PRACTICAL WIRELESS

JANUARY 1970

3/0

PANORAMIC RECEIVER

Also: LOW NOISE MICROPHONE MIXER

VALUABLE NEW HANDBOOK

FREE TO AMBITIOUS ENGINEERS

Have you had *your* copy of "Engineering Opportunities"?

The new edition of **"ENGINEERING OPPORTUNITIES"** is now available—without charge—to all who are anxious for a worthwhile post in Engineering. Frank, informative and completely up to date, the new **"ENGINEERING OPPORTUNITIES"** should be in the hands of every person engaged in any branch of the Engineering industry, irrespective of age, experience or training.

On 'SATISFACTION or REFUND of FEE' terms

This remarkable book gives details of examinations and courses in every branch of Engineering, Building, etc., outlines the openings available and describes our Special Appointments Department.

WHICH OF THESE IS YOUR PET SUBJECT?

RADIO ENGINEERING
Advanced Radio — Gen. Radio — Radio & TV Servicing — TV Eng. — Telecommunications— Sound Recording — Automation — Practical Radio — Radio Amateurs' Exam.

ELECTRICAL ENG.
Advanced Electrical Eng. — Gen. Electrical Eng. — Installations — Draughtsmanship — Illuminating Eng. — Refrigeration — Elem. Electrical Science — Electrical Supply — Mining Elec. Engineering.

CIVIL ENGINEERING
Advanced Civil Eng. — Gen. Civil Eng. — Municipal Eng. — Structural Eng. — Sanitary Eng. — Road Eng. — Hydraulics — Mining — Water Supply — Petrol Tech.

ELECTRONIC ENG.
Advanced Electronic Eng. — Gen. Electronic Eng. — Applied Electronics — Prac. Electronics — Radar Tech. — Frequency Modulation — Transistors.

MECHANICAL ENG.
Advanced Mechanical Eng.— Gen. Mechanical Eng. — Maintenance Eng. — Diesel Eng. — Press Tool Design — Sheet Metal Work—Welding — Eng. Pattern Making — Inspection — Draughtsmanship — Metallurgy — Production Eng.

AUTOMOBILE ENG.
Advanced Automobile Eng.— Gen. Automobile Eng. — Automobile Maintenance — Repair — Automobile Diesel Maintenance — Automobile Elec. Equipment — Garage Management.

WE HAVE A WIDE RANGE OF COURSES IN OTHER SUBJECTS INCLUDING CHEMICAL ENG., AERO ENG., MANAGEMENT, INSTRUMENT TECHNOLOGY, WORKS STUDY, MATHEMATICS, ETC.

Which qualification would increase your earning power?
B.Sc. (Eng.), A.M.S.E., C.Eng., A.M.I.E.R.E., R.T.E.B., A.M.I.P.E., A.M.I.M.I., A.R.I.B.A., A.I.O.B., P.M.G., A.R.I.C.S., M.R.S.H., A.M.I.E.D., A.M.I.Mun.E., CITY & GUILDS, GEN. CERT. OF EDUCATION, ETC.

THIS BOOK TELLS YOU

- ★ **HOW to get a better paid, more interesting job.**
- ★ **HOW to qualify for rapid promotion.**
- ★ **HOW to put some letters after your name and become a key man . . . quickly and easily.**
- ★ **HOW to benefit from our free Advisory and Appointment Depts.**
- ★ **HOW you can take advantage of the chances you are now missing.**
- ★ **HOW, irrespective of your age, education or experience, YOU can succeed in any branch of Engineering.**

164 PAGES OF EXPERT CAREER - GUIDANCE

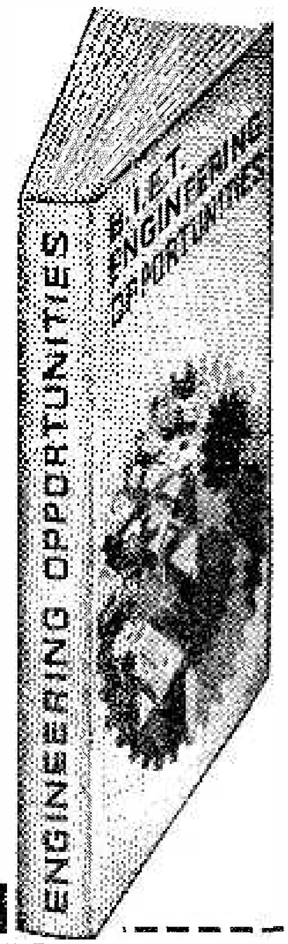
PRACTICAL EQUIPMENT

Basic Practical and Theoretic Course for beginners in Radio, T.V., Electronics, Etc
A.M.I.E.R.E. City & Guilds
Radio Amateurs' Exam.
R.T.E.B. Certificate
P.M.G. Certificate
Practical Radio
Radio & Television Servicing
Practical Electronics
Electronics Engineering
Automation

INCLUDING TOOLS

The specialist Electronics Division of B.I.E.T. NOW offers you a real laboratory training at home with practical equipment. Ask for details.

B.I.E.T.



You are bound to benefit from reading **"ENGINEERING OPPORTUNITIES"**, and you should send for your copy *now*—FREE and without obligation.

POST NOW!

TO B.I.E.T., 453A, ALDERMASTON COURT, ALDERMASTON, BERKSHIRE.

Please send me a FREE copy of "ENGINEERING OPPORTUNITIES." I am interested in (state subject, exam., or career).

. . . .

NAME . . . .

ADDRESS . . . .

. . . .

. . . .

WRITE IF YOU PREFER NOT TO CUT THIS PAGE

British Institute of Engineering Technology
453A ALDERMASTON COURT, ALDERMASTON, BERKSHIRE

THE B.I.E.T. IS THE LEADING INSTITUTE OF ITS KIND IN THE WORLD

XMAS GIFTS?

Your enquiries welcomed at all Branches or by Mail Order

★ *BUMPER ENLARGED 19 PAGE FLOG LIST*

100's OF OFFERS.

FILL IN COUPON NOW AND SEND TOGETHER WITH ONE SHILLING IN STAMPS TO ENSURE YOUR COPY

POST NOW FOR "FLOG LIST"

To TECHNICAL TRADING CO., PARK CRESCENT PLACE, BRIGHTON. Please send "Flog List", without obligation, to

NAME ....

BLOCK CAPITALS PLEASE

ADDRESS ....

....

.... PW 1.70

OR CALL AT YOUR NEAREST BRANCH

★ A FEW EXAMPLES!
★ QUANTITY DISCOUNTS!
★ GUARANTEED GOODS!
★ MANY NEW OFFERS ARRIVING FOR XMAS

GARRARD 3000 LM Autochange Deck, complete with diamond 9TA HC Cartridge. Huge saving at only.. **10gns.**

MODULES with instructions

ADASTRA Electric E1315 organ, 22/6; E1316 Code oscillator, 22/6; E1317 Wireless code oscillator, 22/6; E1318 Dual lamp flasher, 22/6.

Jason KITS

FANTASTICALLY POPULAR

★ TAPE ★

We offer you fully tensilised polyester/mylar and P.V.C. tapes of identical quality hi-fi, wide range recording characteristics as top grade tapes. Quality control manufacturer. They are truly worth a few more coppers than acetate, sub-standard, jointed or cheap imports TRY ONE AND PROVE IT YOURSELF.

Standard Play			Long Play		
3in.	150ft.	2/3	3in.	225ft.	2/9
4in.	300ft.	4/6	4in.	450ft.	5/6
5in.	600ft.	7/6	5in.	900ft.	10/6
5¾in.	900ft.	10/6	5¾in.	1,200ft.	13/-
7in.	1,200ft.	12/6	7in.	1,800ft.	18/6
Double Play			**Triple Play**		
3in.	300ft.	4/-	4in.	900ft.	13/-
4in.	600ft.	8/-	5in.	1,800ft.	25/-
5in.	1,200ft.	15/	5¾in.	2,400ft.	34/-
5¾in.	1,800ft.	19/6	7in.	3,600ft.	44/-
7in.	2,400ft.	27/-	**Quadruple Play**		
			3in.	600ft.	8/6

Postages 1/- reel.
Post Free less 5% on three reels.
Quantity and Trade enquiries invited.
NOTE. *Large tape stocks at all branches*

TAPE RECORDERS—*including*

★ **NOVAC (Belgian Philips) Super-Stereo T/R black/teak** wood finish, 2 mikes. Detb. spkrs. Normal value approx. £85—in makers' boxes .... 49 gns.

★ **SHARP RD504** Super mains/batt. portable 5in. spool. capstan drive m/c mike. 5 yr. guar. approx. £10 under retail list .... 28 gns.

★ **SHARP RD706** professional style, vert. op. 7in. spool. 5 yr. guar., superb value, large saving .... 49 gns.

RECEIVERS—*including*

TOKYO Pocket Radio with amazing loudspeaker reproduction complete with E.R.C. headphone, battery. Really superb value present at only 55/-

WIEN PILOT II. Aircraft/MW receiver .... 11 gns.

ERRES. 4-band L/M/S/FM large type wooden cases, 5in heavy speaker, car socket—bargain offer .... 12 gns. (normal value approx. 25 gns.!!)

FMT640 F.M. TUNER. High sensitivity, $2\mu V$. high fidelity, response 20-20,0000 cps. tuning meter, AFC built-in power pack, attractive plinth. provisioned for multi-plex (RRP over £30) Super snip .... 23 gns.

LOUDSPEAKER CHASSIS—*including*

10×5in EMI ceramic 3 ohms	25/-
Elac 7×4in. 25 ohms (car radio)	15/-
Plessey 5×3in. 30 ohms	12/-
Goodmans 6×4in. 8/10 ohms	15/-
EMI 8×5in. heavy ceramic, 3 ohms	25/-
Elac 9×6in. ceramic, 8 ohms, super	39/-
EMI 10×6in. 8 ohms, ceramic	35/-
Rola Standard silver 10×6in., 3 ohms	29/-
1½×2in Westwell 8 ohms midget speakers	8/6
3in. round 15 ohm speakers	9/6
3in. round 3 ohm speakers	9/6
4in. round 125 ohm speakers	9/6
4½in. round Hi-flux, 8 ohm	13/6
Lightweight Hi-flux, 8 ohm	12/-
12in. R & A with tweeter	35/-
EMI 8×13in. 3 ohms	45/-
EMI 8×13in 15 ohms	45/-
Celestion 3½in. round 125 ohms	8/6

MIXED BARGAIN PARCELS ★★★

Selected from variable condensers, I.F. coils, loudspeakers, plugs, sockets, knobs, potentiometers, condensers, resistors, nuts, bolts, cabinet fittings, switches, valves, transformers, lamps, complete p.c. boards, chokes, rectifiers, transistors, etc., etc. **OFFERED** at a small fraction of list value. **DUE TO HEAVY DEMAND**, we now pack them in several sizes—**BE AMAZED!!—TRY ONE NOW**: 3lb. parcel (post 3/-), 9/-; 7lb, parcel (post 5/-), 17/6; 14lb. parcel (post 6/6), 29/-.

FANTASTIC BARGAIN OFFER

PARCELS OF POTENTIOMETERS
Twenty-five mixed types, our selection, from ganged, presets. switched, un-switched, tandems, log. and lin., at approx. 4½d. each!.... 9/6.

AMPLIFIERS—*including*

SINCLAIR PACKAGE DEAL. 2×Z12 amps, PZ4 power supply, Stereo 25 pre-amps £21

MINET. 3-4W AC amplifier chassis—sacrificed price .. £3.10.0

VALVE RECORD PLAYER AMPLIFIERS. 4W output with 2 valves UY85, UL84 .... 39/-

DITTO high gain UCL82 valve 45/-

ADASTRA 3-3 ditto de luxe model with base and treble controls .... 5 gns.

ADASTRA 5W+5W stereo transistor amplifier... fantastic value .... 10 gns.

ADASTRA NT100 super, compact, high-powered 12V 10W (car, etc.) amp. .... 11 gns.

ARENA F210 superb Danish stereo amp., complete in wooden plinth, magnetic/crystal inputs .... 29 gns

D J PUBLIC ADDRESS AMPLIFIERS

DJ 105 transistor amp 35W multi-input black portable case .... 39 gns

DJ 106 ditto, 70W, ideal super power guitar use ...... 55 gns

EAGLE Transistorised Stereo TSA20 20W per channel RMS magnetic crystal Fantastic performance .... 22 gns

TECHNICAL TRADING

Stockists of Leak, Quad, Goodman, Armstrong, Tripletone Linear, Rogers, Truvox, Ferrograph, Wharfedale, etc., etc.

★ **LONDON** 10 Tottenham Court Rd., W1 Tel. MUSeum 2639

★ **BRIGHTON** 6 Queens Road Tel. 23975

★ **PORTSMOUTH** 350-352 Fratton Rd. Tel. 22034

★ **SOUTHAMPTON** 72 East Street Tel. 25851

★ ALL MAIL ORDER TO

★ **BRIGHTON** Devonian Court, Park Crescent Place. Tel. 680722

24-hour telephone C.O.D. Order Recording Service.

POSTAGE: ADD ½ lb. 1/-; 1½ lb-2/6; 6 lb.-4/6; 10 lb.-6/-; 14 lb.-7/6.

Widest range of audio equipment and electronic components in all branches at keenest prices. Complete installation quotations a speciality.

Lasky's

EXCLUSIVE HI-FI STEREO TUNER AMP. OFFER

THE MT-65 CHASSIS

Solid state AM/FM multiplex tuner with FET front-end/17 + 17 watts stereo amplifier by world famous manufacturer. Frequency response 20–45KHz. Inputs—2·3mV mag p/u and 140mV tape play. Tape record output. Controls: Left/right volume, bass, treble, loudness, monitor. Tuning meter and stereo beacon. Stereo 'phone jack. Machined stainless steel front panel. Overall size 20 x $3\frac{3}{8}$ x 16in.

LASKY'S PRICE £78.0.0 CARRIAGE 12/6

DE-LUXE "COMPACT" PACKAGE OFFER

MT-65 Chassis	£78 0 0
GARRARD AP-75 3-speed Single Player	£23 16 7
AUDIO DEVELOPMENT AD-96K Magnetic Cartridge	£5 18 6
2 WHARFEDALE DENTON Speaker Systems	£36 0 0
"Compact" Teak Cabinet (as shown)	£7 10 0

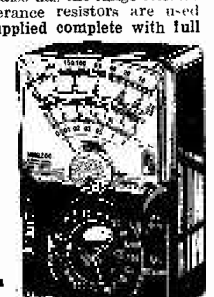
TOTAL RECOMMENDED LIST PRICE £151.5.1

LASKY'S PACKAGE PRICE £132.0.0 U.K. carriage 40/-. All units avail. separately

TMK METER KITS

These two meter kits by TMK offer the unique opportunity of building a really first-class precision multimeter at a worthwhile saving in cost. The cabinets are supplied with the meter scale and movement mounted in position; the Model 200 also has the range selector in position. The highest quality components and 1% tolerance resistors are used throughout. Both offer professional standards of accuracy. **Supplied complete with full constructional, circuit and operating instructions.**

MODEL 200



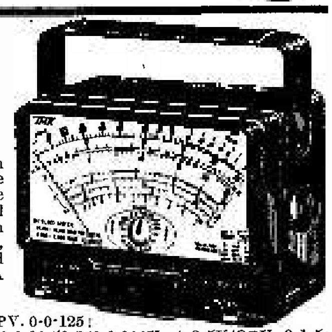
20,000 O.P.V. MULTIMETER. Features 24 measurement ranges with mirror scale. Large 3 × 2in. meter. Full scale accuracy: DCV and current: ±2%, ACV: ±3%, resistance ±3%. Special 10·6V DC range for transistor circuit measurements.

● DCV: 0–0·6–6–30–120–600–1,200V at 20K/OPV. ● ACV. 0–6–30–120–600–1,200V at 10K/OPV. ● DC Current: 0–0·6 6–60–600mA. ● Resistance: 0–10K–100K–1M–10M/ohms (58–580–5·8K–58K at mid-scale). ● Capacitance: 0·002–0·2uf (AC 6V range). ● Decibels −20 to +63dB. ● Output: 0·05uf blocking capacitor. Uses two 1·5V (U.7 type) batteries. Black bakelite cabinet—Size $5\frac{1}{4}$ × $3\frac{3}{8}$ × $1\frac{3}{8}$in. Complete with test leads.

LASKY'S PRICE 85/- Post 3/6

MODEL 5025

50,000 O.P.V. FEATURING 57 MEASUREMENT RANGES



Uses an entirely new range selection mechanism which permits the use of a really large meter in a more compact cabinet. The range selected is clearly indicated on the actual meter face. High speed rotary range selection knob; also features polarity reversal switch, shielded meter movement with overload protection circuit; Special uA and mA measurement ranges.

● **DCV:** 0-0·25-2·5-10-50-250-1,000V at 25K/OPV. 0-0·125: 1·25-5·0-25-125-500V at 50K/OPV. ● **ACV:** 0-3-10-50-250-1,000V at 2·5K/OPV, 0-1·5: 5-25-125-500V at 5K/OPV. ● DCuA: 0-25uA at 125mA: 0-50uA at 250mA. ● **DCmA**. 0-2·5-25-250mA at 125mV; 0-5-50-500mA at 250mV. ● **DC Amps:** 0-5A at 125mV; 0-10A at 250mV. ● Resistance: 0-10M/ohms (13, 65, 650, 6·5K and 65K/ohms at centre scale). ● Output: Capacitor (0·1uF, 400VW) in series with ACV ranges. ● Decibels. −20 to +81·5dB in 10 ranges. ● Operates on two 1·5V (U.7 type batteries). Black bakelite cabinet, size $5\frac{1}{4}$ x $6\frac{3}{4}$ x $2\frac{3}{8}$in. Strong, resilient plastic handle. Complete with test leads.

LASKY'S PRICE £10.10.0 Post 5/-
ALSO AVAILABLE READY BUILT AND TESTED £12.10.0. Post 5/-.

Garrard

SL55 with J2006 stereo cartridge

£11.19.6 Post 5/-

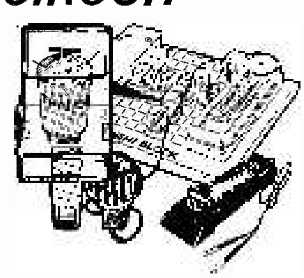
AUTOCHANGERS	
1025 less cartridge	£6.9.6
1025 with GCM21 mono cartridge. Stereo compat.	£6.19.6
2025TC with 9TA stereo diamond cartridge	£8.17.6
AT60 Mk II less cartridge	£13.5.0
SL65B less cartridge	£15.19.6
SL75 less cartridge	£28.10.0
SL95 less cartridge	£35.0.0
A70 Mk II less cartridge	£13.19.6
BSR UA47 less cartridge	£5.9.6
SINGLE PLAYERS	
AP75 with AD.76K magnetic cartridge	£21.10.0
AP75 less cartridge	£18.10.0
SP25 Mk II less cartridge	£11.19.6
SRP22 Mains model less cartridge	£16.12.10
SRP22 Battery model less cartridge	£7.15.3
TRANSCRIPTION DECKS	
401	£28.10.0

GARRARD BASES
WB1 £3.6.11; WB4 Mk II **£5.8.11; WB5 £5.8.11.**

CLEARVIEW PERSPEX COVERS:
SPC1 £3.5.0; SPC4 Mk II **£4.6.6.**
Postage on all above 5/-

DENSHI BOARD KITS

EXPERIMENTAL AND EDUCATIONAL CIRCUIT SYSTEM



The **DENSHI BOARD** system enables the young experimenter and electronics hobbyist to produce a wide range of transistor circuits of increasing sophistication—without soldering or the use of any tools at all! Basically the system comprises a slotted circuit board into which plug-in components and bridge pieces are set to produce up to 30 different circuits. The components are incapsulated in transparent plastic blocks bearing the appropriate circuit symbol and value thus enabling even the complete novice to visually grasp the fundamentals of circuitry after only a few moments study. **In addition each DENSHI BOARD KIT comes complete with an 80 page manual of circuits and data.**

THESE ARE JUST A FEW OF THE CIRCUITS YOU CAN BUILD IN MINUTES:
VARIOUS RADIO RECEIVERS, AMPLIFIERS, MORSE CODE PRACTICE DEVICE, CONTINUITY TESTER, SIGNAL INJECTOR, SIGNAL TRACER, WIRELESS MICROPHONE ETC., ETC.

DENSHI BOARD KIT SR-1A *comprises:*
Base board; tuner block; 4 resistors; choke coil; transformer; 2SA transistor for RF; 2 diodes; 3 capacitors; battery block; morse key; antenna lead; crystal earphone; various bridge and connecting pieces. **This kit permits the building of 16 basic circuits.**

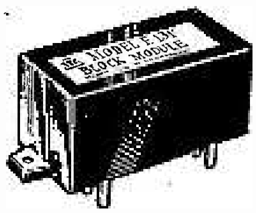
LASKY'S PRICE 99/6 Post 3/6

DENSHI BOARD KIT SR-2A *as SR-1A but with the following additional parts;* 2SB transistor for AF; 2 resistors; 1 capacitor; crystal microphone; test probes; electrode additional connecting pieces; 9V battery. **This kit permits the building of 30 basic circuits**

LASKY'S PRICE £7.2.6 Post 2/6

DENSHI KIT MANUALS are available separately at 4/6* Post 6d.
***Refundable if you purchase kit.**

LASKY'S ENCAPSULATED SOLID STATE MODULES



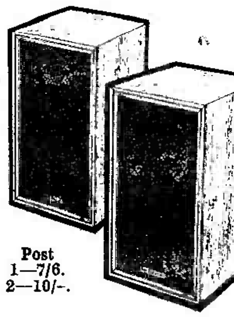
Size of each module only $\frac{1}{4}$ × $1\frac{1}{4}$ × $\frac{7}{8}$in. Ready for immediate use—just connect to power source (usually 9V battery), input and output. Encapsulated modules are shockproof and almost indestructible. Complete with full ins. **Post 1/6 each.**

E-1311 Phono Pre-amp Module—max. output 3V. RMS, input 50mV, input imp. 100kΩ, gain 28dB, RIAA compensation.	**29/6**
F-1312 Tape Head Pre-amp Module—max. output 3V, RMS, input 50mV, input imp. 100kΩ, gain 25dB, NARTB compensation.	**29/6**
E-1313 Microphone Pre-amp Module—max. output 4V, RMS, input 50mV, input imp. 100kΩ, gain 28dB, response 10-50kc/s.	**29/6**
E-1314 Power Amplifier Module—max. output 300mW, input imp. 1kΩ, gain 20dB, response 50–10kc/s, distortion 3% at 20mW.	**29/6**
E-1315 Electronic Organ (tone oscillator) **Module**—frequency 200–1,000c/s, output 80mW. For use with keyboard, variable resistors and 8Ω speaker.	**25/-**
E-1316 Morse Code Practice Oscillator Module—frequency 400c/s, output 80mW. For use with morse key and speaker.	**25/-**
E-1317 Modulated Wireless Signal Transmitter for use in test bench fault finding—frequency 400c/s–30Mc/s, tone freq. 400c/s. For use with any AM receiver.	**25/-**
E-1318 Lamp Flasher Module—flashes two miniature lamps alternately. For use with 6V, 100/200mA bulbs and 6V power supply.	**25/-**

Lasky's

NEW! FOSTER "Criterion" MkII

2 SPEAKER TWO WAY BOOK-SHELF SPEAKER SYSTEM



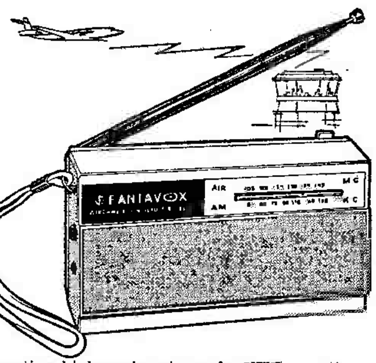
Another high quality sub-miniature bookshelf system from Foster. The "Criterion" Mk. II is a sealed infinite baffle type enclosure using $5\frac{1}{4}$in. bass/mid-range woofer with rolled cloth edge and a $2\frac{1}{4}$in. HF cone type tweeter. The compact cabinet is constructed of $\frac{1}{2}$in. laminate with handsome oiled walnut veneer finish and black woven acoustic gauze front panel with satin chrome edge insert. SPEC: Frequency range 90–20,000Hz. Power handling 10 watts. Impedance 8 ohms. HF crossover. Screw tag connections at rear. Size $12\frac{1}{2} \times 7\frac{1}{4} \times 6\frac{3}{4}$in. The performance of the "Criterion" is superior to many larger and more expensive units and at Lasky's exclusive price offers absolutely unbeatable value.

Post
1—7/6.
2—10/-.

LASKY'S PRICE £9.10.0 or 2 for £17.10.0

FANTAVOX TV-1008

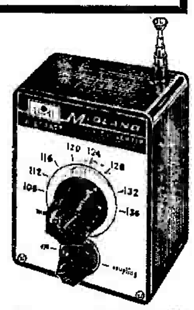
VHF AIRCRAFT BAND AND AM RECEIVER



The first pocket size Receiver of its type allowing you to "tune-in" anywhere to the entire air-to-ground, ground-to-air communications band covered by 108–137Mc/s in addition to full AM medium wave band cover of 535–1605Kc/s. An extremely sensitive 10 transistor and 2 diode, superhet circuit plus 1 variable capacitor and 1 thermistor. Intermediate frequencies: AM-455 Kc/s; VHF-10·7Mc/s. Output power: 200mW. $2\frac{1}{4}$in. Permanent Dynamic 8 ohm speaker, earphone also provided for "silent" listening. A built-in ferrite rod aerial is provided for AM reception and a fully directional telescopic antenna for VHF reception—the latter when collapsed neatly clips across the top of the set. Power is from 4–1·5v penlight cells and a jack socket for connection to a suitable AC converter is also provided. The Model TV-1008 is extremely well made and finished in grey plastic with metallic blue speaker baffle, chrome telescopic antenna; attached wrist strap is also provided. Size $6\frac{3}{4} \times 3\frac{3}{4} \times 1\frac{1}{2}$in. Complete with batteries, magnetic earphone, instructions etc.

LASKY'S PRICE £8.7.6 Post 2/6

MIDLAND Model 10-502 VHF AIRCRAFT BAND CONVERTER



An entirely new item for the radio enthusiast bringing instant reception of the ground-to-air, air-to-ground waveband. For use with any standard AM or FM radio covering 535 to 1605Kc/s, 88 to 108Mc/s respectively—with no electrical conversion or connection required. The Model 10-502 self powered by one 9V (PP3 type) battery is merely placed close to the receiving set and then tuned over 110 to 135Mc/s which covers the whole aircraft communications band. Volume and reception effectiveness is adjusted by moving both sets to the most favourable position and balancing the vol. controls of each accordingly. The Model 10-502 has a smartly designed black plastic cabinet with brushed metal front panel and 18in. chrome telescopic antenna, size only $4 \times 2\frac{3}{4} \times 2\frac{3}{8}$in. (inc. knobs). Complete with battery and full instructions.

LASKY'S PRICE 79/6 Post free

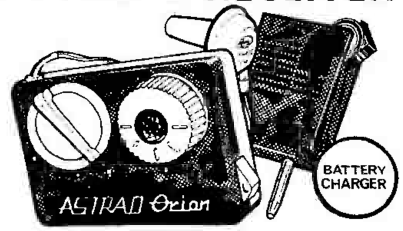
GET YOUR LASKY'S AUDIO-TRONICS PICTORIAL

16 colour page catalogue in large 16 × 11in. format packed with 1,000's of items from our vast stocks. Hi-Fi, Radio, Electronics, Test Equipment, Components etc., etc.
Send 1/- for post only and inclusion on our regular mailing list (5/- overseas)

SCOOP! THE WORLD'S SMALLEST 6 TRANSISTOR TWO WAVEBAND RADIO RECEIVER

Over 10,000 sold

The Astrad ORION



Made to the highest space-age standards—this remarkable micro-set measures only $1\frac{11}{16} \times 1\frac{3}{10} \times 5\frac{5}{16}$ in. yet it contains 6 transistors and other components combined in a photo etched circuit, only $\frac{3}{4} \times \frac{1}{2}$in.; tuning capacitor, ferrite rod aerial, battery, wave band selection switch, etc. Output to a high impedance crystal earpiece, giving ample volume (automatically adjusted) and clear tone. Brief tech. spec.: Waveband coverage—Medium wave 525 to 160 kc/s, Long wave 150 kc/s to 408 kc/s. Sensitivity: 35MV max. Selectivity—10dB (at 30 kc/s de-tuning). Power source: 1 × 1·4V Mercury battery.
The Orion is supplied fully built and tested complete with battery, left and right fitting earphone supports and attractive black and ivory plastic carrying case—the Orion is an ideal gift for all, providing a constant source of enjoyment without disturbing others.

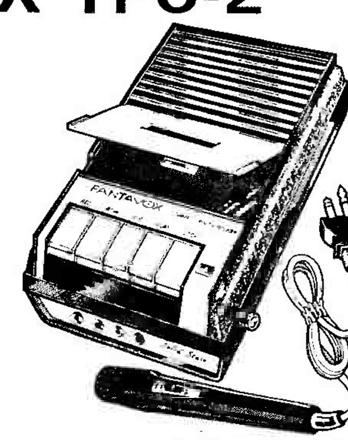
LASKY'S PRICE ONLY 39/6 Post 2/6 Extra rechargeable battery 3/6

*NOTE: The battery we supply with the Orion is a rechargeable type. Charger units are available enabling you to recharge the battery from AC Mains 220/240V supply.

PRICE 19/6 extra Post Free with radio—otherwise 2/-.

FANTAVOX TPC-2

SOLID STATE COMPACT CASSETTE RECORDER



A new Lasky's STAR BARGAIN this beautifully made compact cassette recorder and play back machine offers tremendous performance and value. BRIEF SPEC: 6 transistor and 1 thermister circuit. Constant speed capstan drive system. AC bias recording. PM magnet erase. $2\frac{1}{2}$ in. PM Dynamic speaker. Economical operation on 4 × 1·5V (U-2 type) batteries. SPECIAL FEATURES: Absolutely fool proof operation. Piano key controls. Powerful volume with recessed control. Handsome impact resistant cabinet finished in black with satin aluminium and ivory trim. Size $9\frac{1}{2} \times 5\frac{1}{2} \times 2\frac{1}{2}$in. Jack sockets for remote control microphone, earpiece and external 6V battery pack (or AC adaptor). COMPLETE WITH Remote control Dynamic microphone, earpiece, removable carrying strap, batteries, full instructions and three C-60SX cassettes.

LASKY'S PRICE £16.10 POST 5/- Leather carrying case 30/- extra

NEW INTERNATIONAL TAPE

FAMOUS AMERICAN MADE BRAND TAPE at RECORD LOW PRICES

3in.	Message tape, 150ft	2 6	$5\frac{3}{4}$in.	Standard play, 850ft. PVC	11 6
3in.	Message tape, 225ft.	3 9	$5\frac{3}{4}$in.	Long play, 1200ft. Mylar	15 0
3in.	Message tape, 300ft.	7 6	$5\frac{3}{4}$in.	Triple play, 2400ft. Mylar	45 0
$3\frac{1}{4}$in.	Triple play, 600ft. Mylar	10 0	7in.	Standard play, 1200ft. Acetate	12 6
4in.	Triple play, 900ft. Mylar	17 6	7in.	Standard play, 1200ft. Mylar	12 6
5in.	Double play, 1200ft. Mylar	15 0	7in.	Long play, 1800ft. Mylar	19 6
5in.	Long play, 900ft. Acetate	10 0	7in.	Double play, 2400ft. Mylar	25 0
5in.	Standard play, 600ft. PVC	8 6	7in.	Long play, 1800ft. Acetate	15 0
5in.	Triple play, 1800ft. Mylar	35 0	7in.	Triple play, 3600ft. Mylar	50 0
$5\frac{3}{4}$in.	Double play, 1800ft. Mylar	22 6			
$5\frac{3}{4}$in.	Long play, 1200ft. Acetate	12 6			

P. & P. 1/- extra per reel. 4 reels and over Post Free. Special quotes for quantities.

PRICED CASSETTES from U.S.A.

C.60–7/6 (6 for 42/6), C.90–12/6 (6 for 70/-), C.120–17/6.
Post 1/- each. 3 and over Post Free. Special quotes for quantities.

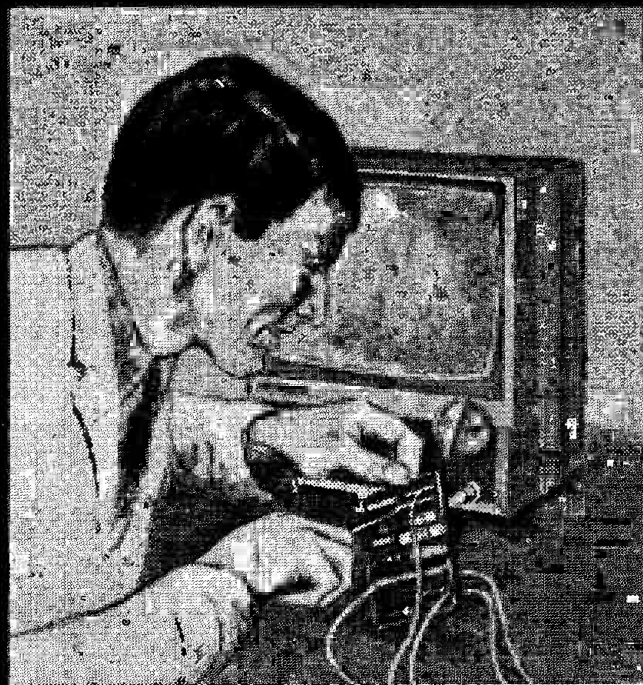
Lasky's Radio Limited

LASKY'S RADIO ESTABLISHED OVER 36 YEARS

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.C.4 Tel. 01-353 2833
Open all day Thursday, early closing 1 p.m. Saturday

High Fidelity Audio Centres
42-45 TOTTENHAM CT. RD., LONDON, W.1 Tel.: 01-580 2573
Open all day, 9 a.m.—6 p.m. Monday to Saturday
118 EDGWARE ROAD, LONDON, W.2 Tel.: 01-723 9789
Open all day Saturday, early closing 1 p.m. Thursday

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



Train for tomorrow's world in Radio and Television at The Pembridge College of Electronics.

The next full time 16 month College Diploma Course which gives a thorough fundamental training for radio and television engineers, starts on 1st January 1970.

The Course includes theoretical and practical instruction on Colour Television receivers and is recognised by the Radio Trades Examination Board for the Radio and Television Servicing Certificate examinations. College Diplomas are awarded to successful students.

The way to get ahead in this fast growing industry—an industry that gives you many far-reaching opportunities—is to enrol now with the world famous Pembridge College. Minimum entrance requirements: 'O' Level, Senior Cambridge or equivalent in Mathematics and English.

To: The Pembridge College of Electronics (Dept. PW11), 34a Hereford Road, London, W.2

Please send, without obligation, details of the Full-time Course in Radio and Television.

NAME..

ADDRESS..

....

ERSIN Multicore 5 CORE SOLDER

for fast, easy, reliable soldering

Contains 5 cores of non-corrosive flux, instantly cleaning heavily oxidised surfaces. No extra flux required.

SAVBIT ALLOY ALSO REDUCES COPPER BIT WEAR.

Ecomically packed for general electrical and electronic soldering. 90 ft. 18 gauge on plastic reel. Recommended retail price **15/-**

THIN GAUGE SOLDER, ESSENTIAL FOR soldering small components and thin wires. High tin content, low melting point, 60/40 alloy, 202 ft. 22 gauge on plastic reel. Recommended retail price **15/-**

A RANGE OF SOLDERS IN HANDY DISPENSERS.

REF.	ALLOY	SWG	
4A	60/40	18	2/6*
Size 5 (illustrated)	Savbit	18	2/6*
15	60/40	22	3/-*

*Recommended Price

INVALUABLE FOR STRIPPING FLEX. THE NEW AUTOMATIC OPENING BIB WIRE STRIPPER AND CUTTER, easily adjustable for all standard diameters. Plastic covered handles can also be used as wire cutter. Recommended retail price **8/6**

From Electrical and Hardware shops. If unobtainable, write to: Multicore Solders Ltd., Hemel Hempstead, Herts.

VALVES

SAME DAY SERVICE
NEW! TESTED! GUARANTEED!

SETS 1R5, 1S5, 1T4, 3S4, 3V4, DAF91, DF91, DK91, DL92, DL94. Set of 4 for 18/6. DAF96, DF96, DK96, DL96, 4 for 26/6.

OZ4	4/6	12K8GT	7/3	DK91	5/9	EH90	6/3	PCL83	9/-	UBF80	5/9
1A7GT	7/6	12SN7GT	6/6	DK92	8/3	EL33	8/9	PCL84	7/6	UBF89	6/9
1H5GT	7/3	19BG6G	17/6	DK96	7/-	EL34	9/6	PCL85	9/-	UC92	5/-
1N5GT	7/9	20F2	13/6	DL35	5/-	EL41	10/6	PCL86	8/3	UCC84	7/-
1R5	5/9	20P3	11/9	DL92	5/9	EL84	4/9	PENA4	12/6	UCC85	6/9
1S5	4/3	20P4	18/6	DL94	6/-	EL90	4/6	PFL200	11/9	UCF80	7/3
1T4	2/9	25L6GT	5/-	DL96	7/-	EL500	12/6	PL36	9/9	UCH42	11/6
3S4	5/9	25U4GT	11/6	DY86	5/9	EM80	7/6	PL81	7/3	UCH81	6/3
3V4	6/-	30C1	6/6	DY87	5/9	EM81	7/6	PL82	6/6	UCL82	6/9
5U4G	4/6	30C15	13/-	EABC80	6/6	EM84	6/6	PL83	6/6	UCL83	11/6
5Y3GT	5/9	30C17	16/-	EAF42	10/-	EM87	7/6	PL84	6/6	UF41	10/6
5Z4G	7/6	30C18	11/6	EB91	2/3	EY51	7/6	PL500	13/-	UF80	7/-
6/30L2	12/-	30F5	16/-	EBC33	8/-	EY86	6/6	PL504	13/6	UF85	6/9
6AL5	2/3	30FL1	13/9	EBC41	9/6	EZ40	8/-	PL508	23/6	UF89	6/9
6AM6	2/9	30FL12	14/6	EBF80	6/9	EZ41	8/-	PL802	14/6	UL41	10/9
6AQ5	4/6	30FL14	12/-	EBF89	6/3	EZ80	4/6	PM84	7/6	UL44	20/-
6AT6	4/-	30L1	6/6	ECC81	3/9	EZ81	4/9	PX25	10/6	UL84	7/-
6AU6	4/6	30L15	14/-	ECC82	4/9	GZ32	8/9	PY32	10/-	UM84	6/6
6BA6	4/6	30L17	15/6	ECC83	7/-	GZ34	9/9	PY33	10/-	UY41	7/6
6BE6	4/9	30P4	12/-	ECC85	5/-	KT61	8/9	PY81	5/3	UY85	5/9
6BJ6	8/6	30P12	13/9	ECC91	3/-	KT66	16/-	PY82	5/3	VP4B	10/-
6BW6	18/-	30P19	12/-	ECC804	12/-	N78	17/6	PY83	5/9	W119	7/-
6F13	3/6	30PL1	13/9	ECF80	6/6	PABC80	7/-	PY88	6/9	Z77	2/9
6F14	9/-	30PL13	15/6	ECF82	5/9	PC86	10/3	PY800	7/6	Transistors	
6F23	14/3	30PL14	15/6	ECH35	6/-	PC88	10/3	PY801	6/9	AC107	3/6
6F25	13/-	35L6GT	8/6	ECH42	12/6	PC96	8/6	R19	6/6	AC127	2/6
6J6	3/-	35W4	4/6	ECH81	5/3	PC97	8/6	R20	12/6	AD140	7/6
6K7G	2/6	35Z4GT	5/-	ECH84	7/6	PC900	7/6	U25	13/-	AF115	3/-
6K8G	2/9	6063	12/6	ECL80	6/9	PCC84	6/6	U26	12/-	AF116	3/-
6L18	6/-	AC/VP2	10/-	ECL82	6/9	PCC85	6/-	U47	13/6	AF117	3/3
6V6G	3/3	AZ31	9/6	ECL83	8/6	PCC88	9/-	U49	13/6	AF125	3/6
6V6GT	6/6	B729	12/6	ECL86	8/-	PCC89	10/6	U52	4/6	AF127	3/6
6X4	4/3	CCH35	13/6	EF37A	6/6	PCC189	11/6	U78	4/3	OC26	5/9
6X5GT	5/9	CL33	18/6	EF39	4/9	PCF80	6/6	U191	12/6	OC44	2/3
7B7	7/-	CY31	6/9	EF41	10/9	PCF82	6/6	U193	8/6	OC45	2/3
7C6	6/9	DAC32	7/3	EF80	4/6	PCF86	11/6	U251	14/6	OC71	2/6
10F1	14/-	DAF91	4/3	EF85	5/3	PCF200	13/6	U301	10/6	OC72	2/6
10F18	7/-	DAF96	6/6	EF86	6/3	PCF800	13/6	U329	14/6	OC75	2/6
10P13	15/6	DF33	7/9	EF89	5/3	PCF801	6/9	U801	19/6	OC81	2/3
12AT7	3/9	DF91	2/9	EF91	2/9	PCF802	9/-	UABC80	6/6	OC81D	2/3
12AU6	4/9	DF96	6/6	EF94	4/6	PCF805	11/6	UAF42	10/3	OC82	2/3
12AU7	4/9	DH77	4/-	EF183	5/9	PCF808	12/-	UB41	6/6	OC82D	2/6
12AX7	4/9	DK32	7/6	EF184	5/6	PCL82	7/-	UBC41	9/-	OC170	2/6

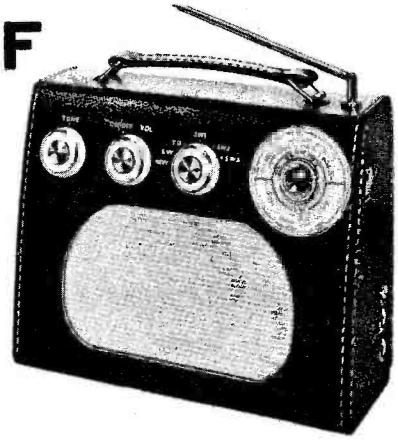
READERS RADIO

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

Postage on 1 valve 9d. extra. On 2 valves or more, postage 6d. per valve extra. Any Parcel Insured against Damage in Transit 6d. extra.

TRANSISTOR RADIOS TO BUILD YOURSELF

Backed by after sales service



NEW! roamer eight mkI

WITH VARIABLE TONE CONTROL

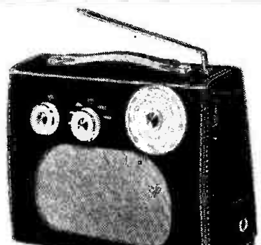
7 Tunable Wavebands: Medium Wave 1, Medium Wave 2, Long Wave, SW1, SW2, SW3 and Trawler Band. Built in Ferrite Rod Aerial for Medium and Long Waves. Five section 22in. chrome plated Telescopic aerial for Short Waves can be angled and rotated for maximum performance. Push pull output using 600 mW transistors. Socket for car aerial. Tape record socket. Selectivity switch. Switched earpiece socket complete with earpiece for private listening. Eight transistors plus 3 diodes. Famous make 7in. x 4in. Speaker. Air spaced ganged tuning condenser. On/Off switch volume control. Wave change switch and tuning control. Attractive case in rich chestnut shade with gold blocking. Size 9 x 7 x 4in. approx. Easy to follow instructions and diagrams make the Roamer Eight a pleasure to build.

Total Building Costs **£6.19.6**

P & P 7/6.

Parts Price List and Easy Build Plans 5/- (FREE with parts).

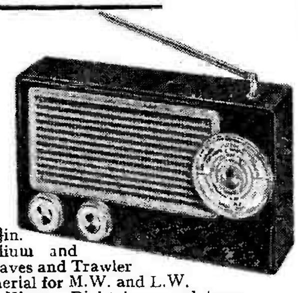
roamer seven mkIV



SEVEN FULLY 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 Medium and Long Waves. Five Section 22in. chrome plated telescopic aerial for Short Waves—can be angled and rotated for peak S.W. listening. Socket for Car Aerial. Powerful push-pull output. Seven transistors and two diodes including Micro-Alloy R.F. Transistors. Famous make 7 × 4in. P.M. speaker. Air spaced ganged tuning condenser. Volume/on/off control, wave change switches and tuning control. Attractive case with carrying handle. Size 9 × 7 × 4in. approx. Easy to follow instructions and diagrams make the Roamer 7 a pleasure to build. Parts price list and easy build plans 3/- (FREE with parts). Personal Earpiece with switched socket for private listening, 5/- extra.

Total building costs **£5.19.6** P. & P. 7/6

NEW! trans eight



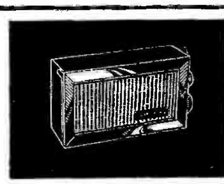
SIX WAVEBAND PORTABLE WITH 3in. SPEAKER

Attractive case in black with red grille and cream knobs and dial with polished brass inserts. Size 9 x $5\frac{1}{2}$ x $2\frac{5}{8}$in. approx. Tunable on Medium and Long Waves, three Short Waves and Trawler Band. Sensitive ferrite rod aerial for M.W. and L.W. Telescopic aerial for Short Waves. Eight improved type transistors plus 3 diodes. Push pull output. Ample power to drive a larger speaker. Parts price list and easy build plans 5/- (FREE with parts). Earpiece with switched socket for private listening 5/- extra.

Total building costs **89/6** P & P 5/6

pocket five

MEDIUM WAVE, LONG WAVE AND TRAWLER BAND PORTABLE WITH SPEAKER AND EARPIECE

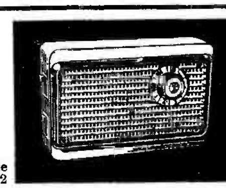


Attractive black and gold case. Size $5\frac{1}{2}$ x $1\frac{1}{2}$ x $3\frac{1}{2}$in. Tunable over both Medium and Long Waves with extended M.W. band for easier tuning of Luxembourg, etc. 7 stages—5 transistors and 2 diodes, supersensitive ferrite rod aerial, fine tone moving coil speaker, also Personal Earpiece with switched socket for private listening. Easy build plans and parts price list 1/6 (FREE with parts).

Total building costs **44/6** P. & P. 3/6

transona five

MEDIUM WAVE, LONG WAVE AND TRAWLER BAND PORTABLE WITH SPEAKER AND EARPIECE

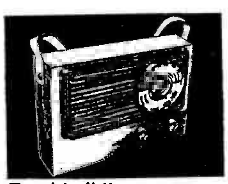


Attractive case with red speaker grille. Size $6\frac{1}{2}$ x $4\frac{1}{4}$ x $1\frac{1}{4}$in. 7 stage—5 transistors and 2 diodes, ferrite rod aerial, tuning condenser, volume control, fine tone moving coil speaker also Personal Earpiece with switched socket for private listening. Easy build plans and parts price list 1/6 (FREE with parts).

Total building costs **47/6** P. & P. 3/9

roamer six

SIX WAVEBAND PORTABLE WITH 3in. SPEAKER



Attractive case with gilt fittings. Size $7\frac{1}{4}$ x $5\frac{1}{4}$ x $1\frac{3}{4}$in. Tunable on Medium and Long waves, two short waves, Trawler Band Plus an extra M.W. band for easier tuning of Luxembourg, etc. Sensitive ferrite rod aerial and telescopic aerial for Short waves. 8 stages—6 transistors and 2 diodes including Micro-Alloy R.F. Transistors etc. (Carrying strap 1/6 extra). Easy build plans and parts price list 2/-. (FREE with parts).

Total building costs **79/6** P. & P. 4/6

** Callers side entrance Stylo 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 EIGHT	☐	ROAMER SEVEN	☐
TRANSONA FIVE	☐	TRANS EIGHT	☐
POCKET FIVE	☐	ROAMER SIX	☐

Parts price list and plans for ....

Name ....

Address ....

.... PW13

Complete stereo system – 28 gns.

The new Duo general-purpose 2-way speaker system is beautifully finished in polished teak veneer, with matching vynair grille. It is ideal for wall or shelf mounting either upright or horizontally.
Type 1 SPECIFICATION:–
Impedance 10 ohms. It incorporates Goodmans high flux 6"×4" speaker and $2\frac{1}{4}$" tweeter. Teak finish 12"×$6\frac{1}{4}$"×$5\frac{3}{4}$". **4 guineas each.** 7/6d. p. & p.
Type 2 as type 1. Size $17\frac{1}{2}$" × $10\frac{3}{4}$" × $6\frac{3}{4}$". Incorporating $10\frac{1}{4}$" × $6\frac{1}{4}$" bass unit and $2\frac{1}{4}$" tweeter. 3 ohms impedance **$5\frac{1}{2}$ guineas** plus 7/6 p. & p.

Garrard Changers from £7.19.6d. p. & p. 7/6d.
Cover and Teak finish Plinth £4.15.0d. 7/6d. p. & p.

The items illustrated can be purchased together for 28 gns.

The Duetto is a good quality amplifier, attractively styled and finished. It gives superb reproduction previously associated with amplifiers costing far more.
SPECIFICATION:–
R.M.S. power output: 3 watts per channel into 10 ohms speakers.
INPUT SENSITIVITY: Suitable for medium or high output crystal cartridges and tuners. Cross-talk better than 30dB at 1Kc/s.
CONTROLS: 4-position selector switch (2 pos. mono and 2 pos. stereo) dual ganged volume control.
TONE CONTROL: Treble lift and cut. Separate on/off switch. A preset balance control.

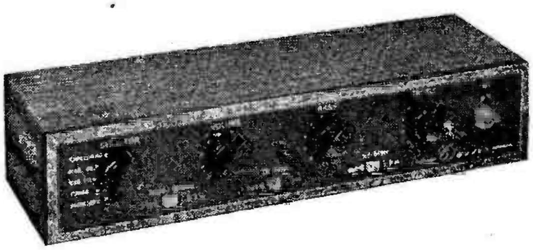
Duetto **Integrated Transistor Stereo Amplifier** **9GNS.** plus 7/6d. p. & p.

The above 5 items can be purchased together for £29.10 + £1.10.0 p. & p.

The Classic **£9** plus 7/6 p. & p.

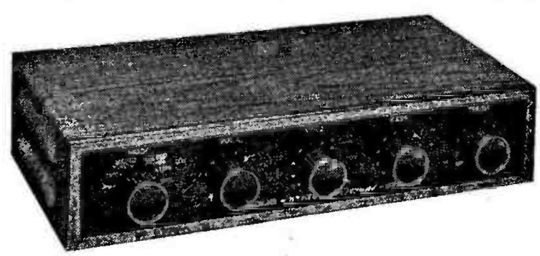
Controls: Selector switch Tape speed equalisation switch ($3\frac{3}{4}$ and $7\frac{1}{2}$ i.p.s.). Volume. Treble. Bass. 2 position scratch filter and 2 position rumble filter.

Specification: Sensitivities for 10 watt output at 1KHz into 3 ohms. *Tape head:* 3mV (at $3\frac{3}{4}$i.p.s.). *Mag.P.U.:* 2mV. *Cer.P.U.:* 80 mV. *Tuner:* 100mV. *Aux.:* 100mV. *Tape/Rec. output:* Equalisation for each input is correct to within ±2dB (R.I.A.A.) from 20Hz to 20KHz. *Tone control range:* Bass ±13dB at 60Hz. Treble ±14dB at 15KHz. *Total distortion:* (for 10 watt output) <1·5%. *Signal noise:* <–60dB. A.C. mains 200-250v. Built and tested. Size $12\frac{1}{2}$in. long, $4\frac{1}{4}$in. deep, $2\frac{3}{4}$in. high. Teak finished case.



The Viscount **£14.5** plus 7/6 p. & p.

Integrated High Fidelity Transistor Stereo Amplifier. Specification—Output: 10 watts per channel into 3 to 4 ohms speakers (20 watts monaural). Input: 6 position rotary selector switch (3 pos. mono and 3 pos. stereo), P.U., Tuner, Tape and Tape Rec. out. Sensitivities: All inputs 100mV into 1·8M ohm. Frequency Response: 40Hz–20KHz ±2dB. Tone Controls: Separate bass and treble controls; treble, 13dB lift and cut (at 15KHz); Bass, 15dB lift and 25dB cut (at 60Hz). Volume Controls: Separate for each channel. A.C. Mains Input: 200–240V. 50–60Hz. Size, $12\frac{1}{2}$" x 6" x $2\frac{3}{4}$" in teak finished case. Built and tested.
VISCOUNT MARK II for use with magnetic pick-ups specification as above. Fully equalised for magnetic pick-ups. Suitable for cartridges with minimum output of 4mV/cm/sec. at 1kc. Input impedance 47k. **£15.15** plus 7/6 p. & p.

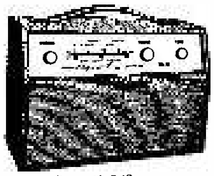


RADIO & TV COMPONENTS
R+TV
(ACTON) LIMITED

SPECIAL OFFER!

Complete stereo system comprising BALFOUR 4-speed autoplayer with stereo head, 2 Duo speaker systems, size 12in. x $6\frac{3}{4}$in. x $5\frac{3}{4}$in. Plinth (less cover) and the DUETTO stereo amplifier. All above items
£20 plus 20/- p. & p.

Also see opposite page



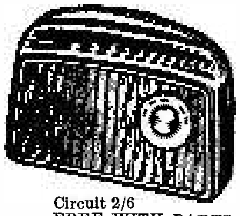
The ELEGANT SEVEN
Mk. III (350mW Output)

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: **9/6** extra.

Circuit 2/6
FREE WITH PARTS.

Price **£4.9.6** plus 7/6 P. & P.

The DORSET
(600mW Output)

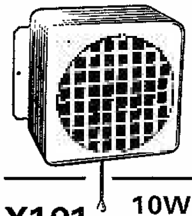


7-transistor fully tunable M.W.-L.W. superhet portable —with baby alarm facility. Set of parts. The latest modulised and pre-alignment techniques makes this simple to build. Sizes: 12 × 8 × 3in.

Price **£5.5.0** plus 7/6 P. & P.

MAINS POWER PACK KIT: **9/6** extra

Circuit 2/6
FREE WITH PARTS.

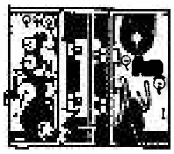


EXTRACTOR FAN

A.C. mains 230/250v. complete with pull switch. Size 6 × 6 × 4in.

Price **27/6** plus 7/6 P. & P.

X101 10W SOLID-STATE HI-FI AMP WITH INTEGRAL PRE-AMP



Specifications: *Power Output* (into 3 ohms speaker) 10 watts.
Sensitivity (for rated output): 1mV into 3K ohms (0·33 microamp).
Total Distortion at 1KHz at 5 watts, 0·35%, at rated output 1·5%.
Frequency Response: Minus 3dB points 20Hz and 40KHz.
Speaker: 3–4 ohms (3–15 ohms may be used).
Supply voltage: 24V. D.C. at 800mA (6–24V. may be used).

Price **69/6** plus 2/6 P. & P.

Control assembly: including resistors and capacitors. 1. Volume: PRICE **5/-**. 2. Treble: PRICE **5/-**. 3. Comprehensive bass and treble: PRICE **10/-**. The above 3 items can be purchased for use with the X101.

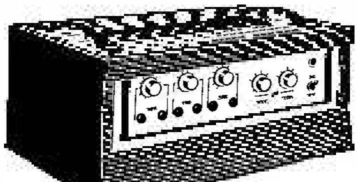
Power Supplies for the X101:
P101 M (for mono) **35/-** plus 4/6 p. & p.
P101 S (for stereo) **42/6** plus 4/6 p. & p.

CAR TRANSISTOR IGNITION SYSTEM
by famous manufacturer

For 6 volt or 12 volt positive earth systems. Comprising: special high voltage working hermetically sealed silicon transistor mounted in finned heat-sink, high output ignition coil, ballast resistor and hardwear (screws, washers etc.).

Price **£4.19.6** plus 5/- P. & P.

50 WATT AMPLIFIER A.C. Mains 200-250V



An extremely reliable general purpose valve amplifier. Its rugged construction yet space age styling and design makes it by far the best value for money.

TECHNICAL SPECIFICATIONS
3 electronically mixed channels, with 2 inputs per channel, enables the use of 6 separate instruments at the same time. The volume controls for each channel are located directly above the corresponding input sockets. **SENSITIVITIES AND INPUT IMPEDANCES.** Channels 1 & 2 4mV at 470K. These 2 channels (4 inputs) are suitable for microphone or guitars. Channels 3 & 4 300mV at 1m. Suitable for most high output instruments (gram, tuner, organ etc.). Input sensitivity relative to 10w output. **TONE CONTROLS ARE COMMON TO ALL INPUTS. Bass Boost** +12dB at 60 Hz. **Bass Cut** —13dB at 60 Hz. **Treble Boost** +11dB at 15 KHz. **Treble Cut** —12dB at 15 KHz. With bass and treble controls central —3dB points are 30 Hz and 20 KHz. **POWER OUTPUT:** For speech and music 50 watts rms. 100 watts peak. For sustained music 45 watts rms. 90 watts peak. For sine wave 38·5 watts rms. Nearly 80 watts peak. Total distortion at rated output 3·2% at 1KHz. Total distortion at 20 watts 0·15% at 1KHz. Output to match into 8 or 15 ohms speaker system. **NEGATIVE FEEDBACK** 20dB at 1 KHz. **SIGNAL TO NOISE RATIO** 60dB. **MAINS VOLTAGES** adjustable from 200–250V. A.C. 50-60 Hz. A protective fuse is located at the rear of unit. Output impedance 3, 8 and 15 ohms.

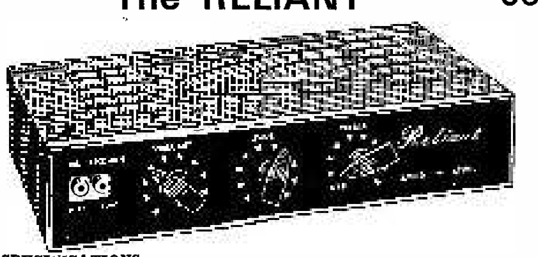
Price **£28.10** plus 20/- p. & p.

B.S.R. TD-2 TAPE DECK

Takes 5¾in. spools, fitted with B.S.R. ½ Track Heads. Size 13½in. long by 8¾in. wide.

Price **£8.19.6** plus 7/6 P. & P.

The RELIANT
SOLID STATE GENERAL PURPOSE AMPLIFIER

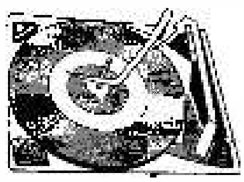


SPECIFICATIONS
Output—10 watts
Inputs—1. -xtal mic 10mV
2. -gram/radio 250mV
Output Impedance—3 to 4 ohms
Tone Controls—Treble control range ±12dB at 10 KHz
Bass control range ±13dB at 100Hz
Frequency Response—(with tone controls central) Minus 3dB points at 20Hz and 40KHz. Signal to Noise Ratio—better than —60dB. Transistors—4 silicon Planar type and 3 Germanium type. Mains input—220/250V. A.C. Size of chassis—10¼" × 4½" × 2¼". For use with Std. or L.P. records, musical instruments, all makes of pick-ups and mikes. Separate bass and treble lift control. Two inputs with control from gram. and mike. Built and tested. 8" × 5" speaker to suit price **14/6** plus 1/6 p. & p. Crystal mike to suit **12/6** plus 1/6 p. & p.

RELIANT Mk. I
As above less teak case
£5.15 plus 7/6 P. & P.

RELIANT Mk. II
In teak finished case.
£6.16 plus 7/6 P. & P.

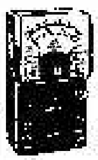
RECORD PLAYER SNIP A.C. Mains 240V



The "Princess", 4-speed automatic record changer and player engineered with the utmost precision for beauty, long life, and trouble free service. Will take up to ten records which may be mixed 7" to 10" or 12". Patent stylus brush cleans stylus after each playing and at shut off, the pick-up locks itself into its recess, a most useful feature with portable equipment—other features include pick-up height adjustment and stylus pressure adjustment. This truly is a fine instrument which you can purchase this month at only **£5.19.6** complete with cartridge and ready to play. Post and ins. 7/6 extra.

ONLY **£5.19.6** plus 7/6 P. & P.

POCKET MULTI-METER



Size 3⅞ × 2½ × 1⅛in. Meter size 2½ × 1⅛in. Sensitivity 1,000 O.P.V. on both A.C. and D.C. volts. 0–15, 0–150, 0 1,000 D.C. current 0–150mA. Resistance 0 100kΩ. Complete with test prods, battery and full instructions.

42/6 plus 3/6 P. & P.

FREE GIFT for limited period only. 30 watt Electric Soldering Iron value **15/-** to every purchaser of the Pocket Multi-Meter.

STEREO PRE-AMPLIFIER

Inputs—6 position rotary switch (3 position mono, 3 position stereo). Tuner 150mW into 680k. Magnetic pick-up fully equalised and suitable for magnetic cartridges with minimising output of 4mV/cm/sec. Load 47k. Ceramic pickup 150mV into 680k. Sensitivities taken for 200mV output. Controls—separate volume controls for each channel. Twin ganged bass, 12dB lift and 15dB cut at 60c/s. Twin ganged treble, 10dB lift and 15dB cut at 10kc/s. Voltage required 23–30V DC at 5mA. Size 12¼ x 3¼ x 2⅝in. In teak finished case, complete with front panel and knobs. Built and tested.

£7.7.0 plus 5/- P. & P.

CYLDON 2 TRANSISTOR U.H.F. TUNER

Brand new. Complete with circuit diagram.

Price **£2.10.0** plus 1/- P. & P.

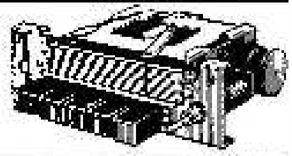
THREE-IN-ONE HI-FI 10 WATT SPEAKER

A complete Loud Speaker system on one frame, combining three matched ceramic magnet speakers with a low loss crossover network. Peak handling power 10 watts. Impedance 15 ohms. Flux density 11,000 gauss. Resonance 40 60 c/s. Frequency range 50c/s to 20Kc/s. Size 13½ × 8¹/₁₆ × 4½in. By famous manufacturer.

List price £7 OUR PRICE **74/6** plus 5/- P. & P.

Similar speaker to the above without tweeters in 3 and 15 ohms 44/6 plus 5/- p. & p.

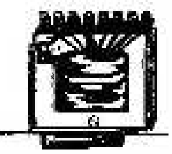
PYE CAR RADIO
Push Button Tuning Heart



This PRESTOLOCK 5 station Push-Button Tuner Heart with Manual Over-ride is an ideal basis for a quality AM car radio. Size 6¼" × 4" × 2".

25/- plus 3/- P. & P.

QUALITY MAINS TRANSFORMER



Input 250 volts. OUTPUT (All RMS values) 4 windings of 11·5 volts connected in series total 46 volts at 4·5 amps (conservatively rated). The following combinations may be used. 1. 23-0-23 volts. 2. 46 volts.
Both of these above voltages are commonly used in medium to high powered transistor amplifiers, power supplies, etc.

Price **35/-** plus 7/6 P. & P.

TERMS C.W.O.
All enquiries S.A.E.

RADIO & TV COMPONENTS
RTV
(ACTON) LIMITED

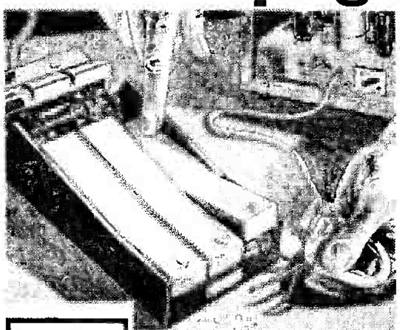
Goods not despatched outside UK

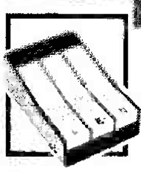
RADIO & T.V. COMPONENTS (ACTON) LTD
21c High Street, Acton, London W.3.
Also at 323 Edgware Road, London W.2.
ALL ORDERS BY POST TO OUR ACTON ADDRESS

MAINS Keynector

A REVOLUTIONARY PRODUCT

cuts out plugs





SAFEST & QUICKEST WAY TO CONNECT ELECTRICAL EQUIPMENT TO THE MAINS

No plugs—no sockets—no risk of bare wires. To connect anything electrical, from an oscilloscope to an electric drill, simply open the fuse housing, depress the keys, insert the wires and close the housing. A neon light on the front of the Keynector glows to indicate proper connection. Multi-parallel connections can be made up to 13 amps. Keys are colour coded and lettered LEN for quick identification. The Keynector casing is in two-tone plastic and measures 5 x 3 x 1¾in. Price 39/6, plus 5/- p. & p.

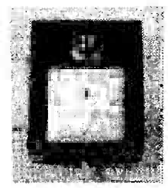
E. B. INSTRUMENTS
DIVISION OF ELECTRONIC BROKERS LTD.
49-53 PANCRAS ROAD, LONDON, N.W.1.
Telephone: 01-837 7781

AUDIO EFFECTS

5 SHAW LANE HALIFAX YORKS.

Buy with confidence and obtain the right results. Refunds without question if any of our products fail to give 100% satisfaction.

REVERBERATION AMPLIFIER. Self-contained transistorised battery operated. An entirely different approach to sound reproduction. Normally sound reproduction from a single source has a flat, one-dimensional effect. With this unit proper sound delay through reverberation, tones are created with a truly third dimension for concert hall originality. Two controls adjust volume and reverberation. Simply plug microphone, guitar, etc. in and the output into your amplifier. Supplied in a beautiful walnut cabinet. 7½ x 3 x 4½in. £10.4.0. P.P. & Ins. 6/-.



POWER CONTROLLER. Power at your finger tips. Not merely half wave control but full wave. A single variable control gives zero to full power. Uses latest 15amp 3kW triac and special triggering device. Ideal for all types of lighting, fires, motors, drills, etc. Complete with box, power socket, cables, etc. In kit form with easy to follow instructions £6.9.6. Ready built £9.4.6 plus 5/6 P.P. & Ins.

VOX SWITCH. This sound operated switch is ideal for mobile TX work, tape recorder switching, etc. You speak, it switches. High and medium imp. inputs. AF take off point. Drives your 12 volt relay. In kit form with full instructions, 42/6. Ready built, tested and guaranteed, 62/6 plus 2/6 P.P.

METRONOME UNIT. Variable beat. Listen while you play and keep in time. Easily built, pocket size with personal mini earphone. In kit form 27/6 post paid. Ready built in an attractive black and white polythene case 37/6 post paid.

MORSE OSCILLATOR. PC board, transistors, high stab. components, battery carrier, ear piece. Adjustable tone. Just attach your key. Drives phones or speakers. In kit form 17/6 post paid. Ready built in similar case as above, 25/- post paid.

JUST ARRIVED IN STOCK. Texas transistors. Complementary symmetry. Driver, NPN, PNP output. The set of three ONLY 6/6 post paid.

Free lists with every order. For lists only send 1/6 *(deductable from first order).*

4-STATION INTERCOM

£7/15/0

Solve your communication problems with this **4-Station Transistor Intercom** system (1 master and 3 Subs), in de-luxe plastic cabinets for desk or wall mounting. Call/talk/listen from **Master** to **Subs** and **Subs** to **Master**. Ideally suitable for Business, Surgery, Schools, Hospital, Office and Home. Operates on one 9V battery. On/off switch. Volume control. Complete with 3 connecting wires each 66ft. and other accessories. P. & P. 7/6.

MAINS INTERCOM

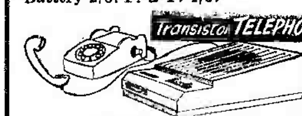
No batteries—no wires. Just plug in the mains for instant two-way, loud and clear communication. On/off switch and volume control. Price 12 gns. P. & P. 8/6 extra.

INTERCOM/BABY ALARM

OUR PRICE ONLY **3 gns.**

Same as 4-Station Intercom for two-way instant communication. Ideal as Baby Alarm and Door Phone. Complete with 66ft. connecting wire. Battery 2/6. P. & P. 4/6.

Transistor TELEPHONE AMPLIFIER

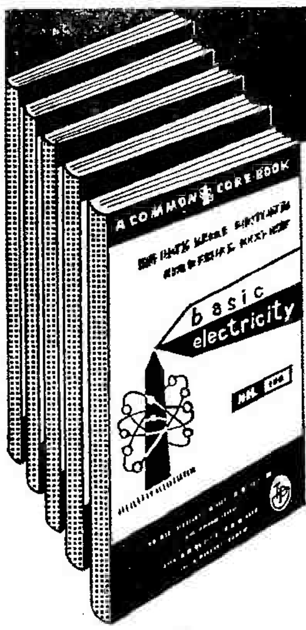


59/6

Why not boost business efficiency with this incredible De-luxe **Telephone Amplifier.** Take down long telephone messages or converse without holding the handset. A useful office aid. On/off switch. Volume Control. Battery 2/6 extra. P. & P. 3/6. Full price refunded if not satisfied in 7 days.

WEST LONDON DIRECT SUPPLIES (P/W1)
169 KENSINGTON HIGH STREET, LONDON, W.8.

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

'Everything is clearly set out . . .'
. . . I am well pleased with this pictorial system. Everything is clearly set out in diagrams . . . *L.P., Co. Armagh.*

'. . . very pleased with the set . . .'
. . . I was very pleased with the set of Basic Electronics. Please send Basic Electricity . . . *D.W., Margate.*

'. . . how understandable your books are . . .'
. . . Pleased to say how understandable your books are, I now have a sound knowledge of the subject . . . *A.A., Hull.*

A TECH-PRESS PUBLICATION

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 75/- Cash Price, or Down Payment of 20/- followed by 3 fortnightly payments of 20/- each. BASIC ELECTRONICS 90/- Cash Price, or Down Payment of 20/- followed by 4 fortnightly payments of 20/- each. 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 ....

....

ELECTROVALUE

Everything brand new and to specification • Large stocks • Good service

RESISTORS:

Code	Power	Tolerance	Range	Values available	1 to 9	10 to 99	100 up
C	1/20W	5%	100Ω–220KΩ	E12	16	14	13
C	1/8W	5%	4.7Ω–1MΩ	E24	2.5	2	1.75
C	1/4W	10%	4.7Ω–10MΩ	E12	2.5	1.75	1.5
C	1/2W	5%	4.7Ω–10MΩ	E24	3	2.25	2
MO	1/2W	2%	10Ω–1MΩ	E24	9	8	7
C	1W	10%	4.2Ω–10MΩ	E12	4	3.25	3
WW	1W	10%+1/20Ω	0.22Ω–3.3Ω	E12	15d all quantities		
WW	3W	5%	12Ω–10KΩ	E12	15d all quantities		
WW	7W	5%	12Ω–10KΩ	E12	15d all quantities		

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

Values: E12 denotes series: 1, 1.2, 1.5, 1.8, 2.2, 2.7, 3.3, 3.9, 4.7, 5.6, 6.8, 8.2 and their decades.
E24 denotes series: as E12 plus 1.1, 1.3, 1.6, 2, 2.4, 3, 3.6, 4.3, 5.1, 6.2, 7.5, 9.1 and their decades.

Prices are in pence each for each ohmic value and power rating. (Ignore fractions of one penny on total resistor order)

COLVERS 3 WATT WIRE-WOUND POTENTIOMETERS:
10Ω, 15Ω, 25Ω, 50Ω, 100Ω, 150Ω, 250Ω, 500Ω, 1KΩ, 1.5KΩ, 2.5KΩ, 5KΩ, 10KΩ, 15KΩ, 25KΩ, 50KΩ. Price only **5/6** each.

CARBON TRACK POTENTIOMETERS: Double wiper ensures minimum noise level. Long plastic spindles.

	each
Single gang linear: 220Ω, 470Ω, 1K etc. to 2.2MΩ	2/6
Single gang log: 4K7, 10K, 22K, etc. to 2.2MΩ	2/6
Dual gang linear: 4K7, 10K, 22K etc. to 1MΩ	8/6
Dual gang log: 4K7, 10K, 22K etc. to 2M2Ω	8/6
Log/Anti-log: 10K, 47K, 1MΩ only	8/6
Dual anti-log: 10K only	8/6
Any type with ½ amp. double pole mains switch:	extra 2/3

FETS n-channel low cost general purpose 2N5163, 25 volt, only **5/-** each. Audio/r.f. Texas 2N3819 **9/-**, Motorola 2N5459 (MPF105) **9/6** each.

NEW PLESSEY INTEGRATED CIRCUIT POWER AMPLIFIER TYPE SL403A. Only **57/-** each. Operates with 18V power supply. Sensitivity 20mV into 20MΩ, 3 watts into 7.5Ω. PE Nov. 69 Stereo Amplifier kit less metal work. **£11/18/-** NET complete.

WATT BAILEY AMPLIFIER COMPONENTS:
Transistors for one channel £7/9/6 list, with 10% discount only **£6/14/6**
Transistors for two channels **£14/19/-** list, with 15% discount only **£12/14/-**
Capacitors and/resistors for one channel list **£2.**
Printed circuit board free with each transistor set.
Complete unregulated power supply kit **£4/14/6** mono or stereo, subject to discount.
Complete regulated power supply kit **£9/5/-** subject to discount. Further details on application.

SINCLAIR IC.10 Integrated Circuit Amplifier and Pre-amplifier This remarkable monolithic integrated circuit amplifier and pre-amp now available from stock. The equivalent of 13 transistor/18 resistor circuit plus 3 diodes and the first of its kind ever. It is d.c. coupled and applicable to an unusually wide range of uses as detailed in the manual provided with it. As advertised, post free **59/6 NET.**

CARBON SKELETON PRE-SETS. Small, high quality, type PR: Linear only, 100Ω, 220Ω, 470Ω 1KΩ, 2K2, 4K7, 10K, 22K, 47K, 100K, 220K, 470K, 1MΩ, 2M2, 5M, 10MΩ vertical or horizontal mounting, **1/-** each.

S-DeCs put an end to "birdsnesting". Components just plug in. Saves valuable time. Use components again and again. S-DeC only **30/6** post free. Compact **T**-DeC, increased capacity, may be temperature-cycled T-DeC only **51/-** post free.

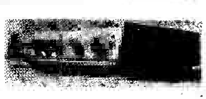
CAPACITORS: All new stock

High ripple current types:
2000µF 25V **7/4**; 2000µF 50V **11/4**; 5000µF 25V **12/6**; 5000µF 50V **21/11**; 1000µF 100V **16/3**; 2000µF 100V **28/9**; 5000µF 70V **36/-**; 5000µF 100V **58/3**; 1000µF 50V 8/2; 2500µF 64V **15/5**; 2500µF 70V 19/6.

Medium elecs.
Axial leads: Values (µF/V): **50/50 1/9; 100/25 1/9; 100/50 2/6;** 250/25 **2/6**; 250/50 **3/9**; 500/25 3/9; 1000/10 **3/-**; 500/50 **4/6**; 1000/25 **4/6**; 1000/50 **7/-**; 2000/25 **6/-**.

Small elecs.
Axial leads: 5/10, 10/10, 25/10, 50/10 **1/-** each, 25/25, 47/25, 100/10, 220/10 **1/3** each.

PEAK SOUND ENGLEFIELD KITS



Brilliant new styling and available in two forms:
Stereo 15 watts per channel
In kit form with complete amplifier and pre-amplifier modules and power supply. **Build it 12+12 or 25+25**
Output per channel into 15Ω 12 watts R.M.S. Price **£38/4/- net**

25 WATTS PER CHANNEL As above but Output per channel into 15Ω 25 watts R.M.S. Price **£53/15/- Net**
Brief specification: Total harmonic distortion 0·1%.
Inputs: Magnetic, Ceramic, Tape, Radio Signal to noise ratios: Better than 60dB all inputs. O/load factor 28dB all channels.

