12·00p
K308	£16·00p
K337	£16·00p
5C22	£18·00p
725A	£16·00p

Colomor (Electronics) Ltd.
170 GOLDHAWK ROAD, LONDON W12.
Tel: 01-743 0899
Open 9–12.30, 1.30–5.30 p.m. Thursday 9–1 p.m.

YOURS FREE FOR 7 DAYS

The 'New Picture-Book' way of learning BASIC ELECTRICITY (5 VOLS.) ELECTRONICS (6 VOLS.)

You'll find it easy to learn with this outstandingly successful NEW PICTORIAL METHOD—the essential facts are explained in the simplest language, one at a time, and each is illustrated by an accurate, cartoon-type drawing. The books are based on the latest research into simplified learning techniques. This has proved that the PICTORIAL APPROACH to learning is the quickest and soundest way of gaining mastery over these subjects.

TO TRY IT, IS TO PROVE IT

This carefully planned series of manuals has proved a valuable course in training technicians in Electricity, Electronics, Radio and Telecommunications.

WHAT READERS SAY

"TERRIFIC TECHNICAL EDUCATIONAL MANUALS"
"As you know I have had from you both sets of Basic Electronics and Basic Electricity, these are terrific educational manuals, the best I have ever read." *K.F.H., Ilford.*

"ASTOUNDED AT THE EASE OF LEARNING"
"I am astounded at the ease of learning and understanding they provide." *B.M., London, E.5.*

"KEY TO LEARNING"
"I cannot say enough in praise of these Manuals, I shall recommend them to anybody interested in electricity and wireless that I know. They are the key to learning." *D.F., Leeds 14.*

POST NOW FOR THIS OFFER!!

To The SELRAY BOOK CO., 60 HAYES HILL, HAYES, BROMLEY, KENT BR2 7HP

Please send me WITHOUT OBLIGATION TO PURCHASE, one of the above sets on 7 DAYS FREE TRIAL, I will either return set, carriage paid, in good condition within 7 days or send the following amounts. BASIC ELECTRICITY £4.50 Cash Price, or Down Payment of £1.00 followed by 4 fortnightly payments of £1.00 each. Total £5.00. BASIC ELECTRONICS £5.40 Cash Price, or Down Payment of £1.00 followed by 5 fortnightly payments £1.00 each. Total £6.00. This offer applies to UNITED KINGDOM ONLY. Overseas customers cash with order, prices as above.

Tick Set required *(Only one set allowed on free trial)*

BASIC ELECTRICITY ☐ BASIC ELECTRONICS ☐

Prices include Postage and Packing.

Signature ....
(If under 21 signature required of parent or guardian)

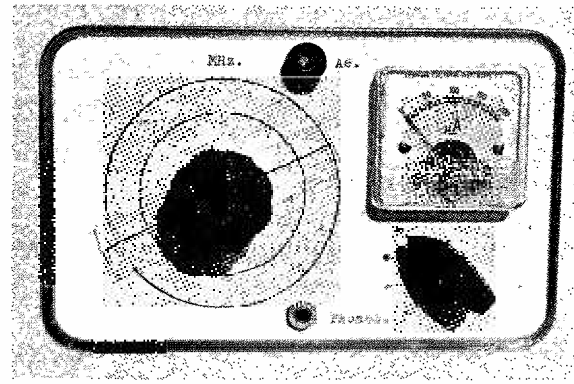
NAME
BLOCK LETTERS ....

FULL POSTAL
ADDRESS ....

....

A TECH-PRESS PUBLICATION

WAVE METER MONITOR



R. F. GRAHAM

THIS unit has four switch-selected bands, covering from 1600kHz to 100MHz and it can be used as a wavemeter, field strength meter or phone transmission monitor. It is fully enclosed, self-contained, and requires no battery.

Figure 1 shows the circuit. One pole of the switch, S1, selects the inductors L1, L2, L3 or L4, which are tuned by VC1. Pole S2 switches the diode D1 to the appropriate small coupling winding. When the circuit is tuned to resonance by VC1, rectified current is indicated by the meter.

To monitor phone signals, high impedance headphones or earpiece can be plugged into the phone jack and the phones are then in series with the meter. C1 is for r.f. and a.f. by-pass purposes, while C2 is an r.f. by-pass capacitor.

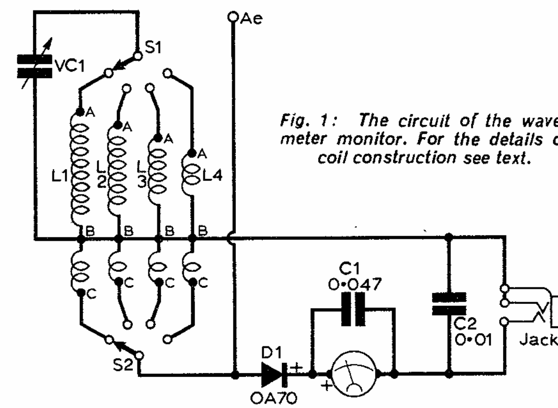


Fig. 1: The circuit of the wavemeter monitor. For the details of coil construction see text.

INDUCTORS

L1, L2 and L3 are wound on ½in. diameter paxolin formers. These can be prepared by cutting 1½in. lengths of ½in. diameter tube, and drilling small holes to secure the ends of the windings. The tubes can later be fixed with adhesive, with small brackets or by having them a push fit on small discs of insulating material screwed in place. Surplus or junk box formers could probably be utilised, but if these are of different diameter it may be necessary to modify the number of turns to suit.

L1 is wound with 34 s.w.g. enamelled copper wire. The tuned portion A to B is 65 turns, in a compact pile about 5/16in. long. A space of about 3/16in. is left and section B to C is wound on in the same direction, and has 8 turns side by side.

L2 also uses 34 s.w.g. enamelled copper wire. A to B is 50 turns wound side by side. A space is left as before, and a 4 turn coupling winding ends at C.

L3 uses 24 s.w.g. enamelled wire and has 12½ turns from A to B, and 2 turns from B to C. Figure 2 shows the general construction of L1, L2 and L3.

The windings are doped, smeared with clear *Bostik 1* or with some other suitable coil cement.

L4 is self-supporting, of 16 s.w.g. bare wire, and is shown in Fig. 3. It is wound and shaped to have 8 turns in all and is ½in. outside diameter, and 1in. long. B is a tapping 2 turns from end C. This coil is soldered directly to tags A and C of the 4-way switch as shown in Fig. 3. A lead runs from tapping B

★ components list

VC1	200pF Wavemaster variable capacitor.
C1	0·047μF or similar.
C2	0·01μF or similar.
D1	OA70 or OA81 diode.
S1/S2	2-pole 4-way miniature rotary switch.
Small closed circuit jack.	
200μA miniature meter.	
Inductors as text.	
Paxolin, perspex, box about 6 x 3½ x 2½in., aerial socket, knobs etc.	

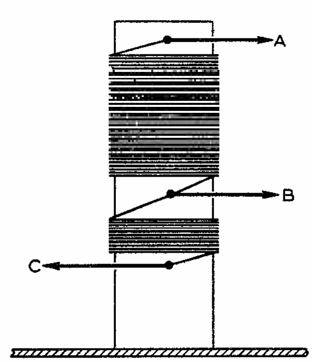


Fig. 2: The general construction of coils L1, L2 and L3 wound on ½in. diameter paxolin formers. Details of L4 are given in the text and in Fig. 3

directly to the moving plates tag of the variable capacitor.

CONSTRUCTION

The wavemeter was built to occupy a rigid plastic 'snack box' approximately 6in.$\times 3\frac{1}{2}$in.$\times 2\frac{1}{2}$in. deep. A piece of paxolin sheet, a little under 6in.$\times 3\frac{1}{2}$in., was cut to fit inside the box lid. The wavemeter is built wholly on this paxolin panel.

Screws holding L1, L2 and L3 are countersunk. A piece of stout paper to bear dial markings is cut the same size as the paxolin, and cemeted to it. The wavemeter is then assembled and calibrated and the scales are marked. The meter and fixing nuts of the switch, jack, and VC1 are then removed and the paxolin panel is fitted inside the box lid. This places the scales under the transparent material of the lid. Paxolin and lid are held together by the meter and the nuts mentioned.

Holes for the jack, switch and VC1 are first drilled in the paxolin and the meter hole cut with an adjustable washer or tank cutter. The paxolin is then placed in the lid, and the positions of holes marked on the lid itself, so that they can be made to match up correctly with those in the paxolin.

The box should be of material which is reasonably strong. It should be drilled and cut with tools which are really sharp, and without forcing, to avoid cracking.

A suitable case could be assembled from $\frac{1}{4}$in. thick wood, glued and pinned at the joints. The paxolin panel would then be large enough to be fixed with small wood screws.

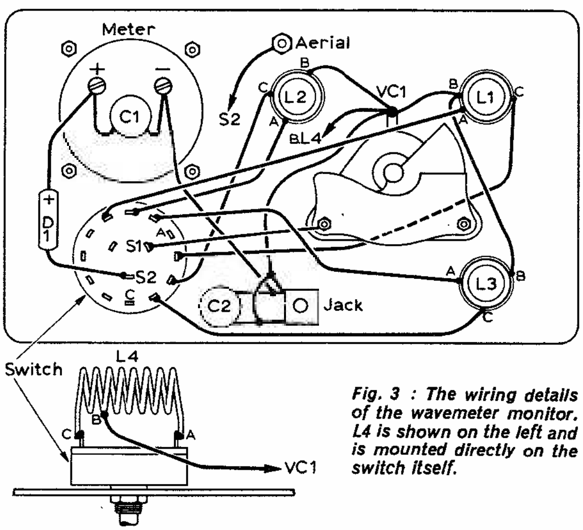
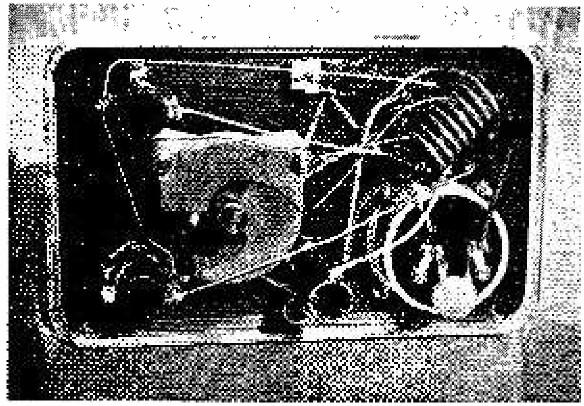


Fig. 3 : The wiring details of the wavemeter monitor. L4 is shown on the left and is mounted directly on the switch itself.

All wiring is shown in Fig. 3. Connections should be of stout wire and run clear of each other, and should be reasonably short and direct, especially for L3 and L4.

VC1 is 200pF, but this exact value is not essential, provided that the ranges overlap a little. If an alternative diode is fitted, be sure it is suitable for frequencies up to 100MHz.

A 100μA meter would be a little more sensitive than the one specified, but would also cost a little more. Should a 500μA meter be to hand, it is suitable, though less sensitive. The sensitivity with a 1mA meter becomes rather low so an instrument in the neighbourhood of 200μA is probably most suitable.



An internal view of the completed prototype.

The dial cursor is a $2\frac{3}{4}$in. piece of perspex about $\frac{5}{8}$in. wide, marked with a hair line. Readings will be confused if VC1 can rotate through 360°, so the extreme corner of the back moving plate was turned up with pliers to limit rotation to about 180°.

Values used for C1 and C2 are not particularly important. A medium or high impedance pair of headphones will give best general results.

CALIBRATION

Actual band coverage with the inductors described is as follows

Range 1	1·6-4MHz
Range 2	2·8-10MHz
Range 3	8-32MHz
Range 4	21-100MHz

This gives 160 and 80m bands in Range 1, 80 and 40m bands in Range 2, all h.f. bands 20-10m in Range 3, and 15-10m bands and harmonics in Range 4, without having to use the extreme h.f. end of the ranges, where readings become close together.

The simplest means of calibration is to use a grid dip oscillator, placing its coil 2in. or so from the appropriate inductor in the wavemeter. This allows complete calibration of all ranges with a minimum of difficulty.

A transmitter can be used for calibration in the amateur bands, and these will probably be of most importance. Place the wavemeter some distance from the transmitter, its dummy load or the aerial lead or tuner, as required to obtain a deflection on the meter.

Some signal generators have an r.f. level meter. If the output of the generator is coupled to the wavemeter by a small loop, a dip may be observed on the level meter when the wavemeter is tuned to resonance. This offers another possible way to secure calibration.

If the wavemeter is coupled to a receiver having a sensitive S-meter, a *slight* dip in the S-meter reading can be observed when the wavemeter is tuned to the receiver frequency. Input to the receiver can be from a signal generator, or transmission.

All calibration is made with no external connection to the wavemeter and minimum coupling to avoid unnecessary inaccuracy.

USES

A wavemeter is normally used to indicate frequency bands and harmonics, not exact frequencies within a narrow band. It is placed or held to pick up sufficient r.f. energy from the circuit being investiga-

—continued on page 534

BRAND NEW GUARANTEED

SEMICONDUCTORS & COMPONENTS

SOLE AGENTS FOR SOLID STATES DEVICES INC., (USA). IN U.K.

RETURN OF POST SERVICE

TRANSISTORS

2G301	20p	2N3404	32½p	40310	45p	BC212L	13p	BSX28	32½p	NKT281	27½p
2G302	20p	2N3405	45p	40311	35p	BCY30	27½p	BSX60	82½p	NKT401	87½p
2G303	20p	2N3414	22½p	40312	47½p	BCY31	30p	BSX61	62½p	NKT402	90p
2G306	42½p	2N3415	22½p	40314	37½p	BCY32	50p	BSX76	22½p	NKT403	75p
2G308	30p	2N3416	37½p	40320	47½p	BCY33	25p	BSX77	27½p	NKT404	62½p
2G309	30p	2N3417	37½p	40323	32½p	BCY34	30p	BSX78	27½p	NKT405	75p
2G371	15p	2N3570	£1·25	40324	47½p	BCY38	40p	BSY10	27½p	NKT406	62½p
2G374	20p	2N3572	97½p	40326	37½p	BCY39	60p	BSY11	27½p	NKT451	62½p
2G381	22½p	2N3605	27½p	40329	30p	BCY40	50p	BSY24	15p	NKT452	62½p
2N404	22½p	2N3606	27½p	40344	27½p	BCY42	15p	BSY25	15p	NKT453	47½p
2N696	20p	2N3607	22½p	40347	57½p	BCY43	15p	BSY26	17½p	NKT603F	32½p
2N697	17p	2N3702	11p	40348	52½p	BCY54	32½p	BSY27	17½p	NKT613F	32½p
2N698	25p	2N3703	10p	40360	42½p	BCY58	22½p	BSY28	17½p	NKT674F	30p
2N706	12½p	2N3704	11p	40361	47½p	BCY59	22½p	BSY29	17½p	NKT677F	30p
2N705A	12½p	2N3705	10p	40362	57½p	BCY60	97½p	BSY32	25p	NKT713	25p
2N708	15p	2N3706	09p	40370	32½p	BCY70	20p	BSY36	25p	NKT781	30p
2N709	62½p	2N3707	11p	40406	57½p	BCY71	25p	BSY37	25p	NKT10419	30p
2N718	25p	2N3708	07p	40407	40p	BCY72	17½p	BSY38	22½p	NKT10439	
2N726	30p	2N3709	09p	40408	52½p	BCZ10	27½p	BSY39	22½p		37½p
2N727	30p	2N3710	09p	40410	62½p	BCZ11	42½p	BSY40	32½p	NKT10519	
2N914	17½p	2N3711	12p	40467A	57½p	BD116	£1·12½	BSY51	32½p		32½p
2N916	17½p	2N3715	£1·23	40468A	35p	BD121	65p	BSY52	32½p	NKT20329	
2N918	30p	2N3716	£1.30	40600	57½p	BD123	82½p	BSY53	37½p		47½p
2N929	22½p	2N3791	£2.06	AC107	30p	BD124	60p	BSY54	40p	NKT20339	
2N930	27½p	2N3819	35p	AC126	20p	BD131	75p	BSY56	90p		37½p
2N1090	22½p	2N3823	97½p	AC127	25p	BD132	85p	BSY78	47½p	NKT80111	
2N1091	22½p	2N3854	27½p	AC128	20p	BDY10	£1·37½	BSY79	45p		77½p
2N1131	25p	2N3854A	27½p	AC154	22½p	BDY11	£1·62½	BSY82	52½p	NKT80112	
2N1132	25p	2N3855	27½p	AC176	25p	BDY17	£1·50	BSY90	57½p		97½p
2N1302	17½p	2N3855A	30p	AC187	62½p	BDY18	£1·75	BSY95A	12½p	NKT80113	
2N1303	17½p	2N3856	30p	AC188	37½p	BDY19	£1·97½	BSW41	42½p		£1.12
2N1304	22½p	2N3856A	35p	ACY17	27½p	BDY20	£1·12½	BSW70	27½p	NKT80211	
2N1305	22½p	2N3858	25p	ACY18	25p	BDY38	97½p	C111	75p		92½p
2N1306	25p	2N3858A	30p	ACY19	25p	BDY60	£1·25	C424	27½p	NKT80212	
2N1307	25p	2N3859	27½p	ACY20	25p	BDY61	£1·25	C425	55p		92½p
2N1308	30p	2N3859A	32½p	ACY21	25p	BDY62	£1·00	C426	40p	NKT80213	
2N1309	30p	2N3860	30p	ACY22	20p	BF115	25p	C428	37½p		92½p
2N1507	17½p	2N3866	£1.50	ACY28	20p	BF117	47½p	C744	30p	NKT80214	
2N1613	25p	2N3877	40p	ACY40	20p	BF163	37½p	D16P1	37½p		92½p
2N1631	35p	2N3877A	40p	ACY41	25p	BF167	18p	D16P2	40p	NKT80215	
2N1632	30p	2N3900	37½p	ACY44	40p	BF173	19p	D16P3	37½p		92½p
2N1638	27½p	2N3900A	40p	AD140	52½p	BF177	30p	D16P4	40p	NKT80216	
2N1639	27½p	2N3901	97½p	AD149	57½p	BF178	30p	GET102	30p		92½p
2N1671B	£1·00	2N3903	35p	AD150	62½p	BF179	30p	GET113	20p	OC20	75p
2N1711	25p	2N3904	35p	AD161	37½p	BF180	35p	GET114	20p	OC22	50p
2N1889	32½p	2N3905	37½p	AD162	37½p	BF181	32½p	GET118	20p	OC23	60p
2N1893	37½p	2N3906	37½p	AF106	42½p	BF184	25p	GET119	20p	OC24	60p
2N2147	82½p	2N4058	17½p	AF114	25p	BF185	42½p	GET120	52½p	OC25	50p
2N2148	57½p	2N4059	10p	AF115	25p	BF194	17½p	GET873	12½p	OC26	27½p
2N2160	57½p	2N4060	12½p	AF116	25p	BF195	15p	GET880	30p	OC28	62½p
2N2193	40p	2N4061	12½p	AF117	25p	BF196	42½p	GET887	20p	OC29	62½p
2N2193A	42½p	2N4062	12½p	AF118	62½p	BF197	42½p	GET889	22½p	OC35	50p
2N2194A	30p	2N4244	47½p	AF119	20p	BF198	42½p	GET890	22½p	OC36	62½p
2N2217	27½p	2N4285	17½p	AF124	22½p	BF200	52½p	GET896	22½p	OC41	22½p
2N2218	23p	2N4286	17½p	AF125	20p	BF224	14p	GET897	22½p	OC42	25p
2N2219	23p	2N4287	17½p	AF126	20p	BF225	19p	GET898	22½p	OC44	20p
2N2220	25p	2N4288	17½p	AF127	17½p	BF237	23p	MJ400	£1·07½	OC45	12½p
2N2221	25p	2N4289	17½p	AF139	37½p	BF238	23p	MJ420	£1·12½	OC46	15p
2N2222	30p	2N4290	17½p	AF178	42½p	BF244	23p	MJ421	£1.12½	OC70	15p
2N2270	47½p	2N4291	17½p	AF179	72½p	BFW61	47½p	MJ430	£1·02½	OC71	12½p
2N2297	30p	2N4292	12½p	AF180	52½p	BFX12	22½p	MJ440	95p	OC72	12½p
2N2368	17½p	2N4303	47½p	AF181	42½p	BFX13	22½p	MJ480	97½p	OC74	32½p
2N2369	17½p	2N5027	52½p	AF239	42½p	BFX29	30p	MJ481	£1·25	OC75	22½p
2N2369A	17½p	2N5028	57½p	AF279	47½p	BFX30	30p	MJ490	£1·00	OC76	22½p
2N2410	42½p	2N5029	47½p	AF280	62½p	BFX42	37½p	MJ491	£1·37½	OC77	30p
2N2483	27½p	2N5030	42½p	AF211	32½p	BFX44	37½p	MJ1800	£2·17½	OC81	20p
2N2484	32½p	2N5172	12½p	ASY26	25p	BFX68	67½p	MJE340	62½p	OC81D	22½p
2N2539	22½p	2N5174	52½p	ASY27	37½p	BFX84	25p	MJE520	60p	OC83	25p
2N2540	22½p	2N5175	52½p	ASY28	27½p	BFX85	32½p	MJE521	73p	OC84	25p
2N2613	35p	2N5176	45p	ASY29	27½p	BFX86	25p	MPF102	42½p	OC139	32½p
2N2614	30p	2N5232A	30p	ASY36	25p	BFX87	27½p	MPF103	37½p	OC140	32½p
2N2646	52½p	2N5245	45p	ASY50	25p	BFX88	25p	MPF104	37½p	OC170	30p
2N2696	32½p	2N5246	42½p	ASY51	32½p	BFX89	62½p	MPF105	37½p	OC171	30p
2N2711	25p	2N5249	67½p	ASY54	25p	BFX93A	70p	MPS3638	32½p	OC200	40p
2N2712	25p	2N5265	£3·25	ASY86	32½p	BFY10	32½p	NKT0013	47½p	OC201	60p
2N2713	27½p	2N5266	£2·75	AU103	£1·25	BFY11	42½p	NKT124	42½p	OC202	75p
2N2714	30p	2N5267	£2·62½	ASZ21	42½p	BFY17	22½p	NKT125	27½p	OC203	42½p
2N2865	62½p	2N5305	37½p	BC107	10p	BFY18	32½p	NKT126	27½p	OC204	42½p
2N2904	30p	2N5306	40p	BC108	10p	BFY19	32½p	NKT128	27½p	OC205	90p
2N2904A	32½p	2N5307	37½p	BC109	10p	BFY20	£1·60	NKT135	27½p	OC207	75p
2N2905	37½p	2N5308	37½p	BC113	15p	BFY21	42½p	NKT137	32½p	OCP71	42½p
2N2905A	40p	2N5309	62½p	BC115	15p	BFY24	45p	NKT210	30p	ORP12	62½p
2N2906	25p	2N5310	42½p	BC116A	15p	BFY25	25p	NKT211	30p	ORP61	50p
2N2906A	27½p	2N5354	27½p	BC118	10p	BFY26	20p	NKT212	30p	P346A	22½p
2N2907	30p	2N5355	27½p	BC121	20p	BFY29	50p	NKT213	30p	TIS34	62½p
2N2923	15p	2N5356	32½p	BC122	20p	BFY30	50p	NKT214	22½p	TIS43	27p
2N2924	15p	2N5365	47½p	BC125	20p	BFY41	50p	NKT215	22½p	TIS44	10p
2N2925	15p	2N5366	32½p	BC126	20p	BFY43	62½p	NKT216	37½p	TIS45	10p
2N2926		2N5367	57½p	BC140	37½p	BFY50	23p	NKT217	42½p	TIS46	11p
Green	14p	2N5457	37½p	BC147	10p	BFY51	20p	NKT219	30p	TIS47	11p
Yellow	12½p	2S005	75p	BC148	10p	BFY52	23p	NKT223	27½p	TIS48	12½p
Orange	12½p	2S020	£2·00	BC149	12p	BFY53	17½p	NKT224	25p	TIS49	12½p
2N3011	30p	2S102	50p	BC152	17½p	BFY56A	57½p	NKT225	22½p	TIS50	17½p
2N3014	32½p	2S103	25p	BC157	20p	BFY75	30p	NKT229	30p	TIS51	12½p
2N3053	18p	2S104	25p	BC158	11p	BFY76	42½p	NKT237	35p	TIS52	12½p
2N3054	46p	2S501	32½p	BC159	12p	BFY77	57½p	NKT238	25p	TIS53	22½p
2N3055	62p	2S502	35p	BC160	62½p	BFY90	67½p	NKT240	27½p	TIS60	22½p
2N3133	30p	2S503	27½p	BC167	11p	BFW58	27½p	NKT241	27½p	TIS61	25p
2N3134	30p	3N83	40p	BC168B	10p	BFW59	25p	NKT242	20p	TIS62	27½p
2N3135	25p	3N128	70p	BC168C	11p	BFW60	25p	NKT243	62½p	TIP29A	50p
2N3136	25p	3N140	77½p	BC169B	11p	BPX25	£1·85	NKT244	17½p	TIP30A	60p
2N3390	25p	3N141	72½p	BC169C	12p	BPX29	£1·80	NKT245	20p	TIP31A	62½p
2N3391	20p	3N142	55p	BC170	12½p	BPY10	£1·45	NKT261	20p	TIP32A	75p
2N3391A	30p	3N143	67½p	BC171	15p	BRY39	47½p	NKT262	30p	TIP33A	
2N3392	17½p	3N152	87½p	BC172	15p	BSX19	17½p	NKT264	20p		£1·02½p
2N3393	15p	R.C.A.	52½p	BC175	22½p	BSX20	17½p	NKT271	20p	TIP34A	£2·05
2N3394	15p	40050	55p	BC182	10p	BSX21	37½p	NKT272	20p		
2N3402	22½p	40251	32½p	BC183	09p	BSX26	45p	NKT274	20p		
2N3403	22½p	40309	32½p	BC184	11p	BSX27	47½p	NKT275	20p		

Post & Packing 12½p per order. Europe 25p. Commonwealth (Air) 65p (MIN.)
Matching charge (audio transistors only) 12½p extra per pair.
Prices subject to alteration without prior notice.

