# PRACTICAL WIRELESS

NOVEMBER 1966

2/6

**FREE INSIDE**

SET OF FIVE TRIMMER TOOLS



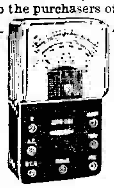
AF and RF

# TRANSISTOR TESTERS

## BSR MONARCH UA16 with FULL-FI HEAD

4-speed, plays 10 records, 12in., 10in. or 7in. at 16, 33, 45 or 78 r.p.m. Intermixes 7in., 10in., and 12in. records of the same speed. Has manual play position: colour, brown. Dimensions: $12\frac{1}{2}$ x $10\frac{3}{4}$in. Space required above baseboard $4\frac{3}{4}$in., below baseboard $2\frac{3}{4}$in. Fitted with Full-Fi-turn-over crystal head. P. & P. 9/-. **£4.19.6**

Complete Amplifier Kit comprising E.C.L. 82 Mains transformer, metal rectifier, volume control, smoothing condenser, metal chassis, speaker, etc. To the purchasers of the above changer only **19/6** plus 3/- P. & P.



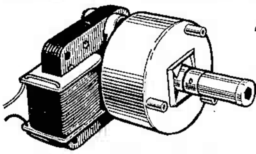
## POCKET MULTI-METER

Size $3\frac{7}{8}$ x $2\frac{1}{2}$ x $1\frac{3}{8}$in. Meter size $2\frac{1}{8}$ x $1\frac{3}{8}$in. 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**. P. & P. 3/6. **FREE GIFT** for limited period only. 30 watt Electric Soldering Iron value **15/-** to every purchaser of the Pocket Multi-Meter.

# MULTIPLEX DECODER

## *for receiving* STEREO FM

Built and tested. Input from FM tuner ranging from ·5 to 1·5 volts RMS. Amplification unity. **£4.4.0** P. & P. 3/-



## Type E MOTOR

Small A.C. mains motor 230/250 volts complete with gearbox. **6 r.p.m.** Price **15/-** plus **4/-** P. & P. Similar to above motor but without gearbox. Price **9/6** plus **3/-** P. & P.

## "MAYFAIR" 5-Transistor TAPE RECORDER

Capstan-driven, battery operated. $7\frac{1}{2}$ and $3\frac{3}{4}$ i.p.s. Precision made. Push-button controls. High quality $2\frac{3}{4}$in. speaker. Push-pull circuit. Output 400mW. Frequency response: 200-7,000 k/s. Fast rewind. Up to 1 hour twin track playing time. Automatic erasing for re-recording. Dimensions: 8in. x 11in. x $3\frac{7}{8}$in. Weighs only 7lb. Takes 5in. spools.

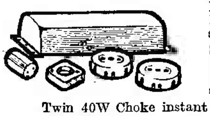
**£11.11.0** plus 9/-. P. & P.


## FIRST QUALITY P.V.C. TAPE

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| $5\frac{3}{4}$in. | Std. | 850ft. | .. | 9/- | 5in. | L.P. | 850ft. | .. | 10/6 |
| 7in. | Std. | 1200ft. | .. | 11/6 | 3in. | T.P. | 600ft. | .. | 10/6 |
| 3in. | L.P. | 240ft. | .. | 4/- | 5in. | T.P. | 1800ft. | .. | 25/6 |
| $5\frac{3}{4}$in. | L.P. | 1200ft. | .. | 11/6 | $5\frac{3}{4}$in. | T.P. | 2400ft. | .. | 32/6 |
| 7in. | L.P. | 1800ft. | .. | 18/6 | 7in. | T.P. | 3600ft. | .. | 42/6 |
| $5\frac{3}{4}$in. | D.P. | 1800ft. | .. | 18/6 | 4in. | T.P. | 900ft. | .. | 15/- |

P. & P. on each 1/6, 4 or more post free.

## 40W FLUORESCENT LIGHT KIT

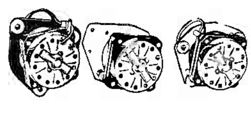


Incorporating **GEC** Choke size $8\frac{1}{4}$in. x $1\frac{3}{4}$in. x $1\frac{3}{4}$in., 2 bi-pin holders, starter and starter-holder. P. & P. 5/6. **11/6**

Similar to above: 80W. Fluorescent Light Kit incorporating **GEC** choke size $11\frac{3}{4}$in. x $1\frac{3}{4}$in. x $1\frac{3}{4}$in. 2 bi-pin holders, starter and starter holder. P. & P. 6/6 **17/6**

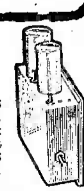
Twin 40W Choke instant start for 2 x 2ft. tubes **17/6**. P. & P. 5/6.

