# PRACTICAL WIRELESS

DECEMBER 1969

3/6

## a stereo decoder

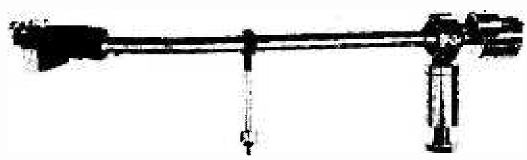
also:

**SIGNAL INJECTOR-TRACER**

# Lasky's

## AMAZING VALUE AD-309K PICK-UP ARM FITTED WITH AD-76K CARTRIDGE

This new AUDIO DEVELOPMENT precision counterbalanced pick-up arm—ready fitted with the outstanding AD-76K magnetic cartridge—offers a truly remarkable breakthrough in quality and value for the Hi-Fi enthusiast. The arm is constructed of brass throughout, heavily chrome plated; uses needle and miniature ball race bearings; both coarse and fine balance adjustment is provided. The fixed head has standard $\frac{1}{2}$in. mounting centres and is finished in black enamel with chrome lifting handle. Tech. details: Overall length 285mm; needle to pivot length 223mm; offset angle 24°; overhang 10mm. Requires single $^{7}/_{16}$in. dia. mounting hole. Completely wired, with all fixing nuts and washers. Arm rest also supplied.
**BRIEF DETAILS OF AD-76K.** Magnetic cartridge: High compliance with stereo diamond LP stylus/ Output 5mV, frequency response: 20–20KHz, tracking weight 2 grammes.



**LASKY'S PRICE £9.19.6** Post 5/-

## LASKY'S EXCLUSIVE 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

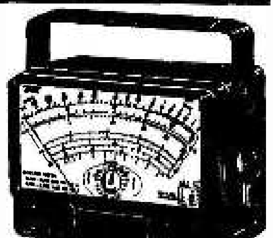
**20,000 O.P.V. MULTIMETER.** Features 24 measurement ranges with mirror scale. Large 3 × 2in. meter. Full scale accuracy: DCV and current: ±2%, ACV: ±3%, resistance ±3%. Special 10·6V DC range for transistor circuit measurements.

**SPECIFICATION**
● 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 ONLY 85/-** Post 3/6

## MODEL 5025

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



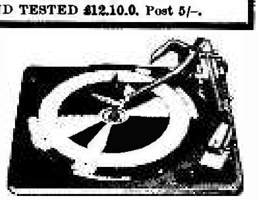
Uses an entirely new range selection mechanism which permits the use of a really large meter in a more compact cabinet. The range selected is clearly indicated on the actual meter face. High speed rotary range selection knob; also features polarity reversal switch, shielded meter movement with overload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

**SPECIFICATION** ● **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 $6\frac{1}{4}$ x $2\frac{1}{8}$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

**AT-60 MkII-4 speed autochanger—less cartridge**



**£13.5.0** Post 5/-

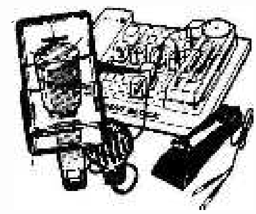
**AUTOCHANGERS**

| | |
|---|---|
| 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 |
| SL55 with J2006 stereo cartridge | £11.19.6 |
| SL65 less cartridge .. .. | £14.15.0 |
| 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.86K magnetic cartridge .. .. .. | £21.10.0 |
| AP75 less cartridge .. .. | £18.10.0 |
| SP25 Mk II less cartridge .. | £11.19.6 |
| SRP22 Mains model less cartridge .. .. .. | £6.12.10 |
| 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

### *NEW 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; 28A 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 £4.19.6** 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.

## *NEW* INTERNATIONAL TAPE

**FAMOUS AMERICAN MADE BRAND TAPE at RECORD LOW PRICES**

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

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

## NEW BUDGET PRICED CASSETTES from U.S.A.

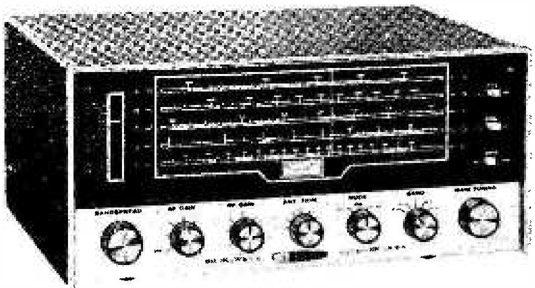
C.60–7/6 (6 for 42/6), C.90–12/6 (6 for 70/-), C.120–17/6.
Post 1/- each. 4 and over Post Free. **Special quotes for quantities.**

## 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)*

# "Listen in" on the World with HEATHKIT shortwave receivers

## TREAT YOURSELF TO A WORLD TOUR . . . *WITHOUT LEAVING HOME!*



GR-54

### DELUXE 5 BAND SHORTWAVE RECEIVER GR-54

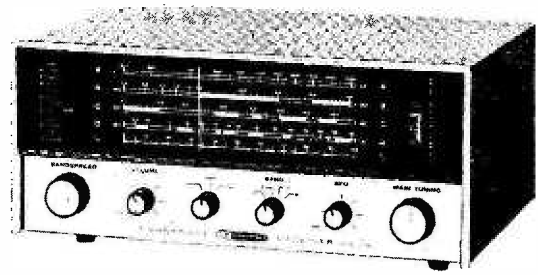
This receiver offers exceptional performance and many special features at such a low price. It covers 2MHz to 40MHz plus 550KHz to 1550KHz AM broadcast band and 150KHz to 420KHz aeronautical and radio navigation band. Receives AM/CW/SSB, 6 x 4in. PM speaker and sleek, "low-boy" styling. Operates on 115–230V 50Hz AC.

**Kit K/GR-54 £48.16.0. Carr. 9/-**

### LOW COST 4 BAND SHORTWAVE RECEIVER GR-64

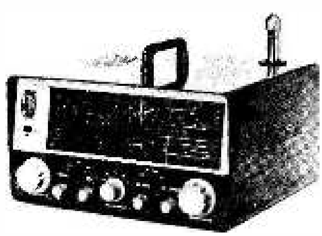
Makes an ideal present for the youngster. It has high performance features plus world-wide reception, shipping, aircraft, radio amateurs plus the popular medium broadcast band. It covers 1MHz to 30MHz plus 550KHz to 1620KHz AM, with sleek "low-boy" styling, operates on 115–250V 50Hz AC.

**Kit K/GR-64 £24.16.0. Carr. 9/-**



GR-64

### GENERAL COVERAGE RECEIVER GC-1U



A welcome traveller wherever you go! Covers 580 to 1550 KHz and to 40MHz in 5 bands with calibrated bandspread scales for 80, 40, 20, 15 and 10 metre amateur bands. Completely solid state and self contained for portability. Operates on two internal PP6 batteries (not supplied) or 230V AC with a suitable power supply.

**Kit K/GC-1U £39.16.0. Carr. 11/-**

### AMATEUR BANDS RECEIVER RA-1

Unequalled value for the radio amateur. Covers 160 to 10 metres. High quality lattice crystal filter for optimum communications selectivity. Optional 100KHz crystal calibrator plugs in inside receiver. 8 valve and 2 diode circuit. Operates on 115, 200–250V AC, 50Hz.

**Kit K/RA-1 £39.16.0. Carr. 9/-**

## Free Catalogue !


See these models and many more in our 1970 catalogue. Models for Stereo/Hi-Fi, Industry, Education and the Home Workshop. Heathkit—the world's largest selling selection of electronic kits and equipment.

HEATHKIT

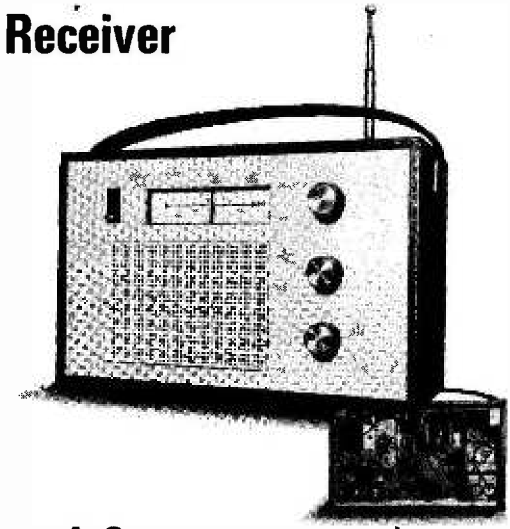
To
**DAYSTROM LTD., Dept. PW-12, GLOUCESTER, GL2-6EE.**
Please send me FREE CATALOGUE ☐
NAME........................................................................
ADDRESS....................................................................
...............................................................................
**Prices and specifications may be subject to change without prior notice**

THIS MONTH IN

THE

# RADIO CONSTRUCTOR

## The "AIRLANE" a 7-Transistor Aircraft Band Receiver



A Super-regenerative Receiver designed expressly for reception on the v.h.f. aircraft band—108 to 140 MHz

2-TRANSISTOR CONVERTER FOR 10 METRES

SUPPRESSED—ZERO VOLTMETER

AUTOMATIC DIMMED/DIPPED HEADLIGHTS

# RADIO CONSTRUCTOR

All in NOVEMBER issue

BUY YOUR COPY NOW 3/-

## TRANSISTORS etc.

| | | | |
|---|---|---|---|
| AC107 | 3/- | OC35 | 7/6 |
| AC126 | 2/- | OC44 | 2/0 |
| AF115 | 3/- | OC45 | 2/0 |
| 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/-).

**THREE 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 megΩ ● 10µµF-·001mfd/1mfd. ● —20 to +22dB. ● **Complete with test leads and instructions.** ● **Over-load protected 1969 model with every refinement. £4.7.6 (2/6). JUNIOR MODEL at 47/6 (2/6) 1000Ω/V described in free list.**

**SOLDERING IRON.** Slim Mod. British High speed, 8½in., all parts replaceable, fully guaranteed for professional, radio and general D.I.Y. use. **19/6** (1/6)

**DIAMOND STYLI** Replacements for BSR TC8LP, TC8/8 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 long or short type, 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, 13/6** ● Stereo Compatible—Mono which also plays Stereo records monaurally with min. wear, **GP91/SC, 19/6.** ● Latest Stereo **GP93, 23/-.** ● Ceramic Stereo, top quality for expensive outfits, **GP94, 38/6** (all 1/-).

**PP3 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 24/9** (1/6). Resistance **32/6** (1/6). Both full range and complete. Full details in list.

**TEST PRODS:** Flexible, unbreakable 24" Red and Black leads, thin 4½" prods, 1½" plugs **4/9** (1/-). Plated Croc. Clips **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 **17/3;** 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 **11/-. 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, 3½ x ¾in. with Base, Adaptor and Neck Cord **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 6½ x 2 x 1½". **£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), **35/6** (5/6); 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, **5/6** (charges paid). **HEADPHONES** High Res. 2000Ω ea. earpiece **18/6** (1/6): Stereo Dyn 8-16Ω, **63/-** (3/-). **EARPIECES** with lead etc., Min. Plug Magnetic **1/6;** Crystal **4/9** (either, up to three, 1/-).

**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 6½-47½in., no swivel, screw hole in base, 12/6. DISAPPEARING** 8 section, swivel fixing assembly, 6½/33in **10/-**. New 6 section **5½/25½in, 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 types. 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. ● **FEEDER CABLE:** Twin r.f. bal. "fig. 8", 80Ω or flat 300Ω transparent polythene insulated, either **6d.** per yd. (all cables 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, 6 ft., **4/6;** 12 ft., **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 October 31st.

# FELSTEAD ELECTRONICS

**(PW25) 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*

# LIND-AIR OPTRONICS LTD

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

## LIND-AIR "COMPACT" HI-FI STEREO SYSTEM

LIMITED PERIOD ONLY

ONLY

**39½ Gns**

Carr. and Ins. 25/-

*Never before such value!*

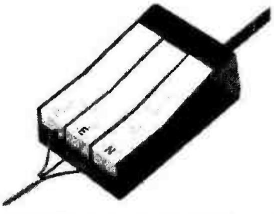
Big sound at low cost! 6 watt r.m.s. per channel. Controls: Bass, Treble, Volume, Balance, Function selector. Mono/Stereo switch. Tape record outlet. Inputs for Tape replay/Tuner. Headphone facility. Beautiful teak case with matched loudspeakers. Garrard Autochanger unit fitted Stereo Cartridge.

**EXCLUSIVE TO LIND-AIR!**

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

## MAINS KEYNECTOR

*SAVES TIME—SAFELY!*



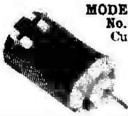
One mains "Keynector" instantly and safely connects electrical appliances to mains supply without the use of a plug. A number of appliances may be used simultaneously up to the full 13 amp rating of this device. A red light glows when "live". The "Keynector" is fused and has its own robust switch which 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 Air-craftBand 108-135 Mc/s. can be obtained. All transistor, 9v battery operation. Fully tunable 18¾in. × 7 section telescopic aerial. Size 4 × 2¾ × 1¼in. 79/6. P. & P. 3/6.

**MODEL MAKER'S MOTOR**



**No. 15RN.** Voltage 1½-5v. Current 400mA. Torque 12g-cm. Body size 1¼" 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.

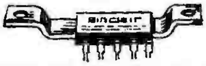
**DE-LUXE STEREO HEADPHONES**

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.

**NEW STEREO/MONO HEADPHONES**

SDH-7. Soft rubber earpieces with slide switch for mono/stereo listening and Ind. vol. controls. Impedance 8–16 ohm Freq. response 25–15,000 cps. With lead and stereo plug.
**£6.6.0.** 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.

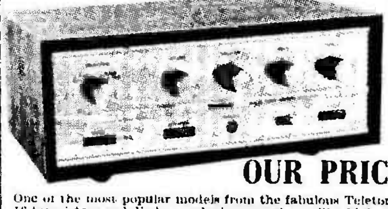
**SPECIAL TRANSFORMER FOR OPERATING SINCLAIR IC-10** from A.C. mains 230/250v. Output 13v. at 0·5 amp. **12/6.** P. & P. 2/6.

## 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. |


## *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 2½ × $1\frac{11}{16}$ × 1⅝in. | Wgt 11oz | Price 12/6 | P&P 2/6 |
| MT64 | 75W | Size 2¾ × 2½ × 2⅞in. | 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 × 4¼ × 4in. | Wgt 4 lb | Price 39/6 | P&P 6/- |
| MT66 | 300W | Size 4 × 4 × 3¾in. | Wgt 6 lb 7 oz | Price 59/4 | P&P 9/- |
| MT110 | 400W | Size 4¼ × 4¼ × 4in. | Wgt 11 lb | Price 85/- | P&P 10/- |
| MT67 | 500W | Size 5¼ × 4 × 4¾in. | Wgt 12 lb 8oz | Price 89/- | P&P 10/6 |
| MT83 | 750W | Size 4¼ × 5¼ × 5¼in. | Wgt 13 lb 4oz | Price 95/7 | P&P 10/6 |
| MT84 | 1000W | Size 4¼ × 5¼ × 5¾in. | Wgt 16 lb | Price 142/2 | Carr. ex. |
| MT93 | 1500W | Size $5\frac{5}{16}$ × 5¾ × 6⅛in. | Wgt 28 lb 9oz | Price 170/6 | Carr. ex. |
| MT94 | 1750W | Size $5\frac{5}{16}$ × 6¼ × 6¾in. | Wgt 31 lb | Price 195/- | Carr. ex. |
| MT95 | 2000W | Size 7 × 6¼ × 8¼in. | Wgt 40 lb | Price 211/2 | Carr. ex. |
| MT73 | 3000W | Size 6¼ × 7¾ × 8⅞ | Wgt 45 lb 8oz | Price 300/- | Carr. ex. |

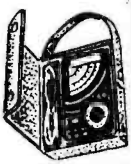
### LOW VOLTAGE 12 VOLT RANGE

Primary 200–250v—Secondary 12v

| | | | | | |
|---|---|---|---|---|---|
| MT111 | 0·5 Amp | Size 3 × 2¼ × 1⅜in. | Wgt 12oz | Price 15/3 | P&P 2/6 |
| MT71 | 2 Amp | Size 2¾ × 2¼ × 2¼in. | Wgt 1 lb | Price 19/- | P&P 3/9 |
| MT69 | 4 Amp | Size 3¼ × 2¾ × 2¾in. | Wgt 2 lb 4oz | Price 28/- | P&P 6/- |
| MT70 | 6 Amp | Size 4 × 3 × 3¾in. | Wgt 3 lb 12oz | Price 39/- | P&P 6/- |
| MT72 | 10 Amp | Size 3¾ × 4¼ × 4in. | Wgt 6 lb 3oz | Price 51/- | P&P 9/- |
| MT115 | 20 Amp | Size 4¼ × 4¼ × 4in. | Wgt 11 lb 13oz | Price 95/- | P&P 9/- |
| MT187 | 30 Amp | Size 5¼ × 4¾ × 4½in. | Wgt 16 lb 12oz | Price 180/- | P&P 13/6 |

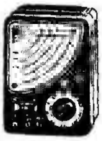
Other ranges available as November. Send for complete Lists

**TTC.C1001 MULTITESTER** in leather case.



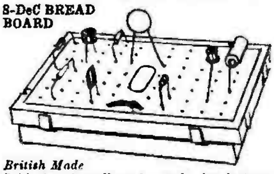
Overload protection. 20,000 opv. AC volts 10, 50, 250, 1,000v. DC volts 5-25, 125, 500, 2500v. D.C. Current 0-50µA, 0-250mA Resistance 0-60K, 0-6 Megohm. Decibels –20 to +22dB. Size of meter 4¾ × 3¼ × 1in. **85/-.** P. & P. 3/6.

**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 4¾ × 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.

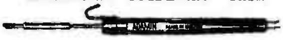
4-DeC KIT. Four S-DeCs with two Control Panels, Jigs and Accessories and the booklet "Projects on S-DeC" all contained in a strong attractive plastic case. Ideal for the professional user. **£5.17.6.** P. & P. 3/6.

## 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/-.

**MINIATURE SOLDERING IRON**



British made and designed for use with transistor circuitry but ideal for many other uses. AC 240v. 18 watt. Length $7^3/_{16}$in., ⅛in. slide on bit. Price 32/6 P. & P. 2/-.

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. PW1269, 54a Tottenham Court Road, London, W1.

# Complete stereo system – 28 gns.

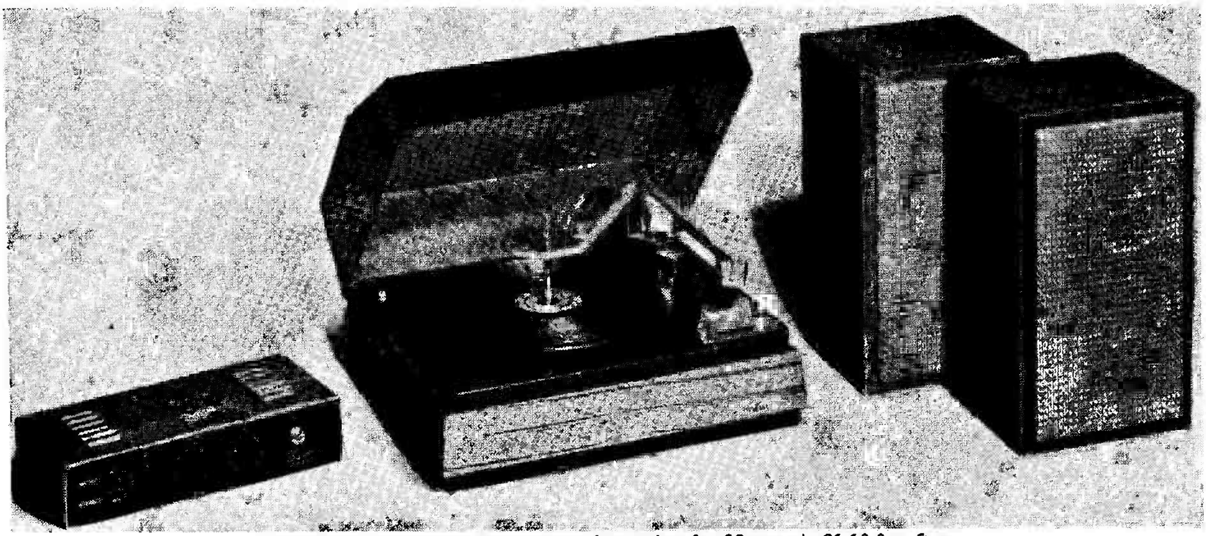
The new Duo general-purpose 2-way speaker system is beautifully finished in polished teak veneer, with matching vynair grille. It is ideal for wall or shelf mounting either upright or horizontally.
**Type 1** SPECIFICATION:–
Impedance 10 ohms. It incorporates Goodmans high flux 6"×4" speaker and 2¼" tweeter. Teak finish 12"×6¾"×5¾". **4 guineas** each. 7/6d. p. & p.
**Type 2** as type 1. Size 17½" × 10¾" × 6¾". Incorporating 10½" × 6¼" bass unit and 2¼" tweeter. 3 ohms impedance **5½ 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.

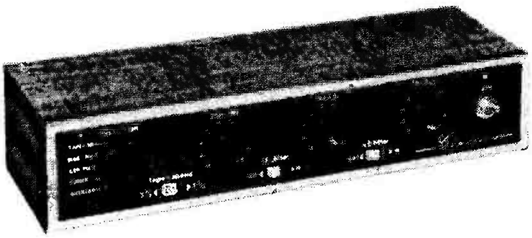


***The above 5 items can be purchased together for 28 gns. + £1.10.0 p. & p.***

## *The Classic* 8½ Gns. plus 7/6 p. & p.

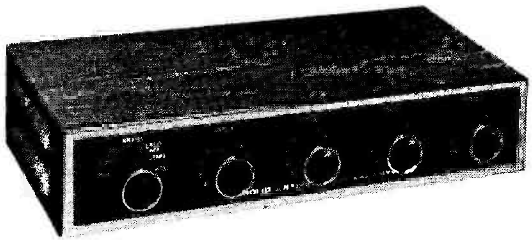
**Controls:** Selector switch Tape speed equalisation switch (3¾ and 7½ i.p.s.). Volume. Treble. Bass. 2 position scratch filter and 2 position rumble filter.

**Specification:** Sensitivities for 10 watt output at 1KHz into 3 ohms. *Tape head:* 3mV (at 3¾ 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 12½in. long, 4½in. deep, 2¾in. high. Teak finished case.



## *The Viscount* 13½ Gns. 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, 12¼" x 6" x 2¾" 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 gns.** plus 7/6 p. & p.

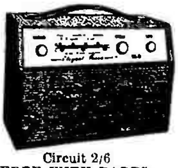


RADIO & TV COMPONENTS
R+TV
(ACTON) LIMITED

## SPECIAL OFFER!

Complete stereo system comprising BALFOUR 4-speed autoplayer with stereo head, 2 Duo speaker systems, size 12in. x 6¾in. x 5¾in. Plinth (less cover) and the DUETTO stereo amplifier. All above items
**19 Gns.** plus 20/- p. & p.

**Also see opposite page**



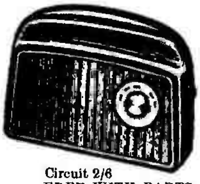
Circuit 2/6
FREE WITH PARTS.

## The ELEGANT SEVEN
### Mk. III (350mW Output)

7 transistor fully tunable M.W.–L.W. 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.

Price £4.9.6 plus 7/6 P. & P.

## The DORSET
### (600mW Output)

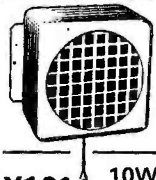


7-transistor fully tunable M.W.–L.W. superhet portable —with baby alarm facility. Set of parts. The latest modulised and pre-alignment techniques makes this simple to build. Sizes: 12 × 8 × 3in.

Price £5.5.0 plus 7/6 P. & P.

MAINS POWER PACK KIT: 9/6 extra

Circuit 2/6
FREE WITH PARTS.

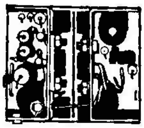


## EXTRACTOR FAN

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.

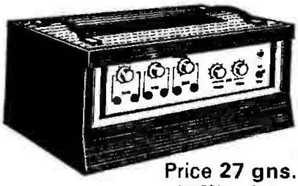
**Power Supplies for the X101:**
P101 M (for mono) 35/- plus 4/6 p. & p.
P101 S (for stereo) 42/6 plus 4/6 p. & p.

## 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.

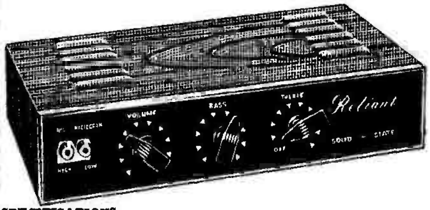
Price 27 gns.
plus 20/- p. & p.

## B.S.R. TD-2 TAPE DECK

Takes 5¾in. spools, fitted with B.S.R. ¼ Track Heads. Size 13¾in. long by 8¾in. wide.

Price £8.19.6 plus 7/6 P. & P.

## The RELIANT
### SOLID STATE GENERAL PURPOSE AMPLIFIER



**SPECIFICATIONS**
Output—10 watts
Output Impedance—3 to 4 ohms
Inputs—1. -xtal mic 10mV
2. -gram/radio 250mV
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″ × 4¼″ × 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
5½ gns. plus 7/6 P. & P.

**RELIANT Mk. II**
In teak finished case.
6½ gns. 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 3¾ × 2¾ × 1¼in. Meter size 2¼ × 1¼in. 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 150mV 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 2¾in. 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.

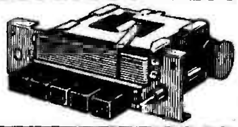
## THREE-IN-ONE HI-FI 10 WATT SPEAKER

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 13¼ × 8¹/₁₆ × 4¼in. 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.

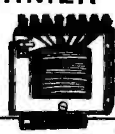
## PYE CAR RADIO
### Push Button Tuning Heart



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.

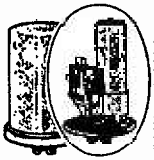
TERMS C.W.O.
All enquiries S.A.E.

RADIO & TV COMPONENTS R+TV (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

## CAR LIGHT FLASHERS



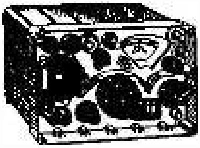
Heavy duty light flasher employs a condenser discharge principle operating on electro mechanical relay. (As inset). Housed in strong plastic case. Flashing rate between 60-120 per minute. 12V DC operation. Maximum load 6 amps. Size 2-11/16in. dia. x 4in. Supplied brand new at a fraction of original cost.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

## HAMMARLUND SP600JX COMMUNICATION RECEIVER

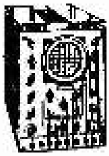
540 Kc/s–54 Mc/s in 6 bands. Few only. **£100** each.

## R209 MK II COMMUNICATION RECEIVER

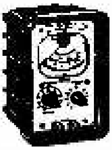
**11 valve high grade communication receiver suitable for tropical use.** 1·20 Mc/s on 4 bands. **AM/CW/FM** operation. Incorporates precision vernier driver, B.F.O., aerial trimmer, internal speaker and 12v. D.C. internal power supply. Supplied in excellent condition, fully tested and checked **£15.0.0.**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

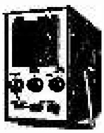
## GEARED MAINS MOTORS

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

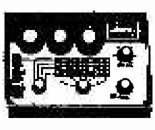
Double beam. D.C. to 9Mc/s. Perfect order. **£65.** Carr. 50/-.

## TO-2 PORTABLE OSCILLOSCOPE



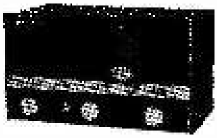
A general purpose low cost economy oscilloscope for everyday use. Y amp. Bandwidth 2 CPS–1 mHz. Input imp. 2 meg Ω 25pF. Illuminated scale. 2in. tube. 115 × 180 × 230mm. Weight 8lb. 220/240V. a.c. Supplied brand new with handbook.
**£22.10.0.** Carr. 10/–.

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

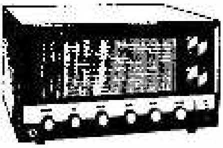


A new portable bridge offering excellent range and accuracy at low cost. Ranges: R. 1Ω–11·1 megΩ 6 Ranges ±1%. L.1 µH – 111 HENRYS 6 Ranges ±2%. C. 10pF ±1110mFd. 6 Ranges ±2%. TURNS RATIO 1:1/1000–1:11100. 6 Ranges ±1%. Bridge voltage at 1,000 cps. Operated from 9 volts. 100µA. Meter indication. Attractive 2 tone metal case. Size 7¼ × 5 × 2in. **£20.** P. & P. 5/-.

## UNR-30 4-BAND COMMUNICATION RECEIVER

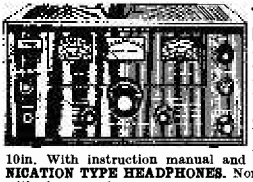


Covering 550 Kc/s–30 Mc/s. Incorporates BFO. Built in speaker and phone jack. Metal cabinet. Operation 220/240V. A.C. Supplied brand new, guaranteed with instructions. Carr. 7/6 **13 gns.**



## 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. × 8½in. Weight 18 lbs. EXCEPTIONAL VALUE. £45. Carr. 10/-. S.A.E. for full details.**

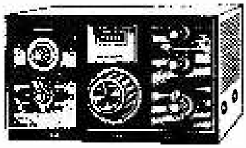


## TRIO COMMUNICATION RECEIVER MODEL 9R-59DE

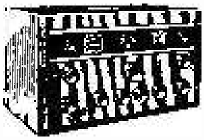
4 band receiver covering 550 Kc/s to 30 Mc/s continuous and electrical bandspread on 10, 15, 20, 40 and 80 metres. 8 valve plus 7 diode circuit, 4/8 ohm output and phone jack. SSB-CW ● ANL ● Variable BFO ● S meter ● Sep. bandspread dial ● IF 455 Kc/s ● Audio output 1·5 W. ● Variable RF and AF gain controls. 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 AMATEUR RECEIVER

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



Covers all the amateur bands in 7 separate ranges between 3·5 and 29·7 Mc/s, 7 valves, 2 transistors and 5 diodes plus 8 crystals: output 8 and 500 ohm and 5,000 ohm phone jack. Crystal controlled oscillator. Variable BFO. VFO. AVC. ANL. S meter, SSB-CW. Stand-by switch. Special double gear dial drive with direct reading down to 1 kHz. Remote control socket for connection to a transmitter. Audio output 1 watt. 115/250v. A.C. mains. Superb modern styling. Size 7 × 13 × 10in. with instruction manual and service data. **£69.10.0.** Carr. Paid.



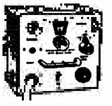
## RCA COMMUNICATIONS RECEIVERS AR88D

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 **£37.10.0.** 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

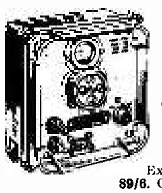


A crystal controlled heterodyne frequency meter covering 1·7-8 Mc/s. Operation on 6 volts D.C. Ideal for amateur use. Available in good used condition. **£5.19.6.** Carr. 7/6. Or brand new with accessories. **£7.19.6.** Carr. 7/6.

## 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.

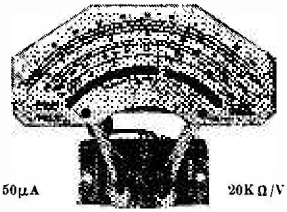
| | | | |
|---|---|---|---|
| | 500-0-500µA **27/6** | 50mA **27/6** | 150V. D.C. **27/6** |
| | 1mA **27/6** | 100mA **27/6** | 300V. D.C. **27/6** |
| | 1-0-1mA **27/6** | 150mA **27/6** | 500V. D.C. **27/6** |
| | 2mA **27/6** | 200mA **27/6** | 750V. D.C. **27/6** |
| | 5mA **27/6** | 300mA **27/6** | 15V. A.C. **27/6** |
| 50µA **40/-** | 10mA **27/6** | 500mA **27/6** | 50V. A.C. **27/6** |
| 50-0-50µA **37/6** | 750mA **27/6** | 3V. D.C. **27/6** | 150V. A.C. **27/6** |
| 100µA **37/6** | 1 amp **27/6** | 10V. D.C. **27/6** | 300V. A.C. **27/6** |
| 100-0-100µA **35/-** | 2 amp **27/6** | 20V. D.C. **27/6** | 500V. A.C. **27/6** |
| 200µA **35/-** | 5 amp **27/6** | 100V. D.C. **27/6** | 8 meter 1mA **32/-** |
| 500µA **40/-** | 20mA **27/6** | | VU meter **42/-** |

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

## *Variable Voltage* TRANSFORMERS

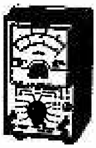
Brand new, guaranteed and carriage paid.
High quality construction. Input 230V. 50–60 cycles.
High output full variable from 0·260 volts. Bulk quantities available.
1 amp.—**£5.10.0;** 2·5 amp—**£6.15.0;** 5 amp.—**£9.15.0;**
8 amp.—**£14.10.0;** 10 amp.—**£18.10.0;** 12 amp.—**£21.0.0;**
20 amp.—**£37.0.0.**

## AVOMETER MOVEMENTS




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.

## TE-40 HIGH SENSITIVITY A.C. VOLTMETER

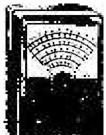


10 meg. input 10 ranges: ·01/·003/·1/·3/1/3/10/30/100/300V. R.N.S. 4cps.-1·2 Mc/s. Decibels –40 to +50dB. Supplied brand new complete with leads and instructions. Operation 230V. A.C. **£17.10.0.** Carr. 5/-.

## 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

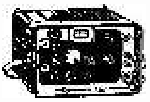


High quality instrument with 28 ranges. D.C. volts 1·5—1,500v. A.C. volts 1·5—1,500v. Resistance up to 1,000 megohms. 200/240v. A.C. operation. Complete with probe and instructions. **£17.10.0.** P. & P. 6/-. Additional probes available: R.F. **35/-.** H.V. **42/6.**

## COSSOR 1049 DOUBLE BEAM OSCILLOSCOPES

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

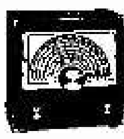
## AM/FM SIGNAL GENERATORS



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 × 3½in. 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. **£1.12.6.** P. & P. 3/6.
300 W. **£2. 7.6.** 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-20RF SIGNAL GENERATOR

Accurate wide range signal generator covering 120 Kc/s-260 Mc/s on 6 bands. Directly calibrated Variable R.F. attenuator. Operation 200/240v. A.C. Brand new with instructions. **£15.0.0.** P. & P. 7/6, S.A.E. for details.

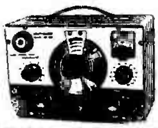
**PEAK-SOUND PRODUCTS.** Full range of Amplifiers, Kits, Speakers in stock.

## TE22 SINE SQUARE WAVE AUDIO GENERATORS

Sine: 20c/s to 200 Kc/s on 4 bands. Square: 20c/s to 30Kc/s. Output impedance 5,000 ohms. 200/250V. A.C. Supplied brand new and guaranteed with instruction manual and leads, **£16.10.0.** Carr. 7/6.

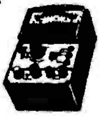
**MARCONI TF142E DISTORTION FACTOR METERS.** Excellent condition. Fully tested. **£20.** Carr. 15/-.

## 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 10μ/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 ⅞in. 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 | *AT60 MK II | £13. 5.0 |
| *2025T/C Mono/Stereo | £8.17.6 | *SL65 | £14.14.0 |
| *3000 Stereo | £9.19.6 | AP75 | £17.17.0 |
| | | 401 | £28. 7.6 |
| | | SL75 | £28.10.0 |
| | | SL95 | £35. 0.0 |

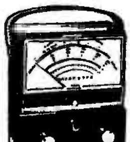
Carriage/insurance 7/6 extra any model. WB4 Bases £3.19.6. Perspex covers £3.10.0. *Special offer base and cover available for these models at £4.15.0. Carr. 5/-. Full range of Garrard accessories available.

## LAFAYETTE LA-224T TRANSISTOR STEREO AMPLIFIER

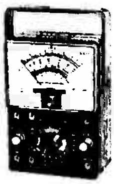
19 transistors, 8 diodes, IHF music power, 30W at 8Ω. Response 30-20,000 ± 2dB at 1W. Distortion 1% or less. Inputs 3mV and 250mV. Output 3-16Ω. Separate L and R. volume controls. Treble and bass control. Stereo phone jack. Brushed aluminium, gold anodised extruded front panel with complementary metal case. Size 10¾ × 3 9/16 × 7 13/16in. Operation 115/230V. A.C. **£28.** Carriage 7/6.

# MULTIMETERS *for EVERY purpose!*

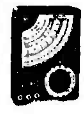
**TE-51. NEW 20,000Ω/VOLT MULTIMETER** with overload protection and mirror scale. 0/6/60/120/1,200v. A.C. 0/3/30/60/300/600/3,000v. D.C. 0·60μA/12/300mA. D.C. 0/60K/6 meg. ohm. **92/6.** P. & P. 2/6.



**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/-.

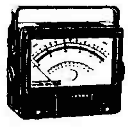


**MODEL AS-100D. 100K Ω/VOLT.** 5in. mirror scale. Built-in meter protection. 0/3/12/60/120/300/600/1,200v DC 0/6/30/120/300/600v AC. 0/10μA/6/60/300 mA/12 amp. 0/2K/200K/2M/200MΩ. −20 to +17dB. **£12.10.0.** P. & P. 3/6.

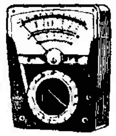


**MODEL TE-10A.** 20kΩ/Volt 5/25/50/250/500/2,500v. D.C. 10/50/100/500/1,000 v. A.C. 0/50μA/2·5mA/250mA D.C. 0/6K/6 meg. ohm. −20 to +22dB. 10·0, 100mFd. 0·100-0·1mFd. **69/6.** P. & P. 2/6.

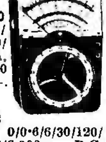
**MODEL TE-90 50,000 OPV mirror scale overload protection** 0/3/12/60/300/600/1200 v. DC. 0/6/30/120/300/1200v. DC. ·03/6/60/600mA. DC. 16K/160K/1·6/16meg Ω. −20 to +63dB. **£7.10.0.** P. & P. 3/-.



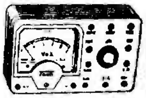
**LAFEYETTE 57 Range Super 50kΩ/volt Multimeter.** D.C. volts 12 mV-1000V. A.C. volts 1·5V-1000V. D.C. current 25μA-10 amp. Ohms 0-10megΩ dB—20 to +81 dB. Overload protection. **£12.10.0.** Carr. 3/6.



**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/160K/1·6M/16 Meg. Ω. **£5.10.0.** P. & P. 3/-.



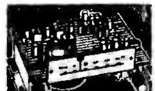
**MODEL TE-80. 20,000 O.P.V.** 0/10/50/100/500/1,000v A C 0/5/25/50/250/500/1,000v D C. 0-50μA, 5/50/500mA. 0/6K/60K/600 K/6meg. **£4.17.6.** P. & P. 3/-.



**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** ¼-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) LIMITED

3 and 34, LISLE STREET, LEICESTER SQ., LONDON, W.C.2 01-437 8204 01-437 9155
311, EDGWARE RD., LONDON, W.2 01-262 0387

**OPEN** 9 a.m. to 6 p.m. every day Monday to Saturday (Edgware Road ½ day Thurs.) Trade supplied.

(ALL MAIL ORDERS TO:- 3, LISLE STREET, LEICESTER SQUARE, LONDON, W.C.2)

# Amplifier & Tuner Kits

The following amplifiers are styled and kitted by T.R.S. using quality components and backing them with well presented instructions and backed by T.R.S. service. Valves and transistors are included as appropriate. All are self-powered unless stated.

### MULLARD SERIES

**3-3 Mono Amplifier**
3 watt output, tapped for 3 and 15 ohms. Sensitivity: 100mV. Bass and treble controls.
Kit .. .. **£7.19.6** *(Carr. 7/6)*
Built and tested **£10.10.0** *(Carr. 7/6)*

**5-10 Amplifier**
Still ranks as one of the best designs ever. 5 valves, 10 watts, o/p for 3 and 15 ohms.
Basic Kit (requiring pre-amp stage) **£10.10.0** *(Carr. 7/6)*
Built .. .. **£13. 0.0** *(Carr. 7/6)*
Basic, with passive control system **£12.10.0** *(Carr. 7/6)*
Built .. .. **£15.15.0** *(Carr. 7/6)*

**2 Valve Pre-Amp**
5 input switching plus auxiliary tone controls, etc.
Kit .. .. **£6.19.6** *(Carr. 5/6)*
Built .. .. **£9.10.0** *(Carr. 5/6)*

**Basic 5-10 Amp and 2 Valve Pre-Amp**
Built and tested **£21.10.0** *(Carr. 10/-)*

**10+10 Stereo Amplifier**
A highly efficient and dependable stereo unit with the best of Mullard and T.R.S. features. O/p transformers tapped for 3 and 15 ohms. Can accept ceramic or crystal P.U. direct otherwise pre-amp is necessary.
Kit .. .. **£18.10.0** *(Carr. 12/6)*
Built and tested **£22.10.0** *(Carr. 12/6)*

**2+2 Valve Stereo Pre-Amp**
Built and tested **£13.19.6** *(Carr. 7/6)*

**T.R.S. 4+4 Stereo Amp**
Transistor amplifier based on Mullard modules and produced to provide good quality and appearance at low cost. 4+4 watts output. For 8-15 ohms speakers. Input switching, etc. Bass and treble controls. Simple module assembly. Amp and pre-amp with front panel and knobs.
Kit .. .. **£7.19.6** *(Carr. 3/6)*
Teak sided cabinet **£1.17.6** *(Carr. 2/6)*
24V. Power pack **£2. 5.0** *(Carr. 2/6)*
Complete kit inc. DIN plugs and sockets **£12.10.0** *(Carr. 7/6)*

**T.R.S. Transistor F.M. Tuner**
Assemblies from modules obtainable separately. Features interstation suppression, A.F.C., etc.
Modules and chassis, scale and tuning drive come to .. **£15.15.0** *(Carr. 7/6)*
Mains power unit **£2. 5.0** *(Carr. 3/-)*
Cabinet to match "4+4" **£1.17.6** *(Carr. 2/6)*
Multiplex decoder for stereo **£10.10.0** *(Carr. 2/6)*

**T.R.S. 6 Valve AM/FM Tuner**
With power supply, valves, large illuminated station-named scale. Push button on-off and wave change, "magic eye" indicator. Tunes Med. waves and F.M. Diode output for tape.
Kit with power unit **£12.10.0** *(Carr. 7/6)*
Built, aligned and tested **£17.10.0** *(Carr. 7/6)*

### MODULES

T.R.S. 12 watt–15 ohm amplifier as specified in *Practical Wireless.*
12-12 Stereo amplifier, built **£5.19.6**
Kit, complete .. .. **£4.11.0**
**Sinclair Z.30**—New power amplifier, as advertised .. .. **£4. 9.6**
**Sinclair Stereo Sixty** Pre-amp/tone control .. **£9.19.6**
**Sinclair PZ.5** power supply unit **£4.19.6**
**Sinclair IC-10** integrated circuit amplifier and pre-amp .. .. **£2. 9.6**
**Sinclair "Micromatic" Midget Radio Receiver**—smaller than a matchbox.
Kit .. .. .. .. **49/6**
Built .. .. .. **59/6**

# Components, Accessories, etc.

**VINAIR**—Latest I.C.I. Cabinet and Speaker covering. Mottled Light-Grey, Off-White, Fawn, Black, etc., **2/6** per sq. ft. Multiples of 6 in. cut, **22/6** per yd. Maximum width **48** in.
*Send 1/- for Samples—Refundable.*

**BONDACOUST**—Speaker Cabinet Acoustic Wadding (as used by leading Hi-Fi Speaker mfrs.). 18 ins. wide. Any length cut **2/6** per ft.; **7/-** per yard

**ENAMELLED COPPER WIRE**
**New 2 oz. reel prices**
14g–20g, **3/-**; 22g–28g, **3/6**; 30g–34g, **4/3**; 36g–38g, **4/9**; 39g–40g, **5/-**.
Other gauges quoted for.