ENGLEFIELD CABINET to house either above assemblies (as illustrated) **£6 Net** OTHER PEAK SOUND PRODUCTS AS ADVERTISED.

MULLARD Sub-min electrolytic C426 range- Price **1/3** each. Axial leads, 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.

Wavechange switches: 1P 12W; 2P 6W; 3P 4W; 4P 3W long spindles, **4/9** each.

Slider switches, double pole double throw, **3/-** each.

BARGAINS IN NEW TRANSISTORS

All power types supplied with free insulating sets

2N696	5/6	2N5192	25/–
2N697	6/–	2N5195	29/3
2N706	3/–	40406	16/3
2N1132	14/3	40408	14/6
2N1302	4/–	AC126	6/6
2N1303	4/–	AC127	6/–
2N1304	4/6	AC128	6/–
2N1305	4/6	AC176	11/–
2N1306	6/9	ACY22	3/9
2N1307	6/9	ACY40	4/–
2N1308	8/9	AD140	19/–
2N1309	8/9	AD149	17/6
2N1613	6/6	AD161 }	16/– pr.
2N1711	7/4	AD162 }	
2N2218	10/6	AF118	16/6
2N2147	18/9	AF124	7/6
2N2369A	6/9	AF127	7/–
2N2646	10/9	BA102	9/–
2N2924	4/3	BC107	3/6
2N2925	5/3	BC108	3/–
2N2926R	2/6	BC109	3/6
2N2926O	2/6	BC147	4/3
2N2926Y	2/3	BC148	3/3
2N2926G	2/6	BC149	4/3
2N3053	5/6	BC153	10/–
2N3054	14/3	BC154	11/–
2N3055	16/6	BC157	3/9
2N3391A	5/6	BC158	3/6
2N3702	3/6	BC159	3/9
2N3703	3/3	BC167	2/6
2N3704	3/9	BC168	2/3
2N3705	3/5	BC169	2/6
2N3706	3/3	BC177	6/3
2N3703	4/–	BC178	5/6
2N3708	2/9	BC179	6/–
2N3709	3/–	BD121	18/–
2N3710	3/3	BD123	24/3
2N3711	3/11	BF178	10/6
2N3904	7/6	BFX29	10/9
2N3906	7/6	BFX85	8/3
2N3731	23/–	BFX88	7/9
2N3820	25/6	BFY50	4/6
2N3325	10/6	BFY51	4/3
2N3794	3/3	BSX20	3/9
2N4286	3/3	MJ480	21/–
2N4289	3/3	MJ481	27/–
2N4291	3/3	MJ491	30/–
2N4292	3/3	P346A	5/9
2N4410	4/9	V405A	7/9

MAIN LINE AMPLIFIER KITS as advertised. Prices Net. Authorised dealer.

COMPONENT DISCOUNTS:
10% on orders for components for £5 or more.
15% on orders for components for £15 or more.
(No discount on net items).

POSTAGE AND PACKING:
Free on orders over £1.
Please add 1/- if order is under £1.
Overseas orders welcome: carriage charged at cost.

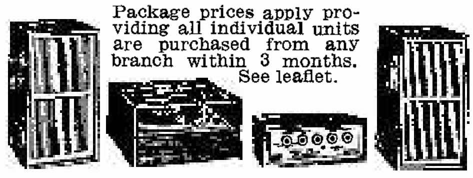
ELECTROVALUE

(Dept. PW.1) 28 ST. JUDES ROAD, ENGLEFIELD GREEN, EGHAM, SURREY. *Telephone: Egham 5533 (STD 0784-3)*
Open 9—5.30 Sats. 1 p.m.

R.S.C. SENSATIONAL HIGH FIDELITY STEREO 'PACKAGE' OFFERS

30 WATT OUTPUT
★ Goldring Transcription Turntable on Plinth
★ Shure or Goldring Magnetic Pick-up Cartridge
★ Super 30 Amplifier in veneered housing
★ Pair of Stanway II Loudspeaker Units
Special total price. Four fully wired units ready to "plug-in". Carr. 30/-. **86 Gns.**
TERMS AVAILABLE ALL PACKAGE OFFERS

Matching as recommended for optimum performance. Send for coloured brochure showing other money saving offers.



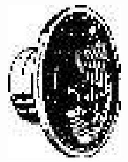
Package prices apply providing all individual units are purchased from any branch within 3 months. See leaflet.

EXTREMELY ATTRACTIVE PLINTHS finished in Teak or Afrormosia veneer. Transparent plastic "roll over" cover.

30 WATT OUTPUT
★ Garrard SP25 Mk II Turntable on Plinth
★ Goldring CS90 Ceramic P.U. Cartridge with diamond stylus
★ Super 30 amplifier in veneered housing
★ Pair Stanway II Speaker Units
Four fully wired units ready to "plug-in" Special total price **76 Gns.** Carr 30/-.

13 WATT OUTPUT
★ Garrard SP25 Mk II 4 sp. player unit on plinth
★ Goldring CS90 Ceramic P.U. Cartridge
★ TA12 Amplifier in veneered housing
★ Pair of Dorchester Loudspeaker Units. Special total price. **51 GNS.** Carr. 25/-
Or Dep. £10 and 9 mthly payments £5.11.0 (Total £59.19.0). Transparent plastic cover 3 gns. extra

AUDIOTRINE HIGH FIDELITY LOUDSPEAKERS



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

				HF100D	10"	15W	£5.15.0
HF510L	5"	10W	57/9	HF120	12"	15W	79/9
HF801D	8"	8W	59/9	HF120D	12"	15W	89/9
HF811D	8"	10W	4 gns.	HF126	12"	15W	£5. 5.0
HF102D	10"	10W	65/-	HF126D	12"	15W	£5.15.0

HIGH FIDELITY LOUDSPEAKER UNITS
Cabinets latest style Satin Teak or Afrormosia veneer. Acoustically lined or filled woollen damping. Ported where appropriate, credit terms available

DORCHESTER Size 16 x 11 x 9in. Appr. Range 45–15,000 c.p.s. Rating 8–10 watts. Fitted High flux 13 x 8in. Dual Cone spkr. Imp. 3 or 15 ohms **£8.19.9** Carr. 7/6

STANWAY II Size 20x10¾x9¼in. Rating 10 watts. Incorporating Fane 13x8in. speaker with rubber cone surround and 11,000 line magnet. High flux tweeter. Handsome Scandinavian design cabinet. Range 35–20,000 c.p.s. Imp. 15 ohms. Gives smooth realistic sound output. **16 Gns.**

GLOUCESTER Size 25 x 16 x 10in. 12in. High flux 12,000 line speaker. Cross-over unit and Tweeter. Rating 10 watts. Frequency range 40–20,000 c.p.s. Impedance 15 ohms. **12½ Gns.**

E2 CABINET


Size 17" wide 14¼" deep, 11¾" high. Cut for TA12, Super 15, Super 30 and other amplifiers. 'Roll over' transp. plastic cover. Satin Teak or Afrormosia veneer finish Inc carr. **8 Gns.**

MOTOR BOARDS cut for Garrard Turntables and many other units. Price **12/9**

RECORD PLAYING UNITS
Money saving units. Mounted on Plinth. Supplied with transparent plastic cover. Ready to plug into Amplifier or Tape recorder.

RP2C Garrard SP25 Mk II (with heavy turntable) fitted Goldring CS90 high compliance ceramic Stereo/Mono cartridge with diamond stylus. Inc. Carr. **22 Gns.**

RP3C Goldring Lenco GL68 Transcription unit and CS90 cartridge. Inc. Carr. **28 Gns.**

Other types available with Magnetic cartridges and with alternative design plinths.

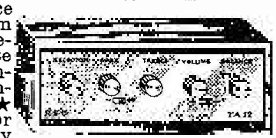
R.S.C. PLINTHS
for Record Playing units. cut for Garrard 1025, 2025, 3000, AT60, SP25 etc.

59/9

Available with trans. plastic cover, Inc. Carr **6 Gns.**

INTEREST CHARGES REFUNDED On Credit Sales settled in 3 months.

R·S·C TA12 13 WATT STEREO AMPLIFIER
FULLY TRANSISTORISED, SOLID STATE CONSTRUCTION
HIGH FIDELITY OUTPUT OF 6·5 WATTS PER CHANNEL



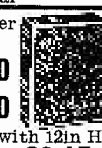
Designed for optimum performance with any crystal or ceramic Gram P.U. cartridge, Radio tuner, Tape recorder, 'Mike' etc. ★ 3 separate switched input sockets on each channel ★ Separate Bass and Treble controls ★ Slide Switch for mono use ★ Speaker Output 3–15 ohms ★ For 200–250v A.C. mains ★ Frequency Response 30–20,000 c.p.s. —2dB ★ Harmonic Distortion 0·3% at 1000 c.p.s. Hum and Noise —70dB ★ Sensitivities (1) 300mV (2) 50mV (3) 100mV (4) 2m V. Output rating I.H.F.M. ★ Handsome brushed silver finish Facia and Knobs. Complete kit of parts with full wiring diagrams & instructions. **12½ GNS.** Carr. 7/9. Factory built with 12 mth gntee **16 GNS** or Deposit **£5.2.6** and 9 mthly pymts **31/6** (Total **£19.6.0**) Or in Teak or Afrormosia veneer housing **19½ Gns.** Dep. £5.10.6 and 9 mthly pymts 39/-. (Total £23.1.6).

AUDIOTRINE HI-FI SPEAKER SYSTEMS

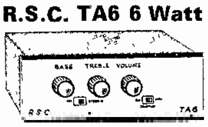

Consisting of matched 12in. 11,000 line 15 watt 15 ohm high quality speaker, cross-over unit and tweeter. Smooth response and extended frequency range ensure surprisingly realistic reproduction. **£5.15.0** Carr. 5/9
Or **Senior 15 watt** inc. HF 126 15,000 line Speaker **£6.15.0** Carr. 6/6

LINEAR L10 HIGH FIDELITY 10W AMPLIFIER
with separate Pre-amp. Magnet P.U. matching. To clear **10 GNS.**

HI-FI SPEAKER ENCLOSURES
Teak or Afrormosia veneer finish. Modern design. Acoustically lined.

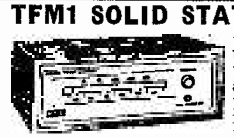


Prices Inc. carr.
JE8 Size 16 x 11 x 9in. Pressurised. Gives pleasing results with any 8in. Hi-Fi 'speaker. **£4.10.0**
SE8 For optimum performance with any 8in. Hi-Fi 'speaker. Size 22 x 15 x 9in. Ported. **£5.10.0**
SE10 For outstanding results with 10in Hi-Fi 'spkr Size 24x15x10in. P'td. **£5.15.0**
SE12 For exclnt prfmnce with 12in Hi-Fi speaker and Tweeter. Size 25 x 16 x 10½in. **£6.15.0**

R.S.C. TA6 6 Watt HIGH FIDELITY 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 x 2¾ x 5¼in. Attractive brushed silver finish facia plate 10¼ x 3¼in. and matching knobs. Complete kit of parts with full wiring diagrams and instructions. Carr. 7/6 **7 Gns.**
Or factory built with 12 months' guarantee. £8.19.9

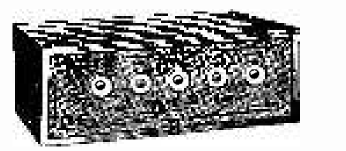
R.S.C. TFM1 SOLID STATE VHF/FM RADIO TUNER
Total cost of parts with detailed wiring diagrams & instructions. Inc. Carr. **14 Gns.**
Or factory built 16½ gns. Or in Teak finished cabinet as illustrated 19½ gns. Terms: Deposit £5 and 9 monthly payments £2. Total £23.



★ **High-sensitivity** ★ **200-250v. A.C. Mains operation.** ★ **Sharp A.M. Rejection.** ★ **Drift-free reception.** ★ **Output ample for any amplifier (approx. 500 m.v.).** ★ **Simple alignment instructions.** ★ **Output available for feeding tuning meter.** ★ **Output for feeding Stereo Multiplexer.** ★ **Tuner head using silicon Planar Transistors.** ★ **Designed for standard 80 ohm co-axial input.** Visually matching our Super 15 and 30 amplifiers and of the same high standard of performance and reliability. The pre-wired tuning head facilitates speed and simplicity of construction. Printed circuitry. Only high grade transistors and components used. A quality product at considerably less than the cost of comparable units. Stereo version, all parts **20 gns.** Inc. carr. Assembled **22½ gns.** inc. carr.

R.S.C. SUPER 30 MK II HIGH FIDELITY STEREO AMPLIFIER
High Grade Components. Specifications comparable with units costing considerably more.

TRANSISTORS 9 high quality types in each channel.
OUTPUT 10 Watts R.M.S. continuous into 15Ω (per channel). 15 Watts R.M.S. continuous into 3Ω.
INPUT SENSITIVITIES Mag. P.U. 4 m.V. Ceramic P.U. 35 mV. Tape Amp. 400 mV. Aux. 100 mV. Mic. 5 mV. Tape Head 2·5 mV.
FREQUENCY RESPONSE ±2 dB. 10–20,000 c.p.s.
TREBLE CONTROL +17 dB to —14 dB at 10 Kc/s.
BASS CONTROL +17 dB to —15 dB at 50 c/s.
HUM LEVEL —80 dB.



Employing Twin Printed Circuits. 200/250v. A.C. mains operation.
HARMONIC DISTORTION 0·1% at 10 watts 1,000 c.p.s.
CROSS TALK 52 dB at 1,000 c.p.s.
CONTROLS 5 Position Input Selector, Bass, Treble, Vol., Bal., Stereo/Mono Switch, Tape Monitor Switch, Mains Switch.
INPUT SOCKETS (1) P.U. (2) Tape Amp. (3) Radio. (4) Mic. or Tape Head. (Operation of Input Selector assures appropriate equalisation).

CHASSIS Strong Steel construction Approx. 12 x 3 x 8in.
FACIA PLATE Attractive design in rigid Perspex. Spun silver matching control knobs as available.
COMPLETE KIT OF PARTS Carr. 15/- **22 Gns.** Point to point wiring diagrams and detailed instructions.
Eminently suitable for use with any make of Pick-up or Mic. (Ceramic or Magnetic, Moving Coil, Ribbon or Crystal) currently available. Superb sound output quality can be obtained by use with first-rate ancillary equipment. Unit factory built **28 Gns.** or Deposit **£7.5.0** and 9 monthly payments **56/3** (Total **£32.11.3**) or in Teak or Afrormosia veneer housing **31 Gns.** Carr. 15/-. Terms: Deposit **£7.3.6** and 9 monthly payments of **64/-** (Total **£35.19.6**). Send S.A.E. for leaflet.

R.S.C. SUPER 15 HIGH FIDELITY SOLID STATE AMPLIFIER
Approx. as Super 30 but single channel. Complete kit with full constructional details and point to point wiring diagrams.
Carr. 12/6 **12½ Gns.**
or factory built **15½ Gns.** Carr. 12/6. Terms: Deposit **4 Gns.** and 9 monthly payments **31/1** (Total **£18.3.9**) or in Teak or Afrormosia veneered housing. **19 Gns.**

BRADFORD 10 North Parade. (Half-day Wed.) Tel. 25349
BLACKPOOL (Agent) O. & C. Electronics, 227 Church Street
BIRMINGHAM 30/31 Gt. Western Arcade 021-236-1279 (Half-day Wed.)
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. Waverley 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: 102 Henconner Lane, Bramley, Leeds 13. No C.O.D. under £1. Terms C.W.O. or C.O.D. Postage 4/6 extra under £2. 5/9 extra under £5. Trade supplied. S.A.E. with enquiries please. **Open all day Sats.**

Mail Orders must not be sent to shops

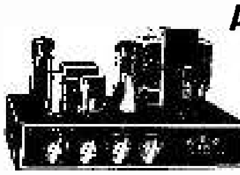
32 High Street. (Half-day Thurs.) Tel. 56420 **LEICESTER**
5-7 County (Mecca) Arcade, Briggate (Half-day Wed) Tel 28252 **LEEDS**
73 Dale St. (Half-day Wed.) Tel. CENtral 3573 **LIVERPOOL**
238 Edgware Road, W2 (Half-day Thurs.) Tel. PAD 1629 **LONDON**
60A Oldham Street (Half-day Wed.) Tel. CENtral 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**

THE 'YORK' HIGH FIDELITY 3 SPEAKER SYSTEM

★ Moderate size, only 25 x 14 x 10in. Complete Kit **20 Gns.**
★ Response 30-20,000 c.p.s. Impedance 15 ohms. Carr. 12/6
★ 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 x 5in. high flux middle range 'speaker. (4) High efficiency tweeter. (5) Woollen acoustic damping material. (6) Teak veneered cabinet. (7) Circuit and full instructions. Terms: Dep. £5.10.6 and 9 monthly payments 39/- (Total £23.1.0).

DEMONSTRATIONS AT ALL BRANCHES

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



Highly sensitive. Push-Pull high output, with Pre-amp./Tone Control Stages. Performance figures of factory built units: Hum level —70dB. Frequency response ±3dB 30-20,000c/s. Sectionally wound output transformer. All high grade components. Valves EF86, EF86, ECC83, 807, 807, GZ34. Separate Bass and Treble Controls. Sensitivity 36 mV. Suitable for high impedance microphones, Crystal or Ceramic P.U's. Designed for **Clubs, Schools, Theatres, Dance Halls** or **Outdoor Functions**, etc. For use with **Electronic Organ, Guitar, String Bass**, etc. Gram, Radio or Tape. Reserve L.T. and H.T. for **Radio Tuner**. Two inputs with associated volume controls so that two separate inputs such as Gram and "Mike" can be mixed. 200-250v. 50c/s A.C. mains. For 3 and 15 ohm speakers. Complete kit of parts with point-to-point wiring diagrams and instructions. **15 Gns** Carr. 12/6

Twin-handled perforated cover 27/6. Supplied factory built with EL34 output valves. 12 months' guarantee for 18 gns. **TERMS: Deposit £6.3.0** and 9 monthly payments of 34/- (Total £21.9.0). Send S.A.E. for leaflet.

R.S.C. A11 HIGH FIDELITY 12-14 WATT AMPLIFIER

PUSH-PULL ULTRA LINEAR OUTPUT "BUILT-IN" TONE CONTROL PRE-AMP. Two input sockets with associated controls allowing mixing of "mike" and gram, etc. etc. High sensitivity. 5 valves—ECC83 (2), EL84 (2), EZ81. High quality sectionally wound output transformer. IND. BASS AND TREBLE CONTROLS. Frequency response ±3dB 30-20,000 c/s. Hum level —60dB. SENSITIVITY 40 millivolts. For Crystal or Ceramic PUs. High Impedance "mikes". For Musical Instruments such as String Bass, Electronic Guitars etc. Size approx. 12 x 9 x 7in. For AC mains 200-250v. 50 cps Output for 3 and 15 ohm spkrs. SAE for leaflet. Complete kit. **9½ Gns.** Full instructions and point-to-point wiring diagrams. Carr 11/6 (or factory built 12½ gns.) Twin handled metal cover 27/6. TERMS ON ASSEMBLED UNITS. Deposit 99/6 and 9 monthly payments of 23/- (Total £15.6.6)

RSC A11T TRANSISTORISED VERSION of above complete kit **9 Gns** (Assembled **13 Gns**)

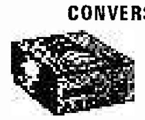
R.S.C. BASS-REGENT 50 WATT AMPLIFIER

An exceptionally powerful high quality all-purpose unit for lead, rhythm, bass guitar, vocalists, gram, radio, tape. Peak O/P rating.
★ Two extra heavy duty 12in. Loudspeakers.
★ Four Jack inputs and two Volume Controls for simultaneous use of up to four pick-ups or "mikes". Bass and Treble controls.

55 Gns. Carr. 30/- or dep. **£13.4.9** and 9 monthly payments of **£5.11.9.** (Total **60½** gns.). Send S.A.E. for leaflet.

G100 100 watt peak output with Pr. speaker columns and a Bass Unit (Six 12" and Two 15" Spkrs). 99½ gns

R.S.C. BATTERY/MAINS CONVERSION UNITS



Type BM1 An all-dry battery eliminator. Size 5½x4½x 2in. approx. Completely replaces batteries supplying 1·5v. and 90v. where A.C. mains 200/250v. 50c/s is available. Complete kit with diagram 52/6 or assembled 3 Gns.

SELENIUM RECTIFIERS | F.W. (Bridged)

All 6/12v. D.C. output. Max. A.C. input 18v. 1a. **4/3.** 2a. **6/11.** 3a. **9/9.** 4a. **12/9.** 6a. **15/9.**

R.S.C. MAINS TRANSFORMERS

FULLY GUARANTEED. Interleaved and Impregnated. Primaries 200-250v. 50c/s. Screened

MIDGET CLAMPED TYPE 2½ × 2⅝ × 2¼in.

250v., 60mA, 6·3v. 2a.	17/11
250-0-250v., 60mA 6·3v. 2a.	18/11

FULLY SHROUDED UPRIGHT MOUNTING

250-0-250v. 60mA, 6·3v. 2a., 0-5-6·3v. 2a.	24/9
250-0-250v. 100mA, 6·3v. 4a., 0-5-6·3v. 3a.	39/9
300-0-300v. 100mA, 6·3v. 4a., 0-5-6·3v. 3a.	39/9
300-0-300v. 130mA, 6·3v. 4a., c.t., 6·3v. 1a. For Mullard 510 Amplifier	47/11
350-0-350v. 100mA, 6·3v. 4a., 0-5-6·3v. 3a.	39/9
350-0-350v. 150mA, 6·3v. 4a., 0-5-6·3v. 3a.	47/9
425-0-425v. 200mA, 6·3v. 4a., c.t., 5v. 3a.	89/9
425-0-425v. 200mA, 6·3v. 4a., 6·3v. 3a., 5v. 3a.	93/9
450-0-450v. 250mA, 6·3v. 4a., c.t., 5v. 3a.	99/9

TOP SHROUDED DROP-THROUGH TYPE

250-0-250v. 70mA, 6·3v. 2a., 0-5-6·3v. 2a.	23/9
250-0-250v. 100mA, 6·3v. 3·5a.	27/9
250-0-250v. 100mA, 6·3v. 2a, 6·3v. 1a.	28/9
350-0-350v. 80mA, 6·3v. 2a., 0-5-6·3v. 2a.	29/11
250-0-250v. 100mA, 6·3v. 4a., 0-5-6·3v. 3a.	39/9
300-0-300v. 100mA, 6·3v. 4a., 0-5-6·3v. 3a.	39/9
300-0-300v. 130mA, 6·3v. 4a., 0-5-6·3v. 1a. Suitable for Mullard 510 Amplifier	46/9
350-0-350v. 100mA, 6·3v. 4a., 0-5-6·3v. 3a.	39/9
350-0-350v. 150mA, 6·3v. 4a., 0-5-6·3v. 3a.	46/11

FILAMENT or TRANSISTOR POWER PACK Types 6·3v. 1·5a. **8/9**; 6·3v. 2a. **9/9**; 6·3v. 3a. **13/9**; 6·3v. 6a. **22/9**; 12v. 1a. **9/11**; 12v. 3a. or 24v. 1·5a. **23/9**; 0-9-18v. 1½a. **19/11**; 0-12-25-42v. 2a. **31/9.**

CHARGER TRANSFORMERS 0-9-15v 1½a. **18/9**; 2½a. **19/11**; 3a. **21/11**; 5a. **25/11**; 6a. **29/9**; 8a. **36/9.**

AUTO (Step UP/step DOWN) TRANSFORMERS 0-110/120v. 200-230-250v. 50-80 watts **19/9**; 150 watts, **33/6**; 250 watts **49/9**; 500 watts **105/-**

OUTPUT TRANSFORMERS

Standard Pentode 5,000 Ω or 7,000 Ω to 3 Ω	8/9
Push-Pull 8 watts EL84 to 3 Ω or 15 Ω	14/9
Push-Pull 10 watts 6V6 ECL86 to 3, 5, 8 or 15 Ω	24/9
Push-Pull EL84 to 3 or 15 Ω 10-12 watts	23/9
Push-Pull Ultra Linear for Mullard 510, etc.	39/9
Push-Pull 15-18 watts, sectionally wound 6L6, KT66, etc., for 3 or 15 Ω	35/9
Push-Pull 20 watt high quality sectionally wound EL34, 6L6, KT66 etc. to 3 or 15 Ω	59/9

SMOOTHING CHOKES 150mA, 7-10H, 250 Ω **12/9**; 100mA, 10H, 200 Ω **10/9**; 80mA, 10H, 350 Ω **8/9**; 60mA, 10H, 400 Ω **4/11.**

6/12V CAR BATTERY CHARGERS

Complete kit of parts with Ammeter and Circuit. Both models with variable charge rate selector.

4 amp 49/9   6 amp 69/9

All types 200-250v. A.C. Mains. Built 10/- extra.

14 WATT HI-FI AMPLIFIERS

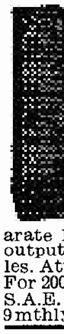
High sensitivity. Two separate inputs. Two vol. controls for mixing purposes. Separate Bass and Treble Controls. Valves ECC83, ECL86, ECL86, EZ80. Output for 15 ohm Loudspeaker. 200-250v 50 c.p.s. A.C. mains operation. Size approx. 8 x 8 x 6in. Factory built and fully guaranteed. Limited number to clear at **£7-19-11** Carr. 10/-

FANE POP 30c LOUDSPEAKERS

R.S.C HI-FI CENTRES LTD.

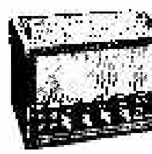
12in. 8-15 Ω 25 watts R.M.S. continuous. Dual cone. Carr. free **£5.19.9**

R.S.C. COLUMN SPEAKERS



Covered in two-tone Rexine/Vynair, ideal for vocalists and Public Address, 15 ohm matching. **C57 15 watts** inc. five 7 x 4in. speakers **£7.19.11.**
TYPE C48S 30 WATTS. Fitted four 8in. high flux 8 watt speakers. Overall size approx. 42 x 10 x 5in. Or deposit 67/- and 9 mthly pmts 34/9 (Total £18.19.9) Carr. 10/-. **16 Gns.**
TYPE C412S, 50 WATTS. Fitted four 12in 11,000 line 15 watt speakers. Overall size 56 x 14 x 9in. approx. Carr. 15/-. **26 Gns.**
Or Deposit £5.17.6 and 9 monthly payments of 54/6 (Total £30.7.0).

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 perspex facia. Neon indicator. For 200-250v. A.C. mains. For 3 or 15 ohm speakers. Send S.A.E. for leaflet. Deposit **5 gns.** and 9 mthly payments of **39/8** (Total **22** gns). **19 Gns.** Carr. 12/6

F.A.L. 'Phase Fifty' PUBLIC ADDRESS AMPLIFIER

Solid State Circuitry. 50 Watts Peak Output. 3 separately controlled inputs for mixing purposes. Separate Bass and Treble Controls. Output for loudspeakers 3—30 ohms. Suitable for Dynamic, Ribbon or Crystal Mikes. For Clubs, Theatres, Restaurants, Hotels, Schools, etc. For Vocal or Instrumental Groups. Send S.A.E. for leaflet. only **29 GNS.** Carr. free

HIGH QUALITY LOUDSPEAKERS

In Teak or Afrormosia veneered Cabinets

L13 13" × 8" 10 Watt 10,000 lines 3 or 15 ohms. Carr 7/6 **£4.19.9**
L12 12" 20 Watt 10,000 lines 15 ohms. Carr 8/9 **£8.19.9**

FANE ULTRA HIGH POWER LOUDSPEAKERS

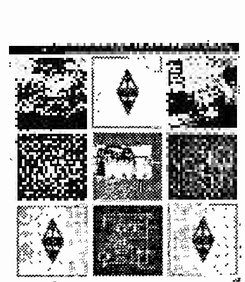
All power ratings are R.M.S. continuous. 2 years' guarantee. High Flux 14,000 line ceramic magnets. Heavy cast chassis.

'POP' 100	'POP' 60	'POP' 50
18" 100 Watt	15" 60 Watt	12" 50 Watt
21 GNS. Carr. free	**12** GNS. Carr. free	**10** GNS. Carr. free

POWER PACK KIT Consisting of Mains transformer, Metal Rectifier, Electrolytics, smoothing choke, chassis and circuit. 200/250v. A.C. mains. Output 250v. 60mA 6·3v. 2a. Supplied with case in lieu of chassis 32/11. Or assembled 44/-. **28/11**

MINI-8 HI-FI Loudspeaker Units Special Offer

Teak or Afrormosia veneered cabinet, size approx. 10⅜ x 6⅛ x 7½in. Peak power handling 8 watts 3-5 ohms. Inc. Carr. **69/11**



over **16,000** copies sold

Now in its second printing

Radio Communication Handbook

832 pages of everything in the science of radio communication. The Handbook's U.K. origin ensures easy availability of components. The standard work in its field.

69s post paid

THE VHF-UHF MANUAL

By George Jessop, G6JP

A complete manual for frequencies above 30 MHz. Covers aerials, receivers, transmitters and test equipment. The first book of its kind outside the USA. **23s post paid**

THE RSGB AMATEUR RADIO CALL BOOK

1970 edition containing 120 pages

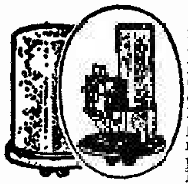
Complete up to date listing of all amateur stations in the U.K. and Eire together with much operating information including beam headings and list of prefixes.

7s 3d post paid

Obtainable from:

RADIO SOCIETY of GREAT BRITAIN
35 DOUGHTY STREET, LONDON, WC1

CAR LIGHT FLASHERS



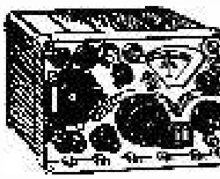
Heavy duty light flasher employs a condenser discharge principle operating on electro mechanical relay. (As inset). Housed in strong plastic case. Flashing rate between 60-120 per minute. 12V DC operation. Maximum load 6 amps. Size 2·11/16in. dia. x 4in. Supplied brand new at a fraction of original cost. **6/6** each P. P. 2/6. (3 for **17/6** P. P. 4/6).

HAMMARLUND SP600JX COMMUNICATION RECEIVER

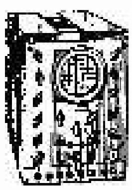
540 Kc/s–54 Mc/s in 6 bands. Few only. **£100** each.

R209 MK II COMMUNICATION RECEIVER

11 valve high grade communication receiver suitable for tropical use. 1·20 Mc/s on 4 bands. AM/CW/FM operation. Incorporates precision vernier driver, B.F.O., aerial trimmer, internal speaker and 12v. D.C. internal power supply. Supplied in excellent condition, fully tested and checked **£15.0.0.** Carr. 20/–



TYPE 13A DOUBLE BEAM OSCILLOSCOPES



An excellent general purpose D/B oscilloscope. T.B. 2 cps–750 Kc/s. Bandwidth 5·5 Mc/s. Sensitivity 33mV/CM. Operating voltage 0/110/200/250V. A.C. Supplied in excellent working condition. **£22.10.0.** Or complete with all accessories, probe, leads, lid, etc. **£25.** Carriage 30/–.

MARCONI T/44/TF956

AF Absorption Wattmeter

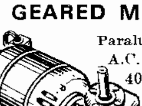
1 µ/watt to 6 watts.

£20. Carr. 10/-.

SOLARTRON CD-1016 OSCILLOSCOPE

Double beam. D.C. To 5 Mc/s. Excellent condition. **£55** each. Carr. 20/–.

GEARED MAINS MOTORS

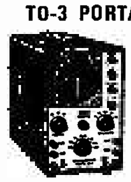


Paralux type SD19 230/250V. A.C. Reversible. 30 r.p.m. 40 lb./ins. Complete with capacitor. Excellent condition. **99/6.** Carr. 10/–.

SOLARTRON CD.711S.2 OSCILLOSCOPES

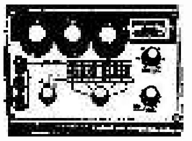
Double beam. D.C. to 9Mc/s. Perfect order. **£65.** Carr. 50/-.

TO-3 PORTABLE OSCILLOSCOPE



3in. tube. Y amp. Sensitivity 0·1v p-p/CM. Bandwidth 1·5 cps–1·5 MHz. Input imp. 2 meg Ω 25pF. X amp. sensitivity 0·9v p-p/CM. Bandwidth 1·5 cps –800KHz. Input imp. 2 meg Ω 20pF. Time base. 5 ranges 10 cps–300 KHz. Synchronization. Internal/external. Illuminated scale 140 × 215 × 330 mm. Weight 15½ lb. 220/240V. A.C. Supplied brand new with handbook. **£35.0.0.** Carr. 10/-.

TRANSISTORISED L.C.R. A.C. MEASURING BRIDGE



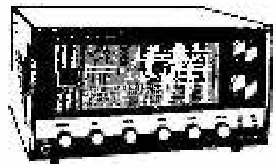
A new portable bridge offering excellent range and accuracy at low cost. Ranges: R. 1Ω–11·1 megΩ 6 Ranges ±1%. L.1 µ H – 111 HENRYS 6 Ranges –2%. C. 10pF ±1110mFd. 6 Ranges ±2%. TURNS RATIO 1:1/1000–1:11100. 6 Ranges ±1%. Bridge voltage at 1,000 cps. Operated from 9 volts. 100µA. Meter indication. Attractive 2 tone metal case. Size 7¾ × 5 × 2in. **£20.** P. & P. 5/-.

UNR-30 4-BAND COMMUNICATION RECEIVER

Covering 550 Kc/s–30 Mc/s. Incorporates BFO. Built in speaker and phone jack. Metal cabinet. Operation 220/240V. A.C. Supplied brand new, guaranteed with instructions. Carr. 7/6 **13 gns.**

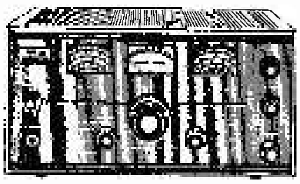
TRIO JR.310 New Amateur Band 10–80 Metre Receiver in stock. **£77.10.0.**

LAFAYETTE SOLID STATE HA600 RECEIVER



5 BAND AM/CW/SSB AMATEUR AND SHORT WAVE 150 Kc/s–400 Kc/s and 550 Kc/s–30 Mc/s F E T front end ● 2 mechanical filters ● Huge dial ● Product detector ● Variable BFO ● Noise limiter ● S meter ● 24in Bandspread ● 230V. A.C./12V. D.C. neg. earth operation ● RF gain control. Size 15in. × 9½in. × 8¼in. Weight 18 lbs. EXCEPTIONAL VALUE. £45. Carr. 10/-. S.A.E. for full details.

TRIO COMMUNICATION RECEIVER MODEL 9R-59DE

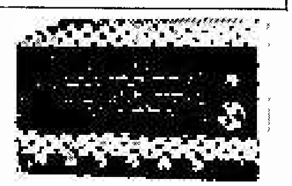


4 band receiver covering 550 Kc/s to 30 Mc/s continuous and electrical bandspread on 10, 15, 20, 40 and 80 metres. 8 valve plus 7 diode circuit, 4/8 ohm output and phone jack. SSB-CW ● ANL ● Variable BFO ● S meter ● Sep. bandspread dial ● IF 455 Kc/s ● Audio output 1·5 W. ● Variable RF and AF gain controls. 115/250V. A.C. Mains. Beautifully designed. Size: 7 × 15 × 10in. With instruction manual and service data. **£42,** carriage paid. **TRIO COMMUNICATION TYPE HEADPHONES.** Normally £5.19.6. OUR PRICE **£3.15.0** if purchased with above receiver.

TRIO JR. 500SE 10-80 Metre Receiver £69.10.0

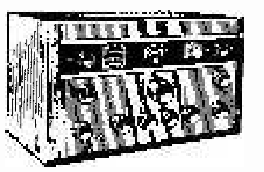
TRIO TS 510 AMATEUR TRANSCEIVER with speaker and mains P.S.U. £212. IN STOCK!

LAFAYETTE HA-800 SOLID STATE AMATEUR COMMUNICATION RECEIVER



Six bands 3·5-4, 7-7·3, 14-14·35, 21-21·45, 28-29·7, 50-54Mc/s. Dual conversion on all bands. 2 × 455 Kc/s mechanical filters. FET front end, product detector, variable BFO, 100Kc/s crystal calibrator. 'S' Meter. Huge slide rule dial. Operation 230V AC or 12V DC. Size 15 × 9¾ × 8½in. Complete with instruction manual. **£57.10.0** Carr. Paid. 100Kc/s crystal 39/6 extra.

RCA COMMUNICATIONS RECEIVERS AR88D

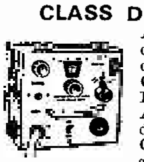


Latest release by ministry BRAND NEW in original cases. 110-250v. A.C. operation. Frequency in 6 Bands. 535 Kc/s—32 Mc/s continuous. Output impedance 2·5-600 ohms. Incorporating crystal filter, noise limiter, variable BFO, variable selectivity, etc. Price **£87.10.0.** Carr. £2.

LAFAYETTE PF-60 SOLID STATE VHF FM RECEIVER

A completely new transistorised receiver covering 152–174 Mc/s. Fully tunable or crystal controlled (not supplied) for fixed frequency operation. Incorporates 4 INTEGRATED CIRCUITS. Built in speaker and illuminated dial. Squelch and volume controls. Tape recorder output. 75Ω aerial input. Headphone jack. Operation 230V. A.C./12V. D.C. Neg. earth. **£37.10.0.** Carr. 10/–.

CLASS D WAVEMETERS

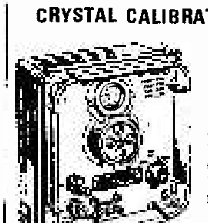


A crystal controlled heterodyne frequency meter covering 1·7–8 Mc/s. Operation on 6 volts D.C. Ideal for amateur use. Available in good used condition. **£5.19.6.** Carr. 7/6 Or brand new with accessories. **£7.19.6.** Carr. 7/6.

CLASS D WAVEMETERS No. 2

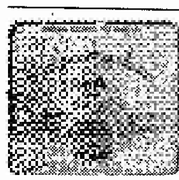
Crystal controlled. 1·2–19 Mc/s. Mains or 12V. D.C. operation. Complete with calibration charts. Excellent condition. **£12.10.0.** Carr. 30/–.

CRYSTAL CALIBRATORS NO. 10



Small portable crystal controlled wavemeter. Size 7 x 7½ x 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. **89/6.** Carr. 7/6.

CLEAR PLASTIC PANEL METERS



First grade quality Moving Coil panel meters. Type MR 38P. $1^{21}/_{32}$in. square fronts.

50µA 40/-
50-0-50µA 37/6
100µA 37/6
100-0-100µA 35/-
200µA 35/-
500µA 40/-

500-0-500µA 27/6
1mA 27/6
1-0-1mA 27/6
2mA 27/6
5mA 27/6
10mA 27/6
750mA 27/6
1 amp 27/6
2 amp 27/6
5 amp 27/6
20mA 27/6

50mA 27/6
100mA 27/6
150mA 27/6
200mA 27/6
300mA 27/6
500mA 27/6
3V. D.C. 27/6
10V. D.C. ... 27/6
20V. D.C. ... 27/6
100V. D.C. .. 27/6

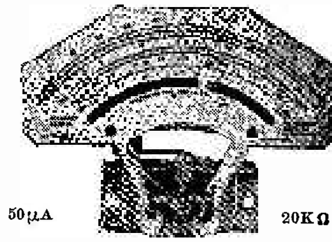
150V. D.C. .. 27/6
300V. D.C. .. 27/6
500V. D.C. .. 27/6
750V. D.C. .. 27/6
15V. A.C. ... 27/6
50V. A.C. ... 27/6
150V. A.C. .. 27/6
300V. A.C. .. 27/6
500V. A.C. .. 27/6
S meter 1mA 32/-
VU meter .. 42/-

FULL RANGE OF OTHER SIZES IN STOCK. SEND S.A.E. FOR LEAFLET

Variable Voltage TRANSFORMERS

Brand new, guaranteed and carriage paid.
High quality construction. Input 230V. 50–60 cycles.
Output full variable from 0·260 volts. Bulk quantities available.
1 amp.—**£5.10.0**; 2·5 amp—**£6.15.0**; 5 amp.—**£9.15.0**;
8 amp.—**£14.10.0**; 10 amp.—**£18.10.0**; 12 amp.—**£21.0.0**;
20 amp.—**£37.0.0.**

AVOMETER MOVEMENTS



50µA 20KΩ/V

Spare movements for Model 8 or 9. (Fitted with Model 9 scale) or basis for any multimeter. Brand New & Boxed. **69/6.** P. & P. **3/6.**

AVO 48A. Perfect order with set of shunts and resistances. **£12.10.0.** P. & P. 7/6.

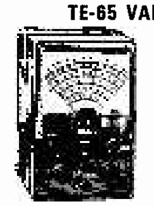
TE-40 HIGH SENSITIVITY A.C. VOLTMETER

10 meg. input 10 ranges: ·01/·003/·1/·3/1/3/10/30/100/300V. R.N.S. 4cps.-1-2 Mc/s. Decibels –40 to +50dB. Supplied brand new complete with leads and instructions. Operation 230V. A.C. **£17.10.0.** Carr. 5/-.

LELAND MODEL 27 BEAT FREQUENCY OSCILLATORS

Frequency 0–20 Kc/s. on 2 ranges. Output 500Ω or 5kΩ. Operation 200/250V. A.C. Supplied in perfect order. **£12.10.0.** Carr. 10/–.

TE-65 VALVE VOLTMETER

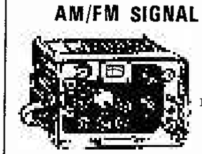


High quality instrument with 28 ranges. D.C. volts 1·5—1,500v. A.C. volts 1·5—1,500v. Resistance up to 1,000 megohms. 200/240v. A.C. operation. Complete with probe and instructions. **£17.10.0.** P. & P. 6/-. Additional probes available: R.F. **35/-**, H.V. **42/6.**

COSSOR 1049 DOUBLE BEAM OSCILLOSCOPES

D.C. coupled. Band width 1Kc/s. Perfect order. **£25.** Carr. 30/-.

AM/FM SIGNAL GENERATORS



Oscillator Test No. 2. A high quality precision instrument made for the ministry by Airmec. Frequency coverage 20-80 Mc/s. AM CW/FM. Incorporates precision dial, level meter, precision attenuator 1µV–100mV. Operation from 12 volt D.C. or 0/110/200/250 volt A.C. Size 12 × 8½ × 9in. Supplied in brand new condition complete with all connectors fully tested. **£45.** Carr. 20/-.

EDDYSTONE VHF RECEIVERS

Model 770R. 19–165 Mc/s. Excellent condition. **£150.**

TE-16A Transistorised Signal Generator. 5 ranges 400kHz–30mHz. An inexpensive instrument for the handyman. Operates on 9v battery. Wide easy to read scale. 800kHz modulation. 5¼ × 5¼ × 3¾in. Complete with instructions and leads. **£7.19.6.** P. & P. 4/-.

FIELD TELEPHONES TYPE L

Generator ringing, metal cases. Operates from two 1·5V batteries (not supplied). Excellent condition. **£4.10.0** per pair. Carr. 10/–.

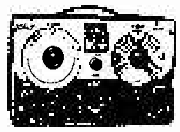
AUTO TRANSFORMERS

0/115/230V. Step up or step down. Fully shrouded.

150 W. **£2. 2.6.** P. & P. 3/6.
300 W. **£2.19.6.** P. & P. 4/6.
500 W. **£4.10.0.** P. & P. 6/6.
1,000 W. **£6.10.0.** P. & P. 7/6.
1,500 W. **£7.19.6.** P. & P. 8/6.
7,500 W. **£15.10.0.** P. & P. 20/–.

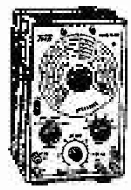
G. W. SMITH & CO (RADIO) LTD.
Also see oppos. page

ARF-100 COMBINED AF-RD SIGNAL GENERATOR



A.F. SINE WAVE 20–200,000 c/s. Square wave 20–30,000 c/s. O/P. HIGH IMP. 21V. P/P600Ω 3·8V. P/P. TF 100 Kc/s–300 Mc/s. Variable R.F. attenuation int/ext. modulation. Incorporates dual purpose meter to monitor AF output and % mod. on R.F. 220/240V. A.C £30.0.0. Carr. 7/6.

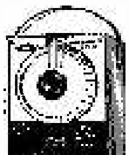
TE-20D RF SIGNAL GENERATOR



Accurate wide range signal generator covering 120 Kc/s–500 Mc/s on 6 bands. Directly calibrated Variable R F attenuator, audio output. Xtal socket for calibration. 220/240V. A.C. Brand new with instructions. £15. Carr. 7/6. Size 140 × 215 × 170 mm.

PEAK-SOUND PRODUCTS. Full range of Amplifiers, Kits, Speakers in stock.

TY75 AUDIO SIGNAL GENERATOR



Sine Wave 20c/s to 200 kc/s. Square Wave 20c/s to 30kc/s. High and low impedance output. Output variable up to 6 volts. 220/240 volts A.C. Size 210 × 150 × 120 mm. Brand new with instructions. £16. Carr. 7/6.

MARCONI TF142E DISTORTION FACTOR METERS. Excellent condition. Fully tested. £20. Carr. 15/-.

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 £17.10.0** Carr. 7/6.

MODEL ZQM TRANSISTOR CHECKER

It has the fullest capacity for checking on A, B and Ico. Equally adaptable for checking diodes, etc. Spec.: A: 0·7–0·9967. B: 5–200. Ico: 0–50 microamps 0–5mA. Resistance for diode 200Ω–1MΩ. Supplied complete with instructions, battery and lead. £5.19.6. P. & P. 2/6

ADVANCE TEST EQUIPMENT

Brand new and boxed in original sealed cartons

VM. 76 VALVE VOLTMETER. R.F. measurements in excess of 100 Mc/s and D.C. measurements up to 100V with accuracy of +2% D.C. range 300 MV to 1 KV. A.C. range 300 MV to 300 V RMS. Resistance ·02–500 MΩ. Price £72.

VM.79 UHF MILLIVOLT METER. Transistorised. A.C. range 10 MV–3 V. D.C. current range ·01μA–·3 MA. Resistance 1 ohm–10 megohms. Price £125.

H1B AUDIO SIGNAL GENERATOR. 15 c/s–50 Kc/s. sine or square wave. Price £30.

J1B AUDIO SIGNAL GENERATOR. 15 c/s–50 Kc/s. Price £30.

TT1S TRANSISTOR TESTER. £37.10.0.

Carriage 10/– per item.

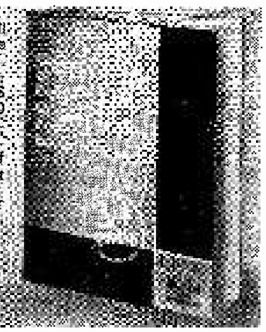
SOLARTRON MONITOR OSCILLOSCOPE TYPE 101

An extremely high quality oscilloscope with time base of 10 μ/sec to 20m/sec. Internal Y amplifier. Separate mains power supply 200/250v. Supplied in excellent condition with cables, probe, etc., as received from Ministry. £8.19.6, carriage 30/–.

HOSIDEN DH04S 2-WAY STEREO HEADSETS

Each headphone contains a 2½in. woofer and a ⅜in. tweeter. Built in individual level controls. 8Ω imp. 25–18,000c/s with cable and stereo plug. £5.19.6. P. & P. 2/6.

Latest Catalogue



The latest edition giving full details of a comprehensive range of HI FI EQUIPMENT, COMPONENTS, TEST EQUIPMENT and COMMUNICATIONS EQUIPMENT.... Nearly 200 pages, fully illustrated and detailing thousands of items—many at bargain prices. FREE DISCOUNT COUPONS VALUE 10/-

SEND NOW—ONLY 7/6 P. & P. ...

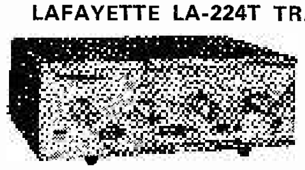
GARRARD

FULL CURRENT RANGE OFFERED BRAND NEW AND GUARANTEED AT FANTASTIC SAVINGS

SRP22 Stereo	£5.19.6	*SP25 MK II	£11.19.6
*1025 Mono	£7.10.0	*SL55	£11.19.6
*1025 Stereo	£7.15.0	A70 MK II	£12.10.0
*2025 Stereo	£7.19.6	*SL65	£14.14.0
*2025T/C Mono/Stereo	£8.17.6	AP75	£17.17.0
		401	£28. 7.6
*3000 Stereo	£9.19.6	SL75	£28.10.0

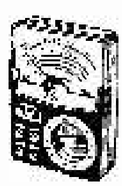
Carriage/insurance 7/6 extra any model. WB4 Bases £3.19.6. Perspex covers £3.10.0. *Special offer base and cover available for these models at £4.15.0. Carr. 5/-. Full range of Garrard accessories available.

LAFAYETTE LA-224T TRANSISTOR STEREO AMPLIFIER



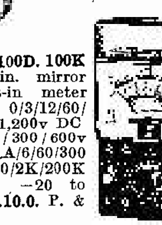
19 transistors, 8 diodes, IHF music power, 30W at 8Ω. Response 30–20,000 ± 2dB at 1W. Distortion 1% or less. Inputs 3mV and 250mV. Output 3–16Ω. Separate L and R. volume controls. Treble and bass control. Stereo phone jack. Brushed aluminium, gold anodised extruded front panel with complementary metal case. Size 10½ × 3 9/16 × 7 13/16in. Operation 115/230V. A.C. £28. Carriage 7/6.

MULTIMETERS *for EVERY purpose!*



TE-51. NEW 20,000Ω/VOLT MULTIMETER with overload protection and mirror scale. 0/6/60/120/1,200v. A.C. 0/3/30/60/300/600/3,000v. D.C. 0–60μA/12/300mA. D.C. 0/60K/6 meg. ohm. 92/6. P. & P. 2/6.

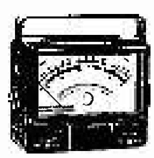
TE-900 20,000Ω/VOLT GIANT MULTIMETER mirror scale and overload protection. 6in. full view meter. 2 colour scale. 0/2·5/10/250/1,000/5,000 v. A.C. 0/25/12·5/10/50/250/1,000/5,000v. D.C.0/50μA/110/100/500 mA/10 amp. D.C. 02K/200K/20 MEG. OHM. £15. P. & P. 5/-.



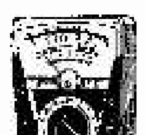
MODEL AS-100D. 100K Ω/VOLT. 5in. mirror scale. Built-in meter protection. 0/3/12/60/120/300/600/1,200v DC 0/6/30/120/300/600v AC. 0/10μA/6/60/300 mA/12 amp. 0/2K/200K/2M/200MΩ. −20 to +17dB. £12.10.0. P. & P. 3/6.

MODEL TE-10A. 20kΩ/Volt 5/25/50/250/500/2,500v. D.C. 10/50/100/500/1,000 v. A.C. 0/50μA/2·5mA/250mA D.C. 0/6K/6 meg. ohm. −20 to +22dB. 10·0, 100mFd. 0·100-0·1mFd. 69/6. P. & P. 2/6.

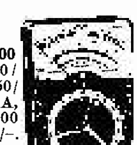
MODEL TE-90 50,000 OPV mirror scale overload protection 0/3/12/60/300/600/1200 v. DC. 0/6/30/120/300/1200v. DC. 16K/160K/1·6/16meg Ω. −20 to +63dB. £7.10.0. P. & P. 3/-



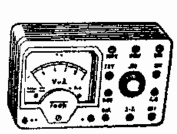
LAFEYETTE 57 Range Super 50kΩ/volt Multimeter. D.C. volts 12 mV –1000V. A.C. volts 1·5V –1000V. D.C. current 25μA–10 amp. Ohms 0–10 megΩ dB—20 to +81 dB. Overload protection. £12.10.0. Carr. 3/6.



MODEL TE-70. 30,000 OPV. 0/3/15/60/300/600/1200v DC. 0/6/30/120/600/1200v AC. 0/30μA/3/30/300mA. 0/16K/160 K/1·6M/16 Meg. Ω. £5.10.0. P. & P. 3/-.



MODEL TE-80. 20,000 O.P.V. 0/10/50/100/500/1,000v AC 0/5/25/50/250/500/1,000v DC. 0–50μA, 5/50/500mA. 0/6K/60K/600 K/6meg. £4.17.6. P. & P. 3/-.



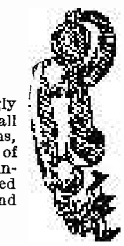
MODEL PT-34. 1,000 OPV. 0/10/50/250/500/1,000v AC and DC. 0/1/100/500mA DC. 0/100K Ω. 39/6. P. & P. 1/6.

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. £5.19.6. P. & P. 3/6.

★ TRANSISTORISED FM TUNER ★

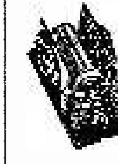
6 TRANSISTOR HIGH QUALITY TUNER, SIZE ONLY 6 × 4 × 2½in. 3 I.F. stages. Double tuned discriminator. Ample output to feed most amplifiers. Operates on 9V battery. Coverage 88–108Mc/s Ready built ready for use. Fantastic value for money. £6.7.6. P. & P. 2/6. Stereo multiplex adaptors 99/6.

TRANSISTORISED TWO-WAY TELEPHONE INTERCOM



Operative over amazingly long distances. Separate call and press to talk buttons, 2-wire connection. 1000's of applications. Beautifully finished in ebony. Supplied complete with batteries and wall brackets. £6.19.6. P. & P. 3/6.

SINCLAIR EQUIPMENT



Z12 12 watt amplifier, 89/6
PZ4 Power Supply Unit 89/6
Stereo 25 Preamp. £9.19.6
Q14 Speakers £7.19.6
Micromatic Radio Kit. 49/6. Built 59/6.
Now in Stock
IC10 59/6. All post paid.

SPECIAL OFFER

Two Z12 Amps., PZ4 Power Supply, Stereo 25 Preamplifier, £22, or with two Q14 speakers, £37.

NEW SINCLAIR 2000 SYSTEM

35 watt Integrated Amplifier, £29. Carr. 5/-. Self-powered FM Tuner, £25. Carr. 5/-.

ECHO HS-606 STEREO HEADPHONES

Wonderfully comfortable. Lightweight adjustable vinyl headband. 6ft. cable and stereo jack plug. 25-17,000 cps. 8 ohm imp. 67/6 P. & P. 2/6.

RACAL MA.168 TRANSISTORISED DIVERSITY SWITCH

Brand New Condition. £15. Carr. 10/-.

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 £27.10.0. P. & P. 5/-.

RECORDING HEADS

COSMOCORD ½-track heads. High imp. record/playback 65/-. Low imp. erase 20/-.
MARRIOTT ¼-track heads. High imp. record/playback 65/-. Low imp. erase 20/-.
Post extra.

AMERICAN TAPE

First grade quality American tapes. Brand new. Discount on quantities.

3in. 225ft. L.P. acetate	3/6
3¼in. 600ft. T.P. mylar	10/-
5in. 600ft. std. plastic	8/6
5in. 900ft. L.P. acetate	10/-
5in. 1,200ft. D.P. mylar	15/-
5¾in. 1,200ft. L.P. acetate	12/6
5¾in. 1,200ft. L.P. mylar	16/-
5¾in. 1,800ft. D.P. mylar	22/6
5¾in. 2,400ft. T.P. mylar	39/6
7in. 1,200ft. std. acetate	12/6
7in. 1,800ft. L.P. acetate	15/-
7in. 1,800ft. L.P. mylar	20/-
7in. 2,400ft. D.P. mylar	25/-
7in. 3,600ft. T.P. mylar	45/-

Postage 2/-. Over £3 post paid.

MAXELL TAPE CASSETTES

C60, 10/3; C90, 14/3; C120, 19/6. Post extra

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

All Mail Orders to—
147, Church Street, London, W.2
Tel: 01-262 6562
(Trade supplied)

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
OPEN 9-6 MONDAY TO SATURDAY (EDGWARE ROAD ½DAY THURSDAY)

Sonotone 9TA and 9TA/HC. Diamond Cartridge brand new, boxed in manufacturers' carton **49/6** plus 2/6 p/p. **Acos** GP 91–1 and GP 91–3 stereo compatible cartridges, new in sealed manufacturers' cartons **22/6** plus 2/6 p/p.

BASF TAPE 25% OFF

5in. 600ft. **14/–** 900ft. **19/–** 1200ft. **30/–**
5¾in. 900ft. **19/–** 1200ft. **24/–** 1800ft. **39/–**
7in. 1200ft. **24/–** 1800ft. **35/–** 2400ft. **57/–**
P/P 2/- per reel—over £5 FREE

SPECIAL PURCHASE
12in. 15 watt HI-FI LOUDSPEAKERS

Made by famous British manufacturer to very high standards, heavy duty cast chassis, twin cone construction, smooth extended range, with very low level of distortion.—Response 35–17,500Hz.—impedance 15 ohms—flux, 11,000 gauss.

WALDON PRICE 97/6 each plus 6/6 P. & P.

E.M.I. HI-FI SPEAKERS

SET 450: 13 x 8 with two built-in tweeters and cross-over unit. **Our Price 69/6** 3 or 15 ohm, 10W, 40–13,000Hz.
SET 850: 6½in. bass plus 3¾in. tweeter and cross-over unit. 8 ohm, 10W, 65–20,000Hz. **79/6**
SET 250: 5in. heavy duty bass plus 3in. tweeter and cross-over unit. 8 ohm, 6W, 80–20,000Hz. **65/–**
Add 5/6 p/p for each speaker set.

TRIO Stereo Moving Magnet Cartridge Model AD76K. Diamond Stereo LP Stylus. Frequency response 20-20,000c/s output. 7mV tracking pressure 2 grammes ± 0·5 grm. Fully guaranteed. Price **85/-** p/p free.

GARRARD UNITS

	£	s	d
SP25 Mk. II	11	9	6
AP75	17	19	6
SL65	14	9	6
*3500	11	9	6

***Denotes** including Sonotone 9TA-Stereo/Diamond Cartridge. Elegantly styled plinth and cover to suit the above units. From **5 gns.** Please add 10/– p/p each on all above items.

SPEAKER ENCLOSURES

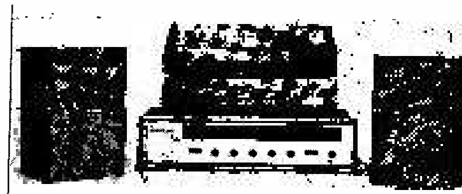
Designed to accept the full range of E.M.I. loudspeakers. Beautifully styled in teak.

Prices from **89/6** each.

25 WATT GROUP SPEAKERS

Guitar group 25. 12in. round, heavy duty cone, with solid aluminium chassis, 15 ohms imp. 12,000 gauss. Response 30-10,000c/s. OUR SPECIAL PRICE

£5.9.6 plus 6/6 P. & P.



The greatest budget system available today—can't be beaten—price or quality anywhere—look at these great features—then compare;

	£	s	d
Teleton FZ000 Mk. II. Tuner amp. Latest version with all the new features. Tuning indicator—fused circuit protection, AM–FM fitted multiplex, A.F.C. 2 × 5 watts per channel. A truly outstanding unit.	43	1	8
Garrard 3500 (Auto/single). Latest in the great new Garrard range, provides facilities and controls that are usually found only on much more expensive units	13	11	0
Teleton SA1003 matching speaker systems	10	0	0
Sonotone 9TA stereo cartridge with diamond styli—a perfect match	4	2	0
Plinth/Cover elegantly styled	7	0	0
Plugs and Leads all supplied	1	5	0
Normal Retail Price	£78	19	8

Exclusively offered by WALDON at the remarkably low price of 63 gns +25/- Carr.

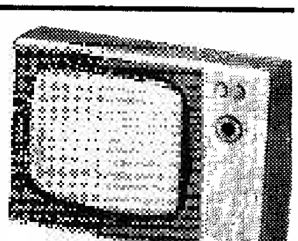
All items may be purchased separately.

WALDON ELECTRONICS, 707 Blackburn Road, Bolton, Lancs. Bolton 54280

PLEASE ENCLOSE 2/– IN STAMPS WITH ENQUIRIES

17in.—£11.10.0
19in. BBC 2
FERGUSON 39 Gns.

TWO-YEAR GUARANTEE EX-RENTAL TELEVISIONS



FREE ILLUSTRATED LIST OF TELEVISIONS
17"–19"–21"–23"
Wide range of models, sizes and prices
Carr. ins. on all sets 30/–
DEMONSTRATIONS DAILY

TWO-YEAR GUARANTEED REGUNNED TUBES

70° and 90° 14in.—**69/6**, 17in.—**89/6**, 21in.—**99/6.** 110° 17in., 19in. and 21in.—**99/6.** 23° (not bonded)—**119/6.** Exchanged bowls. Carr. 10/6.

COCKTAIL/STEREOGRAM CABINET 15 gns.

Polished walnut veneer with elegant glass fronted cocktail compartment, padded. Position for two 10in. elliptical speakers. Record storage space. Height 35½in., width 52¾in., depth 14½in. Legs 1 gn. extra.

Speakers 10/-: 3½"—25Ω. 4"—10Ω. 7" × 4"—3Ω. Brand new. P. & P. 2/6
Asstd. Condensers: 10/- for 50. P. & P. 7/6. **Asstd. Resistors: 10/-** for 50. P. & P. 4/6. **Asstd. Controls: 10/-** for 25. P. & P. 7/6. **Transistors:** Mullard matched output kit **9/-** OC81D—2 OC81's. P. & P. FREE.

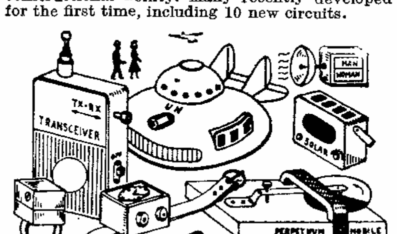
Ferrite Rods 3/6: 6", complete with LW/MW Coils. P. & P. FREE.
TRANSISTOR CASES 19/6. Cloth covered, many colours. Size 9½"x6¾"x3½" P. & P. 4/6. Similar cases in plastic 7/6.
RECORD PLAYER CABINETS 49/6. Cloth covered, size 16¾" x 14¼" x 8". Takes any modern autochanger. P. & P. 7/6.
SINGLE PLAYER CABINETS 19/6. P. & P. 7/6.
STRIP LIGHT TUBES 3/9 each. 11" (284 mm.) 230/240 volts, 30 watts. Ideal for cocktail cabinets, illuminating pictures, diffused lighting etc. 6 for £1. P. & P. free.

DUKE & CO. (LONDON) LTD.
621/3 Romford Road, London, E12 Tel. 01–478 6001/2/3

PRINTED CIRCUIT KIT

BUILD 40 INTERESTING PROJECTS on a PRINTED CIRCUIT CHASSIS with PARTS and TRANSISTORS from your SPARES BOX

CONTENTS: (1) 2 Copper Laminate Boards 4¼" × 2¼". (2) 1 Board for Matchbox Radio. (3) 1 Board for Wristwatch Radio, etc. (4) Resist. (5) Resist Solvent. (6) Etchant. (7) Cleanser/Degreaser. (8) 16-page Booklet *Printed Circuits for Amateurs.* (9) 2 Miniature Radio Dials SW/MW/LW. Also free with each kit. (10) Essential Design Data, Circuits, Chassis Plans, etc. for 40 TRANSISTORISED PROJECTS. A very comprehensive selection of circuits to suit everyone's requirements and constructional ability. Many recently developed very efficient designs published for the first time, including 10 new circuits.



EXPERIMENTER'S PRINTED CIRCUIT KIT

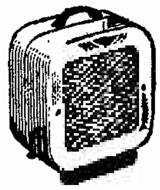
8/6

Postage & Pack. 1/6 (UK)
Commonwealth:
SURFACE MAIL 2/-
AIR MAIL 8/-
Australia, New Zealand South Africa, Canada.

(1) Crystal Set with biased Detector. (2) Crystal Set with voltage-quadrupler detector. (3) Crystal Set with Dynamic Loudspeaker. (4) Crystal Tuner with Audio Amplifier. (5) Carrier Power Conversion Receiver. (6) Split-Load Neutralised Double Reflex. (7) Matchbox or Photocell Radio. (8) "TRI-FLEXON" Triple Reflex with self-adjusting regeneration (Patent Pending). (9) Solar Battery Loudspeaker Radio. The smallest 3 designs yet offered to the Home Constructor anywhere in the World. 3 Subminiature Radio Receivers based on the "Triflexon" circuit. Let us know if you know of a smaller design published anywhere. (10) Postage Stamp Radio. Size only 1·62" × ·95" × ·25". (11) Wristwatch Radio 1·15" × ·80" × ·55". (12) Ring Radio ·70" × ·70" × ·55". (13) Bacteria-powered Radio. Runs on sugar or bread. (14) Radio Control Tone Receiver. (15) Transistor P/P Amplifier. (16) Intercom. (17) 1-valve Amplifier. (18) Reliable Burglar Alarm. (19) Light-Seeking Animal, Guided Missile. (20) Perpetual Motion Machine. (21) Metal Detector. (22) Transistor Tester. (23) Human Body Radiation Detector. (24) Man/Woman Discriminator. (25) Signal Injector. (26) Pocket Transceiver (Licence required). (27) Constant Volume Intercom. (28) Remote Control of Models by Induction. (29) Inductive-Loop Transmitter. (30) Pocket Triple Reflex Radio. (31) Wristwatch Transmitter/Wire-less Microphone. (32) Wire-less Door Bell. (33) Ultrasonic Switch/Alarm. (34) Stereo Preamplifier. (35) Quality Stereo Push-Pull Amplifier. (36) Light-Beam Telephone "Photophone". (37) Light-Beam Transmitter. (38) Silent TV Sound Adaptor. (39) Ultrasonic Transmitter. (40) Thyristor Drill Speed Controller.

YORK ELECTRICS
333 YORK ROAD, LONDON, S.W.11

Send a S.A.E. for full details, a brief description and Photographs of all Kits and all 52 Radio, Electronic and Photoelectric Projects Assembled.



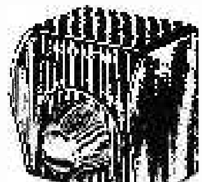
2½kW FAN HEATER

Three position switching to suit changes in the weather. Switch up for full heater (2½ kW), switch down for half heat (1¼kW), switch central blows cold for summer cooling—adjustable thermostat acts as auto control and safety cut-out. Complete kit **£3.15.0.** Post and ins. 7/6 or **made up model £4.15.0. Post & ins. 7/6.**

FLUORESCENT CONTROL KITS

Each kit comprises seven items—Choke, 2 tube ends, starter, starter holder and 2 tube clips, with wiring instructions. Suitable for normal fluorescent tubes or the new "Grolux" tubes for fish tanks and indoor plants. Chokes are super-silent, mostly resin filled. Kit A—15–20 w. **19/6.** Kit B—30–40w. **19/6.** Kit C—80 w. **19/6.** Kit E—65 w. **19/6.** Kit MF1 is for 6in., 9in. and 12in. miniature tubes, **19/6.** Postage on Kits A and B 4/6 for one or two kits then 4/6 for each two kits ordered. Kits C, D and E 4/6 on first kit then 3/6 for each kit ordered. Kit MF1 3/6 on first kit then 3/6 on each two kits ordered.

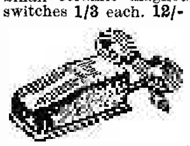
BECKASTAT



This is an instant thermostat, simply plug your appliance into it and its lead into wall plug. Adjustable setting for normal air temperatures. 13A loading Will save its cost in a season. **19/6.** Post and insurance 2/9.

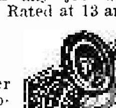
REED SWITCHES

Glass encased, switches operated by external magnet—gold welted contacts. We can now offer 3 types.
Miniature. 1in. long × approximately ⅛in. diameter Will make and break up to ½ amp up to 300 volts. Price **2/6** each. **24/-** dozen.
Standard 2in. long × 3/16in. diameter. This will break currents of up to 1 amp, voltages up to 250 volts. Price **2/-** each. **18/-** per dozen.
Flat. Flat type, 2in. long, just over 1/16in. thick, approximately ¼in. wide. The Standard Type flattened out, so that it can be fitted into a smaller space or a larger quantity may be packed into a square solenoid. Rating 1 amp. 200 volts. Price **6/-** each, **£3** per dozen.
Small ceramic magnets to operate these reed switches **1/3** each. **12/-** dozen.



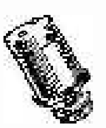
15 Amp FOOT SWITCH

Suitable for Sewing Machine Motor, Drilling Machine or in fact to switch any job where both hands are to be left free. Rated at 13 amps. 250 volts. Price **22/6.**



3 DIGIT COUNTER

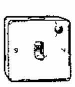
For Tape Recorder or other application, re-settable by depressing button. Price **8/6.**



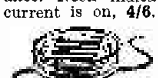
TRANSDUCER

Made by Acos, reference No. I.D.1001. For measuring vibration, etc., to be used in conjunction with "G" Meter. Regular price £5. Our price **49/6.** Brand new and unused.

ISOLATION SWITCH



20 Amp D.P. 250 volts. Ideal to control Water Heater or any other appliance. Neon indicator shows when current is on, **4/6. 48/-** per dozen.



LIGHT CELL

Almost zero resistant in sunlight increases to 10 K. Ohms in dark or dull light, epoxy resin sealed. Size approx. 1in. dia. by ¼in. thick. Rated at 500 MW, wire ended. **8/6** with circuit.

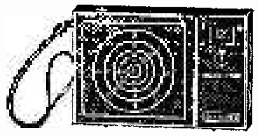
FLEX BARGAINS

Screened 3 Core Flex. Each core 14/0076 Copper PVC insulated and coloured, the 3 cores laid together and metal braided overall. Price **£3.15.** per 100 yds. coil.
15 Amp 3 Core Non-kink Flex. 70/0076 insulated coloured cores, protected by tough rubber sheath, then black cotton braided with white tracer. A normal domestic flex as fitted to 3 Kw. fires. Regular price 3/6 per yd. 50 yd. coil **£4.10.0**, or cut to your length 2/6 per yard.
10 Amp 3 Core Non-kink Flex. As above but cores are 28/0076 Copper. Normal price 2/6 per yd. 100 yd. coil **£7.10.0**, or cut to your length **1/9** yd.
6 Amp 2 Core Flex. As above, but 2 Cores each 23/0076 as used for Vacuum Cleaners, Electric Blankets, etc. **39/6** 100 yd. coil.
23/0076 Triple Core P.V.C. covered, circular, normally sold at 1/6 yd. Our price 100 yd. coil **£3.19.6.** Post and Insurance 6/6.

6, 12 or 24 VOLT SOLENOID

For energising Reed Switches, etc., size approx. 1⅝in. long by 1in. diameter. Hole through Solenoid approx. ⅜in. **8/6** each.

'GLADIATOR' 2 WAVE BAND TRANSISTOR RADIO

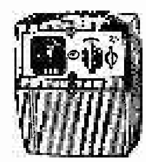


7 transistor, 2 wave band (medium and long) pocket radio with carrying handle and ear-plug. These radios use a ferrite slab aerial and a conventional superhet circuit with built in moving coil speaker. Completely built up, ready to play. Offe... less than importers price due to bankrupt purchase. A remarkable bargain. **39/6** plus 3/6 post and insurance.

MINIATURE EXTRACTOR FAN

Beautifully made by famous German Company. PAPST System, 230/240 A.C. Mains operated, size 3½in. × 3½in. × 2in. Made for instrument cooling but ideal to incorporate in a cooker hood, etc. **65/-.**

BUY TIME SLOT METERS

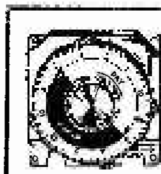


If you hire out equipment such as TV sets by the hour then these slot meters are what you require. We have 3 types, 8d. an hour, 1/- an hour and 1/6 an hour. Brand new. Made by the famous Weston Company. Price **£3.19.6**, postage and insurance 6/6.

DISTRIBUTION PANELS

Just what you need for work bench or lab. 4 × 13 amp sockets in metal box to take standard 13 amp fused plugs. Supplied complete with 6 feet of heavy cable and 13 amp plug. Similar advertised at £5. Our price **39/6**, + 4/6 P & I.

THIS MONTH'S SNIP



24 HOUR TIME SWITCH

Mains operated. Adjustable Contacts give 2 on/offs per 24 hours. Contacts rated 15 amps, repeating mechanism so ideal for shop window control, or to switch hall lights (anti-burglar precaution) while you are on holiday. Made by the famous Smiths Company. This month only **39/6** with Perspex cover, plus 3/6 postage and insurance, a real snip which should not be missed.

DOUBLE ENDED MAINS MOTOR

On feet with holes for screw-down fixing. To drive models, oven, blower heater, etc. **10/-** each, plus 3/6 post and insurance. 6 or more post free.

INSTRUMENT MOTOR WITH GEAR BOX

Made by the famous Smiths Company. This motor has an 8-gear train in perspex gear box. Approximate dimensions, motor 1½in. x 1½in diameter, gear box ⅞in. x 2½in. diameter. Although only 2 watt motor this is really powerful and impossible to stop by hand. Mains operated and available with the following final speeds 1 rpm, 4 rpm, 30 rpm, 60 rpm, and and 1 rev per hour, **35/-.**

ATLAS SLIMLINE FLUORESCENTS
THE TWENTYLITE & THE FORTYTWIN

A Fluorescent lighting unit made by the famous Atlas company, with super silent polyester filled choke and radio suppressed starter. The tube springs in and out and the whole unit is beautifully made and finished white enamel. Amazingly economical. If left on all the time costs only one penny per day (uses ½ unit). Measures 2ft. long. Is ideal in Kitchen, Bedroom, Hallway, Porch, Loft, etc. Don't miss this amazing offer, **39/6** with tube. Assembled ready to install. 4ft. twin model **59/6.** Postage and insurance 6/6 extra.

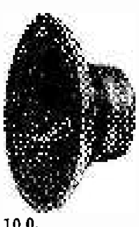
1 WATT AMPLIFIER & PREAMP

5 transistors—highly efficient, made for use with tapehead G4 but equally suitable for microphone or pick up—limited quantity **29/6.** Full circuit diag. also shows tape controls **5/-.**

VARYLITE

Will dim incandescent lighting up to 600 watts from full brilliance to out. Fitted on M.K. flush plate, same size and fixing as standard wall switch so may be fitted in place of this, or mount on surface. Price complete in heavy plastic box with control knob **£3.19.6.**

15, 30 & 100 WATT HI FI SPEAKERS



FULL F1 12 INCH LOUDSPEAKER. This is undoubtedly one of the finest loudspeakers that we have ever offered, produced by one of the country's most famous makers. It has a die-cast metal frame and is strongly recommended for Hi-Fi load and Rhythm Guitar and public address.
Flux Densitity 11,000 gauss—Total Flux 44,000 Maxwells—Power Handling 15 watts R.M.S. Cone Moulded fibre—Freq. response 30-10,000 c.p.s.—specify 3 or 15 ohms—Mains resonance 60 c.p.s.—Chassis Diam. 12in.—12⅜in. over mounting lugs—Baffle hole 11in. Diam.—Mounting holes 4, holes —¼in. diam. on pitch circle 11⅝in. diam.—Overall height 5½in. A £6 speaker offered for only **£3.9.6** plus 7/6 p. & p. Don't miss this offer. **15in. 30 watt £7.19.6. 18in. 100 watt £24.10.0.**

5 kW PORTABLE HEATER

For workshop—stores—greenhouse, etc. Uses twin balanced motors for silent operation and reliability, three position switch gives "max. heat", "half heat", and "blow cold". A really fine heater. Price **£9.19.6**, plus 10/6 post and insurance.