## MAGNAVOX COLLARO



Set of three Tape Deck Motors 240V. A.C. Three Motors, **49/6**, P. & P. 6/-.

## CYLDON U.H.F. TUNER

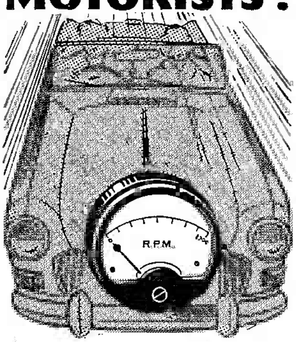


Complete with PC.88 and PC.86 Valves. Full variable tuning. New and unused. Size $4\frac{1}{2}$ x $5\frac{1}{2}$ x $1\frac{1}{2}$in. Complete with circuit diagram. **35/-** plus 3/6 P. & P.

## SILICON RECTIFIERS

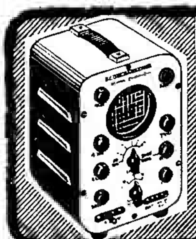
250 v. P.I.V. 750 milliamps. Six for **7/6**, post paid.

# MOTORISTS! — it's so easy to build your own REV COUNTER




## Fully Transistorised for only 19/6

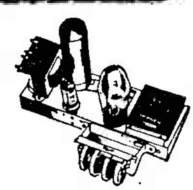
Can be used for 4 or 6 cyl. engines. It would cost you at least £8 to buy one new, at today's prices, but with a few simple tools you can make one at a fraction of the price! This kit makes a modern efficient rev-counter that is essential to your engine's welfare: it contains moving coil movement and all parts including transistors and a circuit diagram. Maximum reading 8000 r.p.m. for 12 volt operation negative or positive earth. Send for your kit today, enclosing a P.O. 22/- which includes 2/6 postage—it will save you £'s and your engine.



## OSCILLOSCOPE for D.C. & A.C. Applications

Push-pull X amplifier: Flyback suppression; Internal Time-base Scan Wave form available for external use; pulse output available for checking TV line O/P Transformers, etc. Provision for external—I/P and C.R.T. Brightness Modulation. A.C. mains 200/250 v., **£18/18/-**. P. & P. 10/-.

## 3 to 4 WATT AMPLIFIER KIT

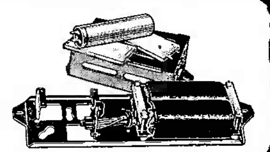


Comprising chassis $8\frac{3}{4}$in. x $2\frac{1}{2}$in. x 1in. Double wound mains transformer, output transformer. Volume and tone controls, resistors, condensers, etc. 6V6. ECC81 and metal rectifier. Circuit 1/6, free with kit. **29/6** plus 5/6 P. & P. The above Amplifier built and tested. **10/6** extra.

## POWER SUPPLY KIT

**A.C. MAINS 200/250V**

Incorporating "C" core type mains transformer, full wave metal rectification and smoothing condenser. Smooth output 250 v. 250 ma and 6.3 v. 4 amp. for Heaters. **25/-** P. & P. 9/6