**TINNED COPPER WIRE**
16g–22g .. .. .. .. **4/6** per 2 oz.

**PVC CONNECTING WIRE**
10 Colours (for Chassis wiring, etc.). Single or stranded Conductor **3d**, per yard.

**SLEEVING—Various Colours**
1 mm., 2 mm., **3d.** yd.; 3 mm., **4d.** yd.; 4 mm., **5d.** yd.; 6 mm., **6d.** yd.

**EXCLUSIVE T.R. TAPE BARGAIN**
Professional quality full frequency Mylar Tape by famous m/fr. Attractively presented in coloured simulated leather wallets with space for spare reel.
5 in. 900 ft. **12/6** 5¾ in. 1200 ft. **17/6**
7 in. 1200 ft. **17/6** 7 in. 1800 ft. **22/6**
*Post and packing 1/6 per reel, plus 6d. each for extra reels*

**EMPTY TAPE REELS** (Plastic)
3 in., **1/6**; 4 in., **2/-**; 5 in., **2/-**; 5¾ in., **2/3**; 7 in., **2/6**.

**VEROBOARD**—All standard sizes stocked.
2½×3¾, **3/-**; 2½×5, **3/8**; 3¾×3¾, **3/9**; 3¾×5, **5/2**; 17×2½, **12/6**; 17×3¾, **15/-**. Accessories—Term Pins. **1/-** doz., **3/-** pkt. Face Cutter, **7/3**. Pin inserting tool, **9/6**.

**"CIR-KIT"**—Adhesive copper strip 5 in. by 1/16 in. spool .. .. .. .. **2/-**

**WAFER SWITCHES**
1×12, 2×6, 4×3, 3×4 way, **4/6** each.

**PLUGS AND SOCKETS**
Phono plugs, **1/-**; sockets, **1/-**; twin, **1/6**; DIN 5-pin plugs, **3/-**; 5-pin sockets, **1/6**; 3-pin plugs, **3/-**; 3-pin sockets, **1/6**.

**VOLUME CONTROLS**
1⅛ in. dia. Long Spindles. Famous make. All values 5000 ohms–2 Megohms. Guaranteed 12 months.
Log or Linear tracks. Less Sw. **3/6**; DP Sw. **5/-**.
ditto Centre Tapped ½ Megohm Log, 1 Megohm .. .. .. .. Less Sw. **5/-**
Twin Ganged Stereo controls, Log or Line, 1⅛ in. dia. Long Spindles.
All values 5000 ohms to 2 Megohms. Less Sw. Each **8/6**
ditto 100K to 2 Megohms. With DP Sw. Each **10/6**

**STEREO BALANCE CONTROLS**
Log/Anti-Log 5K, 10K, ½ Meg, 1 Meg, 2 Meg. Each **9/6**

**RESISTORS**
Full Range 10 ohms–10 Megohms. (Midget type, modern ratings). 10% ¼w, ½w, **4d.**; ¾w, **6d.** 20% 1w, **8d.**; 2w, **1/-**. 5% Hi Stab (Cracked Carbon) all pref. values.
10 ohms–1 Meg. ¼w, **6d.**; ½w, **6d.**
ditto 1·2 Meg.–10 Meg.
10% ¼w, **5d.**; ½w, **6d.**
1% Hi Stab ½w, **2/-** (10 ohms–100 ohms, **2/3**).

**WIRE WOUND RESISTORS—COATED TYPES**
Stand. values 25 ohms–10000 ohms
5w, **1/6**; 10w, **1/9**; 15w, **2/3**
SPECIAL VALUES 15K–35K ohms, 5w, **2/6**

**PRE-SET WIRE WOUND POTS**
Slotted Knurled Knob, T.V. Type.
25 ohms–20 K ohms, **3/9**; 50 K ohms, **4/6**.
ditto carbon track 50K–2 Meg., **3/9**.

**SLIDER PRE-SETS** ¼w.
10K-2·2 Meg., **2/-**; 10 ohms–5K, **2/6**.
**SKELETON PRE-SETS** for P/circuit use. 100 ohms–2·5 Meg., **2/-**.

**STANDARD W/WOUND POTS**
Long Spindle—100 ohms–50000 ohms, **7/6** each; 100000 ohms, **7/9** each.

## PLAYING UNITS, CARTRIDGES & PLINTHS

**GARRARD SP.25 Mk. 11**
10½ in. die-cast t/table, cueing device and counterbalance. Less cartridge.
In maker's carton .. .. **£11.19.6** *(Carr. 7/6)*

**GARRARD LM.2025**
With Sonotone 9TA/HC cartridge and lift control .. .. .. **£10.19.6** *(Carr. 7/6)*

**PLINTHS**
Garrard WB.1 .. .. **£3. 7.6** *(Carr. 5/-)*
Garrard Clearview Cover SCP.1 **£3. 5.0** *(Carr. 4/6)*
Garrard Scandinavian Type Plinth and Cover **£5. 5.0** *(Carr. 5/-)*

**CARTRIDGES**
When bought together with playing units. Decca Deram, **£5.5.0**; BSR TC8/H (Stereo compatible), **25/-**; BSR Stereo TC.8S, **28/6**; Sonotone 9TA/HC, **60/-**; Acos GP.93-1, **30/-**.

## ENQUIRIES & ORDERS

*When sending enquiries, they must be accompanied by a stamped and self-addressed envelope. Orders should be written clearly on one side of the paper and cost of carriage added. Where not quoted, please add as follows: ½ lb., 1/-; 1 lb., 1/9; 2 lb., 3/6; 6 lb., 5/-; 10 lb., 6/6; 14 lb., 8/-; over, 10/6. Where postage is overpaid, we credit you with the difference. S.A.E. brings latest T.R.S. Lists.*

*For BETTER BARGAINS*

# TRS

RADIO COMPONENT SPECIALISTS

**70 BRIGSTOCK ROAD**
**THORNTON HEATH**
**SURREY**

**Telephone: 01-684 2188**

**OPEN ALL DAY SATURDAYS**
**THE MAIL ORDER SUPPLIERS**
**FOR PERSONAL ATTENTION**

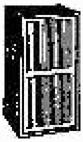
# R.S.C. SENSATIONAL HIGH FIDELITY STEREO 'PACKAGE' OFFERS

## 30 WATT OUTPUT

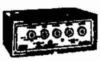
★ Goldring Transcription Turntable on Plinth
★ Shure or Goldring Magnetic Pick-up Cartridge
★ Super 30 Amplifier in veneered housing
★ Pair of Stanway II Loudspeaker Units
Special total price. Four fully wired units ready to "plug-in". Carr. 30/-. **86 Gns.**

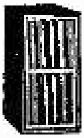
**TERMS AVAILABLE ALL PACKAGE OFFERS**

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 Afromosia veneer. Transparent plastic "roll over" cover.

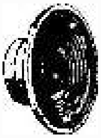
## 30 WATT OUTPUT

★ 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

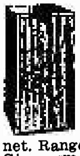


Heavy construction. Latest high efficiency ceramic magnets. Treated Cone surround for low fundamental resonance. "D" indicates Tweeter Cone providing extended frequency range up to 15,000 c.p.s. Impedance 3 or 15 ohms. **Please state choice.** Exceptional performance at low cost. Prices include carriage.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | 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 Afromosia veneer. Acoustically lined or filled woollen damping. Ported where appropriate, credit terms available**

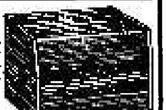


**DORCHESTER** Size 16 x 11 x 9in. Appr. Range 45–15,000 c.p.s. Rating 8–10 watts. Fitted High flux 13 x 8in. Dual Cone spkr. Imp. 3 or 15 ohms **£8.19.9** Carr. 7/6

**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 14½" deep, 11¼" high. Cut for TA12, Super 15, Super 30 and other amplifiers. 'Roll over' transp. plastic cover. Satin Teak or Afromosia veneer finish **8 Gns.** Inc carr.



**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.

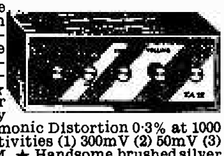
**59/9**

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., 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. 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). **12½ GNS.** Carr. 7/9

## 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. Or Senior 15 watt inc. HF 126 15,000 line Speaker £6.15.0 Carr. 6/6 **£5.15.0** Carr. 5/9

**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.

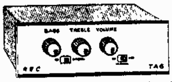
**JE8** Size 16 x 11 x 9in. Pressurised. Gives pleasing results with any 8in. Hi-Fi 'speaker. **£4.10.0**

**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 10¼in. **£6.15.0**

## R.S.C. TA6 6 Watt HIGH FIDELITY SOLID STATE AMPLIFIER

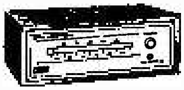


**200–250v. AC mains operated** Frequency Response 30–20,000 c.p.s. –2dB. Harmonic Distortion 0·3% at 1,000 c.p.s. Separate Bass and Treble 'lift' and 'cut' controls. 3 input sockets for Mike, Gram, Radio or Tape. Input selector switch. Output for 3–15 ohm spkrs. Max. sensitivity 5mV. Output rating I.H.F.M. Fully enclosed enamelled case, 9¼ x 2¾ x 5½in. 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 16¼ gns. Or in Teak finished cabinet as illustrated 19¼ 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.

## SUPER 15 MONO

**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 15¼ 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.**

**R·S·C HI-FI CENTRES LTD.**

**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

**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**

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

# PRACTICAL WIRELESS

VOL 45 NO 8

*Issue 754*

DECEMBER 1969


## TOPIC OF THE MONTH

### Regarding Rallies

NOW that the season's spate of mobile rallies is over, it seems in retrospect that there is a large scope for improvement. While admitting that some rallies are parochial and others organised on a grander scale, thus providing a desirable degree of difference, it seems to us that more cohesion would not come amiss.

A central organising body would overcome many of the current defects. Such a body would provide maximum publicity, select the most suitable dates, avoid clashing of events, maintain a better standard and ensure that the calendar contained everything from small local events to large National Mobile Rallies. Events could be arranged to take place in the right part of the country at the right time.

We would like to see more co-operation between clubs in a particular area who could get together as a group and put on a really impressive show, not just a village fête in the back-of-beyond. We would like to see adequate signposting: G3JDG once described the signposts for the Harlow rally as "sweetpapers hidden in hedges", and even this was perhaps too charitable. An organising body could take care of these things and perhaps arrange for commercial organisations to sponsor certain events; for example, if one of the motoring organisations (RAC or AA) is convinced of a large turn-out, its support in signposting can be relied on.

And the tightening up of rally programmes would ensure that they were planned with a bit more imagination. At the moment too much is left to chance and it seems to have escaped many clubs that a rally is partly a *family* affair. All too often the YLs, XYLs and sprigs sit in cars, bored stiff, waiting for the time to go home. We want more efforts like the Woburn Abbey rally where there is plenty to amuse the family as well as the enthusiast. We would like to see more rallies coupled with open days of suitable establishments—the Services, industry and broadcasting. As for a central co-ordinating body, our national society is the natural choice, so how about it RSGB?

W. N. STEVENS—*Editor.*

## NEWS AND COMMENT



## CONSTRUCTIONAL



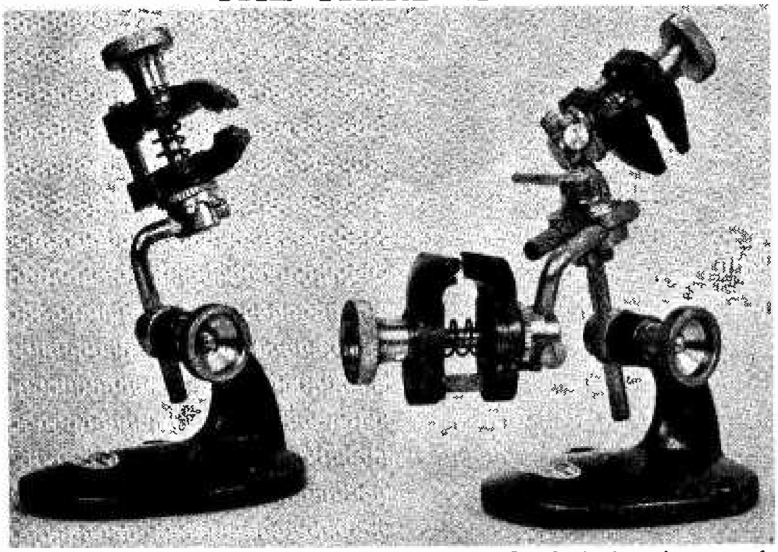
## OTHER FEATURES



**JANUARY ISSUE WILL BE PUBLISHED ON DECEMBER 5th**

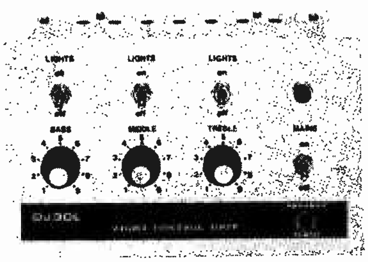
# NEWS AND COMMENT...

## THE THIRD HAND



We are informed by the Coventry Movement Co. Ltd. that they are the manufacturers of the "Multi-Mini" universal vice and stand. This is an ideal device for holding a printed circuit board or components when soldering is taking place. In fact it acts as the "third hand" that many of us wish we had when we are constructing. Price of the Multi-Mini Universal Vice and Stand is 67s. 6d. There is also a model called the Multi-Mini Twin which is basically the same but has an extra set of jaws. Price of this model is £5 18s. It should be possible to obtain both these units at tool stores but should difficulty be experienced, the manufacturers will be pleased to supply direct for a P.P. charge of 3s. extra on each model. *The Coventry Movement Co. Ltd., Burnsall Road, Coventry. Tel: OC03 74364.*

## LIGHTING UNITS



The DJ.10L (£19 10s.) and the DJ.30L (£37 10s.) are light control units. Both units feature dual input sockets for front or rear connections, plus an override switch so that the lights may be left permanently on. Cabinets are made for panel mounting.

DJ.10L makes lights flash on and off with the music; DJ.30L is however a more sophisticated unit with three channels which enable bass, middle and treble frequencies from the amplifier to be operated individually as required. The maximum wattage that each channel will take is 1,000W in the "flashing lights" position or 600W in the "lights on" position with all three channels working simultaneously. *D. J. Electronics (Hackney) Ltd., 170 Albion Road, London, N.16.*

## APAE moves Exhibition to London

It has been found necessary to find a suitable venue to house more exhibitors in larger stands and easier access for visitors from home and abroad for the Assoc. of Public Address Engineers' Exhibition.

The exhibition will be known as "Sound '70 International" and will take place at Camden Town Hall, opposite St. Pancras Station in Euston Road, London N.W.1 from 10th—12th March, 1970, 10 a.m.—5.30 p.m. daily. As in other years stress will be made on the educational theme as well as being a selling and viewing exhibition. Various lectures will take place during the show. The sponsor is the Association of Public Address Engineers.

## "SEMICONDUCTOR DEVICES"

The third booklet in the series of "minibooks" published by the Mullard Educational Service is entitled *Semiconductor Devices.* It is intended as an introduction to the subject which, being treated non-mathematically, should be easily understood by anyone with a basic knowledge of electronics.

The booklet starts with a description of germanium and silicon and shows how they can be made into n- or p-type material by the addition of minute amounts of other elements. Explanations are given of the action of the p-n junction in a diode and the p-n-p or n-p-n arrangement in a transistor. The current-amplifying property of a transistor is explained and several basic transistor circuits are included.

The booklet then describes briefly how various transistors are constructed and has a section on transistor characteristics. In the final section other solid-state devices, such as phototransistors, thyristors, thermistors, f.e.t.s., and Gunn "diodes", are outlined. The booklet ends with a short description of integrated circuits.

*Semiconductor Devices* should be of interest to all students, and apprentices as well as lecturers and teachers of electronics in schools, technical colleges and other training establishments. Priced at 5s. (including packing and postage), it can be obtained from the *Mullard Educational Service, Mullard House, Torrington Place, London, W.C.1.* Cash should accompany orders.

## RAILWAYMEN'S RADIO CLUB

I am a licensed Radio Amateur working for the railway at the town of Eastleigh which is 7 miles north of Southampton. I am trying to form a radio club of railwaymen but they are very hard to contact because of shifts etc.

If railwaymen in the Basingstoke, Fareham, Eastleigh, Southampton and Bournemouth areas would contact me, we may well be able to get a club going. *R. Mannion, G3XFD, 23 Marston Road, Thornhill, Southampton, Hants. Tel: West End 3851.*

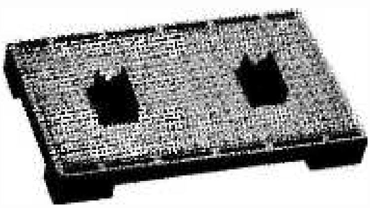
# NEWS AND COMMENT...

## BBC SCHOLARSHIP

The Engineering Division maintains six research scholars at United Kingdom universities, and is awarding one scholarship this year. The scholarships are intended to provide the opportunity for selected honours graduates to work for a higher degree, the subject chosen for post-graduate study being within those fields of physics or engineering which have an application to radio or television broadcasting.

Mr. P. A. Ratliff graduated with first-class honours in electronic engineering from the University of Birmingham in June this year. He has been awarded a three-year BBC Research Scholarship to undertake research in the Department of Electronic and Electrical Engineering, University of Birmingham, under Professor D. G. Tucker, D.Sc., F.I.E.E. The subject of Mr. Ratliff's study is "an aerial system designed to combat multipath fading in VHF mobile communications, using existing AM receivers", and his supervisor will be Professor E. D. R. Shearman, B.Sc., F.I.E.E.

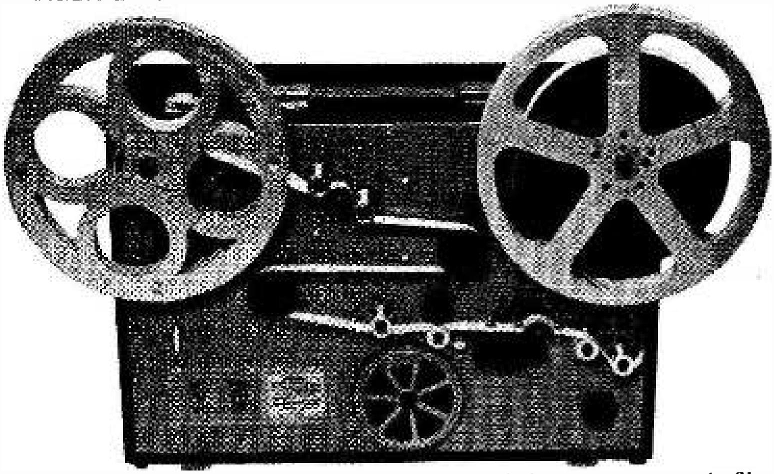
## IC Breadboards from SDC



S.D.C. Products (Electronics) Ltd. now have in their range of modular solderless breadboarding systems, two new DeCs specifically designed to accommodate integrated circuits as well as modern short-lead discrete components and to have an increased contact capability—208 contact points per DeC—as compared with the original S-DeC which is of more limited capacity.

The new μ-DeCs, primarily for integrated circuits, can accommodate two 16-lead DIL stations or four 10-lead TO5 stations. The new T-DeCs, primarily for discrete components, can also accommodate one DIL station or two TO5 stations. *S.D.C. Products (Electronics) Ltd., 34 Arkwright, Astmoor Industrial Estate, Runcorn, Cheshire.*

## MAGNETIC TAPE ON CINE FILM



Supersound Electronic Products announce their new powered film striper. This is a machine that puts a piece of magnetic tape 0·0315in. (standard-8 film) or 0·026in. (super-8) down the side of the film so that a soundtrack can be recorded. The new striper incorporates a footage counter and a power rewind which enables the film to be quickly rewound after it has been striped with tape. Models are available for super/standard-8 (dual gauge), 16mm., and 9·5mm. The 8mm. version (see picture) has a total film capacity of 800ft. and the price for a kit which consists: Striping machine, 800ft. of Superstripe magnetic tape, 1oz. bottle of adhesive, 1oz. bottle of film cleaner and full operating instructions, is £40.

Less sophisticated models are available for £12 10s. and £13 11s. For further details, contact: *Supersound Electronic Products, 114 Mount Pleasant Road, Hastings, Sussex. Tel. Hastings 5647.*

## *SPRAY-ON POWER*

Gould Ionics, an American company, have developed a "spray-on" battery. It can be sprayed on to a printed circuit board in thicknesses down to one-thousandth of an inch. It is also possible to recharge it!

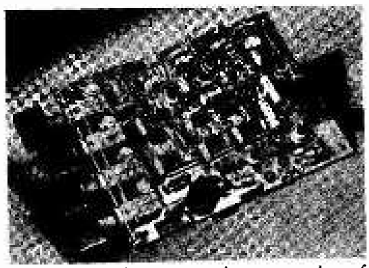
It is formed by first spraying on a silver-carbon electrolyte anode, then a rubidium-silver-iodine electrolyte. After this a specially developed iodine-free cathode is fitted.

A 3-cell 1·5V battery, three-hundredths of an inch thick has been sprayed on to a camera flash tube, illustrating one usage.

The absence of iodine in the cathode is important as it is the diffusion of iodine that shortens the life of other batteries. Current is at the moment limited to 200μA per square centimetre.

Another future application is where a new battery can be selectively sprayed on different portions of a circuit board providing miniaturised isolated power supplies.

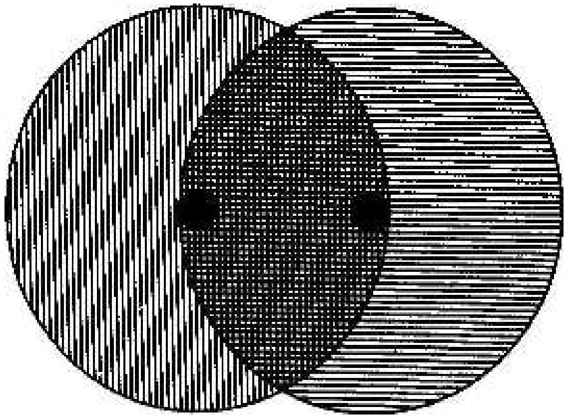
## IC FM TUNER KIT



We now show a photograph of the IC FM Tuner kit mentioned first in News and Comment October 1969 issue. The kit sells at £9 19s. 6d. plus 5s. complete with drilled and tinned printed circuit board, fully illustrated booklet and all necessary components.

## GOLDRING SERVICE AND SPARES

The service and spares department of the Goldring Manufacturing Co. (Great Britain) Ltd., 486-488 High Road, Leytonstone, London, E.11 now has a new telephone number 01-539-4208.



# a stereo decoder

Part 1

F.C.JUDD

STEREOPHONIC f.m. transmissions are at present available to listeners in the UK service areas of the BBC transmitters located at Wrotham, Sutton Coldfield, Holme Moss and Swingate and certain of their relay stations. In order to hear these programmes "stereophonically" a v.h.f./f.m. receiver with a special "decoder" is necessary as the BBC use the "pilot tone" stereo transmission system commonly employed by many European, American, Canadian and Japanese broadcasters. In this system the left- and right-hand channels are "encoded" at the transmitter by a multiplexing process and transmitted on a common frequency. The signals for the respective channels are "decoded", after detection at the receiver. The system is compatible, which means that receivers without a decoder will receive and produce a "monophonic" version of the stereo transmission. An adapted receiver, i.e., one with a decoder will automatically receive and produce a monophonic output from a monophonic transmission and/or a stereophonic output from a stereophonic transmission.

Monophonic transmission of stereo (left- and right-hand channels) involves only adding the signals of the two channels which can be transmitted and received in the normal way. For stereo reception however, additional information is necessary in order to separate the left- and right-hand channels. In the system employed by the BBC (the Zenith-G.E. system) the additional information consists of a difference signal—left minus right—which is transmitted as the upper and lower sidebands of a 38kHz sub-carrier. The sub-carrier itself is totally suppressed. To ensure synchronisation between the receiver "decoder" and the transmitter "encoder", a low level synchronising signal of 19kHz, the pilot tone, is also transmitted.

## Circuit for a decoder

The circuit described in this article can be used with almost any f.m. tuner with a transistor or valve discriminator. The circuit is due to Mullard Limited (Central Technical Services) and the writer is indebted to both Mullard Limited and the BBC for permission to quote from their respective publications.

In the decoder circuit shown in Fig. 1 the pilot tone is extracted from the multiplex input by means of a 19kHz tuned circuit (L1/C2) immediately fol-

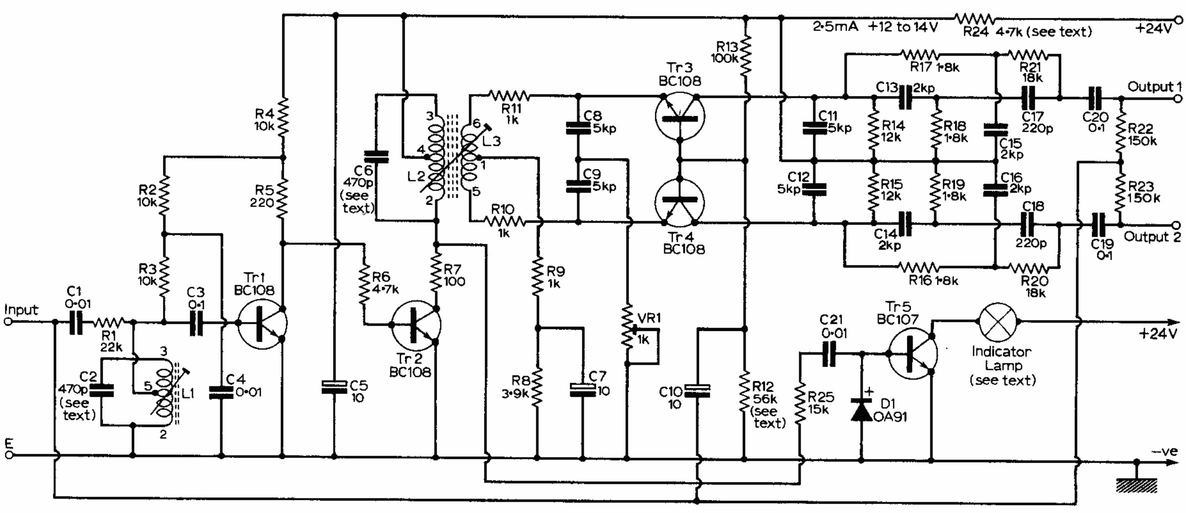
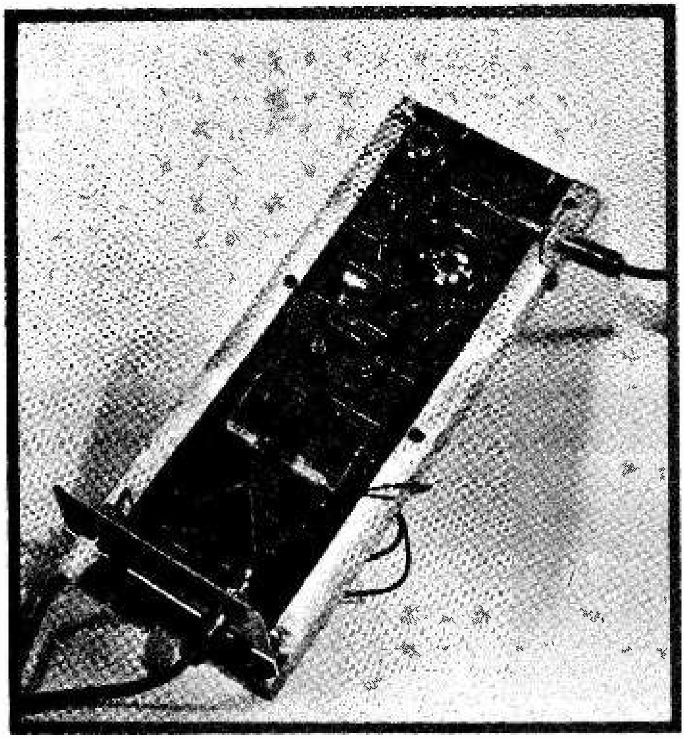



*Fig. 1: Circuit diagram of the stereo decoder.*



*The author's completed decoder.*

lowing the discriminator output. The pilot tone is then amplified by Tr1 and applied to the base of Tr2 which is biased to operate in class B condition, i.e., only the positive half-cycles of the pilot tone are amplified. The distorted waveform resulting from this form of amplification is rich in second harmonic content (38kHz) which is extracted by means of a tuned circuit (L2/C6) in the collector of Tr2. Note that the peak-to-peak amplitude of the 38kHz signal between the collector end of the coil and the tapping (pin 4) is limited to approximately twice the supply voltage. Hence its amplitude is constant once a certain input level has been exceeded.

The centre tapped secondary (L3) applies antiphase switching signals to the emitters of Tr3 and Tr4 whilst the complete multiplex information is applied to the bases. With this arrangement, synchronous detection to obtain the difference signal, together with matrixing of the sum and difference signals occurs, and the now separated left- and right-hand signals appear respectively at the collectors of Tr3 and Tr4. However, with a simple decoder operating as described, only a limited separation is obtained. The circuit of Fig. 1 contains additional arrangements to improve separation which is done by introducing a controlled amount of crosstalk into the two outputs and in antiphase to the inherent crosstalk.

Although conventional de-emphasis occurs in the collector circuits of Tr3 and Tr4 this is insufficient to remove the 38kHz waveform from the output. Any strong residual 38kHz signals could produce distortion in a following audio amplifier or produce spurious whistles on a tape recording by beating with the bias oscillator in the tape recorder. Parallel-T filters are therefore included to reduce the 38kHz signal at the decoder outputs to a more or less negligible amount.

In the absence of a 38kHz switching waveform, i.e., during monophonic transmissions, the switching transistors Tr3 and Tr4 are biased to operate in class A and any signal applied to their bases is reproduced at their collectors. The circuit is therefore compatible and requires no switching from stereo to mono operation.

## Indicator lamp

Stereo transmissions are directly indicated by means of a lamp which lights when the 19kHz pilot tone is present in the transmission. The signal for driving the stereo indicator lamp is actually taken from the 38kHz output at the junction of R7 and L2 in the collector circuit of Tr2. This signal allows Tr5 to conduct and pass sufficient current (20 to 30mA) to light the lamp in its collector circuit. Note that the h.t. voltage required to operate the stereo indicator lamp is 24V assuming the use of a 24V 20mA lamp as originally specified for the Mullard circuit. The decoder itself requires an h.t. rail of only 12 to 14V and could be run from this potential if the indicator circuit and its lamp is omitted. The indicator light is however a valuable asset to reception and to the alignment of the decoder and is therefore best retained.

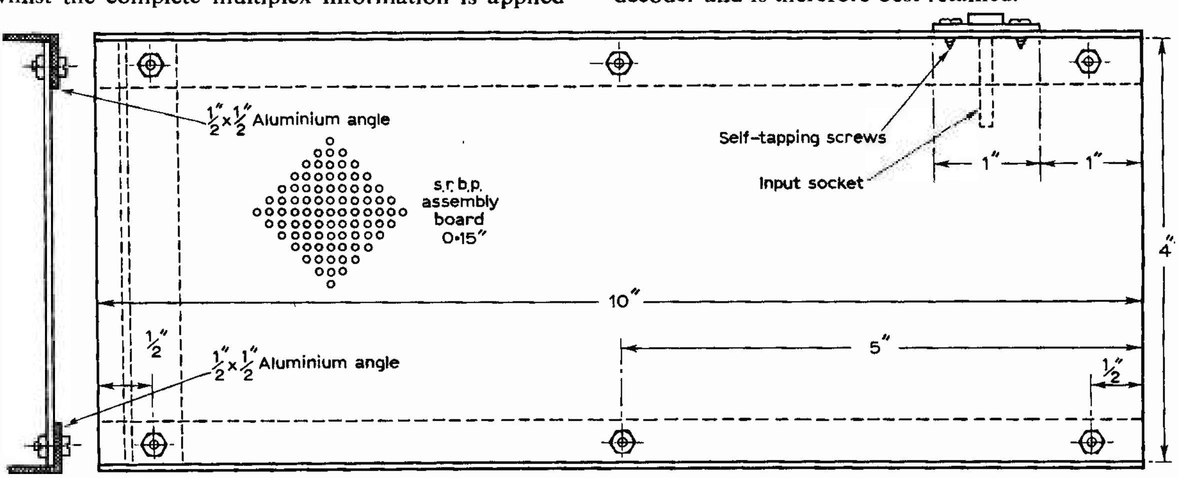
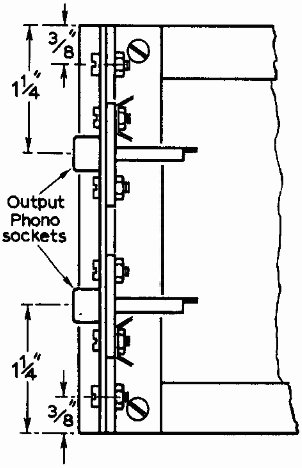



*Fig. 2: Assembly board and support rails.*



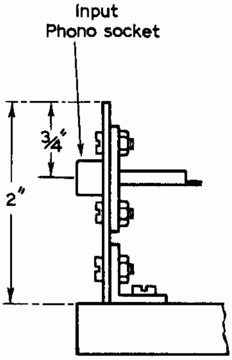




*Fig. 3a: (above left) Output socket assembly.*

*Fig. 3b: (above) Input socket assembly.*

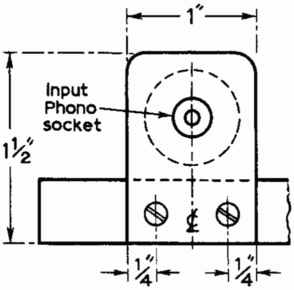



*Fig. 4: (left) Input socket panel.*

## Construction

The entire decoder (except the power supply) could no doubt be accommodated as a much smaller assembly board than that shown in Fig. 2. The use of a fairly large board makes layout a little easier and in fact by extending the length of the board the small 24V power supply might also be included as well. No details for a box of any kind have been given as constructors may wish to mount the unit in some existing form of cabinet perhaps containing the f.m. tuner and amplifier So long as the input and output leads are screened there should be little trouble with hum pick-up but precautions should be taken by keeping the unit away from leads carrying mains voltages and from large mains transformers.

As shown in Fig. 2 the s.r.b.p. perforated assembly board is mounted on $\frac{1}{2} \times \frac{1}{2}$ inch aluminium angle which gives support to the board and could be used for mounting purposes. Attached to one end of the board as in Fig. 3a is the output socket panel, also mounted on $\frac{1}{2} \times \frac{1}{2}$ inch aluminium angle as in Fig. 3b. The input socket panel (Fig. 4) is mounted directly on one side of the main assembly as shown in Fig. 2.

The component layout for use with Mullard decoder coils type WF2949 (19kHz—L1) and WF2951 (38kHz—L2/3) is shown in Fig. 5. Note that the pin connections are as seen when looking at the base of the coils (through the board) and as also shown in Fig. 6. The reference as to orientation on the board itself is the earthing tag pin 8. Note that these coils cannot be obtained direct from Mullard Limited, but are available from Gurneys Radio Limited, 91 The Broadway, Southall, Middlesex. Those who decide to use the alternative coils by Henry's Radio Limited, 303 Edgware Road, London, W.2, should use the layout and wiring shown in Fig. 7 and then continue as in Fig. 5. The Henry's decoder coils which are known by frequency, i.e., 19kHz and 38kHz respectively, are identical to the other coils in characteristics but the pin connections are as shown in Fig. 6. If these coils are used the reference for orientation is the earthing tag on the metal clamp.

## Power supply

A circuit for a suitable 24V power supply is shown in Fig. 8 and a schematic for assembly in Fig. 9. As previously mentioned the power supply could be assembled on an extension of the main component board or separately on a small chassis of its own.

When assembly has been completed preliminary tests should be made. Check the h.t. current at the point marked X in the circuit Fig. 1. This should be approximately 2·5mA if the h.t. is 12 to 14V and in this case no alteration to the value of R24

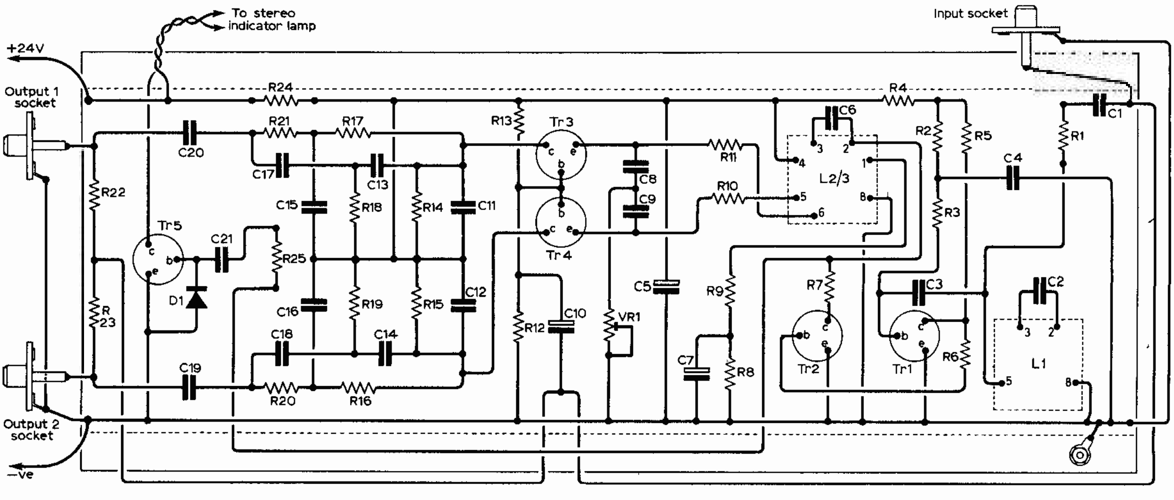



*Fig. 5: Wiring and layout of decoder (Mullard Coils).*

(4·7kΩ) should be necessary. If an audio generator capable of providing a sine-wave output of approximately 50mV at 19kHz is available, a preliminary tuning check on L1 and L2/3 can be carried out. Couple the generator to the input of the decoder and on tuning the coils with the integral tuning slugs, it should be possible to light the stereo indicator lamp. If an r.m.s. reading valve or transistor voltmeter is available further checks can be made as follows. With approximately 50mV of 19kHz signal at the input of the decoder the r.m.s. voltage of the 38kHz signal between the junction of R7 and L2 and earth should be around 4V. The signal at either side of L3 to earth should be approximately 400mV. If an oscilloscope is available examination of the waveforms at the input and at the junction of R7 and L2 should show whether or not the 38kHz signal is being developed.

## ★ components list

**Resistors:**

| | | | | | |
|---|---|---|---|---|---|
| R1 | 22kΩ | R10 | 1kΩ | R19 | 1·8kΩ |
| R2 | 10kΩ | R11 | 1kΩ | R20 | 18kΩ |
| R3 | 10kΩ | R12 | 56kΩ | R21 | 18kΩ |
| R4 | 10kΩ | R13 | 100kΩ | R22 | 150kΩ |
| R5 | 220Ω | R14 | 12kΩ | R23 | 150kΩ |
| R6 | 4·7kΩ | R15 | 12kΩ | R24 | 4·7kΩ |
| R7 | 100Ω | R16 | 1·8kΩ | R25 | 15k |
| R8 | 3·9kΩ | R17 | 1·8kΩ | | |
| R9 | 1kΩ | R18 | 1·8kΩ | | |

**Potentiometer:**
VR1 1kΩ

**Capacitors:**

| | | | |
|---|---|---|---|
| C1 | 0·01μF | C12 | 0·005μF |
| C2 | 470pF (s.m.) | C13 | 0·002μF |
| C3 | 0·1μF | C14 | 0·002μF |
| C4 | 0·01μF | C15 | 0·002μF |
| C5 | 10μF Elec. 25V | C16 | 0·002μF |
| C6 | 470pF (s.m.) | C17 | 220pF (s.m.) |
| C7 | 10μF Elec. 25V | C18 | 220pF (s.m.) |
| C8 | 0·005μF | C19 | 0·1μF |
| C9 | 0·005μF | C20 | 0·1μF |
| C10 | 10μF Elec. 25V | C21 | 0·01μF |
| C11 | 0·005μF | | |

**Transistors:**
Tr1, Tr2, Tr3, Tr4 Mullard BC108
Tr5 Mullard BC107

**Diode:**
D1 Mullard OA91

**Coils:**
L1 19kHz—Henry's Radio or Mullard WF2949—Gurneys Radio
L2 38kHz—Henry's Radio or Mullard WF2951—Gurneys Radio

**Miscellaneous:**
Indicator lamp 24V 20/30mA; 3 single phono sockets; perforated s.r.b.p. assembly board; ½×½ aluminium angle etc.