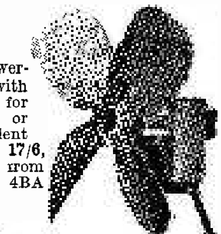
Where postage is not stated then orders over £3 are post free. Below £3 add 2/9. Semi-conductors add 1/- post. Over £1 post free. S.A.E. with enquiries please

MINIATURE WAFER SWITCHES

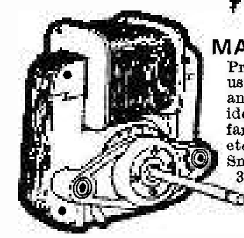
2 pole, 2 way—4 pole, 2 way—3 pole, 3 way—4 pole, 3 way—2 pole, 4 way—3 pole, 4 way—2 pole 6 way—1 pole, 12 way. All at **3/6** each. **36/-** dozen, your assortment

WATERPROOF HEATING ELEMENT
26 yards length 70W. Self-regulating temperature control. **10/-** post free.

AC FAN



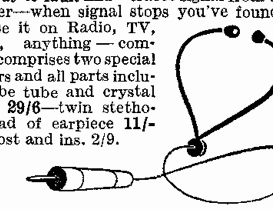
Small but very powerful mains motor with 5⅝in. blades. Ideal for cooling equipment or as extractor. Silent but very efficient. **17/6**, post 4/6. Mounts from back or front with 4BA screws.



MAINS MOTOR

Precision made — as used in record decks and tape recorders—ideal also for extractor fan, blower, heaters etc. New and perfect. Snip at **9/6.** Postage 3/- for first one then 1/- for each one ordered. 12 and over post free.

RADIO STETHOSCOPE



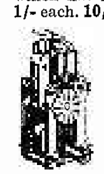
Easiest way to fault find—traces signal from aerial to speaker—when signal stops you've found the fault. Use it on Radio, TV, amplifier, anything — complete kit comprises two special transistors and all parts including probe tube and crystal earpiece. **29/6**—twin stethoset instead of earpiece **11/-** extra—post and ins. 2/9.

MAINS TRANSISTOR POWER PACK

Designed to operated transistor sets and amplifiers. Adjustable output 6v., 9v., 12 volts for up to 500mA (Class B working). Takes the place of any of the following batteries: PP1, PP3, PP4, PP6, PP7, PP9, and others. Kit comprises: mains transformer rectifier, smoothing and load resistor, condensers and instructions. Real snip at only **16/6**, plus 3/6 postage.

PHILIPS TRIMMER

0-30pf an old design but one which has never been bettered. **1/-** each. **10/-** doz. **£4.0.0** per 100.



MOTOR WITH GEAR BOX

Very powerful 7 r.p.m., operates from standard A.C. mains. **29/6**, plus 3/6 P. & P.

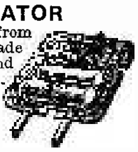
INSTRUMENT BUZZER

6-12 volts adjustable tone. Very neat metal cased U.S.A.-made unit approx. 1¼ in. × 1 in. × ⅝ in. thick, **6/6** each

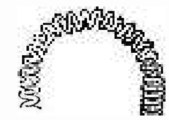
230 VOLT SOLENOID

⅜in. stroke. Size 2⅜in. × 2in. × 1⅞in. **14/6**, postage 2/9.

PP3 BATTERY ELIMINATOR



Run your small transistor radio from the mains—full wave circuit—made up ready to wire into your set and adjustable high or low current. **8/6** each.



SPRING COIL LEADS

as fitted to telephones, 4 core **2/6** each, 3 core **2/-** each.

PANEL LAMPS

In neat plastic cases, available in several voltages as follows: 4v., 6v., 12v., 24v., 36v., 48v., 60v., 110v., 220v., 380v. Note all below 110v. are fitted with lamps. 110v. and above are neons. Price **3/-** each. **30/-** dozen.

APPLIANCE THERMOSTAT

This is a skeleton type control intended for building into oven, for baking, curing, pottery, etc. Two models, one preset for screwdriver control. The other has a shaft for knob control. Approximate operating temperature. Note only high temperature insulation used in these stats. Price **12/6** each.

ELECTRONICS (CROYDON) LTD

Dept PW 266 London Road, Croydon CRO-2TH
Also 102/3 Tamworth Road, Croydon

The Premier Stereo System consists of an all transistor stereo amplifier. Garrard Model 2025 auto/manual record player unit fitted stereo/mono cartridge 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. The 10 transistor 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, stereo/mono switch. Brushed aluminium front panel. Black metal case with teakwood ends: Size 12 × 5½ × 3½in. high (Amplifier available separately if required £14.19.6. Carr. 7/6.)

SPECIAL OFFER CARTRIDGES

SHURE

	List Price	Premier Price
M3D	£8.10.6	£6.19.6
M44-5	£14.9.1.	£10.10.0
M44C	£12.19.5	£9.9.0.
M44E	£17.8.4	£13.19.6
M55E	£20.15.1	£15.15.0
M75-6	£17.8.4	£13.19.6
M75E	£25.18.10	£21.0.0
AUDIO TECHNICA		
A.T.7S stereo	£22.0.0	£15.0.0
A.T.7X elliptical	£25.0.0	£18.0.0

Post and Packing 1/6 each

"NOVA" TRANSISTOR STEREO AMPLIFIER

A superb stereo amplifier offering every facility for the hi-fi enthusiast. Output 10 watts per channel. Frequency response 40-20,000 Hz ± 3dB. Inputs for radio, P.U. Ceramic, P.U. Magnetic Tape, Separate bass and treble controls, Volume and Balance controls Mono/Stereo Switch. Also features headphone socket and tape output. Teak case with attractive illuminated front panel. Size 14⅛ × 9¼ × 3½in. A.C. 200/250V.

WONDERFUL VALUE AT ONLY **25 Gns.** Carr. 10/-.

"NOVA" 5 WATTS PER CHANNEL STEREO AMPLIFIER. Specification as above. £18 18 0, Carr. 10/-.

PICK-UP CARTRIDGES
AT MONEY SAVING PRICES!

GOLDRING G800 (Stereo)	£8.19.6
SONOTONE 9TAHC/D (Stereo)	£2.15.0
ACOS GP91/18C (Mono compatible)	£1.13.5
ACOS GP93-1 (Stereo)	£2. 8.7
ACOS GP94 (Stereo)	£2.14.8
B S R X3M (Mono compatible)	£1.16.5
B S R X3H (Mono compatible)	£1.16.5
RONETTE 105 (Stereo)	£1.15.0
RONETTE 106 (Stereo)	£1.15.0

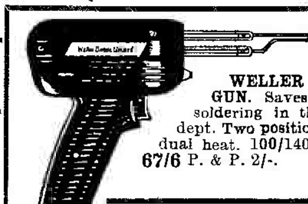
All complete with mounting brackets and instructions. Post and Packing 1/6 each.

WIDE RANGE OF HI-FI STEREO EQUIPMENT ON DEMONSTRATION

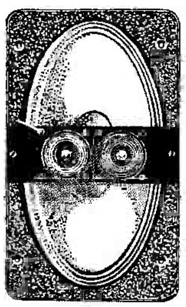
All leading makes available including **Rogers, Armstrong,** Dulci, Wharfedale, Goodmans, Goldring, Shure, etc. etc.

SAVE NEARLY £5!

Premier Stereo System with "Nova" 10 watt Stereo Amplifier as above. 45 Gns. Carr. 35/-.



WELLER "EXPERT" SOLDER GUN. Saves time and simplifies soldering in the home and service dept. Two position trigger gives instant dual heat. 100/140 watt. 240 volt A.C. **67/6** P. & P. 2/-.



E.M.I. 13×8in. HI-FI SPEAKERS

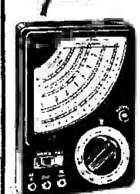
Fitted two 2½in. tweeters and crossover network. Impedance 3 and 15 ohms. Handling capacity 10 watts. Brand new. **99/6**, p.&p. 7/6.
Also available without tweeters **49/6**, p. & p. 7/6.

TEAK FINISHED CABINET Size 17½ × 10 × 7¼in. Ideal for above speakers **£5.10.0**, p. & p. 10/-.

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 **59/6** STEREO MODEL **69/6** P. & P. 2/6.



POCKET SIZE MULTI-TESTER With wide angle, jewelled meter movement, ceramic long-life, low-loss switching, tough impact resisting case. Sensitivity 20,000 ohms/volt D.C. 10,000 ohms/volt A.C.
19 Ranges: 0-5-25-50-250-500-2500 volts DC. 0-10-50-100-500-1000 volts AC. 0-50µA-2·5 mA-250 mA DC. 0-6000 ohms-6 megohms, 10µ µf-0·001 mfd-1 mfd. —20 to +22dB. Complete battery, test lead and instructions. **£4.19.6** P. & P. 3/6.

VERITAS V-313 TAPE HEAD DEFLUXER

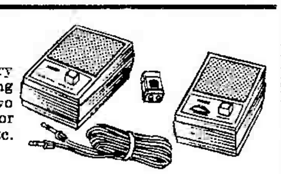
A must for all tape users! Tape heads become permanently magnetized with constant use; this leads to background noise that prevents perfect recordings. Simply applied to recording head the V313 leaves head free of magnetism. Cleans any tape head in seconds. **34/6** P. & P. 1/6.

HI-FI STEREO HEADPHONES

Designed to the highest possible standard. Fitted 2½" speaker units with soft padded ear muffs. Adjustable headband. 8 ohm impedance. Complete with 6ft. lead and stereo jack plug. **59/6** P. & P. 5/-.

MONO HEADPHONES 2000 ohm **14/6** P. & P. 2/6.
STEREO STETHOSCOPE SET Low imp. **25/-** P. & P. 2/-.
MONO STETHOSCOPE SET Low imp. **10/6** P. & P. 2/-.

TWO STATION TRANSISTOR INTERCOMS. Complete with battery and 50ft. connecting wire. Compact size, two way call system. Ideal for home, office, factory, etc. **65/-** P. & P. 4/-.



FOUR STATION INTERCOM. Master unit and 3 slaves. Ideal for office and home. Complete with battery and connecting wire £7.19.6. P & P. 5/6.

SPECIAL BARGAIN OFFER

B.S.R. MA75 RECORD PLAYER UNIT. 4 speeds. Automatic or Manual operation. Low mass arm with cue and pause lever, bias compensator, stylus pressure adjuster, etc. Complete with Stereo/Mono Cartridge. Original Price £17.17.8.

Our Price Carr. 10/6 **12 Gns.**

"PREMIER" TAPE CASSETTES

C60 (60 min.) **7/6** THREE FOR 21/-
C90 (90 min.) **12/6** THREE FOR 36/-
C120 (120 min.) **17/6** THREE FOR 51/-
P. & P. 1/-.

"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.	5/6	LP6	5¾"	1200'	P.V C.	12/6
TT3	3"	450'	POLYESTER	7/6	DT6	5¾"	1800'	POLYESTER	22/6
DT3	3¼"	600'	POLYESTER	11/6	TT6	5¾"	2400'	POLYESTER	37/6
SP5	5"	600'	P.V.C.	8/6	SP7	7"	1200'	P.V C	12/6
LP5	5"	900'	P.V.C.	10/-	DT7	7"	2400'	POLYESTER	25/-
DT5	5"	1200'	POLYESTER	15/-	TT7	7"	3600'	POLYESTER	50/-

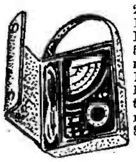
TAPE SPOOLS 3" 1/-, 5", 5¾", 7" 1/9, TAPE CASES 5", 7" 2/6.
Post and Packing 3" 1/-, 5", 5¾" 1/6, 7" 2/-. (3 reels and over Post Free).

CASSETTE HEAD CLEANER
Removes unwanted deposits from delicate tape heads. Fits all cassette recorders. **11/6** P. & P. 1/-

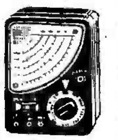
PREMIER RADIO

23, TOTTENHAM COURT ROAD, LONDON, W.1 Tel: 01-636 3451

LIND-AIR OPTRONICS LTD

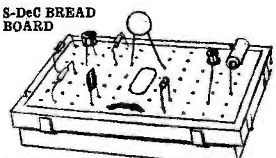


TTC.C1001 MULTITESTER in leather case. Overload protection. 20,000 opv. AC volts 10, 50, 250, 1,000v. DC volts 5-25, 125, 500, 2500v. D.C. Current 0-50μA, 0-250mA Resistance 0-60K, 0·6 Megohm. Decibels -20 to +22dB. Size of meter 4½ × 3¾ × 1in. 85/-. P. & P. 3/6.



SHIRA 62D MULTI-TESTER 20,000 o.p.v. DC voltage: 5-25-50-250-500-2·5K (20,000 ohms per volt). AC Voltage: 10-50-100-500-1000 volts (10,000 ohms per volt). DC Current: 0-50μA, 0-2·5mA, 0-250mA. Resistance: 0-6K, 0-6Mg (300 ohm and 30K at centre scale.) Capacitance: 10pf. to ·001 mfd, ·001μf to ·1μf. Decibels: -20 to +22dB. Size 4½ × 3¼ × 1in. 71/-. P. & P. 3/6

S-DeC BREAD BOARD



British Made

Solderless breadboard panels, for fast reliable component connections.

Single DeCs. One S-DeC with Control Panel, Jig and Accessories for solderless connections to controls, etc., with booklet "Projects on S-DeC" giving construction details for a variety of circuits. 29/6. P. & P. 2/6.

4-DeC KIT. Four S-DeCs with two Control Panels, Jigs and Accessories and the booklet "Projects on S-DeC" all contained in a strong attractive plastic case. Ideal for the professional user. £5.17.6. P. & P. 3/6.

GARRARD DECKS

SRP22 less cartridge	£5. 9.6
1025 Stereo/Mono with cart.	£6.19.6
2025 Stereo/Mono with cart.	£7.19.6
3000S Stereo/Mono with cart.	£9.19.6
3000D Stereo/Mono with cart.	£10.19.6
SP25 less cartridge	£11.19.6
SP25 with Decca Deram cart.	£17. 4.6
SL55 less cartridge	£11.19.6
SL55 with Decca Deram cart.	£17.4.6
SL65 less cartridge	£14.9.6
Covers for above	£2.19.6
Bases for above	£2.10.0
AP75 less cartridge	£18.18.0
SL75 less cartridge	£28.7.0
SL95 less cartridge	£38.19.6
Bases for above	£4.19.6
SPECIAL OFFER!	
SP25 less cart., with base	£13. 2.6

P. & P. Decks 12/6, Cover 4/6, Base 4/6. P. & P. Deck/Cover/Base 17/-.

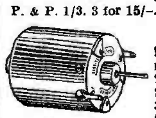
SPECIAL OFFER!

SONOTONE 9TAHC Stereo Cartridge with diamond stylii. Normal retail price 4 gns.

OUR PRICE 55/-. P. & P. 1/6

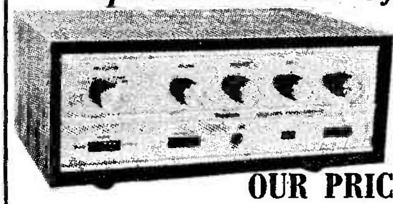
Suitable for use with all Garrard decks.

MODEL MAKER'S MOTOR No. 15RN. Voltage 11·5v. Current 400mA. Torque. 12g-cm. Body size 1⅝" long × ⅞" dia. Shaft ⁵/₁₆" long × ¹/₁₆" dia. Ideal for small models and toys. 5/6 each. P. & P. 1/3. 3 for 15/-. P. & P. 2/6.



9V d.c. Gram deck replacement motor. 2in × 1½in dia. Shaft win long × 3/32in. 17/6. P. & P. 2/6.

Special Lind-air Offer!



Teleton SAQ203

Transistor Stereo Amplifier

List Price £28.7.0.

OUR PRICE 22 Gns

One of the most popular models from the fabulous Teleton range. Incorporates 16 transistors and diodes producing superb quality hi-fi. 10 watts per channel music power. Inputs for Gram (Magnetic and Crystal), Tuner and Auxiliary. Tape Record output. Controls: Volume, Balance, Bass, Treble. Housed in attractive oiled walnut cabinet with brushed aluminium front panel.

TRANSFORMERS

AUTO WOUND TRANSFORMERS

All Winding Voltage Ratings and Tapping 0–115–200–220–240v except MT113–0–115–210–240v.

MT113	20W	Size 2⅛ × 1¹¹/₁₆ × 1¾in.	Wgt 11oz	Price 12/6	P&P 2/6
MT64	75W	Size 2⅝ × 2⅛ × 2⅜in.	Wgt 1 lb 14oz	Price 21/9	P&P 4/6
MT4	150W	Size 3¼ × 2¾ × 3in.	Wgt 3 lb	Price 33/-	P&P 6/-
MT65	200W	Size 3½ × 4½ × 4in.	Wgt 4 lb	Price 39/6	P&P 6/-
MT66	300W	Size 4 × 4 × 3⅞in.	Wgt 6 lb 7 oz	Price 59/4	P&P 9/-
MT110	400W	Size 4⅞ × 4⅝ × 4in.	Wgt 11 lb	Price 85/-	P&P 10/-
MT67	500W	Size 5¼ × 4 × 4½in.	Wgt 12 lb 8oz	Price 89/-	P&P 10/6
MT83	750W	Size 4½ × 5¼ × 5½in.	Wgt 13 lb 4oz	Price 95/7	P&P 10/6
MT84	1000W	Size 4½ × 5¼ × 5½in.	Wgt 16 lb	Price 142/2	Carr. ex.
MT93	1500W	Size 5⁵/₁₆ × 5⅞ × 6⅛in.	Wgt 28 lb 9oz	Price 170/6	Carr. ex.
MT94	1750W	Size 5⁵/₁₆ × 6⅞ × 6⅛in.	Wgt 31 lb	Price 195/-	Carr. ex.
MT95	2000W	Size 7 × 6½ × 8½in.	Wgt 40 lb	Price 211/2	Carr. ex.
MT73	3000W	Size 6¾ × 7½ × 8⅜	Wgt 45 lb 8oz	Price 300/-	Carr. ex.

LOW VOLTAGE 12 VOLT RANGE

Primary 200–250v—Secondary 12v

MT111	0·5 Amp	Size 3 × 2¼ × 1¾in.	Wgt 12oz	Price 15/3	P&P 2/6
MT71	2 Amp	Size 2⅝ × 2¼ × 2¼in.	Wgt 1 lb	Price 19/-	P&P 3/9
MT69	4 Amp	Size 3½ × 2⅝ × 2⅞in.	Wgt 2 lb 4oz	Price 28/-	P&P 6/-
MT70	6 Amp	Size 4 × 3 × 3⅛in.	Wgt 3 lb 12oz	Price 39/-	P&P 6/-
MT72	10 Amp	Size 3⅛ × 4¼ × 4in.	Wgt 6 lb 3oz	Price 51/-	P&P 9/-
MT115	20 Amp	Size 4⅝ × 4⅜ × 4in.	Wgt 11 lb 13oz	Price 95/-	P&P 9/-
MT187	30 Amp	Size 5¼ × 4⅞ × 4¾in.	Wgt 16 lb 12oz	Price 180/-	P&P 13/6

LOW VOLTAGE 24 VOLT RANGE

Primary 200/250v. Secondary 24v

MT58	1 Amp	Size 3¾ × 2⅝ × 2¼in.	Wgt 1 lb 7oz	Price 23/9	P&P 4/6
MT114	3 Amp	Size 2½ × 3 × 3in.	Wgt 3 lb 6oz	Price 38/-	P&P 6/-
MT72	5 Amp	Size 4 × 3¾ × 3⅝in.	Wgt 5 lb 12oz	Price 53/10	P&P 6/-
MT17	8 Amp	Size 4⅞ × 3¾ × 4in.	Wgt 7 lb 8oz	Price 72/7	P&P 9/-
MT115	10 Amp	Size 4¾ × 4½ × 4in.	Wgt 11 lb 13oz	Price 95/-	P&P 11/-

LOW VOLTAGE 30 VOLT RANGE

Primary 200/250v Secondary Tapped 12-15-20-24-30

MT112	0·5 Amp	Size 3¼ × 2⁷/₁₆ × 1¹⁵/₁₆in.	Wgt 1 lb 4oz	Price 17/4	P&P 3/9
MT79	1 Amp	Size 2¾ × 2½ × 2⅝in.	Wgt 2lb	Price 23/-	P&P 6/-
MT20	3 Amp	Size 4 × 3¼ × 3⅝in.	Wgt 4 lb 6oz	Price 46/2	P&P 6/-
MT51	5 Amp	Size 4⅞ × 3¼ × 4in.	Wgt 6 lb 8oz	Price 60/9	P&P 9/-
MT88	8 Amp	Size 5⅛ × 3⅞ × 4½in.	Wgt 9 lb 6oz	Price 92/4	P&P 11/-
MT89	10 Amp	Size 5⅛ × 4 × 4⅛in.	Wgt 12 lb 2oz	Price 103/6	P&P 11/-

LOW VOLTAGE 50 VOLT RANGE

Primary 200-250v SECONDARY TAPPED 19-25-33-40-50v

MT102	0·5 Amp	Size 2¾ × 2⅝ × 2¼in.	Wgt 1 lb 11oz	Price 21/3	P&P 6/-
MT104	2 Amp	Size 4 × 3½ × 3⅜in.	Wgt 5 lb	Price 45/8	P&P 6/-
MT106	4 Amp	Size 4¾ × 4½ × 4in.	Wgt 9 lb 4oz	Price 77/-	P&P 9/-
MT118	8 Amp	Size 5¼ × 5¼ × 4¾in.	Wgt 18 lb 9oz	Price 132/-	P&P 13/6
MT119	10 Amp	Size 6⅛ × 4½ × 6¼in.	Wgt 19 lb 12oz	Price 165/-	P&P 15/6

LOW VOLTAGE 60 VOLT RANGE

Primary 200/250v. Secondary 24–30 40–48–60

MT124	0·5 Amp	Size 3¼ × 2¾ × 2⅝in.	Wgt 2 lb 4oz	Price 24/-	P&P 6/-
MT127	2 Amp	Size 4 × 3½ × 3⅜in.	Wgt 5 lb 6oz	Price 52/10	P&P 6/-
MT123	4 Amp	Size 4½ × 3¾ × 4½in.	Wgt 10 lb 6oz	Price 99/-	P&P 11/-
MT122	10 Amp	Size 6⅛ × 5 × 6½in.	Wgt 23 lb 2oz	Price 152/-	Carr. ex.

MAINS H.T. RANGE

						Size	Price	P&P
MT1AT	250–0–250v	80MA	6·3v 3·5A	5/6·3v 1A		3½ × 3 × 3in.	33/-	6/-
MT6AT	250–0–250v	100MA	6·3v 3·5A	5/6·3v 1A		4 × 3⅛ × 3½in.	38/3	6/-
MT110	250–0–250v	120MA	6·3v 3·5A	5/6·3v 1A		4 × 4 × 3¼in.	44/9	6/-
MT11AT	300–0–300v	100MA	6·3v 3·5A	5/6·3v 1A		4 × 3¾ × 3⅝in.	37/9	6/-
MT12AT	300–0–300v	120MA	6·3v 4A	5/6·3v 1A		4 × 3⅞ × 3⅜in.	46/2	9/-
MT33AT	300–0–300v	150MA	6·3v 4A	5/6·3v 1A		4 × 4 × 3⅛in.	59/4	9/-
MT2AT	350–0–350v	80MA	6·3v 3·5A	5/6v 1A		4 × 3⅛ × 3⅜in.	38/6	6/-
MT7	350–0–350v	100MA	6·3v 3·5A	5/6·3v 1A		4 × 3⅛ × 3⅜in.	42/4	6/-
MT8	350–0–350	120MA	6·3v 3·5A	5-6·3v 1A		4 × 3⅞ × 3⅞in.	50/-	6/-

BATTERY CHARGER TYPES

Primary Voltage 200–250v. Secondary 6–12v.

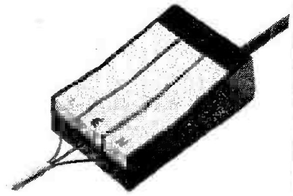
M77	1 Amp	Size 2⅞ × 2⅛ × 2⅜in.	Wgt 1lb 6oz	Price 15/-	P&P 4/6
MT45	1·5 Amp	Size 2⅞ × 2⅜ × 2⅜in.	Wgt 1 lb 9oz	Price 21/9	P&P 4/6
MT46	2 Amp	Size 3¼ × 2⅝ × 2⅜in.	Wgt 2 lb 4oz	Price 25/4	P&P 6/-
MT47	3 Amp	Size 4 × 3 × 3⅜in.	Wgt 3 lb 8oz	Price 28/4	P&P 6/-
MT5	4 Amp	Size 4 × 2⅞ × 3¼in.	Wgt 3 lb 11oz	Price 33/-	P&P 6/-
MT78	5 Amp	Size 4 × 3½ × 3⅜in.	Wgt 5 lb 4oz	Price 42/-	P&P 6/-
MT86	6 Amp	Size 4 × 3½ × 3⅝in.	Wgt 5 lb 12oz	Price 48/-	P&P 6/-
MT48	7 Amp	Size 4 × 4 × 3⅜in.	Wgt 6 lb	Price 56/7	P&P 9/-
MT146	8 Amp	Size 3½ × 4 × 4in.	Wgt 6 lb 4oz	Price 75/-	P&P 9/-
MT49	9 Amp	Size 4¾ × 3¾ × 4in.	Wgt 7 lb 8oz	Price 99/-	P&P 9/-
MT147	10 Amp	Size 4¾ × 3½ × 4in.	Wgt 9 lb 3oz	Price 105/-	P&P 9/-
MT50	12·5 Amp	Size 5¼ × 4¼ × 4¾in.	Wgt 11 lb 14oz	Price 125/-	P&P 11/-

Amperages are D.C. with nominal selenium bridge rectifiers

MAINS ISOLATING RANGE ALSO AVAILABLE

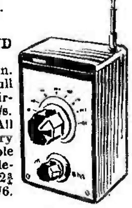
MAINS KEYNECTOR

SAVES TIME—SAFELY!



One mains "Keynector" instantly and safely connects electrical appliances to mains supply without the use of a plug. A number of appliances may be used simultaneously up to the full 13 amp rating of this device. A red light glows when "live". The "Keynector" is fused and has its own robust switch which is interlocked to prevent connections when "live". *Invaluable to handymen, servicemen, demonstrators etc.*

39/6 P. & P. 3/-.



VHF AIRCRAFT BAND CONVERTOR. When placed within 1in. of a MW band radio full coverage of VHF AircraftBand 108-135 Mc/s. can be obtained. All transistor, 9v battery operation. Fully tunable 18½in. × 7 section telescopic aerial. Size 4 × 2⅞ × 1½in. 79/6. P. & P. 3/6.

SINCLAIR IC-10 INTEGRATED CIRCUIT

10 watt Amplifier. Size only 1 × 0.4 × 0.2in. A true hi-fi amplifier complete with manual giving details of a wide range of applications and instructions. Guaranteed 5 years. ONLY 59/6. P. & P. 1/6.

SPECIAL TRANSFORMER FOR OPERATING SINCLAIR IC-10 from A.C. mains 230/250v. Output 13v. at 0·5 amp. 12/6. P. & P. 2/6.

SINCLAIR PROJECT 60

An attractive alternative for the enthusiast prepared to assemble these excellent modules to make a stereo assembly.

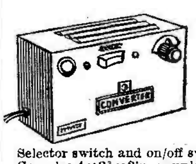
Z.30 24 watt Power Amplifier 89/6 (2 required).

Stereo Sixty Control/Pre-amplifier £9.19.6.

PZ.5 Power Supply Unit £4.19.6.

Project 60 is supplied complete with instruction manual and templates for plinth mounting.

"HI-TEN" LOUDSPEAKER British made full range 10in. unit handles up to 10 watts. Ceramic magnet. Freq. response: 40–10,000 cps. Imp: 15 ohms Flux density: 10,000 lines. 49/6. P. & P. 4/6.



Battery Eliminator. Enables transistor equipment to be operated from AC mains. 6/9/12v. output. Selector switch and on/off switch. 100mA. Case size 4 × 2⅞ × 2in. complete with mains lead, connecting leads and instructions. 59/6. P. & P. 3/6.

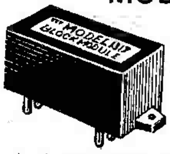
DE-LUXE STEREO HEADPHONES

With soft rubber earpieces. Impedance 8-16 ohms. Frequency response 23-13,000cps. With lead and stereo plug. Only 59/6. P. & P. 3/6.

LIND-AIR OPTRONICS LTD

See our vast range of Electronic Components and Accessories at our enlarged Component Centre 25 Tottenham Court Road

TRANSISTOR MODULES



E.1311. PHONO PRE-AMPLIFIER. Size 2×1×⅞in. Built-in R.I.A.A. characteristics enabling low output magnetic pick-up cartridges to be amplified up to 1 volt. Input 100Kohm. Gain 28dB: Max. output 3v: Max. input 50mV. Distortion 0·15% (at 1v level). Power supply 9–12v. **29/6.** P. & P. 2/-.

E.1313. MICROPHONE PRE-AMPLIFIER. Enables a low output microphone to be used with an amplifier or radio. Input imp. 100Kohms: Gain 28dB: Max. output 3v: Max. input 50mV: Distortion 0·15% (at 1v level): Freq. response 10Hz–50KHz. Power supply 9–12v. **29/6.** P. & P. 2/-.

E.1318. DUAL LAMP FLASHER. A switch module for electronically alternating two miniature bulbs, 6V, 100–200mA. Ideal for models, toy boats and planes, displays, warning and security devices, communication signals, etc. Flasher time ¼ sec: Power supply 6v DC: Current 150mA: Lamp 6v 150mA. **25/-.** P. & P. 2/-.

E.1315. ELECTRONIC ORGAN TONE OSCILLATOR. Used in conjunction with an organ keyboard, variable resistances and a 9 volt power supply, this module acts as the oscillator unit for an electronic organ. Tone Frequency: 200–1,000Hz: Output 80mW: Current 15mA. **25/-.** P. & P. 2/-.

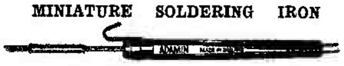
E.1314. POWER AMPLIFIER. When used in conjunction with E.1311, E.1312 and E.1313 units this amplifier module produces about 300mW output for speaker connection (8–16 ohms), without necessity for an output transformer. Input imp. 1,000 ohms: Gain 20dB: Output 300mW: Distortion 3% (at 200mW output level). Freq. res. 50Hz–10KHz. Power supply 9v. Current 20mA at no signal, 80mA at max. output. **29/6.** P. & P. 2/-.

E.1317. MINIATURE MORSE TRANSMITTER. Will transmit to any adjacent AM Receiver, also makes a useful oscillator for trouble shooting. Audio tone 400c/s. Radio frequency range 400c/s to 30Mc/s. Power supply 9v DC. Current 35mA. **25/-.** P. & P. 2/-.

E.1312. TAPE PRE-AMPLIFIER. Incorporating N.A.R.T.B. curve characteristics, this amplifies tape head signals up to 1 volt within the frequency range of 30Hz–15KHz. Input imp. 100Kohm: Gain 25dB: Max. output 2v: Max. input 50mV: Distortion 0·15% (at 1v level): Power supply 9–12 volts. **29/6.** P. & P. 2/-.

E.1316. MORSE CODE OSCILLATOR. A transistorised morse code oscillator (buzzer) to be used in conjunction with an operating key. Suitable for direct connection to a loudspeaker. Tone freq. 400Hz: Power output 80mV: Power supply 3–9v.: Current 45mA. **25/-.** P. & P. 2/-.

MINIATURE SOLDERING IRON



British made and designed for use with transistor circuitry but ideal for many other uses. AC 240v. 18 watt. Length 7³⁄₁₆in., ⅛in. slide on bit. Price **32/6** P. & P. 2/-.

Visit our Brand New enlarged Hi-Fi Demonstration Room, Tape, Record Bar and Scientific Show of Microscopes, Binoculars, Telescopes and Watches at 18/19 Tottenham Court Road

FANTASTIC XMAS OFFER!

IT'S OUT OF THIS WORLD

NEVER BEFORE SUCH VALUE!

Lind Air Audio 'COMPACT' Hi-Fi Stereo System

ONLY **39½ GNS** Carr. & Ins. 25/-

LIMITED PERIOD ONLY!

£5. 9. 6 DEPOSIT plus 25/- Carr. & Ins. and 9 monthly payments of £4. 9. 7. Total Credit Sale Price £45. 15. 9.

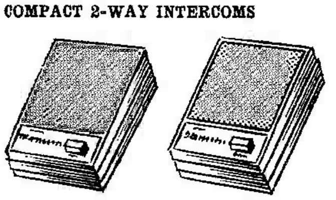
BIG SOUND AT LOW COST!

6 watts r.m.s. per channel. Controls: Bass, Treble, Volume, Balance, Function selector. Mono/Stereo switch. Tape record outlet. Inputs for Tape replay/Tuner. Headphone facility. Beautiful teak case with matched loudspeakers. Garrard Autochanger unit fitted Stereo Cartridge. Sizes: Plinth 16¼″ × 14″ × 3½″ Speakers 12½″ × 6″ × 8″

EXCLUSIVE TO LIND-AIR

See and hear the Lind-Air Audio "Compact" now at London's Newest Hi Fi Store — All leading names in stock plus Expert Advice, Hi Fi and T.V. Demonstrations, Part Exchanges, Mail Order and Export Sales.

COMPACT 2-WAY INTERCOMS



For table of wall mounting. Smart two tone grey cases size 3½×1¼×2¼in. Complete with lead, staples and 9v battery. **55/-.** P. & P. 3/6.

HI-TONE RECORDING TAPE

BRITISH MADE. TOP QUALITY

J1001	3″	Long Play PVC	225ft.	5/6	P. & P. 1/2.
J1002	3″	Triple Play Poly	600ft.	10/6	P. & P. 1/2.
J1003	5″	Long Play PVC	900ft.	10/-	P. & P. 1/8.
J1004	5″	Double Play Poly	1200ft.	15/-	P. & P. 1/8.
J1005	5¾″	Long Play PVC	1200ft.	12/6	P. & P. 2/-.
J1006	5¾″	Double Play Poly	1800ft.	22/6	P. & P. 2/-.
J1007	7″	Standard Play PVC	1200ft.	12/6	P. & P. 2/6.
J1008	7″	Long Play PVC	1800ft.	17/6	P. & P. 2/6.
J1009	7″	Double Play Poly	2400ft.	25/-	P. & P. 2/6.
J1010	7″	Triple Play Poly	3600ft.	50/-	P. & P. 2/6.

LAO

LIND-AIR OPTRONICS LTD

18, 25 & 53 TOTTENHAM COURT ROAD, LONDON W.1.
Telephone: 01-580 2255/4532/7679
Shops open 9-6 pm. Monday to Saturday. Thursday until 7 pm.

ALL MAIL ORDERS To Dept. PW170, 54a Tottenham Court Road, London, W1.

. . . or any day you please (Sundays included)—any time of day or night. Your message will be received loud and clear. Even if we are not there "live" at the other end of the line, our telephone recording machine will take your message for us to deal with as soon as we are back on the job. If your message is a fat order we'll be delighted. If it's just a teeny-weeny order we'll still be delighted.

This "order-by-phone" facility is just one of the many advantages offered by our new CREDIT ACCOUNT SERVICE. Here are a few more advantages:

Order forms and prepaid envelopes are provided, so if you want to order by post, you don't even have to find a stamp. To settle your account you need only *one* cheque, postal order or money order per month. Normally on credit accounts there is a minimum invoice charge of 30/-, but *we* stipulate *no* minimum.

Of course, this Credit Account Service is available only if you are already using our catalogue for ordering components, but after you have been in the service for 12 months we regularly send you an up-to-date catalogue FREE of charge.

Like to know more about this trouble-saving, money-saving service? Then drop us a line or give us a ring, 01-648 8422.

A Merry Christmas to all our readers!

You should certainly have an up-to-date copy of the Home Radio Catalogue even if you do not intend to use our Credit Account Service. It's a *must* for every Radio and Electronics enthusiast. It has 350 pages and lists 8,000 components, over 1,500 of them illustrated. Moreover it contains 6 vouchers, each worth 1/- when used as indicated. Give *yourself* a Christmas present this year. Post the coupon with 12/- (8/6 plus 3/6 post and packing) and we'll send your catalogue by return of post.

Please write your Name and Address in block capitals

Name ....

Address ....

....

....

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

PRACTICAL WIRELESS

VOL 45 NO 9

Issue 755

JANUARY 1970

TOPIC OF THE MONTH

THE optimists will soon be ringing out 1969 and hopefully heralding what they imagine will be a brighter new year. The pessimists will just groan and say things can't be worse. It's all a matter of viewpoint and temperament, but whatever these are one must first assess the retiring year before speculating on the one to come. We have done this with P.W.

Circulation figures and readers' letters remained at a high level, so we assume that most readers got what they wanted. During 1969 we published 194 articles and features, an average of 16-plus per issue. Of these there were 7 on building amplifiers, 11 on receivers and front ends and 10 on test equipment. This apart from the projects under the Take 20 and IC of the Month banners, and constructional items in other categories.

On the semi-constructional and theoretical front there were series on repairing radio sets, pulse circuits, aerials, magnetic sound recording, semiconductor theory and 12 instalments of P.W. Guide to Components. Other articles ranged a varied field and took in home workshop practice, relays, power supply units, a stereo decoder, printed circuit design, a pedal steel guitar, etc.—and, of course, the regular news and comment features.

If we left anyone out during the year he must surely be a weird misfit! Having modestly patted our own editorial backs it is only just to convey our appreciation for the support from readers in the way of comments, criticisms, suggestions and letters of encouragement. And, of course, for sending along manuscripts for consideration; a high proportion of published material is the work of ordinary readers of P.W. So, to every one of you, from the regular subscribers to those who cadge a copy from a mate at the local club. . . .

Merry Christmas and a Happy New Year

from

W. N. STEVENS

L. E. Howes, G3AYA **C. Riches**

H. Moorshead **T. R. Preece, G3TRP**

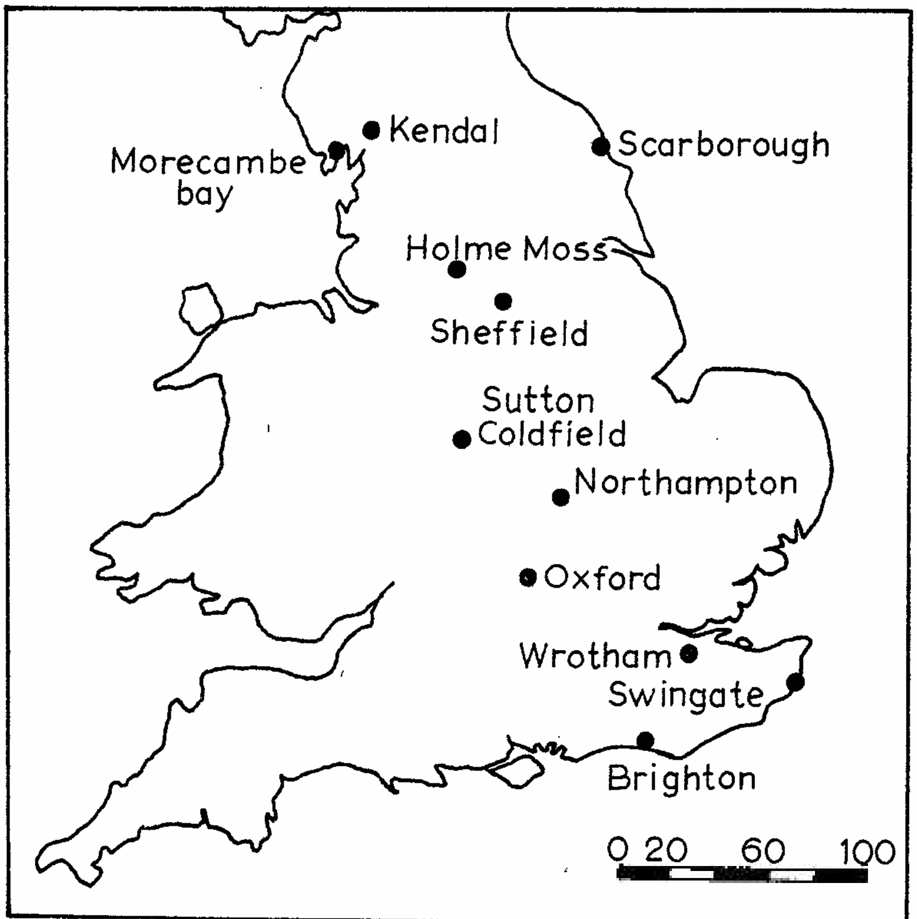
NEWS AND COMMENT

CONSTRUCTIONAL

OTHER FEATURES

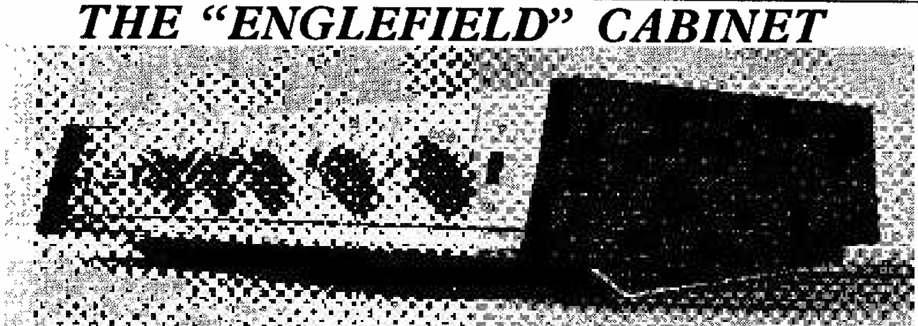
February issue will be published on January 9th.

VHF STEREO RADIO TRANSMITTING STATIONS ON RADIO 3



	Frequency		Maximum ERP
Brighton	92·3MHz	South & West	150W (directional aerial)
Holme Moss	91·5MHz	North	120kW
Kendal	90·9MHz	North	25W (directional aerial)
Morecambe Bay	90·9MHz	North	4kW (directional aerial)
Northampton	91·1MHz	Midland	60W (directional aerial)
Oxford	91·7MHz	Midland	22kW (directional aerial)
Scarborough	92·1MHz	North	25W (directional aerial)
Sheffield	92·1MHz	North	60W
Sutton Coldfield	90·5MHz	Midland	120kW
Swingate	92·4MHz	London	7kW (directional aerial)
Wrotham	91·3MHz	London	120kW

THE "ENGLEFIELD" CABINET



Peak Sound, the CirKit people have announced the "Englefield" cabinet for their amplifier modules. It is in kit form and includes components to complete a stereo amplifier based on the PA.12-15 Power Amp Module, the SCU/400 Stereo Preamp Module and the PS/45K Power Supply Kit. Cost of this kit is £38 4s. for 12W per channel system. *Peak Sound, 32 St. Judes Road, Englefield Green, Egham, Surrey.*

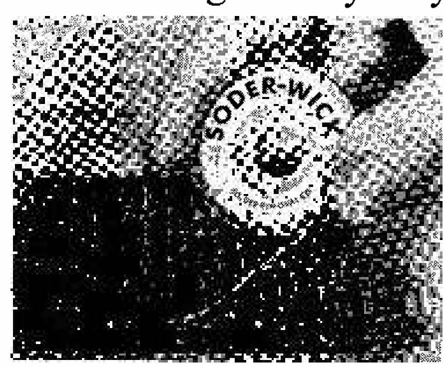
SWANSEA COLLEGE SOCIETY

The University College of Swansea Amateur Radio Society is once again fully active with activities such as Morse code and R.A.E. tuition for students. Amateurs and listeners are also welcomed to the meetings and details may be obtained from: *Rob Wilcox, Room 520, Neuadd Gilbertson, University College of Swansea, Singleton Park, Swansea, SA2 8PS.*

North Leeds Radio Club

The North Leeds Radio Club has recently been formed. Will anyone wishing to join or visit this club please contact the Secretary, G. Brown, 2 Fearnville Close, Dib Lane, Leeds 8, Yorkshire.

Desoldering the dry way

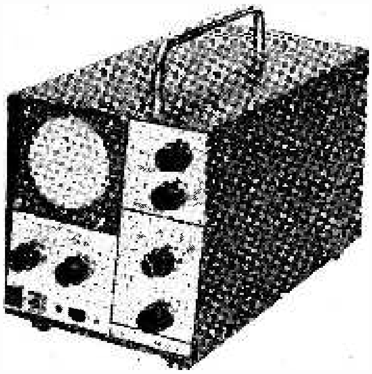


Southern Watch & Clock Supplies Ltd. are UK selling agents for "Soder Wick"—a dry wick method of desoldering. As can be seen in the illustration, it is supplied in reel form and is used by direct contact with the joint together with a soldering iron for heating purposes.

Soder Wick draws the solder up into itself quickly and no excessive heat is required and the desoldered joint is left solder-free, pure and non-corrosive. Prices range from 18 to 20s. but for readers who would like to try it out there is a special offer, open until 31st December whereby they can get a sample for 16s. Further particulars may be obtained from: *Southern Watch & Clock Supplies Ltd., Industrial Tools Division, 48/56 High Street, Orpington, Kent, BR6 0JH*

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

SCOPE FOR SCHOOLS



A new oscilloscope, type EA 0699-1 has been announced by Mitre Electronic Products. It is intended mainly for use as a basic class oscilloscope in schools, and features a $2\frac{3}{4}$in. diameter tube with green medium persistence trace and the Y bandwidth is d.c. to 100kHz. There is less than 100mV/cm Y sensitivity at maximum gain with full Y shift and automatically synchronised timebase range is 100mS/cm to 10μS/cm (approx.). X input with full X shift when timebase is off is 1V/cm.

The oscilloscope is housed in an all-metal case measuring $6\frac{1}{4} \times 6\frac{1}{4} \times 10\frac{1}{2}$in. Weight is 8 lb., supply voltage, 200-250V 50-60Hz and power consumption 25W. It is fully guaranteed and price is £24 10s. (1 off) with a discount for schools. A data sheet is available. *Mitre Electronic Products, 22 Powis Terrace, London, W11.*

LOW VOLTAGE AND ISOLATING TRANSFORMERS

Gardners Transformers Ltd., have introduced a range of open-style (Avon series) and enclosed style (Twynham series) Low Voltage and Isolating Transformers for input voltages of 100-125V and 200-250V. This applies for sizes from 24V/A to 1kV/A with a wide variation of output voltages. Further details in brochure GT.17 obtainable from: *Gardners Transformers Limited, Christchurch, Hampshire.*

Better Things are Electric

A new 16-page illustrated booklet in full colour designed to help people choose the right electrical fitting—plug, switch or socket—for every room in their home, is now available. Called "Better Things are Electric—with MK", it has been produced by MK Electric Ltd. It is available free on request from most electrical retailers or electricity showrooms, or direct from *MK Electric Ltd., Edmonton, London, N9.*

SPLICER FOR CASSETTE TAPES

Bib Division of Multicore Solders Ltd., announce the introduction of the Bib Model 24 $\frac{1}{8}$in. cassette tape splicing and editing kit. It comes in a plastic wallet together with a plastic handled razor blade, Tape marker, reel of splicing tape on dispenser and a device for withdrawing tape from the cassette. The price is 29s.

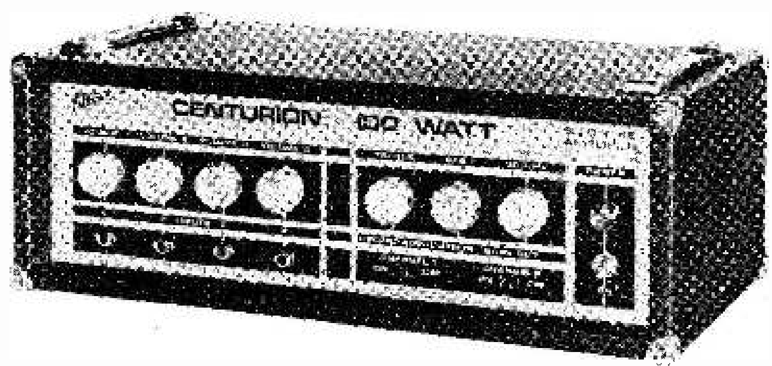
The kit has been specially designed for use in jointing tape from C60, C90 or C120 cassettes and is particularly useful as it enables music from pre-recorded cassettes to be joined so that the playing time of a single cassette is extended.

It's 5 new pence

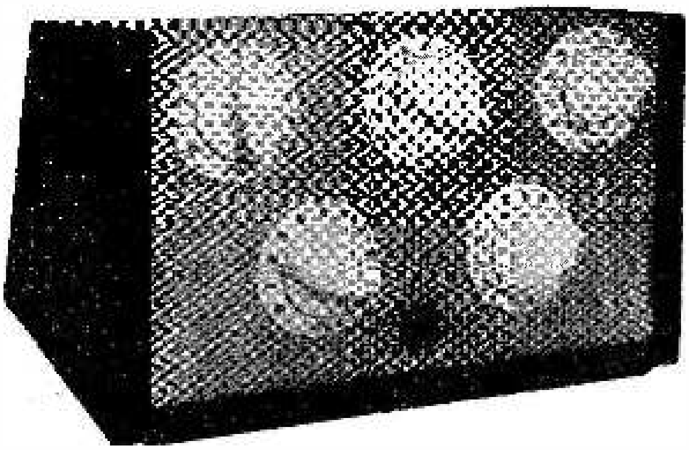
Multicore Ltd. announce an adjustment to their well-known 6d. solder pack. It now costs twice the price but you get double the amount of solder (enough for 100 average joints). It has been given the reference "2D" and packages are marked 1s. or 5p. *Multicore Solders Ltd., Hemel Hempstead, Herts.*

Don't forget the Practical Wireless filmshow

100 WATTS FROM ADASTRA



Adastra Electronics Ltd. announce their "Centurion" 100W amplifier which has a suggested list price of £99 and features a hand-assembled 25-transistor 6-diode printed circuit construction. The four individually gain controlled inputs have a sensitivity range from 1mV to 20V. A feature of this amplifier is that its design allows its output (100W at 4Ω; 140W peak) to be open- or short-circuited without ill effect. The amplifier is housed in a black leathercloth cabinet with carrying handles and matching silver/black control panel. *Adastra Electronics Ltd., 167 Finchley Road, London. N.W.3. Tel. 01-624 8164/5.*



A MICROPHONE MIXER UNIT

V. CAPEL

ONE of the main requirements for a microphone mixer is that of low noise level. Many of the cheaper commercial mixers fall down on this feature; although passable when used with low-output power amplifiers, noise levels become noticeable and disturbing at higher powers such as with large p.a. amplifiers. It is true that the ratio between the signal and the noise level will be the same irrespective of the power of the amplifier, but there are moments of silence especially with speech reproduction when there is no signal to mask the noise and it is then that high level noise is especially unpleasant.

Inexpensive commercial mixers were found unacceptable on this score whereas the better ones were unacceptable because of price. Hence the unit here described was designed and built. Other features required were a degree of amplification as well as mixing, a self-contained arrangement that could be operated at some distance from the main amplifier, and an input for tape or gram which could not be overloaded by too high an input signal resulting from use and operation by unskilled hands.

Circuit

One of the reasons why the cheaper commercial mixers fail to achieve a good signal-to-noise ratio is because the input sockets are connected directly to the gain controls. The output from these is combined and fed to the base circuit of the first stage. An advantage of this arrangement is that only one transistor is needed for all inputs which saves cost. However it also means that the noise generated in it is fed uncontrolled into the following stages. Turning down a control only reduces the input signal thereby decreasing the signal-to-noise ratio.

In the circuit adopted for the mixer, each input has its own transistor which is followed by the gain control. When this control is turned down therefore, the noise from the input transistor decreases as well as the signal. The input stage is always the most significant as respects noise, because it is amplified

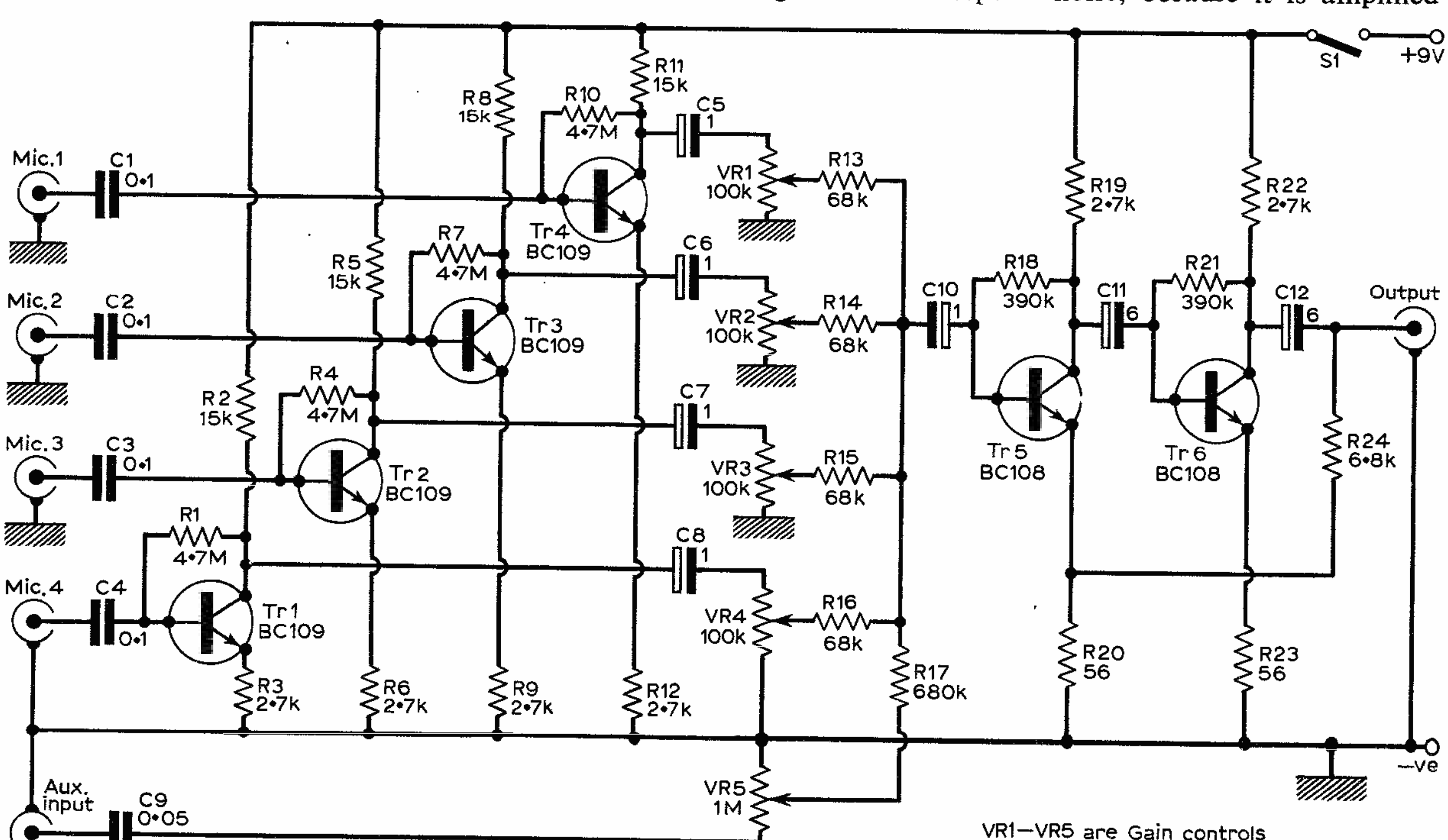


Fig. 1: The circuit of the five channel mixer. Four inputs are provided for microphones with an additional one for high level.

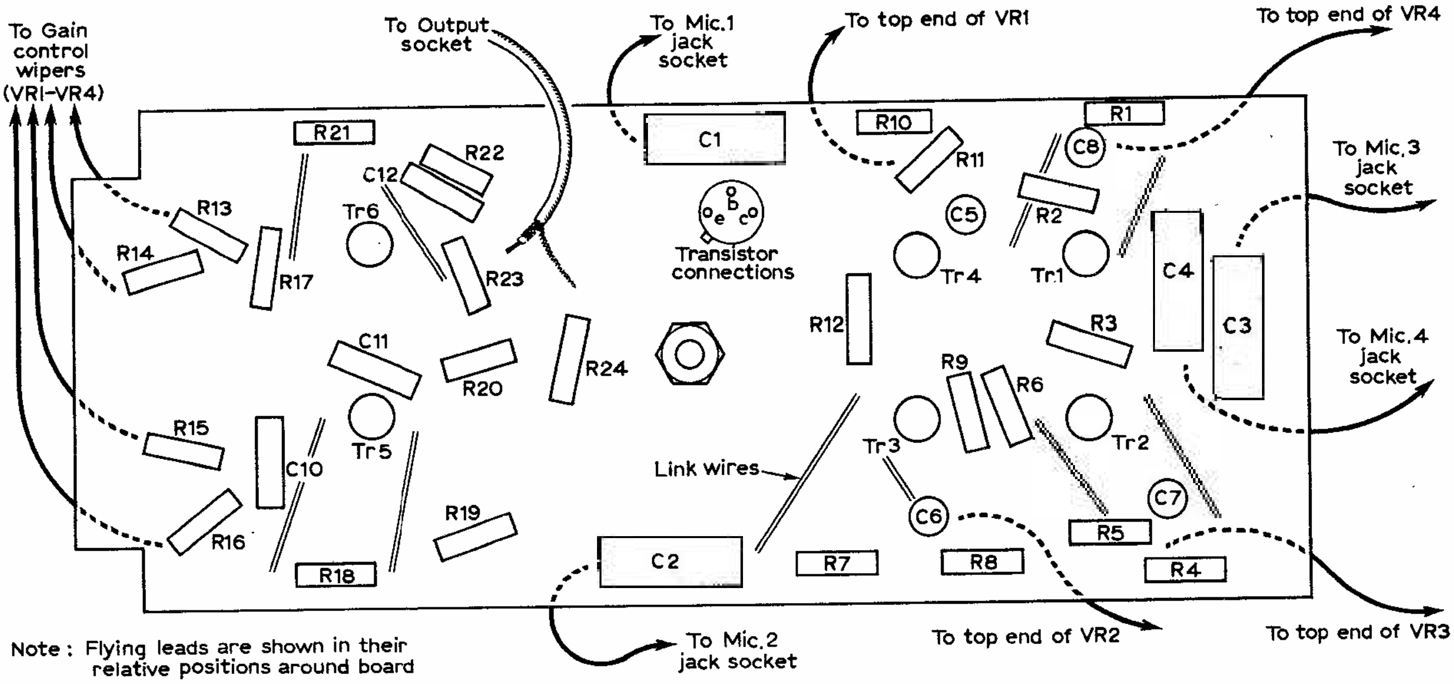


Fig. 2: The components are arranged as shown above on a Radiospares standard printed circuit.

★ components list

Resistors:

R1	4·7MΩ	R13	68kΩ
R2	15kΩ	R14	68kΩ
R3	2·7kΩ	R15	68kΩ
R4	4·7MΩ	R16	68kΩ
R5	15kΩ	R17	680kΩ
R6	2·7kΩ	R18	390kΩ
R7	4·7MΩ	R19	2·7kΩ
R8	15kΩ	R20	56Ω
R9	2·7kΩ	R21	390kΩ
R10	4·7MΩ	R22	2·7kΩ
R11	15kΩ	R23	56Ω
R12	2·7kΩ	R24	6·8kΩ

All 10%, $\frac{1}{8}$ or $\frac{1}{4}$ watt miniature types.
VR1, VR2, VR3 and VR4 100kΩ log. potentiometers
VR5 1MΩ log. pot.

Capacitors:

C1	0·1μF	C7	1μF 12V
C2	0·1μF	C8	1μF 12V
C3	0·1μF	C9	0·05μF
C4	0·1μF	C10	1μF 12V
C5	1μF 12V	C11	6μF 12V
C6	1μF 12V	C12	6μF 12V

Semiconductors:

Tr1	BC109	Tr4	BC109
Tr2	BC109	Tr5	BC108
Tr3	BC109	Tr6	BC108

(Plastic encapsulated versions of the BC108 and BC109 are now very common, have identical characteristics and are cheaper. Their numbers are BC168 for the BC108 and BC169 for the BC109.)

Miscellaneous:

Six jack sockets; pointer knobs; Radiospares printed panel; SW1 toggle on-off switch; battery; battery clips; screened lead etc.

by all the stages that follow, whereas the succeeding stages have less amplification following them.

Obviously, low-noise transistors should be used, so the Mullard silicon planar epitaxial transistors BC109 and BC108 were chosen. These are n-p-n types so battery polarity will be negative to earth. Constructors used to working with the more familiar p-n-p varieties will need to check polarity of the electrolytic capacitors.

Current biasing of the first stages is employed by returning the single high-value base resistor to the collector. A measure of negative feedback results, and further feedback is achieved by leaving the emitter resistor unbypassed. If desired, a greater or lesser number of inputs can be provided as required. Three were really all that were necessary, but an extra one was fitted in case it should be required in the future. It is easier to add one when first constructing, than later! Extra inputs will not add to the noise level providing the controls of those not being used are turned back to zero.

Although all controls are taken to a common input of the next stage each one will have only marginal effect on the settings of the others due to the isolating resistor in series with the wiper of each control.

The auxiliary input is fed into the same point. In this case it is best to feed the input directly to its gain control, because if applied first to an amplifying stage as is the case with the microphone inputs, this stage could be overloaded by a high level signal such as the output of a tape recorder. Here, the control will reduce the signal to an acceptable level. Impedance of this input is kept as high as possible so that crystal or ceramic pick-ups can be used, hence the higher value of the control and isolating resistor.

At first, direct coupling was considered between the second and third stages as this would avoid reactance in the coupling and provide d.c. stabilisation by a d.c. feedback loop. However, as the second stage must be "above" the first as regards d.c. voltage in directly coupled stages, this in effect halves the battery voltage to each. Where a line voltage of around 20 volts is available as is common with most mains-powered transistor equipment, this is quite satisfactory, but things are different when the supply is only 9 volts and reducing as the battery voltage falls. Silicon transistors are less prone to thermal and other vagaries of germanium transistors, so it was deemed best to dispense with the d.c. stabilisation.

To further reduce noise levels, a negative feedback loop was included right from the output socket back to the emitter of the second stage.

Construction

With any construction, one of the first things to consider is the case, as this will determine the way the components are assembled. The case chosen for the prototype started life as a Channel TV tuner unit. There are probably many of these around in dealers' junk rooms, but if one cannot be obtained, a similar construction can easily be made.

A Radiospares transistor printed panel was used for the building of the circuit. These are not obtainable direct from the firm as they deal only with the trade, but almost any dealer could get one within a few days even if he did not have one in stock. There are positions for eight transistors on these boards, and the base, emitter and collector connections are all marked. A centre strip of print running down the middle of the board can be used for earth, and two conductors on either side, for the battery positive rail. Along both edges of the board are triangular multiple connections.

The most straightforward way of wiring is to connect a wire link from the transistor print connection to the nearest multiple, and then wire the associated components from there. It may be necessary to link two adjacent multiples where several connections are needed to the one point. Flying leads were fitted so that connections could be made to the controls and jack sockets.

Performance

The gain of the microphone channels is 35dB, which enables the mixer to be used with power amplifiers having low input sensitivity. High impedance microphones should be used, either crystals or moving-coil and ribbon instruments with built-in transformers. Medium impedance microphones of 600 or 200 ohms will work satisfactorily, there being sufficient gain for these, although the signal-to-noise ratio is decreased. When used with high impedance instruments, the noise level, even with a large p.a. in a hall, is unobtrusive at normal levels.

The gain of the auxiliary input is unity, there being no amplification required here, only the facility of mixing. A fairly high input impedance is presented so that crystal or ceramic pick-ups can be used with no loss of bass.

Overall frequency response is flat between 20Hz and 10kHz, and there is a gradual drop at the upper end to −3dB at 25kHz. Battery consumption is about 6mA so a PP6 battery should give long service.

When using this or any other mixer, always keep the controls that are not in use to the minimum position. Those that are being used should be set at an advanced level and the control on the power amplifier kept to a low position, as this will give a better signal-to-noise ratio than the reverse. ■

THE MW COLUMN

SOUTH AMERICAN medium wave stations are often audible after midnight during the winter. Propagation is good over the long sea path from UK enabling the DXer to hear stations quite considerable distances away. Even when conditions are poor the Argentinian stations LR3 (950) *Radio Belgrano* and LR1 (1070) *Radio el Mundo,* can often be heard, sometimes they are the only DX on the band. South Americans are usually at their best when the North American path is poor. Brazilians most frequently logged are PRA3 (860) with the slogan *Radio Mundial,* PRF4 (940) *Radio Jornal,* PRE8 (980) *Radio Nacional,* PRE3 (1180) *Radio Globo;* all are situated in Rio de Janeiro. Brazilian stations are easy to recognise as the language is Portuguese instead of the more usual Spanish from that continent. A number of Venezuelan stations can be heard, the more prominent being YVRS (1020) *Radio Marguarita* and YVQJ (1080) in Barcelona. Further to the west are the Colombian stations HJDK (750) *La Voz de Antioquia* and HJBI (840) *Ondas del Caribe* in Santa Marta. The Surinam station PZX7 (725) in Paramaribo is frequently a strong signal though interference from the German station on 728 can be troublesome. PZX7 identifies itself as "SRS" which are the initials of the Dutch organisation which owns the station. Announcements are in Dutch, English and Hindi and the station will QSL. More difficult South American countries are Peru with OAX4A (854) *Radio Nacional* and OAX4U (1010) *Radio America,* both stations in Lima; Uruguay with CX16 (850) *Radio Carve* in Montevideo; Chile with CB106 (1060) *Radio Mineria* and CB118 (1180) *Radio Portales,* both in Santiago.

During the late evening while waiting for the DX paths to open, readers may care to try some semi-DX from Europe. The *Portuguese National Radio* operates a number of high power MW transmitters and two of these—on 755 and 1161—have programmes in English at 2245 hrs GMT. Commercial stations to look for include *Radio Coub Portugues* with CSB9 (782) in Miramar and CSB2 (1034) in Lisbon; *Radio Renascena* CSB3 (1286) in Lisbon; *Emissora Norte Reunidas* CSB5 (1578) Oporto; *Emissora Associados de Lisboa* CSB4 (1594) Lisbon. The commercial stations run on well into the night and all will QSL. *Sud Radio* in nearby Andorra on 818 has been heard recently with programmes in English at 2130 hrs and this station too will QSL. Three stations from the far north of Europe that often appear in the late evening are Murmansk (656) in Arctic USSR; Godhavn (650) in Greenland and Hofn (665) in Iceland.

Ramadan ends on 11th December, so have a look for some of the rare Middle East countries mentioned last month while there is still time. Saudi Arabia has been heard on 705 recently at 2100 hrs GMT with a programme in English. The new *All India Radio* megawatt station in Calcutta is reported to be on 1130kHz though it has not been heard yet by the writer.

CHARLES MOLLOY

P.W. at the EXHIBITIONS

RICHARD COLLINS reports...

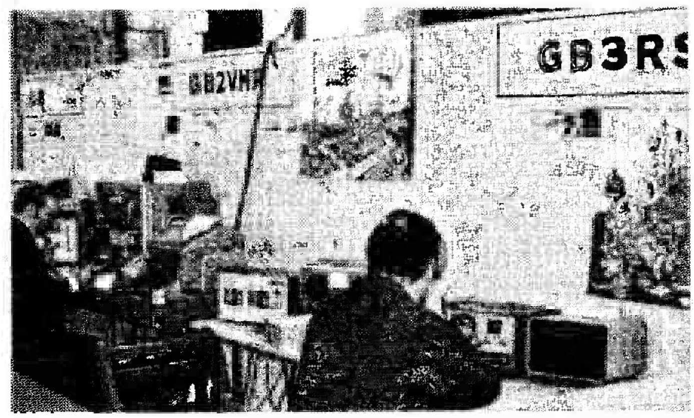
This year PRACTICAL WIRELESS was represented at two exhibitions. The first one was the 1969 International Radio Engineering and Communications Exhibition (the RSGB Exhibition) held at the Royal Horticultural New Hall, Westminster, S.W.1 from 1st to 4th October.

The second exhibition was the 1969 International Audio Fair held at Olympia from 17th to 23rd October. Below are photographs taken during the two exhibitions.

The opening address was made by Mr. R. J. Halsey, C.M.G., F.C.G.I., D.I.C., B.Sc.(Eng.), F.I.L., Director of Cable & Wireless Ltd. He is seen here welcoming visitors to the Exhibition.

Mr. J. W. Swinnerton. T.D., B.Sc.(Econ.), G2YS, President of the Radio Society of Great Britain presents the Exhibition Organisers' Plaque to George Jessop, G6JP, for his 2m Transistorised Transmitter/Receiver.

A group of enthusiasts gathered round the PRACTICAL WIRELESS stand, while staff member, Trevor Preece, G3TRP, explained the workings of the P.W. Pedal Steel Guitar.



The Exhibition transmitting stations which were operating on all Amateur Bands between 1·8 and 144MHz. The equipment was provided and manned by the Crawley group of the RSGB.

Diana and Audrey looking after the magazine sales section of the P.W. and P.E. stand at the Audio Fair.

BASIC SEMICONDUCTOR TECHNOLOGY

PART EIGHT

by M.F. DOCKER, M.Sc.

IN this article several new devices will be discussed and the final two articles in the series will deal with the techniques of producing integrated circuits, both monolithic and hybrid thick and thin film types.

Thyristors

The first device, the thyristor, could well have been described in the section dealing with diodes as it is often found in two lead form. However its construction is radically different from that of a diode and the same device can be easily converted during manufacture to form a triode or tetrode thyristor. The thyristor can be defined as a four layer p-n-p-n device as seen in Fig. 1(a) and relies on regeneration in the structure to produce a switching action.

With the polarities shown in this Fig. 1(a) junctions A and C are both forward biased whilst junction B is reverse biased. Consequently only a very small current, the saturation current of the material, will be able to flow across junction B. However, when the potential difference between the input terminals is increased sufficiently it is found that the current through the device suddenly increases as shown in the voltage-current curve of Fig. 2. This behaviour can be explained by considering the device as composed of a pair of complementary transistors, Tr1 and Tr2, in Fig. 1(c). From Fig. 1 (b) Tr1 is seen to be a p-n-p transistor and Tr2 a complementary n-p-n transistor. If the alphas of the two transistors are $\alpha 1$ and $\alpha 2$ respectively and if the saturation collector current of each device is Isat1 and Isat2 respectively then it is readily seen that:

$$I1 = \alpha 2 I + Isat2$$

and $I2 = \alpha 1 I + Isat1$ also, since the current across junction B must be equal to I:

$$I = I1 + I2$$

or $I = \alpha 1 I + \alpha 2 I + Isat$

where $Isat = Isat1 + Isat2$.

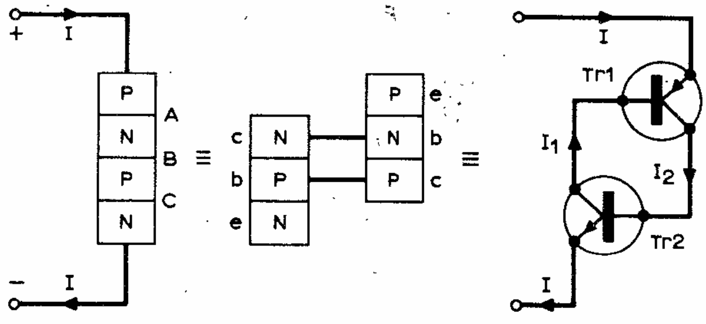


Fig. 1: Basic thyristor representation (a) together with two derived equivalents (b) and (c).

This equation can be reduced to the form:

$$I = Isat/(1 - (\alpha 1 + \alpha 2))$$

and this relates the current through the thyristor to the leakage current and the current gains of the equivalent transistors. Now in a previous article it was shown that the alpha of a transistor depends on the amount of recombination which occurs in the base region, so that for a high alpha the base has to be narrow.* But the thyristor is intended for high voltage applications, so to avoid punch through the individual regions all have to be wide. This gives the device a low alpha.

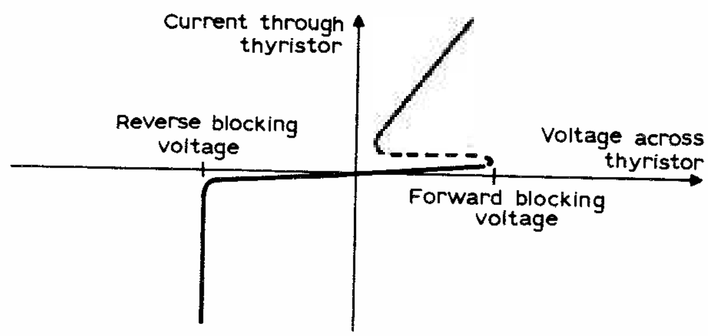


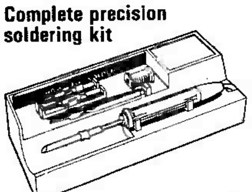
Fig. 2: Characteristic curve of the voltage across a thyristor and the current through it.

Because of this the term $(1-(\alpha 1 + \alpha 2))$ above is fairly large and I is not much larger than the leakage current. If in some way recombination can be reduced the alphas will grow and I becomes large. This is done by temporarily filling the impurity centres in the base so that a larger current will flow, carriers then becoming available to diffuse across to the collector junction B, normal transistor action then taking place. After this regenerative feedback holds the device on until the voltage across the terminals is reduced to zero.

There are various ways of filling the trapping centres and one of these, used in this diode form, is to increase the voltage across the device until the leakage current across junction B goes into an avalanche condition. This results in a large current flowing across the junction into the two base regions. The carriers constituting this current fill the impurity centres and enable the transistor alphas to become larger, this in turn resulting in an increase in the current through the device so that the thyristor is then turned on. When this happens all the junctions are in effect forward biased and the voltage across the thyristor falls to a fraction of a volt. The voltage at which the avalanche starts to take place is called the forward breakover voltage Vbo and is quoted in manufacturers' literature.

When a reverse voltage is applied to the thyristor junctions A and C are reverse biased and junction B is forward biased. However the previously described

Complete precision soldering kit



This kit—in a rigid plastic "tool-box" — contains

- Model CN 15 watts miniature iron, fitted 3/16" bit. Interchangeable spare bits 5/32", 3/32".
- Reel of resin-cored solder
- Felt cleaning pad
- Stand for soldering iron

PLUS 36-page booklet on "How-to-Solder"—a mine of information for amateur and professional.

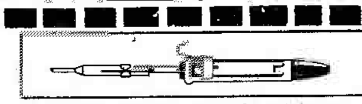
From Electrical and Radio Shops or send cash to Antex. 49/6

Attractively gift wrapped.

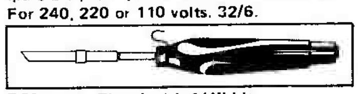
Model CN 240/2
15 watts - 240 volts

Fitted with nickel plated bit (3/32") and in handy transparent pack. From Electrical and Radio Shops or send cash to Antex. **31/-**

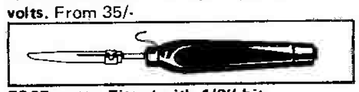
Attractively gift wrapped.



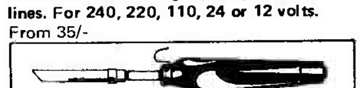
G 18 watts. Fitted 3/32" bit for miniature work on production lines. Interchangeable spare bits, 1/8", 3/16" and 1/4" available. For 240, 220 or 110 volts. 32/6.