# RADIO & T.V. COMPONENTS (ACTON) LTD.

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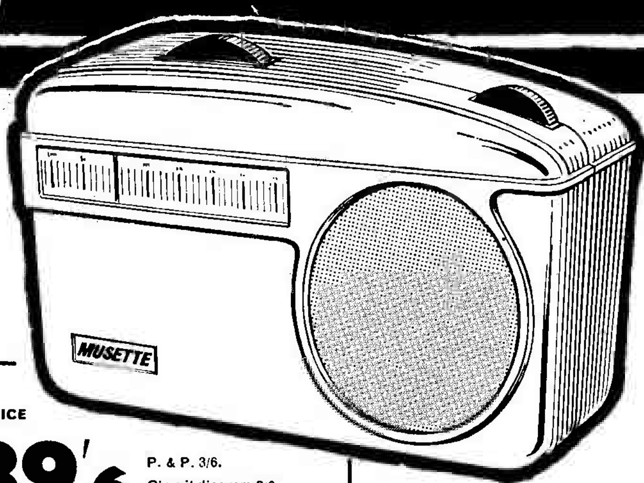
# MUSETTE 6 TRANSISTOR SUPERHET PORTABLE RADIO




- $2\frac{1}{4}''$ Speaker.
- 6 Transistors Superhet Output 200mw.
- Plastic Cabinet in red, size $4\frac{3}{4}'' \times 3'' \times 1\frac{3}{8}''$ and gold speaker louvre.
- Horizontal Tuning Scale.
- Ferrite Rod Internal Aerial.
- IF 470 Kc.
- All components, Ferrite Rod and Tuning Assembly mount on printed board.
- Operated from PP3 Battery.
- Full comprehensive instructions and point-to-point wiring diagram.
- Printed Circuit Board.
- Tunable over medium and long waveband. Car aerial and ear piece socket.

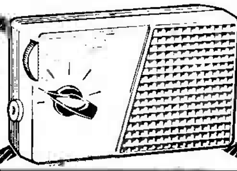
**PRICE**

**39/6**

P. & P. 3/6.
Circuit diagram 2/6.
Free with parts.

*INCLUDING CARRYING STRAP*

## NEW TRANSISTORISED SIGNAL GENERATOR



Size $5\frac{1}{2}'' \times 3\frac{1}{4}'' \times 1\frac{1}{2}''$. For IF and RF alignment and AF output 700 c/s frequency coverage 460 Kc/s to 2 Mc/s in switched frequencies. Ideal for alignment to our Elegant Seven and Musette. Built and tested. **39/6** P. & P. 3/6

# Elegant Seven Mk II

## COMBINED PORTABLE *and* CAR RADIO


### The Radio with the STAR features

★ 4in. Speaker.
★ 7-transistor superhet. Output 350mW.
★ Wooden cabinet, fitted handle with silver coloured fittings. Size $12\frac{1}{4} \times 8\frac{1}{2} \times 3\frac{1}{2}$in.
★ Horizontal tuning scale, size $11\frac{1}{4} \times 2\frac{5}{8}$in. in silver with black lettering.
★ All stations clearly marked.
★ Ferrite-rod internal aerial.
★ I.F. neutralisation on each stage 460 kc/s.
★ D.C. coupled output stage with separate A.C. negative feed back.
★ All components: ferrite rod and tuning assembly mount on printed board.
★ Operated from PP9 battery.
★ Full comprehensive instructions and point-to-point wiring diagrams.
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★ Fully tunable over medium and long waveband.
★ Car aerial socket. Full after-sale service.

ONLY **£4.4.0**

Plus 7/6 P. & P. Parts List and circuit diagram 2/6 FREE with parts.

**POWER SUPPLY KIT**
To purchasers of "Elegant Seven" parts. Incorporating mains transformer, etc. A.C. mains 200-250v. Output 9v. 50mA. 7/6 extra.

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*Demonstrations daily from Large Selection.*

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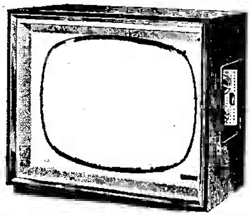

**LATEST RADIOGRAM CABINETS £9.10.0**

Brand new long low design in veneered English walnut, dia. 40 x 16 x 15½ in. Carr. 30/-. Also Small Cabinets £6.19.6. Radiogram/Cocktail Cabinets (Personal Shoppers.) Free List.

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**VALVES, £1** per 100. Assorted TV and Radio. Surplus ex-rental dismantled receivers. Post 4/6. Send for list.

**RECORD PLAYER CABINETS, 49/6.** Latest designed covered cabinets. Takes any modern Autochanger.

**SINGLE PLAYER CABINETS, 19/6.** P. & P. 5/6.

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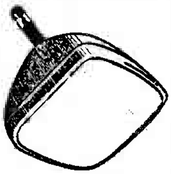

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Carr. 10/6.