**Power supply:**
Transformer T1 (Henry's Radio CT1) Pri 230V with tapped secondary for 15 to 18V.
Rectifier MR1 Contact cooled type 1H3
Capacitor C1 Elec. 2500μF 30V working

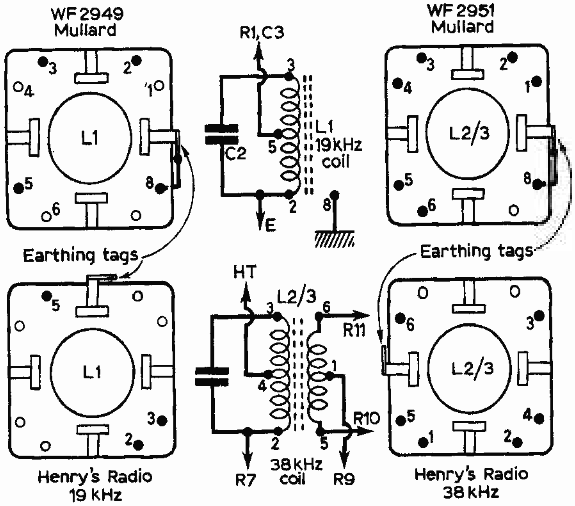



*Fig. 6: Outlines and connections of available coils.*

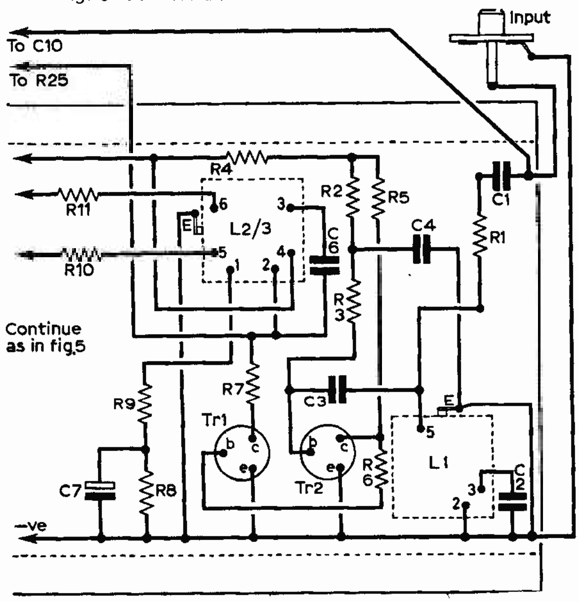



*Fig. 7: Coil wiring for Henry's Radio decoder coils.*

## Coupling to an F.M. tuner output

The input impedance of the decoder is approximately 15kΩ and it may be fed directly from a transistor discriminator capable of providing a loaded output with a peak-to-peak amplitude of approximately 750mV. The decoder may also be fed from a valve discriminator in which case the output will probably have to be attenuated by a series resistor and shunt capacitor. This arrangement not only provides the correct input level at all multiplex frequencies but also reduces the discriminator loading to an acceptable value. The series resistor may be between 3·3kΩ and 33kΩ and the capacitor around 300pF. As an example, a resistor of 15kΩ shunted by 300pF was found just about right when the decoder was operated from a Heathkit (valve) f.m. tuner.

The actual point of signal take off from the tuner

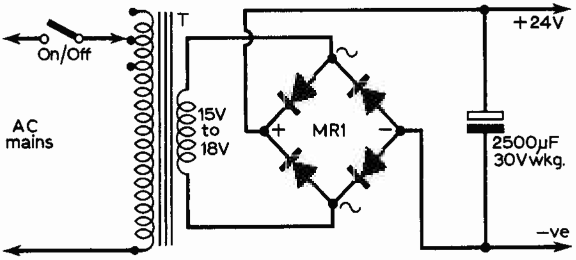


*Fig. 8: Circuit of the power supply.*

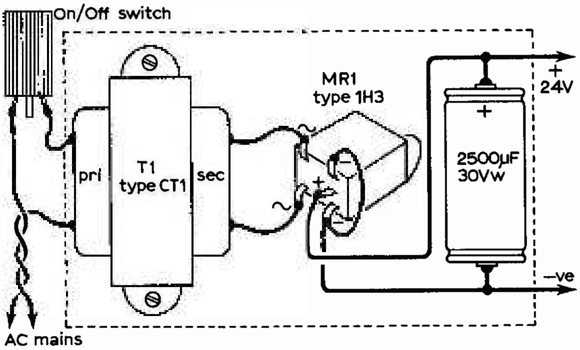


*Fig. 9: Power supply assembly details.*

is best made directly at the output from the discriminator circuit, i.e., before the de-emphasis network which should be disconnected. The circuit of Fig. 10 is the discriminator of a Heathkit tuner used for subjective testing of the decoder and is typical of those employed in f.m. tuners using valves. The circuit of Fig. 11 shows the discriminator of a transistorised tuner and again is typical of those at present in use.

## Alignment of the decoder

For initial alignment any stereo transmission can be used and the procedure is as follows. Connect a potentiometer of at least 50kΩ across the discriminator output and connect the decoder input to the slider of the potentiometer which should now be set to maximum value. Tune the receiver to a stereo broadcast (Radio 3) and carefully and slowly adjust the 19kHz and 38kHz coil slugs for maximum brightness of the stereo indicator lamp. (The preliminary test with an audio signal generator mentioned earlier should have produced the same result, i.e., maximum brilliance of the indicator lamp.) Next adjust the potentiometer until the lamp just glows and then re-set the coil slugs again to produce maximum brightness. Repeat this procedure until any further adjustment of the slugs produces no further increase in brightness. The two coils are now reasonably well aligned. should the slugs fail to tune the coils sharply at approximately their mid-position of travel it may be necessary to alter the value of C2 and/or C6, as the case may be, to 390pF.

When this alignment procedure has been completed disconnect the potentiometer, re-connect the decoder to the discriminator output and adjust the pre-set control VR1 (1kΩ) to its mid-position, i.e., slider halfway round. The decoder should now give a reasonable degree of separation but should now be finally aligned with the help of the BBC test tone transmissions which are transmitted every Wednesday and Saturday at 11.30 p.m. (2330 hrs.) on Radio 3 v.h.f./f.m. Full details of the various tests can be obtained free by writing to the BBC Engineering Information Department, Broadcasting House, London, W1A 1AA. Ask for: *Information Sheet No. 1605(2) May 1969 Stereophonic Broadcasting, Test Tone Transmission.*

The test tone transmissions will facilitate identification of the left- and right-hand channels which should be done with the decoder output connected to the stereo amplifier. Now, when the left-hand channel only is being transmitted disconnect the left-hand amplifier channel and adjust the 38kHz tuning slug very slowly **anti-clockwise** (as viewed from the top of the coil) until the output from the right-hand loudspeaker is at minimum. Anti-clockwise rotation of the slug is necessary because a false minimum will be obtained with clockwise rotation.

Next re-connect the left-hand amplifier channel and when the right-hand channel only is being transmitted disconnect the right-hand amplifier channel and adjust the preset (VR1) to produce minimum output from the left-hand loudspeaker. Reconnect the right-hand amplifier for normal stereo and note that the stereo indicator light will have been on as during any stereo transmission. It does not glow during monophonic transmission.

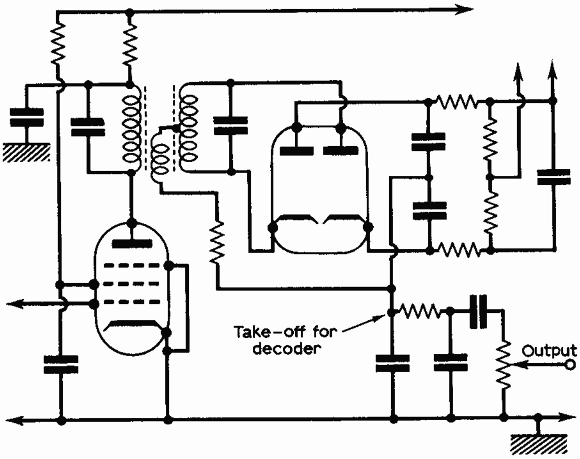


*Fig. 10: Typical discriminator output (valved tuners).*

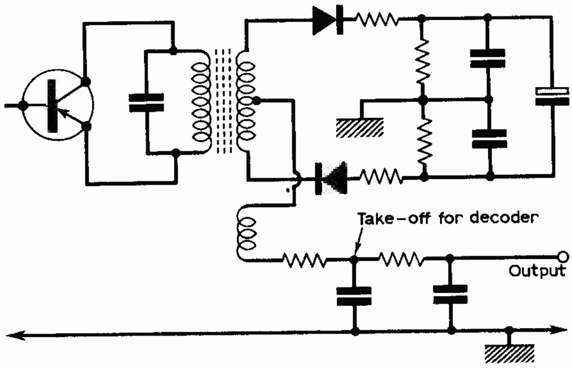


*Fig. 11: Typical discriminator output (transistorised tuners).*

## Performance

The decoder, exactly as per the circuit in Fig. 1, was tested with both valve and transistor f.m. tuners. It was aligned as described above on BBC transmissions and by means of special laboratory stereo test equipment. The performance was quite in accordance with the Mullard specification. Channel separation is around 30dB and the decoder has a good signal-to-noise performance. It is worth noting however, that as the signal-to-noise ratio of a stereo broadcast is slightly lower than that of a monophonic broadcast a good f.m. aerial should be used to maintain the best reception signal-to-noise level. The average audio signal output per channel is around 400 to 500mV and should be more than sufficient for the "tuner" input on stereo amplifiers. The impedance of the amplifier inputs should preferably be not less than 50kΩ.

The following BBC Engineering Information Sheets may also be of interest to those contemplating stereo broadcast reception: *Information Sheet 1603 (6) April, 1969—Stereophonic Broadcasting. Information Sheet 1102(4) May, 1969—VHF Radio Receiving Aerials. Stereo Q and A*—This leaflet deals generally with stereo broadcast reception and can be obtained, as the other leaflets, free of charge from the BBC Engineering Information Department at the address previously given. ■



# THE MW COLUMN

CONDITIONS on the medium waves have been good throughout the summer in spite of occasional fadeouts. Johannesburg 1286 was logged on the 22nd June by Glyn Morgan of Tredegar. A good effort Glyn, not many of us have heard this one. Latin American reception was excellent in June and July. Brazilians such as PRA3 860, PRF4 940, PRE8 980 all in Rio de Janeiro and PRB9 1000, PRG9 1100 in Sao Paulo were particularly prominent just before sunrise. Reception of the West Coast of the United States came on 1st September at 0431 hrs. GMT when the writer logged KOMO 1000 in Seattle. The following morning KFBK 1530 Sacramento, California was heard as a background to WCKY by a DXer in Cumberland.

Ramadan starts on 11th November this year. During this four week period many radio stations in the Arab world remain on the air all night, providing the DXer with the opportunity to log countries that otherwise would rarely be heard. Among the more prominent signals are Morocco on 593 and 837 (Ouijda), 611 (Sebaa Aioun), 935 (Agadir), 1115 and 1232 (Tangier); Algeria with 529 (Constantine), 548 (Oran), 890 and 980 (Algiers); Tunisia on 629 and 962 (Tunis); Egypt with 557 and 773 (Cairo), 620 (Batra). More difficult countries are Libya 674 (Benghazi), 1052 (Tripoli); Saudi Arabia 588 and 647 (Riyadh), 602 and 723 (Jeddah); Jordan 800 (Amman); Syria 566, 665 and 785 (Damascus), 746 (Aleppo); Lebanon 836 (Beirut); Iraq 760 and 908 (Baghdad); Kuwait 1345; Iran 777 (Zahadan), 1390 (Ahwaz). The late evening onwards is the time to look for these stations.

It is now generally agreed that the sunspot maximum has been passed, so we can look forward to a steady improvement on the medium waves possibly with some DX from the Far East. There are two periods of the day for FE reception in the UK. The first is in the afternoon in winter, an hour or so before sunset. Stations to look for include the *Voice of America* stations in Okinawa on 1178kHz and in the Philippines on 920 (Malolos) and 1140 (Poro). The programmes from these stations are mainly in Far East languages but station identification is usually in English on the hour and half-hour. Okinawa can be heard behind Horby Sweden when conditions are good, sometimes with news in English. The second period occurs after midnight when *All India Radio* is often heard on 1070kHz (Rajkot). Others to look for are Jullender 710, Lucknow 910, Delhi 1020, Bikanar 1330. *A.I.R.* Rajkot has a news bulletin in English at 0110 hrs. GMT which helps with identification. Do not be misled if you hear Indian music on 760kHz, it will be from ZFY in Guyana. There is a large Indian population in this South American country and *Radio Demerara* carries special programmes for them.

The new BBC relay station in Masirah Island has been heard on 1410kHZ with sign off at 2115 hrs. GMT. This station is a replacement for Perim Island which was part of the Aden Protectorate. Masirah relays the BBC World Service.

**CHARLES MOLLOY**

# LETTERS...

*The Editor does not necessarily endorse the views expressed by correspondents.*

## Useful Tips

Having read the article in the October issue of PRACTICAL WIRELESS, "Printed Circuit Design", I would like to point out two labour-saving tips.

First of all, having established the final design this can indeed be transferred to the copper laminate board by means of carbon paper, but I have found from practical experience that Sellotape masking can be omitted. Provided one has a fairly steady hand the outline of the design can be painted with a small paint brush using nail varnish. After etching, nail varnish remover can be used. Secondly, I am doubtful whether the best solution to feedback path problems really is a link wire. For v.h.f. work, for instance, the mechanical nature (and capacitative effect) of such a dodge could result in instability. Better to puzzle the link out in the design and remember the copper laminate path need only be, say, ⅛in. wide. This is probably narrow enough to pass between two adjacent paths.—**D. M. Aldridge** *(Co. Durham).*

## When is a dB not a dB?

Mr. Mitchell made some valid points, "Ex-Meter" October PRACTICAL WIRELESS, but the actual situation is even worse. The idea of using an S scale for signal reports, stands or falls on using a standard number of dB's per S point. This is not done in practice. "Home-brew" apart, manufacturers use various ratios for their meter calibration, some use 3dB per point, others use 6dB's per point, while the "cheap" receivers use almost anything. In such circumstances, S reports can be meaningless for any real useful purpose. For example, a station requires a report on an aerial's efficiency, two other stations reply. One says "S9 here O.M.", the second says "S6 here". O.K. so far, but! the first station's meter is calibrated at 3dB per point, while the second is 6dB per point. So we have the position where the "S9" is actually 27dB, while the "S6" is 36dB. What a hopeless situation and of harm to the experimenting station's efforts. However, a meter can be of great help when used purely as a "comparative indicator" during experiments. If the meter is set to mid-scale (whatever type of calibration is used) on the signal any change in level can be observed and reported as a *percentage* of the original reading. A much more helpful report than "slavish" S reports. Decremental modulation and comparison between the side-bands on a.m. is observable, plus other effects, using a meter. So if one wishes to be of help, do use a meter, but allow for its drawbacks in practice, the average S meter is only useful for comparative reports and nothing more.—**M. J. Shepherd** *(Essex).*

## Beware!!

Regular readers of your magazine will certainly be wary of purchasing semiconductors "on the cheap" if good results are expected, but there would appear to be no guarantee of quality even when full prices are paid to some well-known suppliers. On several occasions I have dismissed the odd "dud" when only a couple of shillings has been involved, but I have recently come unstuck to the tune of nearly £3 and am fast losing confidence in ordering semiconductors by post. In this instance, the semiconductors involved were some fairly expensive power transistors for use in a well-known Hi-fi audio amplifier circuit. They have a trade-mark with which I was not familiar, and were found to have most undesirable characteristics in use. Each transistor, for instance, had a very high value of $I_{ceo}$ of the order of hundreds of milliamps with only low $V_{ce}$, so what with the live open-circuit the core-temperature rose to very high values. On replacing these transistors with others bearing a well-known trade-mark, the circuit functioned perfectly. The supplier disclaimed liability, stating that as far as he was concerned, the transistors were "to spec." *Which* spec., though? I have therefore paid out nearly £3 for some TO3, can electric fires—if this had been all that I required I could have searched for a hefty valve from the junk-box!

Manufacturers and distributors naturally cannot supply small quantities to the constructor, and the local shop cannot be expected to stock every obscure semiconductor, but how can the constructor obtain semiconductors through the post with confidence? The only answer would seem to be to persuade reputable suppliers to advertise the manufacturer's name against each semiconductor, as is indeed already done by some suppliers, so that the constructor knows exactly what device he can expect to receive.—**D. J. Farman**, G3TWZ *(Middlesex).*

*[I agree with you that the subject you mention could be aired. With regard to particular cases, I would like you to understand that should you have this sort of trouble with the advertisers of* PRACTICAL WIRELESS *we are always ready to take up the matter on behalf of a reader, providing that we have full details fairly quickly. In this way, we have been able to obtain satisfaction in a number of instances where a reader has had a poor deal from the advertisers. Perhaps you would bear this in mind for the future.—Editor]*

## PSST! WANNA BUY PRACTICALWIRELESS?

We received a letter recently from F. Laverty, BRS 23419, enclosing a cutting from his local paper the *Luton, Beds. Saturday Telegraph.* It read: "The scene: One of those little shops that sell lots of girlie magazines, in a Luton side-street. It's fairly filled with goggle-eyed males.

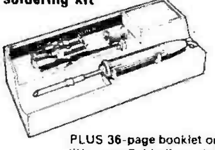
Enter a chap who walks up and murmurs something to the proprietor.

The proprietor draws himself up to his full height and says firmly—and loudly—'We don't sell THAT sort of book here, sir!'

Exit rather abashed gent, while the other customers look at each other wondering what exotic sins they might be missing.

The magazine he asked for? PRACTICAL WIRELESS."


**Complete precision soldering kit**



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

- Model CN 15 watts miniature iron, fitted $\frac{3}{32}$" bit. Interchangeable spare bits $\frac{3}{64}$", $\frac{3}{16}$".
- 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.

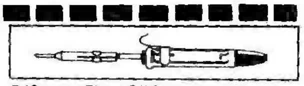
From Electrical and Radio Shops or send cash to Antex. **49/6**

**Attractively gift wrapped.**

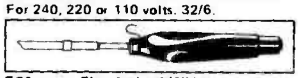

**Model CN 240/2**
**15 watts - 240 volts**

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/-

F 40 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 ..............................................
.............................................. PW12

# ON THE SHORT WAVES

## MONTHLY NEWS FOR DX LISTENERS

Times in GMT • Frequencies in kHz

# THE BROADCAST BANDS

Malcolm Connah

THE beginner to the hobby of short wave listening is possibly not aware of all the interesting and useful information that he can obtain to help him to progress in the hobby. The information which follows is intended to help him gain experience but should also prove useful to the experienced DXer.

*Radio Nederland* has a DX Information Service which publishes many data sheets and offers courses on practically every aspect of the hobby. Although the service is free of charge I usually include an IRC and/or a reception report to promote friendly relations with the station. For further information write to: DX Information Service, c/o Radio Nederland, P.O. Box 222, Hilversum, Holland.

The World Radio-Television Handbook Co. Ltd. of Sundvej 6, 2900 Hellerup, Denmark publishes several books which are of interest to the SWL. The first of these is the *World Radio-Television Handbook* (*WRTH*), this indispensable volume contains full details of every radio and television station in the world. Each entry gives details of the equipment used by the station, a full programme schedule and the address to which reports should be sent. Everyone with an interest in short wave radio should own a copy of this book.

The same company also publishes *How to Listen to the World* which, like *WRTH*, appears yearly. The recently published 1969/70 edition contains a wealth of information for both the beginner and the experienced listener. The following selection of chapter titles should give some indication of the scope of this excellent little book: Physics of the Ionosphere; Interference; Fading; How to Measure Frequencies and Calibrate Receivers; The Crystal Calibrator; How to report to Stations; Tape Recording of Reports; Listening to: Asia and the Pacific, The Far East, Africa, Latin America; Languages in International Radio; Sunspot Information and many other interesting chapters. The book is written by an international team of well-known DXers who each write on their own specialised topics.

Another way of obtaining information and gaining experience in the hobby is by joining one of the established DX clubs. The monthly magazines produced by these clubs will keep you informed on the latest news and enable you to compare your results with those of other SWLs. Most clubs also offer certificates in recognition of various achievements and organise regular competitions for their members. Two of the best-known British based clubs are: The International Short Wave League (ISWL), 60 White Street, Derby, DE3 1HA, and The World DX Club (WDXC), 16 Ena Avenue, Neath, Glamorgan, Wales.

## PROPAGATION FORECAST

The predicted smoothed sunspot number for the month of November is 93 (Switzerland Calling) which leads me to make these predictions of the most suitable megahertz bands for the month: Europe 4MHz; North America 11-25MHz; South America 15-25MHz; Africa 9-17MHz; Asia 9 and 11MHz and Oceania 9 and 11 MHz.

## AFRICA

**United Arab Republic:** The European Service of *Radio Cairo* has dropped the two usual frequencies of 9475 and 12005 and is now using 9740. The times of the broadcasts are unaltered, German can be heard at 2030 and English at 2145.

## ASIA

**Ceylon:** The Commercial Service of *Radio Ceylon*, which broadcasts in English, has replaced 15230 with 15120 for all its broadcasts. The Home Service now starts fifteen minutes earlier at 0100 on 5020.

**Vietnam:** A schedule just received from the *Voice of Vietnam* in Hanoi gives these details of the English programmes broadcast by the station. Frequencies used are given as 7380, 7416, 9840, 10224 and 15018. The times of the broadcasts are 0500, 1000, 1300, 1530, 2000 and 2300, 0830 (except Sundays).

## EUROPE

**Albania:** *Radio Tirana* has introduced the following English programmes: 0030 on 49m. and 41m.; 0100 on 42m. and 31m.; 0230 and 0330 on 49m. and 41m.; 1100 on 31m. and 25m.; 0630, 1630, 1830, 2030 and 2200 on 42m. and 31m. No details of exact frequencies have yet been given but the usual frequencies for this station are: 5950, 6200, 7070, 7300, 9370, 9500, 11840 and 11870.

**Armenia:** A schedule received from Yerevan gives the news that they have forsaken their usual frequencies of 6155, 7185, 7200 and 9540 and are using unspecified frequencies in the 16 and 19 metre bands for the broadcasts to Europe.

**Norway:** The latest schedule received from *Radio Norway* gives the following details of programmes in English:

**Sundays** 0800-0830 on 15345, 21655, 21730, 25730, 25900; 1200-1230 on 7240, 17825, 21655, 25730, 25900; 1400-1430 on 17825, 21655, 21730, 25730, 25900; 1600-1630 on 17825, 21655, 21730, 25730, 25900; 1800-1830 on 15345, 21655, 21730, 25730, 25900; 2000-2030 on 15345, 21670, 21655, 21730, 25730; 2200-2230 on 15345, 17795, 17825, 21655.

**Mondays** 0000-0030 on 11735, 11850, 15345; 0200-0230 on 11735, 11850, 11860; 0400-0430 on 9550, 9645, 15345.

Well, that's the lot for another month except to remind you to send in your reports and suggestions. 73's and good DX until next time.

# THE AMATEUR BANDS

## David Gibson, G3JDG

ONCE again your scribe, one Hippie Gibson, is putting quill to parchment to keep you all fully informed about everything which hasn't happened during the month. For the first time in many moons, the postbag has had that sparse, under-nourished appearance. O.K., so the "Let's all hate Gibbie" month is over, now how about some logs, just to show there's no hard feeling?

There should be no great shortage of DX to listen in to on the h.f. end this month as things are considerably better than the summer. This applies particularly to 20 metres which is almost a 24-hour band these days and carries most of the DX signals.

Down a few kHz on 15, the DX has been quite good with best times to listen from 0600 to 1800. By the time you read this it will in all probability have moved on, so try 0730-1900 or perhaps a little later.

Ten metres should provide something from Oceana, probably some good sigs from VK, although this will be at a price of poor reception from Canada.

Again, as king winter approaches and G3JDG gets his comms out of pawn, the l.f. bands should improve. Don't neglect 40 metres, there's some very good DX about, it just needs a little patience.

Eighty and topband will be improving fast. This could be a good time to have a crack at listening for topband nets. See how many "local" nets you can log and how far they are from you. Mobile stations on topband seem to become quite rare birds during the colder months and many would doubtless appreciate a decent report on their sigs. A good report though, not just the "heard you five and seven, please QSL" type.

Speaking of the winter months, now is the time to think about some constructional projects to keep you all out of mischief during the dark evenings. An a.t.u. (aerial tuner unit) is well worth while. You could look back through all those back issues of P.W. and find something of interest, perhaps a pre-amp or an outboard "S" meter? A grid dip oscillator is an invaluable asset to any s.w.l. or amateur, and circuitry for this has appeared in the magazine from time to time.

For those who are interested purely in logging callsigns and getting a long, long list of countries heard, a good time to listen is during contests. During most contests, the callsign is just about all you get anyway. The VK/ZL Oceana DX contest was a good example. There's nearly always two dates for this type of contest, one for c.w. and one for phone, so you can take your pick. It's nearly always easier to bag the goodies on c.w. so if you can't read Morse, how about learning this winter, then you'll be ready for next year? Incidentally, most radio clubs run Morse sessions and there's always slow c.w. signals on topband put out by RSGB members on a rota basis just for the beginner who wants to learn c.w.

In reply to the many queries about callsigns. You can obtain a list of all the different countries and their callsigns from the RSGB, 35 Doughty Street, London, W.C.1. Just send a 9d. stamp or P.O.

An item of interest to constructors is the TAD 100. This is an IC (integrated circuit) which has the frequency changer, i.f., detector, and audio all on the one chip. Your scribe is trying to get further details and I'll pass on the gen when it arrives. Incidentally, speaking of ICs, an American company has achieved a packing density of 240,000 components to the square inch on a single chip. Admittedly this is only in the laboratory, but it makes you think doesn't it? Perhaps the time will come when you will send the specifications for your ideal receiver to a manufacturer with a ten bob postal order, and receive per return a one-inch slice with it all on, you'll just have to find a dial!

Passing on to the mail this month. **Jim Baker** (Liverpool) writes to say that there's a new ZL on 80 metres. The callsign is ZL4NM or NH (sri OM ur wrtg nt gud) and he lurks on 3·8kHz plus or minus a few kHz using s.s.b. with an FT100. His name is Pat, and he's a Liverpudlian (licensed readers call "CQ Whack") and he's looking for contacts in the UK. S.W.Ls who want a card should send their own card, together with an s.a.e., to Jim Baker at 86 Max Road, Liverpool, Lancs., L14 4BJ. See if you can hear the ZL first!

**Stephen Randall** is very nearly 14 years old and has managed to wrap his digits around a Trio 9R-59DE. The antenna is a 110ft. long wire, and 20 produced—CT1WB, DK1CQ, HV3SJ, JX1OM, LA8TM, UL7SG, VK3AXQ, VK3MO, VP8RCF, W4YNX. Stephen lives in Hendon, London.

Normally I don't print lists of G calls heard unless short skip conditions are proving interesting. But when you get up to 2 metres, G calls are not too easy to come by over long distances.

**J. Simons** (Dudley, Worcs.), has an 8 over 8 antenna, (cor, think of the size of one of those on 20), feeding a homebrew preamp and converter. This supplies the AR88 as a tuneable i.f. from 24-26MHz. On 2, John raised—GI5ALP, EI7AF, EI5BH, GI8AYZ/P, GM3TGL/P (at Kirkcudbright), G3KDG (Devon), G3GJY/P, G8BGR/P, G8APV/P, G3TAB/P, G3PXF/P (Westmorland), G3WSC/P, G2JF, GD3VXK, GW3NWR/P, GW3UCB/P, GW3ILO, GW3NUE/P.

**Philip Batt** (Littleborough, Lancs.), has a PCR3. The antenna is 22ft. bare copper wire on two masts at 15ft., with a 58ft. down lead. Twenty metres produced—CE3FZ, CR6QX, CT1BD, G2MJ, HBØXBX, HP1XAJ, HR1KS, K6MHO, K6AFT, K6SA, OA6S, TI1ECE, TI2CEF, UG6AW, VK2ATT, VK3AM, VK4CK, VK7CR, VK9FW.

Fifteen proved fruitful for Philip too—CE1EF, EA8EG, FØQR/M, HBØAA, IS1DMN, HL2IX (Korea), JA1BAC, JA2GQF, JA3JMC, JA4SNM, JA5DRJ, JA7GHM, JA8DEI, JH1GJF, KZ4VA, KP4DCR, KR6EX, LU1DAB, MP4BHL, OD5BCV, OHØAS, OX2BBA, PY6TP, TF3SB, VK2RV, VS6AD, VS9MB, W6MSM, YV3KT, ZE3RK, 3V8AA, 4X4AM, 9H1BH, 9M2DQ, 9G1GB.

A few contests and happenings in November which are worth a listen. 3rd November, 2 metre s.s.b. contest; 8th-9th, 40 metre phone contest; 15th-16th, topband contest, go on, have a listen; 29th-30th, CQ world-wide DX contest but it's c.w. only. Start those Morse classes now and you can listen next year!

There are two early ones in December. These are 6th-7th December, CHC international DX contest (c.w.); and 7th, 4 metre contest (c.w.).

All logs to the home QTH please before the 18th of the month. 5 Edward Close, St. Albans Herts.

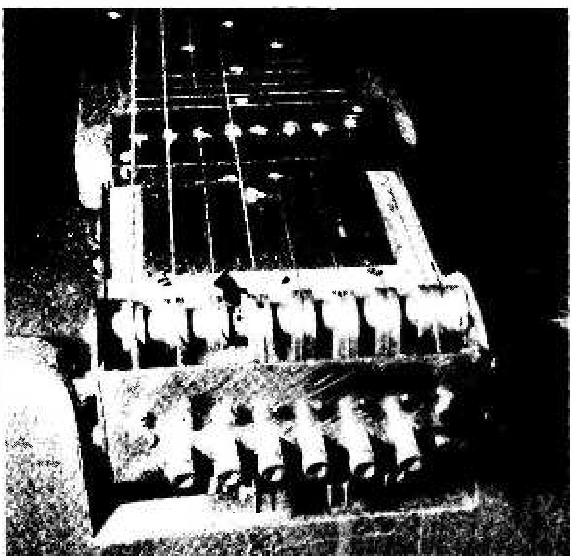
# A PEDAL STEEL GUITAR

## Part 2

F.C. JUDD

AS mentioned in part 1 the production and assembly of the special roller bridge and pedal mechanism calls for fairly accurate work although apart from the usual metal working tools, the writer used only an electric bench drill. Before embarking on the bridge and pedal mechanism however, all the woodwork, i.e., the making of the console and the guitar body should be completed. The tuning pegs do not have to be made of course and these can be purchased from Cyril Proctor, 180 Town Street, Leeds, Yorks. These are known as single geared pegs and cost £2 for a set of eight but make sure that 4 left-hand and 4 right-hand pegs are ordered. The same firm can also supply the plastic fret board which should be ordered as follows: 25in. scale—24 frets for 8 string guitar and the price is 25s. The special 8 string H.G. magnetic pick-up type 2A with adjustable poles is also available from Cyril Proctor and costs £4 5s.

The raw materials required for the bridge and pedal mechanism are ¼in. thick brass for the lever rollers etc., 1/16in. thick mild steel, 3/16in. and ⅛in. diameter mild steel rod, ¼in. diameter silver steel rod and ¾in. and ½in. square section mild steel tube which is for the tie across the bottom of the console between the left- and right-hand sides and the pedals. This tie-bar also serves as a stop for the foot pedals (see Fig. 6 part 1). The remainder of the materials are the 2BA Allen head screws and the compression springs for the lever roller stops and sundry 4 and 6BA screws and nuts as indicated in the various diagrams.



*(A): The Roller Bridge.*

## The Roller Bridge

This consists of a square U-shaped framework which is screwed on to the tail of the guitar body as shown in Fig. 7A (part 1) and in the photograph in this article. It carries the ¼in. diameter spindle on which the circular rollers and lever rollers are mounted together with the spacers. Six "stop" screws have been provided so that lever rollers can be used for strings other than those indicated for the E6th tuning as given in part 1. Strings which run over the circular rollers are secured to the bridge frame at the rear. Strings controlled by the pedals are anchored directly to the lever rollers.

Details for making the bridge frame are given in Figs. 9A, B, C, D and E. Note the small caps which are used to retain the roller spindle in the frame. The six 2BA Allen screws, each 1in. long act as the rear stops for the lever rollers. The compression springs should be about ⅜ to ½in. long and are fitted to prevent the screws turning of their own accord. Although only two stop screws are used for the tuning given in part 1 it is worth fitting all six so that either of the strings 7 to 2 could be used with the pedals if required. Before drilling and tapping the holes for these screws secure the ¼in. thick brass block to the rear plate of the bridge frame. The tapped holes go right through this as per Figs. 9D and 9E.

The spindle for the rollers and lever rollers is ¼in. diameter silver steel cut to fit exactly within the frame but flush with the outer surfaces. The spindle is held in by means of the retaining caps as per Fig. 9E. Next come the plain circular rollers which can be made from ⅝in. diameter brass rod and cut, drilled and grooved as in Fig. 10B. The

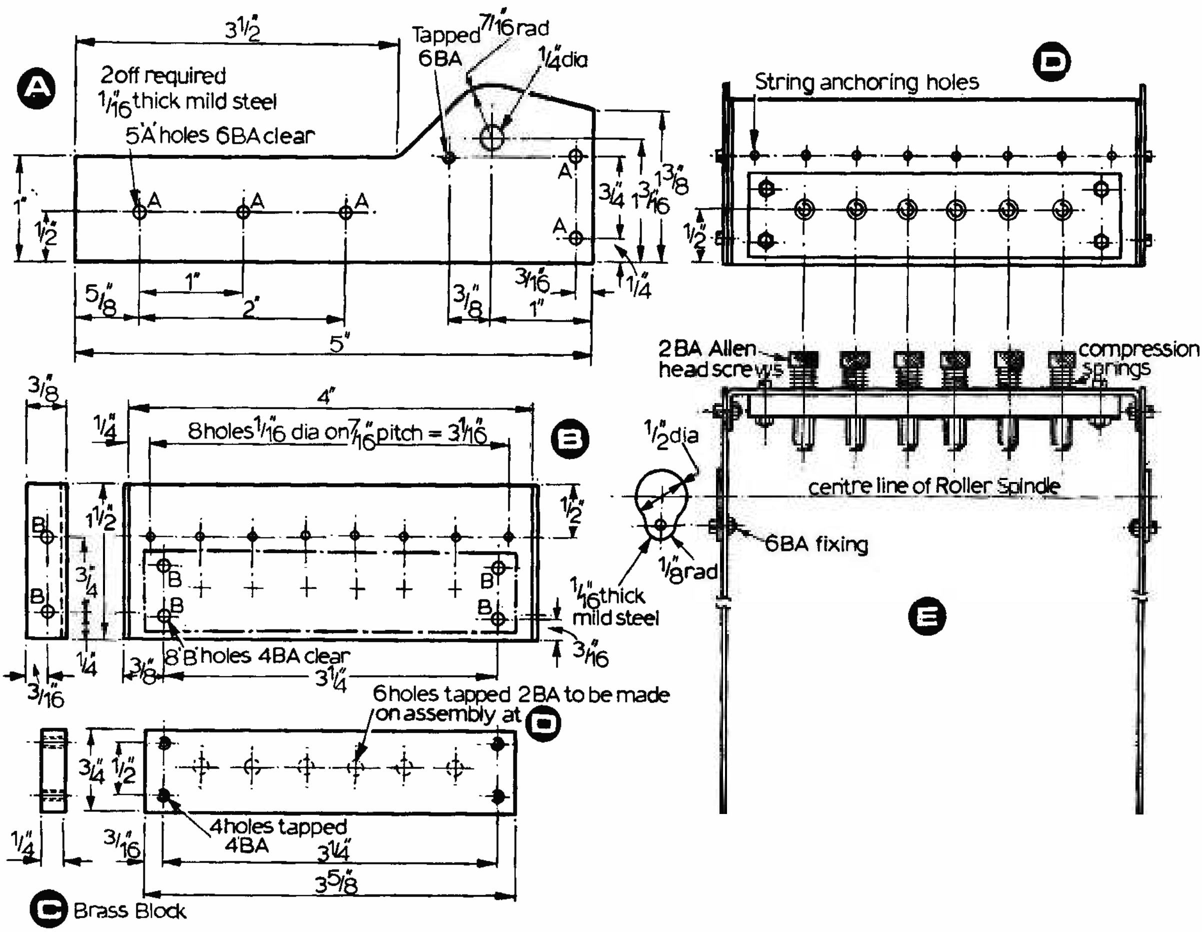
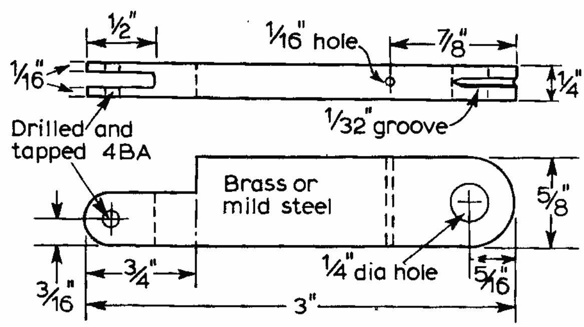
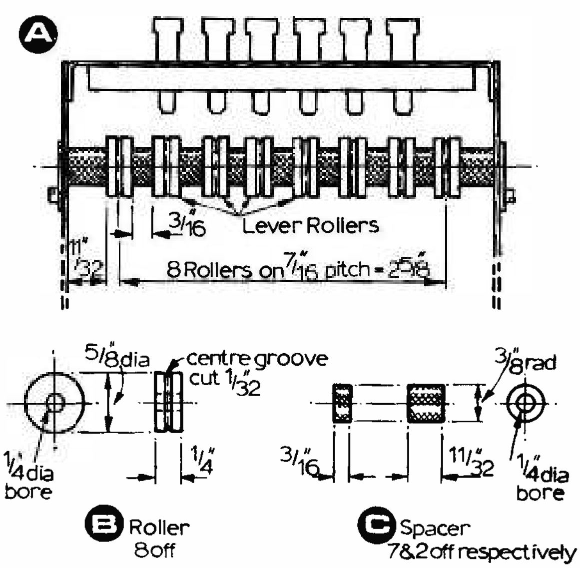



*Fig. 9 (above): (A) Side of frame—two required. (B), (C) Tail plate assembly. (D) Holes for the 2BA Allen screws drilled and tapped after brass block is fitted as in (C). (E) Final assembly of the roller bridge frame. Note retaining caps for roller spindle.*

*Fig. 10 (below): Details of rollers and assembly of rollers and lever rollers in the bridge frame.*

*Fig. 11 (right): Dimensions for the lever rollers.*




spacers are cut from ⅜in. diameter brass tube with a ¼in. diameter inner bore. Details for these and the two end spacers are given in Fig. 10C.

Next come the lever rollers and although only two are required for a two pedal system it is worth making and fitting four as shown for possible future use with an alternative tuning. These are made from ⅛in. thick brass as shown in Fig. 11. Note that they are grooved around the circular portion of the top to hold the strings in place. The action of these lever rollers and the method of securing the string to the lever is shown in Fig 12. The stop screws are set so as to allow only sufficient movement of the lever roller to tension or de-tension the string by an amount required to raise or lower its pitch according to the tuning required. The adjustment available with the stop screws should allow the lever enough movement to raise or lower the string pitch by more than a whole tone. The final adjustment of the stops is of course made in conjunction with the movement of the pedal rods and the pedals.

Readers may by now be wondering why such a complicated mechanism is necessary merely to raise or lower the pitch of a guitar string by a semitone or so. Why not for instance, use a conventional bridge and simply apply pressure to the strings

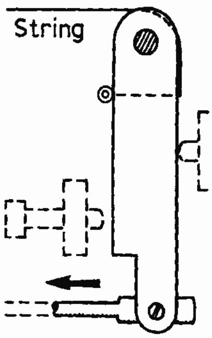



*Fig. 12: Lever roller action. Note method of anchoring guitar string.*

between the bridge and the tailpiece? This has been tried and rejected for the simple reason that strings continually tensioned and de-tensioned across the edge of a bridge very quickly break. The method described in these articles is basically the same as that developed for commercially-made instruments now on the market and overcomes this problem.

Next comes the making and fitting of the forward stop screw assembly shown in Fig. 13A and which must be fitted underneath the tail end of the guitar as in Fig. 13B and before the roller bridge is fitted. This consists of a piece of $\frac{3}{4}$in. aluminium angle to which is bolted the $\frac{1}{4}$in. thick brass block that carries the stop screws. A piece of $\frac{1}{2} \times \frac{1}{2}$in. aluminium angle is fitted across the top of the tail end of the guitar above the stop screw assembly as in Fig. 13B

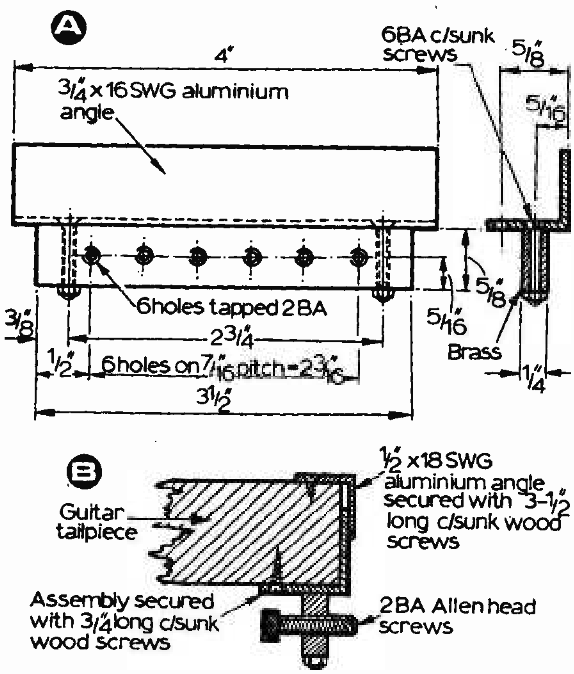



*Fig. 13: Details of the forward stop bar fitted beneath the tail end of the guitar body.*

and which is also shown in Fig. 7A part 1 and marked "Z". Additional guidance as to the function of the forward stop screw assembly is shown in Fig. 14. It will be seen that the lever rollers come forward to meet the lower stop screws and in the opposite direction to meet the higher rear stop screws. The overall movement of the lever rollers should not be more that one-eighth to three-sixteenths of an inch for a pitch change of a semitone up or down.