TTL. LOGIC I.C. NEW PRICES

	1-11	12-24		1-11	12-24
SN7400	20p	18p	SN7446	£1·00	95p
SN7401	20p	18p	SN7447	£1·00	95p
SN7402	20p	18p	SN7448	£1·00	95p
SN7403	20p	18p	SN7449	£1·00	95p
SN7404	20p	18p	SN7450	20p	18p
SN7405	20p	18p	SN7451	20p	18p
SN7406	80p	75p	SN7453	20p	18p
SN7407	20p	18p	SN7454	20p	18p
SN7408	20p	18p	SN7460	20p	18p
SN7409	20p	18p	SN7470	40p	38p
SN7410	20p	18p	SN7472	32p	30p
SN7411	23p	21p	SN7473	43p	41p
SN7412	48p	46p	SN7474	43p	41p
SN7413	40p	38p	SN7475	45p	44p
SN7416	84p	78p	SN7476	45p	44p
SN7417	84p	78p	SN7480	70p	65p
SN7420	20p	18p	SN7481	£1·40	£1·38
SN7423	51p	47p	SN7482	87p	82p
SN7425	48p	45p	SN7483	87p	82p
SN7427	48p	45p	SN7484	£2·00	£1·85
SN7428	80p	75p	SN7485	£3·62	£3·40
SN7430	23p	21p	SN7486	33p	30p
SN7432	48p	45p	SN74174	£2·40	£2·30
SN7433	80p	75p	SN74175	£1·68	£1·60
SN7437	64p	60p	SN74176	£2·64	£2·55
SN7438	64p	60p	SN74177	£2·64	£2·55
SN7440	23p	21p	SN74180	£2·13	£2·05
SN744LAN	87p	83p	SN74181	£9·33	£9·00
SN7442	85p	81p	SN74182	£2·03	£1·95
SN7443	£2·86	£2·70	SN74184	£4·80	£4·60
SN7444	£2·86	£2·70	SN74185	£4·80	£4·60
SN7445	£2·50	£2·40	SN74190	£1·80	£1·70

SILICON RECTIFIERS

PIV	50	100	200	400	600	800	1000	1200
1A	10p	12½p	15p	16p	17½p	19p	20p	—
3A	15p	—	—	22½p	—	30p	—	—
6A	—	—	25p	30p	32½p	35p	—	—
10A	—	52½p	57½p	65p	77½p	86½p	97½p	£1·25
17A	—	57½p	62½p	77½p	90p	97½p	£1·20	£1·57½
35A	—	80p	90p	£1·00	£1·25	£1·50	£2·50	—

1 amp and 3 amp are plastic encapsulation.

DIODES & RECTIFIERS

IN34A	10p	AA119	10p	BAX16	12½p	BYZ13	25p
IN914	07½p	AA129	10p	BAY18	17½p	FST3/4	22½p
IN916	07½p	AAZ13	10p	BAY31	07½p	OA5	17½p
IN4007	22½p	AAZ15	12½p	BAY38	25p	OA10	22½p
IS44	10p	AAZ17	12½p	BY100	17½p	OA9	10p
IS113	15p	BA100	15p	BY103	22½p	OA47	07½p
IS120	15p	BA102	22½p	BY122	47½p	OA70	07½p
IS121	17½p	BA110	32½p	BY124	15p	OA73	10p
IS130	12½p	BA115	07½p	BY126	15p	OA79	09p
IS131	12½p	BA141	32½p	BY127	17½p	OA81	07½p
IS132	15p	BA142	32½p	BY164	57½p	OA85	07½p
IS920	07½p	BA144	12½p	BYX10	22½p	OA90	07½p
IS922	07½p	BA145	20p	BYZ10	35p	OA91	07½p
IS923	07½p	BA154	12½p	BYZ11	32½p	OA95	07½p
IS940	07½p	BAX13	12½p	BYZ12	30p	OA200	10p
						OA202	10p

TRIACS

SC35D	£1·12½	SC51D	£1·95
SC36D	£1·00	40430	97½p
SC40D	£1·50	40486	95p
SC41D	£1·20	40528	72½p
SC45D	£1·62½	40430	£1·30
SC46D	£1·42½	40432	£1·87½
SC50D	£2·05	40512	£1·45

BRIDGE RECTIFIERS

A.	PIV		A.	PIV	
1	100	47½p	4	50	60p
1.4	140	52½p	4	100	70p
2	50	55p	4	400	95p
2	200	70p	5	50	62½p
2	400	80p	6	200	87½p
			4	400	£1·12½

THYRISTORS

PIV	50	100	200	300	400
1A	25p	27½p	37½p	40p	47½p
4A	47½p	55p	57½p	—	77½p
5A	—	55p	65p	—	90p
7A	—	55p	65p	—	97½p

TIC47 0.6 amp. 200 PIV **55p.**
Also 12 amp. 100 PIV **75p**
2N3525 at **£1.12½p**

VEROBOARD

	0·15 Matrix	0·1 Matrix
2½ × 3¾in	17½p	20p
2½ × 5in	21p	24p
3¾ × 3¾in	21p	24p
3¾ × 5in	27½p	27½p
5 × 17in (Plain)	85p	—

Vero Pins (Bag of 36) **20p**
Vero Cutter **45p**
Pin Insertion Tools (·1 and ·15 matrix) at **55p.**

HEAT SINKS

4·8 × 4 × 1in Finned for Two TO-3 Trans., **47½p.** 4·8 × 2 × 1in Finned, for One TO-3 Trans., **32½p.** For SO-1, **2½p.** For TO-5, **5p** Finned. For TO-18, **5p** Finned. For TO-18, **1/-** Finned.

RESISTORS

Carbon Film

⅛ watt 5%, **1p.**
¼ watt 5%, **1½p.**
½ watt 5%, **2p.**
¼ w 2% M/O **4p.**
1 watt 10%, **2½p.**
2 watt 10%, **6p.**

⅛W, 1W & 2W E24 Series.
¼W & ½W E12 Series.

CAPACITORS

A large and comprehensive range available: Electrolytic, Polyester, Ceramic, Polystyrene, Silver Mica, Tantalum, Trimmers, Tuners.

Examples:
2,000mF 25V, **37½p**
2,500mF 50V, **57½p**
3,000mF 25V, **45p**
5,000mF 50V, **97½p**

Most Mullard Electrolytics in stock

WIRE-WOUND RESISTORS

2·5 watt 5% (up to 270 ohms only). **7½p**
5 watts 5% (up to 8·2kΩ only), **10p**
10 watt 5% (up to 25kΩ only), **12½p**

POTENTIOMETERS

Carbon:
Log. and Lin., less switch, **16p.**
Log. and Lin., with switch, **25p.**
Wire-wound Pots (3W), **40p.**
Twin Ganged Stereo Pots, Log. and Lin., **40p.**

PRESETS (CARBON)

0·1 Watt **6p**
0·2 Watt **6p**
0·3 Watt **7½p**

VERTICAL OR HORIZONTAL

THERMISTORS

R53 (STC) **£1·27½** VA3705 **87½p**
K151 (1k) **12½p**
Mullard Thermistors also in stock. Please enquire.

Tel. 01-452 0161/2/3
Telex 21492

A. MARSHALL & SON

28 CRICKLEWOOD BROADWAY, LONDON, N.W.2

Send 5p for new Comprehensive Semiconductor and I.C. list (24 pages).

CALLERS WELCOME

HRS. 9–5.30 MON.-FRI.
9–5.0 SAT.
9–1.0 THURS.

TAKE 20

JULIAN ANDERSON

A series of simple transistor projects, each using less than twenty components and costing less than one pound to build.

"WHAT's an automatic light?" you may well ask. Well, lights are only needed when it's dark, and a very simple electronic switch circuit can be made to turn a small light on as soon as the general light level drops below a certain level; this has its most obvious application in motor cars. Many parts of the country have local regulations requiring cars to display lights shortly after sunset, even when parked. In other areas car parking lights are needed only when the local street lighting is turned off, which in some areas is as late as 2 a.m. There cannot be many people who relish the thought of going out to their cars at that hour to turn on the side or parking lights.

Porch lights which automatically turn themselves on after dusk are another application and although the circuit as shown is not really meant for this, many readers will realise the potential and modify the circuit to operate a thyristor or relay to apply the mains supply to the porch light.

THE CIRCUIT

Like last month we are making use of a light dependent resistor, that is a resistor whose value in ohms falls with an increase in light falling on it. Also like last month this component is coupled into the base bias potential divider circuit, thus controlling the bias on the transistor, Tr1. R1 may have to be altered in value in order to make the "switch" operate at the correct light level.

As darkness falls, the potential at the base of Tr1 falls as the value of the LDR rises and after a certain point Tr1 begins to turn off, less current is passed and the potential between the emitter and the collector rises. This in turn starts to turn Tr2 on. This transistor, when light was falling on the LDR, thus holding Tr1 on, was off since the potential between base and emitter was held at a very low level due to the small potential across Tr1. As soon as Tr2 begins to conduct this increases the current through R4, thus causing Tr1 to cut off even more and in turn switching Tr2 more on. This action takes place very quickly and Tr2 is switched fully on, applying the supply voltage across the bulb causing it to light up.

This switching circuit is known as the *Schmitt Trigger* and a very useful circuit, it is too, with applications in many fields of electronics. As can be seen, only a few components are required and the switching action, using modern transistors, is very rapid and very positive. As soon as the potential at the base of Tr1 either reaches or falls to a preset level, Tr2 will switch.

The supply necessary to operate the circuit is taken directly from the car battery, though it is good practice to take this via the car's fuse as any

—continued overleaf

No. 30
AUTOMATIC LIGHT

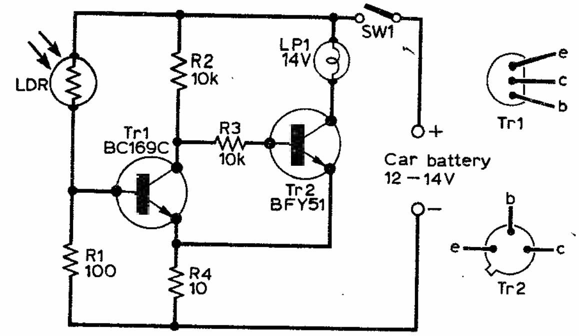


Fig. 1: The circuit of the automatic light with the lead connections of the transistors shown on the right.

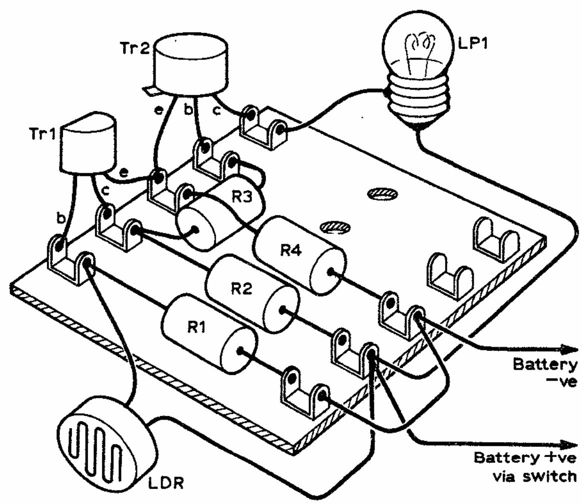


Fig. 2: A suggested component layout on a small piece of tag board.

★ components list

Tr1	BC169C	[illegible]
Tr2	BFY51	[illegible]
LDR	Light Dependent Resistor	[illegible]
R1	100Ω 10% ¼W	[illegible]
R2	10kΩ 10% ¼W	[illegible]
R3	10kΩ 10% ¼W	[illegible]
R4	10Ω 10% ¼W	[illegible]
LP1	14V LES bulb, Radiospares about	[illegible]
SW1	DPST toggle switch	[illegible]
		85p

[illegible]

TAKE 20—*continued from previous page*

mistakes or serious component failure could create a fire risk.

Car batteries are capable of giving very high currents and therefore the quiescent current is of no great importance but it is in fact low, in the order of 2mA. The recommended bulb draws 40mA and it can be seen that these currents can be supplied by a number of dry batteries, though operation in this manner will not be cheap.

The bulb should last a considerable time as it is being slightly under-run; there is of course a small volts drop across R4 and Tr2.

CONSTRUCTION

A suggested layout is shown in Fig. 2 but this is not critical. One point must be watched however; if the light from the bulb is allowed to fall onto the LDR it will switch the circuit in the same way that sunlight will. This will cause the circuit to oscillate; this can easily be seen as the bulb will flicker or flash. To avoid this the LDR must be pointed away from the bulb. ■

WAVEMETER MONITOR—*by R. F. GRAHAM*

continued from page 530

ted. Tuning resonance is shown by maximum meter reading. In driver and similar circuits with small power, the wavemeter needs to be reasonably close to the circuit inductor. For P.A. and high power circuits, it can be at some small distance.

To check the frequency of low level multipliers and similar circuits, or those which are inaccessible, a link line may be used. This is twin flex or co-axial cable about 2ft. long with a loop of two or three turns each end. One loop is held near the equipment inductor, and the other near the wavemeter inductor. Clipping a lead to jack and aerial socket also allows the coil primaries to be used for coupling. Resonance will be shown by a dip in grid current in a subsequent stage.

To monitor the audio of an outgoing transmission, plug in phones, tune to resonance and situate the unit where pick-up gives adequate volume.

To tune an aerial, transmitter, tuner or coupling device for maximum radiation from the aerial, a vertical rod or wire is plugged into the aerial socket of the unit, which should be at some distance. Adjustments are then for maximum meter reading, which corresponds to maximum field strength. It is also possible to link couple a dipole or aerial-earth system to the wavemeter for this purpose, or take a short aerial to VC1, ignoring calibration.

The wavemeter produces no signal. It can be used to find bands on a t.r.f. receiver by adjusting the latter until oscillation *just* arises, and holding the wavemeter coil in line with the receiver coil. Resonance when tuning the wavemeter is then shown by the receiver going out of oscillation. ■

BLUEPRINT SERVICE

We would like to draw readers' attention to the fact that the BLUEPRINT SERVICE has been discontinued and therefore no further BLUEPRINTS are available.

Electronotes..

S. GINSBERG

IN the beginning there were photocells enclosed in glass envelopes. Variations of these were more sensitive and multi-electrode secondary emission cells appeared like the 931A photomultiplier tube.

In more recent years, many experimenters, and indeed, most of the electronics industry too, has opted for solid state when thinking in terms of a light sensing device. An example here is the ORP12 light-dependent resistor, not to mention the earlier plastic-encapsulated transistors with some of their paint removed!

In America, work is currently proceeding on a technique known as charge coupling for imaging devices. One oxidised surface of a tiny silicon chip is covered with some 288 minute electrodes. These are arranged into groups of three, the last electrode in each group being a common conductor for the whole array.

The area immediately beneath each group of three elements forms a tiny light sensitive device in its own right. Minority carriers are generated in the silicon beneath the electrodes whenever light is focussed onto them. The greater the intensity of the light, the greater the charge, thus forming a direct relationship between light intensity and electrical charge.

The centre electrode of each group is purposely made more positive than the other two elements and thus the charges on minority carriers are attracted to, and congregate at, these centre electrodes.

Individual charges are next moved along the array from one electrode group to the next by putting a successively greater positive voltage on the electrode next to the one which is holding the charge. Eventually all the charges will have been passed along to the end of the device where they are collected by an output electrode.

Because the size of the charge will be dependent upon the amount of original light applied, the final electrode has, in effect, an analogue electrical signal which has a linear relationship to original light patterns of intensity.

How big is a 100,000μF capacitor—think of the size of some electrolytics. Now imagine how big a one Farad capacitor would be. Just to stretch the imagination even further, think of a 50 Farad capacitor. Fantastic—but they exist and are for sale. Twist in the tale is that the 50F is contained within one-third of a cubic inch. The devices will also retain their storage (if charged with a voltage) and leakage is so low that even after 16 months they will have retained over 97 per cent of the original charge. Think; they could be charged up and used as a form of battery. When discharged, they could simply be recharged again ad infinitum.

SEW PANEL METERS

USED EXTENSIVELY BY INDUSTRY, GOVERNMENT DEPARTMENTS, EDUCATIONAL AUTHORITIES, ETC.

● LOW COST ● QUICK DELIVERY ● OVER 200 RANGES IN STOCK ● OTHER RANGES TO ORDER

NEW "SEW" DESIGNS!

CLEAR PLASTIC METERS

TYPE SW.100 100 x 80 mm.

50μA	£3·47½	20V. D.C.	£2·97½
50-0-50μA	£3·37½	50V. D.C.	£2·97½
100μA	£3·37½	300V. D.C.	£2·97½
100-0-100μA	£3·25	1 amp. D.C.	£2·97½
500μA	£3·12½	5 amp. D.C.	£2·97½
1mA	£2·97½	300V. A.C.	£2·97½
		VU Meter	£3·75

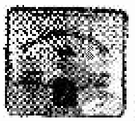
BAKELITE PANEL METERS

TYPE S-80 80 mm. square fronts

50μA	£3·12½	50V. D.C.	£2·47½
50-0-50μA	£2·97½	300V. D.C.	£2·47½
100μA	£2·97½	1 amp. D.C.	£2·47½
100-0-100μA	£2·87½	5 amp. D.C.	£2·47½
500μA	£2·62½	300V. A.C.	£2·62½
1mA	£2·47½	VU Meter	£3·37½
20V. D.C.	£2·47½		

"SEW" CLEAR PLASTIC METERS

Type MR.85P. 4¼in. × 4¼in. fronts.



50μA	£3·60	50mA	£2·60
50-0-50μA	£3·10	100mA	£2·60
100μA	£3·10	500mA	£2·60
100-0-100μA	£3·10	1 amp.	£2·60
200μA	£2·87½	5 amp.	£2·60
500μA	£2·75	15 amp.	£2·60
500-0-500μA	£2·60	30 amp.	£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
		15V. A.C.	£2·60
		300V. A.C.	£2·60
		S Meter 1mA	£2·87½
		VU Meter	£3·60
		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

Type MR.52P. 2½in. square fronts.

50μA	£3·10	10V. D.C.	£2·00
50-0-50μA	£2·60	20V. D.C.	£2·00
100μA	£2·60	50V. D.C.	£2·00
100-0-100μA	£2·87½	300V. D.C.	£2·00
500μA	£2·25	15V. A.C.	£2·00
1mA	£2·00	300V. A.C.	£2·00
5mA	£2·00	S Meter 1mA	£2·10
10mA	£2·00	VU Meter	£3·10
50mA	£2·00	1 amp. A.C.*	£2·00
100mA	£2·00	5 amp. A.C.*	£2·00
500mA	£2·00	10 amp. A.C.*	£2·00
1 amp.	£2·00	20 amp. A.C.*	£2·00
5 amp.	£2·00	30 amp. A.C.*	£2·00

Type MR.65P. 3½in. × 3¼in. fronts.

50μA	3·37½	10V. D.C.	£2·10
50-0-50μA	£2·75	20V. D.C.	£2·10
100μA	£2·75	50V. D.C.	£2·10
100-0-100μA	£2·60	150V. D.C.	£2·10
200μA	£2·60	300V. D.C.	£2·10
500μA	£2·37½	15V. A.C.	£2·10
500-0-500μA	£2·10	50V. A.C.	£2·10
1mA	£2·10	150V. A.C.	£2·10
5mA	£2·10	300V. A.C.	£2·10
10mA	£2·10	500V. A.C.	£2·10
50mA	£2·10	S Meter 1mA	£2·37½
100mA	£2·10	VU Meter	£3·37½
500mA	£2·10	50mA A.C.	*£2·10
1 amp.	£2·10	100mA A.C.	*£2·10
5 amp.	£2·10	200mA A.C.	*£2·10
10 amp.	£2·10	500mA A.C.	*£2·10
15 amp.	£2·10	1 amp. A.C.*	£2·10
20 amp.	£2·10	5 amp. A.C.*	£2·10
30 amp.	£2·10	10 amp. A.C.	*£2·10
50 amp.	£2·37½	20 amp. A.C.	*£2·10
3V. D.C.	£2·10	30 amp. A.C.	*£2·10

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

50μA	£2·00	200mA	£1·87½
50-0-50μA	£1·87½	300mA	£1·87½
100μA	£1·87½	500mA	£1·87½
100-0-100μA	£1·75	750mA	£1·87½
200μA	£1·75	1 amp.	£1·87½
500μA	£1·50	2 amp.	£1·87½
500-0-500μA	£1·87½	5 amp.	£1·87½
1mA	£1·87½	10 amp.	£1·87½
1-0-1mA	£1·87½	3V. D.C.	£1·87½
2mA	£1·87½	10V. D.C.	£1·87½
5mA	£1·87½	15V. D.C.	£1·87½
10mA	£1·37½	20V. D.C.	£1·87½
20mA	£1·37½	100V. D.C.	£1·87½
50mA	£1·87½	150V. D.C.	£1·87½
100mA	£1·87½	300V. D.C.	£1·87½
150mA	£1·37½	500V. D.C.	£1·37½
		750V. D.C.	£1·87½
		15V. A.C.	£1·87½
		50V. A.C.	£1·87½
		150V. A.C.	£1·87½
		300V. A.C.	£1·87½
		500V. A.C.	£1·87½
		S Meter 1mA	£1·60
		VU Meter	£2.10

Type MR.45P. 2in. square fronts.

50μA	£2·25	5 amp.	£1·50
50-0-50μA	£2·10	10V. D.C.	£1·50
100μA	£2·10	20V. D.C.	£1·50
100-0-100μA	£1.87½	50V. D.C.	£1·50
200μA	£1·87½	300V. D.C.	£1·50
500μA	£1·60	15V. A.C.	£1·50
500-0-500μA	£1·50	300V. A.C.	£1·50
1mA	£1·50	S Meter 1mA	£1·87½
5mA	£1·50	VU Meter	£2·25
10mA	£1·50	1 amp. A.C.*	£1·50
50mA	£1·50	5 amp. A.C.*	£1·50
100mA	£1·50	10 amp. A.C.*	£1·50
500mA	£1·50	20 amp. A.C.*	£1·50
1 amp	£1·50	30 amp. A.C.*	£1·50

"SEW" BAKELITE PANEL METERS

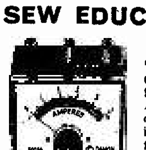
Type MR.65. 3½in. square fronts.

25μA	£3·50	500mA	£1·75
50μA	£2·37½	1 amp.	£1·75
50-0-50μA	£2·25	5 amp.	£1·75
100μA	£2·25	15 amp.	£1·75
100-0-100μA	£2·25	30 amp.	£1·75
500μA	£2·10	50 amp.	£1·75
1mA	£1·75	5V. D.C.	£1·75
1-0-1mA	£1·75	10V. D.C.	£1·75
5mA	£1·75	20V. D.C.	£1·75
10mA	£1·75	50V. D.C.	£1·75
50mA	£1·75	150V. D.C.	£1·75
100mA	£1·75	300V. D.C.	£1·75
		30V. A.C.*	£1·75
		50V. A.C.*	£1·75
		150V. A.C.*	£1·75
		300V. A.C.*	£1·75
		500mA A.C.*	£1·75
		1 amp. A.C.*	£1·75
		5 amp. A.C.*	£1·75
		10 amp. A.C.*	£1·75
		20 amp. A.C.*	£1·75
		30 amp. A.C.*	£1·75
		50 amp. A.C.*	£1·75
		VU Meter	£3·10

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

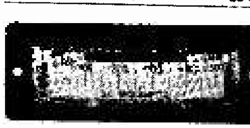
Please add postage

SEW EDUCATIONAL METERS



Type ED.107. Size overall 100mm × 90mm × 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	£4·50	20V d.c.	£3·97
100μA	£4·25	50V d.c.	£3·97
1mA	£3·97	300V d.c.	£3·97
50-0-50μA	£4·25		
1-0-1mA	£3·97	Dual range	
1A d.c.	£3·97	500mA/5A d.c.	£4·25
5A d.c.	£3·97	5V/50V d.c.	£4·25
10V d.c.	£3·97		



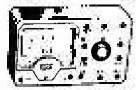
EDGWISE METERS

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

50μA	£3·00	500μA	£2·60
50-0-50μA	£2·87½	1mA	£2·87½
100μA	£2·87½	300V. A.C.	£2·87½
100-0-100μA	£2·75	VU Meter	£3·25
200μA	£2·75		

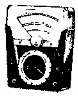
Send for illustrated brochure on SEW Panel Meters—discounts for quantities.