E 20 watts. Fitted with 1/4" bit. Interchangeable spare bits 3/32", 1/8", 3/16" available. For 240, 220, 110 volts. From 35/-



ES 25 watts. Fitted with 1/8" bit. Interchangeable bits 3/32", 3/16" and 1/4" available. Ideal for high speed production lines. For 240, 220, 110, 24 or 12 volts. From 35/-



F40 watts. Fitted 5/16" bit. Interchangeable bits 1/4", 3/16", 1/8", 3/32" available. Very high temperature iron. For 240, 220, 110, 24 or 20 volts. From 42/6 Spare bits and elements for all models and voltages immediately available from stock.

A N T E X

PRECISION MINIATURE SOLDERING IRONS

Antex, Mayflower House, Plymouth, Devon.
Telephone: Plymouth 67377/8.
Telex: 45296. Giro No. 2581000.

☐ Please send me the Antex colour catalogue
☐ Please send me the following irons

Quantity	Model	Bit Size	Volts	Price
....	....	....	....	....
....	....	....	....	....
....	....	....	....	....

I enclose cheque/P.O./cash value
....

NAME ....
ADDRESS ....
.... PW1

action does not occur in this case as the circuit is non-regenerative being in fact simply two diodes in series. The result is that when the reverse voltage does become sufficient to cause avalanching to take place the voltage across the device is maintained and a high power dissipation takes place in the thyristor. The variation of current with voltage across a thyristor is shown in Fig. 2. In most devices the peak reverse capability is made somewhat greater than the forward breakover voltage so that the device can be used as triggerable switch.

The rate of change of voltage across the thyristor can also be used to produce switching. This relies on the injection of charge into the depletion layer as its width changes. In this way it is possible to switch the thyristor by putting a pulse on to the terminals, of amplitude less than the breakover voltage.

Silicon controlled rectifier

A third method of triggering involves the injection of a pulse of current directly into one of the base regions. This produces an increase in the alpha of the equivalent transistor and the regenerative feedback of the circuit causes the current through the thyristor to rise quickly. Devices using this method are called silicon controlled rectifiers (s.c.r.s.). The size of the pulse required to trigger the thyristor depends on which of the two bases the pulse is injected into. The lower p-type base is the more sensitive and devices in which this base is connected as trigger are called conventional s.c.r.s Connection to the upper n-type layer of Fig. 1(a) results in a so-called complementary s.c.r.

Silicon controlled switch and light activated s.c.r.

The silicon controlled switch is a thyristor with connections to both the base regions so that in consequence it is a four terminal device. Current pulses can be injected into either one or both of the bases to produce switching. Another method commonly used to trigger the thyristor is the use of light induced carriers in the base regions. This is used in the light activated silicon controlled rectifier (l.a.s.c.r.) and in the phototran. These are used in many opto-electrical control systems.

Switch off

A point to be noticed in the operation of the thyristor is that once it is switched on it cannot easily be switched off until the voltage across its terminals has been reduced to a very low value. Even then sufficient time has to be given for the charge carriers which are stored in the base region during the forward conducting state of the thyristor. This time is typically several microseconds: if the voltage is reapplied before expiration of this time the thyristor will switch on again immediately.

Types and uses

The construction of a typical alloy-diffused thyristor is shown in Fig. 3(a). The p-type regions are produced by diffusion of acceptor atoms from the gaseous state and the cathode region is produced by alloying suitable impurities into one surface. Leads are then attached as shown. Planar thyristors are also produced as shown in Fig. 3(b), usually several

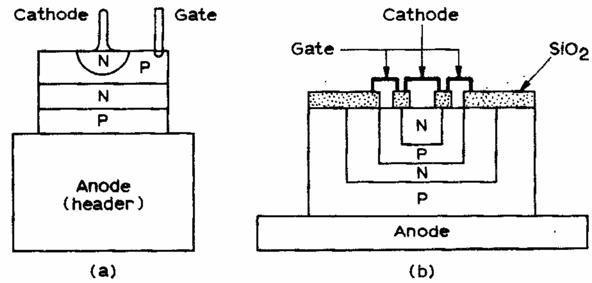


Fig. 3: Two forms of thyristor.

devices being made on one wafer which is then cut up into dices to give the individual thyristors.

The thyristor is often used to control a.c. supplies. However in this application they have the disadvantage that they only switch into their forward conducting state in one direction. In order to permit full wave control of power supplies it is possible either to use two thyristors or to use a device called a triac. This is a multiple layer device which is equivalent to two s.c.r.s so arranged that they switch on alterna-

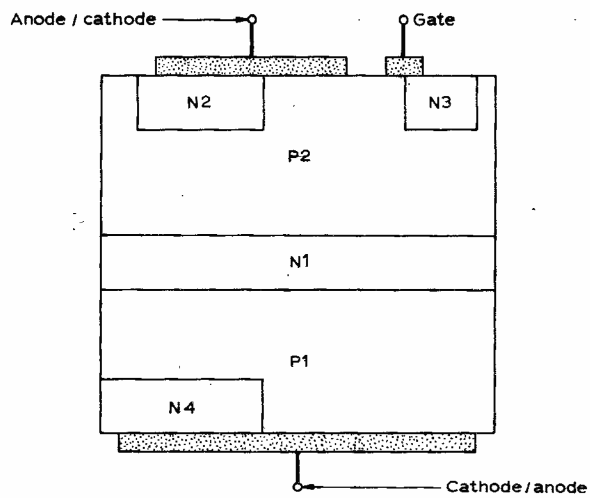


Fig. 4: Triac thyristor construction.

tive half-cycles of the mains. The structure of this device is shown in Fig. 4 and its voltage against current characteristic is given in Fig. 5.

A small s.c.r. with an avalanche diode between the anode and gate electrodes is also available. This can be used as a low current switch and is given the name silicon unilateral switch, or s.u.s. A bilateral version of this device is also available and is used to trigger high power triacs as it provides the alter-

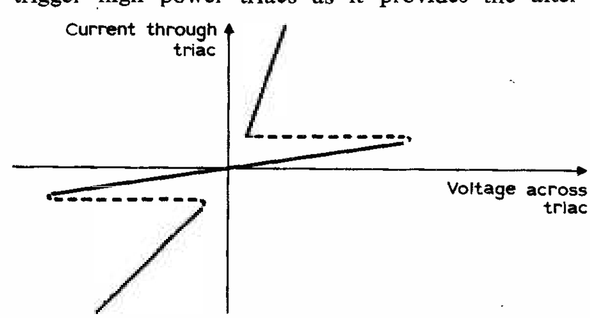


Fig. 5: Characteristic curve showing the variation in current flowing through a triac as the voltage across it is changed.

nately positive and negative pulses required for biphasic operation of the triac.

There are numerous other thyristors available including the diac which is similar to the s.b.s. and is also used to switch the triac. The quadrac, which is a three terminal device containing both a diac and triac and can be used in phase control of biphasic power supplies, is another thyristor which has only recently become available.

Unijunction transistor

Another device exhibiting a negative resistance effect is the unijunction transistor. This is similar in construction to the f.e.t. but its gate electrode is called the emitter and is much smaller than that of the f.e.t. It is normally operated in forward bias and the structure of a typical bar type u.j.t. is shown in Fig. 6 together with its circuit representation. It consists of a silicon bar with two ohmic connections made to each end, called the base terminals, and an aluminium emitter which is alloyed to the base to form a p-n junction. If a current is made to flow through the base the potential at the emitter will be Ve. As long as the voltage applied to the emitter is less than this the junction will be reverse biased and no current will flow. However if the applied voltage is increased beyond Ve the junction will go into a forward conducting state and holes will be injected into the base region. In order to maintain neutrality electrons will be released in the base region between the emitter and base one, which results in the resistance of the region falling. This then causes the potential drop across the bar in this region to fall with a consequent increase in the forward bias applied to the junction and the number of injected holes rises yet again. Obviously this is a regenerative effect and causes the emitter current to rise sharply.

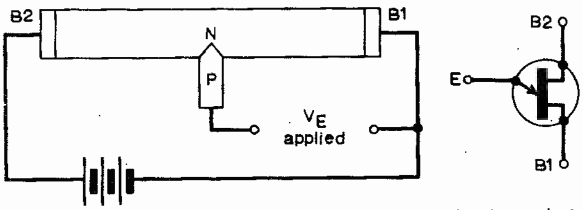


Fig. 6: Unijunction transistor construction and circuit symbol.

A curve showing the variation of emitter voltage as the emitter current changes is shown in Fig. 7, where the curves for different voltages between bases are indicated. The most significant point of this is that when the emitter voltage reaches Ve the emitter current suddenly increases and whilst this is happening the voltage across the emitter falls. This is the opposite behaviour to that shown by a resistor and is consequently called a negative resistance effect. This enables the unijunction transistor to be used in many oscillators, staircase waveform generators and dividers and circuits where a negative resistance effect is required.

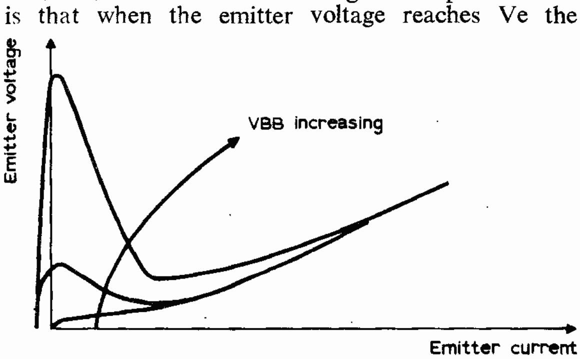


Fig. 7: Variation of emitter voltage with current as the base-to-base voltage in a unijunction transistor is changed.

Spacistor

Two other devices which are occasionally met but which do not yet seem to have reached the world of the amateur are the spacistor and the tetrode transistor. A brief explanation of these devices is worthwhile.

The spacistor is a single junction amplifier. Basically it is a p-n junction with a large reverse bias so that it has a wide depletion region. Current carriers are injected into this depletion region from a metal contact and are swept across the depletion region by the electric field. Because of the high field it is possible to have quite short transit times and thus to have a high cut off frequency. Another type of spacistor employs a fourth electrode called a modulator which affects the gain of the device. It also increases the input and output impedances of the spacistor by increasing the isolation of the injector from the output current. A diagram of the simple spacistor is shown in Fig. 8.

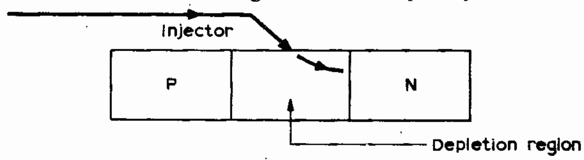


Fig. 8: Basic spacistor construction.

Tetrode transistor

The tetrode transistor is similar to the ordinary transistor except that it has two base contacts. Because of this it is possible to produce a field across the base so that effectively only a small portion of the emitter-base contact is forward biased. This reduces the active width of the base so that its resistance is reduced and also the transition capacitance is reduced. These assets make the tetrode especially useful in high frequency applications including high speed switching circuits. Figure 9 shows the schematic cross-section of a tetrode transistor including a representation of the current flow pattern. The reduction in the base width is clearly seen from this figure and results in a decreased base resistance because of the lessened distance the base current has to travel before recombination.

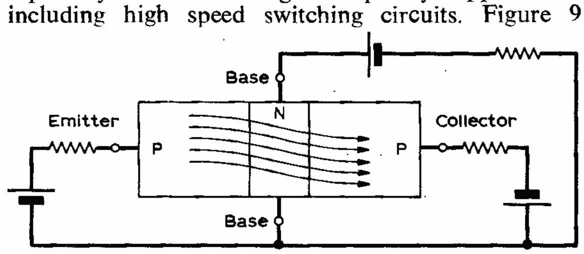


Fig. 9: Construction of a tetrode transistor and its circuit connections.

TO BE CONTINUED

Fully guaranteed Individually packed

VALVES

PERSONAL CALLERS WELCOME

Open 9-12.30, 1.30-5.30 p.m. Thursday 9-1 p.m.

MANY OTHERS IN STOCK include Cathode Ray Tubes and Special Valves. U.K. Orders up to 10/-, 1/-; 10/- to £1, 2/-; over £1, 2/- per £1; over £3 post free. C.O.D. 4/- extra

COLOMOR brand — ALL valves guaranteed

CY31 7/6	ECL80 9/-	KT66 26/-
DAF96 7/9	ECL82 12/6	KT88 32/-
DF96 7/9	ECL83 6/6	N78 25/-
DF92 9/-	ECL86 8/6	OA2 6/-
DK96 7/6	EF36 3/6	OB2 6/-
DL92 6/6	EF37A 8/-	PABC80 7/6
DL94 6/6	EF39 6/-	PC97 9/-
DL96 8/-	EF40 10/-	PC900 7/6
DM70 6/-	EF41 12/6	PCC84 6/9
DM71 7/6	EF42 14/6	PCC89 9/6
DY86 6/-	EF80 5/-	PCC189 11/6
DY87 6/6	EF83 9/6	PCE82 17/-
DY802 9/9	EF85 6/6	PCE800 15/-
EABC80 6/6	EF86 6/3	PCF82 6/8
EAF42 10/-	EF89 5/3	PCF84 9/3
EB91 2/-	EF91 3/-	PCF86 10/-
EBC33 8/-	EF92 2/6	PCF200 15/6
EBC41 10/6	EF95 5/-	PCF201 15/6
EBC81 9/-	EF183 6/6	PCF801 9/9
EBF80 7/6	EF184 7/-	PCF802 9/9
EBF83 8/6	EF800 21/-	PCF805 14/6
EBF89 6/-	EF812 15/6	PCF806 13/-
ECC81 6/-	EFL200 15/6	PCF808 14/6
ECC82 5/9	EH90 7/6	PCH200 12/6
ECC83 5/6	EL34 10/6	PCL81 9/6
ECC84 6/-	EL41 11/6	PCL82 7/6
ECC85 5/6	EL42 11/6	PCL83 13/-
ECC86 9/-	EL84 4/9	PCL84 8/6
ECC88 7/-	EL85 8/-	PCL85 9/3
ECC189 9/9	EL95 7/-	PCL86 9/-
ECC804 12/6	EL500 17/-	PFL200 12/-
ECF80 6/6	EL803S 17/-	
ECF82 6/6	EM31 5/-	
ECF83 12/6	EM80 7/6	PL36 10/9
ECF801 12/6	EM84 7/-	PL81 9/3
ECF802 12/6	EM87 11/-	PL82 8/-
ECF803 12/6	EY51 8/-	PL83 7/-
ECH84 7/6	EY86 7/6	PL84 6/6
ECH35 11/-	EY88 8/6	PL500 14/9
ECH42 13/-	EZ40 8/3	PX4 14/-
ECH81 5/9	EZ41 8/6	PX25 12/6
ECH83 10/9	EZ80 5/-	PY33 12/-
ECH200 12/6	EZ81 5/-	PY80 6/6
	GZ34 10/6	PY81 5/6

TRANSISTORS, ZENER DIODES etc.

OA5 2/6	OC16 15/-	OC83 5/-	AC176 7/6	CRS1/20 9/6	MPF102 11/-
OA10 3/-	OC22 10/-	OC83B 4/6	ACY28 4/-	CRS1/30 10/-	MPF103 9/6
OA70 2/-	OC25 7/6	OC139 7/6	AD140 13/-	CRS1/35 11/6	MPF104 10/-
OA71 2/-	OC26 5/-	OC140 9/6	AF117 5/-	CRS1/40 12/6	MPF105 10/6
OA79 1/9	OC29 15/-	OC170 5/-	AF118 10/-	CRS3/05 6/-	Z Range Zener diodes 3/6 ea.
OA81 1/6	OC35 10/-	OC171 6/-	AF124 7/6	CRS3/20 10/-	Z2A range 7/6 ea.
OA200 1/9	OC38 8/6	OC172 7/6	AF127 5/-	CRS3/30 11/6	Z3B Range 5/- ea.
OA202 2/-	OC44 4/-	OC200 7/6	AF139 10/-	CRS525/025 15/-	ZL range 5/- ea.
OA210 7/6	OC45 2/6	IN21 3/6	AF178 12/6	CRS3/40 12/6	ZS range 7/6 ea.
OA211 9/6	OC71 2/6	IN21B 5/-	AFY19 22/6	GET103 4/-	
OAZ200 11/-	OC72 4/6	IN25 12/-	ASY26 5/6	GET115 9/-	
OAZ201 10/-	OC73 11/-	IN43 4/-	ASY28 5/6	GET116 8/-	
OAZ202 to OAZ206 8/6	OC75 6/-	IN70 4/-	BC107 3/6		
OAZ207 9/6	OC76 5/-	2N1306 6/6	BFY51 5/-		
OAZ208 to OAZ213 6/6	OC81 4/-	2N1307 6/6	BFY52 4/6		
OAZ223 to OAZ225 10/-	OC81D 3/-	2S303 10/-	BSY27 5/-		
	OC81DM 3/-	AC126 6/6	BYZ13 5/-		
	OC82 5/-	AC127 7/6	BYZ16 15/-		
	OC82DM 3/-	AC128 6/6	CRS1/10 5/-		

PY82 5/9	U404 6/-	UY85 5/9	5B/255M 35/-	6AN8 10/-	6BR7 16/-
PY83 7/-	U801 20/-	VR105/30 6/-	5R4GY 10/6	6AQ5 6/-	6BW6 16/-
PY88 7/6	UABC80 6/6	VR150/30 6/-	5U4G 5/6	6AQ5W 9/-	6BW7 13/-
PY800 7/6	UAF42 10/6	Z800U 29/-	5V4G 7/6	6AS6 6/-	6C4 5/9
PY801 9/6	UBC41 9/6	Z801U 25/-	5Y3GT 6/-	6AS7G 16/-	6C6 4/-
PY802 13/6	UBF80 10/6	Z900T 12/-	5Z4 14/-	6AT6 4/6	6CH6 7/-
QQVO3-10 25/-	UBF89 7/-	1L4 2/6	5Z4G 7/6	6AU6 5/-	6CL6 9/9
QQVO6-40 85/-	UCF80 10/6	1R5 6/-	6AB7 4/-	6AX4 8/-	6D6 3/-
QQVO6-40A 100/-	UCH42 12/-	1S4 5/-	6AC7 3/-	6B7 5/6	6EA8 9/-
QS95/10 5/-	UCH81 7/-	1S5 4/6	6AG7 6/-	6BA6 4/6	6EU7 7/-
R17 8/-	UCL82 7/6	1T4 3/-	6AH6 11/6	6BA7 12/6	6F23 15/-
R19 7/6	UCL83 12/-	1X2A 7/6	6AK5 5/-	6BE6 5/3	6F33 20/-
U25 14/6	UF41 10/6	1X2B 7/6	6AK8 6/-	6BG6G 11/-	6H6M 3/-
U26 14/6	UF80 7/3	3D6 3/-	6AL5 3/-	6BJ6 8/6	6J4WA 12/-
U27 8/-	UF89 6/9	3Q4 7/6	6AL5W 7/-	6BJ7 7/-	6J5 7/-
U191 14/-	UL41 11/6	3S4 6/9	6AM5 2/6	6BK7 8/-	6J5GT 5/-
	UL84 6/6	3V4 8/-	6AM6 3/-	6BL7GTA 11/-	6J6 3/6
	UU5 7/-		6AN5 20/-	6BQ7A 6/9	6J7G 5/-
	UY41 7/-				6J7M 5/-

6K6GT 8/-	12BA6 6/-	813 75/-
6K7 6/6	12BE6 6/-	832A 45/-
6K7G 2/-	12BH7 3/6	866A 15/-
6K7GT 4/9	12C8 3/-	954 4/6
6K8G 4/-	12E1 17/-	955 2/6
6K8GT 7/3	12K5 10/-	956 2/-
6K25G 14/-	12K8GT 7/6	957 5/-
6L6 14/6	12Q7GT 5/6	991 6/-
6L6GA 9/6	12SG7 4/6	1622 17/-
6P25 12/6	14S7 15/-	2051 5/-
6SA7 7/-	19AQ5 5/9	3505 18/-
6SA7GT 6/6	19G3 60/-	5676 10/-
6SC7 7/-	19G6 20/-	5678 10/-
6SC7GT 5/-	19H4 70/-	5726 7/-
6SG7 6/-	20P4 20/6	5933 22/6
6SJ7 6/-	25L6GT 7/3	6057 10/-
6SJ7GT 6/6	30C15 15/-	6060 7/6
6SJ7Y 6/6	30C17 16/-	6064 7/-
6SK7 7/-	30C18 15/-	6065 8/-
6SL7GT 6/6	30F5 16/9	6080 27/6
6SN7GT 6/-	30FL1 15/-	6146 28/-
6SQ7GT 7/9	30FL12 19/-	9001 3/-
6V6G 3/6	30FL13 9/3	9002 4/6
6V6GT 6/3	30FL14 15/6	9003 8/6
6V6M 8/-	30L15 17/-	9004 2/6
6X4 4/9	30L17 17/-	9006 2/6
6X5G 5/-	30P12 16/-	C.R. Tubes
6X5GT 5/6	30P19 14/-	E4504/B/16 70/-
6-30L2 14/-	30PL1 14/-	O9J 75/-
6Z4 5/-	30PL13 18/6	VCR97 32/6
7C5 14/6	42 5/-	VCR517 50/-
7C6 6/-	50CD6G 27/6	VCR517B 55/-
7H7 5/6	50EH5 7/-	VCR517C 45/-
7Y4 9/3	75 5/6	5FP7 26/7
9D6 2/6	76 5/-	Photo Tubes
11E2 30/-	78 5/-	GS16 12/6
12AT6 4/6	80 7/6	CMG25 45/-
12AT7 4/-	85A2 7/6	
12AU7 5/9	313C 25/-	
12AV6 5/6	807 9/-	
12AX7 6/-		

29/41ft. AERIALS each consisting of ten 3ft. $\frac{7}{8}$in. 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. £3.9.6. P. & P. 10/6.

METERS Full List of our very large stock of meters on request.

P. C. RADIO LTD.

170 GOLDHAWK RD., W.12

(01) 743 4946

ALL OVERSEAS ENQUIRIES AND ORDERS Please address to

Colomor (Electronics) Ltd.

170 GOLDHAWK ROAD, LONDON W12.

Tel.: 01-743 0899

RADIO AND ELECTRONIC HOBBIES

F. C. Judd — 21s net

Here's a comprehensive guide for the amateur constructor covering Radio Receivers, Audio-amplifiers, Transistor Circuits, High Fidelity and Stereo, Tape Recording, Electronic Music and Musical Instruments, Amateur Radio Transmitting, Radio Control, Short-wave Listening and Amateur Radio, the Cathode Ray Tube, Aerials, Test Equipment, etc.

"Highly recommended as a mine of information for the experimenter wishing to leave audio at a tangent."—*Tape Recorder*

RADIO-CONTROLLED MODELS

R. H. Warring — Second Edition — 18s net

This is a complete book on Radio Control as applied to model aircraft, boats and land vehicles. It describes radio-control principles and the various methods of relating radio signals to mechanically controlled surface movements via actuators and servos. Simple single-channel systems, proportional control systems and multi-channel operations are all fully described, including installation and operation details in various models. Other chapters explain the various types of receivers and transmitters as well as building simple transmitters from components or kits and the selection of equipment.

"Just what the modeller wants and needs to know". *Air Pictorial*—

COMPUTERS FOR THE AMATEUR CONSTRUCTOR

R. H. Warring — 20s net

This book sets out to provide a background knowledge of computers as a whole and their working principles. It gives an overall picture of modern computers and their capabilities. The bulk of the book however, is devoted to practical descriptions of computer circuits and circuit elements well within the capabilities of anyone to build. In particular, detailed circuits are given of two designs intended for amateur construction. Both are easy to build, yet they are quite advanced computer designs.

MUSEUM PRESS

PITMAN PUBLISHING, 39 PARKER STREET, LONDON WC2

CITY & COUNTY OF BRISTOL

BRISTOL POLYTECHNIC

Director: R. W. Bolland, B.Sc., Ph.D., F.R.I.C.

Applications invited for the following technicians in the Science Department, duties to commence as soon as possible

SENIOR TECHNICIAN (Grade T.3) in PHYSICS Ref. T698/66/1

ASSISTANT TECHNICIAN (Grade T.1) in PHYSICS Ref. T698/67/1

Salary Scales:

Senior Technician £930—£1,095

Assistant Technician £355—£800

Starting salary dependent upon age, qualifications and experience. An additional £50 or £30 per annum will be paid to candidates with appropriate National Certificate and C. & G. qualifications.

Applicants for Senior Technician post should be over 21 and have qualifications to at least O.N.C. or C. & G. Ordinary Technician standard and previous laboratory experience. Applicants for Assistant Technician post should have appropriate G.C.E. 'O' level or C.S.E. qualifications.

38-hour 5-day week with generous holiday and sick pay schemes. Opportunities for evening work with additional pay. Permanent posts with superannuation under Local Government conditions of service. All appointments subject to satisfactory medical report.

Further particulars and application forms (to be returned within fourteen days of this advertisement) from Chief Administrative Officer, Bristol Polytechnic, Ashley Down, Bristol BS7 9BU

Please quote appropriate reference number in all communications.

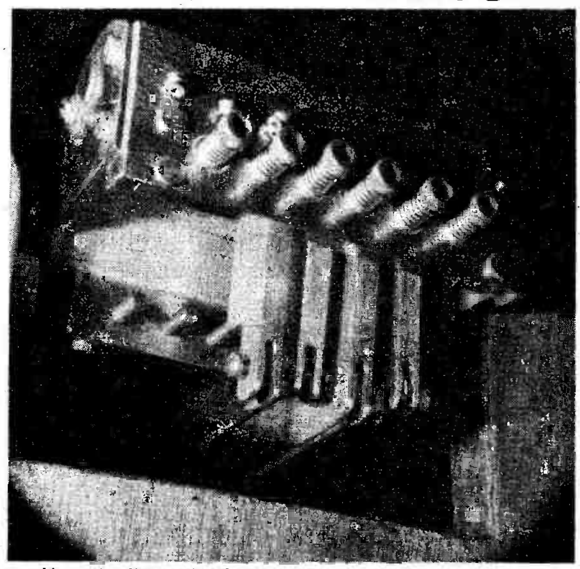
A PEDAL STEEL GUITAR

Part 3

F.C. JUDD

THE conclusion of Part 2 dealt with the last stage of assembly which was the linkage of the pedals to the roller levers by means of the "connecting" rods. The photograph on this page shows the actual connection of the horizontal rods to the roller levers. Adjustment of the pedal movement and linkage depends on the tuning adopted for the instrument but for the example given in Part 1 (an E6th tuning), string 2 will be tuned sharp and string 4 will be tuned flat when their respective pedals are depressed. The accuracy of the raising or lowering of pitch depends entirely on the accuracy of adjustment to the roller lever stop screws and the downward movement of the pedals. Adjustment should be such that when the pedal is depressed the string is re-tuned just as the pedal touches the stop rail beneath it and as the roller lever comes into contact with its own stop screw. The actual downward movement of the pedal for a semitone change of pitch should not be more than half an inch i.e., the pedals should normally rest about ½ inch or even less above the stop rail as shown in the photograph.

When preliminary adjustment of the pedal mechanism has been completed the engraved fretboard can be fitted. This may be glued to the guitar body with Evostik or Bostik. The strings can now be tuned to pitch and the accuracy of tuning checked over the full length of the fretboard i.e., at all fret positions. Providing the distance between the "nut" and the 12th fret and between the 12th fret and the centre line of the roller bridge are exactly equal (see diagrams in Part 1) the tuning should be accurate at all fret positions.



How the flat ends of the connecting rods are secured by 4BA screws to the roller levers.

Linkage to foot pedals. Adjustment is made by the 2BA nuts beneath the pedals, i.e., the pedals can be raised or lowered on the ends of the vertical connecting rods.

The Preamplifier

The final stages of construction are concerned with the preamplifier, its power supply and the optional foot pedal volume control (swell pedal). The preamplifier might also be considered as optional for there is no reason why the guitar pick-up should not be directly connected to a suitable amplifier already equipped with tone controls and volume control and having an input sensitivity of 50 to 100mV.

However, there is a purpose for the built-in preamplifier in that it makes up for gain loss incurred by the foot-operated volume control and more important, it has a treble lift and cut control that will enable the player to obtain that very sharp brilliant tone favoured by players of the pedal steel guitar. In

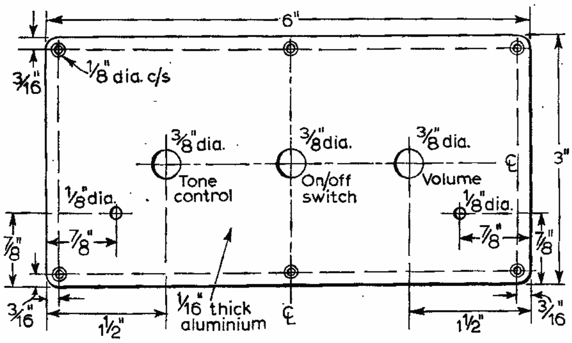


Fig. 20: The preamplifier panel. Details for drilling, etc.

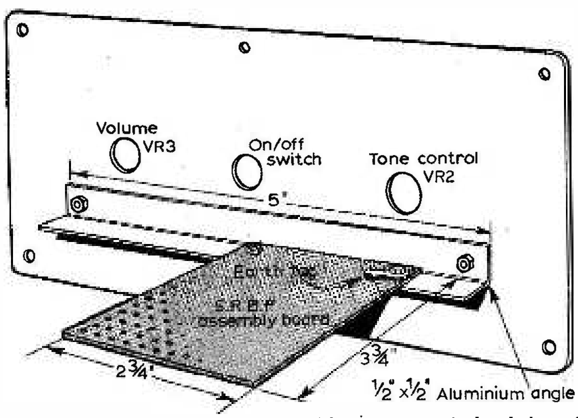


Fig. 21: Assembly of the preamplifier panel and circuit board.

fact the preamplifier may be of interest to plectrum guitarists.

The whole preamplifier is assembled on its own panel and if constructed to the dimensions given in Figs. 20 and 21 will fit into the slot provided on the top of the guitar consol (see Part 1). The circuit is shown in Fig. 22 and employs two Mullard BC109 transistors with a negative feedback tone control system that provides approximately 15dB treble lift

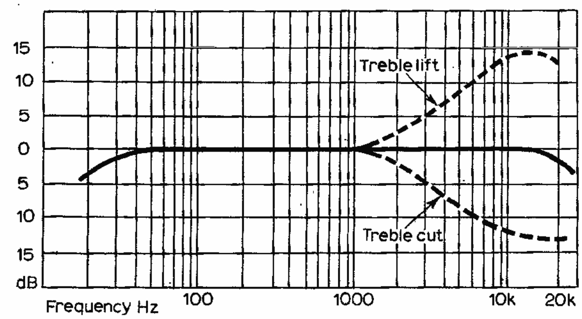


Fig. 23: Frequency response of the preamplifier.

and 12dB treble cut as shown by the response curves in Fig. 23.

The overall gain of the preamplifier can be varied a little by means of the pre-set control VR1 (4·7kΩ). For normal operation this control should be set to about midway position. At its maximum resistance the overall gain of the amplifier will be decreased. At its minimum resistance the gain of the amplifier will be increased but the amount of treble lift will

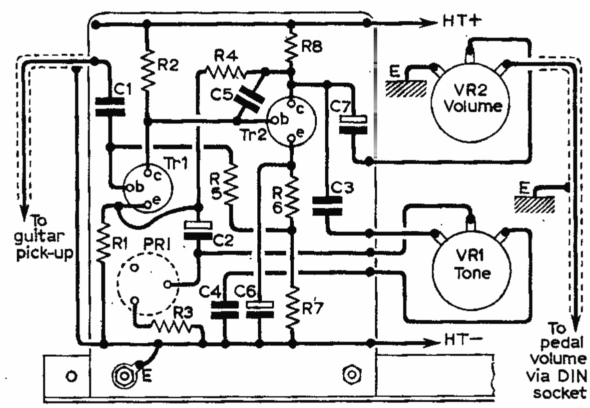


Fig. 24: Pictorial wiring diagram and layout for the preamplifier.

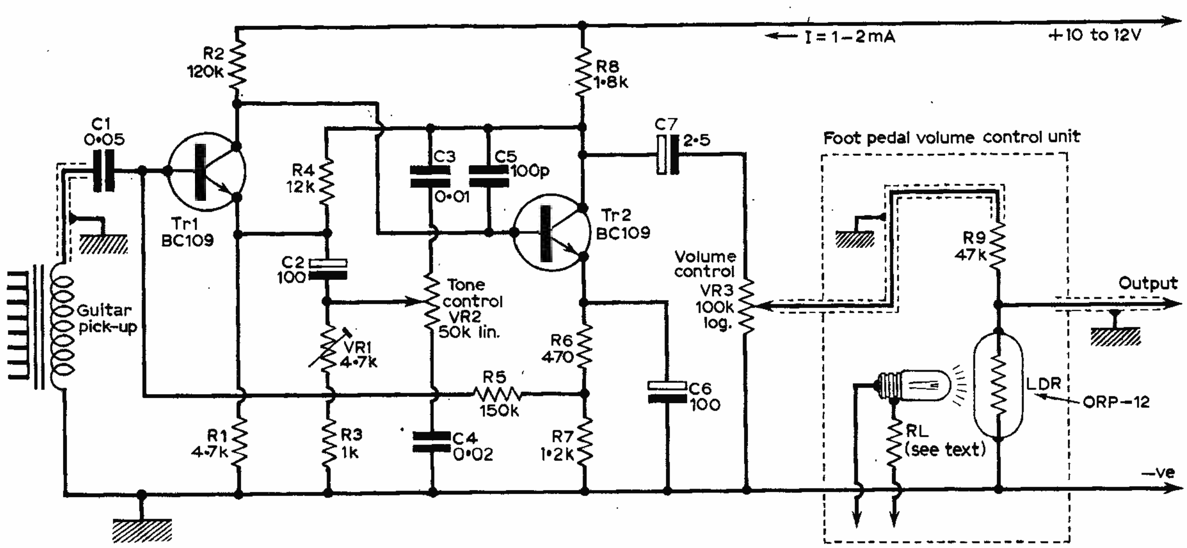
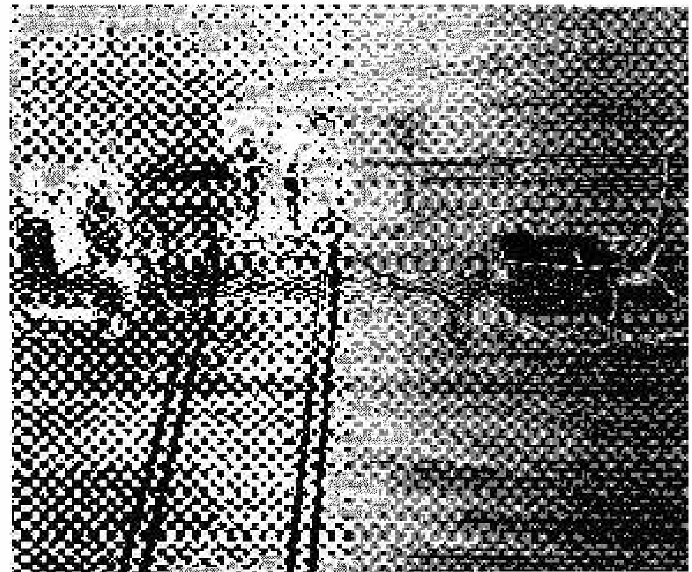


Fig. 22: Circuit diagram of the preamplifier.

be reduced. The average signal output from the preamplifier is about 200mV with VR1 set midway. With the foot pedal volume control in circuit the output is reduced to about 100 to 150mV. If the pedal volume control is not used, the output can be taken from the slider of VR3 and will be around 200mV. The preamplifier, with or without the pedal volume control, can be connected to any amplifier having an input impedance of 10kΩ or greater and an input sensitivity of 100 to 200mV. As already mentioned a higher or lower signal output can be obtained by adjusting the pre-set VR1. A pictorial wiring diagram for the preamplifier is given in Fig. 24.

Details for the power supply are given in Figs. 25A and B. If constructed as shown it can be mounted up inside the console as can be seen in the photograph. It may be necessary to orientate or reposition either the whole assembly or the mains transformer itself to prevent hum being induced into the guitar pick-up.



The position of the power supply (left) and the pre-amp (right). Note also the relative position of the pedal rod linkage mechanism (centre) and the pre-tension spring just to the left of it.

The Foot Pedal Volume Control

Assuming the pedal volume control is to be used, then the pre-amplifier output can be fed to it via a 3-pin DIN socket mounted at the side of the console (see Part 1). This socket also carries the 12V d.c. (from the power supply) to light the control lamp in the pedal volume control. Wiring connections for the socket are shown in Fig. 26. The signal lead must be screened and the overall length of the cables between the two DIN plugs (A and B) should be at least 2 feet.

The pedal volume control employs a light discriminating resistor (ORP12) which becomes part of an attenuating network formed by itself and R9. When the pedal is depressed in the backward direction, light from the control lamp decreases the resistance of the LDR and reduces the signal level. The light must not be too bright hence the need for some series resistance (RL). The author used a 6·3V 0·15A bulb with a series resistor of approximately 60 ohms. Lamps up to 12V at 60 to 100mA

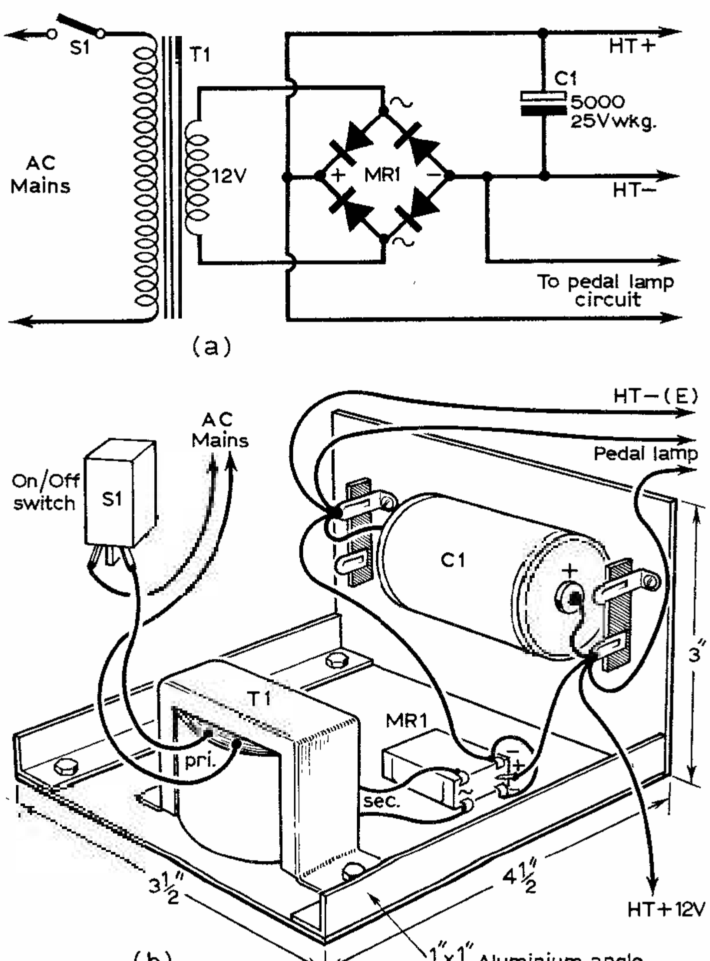


Fig. 25: (a) Power supply circuit. (b) Power supply assembly.

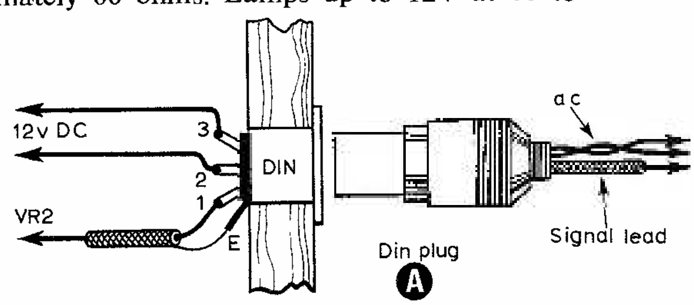
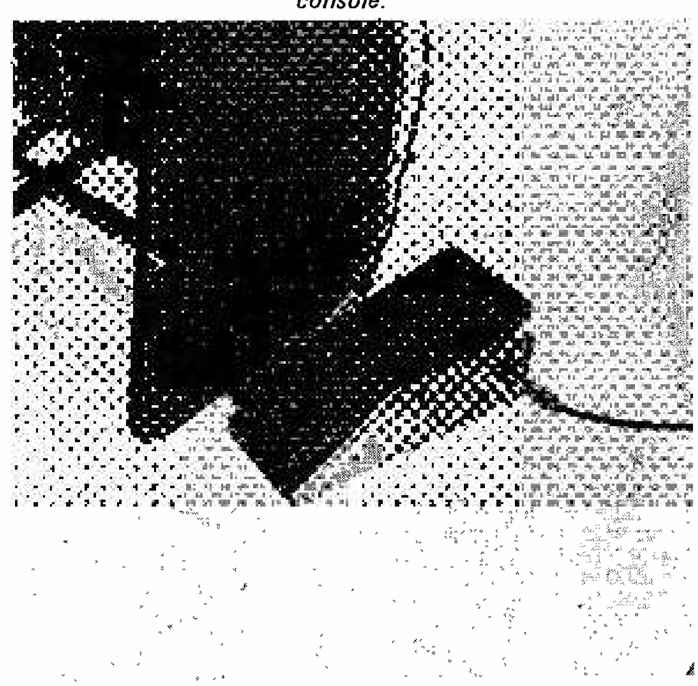


Fig. 26: Connections to the 3-pin DIN socket at the side of the console.



The completed foot pedal volume control.

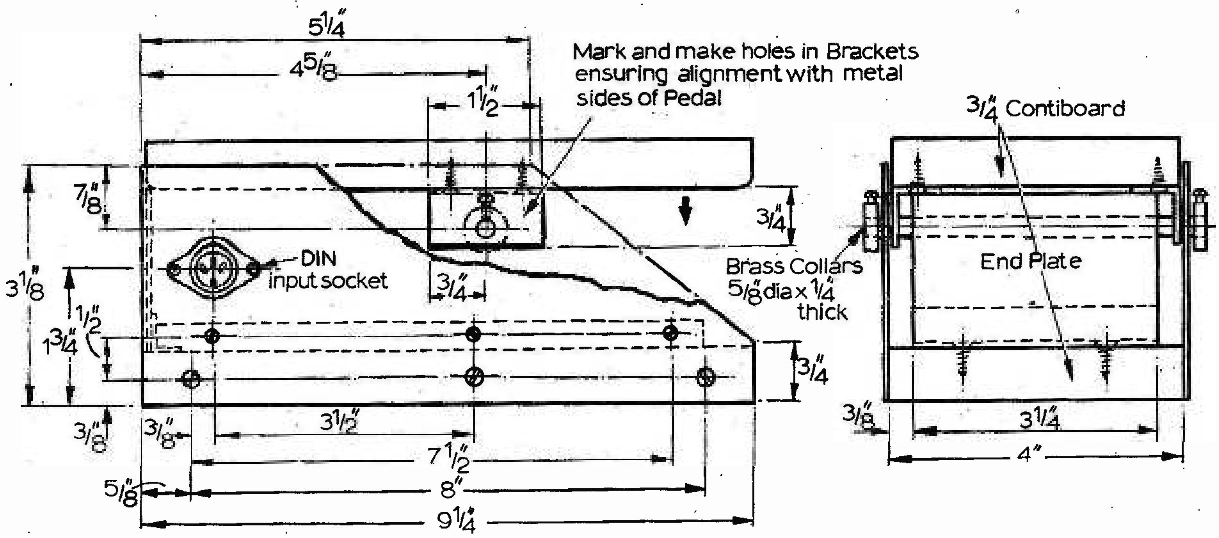


Fig. 27: Details of the foot pedal volume control.

can be used but should be dimmed a little with series resistance of appropriate wattage. A pre-set wire-wound resistor of about 50 ohms and 2W rating would be suitable.

An ordinary geared potentiometer pedal volume control could of course be used. The only real advantage of the LDR system is noiseless operation and the fact that it does not wear out as would a carbon track potentiometer. The photograph shows the completed pedal volume control and the diagrams in Figs. 27, 28, 29, and 30 give details for construction. The base of the control and the foot pedal were cut from ¾in. Contiboard left over from making the console. The two sides were made from $\frac{1}{16}$in. thick Dural. The pedal itself is hinged to the body on a ¼in. diameter spindle held fast by collars at each end and has an overall movement from level to a backward slant, of about 30°.

The control lamp and the LDR are both mounted in small wood blocks as shown in Figs. 30 and 31. It is best to solder the leads for the lamp directly to it and secure the lamp in the block with a spot of adhesive. The two blocks must be only just far enough apart to allow the aperture plate to move freely between them. The wiring for the 3-pin DIN socket, the output jack socket and the LDR and lamp are shown in Fig. 31. Providing the LDR is recessed in its mounting as shown in the diagrams it will not be affected by light coming from outside. Note that the end plate as shown in Fig. 29 serves as a forward stop for the pedal.

The complete and finished instrument, exactly as described in this series of articles, gave a very pleasant but brilliant tone quality with a good *sostenuto* (sustaining of sound) typical of the pedal steel guitar and its forerunner the Hawaiian guitar. As pointed out previously the number of pedals need not be confined at two only—some commercial single-neck instruments have four.

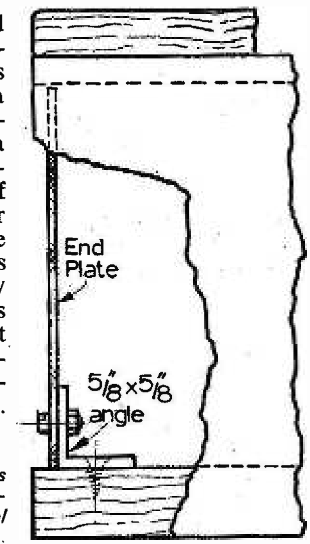


Fig. 29: The end plate acts as a stop for the forward-downward movements of the pedal volume control.

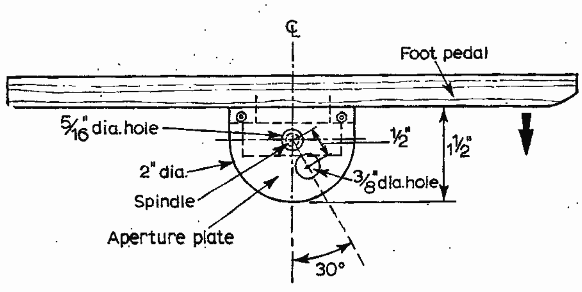


Fig. 28. The foot pedal of the volume control and the LDR aperture plate.

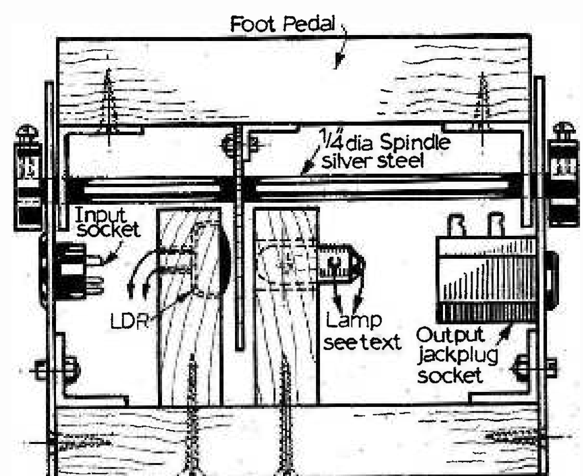


Fig. 30: The LDR and its lamp are mounted so as to be in line with the ¼in. diam. spindle and the centre line of the aperture plate.

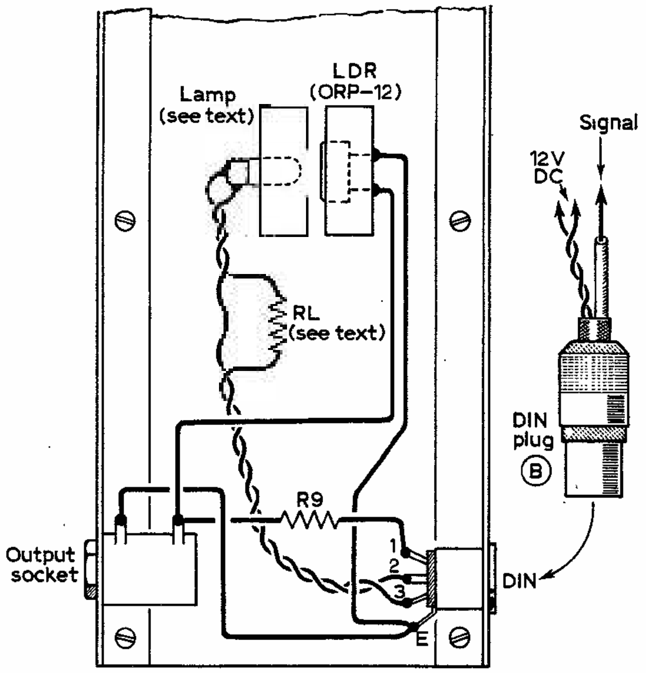


Fig. 31: Wiring for the pedal volume control, its input and output sockets and the 3-pin DIN connecting plug.

However, by making and fitting four roller levers as suggested, the two pedals can be changed over to other strings should alternative tuning combinations be required.

On reading through the first two articles again the writer has discovered one or two points that might not have been clear. First the unused roller levers. These should be locked at midway position (hanging vertically) by means of the locking screws. The strings can be anchored to them directly or to the holes in the tailpiece.

Before adjusting the movement of the pedals and linkage, set the roller levers concerned by means of their stop screws, so that they too hang vertically. The roller that is used to tension its string should now have its forward stop screw adjusted so that the lever can move forward i.e., toward the pick-up. The roller lever that is used to de-tension its string should have the rear (tailpiece) stop screw adjusted so that the lever can move toward the tailpiece. The basic tuning should of course be done with the pedals in their off or neutral position.

Finally a note on suitable strings. Those used for the tuning prescribed in Part 1 which is based on the chord of E6 were selected from the wide range of "Rotosound" strings for guitars of all kinds. These were as follows:

8	7	6	5	4	3	2	1
A♭	B	D	E	A♭	B	C♯	E
0·038″ Covered	0·036″ Covered	0·028″ Covered	0·024″ Plain	0·020″ Plain	0·018″ Plain	0·016″ Plain	0·014″ Plain

Heavy gauge covered strings could be used for 8, 7 and 6 with a resultant rounder and stronger tone. Some experiment with string gauges is well worthwhile and a list giving all the different gauges of strings and a chart showing the different types recommended for guitars i.e., pedal steel, Hawaiian and plectrum can be obtained by writing to Rotosound—James How Industries Limited (Music Division), 20 Upland Road, Bexley Heath, Kent. ■

NEXT MONTH IN PRACTICAL WIRELESS

THE MICROTEST

Few people build multi-range testmeters nowadays because Japanese ready-built meters are freely available at very competitive prices. There does, however, remain one distinct advantage in "rolling one's own", and this is the high degree of accuracy to which a meter can be calibrated. It is quite easy to do, and is fully described in this article on the Microtest 24-range a.c./d.c. multimeter using a 50μA movement.

THE TWO-FIFTY TRANSMITTER

Radio Amateurs who are keen on turning their attention to 2-metres will find G3TYJ's Two-Fifty transmitter very appropriate. It is a relatively simple crystal controlled 4-valve 40watt input design which can be used as it stands for c.w., or connected to any normal modulator for phone. A circuit is also provided to assist those who prefer to use the simpler clamp-tube modulation. Full coil-winding details are given, along with sufficient constructional information to enable anyone who has a transmitting licence to build this transmitter without difficulty.

REPAIRING LOUDSPEAKERS

Loudspeaker cones are very fragile, and the slightest tear can seriously impair reproduction quality. Having a speaker reconed professionally can be very expensive, however, and so this article explains how to carry out this task oneself, replacing the original paper cone with a combination of paper, expanded polystyrene, polyurethane foam and aluminium foil, the mixtures depending on which frequency range the loudspeaker is intended to cover. The complete cost of repairing one of the author's 12in. loudspeakers came to about 14s.

PLUS OTHER CONSTRUCTIONAL PROJECTS AND REGULAR FEATURES

Do not miss your copy of the February issue of Practical Wireless—on sale 9th January price 3/-

DESIGNING CLASS "A" TRANSISTOR AMPLIFIERS

C. R. BOGGIS, M.A.P.A.E.

DESIGNING basic transistor amplifier stages can be made very simple by following a few "rules of thumb", so enabling the experimenter with but a modicum of theoretical knowledge to tailor established circuits to his own needs. This article, which can be read in conjunction with last month's "Experimenters Corner", describes how to work out the component values for germanium or silicon amplifiers and couple them to other stages without upsetting their operation.

Germanium Amplifiers

If a single amplifier stage as shown in Fig. 1 is designed as follows it will be able to function over the temperature range of 20 to 50° Centigrade. In the worked example, a general-purpose small signal transistor is used (Mullard type OC71, or similar).

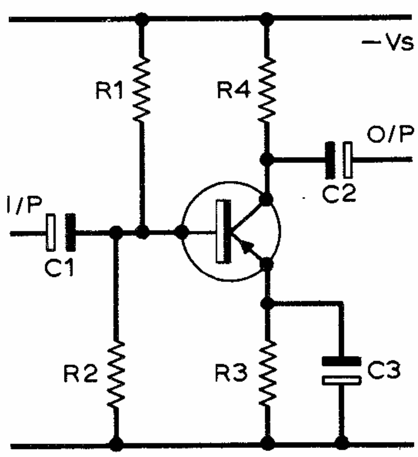


Fig. 1: A straightforward amplifier stage suitable for a germanium transistor.

First the supply voltage is chosen. Here we select 9 volts, this being readily available from standard batteries. We then decide on a value of collector current. For a very small input and low noise this should be around 100-200 microamperes, but for large inputs the current could be anything up to about 100 milliamps. As a general rule a current of 1mA is desirable, and it is around this figure that the stage designed here is evolved.

Having decided on the collector current, the first rule may be applied. This states that the emitter resistor should drop approximately 1 volt. Therefore in our example, R3 will be equal to $\frac{1 \text{ volt}}{1\text{mA}}$, since the emitter current can be considered equal to the collector current for this purpose, which suggests a resistor value of 1000 ohms.

The next rule states that for good stability, the collector voltage should be equal to half of the result of subtracting the emitter voltage from the supply voltage. Here the collector voltage should be $\frac{9-1 \text{ volts}}{2}$ or 4 volts.

With a collector current of 1mA, R4 should be $\frac{4 \text{ volts}}{1\text{mA}} = 4000$ ohms, the nearest preferred value being 3·9kΩ.

Using yet another rule of thumb, R2 should be 10 times R3, which yields a value of $10 \times 1\text{k}\Omega$, or 10kΩ in this case.

The base voltage is determined by the V_{be} for the transistor plus the emitter voltage. For a germanium transistor, $V_{be} = 0{\cdot}2$ volts approx., so the base voltage required is 1·2 volts. The current through R1 is the same as the current through R2, since the base current, being very small, can be ignored. This current equals $\frac{1{\cdot}2 \text{ volts}}{10\text{k}\Omega}$, which is 120 microamps. Thus R1 should drop 9−1·2 or 7·8 volts at 120 microamps. R1 therefore equals $\frac{7{\cdot}8 \text{ volts}}{120\mu\text{A}}$, which is 65kΩ (use a 62kΩ preferred value).

The values of C1 and C2 hardly need calculating. Suffice to say that their reactance should be negligible at the lowest frequency to be amplified. An ideal value for each is 10μF. The working voltage is determined by the collector voltage of the stage and the base voltage in the following stage—usually a 6 volt capacitor will be suitable. Note the polarity of these two capacitors.

C3 should also be chosen such that its reactance is small at the lowest frequency. Here a value of 50μF will be ample, but again, note the polarity.

Silicon Amplifiers

Using silicon transistors it is possible to obtain adequate temperature stability with a simplified circuit as shown in Fig. 2. The design procedure is even simpler

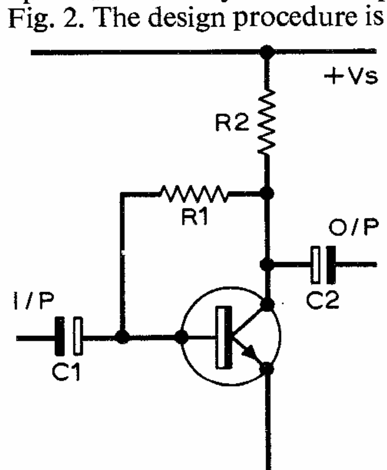
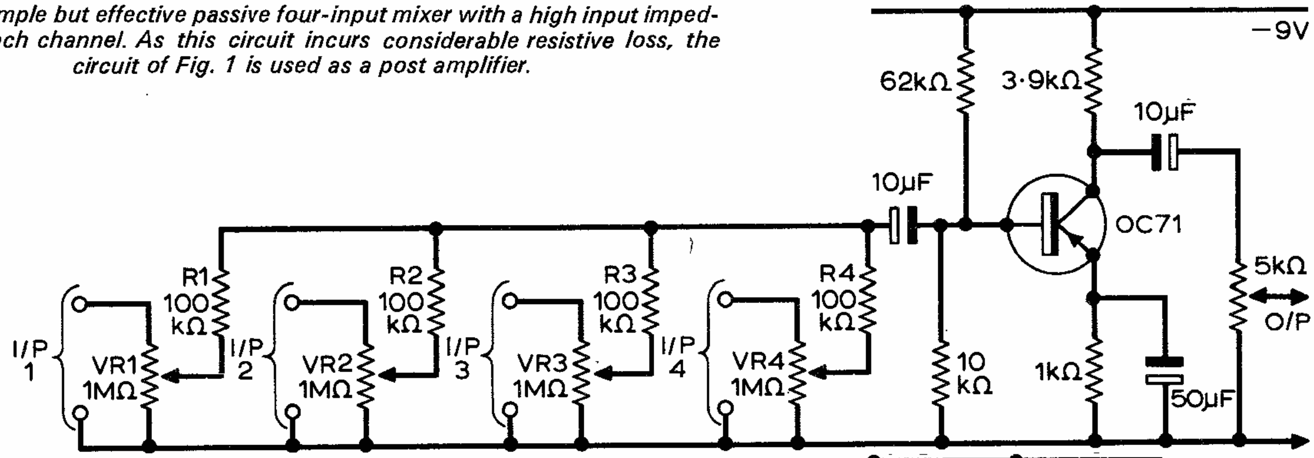


Fig. 2: A simple amplifier particularly suitable for a silicon transistor.

Fig. 3: A simple but effective passive four-input mixer with a high input impedance to each channel. As this circuit incurs considerable resistive loss, the circuit of Fig. 1 is used as a post amplifier.



with this circuit, the number of components being so few.

First, choose the supply voltage; say 6 volts. The collector current is picked next. Here a value of 200μA is used, as we are designing an input stage to be fed from a microphone, and low noise is most important. The transistor chosen is a Mullard BC109 (or similar).

As in the previous example using a germanium transistor, the collector voltage should be approximately half the supply voltage minus the emitter voltage. As the emitter voltage is zero, the collector voltage should be 3V. R2 will therefore be equal to $\frac{3 \text{ volts}}{200\mu A} = 15k\Omega$.

R1 is arranged to drop the collector voltage down to the level required for the base of the transistor. The base voltage needed here is equal to the V_{be} for the transistor, which is about 0·4 volts for silicon.

The base current required is calculated from the collector current divided by h_{fe} or beta for the transistor at that collector current. For the BC109, h_{fe} at I_c= 200μA is typically 300, so the required base current is $\frac{200\mu A}{300}$, which is 0·6μA. R1 is therefore equal to $\frac{3-0{\cdot}4 \text{ volts}}{0{\cdot}6\mu A}$, which is 4MΩ. Allowing for somewhat lower h_{fe} values that may occur in production spreads R1 should be chosen as 2·7-3·3MΩ.

Using the Circuitry

The circuit designed in Fig. 1 could be utilised in many ways. It could be used to amplify the signal from the detector of a tuner up to sufficient level to drive an earphone, in which case R4 should be replaced by a headset with a d.c. resistance of 4000 ohms. Alternatively, R4 may be left in circuit and driver and output stages added to drive a loudspeaker.

Another application could be as an audio mixer for several inputs, and the circuit in Fig. 3 shows such an arrangement. Resistors R1-R4 are included to reduce interaction between each of the mixer volume controls. The volume control at the output is the master volume control, and is effective over all inputs. By inverting the supply rail polarity, the circuit in Fig. 2 could be substituted for the OC71 amplifier stage.

High Input Impedance

Where a high input impedance is required such as for amplification of a gramophone pick-up output, an emitter follower can be used in front of the circuit in Fig. 2. This additional amplifier is shown in Fig. 4, and this will give an input impedance of approximately 2MΩ. This is because the input impedance of the transistor is almost equal to the beta or h_{fe} times R_e.

Input Z=300 × 15kΩ=4·5MΩ.

This is shunted by R1, which is 3·3MΩ, so the input impedance=$\frac{3{\cdot}3 \times 4{\cdot}5}{3{\cdot}3+4{\cdot}5}$MΩ=2MΩ. ■

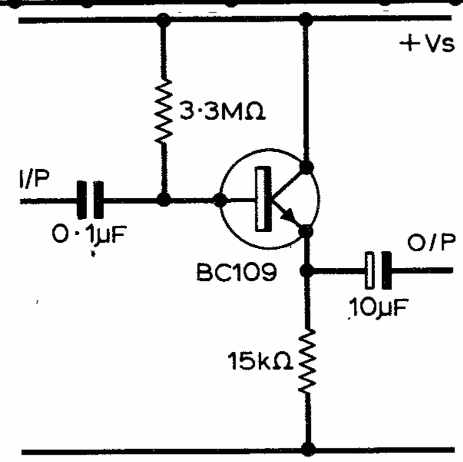
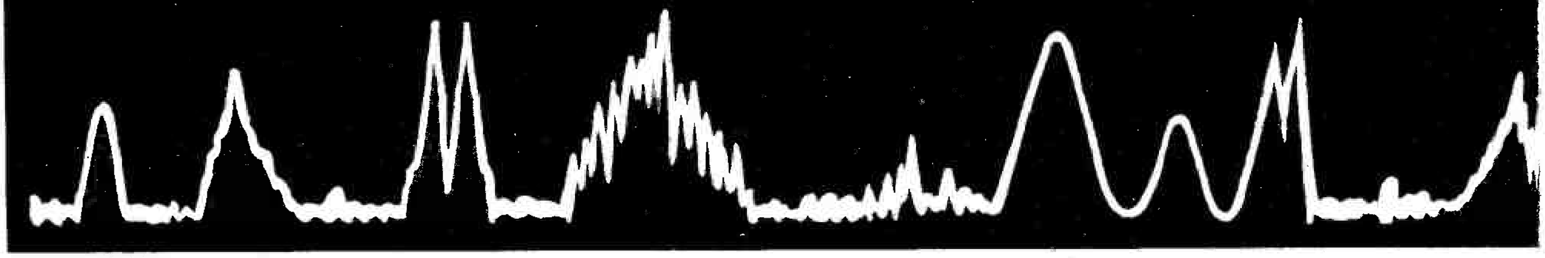
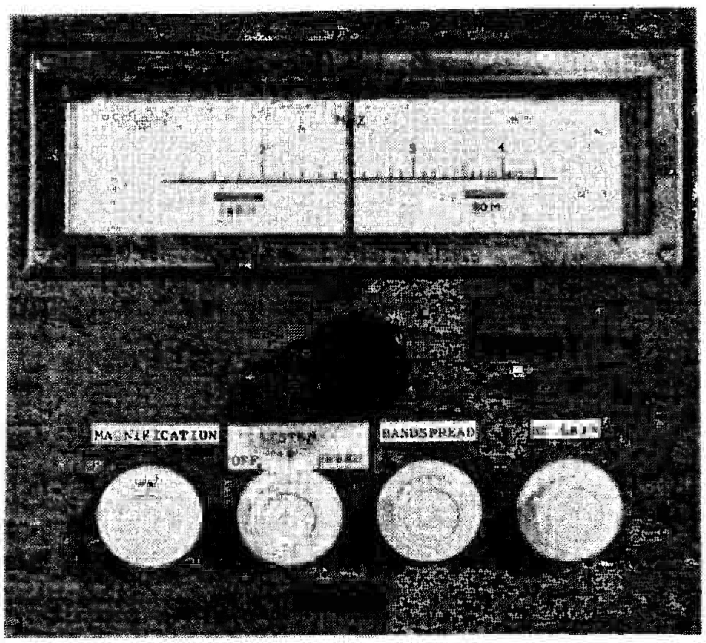


Fig. 4: An emitter-follower which exhibits a very high input impedance and a low output impedance. Its voltage gain is fractionally less than 1.

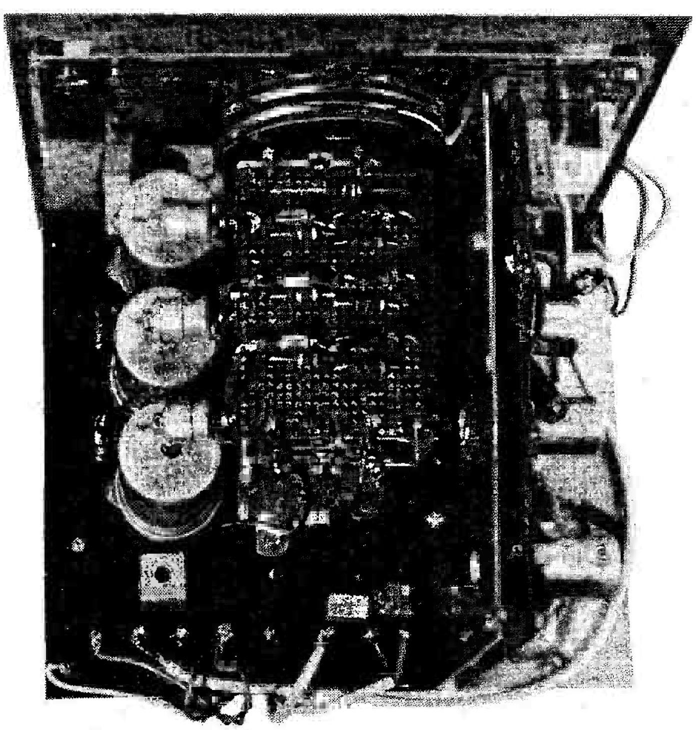
A PANORAMIC RE





D. BOLLEN

PART 1



A PANORAMIC receiver provides a visual display of a band of frequencies when coupled to an oscilloscope, and this can be a useful aid to the serious short-wave listener or radio amateur. Signals appear on the oscilloscope screen as a series of resonance curves, of differing amplitude and character, spaced along the X-axis as though on a tuning scale. All signals are resolved visually without switching, whether they be a.m., c.w., s.s.b. or f.m., and the operator soon learns to distinguish between them. A quick assessment of general conditions on the band can be made without having to break off an existing contact on the main "shack" receiver. Thus, the need for searching by means of frequent manual retuning is largely eliminated.

Before semiconductors came on the scene, automatic "sweep" tuning of a receiver could only be accomplished by complicated arrangements of motor-driven tuning capacitors or reactance valve circuits, but now simple circuits based on the capacitance variation of semiconductor diodes when reversed biased are used.

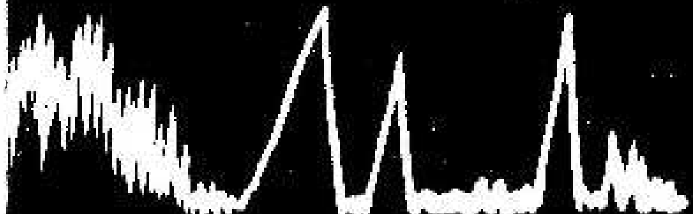
The equipment described here employs ordinary, readily available components, and is designed for simple construction and low cost, to cover bands of frequencies up to 500kHz wide lying between 1·7MHz and 4·5MHz, which includes 160 and 80m.

HOW IT WORKS

Figure 1 gives the block diagram of the panoramic receiver. A conventional two transistor converter, involving three "gang" tuned circuits, is coupled to a 1·6MHz i.f. strip. An alternative arrangement is with the converter feeding a medium wave receiver which is tuned to 1·6MHz, thus achieving a double-superhet configuration. A voltage taken from the oscilloscope timebase simultaneously varies the capacitance of three diodes, each placed across one of the tuned circuits in the converter. At the same time, an output voltage is derived from the final i.f. detector diode for display on the oscilloscope Y-axis. If a continuous unmodulated carrier is received, the oscilloscope will show the overall response curve of the panoramic receiver, in the form of a single peak situated somewhere along the X-axis. Two plain carriers at different frequencies will appear side by side. The effects of modulation will be discussed later.

In practical terms, the small change of diode capacitance, compared with the main tuner capacitance swing, is quite sufficient to offer a useful "sweep". If an attempt is made to get a really wide panoramic bandwidth then signals will be too cramped on the display for easy recognition, and

CEIVER for 160 to 80 METRES



"tracking" problems will arise. Under typical operating conditions, "sweep" bandwidths of less than 50kHz will offer an informative display, but the bandwidth obtained with the prototype receiver is continuously variable between zero and 500kHz on 80 metres, and zero to 100kHz on Top Band, which is sufficient for most requirements.

Although intended primarily as an accompaniment to an existing communications receiver, the panoramic receiver can be used on its own. Switching is included to stop the "sweep" and allow normal reception of an a.m. signal, either with headphones or via an amplifier and loudspeaker, as shown in Fig. 1.

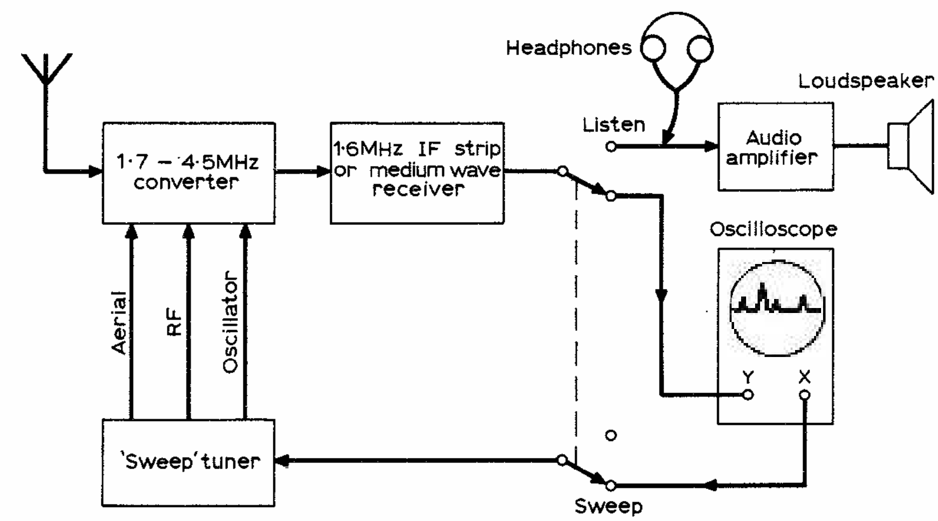


Fig. 1: Block diagram of the panoramic receiver.

The prototype receiver made use of a mixer and 465kHz i.f. strip taken from an old transistor portable radio. After careful peaking of the 465kHz i.f. transformers—made easy by the panoramic receiver display of its own response curve—excellent reception of signals was obtained, including s.s.b. when a b.f.o. was added.

Although, at first sight, the panoramic receiver would seem to involve quite a lot of constructional work, it will only be necessary to build a straightforward two transistor converter, plus a "sweep" tuner circuit panel consisting of a small collection of components, if a medium wave receiver and an inexpensive oscilloscope are already to hand. Even greater simplification results when the "sweep" tuner is fitted to an existing receiver.

DIODE CAPACITANCE

Virtually all semiconductor rectifier diodes exhibit junction capacitance, due to the depletion layer when reversed biased, and this capacitance varies with reverse voltage. Varactor diodes are specially manufactured to exploit depletion layer capacitance and to offer a good performance at very high frequencies. It is not generally realised, however, that ordinary silicon power rectifiers, as used for h.t. supplies, can also be employed as voltage controlled capacitors in circuits working at several MHz. The graph given in Fig. 2 shows the capacitance characteristics of four types of silicon rectifier. It can be seen that the characteristic of each diode is non-linear, and that maximum capacitance depends on the particular diode type. In nearly all cases, a capacitance variation amounting to some 50% of maximum junction capacitance is obtained when a reverse voltage of 10V is applied.

A single diode "sweep" tuner circuit serves to demonstrate how a rectifier diode can be linked to the tuned stage in a radio receiver (see Fig. 3). The tuned circuit, consisting of an r.f. inductor L1, a trimmer capacitor TC1 and a variable capacitor VC1, is coupled in parallel with the variable capacitance diode D1 via d.c. blocking capacitor C1. A re-

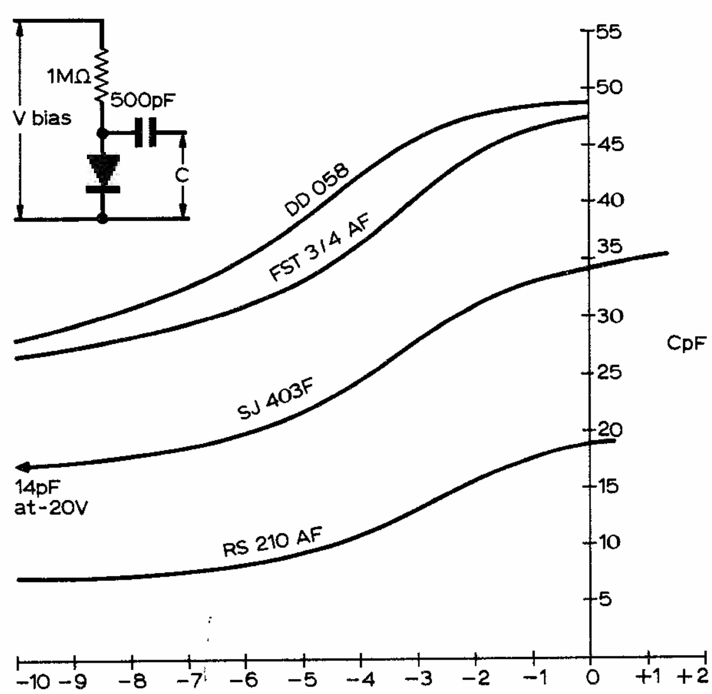


Fig. 2: The capacitance characteristics of four types of silicon diode.

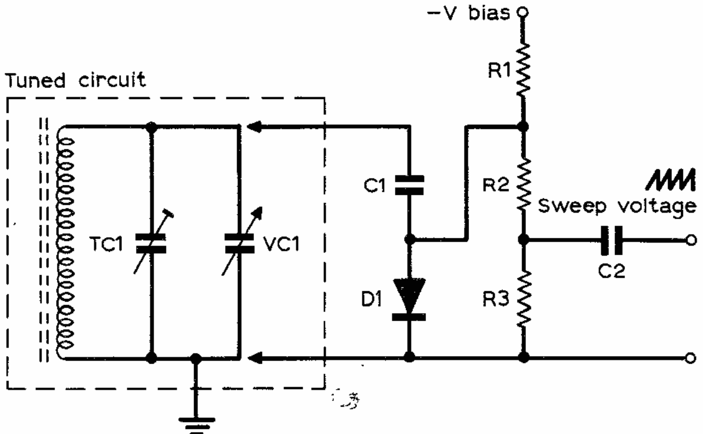


Fig. 3: A single diode "sweep" tuner.

verse voltage is applied to the diode by the potential divider formed by R1, R2 and R3. R1 and R2 have values of more than 1M ohm, to minimise loading of the tuned circuit. Approximately half the bias voltage will appear at the junction of R1 and R2, and the sawtooth timebase voltage, which is fed to R3 via C2, will cause the reverse voltage across the diode to "sweep" in sympathy with the oscilloscope X deflection, between zero and full bias conditions. It is important to avoid driving the diode into conduction by the application of too large a timebase voltage. Although no damage will result, a forward bias across the diode will lower the "Q" of the tuned circuit, and cause loss of gain. An interesting feature of the Fig. 3 circuit is that a small alteration of d.c. bias across the diode will change its capacitance, therefore, bandspread tuning can be accomplished easily merely by placing a variable resistor in series with R1.