## The Pedal Mechanism

Schematic diagrams showing the whole mechanism between the lever rollers and the pedals are given in Figs. 2 and 3 of part 1. The mechanism is a system of rods and levers which is shown in greater detail in Fig. 15. The lever assembly is situated underneath the top of the console a little to the left of midway between the two sides. This assembly consists of a mild steel plate on which are mounted

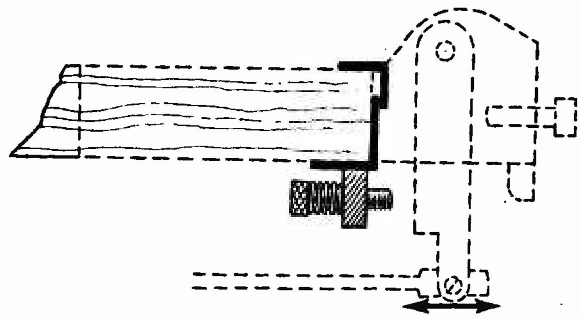


*Fig. 14: Position of forward stop bar relative to the bridge frame and lever rollers.*

the levers and spindles as shown in Fig. 16A. However, let us return to Fig. 15 for a moment. This shows the de-tensioning system which operates as follows. The $\frac{1}{8}$in. diameter rod attached to the roller lever is also bolted to the lever marked "A" and a large tension spring is connected between this and the left-hand side of the cabinet via a piece of steel wire (piano wire). The large spring holds the lever roller against the forward stop screw as shown in the diagram, the tension of the spring being sufficient to overcome the normal tuning tension of the guitar string. When the pedal is pressed, lever "B" actuates lever "A" via the connecting spindle which now moves to the right. This allows the lever roller to move over to the rear stop thus *reducing* the pitch to which the guitar string is tuned. The other pedal produces the reverse of this action, i.e., when the lever "D" is actuated by the pedal then lever "C" moves to the left and pulls its lever roller toward a forward stop screw thus *raising* the pitch to which the string is tuned. A side view of the lever assembly is shown in Fig. 17. Note that the levers A, B, C and D as in Figs. 16A and 17 must be bolted directly to the spindles so that no slipping occurs.

## The Foot Pedals

The dimensions for the pedals and pedal bearings are given in Figs. 18A, B, C and D. The pedal bar is made from $\frac{1}{2}$in. square mild steel tube which is

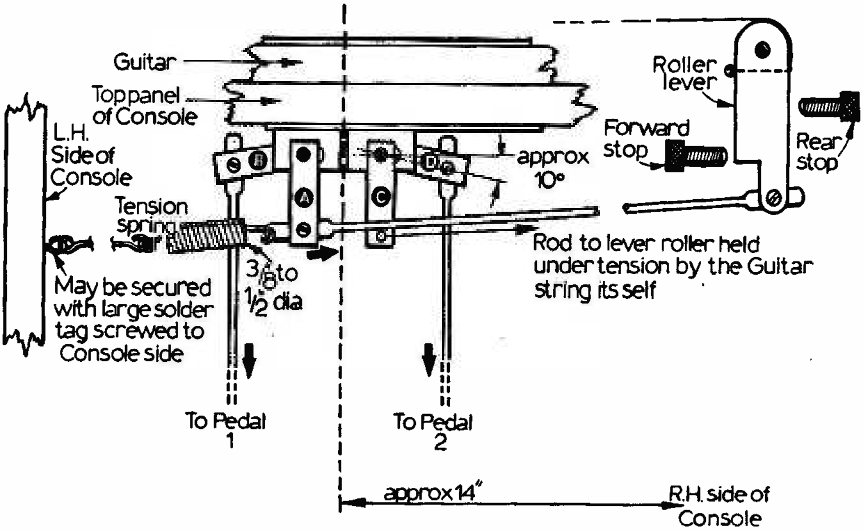
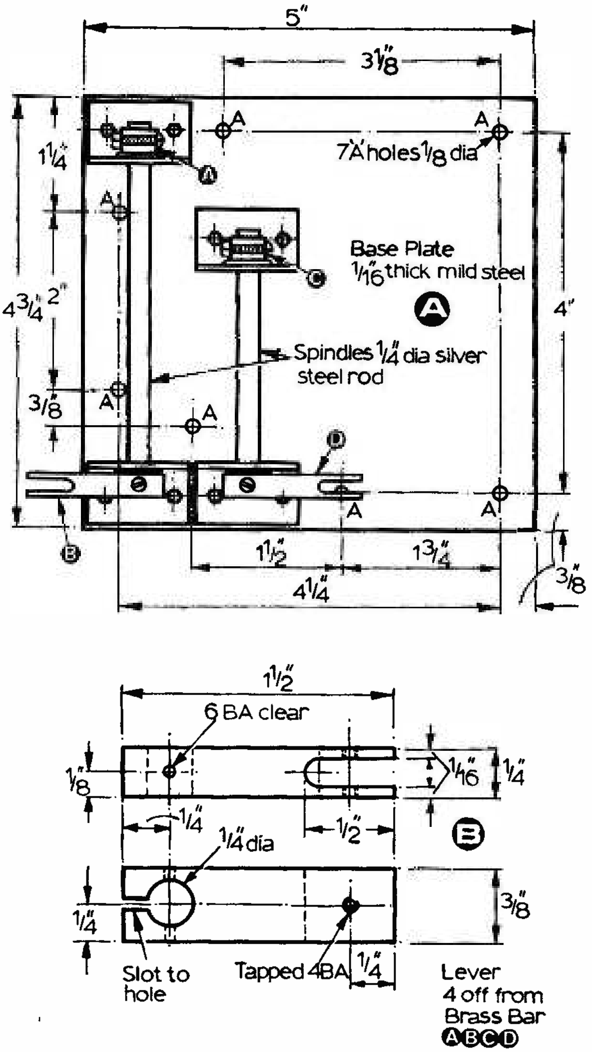



*Fig. 15 (above): The action of the lever roller and pedal coupling mechanism situated beneath the top of the consol. Arrows show movement of rods when pedal 1 is pressed. Text explains mechanism.*

*Fig. 16 (below): Coupling mechanism between lever rollers and pedals.*




attached to its bearing (Fig. 18B) by a ¼in. diameter spindle. The spindle is cut so that about one-sixteenth of an inch projects either side. The ends are lightly hammered to prevent the spindle coming out. Make sure that the pedal has free movement but as little side play as possible. The control rod from the lever assembly is attached to the pedal as shown in Fig. 18C and D. Note the use of a felt washer above the pedal bar and the ⅛in. sleeve below. The size of the foot plate and the length of the pedal bar can be adjusted a little for comfort in playing, otherwise the dimensions given should be used. The foot plate need only be about 1½in. wide and 3in. long. Two pedals and bearings are of course required and they should be mounted directly below and in line with the levers to which they are attached. No measurements have been given for this as the positioning is best done experimentally. However, for correct up and down movement of the pedals the bearing spindle should be at a point about 2in. above the bottom of the lower backboard. The pedals should slope gently to the tie-bar.

## Connecting Rods

Finally comes the connecting rods between the lever rollers on the guitar bridge assembly and the pedal levers under the console top and between these and the foot pedals. The rods from the lever rollers may be made from ⅛in. diameter mild steel and those to the pedals of 3/16in. diameter. The overall length of each rod is best determined experimentally but for guidance here are the lengths of the rods as on the writer's prototype pedal guitar. The de-tensioning rod between its lever roller and lever "A" (as in Fig. 15) is approximately 16in. long. The rods to pedals from levers "B" and "D" (as in Fig. 15) are both approximately 27in. long. The "flats" at each end of the rods are produced by heating and hammering and the holes through these flats as in Fig. 19 should provide more than ample adjustment when the mechanism is finally aligned.

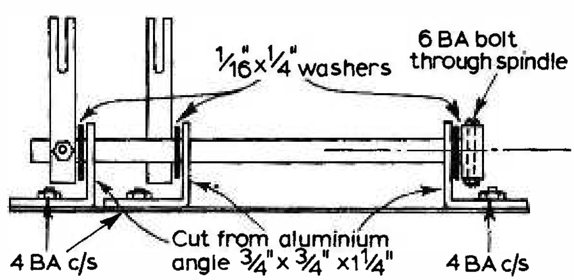



*Fig. 17: Side view of mechanism shown in Fig. 9A.*

As pointed out previously a pedal guitar using the basic control mechanism as described in these articles could of course be built to accommodate more pedals, alternative tuning with 8 or 12 strings or even with twin necks. The roller bridge system is however, the only satisfactory method of tensioning and de-tensioning guitar strings by means of foot pedals.

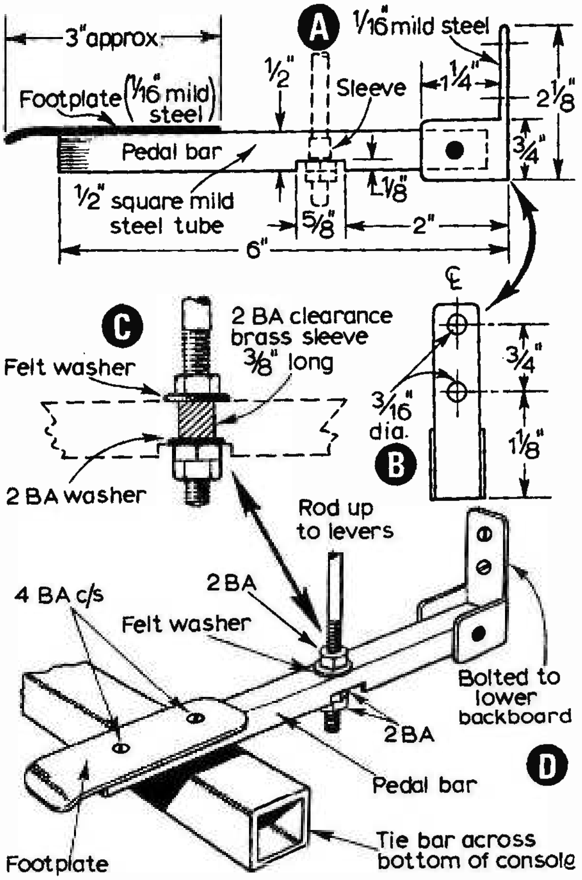



*Fig. 18: Dimensions and assembly of foot pedals.*

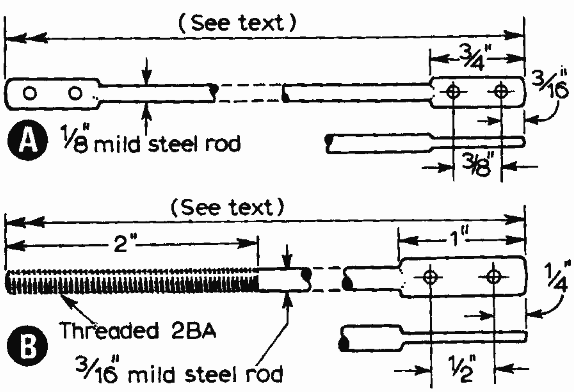
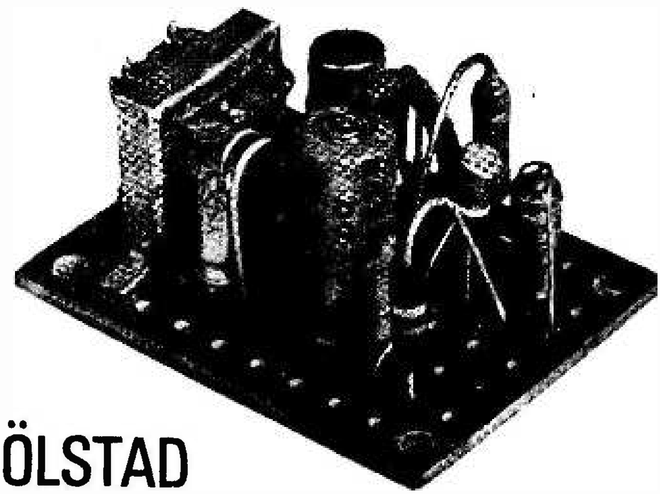



*Fig. 19: Coupling rods. (A), to lever rollers. (B), to pedals.*

**The final part of this article, next month, will deal with the alignment of the pedal mechanism, the circuit for the tone control preamplifier and a pedal volume control.**

# MINIATURE audio amplifier

T. BÖLSTAD



THE amplifier described in this article is a very simple unit, which is very easy to build. It is thus well suited for the beginner, but it may also be of interest to the more experienced constructor as it may be used for a variety of purposes. It consists of three inexpensive transistors and a handful of other small components and can be built for under £1.

Audio amplifiers of this type are usually operating in class B push pull, since class B output stages require very little quiescent current (i.e. under no signal conditions), and since their efficiency is near 80% under signal conditions. However, such an output stage requires matched transistors, which are relatively critical on the biasing circuit, and the beginner may find it difficult to construct a class B push pull output stage with a minimum of harmonic distortion. Class B stages also require a reasonably constant voltage supply, so that the voltage will stay constant when the current in the stage increases with increasing output signal.

The output stage of this particular amplifier operates in class A, which means that the current through the output transistor is constant, whether there is a signal output or not. If a battery is used, this is of course not very economical, but if one uses a mains supply, the constant current drain is not a serious drawback, even if the amplifier is left on for several days. Its power consumption is so small that its existence will not be detected in the electricity bill! However, the maximum efficiency of a class A output stage is only 50%, compared to the 80% for the class B push pull stage, but when one considers the low initial cost of a single class A output stage, its distortionless output, and its non-critical construction, it is well worth using this type of output in a small amplifier.

## THE CIRCUIT

The schematic diagram of the basic amplifier is shown in Fig. 1. The amplifier is designed around three inexpensive silicon transistors, which may be obtained very cheaply indeed from advertisers in this magazine, and it will give a low distortion output power of approximately 80-100mW. The current drain is approximately 40 to 50mA from a 6V supply. The frequency response is from 200c/s to above the audible frequency spectrum, but its lower limit may be improved by increasing the values of C1 and C3.

As the transistors used have negligible leakage currents, very simple biasing techniques have been employed. Tr1 has the input signal applied to its base, via C1, and it is biased by means of a single resistor, R1, giving both d.c. and a.c. feedback. Tr1 acts as a common emitter voltage amplifier and the signal voltage developing across its collector load R2 is coupled via C3 to Tr2. Tr2 acts as a common collector (also known as an emitter follower) amplifier, and its bias is derived from the two resistors R3 and R5. It will thus have a high input impedance so

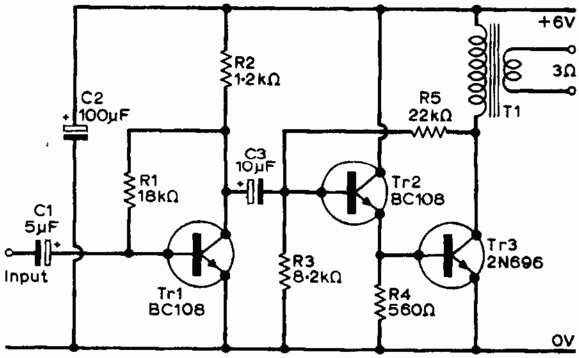



*Fig. 1: The circuit of the transistor amplifier*

## ★ components list

**Resistors:**
- R1 18kΩ
- R2 1·2kΩ
- R3 8·2kΩ
- R4 560Ω
- R5 22kΩ

All ¼-watt miniature types, 10% tolerance.

**Capacitors:**
- C1 5μF 6V—see text
- C2 100μF 15V
- C3 10μF 6V—see text

**Transistors:**
- Tr1 BC108 or equivalent
- Tr2 BC108 or equivalent
- Tr3 2N696

**Miscellaneous:**
Output transformer, 9:1 ratio (Radiospares T/T4, available from retail suppliers); Veroboard 2⅛ x 1½in., 0·15in. matrix; 3Ω loudspeaker.

as not to decrease the effective a.c. load of the first stage, and a low output impedance to match the input impedance of Tr3, which is of the order of 40Ω. As in all emitter followers, the voltage gain is approximately unity.

The output stage consists of a 2N696, which is a medium power transistor. It is directly coupled to the emitter of the previous stage, thus avoiding a coupling capacitor, and at the same time provides the bias for the base. A small output transformer acts as the collector load of Tr3, matching the output to a 3Ω speaker. The feedback resistor is connected to the collector of the output stage, and thus both negative a.c. and d.c. feedback are applied. The d.c. feedback stabilises the d.c. conditions of the output stage, and the a.c. feedback improves the quality.

The output transformer has a turns ratio of approximately 9:1 to achieve the best possible matching, and the Radiospares T/T4 is suitable for this purpose. The output quality is remarkably good, considering the simplicity of the circuit, and the power delivered to the speaker is quite sufficient for most purposes.

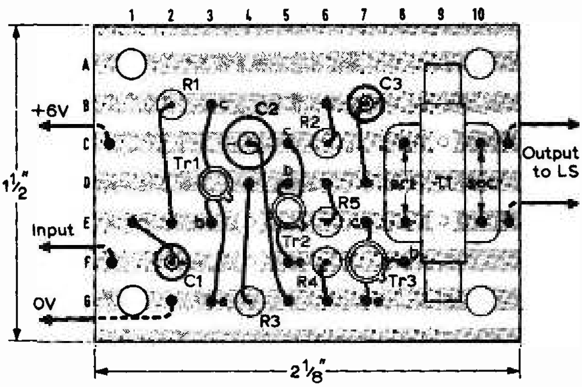



*Fig. 2: The component layout on the Veroboard.*

## CONSTRUCTION

The amplifier is built on a small piece of Veroboard, of $2\frac{1}{8} \times 1\frac{1}{2}$in., as shown in Fig. 2 and the photograph. The connecting pins of the transformer must be bent slightly to fit it into the board, otherwise there is nothing special about the Veroboard construction. All components are mounted vertically, which allows the amplifier to be a very compact unit. A hole is drilled in each corner for fixing the board into a box etc.

No heatsink is required for Tr3, even if its temperature rises slightly above room temperature. The power dissipation of the output transistor is held at a level well below the permissible amount, and besides, silicon transistors may be operated at higher junction temperatures than germanium ones.

## APPLICATION

It should not be difficult to find uses for this little device. It can be used for a gramophone amplifier (the larger the speaker, the better the output quality) or incorporated in a small receiver system, since its sensitivity is of the order of 1mV for full output. However, it was originally designed for home communication purposes.

Figure 3 shows a simple baby alarm system, using the amplifier together with a medium impedance dynamic microphone (1-3kΩ), and a logarithmic

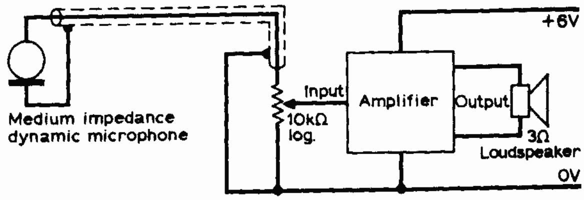



*Fig. 3: Connecting the amplifier as a baby alarm.*

potentiometer connected as a volume control across the input. The output is taken to a 3Ω loudspeaker. In this and the following examples, the mains power supply shown in Fig. 4 is highly recommended, as it would be much more economical to use than conventional dry batteries. It consists of a standard 6·3V heater transformer and a conventional full wave rectifying bridge. The output voltage is dropped slightly across the 10Ω resistor and then smoothed in the large electrolytic capacitor. The 10kΩ resistor connected across the output simply acts as a bleeder, so that a higher voltage will not build up across the storage capacitor when no load is connected to the supply. The maximum current drain is approximately 50mA.

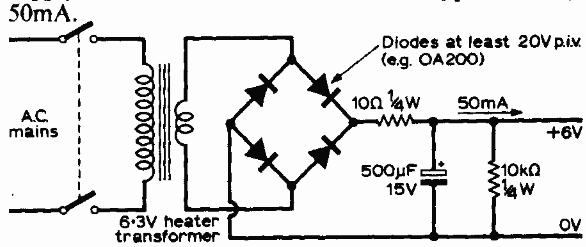



*Fig. 4: A mains power supply for the amplifier.*

As an alternative to the baby alarm just described, the circuit in Fig. 5 can be used. Here, the microphone has been replaced by a small speaker with a matching transformer, to match the low impedance of the speaker to that of the amplifier input. Since the input

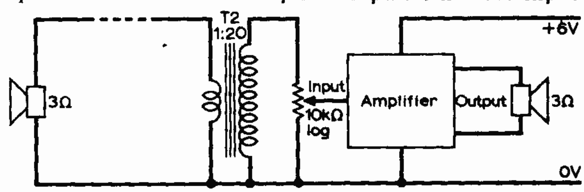



*Fig. 5: Using a small speaker as a microphone.*

impedance of the amplifier is around 1·2kΩ, a transformer with turns ratio of 1:20 is needed (e.g. Repanco type TT52). By arranging a simple switching system, as shown in Fig. 6, the baby alarm is

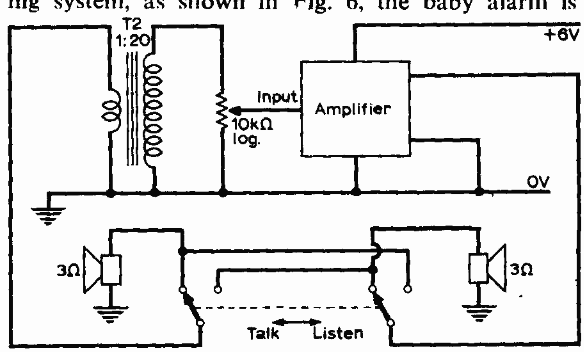
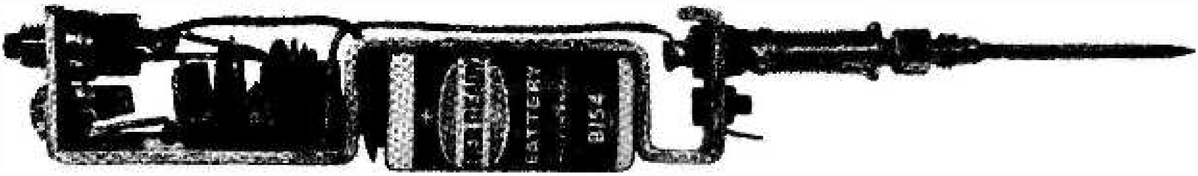


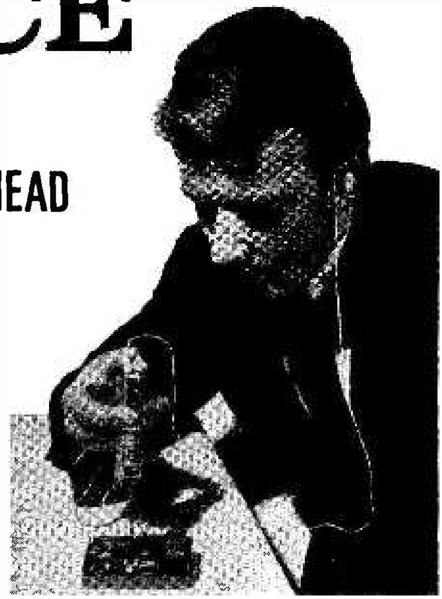

*Fig. 6: Schematic of the amplifier used as an intercom.*

—continued on page 598




# INJECTRACE

HAL
MOORSHEAD



TWO of the most useful pieces of test gear, for both the serviceman and the amateur constructor are a signal source and a signal tracer. The project described here combines both these functions in an inside jacket pocket sized case, 7 × 1 × ⅞in. It generates a very wide band signal from about 1kHz to over 200MHz in the inject mode, heaving out a pretty powerful signal. In the trace mode it will detect a.f. and r.f. up to very high frequencies and is sensitive enough to hear local stations when connected to a short length of wire. Switching between the two functions is automatic; in the normal mode it acts as an injector producing a 1kHz squarewave but as soon as the earpiece is plugged in it becomes a tracer, the earphone itself acting as the switch.

The Injectrace is built into a Wisdom toothbrush case which is strongly built and exactly the right size. Including toothbrush this costs 2s. 6d. (3s. 6d. for bristle!)—not a bad price for a custom size case (never mind the toothbrush). Standard components are used throughout and the metalwork requires only metal cutters, a few drills and a pair of pliers.

## The Circuit

Most readers will be familiar with the straightforward amplifier circuit, that is, R-C coupled. When the earphone is plugged in it is connected to the collector of Tr2 via C3 (see Fig. 1). The connection feeding back to the base of Tr1 is broken while the earphone is connected.

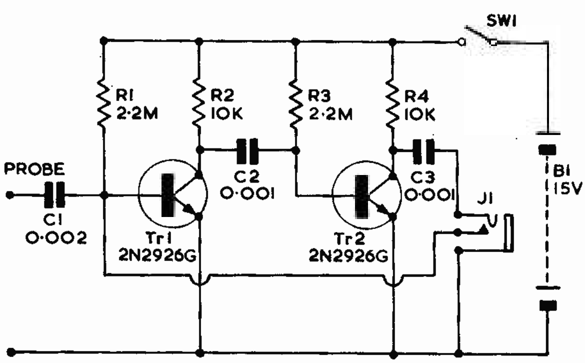



*Fig. 1: The Injectrace signal injector and tracer. Functions are changed merely by plugging in the earphone.*

When the earphone is removed C3 connects to the base of Tr1 forming a multivibrator working at about 1kHz fundamental. However this waveform takes the shape of a square and as we know this is full of harmonics. Due to biasing conditions etc. (the reasons will be described later) the rise time is fairly slow but the cut-off is very sharp. In fact the unit will radiate frequencies well into TV Band III (about 200MHz) but above this the transistor is approaching cut-off.

In its trace mode the deliberate distortion enables the Injectrace to detect r.f. signals. There is always detection in an amplifier which is non-linear; although this distorts a.f. signals we will generally be trying to trace a signal rather than judge for quality.

The very high gain of the transistors used and the high frequency response built in can lead to problems. If a crystal earpiece is used this will not damp the output and stray capacitance can cause the circuit to oscillate. Although this will not generally matter (you can still hear your input and the frequency will normally be outside the audio range) this can be overcome by using a 250Ω earpiece which mismatches the output and consequently reduces the gain. The commoner 8Ω earpieces will do but the sensitivity is considerably reduced.

## Construction

Having a circuit as described is of little use unless it is housed in a robust container of convenient size. A lot of thought was put into the general construction and other layouts were tried but the one shown here is the best from several points of view. All the components are fixed to a ½in. strip of 16s.w.g. aluminium bent as shown. The problem of battery housing and rigid construction are overcome using this method. About the only battery

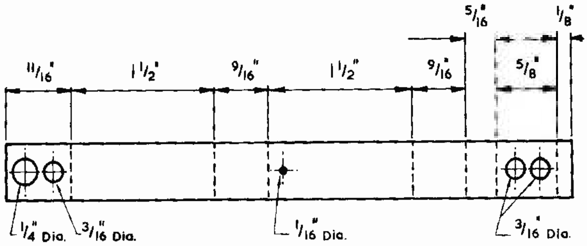



*Fig. 2: The aluminium "chassis".*

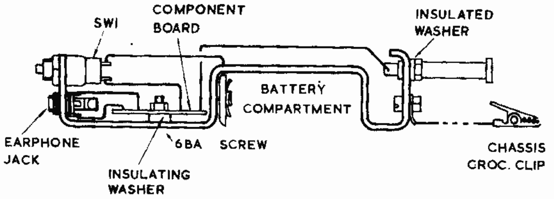



*Fig. 3: Layout of the major components, which also shows how the strip is bent.*

suitable is the Ever Ready B154 which is not fitted with clip battery terminals but with "domes" for pressure contact.

One of these domes, the negative, presses against the aluminium chassis strip while the other presses against the female connection of a PP3 battery clip. Plastic covered clips of this type are widely available and by cutting off the male section, spreading the contacts of the female connector and feeding the wire through a small hole drilled in the chassis, a good spring contact will be made.

The miniature push-button switch and the earphone socket are mounted on the end plate. Care should be taken as there is precious little room and also because of this a 2·5mm. socket should be used for the earphone.

The active components are mounted on a small piece of 0·1in. matrix Veroboard 9 × 5 holes, the centre hole being drilled out for mounting. The mounting screw for the Veroboard is countersunk

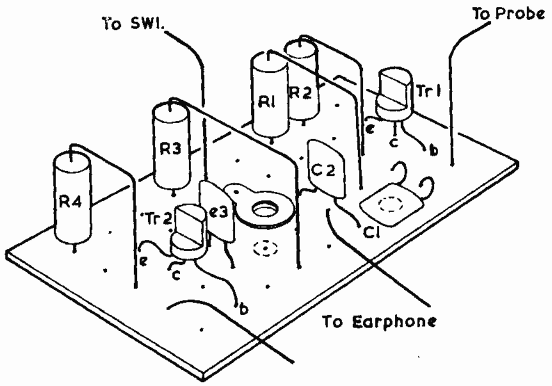
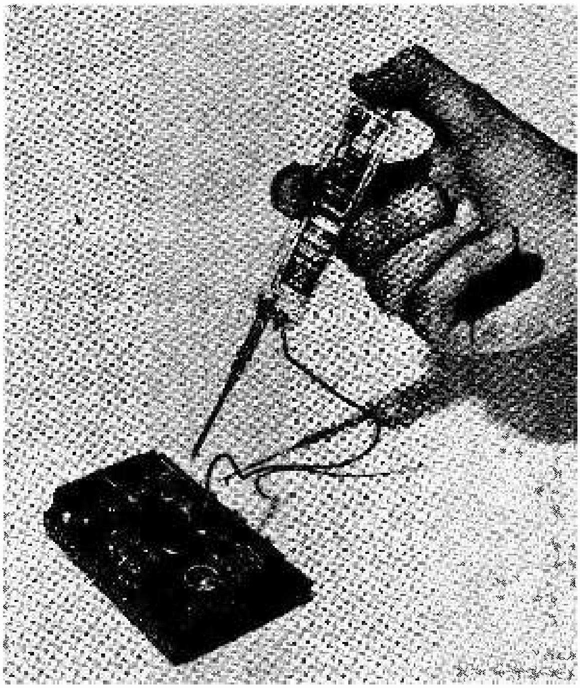



*Fig. 4: The circuit panel, showing where components are mounted.*

through the chassis and an insulating washer should be fitted to space the underside of the component board away from the chassis. The chassis itself is the negative connection and contact is made to the board by fitting a solder tag underneath the securing nut with a wire from the tag to the negative strip on the board.

The probe itself is connected to the front panel and this of course is insulated from the chassis



using a plastic washer of the type used for mounting power transistors.

To increase the versatility of the Injectrace it was required that three different probes should be used and to facilitate this the probes are plugged in. One probe should be straightforward as illustrated, another fitted with a 0·01$\mu$F 500V capacitor for valved or other high voltage equipment and another probe fitted with a 5·6M$\Omega$ resistor for use with high level inputs that would otherwise overload the amplifier in the trace mode. These probes are all soldered to banana plugs which fit into a socket fitted to the front of the unit.

Because of the large diameter of the screws on

## ★ components list

**Resistors:**

| | |
|---|---|
| R1 2·2M$\Omega$ $\frac{1}{4}$ watt | R4 10k$\Omega$ $\frac{1}{8}$ watt |
| R2 10k$\Omega$ $\frac{1}{8}$ watt | R5 5·6M$\Omega$ 1 watt |
| R3 2·2M$\Omega$ $\frac{1}{4}$ watt | (for attenuating probe) |
| All 10% tolerance. | |

**Capacitors:**

| | |
|---|---|
| C1 0·002$\mu$F Mylar Film | C4 0·01 500V |
| C2 0·001$\mu$F Mylar Film | Silvered Mica |
| C3 0·001$\mu$F Mylar Film | (for high voltage probe) |

**Semiconductors:**

| | |
|---|---|
| Tr1 2N2926G | Tr2 2N2926G |

**Miscellaneous:**

B154 15V battery; 0·1in. matrix Veroboard, 9×5 holes; 2·5mm. earphone socket; 250$\Omega$ earphone with 2·5mm. jack; miniature push-button switch; plastic toothbrush case—see text; socket; three banana plugs; aluminium strip; PP3 battery connector; small crocodile clip; nuts and bolts, etc.

such plugs there is a problem in insulating them from the chassis and to overcome this a 6BA nut was soldered to the base of the socket which in turn fitted on to the insulated 6BA screw on the front of the Injectrace.

The earthing connection is taken from a solder tag fitted underneath the probe, the illustrations show this clearly. A small crocodile clip makes the best type of connection and about 9in. of wire should be about right.

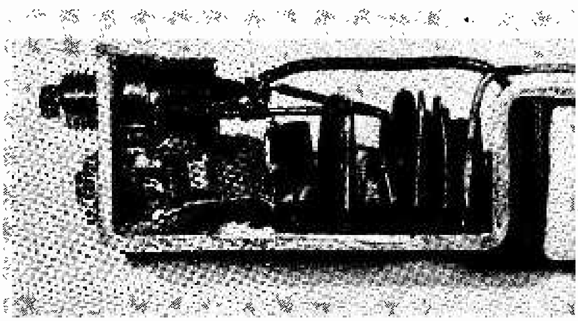
Once the wiring-up of the unit has been completed it should be slipped into the case and holes marked and drilled in the back to line up with the push-button switch and the earphone socket.

The chassis is held into the case by leaving the nut of the push-button switch off while the chassis is being fitted and screwing it on when it protrudes through the back of the case.

One point must be made regarding the switch. These are Japanese imports and are widely available in two forms, both suitable, however the plastic part through which the contacts protrude is very soft and will very easily melt and shift the contacts making the switch useless unless great care is taken when soldering.

## Uses

Once built the Injectrace will prove invaluable and it should not be too long before isolating a



fault in a piece of equipment becomes second nature.

Take for example a transistor superhet radio—and there must be few of us who haven't been called upon to fix one.

First eliminate the two commonest faults—flat or low battery and dirty earphone switch. These are by far the easiest things to check and account for a huge proportion of faults. If both these points are O.K. all the rest can be done with the Injectrace.

Inject at the slider of the volume control; if the signal is heard the fault will lie in the r.f./i.f. section. If not, it will probably lie in the amplifier. Working either forwards or backwards through the circuit injecting or tracing will be very simple and the fault will be easily found. ■

**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.



## MINIATURE AUDIO AMPLIFIER

—continued from page 595

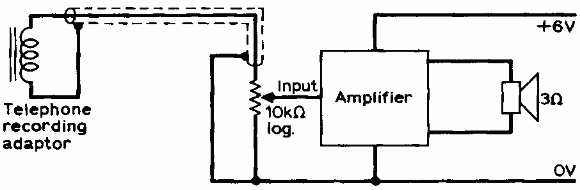



*Fig. 7: Connections for use as a telephone amplifier.*

converted into a two-way intercom system. If one uses this system, a separate calling system could be built using buzzers and push buttons.

Finally, the circuit of a telephone amplifier is given in Fig. 7. A telephone recording adaptor (which is readily obtained from advertisers in this magazine, e.g. Henry's Radio) is connected via the volume control to the input of the amplifier. It connects the telephone inductively to the amplifier so that a telephone conversation may be heard by a third person. The adaptor is fitted with a rubber sucker which is pressed on to the telephone in a position so as to give maximum volume.

This simple amplifier has been a satisfactory (and inexpensive) solution to the author's home communication problem. The devices which were built gave very good results; they had sensitivity enough to pick up weak sounds and voices from sources situated several yards away from the microphone/ speaker, and the output volumes were in excess of most commercial intercom. systems. ■

# practically wireless commentary by HENRY

No. 63

## The Chips are down

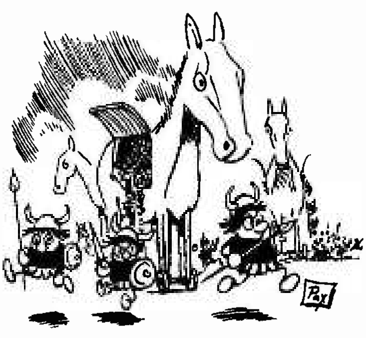
FOLLOWING our Editor's September comments, I could have entitled this piece "Third time lucky". Allow me to repeat—for the benefit of those in whose minds the successive editorials do not burn—the gist of the message.

*"During the heyday of the valve era, designers, constructors, equipment makers and service engineers were plagued with the vast proliferation of valve types . . . complete listing became well-nigh impossible due to sheer numbers. With the advent of transistors it seemed that a new era of rationalisation was dawning . . . it was inconceivable that the same mistakes would be made . . ."*

BUT

*"There must be tens of thousands of types in the catalogues . . . there has been little attempt to rationalise the type numbering system. At this stage of the game it is too late to remedy matters."*

His nibs went on to say that we were on the threshold of another major opportunity for industry to work together. But our Editor must have felt the vain optimism of his hopes, for he warned that unless industry could prevent itself — lemming fashion — from making the same mistakes the third time, a situation even more chaotic would result. "*. . . we are all set to be overwhelmed by an avalanche of IC devices within the next few years.*" The small boy's dream, buried 'neath a mountain of chips!



*Disembarked from their Trojan horses.*

The chip invasion is with us. The recent torrodero laughingly called a Radio Show slipped a number of IC devices into its offerings, and such was the obsession of reporters suffering from incipient chomatomania that the infiltrators disembarked from their coloured Trojan horses and are entering our lives unseen.

Readers of our sister journal, *Practical Television*, are already being brainwashed. A series of articles by E. J. Hoare entitled *Chips with Everything*, which got itself front-page billing, no less, sets out to describe the design, development and application of integrated circuits in detail. It is thoroughly recommended reading.

Trouble with the IC label always seems to me the use some equipment makers put that hard-worked word *integrated* to. In grammar as atrocious as my last sentence they pad out their advertising with "integrated for utmost efficiency" items. These reveal themselves to be no more than the familiar units packed into one case.

At this year's Radio Shows we saw a 9×5×3in. stereo radio with separate dinky loudspeakers. Rather like matching matchboxes —and not an IC in sight, as far as we could gather. Presumably this trend to miniaturisation will bypass the ultimate status symbol, the super-gram. Yet we may find a large central box with dummy dial and turntable, and the IC hiding behind the aerial plug.

On the grounds of reliability, chips have more flavour. But we remember being told just this when transistors came to town. IC design demands a multi-terminal connection to a printed circuit panel with a few discreet components scattered around. Capacitors cannot be formed to any size because of sheer physical limitations, and resistors that

*Too many eggs in one basket.*

must dissipate some power are also doomed to the fringes. The result will probably be a few more expensive breakdowns, where a ninepenny component will require replacement of the whole panel willy-nilly. There is a disadvantage, as Mr. Hoare has said, of having too many eggs in one basket.

One of the present limitations to the IC is the physical size. Power dissipation is limited to about a quarter-watt. About 20 volts for the "high tension" line is the modern extreme and the feedback problems at high frequency make high-gain circuits an untenable proposition.

So, if we want to avoid over-cooking our chips, we shall have to be content with small-signal, low-frequency circuits, such as i.f. stages, TV sync separators, a.g.c. and a.f.c. amplifiers and discriminators.

Power stages are taboo—as yet. (We need the saving phase because, remember? it was not so long ago that the line output stage of a television receiver simply *had* to be a valve. Nowadays a couple of BU105 transistors handle the power for a colour TV line output section with no more than a gentle blush.)

No, we shan't be saying "Goodbye Mr. Chips" for a long, long time, lemming-like proliferation notwithstanding.

# I.C. OF THE MONTH

L.A.J. IRELAND

## Number 2 — The CA3028 used as a S.W. Converter

INTEGRATED circuits have by now fairly well established themselves in many branches of amateur electronics. The cost of these devices is continually decreasing and in some cases use of an i.c. can work out to be cheaper than its discrete counterparts. Moreover due to their compactness and ruggedness they lend themselves especially for use in equipment where reliability is important since they are not easily damaged. This article describes the use of an R.C.A. CA3028 i.c. in a 1·6MHz short wave converter.

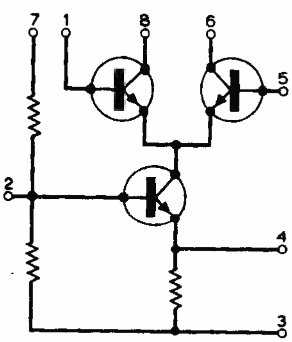



*Fig. 1: The integrated circuit under review this month is the CA3028 manufactured by R.C.A. The theoretical circuit, containing three transistor elements, is shown alongside.*

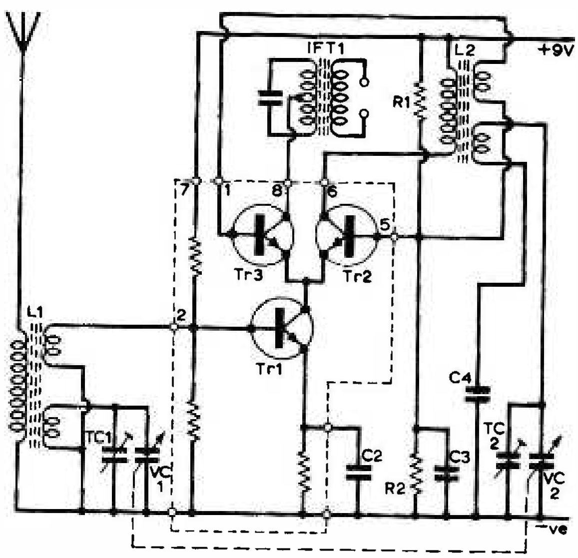



*Fig. 2: The CA3028 can be used as a combined r.f. amplifier, mixer and oscillator in a receiver front-end. This particular circuit is for a short-wave tuner to go ahead of a medium-wave receiver.*

Figure 1 shows the theoretical circuit of the CA3028. As can be seen from the diagram a great number of access points to the unit are available and this makes it particularly useful. The designers intended the unit to be used in either the cascode or differential mode but in the present design each transistor will be used to perform a different function thereby utilising all the advantages afforded by the i.c.