MULTIMETERS for EVERY purpose!



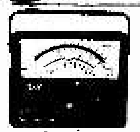
TECH PT-34. 1,000 O.P.V. 0/10/50/250/500/1,000V. A.C. and D.C. 0/1/100/500mA. D.C. 0/100K. **£1·97½.** P. & P. 12½p.

MODEL TE-200 20,000 O.P.V. Mirror scale, overload protection. 0/5/25/125/1,000 V.D.C. 0/10/50/250/1,000 V.A.C. 0/50 uA/250 mA. 0/60K/6 megΩ. −20 to +62 db. **£3·75.** P. & P. 15p.



MODEL TE-70. 30,000 O.P.V. 0/3/15/60/300/600/1,200v. D.C. 0/6/30/120/600/1,200v. A.C. 0/30uA/3/30/300mA. 0/16K/160K/1.6M/16 Meg Ω. **£5·50.** P. & P. 15p.

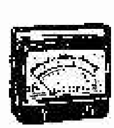
MODEL TE-12
20,000 O.P.V. 0/0.6/6/30/120/600/1,200/3,000/6,000v. D.C. 0/6/30/120/600/1,200v. A.C. 0/60μA/6/60/600mA. 0/6K/600K/6Meg./60 Meg. Ω 50pF. 0.2mFd. **£5·97½.** P. & P. 17½p.



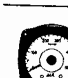
MODEL PL436
20kΩ/Volt D.C. 8kΩ/Volt AC. Mirror scale. .6/3/12/30/120/600V D.C. 3/30/120/600V A.C. 50/600uA/60/600 mA. 10/100K/1 Meg/10 MegΩ. −20 to + 46db. **£6·97½** P & P 12½

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. 1/2·5/10/25/100/250/500/1,000v. A.C. 0/50μA/5/50/500mA. 12 amp. D.C. 0/60K/6 Meg./60 Meg Ω. **£8·87½.** Post paid.

TMK MODEL TW-20CB FEATURES RESETTABLE OVERLOAD BUTTON. Sensitivity: 20K Ω/Volt D.C. 5K Ω/Volt A.C. D.C. Volts: 0–0.5, 2.5, 10, 50, 250, 1,000V. A.C. Volts: 0–2.5, 10, 50, 250, 1,000V. D.C. Currents: 0–0.05, 0.5, 5, 50, 500mA. Resistance: 0–5K. 50K, 0–500K. 5 MEGΩ. Decibels: −20 to +52 db. **£11·50.** P. & P. 17½p.

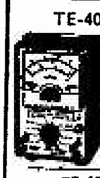


TMK LAB TESTER. 100,000 O.P.V. 6½in. Scale Buzzer Short Circuit Check. Sensitivity: 100,000 O.P.V. D.C. 5K Ω/Volt A.C. D.C. Volts: .5, 2.5, 10, 50, 250, 1,000 V. A.C. Volts: 3, 10, 50, 50, 250, 500, 1,000V. D.C. Current: 10, 100uA, 10, 100, 500mA, 2.5, 10 amp. Resistance: 1K, 10K, 100K, 10MEG, 100 MEGΩ. Decibels: −10 to 49 db. Plastic Case with Carrying Handle. Size 7½in. x 6½in. x 3½in. **£18·90.** P. & P. 25p.



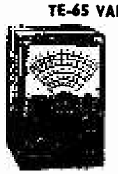
270° WIDE ANGLE 1mA METERS
MW1-6 60mm square **£3·97½**
MW1-8 80mm square **£4·97½**
P. & P. extra

TE-40 HIGH SENSITIVITY A.C. VOLTMETER



10 meg. input 10 ranges: 01/·003/·1/·3/1/3/10/30/100/300V. R.M.S. 4cps.-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



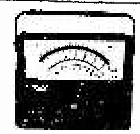
High quality instrument with 28 ranges. D.C.volts 1·5–1,500v. A.C. volts 1·5–1,500v. Resistance up to 1,000 megohms. 200/240v. A.C. operation. Complete with probe and instructions. **£17·50.** P. & P. 30p. Additional probes available: R.F. £2·12½; H.V. £2·50.

HONOR TE.10A. 20k Ω/Volt 5/25/50/250/500/2,500 v. D.C. 10/50/100/500/1,000 v. A.C. 0/50uA/2.5mA/250mA D.C. 0/6K/6 meg. ohm. −20 to +22 dB. 10–0, ·100 mfd. 0.100–0.1 mfd. **£3·47½.** P. & P. 15p.

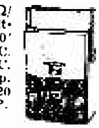
MODEL TE-300. 30,000 O.P.V. Mirror scale, overload protection 0/.6/3/15/60/300/1,200V. D.C. 0/6/30/120/600/1,200V. A.C. 0/30uA/6mA/60mA/300mA/600mA. 0/8K/80K/800K/8 meg. ohm −20 to +63 db. **£5·97½.** P. & P. 15p.

TMK MODEL MD.120
Mirror scale. 20k/Volt D.C. 10k Ω Volt A.C. 30/60/300/600/3,000 V. D.C. 6/120/1,200 V. A.C.
Current 0-60uA/0 — 12/0 300mA. 0-60K/0·6 Mohms −20 to + 63 dB. **£4.62½** P & P 15p

MODEL TE-90 50,000 O.P.V. Mirror scale, overload protection. 0/3/12/60/300/600/1,200 v. D.C. 0/6/30/120/300/1,200 v. A.C. .03/6/60/600mA. D.C. 16K/160K/1.6/16 MEGΩ. −20 to +63 db. **£7·50.** P. & P. 15p.



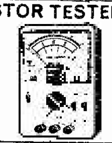
SKYWOOD SW-500
50K Ω/Volt. Mirror scale DC Volts 0.6/3/12/30/300/600. DC Current 20uA/6/600mA Resistance 10K/100K/1 Meg/10 Meg. Decibels — 20 to +57 db. **£7·50.** P. & P. 15p.



MODEL AS-100D. 100K Ω/Volt. 5in., mirror scale. Built-in meter protection 0/3/12/60/120/300/600/1,200 v. D.C. 0/6/30/120/300/600 v. A.C. 0/10uA/6/60/300MA/12 Amp. 0/2K/200K/2M/200MΩ. −20 to +17 bB. **£12·50.** P. & P. 17½p.

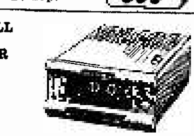
TE-900 20,000 Ω/VOLT GIANT MULTIMETER. Mirror scale and overload protection. 6in. full view meter. 2 colour scale. 0/2.5/10/250/1,000/5,000 v. A.C. 0/25/12.5/10/50/250/1,000/5,000 v. D.C. 0/50uA/110/100/500mA/10 amp. D.C. 02K/200K/20 MEG. OHM. **£15.** P. & P. 25p.

FTC-401 TRANSISTOR TESTER



Full capabilities for measuring A, B and ICO. NPN or PNP. Equally adaptable for checking diodes. Supplied complete with instructions, battery and leads. **£6·97½.** P. & P. 15p.

HONEYWELL DIGITAL VOLTMETER VT.100



Can be panel or bench mounted. Basic meter measures 1 volt D.C. but can be used to measure a wide range of AC and DC volt, current and ohms with optional plug in cards. Specification: Accuracy: ± 0.2, ± 1 digit. Resolution: 1mV. Number of digits: 3 plus fourth overrange digit. Overrange: 100% (up to 1·999) Input impedance: 1000 Meg ohm. Measuring cycle: 1 per second. Adjustment: Automatic zeroing, full scale adjustment against an internal reference voltage. Overload: to 100v. D.C. Input: Fully floating (3 poles). Input power: 110-230v. A.C. 50/60-cycles. Overall size: 5⅝in. x 2 13/16in. x 83/16in.

AVAILABLE BRAND NEW AND FULLY GUARANTEED AT APPROX. HALF PRICE

£49·97½ Carr. 50p.

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

Also see next two pages

SEMI-CONDUCTORS/VALVES

ALL DEVICES BRAND NEW AND FULLY GUARANTEED

Transistors

2G301	20p
2G302	19p
2G303	20p
2G306	30p
2G308	30p
2G309	30p
2G371	15p
2G374	20p
2G381	22p
2N388A	49p
2N404	20p
2N696	15p
2N697	15p
2N698	25p
2N699	42p
2N706	9p
2N706A	11p
2N708	15p
2N709	45p
2N718	25p
2N718A	30p
2N726	25p
2N727	25p
2N914	17p
2N916	17p
2N918	30p
2N929	23p
2N930	24p
2N937	52p
2N1090	22p
2N1091	22p
2N1131	25p
2N1132	25p
2N1302	17p
2N1303	17p
2N1304	22p
2N1305	22p
2N1306	24p
2N1307	24p
2N1308	25p
2N1309	24p
2N1507	17p
2N1613	21p
2N1631	35p
2N1632	30p
2N1637	30p
2N1638	27p
2N1639	27p
2N1701	110p
2N1711	24p
2N1889	32p
2N1893	37p
2N2147	72p
2N2160	57p
2N2193	40p
2N2193A	42p
2N2194	27p
2N2194A	30p
2N2217	27p
2N2218	20p
2N2219	20p
2N2220	25p
2N2221	25p
2N2222	20p
2N2222A	25p
2N2297	30p
2N2368	15p
2N2369	17p
2N2369A	17p
2N2410	42p
2N2483	27p
2N2484	32p
2N2539	22p
2N2540	22p
2N2613	27p
2N2614	30p
2N2646	47p
2N2711	25p
2N2712	25p
2N2713	27p
2N2714	30p
2N2904	20p
2N2904A	25p
2N2905	25p
2N2905A	30p
2N2906	20p
2N2906A	25p
2N2907	23p
2N2923	15p
2N2924	15p
2N2925	15p
2N2926G	13p
2N2926O	13p
2N2926Y	13p
2N3011	24p
2N3014	25p
2N3053	20p
2N3054	49p
2N3055	72p
2N3133	25p
2N3134	30p
2N3135	25p
2N3136	25p
2N3390	25p
2N3391	20p
2N3391A	30p
2N3392	17p
2N3393	15p
2N3394	15p
2N3402	22p
2N3403	22p
2N3404	32p
2N3405	45p
2N3414	22p

2N3415	22p
2N3416	27p
2N3417	37p
2N3439	130p
2N3440	97p
2N3564	17p
2N3565	15p
2N3566	22p
2N3568	25p
2N3569	25p
2N3570	125p
2N3572	97p
2N3605	27p
2N3606	27p
2N3607	22p
2N3638	18p
2N3638A	20p
2N3641	18p
2N3642	18p
2N3643	20p
2N3644	25p
2N3645	25p
2N3691	15p
2N3692	18p
2N3693	15p
2N3694	18p
2N3702	10p
2N3703	10p
2N3704	12p
2N3705	10p
2N3706	10p
2N3707	12p
2N3708	8p
2N3709	10p
2N3710	10p
2N3711	10p
2N3713	187p
2N3714	200p
2N3715	222p
2N3716	290p
2N3773	240p
2N3791	275p
2N3819	34p
2N3820	57p
2N3823	75p
2N3854	27p
2N3854A	27p
2N3855	27p
2N3855A	30p
2N3856	30p
2N3856A	35p
2N3858	25p
2N3858A	30p
2N3859	27p
2N3859A	32p
2N3860	30p
2N3866	150p
2N3877	40p
2N3877A	40p
2N3900	37p
2N3900A	40p
2N3901	97p
2N3903	25p
2N3904	25p
2N3905	30p
2N3906	30p
2N4058	15p
2N4059	10p
2N4060	12p
2N4061	12p
2N4062	12p
2N4244	47p
2N4248	15p
2N4249	15p
2N4250	18p
2N4254	42p
2N4255	42p
2M4284	17p
2N4285	17p
2N4286	17p
2N4287	17p
2N4288	15p
2N4289	15p
2N4290	15p
2N4291	15p
2N4292	15p
2N4294	17p
2N4303	47p
2N4964	15p
2N4965	18p
2N5027	52p
2N5028	57p
2N5029	47p
2N5030	42p
2N5172	12p
2N5174	52p
2N5175	52p
2N5176	45p
2N5232A	30p
2N5245	45p
2N5246	42p
2N5249	67
2N5265	325p
2N5305	37p
2N5306	40p
2N5307	37p
2N5308	30p
2N5309	52p
2N5310	42p
2N5354	27p
2N5355	27p
2N5356	32p
2N5365	47p
2N5366	32p
2N5367	57p
2N5457	34p

2N5458	35p
2N5459	48p
28102	25p
28103	25p
28104	25p
28301	47p
28302	47p
28303	57p
28304	72p
28501	32p
28502	35p
28503	27p
3N83	40p
3N128	70p
3N140	77p
3N141	72p
3N142	55p
3N143	67p
3N152	87p
40050	55p
40250	50p
40251	52p
40309	32p
40310	45p
40311	35p
40312	47p
40314	37p
40315	37p
40316	47p
40317	37p
40319	55p
40320	47p
40323	32p
40324	47p
40326	37p
40329	30p
40344	27p
40347	57p
40348	52p
40360	42p
40361	47p
40362	55p
40370	32p
40406	57p
40407	40p
40408	52p
40409	55p
40410	62p
40412	50p
40467A	57p
40468A	35p
40528	72p
40600	57p
40603	50p
AC107	30p
AC126	20p
AC127	24p
AC128	20p
AC151	18p
AC152	22p
AC154	22p
AC176	22p
AC187	25p
AC188	27p
ACY17	27p
ACY18	24p
ACY19	20p
ACY20	20p
ACY21	20p
ACY22	10p
ACY28	17p
ACY39	47p
ACY40	14p
ACY41	25p
ACY44	40p
AD140	47p
AD149	47p
AD150	62p
AD161	35p
AD162	35p
AF109	45p
AF114	25p
AF115	25p
AF116	25p
AF117	20p
AF118	44p
AF121	30p
AF124	22p
AF125	19p
AF126	18p
AF127	16p
AF139	28p
AF178	42p
AF179	45p
AF180	50p
AF181	40p
AF186	39p
AF239	30p
AF279	47p
AF280	47p
AFZ11	82p
ASY26	25p
ASY27	31p
ASY28	24p
ASY29	27p
ASY50	25p
ASY51	32p
ASY54	25p
ASY67	45p
ASY86	37p
ASZ21	37p
AUY10	150p
BC107	10p
BC108	10p
BC109	10p
BC113	15p

BC114	15p
BC115	15p
BC116	15p
BC118	15p
BC119	35p
BC121	20p
BC122	20p
BC125	15p
BC126	25p
BC134	15p
BC135	15p
BC136	15p
BC137	15p
BC138	37p
BC140	35p
BC141	35p
BC147	15p
BC148	11p
BC149	15p
BC152	17p
BC153	35p
BC154	35p
BC157	15p
BC158	15p
BC159	15p
BC160	35p
BC167	15p
BC168B	14p
BC168C	15p
BC169B	14p
BC169C	15p
BC170	12p
BC171	15p
BC172	15p
BC175	22p
BC177	22p
BC178	20p
BC179	20p
BC182	10p
BC182L	10p
BC183	10p
BC183L	10p
BC184	15p
BC184L	12p
BC186	25p
BC187	27p
BC212L	12p
BC213L	12p
BC214L	15p
BCY10	27p
BCY30	24p
BCY31	30p
BCY32	50p
BCY33	20p
BCY34	25p
BCY38	30p
BCY39	80p
BCY40	50p
BCY41	15p
BCY42	15p
BCY43	15p
BCY54	32p
BCY58	25p
BCY59	25p
BCY60	97p
BCY70	15p
BCY71	20p
BCY72	15p
BCY78	30p
BCY79	30p
BCZ10	27p
BCZ11	40p
BD112	50p
BD116	112p
BD121	65p
BD123	80p
BD124	75p
BD131	75p
BD132	85p
BDY10	125p
BDY20	105p
BDY61	125p
BDY62	100p
BF115	25p
BF117	47p
BF152	23p
BF154	18p
BF158	28p
BF159	57p
BF163	35p
BF167	25p
BF170	33p
BF173	30p
BF177	30p
BF178	35p
BF179	30p
BF180	35p
BF181	35p
BF182	30p
BF184	20p
BF185	20p
BF194	17p
BF195	15p
BF196	15p
BF197	15p
BF198	42p
BF200	35p
BF224	20p
BF225	20p
BF237	22p
BF238	22p
BF244	82p
BFW61	47p
BFW87	25p
BFW88	22p
BFW89	20p

BFW90	22p
BFW91	20p
BFX12	22p
BFX13	22p
BFX29	25p
BFX30	25p
BFX37	30p
BFX44	37p
BFX68	67p
BFX84	25p
BFX85	32p
BFX86	25p
BFX87	25p
BFX88	20p
BFX89	52p
BFX93A	70p
BFY11	42p
BFY18	25p
BFY19	25p
BFY21	42p
BFY24	45p
BFY29	40p
BFY30	40p
BFY41	50p
BFY43	62p
BFY50	22p
BFY51	20p
BFY52	22p
BFY53	17p
BFY56A	57p
BFY76	42p
BFY77	57p
BFY90	65p
BSX19	17p
BSX20	17p
BSX21	20p
BSX26	45p
BSX27	47p
BSX28	32p
BSX60	82p
BSX61	62p
BSX76	15p
BSX77	20p
BSX78	25p
BSY24	15p
BSY25	15p
BSY26	17p
BSY27	17p
BSY28	17p
BSY29	17p
BSY32	25p
BSY36	25p
BSY37	25p
BSY38	20p
BSY39	22p
BSY43	50p
BSY51	32p
BSY52	32p
BSY53	37p
BSY54	40p
BSY56	90p
BSY79	45p
BSY90	57p
BSY95A	13p
C424	15p
C450	15p
GET102	30p
GET113	20p
GET114	15p
GET118	20p
GET120	25p
GET873	12p
GET880	30p
GET887	15p
GET889	22p
GET890	22p
GET896	22p
GET897	22p
GET898	22p
MAT100	25p
MAT101	30p
MAT120	25p
MAT121	30p
MJ400	107p
MJ420	112p
MJ421	112p
MJ430	102p
MJ440	95p
MJ480	97p
MJ481	125p
MJ490	100p
MJ491	137p
MJE340	62p
MJE370	95p
MJE371	87p
MJE520	87p
MJE521	87p
MPF102	42p
MPF103	35p
MPF104	37p
MPF105	37p
MPS3638	32p
NKT124	42p
NKT125	27p
NKT126	27p
NKT128	27p
NKT135	27p
NKT137	32p
NKT210	30p
NKT211	30p
NKT212	30p
NKT213	30p
NKT214	22p
NKT215	22p
NKT216	37p
NKT217	40p

NKT219	30p
NKT223	27p
NKT224	22p
NKT225	22p
NKT229	30p
NKT237	35p
NKT238	25p
NKT240	27p
NKT241	27p
NKT242	20p
NKT243	62p
NKT244	17p
NKT245	20p
NKT261	20p
NKT262	20p
NKT264	20p
NKT271	20p
NKT262	20p
NKT274	20p
NKT275	20p
NKT278	25p
NKT281	27p
NKT401	87p
NKT402	90p
MKT403	75p
NKT404	62p
NKT405	75p
NKT406	62p
NKT451	62p
NKT452	62p
NKT453	47p
NKT713	20p
NKT717	42p
NKT734	27p
NKT736	35p
NKT773	25p
NKT781	30p
OC16	50p
OC19	37p
OC20	75p
OC22	50p
OC23	60p
OC24	60p
OC25	37p
OC26	25p
OC28	60p
OC29	60p
OC35	50p
OC36	60p
OC41	22p
OC42	25p
OC44	17p
OC45	12p
OC46	15p
OC70	15p
OC71	12p
OC72	12p
OC73	18p
OC74	30p
OC75	22p
OC76	22p
OC77	30p
OC78	20p
OC81	20p
OC81D	20p
OC82	25p
OC82D	15p
OC83	25p
OC84	25p
OC139	25p
OC140	32p
OC170	25p
OC171	30p
OC200	40p
OC201	50p
OC202	75p
OC203	40p
OC204	40p
OC205	75p
OC206	90p
OC207	75p
OCP71	42p
ORP12	50p
ORP60	40p
ORP61	42p
P346A	22p
ST140	15p
ST141	20p
TIS34	62p
TIS43	40p
TIS44	12p
TIS45	12p
TIS46	13p
TIS47	13p
TIS48	13p
TIS49	13p
TIS50	17p
TIS51	13p
TIS52	13p
TIS53	22p
XB112	13p
XC141	35p
ZTX107	14p
ZTX108	11p
ZTX109	17p
ZTX300	11p
ZTX301	17p
ZTX302	18p
ZTX303	18p
ZTX304	25p
ZTX500	16p
ZTX501	16p
ZTX502	20p
ZTX503	17p
ZTX504	40p
ZTX531	28p

Integrated Circuits

CA3000	130p
CA3005	117p
CA3007	262p
CA3011	75p
CA3012	88p
CA3013	105p
CA3014	124p
CA3018	84p
CA3018A	110p
CA3019	84p
CA3020	126p
CA3020A	160p
CA3021	156p
CA3022	130p
CA3023	126p
CA3026	100p
CA3028A	74p
CA3028B	105p
CA3029	87p
CA3029A	165p
CA3030	187p
CA3035	122p
CA3036	72p
CA3039	82p
CA3041	109p
CA3042	109p
CA3043	137p
CA3044	120p
CA3045	122p
CA3046	81p
CA3047	137p
CA3048	204p
CA3049	160p
CA3050	185p
CA3051	134p
CA3052	165p
CA3053	46p
CA3054	109p
CA3055	240p
CA3059	165p
CA3064	120p
FCH101	85p
FCH111	105p
FCH121	105p
FCH131	50p
FCH141	105p
FCH151	105p
FCH161	50p
FCH171	105p
FCH181	105p
FCH191	105p
FCH201	130p
FCH211	130p
FCH221	130p
FCH231	150p
FCJ101	160p
FCJ111	150p
FCJ121	275p
FCJ131	275p
FCJ141	525p
FCJ201	100p
FCJ211	275p
FCK101	430p
FCL101	230p
FCY101	102p

FJH101	25p
FJH111	70p
FJH121	25p
FJH131	25p
FJH141	25p
FJH151	25p
FJH161	70p
FJH171	25p
FJH181	25p
FJH221	25p
FJH231	25p
FJH241	25p
FJH251	25p
FJJ101	50p
FJJ111	50p
FJJ121	60p
FJJ131	60p
FJJ141	125p
FJJ181	75p
FJJ191	65p
FJJ211	125p
FJJ251	125p
FJL101	125p
FJY101	25p
IC10	250p
IC12	250p
L900	40p
L914	40p
L923	40p
MC724P	66p
MC780P	247p
MC788P	82p
MC790P	124p
MC792P	66p
MC799P	66p
MC1303L	262p
MC1304P	275p
MC1305P	386p
MC838P	549p
MC1435P	345p
MC1552G	461p
MC1709CG	94p
MFC4000P	112p
PA222	437p
PA230	100p
PA234	100p
PA237	185p
PA246	245p
PA424	235p
PA264	447p
PA265	497p
SN7400	23p
SN7401	23p
SN7402	23p
SN7403	23p
SN7404	23p
SN7405	23p
SN7406	80p
SN7408	23p
SN7409	23p
SN7410	23p
SN7411	23p
SN7413	35p
SN7420	23p

SN7430	23p
SN7440	23p
SN7441AN	87p
SN7442	87p
SN7446	125p
SN7447	110p
SN7448	100p
SN7450	23p
SN7451	23p
SN7453	23p
SN7454	23p
SN7460	23p
SN7472	35p
SN7473	43p
SN7474	43p
SN7475	47p
SN7476	45p
SN7483	87p
SN7486	50p
SN7490	100p
SN7492	87p
SN7493	87p
SN7495	87p
SN7496	87p
SN74107	43p
SN74153	140p
SN74154	220p
SN74160	180p
SN74161	180p
SN74164	220p
SN74165	225p
SN74192	225p
SN74193	225p
TAA241	162p
TAA242	425p
TAA243	150p
TAA263	75p
TAA293	97p
TAA300	175p
TAA310	125p
TAA320	72p
TAA350	175p
TAA435	147p
TAA521	132p
TAA522	360p
TAA530	495p
TAA811	445p
TAB101	97p
TAD100	150p
TAD110	197p
SL403A	187p
SL702C	147p
UA702A	280p
UA702C	77p
UA703C	137p
UA709C	125p
UA710C	125p
UA716	187p
UA723C	162p
UA730C	160p
UA741C	87p

BRIDGE RECTIFIERS PLASTIC ENCAPSULATED

600 PIV 1A	50p	50 PIV 4A	60p
50 PIV 2A	55p	100 PIV 4A	70p
100 PIV 2A	60p	200 PIV 4A	75p
200 PIV 2A	67p	400 PIV 4A	80p
400 PIV 2A	80p	50 PIV 6A	62p
		100 PIV 6A	75p
		200 PIV 6A	85p
		400 PIV 6A	£1·10

SILICON RECTIFIERS MINIATURE WIRE ENDED PLASTIC

	IN SERIES 1 AMP	PL SERIES 1·5 AMP	CL SERIES 3 AMP
4001 50PIV	08p	10p	19p
4002 100PIV	09p	11p	20p
4003 200PIV	10p	12p	22p
4004 400PIV	10p	12p	25p
4005 600PIV	12p	15p	26p
4006 800PIV	15p	17p	27p
4007 1000PIV	20p	20p	30p

50+ less 15% 100+ less 20%

SILICON RECTIFIERS STUD MOUNTING

	6A	10A	17·5A	35A
100PIV	—	45p	50p	£1·22
200PIV	25p	50p	55p	£1·42
400PIV	30p	55p	62p	£1·77
600PIV	32p	60p	72p	£2·12
800PIV	35p	75p	87p	£2·47
1000PIV	40p	85p	£1·05	£2·77

50+ less 15% 100+ less 20%

ZENER DIODES

400MW	1·5 WATT	10 WATT
3·3-33 V	2·4—100	3·9—100V
15p each	20p each	25p each

25+ less 15% 100+ less 20%

TRANSISTOR DISCOUNTS:- 12 + 10%; 25 + 15%; 100 + 20% any one type. Postage on all Semi Conductors 7p extra.
S.A.E. FOR FULL LISTS.