The governing factor in the choice of a diode for receiver tuning is its zero bias capacitance. If the diode has a large capacitance it will seriously restrict the high frequency coverage of the receiver. On the other hand, if the diode has a small capacitance, the "sweep" bandwidth of the panoramic receiver will be correspondingly narrow. As a general rule, a zero bias capacitance of about 10% of the maximum tuned circuit capacitance will be about right.

In the case of the 1·7MHz-4·5MHz converter used for the panoramic receiver, maximum tuned circuit capacitance is in the region of 330pF, calling for a diode capacitance of 33pF. Varactor diodes listed by well-known suppliers fall outside the required capacitance value, being either too large or too small, but a wide choice of rectifier diodes exists. The A.E.I. type SJ 403F was found to be ideal, having a zero bias capacitance typically of 34pF, falling to some 14pF with a reverse voltage of 20V, see Fig. 2. If difficulty is experienced in obtaining the SJ 403F, there is no reason why other types should not be tried. A diode can be checked for zero bias capacitance value by connecting it, in series with a fixed mica capacitor of about 500pF, across the terminals of a capacitance bridge. The aim should be to find three diodes, preferably of the same type, which have a nearly identical capacitance value falling close to 33pF. In practice, anything from, say, 25pF to 40pF can be deemed usable in the panoramic receiver.

The converter circuit of Fig. 4 is designed around Denco transistor tuning coils and n-p-n silicon transistors. Coils T1, T2, and T3 are intended for use with a 310pF+310pF+310pF tuning capacitor and 30pF trimmers. Padder capacitor C7 in Fig. 4 serves to give correct tracking between oscillator and other stages.

Denco 3T coils normally cover the range 1·7MHz to 5MHz, but the addition of extra diode tuner capacitance to the tuned circuits in the converter will lower the upper frequency limit to 4·5MHz, without otherwise affecting performance.

In Fig. 4, the aerial coil T1 is tuned by VC1. A signal is amplified by r.f. stage Tr1 and is then passed to the secondary winding of T2. T2 is tuned by VC2. Self-mixing oscillator Tr2 converts the signal to 1·6MHz, and the oscillator coil T3 is tuned by VC3. I.f. transformer IFT1 provides the correct matching impedance to the base of a following tran-

★ components list

Resistors:
- R1 18kΩ
- R2 6·8kΩ
- R3 2·7kΩ
- R4 18kΩ
- R5 6·8kΩ
- R6 2·7kΩ
- R7 1kΩ
- R8 470Ω
- R9, R10, R11, R12, R13, R14 2·2MΩ
- R15 560kΩ
- VR1 1kΩ carbon linear pot.
- VR2 25kΩ carbon linear pot.
- VR3 100kΩ carbon linear pot.
- VR4 1MΩ miniature skeleton pre-set.

All fixed resistors ½W, 10%.

Transistors:
- TR1, TR2 2N2926 (orange spot)

Diodes:
- D1, D2, D3 SJ403F (see text)

Switch:
- S1 Four-pole three-way rotary

Coils and transformers:
- T1 Blue, T2 Yellow, T3 White: Denco 3T
- IFT1 Denco IFT 16/1·6

Capacitors:
- C1 0·05μF
- C2 0·01μF
- C3 0·05μF
- C4 0·033μF
- C5 0·01μF
- C6 0·01μF
  (C1–C6 polyester 250V)
- C7 340pF polystyrene 125V ±2½%
- C8 0·1μF polyester 250V
- C9, C10, C11 470pF polystyrene 125V ±2½%
- C12 0·1μF polyester 500V
- VC1/VC2/VC3 Jackson type E3 310pF+310pF+310pF
- TC1, TC2, TC3 30pF Philips concentric airspaced.

Miscellaneous:
Jackson SL16 scale drive assembly. Bias battery type B122. S.r.b.p. sheet 7in. × 5¾in., turret tags, 0·1in. matrix Veroboard or plain drilled s.r.b.p. 21 × 30 holes, matrix pins, 18s.w.g. aluminium plate 7in. × 2½in.

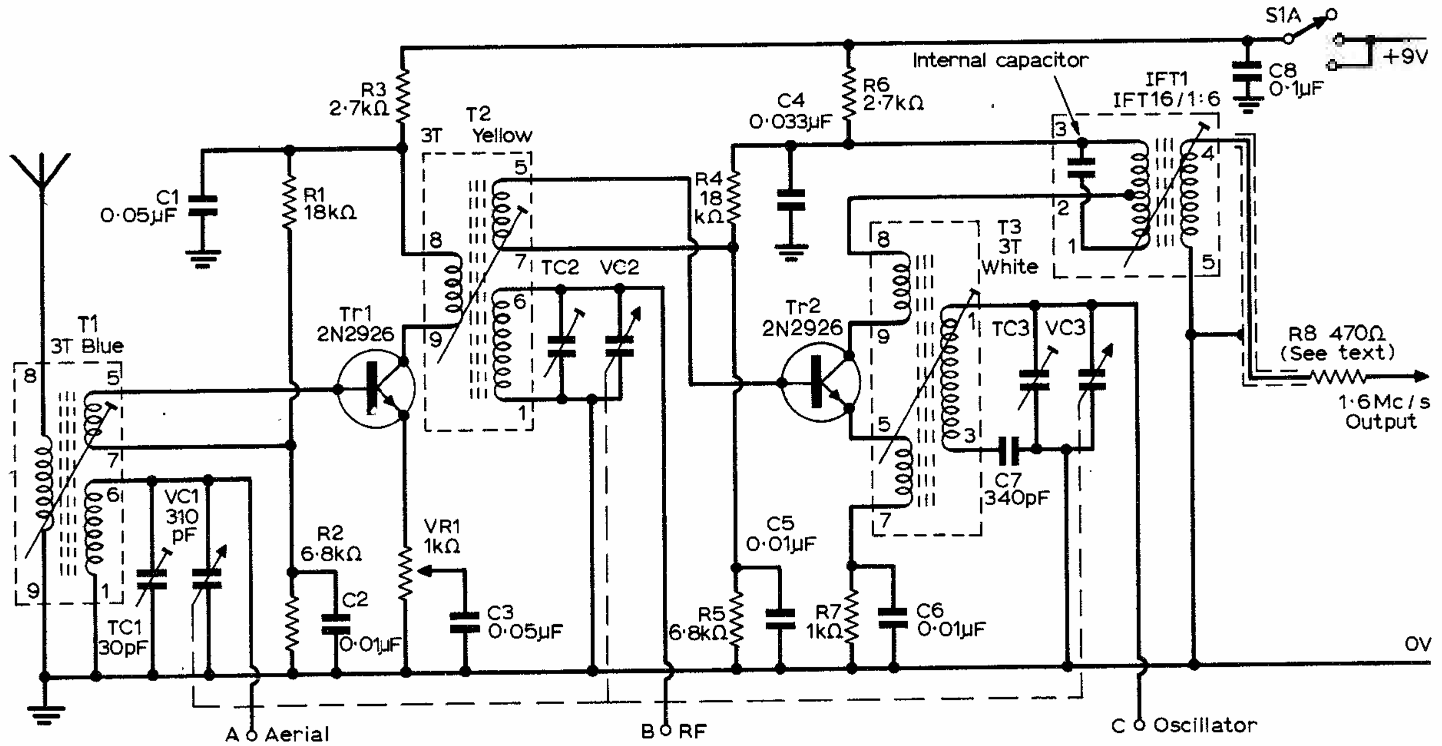


Fig. 4: The 1·7 to 4·5MHz front-end. This is a simple tuner designed around Denco coils.

sistor stage in a 1·6MHz i.f. strip, or a mixer in a medium wave receiver. Methods of coupling the converter to following stages will be outlined later.

To prevent instability, the r.f. stage in Fig. 4 is decoupled by R3 and C1, and the mixer by R6 and C4. C8 decouples the +9V supply line. VR1 is included to allow adjustment of r.f. gain, so that an optimum signal-to-noise performance may be achieved. The purpose of resistor R8 will be explained later.

THREE-GANG diode tuner

In the diode tuner circuit of Fig. 5, d.c. bias for the diodes is conveniently supplied by a small, long-life 22·5V battery. Diode and bias polarities are so arranged that a left to right timebase sweep will give high frequency signals on the right-hand side of the display. VR2 and R15 form a potential divider, and VR2 acts as a bandspread control, giving deviations of the order of ±15kHz at 3·4MHz, and just a few kHz at 1·9MHz. Short-term frequency stability of the diode tuner, when switched to "listen" is sufficiently good to allow s.s.b. signals to be easily resolved with the aid of a b.f.o.

Each diode in Fig. 5 has its own potential divider, formed by the 2·2M ohm bias resistors R9-R14, but the dividers are connected to earth via a common resistor, formed by the track of potentiometer VR3. Thus, while each diode is individually d.c. biased, and is isolated from other diodes by the high value of divider resistors, a sweep voltage injected into VR3 will swing all three diodes simultaneously. Capacitors C9-C11 couple the diodes to the tuned circuits in the converter.

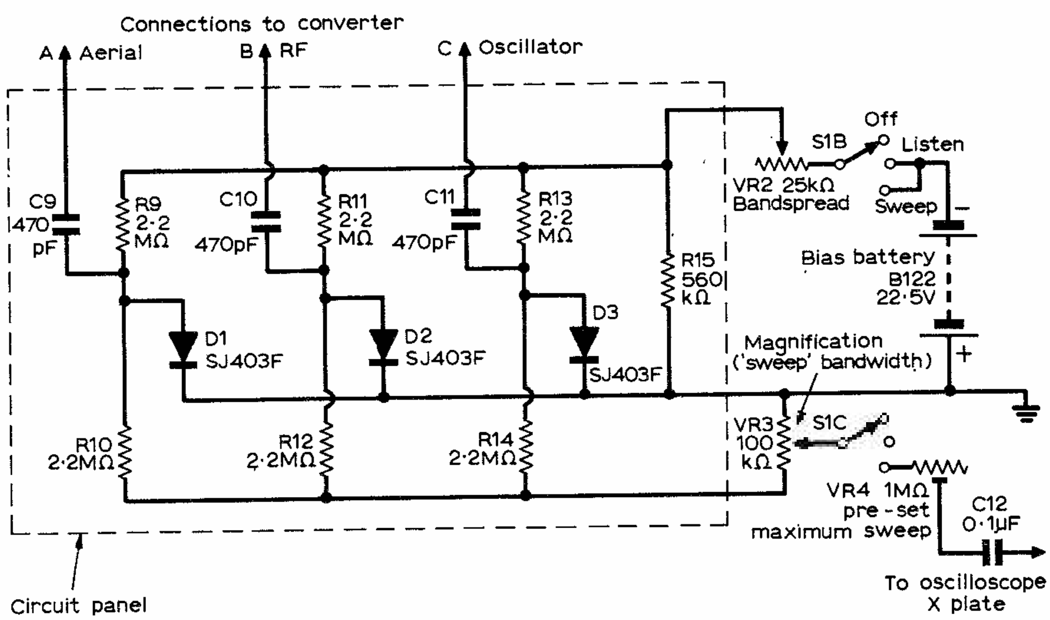


Fig. 5: The "three gang" diode sweep tuner. Sections A and B swing the r.f. tuned circuits T1 and T2 in Fig. 4, and section C sweeps the oscillator T3.

The oscilloscope timebase sweep voltage is fed to the diode tuner via C12 and VR4. VR4 serves to pre-set the maximum sawtooth peak voltage when VR3 is set for minimum magnification (maximum sweep bandwidth), and will cater for typical oscilloscope X-plate voltages of 100V-400V. As the slider of VR3 is moved towards the earth rail, a signal peak at the centre of the display will be expanded, i.e., magnified, until it fills the screen; this facility is useful for a close examination of adjacent signal heterodyne interference, as well as various transmitter modulation defects.

Part 2 next month:
Construction, alignment and use.

ON THE SHORT WAVES

MONTHLY NEWS FOR DX LISTENERS

Times in GMT • Frequencies in kHz

THE BROADCAST BANDS

Malcolm Connah

IT is my intention to devote as much space as possible to news and logs sent in by readers of this column. Several logs were received this month and they have been included in this article.

If you have any news or loggings which you think would be of interest to your fellow-readers you should send them to PRACTICAL WIRELESS by the 14th of each month or to my home address: 58 Kensington Gardens, Ilford, Essex, by the 17th. It would be helpful if you could enclose a list of the equipment you use as this helps people to make a comparison between your logs and their own results.

Readers' Logs

John W. Smith, of Anstruther, in Fife, sent in the following items from his log:

11,770: *Radio Nigeria* in English from 1900 to 1930.

15,080: *Radio Euzkadi,* clandestine, in the late evening.

15,155: *Radio Dif. de Sao Paulo* at 2320.

He also reports that *Radio Denmark* transmits its European Service from 1030 to 1115 (Saturday-Sunday) instead of 1015-1100. The frequency is still 9,520 and the "DX Window" programme will be broadcast at 1045 on Sundays.

Mr. H. Wood, of Manchester, sent in these news items:

Canada: The new autumn schedule of the CBC is 0715-0745 on 9,625 and 5,990, 1217-1313 on 15,325 and 2115-2152 on 11,720, 15,325 and 17,820. All times and frequencies refer to the European Service.

Netherland Antilles: The *Radio Nederland* transmitter at Bonaire is now using the frequency of 9,715 from 0800 to 0920 and from 0500 to 0620.

Roy Patrick, of Derby, sent in these interesting items:

Andorra: The English Service of *Radio Andorra* is from 0100 to 0200 on Saturday mornings (according to my information, Roy, it is from 0000-0100 GMT). Roy also lists the shortwave outlet as being inactive.

Canada: CHNX has been logged by Roy on 6,130 around 0100 with a fair signal.

According to *Radio Canada* the plan to replace the 50kW transmitters with ones of 250kW has been dropped. (This is due to the Government's recent austerity economy measures.—MC.)

Luxembourg: The shortwave outlet of *Radio Luxembourg* on 6,090 will increase its power to 500kW early next year.

S. Arabia: Roy has heard an English newscast from this country at 1700 on 11,855 but has not been able to hear it since.

Africa

Biafra: *The Voice of Biafra* continues to broadcast on 6,144 from 0455 to 0200 whilst *Radio Biafra* uses 7,307 from 0430 to 2230. The two stations do not use parallel programming.

Asia

Cyprus: The Cyprus Broadcasting Corporation has resumed its shortwave transmissions. The station broadcasts at 1900-2105 Monday to Saturday on 15,260 and at 0900-1600 on Sundays on 17,875. The Corporation is very interested in receiving reports from listeners.

Korea: *Radio Pyongyang* has a new frequency of 9,613 for its English transmissions at 1900-2000 which are beamed to Europe, Africa, the Near and Middle East.

Europe

Andorra: The English Service of *Radio Andorra* on 701 and 5,995 is now scheduled for 0000-0100 on Saturday mornings but there is no sign as yet of the shortwave outlet.

Austria: *Radio Austria*'s DX programme is broadcast every second Sunday at 1915 on 6,135, 9,610, 11,925 and 15,210.

Belgium: The English programme "Belgium Speaking" is broadcast at 2205-2215 on 9,550, 9,660 and 11,715 and at 0050-0100 on 6,125, 9,660 and 11,715; 9,660 is a new frequency for this broadcast.

Germany: One of my German colleagues informs me that Europe's most powerful shortwave transmitter will be built at Mindelheim, West Germany. The transmitter will beam programmes to all parts of the world during the Olympic Games at Munich. Six hundred announcers will inform sports fans all over the world about the Games in twenty-eight languages.

Great Britain: The Sunday broadcast of the BBC's "World Radio Club" programme is now broadcast at 0815 instead of 0930.

Sweden: Due to interference problems *Radio Sweden* is altering the frequency of its broadcasts to Eastern North America from 9,710 to 5,990. This change concerns the English, Swedish and Spanish programmes broadcast between 0000 and 0230.

South America

Colombia: *Emisora Atlantico, Barranquilla* (HJAG) which is listed as inactive in the *World Radio-TV Handbook* is now operating on 4,905 until sign-off at 0500 with a power of 10kW.

Ecuador: HCJB, *The Voice of the Andes,* uses two new frequencies of 15,415 and 17,780 for its programmes from 1845 to 2030.

Nicaragua: *Radio Nacional de Nicaragua* can be heard in Europe after 0100 on the new frequency of 11,875.

73's and good DX until next time.

THE AMATEUR BANDS
David Gibson, G3JDG

A VERY good month for the DX hounds, but not too satisfying for those who only listened on 20 metres. This band, although, perhaps, the main DX band for many, has put on its winter overcoat of fading and is usually rather dead in the evenings.

The l.f. bands are beginning to come into their own and there has had been a noticeable improvement, especially on 40 and 80.

Topband has helped to inspire its followers by allowing a few American c.w. signals across the pond and this is very heartening for topband transatlantic enthusiasts. Listen early mornings down the l.f. end for these sigs.

Honours this month go to 10 metres which played host to a very large number of signals throughout the month. Twice when your scribe's ears flapped over the 28-29·7MHz segment, four of the continents could be heard during the same session. It's quite surprising how many a.m. signals are loose on this band as compared to, say, 14MHz where sideband mostly dominates. The majority of the 10 metre signals were romping through at S9 too, so don't forget to keep an eye on this band whenever you switch on.

Two sharp-eyed correspondents have drawn my attention to the G3RPE/P F2FO/P contact made on 10,000MHz. Alas, my "red spot" transistors don't function up that far, but congrats to both operators on a very fine achievement! Who knows, now that the amateurs have shown that it's possible, the professionals may decide to have a go.

Just to be different, let's take a look at the happenings for the month when all good Christmas puds are stirred. Four main events down in my diary are: 6th-7th December, 80 metre c.w. contests; 6-7th, CHC International c.w. contest; 7th, 4 metre c.w. contest; 13th-14th, CHC international s.s.b. contest.

Don't forget that on Christmas morning there will be a large number of "local" club nets on the go. Topband is a favourite for these and some are quite witty. Certainly they all provide good festive r.f. entertainment. G3JDG promises to erect a reasonable antenna for topband on that morning and rude remarks concerning signal strength and mod. from over 25 miles would be appreciated.

So, where's it all been happening? Well, **Charles Morgan** (Northumberland), had great success on topband. Between 0430 and 0630 he logged K1PBW (599), KV4FZ (579), VP9GJ (459), W1BB/1 (599), W2EQS (359), W2IU (499). Figures in brackets are standard RST reports and all signals were c.w. Frequencies to listen from band edge to 1,805kHz.

If you are still unconvinced that the l.f. end of the spectrum is worth a listen, how about the log from **R. Bagwell** (Surrey). He runs a Trio 9R59DE with a PR30 pre-selector, an RQ10 and a switched attenuator fed by an a.t.u. which in turn squints down a 70ft. long wire. Eighty metres revealed—CN8AW, HV3SJ, JW1CI, JW3KJ, VE1IE, PY7ASQ, PY7GV, TF5TP, VO1CW, VU1AX, 3V8NC, 3Z3BLG (new prefix for Poland) 5A2TR, all on s.s.b.

Philip Lawson (Derby), has an Ekco domestic receiver and sends in a long log bearing evidence of high Eu activity on 80 with the majority of stations at S8-9, so there's plenty of stations on the band.

John Moore (Leicester), hasn't done too well on topband mainly due to high noise level with similar remarks for 80, although he did log XE1KB at 0615 and says that W's are beginning to show on 75 metres around this time.

Higher up on good old 20 the stalwarts managed to pull in some good DX sigs even with the band closing in the evenings.

Trevor Rumble (Wilts.), has an HA700 plus PR3OX and a 100ft. long wire. Twenty s.s.b. between 0720 and 0755 produced some good openings to Australia and stations logged included—VK2ID, VK3MO, VK3RZ, VK3UJ, VK5AX, VK6FB, VK7PR and ZL4BX at 5 and 9 plus 10dB.

Fifteen metres was the band for **Stephen Randall** (London), whose 9R59DE and 110ft. long wire produced r.f. music from s.s.b. types like—CR6LVC, CT1BF, CX2SA, EA3RF, EP2CB, JA2JAW, JA9AGP, JH1ODO, KP4AST, KZ5IT, LA7XM, TZ5CJT, VE3OSC, VU1FA, VK2ZQ, VK7AZ, VP2ME, WA9NSR/P1, YV4UA, 4X4FQ, 4Z4HF, 5A2AAF.

Glyn Richards (Isle of Wight), is still the only 2-metre fan who writes in. What about it, all you v.h.f. types? Glyn runs a JXK converter into a Mohican receiver used as an i.f. strip. Although his antenna is only 6ft. of wire, still the signals come in on 2. Examples include—G3CLW (Paignton) and G3MCS (Aylesbury), F5NS (near Normandy) and G3GZJ (Redruth), the latter station being some 120 miles away.

On to the top of the pops for this month, the one and only—10 metres. **John Moore** (see earlier) logged these on s.s.b.—CR6AG, CR6GM, CR6LF, CR7LX, DU1FH, ET3USA, HK4DF, K8YBU, KØSFU, KP4DGX, LU3DD, LU4BH, MP4BHC, MP4BHR, OD5BA, OD5BZ, PY2DVH, UA9TT, VE2DHF/P/YV1, VE3CI/W4, VE3ABS, VP5AA (Caicos Is.), VP8KD, VP8KL. VQ8CV (Mauritius), VS6DR, VU2DK, VU2XX, VU2BEO, W2CRW, W4IQS, WA5SDT, WA8SWV, WØIMC, XW8AL, YV4UA, YV5CIL, ZC4AK, ZE1BP, ZE1JE, ZE3JJ, ZE6JN, ZS2GP, ZS4AA, 4X4UF, 4X4YP, 5H3KJ, 5H3LV, 5N2AAF, 8P6CX, 9J2DT, 9J2VX.

Nicholas Richardson (Bucks), has a CR7OA and PR30. Together with a 40ft. long wire at 18ft. they produced—CT1OF, K8ASM, KV4AD, OD5RZ, PY1MT, PY3GS, UA3NUE, VE2AIH, VE3WY, YV5BX, ZE1CE, 5B4EZ all on s.s.b.

On a.m., Nicholas managed—CE2JA, CR7FM, LU5XE, SV1CX, UA3AFA, UA6OJ, UA6ARA, UB5FAQ, WB4KJF, ZE1BR, 9H1BG which is pretty good going.

Ian Wadman (Berks) reckons that the JGD ear-holes should be alert on 10 metres on Sunday afternoons. Ian sends news of great activity around this part of the day. Ian logged CR7EZ, K4BG, OD5BZ, UW4II, ZE1JE, 4X4GB, 5N2AAF. All these with a CR70A and 70ft. long wire.

That's it for this year! Vy Mx OM's es bcnu in 1970. Address for logs is 5 Edward Close, St. Albans, Herts, and the deadline is that they must reach me by the 18th of the month.

I.C. OF THE MONTH

L.A.J. IRELAND

Number 3 — The PA424 and PA436, power control circuits

ANY definition of electronics today would have to include among its applications not only computation and communications, but also control circuits. More and more mechanical and even electromechanical control systems are being replaced by all-electronic methods, and this month we shall see the initial contribution of integrated circuits to this process. The key device in the development of electronic control circuits is, of course, the silicon controlled rectifier (S.C.R.) in which the device operates as a diode only when a pulse is applied to a gate electrode. Following this event, the device conducts only as long as the voltage applied to it retains its proper polarity. In a.c. circuits, therefore, a separate pulse is required to initiate conduction in each cycle.

For full wave operation, two S.C.R.s are required, though these may take the form of a single bidirectional silicon controlled switch or TRIAC. To maintain conduction in a TRIAC 100 pulses per second are required, one to initiate conduction in each positive and negative-going half-cycle of the waveform. If these pulses are applied simultaneously with the beginning of each half-cycle of an a.c. waveform, the device behaves as a short-circuit, and current flows in exactly the same way as if the device were absent from the circuit.

If, however, the pulse is delayed relative to the start of the half-cycle, no current will flow in the interval, and the total power delivered to the load will be reduced by an amount dependent on the extent of the delay. Obviously, then, if a control system delays or eliminates pulses from the gate circuit of an S.C.R. or TRIAC, the output power is dependent on the control system. And this is where our I.C.s come in.

Many situations requiring power control can be sensed or measured electronically, for example temperature by a thermistor, illumination by a photoconductor, or even pressure by a strain gauge. Control is then exercised by relating transducer output to timing pulses in a TRIAC gate, limiting the power supplied to a heater, lamp, or pump. Two suitable I.C.s for the job are the General Electric types PA424 and PA436.

First the PA424. This unit is described as a zero voltage switch, and acts as a combined threshold detector and pulse generator. The signal from the transducer is compared with a preset internal voltage using the differential amplifier Tr1 and Tr2. If the threshold is not exceeded, pulses are generated and applied to the TRIAC; otherwise pulses are inhibited and the TRIAC will not conduct. This circuit, then, acts as a go/no go control; to some extent this is a limitation, in that the circuit controlled is either fully on or shut off.

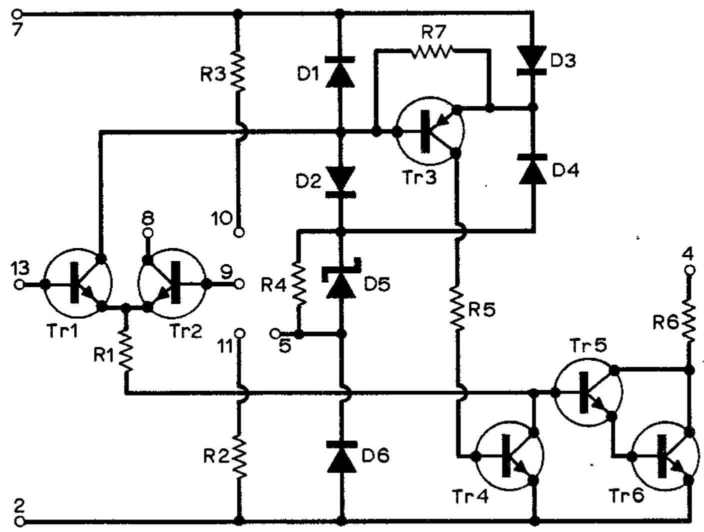


Fig. 1: Circuit of the PA424 'zero voltage switch'. The device is supplied in a 14-lead dual in-line plastic package.

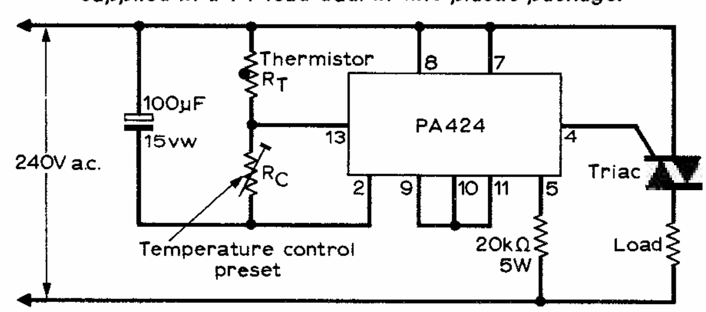


Fig. 2: Application circuit for the PA424. R_T is the thermistor and R_C the temperature control preset.

In practice this is only a slight problem, since in heating systems, for example, the sensitivity of a thermistor/PA424 combination is such that the temperature is held to within a fraction of a degree of the chosen value by the automatic succession of periods off and at full power. Further, as all the pulses occur at the instant of crossover between positive and negative-going half-cycle of the waveform. (hence the name "zero voltage switch") there is no question of repetitive switching of appreciable currents, a factor which can produce r.f. interference in some power control circuits.

One obvious advantage of the PA424 is that it serves as its own d.c. power supply; the application

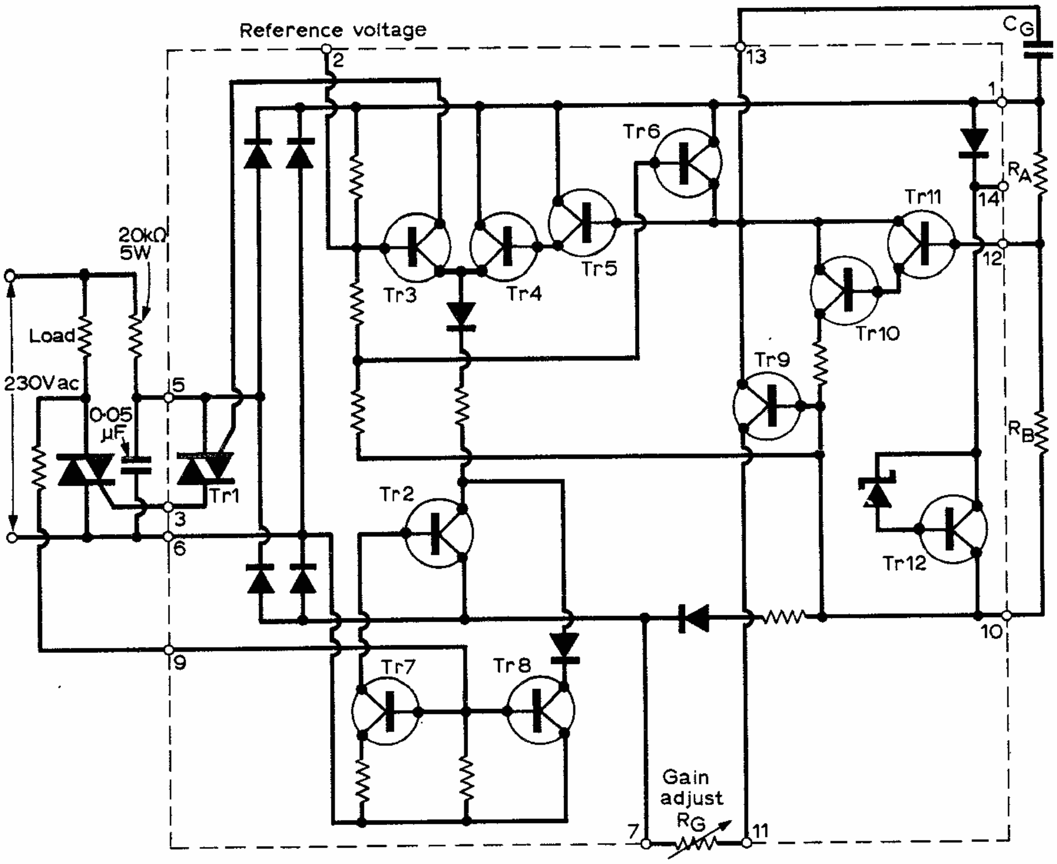


Fig. 3: Application circuit for the PA436, phase control trigger circuit.

diagram shows it in operation directly off the power line without a separate transformer. This is an obvious contribution to economy. In a negative-going half-cycle D1 conducts, charging C1, which supplies d.c. for the remainder of the cycle. As pin 5 approaches zero volts, the output Darlington pair, Tr5 and Tr6 begin to conduct, thereby applying a pulse to the TRIAC gate, unless Trl happens to be conducting. In this case, Tr3 is also conducting, and Tr4 saturates, shunting the base input to Tr5 and inhibiting the pulse. The internal resistors R2 and R3 are available as one arm of a bridge circuit, the other being the thermistor (in heating applications) and a preset potentiometer. The ingenuity of the reader will indicate analogous transducer circuits for the control of other systems, such as those already mentioned.

The other device for our consideration this month is an actual phase controlling trigger circuit. It actually delays the triggering pulses required by the TRIAC to the extent determined by the transducers employed, and in some cases this feature is well worth the slightly higher price. Again, the power for the operation of the circuit comes directly from the mains, and a minimum of external components leads to further convenience and economy. The d.c. from the internal bridge rectifier is regulated by a zener diode and a reference voltage produced at pin 2. As in the PA424 there is a differential amplifier (here Tr3 and Tr4) to compare reference and transducer levels and hence control the pulse output.

One of these is modulated with a time-dependent voltage built-up across the external timing capacitor, and hence the variable delay in pulse generation. The rate of variation of this time-dependent modulation depends on Rg, which therefore acts as a sensitivity control for the system. The actual output pulse is obtained by discharge of the external capacitor C1 through a low current, low voltage TRIAC, Tr1, integrated into the PA436.

Choice of which I.C. to use in any particular situation requires some consideration. In heating circuits, for example, it will not be immediately obvious whether the element is conducting at any instant, provided overall thermal regulation is satisfactory. With lighting, we are all aware that the action of the a.c. mains in incandescent lamps provides quite a satisfactory light, and there is no objectionable flickering; however, this can occur under certain conditions with a PA424 controlled lamp, as the I.C. causes "off" periods much longer than the normal a.c. cycle. Similar considerations lead to the selection of the PA436 true proportional controller in a few other specialised situations, but in general the PA424 is advised, for its greater simplicity and economy, not to mention its "cleaner" r.f.i.-free operation. At any rate, control systems will become much more elegant with the elimination of slow bulky relays, with the associated difficulties of burnt contacts and general unreliability.

APPLICATION DATA, TYPE PA436

	Minimum	*Maximum*
External gain controls R_G	7·5kΩ	100kΩ
C_G	0·01μF	0·1μF
$R_A + R_B$	10kΩ	200kΩ

R_A and R_B: external control resistors (one may be a transducer, e.g. thermistor, photocell, resistive vacuum gauge etc.).
For temperature control systems R_A is a thermistor of resistance about 5kΩ at the controlled temperature: R_B is a preset of 20kΩ.
The integrated circuits PA424 and PA436 are available from:
Jermyn Industries, Vestry Estate, Sevenoaks, Kent; or Neltronic Ltd., 14 Wellington Park, Belfast BT9 6DJ.

N.B. Just before going to press we have learnt from the suppliers of the PA436 that problems in manufacture have led to a temporary withdrawal of stocks. Newer versions using the same type number will be available in a few months but these are only capable of handling 150mA instead of 2A. Constructors should take careful note of the instructions supplied with this device which may modify certain parts of the above article. ■

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.

beginner's PORTABLE RECEIVER

C. R. BRADLEY

ALMOST all radio constructors have memories of unsuccessful first attempts. Beginners are faced with a wide selection of designs and often make the mistake of choosing one that is too advanced for their nascent capabilities, or alternatively, one whose extreme simplicity leads to a disappointing performance. This portable radio design is intended for the beginner and aims to fulfil the following requirements:

1. *The circuit must be straightforward and trouble free.* The radio is a six transistor superhet on conventional lines.

2. *Performance must be good enough to repay the builder's efforts.* In fact, performance of the radio is comparable with commercial portables. Alloy diffused transistors provide high gain in the mixer and i.f. stages, and the audio quality from the transformerless complementary output stage is especially good. No external aerial or earth is required.

3. *All components must be immediately obtainable* so that there will be no necessity to choose substitutes. To this end a matched kit of miniature coils and tuning capacitor is specified in the parts list. A packaged set of matched semiconductors is used for the audio stage. The remaining components are easily found, everything is available from advertisers in PRACTICAL WIRELESS.

4. *Construction must be simple.* The circuit is wired on a small piece of Veroboard using a suitable miniature soldering iron. There is a good prospect of the radio working "first try" provided normal precautions are taken in construction, i.e., insulated sleeving used where required to avoid shorts between closely mounted components, and correct identification of transistor, diode and electrolytic capacitor leads.

The Circuit

The circuit is shown in Fig. 1. The ferrite bar aerial L1 is tuned to the desired station by VC1 and

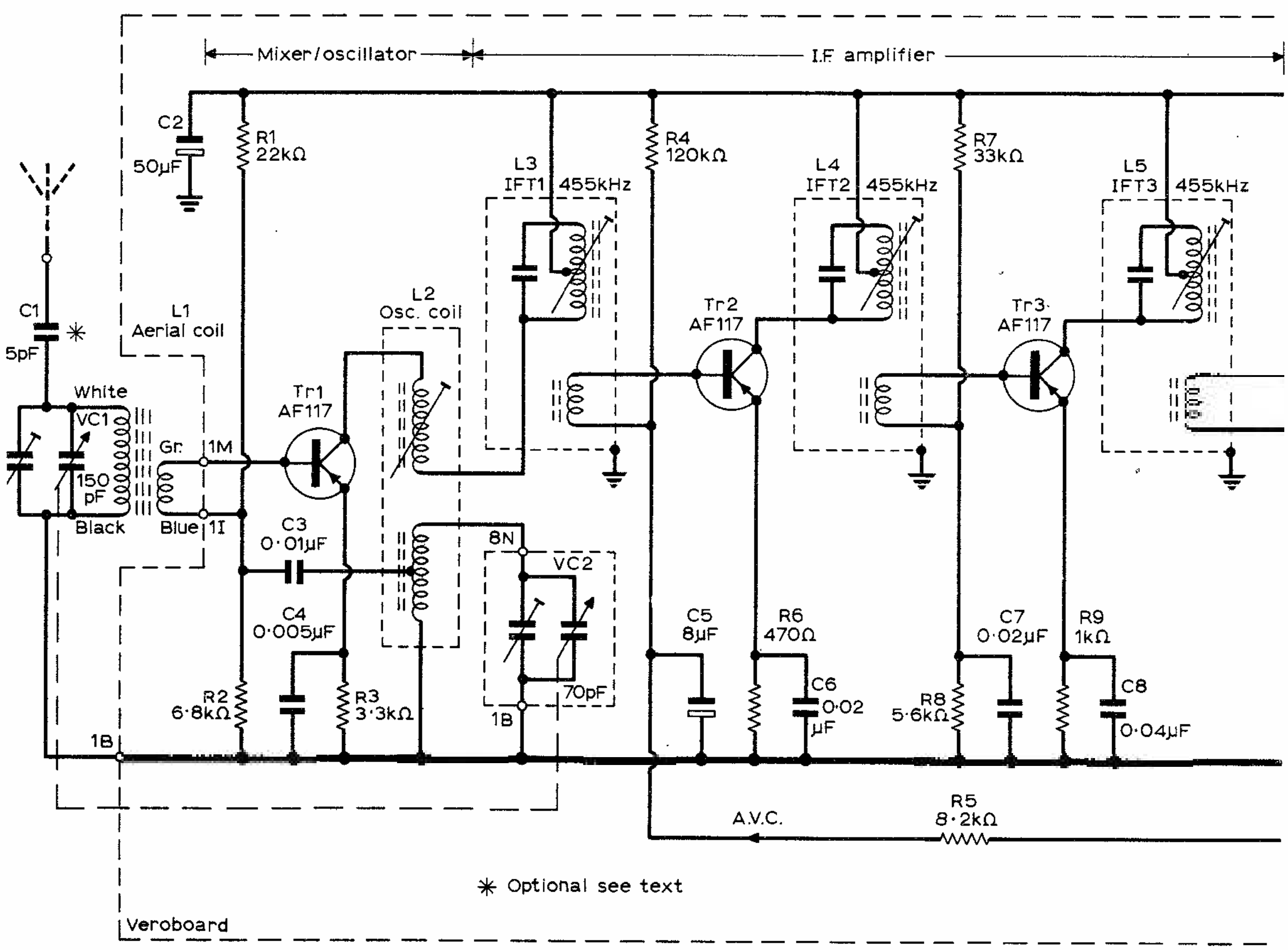


Fig. 1: The mixer/oscillator and i.f. stages, followed by the detector and audio stages. Note that the value of C6 should

★ components list

Resistors:

R1	22kΩ	R10	2·2kΩ
R2	6·8kΩ	R11	1·2kΩ
R3	3·3kΩ	R12	100Ω
R4	120kΩ	R13	560Ω
R5	8·2kΩ	R14	2·2Ω 5% ¼W
R6	470Ω	R15	2·2Ω 5% ¼W
R7	33kΩ	R16	1kΩ
R8	5·6kΩ	R17	2·2kΩ
R9	1kΩ	R18	220Ω

VR1 5kΩ volume control with switch
VR2 10kΩ miniature skeleton potentiometer
All resistors ¼W 10% unless indicated

Capacitors:

C1 5pF ceramic (optional)
C2 50μF 10V electrolytic
C3 0·01μF (10,000pF) ceramic
C4 0·005μF (5,000pF) ceramic
C5 8μF 6V electrolytic
C6 0·05μF (50,000pF) ceramic or paper
C7 0·02μF (20,000pF) ceramic
C8 0·04μF (40,000pF) ceramic or paper
C9 0·01μF (10,000pF) ceramic
C10 50μF 6V electrolytic
C11 100μF 6V electrolytic
C12 25μF 6V electrolytic
C13 500μF 6V electrolytic
C14 200μF 10V electrolytic

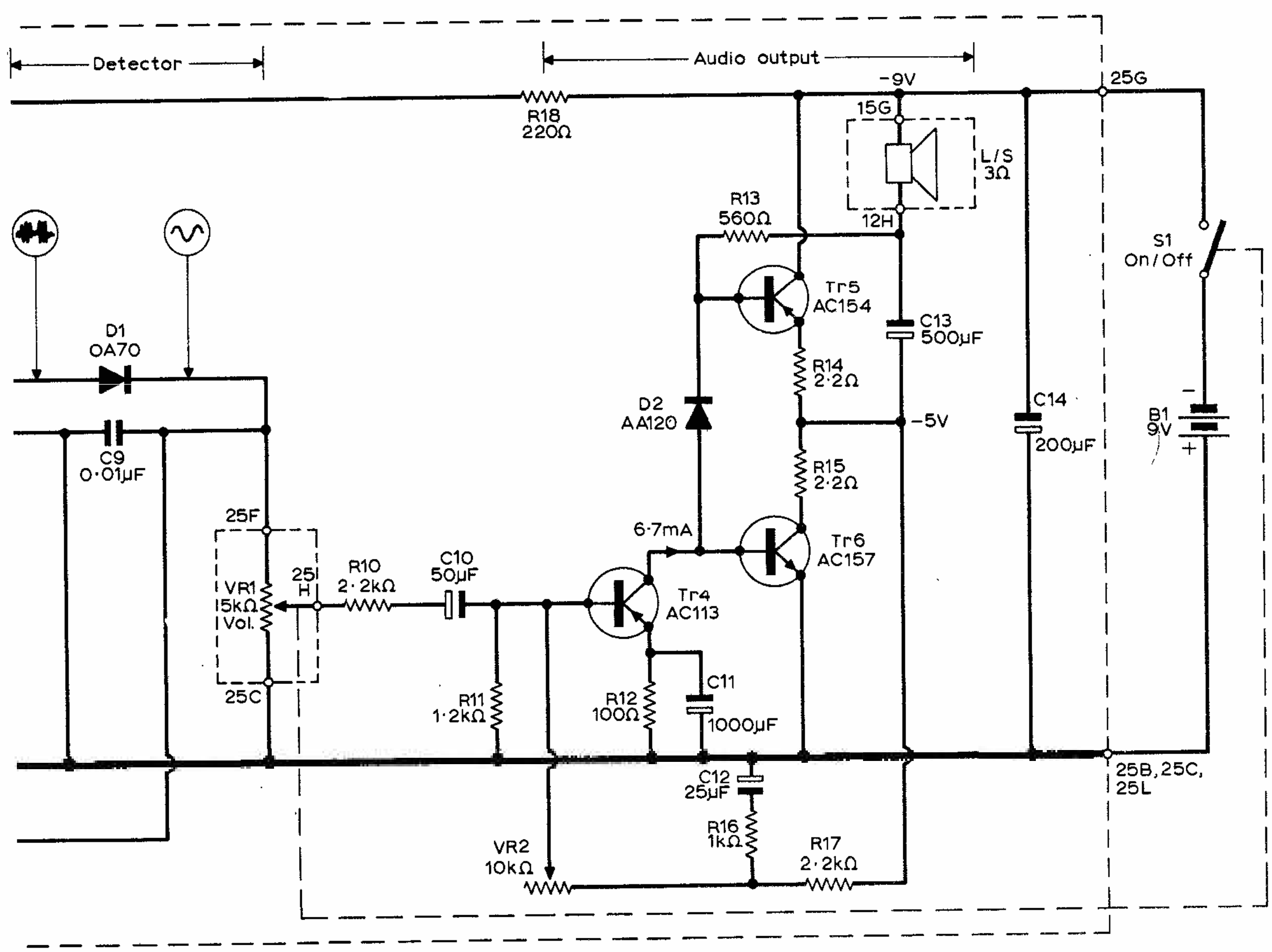
Semiconductors:

Tr1–Tr3 AF117
Tr4 AC113 } Thorn LP15 package
Tr5 AC154
Tr6 AC157
D2 AA120
D1 Germanium detector diode, e.g.: OA70, OA79, OA81, OA90, OA91, IN60 etc.

Miscellaneous:

S1 Single pole on/off switch (on VR1) } Eagle H.402 coil kit
VC1/VC2 Miniature 150/70pF ganged tuning capacitor with trimmers and dial
L1 MW ferrite aerial coil
L2 Oscillator coil "O"
L3 I.F.T.1 "A"
L4 I.F.T.2 "B"
L5 I.F.T.3 "C"

L/S 3Ω 7 x 4in. loudspeaker; B1 PP7 or PP9 9V battery; Veroboard 3¾ x 2½in. 0·15in. matrix; knob for volume control; cabinet; battery clips; loudspeaker grille cloth; wire; solder, etc.



have been shown as 0·05μF and C11 as 100μF. The Veroboard circuitry is indicated by the dotted enclosure.

the radio frequency signals induced in it are fed to the base of Tr1. Base bias current for Tr1 is provided by R1 and R2. C3 couples Tr1 base to a tapping on the oscillator coil L2, and Tr1 therefore oscillates at a frequency tuned by VC2. The radio frequency is mixed with the oscillation frequency in Tr1 to produce a difference frequency known as the intermediate frequency. VC1 and VC2 are ganged together to maintain a constant i.f. (about 455kHz) as VC1 is tuned over the whole tuning range (medium waveband). The importance of this is that subsequent stages can be tuned by their coupling transformers for maximum gain at one frequency only. Tr2 and Tr3 amplify the i.f. signal and are coupled by single tuned i.f. transformers i.f.t.1, i.f.t.2 and i.f.t.3. The AF117 transistor used for Tr1, Tr2 and Tr3 is an alloy diffused type with a low feedback capacitance (2-3pF). We can therefore dispense with the neutralisation components normally needed to maintain stability with the OC44/OC45 junction type transistors which have a higher internal capacitance, and have a higher i.f. gain.

The amplified i.f. signal appears at i.f.t.3 secondary. It is rectified and smoothed by D1 and C9 to isolate (detect) the audio envelope—see waveforms in Fig. 1. A portion of the audio signal is picked off by R5 and fully smoothed by C5 to provide automatic volume control to Tr2 base. If a strong signal is tuned in, the resulting positive a.v.c. voltage returned to Tr2 base reduces the transistor's gain and overloading of subsequent stages is avoided. The a.v.c. compensates to some extent for fading signals and the signal variation caused by moving the radio from place to place. When a weak station is received, there is no a.v.c. feedback and all stages work at full gain.

The audio signal is applied across volume control VR1 whose slider feeds audio driver transistor Tr4. The amplified signal at Tr4 is direct coupled to the base of complementary symmetry output pair Tr5/Tr6. The voltage drop across D2 is fairly independent of battery voltage and maintains the small no-signal bias current to Tr5/Tr6 needed for minimum distortion. Tr6 (n-p-n) and Tr5 (p-n-p) are turned on by positive and negative voltage swings respectively. The transistors drive the loudspeaker in push-pull; each supplies current alternately through C13. This arrangement provides a very low output impedance which permits the circuit to drive the speaker directly without an output transformer. D.C. feedback for stability and a.c. feedback for improved audio quality are provided by R17 and VR2. VR2 is preset to give a no-signal voltage of −5V at the junction of R14 and R15.

The audio output power is about ½ watt. With a 7 × 4in. or larger loudspeaker, volume and clarity are more than ample. The radio is best built in a non-miniature cabinet for best audio quality. But the circuit board is small enough to be incorporated in a pocket size radio in which case a 2in. loudspeaker could be used.

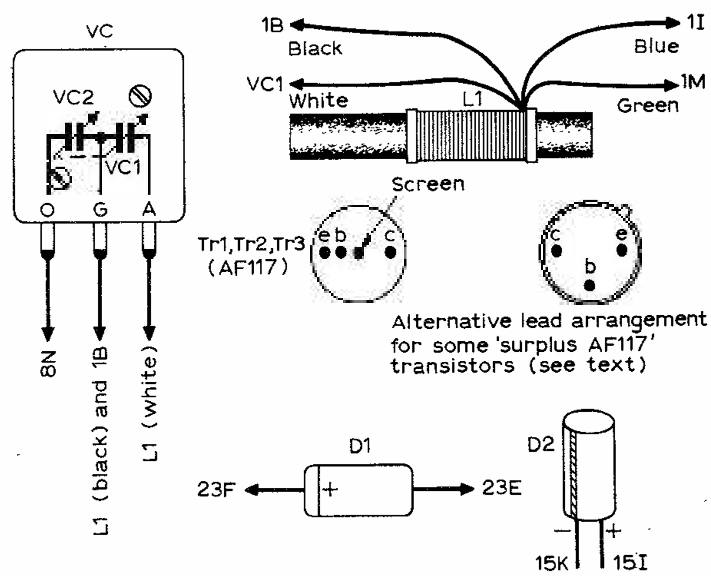


Fig. 3: Lead identification of various components.

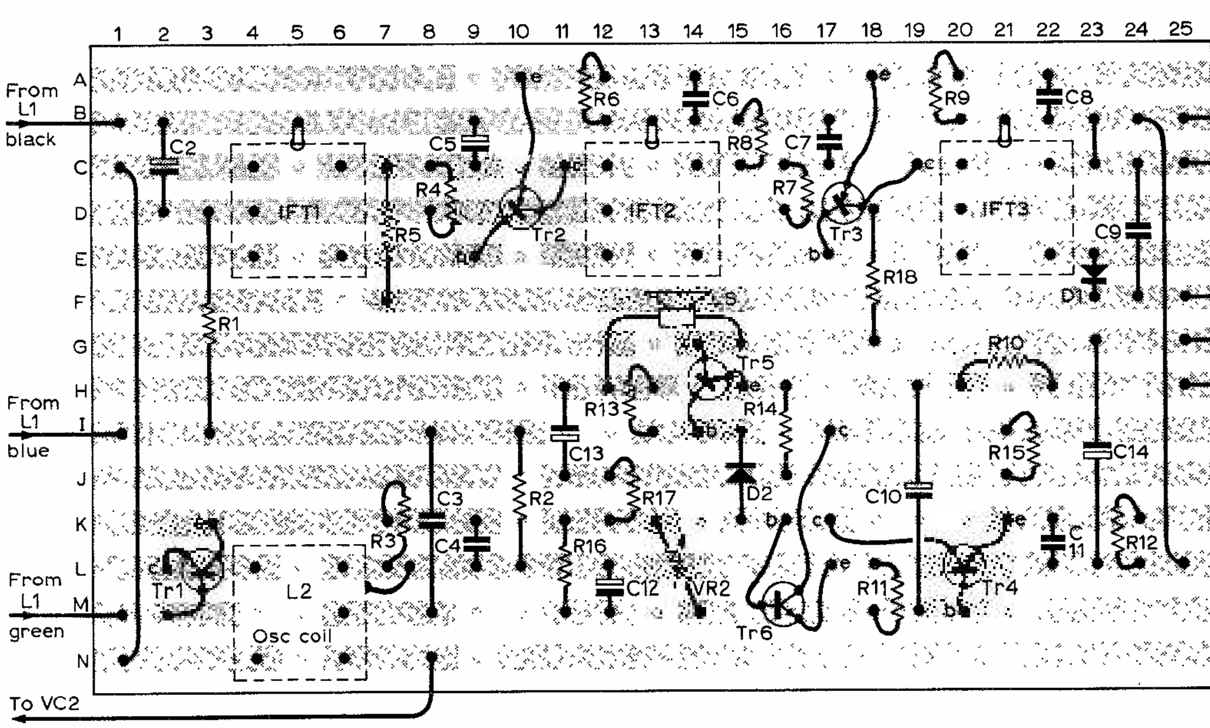


Fig. 2: Veroboard layout viewed from the copper side.

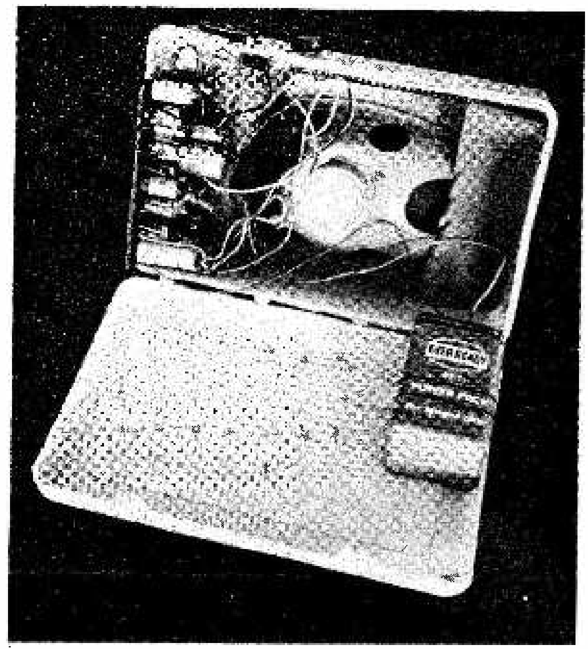
Construction

The components are wired on a standard piece of Veroboard and the layout is given in Fig. 2. The numbers and letters provide a cross-reference for each hole. The top and bottom copper strips (unlettered) are left unused for possible use in mounting the Veroboard in the cabinet.

First cut the Veroboard strips as shown, preferably with the Vero cutting tool. There are 36 breaks in all. It is advisable to mark (say) the top left-hand corner of the board before starting for identification. Wiring is easier if the positions of the components are sketched on the top of the board with a fibre-tip pen. Identify the three i.f.t.s ("A", "B", "C") and oscillator coil L2 ("O") in the coil kit. Bend up the screening can lugs. With slight persuasion the coil pins will make a neat fit in the Veroboard holes in the positions shown in Fig. 2. Solder them in place. It may be noticed that the left-hand pair of pins on the oscillator coil L2 in Fig. 2 are connected oppositely to the manufacturer's data with the coil kit. The author has decided the data is incorrect as the stage will only oscillate with this way of connection, with the coils sampled at least. However, if the mixer subsequently refuses to oscillate, it is easy to try swapping the connections at 2L and 1N to agree with the manufacturer's data. Short pieces of wire are used to earth the screening cans of L2, i.f.t.1, i.f.t.2 and i.f.t.3 to holes 8L, 5B, 13B and 21B respectively. Resistors and capacitors are next mounted with the shortest possible lead lengths, mostly upright. Put a piece of plastic sleeving on the lead from the top of each component wherever there is any danger of it touching any adjacent metal. This is particularly likely if bare metal-cased electrolytic capacitors are used. Electrolytic capacitors must be wired the right way round, i.e., positive lead to earth (except C10 and C13). Finally, solder the diodes and transistors to the board, making sure the leads are identified correctly from Fig. 3. Note that the lead identification of D2 can be misleading. Some surplus transistors marked AF117 were tried by the author and worked satisfactorily; however the lead arrangement was non-standard for AF117 (see Fig. 3) and they had no screen lead. The screen lead of the AF117 has little use at the frequencies used here and can be cut short or connected to the nearest earth point as preferred. Leave about ½ inch of sleeved lead on all transistors and diodes and solder as quickly as possible to avoid heat damage.

The cabinet for the author's prototype was a Woolworth's plastic lunch box. The top of the box carries the tuning capacitor, volume control VR1 and the ferrite aerial is taped underneath. The calibrated knob supplied with VC is rather small and a larger disc of plastic glued to it would make tuning easier. The 7 × 4in. loudspeaker is mounted in the side of the box and the aperture is covered with Tygan speaker fret. The largest 9 volt battery the cabinet

—continued on page 706



Internal view of the completed receiver.

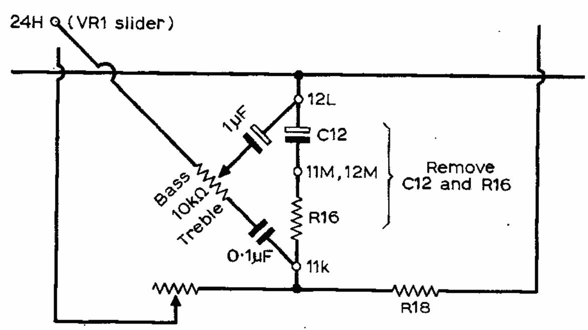


Fig. 5: Adding a bass/treble tone control.

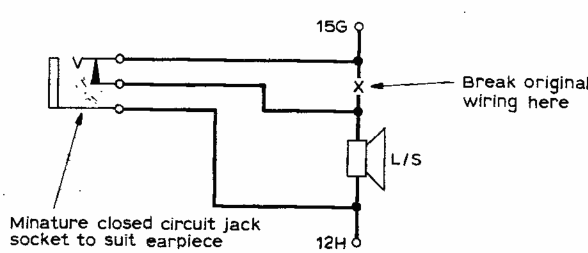


Fig. 4: Adding a socket for a low impedance magnetic earpiece.

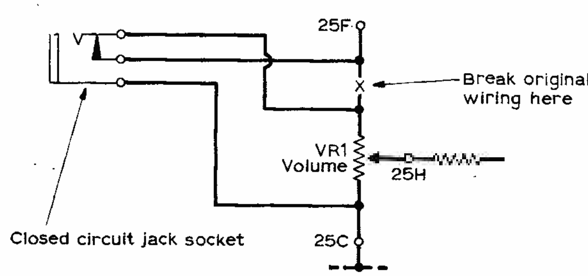


Fig. 6: Adding a socket for microphone, guitar, record player etc.

practically wireless commentary by HENRY

No. 64

Spin-off

SIX hundred million people, we are told, watched Neil Armstrong plant his foot in the moondust on 20th July, 1969—the day that President Nixon, begging a few questions, described as '. . . the greatest since Creation'.

You have had time to simmer down since then; to consider the equally stupendous achievement of discovering that Mars has no little green men paddling along its canals. And perhaps join a disgruntled chorus who were muttering, even as the Eagle took flight, that the 24,000,000,000 dollars might have been better spent on child welfare, cures for cancer or ear-muffs for under-privileged ocelots.

"... ear-muffs for under-privileged ocelots."

In answer to these mutterings the science-bent will usually say something about the spin-off. Non-stick aluminium frying pans often find their way into the conversation.

"And it took 300,000 technicians eight years to produce a non-stick pan?" someone is bound to ask.

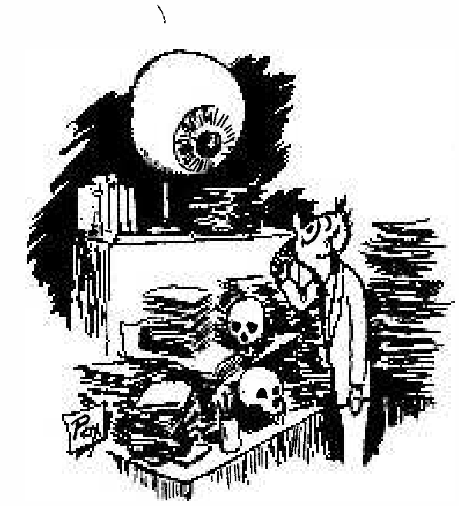
Well, there is more to it than that. Many of the technical innovations creeping into our lives had their origins in space research.

You need look no farther than the flip-chips that are occupying our editorial wizards at present. How do you think contributors could continue to dream up ten different ways of constructing an electronic shoehorn * † without integrated circuits to save them from repetitions? Only recently I sat in a high-level quorum who wanted to know how the advent of IC designs would affect serviceability. And had to admit that my own opinion was for a shift in emphasis, no more. I cannot see the spin-off as a threat—yet.

There is, however, a much more human type of spin-off problem. Inspiration was drawn from a very readable book, *Don't Launch him, he's mine!* by Mary Jane Chambers, who is the wife (or space-widow) of one of the boffins behind the Apollo project.

Randall Chambers is an experimental psychologist whose work on the centrifuge which gave the astronauts their moon-legs has earned him world scientific recognition. Mary Jane describes life with him very amusingly and touches Henry on several risible trigger-points.

First, his "study", which seems as typical as the den of any wireless ham I've met. Looking like "a library recently wrecked by an explosion", it houses "piles of graphs, notes, charts of atmospheric measures and weights and measures and maps of many places, including outer space. There are railway timetables, old telephone books, a sterilizer with an assortment of old surgical instruments . . . an assortment of synthetic hearts, brains, ears, skulls. Overlooking all, a huge model of the human eye, staring balefully at the casual visitors".



"... Staring balefully at the casual visitors."

More than ever am I reminded of life with the Henrys by Mrs. Chambers' account of the day the children knocked the extractor fan out of the window. There were present: an aeronautical engineer, a project engineer, a mechanical engineer and a human factors engineer. "Prodded by several doctors and psychologists, the engineers hesitantly studied the fan, but they made no promises. Each one kept saying: 'I'm not that kind of engineer' ".

They finally mended it with the help of a flight-surgeon and a research psychologist. That gives you and me, Joe, a fine excuse for the day the 'fridge breaks down or the washing machine develops a "kerplunk". We are chips specialists, not *that* kind of engineer.

If only Mrs. Henry, confronted with a scattered square-wave generator on the draining-board—because that is just the right height and the soldering iron lead will reach, and there is a half-drawn "project" on the only flat surface of the den—would realise, as Mary Jane has done, that a male brain runs anti-clockwise . . .

I hope Mrs. Chambers gets her book serialised in the women's magazines. That would be the best possible spin-off from the space-race. Henry wants to construct a few of these chip-flavoured projects, and the ironing-board seems ideal for the purpose. We boffins need encouragement.

* *Bootstrapped, of course.*
† *Ouch!! Ed.*

LETTERS...

The Editor does not necessarily endorse the views expressed by correspondents

Martians Again !

Whilst not having heard that Marconi claimed to have received signals from Mars as A. Trowbridge of Middlesex says, I was told many years ago that some person who believed in the existence of men on Mars paid the GPO a sum of money to transmit a certain regular pattern of Morse code signals each day either from Daventry or Rugby, on long waves.

I was told that this went on for quite a time but with no response from the Red Planet.

I would imagine that we shall not hear anything from other planets until we are able to probe frequencies such as those involved in thought-transference and in which extra-sensory perception is only on the extreme outer fringe.

When the thought-transference frequencies are discovered, all will be plain sailing.

In answer to the letter from Mr. Richard Ross of Worcester, I think perhaps he is using a plumber's soldering iron and no heatsink!—**R. Hall** *(Penzance, Cornwall).*

The Early Days

I would like to comment on two of the letters in the November issue.

As another "oldie" I also remember the early days of wireless. Around 1917 I made an 8in. dia. coil, tapped every turn to a stud switch for tuning, and a coherer as detector, with which I could hear Morse from ships. As I could not read Morse a recorder was made to mark it on paper tape.

The gift of a box camera, loaded in the dark with 12 glass plates, took my interest for some years, but when broadcasting started interest in wireless was revived, and a crystal set was made using the large coil.

The purchase of a valve was a big step, there was not much money to spare in those days. Two tins sliding inside each other made an experimental condenser. A real 0·005μF tuning condenser was the next purchase, and with a few more home-made items mounted on a base-board, and a 3ft. long wooden rod fitted to the condenser shaft, it was a thrill to hear Sydney, Australia, for the first time.

A fortunate find at a surplus shop in Strutton Ground was a number of fixed condensers made of copper foil and mica sheets clamped between ebonite plates. These could easily be altered to give other capacities. I still have some of the mica.

Then with the arrival in shops of more components, remember Igranic and Telsen etc? a multi-valve receiver was built with elaborate dials and panel of ebonite on an oak case. The loudspeaker was a 6ft. papier-maché exponential horn which was pretty good. Next, to save the space this took up, I made a stretched doped linen cone 2ft. square which hung up like a picture. It was some time before an 8in. permanent-magnet speaker could be bought and mounted in a 3ft. square board as a "fire-screen". That gave beautiful music.

The h.t. battery was made from a lot of little glass pots, copper, zinc and chemicals obtained from a chemist in Charing Cross Road. I was just married then and my wife and I sat for hours packing manganese dioxide in linen bags. The finished battery giving 120 volts was packed in a wooden crate. L.T. was from an accumulator, one in the set and one at the shop being charged. The local electricity station also charged them for you.

Licences at that time were in my father's name as the householder, but I still have one for 1927. On the back are regulations such as "the combined height and length of the aerial shall not exceed 100 feet", "interference is taking place if a . . . whistle is heard, if this . . . changes when the wavelength of the receiver is altered the cause is inside the receiver and the reaction must be reduced".

At an early Radio Exhibition I bought "Commander Someone's" aerial device for which marvellous results were claimed. It made no difference in my case so I opened it to find no wonderful new invention, only a coil of wire and a small condenser in a card tube filled with pitch.

A trick to mystify friends was to wind a certain number of turns of wire around the hand, twist one end to a needle resting on a piece of coal and with headphones hear 2LO. For this you still required a licence!

I have some sub-min diodes in a small tin labelled the "Mighty Atom Crystal", one of the first I bought and mounted in Wood's metal in a brass cup.

No doubt youngsters nowadays get some satisfaction when they put supplied components into holes in a printed-circuit board and it works, but I bet it is not the kind of thrill we got in those early days, and now with cheap i.c's. even less is left to the constructor.

The second item I would refer to is the Hertz, a term which I refuse to use, and no one can make me! The good old "cycle per second" is clear and self-sufficient, whether for electrical or mechanical purposes. Imagine, my watch ticks 5Hz. And Hz itself could mean Henry × Impedance.

As to the new mains-lead colours, can anyone explain the reasoning behind the decision to use brown for live. Is it not natural to us to connect the colour red with danger, green with safety and black or grey with neutral? Brown has usually been used for things like valve heater supplies. Anything red made one think before touching. Do "they" contemplate changing all the traffic warning signs to brown? Shall we soon hear it referred to as the "Brown Button"?

I could not agree more with Mr. Harold's last paragraph. Trouble is, except in things like using Hz, we do have to acquiesce. Of course, behind the decimal currency there is a well-laid scheme to put prices up and get even more of our money out of us, as well as using our money to effect the change. I feel that in major decisions such as this, and any others which profoundly affect our way of life, there should be a nation-wide referendum. After all, in most of the things being altered, we WERE first. — **E. W. Baigent** *(High Wycombe, Bucks.).*

CODAR CR.70A

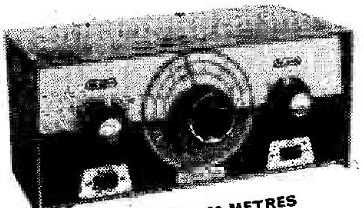
Communications Receiver 540-10 metres

20 gns.

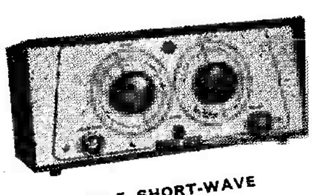
Carriage 7/6 extra

***Ideal for SWLs *5 valves (inc. two twin triodes) giving 7 valve line-up *Excellent on amateur and shipping frequencies *Calibrated signal strength meter (illuminated) *Automatic volume control *Separate B.F. oscillator for morse and S.S.B. signals *Two speed vernier tuning *Separate output for recording etc.**

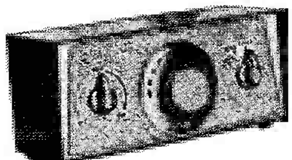
The Codar CR.70A is an excellent general coverage communications receiver for the keen short wave listener. Very reasonably priced at just £21 the CR.70A is outstanding value for money. In four stable ranges, the receiver covers from 540 metres medium wave, right through the shipping and coastguard frequencies all the short wave and international amateur bands up to and including 10 metres, where the rapidly improving conditions that now prevail allow the regular reception of world-wide call-signs! The CR.70A has a high 'Q' aerial input stage using exclusive CODAR COIL air space inductor. Double tuned, iron cored I.F. transformers produce high selectivity. Ready to plug into 200-250 volt AC mains, the CR.70A needs only your aerial and a 2-3 ohm loudspeaker. The cabinet measures only 13" x 5¾" x 7¾" and the control panel is finished in black and white with chrome trim knobs. Fully guaranteed for 12 months! New model has separate direct output socket for feeding tape recorder, Hi-Fi equipment, etc.



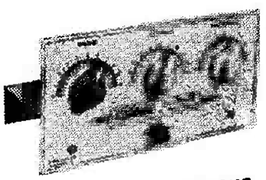
T28 RECEIVER FOR 160 & 80 METRES AMATEUR BANDS
9 transistors, bandspread 1.8-2Mc/s and 3.5-4Mc/s 12 volts, only 8" x 4" x 3½", Ideal portable, mobile or home receiver. Efficient BFO, printed circuits. ONLY £15.17.6. Carr. 4/6.



CR45 MAINS T.R.F. SHORT-WAVE RECEIVER
World wide reception. *Separate electrical bandspread. *3 slow motion drives. *Output 3 watts for 2/3 ohm speaker. *Valves ECC81, EL84, EZ80. Size 12" x 5½" x 7". CODAR-KIT CR.45K with 3 coils (10-28, 25-75, 60-176 metres). £9.15.0. Carr. 6/-, or ready built CR.45 £11.19.6. Carr. 6/-. Extra coils 5/4 each.



R.F. PRE-SELECTOR MODEL P.R.30
1.5-30Mc/s
Provides up to 20dB gain plus substantial image rejection, improved signal/noise ratio and selectivity. Power requirements 180-250 volts 12mA H.T. 6.3 volts, .3 amp L.T. Size 8½" x 5" x 4". Ready built complete with cables, plugs and instructions. £5.19.6. Carr. 4/6. Self-powered P.R.30x £7.19.6. Carr. 4/6.



MINI-CLIPPER—OUR FAMOUS SHORT-WAVE RECEIVER
*Can be built in one evening. *Complete with valve, one coil 25-75 metres and 4 page instruction manual. Price £2.4.6. Carr. 3/-. Extra coils 5/4.

CRC CODAR RADIO COMPANY
UNIT 1, MEADOW ROAD, INDUSTRIAL ESTATE, EAST WORTHING, SUSSEX. WORTHING 37315
World-wide Mail Order Service

Please supply
(tick as required)

☐ I enclose cheque/M.O./P.O. value of £

☐ 8d stamp enclosed for leaflets

NAME

ADDRESS

POST ORDER FORM TODAY

There's Something for Everyone in the NEW HEATHKIT CATALOGUE!

- GUITAR PRACTICE AMPLIFIER
- ELECTRONIC METRONOME
- AMBASSADOR SPEAKERS
- AUTO-TUNE-UP METER
- AIRCRAFT MONITOR RECEIVER
- CAR RADIO
- TECHNICIANS LOW-COST 'VVM'
- SEVERN AM/FM RADIO
- FABULOUS STEREO HI-FI COMPACTS
- STEREO RECORD PLAYER
- D.I.Y. SPEAKER SETS
- GENERATORS
- POWER SUPPLIES
- D.I.Y. RADIOGRAM PACKS
- MANY OTHER MODELS TOO NUMEROUS TO MENTION

Send for this FREE Catalogue and see for yourself, Today!

TO DAYSTROM LTD, GLOUCESTER GL2-6EE

☐ Please send me my free copy of the 1970 HEATHKIT CATALOGUE

NAME ....

ADDRESS ....

PW-1A

HEATHKIT

DAYSTROM LTD
GLOUCESTER
GL2-6EE

P.W. GUIDE TO COMPONENTS

PART 13

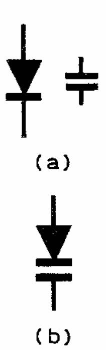
M.K.TITMAN, B.Sc.(Eng)

THE number of devices using semiconductor materials to meet specific requirements in electronic circuits is increasing rapidly as research and development continues on an unprecedented scale. The devices examined in this part of the series are the most common and easily obtainable of such devices, but because of the diversity and number of items to be discussed only general practical information has been included. Further detailed information can usually be obtained from manufacturers. Let us now examine the usage, construction, limitations, cost and operation of each type.

Variable Capacitance Diode or Varactor

The variable capacitance diode, varactor or voltage variable capacitor is a device which behaves essentially as a capacitor and circuit symbols are shown in Fig. 1. The capacitance is however capable of variation by means of a d.c. bias voltage. It is therefore particularly useful for automatic frequency control (a.f.c.), frequency modulation, fine tuning and bandwidth regulation. Varactors are also used for frequency multiplication purposes at microwave frequencies.

Varactors are constructed from single p-n junction semiconductor material and are operated in the reverse—non-conducting—direction, the capacitance being the normal diode junction capacitance. They are thus diodes which utilise normal diode construction—such as the alloy, diffusion or planar processes described in a previous part in this series. The junction size and impurity levels are modified to give the required capacitance values and characteristic. A typical capacitance against reverse voltage characteristic is shown in Fig. 2.



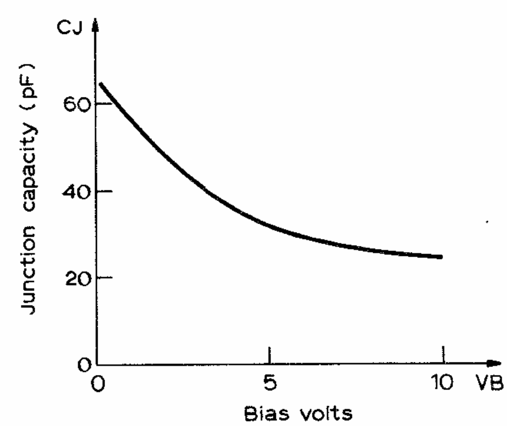


Fig. 1a, b (left): Circuit symbols for a diode used as a variable capacitor or varactor.

Fig. 2 (right): Reverse biased diode capacitance characteristic.

It is worth noting that all semiconductor diodes exhibit a similar characteristic and can therefore be used by the home constructor for applications where variable capacitance diodes are required. However the actual capacitance level differs from diode to diode and for most signal diodes is reduced to a minimum since it is parasitic and determines the upper frequency limit of the diode. Improvisation can nevertheless save time and expense and the home constructor is well advised to try a selection of available diodes for a.f.c. and oscillator tuning applications.

The ideal varactor should have all the characteristics of a capacitor: low leakage, low capacitance tolerance, stability and reliability. The real device closely approaches this ideal except for leakage current which is generally 0·1μA-10μA and is generally higher than all but eletrolytic capacitors. Capacitance tolerance varies and is usually ±10% or ±20%. Stability and reliability are both good as it is a semiconductor device. The main disadvantage is the requirement for a d.c. bias since they are polarised devices; also the Q factors, which are generally 30-40 for the v.h.f. range low cost units, although Q factors up to 500 can be obtained.

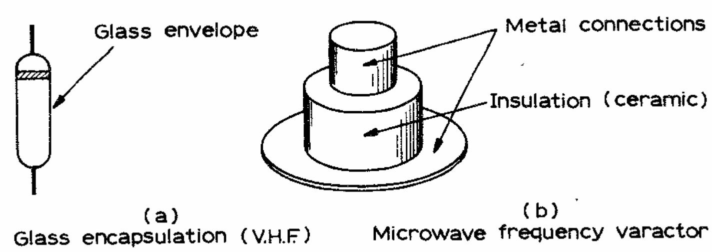


Fig. 3: Varactor encapsulations.