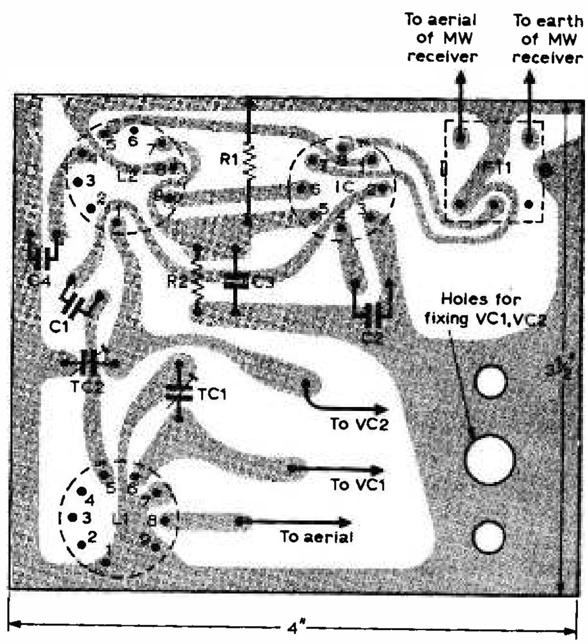



*Fig. 3: The printed-circuit layout for Fig. 2, seen from the copper side.*

The complete circuit diagram of the converter is shown in Fig. 2. The r.f. signal from the tuned circuit is fed to the base of Tr1 operating as an r.f. amplifier in the common emitter mode. Tr2 oscillates at a frequency determined by L2 and VC2 with regeneration provided by the coupling winding from the base of Tr3, which in addition provides the

## ★ components list

**Resistors:**
R1 2·2kΩ R2 1kΩ
Both 10%, ¼ watt miniature

**Capacitors:**
C1 0·01μF C3 0·01μF
C2 0·01μF C4 960pF
VC1/2 365pF variable
TC1, TC2 5–30pF Beehive trimmers

**Coils:**
IFT 1·6MHz, Denco type IFT.16/1·6
L1 Aerial coil, Denco type 4T Blue
L2 Oscillator coil, Denco type 4T White

**Miscellaneous:**
Integrated circuit, R.C.A. CA3028; printed circuit board, coax sockets, battery, etc.

proper biasing conditions for Tr3. The amplified r.f. aerial signal appearing at the collector of Tr1 is mixed with the oscillator signal appearing at the emitter of Tr2 and the resultant 1·6MHz i.f. signal is extracted at the collector of Tr3. From here it is fed to the aerial socket of a medium wave receiver tuned to a vacant spot on the high frequency end of the band around 1·6MHz.

The printed circuit layout pattern is shown in Fig. 3. This pattern should be painted on a sheet of copper laminate board and etched in the usual way in a solution of ferric chloride. The etched board should be thoroughly cleaned and all traces of paint removed. Drilling should be done from the copper side of the board to prevent peeling of the copper, noting that larger holes are required for the mounting of the B9A valve holders and the trimmer capacitors. The pins of the valve holders are numbered in a clockwise direction with a larger gap between pins 1 and 9. This helps to identify the pins on the coils.

The prototype used Denco range 4 coils covering the 20-60 metre band. Any other range may be utilised by inserting the proper coils and associated padders. It should be noted that all component leads must be kept as short as possible to prevent instability. Both the aerial and oscillator coils should be mounted in their shielding cans with solder tags bolted to them to provide suitable earth connections.

A small aluminium chassis together with a few ¼in. standoff spacers were used to mount the printed circuit board, with the coax sockets, on-off switch and tuning control mounted on a front panel bolted to it. The drilling details for these panels are given in Fig. 4.

The unit is now ready for testing and calibrating. The tuning on the medium wave receiver should be set to a vacant spot near 1·6MHz. Next tune-in a station on the converter at the low frequency end of the band and adjust the cores of the aerial and oscillator coils for maximum volume. A small adjustment to the core of the i.f.t. may also be required. After this tune-in a station at the high frequency end of the band and adjust the trimmers for maximum volume. Repeat this procedure until the tracking is correct. The easiest method of calibration, if one has not access to a signal generator, is

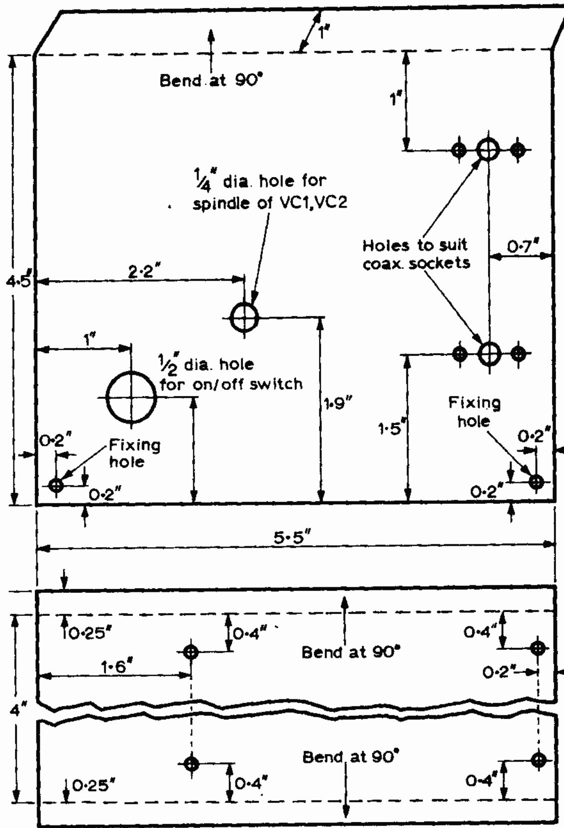


*Fig. 4: A small chassis and panel suitable for the i.c. tuner.*

to obtain a few spot frequencies on the band and calibrate it accordingly. Many stations regularly give their operating frequencies. For the newcomer to short wave listening this will prove to be an ideal project since with so few components involved in its construction results are virtually guaranteed. ■

# LOW COST valve amplifier

R. J. WINFROW

WITH the current trend towards complicated transistor Hi-Fi amplifiers and preamplifiers, it is often forgotten that very good quality can be obtained from fairly simple, low cost valve amplifiers. The amplifier described here is a two valve one giving very acceptable quality at a cost of under £6.

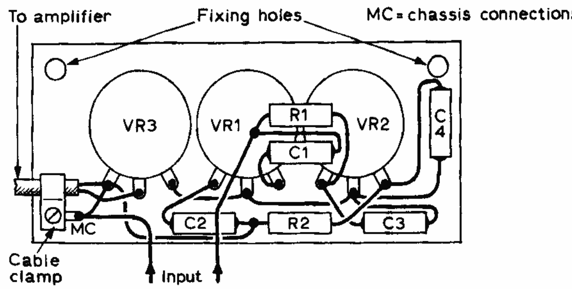



*Fig. 2: The wiring of the tone control panel.*

## The Circuit

The input is fed directly to the tone and volume control stage and although this is a passive network, gives wide control over the tone. The output from this is fed to the first valve, EF86, which is a high gain, low noise type, this acts as a simple voltage amplifier. Negative feedback from the output transformer is fed to the cathode of this stage which makes use of extra gain by improving the overall quality.

The output of the first stage is fed to the triode section of the ECL86 which further amplifies the signal and applies this to the grid of the output section in the same valve which applies the signal to the output transformer in the anode circuit.

The only component that is critical with regard to quality is the output transformer, the difference between a good one and a small cheap one is tremendous. Any good transformer having a primary impedance of about 8kΩ will do.

Because of the high gain of the EF86, care should be exercised in the layout of the components. The main sources of noise in an amplifier are the components associated with this valve and if good noise figures are wanted R3, R4, R5 and R6 should be high stability types. The unscreened lead to the grid of the first valve should be kept as short as possible.

All the main components are mounted on a chassis

—*continued on page 618*

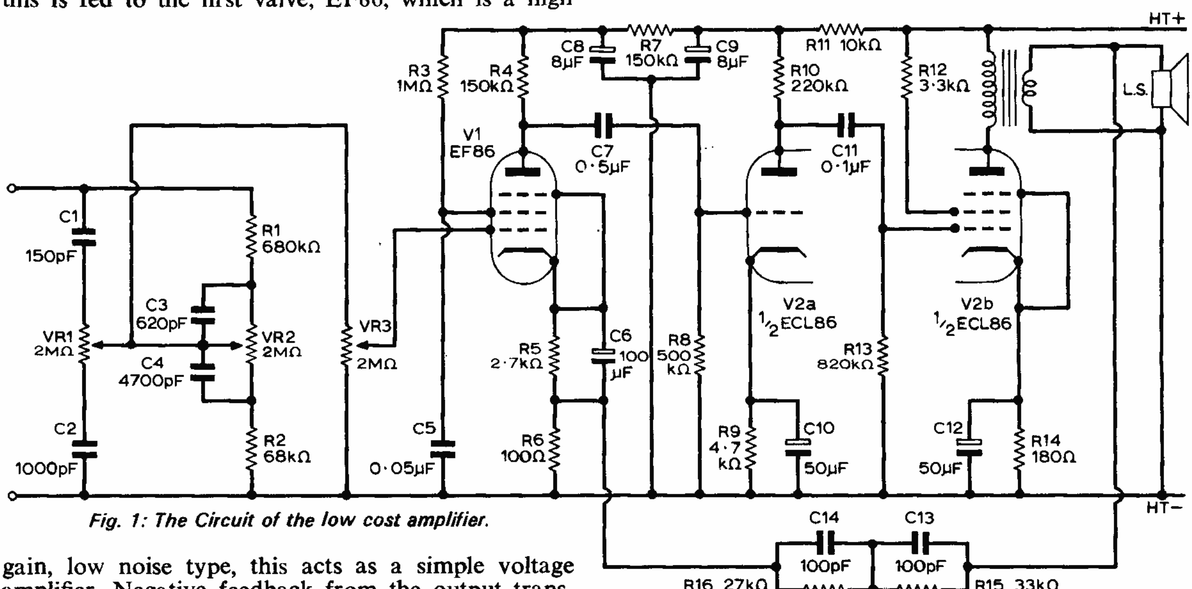



*Fig. 1: The Circuit of the low cost amplifier.*

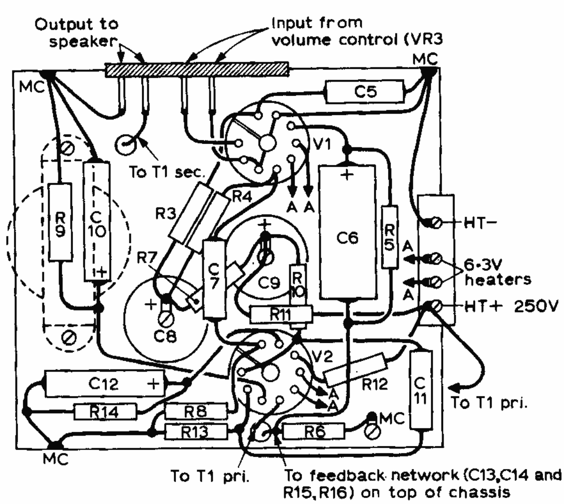



*Fig. 3: The under chassis wiring.*

# SUPER-BARGAIN STOCKTAKING SALE!

Use the form below for your order. CONDENSERS MUST BE ORDERED BY STOCK NUMBER ONLY. If any sale item is 'sold-out' when order received we shall substitute items of equal value.

## ELECTROLYTIC CAPACITORS

| Stock No. | Capacity | Voltage | Price | No. Req'd | £ s. d. |
|---|---|---|---|---|---|
| 1 | 1uf | 6 | 4d. | | |
| 2 | 4uf | 25 | 4d. | | |
| 3 | 4uf | 4 | 4d. | | |
| 4 | 6uf | 6 | 4d. | | |
| 5 | 3uf | 25 | 4d. | | |
| 6 | 64uf | 9 | 4d. | | |
| 7 | 20uf | 6 | 4d. | | |
| 8 | 20uf | 50 | 6d. | | |
| 9 | 30uf | 15 | 6d. | | |
| 10 | 8uf | 12 | 4d. | | |
| 11 | 8uf | 6 | 4d. | | |
| 12 | 1uf | 350 | 6d. | | |
| 13 | 8/8/8 | 350 | 1/- | | |
| 14 | 50uf | 6 | 4d. | | |
| 15 | 100/200 | 275 | 6/- | | |
| 16 | 32 | 150 | 9d. | | |
| 17 | 64 | 2·5 | 3d. | | |
| 18 | 100/200/200/50 | 275 | 7/6 | | |
| 19 | 50/80 | 300 | 3/- | | |
| 20 | 150/200 | 275 | 6/- | | |
| 21 | 24 | 275 | 1/- | | |
| 22 | 10 | 25 | 3d. | | |
| 23 | 125 | 2·5 | 3d. | | |
| 24 | 2 | 150 | 3d. | | |
| 25 | 16/32 | 350 | 2/6 | | |
| 26 | 32 | 275 | 1/6 | | |
| 27 | 350 | 12 | 6d. | | |
| 28 | 75/75/75/75 | 150 | 2/6 | | |
| 29 | 1 | 20 | 3d. | | |
| 30 | 12·5 | 40 | 9d. | | |
| 31 | 640 | 2·5 | 3d. | | |
| 32 | 3,000 | 35 | 7/6 | | |
| 33 | 3,000 | 15 | 3/- | | |
| 34 | 3,000 | 30 | 7/- | | |
| 35 | 250 | 70 | 2/- | | |
| 36 | 2,500 | 9 | 2/- | | |
| 37 | 32 | 50 | 9d. | | |
| 38 | 750 | 12 | 1/9 | | |

| Stock No. | Capacity | Voltage | Price | No. Req'd | £ s. d. |
|---|---|---|---|---|---|
| 39 | 100uf | 275 | 2/6 | | |
| 40 | 30uf | 10 | 3d. | | |
| 41 | 2,000/2,000 | 25 | 7/6 | | |
| 42 | 16uf | 50 REV | 2/- | | |
| 43 | 16/16 | 275 | 2/- | | |
| 44 | 16 | 275 | 1/- | | |
| 45 | 350 | 12 | 9d. | | |
| 46 | 20/4 | 275 | 1/- | | |
| 47 | 250 | 50 | 2/- | | |
| 48 | 500 | 25 | 1/6 | | |
| 49 | 400 | 15 | 1/- | | |
| 50 | 400 | 2·5 | 3d. | | |
| 51 | 64 | 275 | 1/9 | | |
| 52 | 32/32 | 350 | 2/6 | | |
| 53 | 8/8/8 | 275 | 1/9 | | |
| 54 | 500 | 6 | 6d. | | |
| 55 | 64 | 275 | 1/3 | | |
| 56 | 25 | 6 | 3d. | | |
| 57 | 100 | 9 | 6d. | | |
| 58 | 400 | 50 | 2/- | | |
| 59 | 400 | 30 | 1/6 | | |
| 60 | 500 | 4 | 3d. | | |
| 61 | 150 | 30 | 1/6 | | |
| 62 | 64/32/8 | 275 | 2/6 | | |
| 63 | 200 | 275 | 2/6 | | |
| 64 | 40 | 6·4 | 3d. | | |
| 65 | 50 | 25 | 6d. | | |
| 66 | 250 | 50 | 1/9 | | |
| 67 | 30 | 6 | 3d. | | |
| 68 | 100/100/50 | 275 | 5/- | | |
| 69 | 50/50/50 | 350 | 4/- | | |
| 70 | 40/40/20 | 275 | 2/- | | |
| 71 | 400 | 6·4 | 3d. | | |
| 72 | 320 | 10 | 3d. | | |
| 73 | 32/32 + 25 | 275 + 25 | 2/6 | | |
| | | TOTAL | | | |

**RESISTORS.** 5% EXCELLENT QUALITY. **7/6** per 100 of any one value or **2/-** per dozen of any one value. Less than 1 dozen **3d.** each. Tick the values required.

| | | | | | |
|---|---|---|---|---|---|
| 13 ohms | 1 k ohm | 5·6 k ohm | 30 k ohm | 130 k ohm | 1·8 meg ohm |
| 22 ohms | 1·5 k ohm | 6·8 k ohm | 39 k ohm | 360 k ohm | 3·6 meg ohm |
| 36 ohms | 1·8 k ohm | 7·5 k ohm | 43 k ohm | 430 k ohm | 5·1 meg ohm |
| 47 ohms | 2·2 k ohm | 10 k ohm | 47 k ohm | 470 k ohm | 6·2 meg ohm |
| 91 ohms | 2·4 k ohm | 16 k ohm | 51 k ohm | 560 k ohm | 7·5 meg ohm |
| 220 ohms | 3·3 k ohm | 18 k ohm | 62 k ohm | 620 k ohm | 8·2 meg ohm |
| 470 ohms | 3·6 k ohm | 22 k ohm | 75 k ohm | 1·2 meg ohm | 9·1 meg ohm |
| 560 ohms | 4·3 k ohm | 24 k ohm | 82 k ohm | 1·5 meg ohm | 10 meg ohm |
| 750 ohms | 4·7 k ohm | 27 k ohm | 91 k ohm | | |

or our selection (mixed) **6/6** per 100.

TOTAL

**SILVER MICA/CERAMIC/POLYSTYRENE CONDENSERS**
**10/-** per 100 of any one value. **3/-** per dozen of any one value. Individual condensers **6d.** each.
Available in following values. Tick those required.

| | | | | | |
|---|---|---|---|---|---|
| 2 pf | 12 pf | 50 pf | 135 pf | 250 pf | 1,000 pf |
| 3·9 pf | 15 pf | 58 pf | 140 pf | 330 pf | 1,100 pf |
| 4 pf | 18 pf | 62 pf | 158 pf | 420 pf | 1,500 pf |
| 4·7 pf | 22 pf | 72 pf | 170 pf | 600 pf | 2,200 pf |
| 5 pf | 25 pf | 80 pf | 180 pf | 680 pf | 2,500 pf |
| 6 pf | 27 pf | 82 pf | 190 pf | 800 pf | 2,700 pf |
| 8 pf | 30 pf | 100 pf | 200 pf | 820 pf | 3,000 pf |
| 10 pf | 39 pf | 125 pf | 240 pf | 900 pf | 6,200 pf |

TOTAL

## COMPARE THESE PRICES!!!

**MULLARD POLYESTER CONDENSERS**

| | Price | | | No. |
|---|---|---|---|---|
| 1,000 pf | 3d. | each | 400V | |
| 1,500 pf | 3d. | .. | .. | |
| 1,800 pf | 3d. | .. | .. | |
| 2,200 pf | 3d. | .. | .. | |
| ·15 uf | 6d. | .. | 160V | |
| ·22 uf | 6d. | .. | 160V | |
| ·27 uf | 6d. | .. | 160V | |
| 1 uf | 1/- | .. | 125V | |
| | | | Total | |

25% discount lots of 100 per type.
50% discount lots of 1,000 per type.

**GANGED STEREO POTS.** 250K, **2/6** each.

**SKELETON PRESETS.** Mixed, **6/-** dozen.

**VOLUMECONTROLS.** ½meg, 1meg, with D.P. switch, **2/-** each.

**TELEVISION REMOTE CONTROLS.** Philips, contain 11' 7-way cable, 1 double pot., 5 resistors, 2 condensers, **10/-** each. (Cost **£3.3.0.**)

**THIN CONNECTING WIRE.** 10yds **1/-**, 100yds **7/6**, 1,000yds **50/-**.

**CO-AXIAL CABLE.** Black. **6d.** yd, **£1** 50 yds.

**CRYSTAL MIKES.** **10/-** each.

**TRANSISTOR BARGAIN! THEY CAN'T GET ANY CHEAPER!!!!**
P.N.P. Audio. Untested, unmarked. Mainly O.K., **10/-** per 100.
N.P.N. Silicon. R.F. types, unmarked. All Useable, **10/-** per 50.
Power Output (similar OC35). All Tested, **4/-** each, **£2.0.0.** dozen.

**SILICON PLANAR TRANSISTORS.** All Tested. No Leaks or Shorts. Gain of 20/50, **6d.** each; 50/100, **9d.** each; 100/200, **1/-** each. Transistors similar to OCP71 (light sensitive), **2/-** each.

**THYRISTORS.** 400 volt BTY 79, **7/6** each; SCR 51 (10 amp.), **£1** each.

**RECTIFIERS.** Latest type. All marked, 800 volt peak, 1 amp. mean current type 1N4006 **2/6** each, **24/-** dozen, **£7.10.0** 100. S.T.C. 3/4 (400 volt) **2/6** each, **24/-** dozen, **£7.10.0** 100. BYZ 13 or 19 (6 amp.) **2/6** each, **24/-** dozen, **£7.10.0** 100.

**RECORDING TAPE GIVE-AWAY!!!!**
ALL BRITISH MADE, BEST QUALITY. 5" 600', **7/3**; 5¾" 900', **9/-**; 7" 1,200', **12/-**; 3" 'odd-ends'—may be standard, long or double play—but minimum 150', **2/3**.

**MAINS DROPPER TYPE RESISTORS.** Hundreds of types from ·7 ohm upwards. 1 watt to 50 watts. A large percentage of these are Multi-tapped droppers for radio/television. Owing to the huge variety these can only be offered 'assorted', **10/-** per dozen.

**GIANT SELENIUM SOLAR CELLS.** Last few to clear at half price! Circular, 67 m.m. diameter, **5/-** each. 50mm × 37mm, 3 for **10/-**.

**RECORD PLAYER CARTRIDGES**
ACOS GP67/2, **15/-** (Mono); GP91/3, **20/-** (Compatible); GP93/1, **25/-** (Stereo); GP94/1, **30/-** (Stereo, ceramic); GP93/1 with diamond needle, **32/6**; GP94/1 with diamond needle, **37/6**.

**TRANSISTORISED FLUORESCENT LIGHTS.** 12 VOLT.
8 watt 12" tube, Reflector type, **59/6**. 15 watt 18" tube, Batten type, **79/6**. Complete with tube, Postage 3/-.

**TRANSISTORISED SIGNAL INJECTOR KIT.** 10/-
**TRANSISTORISED SIGNAL TRACER KIT.** 10/-
**TRANSISTORISED REV. COUNTER (CAR).** 10/-

**VERO-BOARD**

| | | | | | |
|---|---|---|---|---|---|
| 2½" × 1" × ·15 | 1/3 | 5" × 3¾" × ·15 | 5/6 | 3¾" × 3¾" × ·1 | 4/9 |
| 3¾" × 2½" × ·15 | 3/3 | 17" × 2½" × ·15 | 11/- | 5" × 2½" × ·1 | 4/7 |
| 3¾" × 3¾" × ·15 | 3/11 | 17" × 3¾" × ·15 | 14/8 | 5" × 3¾" × ·1 | 5/6 |
| 5" × 2½" × ·15 | 3/11 | 3¾" × 2½" × ·1 | 4/2 | | |

Spot Face Cutter, **7/6**. Pin Insert Tool, **9/6**. Terminal Pins, **3/6** for 36.
Spot Face Cutter and five 2½" × 1" boards, **9/9**.

These prices cannot be repeated. Order now. Don't forget to add your name and address! Please include suitable amount to cover post and packing Minimum 2/–.

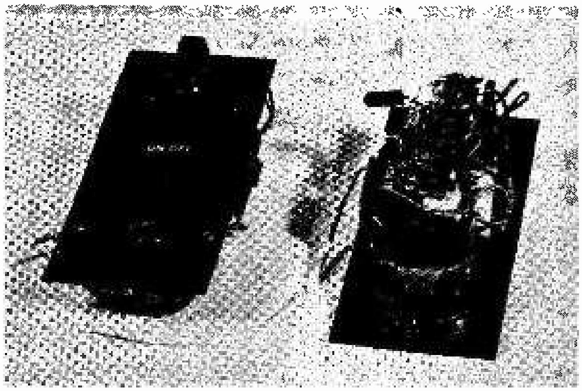
**G. F. MILWARD, DRAYTON BASSETT, NEAR TAMWORTH, STAFFS. 'Phone Tamworth 2321**

# TAKE 20

JULIAN ANDERSON

# No. 8 INTERCOM

**A series of simple transistor projects, each using less than twenty components and costing less than twenty shillings to build.**



*The two intercom stations.*

THERE are on the market several types of intercom costing upwards of £2 10s., and there is no doubt that many readers could find a use for one, but doubt whether even this expenditure would be justified. The unit described here comes within our 20s. limit and this expenditure may make it a viable proposition. It can easily be used as a baby alarm—it is certainly sensitive enough—merely by switching one of the units on permanently.

Most of the commercially available units are arranged so that first a signal button is pressed and the unit is then switched on and the volume level set. Also nearly all of them can be used for "spying", that is, switching on by the master activates the slave microphone so that the master can eavesdrop.

The unit described here is not fitted with a buzzer as calling over the unit is usually enough to draw the attention of the distant party. It cannot be used for eavesdropping (an undesirable, "Big Brother" type feature) and thus its installation can cause no offence. Since no volume control is fitted (this is really unnecessary for this type of equipment) only one control is made by either end to activate the unit.

## The Circuit

The basis of the intercom is a simple amplifier which boosts the "microphone" output to feed a speaker. To make the project simpler and cheaper we use balanced armature earpieces which, by being switched, serve both functions as microphone and loudspeaker. These balanced armature earpieces are really marvellous pieces of design. They are extremely sensitive, have a perfect impedance for transformerless transistor work and are very cheap —mine cost me 2s., unfortunately from a retailer who doesn't do mail order. After the *Take 20* Electronic Organ I had a number of letters asking where to obtain these and I understand that they are no longer made and are in short supply. However, some are still available from various retailers, but this will not help those who can't obtain them. Eighty-ohm loudspeakers can be used in their place and these, even if a little more expensive and taking us over the 20s. limit, are available.

The amplifier is slightly unusual and is an alternative to the one described in *Take 20* No. 1 as a very simple Lo-Fi (I imagine that's the opposite of Hi-Fi!) sensitive a.f. amplifier. It uses a p-n-p and an n-p-n transistor and is R-C coupled. The switching is straightforward; two batteries are used, one each in the master and slave section. This is done purely to enable a three-wire rather than a four-wire connector to be used.

In the normal position (as shown in Fig. 1) no current is drawn and the switch on the master is set to receive calls from the slave. The only thing the slave has to do is apply battery voltage to the master by making SW2.

When the master makes a call the output from the amplifier is fed to the slave loudspeaker, its own loudspeaker is switched to the input, becoming the microphone, and the slave's microphone becomes the loudspeaker switched to the output of the amplifier. The master unit will, of course, override the slave.

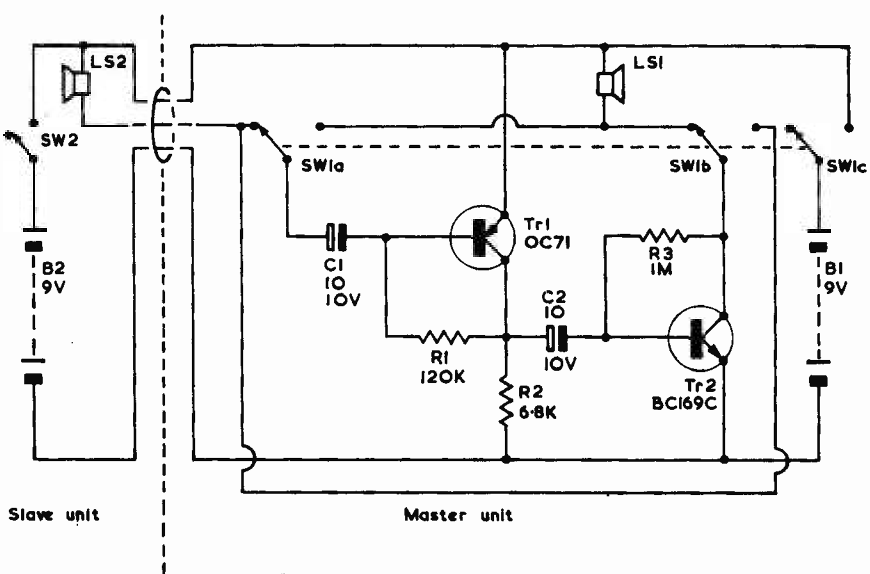



*Fig. 1: Intercom theoretical circuitry.*

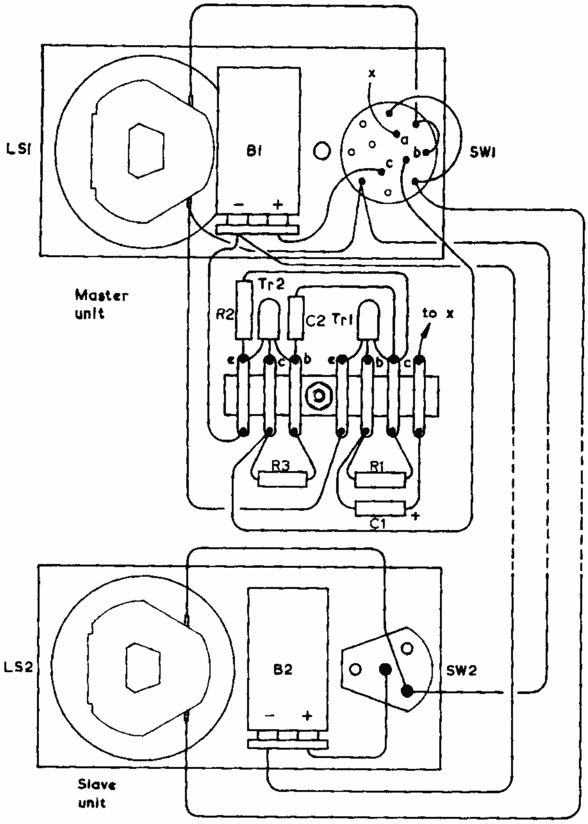



*Fig. 2: Component layout and wiring details*

## ★ components list

| | | |
|---|---|---|
| R1 | 120kΩ ¼W miniature | 3d. |
| R2 | 6·8kΩ ¼W miniature | 3d. |
| R3 | 1MΩ ¼W miniature | 3d. |
| C1, C2 | 10μF 10V | 2s. 0d. |
| Tr1 | OC71 or equivalent | 1s. 6d. |
| Tr2 | BC169C or equiv. | 2s. 3d. |
| SW1 | three-pole, two-way | 3s. 0d. |
| SW2 | one-pole, two-way | 2s. 0d. |
| LS1, LS2 | balanced armature earpieces | 4s. 0d. |
| **Miscellaneous:** | | |
| | Paxolin boards, tagstrip battery clips | 3s. 0d. |
| | | 18s. 6d. |

## Construction

Both the sections are built on Paxolin panels about $4\frac{1}{2} \times 2\frac{1}{2}$in. and all the components, including the battery, are mounted on this; the layout is by no means critical and the drawing is self-explanatory (see Fig. 2).

Although it may be better if press button switches were used, these are not readily available and are rather dear compared with the rotary switches used here. Also, using rotary switches enables either of these units to be switched on permanently for use as a baby alarm. ■

# EXPERIMENTERS CORNER

## DESIGNING CLASS "A" TRANSISTOR OUTPUT STAGES

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

THE purpose of this article is to show that it is possible to design an output stage operating in the class "A" mode, with very little involved mathematics. The design procedure is based on several "rules of thumb" and the assumption that the losses are negligible.

A power amplifier designed by this method will prove to be a viable proposition, and gives the added satisfaction of being able to say "I designed and built it myself". For simplicity of design the input to the amplifier is transformer coupled, see Fig. 1.

First we decide on the output power required and the supply voltage that is available. We then choose a transistor capable of meeting the specification. In this example, the required power is 2 watts and the power supply is to be a fully-charged car battery, the voltage of which will be about 14·5 volts.

A transistor which will more than "fit the bill" is type OC35, which is, incidentally, readily available on the surplus market. Ignoring any losses, the power required ($P_o$) is equal to the peak collector current ($I_c$) times the peak collector voltage ($V_c$), each divided by the square root of 2 to obtain r.m.s. values.

The peak collector current can be determined thus:

$$P_o = \frac{V_c}{\sqrt{2}} \times \frac{I_c}{\sqrt{2}} \qquad \therefore I_c = P_o(\sqrt{2}) \times \frac{\sqrt{2}}{V_c}$$

Substituting our requirements this becomes:

$$= 2\sqrt{2} \times \frac{\sqrt{2}}{14{\cdot}5} = 278\text{mA, or approx. 300mA.}$$

In class "A", the d.c. collector current and the peak collector current are similar, and can be considered equal. Thus the collector voltage and current are 14·5 volts and 0·3 amps respectively. The voltage drop across $R_e$ is usually around 0·6 volts in power output stages. This value is calculated from: $R_e = \frac{V}{I_e}$ where $V$ equals 0·6 volts, and $I_e$ is considered equal to $I_c$, which is equal to 0·3 amps. Thus here $R_e$=2 ohms.

The voltage from base to earth is equal to the base-to-emitter voltage ($V_{be}$) of the transistor (normally 0·6 volts in silicon, 0·4 volts in germanium transistors) plus the voltage drop across $R_e$, in this case 0·6V. The voltage across R2 is therefore 1V. By "rule of thumb" R2 is made equal to $R_e$ times 10, or 20 ohms (use preferred value 22 ohms). Thus the current through R2 is equal to the voltage across R2 divided by R2, which equals in this example 45mA.

The current through R1 can be considered equal, since the base current is very small in comparison with the bleed current through resistors R1 and R2.

Thus $R1 = \frac{14{\cdot}5 - 1}{45\text{mA}}$ =320 ohms (use 330 ohms). (The voltage drop across T1 can be ignored, the d.c. resistance being very small.)

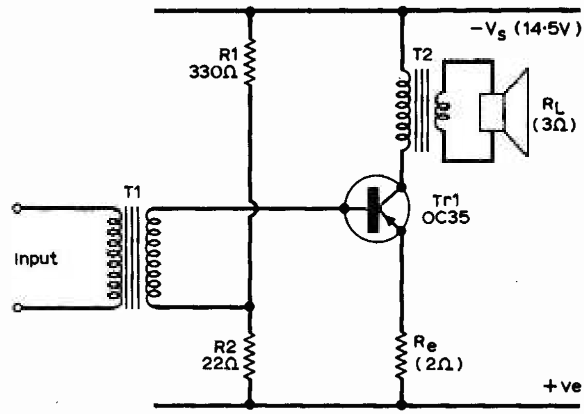



*Fig. 1: The circuit referred to in the text.*

The output transformer requirements are calculated from the a.c. voltages and currents in the circuit. The peak collector voltage swing that can be utilised before "clipping" occurs is approximately 90% of the supply voltage, or 13 volts in this example.

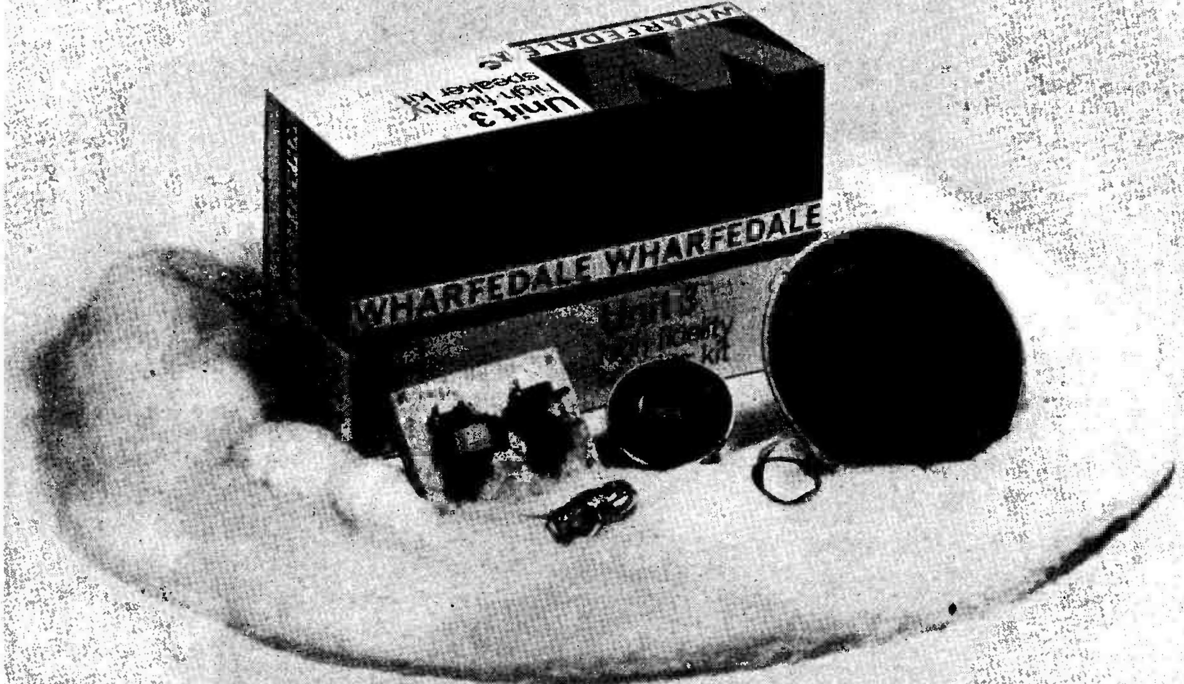
The peak collector current swing available is, as previously stated, 300mA. The collector load should thus be 13 volts divided by 300mA or approx. 43 ohms in this case. The transformer should match this impedance to the actual load impedance used. A 3 ohm loudspeaker is to be the load here, thus the impedance ratio should be 43:3 ohms or the turns/voltage ratio should be $\sqrt{(43:3)}$ or 3·8:1.

The total input power that is required to drive the stage to full output is the voltage needed across T1 secondary times the current. This current is equal to the base current required. This is determined from the transistor characteristics, being the value of peak collector current divided by the $\beta$ value for the transistor at that current. Here, $\beta$ is equal to the range 25-75 for an OC35. Choosing the mean, 50, and from previously calculated collector current 300mA, drive signal required is 0·3A divided by 50, which equals 6mA peak, or 4·2mA r.m.s.

The peak input a.c. voltage is nearly equal to the sum of the base-emitter voltage, plus the voltage across $R_e$, plus the peak a.c. voltage across R2 (6mA × 22 ohms).

Thus, in this case, the drive voltage required is equal to 1·132V peak (0·4V+0·6V+0·132V) or 0·8 volts r.m.s. The total a.c. power required is thus 0·8 volts times 4·2mA, or 3·4mW. The input impedance is 0·8 volts divided by 4·2mA, that is about 200 ohms. T1 should be designed to match this impedance to the optimum load for the preceding stage. This can be designed along the same lines as the power amplifier discussed in this article. ■

# Wharfedale Unit 3 build-it-yourself high fidelity loudspeaker kit




A big success right from the word 'Go', the Wharfedale Unit 3 kit gives you a genuine hi-fi speaker system at a very low cost.
Thousands of satisfied buyers will confirm how simple it is to build: assembly instructions are easy to follow, and include plans of two different cabinets.

**Each kit contains:**

- 8" Speaker covering the bass and middle ranges.
- Wharfedale tweeter with Cellulose Acetate Butyrate dome and plastic diffuser.
- Electrical cross-over unit.
- Acoustic wadding, wiring etc.

## The bookshelf speaker you can build yourself

The Unit 3 kit can be built into two cabinet sizes: in the smaller cabinet the system gives faithful reproduction of all musical sounds from 65—17,000 Hz: in the larger cabinet the range is increased from 40—17,000 Hz. Power handling capacity 15 watts; impedance 4—8 ohms.

Recommended retail price, including purchase tax, only £10.19.6. Write for detailed leaflet, or see your dealer to-day.

RANK WHARFEDALE LIMITED, IDLE, BRADFORD, YORKSHIRE

# BASIC SEMICONDUCTOR TECHNOLOGY

## PART SEVEN

by M.F. DOCKER, M.Sc.

IN the last two parts the operation of the minority carrier transistor was explained. These devices depend on the injection of carriers into a base region across which they diffuse towards the collector. They can thus be thought of as charge controlled devices. Shockley and his colleagues discovered these devices in 1948. They had been trying to make an amplifying device, though of a different type to that they found. Their idea had been to find a device whose conductivity was altered by changing the voltage applied to a separate electrode. They were looking in fact for a field controlled device which would not depend on the injection of minority carriers for its operation but rather on the regulation of the current carried by the majority carriers by a field in the device. It would thus be a majority carrier device and because the current would be carried by only one type of carrier it would be "unipolar".

However because of the rather poor specimens of semiconducting material which were then available Shockley had very little success. It was not until 1958 that the first field effect transistor was produced, by a French firm under the name Technetron. This was not a commercial device and it was not until 1962 that an American firm produced the first commercial f.e.t., priced at about 50s.

The first f.e.t. devices were junction field effect transistors, or j.u.f.e.ts. Later a superior device became available, the metal oxide field effect transistor or m.o.s.t. This latter device has an insulated gate electrode and is sometimes called an insulated gate field effect transistor or in short an i.g.f.e.t.

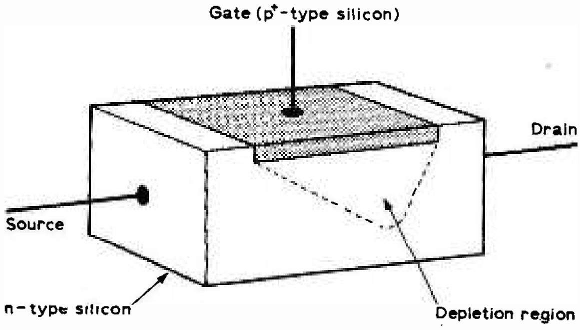
### *Junction Field Effect Transistors*

Before describing the method of operation of the junction field effect transistor it is perhaps best to describe its construction. The simplest geometrical arrangement is that shown in Fig. 1. It consists of an n-type slice of silicon into which a heavily doped p-type layer is diffused to form the gate of the transistor. Contacts are provided at either end of the slice by $n^+$diffusion, giving ohmic contacts which are called the source and drain terminals. Practical devices are constructed by a double diffusion process. A p-type substrate is used and an n-type channel region diffused into it. A second diffusion of p-type material then forms the gate region. Such a structure is shown in Fig. 2.

Returning to the simple structure shown in Fig. 1 it will be seen that if the gate electrode is made negative with respect to the source the junction will be reverse biased. Consequently a depletion layer will extend into the n-type silicon. If at the same time a voltage is applied between the source and drain electrodes a current will flow through the channel of n-type silicon. By definition the source terminal is that from which the current carriers originate and the drain terminal is the one to which they go.

### *Junction f.e.t. Characteristics*

In this example the source is the negative terminal and the drain is positive, thus there is a potential drop between these electrodes. Near the source the reverse bias across the junction will be essentially the same as the gate to source voltage, Vgs, but nearer the drain the reverse bias is greater because of the voltage drop across the drain to source channel region. The result of this is that the channel available for conduction is reduced in



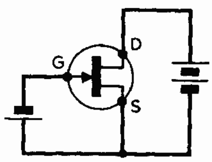
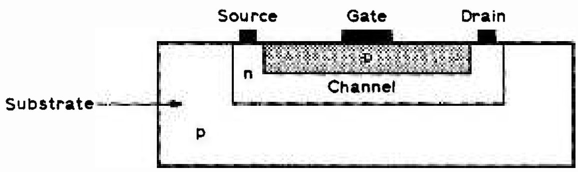




*Fig. 1: Basic junction field effect transistor and its equivalent circuit and biasing.*

*Fig. 2 (below): Practical junction f.e.t. structure.*




width so that the resistance between the source and drain electrodes is increased as the drain current increases. Eventually, the channel is reduced to such a width that further increase in the drain to source voltage produces no increase in the drain current. Of course the channel is never completely closed as this would lead to zero drain current, with a resultant fall in the potential drop between the drain and source and a widening of the channel once more. The voltage at the gate which produces an essentially constant drain current is called the pinch off voltage, Vp. This depends very much on the construction of the device and at present most of the commercially available field effect transistors have a large spread in their pinch off voltages.