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Most makes and Types (Not Slimline) Carr. 5/-

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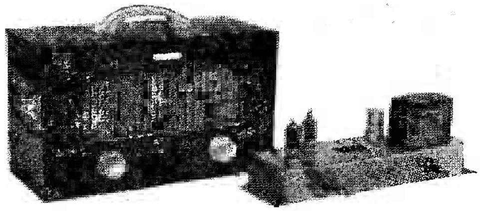
# THE Radio Constructor

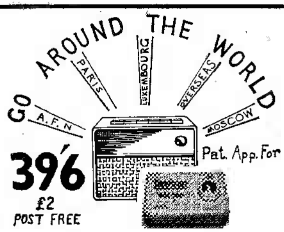
## BUILD THIS SIMPLE 3-VALVE AMPLIFIER

*By V. E. Holley*



**OCTOBER ISSUE ON SALE NOW 2/6**

THE Radio Constructor

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On your own **TRANSISTOR PORTABLE!**

★ Boosts Pirate and distant stations.
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**1% Wirewound Resistors**

1% 1 watt, 1 ohm to 5K, **3/3**; to 20K, **4/6**; ½% add **3d.** Your value wound to order.

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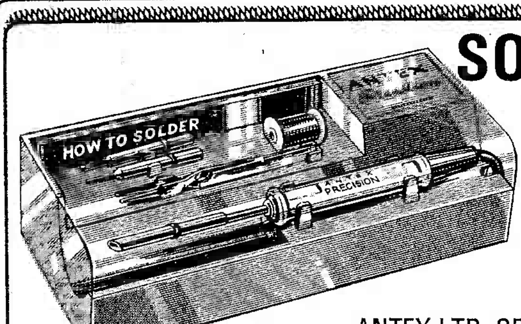


Made by ANTEX — makers of the finest precision soldering irons in the world, this Soldering Kit contains *everything* you need for successful soldering. Unique plastic "tool-box" format (with space for iron stowage *with* plug) keeps everything where you want it.

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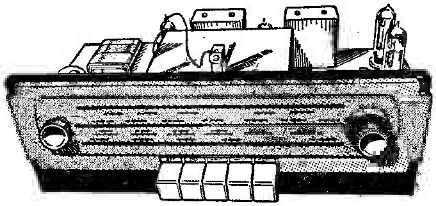
**BRAND NEW AM/FM (V.H.F.) RADIOGRAM CHASSIS AT £15.15.0 (Carriage Paid)**



Chassis size 15 x 6¾ x 5¾in. high. New manufacture. Dial 14½ x 4in. in 2 colours, predominantly cream. 200-250v. A.C. only.
Pick-up Ext. Speaker. Ae., E. and Dipole Sockets. Five push-buttons—LW, MW, SW, FM and Gram. Aligned and tested. O.P. Transformer Tone control 1000-1900M; 200-550M; 88-98 Mc/s. 6-17 mc/s. EZ80 rect.; ECH81, EF89, EABC80, EL84, ECC85, 3-ohm speaker required.
9 x 6in. ELLIPTICAL SPEAKER, 20/- to purchasers of this chassis.
**TERMS:** (Chassis). £5.5.0 down and 5 monthly payments of £2.5.0. Total H.P. price, £16.10.0. Cheap Room Dipole for V.H.F., 12/6. Feeder 6d. per yard. Circuit diagram, 2/6. Carriage to N. Ireland, 20/- extra.

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**NEW 6 PUSH-BUTTON STEREOGRAM CHASSIS.** M.W.; S.W.1; S.W.2; V.H.F.; Gram; Stereo Gram. Two separate channels for Stereogram with balance control. Also operates with two speakers on Radio. Chassis size: 15 x 7 x 6½in. high. Dial cream and red. 15 x 3in. 190-550M; 18-51M; 60-187M; VHF 86-100 m/cs. Valves: ECC85, ECH81, EF89, 2 x ECL86, EM84 and Rect. Price £19.19.0, carr. paid or £6.13.0 deposit and 5 monthly payments of 56/6. Total H.P. price. £20.15.6 Cream moulded escutcheon included.