As varactors employ the basic diode structure the encapsulations follow the same pattern. Oscillator trimming and a.f.c. diodes at v.h.f. frequencies, with capacitances of approximately 30pF at 1V reverse, usually employ standard glass encapsulations as shown in Fig. 3(a). Microwave varactors which operate at extremely low capacitance values from 0·1pF to 10pF, with reverse voltages in excess of 50V, utilise special low capacitance encapsulations such as that illustrated in Fig. 3(b). Microwave varactors—which operate in various bands up to 250GHz—frequently operate at higher power levels and consequently have metal encapsulations which directly connect to heatsinks to give increased dissipation.

With all semiconductor devices costs are largely determined by the level of demand and the tolerance ratings and yield of the device. Varactors are no exception and glass encapsulated v.h.f. devices with high demand levels and low Q factors (10-40) are available from 7s. to 30s. whilst devices with higher Q factors and tuning ranges can cost from £2 to £5. Microwave varactors, particularly power devices, are correspondingly more expensive and cost from £3 to £20 for low power and from £15 upwards for high power types.

Tunnel Diode and Backward Diode

Tunnel diodes, like varactors, are two-terminal single-junction devices, but unlike the varactor their action is active in that they are capable of producing power gains despite the two-terminal configuration. They are used as oscillators, amplifiers and switching devices and can be used up to very high frequencies. Indeed tunnel diodes are used in amplifiers operating at 6GHz. They are extremely stable components and crystal controlled transmitters and chronometers use tunnel diodes particularly in frequency division circuits—where three tunnel diodes can give an accurate frequency division of 2,000 to 1. At present the circuit symbol for the tunnel diode has not been standardised and consequently a selection of symbols is shown in Fig. 4, with the B.S. preferred symbol indicated.

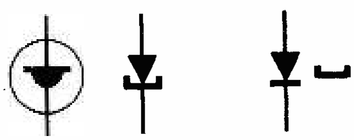


Fig. 4: Tunnel diode symbols.

A typical tunnel diode characteristic is illustrated in Fig. 5 and this clearly indicates its essentially active mode of operation. The characteristic shows a peak and a valley, and a region between in which the current falls with increase in voltage, indicating a negative resistance and therefore unstable region. Switching action from point A to point B can occur and is used to aid tuned circuits to give gain or oscillations. Following this region the characteristic follows a normal diode characteristic as would be expected from its single p-n junction structure. This curve is shown for comparison.

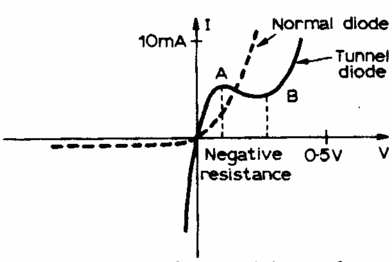
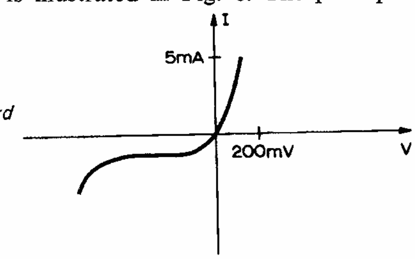


Fig. 5: Tunnel diode characteristic.

The mechanism which produces the negative resistance region in the characteristic is called the quantum-mechanical tunnelling effect, from which the device takes its name. This rather awe-inspiring terminology tends to overwhelm the potential user but—although the mechanism is mathematically complicated to prove—this should not be a deterrent to the practical engineer. Suffice it to say that the tunnelling effect causes an increase of current at a definite point in the characteristic by sweeping or tunnelling the electrons across the junction, thus producing the characteristic of Fig. 5. The parameters quoted by manufacturers confine themselves to the characteristic and when considered with the characteristic are relatively self-explanatory. Table 1 shows the parameters with a range of values for typical general-purpose tunnel diodes. Microwave diodes up to 40GHz have negative conductance values of 65-75 mhos $\times 10^{-3}$ and capacitance values of 0·35-5pF.

Backward diodes are tunnel diodes with current values below 0·5 to 1mA and a consequent negative resistance greater than 1kΩ. The characteristic is consequently modified and a typical backward diode characteristic is illustrated in Fig. 6. The peak point

Fig. 6: Backward diode characteristic.



current varies from 0·01 to 1mA with capacitance values of 1–20pF. The characteristic allows the backward diode to be particularly useful as mixer and detector diodes at extremely high frequencies.

Both tunnel and backward diodes, being single p-n junction structures, use normal diode manufacturing techniques. They are manufactured from germanium material with extremely heavily doped, small area junctions. The heavy doping produces the tunnelling effect whilst the small junction area minimises junction capacitance. Due to the extremely high operating frequencies lead inductance is a problem and is reduced to a minimum (0·5nH to 5nH) in diodes operating below 2GHz which use axial or TO-18 packages. Epoxy resin plastic packages are used and have lead inductances of 1-2nH whilst microminiature pill packages having lead inductances of 0·1nH are used for microwave diodes. Some typical encapsulations are illustrated in Fig. 7.

Tunnel diode costs vary considerably but increase

Fig. 7: Tunnel diode encapsulations.

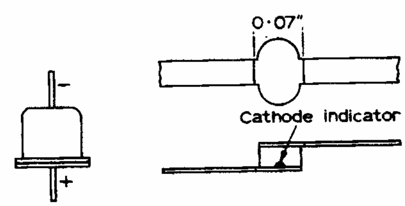
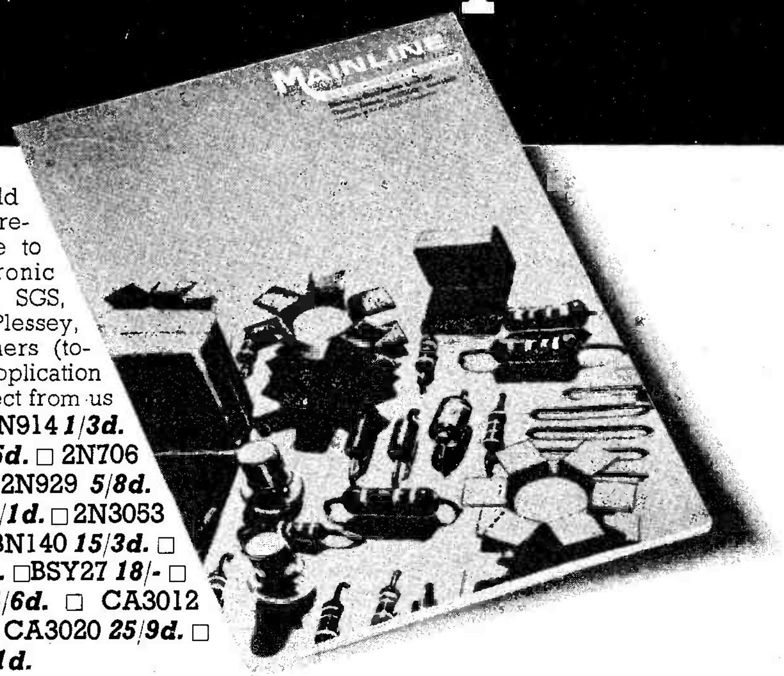


Table 1: General purpose tunnel diode parameters with typical values

Peak point current Ip	Max. valley point current Iv	Peak voltage Vp	Max. series resistance Rs	Capacitance C	Negative conductance G	Cut off frequency from
1-25mA	0·5-5mA	50-60mV	1-10Ω	5-150pF	4-200mhos $\times 10^{-3}$	1-4GHz

4/- brings you a mountain of components at manufacturers' prices



The serious amateur should never be without this comprehensive price list and guide to semiconductors and electronic components from RCA, IR, SGS, Emihus, Semitron, Keyswitch, Plessey, Morganite, Litesold and others (together with manufacturers' application data) which you can buy direct from us at *manufacturers' prices* e.g. IN914 ***1/3d.*** □ IN916 ***1/11d.*** □ 2N697 ***4/5d.*** □ 2N706 ***2/3d.*** □ 2N706A ***2/9d.*** □ 2N929 ***5/8d.*** □ 2N1613 ***4/8d.*** □ 2N3011 ***9/1d.*** □ 2N3053 ***6/2d.*** □ 2N3055 ***15/9d.*** □ 3N140 ***15/3d.*** □ BFY50 ***4/8d.*** □ BFY51 ***3/9d.*** □ BSY27 ***18/-*** □ BSY95A ***3/3d.*** □ C407 ***4/6d.*** □ CA3012 ***18/3d.*** □ CA3014 ***25/6d.*** □ CA3020 ***25/9d.*** □ OA200 ***1/9d.*** □ OA202 ***1/11d.***

Build the NEW Mainline Audio Amplifier kits – UP TO 70 WATTS

The result of the combined resources of SGS and RCA, these quasi circuits set new standards in quality and performance. Each kit is complete with circuit diagram, all semiconductors, resistors, capacitors and printed circuit board.

12A	**£7. 0. 0.**
25A	**£8. 5. 0.**
40A	**£9. 0. 0.**
70A	**£10.10. 0.**

Any two will make an outstanding stereo equipment.

To: Mainline Electronics Limited, Thames Avenue, Windsor, Berkshire

I enclose 4/-. Please send me your price list and guide □

I am interested in .... Amp Mainline Audio Amplifier Kits. Please send me full data □

I am interested in receiving data on preamplifier & power supply kits □

NAME____________ ADDRESS____________

(A member of the ECS Group of Companies) PW170 rapidly in the regions beyond 1GHz. Average axial and plastic package diodes for use below 1GHz are available from 15s. to £4, with metal encapsulations ranging from 30s. to £7. Microwave devices are available from £10 upwards.

Unijunction Transistor

As its name implies the unijunction transistor is a three-terminal, single-junction device and its symbol is shown in Fig. 8. The circuit operation is however unlike either a transistor or diode, as indeed is the construction.

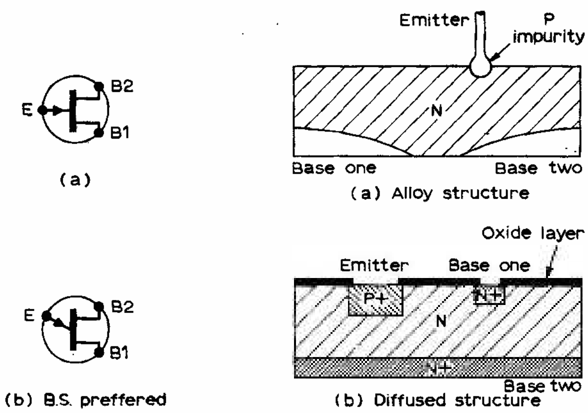


Fig. 8a, b (left): Unijunction transistor symbols.
Fig. 9a, b (right): Unijunction transistor constructions.

The structure consists of a block of resistive semiconductor material with a junction formed at a definite position along the length of the bar. Leads are connected to the ends of the bar and are denoted base 1 and base 2 whilst the connection to the junction is referred to as the emitter. Hence the designation double base diode which was the original term for this device. At present only n-type silicon is used for the bar and the junction is formed by alloying or diffusing a p-type impurity at the required point along the bar. Typical alloy and diffused junction constructions are shown in Fig. 9 and although alloy junction types are the cheapest as well as the most widely used the diffused construction is increasingly popular due to the low leakage currents and faster switching times. Encapsulation is usually in the familiar TO-18 and TO-5 transistor casing although plastic is used increasingly for the cheaper devices. At present terminations are not completely standardised and the manufacturers' data should be consulted.

The circuit operation of the unijunction transistor can be understood by referring to Fig. 10 which shows the essential diagrammatic structure and its equivalent

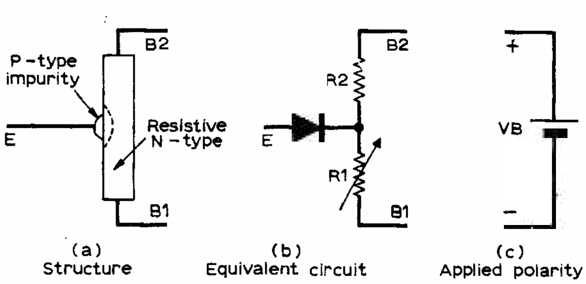


Fig. 10: Basic unijunction structure.

circuit. If the battery is connected as indicated, a voltage gradient is set up in the high resistivity n-type bar. As a result the position of the junction along the bar determines the positive potential required at the emitter terminal to enable the p-n junction diode to conduct. Thus if the battery is 12V and the junction is midway between base 1 and base 2—the potential required to make the diode conduct is (6V+diode drop) $\simeq$6·7V. This parameter is sometimes quoted in specifying unijunction transistors and is known as the peak point emitter voltage (Vp). The resistance ratio which determines this potential on the equivalent circuit is $\left(\frac{R1}{R1+R2}\right)$ and this is known as the intrinsic standoff ratio (η). Hence to turn on the unijunction transistor the emitter voltage must satisfy the following equation:

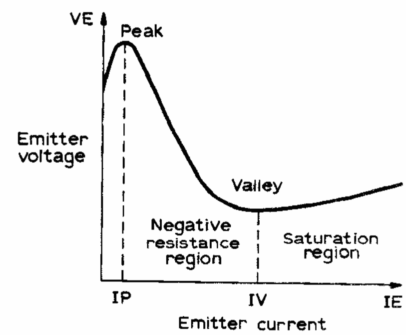
$$V\ \text{emitter}=Vp=\left(\frac{R1}{R1+R2}\right)V_B+Vd$$
$$=\eta V_B+Vd \qquad (1).$$

Since the intrinsic standoff ratio η determines Vp for any supply voltage this is always quoted as a parameter and for any given device has a stated tolerance.

When the diode is made to conduct by this potential Vp then the base 1 resistance R1 reduces rapidly to a low value—thus causing a rapid increase in emitter current and a drop in emitter voltage towards zero volts. This effect is achieved by the electron input through the emitter causing the reduction in resistivity of the base 1 region of the bar structure.

In order to reduce the base 1 region to low resistivity a minimum current into the emitter is required. This parameter is called the peak point current (Ip) and is clearly shown in the unijunction characteristic Fig. 11.

Fig. 11: Unijunction transistor characteristic.



The characteristic also shows the negative resistance region which causes the switching action and the stable saturation region which is achieved after Ip is exceeded. Ip is usually of the order of 0·5 to 100μA and η of the order of 0·5 to 0·85. The total resistance known as the interbase resistance R_{BB1} varies between 4kΩ and 12kΩ. Other parameters supplied by the manufacturer are peak emitter current ($\sim$2A), power (P_D), maximum base to base voltage (V_{B2} V_{B1}, $\sim$30-50V) and frequency—which can be in the megacycle region.

It can be seen from the characteristics that until the diode conducts the impedance is very high (1-10MΩ) whilst at switch on it drops rapidly towards zero. When coupled to a charging capacitor it is off until Vp is reached, then rapidly conducts and discharges the capacitor. When the discharge current falls below Ip it switches off and the capacitor can recharge to Vp. Thus it is useful as a relaxation oscillator but can also be used for thyristor triggering, voltage sampling and in protection circuits.

The disadvantages of unijunction transistors are that the ratio η varies considerably as it depends on the positioning of the junction—as a result the turn-on emitter voltage (peak point voltage Vp) also varies considerably. In addition these parameters are affected by temperature.

Unijunction transistors are available at varying price levels depending on the demand, range of tolerance of η and hence Vp, and frequency response. Cheapest types are plastic encapsulated at 5s. with high frequency, low leakage devices available at 9s. to 35s. At present only p-type emitter devices are available as shown by the symbol which indicates—in the emitter arrow—the direction of current flow. If n-type emitter devices become available they will be expensive initially and as with transistors the reversal of current flow will be indicated on the symbol by a reversal of the emitter arrow.

TO BE CONTINUED

BEGINNERS PORTABLE RECEIVER

—continued from page 695

will accommodate should be used. The wires between L1, VC and the board must be short and not liable to flexing or the alignment will be affected. If possible, L1 and VC should be fixed rigidly to the Veroboard to ensure this. The wires connecting the volume control to the board are not so critical.

Operation

The receiver should work fairly well without any alignment at this stage and the coil cores must not be adjusted indiscriminately if it does not. If there is no sound, the stages can be checked individually as follows. Connect one end of a capacitor (about 0·1μF) to battery negative and touch the other end to successive transistor bases, working from the loudspeaker to the aerial. Clicks should be heard in the loudspeaker until the faulty stage is located.

The radio works well without an external aerial but this can be used by adding C1 to the circuit (see Fig. 1). A car aerial can be connected in this way. If the connection of the external aerial upsets the radio tuning unduly or causes overloading, use a smaller value for C1.

Alignment

If the radio is receiving signals, it can be aligned without other equipment if proper care is taken. Tune in a *weak* station at the centre of the range. Use a plastic screwdriver blade (e.g., a filed down plastic knitting needle or toothbrush handle) to adjust i.f.t.1, i.f.t.2, i.f.t. 3 for the strongest signal. Repeat this adjustment several times, keeping the signal tuned in as well as possible with VC. Find a weak station at the l.f. end of the range. Adjust L2 oscillator core in one direction somewhat and retune the station with VC. If the reception is better, continue adjusting the dust core in the same direction until the best signal is obtained; if the reception is worse, adjust in the opposite direction. After each core adjustment, the same station must be retuned with VC. Retune VC to a weak station at the h.f. end of the range and adjust VC2 trimmer for correct station position. Finally adjust VC1 trimmer for maximum signal strength. The process must be repeated until best results are obtained. Alignment is now complete.

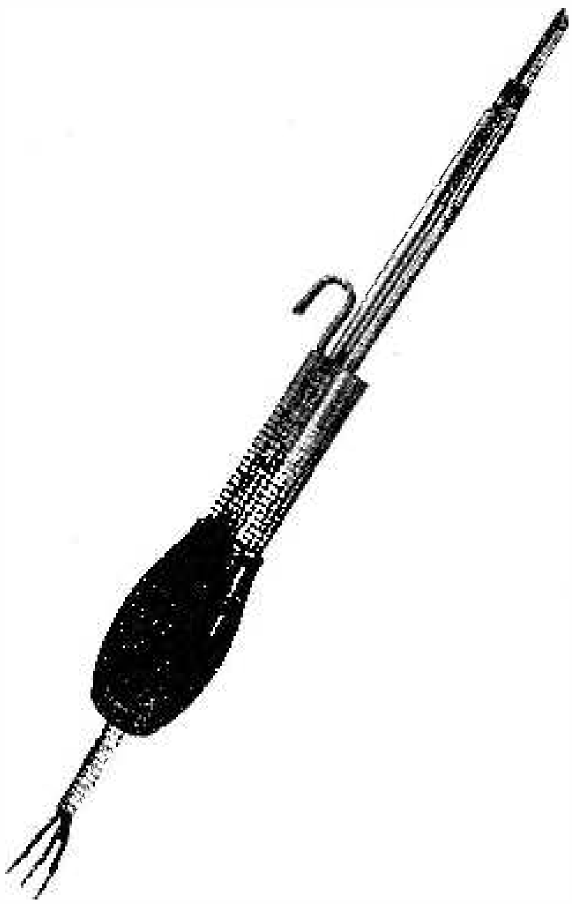
A socket for a magnetic earpiece can be connected as shown in Fig. 4. The same socket can be used to operate extension speakers. If the socket is wired as shown, the radio speaker is muted when anything is plugged in.

Figure 5 shows a treble/bass tone control that can be added to the circuit. R16 and C12 are no longer used and should be removed from the board. The tone control reduces the audio gain slightly but provides a useful range of adjustment.

The audio stages can be used as a useful loudspeaker amplifier for microphone, guitar, signal tracing, record playing, etc. by adding a socket as shown in Fig 6. ■

ADCOLA
PRODUCTS LIMITED
(Regd Trade Mark)

THE RELIABLE SOLDERING INSTRUMENT!



SEND COUPON FOR LATEST LEAFLET

ADCOLA PRODUCTS LTD
ADCOLA HOUSE
GAUDEN ROAD
LONDON SW4
Telephone 01-622 0291/3

NAME ....
ADDRESS ....
....
....
....
PW177

SEMICONDUCTORS

BRAND NEW AND FULLY GUARANTEED

1N914	1/6
1N916	1/6
1S021	4/-
1S025	5/-
1S113	3/-
1S120	2/6
1S121	2/6
1S130	2/6
1S131	2/6
1S132	2/6
1S44	2/-
2G301	4/-
2G302	4/-
2G303	4/-
2G371	3/-
2N696	4/6
2N697	5/-
2N698	4/6
2N706	2/6
2N706A	2/6
2N708	4/-
2N929	5/6
2N930	7/-
2N1090	6/6
2N1091	6/6
2N1131	6/6
2N1132	6/6
2N1302	3/6
2N1303	3/6
2N1304	4/6
2N1305	4/6
2N1306	5/-
2N1307	5/-
2N1308	6/-
2N1309	6/-
2N1507	5/6
2N1613	5/6
2N1711	6/6
2N1889	6/6
2N1893	8/6
2N2102	15/-
2N2147	14/6
2N2148	12/6
2N2160	14/6
2N2193	5/6
2N2193A	5/6
2N2194A	5/6
2N2217	6/6
2N2218	6/6
2N2219	6/6
2N2220	5/-
2N2221	5/-
2N2222	6/6
2N2368	5/-
2N2369	5/-
2N2369A	5/6
2N2539	4/6
2N2540	4/6
2N2646	11/6
2N2904	8/-
2N2904A	8/-
2N2905	8/-

2N2905A	8/-
2N2906	6/-
2N2906A	8/-
2N2923	4/-
2N2924	4/-
2N2925	3/6
2N2926	
,, Green	3/-
,, Yellow	2/9
,, Orange	2/9
2N3011	12/6
2N3053	6/6
2N3054	12/6
2N3055	15/-
2N3702	3/6
2N3703	4/6
2N3704	4/6
2N3705	4/-
2N3706	4/6
2N3707	4/-
2N3708	3/6
2N3709	3/6
2N3710	4/-
2N3711	4/-
2N3819	9/-
2N3820	23/6
2N4058	5/6
2N4059	5/-
2N4060	5/-
2N4061	4/6
2N4062	4/6
2N44254	8/6
2N4255	8/6
2N4284	3/6
2N4285	3/6
2N4286	3/6
2N4287	3/6
2N4288	3/6
2N4289	4/6
2N4291	3/6
2N4292	3/6
40361	12/6
40362	14/6
3N128	18/6
3N140	19/6
3N141	21/6
3N142	16/6
AAZ13	2/-
AAZ15	2/6
AAZ17	2/6
AC107	6/-
AC126	4/-
AC127	5/-
AC128	4/-
AC176	5/-
AC187	12/-
AC188	12/-
ACY17	5/-
ACY18	5/-
ACY19	5/-
ACY20	5/-
ACY21	5/-

ACY22	4/-
ACY28	4/-
AD140	8/-
AD149	11/6
AD161	7/6
AD162	7/6
AF114	5/-
AF116	5/-
AF117	5/-
AF118	12/6
AF124	4/6
AF125	4/6
AF126	4/-
AF127	3/6
AF139	7/6
AF181	8/6
AF186	11/-
AF239	7/6
AFZ12	8/6
ASY26	5/6
ASY27	8/6
ASY28	5/6
ASY29	5/6
ASZ20	7/6
ASZ21	7/6
BAX13	2/6
BAX16	2/9
BAY31	1/6
BAY38	3/6
BC107	3/6
BC108	3/6
BC109	3/6
BC113	6/6
BC116	12/6
BC118	6/6
BC125	11/-
BC126	11/-
BC147	3/6
BC148	3/6
BC149	3/6
BC167	3/6
BC168B	3/6
BC168C	3/9
BC169B	3/6
BC169C	3/9
BC212L	5/-
BCY30	5/6
BCY31	5/6
BCY32	7/6
BCY33	4/-
BCY34	4/6
BCY38	4/6
BCY39	7/6
BCY40	6/6
BCY42	3/-
BCY43	3/-
BCY54	7/6
BCY70	4/6
BCY71	8/6
BCY72	4/-
BD116	35/-
BD121	17/6

BD123	21/6
BD124	12/-
BF115	5/-
BF117	10/6
BF167	5/6
BF173	7/6
BF180	7/-
BF181	6/6
BF184	7/6
BF194	5/-
BFX12	4/6
BFX13	4/6
BFX29	12/6
BFX30	9/-
BFX35	19/6
BFX43	8/6
BFX44	8/6
BFX84	7/6
BFX85	9/-
BFX86	6/6
BFX87	6/6
BFX88	5/-
BFY10	4/6
BFY17	4/6
BFY18	4/6
BFY19	4/6
BFY20	12/6
BFY41	10/-
BFY43	12/6
BFY50	4/6
BFY51	4/6
BFY52	4/6
BFY76	8/6
BFY77	11/6
BFY90	12/6
BSX19	3/6
BSX20	3/6
BSX21	7/6
BSX26	10/6
BSX27	10/6
BSX28	6/-
BSX29	13/6
BSY26	4/-
BSY27	4/-
BSY28	4/-
BSY29	4/-
BSY38	4/6
BSY39	4/6
BSY40	6/6
BSY51	8/6
BSY52	9/-
BSY53	8/6
BSY54	10/6
BSY95A	3/6
BY100	4/6
BYX10	5/6
BYZ10	9/-
BYZ11	7/6
BYZ12	6/-
BYZ13	5/-
MJ480	20/6
MJ481	27/6

MJ490	22/6
MJ491	29/6
MPF102	8/6
MPF103	7/6
MPF104	7/6
MPF105	8/-
NKT0013	8/6
NKT216	7/6
NKT217	8/6
NKT261	4/-
NKT262	4/-
NKT264	4/-
NKT271	4/-
NKT272	4/-
NKT274	4/-
NKT275	4/-
NKT281	5/6
NKT403	15/-
NKT404	12/6
NKT405	15/-
NKT613	6/6
NKT674	5/-
NKT677	5/-
NKT713	5/-
NKT773	5/-
NKT781	6/-
NKT20329	8/6
NKT80111	15/6
NKT80112	19/6
NKT80113	22/6
OA5	2/6
OA9	2/-
OA70	1/6
OA73	2/-
OA79	1/9
OA81	1/6
OA85	1/6
OA90	1/6
OA91	1/6
OA95	1/6
OA200	2/-
OA202	2/-
OC26	6/6
OC28	8/6
OC35	6/6
OC36	6/6
OC44	4/-
OC45	2/6
OC71	2/6
OC72	2/6
OC75	4/6
OC81	4/-
OC83	4/6
OC81D	4/6
OC84	5/-
OC139	6/6
OC140	6/6
OC200	6/6
OC201	7/6
OC202	10/6

MULLARD INTEGRATED CIRCUITS

FCH211 Hextuple DTL Inverter Gate	28/6
FCH221 Triple 3 Input DTL Line	28/6
FCJ101 3 Input JK Flip Flop	35/-
TAA241 Operational Amplifier	47/6
TAA243 Operational Amplifier	47/6
TAA 263 Linear AF Amplifier	18/6
TAA320 Most LF Preamplifier	15/6

SPEAKERS (3 ohm)

10″ × 6″ **37/6**, 9″ × 4″ **23/6**, 8″ × 5″ **19/6**, 7″ × 4″ **15/6**, 5″ × 3″ **12/6**, 3″ **9/6**, 5″ **14/6**, 8″ **27/6**, 12″ **39/6**.

Post and Packing 2/9

SEND 6d. STAMP FOR CATALOGUE

P.P. for Components 1/6 per order

THYRISTORS

1 AMP: 50V **5/-**, 100V **5/6**, 200V **7/-**, 400V **9/6**.
3 AMP: 50V **6/-**, 100V **7/6**, 200V **8/-**, 400V **10/6**.
ZENERS. 1½ WATT 2·7–33V **4/6**, 400m/w 3·0–33V **5/-**.

INTEGRATED CIRCUITS—R.C.A.

CA3005 **30/-**, CA3011 **20/-**, CA3012 **25/-**, CA3013 **30/-**, CA3014 **30/-**, CA3018 **25/-**, CA3019 **25/-**, CA3020 **27/6**, CA3021 **42/6**, CA3022 **35/-**, CA3023 **32/6**, CA3026 **27/6**, CA3028A **25/-**, CA3028B **35/-**, CA3035 **35/-**, CA3036 **20/-**.
FAIRCHILD
L900, 914 **11/-**, L923 **14/-**.
DATA SHEETS FOR RCA DEVICES **2/-** per type.

Presets std., horiz. or vert. **1/6**
Potentiometers, Log/Lin **3/3** each

MFD	V	Price	MFD	V	Price	MFD	V	Price
1	15	1/6	25	10	1/6	200	6·4	1/9
1	40	1/9	25	25	1/6	200	16	2/-
2	15	1/6	25	50	1/6	250	25	2/9
2	350	2/-	32	15	1/6	250	50	3/9
2·5	16	1/9	32	450	1/6	320	10	1/6
4	15	1/6	40	6·4	1/6	400	16	2/9
4	40	4/9	40	16	1/6	500	6	2/6
4	350	2/3	50	12	1/6	500	25	3/9
5	15	1/6	50	25	1/6	500	50	4/9
6·4	6·4	1/9	50	50	2/-	640	16	3/6
8	18	1/6	64	25	1/6	1000	12	3/9
8	40	1/6	80	6·4	1/6	1000	16	4/-
8	450	3/-	80	16	1/6	1000	25	5/-
10	15	1/6	100	6·4	1/6	1000	50	7/6
10	25	1/6	100	12	1/6	2000	25	8/6
12·5	25	1/9	100	25	1/6	2000	50	12/6
16	18	1/6	100	50	2/6	2500	25	9/6
25	6·4	1/6	125	4	1/6	5000	25	12/6

VEROBOARD

	·15 Matrix	·1 Matrix
2½″ × 3¾″	3/6	4/-
2½″ × 5″	4/3	4/9
3¾″ × 3¾″	4/3	4/9
3¾″ × 5″	5/6	5/6
2½″ × 17″		12/6
3¾″ × 17″	16/-	21/6

Cutter **9/-**

RESISTORS

¼ watt 10%, **4d.**
½ watt 5%, **5d.**
½ and **1** watt, **6d.**
3 watt, 5%, **1/6**
5 watt **2/-**
1 watt Metal Oxide, **1/6**

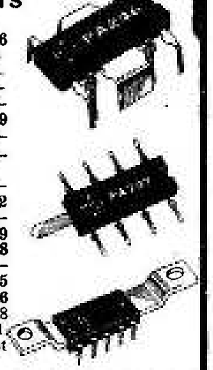
A. MARSHALL & SON

28 CRICKLEWOOD BROADWAY, LONDON N.W.2
01-452 0161/2/3 CALLERS WELCOME

Post & Packing U.K. only, 1/6. Europe 10/-. Commonwealth (Air) 13/-.

Kinver for Components

LINEAR INTEGRATED CIRCUITS FOR ALL YOUR REQUIREMENTS



Plessey SL403A 3 Watt Audio Amplifier	59/6
G.E. type PA230 Low Level Amplifier	21/-
G.E. type PA234 1 Watt Audio Amplifier	23/-
G.E. type PA237 2 Watt Audio Amplifier	34/-
G.E. type PA246 5 Watt Audio Amplifier	57/-
RCA type CA3000 D.C. Amplifier	54/9
RCA type CA3011 Wide Band Amplifier	20/-
RCA type CA3020 ½ Watt Wide Band Amplifier	32/-
RCA type CA3028A Differential/Cascode Amp (120 MHz)	30/-
RCA type CA3029 Operational Amplifier	55/2
RCA type CA3035 Ultra High Gain Amplifier	30/-
Mullard type TAA263 A.F. Amplifier	15/9
Mullard type TAA293 General Purpose Amplifier	21/8
Mullard type TAA310 Record/Playback Pre-Amplifier	32/-
Mullard type TAA320 MOS L.F. Amplifier	13/5
G.E. type 2N5306 Darlington Pair	11/6
G.E. type DI3TI Programmable Unijunction Transistor	10/8

ADD 1/- each to the above i.c.s. for data sheets if required. Data sheets may be purchased separately at 1/6d. each post free. Issued free with SL403A only

TRANSISTORS

ACY17	8/6	BC212L	3/9	OC26	9/-	2N1308	9/6
ACY18	4/3	BC213L	3/9	OC28	9/-	2N1309	9/6
ACY19	5/3	BC214L	4/-	OC35	9/-	2N2906	13/-
ACY20	4/6	BCY70	5/4	OC36	9/-	2N2924	4/4
ACY21	4/11	BCY71	10/4	OC71	3/-	2N2925	5/3
ACY22	2/10	BCY72	4/6	OC72	3/9	2N2926	3/-
ACY39	18/-	BD121	18/-	OC76	3/9	2N3053	6/8
ACY40	3/5	BF184	7/6	OC81D	3/-	2N3055	19/6
ACY41	4/4	BF194	7/-	OC170	3/9	2N3702	3/6
ACY44	8/-	BFY50	5/-	OC171	3/9	2N3703	3/3
ASY26	6/2	BFY51	4/6	2N696	4/9	2N3704	3/9
ASY27	8/-	BFY52	5/-	2N697	5/-	2N3705	3/4
ASY28	6/2	BSY95A	3/11	2N706	3/3	2N3707	4/-
ASY29	8/-	MJ481	27/3	2N1132	10/9	2N3708	2/5
BC107	3/3	MJ491	32/11	2N1302	3/11	2N3819	9/-
BC108	3/-	TIP31A	17/-	2N1303	3/11	2N3820	18/9
BC109	3/3	TIP32A	23/-	2N1304	5/-	2N3826	5/11
BC153L	3/2	TIS44	1/9	2N1305	5/-	2N4058	4/6
BC158L	2/5	TIS49	2/6	2N1306	6/5	2N4059	3/5
BC184L	3/2	TIS50	3/9	2N1307	6/5	40408	14/11
2N2160 Unijunction	14/11						

DIODES

AA119	3/-	OA91	1/3	1N82A	9/6	1S134	5/3
AAY11	2/6	OA202	2/-	1N87A	4/6	1S940	1/-
AAZ15	3/3	1N34A	4/-	1N914	2/-		
BAY38	3/9	1N60	4/-	1S44	1/8		
OA47	2/-	1N64	4/-	1S131	3/-		

VEROBOARD

	0·1	0·15
2½in x 5in	4/9	4/2
2½in x 3¾in	4/2	3/5
3¾in x 5in	5/6	5/6
3¾in x 3¾in	4/9	3/11
17in x 2½in		10/6
17in x 3¾in		14/8

PLAIN VEROBOARD

(Uncoppered)
(0·15in Matrix only)

2½in x 5in	3/8
2½in x 3¾in	3/-
17in x 2½in	7/6
17in x 3¾in	9/8
17in x 5in	14/8
Cutter	7/3
Pin Insertion Tool (0·1)	9/6
Pin Insertion Tool (0·15)	9/6
Packet of 36 pins (0·1)	3/11
Packet of 36 pins (0·15)	3/11

INTERNATIONAL RECTIFIER HANDBOOKS

HB10 Rectifier Engineering Handbook	16/9
HB20 Zener Diode Handbook	16/9
HB30 Solar Cell and Photocell Handbook	16/9
HB40 SCR Handbook	20/-

PHOTOCELLS

IR CS-120	19/8
Mullard Type ORP12	9/-

ZENER DIODES

1S2030 Series (400mW, 3·3V to 15V)	4/8
Z1100-C Series (1 Watt, 3·9V to 27V)	7/11

COMPONENTS CATALOGUE 2/- Post Free (Inland) P. & P. 1/6 inland, overseas at cost (min. 10/-)

Cash with order please, discounts may be deducted as follows:—order over £5—10%; order over £10—15%. Trade orders—net 30 days. Please send SAE with enquiries. CALLERS WELCOME. Open 9.00 a.m.–12.50 p.m., 2.00 p.m.–5.00 p.m. Weekdays and Saturday Mornings 9.00 a.m.–12.50 p.m.

KINVER ELECTRONICS LTD

STONE LANE KINVER
STOURBRIDGE WORCS
Telephone KINVER 2099

TRANSISTORS etc.

AC107	3/-	OC35	7/6
AC126	2/-	OC44	2/-
AF115	3/-	OC45	2/-
AF116	3/-	OC70	2/3
AF117	2/9	OC71	2/-
BFY18	4/6	OC72	2/2
BFY51	4/-	OC73	2/3
GET113	2/6	OC75	2/2
OA5	1/6	OC81	2/-
OA9	1/8	OC81D	2/-
OA47	1/9	OC82D	2/3
OA81	1/6	OC140	5/-
OA85	1/6	OC169	3/6
OC23	6/6	OC170	2/2
OC25	5/-	OC171	2/2
OC26	5/-	OC202	4/6
OC28	6/6	TK22C	1/6

Crystal Diodes—6 for 2/6. (7d.)

SILICON DIODE RECTIFIERS

BY100 800 piv	2/10
500 mA 250 piv	1/9
Avalanche 1¼A 1200 piv	4/-
Six Amp Series	
BYZ13 300 piv	3/6
BYZ12 600 piv	4/6
BYZ11 900 piv	5/-
BYZ10 1200 piv	5/6
Mullard Stack FW Bridge	
12A 100 piv	39/6 (3/-)

THYRISTORS

5 amp series	
100 piv	7/6
200 piv	9/-
300 piv	10/6
400 piv	12/-
800 piv	25/-
10 amp series	
50 piv	10/-
100 piv	12/-

100 amp series prices available on request.

Midget Electrolytic Conds. Wire Ends

At 6d. each	
0·8µF	25 volt
4µF	150 volt
640µF	2·5 volt
At 9d. each	
2µF	350 volt
4µF	12 volt
8µF	12 volt
16µF	16 volt
30µF	10 volt
100µF	6 volt
125µF	4 volt
At 1/- each	
16µF	250 volt
50µF	10 volt
100µF	12 volt
100µF	25 volt
200µF	10 volt
320µF	10 volt
2000 MFD. 30V	4/6
1500 MFD. 30V	4/6

Additional Transistors—**AF147** and **AF150**, 24V. Larger envelope, 4 leads, collective current 10mA. gain 70—**4/-** each. **AF149**—gain 225—**4/6** each.

Also 8µF 350V **1/2**. 25µF 25V **1/3** and **50µF 50V 1/9**. Other electrolytics in current list Postage, Packing and Insurance all above **1/-** up to 11, 12 and over charges paid.

2 GANG VAR. CONDENSER: Mod., air-spaced, ·0005 ea. sec. **5/-** (1/-). **3 GANG, 7/6 (1/-).**
SUB-MIN TRANSFORMERS: Output (3Ω for OC72 etc.) **2/6. Driver 2/9** (up to six, 1/-).
MULTIMETER: 20,000 Ω/V D.C., 10,000 Ω/V A.C. 0–5/25/50/250/500/1K volts D.C. ●0–10/50/100/500/1K volts A.C. ●0–50µA/2·5mA/250mA D.C. ●0–6KΩ/6 meg Ω ●10µµF–·001mfd/1mfd. ●—20 to +22dB. ●Complete with test leads and instructions. ●Over-load protected 1970 model with every refinement. **£4.7.6** (2/6). **JUNIOR MODEL** at **47/6** (2/6) 1000 Ω/V described in free list.
SOLDERING IRON. Slim Mod. British High speed. 8¼in., all parts replaceable, fully guaranteed for professional, radio and general D.I.Y. use. **19/6** (1/6).
DIAMOND STYLI. Replacements for BSR TC8LP, TC8/S and TC8LP/STEREO: COLLARO "O"; RONETTE BF40LP; GARRARD GC2LP and GC8LP; ACOS GP65/67; all at **7/6** each (1/-). **ACOS GP91 ST/LP; BSR ST4 and ST9; SONOTONE 9TA and** 9TAHC, PHILIPS AG3306, 3060 (3063, 3066, 3301, 3302, 3304) state whether ¾in. or ½in., all at **13/6** (1/-).
SAPPHIRE all the above 7/6 types only, also **ACOS GP37 at 3/3** each (1/-). **ACOS GP91** at **6/9** (1/-). No other types at present, and no 78 rpm available in any type.
PICK-UP CARTRIDGES. All fitted Styli and Standard fittings. Mono **GP67/2, 18/6** ● Stereo Compatible—Mono which also plays Stereo records monaurally with min. wear, **GP91/SC, 19/6.** ●Latest Stereo **GP93. 24/6.** ●Ceramic Stereo, top quality for expensive outfits, **GP94, 38/6** (all 1/-).
PP8 ELIMINATOR (A.C.) **17/6.** (1/6) **TWO STATION TRANS. INTER-COM.** Excellent baby alarm. Instant, easy fitting with leads, plugs and battery. All you require **52/6** (3/-).
TRANSISTORISED AMPLIFIERS. 3 watt, 9V operation, **45/6 (1/6); 7½ watt, 6 trans.** 24V operation, **67/6** (2/6).
Extra High Torque **MINI-MOTOR,** 4½ to 12V, 1½ x ⅞in. **5/-** (1/-). 9,000 r.p.m.
SUBSTITUTION BOXES, Capacitance **25/6** (1/6). Resistance **32/6** (1/6). Both full range and complete. Full details in list.
TEST PRODS: Flexible, unbreakable 24in. Red and Black leads, thin 4¼in. prods, 1¼in. plugs **4/9** (1/-). Croc. Clips: Plated with screw, or with red/black handles, **6d.** each, **5/-** doz. (1/-).
RECORDING TAPE: Finest quality British Mylar. **STANDARD:** 5in. 600ft. **7/3,** 5¾in. 850ft. **8/9,** 7in. 1200ft. **11/3. LONG PLAY** 5in. 900ft. **10/-,** 5¾in. 1200ft. **11/3,** 7in. 1800ft. **18/-** (1/3 reel). Still the finest quality and value obtainable.
MICROPHONES—CRYSTAL. MIC91, Desk, **16/3;** MIC45, curved hand grip **17/6;** Stick "60" **20/3;** Stick "39" **26/6** (1/6 each type). Cream plastic hand type **7/6,** or with "strut" stand, switch and 2 leads with 2·5 and 3·5 plugs **12/6** (1/3). Lapel (or hand) with clip **6/6** (1/-). Machined metal tapered stick type with neck cord and adaptor to fit standard floor stands, **25/-** (1/6). **DYNAMIC:** Cream hand/table **15/6** (1/6). **MS10** 50KΩ, 3¼ x ⅞in. with Base, Adaptor **37/6** (2/6). **MS11,** similar, but fixed on flexible Swan neck to switch-fitted base **42/6** (2/6). **DM128** Uni-directional, 50K/600 ohms imp, stand adaptor, very high quality 6¼ x 2 x 1½in., **£5.9.6** (5/-).
CARDIOID DYNAMIC OMNI-DIRECTIONAL: Two highly successful mikes "SQUARE" 208, **£5.10.0.** "BALL" type, 209. with built-in vol. control. switch 50K/600 ohms imp., **£5.17.6** (either type 5/-). Full details in list.
MICROPHONE INSERTS: Diameter 1·75in. or 0·9in. either size **5/6** (1/-).
SPEAKERS: 12in. round, fitted Tweeter, 6W, 3 or 15Ω (state which), **87/6** (5/6); or for stereo, **80/-** per pair (charges paid); 2½in. 3Ω **6/6** (1/-); 6 x 4 heavy duty 3Ω **14/6** (3/6) or for Stereo **34/6** pair (charges paid); (1/-). Limited quantity powerful 2½in. PM transistor replacement speaker, high ohms, excellent **5/9** (1/-). **HEADPHONES:** High Res. 2000Ω ea. earpiece **18/6** (1/6); Stereo Dyn 8–16Ω **63/-** (3/-). **EARPIECES** with lead and min. jack plug, magnetic **1/9,** Crystal **4/9** (up to 3 for 1/- on either). State if 2·5mm. or 3·5mm. plug required. (Crystal 3·5mm. only.)
AERIALS, Car Types: Telescopic, vandal proof, locks retracted, 2 keys and all fittings, **22/6** (2/6) Motor driven, 12V, 5 section, complete **£7.10.0** (5/-).
FOR ALL PORTABLES and F.M. SETS. 7-Section 5½–32in., no swivel, screw hole in base, **6/6.** ●10-section 6⅛–47½in., no swivel, screw hole in base, **12/6. DISAPPEARING** 8 section, swivel fixing assembly, 6½–33in. **10/-.** New 6 section 5¼–25¼in., screw hole in base, no swivel **4/-.** (1/- all sizes).
SWITCHES: Standard toggle, metal, 250V 2A. One hole fixing: SPST **2/3,** SPDT **2/9,** DPST **3/-.** DPDT **3/3.** Slide type. Sub-min. DPDT **1/6** each. Small DPDT 3 way, centre "off" **1/9.** Reed magnetic on/off **1/9** (up to three, 1/-: 1d. each all additional). Rotary Switches etc. in list.
VIBRATORS: Famous makes only. 12 volt 4 pin non-synch **2/6.** 12 volt 7 pin synch **10/-.** 6 volt 7 pin synch **10/-** (1/- each, all types). No other types available.
MAINS NEON TESTER: Fly leads **2/-.** Pocket screwdriver type **3/6. PLUGS:** Std. Jack, plastic body **2/3.** Screened **3/-. VALVE HOLDERS:** B7G or B9A, Moulded **6d.** (all above, 1/- up to three). **CONNECTING WIRE:** 5 coils asstd. cols. each 5 yds. Solid Core **2/6.** Flexible **3/-.** Super thin for transistor wiring etc. **3/-** (1/- all types per 5 coils). **PICK-UP WIRE:** Twin Super thin Flex, Screened, Sheathed. **1/3** yd. (6d. up to 6 yds., over 6 yds. post free). **TWIN MIKE CABLE:** 1/3 yd. **SINGLE MIKE CABLE: 7d.** yd. Both flexible, screened and sheathed. (Up to 3 yds **8d.,** each additional yard, **1d.** extra.)
R.F. INDICATOR, 5-Band, with meter antenna, monitoring crystal earpiece etc., **48/6** (1/6). Details in list.
RETRACTABLE FLEXIBLE LEADS. Space saving "Curly", many uses in car and home: with phono plug each end, 6ft., **4/6;** 12ft., **7/9.** With phono plug one end, phono socket at other, 6ft., **5/-,** 12ft., **8/6** (1/- each all types).
CAR RADIO: Splendid new **All-British** dash-mounting radio using Mullard transistors and circuit. M. and L. wave. Separate speaker and baffle. Absolutely complete, for + or − chassis. **£11.11.0** (6/6). A huge success since introduction.
CURRENT LIST: Sent with all orders or free for s.a.e. details of cable, croc. clips and leads, Continental din plugs for Grundig, Telefunken equipment, etc., dials, plugs and sockets, panel meters, record player and tape recording accessories. **BATTERY CHARGERS:** test equipment, terminals, tape recorder, special transistors, portable sets, more switches and other components, tools, Veroboard etc., etc. This advertisement cancels all previous ones and lists supplied prior to November 30th.

FELSTEAD ELECTRONICS

(PW26) LONGLEY LANE, GATLEY, CHEADLE, CHESHIRE, SK8 4EE

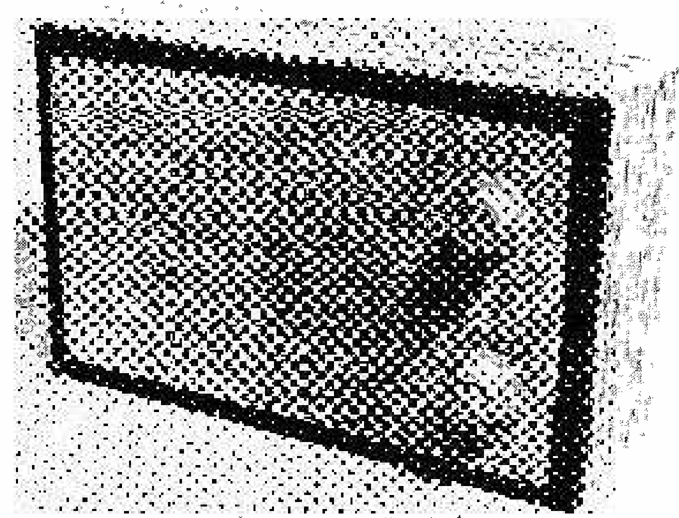
TERMS: Cash with order only. No C.O.D. or caller service. Post, packing and insurance charges are shown in brackets after all items. Regret orders under 5/- plus carriage cannot be accepted, and a minimum charge of 1/- is now made. Charges apply to G.B. and Eire only. Overseas air or surface mail extra at cost, plus 3/2 registration or insurance fee.
S.A.E. please for all enquiries, otherwise regret cannot be replied to

TAKE 20

JULIAN ANDERSON

No. 9
THREE TRANSISTOR RADIO

This month's special Christmas project describes a three transistor radio which is highly selective together with a good output level. By careful 'shopping around' among the advertisers the complete radio may be built for under 20s; as usual less than twenty components are used



The Take 20 three transistor radio.

A FEW months ago our project was a one transistor radio which did not require an external aerial and operated a loudspeaker; however this design did have limitations—especially volume which was mentioned in the text. With Christmas just around the corner there must be many readers who would like to take advantage of their interest in electronics and knock up something for the children, and it was with this specifically in mind that this month's project was planned.

First, the radio had to have decent selectivity and volume, and as it is intended primarily for children it had to be able to get Radio Luxembourg well. The circuit had to be reliable and quickly built. (To this end three prototypes were built to ensure the circuit was reliable.) Building of the prototype shown in the photographs took under three hours including the cabinet. Also the radio had to have a presentable but cheap case.

The Circuit

There is nothing particularly unusual about the circuit. The first transistor acts as an r.f. amplifier with VR1 as its collector load. Positive r.f. feedback (regeneration) is taken from the slider of VR1 and connected via VC2 to the top of the aerial coil.

The r.f. signal is fed to the base of Tr2 which is biased in such a way as to detect the r.f. signal, the output is smoothed by C3. The audio output is d.c. connected to Tr3, the output transistor. The emitter resistor is bypassed by C4, the base bias for Tr2 being taken from this circuit via R3, 100kΩ. The 200μF capacitor, C5, decouples r.f. and a.f. from the positive rail.

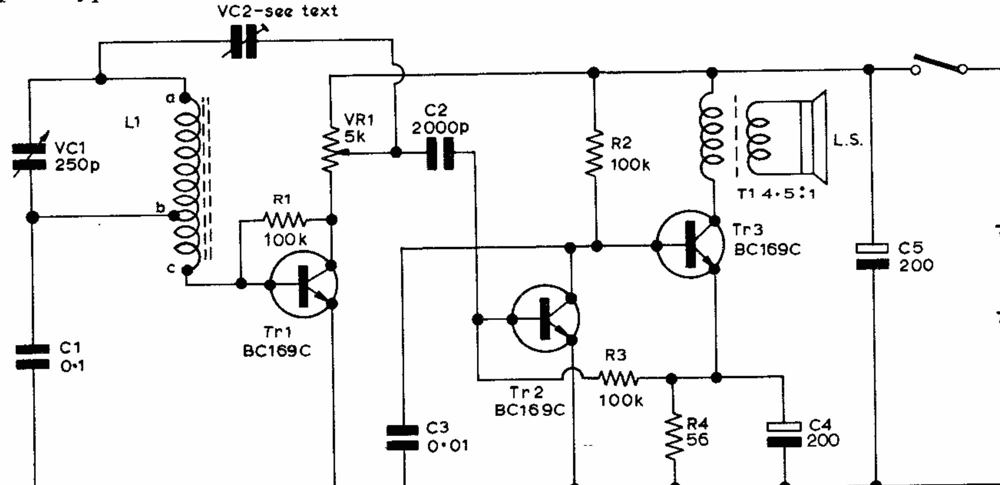


Fig. 1: The circuit of the three transistor radio.

Components

Care will have to be taken in the purchase of components to come within our 20s. maximum. Whereas aerial coils can be bought, it is far cheaper and very simple to wind your own. For this L1 should consist of about 70 turns and L2 of 5 turns on a four to six inch length of $\frac{3}{8}$in. or $\frac{1}{4}$in. ferrite rod. VC1 may be any type of tuning capacitor between 200pF and 350pF. For economy the loudspeaker should be a 6 × 4in. size removed from old TV sets.

Construction

All components apart from the speaker, VR1, VC1 and the battery are mounted on an eleven-way minia-

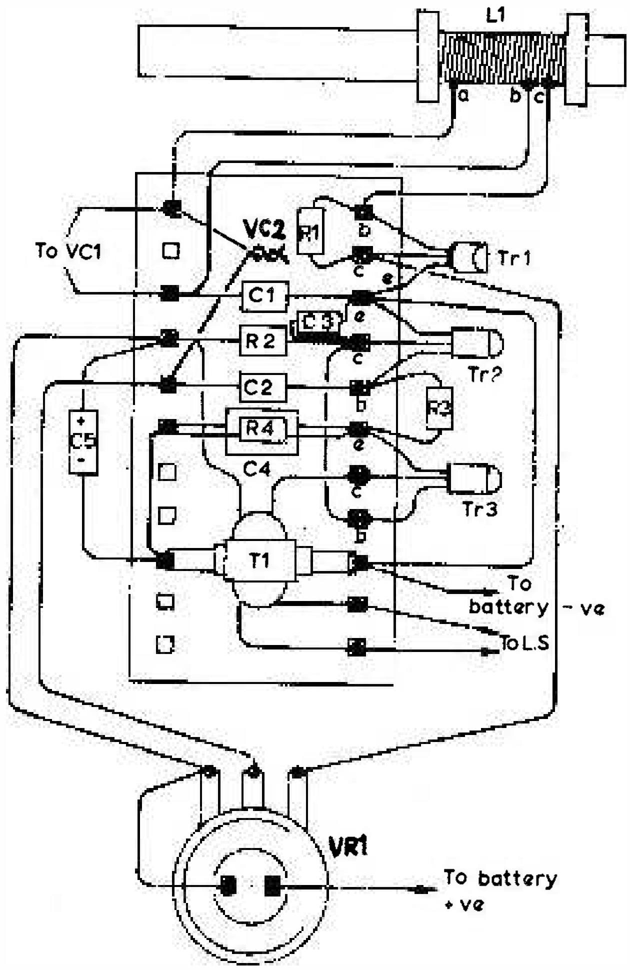


Fig. 2: The components are mounted on an eleven way tag-board. Compare this with the photograph.

ture tag board as shown in Fig. 2. The ferrite rod is secured to this board by tying one end to the top of the tag board as shown in the photograph.

The cabinet front is made from a piece of hard-board 9 × 5in. to which are fixed the sides made from $2\frac{1}{2} \times \frac{1}{2}$in. planed softwood. These sides should be glued and nailed together and nailed with hard-board pins to the side framework. Holes must of course be drilled for the speaker and the two controls. The tag board is held inside the case by making a small bracket, one end of which is bolted to one of the holes in the tag board and the other screwed to the inside of the case ensuring that the ferrite rod is not too close to the speaker magnet.

The cabinet front can be covered with speaker fabric or any reasonably strong material. This should be cut exactly to size and glued. The sides and the back of the cabinet are covered in self-adhesive plastic covering such as Fablon. The junction of the speaker fabric and plastic covering may be hidden by using black plastic tape.

★ components list

Resistors:

R1	100kΩ	R3	100kΩ
R2	100kΩ	R4	56Ω

All $\frac{1}{8}$ or $\frac{1}{4}$ watt, 10% miniature types
VR1 5kΩ log pot. with switch

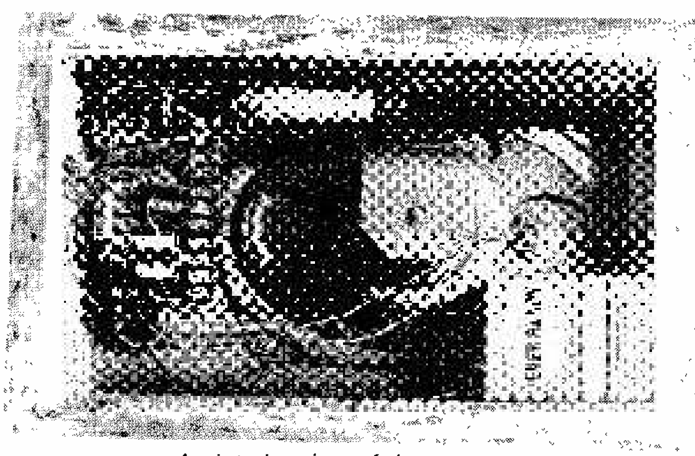
Capacitors:

C1	0·1μF	C4	200μF 9V
C2	2,000pF	C5	200μF 12V
C3	0·01μF		

VC1 250pF variable—see text
VC2 see text

Miscellaneous:

Tr1, Tr2, T3r BC169C; Ferrite rod with windings—see text; T1, transistor output transformer, approx. 4·5:1; Loudspeaker 3Ω; Battery PP7 or equivalent; Eleven-way tag board; Hardboard and softwood for case—see text; Speaker fabric; Self-adhesive plastic covering.



An interior view of the prototype.

Conclusion

Assuming everything has been wired up correctly the only adjustment is that of VC2 and this, being frequency selective, should be peaked so that the set just fails to break into oscillation on Radio Luxembourg. VC2 consists of two 1in. lengths of wire twisted together. Incidentally the gain of the first stage is so high that unless the general layout is carefully followed there is a danger of the set continually oscillating. Because of the fairly high capacitance of Veroboard it is not to be recommended for this particular project. ■

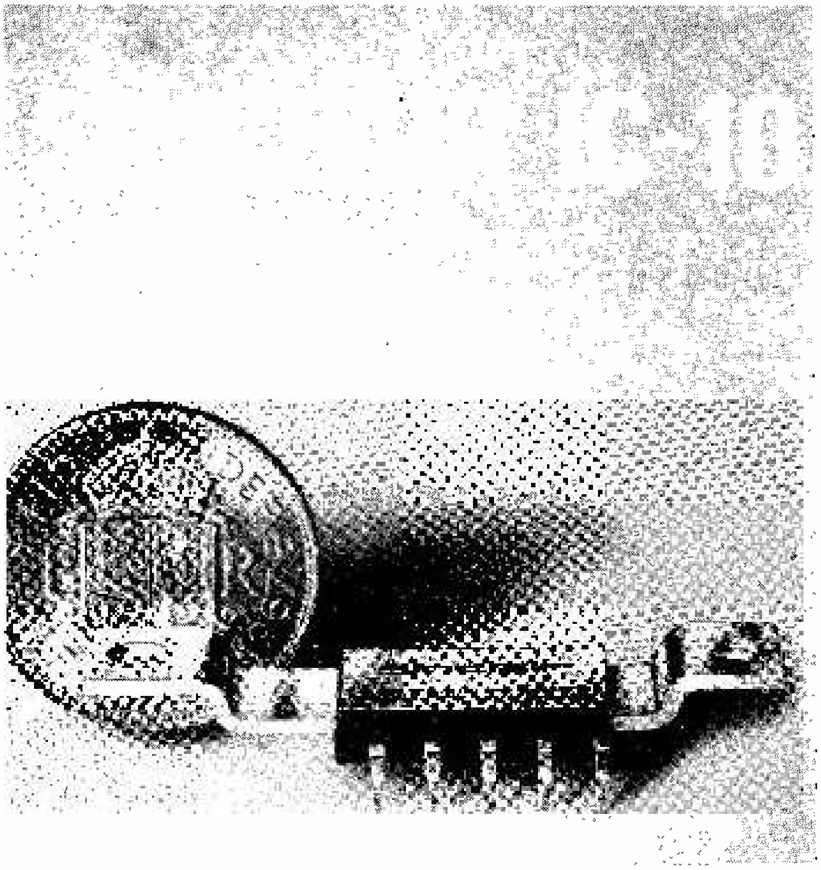
QUERY COUPON

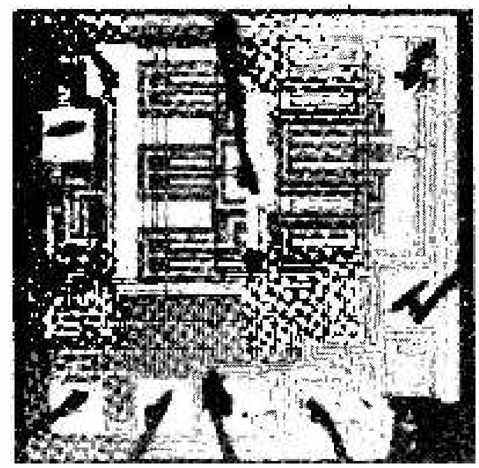
This coupon is available until 7th January, 1970 and must accompany all queries in accordance with the rules of our Query Service.
PRACTICAL WIRELESS, JANUARY 1970

Next month's *Take 20* article describes a small, cheap, transformerless amplifier. It provides between 750mW and 1W into a 3Ω loudspeaker.

Published approximately on the 7th of each month by IPC Magazines Limited, Tower House, Southampton Street, London, W.C.2. 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, Malawi 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 2s 0d.

MONOLITHIC INTEGRATED CIRCUIT HIGH FIDELITY AMPLIFIER AND PRE-AMP





the world's most advanced high fidelity amplifier

The Sinclair IC-10 is the world's first monolithic integrated circuit high fidelity power amplifier and pre-amplifier. The circuit itself, a chip of silicon only a twentieth of an inch square by a hundredth of an inch thick, has an output of 5 watts R.M.S. (10 watts peak). It contains 13 transistors (including two power types), 2 diodes, 1 zenor diode and 18 resistors, formed simultaneously in the silicon by a series of diffusions. The chip is encapsulated in a solid plastic package which holds the metal heat sink and connecting pins. This exciting device is not only more rugged and reliable than any previous amplifier, it also has considerable performance advantages. The most important are complete freedom from thermal runaway due to the close thermal coupling between the output transistors and the bias diodes and very low level of distortion.

The IC-10 is primarily intended as a full performance high fidelity power and pre-amplifier, for which application it only requires the addition of the usual tone and volume controls and a battery or mains power supply. However, it is so designed that it may be used simply in many other applications including car radios, electronic organs, servo amplifiers (it is d.c. coupled throughout) etc. The photographic masks required for producing monolithic I.Cs are expensive but once made, the circuits can be produced with complete uniformity and at very low cost. It also enables us to give a 5 year guarantee on each IC-10 knowing that every unit will work as perfectly as the original and do so for a lifetime.

■ SPECIFICATIONS

Output	10 Watts peak, 5 Watts R.M.S. continuous.
Frequency response	5 Hz to 100 KHz±1dB.
Total harmonic distortion	Less than 1% at full output.
Load impedance	3 to 15 ohms.
Power gain	110dB (100,000,000,000 times) total.
Supply voltage	8 to 18 volts.
Size	1 × 0.4 × 0.2 inches.
Sensitivity	5mV.
Input impedance	Adjustable externally up to 2.5 M ohms.

■ CIRCUIT DESCRIPTION

The first three transistors are used in the pre-amp and the remaining 10 in the power amplifier. Class AB output is used with closely controlled quiescent current which is independent of temperature. Generous negative feedback is used round both sections and the amplifier is completely free from crossover distortion at all supply voltages, making battery operation eminently satisfactory.

■ APPLICATIONS

Each IC-10 is sold with a very comprehensive manual giving circuit and wiring diagrams for a large number of applications in addition to high fidelity. These include stabilised power supplies, oscillators, etc. The pre-amp section can be used as an R.F. or I.F. amplifier without any additional transistors.

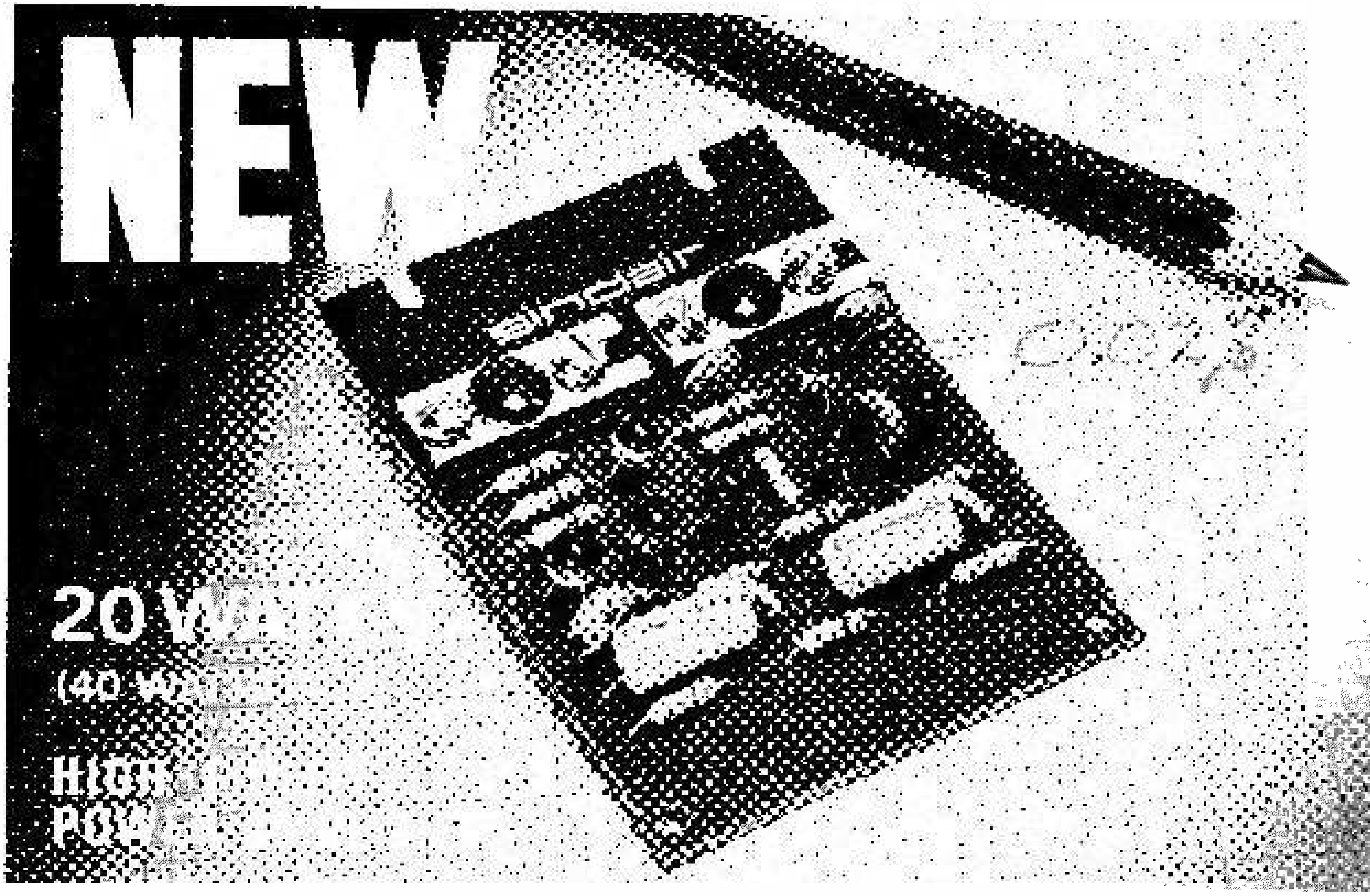
SINCLAIR

IC.10 *with IC.10 manual and 5 year guarantee* **59/6**

POST FREE

sinclair

SINCLAIR RADIONICS LIMITED
22 NEWMARKET ROAD · CAMBRIDGE
Tel. 0233-52731



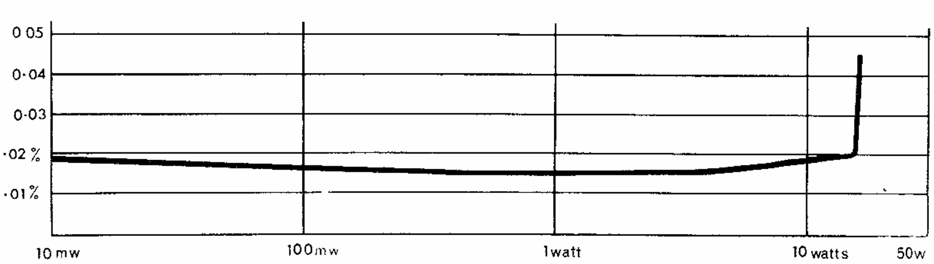
Z.30 THE WORLD'S LOWEST DISTORTION HIGH FIDELITY AMPLIFIER.

For four years, the Sinclair Z.12 dominated the constructor world, being the best selling unit of its kind this side of the Atlantic. Excellent as it was, the new Sinclair Z.30 is still better. Half the size of the Z.12, it has more than twice the power, very much greater gain and a level of distortion 50 times lower. This incredible figure results from using over 60dB of negative feed back with a constant current load to the driver stage obtained by incorporating a two transistor circuit in place of the more usual boot-strapping. 9 silicon epitaxial planar transistors are used to provide enormous power (up to 20 watts RMS continuous sine wave, 40 watts peak). The circuitry of this marvellous amplifier allows it to be operated from any voltage from 8 to 35 to perfection.

At all output levels, distortion is only 0·02%. This puts true laboratory standards into the hands of every user of a Z.30. Two Z.30s and a new Stereo Sixty will make a stereo assembly of such perfection that it could not be bettered in its class no matter how much you spent. But the Z.30 has an enormous variety of applications, particularly where quality, precision and reliability are essential. Yet this brilliant new Sinclair design costs not a penny more than its famous predecessor.

APPLICATIONS

Hi-fi amplifier; car radio amplifier; record player amplifier fed directly from pick-up; intercom; electronic music and instruments; P.A.; laboratory work, etc. Full details for these and many other applications are given in the manual supplied with the Z.30.



SPECIFICATIONS

Power output: 15 watts R.M.S. into 8 ohms using a 35 volt supply: 20 watts R.M.S. into 3 ohms using a 30 volt supply.

Output: Class AB.

Frequency response: 30 to 300,000Hz ± 1dB.

Distortion: 0·02% total harmonic distortion at full output into 8 ohms and at all lower output levels.

Signal-to-noise ratio: better than 70dB unweighted.

Input sensitivity: 250mV into 100 Kohms.

Damping factor: > 500.

Loudspeaker impedances: 3 to 15 ohms.

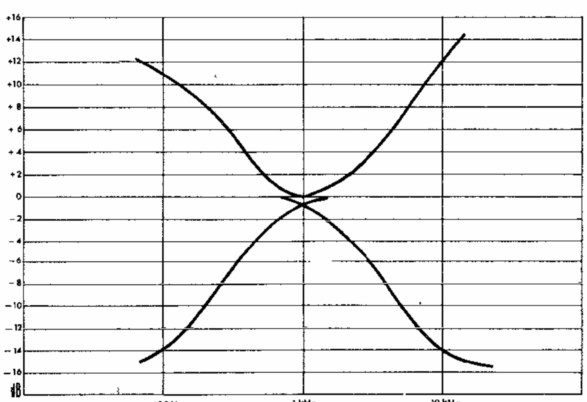
Power requirements: From 8 to 35V. d.c. (The Z.30 will operate ideally from batteries if required).

Size: $3\frac{1}{2} \times 2\frac{1}{4} \times \frac{1}{2}$ inches.

Built, tested and guaranteed, with circuits and instructions manual **89/6**

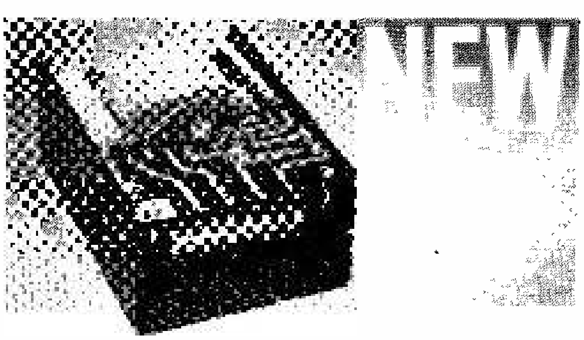
sinclair

SINCLAIR RADIONICS LIMITED
22 NEWMARKET ROAD, CAMBRIDGE Tel: 0223 52731



Curves to show bass and treble cut and boost

Ready built, tested and guaranteed with instructions **£9.19.6**



This attractive and completely new unit is intended for use with two new Z.30 amplifiers to provide the finest possible standards of stereo reproduction. Four press buttons and four rotary controls are used to provide on-off, three input selectors and Volume, Bass cut/boost, Treble cut/boost and Stereo balance. The on-off button also switches the power amplifiers. The front panel in brushed aluminium is flush mounted to the cabinet front, it being necessary only to drill holes to accommodate the controls. Rear adjustable brackets hold the chassis tight to the cabinet. The very latest ganged rotary controls are used to afford compactness and extra long working life free from noise.
The Stereo-60 may also be used with 2 IC-10's or any other high performance amplifiers.

SPECIFICATIONS

- Input sensitivities—Radio—up to 3mV Magnetic Pickup —3mV; correct to R.I.A.A. curve ± 1dB; 20 to 25,000 Hz. Ceramic Pickup—up to 3mV: Auxiliary —up to 3mV.
- Output—1 volt.
- Signal-to-noise ratio—better than 70dB.
- Channel matching—within 1dB.
- Tone Controls—TREBLE +15 to —15dB at 10kHz. BASS +15 to —15dB at 100Hz.
- Power consumption 5mA.
- Front panel—brushed aluminium with black knobs and controls.
- Size $8\frac{1}{4}$ x $1\frac{1}{2}$ x 4 ins.

PZ.5 POWER SUPPLY UNIT

A new heavy duty mains power supply unit designed specially to drive two Z.30s and a Stereo Sixty. New compact design. For AC Mains, 200-240V/50Hz. **£4.19.6**

Q.16 Loudspeaker and Micromatic on next page.

To: SINCLAIR RADIONICS LTD., 22 NEWMARKET RD., CAMBRIDGE
Please send

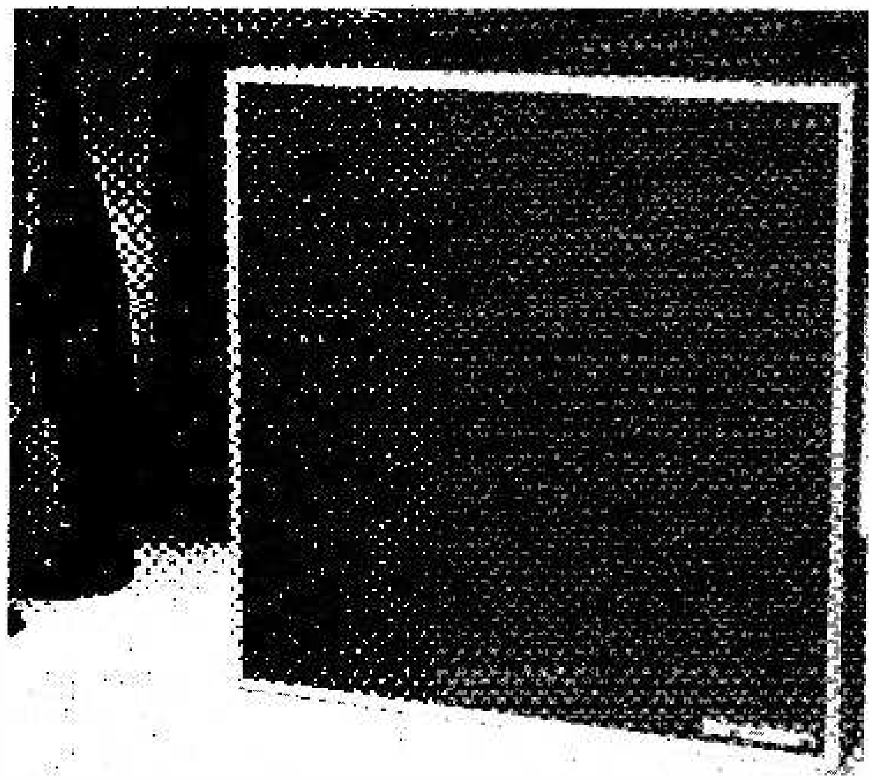
.... *NAME* ....
.... *ADDRESS* ....
....
....
For which I enclose cash/cheque/money order PW.170

sinclair

SINCLAIR

Q.16

new elegance in an outstanding loudspeaker



All the superb features which went to make the Sinclair Q.14 have been incorporated in the new Q.16 which gives an exciting new opportunity for you to match your Sinclair equipment with modern decor. Employing the same well proven acoustic system in which materials, processing and styling are used in such a radical and successful departure from conventional design, the new Q.16 presents an entirely new appearance with its attractive teak surround and all-over special cellular foam front chosen as much for its appearance as for its ability to pass all audio frequencies without loss. The Q.16 is compact and slim. Its new styling makes it eminently suitable for shelf mounting, but it is no less versatile than its famous predecessor. Listen to a pair of Q.16s in stereo and marvel at the standards of quality and clarity they give.