VALVES

OA2	38p	25Z4	30p	EL95	35p
OB2	45p	25Z5	42p	EM80	40p
OZ4	30p	25Z6	65p	EM81	50p
IL4	20p	30C15	60p	EM84	35p
IR5	35p	30C17	85p	EM85	£1·00
IS5	25p	30C18	75p	EM87	43p
IT4	25p	30F5	85p	EY51	40p
IU4	27p	30FL1	70p	EY86	40p
IU5	50p	30FL12	92p	EY87	42p
2D21	35p	30FL14	75p	EZ40	45p
3Q4	40p	30L15	85p	EZ41	45p
3S4	35p	30L17	80p	EZ80	25p
3V4	45p	30P12	80p	EZ81	28p
5R4	60p	30P19	80p	GZ32	48p
5U4	33p	30PL1	70p	GZ34	60p
5V4	42p	30PL13	93p	KT66	£2·05
5Y3	32p	30PL14	90p	KT88	£2·00
5Z4G	40p	35L6	50p	MU14	60p
6/30L2	75p	35W4	30p	PABC80	40p
6AC7	25p	35Z4	30p	PC86	60p
6AG7	40p	35Z5	40p	PC88	60p
6AK5	30p	50B5	45p	PC97	45p
6AK6	57p	50C5	40p	PC900	43p
6AL5	20p	80	50p	PCC84	40p
6AM6	33p	85A2	45p	PCC85	40p
6AQ5	35p	807	50p	PCC88	55p
6AS6	37p	1625	50p	PCC89	50p
6AT6	30p	5763	70p	PCC189	55p
6AU6	25p	6146	£1·50	PCF80	30p
6AV6	30p	AZ31	50p	PCF82	34p
6BA6	25p	CY31	35p	PCF84	50p
6BE6	30p	DAF91	25p	PCF86	60p
6BH6	45p	DAF96	42p	PCF800	80p
6BJ6	45p	DF91	25p	PCF801	50p
6BQ7A	40p	DF96	42p	PCF802	50p
6BR7	85p	DK91	35p	PCF805	75p
6BR8	65p	DK92	50p	PCF806	70p
6BW6	85p	DK96	42p	PCF808	75p
6BW7	70p	DL92	35p	PCL82	35p
6BZ6	35p	DL94	45p	PCL83	65p
6C4	33p	DL96	42p	PCL84	45p
6CD6	£1·15	DM70	32p	PCL85	40p
6CL6	50p	DY86	33p	PCL86	45p
6CW4	63p	DY87	35p	PFL200	70p
6F1	62p	E88CC	65p	PL36	55p
6F6G	30p	E180F	95p	PL81	50p
6F13	38p	EABC80	35p	PL82	45p
6F14	65p	EAF42	35p	PL83	45p
6F15	65p	EB91	20p	PL84	40p
6F18	45p	EBC41	55p	PL500	75p
6F23	80p	EBC81	30p	PL504	80p
6H6	20p	EBF80	40p	PY32	55p
6J4	50p	EBF83	40p	PY33	63p
6J5	20p	EBF89	32p	PY80	35p
6J5GT	30p	EBL21	60p	PY81	30p
6J6	20p	EC86	60p	PY82	30p
6J7	45p	EC88	60p	PY83	38p
6K8G	35p	ECC40	60p	PY88	40p
6L6GT	45p	ECC84	30p	PY800	50p
6LD20	40p	ECC85	60p	PY801	50p
6Q7	40p	ECC88	40p	U25	75p
6SA7	40p	ECF80	35p	U26	75p
6SG7	35p	ECF82	35p	U50	32p
6SJ7	40p	ECF86	65p	U52	33p
6SK7	35p	ECH21	57p	U191	75p
6SL7	35p	ECH35	80p	U281	40p
6SN7	35p	ECH42	70p	U282	40p
6SQ7	40p	ECH81	30p	U301	40p
6U4	60p	ECH83	40p	U801	£1·00
6V6G	25p	ECL80	40p	UABC80	35p
6V6GT	32p	ECL82	35p	UAF42	55p
6X4	30p	ECL83	65p	UBC41	50p
6X5G	30p	ECL86	40p	UBC81	40p
6X5GT	27p	EF37A	60p	UBF80	40p
10C2	50p	EF39	40p	UBF89	35p
10F1	90p	EF40	50p	UCC84	49p
10P13	55p	EF41	65p	UCC85	40p
10P14	£1·10	EF42	70p	UCF80	55p
12AT6	30p	EF80	25p	UCH21	60p
12AT7	30p	EF85	35p	UCH42	70p
12AU7	30p	EF86	30p	UCH81	35p
12AX7	30p	EF89	28p	UCL82	35p
12AV6	33p	EF91	33p	UCL83	60p
12BA6	35p	EF92	40p	UF41	60p
12BE6	35p	EF183	30p	UF80	35p
12BH7	40p	EF184	35p	UF85	40p
19AQ5	35p	EH90	40p	UF89	35p
20D1	45p	EL34	50p	UL41	65p
20F2	75p	EL33	£1·25	UL84	30p
20L1	£1·10	EL41	55p	UY41	45p
20P1	50p	EL42	58p	UY85	30p
20P3	60p	EL81	55p	VR105/30	38p
20P4	£1·10	EL84	25p	VR150/30	35p
20P5	£1·20	EL85	48p	*Add 12p in £*	
25L6	45p	EL91	32p	*for postage*	

DIODES & RECTIFIERS

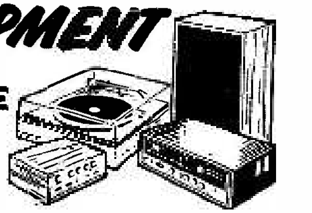
1N34A	10p	BA154	12p	GJ7M	37p
1N914	7p	BAX13	12p	OA5	17p
1N916	7p	BAX16	7p	OA6	12p
AA119	7p	BAY31	7p	OA10	22p
AA129	10p	BAY38	17p	OA9	10p
AAZ13	10p	BY100	15p	OA47	7p
AAZ15	12p	BY103	22p	OA70	7p
BA100	15p	BY122	37p	OA73	10p
BA102	22p	BY124	15p	OA79	9p
BA110	32p	BY126	15p	OA81	7p
BA111	27p	BY127	17p	OA85	7p
BA112	70p	BY164	57p	OA90	7p
BA115	7p	BY210	35p	OA91	7p
BA141	32p	BYZ11	32p	OA95	7p
BA142	32p	BYZ12	30p	OA200	7p
BA144	12p	BYZ13	25p	OA202	10p
BA145	20p	BYZ16	40p	OA210	17p

← See previous page • G.W. SMITH & Co. (RADIO) LTD. • See opposite page →

HI-FI EQUIPMENT

SAVE UP TO 33⅓% OR MORE

SEND S.A.E. FOR DISCOUNT PRICE LISTS AND PACKAGE OFFERS!

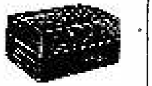


RECORD DECKS

B.S.R.		**GARRARD**	
Mini Mono†	£4·97	A40 II*	£8·40
C129*	£6·70	2025 T/C*	£8·50
MP60	£11·30	3500*	£9·75
610	£15·15	SP25 III	£11·30
510	£12·47	A70 II	£11·97
310	£10·55	SL65B	£14·40
MP60 T.P.D.1.	£18·75	AP76	£20·20
MP60 T.P.D.2	£17·55	SL72B	£25·00
610 T.P.D.1	£22·12	SL75B	£27·50
510 T.P.D.I.	£20·19	SL95B	£37·00
210 Package*	£11·30	401	£28·40
H.T.70	£16·60	**GOLDRING**	
H.T. 70 Package	£24·00	GL69/2	£21·25
THORENS		GL69P/2	£28·50
TD125	£59·65	GL75	£29·97
TD125AB	£94·25	GL75P	£38·50
TX25	£6·70	LID69/75	£3·40
TD150AII	£34·60	G99	£21·97
TD150ABII	£41·35	**PIONEER**	
TX11	£3·77	PL12AC	£36·50

† Mono * Stereo Cartridge
All other models less Cartridge
Carriage 50p extra any model.

RECORD DECK PACKAGES



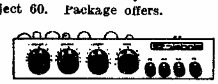
Decks supplied ready wired in plinth and cover fitted with cartridge.
Garrard 2025 T/C with Sonotone 9TAHCD £13·95

Garrard SP25III Goldring G800....	£18·95
Garrard AP76 Goldring G800	£30·95
BSR MP60 Audio Technica AT.55..	£21·00
Goldring GL69/2 Goldring G800 ..	£37·50
Goldring GL75 Goldring G800	£45·50
Goldring GL75 Goldring G800E....	£50·00

Carriage 50p extra any model.

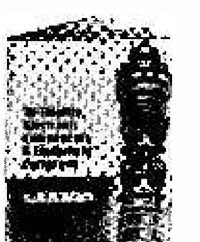
SINCLAIR EQUIPMENT

Project 60. Package offers.



2 x Z30 amplifier, stereo 60 pre-amp, PZ5 power supply. **£16·75** Carr. 37½p. Or with PZ6 power supply **£18·85** Carr. 37½p. 2 x Z50 amplifier, stereo 60 pre-amp, PZ8 power supply. **£20·25.** Carr. 37½p.
Transformer for PZ8. **£2·97½** extra.
Add to any of the above **£4·87½** for active filter unit and **£16** for a pair of Q16 speakers.
Project 60 FM Tuner **£20·97½**. Carr. 37½p.
All other Sinclair products in stock.
2000 Amp **£24·50** Carr. 37½p.; 3000 Amp **£31.50** Carr. 37½p.: Neoteric Amp **£45·97½** Carr. 37½p IC10/IC12 **£2·50**

LATEST CATALOGUE



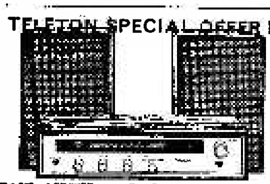
SEND NOW!
•
STILL ONLY 37½p
P&P 10p

Our new 6th edition gives full details of a comprehensive range of HI-FI EQUIPMENT, COMPONENTS, TEST EQUIPMENT and COMMUNICATIONS EQUIPMENT. FREE DISCOUNT COUPONS VALUE **50p** 272 pages, fully illustrated and detailing thousands of bargains.

TELETON SAQ-206 STEREO AMPLIFIER

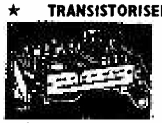
Latest exciting release. Brand new model. 6 + 6 watts rms. Inputs for mag. xtal, aux tape. Volume, bass, treble, sliding balance, scratch filter and loudness controls. List £32.50 OUR PRICE **£18·50** Carr. 37p.

TELETON SPECIAL OFFER!



CR10T AM/FM STEREO TUNER AMPLIFIER WITH MATCHING PAIR SA1003 SPEAKER SYSTEMS. Output 4 watts per channel. Excellent reception, AFC, built-in MPX. Cer/XTAL Input. Total List **£50·25**. OUR PRICE **£29·95**. Carr. 62½p.
Also available with Garrard 2025T/C Record Changer, Plinth, cover and stereo cartridge. Ready wired **£42·50.** Carr. £1·00.

★ TRANSISTORISED FM TUNER

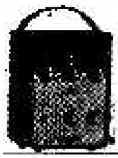


6 TRANSISTOR HIGH QUALITY TUNER, SIZE ONLY 6×4×2½in. 3 I.F. stages. Double tuned discriminator. Ample output to feed most amplifiers. Operates on 9 V battery. Coverage 88–108Mc/s. Ready built ready for use. Fantastic value for money. **£6·37½**. P. & P. 12½p.
Stereo multiplex adaptors **£4·97½**.

TE-1035 STEREO HEADPHONES

Low cost high performance stereo headphones. Foam rubber ear cups. Adjustable head-band. 8 ohm impedance. 25-18,000 Hz, With lead and stereo jack plug. ONLY **£1·97½**. P. & P. 12½p

BELCO DA-20 SOLID STATE DECADE AUDIO OSCILLATOR



New high quality portable instrument. Sine 1 Hz to 100 KHz. Square 20 Hz to 20 KHz. Output max + 10 dB (10 K ohms). Operation 220/240v. A.C. Size 215mm x 150mm x 120mm.
Price **£27·50.** Carr. 25p.

TE-20 RF SIGNAL GENERATOR

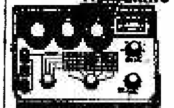
Accurate wide range signal generator covering 120 kc/s-260 Mc/s on 6 bands. Directly calibrated variable R.F. attenuator. Operation 200/240V a.c.

Brand new with instruction. **£15.** P. & P. 37½p. S.A.E. for details.

B.C. 221 FREQUENCY METERS

latest release 125 KHz—20 MHz. Excellent condition. Fully tested and checked and complete with calibrator charts. **£27·50** each. Carr. 50p.

TRANSISTORISED L.C.R. A.C. MEASURING BRIDGE

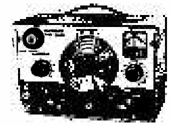


A new portable bridge offering excellent range and accuracy at low cost. Ranges: R. 1Ω-11·1 megΩ 6 Ranges ±1% L.1 μ H - 111 HENRYS 6 Ranges2=%C.10pF±1110mFd. 6 Ranges ±2%. TURNS RATIO 1:1/1000–1:11100. 6 Ranges ±1%. Bridge voltage at 1,000 cps. Operated from 9 volts. 100μA. Meter indication. Attractive 2 tone metal case. Size 7¾ × 5 × 2in. **£20.** P. & P. 25p

TE-16A Transistorised Signal Generator.

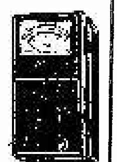
5ranges 400kHz—30mHz. An inexpensive instrument for the handyman. Operates on 9v battery. Wide easy to read scale. 800kHz modulation. 5¼ × 5¼ × 3⅝in. Complete with instructions and leads. **£7·97½**. P. & P. 20p.

LAFAYETTE TE-46 RESISTANCE CAPACITY ANALYSER



2 pF-2000 mFd 2 ohms 200 megohms. Also checks impedance, turns ratio, insulation, 200/250V. A.C. **Brand New £17·50.** Carr. 37½p.

RUSSIAN 22 RANGE MULTIMETER



Model U437 20,000 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. 2·5/10/50/250/500/100v/ AC. DC Current 100 wA/1/10/100mA/1A. Resistance 300 ohms/3/30/300K/3MΩ. Complete with batteries, test leads, instructions and sturdy steel carrying case. OUR PRICE **£5·97** P. & P. 25p.

RUSSIAN C1-16 DOUBLE BEAM OSCILLOSCOPES

5 MHz Pass Band. Separate Y1, Y2 amplifiers. Calibrated triggered sweep from ·2 sec to 100 milli sec/cm.
Supplied complete with all accessories and instructions **£87.** Carr. paid.

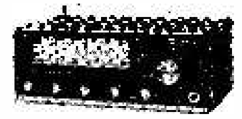
TE111. DECADE RESISTANCE ATTENUATOR

Variable range 0-111dB. Connections, Unbalanced T and Bridge T. Impedance 600Ω range (0.1dB × 10) + (1dB × 10) + 10 + 20 + 30 + 40dB. Frequency: d.c. to 200kHz (−3dB). Accuracy: 0.05dB. +Indication dB × 0.01. Maximum input less than 4W (50V). Built in 600Ω load resistance with internal/external switch. Brand new. **£27·50.** P. & P. 25p.

ROUND SCALE TYPE PENCIL TESTER MODEL TS.68

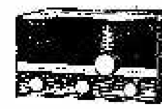
Completely portable, simple to use pocket sized tester. Ranges 0/3/30/300V AC and DC at 2,000 o.p.v. Resistance 0-20K ohms. ONLY **£1·97** P. & P. 13p.

UR-1A SOLID STATE COMMUNICATION RECEIVER



4 Bands covering 550kc/s–30mc/s. FET, S Meter, Variable BFO for SSB, Built-in Speaker, Bandspread, Sensitivity Control. 220/240v. A.C. or 12v. D.C. 12⅞" x 4½" x 7". Brand new with instructions. **£25.** Carr. 37½p.

UNR-30 RECEIVER

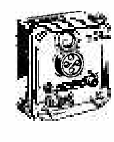


4 Bands covering 550kc/s-30mc/s. B.F.O. Built-in Speaker 220/240v. A.C. Brand new with instructions. **£15·75.** Carr. 37½p.

LAFAYETTE HA-600 SOLID STATE RECEIVER

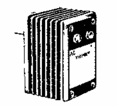
General coverage 150–400kc/s, 550 kc/s–30mc/s. FET front end. 2 mech. filters, product detector, variable B.F.O., noise limiter, S. Meter, Bandspread. RF Gain. 15" x 9½" x 8½". 18 lbs. 220/240v. A.C. or 12v. D.C Brand new with instructions. **£45.** Carr. 50p.

CRYSTAL CALIBRATORS NO. 10



Small portable crystal controlled wavemeter. Size 7 × 7½ × 4in. Frequency range 500 Kc/s–10 Mc/s (up to 30 Mc/s on harmonics). Calibrated dial. Power requirements 300V. D.C. 15mA and 12V D.C. 0.3A. Excellent condition. **£4·47½**. Carr. 37½p.

SOLID STATE VARIABLE A.C. VOLTAGE REGULATORS



Compact and panel mounting. Ideal for control of lamps, drills, electrical appliances etc. Input 230/240v. A.C. Output continuously variable from 20v—230v. Model MR 2305 5 amp 68 x 46 x 43mm **£8·37½**.
Model MR 2310 10 amp 90 x 68 x 60mm **£11·97½**. Postage 12½p.

AUTO TRANSFORMERS

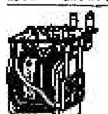
0/115/230V. Step up or step down. Fully shrouded.

150 W.	£2·37½	P. & P. 17½p
300 W.	£3·25	P. & P. 22½p
500 W.	£4·97½	P. & P. 32½p
1000 W.	£7·25	P. & P. 37½p
1500 W.	£8·97½	P. & P. 42½p
5000 W.	£36·00	P. & P. £1

VOLTAGE STABILISER TRANSFORMERS

180—260v. input. Output 230v. Available 150w or 225w. **£12·50.** Carr. 25p.

230 VOLT A.C. 50 CYCLES RELAYS



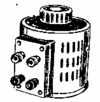
Brand new. 3 sets of changeover contacts at 5 amp rating. **50p** each. P. & P. 10p (100 lots **£40**) Quantities available.

POWER RHEOSTATS

High quality ceramic construction. Windings embedded in vitreous enamel. Heavy duty brush wiper. Continuous rating. Wide range ex-stock. Single hole fixing, ¼in. dia. shafts. Bulk quantities available.
25 WATT. 10/25/50/100/250/500/1000/1500/2500 or 5000 ohms, **72½p**, P. & P. 7½p.
50 WATT. 10/25/50/100/250/500/1000/2500 or 5000 ohms, **£1·05** P. & P. 7½p.
100 WATT. 1/5/10/25/50/100/250/500/1000 or 2500 ohms, **£1·37½** P. & P. 7½p.

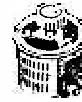
"YAMABISHI" VARIABLE VOLTAGE TRANSFORMERS

Excellent quality . Low price . Immediate delivery



S-260 General Purpose Bench Mounting

1 Amp	£5·50
2.5 Amp	£6·75
5 Amp	£9·75
8 Amp	£14·50
10 Amp	£18·50
12 Amp	£21·00
20 Amp	£37·00



S-260B Panel Mounting

1 Amp	£5·50
2.5 Amp	£6·62½

Please add postage
ALL MODELS
INPUT 230 VOLTS,
50/60 CYCLES,
OUTPUT VARIABLE
0–260 VOLTS.
Special discounts for quantity

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

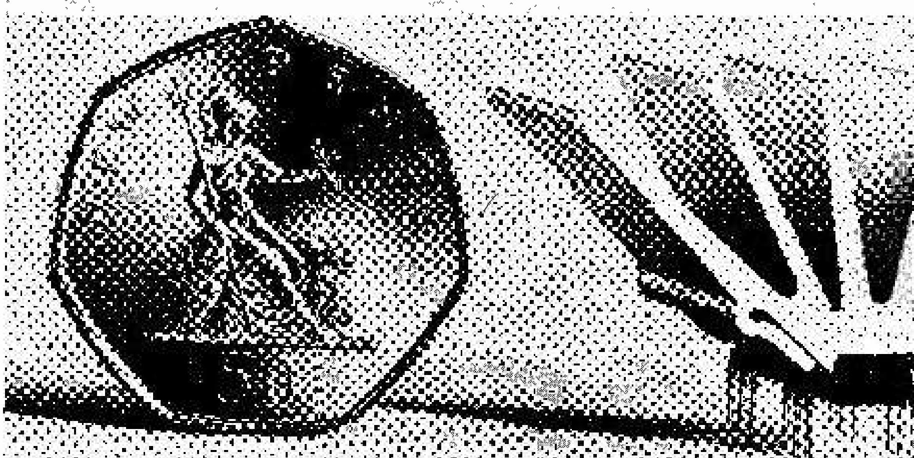
27 TOTTENHAM CT. RD. LONDON, W.1 Tel: 01-636 3715
3 LISLE STREET, LONDON, W.C.2 Tel: 01-437 8204
34 LISLE STREET, LONDON, W.C.2 Tel: 01-437 9155
311 EDGWARE ROAD, LONDON, W.2 Tel: 01-262 0387

All Mail Orders to—
11-12, Paddington Green,
London, W.2
Tel: 01 2626562
(Trade supplied)

OPEN 9-6 MONDAY TO SATURDAY

new

Super IC-12



High fidelity Monolithic Integrated Circuit Amplifier

Two years ago Sinclair Radionics announced the World's first monolithic integrated circuit Hi-Fi amplifier, the IC.10. Now we are delighted to be able to introduce its successor, the Super IC.12. This 22 transistor unit has all the virtues of the original IC.10 plus the following advantages:

1. Higher power.
2. Fewer external components.
3. Lower quiescent consumption.
4. Compatible with Project 60 modules.
5. Specially designed built-in heat sink. No other heat sink needed.
6. Full output into 3, 4, 5 or 8 ohms.
7. Works on any voltage from 6 to 28 volts without adjustment.
8. NEW 22 transistor circuit.

Output power 6 watts RMS continuous (12 watts peak).

Frequency Response 5 Hz to 100KHz ± 1 dB.

Total Harmonic Distortion Less than 1%. (Typical 0.1%) at all output powers and all frequencies in the audio band.

Load Impedance 3 to 15 ohms.

Power Gain 90dB (1,000,000,000 times) after feedback.

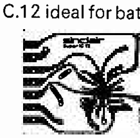
Supply Voltage 6 to 28 volts (Sinclair PZ-5 or PZ-6 power supplies ideal).

Size 22 x 45 x 28 mm including pins and heat sink.

Input Impedance 250 Kohms nominal.

Quiescent current 8mA at 28 volts.

With the addition of only a very few external resistors and capacitors the Super IC.12 makes a complete high fidelity audio amplifier suitable for use with pick-up, F.M. tuner etc. Alternatively, for more elaborate systems, modules in the Project-60 range such as the Stereo 60 and A.F.U. may be added. The comprehensive manual supplied with each unit gives full circuit and wiring diagrams for a large number of applications in addition to high fidelity. These include car radios, oscillators etc. The very low quiescent consumption makes the Super IC.12 ideal for battery operation.



Price, inc. **FREE** printed circuit board for mounting.

£2.98 Post free

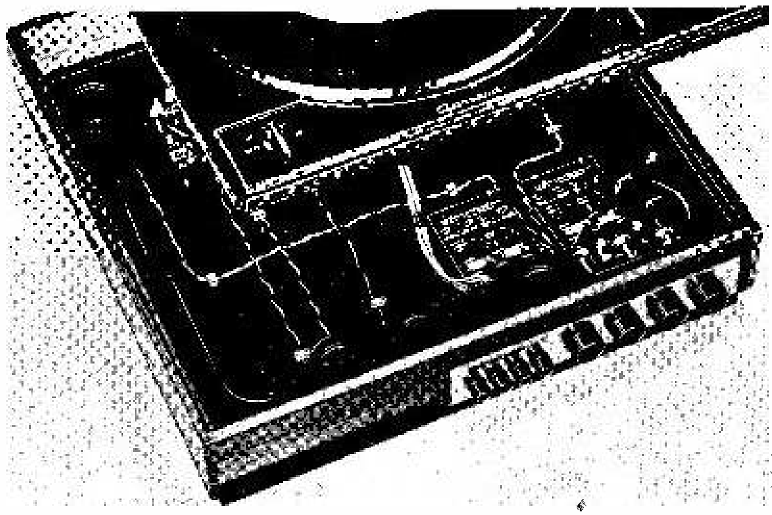
SINCLAIR GENERAL GUARANTEE
Should you not be completely satisfield with your purchase when you receive it from us, return the goods without delay and your money will be refunded in full, including cost of return postage, at once and without question. Full service facilities are available to all Sinclair customers.