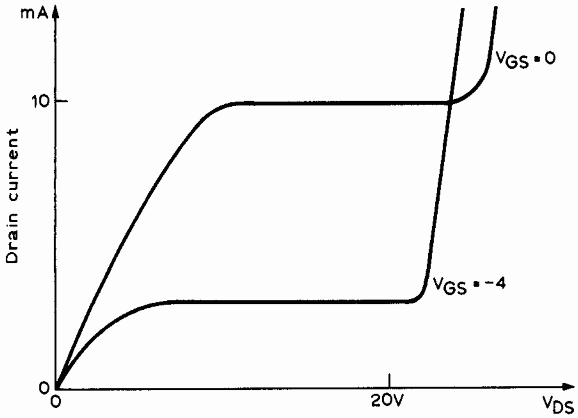



*Fig. 3: Curves showing variation in drain current with drain voltage for different gate voltages.*

From the characteristic curve shown in Fig. 3 it is seen that at high drain to source voltages the drain current suddenly increases. This is because of our old friend the avalanche effect. The large voltage is in effect in series with the reverse voltage across the gate junction and produces avalanching in this region. This effect sets a limit to the maximum voltage that can be applied to the f.e.t. either directly to the gate or via the drain supply.

It is possible to make both n- and p-channel junction field effect devices. The n-channel device gives a decreased drain current if the gate is made negative whilst p-channel device gives a decreased drain current if the gate is made positive.

## Insulated Gate Field Effect Transistors

A later addition to the range of the majority carrier devices was the insulated gate field effect transistor. Although the input resistance of the gate electrode of the junction f.e.t. is high, often being of the order of 100M$\Omega$, that of the i.g.f.e.t. is often up to $10^{14}\Omega$ or 100MM$\Omega$. This is of course of immense value in high input impedance instruments used in laboratories and for circuits requiring low loading of previous stages.

The insulated gate field effect transistor, or metal oxide silicon transistor as it is more usually called, is made by diffusing into a p-type substrate two heavily doped $n^+$ regions which act as source and train electrodes, being separated by perhaps 1 mil. A layer of silicon oxide is then grown over the top of the device and two holes are etched in this to enable metal contacts to be attached to the source and drain. A further layer of metal is attached to the oxide over the region between the source and drain as seen in Fig. 4: this becomes the gate terminal of the complete device.

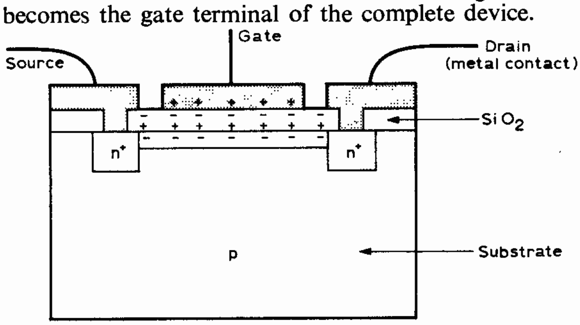



*Fig. 4: Structure of an enhancement-mode insulated gate field effect transistor.*

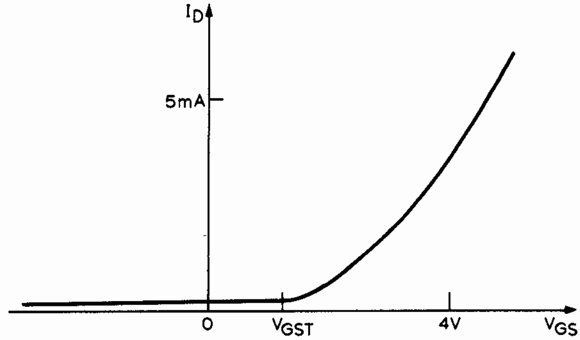



*Fig. 5: Enhancement-mode insulated gate field effect transistor characteristic curve.*

The operation of the m.o.s.t. is explained quite easily by considering the arrangement of Fig. 4. If the gate is made positive with respect to the substrate an electric field will be developed and will induce charges on the surface of the semiconductor. Since the field is directed into the surface negative charges will be induced by the force acting on the atoms in the semiconductor. In this way a layer of negative charge is produced between the source and drain, which results in a decreased source to drain resistance and an increase in the drain current.

## Enhancement Mode Operation

The layer of induced charge is called an inversion layer because the charge carrier is of opposite type to that in the bulk of the semiconductor. This arrangement is called the enhancement type of m.o.s.t. as the conductivity of the channel is enhanced by application of the gate potential. It is characterised by the fact that very little current flows through the channel when there is no field at the gate. A curve showing the relationship between the drain current and the gate voltage of a typical m.o.s.t. of the enhancement type is shown in Fig. 5. It is seen that only a very small current flows through the device until a gate threshold voltage Vgst is reached. This threshold voltage varies from device to device and is the voltage required to produce the inversion charge layer.

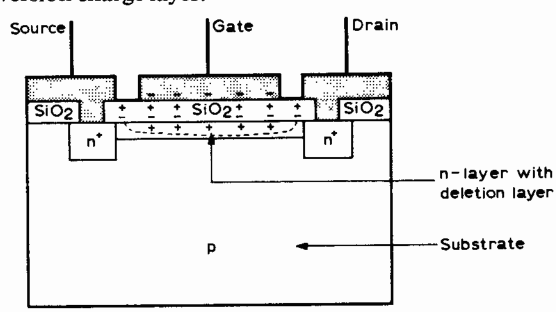



*Fig. 6: Depletion-mode i.g.f.e.t. construction.*

## Depletion Mode Operation

A second type of insulated gate f.e.t. exists, called a depletion type device. This has an n-type layer diffused into the region between the source and drain as can be seen in Fig. 6. Consequently a considerable current flows through the device when there is zero applied gate voltage because of the conductivity of this channel. However if the gate is made negative relative to the

*continued on page 622*

# AUDIO NOISE LIMITER

M. WALLIS


ANYONE who has tried DXing will know that one of the limitations on receiving those prized stations is the background noise, static etc. Frequently one can hear a station below this noise but it cannot be identified for sure because it is swamped by the noise level, and of course increasing the volume doesn't help.

Others may be interested in very old 78r.p.m. records, some of which have a very low modulation level compared with the inevitable scratches; here the audio limiter will work well, although it is primarily designed for radio use, fitting between the phone output socket and the headphones.

Most good communication receivers are fitted with a noise limiter which automatically adjusts itself to limit just above the level of the incoming signal. There is however a strong disadvantage in this system; the limiter will only cut signals above the average and of course the noise *itself* contributes to that average. Such a limiter, in heavy noise conditions, will limit the peaks of the noise rather than that of the signal. Simpler non-automatic noise limiters do not suffer from this, but since they cannot be controlled are virtually ineffective on weak signals.

The unit described here not only overcomes these problems but requires no modification to the set; it is a self-powered unit which is fitted between the set and the headphones. It doesn't matter whether the phones' take-off point is immediately after the volume control or across the loudspeaker, it will work equally well on both.

In addition to acting as a limiter in the normal manner it is also extremely effective at reducing the effects of side-band splash caused either by a close adjacent transmission or cross-modulation within the receiver itself. The unit can be adjusted so that the wanted signal is at comfortable listening level and the splash only reaching that level at a maximum. In addition treble cut is incorporated in the circuit making this even less objectionable.

As well as doing all the above it provides audio gain—useful when the audio stages are working flat out and the signal is still too quiet. It has another advantage over more conventional diode type clippers in that it "rounds off" the clipped signal rather than converting it into a sort of square wave which is heard as a nasty "rasping" sound. The same circuit can be used as a speech compressor for transmitters and similar equipment.

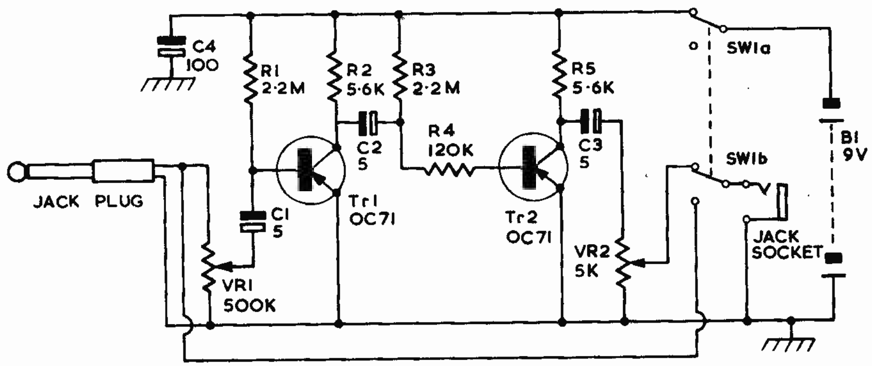



*Fig. 1: The audio noise limiter using transistors biased almost to cut-off for clipping noise.*

## ★ components list

**Resistors:**
R1, 3 2·2MΩ
R2, 5 5·6kΩ
R4 120kΩ
VR1 500kΩ log.
VR2 5kΩ log.

**Capacitors**
C1, 2, 3 5μF, 12V

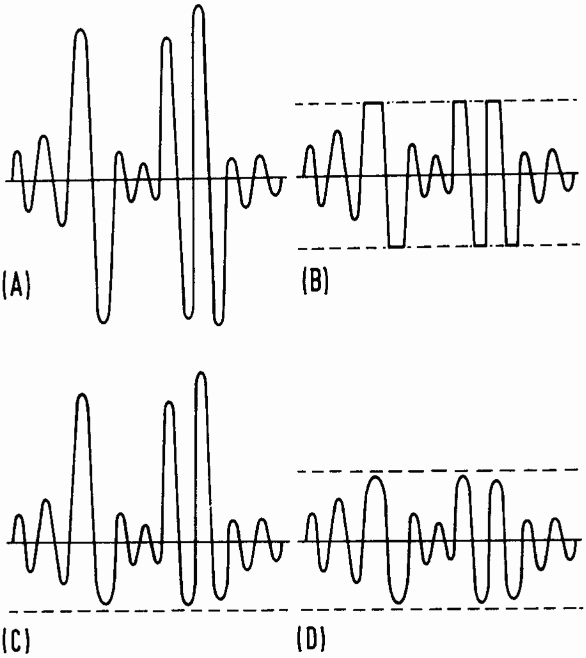
**Transistors**
Tr1, 2 OC71

**Miscellaneous**
SW1 2 pole, 2 way slide switch. Phone jack; 9V battery, knobs, chassis/case, Veroboard, rubber grommet, soldering tags.

## The Circuit

The output from the receiver is connected across VR1, a 500kΩ potentiometer. Its high value prevents it loading previous stages in certain types of radios, at the same time this value works perfectly well for all inputs. (It may be found that with VR1 at its maximum setting the input impedance of the transistor loads previous stages on certain radios. This will not generally matter as the control will rarely be on maximum but can be overcome by fitting a 47kΩ resistor between the input and the top of VR1.)

The signal is fed to the base of Tr1 via C1 which acts




(A) A typical incoming audio signal with noise peaks apparent. (B) A diode type noise limiter will clip the peaks squarely, causing splatter. (c) The first stage of the audio limiter (Fig. 1) will clip and round off the lower peaks. (D) TR2 completes the process by flattening the upper peaks.

as a d.c. blocking capacitor. Tr1 is biased by R1, 2·2M$\Omega$; in small signal conditions this acts as a linear amplifier but with high level signals the positive peaks will bias Tr1 towards cut-off. Phase inversion takes place in Tr1 since it is arranged as a common-emitter amplifier and the signal is fed via C2 to the junction of R3 and R4. R3, 2·2M$\Omega$ provides the bias for Tr2 while

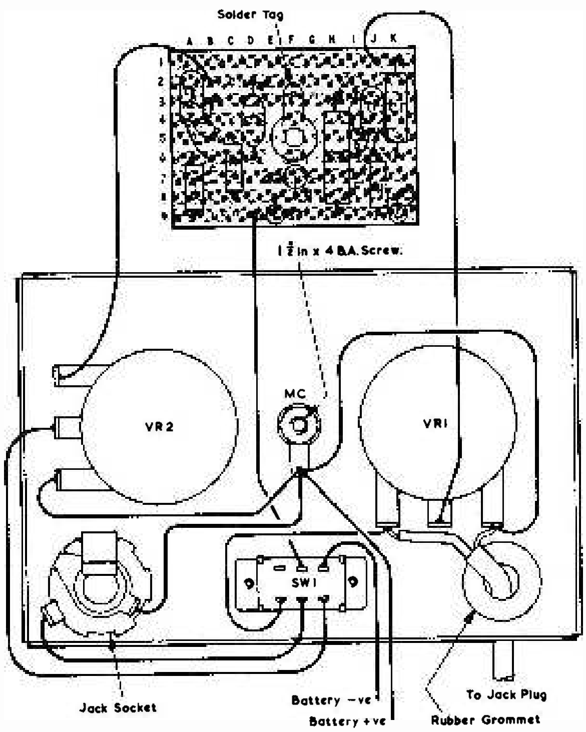
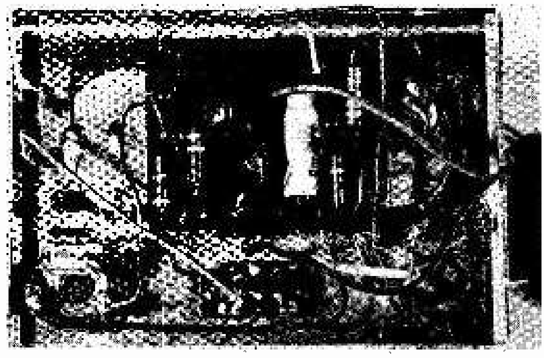



Fig. 2: The rear view chassis layout and component grouping on the Veroboard. The soldering tag connects to F1.



The rear view o' the limiter.

R4 attenuates the signal so that the cut-off points will be the same as for Tr1.

Negative peaks were unaffected by Tr1 but after inversion they become positive peaks and are limited by Tr2. The output from Tr2 is taken via C3 to the top of VR2 which acts as a straightforward volume control. This is necessary as the level at which it is required to limit is not necessarily the level at which you want to listen.

SW1 in the *on* position as shown in Fig. 1 provides battery power to the unit and also the headphones to the output of the limiter. In the *off* position the battery is disconnected and the phones taken directly to the input, making the limiter inoperative. This enables the limiter to be permanently connected and makes for easy comparison between the corrected and uncorrected signal.

## Construction

The prototype was built into a small aluminium case, $4 \times 2\frac{1}{2} \times 2$in., which was supplied with a flanged lid. These small instrument cases are fairly widely available but if difficulty is experienced a small aluminium case can be made up or another type of box (even plastic) used. All the components are mounted on the lid as shown in the photograph. The two transistors and associated components are mounted on a small piece of Veroboard $13 \times 9$ holes.

The centre hole of the board is drilled out to take a 4BA screw and six adjacent holes should have the copper strip removed as shown in Fig. 2. The board itself is mounted behind the two variable resistors on a $1\frac{1}{2}$in. screw and held by a couple of 4BA nuts. A solder tag should be fitted under the top nut and a wire from this taken to the positive strip. Apart from the above points construction is perfectly straightforward if Fig. 2 is carefully followed.

## Usage

After checking that all wiring etc. is correct, with the slide switch in the *off* position, plug the unit into the radio and the phones into the unit. Set the volume of the radio to a comfortable level. Now switch the unit on and adjust VR1 to a level just below a point where rasping is heard and distortion is not noticeable. Above this point the limiter is overloaded and the transistors are completely cut off. Next set VR2 to a comfortable listening level. VR1 and VR2 will have to be set for each signal heard but a considerable improvement will be heard between the unit inserted and out of circuit. A little practice to achieve the best balance between receiver volume, limiting level and output level is needed but after this it should be invaluable for DX listening. ■

# CODAR CR.70A

## Communications Receiver 540-10 metres

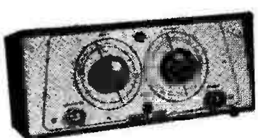

The Codar CR.70A is an excellent general coverage communications receiver for the keen short wave listener. Very reasonably priced at just £21 the CR.70A is outstanding value for money. In four stable ranges, the receiver covers from 540 metres medium wave, right through the shipping and coastguard frequencies 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.

# 20 gns.

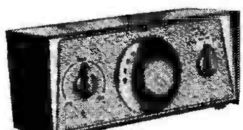
Carriage 7/6 extra

*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.

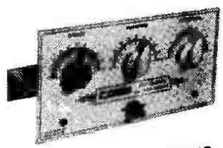
**T28 RECEIVER FOR 160 & 80 METRES AMATEUR BANDS**
9 transistors, bandspread 1.8-2Mc/s and 3.5-4Mc/s 12 volts, only 8" x 4" x 3½", ideal portable, mobile or home receiver. Efficient BFO, printed circuits. ONLY £15.17.6. Carr. 4/6.



**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 8¼" 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

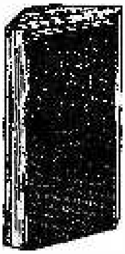
NAME ..................................................

ADDRESS ..................................................

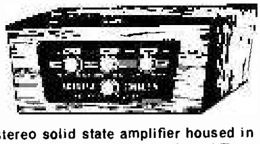
**POST ORDER FORM TODAY**

# LOW PRICE, HIGH QUALITY SPEAKER SYSTEMS

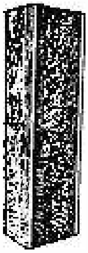
**All cabinets are new and carefully designed acoustically with speakers mounted on $\frac{1}{2}$in. chipboard baffles. All speakers are ex-TV high quality with hi-flux magnets carefully matched and tested.**



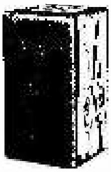
**COWDREY FIVE.** Specially designed Corner Cabinet; Fitted rubber feet. $20\frac{3}{4}$ x 13 x $7\frac{3}{4}$in. deep. Finished in natural teak veneers with Vynair front. Fitted 8 x 3in., 7 x 4in. and three 5in. round speakers wired in series to match. 15 ohm impedance (handles 15 watts). **£6.6.0.** P. & P. 8/6 each.



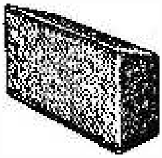
**ADASTRA DOUBLE** 5 stereo solid state amplifier housed in handsome cabinet veneered in natural teak. Size $11\frac{3}{4}$ x 6 x $5\frac{1}{4}$in. **10** Transistors—power output 5 watts peak per channel. 220-240v AC. Output impedance 12 to 15 ohms (our Cowdrey speaker system eminently suitable). Smart blue escutcheon. **£14.14.0.** P. & P. 10/6.



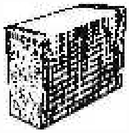
**CAXTON COLUMN.** This is a column cabinet $23\frac{3}{4}$ x $5\frac{1}{2}$ x $5\frac{1}{4}$in. deep fitted with three speakers. Handles 8 watts and will improve the quality of any tape recorder or record player. Finished in wood grain cloth with sandstone Vynair front it is a real bargain at **59/6.** P. & P. 10/6 each



**ELF.** An extension speaker of quality. 9 x $5\frac{1}{2}$ x $3\frac{1}{2}$in. veneered in natural teak, with smart gold and brown Vynair front trimmed with white. Fitted re-conned 5in. 3 ohm speaker. The baffle is half inch thick. A real bargain at **37/6.** P. & P. 3/6.



**SCOTT.** The elegant tapered cabinet, for table or wall mounting measuring $10\frac{3}{4}$ x 16 x $5\frac{1}{4}$in. deep, is attractively finished in black cloth with a striped grey Vynair front fitted with $13\frac{1}{2}$ x 8in. speaker with volume control. Please state impedance required—3 or 15 ohm. **£4.5.0.** P. & P. 7/6 each. Fitted with E.M.I. 13 x 8in. speaker and twin tweeters, 15 ohm impedance capacity 10 watts **30/-** extra.



**IMP.** Wedge shaped extension speaker cabinet is fitted with 7 x 4in. speaker. Covered in walnut wood grain cloth with fawn Vynair front, keyhole slot in back. $7\frac{1}{2}$ x $6\frac{1}{4}$in. Only **25/6.** P. & P. 4/6 each.

**SPEAKERS:** Elac Heavy duty Ceramic Magnets 11,000 line, 10in. round, 10 x 6in. 3 ohm or 15 ohm. **48/6,** P. & P. 3/6. 8in. round 15 or 3 ohm, **42/6,** P. & P. 3/6. E.M.I. $13\frac{1}{2}$ x 8in. 3 ohm, **45/-,** 15 ohm **48/6,** P. & P. 1/6. E.M.I. 3in. tweeter **17/6,** P. & P. **1/6.** E.M.I $13\frac{1}{2}$ x 8in. fitted two $2\frac{1}{2}$in. tweeters. 15 ohm **77/6,** P. & P. 4/6. E.M.I. $13\frac{1}{2}$ x 8in. (15 ohm) Hi-Fi quality **£5.19.6,** P. & P. 4/6. E.M.I. Woofers, $6\frac{1}{2}$ x $6\frac{1}{2}$in. square, 8 ohm, **59/6,** P. & P. 4/6. E.M.I. Crossover, **16/6,** P. & P. 1/-. EAGLE Crossover units 3 or 16 ohms. **16/-,** P. & P. 1/-. Bakers 12in., 25 watt 15 ohm **£6.6.0,** P. & P. 3/6.

**BROADWAY Electronics** (Few minutes from Tooting Broadway Underground Stn)
**92 MITCHAM ROAD, TOOTING BROADWAY, LONDON, S.W.17 01-672 3984** *(Closed all day Wednesday)*

**TEAK PLINTH AND PERSPEX DUST COVER** for SP25 etc. **£5.5.0.** P. & P. 5/-.

**VYNAIR.** Widths from 40 to 54in., **17/6** yd. off roll. P. & P. 1/9. $\frac{1}{2}$ yard, **9/-,** P. & P. 1/9. Send 1/- stamps for samples.

**SPEAKER MATCHING TRANSFORMERS.** 3, 7, 15 ohms, 8 watt, **11/6.** P. & P. 1/6.

**MICROPHONES:** Xtal Hand Mikes. B1201 with stand, **54/6.** P. & P. 3/6. ACOS Mike **45, 21/-.** ACOS Mike 40, **18/6.** Dyn. Mike DM-391, **30/-.** CM21 Xtal, **12/6.** Telephone Pick-up, **10/6.** P. & P. 1/-. Xtal lapel Mike, **7/6.** Guitar Mike, **12/6.** P. & P. 1/-.

**FERROX RODS:** 6 × $\frac{5}{16}$in., **2/6;** $4\frac{1}{2}$ × $\frac{3}{8}$in., **2/-;** 6 × $\frac{3}{8}$in., **2/6;** 8 × $\frac{3}{8}$in., **3/-.** P. & P. 1/- each.

**FERROX RODS WITH COILS,** $4\frac{1}{2}$ × $\frac{3}{8}$in., **3/6;** 8 × $\frac{5}{16}$in., **5/6.** P. & P. 1/- each.

**ROTARY SWITCHES:** 2 Pole Mains Switch, **3/-;** 1 pole 12 way, 2 pole 2 way, 3 pole 3 way, 3 pole 4 way, 4 pole 3 way, **3/6** each. P. & P 1/-.

**TRANSISTOR SPEAKERS** 8 ohm 2in., **8/6.** 3in., **10/6.** P. & P. 1/-.

**CARTRIDGES. Stereo:** Sonotone 9TA H/C Diamond, **47/6.** 9TA Sapphire, **37/6.** 8TA Sapphire, **30/-.** Ronette 8105 Medium Output, **28/6.** 8106 High Output, **28/6.** DC284 Stereo Compatible, **22/6.** Acos GP93/1 Sapphire, **37/6.** GP94/1 Sapphire, **39/6.** GP81 Diamond, **42/-.** GP91 Stereo Compatible (High, Medium or Low Output), **25/-.** TA800 converts Philips AG3301, AG3306 to B.S.R. SX1H. Plug-in head complete with cartridge, **50/-.** TA700 equivalent to B.S.R. SX1M, **35/-.** Japanese equivalent to B.S.R. TC8, **35/-.**

**Mono:** Acos GP67/2 will replace Collaro and Garrard Mono cartridges, **18/6.** T.T.C. Crystal High Gain, **15/-.** B.S.R. TC8H Jap. equivalent, **26/-.** Sonotone 2T8S, **15/-.** P. & P. 1/6.

**EARPIECES WITH CORD** and 3·5 mm. plug. 8 ohm magnetic, **3/-.** 250 ohm, **4/-.** 180 ohm with clip, **6/6.** Xtal. P. & P. 6d.

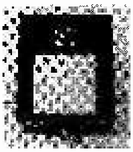
**PIANO KEY PUSH BUTTON SWITCHES.** 7 button inc. mains on off. 6 banks of 6 P.C.O., **8/6.** P. & P. 1/-.

# 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. $7\frac{3}{4}$ × 3 × $4\frac{1}{4}$in. **£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.

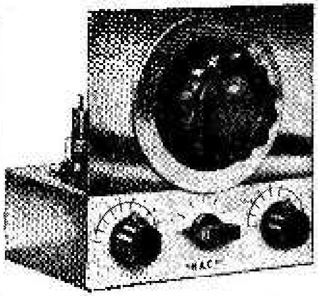
**MORSE OSCILLATOR.** PC board, transistors, high stab. components, battery carrier, ear piece. Adjustable tone. Just attach your key. Drives phones or speakers. In kit form **17/6** post paid. Ready built in similar case as above, **25/-** post paid.

**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).***

# H.A.C. SHORT-WAVE KITS

## WORLD-WIDE RECEPTION




Famous for over 30 years for Short-Wave Equipment of quality, "H.A.C." were the Original suppliers of Short-Wave Receiver Kits for the amateur constructor. Over 10,000 satisfied customers—including Technical Colleges, Hospitals, Public Schools, R.A.F., Army, Hams, etc.

**IMPROVED 1969 RANGE**

One-valve model "DX", complete kit—price **56/6** (Postage and packing 3/6).

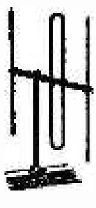
Customer writes:—"Definitely the best one-valve S.W. Kit available at any price. America and Australia received clearly at good volume." This kit contains all genuine short-wave components, drilled chassis, valve accessories and full instructions. Ready to assemble, and of course, as all our products—fully guaranteed. Full range of other S.W. kits still available, including the famous model "K" (recommended by radio clubs). All orders despatched by return. (Mail order only.) Send now for a descriptive catalogue, order form.

**"H.A.C." SHORT-WAVE PRODUCTS**
**29 Old Bond Street, London W.1**

# 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**

# P.W. GUIDE TO COMPONENTS

## PART 12

M.K.TITMAN, B.Sc.(Eng)

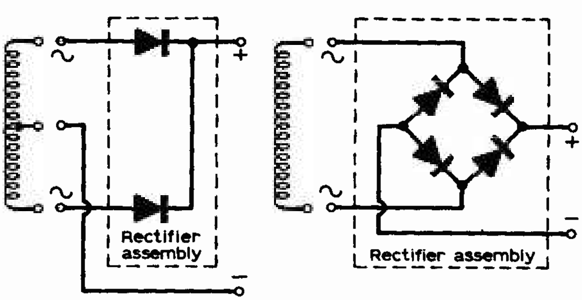
BOTH germanium and silicon diffused diodes are available but due to the greater operating temperature and low reverse leakage of silicon devices they have virtually eliminated germanium diodes for power rectification. Diffused diodes are capable of passing high currents and can be made to close tolerances to give the required reverse characteristics. They are robust and reliable and therefore ideal for general purpose applications.

A further increase in robustness is obtained in the glass encapsulation by using a technique of inserting molybdenum blocks between the junction and the lead-out wires. These blocks match the glass and metal temperature coefficients and thus remove the requirement for the "S"-shaped connection. Such devices are sometimes referred to as "whiskerless diffused diodes" and despite the construction are obtainable at prices between 2s. and 5s. each.

### Avalanche Diodes

The avalanche diode is a development of the diffused construction which considerably reduces failures due to reverse voltage transients. To enhance the avalanche breakdown protection the periphery of the diffused junction is chamfered to a fairly critical angle. The slice is then cleaned and the edge treated with varnish or resin.

The chamfering affects the edge irregularities and properties. During transient switch-off the current flows mainly in the periphery of the junction and as a result this technique enables the diode to withstand greater transients. The avalanche rectifier is therefore particularly suitable for applications in which transients are likely to be encountered—such as high-speed power switching. It must be remembered however that the avalanche diode does not have a higher frequency response than the normal diffused rectifier and is only suitable for power switching below 20kHz before derating for switching losses is necessary.




(a) Centre tapped (b) Bridge

*Fig. 10: Basic rectifier assemblies.*

A development which does lead to an increased working frequency is the addition of gold to the diffused junction. The gold reduces the recombination time of the charges within the junction on switch-off and considerably reduces the switch-off time. Most fast switching rectifiers operating with up to 50kHz squarewaves utilise this modified construction.

### Gold-Bonded Diodes

Signal diodes which utilise this addition of gold are referred to as gold-bonded diodes and are available in both silicon and germanium materials. As they are manufactured to give increased frequency of operation germanium is often used and germanium gold-bonded diodes have high frequency characteristics closely approaching those of the point contact diode.

### Planar Epitaxial Diodes

Another form of construction which has resulted in increased switching speeds is the planar epitaxial construction. This method of forming the junction utilises silicon dioxide as a masking layer and a photographic etching technique: it is explained fully in other parts in this series. The encapsulation for signal diodes is usually glass as shown in Fig. 8 but plastic encapsulations are now appearing with a resultant reduction in cost.

Planar diodes are reliable and are used in high-speed switching circuits such as computers. Several power rectifiers are now available with this form of construction which gives increased switching performance, although at the present time they are considerably more expensive than diffused rectifiers.

### Bridges and Assemblies

The general use in industrial and commercial applications of plastic encapsulation has led to the introduction of diode rectifier assemblies encapsulated in plastics. These assemblies are available in various forms of which the bridge rectifier and centre tapped transformer rectifier configurations shown in Fig. 10 are the most popular. Individual rectifiers, signal diodes and zener diodes are all now available in plastic encapsulations at a considerable saving in cost.

**Table 4: General comparison of available diodes**

| *Construction* | *Material* | *Typical parameters* Maximum forward current | Average reverse current | Reverse voltage | *Encapsulation* | *Cost* | *Application* |
|---|---|---|---|---|---|---|---|
| Point contact | Germanium | 50mA | 10–500$\mu$A | 30–150V | glass | 1s. to 5s. | V.H.F. signal diode |
| Gold bonded | Germanium | 100mA | 7–200$\mu$A | 30–150V | glass | 1s. 1d. to 5s. | V.H.F. signal diode |
| Junction | Germanium<br>Silicon | 1A<br>1A | 1–100$\mu$A<br>0·01–1$\mu$A | 100–800V<br>100–800V | glass, metal and plastic | 3s. to 10s.<br>2s. to 10s. | general purpose |
| Whiskerless diffused | Silicon | 200mA | 0·01–1$\mu$A | 50–200V | glass | 2s. to 5s. | High-speed switching |
| Diffusion | Silicon | >250A | 0·01–100$\mu$A | 100–1,200V | metal and plastic | see table 1 | General purpose and rectification |
| Planar | Silicon | 100mA and 10A | 0·001–1$\mu$A | 25–800V | glass, metal and plastic | 1s. to £1<br>£2 upward | Signal<br>Power rectification h.f. |
| Avalanche diffused | Silicon | >50A | 0·01–100$\mu$A | 200–1200V | metal and plastic | 10s. upward | Switching and rectification with transients |
| Bridges | Silicon | >10A | 0·01–100$\mu$A | 100–1000V | metal but mainly plastic | 11s. to £20 | Transformer power rectification |

Figure 11 illustrates two bridge encapsulations primarily intended for use as rectifier bridges. Figure 11(a) shows a 1·8A silicon rectifier bridge which can be wired directly to a printed circuit without the necessity of a heatsink. Figure 11(b) shows a 10A silicon rectifier bridge which can be bolted to a heatsink. Both are considerably smaller than general attempts to mount four diodes to give the same performance.

## Conclusion

Table 4 summarises the main methods of construction, their parameters, cost and uses. This should not be regarded as absolute in any parameter or statement but just a typical device range of the

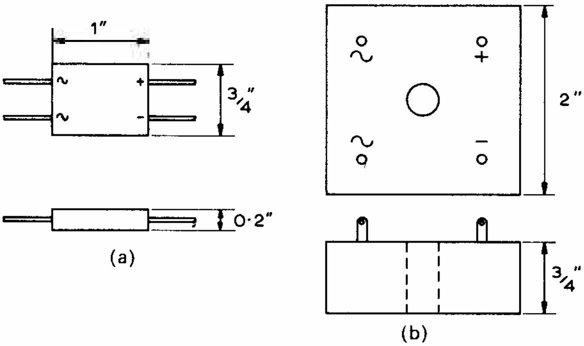



*Fig. 11: (a) 1·8A and (b) 10A bridge encapsulations.*

particular construction. There are many hundreds of different device types and this article will have served its purpose if the search for a required diode is reduced to a given form of construction.

**TO BE CONTINUED**

# LOW COST VALVE AMPLIFIER

*—continued from page 602*

## ★ components list

**Resistors:**

R1 680kΩ
R2 68kΩ
R3 1MΩ high-stab.
R4 150kΩ high-stab.
R5 2·7kΩ high-stab.
R6 100Ω high-stab.
R7 150kΩ
R8 560kΩ
R9 4·7kΩ
R10 220kΩ
R11 10kΩ
R12 3·3kΩ 1 watt
R13 820kΩ
R14 180Ω 2 watt
R15 33kΩ
R16 27kΩ
All 10% ¼ watt except where stated.

**Capacitors:**

C1 150pF
C2 1000pF
C3 620pF
C4 4700pF
C5 0·05$\mu$F 150V
C6 100$\mu$F 25V
C7 0·5$\mu$F 150V
C8, C9 8$\mu$F 350V
C10 50$\mu$F 25V
C11 0·1$\mu$F 150V
C12 50$\mu$F 25V
C13 100pF
C14 100pF

**Miscellaneous:**

VR1, VR2, VR3 2MΩ log pots.
V1 EF86
V2 ECL86

Metal chassis, metal panel (see text); Output transformer (see text); Two B9A valve bases, Suitable power supply.

about 6 × 6 × 2½ ins., and the controls on a panel 6 × 2½. No details are given for a power supply as any capable of giving between 200V. and 350V. at 75mA and 6·3V. 1·5A. will do. ■

# L.C. MEASUREMENTS

W.D.WATKINS

THIS article is intended to help those constructors and experimenters who like myself have been frustrated in attempting to decide which, out of a number of capacitors or inductors, is the one with the required value. A bridge is undoubtedly the quickest, and possibly the best method, but values may be easily determined by another method employing a grid dip oscillator (g.d.o.), a calibrated capacitor and a coil of an arbitrary value.

The method used is simplicity itself. If the coil is connected across the calibrated capacitor, which should be adjusted to somewhere near its maximum capacitance the combination will resonate at some particular frequency which is determined by use of the grid dip oscillator, with as loose a coupling as possible to prevent "pulling" of the oscillator frequency. The unknown capacitor is now connected across the combination in parallel, and the variable capacitor is reduced in value until the combination once again resonates at the same frequency. Now, since the frequencies are the same, and the coil is the same, the total capacitance must also be the same as before. Thus it must be obvious that the variable capacitor has been decreased in value by an amount which is equal to the value of the unknown capacitor. The value of this is, therefore, simply the difference between the two readings on the calibrated capacitor.

The method used in the determination of inductance is slightly different, inasmuch as it involves a small amount of calculation. The unknown inductor is connected as before, across the calibrated capacitor, and the resonant frequency is determined with the grid dip oscillator. The value is now calculated using the formula:

$$f = \frac{1}{2\pi\sqrt{L.C.}}$$

Where f is the measured resonant frequency in Hz, L is the inductance in Henrys, C is the capacitance in Farads.

## CONSTRUCTION AND CALIBRATION

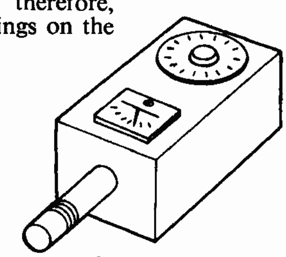
The variable capacitor to be employed should be beyond reproach, in that it should be free from any backlash or play in the bearings. Attention to these details will contribute to the final accuracy and quality of the capacitor. The most useful value to use is in the region of 200pF, since this will enable small increments of capacitance to be read off with ease. Larger values may be made up by adding good quality capacitors of known value in parallel. Direct calibration may be used where the actual value of capacitance is marked for each division on the scale, or a calibration graph may be drawn where the angle of rotation of the cursor is plotted against capacitance. The latter is the better method, since a good graph will avoid any errors which may be made in drawing in the individual points using direct calibration. Another advantage is that scales and knobs are available already marked in degrees.

Calibration may be carried out, either by the easiest method of borrowing a bridge from an affluent friend, or a simple bridge may be made up for the purpose. The circuit shown in Fig. 2 will serve.

The oscillator is a simple feedback type which has a frequency of about 1kHz, but if an oscillator is already available with a higher frequency, then it may be used, provided it operates in audible frequency range.

The bridge section uses headphones for detection. The resistors R5 and R6 should be close tolerance high stability types and, for Cx, a number of close tolerance, silvered mica capacitors, with values ranging up to near the maximum value of the capacitor to be calibrated. Where is graph to be drawn, a smaller number of fixed value capacitors will be required, since the number of points needed in order to draw the graph is less than the number required to give individual points for direct calibration.

When the bridge is at balance, the voltage at point A, equals the voltage



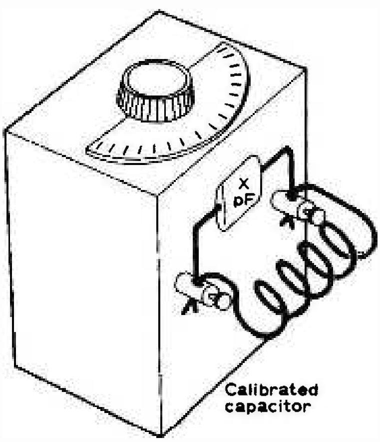




*Fig. 1: By placing a G.D.O. near the tuned circuit using the calibrated capacitor, unknown capacitors and inductors are quickly measured.*

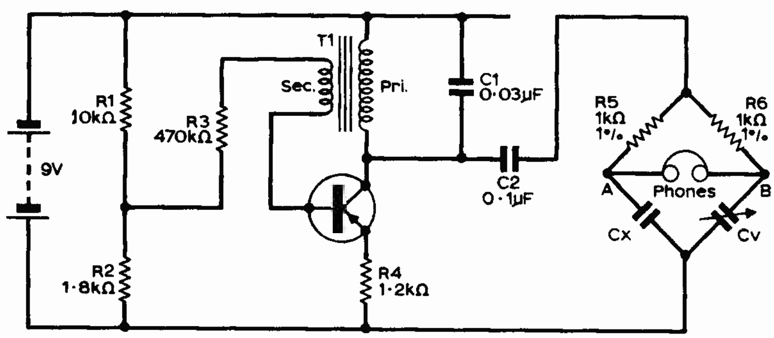



*Fig. 2: The circuit used for accurately calibrating the capacitor, shown as Cv above.*

at point B. Therefore, the potential difference across Cx and Cv must be equal. Thus since the values of the resistors are the same with equal potential differences across each, it will follow that the values of capacitors Cx and Cv will be the same. The balance condition for the bridge is, of course, that at which a null point is detected in the phones.

No dimensions in relation to the actual construction are offered, as the types of capacitor available will differ in physical size. The best type to use is one providing a linear relationship between capacitance and angle of rotation.

For the case, plywood or aluminium is suitable, but the terminals should be mounted on a panel of paxolin or synthetic resin-bonded paper in order to minimise losses. For this reason also, it is best not to place the terminals too close together; a separation of about two inches is suitable, whilst bearing in mind the lengths of the wire leads on components which may have to be connected across.

The capacitor terminals should be brought out through the same side of the case as that upon which the capacitor itself is mounted. This will minimise upsetting of the calibration should the case have to be opened for any reason. For ease of dial positioning, a reduction drive should be fitted, which, needless to say, must be free from backlash.

As a final note the constructor will find this simple unit of great value, and apart from the previously mentioned uses, it will be found most useful in a number of other ways which include: frequency comparison, calibration, as a bridge component, etc. ■

# BASIC SEMICONDUCTOR TECHNOLOGY

—*continued from page 610*

source, an induced positive charge appears on the surface of the n-type channel layer and as this is composed of relatively immobile charges the conductivity of the channel is decreased. Because the device relies on the reduction in the number of charge carriers as the gate voltage is increased it is called a depletion m.o.s.t. A maximum value of gate voltage which can be applied to this device is set by the field required to reduce the drain current to a negligible value.

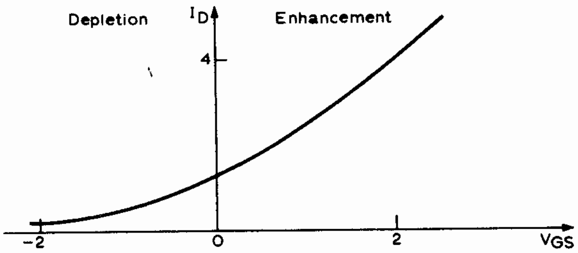



*Fig. 7: Curve of drain current against gate voltage for a depletion mode i.g.f.e.t.*

This very same device can also be used in the enhancement mode by making the gate positive with respect to the source. In this situation negative charges are induced on the surface of the channel which increase its conductivity. A curve showing the variation of drain current with the gate voltage is shown in Fig. 7, where the regions of enhancement and depletion operation are shown. In most applications the substrate is connected to the source terminal. However it can also be used as a second gate terminal.