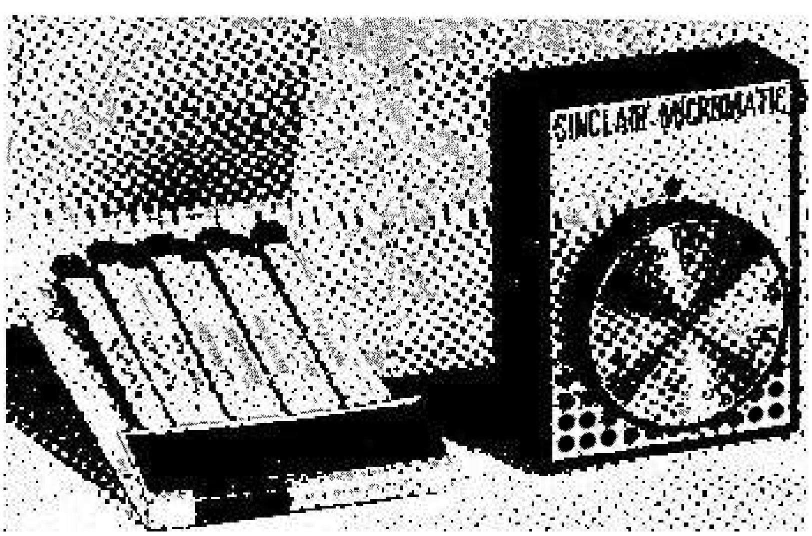
The Q.16 will handle loading up to 14 watts R.M.S. and presents an 8 ohm impedance to the amplifier output. Frequency response extends from 60 to 16,000Hz with exceptional smoothness. A specially designed driver system is used in a sealed and contoured pressure chamber to ensure good transient response at all frequencies. Size: $9\frac{3}{4}''$ square × $4\frac{3}{4}''$ deep from front to back.

£8.19.6

POST FREE

SINCLAIR MICROMATIC

The world's most successful miniature radio



SPECIFICATIONS—Size: $1\frac{13}{16}'' \times 1\frac{7}{16}'' \times \frac{1}{2}''$ (46×33×13mm). **Weight incl. batteries:** 1 oz. (28·35gm) approx. **Tuning:** Medium wave band with bandspread at higher frequency end. **Earpiece:** Magnetic type. **Case:** Black plastic with anodized aluminium front panel, spun aluminium dial.

Complete kit incl. earpiece, case, solder and instructions in fitted pack. **49/6**
Plus 11d. P.T. surcharge

Ready built, tested and guaranteed, with earpiece. **59/6**
Plus 1/1d. P.T. surcharge

Mallory Mercury Cell RM675 (2 req.) 2/9 each

To: SINCLAIR RADIONICS LTD., 22 NEWMARKET RD., CAMBRIDGE
Please send

....
....
....
....

For which I enclose cash/cheque/money order

NAME ....
ADDRESS ....
....
....
.... PW.170

Considerably smaller than an ordinary box of matches, this is a multi-stage A.M. receiver meticulously designed to provide remarkable standards of selectivity, power and quality. Powerful A.G.C. is incorporated to counteract fading from distant stations; bandspread at higher frequencies makes reception of Radio 1 easy at all times. Vernier type tuning plus the directional properties of the self-contained special ferrite rod aerial makes station separation much easier than with many larger sets. The plug-in magnetic earpiece which matches exactly with the output provides wonderful standards of reproduction.
Everything including the batteries is contained within the attractively designed case. Whether you build your Micromatic or buy it ready built and tested, you will find it as easy to take with you as your wrist-watch, and dependable under the severest listening conditions.

USE THIS COUPON FOR MICROMATIC AND Q.16 ORDERS

SINCLAIR GENERAL GUARANTEE

Should you not be completely satisfied 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

SINCLAIR RADIONICS LIMITED
22 NEWMARKET RD., CAMBRIDGE
Tel: 0223 52731

WIRECOMP ELECTRONICS

LONDON'S LEADING BARGAIN SPECIALISTS

FOR THE RADIO • HI-FI & ELECTRONICS ENTHUSIAST

Special displays of radios, recorders, record decks, tuners, amps., meters, speakers, etc., etc. ALL faulty or damaged needing repair—

AT GIVE AWAY PRICES!

100's of component bargains from our easy to see and choose from self service racks.

100's OF OLD TYPE VALVES — from 2/- each

ASSORTED TRANSISTORS 9d each. 7/6 per doz

Huge stocks of shop soiled and reconditioned second hand radios, record players, tape recorders, etc.

SPOT CASH PART EXCHANGES

WE OFFER THE HIGHEST RATES IN LONDON

There's something for everyone

COME AND LOOK TODAY *(Open 6 days a week!)*

ALL THESE ITEMS ARE AVAILABLE TO CALLERS ONLY

PERSONAL CALLERS TO:

48 TOTTENHAM CT. RD., W.1 Tel. 01-636 0647

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.

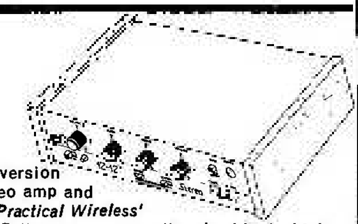
.... Please

1/70

BRITISH NATIONAL RADIO SCHOOL

BETTER Bargains Service FROM TRS

BUILD THIS FINE VERSION OF THE PW.12-12 WITH A TRS KIT



T.R.S. have produced their own kit version of this outstanding combined stereo amp and pre-amp. It conforms precisely to *Practical Wireless'* excellent circuit but is styled for a flatter, more conventional cabinet which will be available shortly. Kit includes two-tone front panel and control knobs, components and transistors.

Inputs—Mag. P.U. (R.I.A.A.) 2·5mV into 68 Kohms; Ceramic P.U. and Radio; Response 20Hz to 30KHz ±1dB. Output—12 watts per channel. R.M.S. into 15 ohms.

Kit complete, less cabinet **£24.10.0** (Carr. 7/6)

Power Amplifier & Pre-amp Kits available separately. S.A.E. brings list.

AMPLIFIERS

Styled and kitted by T.R.S., using quality components, including valves or transistors as necessary and excellent instructions. Backed by T.R.S. service.

MULLARD 5-10. Basic kit (requires pre-amp). Input Sensitivity—40mV; Response 20Hz–15KHz ±1dB; Output 10 watts R.M.S. at 3 or 15 ohms. KIT **£10.10.0.** BUILT **£13.0.0** (Carr. either, 7/6).

MULLARD 2 VALVE PRE-AMP. Switching for 5 inputs; bass/treble/volume controls, etc. Sensitivity at input—4mV max. into 80K–1 Megohm; Response 20–25,000Hz ±1dB. KIT **£6.19.6.** BUILT **£9.10.0** (Carr. either 5/6).

MULLARD 10-10 STEREO AMPLIFIER. Input sensitivity—210mV per channel; Response 12Hz–35KHz ±3dB; 10 watts R.M.S. output per channel into 3 or 15 ohms. KIT **£18.10.0.** BUILT **£22.10.0** (Carr. either 12/6).

Basic Kit (no panel or controls) **£17.0.0.** Built **£21.0.0.** Pre-amp must be used here.

MULLARD 2+2 STEREO PRE-AMP with same characteristics per channel as mono pre-amp (+ balance). BUILT **£13.19.6** (Carr. 7/6).

T.R.S. 4×4 ECONOMY STEREO. Modular assembly. With cabinet power supply and Din plugs **£12.10.0** (Carr. 7/6).

SINCLAIR PRODUCTS AS ADVERTISED

TUNERS

T.R.S. 6 VALVE AM/FM. Self-powered, large scale; push-buttons. Magic eye. Med. Wave and F.M. Diode output per tape. COMPLETE KIT **£12.10.0** (Carr. 7/6).

T.R.S. FM TUNER. Transistors, inter-station suppression, A.F.C. etc. Modular assembly. Modules, chassis, drive etc. come to **£15.15.0** (Carr. 7/6)

Cabinet to match T.R.S.4+4	**£1.17.6** (Carr. 2/6)
Power supply	**£2.5.0** (Carr. 3/-)
Decoder for Stereo	**£10.10.0** (Carr. 2/6)

GRAMO UNITS & PLINTHS

GARRARD SP.25 MK. II. Manual: Arm and 10½in. die-cast t/table, cueing device, etc. less cartridge. Brand new in maker's carton **£12.7.6.**

GARRARD LM.2025. With Sonotone 9TA/HC Stereo Cartridge and lift control

control	**£10.19.6** (Carr. 7/6)
Garrard WB.1 Plinth	**£3.7.6** (Carr. 5/-)
Garrard CLEARVIEW Cover SCP.1	**£3.5.0** (Carr. 4/6)
Garrard Scandinavian Type Plinth	**£5.5.0** (Carr. 5/-)

ALWAYS IN STOCK

Resistors in all values; wire-wound resistors; volume controls log or linear, 10K–2meg. Mono **3/6** (with switch **5/-**). Stereo **8/6** (with switch, certain values **10/6**). Log/antilog balance controls, capacitors and electrolytics; Vinair speaker covering 48in.—**22/6** yd; Bondacoust 48in. x 1in. thick 7/- yd.; Veroboard; Cir-Kit; valves; transistors. S.A.E. with enquiries please.

TRS

**RADIO COMPONENTS
70 BRIGSTOCK ROAD,
THORNTON HEATH,
SURREY**

Open Sats. Close early Weds. • *½ min. Thornton Heath Stn. (Southern)* • Phone: 01-684 2188

BI-PRE-PAK LTD

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

FULLY TESTED AND MARKED

AC107	3/-	OC170	3/-
AC126	2/6	OC171	4/-
AC127	2/6	OC200	3/6
AC128	2/6	OC201	7/-
AC176	5/-	2G301	2/6
ACY17	3/-	2G303	2/6
AF114	4/-	2N1302-3	4/-
AF115	3/6	2N1304-5	5/-
AF116	3/6	2N1306-7	6/-
AF117	3/6	2N1308-9	8/-
AF239	12/6	2N3819 FET.	9/-
AF186	10/-	2N3844A	5/-
AF139	10/-	**Power**	
BFY50	4/-	**Transistors**	
BSY25	7/6	OC20	10/-
BSY26	3/-	OC23	10/-
BSY27	3/-	OC25	8/-
BSY28	3/-	OC26	5/-
BSY29	3/-	OC28	7/6
BSY95A	3/-	OC35	5/-
OC41	2/6	OC36	7/6
OC44	2/6	AD149	10/-
OC45	2/6	AUY10	30/-
OC71	2/6	2N3055	15/-
OC72	2/6	**Diodes**	
OC73	3/6	AAY42	2/-
OC81	2/6	OA95	2/-
OC81D	2/6	OA70	1/9
OC83	4/-	OA79	1/9
OC139	2/6	OA81	1/9
OC140	3/6	IN914	1/6

FREE! Packs of your own choice up to the value of 10/- with orders over £4.

NEW UNMARKED UNTESTED PAKS

B78	12	Integrated Circuits, Data and Circuits of types, supplied with orders.	10/-
B80	8	Dual Trans. Matched O/P pairs NPN. Sil. in TO-5 can.	10/-
B82	10	OC45, OC810 and OC81 Trans. Mullard glass type.	10/-
B83	200	Trans. Makers rejects. NPN/PNP. Sil. and Germ.	10/-
B84	100	Silicon Diodes DO-7 glass equiv. to OA200, OA202.	10/-
B66	150	High quality Germ. Diodes. Min glass type.	10/-
B86	50	Sil. Diodes sub. min. IN914 and 1N916 types.	10/-
B87	100	Germ. PNP Trans. equiv. to OC44, OC45, OC81, etc.	10/-
B88	50	Sil. Trans. NPN, PNP, equivalent to OC200/1, 2N706A, BSY95A, etc.	10/-
B60	10	7 Watt Zener Diodes. Mixed voltages.	10/-
H5	16	1 Amp. Plastic Diodes. 50-1,000 Volts.	10/-
H6	40	250mW. Zener Diodes DO-7 min. Glass Type.	10/-

NEW TESTED AND GUARANTEED PAKS

B2	4	Photo Cells, Sun Batteries ·3 to ·5 volt, ·5 to 2ma.	10/-
B77	2	AD161-AD162 NPN/PNP Trans. Comp. Output. Pair	10/-
B79	4	IN4007 Sil. Rec. Diodes. 1,000 P.I.V. 1 amp. Miniature.	10/-
B81	10	Reed Switches, mixed types, large and small.	10/-
B89	2	5SP5 Light Sensitive Cells. Light Res. 400Ω Dark 1MΩ	10/-
B91	8	NKT163/164 PNP Germ. TO-5 equivalent to OC44, OC45.	10/-
B92	4	NPN. Sil Trans. AO6 = BSX20, 2N2369 500 MHz, 360mW.	10/-
B93	5	GET113 Trans. equiv. to ACY17 to ACY21 PNP Germ.	10/-
B96	5	2N3136 PNP Sil. Trans. TO-18, HFE 100-300 I.C. 600mA. 200 MHz.	10/-
B98	10	XB112 and XB102 equiv. to AC126, AC156, OC81/2, OC71/2, NKT271, etc.	10/-
B99	200	Capacitors, Electrolytics, paper silver mica, etc. Post and packing, this Pak 2/6.	10/-
H4	250	Mixed Resistors. Post and packing 2/-.	10/-
H7	40	Wirewound Resistors. Mixed Values. Postage 1/6.	10/-

RETURN OF THE UNBEATABLE P.1, PAK. NOW GREATER VALUE THAN EVER

Full of short lead semiconductors and electronic components, approx. 170. We guarantee at least 30 really high quality factory marked Transistors PNP and NPN, and a host of diodes and rectifiers. Mounted on printed circuit panels. Identification chart supplied to give some information on the transistors.

P1 PLEASE ASK FOR PAK P.1. 2/- P & P on this Pak. ONLY **10/-**

Complementary Set. NPN/PNP Germ. trans., Pak F.3 **2/6** PAIR

MULLARD DATA BOOK Semiconductor & Valve Data & equivalents. Postage 6d. **3/6** EACH

★ **ALL OUR TESTED SEMICONDUCTORS HAVE A WRITTEN GUARANTEE** ★

SEND FOR OUR **FREE** LISTS AND CATALOGUE OF ALL OUR PRODUCTS. CHECK YOUR OWN EQUIVALENT WITH OUR FREE SUBSTITUTION CHART.

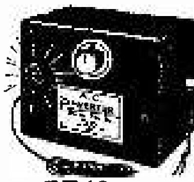
NO CONNECTION WITH ANY OTHER FIRM. MINIMUM ORDER 10/-, CASH WITH ORDER PLEASE. Add 1/- post and packing per order OVERSEAS ADD EXTRA FOR AIRMAIL.

MAINS UNITS for all types of TRANSISTOR EQUIPMENT

The ideal, economical and safe way of running Transistor Radios, Record Players, Tape Recorders, Amplifiers etc. from A.C. Mains. All units are completely isolated from mains by double wound transformer ensuring 100% safety.

PLUS-3

MAINS UNIT



Provides three separate switched output voltages 6v., 7½v. and 9v. DC. attractive case with indicator light, mains lead output socket, plug and lead. Size 4¼ x 3½ x 2¼ in. **57/6** P. & P. 2/6
(Extra lead with DIN plug for Cassette Recorders 7/6)

POWER PLUS

MAINS UNIT

for Cassette Tape Recorders using 7½v. Complete with DIN plug for recorder power socket. Can also be supplied for a 6-volt output complete with suitable plug. (Please state make, model and voltage required.)

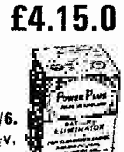
45/- P. & P. 2/6

Also available—Unit to run your Cassette Recorder from 12v. Car Battery 32/6. P. & P. 2/6.

MAINS UNIT for FI-CORD 202A TAPE RECORDER P. & P. 5/-. **£4.15.0**

MAJOR POWER PLUS

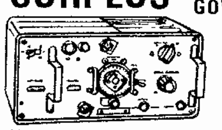
MAINS UNITS



For single outputs, 6v, 9v, 12v, 18v, 39/6. For two separate outputs, 4½v + 4½v, 6v + 6v., 9v + 9v. 42/6. P. & P. 2/6 per unit. *(Please state outputs reqed).*

R.C.S. PRODUCTS (RADIO) LTD.
(Dept. P.W.), 31 Oliver Road, London, E.17

SURPLUS EX GOVT. BARGAINS

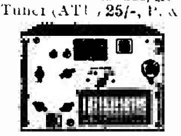


AMPLIFIER RF NO. 2 MK III. Increases output of 19 set to 25 watts. Brand New. 12v operation. **75/-**, Carr. 15/-.

No. 19 Sets and Ancillary Equipment available, 12v D.C. Power Units **50/-**, Carr. 10/-.

12024 WILL VIBRATOR MK II No. 2. 70/-, Carr. 10/-.

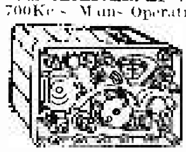
H/MIC SETS. Used **15/-**, New **22/6**, P. & P. 5/-. Mains P.S.U.'s for 19 TM/RC **£6.15.0**, Carr. 10/-. R.F. Antenna Tuner (ATU) **25/-**, P. & P. 5/-.



COLLINS TCS RECEIVER 7 valve Int. Octal Covers 1·5–12 Mc/s Tuneable RF.AF.BFO. Power required 240v D.C. 80 MA 12v 1·25A. **£8.10.0.** Carr 15/-.

CR100 RECEIVERS. Amateur Shipping Broadcast. 60Kc/s–30Mc/s AC or DC. Mains operation. Fully tested. **£23.10.0**, Carr. 50/-.

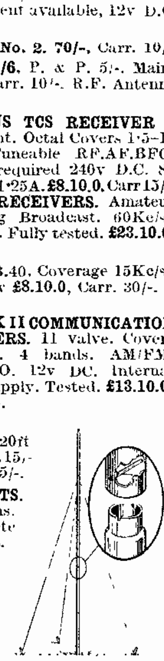
B.41 RECEIVER. LF Version of B.40. Coverage 15Kc/s–700Kc/s Mains Operation. As new **£8.10.0**, Carr. 30/-.



R.209 MK II COMMUNICATION RECEIVERS. 11 valve. Covers 1–20Mc/s. 4 bands. AM/FM. CW. BFO. 12v DC. Internal Power Supply. Tested. **£13.10.0**, Carr. 15/-.

TELESCOPIC MASTS. 20ft Closes to 5ft.9in. **70/-** Carr. 15/- 34ft. Ditto **80/-**, Carr. 15/-.

35FT. AERIAL MASTS. Seven 2in. dia. sections. Interlock 8in. Complete with base, Nylon Guys. **£12.10.0**, Carr. 50/-.



TELE 'F' FIELD TELEPHONES. Communication up to 10 miles. Tested with batteries. **£5.15.0**, Carr. 20/-.

LIVINGSTONE LAB TRANSISTOR AMPLIFIER. 50 watts R.M.S. Size 14½ 9 4in With mains p.s.u. Size 16 9½ 6½in 22 Gns. Carr 20/-

A.J. THOMPSON (Dept. P.W.)

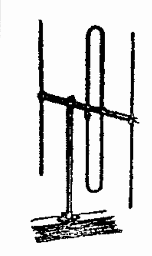
"Eiling Lodge", Codicote, Hitchin, Herts.
Phone: Codicote 242

C.W.O. Carriage charges apply to mainland only.

NEW RANGE BBC 2 AERIALS

All U.H.F. aerials now fitted with tilting bracket and 4 element grid reflectors. **Loft Mounting Arrays,** 7 element, **37/6.** 11 element, **45/-.** 14 element, **52/6.** 18 element, **60/-. Wall Mounting** with **Cranked Arm,** 7 element. **60/-.** 11 element, **67/-.** 14 element, **75/-.** 18 element, **82/6. Mast Mounting** with 2in. clamp. 7 element. **42/6.** 11 element, **55/-.** 14 element, **62/-.** 18 element. **70/-. Chimney Mounting Arrays, Complete.** 7 element, **72/6.** 11 element, **80/-.** 14 element, **87/6.** 18 element, **95/-.** Complete assembly instructions with every unit. **Low Loss Cable, 1/6** yd. **U.H.F. Preamps** from **75/-.** State clearly channel number required on all orders.

BBC · ITV AERIALS



BBC (Band 1). Telescopic loft, **25/-.** External S/D. **30/-.** "H" **£2.15.0. ITV (Band 3).** 3 element loft array, **30/-.** 5 element, **40/-.** 7 element **50/-.** Wall mounting. 3 element. **47/6.** 5 element. **52/6. Combined BBC/ITV.** Loft 1+3, **40/-;** 1+5, **50/-;** 1+7, **60/-;** Wall mounting 1+3, **57/6;** 1+5, **67/6;** Chimney 1+3, **67/6;** 1+5, **75/-. VHF** transistor preamps, **75/-.**

COMBINED BBC1 — ITV — BBC2 AERIALS 1+3+9, **70/-.** 1+5+9, **80/-.** 1+5+14, **90/-.** 1+7+14, **100/-.** Loft mounting only. Special leaflet available.
F.M. (Band 2). Loft S/D, **15/-.** "H", **32/6.** 3 element, **55/-.** External units available. Co-ax. cable **8d.** yd. Co-ax. plugs, **1/4.** Outlet boxes, **5/-.** Diplexer Crossover Boxes, **13/6.** C.W.O. or C.O.D. P. & P. 6/-. Send 6d. stamps for illustrated lists.

Callers welcomed – open all day Saturday

K.V.A. ELECTRONICS (Dept. P.W.)
40-41 MONARCH PARADE
LONDON ROAD, MITCHAM,
SURREY 01-648 4884

COMET Hi-Fi DISCOUNT WAREHOUSE

- ALL ITEMS OFFERED ARE FULLY GUARANTEED AND BACKED BY COMET.
- OPEN TO THE PUBLIC 9 to 5.30 p.m. daily (8 p.m. Thursday and Friday evenings) and 5 p.m. Saturdays.
- COMPLETE FREE PRICE LIST CONTAINING OVER 800 ITEMS ON REQUEST.

AMPLIFIERS

	Rec. Retail Price	Comet Price
ARENA 210 Amplifier ..	£34 13 0	£28 0 0
ARMSTRONG 521 25 watts per channel	£52 0 0	£44 0 0
DULCI 207 Stereo Amplifier	£25 0 0	£17 0 0
DULCI 207M Stereo Amplifier takes magnetic P/U ..	£30 0 0	£20 19 0
GOODMANS Maxamp ..	£54 0 0	£41 19 6
New LEAK Stereo 30 Plus ..	£53 0 0	£43 19 6
New LEAK Stereo 30 Plus in teak case	£59 10 0	£47 19 6
New LEAK Stereo 70 ..	£63 0 0	£49 19 6
New LEAK Stereo 70 Plus in teak case	£69 10 0	£54 19 6
LEAK Stereo 70 in Teak case	£69 10 0	£54 49 6
LINEAR LT.66 Stereo Amplifier	£18 18 0	£13 19 6
QUAD 33 Pre-amplifier ..	£43 0 0	£35 19 6
QUAD 303 Stereo Main Amplifier	£55 0 0	£46 19 6
ROGERS Ravensbourne 50 watt Stereo	£59 10 0	£48 19 6
ROGERS Ravensbourne in Teak case	£64 0 0	£52 13 6
ROGERS Ravensbrook ..	£44 0 0	£36 19 6
ROGERS Ravensbrook in Teak case	£49 0 0	£38 19 6
TELETON 203E ..	£28 7 6	£20 15 6
TRUVOX TSA.200 ..	£54 12 0	£39 19 6

TUNERS

	Rec. Retail Price	Comet Price
ARENA 211 Stereo with decoder	£39 10 0	£33 19 6
ARMSTRONG 523 FM ..	£52 9 0	£44 19 6
ARMSTRONG 524 FM ..	£40 4 6	£34 19 6
ARMSTRONG M8 Stereo decoder	£9 10 0	£7 19 6
DULCI FMT.7 FM Tuner ..	£22 1 0	£17 19 6
DULCI FMT.7S FM Stereo Tuner	£31 0 0	£25 5 0
GOODMANS Stereomax AM/FM Stereo Tuner	£82 10 5	£71 19 6
LEAK Troughline Tuner with multiplex	£51 10 6	£39 19 6
LEAK Stereofetic Chassis form	£56 11 0	£45 19 0
LEAK Stereofetic in Teak case	£64 14 4	£52 19 6
QUAD Stereo FM	£51 0 0	£44 19 6
ROGERS Cadet Mark III Tuner	£20 12 6	£17 13 0
ROGERS Ravensbourne Tuner with Decoder ..	£61 17 9	£52 12 6
TRUVOX FM 200/IC with decoder	£60 11 10	£45 19 0

TUNER-AMPLIFIERS

	Rec. Retail Price	Comet Price
ARENA 2400 with Decoder ..	£90 6 0	£69 19 6
ARENA 2500 complete with Decoder	£97 0 0	£79 0 0
(NEW) GOODMANS Model 3000 with stereo decoder ..	£77 14 7	£66 19 6
ARMSTRONG 525 25 watts per channel. FM	£87 16 9	£74 19 6
ARMSTRONG 526 25 watts per channel. AM/FM ..	£98 15 6	£85 19 6
ARMSTRONG 127	£43 19 9	£37 19 6
(Teak Case for 127)	£3 17 0	£3 10 0
TANDBERG Solv Super 10/71 Tuner/Amplifier AM/FM and 2 short wavebands ..	£75 18 0	£65 18 0
TELETON MX.990 Stereo Tuner/Amplifier with AM/FM Multiplex Stereo Radio c/w two Speakers, each Speaker containing 8in. bass, 2in. tweeter	£64 13 2	£48 19 6
TELETON F.2000 AM/FM Stereo Tuner/Amplifier 2 x 5 watts RMS with silicon transistors	£51 0 0	£37 19 6
TELETON R.8000 AM/FM Stereo Tuner/Amplifier 2 x 6 watts RMS, complete with 2 speaker boxes	£60 19 6	£49 19 6
TELETON CMS.400 AM/FM Multiplex Tuner/Amplifier with 2 speaker boxes and turntable	£126 0 0	£99 0 0
TELETON 7ATI Stereo Tuner/Amplifier AM/FM 50 watts RMS, Stereo Decoder and F.E.T.	£133 0 0	£95 0 0

THE GOODMAN 3000 MUSIC AUDIO SUITE
A complete Audio Suite with Stereo Radio complete with Speakers, Turntable and magnetic cartridge. All wired and ready to go. Beautifully finished in Teak.
£140 9 0 **£115 9 4**

CARTRIDGES ALL MAKES STOCKED AT DISCOUNT PRICES

SPEAKERS

	Rec. Retail Price	Comet Price
BOWERS & WILKINS DM3 A and W..	£63 0 0	£53 6 0
BOWERS & WILKINS DM3 M	£69 10 0	£58 16 0
BOWERS & WILKINS P2H ..	£94 10 0	£81 5 6
CELESTION Ditton 10 ..	£21 3 2	£17 5 0
CELESTION Ditton 15 ..	£31 3 7	£25 19 6
DULCI AS3 Speaker	£8 8 0	£6 19 6
GOODMANS Maxim ..	£20 7 9	£15 19 6
GOODMANS Mezzo II ..	£30 18 0	£24 19 6
GOODMANS Magnum-K ..	£40 2 0	£32 19 6
GOODMANS Mirimba ..	£24 0 1	£19 19 6
GOODMANS Mambo ..	£22 5 6	£18 11 9
GOODMANS Loudspeaker System Model 2005 (per pair)	£25 0 0	£21 0 0
KEF Celeste	£29 0 0	£23 19 6
KEF Concord	£43 10 0	£34 19 6
LEAK Sandwich	£43 10 0	£34 19 6
LEAK Mini-Sandwich ..	£29 15 0	£23 19 6
QUAD Electrostatic	£66 0 0	£57 19 6
TRUVOX LS 200 ..	£22 7 3	£17 19 6
WHARFEDALE New Airedale	£69 10 0	£57 14 0
WHARFEDALE Denton ..	£18 0 0	£13 19 6
WHARFEDALE Super Linton	£21 10 0	£17 19 6
WHARFEDALE Melton ..	£29 10 0	£23 19 6
WHARFEDALE New Dovedale 3	£39 10 0	£31 19 6
WHARFEDALE Rosedale ..	£55 0 0	£43 19 6
WHARFEDALE UNIT 3 Speaker Kit	£10 19 6	£8 19 6

Most types of chassis, speakers, cross-over networks, etc., available ex stock.

TURNTABLES

	Rec. Retail Price	Comet Price
GARRARD SP.25, Mark II ..	£15 11 4	£11 19 6
GARRARD AP.75	£23 16 0	£16 19 6
GARRARD SL.55	£13 17 9	£11 12 6
GARRARD SL.65	£19 6 5	£14 9 6
GARRARD SL.75	£35 12 5	£25 19 6
GARRARD SL.95	£45 9 1	£33 19 6
GARRARD 401	£31 14 2	£26 10 0
GARRARD 3000 fitted with GKS 25/Cartridge	£13 18 3	£9 19 6
GARRARD 3500 fitted with GKS 25/Cartridge	£15 15 0	£10 19 6
GOLDRING GL69	£25 1 6	£21 5 0
GOLDRING 69P	£33 11 9	£28 19 6
GOLDRING Lenco GL.75 ..	£36 8 2	£27 19 6
GOLDRING 75P inc. cover ..	£46 18 8	£30 0 0
GOODMANS Model 3025 Complete with magnetic Cartridge	£37 14 9	£32 19 6
THORENS TD.125	£69 11 2	£53 19 6
THORENS TD.150A Mark II	£41 14 9	£32 19 6
THORENS TD.150AB Mark II	£45 10 7	£34 19 6
THORENS TD.124/11.. ..	£46 15 10	£42 0 0

Bases, plinths and covers stocked to suit all the above turntables.

HI-FI STEREO TAPE DECKS AND TAPE RECORDERS

	Rec. Retail Price	Comet Price
AKAI X-360 4-track	£339 0 0	£284 0 0
AKAI X-360D deck 4-track ..	£290 0 0	£243 0 0
AKAI 1710 4-track without accessories	£109 0 0	£89 19 6
AKAI 1800 4-track	£158 0 0	£133 0 0
AKAI 1800SD 4-track.. ..	£199 0 0	£167 0 0
AKAI 4000D deck 4-track ..	£87 10 0	£75 10 0
FERGUSON 3324 Twin Track	£33 14 0	£24 19 6
FERGUSON 3226 Four Track	£46 6 0	£29 19 6
GRUNDIG TK 124	£41 18 6	£36 19 6
GRUNDIG TK 144	£47 13 1	£39 19 6
GRUNDIG TK 149	£55 18 10	£47 19 6
MARCONI 4218 Stereo Tape Recorder	£89 11 2	£69 19 6
MARCONI 4238 4-track Tape Recorder	£58 11 0	£49 19 6
PHILIPS battery operated tape recorder Model 4200 ..	£35 6 0	£21 19 6
TELETON 7D 70 Stereo Tape Deck	£85 10 3	£62 0 0
TELETON FXB501D Stereo Tape Deck and preamplifier	£65 0 0	£49 0 0
TELETON 401X FM Multiplex stereo tuner/amplifier 20 watts RMS	£67 2 6	£49 0 0
TRUVOX R52 & R54 3-speed 2-track	£77 5 1	£52 2 0
TRUVOX PD Stereo Tape Deck	£114 15 3	£79 0 0

PICKUP ARMS

	Rec. Retail Price	Comet Price
GOLDRING Lenco L75 ..	£12 6 6	£10 10 0
GOLDRING Lenco G65 ..	£7 13 6	£6 10 0
SME 3009 with S2 shell ..	£31 6 3	£24 19 6
SME 3012 with S2 shell ..	£33 7 3	£26 19 6

COMET DISCOUNT WAREHOUSE

Reservoir Road, Clough Road, Hull. Tel 407906
68a Armley Rd (Artist St) Leeds LS12 2EF Tel 32055

Customers are welcome to call personally
Ample Car Parking facilities

Comet guarantee that all prices quoted are genuine. All items offered available at these prices at the time this issue closed for press.
Add 9/- for post and packing on all orders. Make cheques, Money Orders payable to "COMET".

15/20 AMP CONNECTORS
Polythene insulated 12-way strip. **2/6** each, **24/-** per doz.

13 AMP FUSED SWITCH
Made by G.E.C. For connecting water heater, etc., into 13 amp ring mains. Flush type 3/6 each, 30/- per doz.

MICRO SWITCH
5 amp changeover contacts **1/9** each, **18/-** per doz.

0·0005mFd TUNING CONDENSER
Proved design, ideal for straight or reflex circuits **2/6** each. **24/-** doz.

ELLIOT SEALED CONTACT REED RELAY
Three circuits closed by 3V or 100MA. **9/6** each.

SLIM TUBULAR MICROPHONE
For hand holding or frontal suspension—lever switch—high impedance with lead and plugs for cassette tape recorder but suitable for most amplifiers. **19/6**.

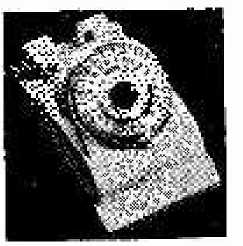
750 MICRO AMP MOVING COIL METER
2¼in. ex W.D. but brand new and unused **19/6**.

HIGH CAPACITY ELECTROLYTICS
Brand new, not ex equipment.
100 mfd 25v, **1/3** each, **12/-** doz.
200 mfd 25v, **1/6** each, **15/-** doz.
500 mfd 12v, **2/-** each, **£1.1.0** doz.
1,000 mfd 12v, **3/-** each, **£1.10.0** doz.
5,000 mfd 12v, **4/9** each, **£2.8.0** doz.
10,000 mfd 6v, **5/9** each, **£3.0.0** doz.
10,000 mfd 15v, **8/6** each, **£4.10.0** doz.
15,000 mfd 10v, **10/6** each, **£5.0.0** doz.
60,000 mfd 8v, **22/-** each, **£10.0.0** doz.
70,000 mfd 13v, **40/-** each, **£20.0.0** doz.

TOGGLE SWITCH
3 amp 250v with fixing ring, **1/6** each, **15/-** doz.

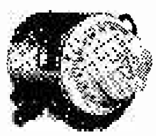
3-CORE WATERPROOF FLEX
6A, 23/0076 circular PVC covered as fitted to electric drills and most portable appliances, ideal extension lead. Regular price 1/6 per yard, our price **79/6** for 100 yard coil. Post 6/6.

5A, 3 PIN SWITCH SOCKETS
An excellent opportunity to make that bench dis board you have needed or to stock up for future jobs. This month we offer 6 British made (Hicraft) bakelite flush mounting shuttered 5A switch sockets for only **10/-** plus 3/6 post and insurance. (20 boxes post free).

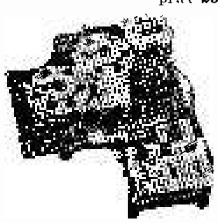


DREAMLAND CLOCK SWITCH
The wonderful DREAMLAND mains operated clock switch will automatically switch your blanket on and off each evening and you will always have a warm bed. It's luminous; you can always see the time and it's a really beautiful unit. An ideal gift. Can also control tape recorder, radio, lamp, etc., up to 500 watts. **39/6** plus 3/6 post & ins.

PROTECT VALUABLE DEVICES FROM THERMAL RUNAWAY OR OVERHEATING: Thyristors, rectifiers, transistors, etc., which use heat-sinks can easily be protected. Simply make the contact thermostat part of the heat-sink. Motors and equipment generally, can also be adequately protected by having thermostats in strategic spots on the casing. Our contact thermostat has a calibrated dial for setting between 90deg. to 190deg.F. or with the dial removed range setting is between 80 to 800deg. F. Price **10/-**.



Horstmann "Time and Set" Switch
(A 15 amp Switch). Just the thing if you want to come home to a warm house without it costing you a fortune. You can delay the switch on time of your electric fires, etc., up to 14 hours from setting time or you can use the switch to give a boost period of up to 3 hours. Equally suitable to control processing. Regular price probably around £5. Special snip price **29/6**, p. & ins. 4/6.



BATTERY OPERATED TAPE DECK
With Capstan control. This unit is extremely well made and measures approx. 6 × 5 × 2in. deep. Has three piano key type controls for Record, Playback and Rewind. Motor is a special heavy duty type intended for operation off 4/5 volts. Supplied complete with 2 spools ready to install. Record, Replayhead is the sensitive M4 type intended for use with transistor, amplifier. Price **79/6**. Post and insurance 4/6.

Where postage is not stated then orders over £3 are post free. Below £3 add 2/9. Semi-conductors add 1/- post. Over £1 post free. S.A.E. with enquiries please.

INSTRUMENT MOTORS WITH GEARBOX
Made by famous Smiths Company. Very powerful, although only quite small. Overall dimensions approx. 1½in. deep by 2in. dia. Available with the following speeds: Revs per day, 2-8-12. Revs per hour, 1,2,4,6,12,20,30. Revs per minute, 1,2,3,4,6, 8,15,30,60. **17/6** each.

BLANKET SWITCH
Double pole with neon let into side so luminous in dark, ideal for dark room light or for use with waterproof element—new plastic case. **5/6** each. 3 heat model **7/6**.

PHOTO-ELECTRIC KIT
All parts to make light operated switch/burglar alarm/counter, etc. Kit comprises printed circuit. Laminated Boards and chemicals. Latching relay. Infra-red sensitive Photocells and Hood, 2 transistors, cond., terminal block. Plastic case. Essential data, circuits and P.C. chassis plans of 10 photo-electric devices including auto. car parking light, modulated light alarm. Simple invisible ray switch—counter—stray light alarm—warbling tone electronic alarm—project lamp stabiliser, etc., etc. Only **39/6**, plus 2/- post and insurance.

TELESCOPIC AERIAL

for portable, car radio or transmitter. Chrome plated—six sections, extends from 7¼ to 47in. Hole in bottom for 6BA screw. **7/6**. KNUCKLED MODEL FOR F.M. **9/6**.

M.W. SIGNAL GENERATOR KIT
Complete kit as described in November issue **12/6** ea.

80 OHM BALANCED ARMATURE EAR PIECE
Usable as microphone or loudspeaker, **4/6** each.

MINIATURE EAR PIECE
As used with imported pocket radios **1/6** ea. **15/-** doz.

BLACK LIGHT
G.E.C. Tube for experiments and special lighting effects—40 watt 2ft. tubes only. **18/6** each; holders and control gear **19/6**, postage on single item 4/6 inc. insurance or both items ordered together postage 6/6 inc. insurance.

ELECTRONICS (CROYDON) LTD
Dept PW 266 London Road, Croydon CRO-2TH
Also 102/3 Tamworth Road, Croydon

MARCONI CR 150/2 double Superhet receiver 1·5–22Mc/s AM/CW/SSB operation Xtal Filter, BFO fast/slow motion tuning 'S' Meter, etc. Good condition. Tested and working. **£22.10.0.** P.P. 30/-

R209 RECEIVER, AM/CW/FM, 1–20Mc/s, Four bands, Vernier tuning. 12 volt DC input. Tested and working. **£13.10.0.** P.P £1.

COMPUTER BOARDS. Min 30 transistors and diodes and res.etc. 10 boards, **10/-** and P.P. 2/6; 25 boards **22/6** and P.P. 4/6.

HEADPHONES. Chamois padded, low impedance. Moving coil, magnetic microphone, new ex W.D., rare type, limited stock. **25/-** per pair and 3/6 P.P.

AERIALS, new condition, extending to 11ft fully open; whip type; **12/6** and P.P. 3/6. Whip aerials, 12ft collapsible type; used condition. **10/-** and P.P. 3/6 Bases for above **5/-** and 2/6 P.P.

BARGAIN PARCELS. 14 lb. **29/-** and 6/6 P.P.; 28 lb. **55/-** and 12/6 P.P.; 56 lb. **90/-** and 25/- P.P. Contain Pots., Res., Valves, Diodes, Tagboards, Chassis, Valveholders, etc. Good value saves £££s. LUCKY DIP SERVICE.

FURZHILL BEAT FREQUENCY OSCILLATOR. 0–10Kc/s, 110/250 volt. Good condition; complete with spares. **£5.10.0** and 25/- P.P.

VHF RECEIVER TYPE 715, less crystal 60–100Mc/s, can be operated on 2 or 4 meters or made tunable 12 volt input; not tested, complete with valves and speaker. **£3.0.0** and £1 P.P.

VIBRATOR POWER SUPPLY TYPE 69 by BCC for 69 T/R. Small compact 12V input gives 250V DC at 80mA and 12V output. Good condition. **25/-** and 7/6 P.P.

MOBILE POWER UNITS by **PYE** for the C12 T/R. Power output is 400V DC at 140mA and 300V DC at 100mA. Good condition. **£3.10.0** and £1 P.P.

INSULATION TESTERS. Bench or fieldwork; speed clutch; new condition, complete with leather case; 500V, 500 megohms. **£20** and 12/6 P.P. Also 1000V 1000 megohms with case. **£23** and 12/6 P.P.

CRYSTALS AS NEW. Hc6U 5,345; 5,055; 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 and 10 x J 465 Kc/s. All at **10/-** and 1/6 P.P.

METERS/MOVING COIL EX EQUIPMENT. Good condition; all from 0–10mA, 30mA, 50mA, 100mA, 500mA. All 2¼in. round **10/-** ea and 5/- P.P. from 0–1mA, 5mA, 15 amp D.C., 20 amp D.C., 40 amp D.C. All 2in. round. **10/-** ea and 5/- P.P.

A. H. THACKER
Radio Dept.
HIGH ST., CHESLYN HAY, Nr. WALSALL, STAFFS.

AMAZING MINI·DRILL

Indispensable for precision drilling, grinding, polishing, etching, gouging, shaping. Precision power for the enthusiast. Shockproof. Completely portable power from 4½ volt external battery. So much more scope with MINI-DRILL. Super Kit (extra power, interchangeable chuck) **79/6**, p.p. 2/6. De Luxe Professional Kit with 17 tools **130/-** p.p. 4/6. Money ref. g'tee.

MERLIN SUPPLY CO.
Dept. PW1D, Nailsea, Bristol BS19 2LP

SENSATIONAL BRITISH MADE RADIO CONSTRUCTION OUTFIT—MAKES 5 DIFFERENT TRANSISTOR RADIOS

total building costs–everything **47/6**

No soldering—no experience needed—simple lavishly illustrated step-by-step plans enables anyone 9 to 90 to build radios easily with terrific results. Educational—almost a complete **Home Radio Course**—you start with a simple semi-conductor radio which takes under 1 hour to build, you then progress to multi-transistor internal loudspeaker radio complete *in attractive case.* All operate off tiny self contained battery costing pennies and lasting months. *True to life sound reproduction.* Fully tuneable. Receives standard medium wave broadcasts. All parts down to last screw—including 3 Transistors, 1 Semiconductor, 1 Moving Coil Loudspeaker (*this alone must be worth* 19/6), Personal phone for smaller radios, all resistors, condensers, coil, wire, knobs, Radio Case, A.B.C. Plans etc., etc., **ONLY 47/6** plus 4/6 P. & P. (Parts available separately.) **New and boxed direct from Manufacturers to you saving £Es in middlemen's profits. MAKES FANTASTIC XMAS PRESENT** (*Check prices of less comprehensive educational toys in the shops!*) **SOLD EVERY YEAR FOR THE LAST 9 YEARS—MANY TESTIMONIALS.**

PHOENIX ELECTRONICS (PW7) 18 Little Preston St., Brighton 1, Sussex.

DE LUXE PLAYERS

PORTABLE CABINET As illustrated To fit standard player or autochanger **75/-**

RCS AMPLIFIER 3 WATT. Ready made and tested This is a 2-stage unit using a triode pentode condenser coupled valve, giving 3 watts output into a 3 ohm loudspeaker. Tone and volume controls mounted on panel. Supplied with knobs, loudspeaker and valves UCL82, UY85. Frequency response 50-12,000 cps. Sensitivity 200mV. **59/6**

Post 5/6 each item

AUTOCHANGERS MONO.	
Balfour Princess	£5.5.6
BSR Superslim UA25	£6.19.6
BSR Mini Changer	£8.19.6
AUTOCHANGERS STEREO	
BSR Superslim	£7.19.6
Garrard 1025	£7.19.6
Garrard 3000	£12.19.6
SINGLE PLAYERS MONO	
EMI Junior Mains	£2.19.6
Garrard SRP22	£6.19.6
SINGLE PLAYERS STEREO	
Garrard SP25 MkII	£12.19.6

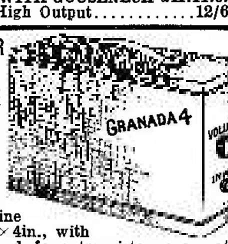
GARRARD TEAKWOOD BASE WB.1. Ready cut out for mounting 1025, 3000, SP25, AT60, etc. **65/-**
GARRARD PLASTIC COVER SPC.1 for WB.1 BASE. Durable tinted attractive appearance. **65/-**

E.M.I. PICK-UP ARM. Complete with mono cartridge 29/6; XTAL GP67 17/6; Stereo Ceramic 35/-. ACOS LP only 10/6.

CRYSTAL MIKE INSERTS

1½" dia. 6/6; ACOS 1½" dia. 12/6. BM3, 1" dia. 9/6.
QUALITY RIBBON MIKE WITH GOOSENECK £11.11.0.
CRYSTAL HAND MIKE, High Output............12/6

PORTABLE TRANSISTOR AMPLIFIER PLUS DYNAMIC MICROPHONE



A self-contained fully portable mini p.a. system. Many uses — ideal for Parties, or as a Baby Alarm, Intercom, Telephone or Record Player Amplifier, etc. Attractive rexine covered cabinet, size 12×9×4in., with powerful 7×4in. speaker and four transistor one watt power amplifier plus ultra sensitive microphone. Uses PP9 battery. Brand new in makers' carton with full makers' guarantee. World famous make. Only **90/-** Post Free

WEYRAD P50—TRANSISTOR COILS

RA2W 6in. Ferrite Aerial with car aerial coil 12/6	Spare Cores .... 6d.
Osc. P50/1AC 5/4	Driver Trans. LFDT4 ... 9/6
I.F. P50/2CC 470 kc/s ...5/7	Printed Circuit, PCA1... 9/6
3rd I.F. P50/3CC...........6/-	J.B. Tuning Gang 10/6
	Weyrad Booklet 2/-

Telescopic Chrome Aerials 6in. extends to 23in. 5/-.
Ferrite Rods Only 8×⅜in. 4/-. 6×½in. 5/-.

VOLUME CONTROLS

Long spindles. Midget Size 5 K. ohms to 2 Meg. LOG or LIN. L/S 3/-. D.P. 5/- STEREO L/S 10/6, D.P. 14/6 Edge 5K. S.P. Transistor, 5/-.

80 Ohm Coax 8D yd.

BRITISH AERIALITE AERAXIAL-AIR SPACED 40 yd. 20/-; 60 yd. 30/-. FRINGE LOW LOSS Ideal 625 lines **1/6** yd.

WIRE-WOUND 3-WATT POTS. T.V. Type. Knurled Knob. Values 10Ω to 30 K., Carbon 30 K to 2 meg. **4/6**

WIRE-WOUND 3-WATT STANDARD SIZE POTS. LONG SPINDLE 10 OHMS to 100 K. **7/6**

VEROBOARD 0·15 MATRIX
2½×5in. 3/8. 2½×3¾in. 3/2. 3¾×3¾in. 3/8. 3¾×5in. 5/2.
EDGE CONNECTORS 16 way 5/-; 24 way 7/6.
PINS 36 per packet 3/4. FACE CUTTERS 7/6.
S.R.B.P. Board 0·15 MATRIX 2½in. wide 6d. per 1in., 3¾in. wide 9d. per 1in.; 5in. wide 1/- per 1in. (up to 17in.).
S.R.B.P. undrilled 1/16in Board 10×8in. 3/-.

BLANK ALUMINIUM. CHASSIS 18 s.w.g. 2½in. sides, 7×4in., 5/6; 9×7in., 6/6; 11×3in., 6/6; 11×7in., 7/6; 13×9in., 9/6; 14×11in., 12/6; 15×14in., 15/-
ALUMINIUM PANELS 18 s.w.g. 12×12in., 6/6; 14×9in. 5/6; 12×8in., 4/6; 10×7in. 3/6; 8×6in. 2/6; 6×4in. 1/6.

Q MAX CHASSIS CUTTER

Complete: a die, a punch, an Allen screw and key

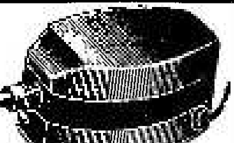
½in. 16/-	⅞in. 17/6	1⅛in. 19/6	1½in. 24/-	2 3/32in. 44/3
⅝in. 16/-	1in. 19/6	1¼in. 20/6	1¾in. 29/-	2½in. 57/3
¾in. 16/9	1 1/16in. 19/6	1⅜in. 21/6	2in. 39/-	1in. sq. 36/6

WAVE-CHANGE SWITCHES 1⅛in. Diameter.
2 p. 2-way, or 2 p. 6-way, or 3 p. 4-way 4/6 each.
1 p. 12-way, or 4 p. 2-way, or 4 p. 3-way, 4/6 each.
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 12/-, 2 wafer 18/-, 3 wafer 24/-, 4 wafer 30/-. 5 wafer 36/-.
TOGGLE SWITCHES, sp. 2/6; sp. dt. 3/6; dp. 3/6; dp. dt. 4/6

ALL PURPOSE HEADPHONES

H.R. HEADPHONES 2000 ohms Super Sensitive ... 35/-
LOW RESISTANCE HEADPHONES 3-5 ohms...... 39/6
DE LUXE PADDED STEREO PHONES 8 ohms ... 79/6

"THE INSTANT" BULK TAPE ERASER AND RECORDING HEAD DEMAGNETISER **42/6** Post 2/6.



200/250 v. A.C. Leaflet S.A.E.

BARGAIN STEREO/MONO SYSTEM

Attractive Slim PLAYER CABINET with B.S.R. Stereo Autochanger, 3 valve Stereo Amplifier, two 6½ in. LOUDSPEAKERS. (Only 4 pairs of wires to join). Carr. 10/6. S.A.E. for details **£19.19.6**

NEW TUBULAR ELECTROLYTICS		CAN TYPES
2/350V ... 2/3	100/25V ... 2/-	8/600V... ... 9/6
4/350V ... 2/3	250/25V ... 2/6	16/600V ... 12/6
8/450V ... 2/3	500/25V ... 4/-	16+16/500V ... 7/6
16/450V ... 3/-	8+8/450V... 3/6	50+50/350V ... 7/-
32/450V ... 3/9	8+16/450V 3/9	60+100/350V... 11/6
25/25V ... 1/9	16+16/450V 4/3	32+32+32/350v. 8/-
50/50V ... 2/-	32+32/350V 4/6	100+50+50/350v 9/6

SUB-MIN. ELECTROLYTICS. 1, 2, 4, 5, 8, 16, 25, 30, 50, 100, 250mF 15V 2/-; 500, 1000mF 12V 3/6; 2000mF 25V 7/-.
CERAMIC. 500V 1pF to 0.01mF, 9d.
PAPER 350V-0·1 9d, 0·5 2/6; 1mF 3/-; 2mF 150V 3/-. 500V-0·001 to 0·05 9d; 0·1 1/-; 0·25 1/6; 0·5 3/-. 1,000V-0·001, 0·0022, 0·0047, 0·01, 0·02, 1/6; 0·047, 0·1, 2/6.
SILVER MICA. Close tolerance 1%. 5-500pF 1/-; 560-2,200pF 2/-; 2,700-5,600pF 3/6; 6,800pF 0·01, mfd 6/- each.
TWIN GANG. "0-0" 208pF+176pF, 10/6; 365pF, miniature 10/6; 500pF standard with trimmers, 12/6; 500pF midget less trimmers, 7/6; 500pF slow motion, standard 9/-; small 3-gang 500pF 19/6. Single "0" 365pF 7/6. Twin 10/6.
SHORT WAVE. Single 10pF, 25pF, 50pF, 75pF, 100pF 160pF, 200pF, 10/6 each.
TUNING. Solid dielectric 100pF, 300pF, 500pF, 7/- each.
TRIMMERS. Compression 30, 50, 70pF, 1/-; 100pF, 150pF, 1/3; 250pF, 1/6; 600pF, 750pF, 1/9; 1000pF, 2/6.
RECTIFIERS CONTACT COOLED ½wave 60mA, 7/6; 85mA, 9/6. SILICON. BYZ13, 6/-; BY100, 10/-.
Full wave Bridge 75mA 10/-; 150mA 19/6; TV rects. 10/-.
NEON PANEL INDICATORS 250v. AC/DC 3/6, Red, Green.
RESISTORS. Preferred values, 10 ohms to 10 meg. ¼ w., ½ w., 1 w., 20% 3d.; 1½ w. 8d.; 2 w. 1/-; ½ w. 10% 6d.
HIGH STABILITY. ½ w. 1% 10 ohms to 10 meg., 2/-. Ditto 5%. Preferred values 10 ohms to 22 meg., 9d.
WIRE-WOUND RESISTORS 5 watt, 10 watt, 15 watt, 10 ohms to 100K, 2/- each; 3 watt, 0·5 ohm to 8·2 ohms, 2/-.
BRAND NEW TRANSISTORS 6/- each
OC71, OC72, OC81, OC44, OC45, AF117,
MAT100, 7/9; MAT101, 8/6; MAT120, 7/9; MAT121, 8/6.
REPANCO TRANSISTOR TRANSFORMERS
TT45. Push Pull Drive. 9:1 CT, 6/-. TT46 Output, CT3:1 6/-.
TT49. Interstage, 4·5:1, 6/-; TT52 Output 3 ohms, 20:1 6/.
TT23/4 PAIR 10 watt Amp. Transformers and circuit 35/-.

TRANSISTOR MAINS POWER PACKS, FULL WAVE 9 volt 500mA. Size 4½×2½×2in. Metal case. Crackle finish. Output terminals. On/off switch. **49/6**
Half Wave 9 volt 50mA. Size 2½×1⅛in. Snap terminals 32/6
9 volt 500mA. TRANSFORMER ONLY. 2¼×1¾×1¾in. 10/6

MAINS TRANSFORMERS

Post 5/- each

250-0-250 50 mA. 6.3 v. 2 amps, centre tapped	19/6
250-0-250 80 mA. 6.3 v. 3.5 a. 6.3v. 1 a, or 5 v. 2 a	30/-
350-0-350 80 mA. 6.3 v. 3.5 a 6.3 v. 1 a, or 5 v. 2 a.	35/-
300-0-300 v. 120 mA., 6.3 v. 4 a. C.T.; 6.3 v. 2 a. ...	45/-
MINIATURE 200 v. 20 mA., 6.3 v. 1 a. 2⅛×2×1⅝in.	12/6
MIDGET 220 v. 45 mA., 6.3 v. 2 a. 2¾×2½×2in. ...	17/6
HEATER TRANS. 6.3 v. 1½ a., 8/6; 6.3 v. 4 a	12/6
Ditto tapped sec. 1.4 v., 2, 3, 4, 5, 6.3 v. 1½ amp. ...	12/6
GENERAL PURPOSE LOW VOLTAGE. Outputs 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 24 and 30 v. at 2 a.	30/-
1 amp., 6, 8, 10, 12, 16, 18, 20, 24, 30, 36, 40, 48, 60...	35/-

AUTO TRANSFORMERS 0-115-230 v. Input/Output, 60w. 18/6; 150w. 30/-; 500w. 92/6; 1000w. 195/-.
CHARGER TRANSFORMERS. P. & P. 5/-. Input 200/250v. for 6 or 12v., 1½ amp., 17/6; 2 amp., 21/-; 4 amp., 30/-.
FULL WAVE BRIDGE CHARGER RECTIFIERS: 6 or 12v. outputs. 1½ amp. 8/9; 2 amp. 11/3; 4 amp. 17/6.

COAXIAL PLUG 1/3. PANEL SOCKETS 1/3. LINE 2/-. OUTLET BOXES. SURFACE OR FLUSH 4/6.
BALANCED TWIN FEEDERS 1/- yd. 80 ohms or 300 ohms.
JACK SOCKET Std. open-circuit 2/6, closed circuit 4/6; Chrome Lead Socket 7/6. Phono Plugs 1/-. Phono Socket 1/-.
JACK PLUGS Std. Chrome 3/-; 3·5mm Chrome 2/6. DIN SOCKETS Chassis 3-pin 1/6; 5-pin 2/-. DIN SOCKETS Lead 3-pin 3/6; 5-pin 5/-. DIN PLUGS 3-pin 3/6; 5-pin 5/-.
VALVE HOLDERS, 9d.; CERAMIC 1/-; CANS 1/-.

T.S.L. LOUDSPEAKER CROSSOVER HLP2

2-way crossover for 8 or 15 ohm speakers and tweeters. 3 phono input/output sockets. Made to sell at 42/- OUR PRICE Post 2/6. **22/6**

Tape Spools 2/6. Tape Splicer 5/-. Leader Tape 4/6.
Reuter Tape Heads for Collaro models 2 track 21/- pair.
PHOTO-ELECTRIC RELAY SYSTEM. 240v. A.C. Exciter and relay unit with infra red filter. For counting, door signals, alarms, etc. £12 POST FREE.

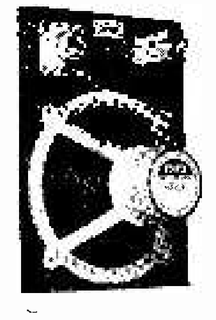
MINI-MODULE LOUDSPEAKER KIT

10 WATT **55/-** CARRIAGE 5/-

Triple speaker system combining on ready cut baffle. ½in. chipboard 15in.×8½in. Separate Bass, Middle and Treble loudspeakers and crossover condenser. The heavy duty 5in. 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 8 ohm.

TEAK VENEERED BOOKSHELF ENCLOSURE. 16×10×9in. Modern Scandinavian fluted front design for Mini-Module **94/6** Post 5/-

BAKER MAJOR £8



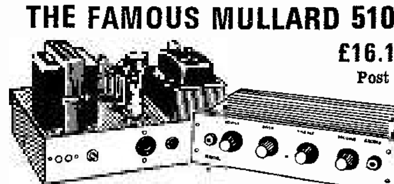
30–14,500 c.p.s., Hi-Fi double cone, woofer and tweeter cone together with a ceramic BAKER magnet assembly having a flux density of 14,000 gauss and a total flux of 145,000 Maxwells. Bass resonance 45 c.p.s. Rated 20 watts. Voice coils available 3 or 8 or 15 ohms. Price £8, or Module kit. 30-17,000 c.p.s. with tweeter, crossover, baffle and instructions. £10.19.6

LOUDSPEAKER CABINET WADDING 18in. wide, 2/6ft.

Goodmans Tweeter 3½in 3 ohm 35/-, EMI 2½in 8 ohm 17/6, Horn Tweeters 2-18kc/s, 10W 15 ohm 29/6. Crossover 16/6.
LOUDSPEAKERS P.M. 3 OHMS. 2¾in 3in, 4in, 5in, 5×2¾in. 7×4in. 17/6 each; 6½in 22/6; 8×5in, 21/-; 8×2½in, 21/-; 10×6in. 30/-; 10in. or 12in. Double cone 3 or 15 ohm, 39/6.
E.M.I. Double Cone 13½×8in, 3 or 15 ohm 10 watt. 45/-, DITTO twin tweeters and X/over, 3 or 8 or 15 ohm 10w. 79/6.
TEAK HI-FI SPEAKER ENCLOSURES. Fluted front; For 10in. or 12in. dia. Loudspeaker £8.10.0.
For 13in.×8in. or 8in. dia. Loudspeaker £4.14.6.
For 10in.×6in. or 6½in. dia. Loudspeaker £3.16.6.
SPECIAL OFFER! **15/6** EACH TYPE 8 ohm, 2¼in; 6×4in; 80 ohm, 2¾in; 25 ohm, 6×4in; 35 ohm, 3in; 15 ohm, 7×4in., 8×5in.
8in. LOUDSPEAKER UNITS 3 ohm 27/6; 15 ohm 30/-; ELAC 8in. De Luxe Ceramic 3 ohm 45/-; 15 ohm 50/-.
8in. LOUDSPEAKER. TWIN CONE 3 ohm 35/-.
5in. WOOFER. 8 watts max. 20-10,000 cps. 8 or 15 ohm. 39/6.
OUTPUT TRANS. EL84 etc. 4/6; MIKE TRANS. 50:1 3/9.
SPEAKER COVERING MATERALS. Samples Large S.A.E.

THE FAMOUS MULLARD 510

£16.19.6 Post 10/6



Main power amplifier and 2 valve pre-amplifier. Silver grey fascia panel. Volume, treble and bass controls. Function switch: Radio, Tape 1, Tape 2, Gram LP, Gram 78. Tape output socket. Valves: 2×EL84, 3×EF86, 1×ECC83, 1×EZ81. Ultra linear Parmeko output transformer. 20dB negative feedback. 10 watts r.m.s. mono. 3 or 15 ohm output. Brand New. Guaranteed.

ALL EAGLE PRODUCTS

SUPPLIED AT LOWEST PRICES
45-page Eagle catalogue 5/- Post free.

BARGAIN AM TUNER. Medium Wave. Transistor Superhet. Ferrite aerial. 9 volt. **79/6**
BARGAIN DE LUXE TAPE SPLICER. Cuts, trims, joins for editing and repairs. With 3 blades **17/6**
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. **59/6**
BARGAIN FM TUNER 88-108 Mc/s Six Transistor. Ready built. Printed Circuit. Calibrated slide dial tuning. Size 6×4×2½in. 9 volt. **£6.19.6**
BARGAIN 3 WATT AMPLIFIER. 4 Transistor Push-Pull Ready built, with volume control. 9v. **69/6**

★ RADIO BOOKS ★ (Postage 9d.)

Practical Transistor Receivers	5/-
Practical Radio Inside out	4/6
Supersensitive Transistor Pocket Radio	3/6
Radio Valve Guide, Books 1, 2, 3 or 4 ea. 5/- No.5 ea.	6/-
T.V. Fault Finding 405/625 lines	8/6
Shortwave Transistor Receivers	5/-
Transistor Communication Sets	6/-
Modern Transistor Circuits for Beginners	7/6
Sub-Miniature Transistor Receivers	5/-
Wireless World Radio Valve Data	9/6
International Radio Stations Guide	2/6
ReceiveforeignTV programmes by simple modifications	5/-
Valves, Transistors and Diodes equivalents Manual ...	10/6

MANUFACTURERS SURPLUS! **25/-**
TAPE RECORDER CABINET. Grey/Red or Grey 2-Tone. Rexine covered. Size 15×12×5½in. POST FREE

3 inch MOVING COIL METERS
Various calibrations/movements. 500 Microamp; 1 Milliamp; 50-0-50 Microamp, etc. S.A.E. for list. **45/-**

BRAND NEW QUALITY EXTENSION LOUDSPEAKER

Handsome plastic cabinet, 20ft. lead and adaptors. For any radio, intercom, tape recorder, etc. 3 to 15 ohms. Size: 7½×5½×3in. POST 2/6 **30/-**

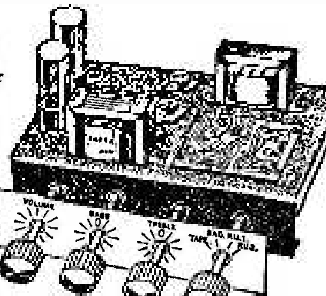
Minimum Post and Packing 2/6. RETURN OF POST DESPATCH. HI-FI STOCKISTS CUSTOMERS FREE CAR PARK CALLERS WELCOME

RADIO COMPONENT SPECIALISTS

337 WHITEHORSE ROAD, WEST CROYDON
Open 9–6 p.m. (Wednesdays 9–1 p.m., Saturdays 9–5 p.m).

Full List 1/- **Written guarantee with every purchase.** *(Export: Remit cash and extra postage.) Buses 133 68 pass door. S.R. Stn. Selhurst.* **Tel. 01-684-1665**

MONO TRANSISTOR AMPLIFIER HSL.700



A really high fidelity monaural amplifier with performance characteristics to suit the most discriminating listener. 6 transistor circuit with integrated pre-amplifier assembled on special printed sub panel. AD161-AD162 operating in symmetrical complementary pair. Output transformer coupled to 3 ohm and 15 ohm speaker sockets. Standard phono input sockets. Full wave bridge rectifier power supply for AC mains 200-240v. Controls: Bass, Treble, Volume/on/off. Function selector for PU1, PU2, Tape, Radio. The HSL.700 is strongly constructed on rigid steel chassis bronze hammer enamel finish, size 9½ × 5 × 4½ in. Sensitivity: PU1-50m/v. 56K input impedance.
PU2-110m/v, 1 meg input impedance.
Tape—110m/v, 1 meg input impedance.
Radio—110m/v, 1 meg input impedance.
Output power measured at 1Kc—6.2 watts RMS into 3 ohms, 5.8 watts RMS into 15 ohm. Overall frequency response 30 c/s-18 Kc/s: Continuously variable tone controls; Bass, + 8 db to − 12 db at 100 c/s. Treble, + 10 db to −10 db at 10 Kc/s. The HSL.700 has been designed for true high fidelity reproduction from Radio Tuner, Gramophone deck and Tape Recorder preamp. Supplied ready built and tested, complete with knobs, attractive anodised aluminium front escutcheon panel, full circuit diagram and operating instructions.

Our Special Price **£7.19.6** P. & P. 7/6.

LOUDSPEAKER BARGAINS

5in. 3 ohm **16/-**. P. & P. 3/-. 7 × 4in. 3 ohm **21/-**. P. & P. 4/-. 10 × 6in 3 ohm. **27/6**. P. & P. 6/-. E.M.I. 8 × 5 in. 3 ohm with high flux magnet **21/-**. P. & P. 4/-. E.M.I. 13½ × 8in. 3 ohm with high flux ceramic magnet **42/-** (15 ohm **45/-**). P. & P. 6/-. E.M.I. 13 × 8in. 3 or 15 ohm with two inbuilt tweeters and crossover network **4 gns.** P. & P. 6/-.

BRAND NEW. 12in. 15w. H/D Speakers, 3 or 15 ohms. Current production by well-known British maker. Now with Hiflux ceramic ferrobar magnet assembly **£5.10.0.** P. & P. 7/6. Guitar models: 25w. **£6.0.0**, 35w. **£8.0.0.**

E.M.I. 3½in. HEAVY DUTY TWEETERS. Powerful ceramic magnet. Available in 3 or 8 ohms **15/-** each; 15 ohms **18/6** each. P. & P. 2/6.

12in. "RA" TWIN CONE LOUDSPEAKER. 10 watts peak handling. 3 or 15 ohm **37/6**. P. & P. 6/-.

35 OHM SPEAKERS
3½in. **14/-**. P. & P. 2/6; 7 × 4in. **21/-**. P. & P. 4/-.

80 OHM MOVING COIL SPEAKERS
High Flux Magnet. 2½in. dia. **12/-** each. P. & P. 1/6.

SPECIAL OFFER
Hi-Fi Celestion Speaker Unit. Size 6 x 4in. Powerful 11,000 line magnet with specially treated cone surround. 10–12 ohm impedance. Few only at 20/-. P. & P. 3/6.

CRYSTAL MIKES. High imp. for desk or hand use. High sensitivity. **18/6.** P. & P. 1/6.
HIGH IMPEDANCE CRYSTAL STICK MIKES. OUR PRICE **21/-**. P. & P. 1/6.
HIGH IMPEDANCE DYNAMIC STICK MIKES. High sensitivity. **39/6** P. & P. 2/6.

PYE MICROSWITCHES S/P. C/O. Lever roller action. Rating 250v. AC at 5 amps. Size approx. 1 × ⅝ × ⅜in. **4/-** each. P. & P. 1/- (6 or more post free).
HONEYWELL MICROSWITCHES. S/P. C/O. Push button action. Rating 250v. AC at 15 amps. Size approx. 1⅞ × ⅞ × ⅝in. **5/-** each. P. & P. 1/- (6 or more post free)
TELESCOPIC AERIALS WITH SWIVEL JOINT. Can be angled and rotated in any direction. 12 section Heavy Chrome. Extends from 7in. to approx. 56in. Maximum diameter ½in. **10/-** each. P. & P. 1/6. 6 section Lacquered Brass. Extends from 6in. to 22½in. approx. Maximum diameter ¼ in. **5/-** each. P. & P. 1/-.
BRAND NEW MULTI-RATIO MAINS TRANSFORMERS. Giving 13 alternatives. Primary: 0–210–240v. Secondary combinations. 0–5–10–15–20–25–30–35–40–60v. half wave at 1 amp. or 10–0–10, 20–0–20, 30–0–30v. at 2 amps full wave. Size 3in. long × 3½in. wide × 3in. deep. Price **32/6.** P. & P. 6/-.
MAINS TRANSFORMER. For transistor power supplies. Pri. 200/240v. Sec. 9–0–9 at 500 mA. **11/-**. P. & P. 2/6. Pri. 200/240v. Sec. 12–0–12 at 1 amp. **14/6.** P. & P. 2/6. Pri. 200/240v. Sec. 10–0–10 at 2 amp. **27/6.** P. & P. 3/6. Tapped Primary 200–220–240v. Sec. 21·5v. at 500mA **12/6** P. & P. 2/6.
BRAND NEW MAINS TRANSFORMERS for Bridge Rectifier. Pri. 240v. AC Sec. 240v. at 50mA and 6·3v. at 1·5 amp. Stack size 2¾ × ⅞ × 2½in. **10/6.** P. & P. 3/6. (Special quotations for quantities.)

BRAND NEW! PARMEKO MAINS TRANSFORMERS Primary 110v–250v. Secondary 330–0–330v. 100 mA and 6·3v. at 2 amps, 6·3v at 2 amps and 6·3 v. at 1 amp. Conservatively rated. Fully impregnated Electrostatic screen. Suitable for vertical or drop through mounting. Overall size 4½ x 3¾ x 3½in. Weight 8 lb. Limited number only at **37/6.** P. & P. 8/-.

SPECIAL OFFER!!

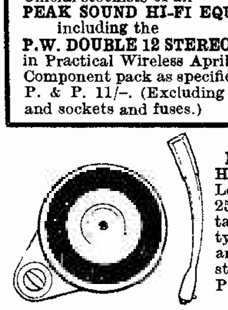
Your opportunity to acquire a first class HI-FI LOUDSPEAKER SYSTEM at an extremely moderate price! Beautifully made teak finish enclosure with most attractive Tygan front. Size 16½" high × 10½" wide × 6" deep. Fitted with E.M.I. Ceramic Magnet 13" × 8" bass unit, two H.F. tweeter units and crossover. Power handling 10 watts. Available 3 or 15 ohm impedance.

OUR PRICE WHILE LIMITED STOCKS LAST 8 GNS.
Carriage 10/-

TRANSISTOR STEREO 8 + 8 MK II

Now using Silicon Transistors in first five stages on each channel resulting in even lower noise level with improved sensitivity. A really first-class Hi-Fi Stereo Amplifier Kit. Uses 14 transistors giving 8 watts push pull output per channel (16W. mono). Integrated pre-amp. with Bass, Treble and Volume controls. Suitable for use with Ceramic or Crystal cartridges. Output stage for any speakers from 3 to 15 ohms. Compact design, all parts supplied including drilled metal work. Cir-Kit 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: Freq. response ±3dB. 20–20,000 c/s. Bass boost approx. to +12dB. Treble cut approx. to —16dB. Negative feedback 18dB over main amp. Power requirements 25V at ·6 amp.
PRICES: AMPLIFIER KIT £10.10.0; POWER PACK KIT £3.0.0; CABINET £3.0.0. All Post Free.
Also available STEREO 10+10. As above but 10 watts per channel. **PRICES:** AMPLIFIER KIT **£12.** POWER PACK KIT £3.10.0.
Circuit diagram, construction details and parts list (free with kit) 1/6. (S.A.E.).

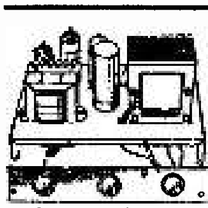
Official stockists of all
PEAK SOUND HI-FI EQUIPMENT
including the
P.W. DOUBLE 12 STEREO AMPLIFIER as featured in Practical Wireless April, May and June issues. Component pack as specified. Total cost **£23.5.6** Plus P. & P. 11/-. (Excluding metalwork, knobs, plugs and sockets and fuses.)



SPECIAL PURCHASE! E.M.I. 4-SPEED PLAYER
Heavy 8½in. metal turntable. Low flutter performance 200/250 v. shaded motor (90 v. tap). Complete with latest type lightweight pick-up arm and mono cartridge with t/o stylii for LP/78. ONLY **63/-**. P. & P. 6/6.

QUALITY RECORD PLAYER AMPLIFIER MKII
A top quality record player amplifier employing heavy duty double wound mains transformer, ECC83, EL84, EZ80 valves. 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 **75/-**. P & P. 6/-.
ALSO AVAILABLE mounted on board with output transformer and speaker ready to fit into cabinet below. PRICE **97/6.** P. & P. 7/6.

DELUXE QUALITY PORTABLE R/P CABINET MKII
Uncut motor board size 14½ × 12in. clearance 2in. below. 5½in. above. Will take above amplifier and any B.S.R. or GARRARD autochanger or Single Player Unit (except AT60 and SP25). Size 18 × 15 × 8in. PRICE **79/6.** P & P. 9/6.



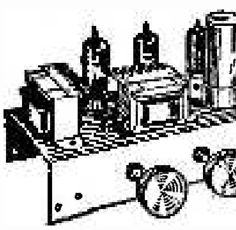
3-VALVE AUDIO AMPLIFIER HA34 MK II.
Designed for Hi-Fi reproduction of records. A.C. Mains operation. Ready built on plated heavy gauge metal chassis, size 7½" w. × 4" d. × 4½" h. Incorporates ECC83, EL84, EZ80 valves. Heavy duty, double wound mains transformer and output transformer matched for 3 ohm speaker. Separate volume control and now with improved wide range tone controls giving bass and treble lift and cut. Negative feedback line. Output 4½ watts. Front panel can be detached and leads extended for remote mounting of controls. Complete with knobs, valves, etc., wired and tested for only **£4.15.0.** P. & P. 6/-.
HSL "FOUR" AMPLIFIER KIT. Similar in appearance to HA34 above but employs entirely different and advanced circuitry. Complete set of parts, etc. **79/6.** P. & P. 6/-.

BRAND NEW TRANSISTOR BARGAINS. GET 15 (Matched Pair) **15/-**; V15/10p **10/-**; OC71 **5/-**; OC76 **6/-**; AF117 **3/6**; 2G339 (NPN) **3/-**.
Set of Mullard 6 transistors OC44, 2—OC45, AC128D matched pair AC128 **25/-**; ORP12 Cadmium Sulphide Cells **10/6.** All post free.

VYNAIR AND REXINE SPEAKER AND CABINET FABRICS. Approx. 54in. wide. Usually 35/- yard. Our PRICE **15/-** per yard length. P. & P. 2/6 (min. one yd.). S.A.E. for samples.