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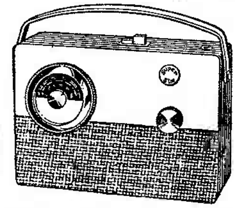
## TAPE AMPLIFIER FOR MAGNAVOX TAPE DECKS — 2 or 4 TRACK (4 TRACK 25/- EXTRA)

Chassis 12½ x 5½ x 4¾in. high. Plastic front panel "gold" finish—12¾ x 4¼in. 200-250 A.C. Record/Playback amp. switch; Off/On-Tone; Vol/Mic; Vol/Gram; Mic. Input; Gram. Input; Monitor; Speaker Sockets. Valves 6BR7; 12AX7; EM84; EL84; 6X4 Separate power pack. Complete amp. and power pack. £10.17.6. (6/- P. & P.). Rexine covered cabinet (tan) 15½ x 17 x 9½in. high with sloping front for amp; complete with two tweeter speakers, and special adapting brackets for Magnavox Deck—85/- (8/- carr.) 3 speed Magnavox 2 track tape deck £10.17.6; 4-track £12.15.0. Complete Recorders (with speed compensation) 2-track £29; 4-track £32 (carr. 25/-). Worth £10 more on normal retail prices.

*The*
# SUPER 6
## LONG & MEDIUM WAVE TRANSISTOR RADIO



A quality radio available as a kit or ready-built. The sparkling performance and superb finish of the completed receiver give you value equivalent to a £12.12.0 commercial model.
★ All new parts. ★ 6 transistors and diode. ★ 350mW output. ★ Superhet circuit ★ Ferrite rod aerial. ★ Weymouth Radio printed circuit board. ★ Component positions and references printed on back of board. ★ Nicely styled wooden cabinet 11 x 7½ x 3¾in. ★ Vinyl covered in various colours. ★ 6 x 4in. speaker giving good bass and treble response. ★ Full instruction booklet, 2/-. Free with kit. ★ I.f. frequency 470 kc/s. ★ Lining up service if required. ★ All parts supplied separately.

Write for list, S.A.E. **COMPLETE KIT ONLY** **£4.0.0** P. & P. 5/-
*OR FULLY BUILT* £6.7.6. *Tax and Carr. Paid.*

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**BATTERY ELIMINATOR** for Transistor Radios requiring 9v. Fully smoothed (5000+1000mfd). 5 x 3½ x 1¾in. overall. Tapped input for 200/10, 220/30, 240/50v. Output 9v. at 100ma. Good Regulation. Price 25/-. (3/- P. & P.).

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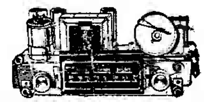
**SELF-POWERED VHF TUNER CHASSIS**



Covering 88-95 Mc/s, Dims. 8 x 6 x 6in. high, Valves ECC85, EABC80 and 2-EF89 with metal rectifier. Mains transformer. Fully wired and tested ONLY £8.17.6 (carr. paid). Room dipole. 12/6. Feeder 6d. per yard.

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CATALOGUE 6d.
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# 2 *METRES* 4

The thrills of VHF Amateur Radio! Complete Kit, 70-150 Mc/s, costs only 42/6 (by post, UK, 3/3 extra) also now available, new transistor Short-Wave kit model TR2 10—180 metres, ideal for beginners to Ham radio via simplified "Easy-Build" step-by-step instructions from 79/6. Write today enclosing a stamped addressed envelope for literature and full details. Overseas enthusiasts note we despatch to all parts of the world—local stamp OK for literature. "GLOBE-KING" (Regd.) precision standard products tried and trusted by Amateurs everywhere.

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**Characteristics of approx. 7,000 types of British Valves, Transistors, Semiconductors, Rectifiers and Cathode Ray Tubes.** 9/6. P. & P. 1/-.