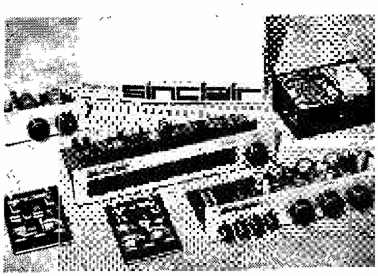
Sinclair Radionics Ltd, London Rd, St. Ives
Huntingdonshire PE17 4HJ
Telephone St Ives (048 06) 4311

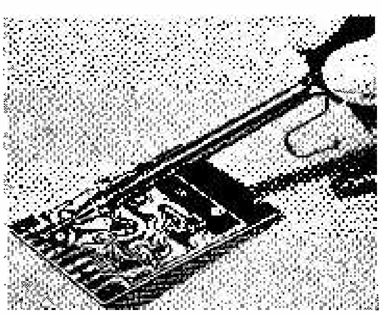
sinclair

Sinclair Project 60

The World's leading range of high fidelity modules







Project 60 offers more advantage to the constructor and user of high fidelity equipment than any other system in the world.
Performance characteristics are so good they hold their own with any other available system irrespective of price or size.
Project 60 modules are more versatile – using them you can have anything from a simple record player or car radio amplifier to a sophisticated and powerful stereo tuner-amplifier. Either power amplifier can be used in a wide variety of applications as well as high fidelity. The Stereo 60 pre-amplifier control unit may also be used with any other power amplifier system, as can the AFU filter unit. The stereo FM tuner operates on the unique phase lock loop principle to provide the best ever standards of sensitivity and audio quality. Project 60 modules are very easily connected together by following the 48 page manual supplied free with all Project 60 equipment. The modules are great space savers too and are sold individually boxed in distinctive white and black cartons. With all these wonderful advantages, there remains the most attractive of all – price. When you choose Project 60 you know you are going to get the best high fidelity in the world, yet thanks to Sinclair's vast manufacturing resources (the largest in Europe) prices are fantastically low and everything you buy is covered by the famous Sinclair guarantee of reliability and satisfaction.

Typical Project 60 applications

System	The Units to use	together with	Cost of Units
Simple battery record player	**Z.30**	Crystal P.U., 12V battery volume control	**£4.48**
Mains powered record player	**Z.30, PZ.5**	Crystal or ceramic P.U. volume control etc.	**£9.45**
20+20W. stereo amplifier for most needs	**2 x Z.30s, Stereo 60, PZ.5**	Crystal, ceramic or mag. P.U., F.M. Tuner, etc.	**£23.90**
20+20W. stereo amplifier with high. performance spkrs.	**2 x Z.30s, Stereo 60, PZ.6**	High quality ceramic or magnetic P.U., F.M. Tuner, Tape Deck, etc.	**£26.90**
40+40W. R.M.S. de-luxe stereo amplifier	**2 x Z.50s, Stereo 60 PZ.8, mains trsfrmr**	As above	**£34.88**
Indoor P.A.	**Z.50, PZ.8, mains transformer**	Mic., guitar, speakers, etc., controls	**£19.43**

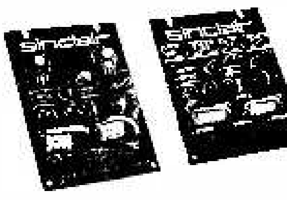
F.M. Stereo Tuner **(£25)** & A.F.U. Filter Unit **(£5.98)** may be added as required.

Sinclair Radionics Limited, London Road,
St. Ives, Huntingdonshire PE17 4HJ.
Tel: St. Ives (048 06) 4311

sinclair

from a simple amplifier to a complete stereo tuner amplifier with Project 60 modules

Z.30 & Z.50 power amplifiers



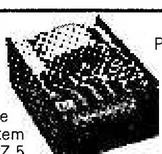
The Z.30 and Z.50 are of advanced design using silicon epitaxial planar transistors to achieve unsurpassed standards of performance. Total harmonic distortion is an incredibly low 0.02% at full output and all lower outputs. Whether you use Z.30 or Z.50 amplifiers in your Project 60 system will depend on personal preference, but they are the same size and may be used with other units in the Project 60 range equally well.

SPECIFICATIONS ***(Z.50 units are interchangeable with Z.30s in all applications).***
Power Outputs
Z.30 15 watts R.M.S. into 8 ohms using 35 volts: 20 watts R.M.S. into 3 ohms using 30 volts.
Z.50 40 watts R.M.S. into 3 ohms using 40 volts: 30 watts R.M.S. into 8 ohms using 50 volts.
Frequency response: 30 to 300,000Hz ±1dB.
Distortion: 0.02% into 8 ohms.
Signal to noise ratio: better than 70dB unweighted.
Input sensitivity: 250mV into 100 Kohms.
For speakers from 3 to 15 ohms impedance.
Size: 14 x 80 x 57 mm.

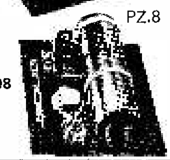
Z.30
Built, tested and guaranteed with circuits and instructions manual. **£4.48**

Z.50
Built, tested and guaranteed with circuits and instructions manual. **£5.48**

Power Supply Units



PZ.5



PZ.8

Designed special for use with the Project 60 system of your choice. Use PZ.5 for normal Z.30 assemblies and PZ.6 where a stabilised supply is essential.

PZ.5 *30 volts unstabilised* **£4.98**
PZ.6 *35 volts stabilised* **£7.98**
PZ.8 *45 volts stabilised (less mains transformer)* **£7.98**
PZ.8 *mains transformer* **£5.98**

The Sinclair Guarantee

If within 3 months of purchasing Project 60 modules directly from us, you are dissatisfied with them, we will refund your money at once. Each module is guaranteed to work perfectly and should any defect arise in normal use we will service it at once and without any cost to you whatsoever provided that it is returned to us within 2 years of the purchase date. There will be a small charge for service thereafter. No charge for postage by surface mail. Air-mail charged at cost.

Project 60 Stereo F.M. Tuner

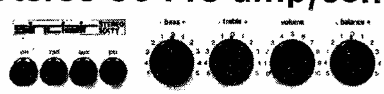
First in the world to use the phase lock loop principle

The phase lock loop principle was used for receiving signals from space craft because of its vastly improved signal to noise ratio. Now, Sinclair have applied the principle to an F.M. tuner with fantastically good results. Other original features include varicap diode tuning, printed circuit coils, an I.C. in the specially designed stereo decoder and squelch circuit for silent tuning between stations. Good reception is possible in difficult areas, and often a few inches of wire are enough for an aerial. In terms of a high fidelity this tuner has a lower level of distortion than any other tuner we know. Stereo broadcasts are received automatically as the tuning control is rotated, a panel indicator lighting up as the stereo signal is tuned in. This tuner can also be used to advantage with any other high fidelity system.

SPECIFICATIONS—Number of transistors: 16 plus 20 in I.C. **Tuning range:** 87.5 to 108 MHz. **Capture ratio:** 1.5dB. **Sensitivity:** 2μV for 30dB quieting: 7μV for full limiting. **Squelch level:** 20μV. **A.F.C. range:** ±200 KHz. **Signal to noise ratio:** > 65dB. **Audio frequency response:** 10 Hz – 15 KHz (±1dB). **Total harmonic distortion:** 0.15% for 30% modulation. **Stereo decoder operating level:** 2μV. **Cross talk:** 40dB. **Output voltage:** 2 x 150mV R.M.S. **Operating voltage:** 25-30 VDC. **Indicators:** Mains on; Stereo on; tuning. **Size:** 93 x 40 x 207 mm.

Built and tested. Post free. **£25**

Stereo 60 Pre-amp/control unit



Designed for Project 60 range but suitable for use with any high quality power amplifier. Again silicon epitaxial planar transistors are used throughout, achieving a really high signal-to-noise ratio and excellent tracking between channels. Input selection is by means of push buttons and accurate equalisation is provided for all the usual inputs.

SPECIFICATIONS—Input sensitivities: Radio – up to 3mV. Mag. p.u. 3mV: correct to R.I.A.A curve ±1dB:20 to 25,000 Hz. Ceramic p.u. – up to 3mV: Aux – up to 3mV. **Output:** 250mV. **Signal to noise ratio:** better than 70dB. **Channel matching:** within 1dB. **Tone controls:** TREBLE + 15 to —15dB at 10 KHz: BASS + 15 to —15dB at 100Hz. **Front panel:** brushed aluminium with black knobs and controls. **Size:** 66 x 40 x 207mm.
Built tested and guaranteed. **£9.98**

A.F.U. High & Low Pass Filter Unit

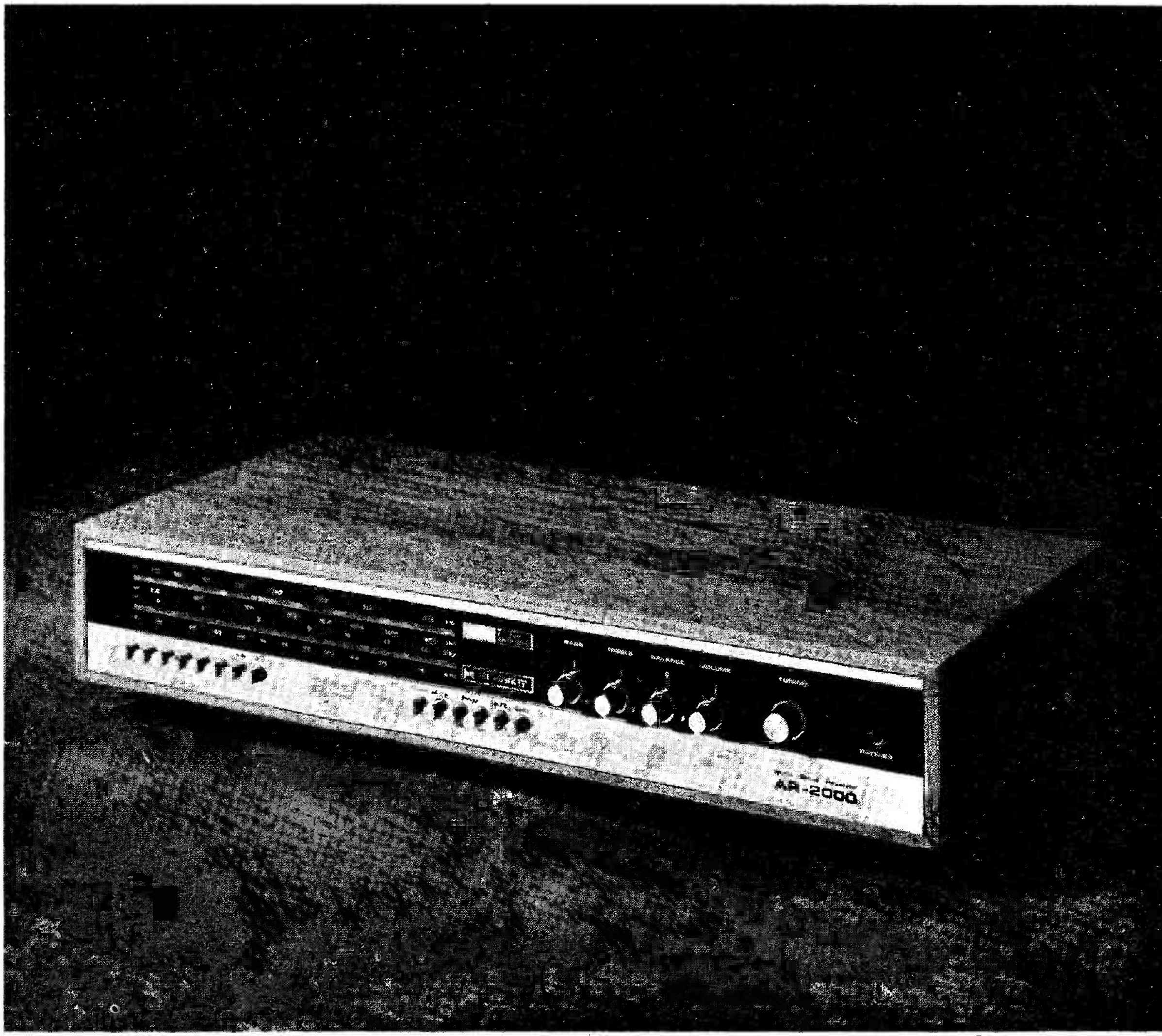
For use between Stereo 60 unit and two Z.30s or Z.50s, and is easily mounted. It is unique in that the cut-off frequencies are continuously variable, and as attenuation in the rejected band is rapid (12dB/octave), there is less loss of the wanted signal than has previously been possible. Amplitude and phase distortion are negligible. The A.F.U. is suitable for use with any other amplifier system. Two filter stages – rumble (high pass) and scratch (low pass). Supply voltage – 15 to 35V. Current – 3mA. H.F. cut-off (–3dB) variable from 28KHz to 5KHz. L.F. cut-off (–3dB) variable from 25Hz to 100Hz. Distortion at 1KHz (35V. supply (0.02% at rated output. **Size:** 66 x 40 x 90 mm. *Built tested and guaranteed.* **£5.98**

To: SINCLAIR RADIONICS LTD LONDON ROAD ST. IVES HUNTINGDONSHIRE PE17 4HJ

Please send	Name
	Address
I enclose cash/cheque/money order.	PW 10

Send for Heathkit – and send for the best

The best in hi-fi; the best in short-wave;
the best in domestic, marine and auto equipment;
the best in everything electronic.



The new AR 2000

Heathkit comes direct from the world's leading suppliers of top-quality electronic equipment. You assemble your components using the unique Heathkit 'step-and-check' method and there's a team of experts ready to help and advise you on any problem. But you won't need them. Hardly anyone does!
Send for your FREE catalogue – NOW.

Please send me details of your complete range of kits.

Name

Address

Heath (Gloucester) Limited,
Gloucester, GL2 6EE

a Schlumberger Company

PW 10

(OVER 1,520 sq. yds.)

OVER 1000 ITEMS ALWAYS IN STOCK

ALL FULLY GUARANTEED — WITH AFTER-SALES SERVICE

All items offered are brand new, latest models in manufacturers' sealed cartons

	Rec. Retail Price	Comet Price
GOODMANS Audiom 51	13·05	9·75
GOODMANS Audiom 61	18·95	14·00
GOODMANS 12P	12·37	10·00
GOODMANS 15P	20·00	16·97
GOODMANS Audiom 18P	34·00	26·97
GOODMANS Twin Axiom 10	10·23	8·25
GOODMANS ARU172	4·50	3·50
GOODMANS Trebax 100	8·60	6·00
GOODMANS Trebax 5K/20XL	9·70	7·50
GOODMANS Midax	12·95	9·00
GOODMANS Attenuator	3·55	2·50
GOODMANS Crossover Networks XO/950/5000	9·75	7·25
GOODMANS Crossover Networks XO/950	7·40	5·75
GOODMANS Crossover Networks XO/5000	2·65	2·00
WHARFEDALE 8in.Bronze/RS/DD	5·00	4·00
WHARFEDALE Super 8/RS/DD	8·50	7·00
WHARFEDALE Super 10/RS/DD	14·00	11·50
WHARFEDALE WMT1 Matching Transformer	0·84	0·75
HI-FI STEREO SYSTEMS COMPLETE		
ARENA MR15	145·00	109·95
ALBA UA552	45·86	35·50
ALBA UA662	60·32	46·95
DECCA Sound 6013	69·89	57·95
DECCA Sound 6014	70·86	68·95
DECCA Sound 1204	95·30	75·95
DECCA Compact 3	130·14	109·95
DECCALIAN 5 complete with stand	65·50	51·95
EKCO SRG 609	85·44	66·95
EKCO ZU5	159·29	129·00
FERGUSON 3422	84·80	67·95
FERGUSON 3423	114·15	89·95
FERGUSON 3424	119·00	94·95
FERGUSON 3425	140·10	108·00
FERGUSON 3450 with radio	72·40	59·95
FIDELITY UA2 Music Master	44·41	31·95
FIDELITY UA1 Music Master	103·30	82·95
HMV 2416	129·70	99·95
HMV 204/5/6	198·00	159·95
HMV 2452	65·65	53·95
HMV 2450 with stereo radio	134·20	109·00
KB KA1250 complete with two 653 speakers	71·55	58·50
KB KA1250 complete with two 651 speakers	80·25	64·95
KB 2010 with radio	73·40	60·95
LEAK 30/Goldring/Wharfedale	182·65	142·95
LEAK 70/Thorens/Wharfedale	226·87	175·00
MARCONI Unit 4	74·77	63·95
MARCONI Unit 3	84·79	67·95
METROSOUND Stereo 1010	82·30	65·95
PHILIPS 580/481/105	71·00	55·95
PHILIPS GF 823	47·79	38·95
PHILIPS GF 824	67·09	54·95
PHILIPS GF 833	65·16	54·95
PHILIPS GF 834	84·95	69·95
PHILIPS GF 417	96·06	73·95
PHILIPS 882 Less L/S	96·50	76·95
TELETON 2S60F with radio	72·40	53·95
TELETON 8TK Stereo System	54·75	48·00
TOSHIBA SP8507	248·00	175·00
ULTRA 6405	77·00	64·95
TAPE RECORDERS AND TAPE DECKS		
AKAI 1720L	93·67	65·95
AKAI 4000 D 4-track stereo deck	86·68	67·50
AKAI CR 80D 8-track stereo tape deck	91·56	76·95
AKAI CR80 8-track stereo recorder	110·83	96·95
AKAI X200D	183·07	129·95
AKAI 1800SD	192·16	129·00
AKAI 2000SD	300·00	239·00
BUSH Discassette DC70	21·19	16·95
BUSH TP60 Cassette tape recorder	28·38	23·95

	Rec. Retail Price	Comet Price
BUSH TP70 Cassette battery/mains tape recorder	28·91	23·50
FERGUSON 3245 Twin track	36·70	28·95
FERGUSON 3246 4-track	42·55	33·95
FERGUSON 3247 4-track	47·93	38·95
FERGUSON 3248 4-track	52·76	42·95
FERGUSON 3252 4-track	100·70	81·95
FERROGRAPH 702 2-track tape deck	220·22	189·00
FERROGRAPH 704/W 4-track tape deck	220·22	189·00
FERROGRAPH 722	257·52	215·00
FERROGRAPH 724	257·52	215·00
GRUNDIG C200 De Luxe Cassette	38·46	28·95
GRUNDIG TK 121 twin track	55·30	42·95
GRUNDIG TK 149 4-track	57·63	47·95
GRUNDIG TK 141 4-track	61·62	49·50
GRUNDIG TK 146 4-track Auto	67·30	52·95
GRUNDIG 222 stereo cassette	57·70	47·95
GRUNDIG TK 147 4-track Auto	93·96	77·95
MIDLAND TC 144 cassette	18·00	11·95
PHILIPS 2202 cassette	26·89	19·95
PHILIPS 2204 cassette battery/mains	32·30	25·50
PHILIPS 2205 cassette tape recorder	41·59	33·95
PHILIPS 3302 cassette tape recorder	23·04	17·95
PHILIPS 4303 new release	40·55	33·95
PHILIPS 4307 4-track	47·78	37·95
PHILIPS 4308 De luxe 4-track	58·40	43·95
PHILIPS 4404 2-track stereo recorder	91·71	71·95
PHILIPS 4407 4-track stereo recorder	106·19	87·95
PHILIPS 4500 4-track stereo tape deck	121·64	96·95
PHILIPS 4408 4-track stereo	134·18	106·00
PHILIPS Cassette Stereo N2503 tape deck	52·05	44·95
PYE Cassette Recorder/Radio 9000 battery/mains	43·86	35·95
PHILIPS 2400 stereo cassette less L/S	65·55	57·95
TANDBERG 1841 4-track stereo tape deck	69·75	50·95
TANDBERG 3021X twin track stereo	109·90	93·00
TANDBERG 3041X 4-track stereo	109·90	93·00
TANDBERG 4021X twin track stereo	180·00	150·00
TANDBERG 4041X 4-track stereo	180·00	150·00
TANDBERG 6041X 4-track stereo	188·00	158·00
TANDBERG 6021X twin track stereo	188·00	158·00
TELETON 8110 cassette	22·00	14·95
TELETON TC110 cassette battery/mains	26·79	19·50
TELETON TRC130 cassette with VHF/AM Radio Batt./Mains twin motors	40·31	31·50
TELETON 511 battery/mains cassette	29·50	17·50
TELETON FXB 510 D 4-track stereo	65·16	47·50
TOSHIBA GT 601V twin track	43·95	25·95
TOSHIBA 850 SA 4-track stereo tape deck	91·50	49·95
TOSHIBA GT 840S 4-track stereo tape deck	105·20	55·95
WHARFEDALE Dolby DC9 cassette stereo tape deck	110·40	94·50
BASES AND COVERS		
GARRARD WB1 Base	3·86	3·25
GARRARD WB4 Base	5·69	4·75
GARRARD SPC 1 Cover	3·74	3·00
GARRARD SPC 4 Cover	4·44	3·75
Special offer of Base and Cover to fit GARRARD SP25, SL55, SL65B and 3500	Special Price	4·00
GOLDRING Plinth 75	8·52	7·00
GOLDRING Plinth 69	8·52	7·00
GOLDRING Covers for 69P and 75P	4·21	3·50
THORENS TX25 (for TD125AB)	8·22	6·50
THORENS TX11 Cover	4·11	3·75
Base and Cover for TD 125	15·18	12·50
SME Plinth System 2000	39·20	31·25
MOTORBOARDS only	4·95	3·00

COMPLETE HI-FI SYSTEMS

Completely wired, mounted and ready for use.

	Rec. Retail Price	Comet Price
GOODMANS AUDIO SUITE, Goodmans Maxamp stereo amplifier, Goodmans stereomax AM/FM Tuner with decoder. Pair of Goodmans Magnum K2 speakers, Garrard AP76 turntable in base, complete with cover and Goldring G800 Cartridge. Beautifully finished in walnut	257·13	169·95
GOLDRING 705P turntable complete with G850 Cartridge, Midland Tuner/Amp., pair of Metrosound 103 Speakers	99·56	69·95
GOODMANS Module 80 Tuner/Amplifier, Garrard AP76 Turntable with Goldring G800 Cartridge and 2 Goodmans Minister Speakers	199·00	139·00
METROSOUND 448 8-track stereo play-back unit complete with 2 HFS 10 Speakers	83·56	70·95
GOLDRING 705P turntable complete with G850 Cartridge, Teleton 206 Amplifier, pair of Keletron KN500 Speakers	77·00	49·95
TELETON STP 801 Stereo 8 track tape Audio system complete with speakers	54·75	48·00
GARRARD SP 25, Mk. III mounted in base, plinth and cover with GOLDRING G800 Cartridge. Teleton 206 Stereo Amplifier 12 watts RMS, and 2 KELETRON KN500 Speakers, each speaker is a 4 speaker system	88·33	58·95
PIONEER PL 12 turntable, Goodmans Maxamp, Shure M55E Cartridge, 2 Keletron KN 700 speakers (each speaker cabinet contains 4 speakers)	144.38	105·00
GARRARD AP76 turntable complete with Goldring G800 Cartridge, base and cover, Rogers Ravensbrook Amplifier in teak case and 2 Goodmans Minister Speakers	142·51	108·50
LEAK 30/THORENS/WHARFEDALE	182·65	142·95
GOLDRING GL 75P mounted in teak base with hinged perspex cover complete with GOLDRING G800E Cartridge. Leak Stereo 30 Plus Amplifier in Teak case. 2 GOODMANS Mezzo 3 Speakers	200·50	154·20
THORENS TD 150AB Mk. II with TX11 dust cover, SHURE M55E Cartridge, LEAK Stereo 70 Amplifier in Teak case. 2 Wharfedale Dovedale 3 Speakers	226·87	175·00
THORENS TD 125AB Electronic Turntable complete with cover. SHURE V15-11 Cartridge, GOODMANS Maxamp, GOODMANS Stereomax AM/FM Tuner. 2 GOODMANS Magister Speakers	422·48	309·00
TELETON STP 801. Stereo 8 track Tape Audio Systems comp. with speakers	54·75	48·00

Complete Price List FREE on request!

COMET HIGH FIDELITY DISCOUNT WAREHOUSES

(Dept. P.W.) Reservoir Rd., Clough Rd., Hull HU6 7QD Tel. 407906 and 407877

(Dept. P.W.) 68A Armley Rd. (Artist St.), Leeds LS12 2EE Tel. 32055 (5 lines)

(Dept P.W.) Teesway, Portrack Lane, North Teesside Industrial Estate, Teesside, TS18 2RH Tel. 68132/65215

(Dept P.W.) Heeley Road, Selly Oak, Birmingham Tel. 021–472 6181

Comet guarantees that all prices quoted are genuine. All items offered available at these prices at the time this issue closed for press.
Add 75p for postage, packing and insurance on all orders (Cartridges 20p)
or, if Securicor delivery required, add £1.75 only.
Make cheques, Money Orders payable to "COMET".