POWERFUL COMPACT Motor for 6-9v. Battery operation approx 25 mA. Made originally for "Staar" and "Greencoat" record player decks. Built in constant speed device. Ideal for models etc. Overall size approx 1⅝ × 1⅞. **7/6** each. P. & P. 1/6 (3 or more Post Free)

DE LUXE STEREO AMPLIFIER



A.C. mains 200-240 volts. 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 full wave rectifier. Two Dual potentiometers are provided for bass and treble control, giving bass and treble boost and cut. A Dual volume control is used. Balance of the left and right hand channels can be adjusted by means of a separate 'Balance' control fitted at the rear of the chassis. Input sensitivity is approximately 300m/v. for full peak output of 4 watts per channel (8 watts mono), into 3 ohm speakers. Full negative feedback in a carefully calculated circuit, allows high volume levels to be used with negligible distortion. Supplied complete with knobs. Chassis size 11"w × 4"d. Overall height including valves 5". Ready built and tested to a **high standard. PRICE 8 gns.** P. & P. 8/-.

4-SPEED RECORD PLAYER BARGAINS
Mains models. All brand new in maker's packing. B.S.R. UA25 with latest mono compatible cart. £6.19.6
All plus Carriage and Packing 6/6

LATEST GARRARD MODELS. All types available 1025, 2025, SP25, 3000, AT60 etc. Send S.A.E. for latest Prices!

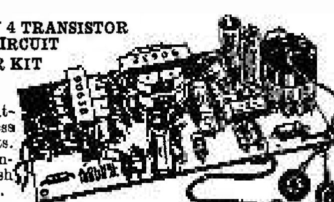
PLINTH UNITS cut out for Garrard Models, 1025, 2025, 2000, 3000, AT60, SP25. With transparent plastic cover. OUR PRICE **5 gns.** complete. P & P. 8/6.

LATEST RONETTE T/O STEREO/COMPATIBLE CARTRIDGE for EP/LP/Stereo/78. Only **32/6.** P. & P. 2/-.

LATEST RONETTE T/O MONO COMPATIBLE CARTRIDGE for playing EP/LP/78 mono or stereo records on mono equipment. Only **30/-**. P. & P. 2/-.

SONOTONE 9TAHC compatible Stereo Cartridge with diamond stylus **50/-**. P. & P. 2/-.

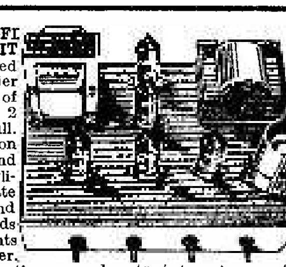
HIGH GAIN 4 TRANSISTOR PRINTED CIRCUIT AMPLIFIER KIT
Type TA1



- Peak output in excess of 1½ watts.
- All standard British components.
- Built on printed circuit panel size 6 × 3in.
- Generous size Driver and Output Transformers.
- Output transformer tapped for 3 ohm and 15 ohm speakers.
- Transistors (GET114 or 81 Mullard AC128D and matched pair of AC128 o/p).
- 9 volt operation.
- Everything supplied, wire, battery clips, solder, etc.
- Comprehensive easy to follow instructions and circuit diagram **2/6** (Free with Kit). All parts sold separately.

SPECIAL PRICE 45/-. P. & P. 3/-.
Also ready built and tested, **52/6.** P. & P. 3/-.

10/14 WATT HI-FI AMPLIFIER KIT



A stylishly finished monaural amplifier with an output of 14 watts from 2 EL84s in push-pull. Super reproduction of both music and speech, with negligible hum. Separate inputs for mike and gram allow records and announcements to follow each other. Fully shrouded section wound output transformer to match 3–15 Ω speaker and 2 independent volume controls, and separate bass and treble controls are provided giving good lift and cut. Valve line-up 2EL84s, ECC83, EF86 and EZ80 rectifier. Simple instruction booklet **2/6** (Free with parts). **All parts sold separately.** ONLY **£7.9.6.** P. & P. 8/6. Also available ready built and tested complete with std. input sockets, **£9.5.0.** P. & P. 8/6.

HARVERSON'S SUPER MONO AMPLIFIER

A super quality gram amplifier using a double wound mains transformer, EZ80 rectifier and ECL82 triode pentode valve as audio amplifier and power output stage. Impedence 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 valves and good quality output transformer. FEW ONLY.

OUR ROCK BOTTOM BARGAIN PRICE **49/6** P. & P. 6/-

Open all day 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.

BI-PAK SEMICONDUCTORS

KING OF THE PAKS

SUPER PAKS

Unequalled Value & Quality

BI-PAK NEW—UNTESTED SEMICONDUCTORS

Satisfaction GUARANTEED in Every Pak, or money back.

Pak No.		
U1	120 Glass Sub-min. General Purpose Germanium Diodes	10/-
U2	60 Mixed Germanium Transistors AF/RF	10/-
U3	75 Germanium Gold Bonded Diodes sim. OA5, OA47	10/-
U4	40 Germanium Transistors like OC81, AC128	10/-
U5	60 200mA Sub-min. Sil. Diodes	10/-
U6	40 Silicon Planar Transistors NPN sim. BSY95A, 2N706	10/-
U7	16 Silicon Rectifiers Top-Hat 750mA up to 1,000V	10/-
U8	50 Sil. Planar Diodes 250mA OA/200/202	10/-
U9	20 Mixed Volts 1 watt Zener Diodes	10/-
U11	30 PNP Silicon Planar Transistors TO-5 sim. 2N1132	10/-
U12	12 Silicon Rectifiers EPOXY BY126/127	10/-
U13	30 PNP-NPN Sil. Transistors OC200 & 2S104	10/-
U14	150 Mixed Silicon and Germanium Diodes	10/-
U15	30 NPN Silicon Planar Transistors TO-5 sim. 2N697	10/-
U16	10 3-Amp Silicon Rectifiers Stud Type up to 1,000 PIV	10/-
U17	30 Germanium PNP AF Transistors TO-5 like ACY 17-22	10/-
U18	8 6-Amp Silicon Rectifiers BYZ13 Type up to 600 PIV	10/-
U19	30 Silicon NPN Transistors like BC108	10/-
U20	12 1·5-amp Silicon Rectifiers Top-Hat up to 1,000 PIV	10/-
U21	30 AF Germanium alloy Transistors 2G300 Series & OC71	10/-
U23	30 Madt's like MAT Series PNP Transistors	10/-
U24	20 Germanium 1-amp Rectifiers GJM up to 300 PIV	10/-
U25	25 300 Mc/s NPN Silicon Transistors 2N708, BSY27	10/-
U26	30 Fast Switching Silicon Diodes like IN914 Micro-min.	10/-
U28	Experimenters' Assortment of Integrated Circuits, untested. Gates, Flip-Flops, Registers, etc., 8 Assorted Pieces	20/-
U29	10 1-amp SCR's TO-5 can up to 600PIV CRS1/25-600	20/-
U30	15 Plastic Silicon Planar trans. NPN 2N2924-2N2926	10/-
U31	20 Sil. Planar NPN trans. low noise Amp 2N3707	10/-
U32	25 Zener diodes 400mW D07 case mixed Volts, 3-18	10/-
U33	15 Plastic case 1-amp Silicon Rectifiers IN-4000 series	10/-
U34	30 Sil. PNP alloy trans. TO-5 BCY26, 2S302/4	10/-
U35	25 Sil. Planar trans. PNP TO-18 2N2906	10/-
U36	25 Sil. Planar NPN trans. TO-5 BFY50/51/52	10/-
U37	30 Sil. alloy trans. SO-2 PNP, OC200 2S322	10/-
U38	20 Fast Switching Sil. trans. NPN 400Mc/s 2N3011	10/-
U39	30 RF Germ. PNP trans. 2N1303/5 TO-5	10/-
U40	10 Dual trans. 6 lead TO-5 2N2060	10/-
U41	30 RF Germ. trans. TO-1 OC45 NKT72	10/-
U42	10 VHF Germ. PNP trans. TO-1 NKT667 AF117	10/-

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

FULLY TESTED

AC107	3/6
AC126-7-8	2/6
AF116-117	3/6
AF139	10/-
AL102	15/-
BC107-8-9	2/-
BFY50-51-52	4/6
BSY26-7	3/6
BSY28-9	4/6
BSY95-95A	4/6
OC22-25	5/-
OC26-35	5/-
OC28-29	7/6
OC44-45	1/9
OC71-81	1/6
OC72-75	2/6
OC81D-82D	2/3
OC82	2/6
OC140	5/-
OC170	2/6
OC171	3/6
OC201	7/6
ORP12-60	8/6
OCP71	8/6
OA5-10	1/9
OA47	2/-
OA70	1/3
OA79	1/9
OA81-85	1/6
OA91	1/3
OA95	1/9
OA200	3/-
OA202	3/6
2N696-7	3/6
2N706	3/6
2N708	5/-
2N2160	15/-
2N2646	15/-
2N2712	5/6
2N2926	2/6
MAT100-101	3/-
MAT120-121	3/6
ST140	3/-
ST141	4/-
2N3819	10/-
2N3820	25/-
2N3055	12/6

TESTED SCR's

PIV	1 Amp	3A	7A	16A
50	4/6	5/-	6/6	9/6
100	5/-	6/6	7/6	10/6
200	7/-	7/6	9/-	11/6
400	8/6	9/6	11/-	13/6
600	10/6	11/6	13/6	15/6
800	12/6	14/-	16/-	18/-

SIL. RECTS. TESTED

PIV	750mA	3A	10A	30A
50	1/-	2/9	4/3	9/6
100	1/3	3/3	4/6	15/-
200	1/9	4/-	4/9	20/-
300	2/3	4/6	6/6	22/-
400	2/6	5/6	7/6	25/-
500	3/-	6/-	8/6	30/-
600	3/3	6/9	9/-	37/-
800	3/6	7/6	11/-	40/-
1000	5/-	9/3	12/6	50/-
1200	6/6	11/6	15/-	—

INTEGRATED CIRCUIT AMPLIFIER

Sim. to the SL402-3 as used in the "P.E. projects" Each circuit incorporates a Pre-Amp and a class A–B Power Amplifier stage, capable of delivering up to 3 watts (RMS). Fully tested and guaranteed, supplied with circuit details for simple audio amplifier, amplifier with tone controls and stereo amplifier, plus all technical data.

Lowest of Low Price 25/- ea. 10 up 21/- ea. Absolutely unbeatable value only obtainable from BI-PAK.

BRAND NEW TEXAS GERM. TRANSISTORS

Coded and Guaranteed

Pak No.		EQVT.	
T1	8 2G371	OC71	10/-
T2	8 2G374	OC75	10/-
T3	8 2G3744A	OC81D	10/-
T4	8 2G381A	OC81	10/-
T5	8 2G382T	OC82	10/-
T6	8 2G344A	OC44	10/-
T7	8 2G345A	OC45	10/-
T8	8 2G378	OC78	10/-
T9	8 2G399A	2N1302	10/-
T10	8 2G417	AF117	10/-

FULL RANGE OF ZENER DIODES
VOLTAGE RANGE 2-16V.

400mW .... **2/6** each
1-5W .... **3/6** each
10W .... **5/-** each

All fully tested. State voltage required.

120 VCB NIXIE DRIVER TRANSISTOR. Sim. BSX21 & C407. 2N1893 FULLY TESTED AND CODED ND120. 1-24 **3/6** each. TO-5 NPN 25 up to **3/-** each.

UNIJUNCTION

UT46 Eqvt. 2N2646, Eqvt. TIS43 BEN3000 **7/6**
25-99 **5/-**, 100 up **4/-** each

F.E.T.'s To-18 case. FE19.Eqvt. 2N3819, MPF105, etc. **7/6.** each Data supplied.

We request you to send all your orders together with your remittance, direct to our Warehouse and Despatch Department, postal address: **BI-PAK SEMI-CONDUCTORS, Despatch Dept., P.O. BOX 6, WARE, HERTS.** Postage and packing still 1/- per order. Minimum order 10/-.

100 mixed ¼W and ½W **RESISTORS, 10/-**; 10₀ **SILVERED MICA CAPACITORS, 10/-**; 100 **CERAMIC CAPACITORS, 20/-.**

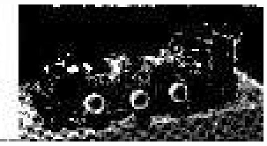
PRINTED CIRCUIT BOARD (for 6 Transistor Radio) 8¼ × 2½in. with Osc., 1st, 2nd and 3rd I.F.S. **M.W.** and **L.W. FERRITE AERIAL**, 2 gang tuner, circuit diagram giving values of components. (Limited quantity). **30/-** (2/6 post).

MAKE YOUR OWN RECORD PLAYER. "Soft-Top" Cabinet 17 × 15 × 7in; motor board (for BSR UA15 or UA25 Autochanger); 1 Tygan for front covering; Amplifier with UY85 and UCL82 valves; Tone & volume, with knobs; 3 ohm loudspeaker to fit; full assembly instructions. All for **£6.10.0** (part carr. 10/-).

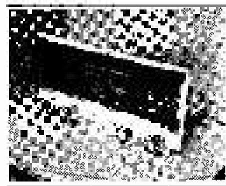
STEREO AMPLIFIER type HV— 2 x 3 Watts

Fully built. On off. sep. vol. and tone each channel 12 x 4¾ x 6in. high. EZ80. 2 x ECL86; for 3 ohm speakers, double wound main trans: fixing flanges and base plate; suitable for crystal cart., tuner etc. **£6.10.0** (8/- p. & p).

STEREO AMPLIFIER type RC— 2 x 3 Watts



Fully built. 2 x UCL82, metal rect: ganged vol. and tone cont: on-off, balance. 11 x 3½ x 4in. high, Double wound mains trans. with supporting brackets. For 3-ohm speaker. **£6** (8/- p. & p.).



MONO GRAM CHASSIS

3 Wave band long–med–short. Gram., 200-250v AC Ferrite aerial. Chassis 13 x 7 x 5in. Dial 13 x 4in. Double wound mains transformer 5 valves ECH81 EF89, EBC81, EL84, EZ80. Price **£10.12.6.** (7/6 p. & p.).

AUDIO ACCESS. min. order **10/-**. Std. jack plug moulded **2/6**; metal **3/6**; sockets **2/6**; 3·5 and 2·5mm jack plugs and sockets **1/-** each; phono plugs **1/-**, metal **2/-**; sockets: single **10d.**, double **1/3**, triple **2/-**; phono line couplers **2/-**; 3-pin DIN plug **2/9**, 4-pin **3/-**, 5-pin **3/4**; sockets: 3-pin **1/6**, 5-pin **1/9**; DIN speaker plug **2/6**; one-yd screened lead with phono plug attached, 7 for **10/-**; 1-yd with 2·5mm jack plug 10 for **10/-**. All post paid, minimum order **10/-**.

BAKERS' Selhurst Speakers, 12in., cast frame, 3, 8 or 15 ohm (state which). Group 25 (25 watt) for guitars, etc, **£6.6.0**; Stalwart 45–13,000cps, 15W **£6.6.0**; de Luxe Mk2 dual cone 25–16,000cps. 15W **£9** (all carr. paid) less 10% for 2 speakers.

GLADSTONE RADIO

66 ELMS ROAD, ALDERSHOT, Hants.

(2 mins. from Station and Buses). FULL GUARANTEE. Aldershot 22240
CLOSED WEDNESDAY. S.A.E. for enquiries please.

M. & B. RADIO

15a HUNSLET ROAD, LEEDS LS10 1JQ

Telephone: 0532-35649

STEREO CABINETS. A beautifully finished polished wood cabinet supplied in original carton. Size approx. 22 × 16 × 8in. New 47/6 plus 6/6 carriage.

TELEMETERS. A well finished cabinet containing lots of useful items for the constructor. Endless tape unit and tape head, 2 motors, auto and mains transformers, miniature valve I.F. strip etc. Ideal for modifying or stripping. 77/6 plus 7/6 carr.

STETHOSCOPE HEADSETS. Brand New. Ideal for stereo or mono. Low impedance. 27/6 plus 3/6 pp.

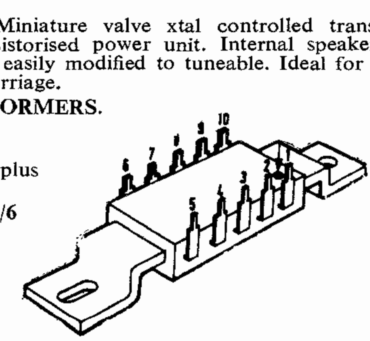
MICROPHONES. Radiotelephone type, used. 5/- plus 2/- pp.

SPRING LOADED aerial base sections. New 6/6 plus 1/6 pp.

TRANSISTORISED 2 METER CONVERTERS. Please state preference of I.F. frequency when ordering. £7.15.0 plus 5/- pp. 4 metre models available at the same price. VHF Marine band model £8.5.0 plus 5/- pp.

VHF MOBILE TX/RX. Miniature valve xtal controlled transreceiver with 12 volt transistorised power unit. Internal speaker. Double conversion receiver easily modified to tuneable. Ideal for 4 metres. £9.10.0 plus 27/6 carriage.

MODULATION TRANSFORMERS. scr522 type. 7/6 plus 2/- pp.



AERIAL CHANGE OVER RELAYS 12 volt. Used 4/- plus 1/6 pp.

60 UNTESTED DIODES 2/6 plus 1/- pp.

60 UNTESTED TRANSISTORS 5/- plus 1/- pp.

2–3W. INTEGRATED CIRCUIT AMPLIFIERS. Tested £1, plus 1/- pp.

USED TESTED VALVES. QQVO3/10 6/-, 6AQ5 3/-, 6BJ6 1/6, ECC83 2/6, 5U4 6/-, all plus 1/6 pp.

LOTS OF OTHER EQUIPMENT

PLEASE SEND 6d. PLUS S.A.E. FOR LIST

DUXFORD ELECTRONICS

ELECTROLYTIC CAPACITORS (Mullard).—10% to + 50%.

Working Voltage (V)—Capacitance (µF)

4V	6·4V	10V	16V	25V	40V	64V	Price each	Pack Prices 10 off	25 off	100 off
8	6·4	4	2·5	1·6	1	0·64	1/4	12/4	26/6	89/6
32	25	16	10	6·4	4	2·5	1/2	10/6	23/–	80/3
64	50	32	20	12·5	8	5	1/2	10/4	22/6	77/9
125	100	64	40	25	16	10	1/–	8/9	18/9	63/6
250	200	125	80	50	32	20	1/1	9/6	20/9	70/9
400	320	200	125	80	50	32	1/2	10/4	22/6	77/9
800	640	400	250	160	100	64	1/6	13/4	29/6	102/9
1250	1000	640	400	250	160	100	2/–	18/10	37/9	134/4
2000	1600	1000	640	400	250	160	2/6	22/3	44/3	165/6
3200	2500	1600	1000	640	400	250	3/–	26/9	59/–	204/3
				800	500	320	5/3	46/6	101/–	343/9
				1250	800	500	6/6	57/6	125/4	427/–
				2000	1250	800	8/–	71/4	157/–	541/8
				4000	2500	1600	12/6	91/6	194/9	843/9
				6400	4000	2500	15/–	133/4	291/8	1000/–

POLYESTER CAPACITORS (Mullard)

Tubular, 10%, 160V:

Prices per Capacitance value (µF)	each	10 off	25 off	100 off
0·01, 0·015, 0·022,	7d.	5/1	10/11	36/5
0·033, 0·047,	7d.	5/8	11/10	37/6
0·068	8d.	6/6	13/6	43/9
0·1	9d.	6/8	14/3	47/7
0·15	11d.	7/6	16/6	57/3
0·22	1/–	8/2	17/9	61/5
0·33	1/3	10/11	23/3	77/1
0·47	1/6	13/2	28/1	93/9
0·68	2/3	19/7	42/3	140/7
1·0	2/8	23/4	48/9	165/7

Tubular, 10%, 400V:

Prices per Capacitance value (µF)	each	10 off	25 off	100 off
0·001, 0·0015, 0·0022	6d.	4/5	9/9	33/4
0·0033, 0·0047	6d.	4/6	9/10	33/6
0·0068, 0·01	7d.	5/1	10/11	36/5
0·015	7d.	5/2	11/10	37/6
0·022	7d.	5/3	12/–	37/9
0·033	8d.	5/8	12/7	42/7
0·047	9d.	6/7	14/5	49/–
0·068	11d.	7/8	16/7	51/–
0·1	11d.	8/–	17/2	57/4
0·15	1/2	10/3	22/–	74/–
0·22	1/6	14/3	28/5	95/10
0·33	2/3	19/7	42/3	140/7
0·47	2/8	23/4	48/9	165/7

Modular, metallised, P.C. mounting, 250V:

Prices per Capacitance value (µF)	each	10 off	25 off	100 off
0·01, 0·015	7d.	5/2	11/3	38/7
0·022	7d.	5/4	11/9	41/8
0·033, 0·047	8d.	5/11	12/10	43/9
0·068	9d.	6/7	14/1	47/1
0·1	9d.	6/9	14/9	51/–
0·15	11d.	8/2	18/–	62/6
0·22	1/–	8/9	18/11	63/6
0·33	1/5	12/6	27/–	91/8
0·47	1/8	14/8	31/9	107/10
0·68	2/3	19/10	43/2	146/9
1·0	2/9	23/8	49/8	160/4

CAPACITORS

Subminiature Polyester film, Modular for P.C. mounting. Hard epoxy resin encapsulation. Radial leads.
±10% tolerance. 100 Volt Working.
Prices—per Capacitance value (µF)

0·001, 0·002, 0·005,	each	10 off	25 off	100 off
0·01, 0·02	6d.	4/3	8/4	30/–
0·05	8d.	6/–	12/6	41/8
0·1	10d.	7/1	15/6	51/–
0·2	1/2	10/–	20/10	68/6

Polystyrene film, Tubular, Axial leads. Unencapsulated. ±5% or ±1pf tolerance. 160 Volt Working.
Prices—per Capacitance value (µµF)

10, 12, 15, 18, 22, 27, 33,	each	10 off	25 off	100 off
39, 47, 56, 68, 82, 100, 120, 180, 220, 270, 330, 390 ..	5d.	3/7	7/9	24/–
470, 560, 680, 820, 1,000, 1,500	6d.	4/–	8/8	26/8
2,200, 3,300, 4,700, 5,600 ..	7d.	5/–	10/10	33/4
6,800, 8,200, 10,000, 15,000	8d.	6/–	13/–	40/–
22,000	9d.	6/9	18/–	45/4

POTENTIOMETERS (Carbon)

Miniature, fully enclosed, rear tags, carbon brush wiper. Long life, low noise. Body dia., ¾in. Spindle, 1in. × ¼in. ¼W at 70°C. ±20% below ½M, ±30% over ½M. Lin. 100 ohms to 10 Megohms. Log. 5 Kohms to 5 Megohms.

Prices—per ohmic value	each	10 off	25 off	100 off
	2/–	18/4	41/8	150/–

GANGED STEREO POTENTIOMETERS (Carbon)

½W at 70°C. Long Spindle.
Logarithmic and Linear: 5k + 5k to 1M + 1M.

Prices—per ohmic value	each	10 off	25 off	100 off
	8/–	70/–	162/6	575/–

SKELETON PRE-SET POTENTIOMETERS (Carbon)

High quality pre-sets suitable for printed circuit boards of 0·1in. P.C.M. 100 ohms to 5 Megohms (Linear only). Miniature: 0·3W at 70°C. ±20% below ½M, ±30% above ½M. Horizontal (0·7in. + 0·4in. P.C.M.) or Vertical (0·4in. × 0·2in. P.C.M.). Subminiature: 0·1W at 70°C. ±20% below 2·5M, ±30% above.

Prices—per ohmic value	each	10 off	25 off	100 off
Miniature (0·3W)	1/–	8/9	18/9	66/8
Subminiature (0·1W) ..	10d.	7/1	14/7	46/8

RESISTORS

High stability, carbon film, low noise. Capless construction, molecular termination bonding.
Dimensions (mm.): Body: ¼W; 8×2·8
½W; 10×4·3
Leads: 35
10% ranges; 10 Ohms to 10 Megohms (E12 Renard Series).
5% ranges; 4·7 Ohms to 1 Megohm (E24 Renard Series).
Prices—per Ohmic value.

		each	10 off	25 off	100 off
¼W	10%	2d.	1/6	3/3	10/4
¼W	5%	2½d.	1/9	3/8	11/8
½W	10%	2½d.	1/9	3/8	11/7
½W	5%	3d.	2/–	4/–	12/10

SEMICONDUCTORS

Type	1 off	10 off	25 off	100 off	Type	1 off	10 off	25 off	100 off
AC107	3/6	26/3	63/–	232/9	OA5	2/–	15/–	36/–	133/4
AC127	2/6	18/9	45/–	166/3	OA81	2/–	15/–	36/–	133/4
AC128	2/6	18/9	45/–	166/3	OA202	2/–	15/–	36/–	133/4
AD140	8/–	60/–	144/–	533/4	OC23	7/4	58/8	132/–	497/8
AD149	9/–	67/6	162/–	600/–	OC25	6/–	45/–	108/–	399/–
AF115	2/6	18/9	45/–	166/3	OC28	9/–	67/6	162/–	598/6
AF116	2/6	18/9	45/–	166/3	OC35	6/–	45/–	108/–	399/–
AF117	2/6	18/9	45/–	166/3	OC44	3/–	22/6	54/–	199/6
BC107	3/6	26/3	63/–	232/9	OC45	2/6	18/9	45/–	166/3
BC108	3/–	22/6	54/–	199/6	OC71	2/–	15/–	36/–	133/4
BC109	3/6	26/3	63/–	232/9	OC72	2/6	18/9	45/–	166/3
BY234	2/9	24/3	52/4	177/–	OC75	2/4	17/6	42/–	155/4
BY235	3/–	26/3	56/3	187/6	OC81	2/–	15/–	36/–	133/4
BY236	3/3	28/8	61/9	208/4	OC81D	2/4	17/6	42/–	155/4
BY237	3/6	30/8	65/6	218/9	OC82D	2/4	17/6	42/–	155/4
BY238	3/9	34/4	71/6	227/6	OC139	3/4	25/–	60/–	221/8
BYZ10	6/–	45/–	108/–	399/–	OC170	2/6	18/9	45/–	166/3
BYZ11	5/4	40/–	96/–	354/8	OC171	2/6	18/9	45/–	166/3
BYZ12	4/8	35/–	84/–	310/4	2N2926	2/8	20/–	48/–	177/4
BYZ13	4/–	30/–	72/–	266/–	(Green)				

Thyristors (5 amp)—Stud mounting.

P.I.V.	1 off	10 off	25 off	100 off
100	8/–	60/–	144/–	532/–
200	10/–	75/–	180/–	665/–
400	15/–	112/6	270/–	997/–

VEROBOARD & ACCESSORIES

0·15in. Matrix	1 off	10 off	25 off	0·1in. Matrix	1 off	10 off	25 off
2½ × 3¾in.	3/3	30/–	67/9	2½ × 3¾in.	4/–	37/8	86/–
2½ × 5in.	3/11	35/10	80/9	2½ × 5in.	4/6	42/6	96/3
3¾ × 3¾in.	3/11	35/10	80/9	3¾ × 3¾in.	4/6	43/4	100/–
3¾ × 5in.	5/6	50/–	114/7	3¾ × 5in.	5/6	48/4	111/5

Spot Face Cutter 7/3 Pin Fitting Tool 9/6
Terminal Pins 2/– (per 25 off); 6/9 (per 100 off)

SEND S.A.E. FOR 1969 CATALOGUE

DUXFORD ELECTRONICS (PW)

97/97A MILL ROAD, CAMBRIDGE

Telephone: CAMBRIDGE (0223) 63687

(Visit us—at our new Mail Order, Wholesale and Retail Premises)

MINIMUM ORDER VALUE 5/–

C.W.O. Post and Packing 1/6

Practical Wireless Classified Advertisements

The pre-paid rate for classified advertisements is 1/8d. per word (minimum order 20/-), box number 1/6d. extra. Semi-displayed setting £5 2s. 0d. 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, E.C.4 for insertion in the next available issue.

MISCELLANEOUS

ETCHED PRINTED CIRCUIT BOARD KITS. Full instructions 19/6 C.W.O. 'Circuit-etch', 12 Cambridge Road, St. Albans, Herts.

BUILD IT in a DEWBOX quality cabinet. 2in. x 2¼in. x any length. D.E.W. Ltd., Ringwood Road, FERNDOWN, Dorset. S.A.E. for leaflet. Write now—Right now.

UFO DETECTOR CIRCUITS, data. 10s. (refundable). Paraphysical Laboratory (UFO Observatory), Downton, Wilts.

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 4d. stamp.

MUSICAL MIRACLES. Send S.A.E. for details of Rhythm Modules, versatile bass-pedal unit, self-contained with unique effects, kits for waa-waa pedals. Also new 50μA meters, 25/- post paid. HURRY. D.E.W. Ltd., 254 Ringwood Road, Ferndown, Dorset.

A CORNUCOPIA OF COMPONENTS! Scarce valves, selected TV components, Educational and Projects Kits, speakers and cabinets, transistors. Resistors all values ½ watt 3d. each. State your requirements. S.A.E. for details. MAIL-MART, 6 Eastbourne Road, Pevensey Bay, Sussex.

6 OR 12 VOLT FLUORESCENT LIGHTS

12 ins. 8 Watt tube ample light for caravan, tent, etc. Fully transistorised, low battery drain. Unbeatable at **£2.19.6** post paid.

or in kit form **50/-**

4 WATT GRAM AMPS.

Volume and tone controls, mains operation, 3Ω output, new and boxed **65/-** POST PAID

SALOP ELECTRONICS
23 Wyle Cop, Shrewsbury, Shropshire
Callers welcome
S.A.E. for lists

SERVICE MANUALS for Pre 1958 H.M.V. and E.M.I. MODELS. Radio and Record Player Manuals 5/- each. Television Manuals 7/6 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.

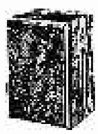
SELL or exchange for stereo amplifier or W.H.Y. Little used Heathkit Ra-1. Moffett, 11 Riccartsbar Avenue, Paisley.

EXPRESS ROTARY SWITCHES. Switches for Mullard audio circuits, also switches made to customers own specifications. For details and price list, write or phone to 189 Edgware Rd., London W.2. Tel. 01-723 4455.

BARGAIN PACKS. 200 assorted springs, nuts, washers, screws. Popular sizes, 7/6 including postage. Cohaven Industrial Estate, Ripley, Derbyshire.

MISCELLANEOUS
(continued)

SPEAKER CABINET BARGAIN



Beautifully finished in Teak veneer. Size 16 x 8 x 6 in.
Great value at
ONLY **72/6** each, p.p. 7/6 or two at **67/6** each, p.p. 10/6.
Send SAE for Hi-Fi lists.

ASR-FLETCHER
(Audio Equipment)
16 ALBION ROAD, BIRCHINGTON, Kent

PRINTED CIRCUITS Prototype, Medium and Batch Production of all types of circuits. Design and layout facilities available. Brooklands Plating Co., Spices Yard, South End, Croydon. Tel. 01-688-2128.

WANTED

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.

WE BUY New Valves and Transistors. State price. A.D.A. MANUFACTURING CO., 116 Alfreton Road, Nottingham.

WANTED NEW VALVES, televisions, radiograms, transistors, etc. STAN WILLETTS, 37 High Street, West Bromwich, Staffs. Tel.: WES 0186.

AVO METERS, MODELS 8 & 9, ANY QUANTITY, ANY CONDITION, ALSO WEE MEGGERS. SEND FOR PACKING INSTRUCTIONS. HUGGETT'S LTD., 2/4 PAWSONS ROAD, W. CROYDON.

WANTED *NEW* VALVES ONLY

Must be new and boxed
Payment by return

WILLIAM CARVIS LTD
103 North Street, Leeds 7

GEC RELAYS, SEALED, 12v, 180 ohms, four make-before-break contacts. Also tantalum Capacitors 750uF, 3v. Any quantity. 021-454-8305.

SHORT-WAVE LISTENERS

INTERESTED IN SHORTWAVE RADIO? Then you'll be interested in the Radio World-wide Listeners Club! Thousands of members throughout the world now receive a magazine filled with special features dealing with almost every aspect of communications (including SWL) and electronics. Discover the Club. Write for your free sample issue of the Radio World wide magazine or join now, dues are just 8/4 for your first year. RADIO WORLD-WIDE LISTENERS CLUB, WNYW International, Dept. 188, 485 Madison Avenue, New York 10022 USA.

SERVICE SHEETS

SERVICE SHEETS. RADIO, TV. 5,000 Models. List 1/6. S.A.E. Enquiries. TELRAY, 11 Maudland Bank, Preston, Lancs.

SERVICE SHEETS (75,000) 5/- each: please add loose 4d. stamp: callers welcome; always open. THOMAS BOWER, 5 South Street, Oakenshaw, Bradford.

SERVICE SHEETS (1925–1969) for TELEVISIONS, RADIOS, TRANSISTORS, TAPE RECORDERS, RECORD PLAYERS, etc., by return post, with free fault-finding guide. Prices from 1/–. Over 8,000 models available. Please send S.A.E. with all orders/enquiries. HAMILTON RADIO, 54 London Road, Bexhill, Sussex.

RADIO, TELEVISION over 3,000 models. JOHN GILBERT TELEVISION, 1b Shepherds Bush Rd., London W.6. SHE 8441.

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 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 send 8d. stamp for explanatory booklet to:
G3CHS (BOX 11), 45 GREEN LANE, PURLEY, SURREY

FANTASTIC SALE. 1,000 of the following Amplifier Kits to clear:

	List price	Sale price	P.8
5 watts	£3.15.0	£1.17.6	9V
7 watts	£6.19.0	£2.7.6	9V
10 watts	£8.19.0	£2.17.6	9V

M. GLEAVES & BROTHER, 28 Wenny Estate, Chatteris, Cambs.

SEEN MY CAT? 5,000 items. Mechanical & Electrical Gear, and materials. S.A.E. K. R. WHISTON, Dept. PW, NEW MILLS, Stockport.

ELECTRICAL

240 VOLT ELECTRICITY ANYWHERE

BEST EVER 200/240 VOLT "MAINS" SUPPLY FROM 12 VOLT CAR BATTERY

Exclusive World Scoop Purchase. The fabulous **Mk. 3D American Heavy Duty Dynamotor Unit with** a Massive 220 watt output and giving the most brilliant 200/240 volt performance of all time. Marvellous for **Television, Drills, Power Tools, Mains Lighting, AC Fluorescent Lighting** and all **200/240 volt Universal AC/DC mains equipment.** Made at tremendous cost for U.S.A. Govt. by Delco-Remy. This magnificent machine is unobtainable elsewhere.

Brand New and Fully Tested, only **£4.19.6,** plus 10/6 postage. C.O.D. with pleasure. Money back if not delighted. Please send s.a.e. for interesting illus. details.

Dept. PW STANFORD ELECTRONICS, Rear Derby Road, North Promenade, Blackpool, Lancashire.

BOOKS & PUBLICATIONS

SURPLUS HANDBOOKS

19 set Circuit and Notes ..	.. 6/6 p/p 6d.
1155 set Circuit and Notes ..	.. 6/6 p/p 6d.
H.R.O. Technical Instructions	.. 5/6 p/p 6d.
38 set Technical Instructions	.. 5/6 p/p 6d.
46 set Working Instructions ..	.. 5/6 p/p 6d.
88 set Technical Instructions	.. 7/- p/p 6d.
BC.221 Circuit and Notes ..	.. 5/6 p/p 6d.
Wavemeter Class D Tech. Instr.	.. 5/6 p/p 6d.
18 set Circuit and Notes ..	.. 5/6 p/p 6d.
BC.1000 (31 set) Circuit and Notes	.. 5/6 p/p 6d.
CR.100/B.28 Circuit and Notes	.. 10/- p/p 9d.
R.107 Circuit and Notes ..	.. 7/- p/p 6d.
AR.88D Instruction Manual ..	.. 18/- p/p 6d.
62 set Circuit and Notes ..	.. 6/6 p/p 6d.

Circuit Diagram 5/- each post free, R.1116/A, R.1224/A, R.1355, R.F. 24, 25 and 26, A.1134, T.1154, CR.300, BC.312, BC.342, BC.348J, BC.348 (E.M.P.), BC.624, 22 set.

52 set Sender and Receiver circuits 7/6 post free

Colour code Indicator 2/6 p/p 6d.

S.A.E. with all enquiries please.

Postage rates apply to U.K. only.

Mail order only to:

INSTRUCTIONAL HANDBOOK SUPPLIES

DEPT. PW, TALBOT HOUSE, 28 TALBOT GARDENS, LEEDS 8

EDUCATIONAL

RADIO OFFICERS see the world! Sea-going and shore appointments. Trainee vacancies during 1970. Grants available. Day and Boarding students. Stamp for prospectus, Wireless College, Colwyn Bay.

BECOME "Technically qualified" in your spare time, guaranteed diploma and exam. home-study courses in radio, TV servicing and maintenance. T.T.E.B., City and Guilds, etc.: highly informative 120-page Guide—free. CHAMBERS COLLEGE (Dept. 857K), 148 Holborn, London, E.C.1.

CITY & GUILDS (electrical, etc.) on "Satisfaction or Refund of Fee" terms. Thousands of passes. For details of modern courses in all branches of electrical engineering, electronics, radio, TV, automation, etc., send for 132-page Handbook—FREE. B.I.E.T. (Dept. 168K), Aldermaston Court, Aldermaston, Berks.

RADIO OFFICER training courses. Write: Principal, Newport and Monmouthshire College of Technology, Newport, Mon.

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. Closed circuit TV, 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

METAL WORK

METAL WORK: All types cabinets, chassis, racks etc., to your specifications. PHILPOTTS METAL WORKS LTD., Chapman Street, Loughborough

SITUATIONS VACANT

TAPE RECORDER ENGINEER required for workshop repair of DICTATING MACHINES in Central London. Write to PAX-DICTATOR (SOUTHERN) LTD., Lysons Ave., Ash Vale, Aldershot.

SERVICE ENGINEERS—we are an old established electronics company, but headed by a young management team and we need you to help us. Age is no barrier to a high salary as you will find out when you join us. If you have experience in T.V., Radio or Hi-Fi Service and want a job that looks ahead phone Michael Adler at 01-636 9606.

SERVICE ENGINEER. We specialise in the repair and maintenance of 16 mm. Sound Projectors, Tape Recorders and similar Visual Aids Equipment. We need another engineer with some knowledge of Audio Amplifiers. Must be able to drive. Write: Burgess Lane & Co. Ltd., Thornton Works, Thornton Avenue, Chiswick, London W.4.

TV and Radio, A.M.I.E.R.E., City & Guilds, R.T.E.B. Certs., etc. on 'Satisfaction or Refund of Fee' terms. Thousands of passes. For full details of exams and home training Courses (including practical equipment) in all branches of Radio, TV, Electronics, etc. write for 132 page Handbook—FREE. Please state subject. BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY (Dept. 137K), Aldermaston Court, Aldermaston, Berks.

ENGINEERS. A TECHNICAL CERTIFICATE or qualification will bring you security and much better pay. Elem. and adv. private postal courses for C.Eng., A.M.I.E.R.E., A.M.S.E. (Mech. & Elec.), City & Guilds, A.M.I.M.I., A.I.O.B., and G.C.E. Exams. Diploma courses in all branches of Engineering —Mech., Elec., Auto., Electronics, Radio, Computers, Draughts., Building, etc. For full details write for FREE 132 page guide: BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY, (Dept. 169K), Aldermaston Court, Aldermaston, Berks.

HENRY'S RADIO LTD.

303 EDGWARE ROAD, LONDON, W.2

HAVE THE FOLLOWING VACANCIES IN THEIR ORGANISATION.

Sales Assistants

Young man with good general knowledge of electronic components required for our retail sales dept. Please Phone 723-1008/9 Extn. 1.

Sales Assistants Hi-Fi Dept.

Young man with a good general knowledge of HIGH FIDELITY EQUIPMENT required for our retail HI-FI SALES DEPT. Please contact Mr. STEVENS Telephone 723-6963.

RECEIVERS & COMPONENTS

BARGAIN PARCELS

Any 5, 9/-; 10, 14/-; 100, £5.10.0 from the following:

ECC82, ECL80, EF80, EF85, EF183, EBF89, EB91, EY86, PCC84, PCC89, PCF80, PCL82, PCL83, PCL84, PL36, PL81, PY33, PY81, PY82, U191, 6-30L2, 30FL1, 30F5.

U.H.F. AERIAL BOOSTER

Transistorised, cavity tuned, high-gain. All uhf channels. Complete with battery and lead, 69/-, p. & p. 1/-. VELCO ELECTRONICS, 62 Bridge Street, Ramsbottom, Bury, Lancs.

FOR TOP DISCOUNT ON

Changers, Amplifiers, Speakers

visit the

HI-FI CENTER

15 Market Shops, Victoria Road

CHELMSFORD, Essex

RECEIVERS & COMPONENTS

(continued)

WE ARE BREAKING UP COMPUTERS

EX COMPUTER PRINTED CIRCUIT PANELS 2in × 4in. packed with semi-conductors and top quality resistors, capacitors, diodes, etc. Our price, 10 boards 10/-. P. & P. 2/-. With a guaranteed minimum of 35 transistors.

SPECIAL BARGAIN PACK. 25 boards for £1, P. & P. 3/6. With a guaranteed minimum of 85 transistors. 100 boards 55/-. P. & P. 7/6. With a guaranteed minimum of 350 transistors.

GIANT PANELS. 5½in. × 4in., min. 20 transistors, 9 × 56 μH Inductors, resistors, diodes, etc. 3 for £1. P. & P. 2/-.

As above, only 21 transistors, 70 diodes, 62 min. $\frac{1}{10}$th.W resistors. 3 for 25/-. P. & P. 2/-.

PANELS with 2 power transistors sim. to OC28 on each board + components. 2 boards (4 × OC28) 10/-. P. & P. 2/-.

TRIM POTS. On 2in × 4in boards + Ta caps and other components. Ideal for organ keyboard tuning etc. 100Ω, 500Ω, 15K., 20K. State requirements. 5 boards 10/-. P. & P. 2/-.

NPN GERMANIUM TO5 1 WATT POWER TRANSISTORS. On small heat sink, on 2in. × 4in. panel. 5 for 10/-. P. & P. 2/-.

POWER TRANSISTORS. Sim. to 2N174 ex-eqt. On Finned Heat Sink (10D). 4 for £1. P. & P. 5/-.

DIODES. Ex eqpt., Silicon, 150 PIV, 10 amp. 4 for 10/-. 150 PIV, 20 amp. 4 for £1. Post free.

MINIATURE GLASS NEONS, 13/6 doz.

PAPST FANS. Powerful Extractor/Blower fans. 4½in. × 4½in. × 2in. 230/250V. 100 c.f.m., 2,800 r.p.m. 50/- post free.

SPRAGUE POLYESTER. 0·22μF 250V small capacitors. 5/- doz. P. & P. 1/-.

SPRAGUE ELECTROLYTICS. 4μF 150V. 5/- doz. P. & P. 1/-.

NON-POLAR TANTALUM CAPS. 2·2μF 50V. 10/- doz. P. & P. 1/-.

NEW MIXED COMPONENTS

150 High stab. resistors 5% and better. 12/6. P. & P. 1/-.

250 mixed resistors ¼W + ½W. 12/6. P. & P. 1/-.

Large handful of mixed capacitors. 12/6. P. & P. 1/-.

LARGE CAPACITY ELECTROLYTICS

4½in., 2in. diam. Screw terminals.

7/6 each post free.

4,000μF	72V d.c. wkg.
10,000μF	25V d.c. wkg.
25,000μF	12V d.c. wkg.

4½in. × 1¾in. Plessey 5,000μF 55V d.c. wkg. 8/- each. 3in. × 1in. Plessey 2,000μF 25V d.c. wkg. 6/- each. 4½in. × 1¾in. screw terminals 2,500μF 55V d.c. wkg. 6/- each.

KEYTRONICS, 52 Earls Court Road London, W.8. Mail order only

Tel. 01-478 8499

NEW VHF KIT

Receives Television Sound, Ambulances, Aircraft, Radio 2, 3 and 4 on VHF etc.

This novel little set will give you endless hours of pleasure and can be built in one evening. The Kit comes with easy to follow instructions and circuit. Powered by 9v Battery. Complete with built in Jack Plug Socket for use with Earphones or Amplifier.

ONLY 57/-. P. & P. FREE U.K. ONLY

Postal Orders, Cheques to Dept. P.W.6

Galleon Trading Co., 298A Lodge Lane, Romford, Essex.

NEW DEVICES AT LOWEST PRICES GE PA230 Audio Preamplifier 18/6 each. GE PA234 1W Audio Amplifier 17/6 each. GE PA237 2W Audio Amplifier 32/6 each. GE 2N5172 NPN 200mW Transistor 1/9 each. All with data. C.W.O. P. & P. 1/- per order. JEF ELECTRONICS, York House, 12 York Drive, Grappenhall, Warrington, Lancs. Mail Order only.

ATTENTION, Radio Constructors, Amateurs, Hi-Fi and Electronic addicts, we can supply all your needs at competitive prices. Send 9d. for lists to INVENTRONICS, 14 Elizabeth Drive, Ferrybridge, Yorkshire.

RECEIVERS & COMPONENTS
(continued)

RECEIVERS & COMPONENTS
(continued)

AERIALS

Head Office and Warehouse
44A WESTBOURNE GROVE
LONDON W2
Tel. PARK 5641/2/3

Z & I AERO SERVICES LTD.

Please send all correspondence and Mail-Orders to the Head Office

When sending cash with order, please include 2/6 in £ for postage and handling

MINIMUM CHARGE 2/6. No C.O.D. orders accepted.

Retail Shop
85 TOTTENHAM COURT ROAD
LONDON W1
Tel. LANgham 8403
Open all day Saturday

First Quality **Fully Guaranteed**

AERO X BRAND

ELECTRONIC VALVES

OA2 6/6
OA3 9/-
OB2 6/6
OB3 10/-
OC3 7/-
OD3 6/6
1B3GT 7/6
1L4 3/6
1N5GT 8/6
1Q5GT 10/-
1R4 6/6
1R5 7/-
1S4 5/6
1S5 5/-
1T4 4/6
1U4 6/-
1U5 9/6
1V2 9/-
1X2B 7/6
2CW4 12/-
2D21 6/6
3A4 4/-
3A5 10/-
3A8GT 10/-
3Q4 8/-
3Q5GT 8/-
3S4 7/-
3V4 8/-
5R4GY 11/-
5U4G 6/-
5U4GB 7/6
5V4G 8/-
5Y3GT 6/-
5Z3 9/-
5Z4G 7/6
5Z4GT 8/-
6/30L2 15/-
6A8G 6/6
6AB4 6/6
6AC7 4/6
6AF4A 9/6
6AG7 7/6
6AH6 10/-
6AJ8 5/9
6AK5 6/-
6AK6 11/6
6AL3 8/6
6AL5 3/3
6AM5 5/-
6AM6 4/6
6AQ5 6/6
6AQ6 10/-
6AR5 6/6
6AR6 6/6
6AS5 7/-
6AS7G 16/-
6AT6 5/-
6AU4GTA 9/-
6AU5GT 22/6
6AU6 5/-
6AV5GTA 13/-
6AV6 6/-
6AW8A 11/-
6AX5GT 13/-
6BA6 4/6
6BE6 5/-
6BF5 16/-
6BF6 9/-
6BG6G 12/-
6BH6 8/6
6BJ6 8/6
6BK4 21/-
6BK7A 10/-
6BL7GTA 12/-
6BL8 7/-
6BN4 13/-
6BN5 8/6
6BN6 8/-
6BQ5 5/-
6BQ6GTB 13/-
6BQ7A 7/6
6BR7 17/-
6BR8 13/-
6BS7 26/-
6BW6 16/-
6BW7 13/6
6BX6 5/-
6BZ6 6/6
6C4 6/-
6C5GT 7/-
6C9 17/3
6CA4 5/6
6CA7 10/6
6CB6 5/6
6CD6GA 23/-
6CG7 9/-
6CH6 11/-
6CL6 10/-
6CU6 13/-
6CW4 12/6
6CY5 8/-
6CY7 12/-
6D3 8/-
6DC6 13/6
6DK6 8/6
6DQ6B 12/-
6DS4 15/-
6EA8 11/-
6EH7 6/6
6EJ7 7/-
6EW6 12/-
6F1 14/-
6F6G 5/-
6F11 6/6
6F12 4/6
6F13 7/-
6F14 12/-
6F15 11/-
6F18 8/-
6F22 6/6
6F23 15/6
6F24 13/6
6F25 15/-
6F26 7/-
6F28 14/-
6F29 6/6
6F30 7/-
6J4 9/6
6J5GT 6/-
6J7 8/6
6K6GT 10/-
6K7 6/6
6K8G 6/-
6K23 10/-
6K25 15/-
6L6GT 9/-
6L7 6/6
6L18 6/-
6LD20 6/6
6N7GT 7/-
6P1 12/-
6P28 12/6
6Q7 7/6
6R7G 7/-
6S2 8/-
6S4A 11/-
6SA7 7/3
6SG7 6/6
6SJ7 7/6
6SK7 6/6
6SL7GT 6/6
6SN7GT 6/-
6SQ7 8/-
6SR7 7/6
6T8 6/6
6U4GT 12/6
6U8 7/-
6V6GT 6/6
6X4 5/-
6X5GT 5/6
6X8 11/-
6Y6G 12/-
6Z4 5/6
9BW6 8/6
10C2 10/-
10D1 8/-
10D2 8/-
10F1 18/-
10F9 10/-
10F18 8/-
10L1 8/-
10LD11 11/-
10P13 11/-
10P14 20/-
12AB5 10/-
12AC6 7/6
12AD6 7/6
12AH7GT 5/-
12AL5 8/-
12AQ5 8/-
12AT6 5/-
12AT7 6/6
12AU6 5/6
12AU7 6/-
12AV6 6/-
12AV7 9/-
12AX4GTB 10/-
12AX7 6/-
12AY7 13/6
12B4A 10/-
12BA6 6/6
12BA7 6/6
12BE6 6/6
12BH7 6/6
12BY7 10/-
12C8 6/-
12CU6 15/-
12J5GT 4/-
12K5 10/-
12K7GT 7/-
12K8 10/-
12Q7G 5/-
12SC7 5/-
12SG7 7/-
12SH7 5/-
12SJ7 5/
12SK7 8/-
12SL7GT 8/-
12SN7GT 8/-
12SQ7 8/-
12SR7 6/6
14S7 16/-
20D1 9/-
20L1 20/-
20P1 10/-
20P3 12/-
20P4 20/-
20P5 20/-
25C5 9/-
25L6GT 7/6
25Z4G 6/-
25Z6GT 12/-
30A5 8/-
30AE3 8/-
30C1 6/6
30C15 15/-
30C17 16/-
30C18 15/-
30F5 17/-
30FL1 15/-
30FL12 18/6
30FL13 10/-
30FL14 15/6
30L1 7/-
30L15 17/-
30L17 17/-
30P12 16-
30P18 7/-
30P19 15/-
30PL1 15/6
30PL13 18/-
30PL14 17/-
35A3 10/-
35A5 11/-
35B5 13/-
35C5 7/-
35D5 13/-
35L6GT 9/6
35W4 5/-
35Z3 11/-
35Z4G 5/-
35Z5GT 7/6
50A5 13/-
50B5 7/-
50C5 7/-
50CD6G 30/-
50L6GT 8/-
83A1 14/-
85A1 25/-
85A2 7/6
90AG 48/-
90AV 48/-
90C1 12/-
90CG 25/-
90CV 25/-
807 9/6
812A 65/-
866A 14/-
6080 27/6
6146 30/-
6146B 47/6
6267 6/6
6360 25/-
6939 42/-
7199 15/-
7586 25/-
7591A 20/-
9002 6/6
9003 10/-
AZ31 10/-
CBL1 16/-
CBL31 17/-
CL33 17/6
CY31 7/-
DAF41 11/-
DAF91 5/-
DAF92 9/6
DAF96 7/9
DC90 9/-
DF96 7/9
DK40 10/-
DK91 7/-
DK92 9/-
DK96 8/-
DL91 5/6
DL92 7/-
DL93 4/-
DL94 8/-
DL95 8/-
DL96 7/9
DM70 6/6
DY70 12/-
DY86 6/6
DY87 7/-
DY802 10/-
E55L 55/-
E130L 90/-
E180F 19/-
E280F 42/-
EABC80 6/6
EAF42 10/-
EAF801 9/6
EBC33 9/-
EBC41 10/6
EBC81 6/6
EBC90 5/-
EBC91 6/-
EBF80 8/-
EBF83 8/6
EBF89 6/6
EBL31 25/-
EC53 10/-
EC86 12/-
EC88 12/-
EC90 6/-
EC92 6/6
EC93 9/6
ECC34 8/-
ECC40 11/-
ECC81 6/6
ECC82 6/-
ECC83 6/-
ECC84 6/-
ECC85 5/6
ECC86 9/6
ECC89 11/-
ECC91 4/-
ECF80 7/-
ECF82 7/-
ECF83 15/-
ECF86 12/6
ECF804 30/-
ECH42 13/-
ECH81 5/9
ECH83 8/6
ECH84 9/-
ECL80 9/-
ECL81 8/6
ECL82 6/6
ECL83 12/6
ECL84 11/-
ECL85 10/6
ECL86 8/6
EF37A 9/-
EF39 8/-
EF40 10/-
EF41 12/6
EF42 14/-
EF55 13/-
EF80 5/-
EF83 10/-
EF85 7/-
EF86 6/6
EF89 5/6
EF91 4/6
EF92 7/6
EF93 4/6
EF94 5/-
EF95 6/-
EF96 4/-
EF97 10/-
EF183 6/6
EF184 7/-
EF800 20/-
EF804 20/-
EF811 15/-
EF812 15/6
EF814 13/6
EK90 5/-
EL34 10/6
EL36 9/6
EL41 11/-
EL42 11/6
EL81 10/-
EL83 8/3
EL84 5/-
EL85 8/6
EL86 8/6
EL90 6/6
EL91 5/-
EL95 7/-
EL360 23/-
EL803 17/-
EL821 11/-
EL822 18/-
ELL80 15/-
EM34 16/-
EM71 12/6
EM80 8/-
EM81 8/6
EM84 7/6
EM87 11/-
EN91 6/6
EY51 8/-
EY80 9/-
EY81 8/-
EY83 11/-
EY84 10/-
EY86 8/-
EY87 8/6
EY88 8/6
EZ35 5/6
EZ40 9/-
EZ41 9/-
EZ80 5/6
EZ81 5/6
EZ90 5/-
FW4/500 13/6
GS47X 55/-
GY501 16/-
GZ30 7/6
GZ31 6/-
GZ32 9/6
GZ33 16/-
GZ34 11/-
HABC80 8/6
HBC90 5/-
HBC91 6/-
HF93 6/6
HF94 5/6
HK90 6/6
HL92 7/-
HL94 8/-
KT66 27/6
KT88 33/-
MSPENT 10/-
MU12/14 10/-
N78 21/-
PABC80 8/-
PC86 11/6
PC88 13/-
PC97 8/6
PC900 9/6
PCC84 7/-
PCC85 8/-
PCC88 12/-
PCC89 10/6
PCC189 11/-
PCC805 17/-
PCC806 17/-
PCE800 15/-
PCF80 6/6
PCF82 6/9
PCF84 9/-
PCF86 11/-
PCF87 16/-
PCF800 15/-
PCF801 10/-
PCF802 10/-
PCF805 15/-
PCF806 18/-
PCF808 15/6
PCH200 14/-
PCL81 10/-
PCL82 7/9
PCL83 13/-
PCL84 8/9
PCL85 9/6
PCL86 9/6
PCL88 17/-
PCL800 18/-
PCL801 15/6
PD500 30/-
PEN4DD 8/-
PEN36C 13/6
PEN45 7/-
PEN45DD 15/-
PEN46 7/6
PEN383 10/-
PEN384 10/-
PEN453DD 11/-
PENA4 8/6
PF86 11/-
PF818 17/-
PFL200 14/-
PL33 7/-
PL36 11/-
PL81 9/6
PL82 9/-
PL83 8/-
PL84 7/-
PL302 15/-
PL500 15/-
PL504 16/-
PL508 17/6
PL509 30/-
PL801 16/-
PL802 14/-
PLL80 11/-
PM84 9/-
PX4 30/-
PX25 30/-
PY31 5/-
PY32 11/-
PY33 12/6
PY80 6/6
PY81 6/-
PY82 6/-
PY83 7/6
PY88 8/-
PY500 20/-
PY800 10/-
PY801 10/-
QQVO2-6 42/-
QQVO3-10 25/-
QQVO3-20A 105/-
QQVO6-40A 110/-
QVO3-12 13/-
SP41 7/-
SP42 12/-
SP61 7/-
SU2150A 15/-
TT21 48/-
TT22 50/-
TT22 50/-
U17 10/-
U18/20 13/6
U20 13/6
U25 15/-
U26 15/-
U31 9/-
U37 30/-
U50 6/-
U52 6/-
U76 5/-
U78 5/-
U81 13/-
U191 15/-
U201 7/-
U281 8/-
U282 8/-
U301 11/6
U403 10/-
U404 7/6
U801 20/-
UABC80 6/9
UAF41 10/-
UAF42 10/6
UB41 11/-
UBC41 9/6
UBC81 8/-
UBF80 7/3
UBF89 7/-
UBL1 10/-
UBL21 12/-
UC92 6/6
UCC85 8/-
UCF80 10/6
UCH21 11/-
UCH42 13/-
UCH43 12/-
UCH81 6/6
UCL81 11/-
UCL82 7/-
UCL83 12/-
UD143 15/-
UF9 11/-
UF11 10/-
UF41 10/-
UF42 12/-
UF43 11/-
UF80 7/6
UF85 8/-
UF89 7/-
UL41 12/-
UL84 6/6
UM4 8/-
UM84 4/-
UY1N 10/-
UY11 11/-
UY21 11/-
UY41 8/-
UY82 10/-
UY85 6/6
VP23 6/-
VP41 7/-
VP133 15/-
VR75/30 9/-
VR105/30 7/-
VR150/30 6/6
VU33 10/-
VU39A 10/-
VU111 10/-
VU120 15/-
VU133 10/-
W729 12/-
Z309 10/-
Z329 17/-
Z803U 17/6

INTEGRATED CIRCUIT AMPLIFIERS

CA3005 RF Amplifier with 100mc/s bandwidth. Max. dissipation 26mW. For use as RF amplifier, balanced mixer, product detector or self-oscillating mixer 27/-

CA3012 wide Band Amplifier (up to 20mc/s), suitable as IF Amplifier for VHF/FM receivers 22/-

CA3020 General Purpose Audio Amplifier of 550mW output 30/-

CA3036 Buffer amplifier consisting of two 'super-alpha' pair of transistors suitable for stereo pick-up systems 19/-

The above four I.C's are in TO5 encapsulation.

PA222 Audio Amplifier providing a max. output of 1·2 watts 65/-

PA234 Audio Amplifier providing a max. output of 1 watt 27/6

PA237 2 watts Audio Amplifier 40/-

The above three I.C's are in epoxy moulded double four-in-line package.

MC1709CG General Purpose operational amplifier in TO-99 case 40/-

TAA263 3-stage direct coupled amplifier for use from DC to 600kc/s; 70mW dissipation. Output 10mW into 150Ω load 15/-

TAA293 3-stage amplifier with connection brought out to the individual leads. Bandwidth 600kc/s. 160mW dissipation. Output 10mW into 150Ω load 20/-

TAA320 MOST input stage followed by a bi-polar transistor stage. 200mW dissipation. 13/-

TAD100 Integrated AM receiver circuit containing *all* active components, except output stage, required to build a complete receiver. 45/-

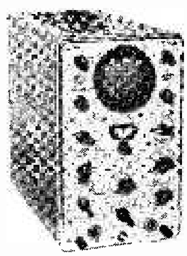
SL403A 3 Watts Audio Amplifier into a 7·5Ω Loudspeaker. Distortion 0·3% at 1 Watt and 0·5% at full output. Frequency response 20c/s to 20kc/s. Operating voltage 18V. Built-in overvoltage protection. Price, complete with application sheet 55/-

Data sheets are available for all the above I.C's.

OUR NEW CATALOGUE 1969/1970 IS NOW READY. IT INCLUDES PRICES OF SOME 4,000 TYPES OF VALVES AND TUBES AND SEMICONDUCTORS. ESSENTIAL CHARACTERISTICS OF KLYSTRONS, MAGNETRONS, CATHODE RAY TUBES AND SEMICONDUCTORS ARE GIVEN. THIS IS A REAL REFERENCE BOOKLET AND IS AVAILABLE FREE OF CHARGE. PLEASE ENCLOSE QUARTO S.A.E.

NEW OSCILLOSCOPE FROM RUSSIA

SYNCHROSCOPE TYPE C1-5



3-in tube fitted with telescopic viewing hood, giving bright display in full daylight. Bandwidth 100mc/s.

Triggered sweep preset at 1-2-5-10-30-100-300-1000-3000 μsec per sweep.

Free running time base 20 c/s to 200 kc/s. Built-in duration calibrator provides marks at 005-0·2-1-5-2-100 μsec. Voltage measurement scale. Input attenuator 1-10-100 times Power supplies 127/230 V A.C.

NOW AT NEW REDUCED PRICE OF £39

Packing, carriage £1.10.0

ZENER DIODES

300mW wire ended, 10% tolerence

KS139A 3·9V	KS168A 6·8V	D814V 9·5V
KS147A 4·7V	D814A 7·8V	D814G 11·0V
KS156A 5·6V	D814B 8·8V	D814D 12·6V

All at 3/6

5 watts Stud Mounted 15% tolerance

22V D816A	39V D816G	68V D817B
27V D816B	47V D816D	82V D817V
33V D816V	56V D817A	100V D817G

All at 7/6

8 watts Stud Mounted 15% tolerance

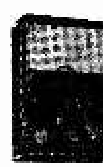
4·7V D815I	8·2V D815V	15V D815E
5·6V D815A	10V D815G	18V D815Z
6·8V D815B	12V D815D	

All at 7/6

WESTINGHOUSE EPOXY ENCAPSULATED WIRE ENDED MINIATURE RECTIFIERS

1N5399, 1,000 p.i.v., 1·5 amps D.C.; Max. surge 50A diameter ·140in. Overall length (with leads) 2·3in. 4/6.
1N5408, 1,000 p.i.v., 3 amps D.C.; max. surge 200A. Diameter ·210in.; overall length (with leads) 2·875in. 6/3.

MULTIMETERS



TYPE MF16

D.C. voltage range: 0-0·5-10-50-250-500V.
A.C. voltage range: 0-10-50-250-500V.
D.C. current range: 500μ-10-100mA.
Resistance ranges: 100MΩ-1MΩ. The meter is also calibrated for capacity and output level measurements. Sensitivity 2000ΩV. Accuracy ±2·5% for D.C. and ±4% for A.C. measurements.
Dimensions: 4⅝ x 3¼ x 1⅞in. Price £4.5.0.

Type 108-1T: 24 range precision portable meter, 5000 o.p.v. D.C. Volts: 2·5-10-50-250-500-2500V. A.C. Volts: 10-50-100-250-500-2500V; D.C. current 0·5-5-50-500mA Resistance 2000–20,000 ohms; 2–20 megohms. Power output calibration in A.C. for 600 ohms line. Complete with prods and batteries, £6.5.0. P. & P. 5/-.

SPECIAL OFFER OF PNP GERMANIUM TRANSISTORS

AC154 large signal type, suitable for class 'B' output and oscillator applications. Max. collector-base voltage—26V. Max dissipation 200mW. Audio power output per pair 400mW free air or 1·1W on heat sink. Price, per pair 6/-

AC169 PNP Diode-connected Bias Stabilizing Transistor. Max dissipation 60mW. Max. collector-base voltage—2V. Max collector current 30mA. Price, each 2/-

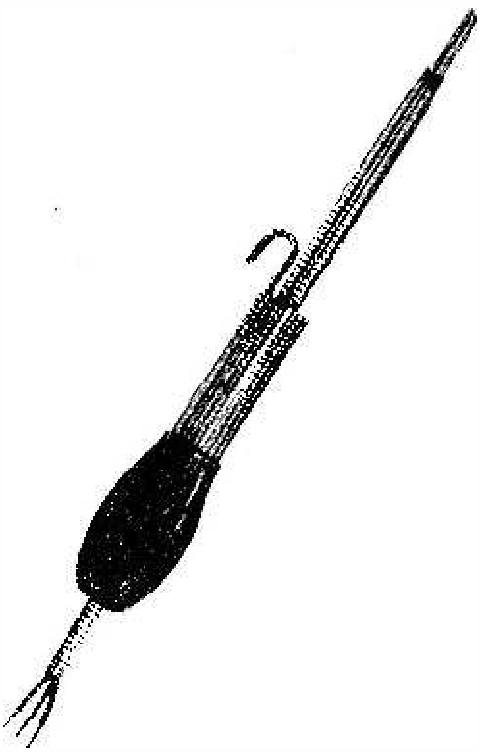
SILICON MATCHED DIODE PAIRS

1N4951 Two diodes in common TO92 epoxy case. Separate anode leads and common cathode. Diodes are statically and dynamically balanced. Max. reverse voltage 20V. Max. dissipation 200mW. Suitable for TV horizontal phase discriminators and similar applications. Price 8/- each. Considerable discount for quantities.

ADCOLA PRODUCTS LIMITED

(Regd Trade Mark)

THE RELIABLE SOLDERING INSTRUMENT!



SEND COUPON FOR LATEST LEAFLET

ADCOLA PRODUCTS LTD
ADCOLA HOUSE
GAUDEN ROAD
LONDON SW4
Telephone 01-622 0291/3

NAME ....

ADDRESS ....

....

....

....

PW177

SEMICONDUCTORS

BRAND NEW AND FULLY GUARANTEED

1N914	1/6
1N916	1/6
1S021	4/-
1S025	5/-
1S113	3/-
1S120	2/6
1S121	2/6
1S130	2/6
1S131	2/6
1S132	2/6
1S44	2/-
2G301	4/-
2G302	4/-
2G303	4/-
2G371	3/-
2N696	4/6
2N697	5/-
2N698	4/6
2N706	2/6
2N706A	2/6
2N708	4/-
2N929	5/6
2N930	7/-
2N1090	6/6
2N1091	6/6
2N1131	6/6
2N1132	6/6
2N1302	3/6
2N1303	3/6
2N1304	4/6
2N1305	4/6
2N1306	5/-
2N1307	5/-
2N1308	6/-
2N1309	6/-
2N1507	5/6
2N1613	5/6
2N1711	6/6
2N1889	6/6
2N1893	8/6
2N2102	15/-
2N2147	14/6
2N2148	12/6
2N2160	14/6
2N2193	5/6
2N2193A	5/6
2N2194A	5/6
2N2217	6/6
2N2218	6/6
2N2219	6/6
2N2220	5/-
2N2221	5/-
2N2222	6/6
2N2368	5/-
2N2369	5/-
2N2369A	5/6
2N2539	4/6
2N2540	4/6
2N2646	11/6
2N2904	8/-
2N2904A	8/-
2N2905	8/-

2N2905A	8/-
2N2906	6/-
2N2906A	8/-
2N2923	4/-
2N2924	4/-
2N2925	3/6
2N2926	
,, Green	3/-
,, Yellow	2/9
,, Orange	2/9
2N3011	12/6
2N3053	6/6
2N3054	12/6
2N3055	15/-
2N3702	3/6
2N3703	4/6
2N3704	4/6
2N3705	4/-
2N3706	4/6
2N3707	4/-
2N3708	3/6
2N3709	3/6
2N3710	4/-
2N3711	4/-
2N3819	9/-
2N3820	23/6
2N4058	5/6
2N4059	5/-
2N4060	5/-
2N4061	4/6
2N4062	4/6
2N44254	8/6
2N4255	8/6
2N4284	3/6
2N4285	3/6
2N4286	3/6
2N4287	3/6
2N4288	3/6
2N4289	4/6
2N4291	3/6
2N4292	3/6
40361	12/6
40362	14/6
3N128	18/6
3N140	19/6
3N141	21/6
3N142	16/6
AAZ13	2/-
AAZ15	2/6
AAZ17	2/6
AC107	6/-
AC126	4/-
AC127	5/-
AC128	4/-
AC176	5/-
AC187	12/-
AC188	12/-
ACY17	5/-
ACY18	5/-
ACY19	5/-
ACY20	5/-
ACY21	5/-

ACY22	4/-
ACY28	4/-
AD140	8/-
AD149	11/6
AD161	7/6
AD162	7/6
AF114	5/-
AF116	5/-
AF117	5/-
AF118	12/6
AF124	4/6
AF125	4/6
AF126	4/-
AF127	3/6
AF139	7/6
AF181	8/6
AF186	11/-
AF239	7/6
AFZ12	8/6
ASY26	5/6
ASY27	8/6
ASY28	5/6
ASY29	5/6
ASZ20	7/6
ASZ21	7/6
BAX13	2/6
BAX16	2/9
BAY31	1/6
BAY38	3/6
BC107	3/6
BC108	3/6
BC109	3/6
BC113	6/6
BC116	12/6
BC118	6/6
BC125	11/-
BC126	11/-
BC147	3/6
BC148	3/6
BC149	3/6
BC167	3/6
BC168B	3/6
BC168C	3/9
BC169B	3/6
BC169C	3/9
BC212L	5/-
BCY30	5/6
BCY31	5/6
BCY32	7/6
BCY33	4/-
BCY34	4/6
BCY38	4/6
BCY39	7/6
BCY40	6/6
BCY42	3/-
BCY43	3/-
BCY54	7/6
BCY70	4/6
BCY71	8/6
BCY72	4/-
BD116	35/-
BD121	17/6

BD123	21/6
BD124	12/-
BF115	5/-
BF117	10/6
BF167	5/6
BF173	7/6
BF180	7/-
BF181	6/6
BF184	7/6
BF194	5/-
BFX12	4/6
BFX13	4/6
BFX29	12/6
BFX30	9/-
BFX35	19/6
BFX43	8/6
BFX44	8/6
BFX84	7/6
BFX85	9/-
BFX86	6/6
BFX87	6/6
BFX88	5/-
BFY10	4/6
BFY17	4/6
BFY18	4/6
BFY19	4/6
BFY20	12/6
BFY41	10/-
BFY43	12/6
BFY50	4/6
BFY51	4/6
BFY52	4/6
BFY76	8/6
BFY77	11/6
BFY90	12/6
BSX19	3/6
BSX20	3/6
BSX21	7/6
BSX26	10/6
BSX27	10/6
BSX28	6/-
BSX29	13/6
BSY26	4/-
BSY27	4/-
BSY28	4/-
BSY29	4/-
BSY38	4/6
BSY39	4/6
BSY40	6/6
BSY51	8/6
BSY52	9/-
BSY53	8/6
BSY54	10/6
BSY95A	3/6
BY100	4/6
BYX10	5/6
BYZ10	9/-
BYZ11	7/6
BYZ12	6/-
BYZ13	5/-
MJ480	20/6
MJ481	27/6

MJ490	22/6
MJ491	29/6
MPF102	8/6
MPF103	7/6
MPF104	7/6
MPF105	8/-
NKT0013	8/6
NKT216	7/6
NKT217	8/6
NKT261	4/-
NKT262	4/-
NKT264	4/-
NKT271	4/-
NKT272	4/-
NKT274	4/-
NKT275	4/-
NKT281	5/6
NKT403	15/-
NKT404	12/6
NKT405	15/-
NKT613	6/6
NKT674	5/-
NKT677	5/-
NKT713	5/-
NKT773	5/-
NKT781	6/-
NKT20329	8/6
NKT80111	15/6
NKT80112	19/6
NKT80113	22/6
OA5	2/6
OA9	2/-
OA70	1/6
OA73	2/-
OA79	1/9
OA81	1/6
OA85	1/6
OA90	1/6
OA91	1/6
OA95	1/6
OA200	2/-
OA202	2/-
OC26	6/6
OC28	8/6
OC35	6/6
OC36	6/6
OC44	4/-
OC45	2/6
OC71	2/6
OC72	2/6
OC75	4/6
OC81	4/-
OC83	4/6
OC81D	4/6
OC84	5/-
OC139	6/6
OC140	6/6
OC200	6/6
OC201	7/6
OC202	10/6

MULLARD INTEGRATED CIRCUITS

FCH211 Hextuple DTL Inverter Gate	28/6
FCH221 Triple 3 Input DTL Line	28/6
FCJ101 3 Input JK Flip Flop	35/-
TAA241 Operational Amplifier	47/6
TAA243 Operational Amplifier	47/6
TAA 263 Linear AF Amplifier	18/6
TAA320 Most LF Preamplifier	15/6

SPEAKERS (3 ohm)

10″ × 6″ 37/6, 9″ × 4″ 23/6, 8″ × 5″ 19/6, 7″ × 4″ 15/6, 5″ × 3″ 12/6, 3″ 9/6, 5″ 14/6, 8″ 27/6, 12″ 39/6.

Post and Packing 2/9

SEND 6d. STAMP FOR CATALOGUE

P.P. for Components 1/6 per order

THYRISTORS

1 AMP: 50V **5/-**, 100V **5/6**, 200V **7/-**, 400V **9/6**.
3 AMP: 50V **6/-**, 100V **7/6**, 200V **8/-**, 400V **10/6**.
ZENERS. 1½ WATT 2·7–33V **4/6**,
400m/w 3·0–33V **5/-**.

INTEGRATED CIRCUITS—R.C.A.

CA3005 **30/-**, CA3011 **20/-**, CA3012 **25/-**, CA3013 **30/-**, CA3014 **30/-**, CA3018 **25/-**, CA3019 **25/-**, CA3020 **27/6**, CA3021 **42/6**, CA3022 **35/-**, CA3023 **32/6**, CA3026 **27/6**, CA3028A **25/-**, CA3028B **35/-**, CA3035 **35/-**, CA3036 **20/-**.

FAIRCHILD

L900, 914 **11/-**, L923 **14/-**.

DATA SHEETS FOR RCA DEVICES **2/-** per type.

Presets std., horiz. or vert. **1/6**

Potentiometers, Log/Lin **3/3** each

MFD	V	Price	MFD	V	Price	MFD	V	Price
1	15	1/6	25	10	1/6	200	6·4	1/9
1	40	1/9	25	25	1/6	200	16	2/-
2	15	1/6	25	50	1/6	250	25	2/9
2	350	2/-	32	15	1/6	250	50	3/9
2·5	16	1/9	32	450	1/6	320	10	1/6
4	15	1/6	40	6·4	1/6	400	16	2/9
4	40	4/9	40	16	1/6	500	6	2/6
4	350	2/3	50	12	1/6	500	25	3/9
5	15	1/6	50	25	1/6	500	50	4/9
6·4	6·4	1/9	50	50	2/-	640	16	3/6
8	18	1/6	64	25	1/6	1000	12	3/9
8	40	1/6	80	6·4	1/6	1000	16	4/-
8	450	3/-	80	16	1/6	1000	25	5/-
10	15	1/6	100	6·4	1/6	1000	50	7/6
10	25	1/6	100	12	1/6	2000	25	8/6
12·5	25	1/9	100	25	1/6	2000	50	12/6
16	18	1/6	100	50	2/6	2500	25	9/6
25	6·4	1/6	125	4	1/6	5000	25	12/6

VEROBOARD

	·15 Matrix	·1 Matrix
2½″ × 3¾″	3/6	4/-
2½″ × 5″	4/3	4/9
3¾″ × 3¾″	4/3	4/9
3¾″ × 5″	5/6	5/6
2½″ × 17″		12/6
3¾″ × 17″	16/-	21/6

Cutter **9/-**

RESISTORS

¼ watt 10%, **4d.**
½ watt 5%, **5d.**
½ and 1 watt, **6d.**
3 watt, 5%, **1/6**
5 watt **2/-**
1 watt Metal Oxide, **1/6**

A. MARSHALL & SON

28 CRICKLEWOOD BROADWAY, LONDON N.W.2

01-452 0161/2/3 CALLERS WELCOME

Post & Packing U.K. only, 1/6. Europe 10/-. Commonwealth (Air) 13/-.