Because of the very high input impedance of the m.o.s.t. the gate is capable of storing a very small quantity of charge for a long time. This is useful when it is required to measure the voltage of a small capacitor. However it also means that if the gate is left open-circuited small charges induced on it from external static electricity can build up large voltages which are capable of puncturing the very thin insulating layer between the gate and channel. In order to avoid this it is necessary to keep an external short between the gate and source. This is provided by the manufacturers and should not be removed until the device is wired into the circuit. A second method of avoiding this danger is adopted in some devices. This involves a diode built into the device across the vulnerable leads. The breakdown voltage of the diode is arranged to be less than that of the m.o.s.t. so that irreparable damage is not done to the device if an excessive voltage is applied. However this reduces the input impedance of the device which is not therefore suitable for use in very high impedance circuits.

## *Advantages of f.e.t.s.*

The main advantages of field effect transistors over conventional bipolar transistors are as follows:

(1) They have in general very high input impedances; in the case of the m.o.s.t. this can reach $10^{14}\Omega$. This makes them very useful for measuring voltages from very high impedance sources in such applications as pH measurement, measurement of very small charges etc.

(2) Except at low frequencies they are much quieter than valves or bipolar transistors. This makes them more suitable for low level amplification where noise is especially important.

(3) Since they do not rely on the diffusion of minority carriers across a potential barrier—as the bipolar transistor does—they are far more stable with respect to temperature than the conventional transistor.

(4) The input signal to the gate terminal is measured in volts rather than the millivolts commonly applied to minority carrier devices. This leads to their use in applications where higher voltages are involved, such as high level logic circuits. They can even be used in valve circuits, forming hybrid arrangements, providing the correct voltages are applied to them.

(5) Lastly but perhaps of most importance there is no offset voltage in their drain current versus drain voltage characteristic so that they are ideally suited for use as analogue switches and in chopper circuits for amplifying small d.c. voltages.

It would appear that these devices are always better than bipolar transistors. However they do have some disadvantages. For example they have a smaller gain-bandwidth product than the normal transistor, and as a switch they have a much greater "on" resistance than the bipolar device does, amounting to several hundred ohms.

**TO BE CONTINUED**

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.


# Z.30

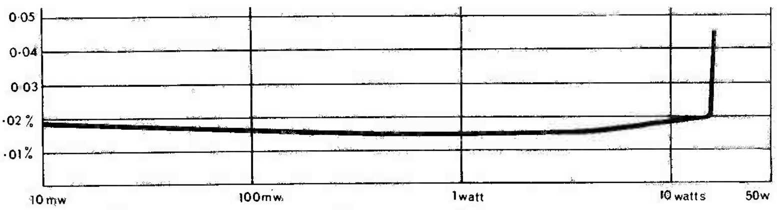
## THE WORLD'S LOWEST DISTORTION HIGH FIDELITY AMPLIFIER.

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.

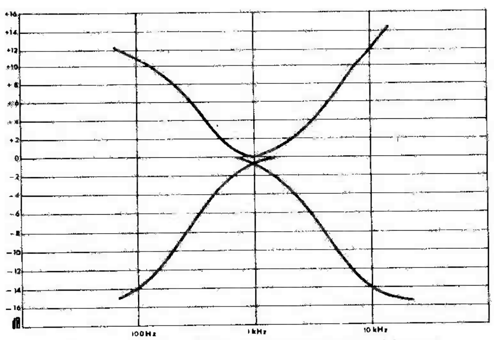
**Power requirements**: From 8 to 35V. d.c. (The Z.30 will operate ideally from batteries if required).

**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**

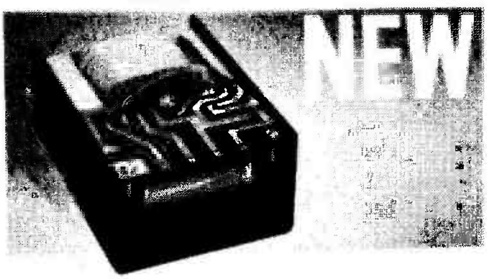
sinclair

**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* ....................................................

.................................................... ....................................................

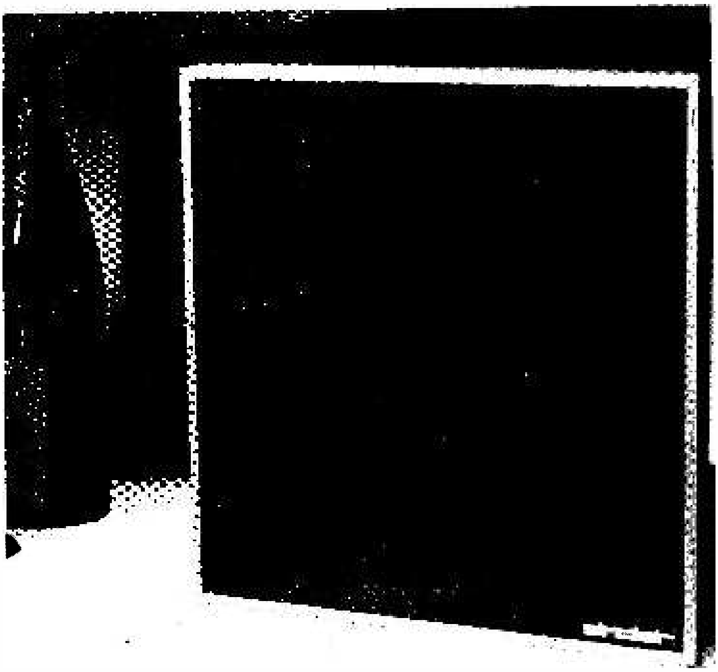
*For which I enclose cash/cheque/money order* PW.1269

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.

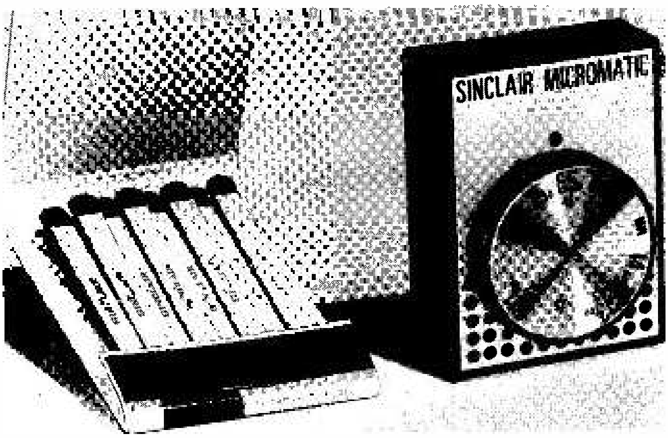
The Q.16 will handle loading up to 14 watts R.M.S. and presents an 8 ohm impedance to the amplifier output. Frequency response extends from 60 to 16,000Hz with exceptional smoothness. A specially designed driver system is used in a sealed and contoured pressure chamber to ensure good transient response at all frequencies. Size: $9\frac{3}{4}''$ square $\times$ $4\frac{3}{4}''$ 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*

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 wristwatch, and dependable under the severest listening conditions.

**USE THIS COUPON FOR MICROMATIC AND Q.16 ORDERS**

To: SINCLAIR RADIONICS LTD., 22 NEWMARKET RD., CAMBRIDGE

*Please send*

*NAME* ..........

*ADDRESS* ..........

*For which I enclose cash/cheque/money order*

PW.1269

### 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**

Litesold

## SOLDERING INSTRUMENTS

as selected for the DESIGN CENTRE LONDON

- SEVEN SIZES—10 WATTS TO 60 WATTS
- EXCELLENT THERMAL STABILITY (see new Litestat models for thermostatic control)
- STRONG, LIGHTWEIGHT, COMFORTABLY ELEGANT DESIGN
- UNEQUALLED PERFORMANCE
- LONG-LIFE BITS, PHILIPS IRON-COATED OR 'PERMATIP'
- INDICATOR LAMPS OPTIONAL ON ALL MODELS
- ALL VOLTAGES
- MANY ACCESSORIES: Heat Guards, Bench Stands, Bit-temperature Pyrometers, Thermal Wire Strippers, Solder Pots

**Please ask for literature L10**

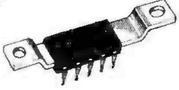
**LIGHT SOLDERING DEVELOPMENTS LTD**

**28 Sydenham Road, Croydon, CR9 2LL**

**Telephone: 01-688-8589 & 4559**

---

# Kinver for Integrated Circuits



LINEAR INTEGRATED CIRCUITS FOR ALL YOUR REQUIREMENTS


| | | | |
|---|---|---|---|
| Plessey | type | SL403A 3 Watt Audio Amplifier | 49/6 |
| 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) | 20/- |
| 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 | D13T1 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.

| KINVER GIFT TOKENS | Value £1 or multiples of £1. The ideal gift for the amateur radio and electronics enthusiasts. FREE catalogue, value 2/- with every gift token purchased. |
|---|---|

**PROFESSIONAL COMPONENTS AT REALISTIC PRICES!**

Send NOW for our COMPONENTS CATALOGUE, at only 2/- post free. This catalogue is packed with information on a host of up-to-the-minute components by leading manufacturers. Included are International Rectifier Products, Resistors, Capacitors, Veroboard, Plugs and Sockets, Switches, etc.

Please note that all goods supplied by us are brand new and guaranteed to fully conform to the manufacturer's published specifications.

DISCOUNTS: Order value of £5—10%: Order value over £10—15%. Cash with order please. Post and packing 1/6 per order.

**Kinver ELECTRONICS LTD**

STONE LANE KINVER STOURBRIDGE WORCS Telephone KINVER 2099

---

**FABULOUS VALUE**

**TRANSISTORISED STEREO HI-FI RECORD PLAYER**

Build your own Hi-Fi Record Player with the Serenade fully transistorised amplifier which comes complete with 2-10" x 6" speakers and the latest BSR 4 Speed Stereo/Mono Record Changer.

Advanced solid state amplifier only 4½" deep. 14 transistors plus 4 diodes, separate Bass and Treble—10 watts total power. Frequency response 50-15,000 c/s.

EASY TO INSTALL NO TECHNICAL KNOWLEDGE REQUIRED

Only **28** Gns. + P & P 17/6

Credit terms available, first monthly payment £3.6.2 followed by 9 monthly payments of £3.6.2. (Total "Credit Sale" Price £33.1.8). Send £4.3.8 today.

**FANTASTIC BARGAIN OFFER!**

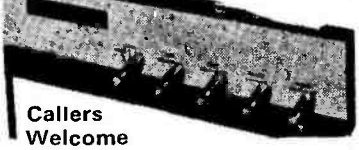
**"TRANSCONTINENTAL" FULLY TRANSISTORISED STEREOPHONIC RADIOGRAM CHASSIS**

Complete with 2-10" x 6" speakers and the latest BSR Mono/Stereo Record Changer—a complete radiogram at half normal price ONLY

10 Watts Total output, 17 Transistors & 10 diodes **£36.10.0** P&P 17/6

EASILY FITTED NO TECHNICAL KNOWLEDGE NECESSARY

**Credit Terms available. First monthly payment £4.2.2 followed by 9 monthly payments of £4.2.2. (Total "Credit Sale" Price £41.1.8.) Send £4.19.8 today.**



Callers Welcome

POST THIS COUPON NOW!

PLEASE SEND ME FREE DETAILS OF YOUR RANGE

Name ..............................

Address ..............................

LEWIS radio 100 CHASE SIDE, SOUTHGATE, Dep. P1269 LONDON, N.14. TELEPHONE PAL 3733/9666

# SEMICONDUCTORS

## BRAND NEW AND FULLY GUARANTEED

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1N914 | 1/6 | 2N2905A | 8/- | ACY22 | 4/- | BD123 | 21/6 | MJ490 | 22/6 |
| 1N916 | 1/6 | 2N2906 | 6/- | ACY28 | 4/- | BD124 | 12/- | MJ491 | 29/6 |
| 1S021 | 4/- | 2N2906A | 8/- | AD140 | 8/- | BF115 | 5/- | MPF102 | 8/6 |
| 1S025 | 5/- | 2N2923 | 4/- | AD149 | 11/6 | BF117 | 10/6 | MPF103 | 7/6 |
| 1S113 | 3/- | 2N2924 | 4/- | AD161 | 7/6 | BF167 | 5/6 | MPF104 | 7/6 |
| 1S120 | 2/6 | 2N2925 | 3/6 | AD162 | 7/6 | BF173 | 7/6 | MPF105 | 8/- |
| 1S121 | 2/6 | 2N2926 | | AF114 | 5/- | BF180 | 7/- | NKT0013 | 8/6 |
| 1S130 | 2/6 | ,, Green | 3/- | AF116 | 5/- | BF181 | 6/6 | NKT216 | 7/6 |
| 1S131 | 2/6 | ,, Yellow | 2/9 | AF117 | 5/- | BF184 | 7/6 | NKT217 | 8/6 |
| 1S132 | 2/6 | ,, Orange | 2/9 | AF118 | 12/6 | BF194 | 5/- | NKT261 | 4/- |
| 1S44 | 2/- | 2N3011 | 12/6 | AF124 | 4/6 | BFX12 | 4/6 | NKT262 | 4/- |
| 2G301 | 4/- | 2N3053 | 6/6 | AF125 | 4/6 | BFX13 | 4/6 | NKT264 | 4/- |
| 2G302 | 4/- | 2N3054 | 12/6 | AF126 | 4/- | BFX29 | 12/6 | NKT271 | 4/- |
| 2G303 | 4/- | 2N3055 | 15/- | AF127 | 3/6 | BFX30 | 9/- | NKT272 | 4/- |
| 2G371 | 3/- | 2N3702 | 3/6 | AF139 | 7/6 | BFX35 | 19/6 | NKT274 | 4/- |
| 2N696 | 4/6 | 2N3703 | 4/6 | AF181 | 8/6 | BFX43 | 8/6 | NKT275 | 4/- |
| 2N697 | 5/- | 2N3704 | 4/6 | AF186 | 11/- | BFX44 | 8/6 | NKT281 | 5/6 |
| 2N698 | 4/6 | 2N3705 | 4/- | AF239 | 7/6 | BFX84 | 7/6 | NKT403 | 15/- |
| 2N706 | 2/6 | 2N3706 | 4/6 | AFZ12 | 8/6 | BFX85 | 9/- | NKT404 | 12/6 |
| 2N706A | 2/6 | 2N3707 | 4/- | ASY26 | 5/6 | BFX86 | 6/6 | NKT405 | 15/- |
| 2N708 | 4/- | 2N3708 | 3/6 | ASY27 | 8/6 | BFX87 | 6/6 | NKT613 | 6/6 |
| 2N929 | 5/6 | 2N3709 | 3/6 | ASY28 | 5/6 | BFX88 | 5/- | NKT674 | 5/- |
| 2N930 | 7/- | 2N3710 | 4/- | ASY29 | 5/6 | BFY10 | 4/6 | NKT677 | 5/- |
| 2N1090 | 6/6 | 2N3711 | 4/- | ASZ20 | 7/6 | BFY17 | 4/6 | NKT713 | 5/- |
| 2N1091 | 6/6 | 2N3819 | 9/- | ASZ21 | 7/6 | BFY18 | 4/6 | NKT773 | 5/- |
| 2N1131 | 6/6 | 2N3820 | 23/6 | BAX13 | 2/6 | BFY19 | 4/6 | NKT781 | 6/- |
| 2N1132 | 6/6 | 2N4058 | 5/6 | BAX16 | 2/9 | BFY20 | 12/6 | NKT20329 | 8/6 |
| 2N1302 | 3/6 | 2N4059 | 5/- | BAY31 | 1/6 | BFY41 | 10/- | NKT80111 | 15/6 |
| 2N1303 | 3/6 | 2N4060 | 5/- | BAY38 | 3/6 | BFY43 | 12/6 | NKT80112 | 19/6 |
| 2N1304 | 4/6 | 2N4061 | 4/6 | BC107 | 3/6 | BFY50 | 4/6 | NKT80113 | 22/6 |
| 2N1305 | 4/6 | 2N4062 | 4/6 | BC108 | 3/6 | BFY51 | 4/6 | OA5 | 2/6 |
| 2N1306 | 5/- | 2N44254 | 8/6 | BC109 | 3/6 | BFY52 | 4/6 | OA9 | 2/- |
| 2N1307 | 5/- | 2N4255 | 8/6 | BC113 | 6/6 | BFY76 | 8/6 | OA70 | 1/6 |
| 2N1308 | 6/- | 2N4284 | 3/6 | BC116 | 12/6 | BFY77 | 11/6 | OA73 | 2/- |
| 2N1309 | 6/- | 2N4285 | 3/6 | BC118 | 6/6 | BFY90 | 12/6 | OA79 | 1/9 |
| 2N1507 | 5/6 | 2N4286 | 3/6 | BC125 | 11/- | BSX19 | 3/6 | OA81 | 1/6 |
| 2N1613 | 5/6 | 2N4287 | 3/6 | BC126 | 11/- | BSX20 | 3/6 | OA85 | 1/6 |
| 2N1711 | 6/6 | 2N4288 | 3/6 | BC147 | 3/6 | BSX21 | 7/6 | OA90 | 1/6 |
| 2N1889 | 6/6 | 2N4289 | 4/6 | BC148 | 3/6 | BSX26 | 10/6 | OA91 | 1/6 |
| 2N1893 | 8/6 | 2N4291 | 3/6 | BC149 | 3/6 | BSX27 | 10/6 | OA95 | 1/6 |
| 2N2102 | 15/- | 2N4292 | 3/6 | BC167 | 3/6 | BSX28 | 6/- | OA200 | 2/- |
| 2N2147 | 14/6 | 40361 | 12/6 | BC168B | 3/6 | BSX29 | 13/6 | OA202 | 2/- |
| 2N2148 | 12/6 | 40362 | 14/6 | BC168C | 3/9 | BSY26 | 4/- | OC26 | 6/6 |
| 2N2160 | 14/6 | 3N128 | 18/6 | BC169B | 3/6 | BSY27 | 4/- | OC28 | 8/6 |
| 2N2193 | 5/6 | 3N140 | 19/6 | BC169C | 3/9 | BSY28 | 4/- | OC35 | 6/6 |
| 2N2193A | 5/6 | 3N141 | 21/6 | BC212L | 5/- | BSY29 | 4/- | OC36 | 6/6 |
| 2N2194A | 5/6 | 3N142 | 16/6 | BCY30 | 5/6 | BSY38 | 4/6 | OC44 | 4/- |
| 2N2217 | 6/6 | AAZ13 | 2/- | BCY31 | 5/6 | BSY39 | 4/6 | OC45 | 2/6 |
| 2N2218 | 6/6 | AAZ15 | 2/6 | BCY32 | 7/6 | BSY40 | 6/6 | OC71 | 2/6 |
| 2N2219 | 6/6 | AAZ17 | 2/6 | BCY33 | 4/- | BSY51 | 8/6 | OC72 | 2/6 |
| 2N2220 | 5/- | AC107 | 6/- | BCY34 | 4/6 | BSY52 | 9/- | OC75 | 4/6 |
| 2N2221 | 5/- | AC126 | 4/- | BCY38 | 4/6 | BSY53 | 8/6 | OC81 | 4/- |
| 2N2222 | 5/- | AC127 | 5/- | BCY39 | 7/6 | BSY54 | 10/6 | OC83 | 4/6 |
| 2N2368 | 5/- | AC128 | 4/- | BCY40 | 6/6 | BSY95A | 3/6 | OC81D | 4/6 |
| 2N2369 | 5/- | AC176 | 5/- | BCY42 | 3/- | BY100 | 4/6 | OC84 | 5/- |
| 2N2369A | 5/6 | AC187 | 12/- | BCY43 | 3/- | BYX10 | 5/6 | OC139 | 6/6 |
| 2N2539 | 4/6 | AC188 | 12/- | BCY54 | 7/6 | BYZ10 | 9/- | OC140 | 6/6 |
| 2N2540 | 4/6 | ACY17 | 5/- | BCY70 | 4/6 | BYZ11 | 7/6 | OC200 | 6/6 |
| 2N2646 | 11/6 | ACY18 | 5/- | BCY71 | 8/6 | BYZ12 | 6/- | OC201 | 7/6 |
| 2N2904 | 8/- | ACY19 | 5/- | BCY72 | 4/- | BYZ13 | 5/- | OC202 | 10/6 |
| 2N2904A | 8/- | ACY20 | 5/- | BD116 | 35/- | MJ480 | 20/6 | | |
| 2N2905 | 8/- | ACY21 | 5/- | BD121 | 17/6 | MJ481 | 27/6 | | |

### 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 |

### 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 | 2/0 | 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 |

### 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 1/6*

SEND 6d. STAMP FOR CATALOGUE

P.P. for Components 1/6 per order

**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 |
| 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, 1/9

## 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 5/-. Commonwealth (Air) 13/-.

# BI-PAK SEMICONDUCTORS

## 500 CHESHAM HOUSE, 150 REGENT ST., LONDON, W.1.

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/- |
| U22 | 10 1-amp Glass Min. Silicon Rectifiers High Volts | 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 | 5/- |
| BFY50-51-52 | 7/6 |
| 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 | 5/- |
| 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/- |

### TESTED SCR's

| PIV | 1 AMP | 7A | 16A | 30A |
|---|---|---|---|---|
| 25 | — | 7/6 | — | 30/- |
| 50 | 7/6 | 8/6 | 10/6 | 35/- |
| 100 | 8/6 | 10/- | 15/- | 45/- |
| 200 | 12/6 | 15/- | 20/- | 55/- |
| 300 | 15/- | 20/- | 25/- | — |
| 400 | 17/6 | 25/- | 35/- | 80/- |
| 500 | 30/- | 40/- | 45/- | 95/- |
| 600 | — | 40/- | 50/- | — |

### 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/- | — |

**PLEASE NOTE.** To avoid any further Increased Postal Charges to our Customers and enable us to keep our "By Return Postal service" which is second to none, we have re-organized and streamlined our Despatch Order Department and we now request you to send all your orders together with your remittance, direct to our Warehouse and Despatch Department, postal address: **BI-PAK SEMICONDUCTORS, Despatch Dept., P.O. BOX 6, WARE, HERTS.** Postage and packing still 1/- per order. Minimum order 10/-.

### BRAND NEW TEXAS GERM. TRANSISTORS

**Coded and Guaranteed**

| Pak No. | | EQVT. | |
|---|---|---|---|
| T1 | 8 2G3710 | 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

### PRINTED CIRCUITS

**EX-COMPUTER**

Packed with semiconductors and components, 10 boards give a guaranteed 30 trans and 30 diodes. Our price 10 boards 10/-. Plus 2/- P. & P.

**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

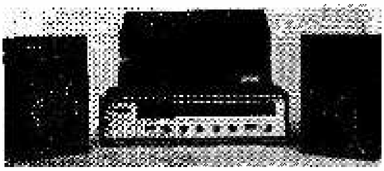
Designed to accept the full range of E.M.I. loudspeakers. Beautifully styled in teak.

**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

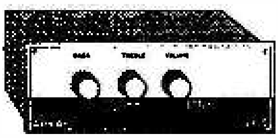
*PLEASE ENCLOSE 2/- IN STAMPS WITH ENQUIRIES*

---

# LINEAR

## RANGE OF SOLID STATE A.C. MAINS AMPLIFIERS

Employing only high grade components and transistors.



### LT55 6 WATT AMPLIFIER

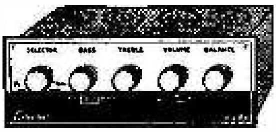
A HIGH FIDELITY UNIT PROVIDING EXCELLENT RESULTS AT MODEST OUTPUT LEVELS.

**Recommended Retail price £10**

**Size** 9¼ × 2¾ × 5¼in.
**Controls** (5) Volume, Bass, Treble, Mains Switch, Input Selector Switch.
**Sensitivity** 5 mv (max).
**Frequency Response** 30–20,000 cps—2dB
**Harmonic Distortion** 0·5% at 1,000 cps
**Output** for 3-8-15 ohm Loudspeakers.
**Input Sockets** for "Mike," Gram and Radio Tuner/Tape Recorder.

### LT66 12 WATT STEREO AMPLIFIER

A TWIN CHANNEL VERSION OF THE LT55 PROVIDING UP TO 6 WATTS HIGH FIDELITY OUTPUT ON EACH CHANNEL.



**Switched Input Facilities** Socket (1) Tape or crystal PU (2) Radio Tuner (3) Ceramic PU Microphone.

**Recommended Retail price 18 gns**
**Size** 12 × 3½ × 6in.

**Controls** (6) Volume, Bass, Treble, Balance, Mains Switch, Input Selector Switch, Stereo/Mono Switch.
**Facia Plate** Rigid Perspex with black/silver background and matching black edged knobs with spun silver centres.

If required an attractive wood cabinet with veneer finish can be supplied for any model. Prices from **70s.**

*Please send a stamped addressed envelope for full details of above units, also TUNER/AMPLIFIERS STEREO and MONO*

**AVAILABLE FROM YOUR LOCAL HI-FI DEALER**

*Wholesale and Retail enquiries to:*

**LINEAR PRODUCTS LTD, Electron Works, Armley, Leeds**

---

# 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

# 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) | each | 10 off | 25 off | 100 off |
|---|---|---|---|---|
| 0·001, 0·002, 0·005, 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) | each | 10 off | 25 off | 100 off |
|---|---|---|---|---|
| 10, 12, 15, 18, 22, 27, 33, 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)

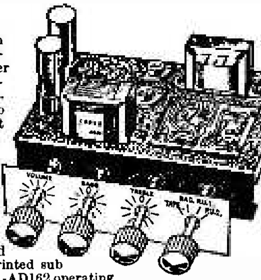
**SEND S.A.E. FOR 1969 CATALOGUE**

## 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

## NEW! HSL.700 MONO TRANSISTOR AMPLIFIER




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.

Performance figures:
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.

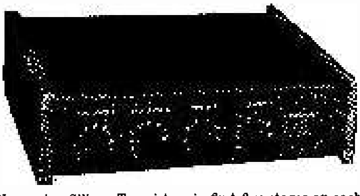
**SPECIAL OFFER**
**Hi-Fi Celestion Speaker Unit. Size 6 x 4in. Powerful 11,000 line magnet with specially treated cone surround. 10-12 ohm impedance. Few only at 20/-. P. & P. 3/6.**

**DUAL PURPOSE BULK TAPE ERASER AND TAPE HEAD DEMAGNETISER 42/6.** P. & P. 3/-.
**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.

**PYE MICROSWITCHES S/P. C/O.** Lever roller action. Rating 250v. AC at 5 amps. Size approx. 1 × ⅜ × 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 × ⅜in. **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 ⅜in. **10/-** each. P. & P. 1/6. 6 section Lacquered Brass. Extends from 6 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.
**BRAND NEW MAINS TRANSFORMERS for Bridge Rectifier.** Pri. 240v AC Sec. 240v. at 50mA and 6·3v. at 1·5 amp. Stack size 2⅞ × ⅞ × 2⅛in. **10/6.** P. & P. 3/6. (Special quotations for quantities.)

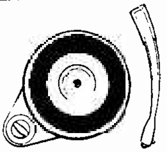
**BRAND NEW! PARMEKO MAINS TRANSFORMERS** Primary 110v–250v. Secondary 330–0–330v. 100 mA and 6·3v. at 2 amps, 6·3v at 2 amps and 6·3 v. at 1 amp. Conservatively rated. Fully impregnated Electrostatic screen. Suitable for vertical or drop through mounting. Overall size 4½ x 3⅞ x 3½in. Weight 8 lb. Limited number only at **37/6.** P. & P. 8/-.

## 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.).

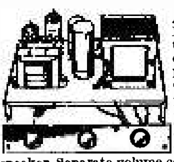
Official stockists of all
**PEAK SOUND HI-FI EQUIPMENT**
including the
**P.W. DOUBLE 12 STEREO AMPLIFIER** as featured in Practical Wireless April, May and June issues. Component pack as specified. Total cost **£23.5.6** Plus P. & P. 11/-. (Excluding metalwork, knobs, plugs and sockets and fuses.)



**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.



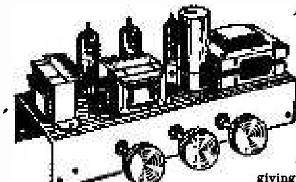
**3-VALVE AUDIO AMPLIFIER HA34 MK II.**
Designed for Hi-Fi reproduction of records. A.C. Mains operation. Ready built on plated heavy gauge metal chassis, size 7½" w. × 4" d. × 4½" h. Incorporates ECC83, EL84, EZ80 valves. Heavy duty, double wound mains transformer and output transformer matched for 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 **13/6** per yard length. P. & P. 2/6 (min. one yd.). S.A.E. for samples.

**POWERFUL COMPACT Motor** for 6–9v. Battery operation approx mA. Made originally for "Staar" and "Greencoat" record player decks. Built in constant speed device. Ideal for models etc. Overall size approx 1⅜ × 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.

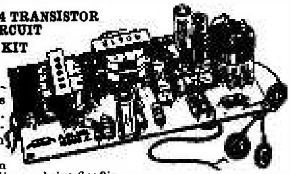
**LATEST RONETTE T/O STEREO/COMPATIBLE CARTRIDGE** for EP/LP/Stereo/78. Only **32/6.** P. & P. 2/-.

**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/-.

**FEW ONLY!** ACOS High-G for EP and LP. Only **10/-**. P. & P. 2/-.

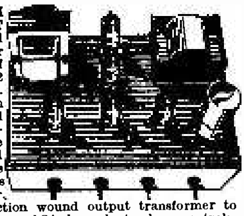
**HIGH GAIN 4 TRANSISTOR PRINTED CIRCUIT AMPLIFIER KIT**
**Type TA1**



- 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 2 EL84s, 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.

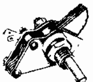
OUR ROCK BOTTOM BARGAIN PRICE **49/6** P. & P. 6/-

*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.**

## 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.

## 500 MICRO AMP MOVING COIL METER

2in. flush mounting round meter, ex Government but unused and perfect. 17/6.

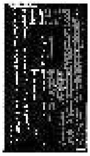
## PP3 BATTERY ELIMINATOR

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.

## 5000mFd 12V CONDENSER

Tubular size 3in. x 1in. dia. made by Plessey. 4/9 each, 48/- doz.

## 5A, 3 PIN SWITCH SOCKETS

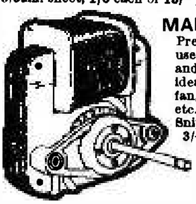


An excellent opportunity to make that bench dis board you have needed or to stock up for future jobs. This month we offer 6 British made (Hicraft) bakelite flush mounting shuttered 5A switch sockets for only 10/- plus 3/6 post and insurance. (20 boxes post free.)

## 5in. x 5in. Printed Circuit Board

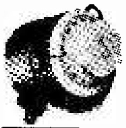
Ideal for dozens of projects. Heavy copper on 3/32in. sheet, 1/6 each or 15/- per dozen.

## 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.

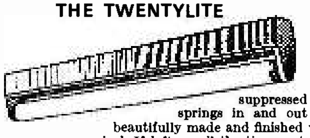
## Horstmann "Time and Set" Switch



(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.

## ATLAS SLIMLINE FLUORESCENTS

### THE TWENTYLITE

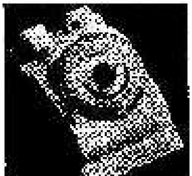


A Fluorescent lighting unit made by the famous Atlas company, with super silent polyester filled choke and radio suppressed starter. The tube springs in and out and the whole unit is beautifully made and finished white enamel. Amazingly economical. If left on all the time costs only one penny per day (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. 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/-.

## 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.

## 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 500MW, wire ended. 8/6 with circuit.

## INSTRUMENT BUZZER

6–12 volts, adjustable tone, a very neat metal cased U.S.A. made unit, approx. 1½in. x 1in. x ¾in. thick. 6/6 each.

## ELECTRIC BLANKET BARGAIN

Famous Norvic electric blanket claimed to be the most reliable in Britain. We offer at less than wholesale price "Corona de luxe" model, this has flame resistant super safe element and double-thick fleecy cover attached by press studs—just undo the press studs to wash cover—double bed size 60 x 48in.—with control switch giving choice of three heats—in presentation box showing regular price £9.3.9—we offer at £5.19.6, post and ins. paid.

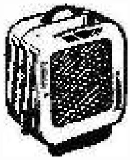
## THERMAL CUTOUT

A miniature device ⅝in. dia. on one screw fixing mount—can be used for motor overload protection—fire alarm—soldering iron switch off, etc., etc.—15 amp contacts open with flame—radiant or conducted heat. 1/6 each, 15/- doz. £5 100.

## STEREO CABINET

Size 25 x 14 x 9½in. deep—speaker compartment each end—centre portion with hinged lid and removable bottom has platform for autochanger and room for amplifier—two tone (red and grey) rexine covered by loud speaker ends need metal grilles—with handle and clips—22/6, carriage and packing 15/-.

## 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

## COPPER CLAD ELEMENT

1250 watts—4ft. long but bent to U shape, ideal for overhead heater—just mount reflector above. 12/6 each, plus 4/6 post. £6 doz. post paid.

## 500W IMMERSION HEATER

For small process tanks, etc., 200/240V 4½in. into tank, 2½in. outside of tank, dia. approx. 1 in., chrome plated 14/6. 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.

# ELECTRONICS (CROYDON) LTD

**Dept PW 266 London Road, Croydon CRO-2TH**

**Also 102/3 Tamworth Road, Croydon**

---

ERSIN Multicore 5 CORE SOLDER

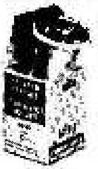
# for fast, easy, reliable soldering

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.

---

100 mixed ½W and ¼W **RESISTORS, 10/-**; 100 **SILVERED MICA CAPACITORS, 10/-**; 100 **CERAMIC CAPACITORS, 20/-**.

**PRINTED CIRCUIT BOARD** (for 6 Transistor Radio) 8¼ x 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 x 15 x 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/-)

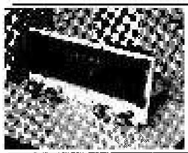
## STEREO AMPLIFIER type HV—2 x 3 Watts

Fully built. On off. sep. vol. and tone each channel 12 x 4½ 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 3¾ 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.

# 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 2½in. 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.

SCREWS. 1 lb. assorted countersunk wood-screws for 10/- post paid. CLARKES HANDI-CRAFTS, Bridge Street, Sturminster Newton, Dorset.

A CORNUCOPIA OF COMPONENTS! Scarce valves, selected TV components, Educational and Projects Kits, speakers and cabinets, transistors. Resistors all values ¼ watt 3d. each. State your requirements. S.A.E. for details. MAIL-MART, 6 Eastbourne Road, Pevensey Bay, Sussex.

POWER SUPPLIES No 19. Input 100/250 VAC, two separate outputs 12 VDC 3 amps. 6 amps in parallel or 24 VDC 3 amps. Metal cased, tested, excellent value £2.17.6, carr. 15/-. R. COUGHLIN, 74 Heol Gabriel, Whitchurch, Cardiff. Tel: OCA2 67746.

**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.

## EDUCATIONAL

**RADIO AND TELEVISION SERVICING**
**RADAR THEORY AND MAINTENANCE**
**TELECOMMUNICATIONS**

LEC

This private College provides efficient theoretical and practical training in the above subjects. One-year day courses are available for beginners and shortened courses for men who have had previous training.
*Write for details to:*
**The Secretary, London Electronics College, 20 Penywern Road, Earls Court, London, S.W.5. Tel. 01-373-8721**

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 and Radio Amateurs') R.T.E.B., etc. Many unique diploma courses incl. Colour TV, Electronics, Telemetry & 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.

## AERIALS

**BAKER and BAINES**

FOR TELEVISION AND FM AERIALS
Examples of prices: FM dipole 21/-, H 38/-, BBC dipole 30/-, X 38/-, H 42/-, 3 ele 89/-, ITA 3 ele 26/-, 5 ele 34/-, 8 ele 47/6, 13 ele 71/-, Double 8 112/-, 13 159/-, combined BBC/ITA 1+5 45/-, H+5 69/-, X+5 75/-, BBC 2 14 ele 37/-, 18 ele 54/-, 22 ele 63/-, double 22 142/-. Poles, lashings, Coax, diplexers, etc. SAE for lists. Please state channel when ordering.
**11 DALE CRESCENT, TUPTON, CHESTERFIELD**

## SITUATIONS VACANT

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.

**SEMICOMPS** LIMITED *try harder*

Semiconductor enthusiast wanted living in Wembley region with interest in semiconductors and integrated circuits to train as inside sales engineer. Good starting salary and prospects. Apply to Managing Director, Semicomps Limited, Station Wharf, Alperton, Middlesex. 01-903 3161.

## 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.

# LARGE SUPPLIER OF SERVICE SHEETS

(T.V., RADIO, TAPE RECORDERS, RECORD PLAYERS, TRANSISTORS, STEREOGRAMS, RADIOGRAMS, CAR RADIOS)

Only 5/- each, plus large S.A.E.

(Uncrossed P.O.'s please, returned if service sheets not available.)

**C. CARANNA**
**71 BEAUFORT PARK**
**LONDON, N.W.11**

We have the largest supplies of Service Sheets (strictly by return of post). Please state make and model number alternative.

Free TV fault tracing chart or TV list on request.

Mail order only.

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.

## 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.

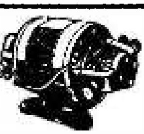
*Mail order only to:*

**INSTRUCTIONAL HANDBOOK SUPPLIES**

**DEPT. PW, TALBOT HOUSE, 28 TALBOT GARDENS, LEEDS 8**

## ELECTRICAL

# 240 VOLT ELECTRICITY ANYWHERE



**BEST EVER 200/240 VOLT "MAINS" SUPPLY FROM 12 VOLT CAR BATTERY**

Exclusive World Scoop Purchase. The fabulous **Mk. 2D 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.**

## FOR SALE

SEEN MY CAT? Tools, Rod, Bar and Tube, Small Screws, mechanical and electrical gear. 21-years' trading £6,000 in vouchers given away. Free Cat. of 5,000 items. S.A.E. to: K.R. WHISTON, Dept. VCW, New Mills, Stockport.

# 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.

## 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.

# WANTED *NEW* VALVES ONLY

Must be new and boxed
Payment by return

WILLIAM CARVIS LTD
103 North Street, Leeds 7

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.

## RECEIVERS & COMPONENTS

# 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.

**OVERLOAD CUT OUTS.** Panel mounting in the following values . . . **5/-** each. 3, 4 amp. P. & P. 1/-.

**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.

**MICRO SWITCHES.** Miniature button type. **10/-** doz. P. & P. 1/6.

**NEW SPRAGUE.** 0·22μF 250V small capacitors. **5/-** doz. P. & P. 1/-.

**NEW SPRAGUE ELECTROLYTICS.** 4μF 150V. **5/-** doz. P. & P. 1/-.

**NON-POLAR TANTALUM CAPS.** 2·2μF 50V. **10/-** doz. 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. × 1½in. 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**

# 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.

INTEGRATED CIRCUITS at lowest price. GE Type PA 234, 1 Watt Audio Amplifier 17/6 each inc. data. Newest GE Silicon NPN planar transistor 2N5172, 25 Volt, 200 mW, hfe 100 min. Epoxy for economy. Passivated for reliability. 1/9 each. C.W.O. P. & P. 1/- per order. JEF ELECTRONICS, 12 York Drive, Grappenhall, Warrington, Lancs. Mail Order only.

*Single channel Radio Control at a price you can afford*

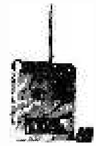
# RADIO CONTROL PRODUCTS

EXCELLENT RANGE AND PERFORMANCE

## TRANSMITTER—

- Crystal controlled tone Tx 12v. operation. Silicon transistors. In smart blue anodised case with micro-switch.

Tx only **£6.5.0**



## RECEIVER—

- Relayless weight 1¼oz. Size 2¼ × 1½ × ⅜ in., working on 4·5 volts. In matching blue case.

Rx only **£4.5.0**

SUITABLE FOR MODELS OF ALL KINDS

**ONLY £10.10.0 COMPLETE**

*Full off-the-shelf Guarantee, including crash damage, for 1 year*

OBTAINABLE FROM

MODEL MART
3 COMBERTON ROAD
KIDDERMINSTER. Tel. 5879

OR DIRECT FROM

RADIO CONTROL PRODUCTS
38 FRANCHE ROAD
KIDDERMINSTER, WORCS.

---

COMMUNICATIONS RECEIVER. RCA AR88D fine condition but requires new smoothing pack, £30 or nearest. TAYLOR, 60 Headley Park Avenue, Bristol 3.

---

## FET HI-FI PRE-AMP MODULE

Latest low-noise FET in special circuit. Matches ANY ceramic/Xtal PU, Xtal mike, valve pre-amp, FM tuner, etc. DIRECTLY into ANY transistor power amp. Input impedance 2 Meg. Dist. <0·2%. 25 Hz—200 kHz ± 1 dB. Power 6–24 volts. Neg. earth. With full instructions ONLY 25/-, post free (Stereo pair 45/-). Mail order only, c.w.o.

**W. T. MORRIS**
1 Birch Drive, Shawbury, Shrewsbury.

---

We have in stock, quantities of Solartron Laboratory Oscilloscopes type CT316, reconditioned Avo Meters, radio receivers, and thousands of assorted components, including high voltage capacitors. Send 9d. stamps or P.O. for details.

**D. F. ELECTR-VISION**
4 Huntingdon Close, Cranbrook, Kent

---

FOR TOP DISCOUNT ON
Changers, Amplifiers, Speakers
visit the
**HI-FI CENTER**
15 Market Shops, Victoria Road
CHELMSFORD, Essex

---

HI-FI loudspeaker systems for the home constructor, cabinet kits, the new range of Peerless speakers, speaker kit systems and cross-over networks. BAF wadding, speaker fabric (samples on request) and all other necessary components. Send 5d in stamps to: AUDIOSCAN, Dept. PW, 4 Princes Square, Harrogate, Yorks.

---

BRAND NEW ELECTROLYTICS, 15/16 volt, 0, 5, 1, 2, 6, 8, 10, 15, 20, 30, 40, 50, 100, 200 mfds. 8/- per dozen, postage 1/-. The C.R. Supply Co., 127 Chesterfield Road, Sheffield 8.

---

**CONSTRUCTOR'S BARGAIN PACK** containing 10 PNP germ. transistors, 10 sil. diodes, 2 ex-computer panels (dozens of useful components), 3 reed switches, 50 mixed resistors (¼ to 1 watt), 25 condensers. All components brand new (diodes and transistors untested, not guaranteed). Unbelievable value at 22/6 + 2/6 p.p. SATISFACTION GUARANTEED OR MONEY BACK.