Open daily to the public from 9-0 A.M. until—

5-30 P.M. MON.
1-0 P.M. TUES.
8-0 P.M. WED.
8-0 P.M. THUR.
8-0 P.M. FRI.
5-30 P.M. SAT.

Customers are welcome to call - Ample car parking facilities

Free Technical Advisory Service. If in doubt, ask us!

All in-stock items delivered by SECURICOR WITHIN 72 HOURS
(Add £1·75 only for Securicor delivery)
ALL GOODS FULLY INSURED AGAINST LOSS OR DAMAGE WHILST IN TRANSIT

Practical Wireless Classified Advertisements

The pre-paid rate for classified advertisements is 8½p per word (minimum 12 words), box number 7½p extra. Semi-displayed setting £6 per single column inch. All cheques, postal orders, etc., to be made payable to PRACTICAL WIRELESS and crossed "Lloyds Bank Ltd." Treasury notes should always be sent *registered post*. Advertisements, together with remittance, should be sent to the Classified Advertisement Manager, PRACTICAL WIRELESS, IPC Magazines Ltd., Fleetway House, Farringdon Street, London, EC4A 4AD for insertion in the next available issue.

Educational

LEC

TELEVISION TRAINING

(MONOCHROME AND COLOUR)

This private College provides theoretical and practical training in Radio and TV Servicing. Courses of 16 months' duration, with daily attendance, are available for beginners and shorter courses for men with previous training in Electronics and Radio. Training courses in Marine Radiocommunication and Radar are also available. Write for prospectus to: **London Electronics College, Dept. A/10, 20 Penywern Road, Earls Court, London SW5 9SU. Tel. 01-373 8721.**

RTEB CERTS., City & Guilds, Colour TV, Radio, Computers, Radio Amateurs Cert., Practical Electronics (with kit). Thousands of successes. Send for full details of Home Study Courses and illustrated book—FREE: BIET, (Dept. H.7), Aldermaston Court, Reading, RG7 4PF.

Situations Vacant

EAGLE INTERNATIONAL require Audio Engineers; excellent prospects. Must be fully conversant with Stereo Amplifiers, Tuners, Multiplex, etc. Contact Mr. Morrow 01-636 0961.

RADIO

OPERATORS

DO YOU HOLD PMG II OR PMG I OR NEW GENERAL CERTIFICATE OR HAD TWO YEARS' RADIO OPERATING EXPERIENCE ?

Looking for a secure job with good pay and conditions?
Then apply for a post with the Composite Signals Organisation. These are Civil Service posts, with opportunities for service abroad, and of becoming established, i.e., non-contributory pension scheme. Specialist Training Courses (free accommodation) starting January, April and September, 1972.
If you are British born and resident in the United Kingdom, under 35 years of age (40 for exceptionally well qualified candidates), write NOW for full details and an application form from:—

GOVERNMENT COMMUNICATIONS HEADQUARTERS,
Recruitment Officer,
Oakley, Priors Road, Cheltenham, Glos. GL52 5AJ.
(Telephone: Cheltenham 21491, Ext. 2270.)

GO TO SEA as a Radio Officer. Write: Principal, National College, Broadwater, Fleetwood FY7 8JZ.

TRAIN FOR SUCCESS WITH ICS

Study at home for a progressive post in Radio, TV and Electronics. Expert tuition for City & Guilds (Telecoms Techn's Cert. and Radio Amateurs') R.T.E.B., etc. Many non-exam courses incl. Colour TV Servicing, Numerical control & Computers. Also self-build kit courses—valve and transistor.

Write for FREE prospectus and find out how ICS can help you in your career.

ICS, DEPT. 541 INTERTEXT HOUSE, STEWARTS ROAD, LONDON, SW8 4UJ

CIE, AMSE, City & Guilds, etc., on 'Satisfaction or Refund' terms. Thousands of exam. successes. Postal Courses for all branches of Engineering. Illustrated prospectus FREE. Please state subject of interest: BIET, (Dept. H.8), Aldermaston Court, Reading, RG7 4PF.

Receivers and Components

MICROCIRCUITS:

709	36p	SL402A	£1·75	7430	19p
741	73p	MEL 11	35p	7473	42p
PA230	97p	D40C1	55p	7474	44p
PA234	86p	7400	19p	7486	33p
PA237	£1·55	7410	19p	DILconn.	25p

TRANSISTORS:

2N3055	54p	ME0402	21p	ME4102	12p
2N5172	7p	ME0412	20p	ME6001	13p
BCY70	16p	ME0413	15p	ME6101	15p
BD124	73p	ME1002	12p	MEF104	45p
BFX86	15p	ME4101	11p	MP8111	35p

1 AMP RECTIFIERS

57V	3p	400V	6p	600V	9p	1000V	14p
Bridges	—	50V	25p	100V	26p	200V	27p

Printed Circuit Resist Pen .. 80p

JEF ELECTRONICS (P.W.9)

York House, 12 York Drive, Grappenhall, Warrington, Lancs. Mail Order Only. C.W.O.
P.&P. 5p per order. Overseas 40p.
Money back if not satisfied.
List free on application.

NEW MODEL V.H.F. KIT MK2

Our latest Kit, improved design and performance plus extra Amplifier Stage, receives Aircraft, Amateurs, Mobile, Radio 2, 3, 4, etc.
This novel little set will give you endless hours of pleasure and can be built in one evening. Powered by 9 Volt Battery. complete with easy to follow instructions and built in Jack Socket for use with Earphones or Amplifier.

Only £3·40. P. & P. Free U.K. only

Illustrated Catalogue of Selected Kits and Components 12½p. P. & P. Free.

Cheques, Postal Orders to:
Dept. P.W.,
Galleon Trading Co., 25 Avelon Road, Romford, Essex

EX COMPUTER PRINTED CIRCUIT PANELS 2in x 4in packed with semi-conductors and top quality resistors, capacitors, diodes, etc. Our price, 10 boards **50np** + 7np P. & P. With a guaranteed minimum of 35 transistors. Data on transistors included.
SPECIAL BARGAIN PACK. 25 boards for **£1.** P. & P. 18np. With a guaranteed minimum of 85 transistors. Data on transistors included.

PANELS with 2 power transistors similar to OC28 on each board + components. 2 boards (4 x OC28) **50np** + 6np P. & P.

9 OA5, 3 OA10, 3 Pot Cores, 26 Resistors, 14 Capacitors, 3 GET 872, 3 GET 872B, 1 GET 875. All long leaded on panels 13in x 4in. **4** for **£1** + 25np P. & P.

LARGE CAPACITY ELECTROLYTICS
10000MFD 30V, 16000MFD 12V **40np** + 6np P. & P.
or **£3.50** per doz. Carr. 50np

250 MIXED RESISTORS 62np
¼ & ½ watt.

150 MIXED HI STABS 62np
¼ ½ & 1 watt 5% and better.

QUARTZ HALOGEN BULBS
With long leads, 12V 55W for car spot lights, projectors etc. **50p each** p & p 5p.

DIODES SILICON
1 Amp 1000 PIV. 4 for **50np.** + 5np P. & P.

BARGAIN RELAY OFFER
Single pole change over silver contacts. 25V to 50V. 2.5kΩ coil. 8 for **50np.** + 5np P. & P.

KEYTRONICS mail order only
44 EARLS COURT ROAD, LONDON W.8 01-478 8499

Receivers and Components

Kits for **P.W. CONSTRUCTIONAL ARTICLES**

Amateur Bands Communications Receiver £23·85, p. & p. 75p (or in 3 parts). RF Detector £9·64 p. & p. 25p. Signal Injector Tracer £3·95 p. & p. 20. **Workshop Oscilloscope £28·35** p. & p. 60p. Crystal Companion £1·95 p. & p. 20p. Hi-Z Noltmeter £4·52 p. & p. 20p. 10W Audio Amplicer £8·75 p. & p. 35p. Hi-Fi Signal Generator £11·30 p. & p. 35p. Simple Signal Generator £6·95 p. & p. 30p. Electronic Ignition System £6·30 p. & p. 30p. Solid State Enlarger Timer £6·30 p. & p. 35p. For prices of recent kits please send S.A.E.

F. & B. ELECTRONICS 5, Staples Inn, Holborn Bars, London WC1V 7QH

C.W.O. mail order only—please enquire for overseas p. & p.

COMPLETE RANGE of receivers by Trio, Lafayette, Hallicrafters, etc. Chassis, panels, cabinets. S.A.E. for lists. Stephens-James Ltd., 70 Priory Road, Liverpool 4. Tel. 051-263 7829.

PROJECT 60 OFFERS Post 37p

Stereo 60/2 Z30/PZ5	£16·40
Stereo 60/2 Z30/PZ6	£19·00
Stereo 60/2 Z50/PZ8	£21·25
Transformer for PZ8	£2·20
Project 60 FM tuner	£20·50
Active Filter Unit	£4·75
Q16 Loudspeaker	£7·70
Kit of extra capacitors, plugs, cables, fuse to complete Project 60	£2·40
Antex 15W soldering iron CN240/2	£1·70

All items available separately.

SINCLAIR SUPER IC-12

Ideal for use with PZ5 power unit. Supplied with instructions and free PC board .. .. .. £2·45

SINCLAIR BARGAINS

Power units: PZ5 £3·80. PZ6 £6·40. PZ8 £6·40 Transformer for PZ8 £2·20.

Amplifiers: Z30 £3·60. Z50 £4·35. Stereo 60 £8·35.

Receivers: Micromatic kits £2·25. Assembled £2·75. Batteries 27p extra.

SINCLAIR SYSTEM 3000

£32·90, Post 37p

S-DECS

S-DeCs £0·95. T-DeCs £2·25. μ-DeC A £3·10 Carriers with sockets to mount 14 and 16 pin in line ICs on T-DeCs and μ-DeC A £1·25.

MULLARD UNILEX

EP9000 Amp £2·40. EP9001 Pre-amp £2·60. EP9002 Power unit £3·90. Control unit £2·80. Unilex booklet £0·22.

THE 0.7P TRANSISTOR

PNP silicon transistors from 2S300 series with data. Typical Vcb=25 V, hfe=35, ft=1 Mcs, Pmax=300 mW. Untested and unmarked, but at least 80% are perfect to maker's spec. 50 for 40p. 100 for 70p.

SWANLEY ELECTRONICS

32 GOLDSEL RD., SWANLEY, KENT

Mail order only.
Minimum postage 10p per order.

CIRCUITS CIRCUITS CIRCUITS

Ten exciting circuits per month with instructions to build. Every month a completely new set. This month's circuits cover

MISCELLANEOUS PROJECTS

Only 50p per set of ten p & p free

Free Data and Technical A-Z cards (build up the complete set month by month). Cheques and PO to **Dept PWC, Photronics, 3 Whitehall Gardens, London, E4.**

COMMUNICATION RECEIVERS

Checked, tested HRO, AR88, B40 and many others, also Power Supplies, Testgear etc. SAE please, stating requirements.

STC AIRCRAFT RECEIVERS

Small compact 16 valve double conversion RX of modern design, covering 2·8–18·5 MHz in 3 bands. Features include: Unit Construction, Variable Selectivity, Xtal Controlled BFO, Manual or Remote Tuning, Illuminated Dial.
The RX is designed to operate from 24 volts DC on 24 channels but can easily be modified for continuous tuning and mains operation. Circuit and modification details supplied with each unit. Excellent condition. £6·95. Carr. £1.

RICHARD SELLERS,
EASTRINGTON, GOOLE, YORKSHIRE.
04-305 254

TV's TV's TV's

SPECIAL OFFER
LIMITED PERIOD ONLY

19" slim Thorn 800 TV's. 13 channel
Good working order. Polished cabinets.
Only £9·50 PLUS £1·50 Carr.

EX-RENTAL TV's (Untested)

Complete with 13 channel tuners. Good cabinets. Carriage £1·50 extra.

17" Semi Slim (90° Tube)	£2·50
17"/21" Slim (110° Tube)	£4·50
19" Slimline	£6·50
23" Slimline	£8·50
19" BBC2 Sets	£14·50

PERFECT SPEAKERS EX T.V.

Pm 3 ohm (minimum order two) 5 in. round, 8 in by 2 in rectangular—12½p each. Add 7½p per speaker p. & p.

VALVES EX EQUIPMENT

EB91	5p	30P4	12½p	PY81	15p
EBF89	12½p	PC97	17½p	PY800	15p
ECC82	12½p	PCF86	17½p	PY82	7½p
EC180	7½p	PC84	7½p	PY33	22½p
EF80	12½p	PCF80	7½p	U191	17½p
EF85	12½p	PCC89	12½p	6F23	17½p
EF183	12½p	PCL85	22½p	30PL1	22½p
EF184	12½p	PCL82	17½p	30P12	20p
EY86	17½p	PCL86	17½p	30F5	10p
30PL13	20p	PCL83	12½p		
630LZ	12½p	PL36	22½p		
30L15	12½p	PL81	17½p		

Add 2½p per valve p. & p., orders over £1 p. & p. free

UHF TUNERS

For Ferguson 850 900 chassis adaptable for KB, Ekco T415, 1084 Chassis £2·50, p. & p. 50p.

SLOT METERS
SPECIAL OFFER

Smiths Mk. II 6d. Convertible to 5p. (Smiths Kit costs 35p each) £1 each inc. p. & pkg. or 10 for £5 inc. p. & pkg.

Please write with SAE for quotations on any spares.

TRADE DISPOSALS (Dept. T.S.)

Thornbury Roundabout, Leeds Road, Bradford.
(Telephone 665670)

AERIAL BOOSTERS (£2·95)

We make four types of R.F. high gain transistorized pre-amplifiers L45 U.H.F. TV, L12 V.H.F. TV, L11 V.H.F. radio, L10 medium and short wave. For full details send S.A.E.

PRINTED CIRCUIT BOARDS

2—9in by 4in boards with etching powder and instructions. 50p

MAINS DROPPER

Three section 33 ohms by 33 ohms by 33 ohms. 9p each

TV VALVES (Ex EQ)

Any 5—45p, 10—70p, ECC82, ECL80, EF80, EF85, EF183, EB91, EY86, PCC84, PCC89, PCF80, PCF86, PCL82, PCL83, PCL84, PL36, PY33, PY81, PY82, Y800, 30L15

P&P ALL ORDERS 10p, SAE for details

VELCO ELECTRONICS, 62a Bridge St, Ramsbottom, Bury, Lancs.

¾ MILLION RESISTOR SCOOP

Fantastic savings by huge purchase from manufacturer. High stability, close tolerance (½% to 5%) Carbon Film and a few Electrosils 1/10 watt to 2 watt, 2Ω to 40 Meg Ω packed in 10's except 2 watt in 5's. Big choice values and wattages with plenty small types.
Our selection: 85p per 500 car. 25p
£1·50 per 1,000 car. 28p
£15 per 10,000 car. free
DON'T MISS THIS BARGAIN
OFFER CANNOT BE REPEATED

ELEY ELECTRONICS
112 Groby Road, Glenfield,
Leicester LE3 8GL

Stella Nine Range Cases

LIST OF PRICES AND SIZES

Width	Depth	4" Height	6" Height	7½" Height
6¼"	3¾"	90p	£1·05	£1·23
6¼"	4¾"	96p	£1·23	£1·40
8¼"	3¾"	£1·05	£1·40	£1·40
8¼"	6¾"	£1·40	£1·74	£2·00
10¼"	7¾"	£1·88	£2·28	£2·45
12¼"	3¾"	£1·40	£1·74	£2·03
12¼"	5¾"	£1·85	£2·25	£2·43
12¼"	8¾"	£2·30	£2·74	£2·93
14¼"	3¾"	£1·65	£2·03	£2·25
14¼"	9¾"	£2·73	£3·50	£3·65
16¼"	6¾"	£2·45	£2·93	£3·24
16¼"	10¾"	£3·15	£4·05	£4·45

Cases—Post 25p. per order.
Discounts available on quantities.

CHASSIS in Aluminium, Standard Sizes, with Gusset Plates

Sizes to fit Cases. All 2½" Walls

6" × 3"	33p	10" × 7"	51p	14" × 3"	44p
6" × 4"	34p	12" × 3"	40p	14" × 9"	84p
8" × 3"	39p	12" × 5"	45p	16" × 6"	64p
8" × 6"	46p	12" × 8"	64p	16" × 10"	95p

Chassis—Post 15p. per order.
Discounts available on quantities.

Electro magnetic counters. New Boxed. 500 ohm 4 digit 30p post free.
Copper Laminate Board 1/16" single sided. 12" × 12" 30p. post free.
P.O. relays (600 Type) 500 ohm + 500 ohm. 1 make 1 break 2 change over New boxed 30p post free.
Heavy duty sliding reostat. 1 ohm 12 amp New boxed £1·25p. post free.

E. R. NICHOLLS
Manufacturer of Electronic Instrument Cases
46 LOWFIELD ROAD
STOCKPORT - CHESHIRE
Tel: 061-480 2179

CHROMASONIC electronics

supply only brand new guaranteed goods

LOW NOISE HI-STABS

½ watt 5% all E24 values 3 for 2p plus p. & p. 6p up to 50 resistors + 1p for each additional 50.

CAPACITORS

Mullard C280 ·01 μf, ·015 μf, ·022 μf, ·033 μf. ·047 μf, 3p each. ·068 μf 3½p, ·1 μf, ·15 μf 4p. ·22 μf 5p, ·33 μf 6½p. ·47 μf 8p. ·68 μf 11p. 1 μf 13p. 1'5 μf 20p. 2·2 μf 24p.
C426 series now all 6p. Also in stock C333, C431 and C437 series, plus polystryrene and S. micas.

INTEGRATED CIRCUITS

SN7400N, 1, 2, 4, 5, 10, 20, 26, 30, 40, 50, 51, 54
SN7460N .... all 23p ea.
SN7441AN, 42, 75, 81, 82, 90, 92, 93, 94, 95 all 87p ea.

MC1303L	£1·55	PA234	87p	TAA320	65p
MC1304P	£2·50	PA237	£1·57	TAD100	£1·95
MC1305P	£2·50	PA246	£1·60	μA709e	35p
MFC4000P	70p	TAA263	70p	μA710	35p
MFC4010P	75p	TAA661B	£1·90	μA741C	75p

TRANSISTORS

BC107	12p	AC128	17p	BF167	25p
BC108	11p	AD161/162	63p	BF173	25p
BC109	12p	2N2484	53p	BB104	37p
BC168	15p	2N2926 O/Y	15p	BB105G	29p
BC261	30p	2N3707	15p	BZY88 series	
BFY51	21p	2N4058	17p	Zeners	15p
2N3053	25p	2N5458	48p	2N3819	35p
2N3054	50p	OA81/90/91	7p	TIS43	39p
2N3055	70p	1N914	7p	1N4004	10p

FREE CATALOGUE p. & p. 3p.

P. & p. on all orders other than resistors 6p
56 FORTIS GREEN ROAD, LONDON, N10 3HN

Receivers and Components

EX-GOVT. COMMUNICATIONS RECEIVERS. calibrators, signal generators, components, etc., with money back guarantee. SAE list. Callers welcome, please phone first.—P. R. Golledge, G3EDW, Glen Tor, Torrington, Devon. (STD 08-052) 2411.

BRAND NEW COMPONENTS by return. Electrolytics 15 or 25 volts, 1, 2, 5, 10 mfds. 3·5p 25, 50 4p, 100 5p. Mylar film 100V ·001, ·002, ·005, ·01, ·02 2p, ·04, ·05, ·1 2·5p. Mullard miniature Carbon Film Resistors ⅓ W E.12 series 1Ω-10MΩ8 for 5p. Postage 5p. The C.R. Supply Co., 127 Chesterfield Road, Sheffield S8.

Service Sheets

SERVICE SHEETS & MANUALS

LARGE RANGE OF MODELS AVAILABLE FOR RADIO, TELEVISION, TAPE RECORDERS, ETC.
FROM 40p EACH – S.A.E. WITH ENQUIRIES PLEASE – 1971 INDEX LIST AVAILABLE 20p

MULLARD TRANSISTOR AUDIO AND RADIO CIRCUITS	PRICE	£1.70p	
T.V. FAULT FINDING BOOK by DATA PUBLICATIONS LTD.	"	57p	
MULLARD VALVE & SEMI CONDUCTOR DATA BOOK	"	25p	POST
MAZDA VALVE & PICTURE TUBE DATA BOOKLET	"	25p	FREE
BRIMAR VALVES & TELE-TUBE DATA LIST	"	20p	
RESISTOR COLOUR CODE INDICATOR DISC	"	13p	

Large selection of Television Colour Manuals available – Prices on request.

BELL'S TELEVISION SERVICES
Albert Place, Harrogate, Yorkshire. Tel. 0423-86844

SERVICE SHEETS. Radio, TV etc. 8,000 models. List 10p. S.A.E. enquiries. TELRAY, 11 Maudland Bank, Preston.

SERVICE SHEETS (1925-1971) for Televisions, Radios, Transistors, Tape Recorders, Record Players, etc., by return post, with free Fault-Finding Guide. Prices from 5p. Over 8,000 models available. Catalogue 13p. Please send S.A.E. with all orders/enquiries. Hamilton Radio, 54 London Road, Bexhill, Sussex. Telephone Bexhill 7097.

SERVICE SHEETS. TV, Radio, etc., 40p. Large stocks. S.A.E. with enquiries please, callers welcome. K. L. Bower, 35 Briarwood Drive, Wibsey, Bradford.

TRADER SERVICE SHEETS

40p. each plus postage

We can supply Trader Service Sheets for most makes and types of Radios, Tape Recorders and Televisions—Manuals for some.

Cheques and open P.O.s returned if sheets not available.

OAKFIELD ENTERPRISES
LIMITED

29 CHURCH ROAD, TUNBRIDGE WELLS, KENT

Make	Model	Radio/TV

1971 List now available at 10p. plus postage — If list is required indicate with X

From ....

Address ....

....

enclose remittance of ....

(and a stamped addressed envelope)
s.a.e. with enquiries please

MAIL ORDER ONLY

RADIO, TELEVISION and Tape Recorders, 50 mixed odd sheets 50p. Also large stock of Obsolete/Current Valves. John Gilbert TV, 1B Shepherds Bush Road, London W6. 01-743 8441. SAE enquiries.

LARGE SUPPLIER OF SERVICE SHEETS

(T.V., RADIO, TAPE RECORDERS, RECORD PLAYERS, TRANSISTORS, STEREOGRAMS, RADIOGRAMS, CAR RADIOS)

Only 25p each, Manuals from 50p.

"PLEASE ENCLOSE LARGE S.A.E. WITH ALL ENQUIRIES & ORDERS"
Otherwise cannot be attended to
(Uncrossed P.O.'s please, original returned if service sheets not available.)

C. CARANNA
71 BEAUFORT PARK
LONDON, N.W.11

We have the largest supplies of Service Sheets (strictly by return of post). Please state make and model number alternative.

Free TV fault tracing chart or TV list on request with order.

Mail order only.

QUICK, EFFICIENT, UNIQUE SERVICE SHEET SERVICE

Very Large Stock
TVs, Radio, Amps, Test Gear.
Special Telephone Service available to Trade Customers.
Colour TV and Test Gear Circuits.
Exchange Service.

Full details with First Order.
List price 10p post free.

State Make and Model Number
Large S.A.E. and 25p unfilled P.O.

Mail Order Only.

A.S.L., 21c Drydon Chambers,
119 Oxford Street,
London, W1R 1PB

Courses

BOURNEMOUTH COLLEGE OF TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

B.Sc. (Eng.) HONOURS DEGREE

in Electrical and Electronic Engineering

Entrance Requirements G.C.E. O or A Levels, O.N.D., O.N.C. or H.N.C.

DIPLOMA IN COMPUTOR TECHNOLOGY

Two year full-time course of O.N.D. standard. Entrance requirements G.C.E., O or C.S.E.

For details and application forms write to T. A. Goodchild, Head of Department of Electrical and Electronic Engineering, Room E3, College of Technology, Lansdowne, Bournemouth, BH1 3JJ.

For Sale

MORSE MADE EASY !!

FACT NOT FICTION If you start **RIGHT** you will be reading amateur and commercial Morse within a month (normal progress to be expected).

Using scientifically prepared 3-speed records you automatically learn to recognise the code RHYTHM without translating. You can't help it, it's as easy as learning a tune. 18 W.P.M. in 4 weeks guaranteed.

For details and course C.O.D. ring S.T.D. 01-660 2896 or send 4p stamp for explanatory booklet to:

G3HSC (Box 19), 45 GREEN LANE, PURLEY, SURREY

YUKAN SELF-SPRAY

Get these NOW! air drying GREY HAMMER OR BLACK WRINKLE (CRACKLE) Finishes

Yukan Aerosol spraykit contains 453g fine quality durable easy instant spray. No stove baking required. Hammer available in grey, blue. Modern Eggshell Black Wrinkle (Crackle) all at 85p at our counter or 90p carriage paid per push-button self-spray can. Also Durable, heat and water resistant Black Matt finish (339g self-spray cans only) 75p carriage paid.
SPECIAL OFFER: 1 can plus optional transferable snap-on trigger handle (value 25p) for 96p, carriage paid. Choice of 13 self-spray plain colours and primer (Motor car quality) also available. Please enclose cheque or crossed P.O. for total amount direct to:

Other Yukan Air Drying Aerosols, 453g at 90p carr. paid include: Zinc Chromate, Clear Lacquer, Metallic Grey, Blue.

Dept: M9 YUKAN, 307a, EDGWARE ROAD, LONDON, W2 1BN

We supply many Government Departments, Municipal Authorities, Institutes and Leading Industrial Organisations. We can supply you too.
Open all day Saturday. Closed Thursday afternoons.

SEEN MY CAT? 5,000 items. Mechanical & Electrical Gear, and materials. S.A.E. K. R. WHISTON, Dept. PW, NEW MILLS, Stockport.

BUSH TP60 Cassette Recorder, Mains supply, microphone, extra output socket, good condition, maker's carton, £12 o.n.o.—Box No. 98.

Wanted

WE BUY New Valves and Transistors. State price: A.D.A. MANUFACTURING CO., 116 Alfreton Road, Nottingham.

TOP PRICES PAID for NEW VALVES
popular T.V. and Radio types.
KENSINGTON SUPPLIES (C),
367 Kensington Street, Bradford 8, Yorkshire.

WE BUY New Valves, Transistors and clean new components, large or small quantities, all details, quotation by return. WALTON'S WIRELESS STORES, 55 Worcester Street, Wolverhampton.

CASH PAID for New Valves. Payment by return. WILLOW VALE, ELECTRONICS, 4 The Broadway, Hanwell, London, W.7. 01-567/5400-2971.

WANTED. Ex-RAF HF Transmitter Type T1119 or T1138. Circuit. Condition not important. Box No. 97.

HIGHEST POSSIBLE cash prices for Akai, B. & O., Brenell, Ferrograph, Revox, Sanyo, Sony, Tandberg, Uher, Vortexion, etc. 9.30-5.00. 01-242 7401.

Ladders

VARNISHED TIMBER LADDERS from manufacturer. Lowest prices anywhere. 15½ ft. extd. £6·20, 17ft. ext. £6·50, 20ft. ext. £7, 21½ ft. ext. £7·75. 24½ ft. ext. £8·90. 29ft. ext. £10·25. 31½ ft. triple ext. £12·25. 36ft. triple ext. £16. Carr. 80p. Free lists. Also Aluminium Ext. & Loft Ladders. Callers welcome.—(Dept. W.L.S.) Home Sales, Baldwin Road, Stourport, Worcs. Phone 02-993 2574/5222. Placing order on C.O.D.

Metal Work

METAL WORK: All types cabinets, chassis, racks, etc., to your specifications. PHILPOTTS METAL WORKS LTD., Chapman Street, Loughborough.

Miscellaneous

TOP TRANSISTORS

Brand New and Individually Tested Transistors supplied unmarked, but packed separately for indentification and guaranteed to be within their correct specification or money refunded. All at 9p. each or

Any 25 transistors for only £1.90

ACY22	BFY51	OC72	2N3702
BC108	BFY52	OC202	2N3703
BC109	BSY27	ZTX300	2N3705
BC168	OC45	2N706	2N3706
BC169	OC71	2N2926	2N3708

Money back guarantee, P. & P. 10p.
J. M. KING (M)
17 Buckridge, Portpool Lane, London, E.C.1

INCOMPARABLE V.H.F. KIT

CV2—unique triple-purpose (Converter, Receiver, Tuner-Feeder) kit for the Amateur enthusiast. Fantastic transistorized performance, World Wide Sales. Complete kit of top grade parts with coils covering 80-180 mHZ, plus easy/built diagrams and instructions. £4 direct from makers or S.A.E. for free literature.

JOHNSONS (RADIO)
ST. MARTINS GATE WORCESTER
Est. 1943 Tel. 24864
(A division of the G-BAN Organisation)

NO NEED TO WORRY ABOUT A TRANSMITTING LICENCE

because this GPO approved transmitter/receiver kit does not use R.F. and you can get one easily. Your transmissions will be virtually SECRET since they won't be heard by conventional means. Actually it's TWO KITS IN ONE because you get all the printed-circuit boards and components for both the transmitter AND receiver. You're going to find this project REALLY FUN-TO-BUILD with the EASY-TO-FOLLOW instructions. An extremely flexible design with quite an AMAZING RANGE—has obvious applications for HOUSE-TO-HOUSE USE, SCHOOL PROJECTS, LANGUAGE, LABORATORIES, SCOUT CAMPS, etc.

GET YOURS ! SEND £5·20 NOW
TO: 'BOFFIN PROJECTS'
DEPT. KW2010
4 CUNCLIFFE ROAD
STONELEIGH, EWELL, SURREY

LIGHTWEIGHT TREASURE-PROBE

Look for BURIED COINS, silver, gold and metal relics PROFESSIONALLY with the BOFFIN solid-state TREASURE-PROBE. An extremely EASY-TO-BUILD kit that REALLY DOES WORK! SIMPLE-TO-FOLLOW INSTRUCTIONS. It comes to your doorstep with maximum-copper PRINTED-CIRCUIT BOARD plus ALL ELECTRONIC COMPONENTS including search-coil and earphone. Think of the fun you'll have BEACHCOMBING with the sensitive TREASURE-PROBE, and the expectancy of hearing its LOUD 'BEEP' to tell you "YOU'RE ON TO SOMETHING" GET YOUR TREASURE-PROBE SEND £6·95 NOW!

BOFFIN PROJECTS
4, CUNLIFFE RD.
STONELEIGH EWELL
SURREY
Designed by GERRY BROWN & JOHN SALMON and presented on TV

TAPE HEADS PICK-UP CARTRIDGES

SERVICE MANUALS for Pre 1958 H.M.V. and E.M.I. MODELS. Radio and Record Player Manuals 25p each. Television Manuals 37½ p each. Send C.W.O. stating model required.

Send stamp for comprehensive lists of transformers, condensers, resistors, cartridges and tape heads.

R.D.I. LTD.,
Chilton Works, Garden Road,
Richmond, Surrey.

17" BBC/ITV TELEVISIONS £5

Working Perfectly
plus P&P £1 CWO.

SUITABLE FOR ANY AREA

3 Channel 19in D/S TVs. ITV, BBC 1, BBC 2, £25 inc. carriage. 17in 13 Channel, complete but untested £1·50 each, plus £1 P&P. CWO.

SPEAKERS

6in x 4in. 7in x 4in 3OHM
20p plus 8p P&P each. CWO.

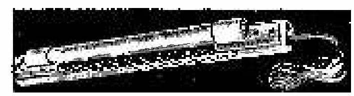
Regular deliveries throughout England and N. Ireland.

TRADE TV's
407 Thornton Road, Girlington, Bradford 8, Yorks.

THE NEW ELECTRONIC MUSIC FOR YOU

Then how about making yourself an electric organ? Constructional data available—full circuits, drawings and notes! It has 5 octaves, 2 manuals and pedals with 24 stops—uses 41 valves. With its variable attack you can play Classics and Swing. Write NOW for free leaflet and further details to C. & S., 20 Maude Street, Darlington, Durham. Send 2½p stamp.

12 VOLT FLUORESCENT LIGHTS



Beat Power Cuts, 12 ins 8 watt Tube, Ideal for Caravan, Tent, Emergency Lighting etc, Fully Transistorised, Low Battery Drain, With ON/OFF Switch and 12v Socket to Run other Lights or 12V Equipment.

Unbeatable at **£3·30** post paid
or in kit form **£2·90**

SALOP ELECTRONICS Callers welcome
23 Wyle Cop
Shrewsbury, Shropshire *S.A.E. for lists*

JOHN SAYS...

RING MODULATOR by Dewtron is professional, transformerless, 5-transistor, has adjustable F1/F2 rejection. Module **£7.** Unit **£8·90. WAA-WAA** Pedal kit of all parts, incl. all mechanics & instr. **Only £2·45. AUTO RHYTHM** from Dewtron modules. Simple unit for waltz, foxtrot etc. costs **£16·55** in modules. **SYNTHESISER MODULES** and other miracles. Send 15p for illust. list.
D.E.W. Ltd., 254 Ringwood Road, Ferndown, Dorset.

We stock all those components and materials required by the home Hi-Fi constructor, including speaker grille fabrics, BAF wadding, speaker kits, cabinets, cross-over networks, inductors, etc. AT TOP DISCOUNTS. Price list free of charge. Send 2 x 3p stamps for pattern card of speaker grille fabrics. Mail order ONLY. No callers please.

AUDIOSCAN Dept. PW9
4, PRINCES SQUARE, HARROGATE, YORKS.

SERVICE MANUALS for Pre 1958 H.M.V. and E.M.I. MODELS. Radio and Record Player Manuals 25p each. Television Manuals 37½p each. Send C.W.O. stating model required. Also limited range of components and spares. Send details of your requirements. R.D.I. Ltd., Chilton Works, Garden Road, Richmond Surrey.

DAILY UFO Flight Patterns, 37½p.. UFO Map, S. England, 37½p. TV Notes on UFO Detection, two Optical Circuits, 50p. UFO Wave Pattern and Prediction, 45p. R & P Publications, "Highlands," Needham Market, Suffolk.

PETERBOROUGH MOBILE RALLY will be held on Sunday, 26th September. From 11 a.m. to 5 p.m., at Walton School, Walton, 3 miles north of Peterborough.

SYNTHESISER MODULES

Send SAE for details of voltage-controlled modules for synthesiser construction to D.E.W. Ltd., 254 Ringwood Road, Ferndown, Dorset.

HEADPHONES (Stereo) Diplomat Model by S. G. Brown, 10 pairs. Bargain £4·95 each. R.J.W. 27 Huxley Road, London, E.10. Tel. 01-556 8362.

BUILD IT in a DEWBOX quality cabinet. 2in x 2½in x any length. D.E.W. Ltd., Ringwood Road, FERNDOWN, Dorset. S.A.E. for leaflet. Write now—Right now.

RECORD TV SOUND using our loudspeaker isolating transformer. Provides safe connection to recorder. Instructions included. 70p +10p P&P. CROWBOROUGH ELECTRONICS (P.W.), Eridge Road, Crowborough, Sussex.

FAMOUS TELETON—AM/FM

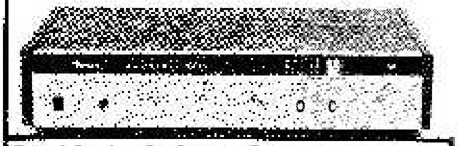
Stereo Tuner Amplifier R8000

Supplied complete with 2 speakers. Total 12 watts RMS. Specification MPX Beacon, AFC Connections for Tape Recorder, Stereo Headphone Socket, etc.
Mfgs. Rec. Price £63·50
P.S.P. FANTASTIC OFFER only £39.95

Plus GARRARD DECK 2025 Complete with plinth and perspex cover. Fitted with **superb Sonotone** 9TAHCO cartridge. P.S.P. offer **ONLY IF YOU BUY THE ABOVE only £15.40**

SAVE ££s

ANOTHER PSP SUPER SCOOP



All orders C.W.O. Special Securicor fast delivery £3.

TELETON SAQ 206 STEREO AMPLIFIER

Latest release, beautifully styled in walnut case, 6+6 watts r.m.s. Switched inputs for magnetic X tal, aux, Tape. Incorporates volume, bass, treble and, slide balance control, scratch filter and loudness control. Rec. £32·50.
Our price £19·95.

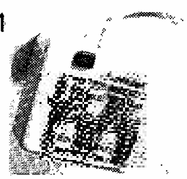
Suggested System.

SAQ 206 Amplifier, SP25 III Plinth and Cover. G800 cartridge, pair large 3-way speaker system size 18" × 10" × 7" Would normally cost £85 complete. **Our price £59·95**

PERSONAL SHOPPERS PLAN LTD.
The Centre
36-38 West Green Road, Tottenham, N.15
Tel. No. 01-800 5533

The BATTERIES That Won't Let You Down! RECHARGEABLE

Cells in U2, U11 and Penlite U7 sizes
Kestral Battery Charging Unit



Uses :
Tape recorders, Portable radio and TV, Radio controlled model aircraft and boats, Cine cameras, Flashguns, Cordless shavers and other battery appliances.

Whenever you *must* have utterly dependable battery power—then these new Alkaline-Manganese rechargeable cells will provide it. The cells can be recharged many times, a simple job with the Kestrel Charging Unit which has been specially designed for these new type batteries.

PRICES
Batteries U2 equiv. £1·25
Penlite U7 equiv. 50p
U11 equiv. £1·03
Charging unit £3·99 with one battery holder

KESTREL
Bush & Meissner

Send to:
275 WEST END LANE LONDON, N.W.6
01-794 9611

LOOK AT THESE PRICES

CARTRIDGES

Acos GP67-2, GP91-35C **£1·12½** : Acos GP93·1 **£1·33½** ; Acos GP94-1 **£1·62½** ; Sonotone 9TAHC **£1·97½**. All above in makers' cartons. BSR X4H **£1·50.**

THIS MONTH'S SPECIAL OFFER

Garrard SP25 Mk. III with KS40A cartridge. In good quality teak plinth with perspex dust cover. Complete with all leads ready to use **£20.** SP25 Mk. III deck only less cartridge **£11·87.**

PLUGS & SOCKETS

Phono plugs, assorted colours **4½p** : **45p** per doz.: Coaxial plugs, aluminium **7½p**; Coaxial couplers **7½p**; 2 pin DIN plugs **15p**; 3 pin DIN plugs **15p**; 5 pin DIN plugs **17p**; 2 pin, 3 pin & 5 pin DIN sockets **7½p**; Wander plugs **2½p**; sockets **3½p**; Banana plugs **5½p**; Sockets **5p**; 3·5mm J/Plugs **7½p** and **12½p**; Standard J/Plugs with solder terminals **10p** : Chrome **15p** ; Side Entry J/Plugs black and chrome **24p**: Insulated j/sockets—o/cct **20p**, c/cct **17p.**

ELECTROLYTIC CAPACITORS

4uF 150v **4p** ; 8uF 500v **15p** : 10uF 150v **4p** ; 12uF 25v **4p** ; 16uF 450v **14p** ; 16uF + 16uF 450v **23½p** ; 30uF 10v **4p** ; 50uF 10v **4p** ; 100uF 9v **4p** ; 100uF 12v **4p** ; 150uF 12v **4p** ; 320uF 9v **5p** ; 1500uF 30v **19p** ; 10uF 16v **7½p** ; 5000uF 25v **50p** ; 10,000uF 25v **75p** ; 20,000uF 30v **£1·05.**

MICROPHONES

Acos Mic 45 **£1·12½** ; Acos Mic 60 **99½p** : Planet CM70 **£1·50** ; Hand Mike **75p.**

VALVES

PY81 **36p** : PCL82 **39p**; EF.183 **45p** : EF184 **45p**

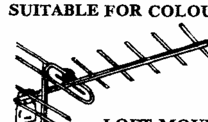
Postage extra.

GEORGE FRANCIS (Dept PW),

12-14. MIDDLE GATE, NEWARK, NOTTS.
Telephone : Newark 4733.

U.H.F. T.V. AERIALS

SUITABLE FOR COLOUR AND MONOCHROME RECEPTION



All U.H.F. aerials now fitted with tilting bracket and 4 element reflector.
LOFT MOUNTING ARRAYS 7 element 2·25. 11 element 2·75. 14 element 3·25. 18 element 3·75. **WALL MOUNTING c/w WALL ARM & BRACKET** 7 element 3·25. 11 element 3·75. 14 element 4·25. 18 element 4·75. **CHIMNEY MOUNTING ARRAYS c/w MAST & LASHING KIT.** 7 element 4·00. 11 element 4·50. 14 element 4·75. 18 element 5·25. **MAST MOUNTING** arrays only. 7 element 2·25. 11 element 2·75. 14 element 3·25. 18 element 3·75. Complete assembly instructions with every aerial. **LOW LOSS** coaxial cable 9np yd. **KING TELEBOOSTERS** from 3·75. **LABGEAR** all band V.H.F.—U.H.F.—F.M. radio mains operated pre-amps 7·50. State clearly channel number required on all orders. P.p. on all aerials 50np. Accs. 15np C.W.O. Min. C.O.D. charge 25np.

BBC—ITV—FM AERIALS

BBC (band 1) Wall S/D 2·00. **LOFT** inverted 'T' 1·25. **EXTERNAL 'H'** array only 3·00. **ITV** (band 3) 5 element loft array 2·50. 7 element 3·00. **COMBINED BBC—ITV,** loft 1+5 2·75. 1+7 3·50. **WALL & CHIMNEY UNITS ALSO AVAILABLE.** Pre-amps from 3·75. **COMBINED U.H.F.—V.H.F.** aerials 1+5+9 4·00. 1+5+14 4·50. 1+7+14 5·00. **F.M. RADIO** loft S/D 1·00 3 element 3·25. 4 element 3·50. Standard coaxial plugs 9np. Coaxial cable 5np yd. Outlet box 30np. P.p. all aerials 50np. Accs. 30np. C.W.O. Min. C.O.D. charge 25np. Send 5np for fully illustrated lists.

CALLERS WELCOMED
OPEN ALL DAY SATURDAY

K.V.A. ELECTRONICS

40-41 MONARCH PARADE, LONDON ROAD, MITCHAM, SURREY
Telephone 01–648 4884

INDEX TO ADVERTISERS

Head Office and Warehouse
44A WESTBOURNE GROVE
LONDON W2
Tel: 727 5641/2/3

Z & I AERO SERVICES LTD.

Retail Shop
85 TOTTENHAM COURT ROAD
LONDON W1
Tel: 580 8403
Open all day Saturday

Please send all correspondence and Mail-Orders to Head Office
When sending cash with order, please include 12½np in £ for postage and handling
MINIMUM CHARGE 15np. No C.O.D. orders accepted
Please note that the valves offered below are not necessarily of U.K. origin

OA2	0.38	6AR11	1.25	6F11	0.40	10D2	0.50
OA3	0.45	6AS5	0.45	6F13	0.45	10F1	0.75
OB2	0.35	6AS7G	0.85	6F14	0.70	10F9	0.60
OB3	0.70	6AT6	0.35	6F15	0.65	10F18	0.50
OC3	0.38	6AU6	0.25	6F18	0.50	10L1	0.50
OD3	0.35	6AV6	0.30	6F23	0.85	10LD11	0.65
1B3GT	0.40	6AW8A	0.60	6F24	0.75	10P13	0.60
1CP31	7.00	6BA6	0.25	6F25	1.00	10P14	1.10
1L4	0.20	6BE6	0.30	6F26	0.35	12AB5	0.70
1R4	0.45	6BF5	1.00	6F28	0.65	12AC6	0.50
1R5	0.40	6BF6	0.55	6J4	0.50	12AD6	0.55
1S4	0.30	6BH6	0.75	6J5GT	0.30	12AE6	0.55
1S5	0.30	6BJ6	0.50	6J6	0.20	12AL5	0.50
1T4	0.30	6BK7A	0.60	6J7	0.45	12AQ5	0.50
1U4	0.30	6BN5	0.43	6K6GT	0.60	12AT6	0.30
1U5	0.60	6BN6	0.45	6K7	0.35	12AT7	0.35
1V2	0.50	6BQ5	0.25	6K8G	0.40	12AU6	0.35
1X2B	0.50	6BR8	0.70	6K25	0.75	12AU7	0.30
2D21	0.38	6BS7	1.30	6L6GT	0.45	12AV6	0.40
3A4	0.40	6BW6	0.85	6L7	0.40	12AV7	0.65
3BP1	3.00	6BW7	0.80	6L18	0.45	12AX7	0.30
3S4	0.35	6BX6	0.25	6LD20	0.50	12AY7	0.75
3V4	0.48	6BZ6	0.40	6N7GT	0.45	12B4A	0.60
5R4GY	0.75	6C4	0.38	6P1	0.60	12BA6	0.40
5U4G	0.35	6C5GT	0.40	6P28	0.65	12BA7	0.40
5V4G	0.45	6CB6	0.35	6Q7	0.40	12BE6	0.40
5Y3GT	0.40	6CD6GA	1.25	6SA7	0.40	12BH7	0.45
5Z3	0.60	6CG7	0.55	6SG7	0.40	12BY7	0.60
5Z4G	0.40	6CH6	0.60	6SK7	0.40	12K5	0.70
6/30L2	0.80	6CL6	0.55	6SL7GT	0.35	12K7GT	0.40
6AB4	0.35	6CW4	0.65	6SN7GT	0.35	12Q7GT	0.40
6AF4A	0.55	6CY5	0.45	6SQ7	0.40	12SR7	0.40
6AG7	0.40	6CY7	0.70	6SR7	0.40	20D1	0.50
6AH6	0.50	6D3	0.50	6T8	0.35	20L1	1.10
6AJ8	0.30	6DC6	0.80	6U4GT	0.65	20P1	0.50
6AK5	0.35	6DK6	0.50	6U8A	0.40	20P4	1.10
6AK6	0.60	6DQ6B	0.70	6V6GT	0.40	20P5	1.20
6AL3	0.43	6DS4	0.75	6X4	0.35	25C5	0.50
6AL5	0.20	6EA8	0.60	6X5GT	0.40	25L6GT	0.50
6AM5	0.35	6EH7	0.30	6X8	0.60	25Z4G	0.30
6AM6	0.33	6EJ7	0.35	6Y6G	0.70	25Z6GT	0.65
6AQ5	0.38	6EW6	0.70	7Y4	0.65	30A5	0.50
6AQ6	0.65	6F1	0.75	9BW6	0.60	30AE3	0.40
6AR5	0.45	6F5	0.75	10C2	0.50	30C1	0.30
6AR6	0.55	6F6G	0.35	10D1	0.55	30C15	0.80

First Quality Fully Guaranteed

ZAERIX BRAND

ELECTRONIC VALVES

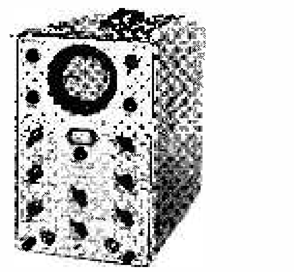
30C17	0.90	90AG	2.40	DY87	0.33	ECC189	0.65
30C18	0.80	90AV	2.50	DY802	0.35	ECF80	0.35
30F5	0.85	90C1	0.65	E88CC	0.65	ECF82	0.35
30FL1	0.75	90CV	2.40	E180F	1.00	ECF86	0.65
30FL12	1.20	807	0.50	E810F	2.90	ECF804	1.65
30FL14	0.85	813	3.75	EABC80	0.35	ECH42	0.75
30L1	0.40	866A	0.75	EAF42	0.55	ECH81	0.30
30L15	0.85	5642	0.70	EBC33	0.50	ECH83	0.45
30L17	0.80	6080	1.60	EBC41	0.55	ECH84	0.45
30P12	0.80	6146	1.60	EBC81	0.30	ECL80	0.45
30P19	0.85	6360	1.25	EBF80	0.40	ECL81	0.50
30PL1	0.75	6939	2.25	EBF83	0.40	ECL82	0.35
30PL13	0.93	7199	0.80	EBF89	0.30	ECL83	0.70
30PL14	0.90	7360	2.00	EC53	0.50	ECL84	0.55
35A3	0.55	7586	1.25	EC86	0.60	ECL85	0.55
35A5	0.75	7895	1.25	EC88	0.60	ECL86	0.40
35B5	0.65	9002	0.40	EC90	0.33	ECLL800	1.65
35C5	0.50	9003	0.50	EC91	0.60		
35D5	0.75	AZ1	0.55	EC92	0.35	EF40	0.50
35L6GT	0.50	AZ31	0.55	EC93	0.55	EF41	0.65
35W4	0.35	CBL1	0.90	EC8010	2.25	EF42	0.70
35Z3	0.70	CBL31	1.00	ECC40	0.65	EF80	0.25
35Z4G	0.35	CY31	0.35	ECC81	0.35	EF83	0.55
35Z5GT	0.60	DAF96	0.45	ECC82	0.30	EF85	0.35
50A5	0.75	DF96	0.45	ECC83	0.30	EF86	0.30
50B5	0.50	DK40	0.60	ECC84	0.30	EF89	0.28
50C5	0.50	DK92	0.55	ECC85	0.40	EF91	0.33
50CD6G	1.20	DL96	0.45	ECC88	0.40	EF92	0.35
50L6GT	0.55	DM160	0.65	ECC89	0.50	EF95	0.35
85A2	0.50	DY86	0.32	ECC91	0.20	EF97	0.65