**BRAND NEW HEADPHONES** complete with heavy duty hand mike. To clear at only 15/- + 5/- p.p. 6 new ARP 12 valves - 6/- post free, 12—10/- post free.

MEPPEN-WALTER MAIL ORDER
12 GLEDHOW PARK DRIVE, LEEDS LS7 4JS

---

P.C. Boards brand new but have corners cut off at the request of the manufacturer.
P.C.1: Rectifier assembly with 4 silicon diodes HS3108 800 p.i.v. at 165 M/a 1, 25 mfd. 50 vw. transistor electrolytic, 1, germanium diode 2102, 2 resistors, 1 R.F. choke **4/6** each.
P.C.2: Rectifier assembly with 4 silicon diodes HS3106 600 p.i.v. at 165 M/a 4 silicon diodes 18134 400 p.i.v. at 200 M/a, 1 germanium diode 2102, 6 resistors, 1 capacitor 25 mf. 50 vw. **6/6** each.
P.C.3: 2nd Mixer units OA73 as mixer, AF114 crystal oscillator with 11·115 Mc/s miniature wire ended crystal, GET887 or equiv. as 455 I.F. amp. converts 10·7 Mc/s I.F. to 455 Kc/s with connecting data, used ex-equip. **12/6.**
P.C.4: Board containing 2 NKT223A, 1 NKT228, 9 transistor electrolytics, 4 paper capacitors, 18, 10th watt resistors, 1 pot core, B7G valveholder and miniature potentiometer, **6/6** each.
T.V. Pre-amps 1, AF139, plus resistors etc., approx. 1⅞in. sq. **3/-** each (no details). Send for list of other P.C. boards I.F. strips, R.F. units, modulators etc.
Tuning capacitors 125 plus 125pf, approx. 1in. cube, ¼in. spindle direct drive, only **3/6** (brand new).
Tag strips 4¾in. long 9 insulated tags and 2 earth tags box of approx. 144 new and unused to clear at **15/-** post paid.
ELECTROLYTICS (can type) 32 MFD. 450 vw. **4/6** each.
POLYSTYRENE capacitors 1000 pf. and 5000 pf. 30 vw. 5% tol. **2/6** doz.
OUTPUT transformers to suit single ECL86 etc. **4/-** each.
TRANSISTOR 470 Kc/s single tuned I.F. transformers, no data **1/-** each.
S.A.E. for new list. POSTAGE AND PACKING PLUS 1/6. MAIL ORDER ONLY.

**A. J. H. ELECTRONICS**
59 Waverley Road, The Kent, Rugby
Warwickshire. Tel. Rugby 71066

---

## BARGAIN LIST

Transistors OC44, OC71, OC72, OC45, at 2/- each. OC140, BSY26, BYZ12, BYZ16 at **3/-** each.
Metal Rectifiers, 12v lamp contact cooled tcc, **3/9** each.
Metal Rectifiers, 12v 2amp at **3/9** each. Metal Rectifiers, 12v 4amp at **7/6** each. TV Metal Rectifiers, 250v 200m/a at **4/6**.
Edgewise Volume Controls 5k Jap Replacements, **3/6** each.
Panel Meters, new square Clear Plastic, 1.65 x 1.65 0-1ma Front at **£1.0.0** each.
Panel Meters 500 micro amp at **£1.4.0** each.
Toggle Switches SPST, **2/6**. DPDT at **3/-** each.
New Resistances small ½ watt, at **3d.** each.
Transformers-Subminiature output 3 ohms for OC72 etc. at **2/6** each.
Transformers-Subminiature Driver for above at **2/6** each.
Jack Plugs Standard at **2/-**. Jack Sockets at **1/9.**
Pax Panels 6in. x 4in. x 1/16in. at **10d.** 8in. x 6in. at **1/6** each.
Condensers 25mf 25v at **1/-**. ¼in. Iron dust cores at **6d.** per doz.
Miniature slide switches DPDT at **1/6** each.
Aluminium Panels 6in. x 4in. at **1/3.** 8in. x 6in. at **2/-** each.
Earpieces with lead and 3·5 mm Plug **1/9.**
Mail Order Only. Post & Packing 1/-. S.A.E. for List.

**HALSE SERVICES**
36 GLOUCESTER ROAD, FELTHAM, MIDDLESEX

---

## VALVE SALE

All brand-new and perfect, guar. six months. DK96 7/4, DL96 6/4, DY86 5/8, ECF80 6/6, ECL80 6/4, EF183 5/2, EL34 9/6, EY86 6/1, PCF86 8/3, PCF801 6/9, PY801 6/4, UCC85 6/-, UCL83 8/4, UY41 6/7, 6J6 2/-, 6V6GT 5/8. Orders 10/- and over are post paid, under add 6d. Full price lists with goods or free on request.

**J. R. HARTLEY**
78B High Street, Bridgnorth, Shropshire

---

**150 NEW ASSORTED** Capacitors, Resistors, Silvered Mica, Ceramic, etc. Carbon, Hystab, Vitreous, ⅛-20 watt, 12/6 Post Free. WHITSAM ELECTRICAL, 33 Drayton Green Road, West Ealing, W.13.

---

COMPLETE RANGE of Amateur, Aircraft, Communications receivers. Chassis, panels, meters, cabinets, microphones, etc. Stephens-James Ltd., 70 Priory Road, Liverpool 4. Tel. 051-263-7829.

---

AMATEUR TIDYING UP. Receivers, power-packs, valves, components. Very cheap. S.A.E. list. A. MacRae, 94 Farrar Road, Bangor, Caerns.

---

EMSAC BASIC ANTENNA SYSTEMS. Two meter converter—assembled £10, kit £8.10.0. Send SAE for details of this and antenna systems, antenna tuning units, etc. to— Electronic & Mechanical Sub-Assembly Co. Ltd., Highfield House, West Kingsdown, Kent.

---

## 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.5
Galleon Trading Co., 298A Lodge Lane, Romford, Essex.

---

# NEW VALVES!

**Guaranteed and Tested**
**24-HOUR SERVICE**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1R5 | 5/6 | DL94 | 5/9 | EY51 | 6/9 | PL84 | 6/6 |
| 1S5 | 4/3 | DL96 | 6/9 | EY86 | 5/9 | PL500 | 12/9 |
| 1T4 | 2/9 | DY86 | 5/3 | EZ80 | 3/9 | PL504 | 13/3 |
| 3S4 | 5/9 | DY87 | 5/3 | EZ81 | 4/6 | PY32 | 10/- |
| 3V4 | 5/9 | EABC80 | 5/9 | KT61 | 8/3 | PY33 | 10/- |
| 6AQ5 | 4/3 | EBC41 | 9/9 | KT66 | 15/9 | PY81 | 5/- |
| 6V6G | 3/- | EBF80 | 6/- | N78 | 17/- | PY82 | 5/- |
| 25L6GT | 4/6 | EBF89 | 5/9 | PABC80 | 6/9 | PY83 | 5/3 |
| 30C18 | 8/6 | ECC82 | 4/- | PC86 | 10/3 | PY88 | 6/6 |
| 30FL1 | 13/6 | ECC83 | 4/9 | PC88 | 10/3 | PY800 | 6/3 |
| 30FL12 | 14/3 | ECC85 | 5/- | PC97 | 8/3 | PY801 | 6/3 |
| 30FL14 | 11/9 | ECH35 | 5/6 | PC900 | 7/- | R19 | 6/3 |
| 30P4 | 11/6 | ECH42 | 10/6 | PCC84 | 6/3 | U25 | 12/9 |
| 30P19 | 11/6 | ECH81 | 5/- | PCC89 | 8/11 | U26 | 11/6 |
| 30PL1 | 13/6 | ECL80 | 6/3 | PCF80 | 5/11 | U191 | 12/- |
| 30PL13 | 14/9 | ECL82 | 6/3 | PCF801 | 6/6 | U193 | 8/6 |
| CCH35 | 9/9 | ECL86 | 7/6 | PCF802 | 8/6 | UABC80 | 6/- |
| CL33 | 17/6 | EF37A | 6/- | PCF805 | 8/6 | UBC41 | 8/3 |
| DAC32 | 6/9 | EF39 | 4/6 | PCF808 | 11/9 | UBF89 | 6/3 |
| DAF91 | 4/3 | EF80 | 4/6 | PCL82 | 6/9 | UCC85 | 6/6 |
| DAF96 | 6/3 | EF85 | 4/9 | PCL83 | 8/9 | UCH42 | 10/6 |
| DF33 | 7/6 | EF86 | 6/3 | PCL84 | 7/- | UCH81 | 6/- |
| DF91 | 2/9 | EF89 | 4/9 | PCL85 | 8/- | UCL82 | 6/9 |
| DF96 | 6/3 | EF183 | 5/9 | PCL86 | 8/- | UF41 | 10/6 |
| DK32 | 6/9 | EF184 | 5/3 | PFL200 | 11/9 | UF89 | 6/- |
| DK91 | 5/6 | EH90 | 6/- | PL36 | 9/3 | UL41 | 10/3 |
| DK96 | 6/6 | EL33 | 8/3 | PL81 | 7/- | UL84 | 6/3 |
| DL35 | 4/9 | EL41 | 10/3 | PL82 | 5/9 | UY41 | 8/3 |
| DL92 | 5/9 | EL84 | 4/9 | PL83 | 6/3 | UY85 | 5/3 |

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. Office address, no callers.

**GERALD BERNARD**
83 OSBALDESTON ROAD
STOKE NEWINGTON
LONDON, N.16

---

Est. 1943 **JOHNSONS** Tel: 24864

New! CV2—a unique triple-purpose VHF kit for the Amateur enthusiast. Integrated converter, receiver, and tuner-feeder. Fantastic single transistor performance! Comprehensive kit of high grade parts with three coils covering 80-178MHz, 9v battery, etc., together with simplified diagrams and instructions. Price complete, **£4**, post, packing and insurance paid, direct from makers. S.A.E. for literature.

**JOHNSON'S (RADIO)**
St. Martin's Gate, Worcester

# R.S.T. VALVE MAIL ORDER CO.

## BLACKWOOD HALL, 16a WELLFIELD ROAD, STREATHAM S.W.16

Mon.—Sat. 9 a.m. —5.30 p.m.
Closed Sat. 1.30—2.30 p.m.
Open Daily to Callers

Tel. 769-0199/1649

| Type | Price |
|---|---|
| 1A7 | 7/9 |
| 1D5 | 7/6 |
| 1H5 | 7/- |
| 1LD5 | 6/- |
| 1N5GT | 8/- |
| 1R5 | 6/- |
| 1S4 | 5/6 |
| 1S5 | 4/6 |
| 1T4 | 4/- |
| 3A4 | 4/- |
| 3Q4 | 7/9 |
| 3Q5 | 7/- |
| 3S4 | 6/3 |
| 3V4 | 6/9 |
| 5R4GY | 10/6 |
| 5U4G | 5/6 |
| 5V4G | 6/- |
| 5Y3GT | 6/- |
| 5Z4G | 7/- |
| 6/30L2 | 15/- |
| 6A7 | 15/- |
| 6A8G | 12/6 |
| 6AC7 | 4/- |
| 6AK5 | 5/- |
| 6AL5 | 3/- |
| 6AM5 | 4/6 |
| 6AM6 | 3/6 |
| 6AQ5 | 6/3 |
| 6AS7G | 16/- |
| 6AT6 | 4/9 |
| 6AU6 | 5/- |
| 6B4G | 20/- |
| 6B8G | 2/- |
| 6BA6 | 5/- |
| 6BE6 | 5/- |
| 6BH6 | 9/- |
| 6BJ6 | 9/- |
| 6BQ7A | 7/- |
| 6BR7 | 17/- |
| 6BR8 | 12/6 |
| 6BS7 | 25/- |
| 6BW6 | 14/6 |
| 6BW7 | 13/- |
| 6C4 | 5/- |
| 6C5G | 5/- |
| 6C6 | 3/9 |
| 6C8G | 6/- |
| 6CD6G | 24/- |
| 6CH6 | 7/6 |
| 6CW4 | 12/- |
| 6D6 | 3/9 |
| 6E5 | 7/6 |
| 6F1 | 12/6 |
| 6F5G | 8/- |
| 6F6G | 5/- |
| 6F8G | 5/6 |
| 6F11 | 6/6 |
| 6F13 | 6/6 |
| 6F14 | 12/6 |
| 6F23 | 16/- |
| 6F24 | 14/- |
| 6F25 | 15/- |
| 6F28 | 14/- |
| 6F32 | 2/9 |
| 6G6 | 2/6 |
| 6H6 | 3/- |
| 6J5M | 9/- |
| 6J5G | 4/- |
| 6J5GT | 5/6 |
| 6J6 | 3/6 |
| 6J7M | 6/6 |
| 6J7G | 6/- |
| 6J7GT | 7/6 |
| 6K6GT | 5/- |
| 6K7 | 1/9 |
| 6K7M | 6/6 |
| 6K7G | 2/- |
| 6K7GT | 4/6 |
| 6K8 | 2/9 |
| 6K8M | 11/6 |
| 6K8G | 3/- |
| 6K8GT | 7/- |
| 6K25 | 15/- |
| 6L1 | 12/- |
| 6L6G | 7/9 |
| 6L18 | 6/- |
| 6Q7G | 6/- |
| 6Q7GT | 8/6 |
| 6SA7M | 7/- |
| 6SC7 | 7/- |
| 6SG7 | 6/- |
| 6SH7 | 3/3 |
| 6SJ7 | 6/- |
| 6SK7GT | 4/9 |
| 6SL7GT | 6/- |
| 6SN7GT | 5/6 |
| 6SQ7 | 7/6 |
| 6U4GT | 12/- |
| 6U5G | 7/6 |
| 6V6M | 12/- |
| 6V6G | 4/6 |
| 6V6GT | 6/6 |
| 6X4 | 4/6 |
| 6X5G | 4/6 |
| 6X5GT | 6/- |
| 7B6 | 11/6 |
| 7B7 | 7/6 |
| 7C5 | 22/6 |
| 7C6 | 15/- |
| 7D5 | 8/- |
| 7H7 | 6/6 |
| 7R7 | 13/- |
| 7S7 | 45/- |
| 7Y4 | 8/6 |
| 9BW6 | 7/- |
| 10C1 | 12/6 |
| 10C2 | 12/6 |
| 10F1 | 14/9 |
| 10F3 | 18/- |
| 10F9 | 10/6 |
| 10F18 | 8/- |
| 10L1 | 6/- |
| 10LD11 | 10/6 |
| 10P13 | 13/6 |
| 11E3 | 70/- |
| 12AT6 | 4/9 |
| 12AT7 | 6/- |
| 12AU6 | 5/9 |
| 12AU7 | 5/9 |
| 12AX7 | 6/3 |
| 12BA6 | 6/- |
| 12BE6 | 6/3 |
| 12C8GT | 5/- |
| 12E1 | 20/- |
| 12J5GT | 2/6 |
| 12J7GT | 6/6 |
| 12K7GT | 7/- |
| 12K8GT | 8/- |
| 12Q7GT | 6/- |
| 12SA7 | 8/- |
| 12SG7 | 6/- |
| 12SH7 | 3/- |
| 12SJ7 | 3/9 |
| 12SK7 | 4/9 |
| 12SR7 | 5/- |
| 14H7 | 9/6 |
| 19AQ5 | 5/- |
| 20D1 | 10/- |
| 20F2 | 14/- |
| 20L1 | 20/- |
| 20P4 | 20/- |
| 20P5 | 20/- |
| 25A6 | 5/9 |
| 25L6GT | 7/- |
| 25Y5 | 6/- |
| 25Z4 | 6/3 |
| 25Z5 | 8/- |
| 25Z6 | 8/6 |
| 28D7 | 9/3 |
| 30C1 | 6/9 |
| 30C15 | 15/- |
| 30C17 | 16/- |
| 30C18 | 15/- |
| 30F5 | 17/- |
| 30FL1 | 16/- |
| 30FL12 | 19/- |
| 30FL14 | 15/6 |
| 30L15 | 17/- |
| 30L17 | 17/- |
| 30P12 | 16/- |
| 30P19 | 15/- |
| 30PL1 | 16/- |
| 30PL13 | 18/6 |
| 30PL14 | 15/- |
| 35A5 | 11/6 |
| 35L6 | 9/- |
| 35W4 | 4/6 |
| 35Z3 | 10/- |
| 35Z4GT | 6/6 |
| 35Z5 | 6/- |
| 37 | 6/6 |
| 42 | 6/- |
| 50B5 | 6/6 |
| 50C5 | 6/3 |
| 50CD6G | 31/- |
| 50L6GT | 8/- |
| 75 | 9/6 |
| 78 | 5/- |
| 80 | 7/6 |
| 85A2 | 7/3 |
| 150B2 | 11/6 |
| 150C4 | 9/6 |
| 801 | 9/6 |
| 807 | 9/- |
| 813USA | 120/- |
| 813 | 75/- |
| 866A | 15/- |
| 954 | 5/3 |
| 1625 | 6/6 |
| 4022AR | 67/- |
| 5763 | 12/- |
| 7193 | 2/- |
| 7475 | 14/- |
| A61 | 9/6 |
| ATP4 | 2/3 |
| ATP5 | 12/- |
| ATP7 | 8/6 |
| AU2 | 80/- |
| AU5 | 8/9 |
| AZ1 | 8/- |
| AZ31 | 10/- |
| CBL31 | 16/- |
| CCH35 | 15/- |
| CL33 | 20/- |
| CY30 | 12/6 |
| CY31 | 8/6 |
| DAC32 | 7/- |
| DAF91 | 4/6 |
| DAF96 | 7/6 |
| DCC90 | 10/6 |
| DF33 | 8/- |
| DF70 | 9/- |
| DF91 | 4/- |
| DF92 | 3/6 |
| DF96 | 7/6 |
| DH77 | 4/9 |
| DK32 | 7/9 |
| DK91 | 6/- |
| 9K92 | 9/- |
| DK96 | 7/9 |
| DL66 | 25/- |
| DL92 | 6/3 |
| DL93 | 4/- |
| DL94 | 6/9 |
| DL95 | 7/9 |
| DL96 | 7/6 |
| DM70 | 6/- |
| DY86 | 6/- |
| DY87 | 5/- |
| E88CC | 12/- |
| EA50 | 3/6 |
| EABC80 | 6/6 |
| EAF42 | 10/- |
| EB41 | 10/- |
| EB91 | 3/- |
| EBC33 | 8/6 |
| EBC41 | 9/9 |
| EBC90 | 4/9 |
| EBF80 | 7/6 |
| EBF83 | 9/- |
| EBF89 | 6/6 |
| EBL1 | 14/- |
| EBL21 | 12/- |
| EBL31 | 27/6 |
| EC90 | 5/- |
| ECC81 | 6/- |
| ECC82 | 5/9 |
| ECC83 | 6/3 |
| ECC84 | 5/6 |
| ECC85 | 5/- |
| ECC88 | 7/6 |
| ECF80 | 6/6 |
| ECF82 | 6/6 |
| ECH21 | 12/6 |
| ECH35 | 11/6 |
| ECH42 | 11/- |
| ECH81 | 5/9 |
| ECH83 | 8/6 |
| ECL80 | 5/9 |
| ECL82 | 7/- |
| ECL83 | 10/3 |
| ECL86 | 9/- |
| ECLL800 | 30/- |
| EF9 | 20/- |
| EF37A | 7/- |
| EF39 | 8/- |
| EF41 | 10/- |
| EF50 | 5/- |
| EF80 | 4/3 |
| EF85 | 7/- |
| EF86 | 6/6 |
| EF89 | 5/6 |
| EF91 | 2/9 |
| EF92 | 2/6 |
| EF98 | 15/- |
| EF183 | 6/6 |
| EF184 | 7/- |
| EL32 | 3/6 |
| EL33 | 12/6 |
| EL34 | 10/6 |
| EL41 | 10/6 |
| EL42 | 10/6 |
| EL84 | 4/9 |
| EL90 | 6/3 |
| EL95 | 6/6 |
| ELL80 | 20/- |
| EM34 | 21/- |
| EM80 | 7/6 |
| EM81 | 8/3 |
| EM84 | 7/6 |
| ESU150 | 20/- |
| EY51 | 7/6 |
| EY86 | 7/- |
| EZ35 | 6/- |
| EZ40 | 8/3 |
| EZ41 | 9/6 |
| EZ80 | 5/6 |
| EZ81 | 5/6 |
| GZ30 | 10/- |
| GZ32 | 10/- |
| GZ34 | 11/- |
| KT36 | 18/- |
| KT61 | 17/6 |
| KT66 | 21/- |
| KT81 | 35/- |
| KT81 (7C5) | 15/- |
| KT88 | 30/- |
| KTW61 | 8/6 |
| KTZ41 | 6/- |
| ML4 | 17/6 |
| ML6 | 7/6 |
| MSP4 | 10/- |
| MU14 | 7/6 |
| MX40 | 12/6 |
| N78 | 19/- |
| N108 | 25/- |
| NGT1 | 3/6 |
| NGT7 | 55/- |
| OA2 | 6/- |
| OC3 | 5/- |
| OZ4 | 4/6 |
| PC86 | 11/6 |
| PC88 | 11/6 |
| PC97 | 8/9 |
| PCC84 | 6/6 |
| PCC89 | 10/6 |
| PCC189 | 10/6 |
| PCF80 | 6/9 |
| PCF82 | 6/6 |
| PCF84 | 8/- |
| PCF86 | 9/- |
| PCF801 | 9/9 |
| PCF802 | 9/9 |
| PCF805 | 15/- |
| PCF806 | 13/- |
| PCF808 | 15/6 |
| PCL82 | 7/9 |
| PCL83 | 10/3 |
| PCL84 | 8/6 |
| PCL85 | 9/3 |
| PCL86 | 9/3 |
| PENA4 | 20/- |
| PENB4 | 20/- |
| PEN45 | 7/- |
| PEN46 | 4/- |
| PL36 | 10/9 |
| PL81 | 8/- |
| PL82 | 8/6 |
| PL83 | 7/6 |
| PL84 | 7/- |
| PL500 | 14/6 |
| PX4 | 14/- |
| PY33 | 10/9 |
| PY81 | 5/9 |
| PY82 | 4/9 |
| PY83 | 7/- |
| PY800 | 9/6 |
| PY801 | 9/6 |
| R2 | 7/6 |
| R19 | 7/9 |
| RG5/500 | 80/- |
| S130 | 40/- |
| SP4 | 8/- |
| SP41 | 5/6 |
| SP61 | 5/- |
| STV280/80 | 95/- |
| SU25 | 19/6 |
| SU2150 | 12/6 |
| T41 | 17/6 |
| TDD4 | 8/6 |
| U10 | 7/6 |
| U14 | 7/6 |
| U19 | 35/- |
| U25 | 15/6 |
| U26 | 15/6 |
| U78 | 4/6 |
| U191 | 13/9 |
| U251 | 16/3 |
| U301 | 12/6 |
| U403 | 6/6 |
| U404 | 7/6 |
| U801 | 22/6 |
| UABC80 | 6/6 |
| UAF42 | 10/6 |
| UBC41 | 9/3 |
| UBC81 | 9/3 |
| UBF80 | 7/- |
| UBF89 | 7/6 |
| UCC84 | 8/6 |
| UCC85 | 7/6 |
| UCF80 | 8/6 |
| UCH42 | 10/6 |
| UCH81 | 7/- |
| UCL82 | 6/9 |
| UCL83 | 10/- |
| UF41 | 10/6 |
| UF89 | 7/6 |
| UL41 | 12/- |
| UL84 | 7/- |
| UM80 | 5/6 |
| UU6 | 21/- |
| UU7 | 21/- |
| UU8 | 21/- |
| UU9 | 8/3 |
| UY21 | 9/6 |
| UY41 | 8/6 |
| UY85 | 8/5 |
| VMP4G | 17/- |
| VP4B | 25/- |
| VR105/30 | 6/6 |
| VR150/30 | 6/- |
| VT25 | 15/- |
| VT31 | 80/- |
| VU111 | 8/9 |
| VU120 | 12/6 |
| VU508 | 35/- |
| W81M | 12/6 |
| XH1-5 | 5/- |
| XP1-5 | 5/- |
| XSG1-5 | 10/- |
| Y63 | 7/6 |
| Tubes | |
| 3EG1 | 65/- |
| 3FP7 | 29/- |
| 5CP1 | 55/- |
| CV1526 | 40/- |
| ACR131 | 100/- |
| VCR97 | 35/- |
| VCR517B | 46/- |
| VCR517C | 46/- |

SPECIAL 24 HOUR SERVICE
OBSOLETE TYPES A SPECIALITY
QUOTATIONS FOR ANY VALVE NOT LISTED
Express postage 9d. per valve.
Ordinary postage 6d. per valve. C.W.O. No C.O.D.
Complete range of T.V. Tubes available from £4.5.0.
Manufacturers and Export Inquiries Welcome

***Special 24 Hour Express Mail Order Service***

**SETS OF VALVES**

DAF91, DF91, DK91, DL92 or DL94 .. .. 19/- plus postage
DAF96, DF96, DK96, DL96 .. .. .. .. 27/6 plus postage

**TRANSISTORS**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| AC127 | 7/6 | OC25 | 11/- | OC71 | 4/6 | OC81 | 4/- | OC82D | 6/- |
| AF114 | 7/- | OC28 | 16/- | OC72 | 6/- | OC81D | 4/- | OC83 | 6/- |
| AF115 | 7/- | OC35 | 11/6 | OC75 | 6/- | OC81DM | 6/- | OC170 | 7/- |
| AF116 | 7/- | OC44 | 4/6 | OC76 | 6/- | | | OC171 | 8/- |
| AF117 | 7/- | OC45 | 4/- | OC77 | 8/- | OC82 | 6/- | OC200 | 7/6 |

**SEND S.A.E. FOR LIST OF 2,000 TYPES**

# Alistair Maclean's latest

# 'PUPPET ON A CHAIN'

**Paul Sherman (Narcotics Bureau, Interpol) flies to Holland with two beautiful girl-Fridays. His assignment: to smash a deadly drug ring . . . Read this breathless new novel by the prince of thriller-writers starting in the December issue of ARGOSY.**

Plus short stories set in India, France and the South Sea Islands, behind-the-scenes coverage of books and authors, cartoons and a crossword.

**argosy**

DECEMBER ISSUE OUT NOW 3/6

# PADGETTS RADIO STORE

**OLD TOWN HALL, LIVERSEDGE, YORKS.**
Tel. Cleckheaton 2866

**Indicator Unit Type 26.** Size 12 × 9 × 9in. With outer Case fitted with 2½in. CRT Type CV1526 9 B7G Valves. Clean condition but not tested. **32/6**, p. & p. 10/–.

**Aircraft Sighting Head** with Gyro Unit complete with Transit Case, Condition fair. **18/6**, carriage B.R.S. 12/–.

**Oscillator Type 37.** Complete with AC230 Volt Power Pack, Circuit and Grid Ref. Map condition good, **37/6**, carriage B.R.S. 12/–.

**N.S.F. Toggle Switches** D.P.D.T. Ex Units **1/–**, post 1/–; 12 for **10/–** post paid.

**Complete untested 17 inch T.V. Sets**, 12 channel **50/–**, 15/– carriage.

**Model Makers Motor** with Train of Gears. 24 volts. Will run off 12 or 6 volts at slower speeds. **5/–**, post and packing 3/6.

**Speakers removed from T.V. Sets.** All PM and 3 ohm. 6in. round **3/–**, p. & p. 3/–; 6 for **24/–** post paid. 6 × 4in. **3/–**, p. & p. 3/–; 6 for **24/–**, post paid. 5in. round **3/–**, p. & p. 3/–; 6 for **24/–**; post paid. 7 × 4in. **5/–**, p. & p. 3/–; 6 for **34/–** post paid. Slot Speakers 8 × 2½in. **5/–**, p. & p. 3/–; 6 for **30/–** post paid.

**Reclaimed T.V. Tubes**, with 6 months' guarantee 17in. Type AW43/80, AW43/88 **40/–**, MW43/69 **30/–**, 14in. Type **17/–**. All Tubes 12/– carriage. T.V. Tubes as above with slight scratch on face £1 each. Carriage 12/–.

**Silicon Rectifier** 500mA 800 PIV. **2/6** post paid. **24/–** per dozen post paid.

**Jap Earpiece.** Magnetic 8 ohm. Small and large Plug. **1/11** post paid.

**G.P. Diodes 3/6** per dozen, post paid.

**Top Grade Mylar Tapes.** 7in. Standard **11/6**. 7in. Long Play **14/–**. 7in. Double Play **19/6**. 5in. Standard **7/9**. 5in. Long Play **10/–**, plus post on any tape 1/9.

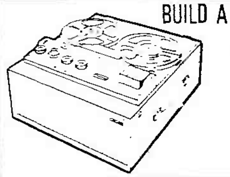
**VALVE LIST—Ex Equipment, 3 months guarantee**
Single Valves Post 7d., over 3 Valves p. & p. paid

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ARP12 | 1/6 | EY86 | 5/- | PZ30 | 5/- | 6P28 | 5/- |
| EB91 | 9d. | PCC84 | 2/- | U191 | 5/- | 10P13 | 2/6 |
| EF85 | 3/- | PCF80 | 2/- | U281 | 5/- | 185BT | 8/6 |
| EBF80 | 3/- | PCL82 | 4/- | U282 | 5/- | 20D1 | 3/- |
| ECC81 | 3/- | PCL83 | 5/- | U301 | 5/- | 20P1 | 5/- |
| ECC82 | 3/- | PL36 | 5/- | U329 | 5/- | 20P3 | 2/6 |
| ECC83 | 4/- | PL38 | 6/- | U251 | 5/- | 30PL1 | 5/- |
| ECL80 | 1/8 | PL81 | 4/- | 6B8 | 1/8 | 30P12 | 5/- |
| EF50 | 1/- | PY33 | 5/- | 6BW7 | 2/6 | 30F5 | 2/6 |
| EF80 | 1/6 | PY81 | 1/6 | 6K7 | 1/9 | 30FL1 | 5/- |
| EF91 | 9d. | PY82 | 1/6 | 6U4 | 5/- | 6/30L2 | 5/- |

Published on or about the 7th of each month by I.P.C. MAGAZINES LIMITED, Tower House, Southampton Street, London, W.C.2. at the recommended maximum price shown on the cover. Printed in England by Index Printers, Dunstable, Beds. Sole Agents for Australia and New Zealand: GORDON & GOTCH (A/sia) Ltd. South Africa: CENTRAL NEWS AGENCY LTD. Rhodesia, Malawi and Zambia: KINGSTONS LTD. East Africa: STATIONERY & OFFICE SUPPLIES LTD. Subscription rate including postage for one year: To any part of the World £2.2s.0d.

# HENRY'S RADIO LTD. ENGLAND'S LEADING COMPONENT AND EQUIPMENT CENTRES

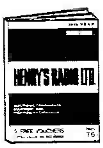
## BUILD A QUALITY 4 TRACK TAPE RECORDER

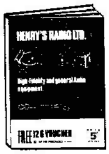


To get the best out of your MAGNAVOX DECK, you need a MARTIN RECORDAKIT. This comprises a special high quality 6 valve amplifier and pre-amplifier which comes to you assembled on it's printed circuit board – in fact everything for making a superb Tape Recorder. You need no experience or technical skill to bring this about.
THE INSTRUCTIONS MANUAL MAKES BUILDING EASY, AND SUCCESS IS ASSURED.
Kit comprises: Deck, Amplifier, Cabinet and speaker, with microphone, 7" 1200 ft. tape, and spare spool.
ASK FOR BROCHURE 6. TODAYS VALUE £60.
**PRICE 39 gns. p.p. 22/6.** NOTHING ELSE TO BUY

## HENRY'S RADIO *Fully Illustrated* CATALOGUES

A
ALL TYPES OF ELECTRONIC COMPONENTS TEST EQUIPMENT KITS BUILT UNITS





B
HIGH FIDELITY & GENERAL AUDIO EQUIPMENT CATALOGUE

COMPREHENSIVE · CLEAR · CONCISE · CATALOGUES

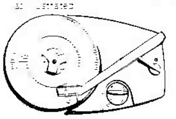
A Over 300 pages fully detailed and illustrated with more than 6,000 stock items. Everything for amateur and professional use. Complete with 5 vouchers. 10/- value, for use with purchases.
ORDER AS CATALOGUE A PRICE 7/6. p.p. 2/-.

B New audio and high fidelity catalogue 120 pages containing ideas and equipment for every application. Special low prices for all leading makes Plus 12/6 extra discount voucher.
ORDER AS CATALOGUE B PRICE 5/-. p.p. 1/-.

WHY NOT SEND AWAY TODAY!

## *SCOOP!* STAAR RECORD PLAYER

Deck plays 33 45 78, R.P.M. records. 9 volt operated with mono cartridge. BRAND NEW . . . as illustrated



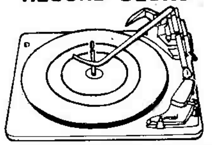
**PRICE 59/6. p.p. 3/6.**
Send for leaflet No. 2.

## MULLARD 1 WATT AMPLIFIER

Portable Transistor Unit-Ideal for Intercoms, Baby Alarms, Tele phone, Record Players or Guitar Practice.
9 Volt 5 transistors with volume control, output 3 ohms.
Ideal for use with STAAR RECORD DECK.
**PRICE 45/-. p.p. 2/6.**

OTHER ITEMS. Suitable 7 x 4 inch.
3 ohm speaker 17/6 p.p. 1/6.
Rexine covered cabinet 12 x 9 x 4 12/6 p.p. 2/6.
P.P.9 9 volt battery 3/9. Write for leaflet No. 2.

## GARRARD RECORD DECKS

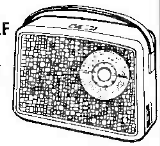


All the latest models BRAND NEW and guaranteed – TERRIFIC SAVINGS!

| | |
|---|---|
| *2025 STEREO | £ 7.19.6. |
| *2025TC DIAMOND. STAH.C. | £ 8.19.6. |
| *3000 STEREO STAH.C. | £ 9.19.6. |
| *SP 25 Mk.II | £11.19.6. |
| *SL 55 | £11.19.6. |
| A70 Mk.II | £12.10.0. |
| *AT 60 Mk.II | £13.10.0. |
| *SL 65 | £14.14.0. |
| AP 75 | £16. 0.0. |
| 401 | £23. 7.6. |
| SL 75 | £29. 0.0. |
| SL 95 | £35. 0.0. |
| GL 75 GOLDRING | £33. 0.0. |
| GL 75 P | £46.15.0. |

ALSO IN STOCK – THORENS – LENCO – B.S.R.
Carriage insurance 7/6 extra on 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. Carriage 5/-.
Complete range of Cartridges/Plinths/Covers.
SEND FOR 8 PAGE BROCHURE 16/17 TODAY.

## BUILD YOURSELF A QUALITY RADIO



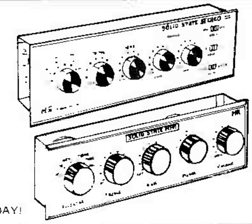
New printed circuit design with full power output. Fully tuneable on both mw/lw. bands. 7 Mullard transistors. Fitted 5" speaker. Room Filling Power. Easy to build with terrific results. All local and continental stations. Complete detailed instructions.
**TOTAL COST £6.19.6. p.p. 4/6.**
Ask for Leaflet No. 1.

## TRANSISTORS DIODES RECTIFIERS

WE HAVE THE MOST COMPREHENSIVE STOCK IN GREAT BRITAIN.
NEW 1969 LIST OF 1000 TYPES.
SEND FOR FREE COPY TODAY (LIST 36)
Whether you require one or 1000, devices we can fulfil your order from stock!
For quantity quotations telephone:
(01) 723 0401 Ex. 4. or (01) 402 6823.

## AUDIO EQUIPMENT

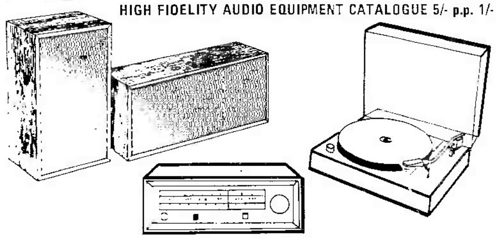
Mono or Stereo Audio equipment developed from Dinsdale Mk.II – each unit or system will compare favourably with other professional equipment selling at much higher prices. COMPLETE SYSTEMS AND MIXERS from
**£11.12.6. to £38.17.6.** (all units available separately)



THE FINEST VALUE IN LOW COST HIGH FIDELITY – CHOOSE A SYSTEM TO SUIT YOUR NEEDS AND SAVE YOURSELF POUNDS.
SEND FOR BROCHURES No. 12/14 and 21 TODAY!

## *HI-FI equipment to suit EVERY POCKET*

HIGH FIDELITY AUDIO EQUIPMENT CATALOGUE 5/- p.p. 1/-



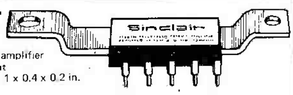
VISIT OUR NEW HI-FI CENTRE AT 309 EDGWARE ROAD, for all leading makes of – AMPLIFIERS, TUNERS, DECKS, SPEAKERS, MICROPHONES, TEST EQUIPMENT. ALL WITH DISCOUNTS – IT WILL PAY YOU TO PAY US A VISIT. AUDIO SYSTEMS £40 – £300 TO SUIT EVERY POCKET. DEFERRED TERMS AVAILABLE.
SEND FOR ILLUSTRATED BROCHURE 16 17. TWO DEMONSTRATION ROOMS

## HENELEC 5–5 STEREO AMPLIFIER

Excellent low priced British designed Stereo Amplifier for use with Record Decks, Mike, Tuners.
16 transistor mains operated. Output 5+5 watts for 8–15 ohm speakers. Black, silver and wood finish, size 13" x 3" x 6".

**PRICE £13.10.0. p.p. 7/6.** (Leaflet on request).
Complete Stereo System 5-5.
Garrard 2025 stereo, 5-5 Amplifier, Plinth/Cover, Two 10 watt speakers with tweeters in polished cabinets.
**Usual price £47.0.0. OUR PRICE £39.10.0. p.p. 20/-.** ASK FOR BROCHURE 13

## SINCLAIR EQUIPMENT




The SINCLAIR IC-10 is the worlds first monolithic intergrated circuit high fidelity power amplifier and pre-amplifier. The circuit itself has an output power of 10 watts, yet with an overall size of 1 x 0.4 x 0.2 in.

| | |
|---|---|
| IC-10 Integrated Circuit Amplifier | 59/6 |
| Z30 | 89/6 |
| Stereo 60 | £9.19.6. |
| PZ5 Power Supply | £4.19.6. |
| Q16 Loud Speaker | £8.19.6. |
| Z12 Amplifier | 89/6 |
| PZ 4 Power unit | 99/6 |
| Stereo 25 | £9.19.6. |
| Q14 Speaker system | £7.19.6. |

All post paid, delivery from stock.

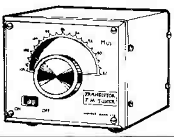
OTHER TYPES OF INTEGRATED CIRCUITS

| | |
|---|---|
| RCA. CA3014 | 29/6 |
| RCA. CA3018 | 22/6 |
| RCA. CA3020 | 29/6 |
| RCA. CA3036 | 18/6 |
| Sinclair I.C.10. | 59/6 |
| G.E. PA230* | 22/6 |
| G.E. PA234* | 20/0 |
| G.E. PA237* | 37/6 |
| G.E. PA246* | 52/6 |
| SL 402 Plessey | 45/0 |
| SL 403 Plessey | 49/6 |
| S.G.S. UL910 | 10/0 |
| S.G.S. UL900 | 10/0 |
| S.G.S. UL914 | 11/0 |
| Mullard TAA263 | 15/0 |

*Data sheets 3/6 set for these, for others see catalogue.

## BUILD THIS VHF FM TUNER

5 MULLARD TRANSISTORS. 300 kc/s BANDWIDTH. PRINTED CIRCUIT. HIGH FIDELITY REPRODUCTION MONO & STEREO. A popular VHF FM Tuner for quality and reception of mono and stereo. There is no doubt about it – VHF FM gives the REAL sound.



**PARTS TOTAL COST £6.19.6. DECODER £5.19.6.**
ASK FOR LEAFLET No. 3. (FOR STEREO)

Electronic Musical Instruments

## ELECTRONIC ORGANS

COMPLETE KITS FOR THE HOME CONSTRUCTOR

START BUILDING FOR AS LITTLE AS £10.
MODELS FROM £99 – £350.

STAR FEATURES:
*ALL TRANSISTOR PRINTED CIRCUIT DESIGNS. *BRITISH DESIGN. *STEP BY STEP DETAILED INSTRUCTIONS. *SAVES UP TO 50% ON COMMERCIAL EQUIVALENT. *EVERYTHING SUPPLIED DOWN TO THE LAST ITEM. *FULL AFTER SALES SERVICE & ADVICE. *CREDIT SALE & H.P. TERMS AVAILABLE.

We are pleased to offer the choice of FOUR British designs from a single manual portable at £99 THE MAYFAIR for light or classical music – to a two manual five octave de-luxe model with OAK CONSOLE from £285 for the serious music art.

These kits are the result of years of research and design and offer the best that is essential to good organ designs, coupled with excellent value are within the reach of most pockets. No technical skill or knowledge is required in construction with the aid of the STEP BY STEP illustrated manuals will produce an instrument that will be a delight to own and use and will give years of trouble free entertainment for the whole family.

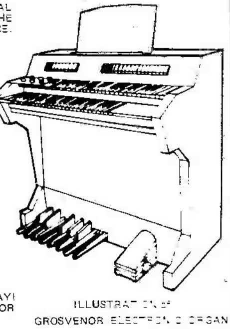


ILLUSTRATION OF GROSVENOR ELECTRONIC ORGAN

SEND FOR ILLUSTRATED BROCHURES 9 10/11 TODAY!
When in LONDON. . . CALL IN SEE, HEAR, PLAY FOR YOURSELF.
Organ Demonstration Room 1st Floor.
PRACTICAL ELECTRONICS ORGAN – ORGAN COMPONENTS

We are able to supply all items for this series, details on request. Built models available from £124.

# HENRY'S RADIO LTD.

Mail Order Dept., Components, Organ Dept.
303 EDGWARE ROAD, LONDON W.2.
Telephone: 01-723 1008/9
OPEN MON-SAT 9am-6pm THURS 9am-1pm

High Fidelity and Equipment Centre
309 EDGWARE ROAD, LONDON W.2.
Telephone: 01-723 6963