EP98	0.65	GZ34	0.60	PL82	0.45	U301	0.40
EF183	0.30	HABC80	0.45	PL83	0.45	U403	0.60
EF184	0.35	HK90	0.40	PL84	0.40	U404	0.60
EF800	1.00	KT66	2.05	PL302	0.85	U801	0.80
EK90	0.30	KT88	2.00	PL504	0.80	UABC80	0.40
EL33	1.25	N78	1.50	PL508	0.90	UAF41	0.50
EL34	0.50	PABC80	0.40	PL509	1.10	UAF42	0.55
EL36	0.50	PC86	0.60	PL801	0.80	UBC41	0.50
EL37	1.60	PC88	0.60	PL802	0·95	UBC81	0.40
EL41	0.60	PC97	0.50	PM84	0.60	UBF80	0.40
EL42	0.65	PC900	0.48	PY31	0.30	UBF89	0.35
EL81	0.55	PCC84	0.40	PY33	0.63	UBLI	0.60
EL83	0.42	PCC85	0.40	PY80	0.40	UBL21	0.65
EL84	0.25	PCC88	0.55	PY81	0.30	UC92	0.40
EL85	0.43	PCC89	0.55	PY82	0.35	UCC85	0.40
EL86	0.40	PCC189	0.55	PY83	0.38	UCF80	0.55
EL90	0.38	PCC805	0.85	PY88	0.40	UCH21	0.60
EL95	0.35	PCC806	0.80	PY500	1.00	UCH42	0.70
EL821	0.60	PCF80	0.30	PY800	0.40	UCH81	0.40
EL822	1.30	PCF82	0.35	PY801	0.50	UCL81	0.60
ELL80	0.75	PCF84	0.60	PZ30	0.35	UCL82	0.35
EM34	1.00	PCF86	0.60	QQVO2-6	2.25	UCL83	0.60
EM71	0.80	PCF87	0.90	QQVO3-10	1.25	UF41	0.60
EM80	0.45	PCF801	0.50	QQV03-20A	5.25	UF42	0.60
EM81	0.60	PCF802	0.50	QQV06-40A	5.50	UF43	0.60
EM84	0.35	PCF805	0.80	TT21	3.00	UF80	0.35
EM85	1.00	PCF806	0.70	TT22	3.20	UF85	0.40
EM87	0.70	PCF808	0.85	TY2-125	10.00	UF89	0.40
EN91	0.38	PCH200	0.70	U18/20	0.75	UL41	0.65
EY51	0.40	PCL81	0.50	U25	0.80	UL84	0.40
EY80	0.55	PCL82	0.35	U26	0.80	UM84	0.25
EY81	0.40	PCL83	0.65	U31	0.60	UU8	0.60
EY83	0.55	PCL84	0.45	U37	2.10	UY1N	0.50
EY86	0.40	PCL85	0.40	U52	0.35	UY11	1.00
EY87	0.43	PCL86	0.45	U76	0.35	UY41	0.48
EY88	0.43	PCL88	0.90	U78	0.35	UY82	0.50
EZ40	0.50	PCL800	0.93	U191	0.75	UY85	0.40
EZ41	0.50	PCL801	0.75	U201	0.35	W729	0.75
EZ80	0.27	PD500	1.30	U281	0.40	Z759	2.00
EZ81	0.29	PF86	0.65	U282	0.40	Z803U	1.20
GY501	0.80	PF818	0.85				
GZ30	0.40	PFL200	0.65				
GZ31	0.35	PL33	0.35				
GZ32	0.48	PL36	0.55				
GZ33	0.70	PL81	0.50				

TRANSISTORS

2N696	0.17	AC127	0.20	BD121	0.65
2N697	0.17	AC128	0.15	BD123	0.80
2N698	0.30	AC132	0.35	BD131	0.85
2N705	0.70	AC153	0.20	BD132	0.85
2N706	0.10	AC154	0.15	BD135	0.80
2N708	0.15	AC157	0.20	BF115	0.20
2N753	0.25	AC169	0.10	BF167	0.18
2N929	0.22	AC176	0.25	BF173	0.20
2N930	0.25	AC187	0.30	BF178	0.25
2N987	0.30	AC188	0.30	BF179	0.30
2N1131	0.25	ACY17	0.275	BF180	0.35
2N1132	0.25	ACY18	0.20	BF181	0.25
2N1184	1.25	ACY19	0.25	BF184	0.25
2N1301	0.40	ACY20	0.20	BF185	0.20
2N1302	0.75	ACY21	0.20	BF194	0.15
2N1304	0.25	ACY22	0.15	BF195	0.15
2N1305	0.25	AD140	0.50	BF196	0.20
2N1306	0.25	AD149	0.50	BF197	0.20
2N1307	0.30	AD161	0.35	BF200	0.35
2N1308	0.25	AD162	0.35	BFW87	0.25
2N1309	0.30	ADZ11	1.25	BFW88	0.28
2N1613	0.22	ADZ12	1.25	BFW89	0.20
2N1711	0.25	AF114	0.20	BFW91	0.20
2N1756	0.75	AF115	0.20	BFX88	0.25
2N2147	0.75	AF116	0.20	BFY17	0.40
2N2160	0.65	AF117	0.20	BFY19	0.60
2N2217	0.30	AF118	0.45	BFY50	0.25
2N2218	0.30	AF125	0.25	BFY51	0.20
2N2219	0.35	AF127	0.20	BFY52	0.25
2N2369A	0.20	AF180	0.35	BSY26	0.20
2N2477	0.65	AF181	0.35	BSY27	0.20
2N2646	0.60	AF186	0.40	BSY28	0.20
2N2905	0.35	AF239	0.40	BSY65	0.20
2N2923	0.15	AFZ11	0.45	BSY95A	0.15
2N2924	0.15	ASY26	0.25	OC16	0.50
2N2926	0.125	ASY27	0.30	OC22	0.50
2N3053	0.25	ASY28	0.25	OC23	0.60
2N3054	0.60	ASY29	0.30	OC24	0.60
2N3055	0.75	ASY54	0.25	OC25	0.35
2N3133	0.30	ASZ15	0.70	OC26	0.25
2N3134	0.30	ASZ16	0.70	OC28	0.60
2N3391	0.20	ASZ17	0.75	OC29	0.60
2N3392	0.15	ASZ18	0.75	OC30	0.75
2N3393	0.15	ASZ20	0.25	OC35	0.50
2N3394	0.15	ASZ21	0.40	OC36	0.60
2N3395	0.20	BC107	0.125	OC42	0.20
2N3402	0.15	BC108	0.125	OC44	0.20
2N3403	0.15	BC109	0.125	OC45	0.15
2N3404	0.35	BC113	0.25	OC70	0.10
2N3414	0.20	BC118	0.30	OC71	0.12
2N3415	0.15	BC134	0.30	OC72	0.25
2N3416	0.25	BC147	0.175	OC73	0.30
2N3417	0.25	BC148	0.15	OC75	0.20
2N3702	0.12	BC149	0.15	OC76	0.20
2N3703	0.12	BC152	0.15	OC78	0.25
2N3704	0.17	BC158	0.15	OC78D	0.20
2N3707	0.15	BC175	0.20	OC81	0.25
2N3709	0.12	BC186	0.25	OC81D	0.15
2N3710	0.12	BCY30	0.25	OC83	0.20
2N3819	0.35	BCY31	0.40	OC139	0.30
2N3906	0.20	BCY33	0.25	OC140	0.85
2S702	0.50	BCY34	0.30	OC141	0.60
2S746	0.25	BCY72	0.20	OC170	0.25
AC113	0.15	BCZ10	0.30	OC171	0.25
AC125	0.30	BCZ11	0.40	OC200	0.30
AC126	0.20	BD115	0.80	OC202	0.65

SYNCHROSCOPE TYPE C1-5



3-in tube fitted with telescopic viewing hood, giving bright display in full daylight.
Bandwidth 10 c/s—10 mc/s. Triggered sweep pre-set at 1-2-5-10-30-100-300-1000-3000 μsec per stroke. Free-running time base 20 c/s to 2000kc/s with built-in crystal calibrator providing timing marks at .05-.2-1-5-20-100 μ sec + 5%.
Amptitude calibrator directly calibrated in volts.
Input attenuator 1-10-100.
Power supplies 127/230v AC.

PRICE £39.00. Packing and carriage 1.50

MINIATURE CERAMIC CAPACITORS 25V WORKING

5% tolerance 22-27-33-39-47-56-68-82-100-120-150-180-220-270-330-390-470-560-680-820-1000pF
All at 20np per twenty.
+50%-20% tolerance 1500-2200-3300-4700-6800-10,000-15,000 pF—All at 23np per twenty.
+80%-20% tolerance 0.022-0.033-0.047 μF.
All at 28np per twenty.
Minimum orders 20 of one size.

10% TOL. METAL CASED PAPER CAPACITORS

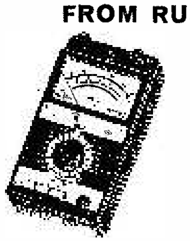
250V DC: 0·05-0·10-0·25-0·5-1·0μF £1·00 per twenty
500V DC: 0·025-0·05-0·10-0·25-0·50μF £1·25 per twenty
Minimum Orders: 20 Capacitors

10-AMP SILICON STUD MOUNTED RECTIFIERS

BYX42- 300 piv 0·35
BYX42- 600 piv 0·40
BYX42- 900 piv 0·55
BYX42-1200 piv 0·65

All these are available also with reversed polarity, i.e. stud anode.

TWO NEW MULTIMETERS FROM RUSSIA

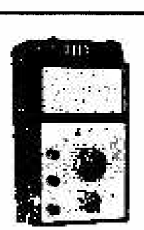


Type U4312
U4313
with AC current ranges

Type U4312—Low sensitivity instrument (667 o.p.v.) 1% accuracy on DC and 1·5% on AC. 9 current ranges on DC (300μA to 6A) and 8 current ranges on AC (1·5mA to 6A). 9 voltage ranges 0·3 to 900V AC/DC. Resistance 0·2 to 30k Ω. Mirror scale.

PRICE, complete with leads and steel carrying case £9.75

Type U4313—20,000 o.p.v. DC and 2,000 o.p.v. on AC. 8 DC current ranges 60μA to 1·5A. 6 AC current ranges 0·6 to 1·5A. 9 DC and AC voltage ranges 1·5-500V. Resistance ranges 0·5-500k Ω. Accuracy 1·5% DC and 2·5% AC. Mirror scale.
PRICE, complete with test leads and steel carrying case £10.50



AC/DC MULTIMETER AND TRANSISTOR TESTER

8-DC voltage ranges 0·3-900V
6-AC voltage ranges 1.5-750V
5-DC current ranges 0·06-600mA
4-AC current ranges 0·3-300mA
4-resistance ranges 0·5-500 Kohms
Transistor cut-off current 60μA max
Transistor DC current gain 10-350
Sensitivity: 16700 Ω/V DC; 3300 Ω/V AC
PRICE £10·50

OUR NEW 1971/1972 CATALOGUE IS NOW READY AND AVAILABLE FREE OF CHARGE. PLEASE SEND QUARTO STAMPED AND ADDRESSED ENVELOPE FOR THIS VALUABLE SOURCE OF REFERENCE LISTING MANY THOUSAND TYPES OF VALVES, SEMICONDUCTORS, TUBES, ETC.

In just 2 minutes, find out how you can qualify for promotion or a better job in Engineering...

That's how long it will take you to fill in the coupon below. Mail it to B.I.E.T. and we'll send you full details and a free book. B.I.E.T. has successfully trained *thousands* of men at home – equipped them for higher pay and better, more interesting jobs. We can do as much for YOU. A low-cost B.I.E.T. Home Study Course gets results fast – makes learning easier and something you look forward to. There are no books to buy and you can pay-as-you-learn on 'SATISFACTION – OR REFUND OF FEE' terms. If you'd like to know how just a few hours a week of your spare time, doing something constructive and enjoyable, could put you out in front, post the coupon today. No obligation.

WHICH SUBJECT WOULD INTEREST *YOU?*

Mechanical
A.M.S.E. (Mech.)
Inst. of Engineers
Mechanical Eng.
Maintenance Eng.
Welding
General Diesel Eng.
Sheet Metal Work
Eng. Inspection
Eng. Metallurgy
C. & G. Eng. Crafts
C. & G. Fabrication

Draughtsmanship
A.M.I.E.D.
Gen. Draughtsmanship
Die & Press Tools
Elec. Draughtsmanship
Jig & Tool Design
Design of Elec. Machines
Technical Drawing
Building

Electrical & Electronic
A.M.S.E. (Elec.)
C. & G. Elec. Eng.
General Elec. Eng.
Installations & Wiring
Electrical Maths.
Electrical Science
Computer Electronics
Electronic Eng.

Radio & Telecomms.
C. & G. Telecomms.
C. & G. Radio Servicing
Radio Amateurs' Exam.
Radio Operators' Cert.
Radio & TV Engineering
Radio Servicing
Practical Television
TV Servicing
Colour TV
Practical Radio & Electronics (with kit)

Auto & Aero
A.M.I.M.I.
MAA/IMI Diploma
C. & G. Auto Eng.
General Auto Eng.
Motor Mechanics
A.R.B. Certs.
Gen. Aero Eng.

Management & Production
Computer Programming
Inst. of Marketing
A.C.W.A.
Works Management
Work Study
Production Eng.
Storekeeping
Estimating
Personnel Management
Quality Control
Electronic Data Processing
Numerical Control
Planning Engineering
Materials Handling
Operational Research
Metrication

Constructional
A.M.S.E. (Civ.)
C. & G. Structural
Road Engineering
Civil Engineering
Building
Air Conditioning
Heating & Ventilating
Carpentry & Joinery
Clerk of Works
Building Drawing
Surveying
Painting and Decorating.
Architecture
Builders' Quantities

General
C.E.I.
Petroleum Tech.
Practical Maths.
Refrigerator Servicing.
Rubber Technology
Sales Engineer
Timber Trade
Farm Science
Agricultural Eng.
General Plastics

General Certificate of Education
Choose from 42 'O' and 'A' Level subjects including:
English
Chemistry
General Science
Geology
Physics
Mathematics
Technical Drawing
French
German
Russian
Spanish
Biology
B.I.E.T. and its associated schools have recorded well over 10,000 G.C.E. successes at 'O' and 'A' level.

WE COVER A WIDE RANGE OF TECHNICAL AND PROFESSIONAL EXAMINATIONS.

Over 3,000 of our Students have obtained City & Guilds Certificates. Thousands of other exam successes.

THEY DID IT– SO COULD YOU

"My income has almost trebled . . . my life is fuller and happier." – Case History G/321.

"In addition to having my salary doubled, my future is assured." – Case History H/493.

"Completing your Course meant going from a job I detested to a job I love." – Case History B/461.

FIND OUT FOR YOURSELF

These letters – and there are many more on file at Aldermaston Court – speak of the rewards that come to the man who has given himself the specialised know-how employers seek. There's no surer way of getting ahead or of opening up new opportunities for yourself. It will cost you a stamp to find out how we can help *you.*

Free!

Why not do the thing that really interests you? Without losing a day's pay, *you* could quietly turn yourself into something of an expert. Complete the coupon (or write if you prefer not to cut the page). We'll send you full details and a FREE illustrated book. No obligation and nobody will call on you . . . but it could be the best thing you ever did.

BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY

Dept B2, Aldermaston Court, Reading RG7 4PF.

(Write if you prefer not to cut this page)

POST THIS COUPON TODAY

CARPE DIEM

BIET

To: B.I.E.T., Dept B2, Aldermaston Court, Reading RG7 4PF.
Please send me book and details of your Courses in
....
Name.. Age.....................
Address..
....
.... Occupation..............................
453A

B.I.E.T – IN ASSOCIATION WITH THE SCHOOL OF CAREERS – ALDERMASTON COURT, BERKSHIRE

Published approximately on the 7th of each month by IPC Magazines Limited, Fleetway House, Farringdon Street, London. E.C.4. Tel: 01-634 4444. Printed in England by Index Printers, Dunstable, Beds. Sole Agents for Australia and New Zealand—Gordon and Gotch (A/sia) Ltd.; South Africa—Central News Agency Ltd.; Rhodesia and Zambia—Kingston Ltd.; East Africa—Stationery and Office Supplies Ltd. Subscription rate (including postage); For one year to any part of the world £2·65.

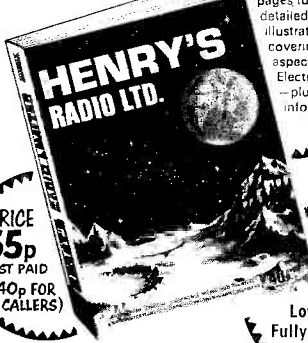
HENRY'S RADIO LIMITED

ENGLAND'S LEADING ELECTRONIC CENTRES

HENRY'S RADIO

HI-FI · COMPONENTS · TEST · P.A. · DISCOTHEQUE · ELECTRONIC ORGANS · MAIL ORDER

COMPLETELY NEW 10th EDITION CATALOGUE



350 pages fully detailed and illustrated covering every aspect of Electronics—plus data and information

PRICE **55p** POST PAID (40p FOR CALLERS)

10,000 Stock lines at Special Low Prices and Fully Guaranteed

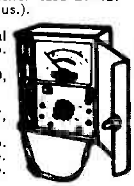
PLUS! FIVE 10p VOUCHERS FOR USE WITH PURCHASES

Send to this address—**Henry's Radio Ltd., (Dept. PW), 3 Albemarle Way, London, E.C.1.**—for catalogue only.

A NEW HENRY'S CATALOGUE IS A MUST FOR ELECTRONICS TODAY!

TEST EQUIPMENT FOR EVERY PURPOSE

AF105 50k/V multimeter (illus.). Price **£8·50**, p.p. 20p. Leather case **£1·42**.
200H 20k/V. Price **£3·87**, p.p. 20p. Case **62p**.
500 30k/V multimeter. Price **£8·87**, p.p. 20p. Leather case **£1·50**.
THL33 2k/V. Price **£4·12**, p.p. 15p. Leather case **£1·15**.
TE65 Valve voltmeter (illus.). Price **£17·50**, p.p. 40p.
SE250B Pocket pencil signal injector. Price **£1·75**, p.p. 15p.
SE500 Pocket pencil signal tracer. Price **£1·50**, p.p. 15p.
TE20D RF generator. Price **£15**, p.p. 40p.
TE22D Matching audio generator. Price **£17**, p.p. 40p.
TE15 Grid dip meter. Price **£12·50**, p.p. 40p.
TO3 Scope 3 in. tube. Price **£37·50**, p.p. 50p.
TE22 Audio Generator. Price **£17**, p.p. 40p.



PANEL METERS

Complete range in stock. 38, 65 and 85 types plus large range Edge types also 240°–250° types.
(Get a copy of our latest catalogue for full specifications and further ranges.)

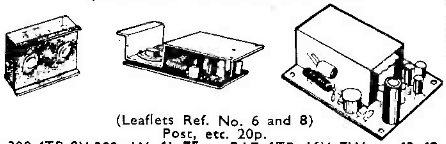
MORE OF EVERYTHING AT LOW PRICES ALWAYS FROM HENRY'S

★ COMPONENTS IN STOCK FOR ALMOST ALL PUBLISHED DESIGNS. YOUR ENQUIRIES INVITED. SEND LARGE S.A.E. FOR QUOTATION.

See our advertisement inside this magazine for the largest range of transistors etc. available in U.K.—Free list No. 36 on request.

HENRY'S SUPPLY ALL YOUR AUDIO-ELECTRONIC NEEDS!

TRANSISTOR AMPLIFIERS



(Leaflets Ref. No. 6 and 8)
Post, etc. 20p.

4-300 4TR 9V 300mW	£1·75	PA7 6TR 16V 7W	£3·62
104 4TR 9V 1W	£2·12	608 6TR 24V 10W	£4·12
304 4TR 9V 3W	£2·47	410 4TR 28V 10W	£4·97
555 6TR 12V 3W	£2·75	MPA12/3 6TR 18V 12W	£4·50

MPA12/15 6TR 36V 12W **£5·25**

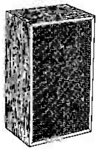
OPTIONAL POWER SUPPLIES Post, etc. 20p

P500 (1 or 2) for 104, 304	£2·62
PS20 (1 or 2) for PA7	£3·47
MU24/40 (1 or 2) for MPA12/3 or MPA12/15	£4·50
P11 for 608 £2·87 P15 for 410	£2·62

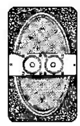
SINCLAIR PROJECT 60 PACKAGE DEALS—SAVE POUNDS!

2xZ30 amplifier, stereo 60 pre-amp, PZ5 power supply, **£16·75**, Carr. 40p. Or with PZ6 power supply **£18·25**. Carr. 40p, 2xZ50 amplifier, stereo 60 pre-amp, PZ8 power supply **£20·25** Carr. 40p. Transformer for PZ8 **£2·45** extra. Any of the above with Active Filter unit add **£4·75** or with pair Q16 speakers add **£16**. Also new FM Tuner **£21**. 2000 Amplifier **£24·50**, p.p. 50p. 3000 Amplifier **£31·50**, p.p. 50p. Also IC12 **£2·50**.

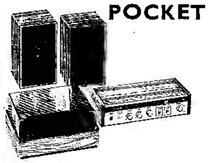
LOW COST HI-FI SPEAKERS



E.M.I. Size 13¼" x 8¼"
TYPE 150 6 watt, 3, 8 or 15 ohms **£2·12**. Post 22p.
TYPE 150TC Twin cone version **£2·75**. Post 22p.
TYPE 450 10 watt with twin tweeters and crossover. 3, 8 or 15 ohms. **£3·50**. Post 25p.
TYPE 350 20 watt with tweeter and crossover. 8 and 15 ohms. **£7·50**. Post 28p.
POLISHED CABINETS
For 150, 150TC and 450 **£4·50**. Post 30p.
TERRIFIC RANGE OF SPEAKERS, KITS AND CABINETS IN STOCK—SEE CATALOGUE OR YOUR ENQUIRIES INVITED.



HI-FI TO SUIT EVERY POCKET



TELETON '206', Garrard SP25 Mk.III, Goldring G800 Series Cart., Plinth/Cover, 10 watt 3 way bookshelf Speaker Systems. All leads etc. (Rec. Price £81).

SAVE £21·55 **£59·45** Carr. £2

PLUS FREE STEREO HEADPHONES.

TELETON F2000, Med. Wave, Stereo FM Tuner Amplifier, Garrard 2025TC, 9TAHC Diam., Plinth/Cover, 10 watt Speaker Systems as above, all leads etc. (Rec. Price £91).

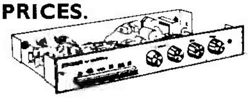
SAVE £26·50 **£64·50** Carr. £2

PLUS FREE STEREO HEADPHONES.

THE TWO MOST POPULAR SYSTEMS EVER—PLUS FULL 12 MONTHS' GUARANTEE AS WITH ALL "HENRY'S" OFFERS!

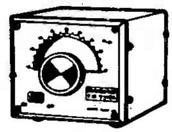
FREE 12 page Audio-Hi Fi Stock and Stereo Systems Discounts Lists. Save up to 40%! Demonstrations and Credit Terms (to callers) plus 12 months' guarantee.

MONO, STEREO AND MIXING EQUIPMENT. HIGH QUALITY WITH LOW PRICES.



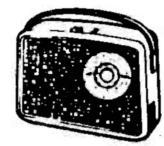
SELF POWERED SILICON-FET CONTROL UNITS / PRE-AMPLIFIERS
FET 9/4 Mono or single channel. Adjustable levels. All facilities plus microphone. Mixing. Price **£12·50**
FET 154 Stereo with all facilities, magnetic cart. input etc. Price **£16·50**
SILICON POWER AMPLIFIERS FOR USE WITH ABOVE
PA 25 25 watts into 8 ohms **£7·50**
PA 50 50 watts into 4 ohms **£9·50**
MU442 Power Supply for 1 or 2 PA25's or 1 only PA50 **£6·00**. Post 20p.
FREE BROCHURE NO. 25 ON REQUEST.
NO SOLDERING — ALL UNITS INTERCONNECTING.
ON DEMONSTRATION AT "356"

BUILD THIS VHF FM TUNER



5 MULLARD TRANSISTORS 300 kc/s BAND-WIDTH, PRINTED CIRCUIT, HIGH FIDELITY REPRODUCTION. MONO AND STEREO.
A popular VHF FM Tuner for quality and reception of mono and stereo. There is no doubt about it—VHF FM gives the REAL sound. All parts sold separately.
Free Leaflet No. 3 & 7.
TOTAL £6·97 p.p. 20p. Cabinet **100p**. Decoder Kit **£5·97**
Tuning meter **£1·75**
Mains unit (optional) Model PS900 **£2·47**
Mains unit for Tuner and Decoder PS1200 **£2·62**

BUILD YOURSELF A QUALITY RADIO



Excellent printed circuit design with full power output. Fully tuneable on both MW/LW bands. 7 Mullard transistors. Fitted 5in. speaker. Room filling power. Easy to build with terrific results. Two colour leather-cloth cabinet with silvered front. All local and continental stations. Complete detailed instructions.
Total cost **£6·98** p.p. 35p. All parts sold separately. Ask for leaflet No. 1.

PUBLIC ADDRESS AND DISCOTHEQUE EQUIPMENT

The largest and most versatile range available—all your requirements for outdoor, indoor, mobile and permanent installations. Sound and lighting supplied. Brochure No. 18 on request or call into "309" and see for yourself. Also Electronic Organs in Kit form—ask for Brochure No. 9.

Electronic Components, Audio and Test Gear Centre	*High Fidelity Sales & Demonstrations Centre*	*Electronic Organs, P.A. & Discotheque Centre*	*Mail Orders, Special Bargain Shop, Industrial Sales*
356 EDGWARE ROAD, LONDON, W.2.	**354 EDGWARE ROAD, LONDON, W.2.**	**309 EDGWARE ROAD, LONDON, W.2.**	**303 EDGWARE ROAD, LONDON, W.2.**
Tel: 01-402 4736	**Tel: 01-402 5854**	**Tel: 01-723 6963**	**Tel: 01-723 1008/9**

"354" & "356" OPEN SIX FULL DAYS A WEEK 9 am to 6 pm MONDAY TO SATURDAY