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***This is what the ANTEX Kit contains:***

- Model CN240 15W Precision Iron with 3/16" bit, (used in electronic workshops and factories all over the world)
- Two spare Interchangeable Bits (5/32" and 3/32")
- Reel of resin-cored Solder
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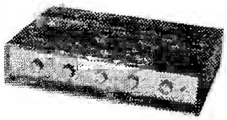
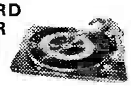
# HI-FI AMPLIFIERS — TUNERS — RECORD PLAYERS

20+20 STEREO AMP. AA-22U



GARRARD PLAYER AT-60



**TRANSISTOR MIXER. MODEL TM-1.** A must for the tape enthusiast. Four channels. Battery operated. Similar styling to Model AA-22U Amplifier. Kit **£11.16.6.** Assembled **£16.17.6**

**20+20W TRANSISTOR STEREO AMPLIFIER. Model AA-22U.** Outstanding performance and appearance. 5 stereo inputs each channel, 20 transistor, 10 diode circuit. Kit **£39.10.0** Assembled **£57.10.0** (Cabinet **£2.5.0** extra).

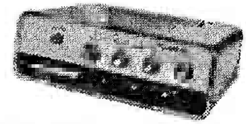
**GARRARD AUTO/RECORD PLAYER. Model AT-60,** less cartridge **£13.1.7.** With Decca Deram pick-up **£17.16.1** incl. P.T.

Many other Garrard models available, ask for Lists.

**HI-FI MONO AMPLIFIER. Model MA-5.** A general purpose 5W Amplifier, with inputs for Gram., Radio. Modern functional appearance. Kit **£11.9.6** Assembled **£15.15.0**

10W POWER AMP. MA-12

9+9W STEREO AMP. S-99



**HI-FI MONO AMPLIFIER. Model MA-12.** 10W output, wide freq. range, low distortion. Use with control units. Models UMC-1 (Mono) or USC-1 (Stereo). Kit **£12.18.0** Assembled **£16.18.0**

**3+3W STEREO AMPLIFIER. Model S-33.** An easy-to-build, low cost unit. 2 inputs per channel. Kit **£13.7.6** Assembled **£18.18.0**

**DE LUXE STEREO AMPLIFIER. Model S-33H.** De luxe version of the S-33 with two-tone grey perspex panel, and high sensitivity necessary to accept the Decca Deram pick-up. Kit **£15.17.6** Assembled **£21.7.6**

**HI-FI STEREO AMPLIFIER. Model S-99.** 9+9W output. Ganged controls. Stereo/Mono gram, radio and tape inputs. Push-button selection. Printed circuit construction. Kit **£28.9.6** Assembled **£38.9.6**

**POWER SUPPLY UNIT. Model MGP-1.** Input 100/120V, 200/250V, 40-60 c/s. Output 6·3V, 2·5A A.C. 200, 250, 270V, 120mA max. D.C. Kit **£5.12.6** Assembled **£7.2.6**

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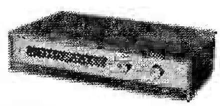

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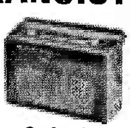
Many special features including:—

★ Pre-assembled and aligned RF tuning unit.
★ 4 stage IF amplifier, Automatic freq. control.
★ Printed circuit board, 14 transistor circuit.

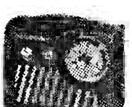
Available in two units, sold separately, can be built for a **TOTAL PRICE KIT (STEREO) £24.18.0** incl. P.T. Kit (MONO) **£20.19.0** incl. P.T. can be converted to stereo with adaptor, optional extra. Cabinet, optional extra **£2.5.0.** Send for details.

## TRANSISTOR RADIOS



Oxford

**"OXFORD" LUXURY PORTABLE Model UXR-2.** Specially designed for use as a domestic or personal portable receiver. Many features, including solid leather case. Kit **£14.18.0** incl. P.T.



UXR-1

**TRANSISTOR PORTABLE. Model UXR-1.** Pre-aligned I.F. transformers, printed circuit. Covers L.W. and M.W. Has 7″ x 4″ loudspeaker. Real hide case. Kit **£12.11.0** incl. P.T.

**JUNIOR EXPERIMENTAL WORKSHOP Model EW-1.** More than a toy! Will make over 20 exciting electronic devices, incl.: Radios, Burglar Alarms, etc. 72 page Manual. The ideal present! Kit **£7.13.6** incl. P.T.

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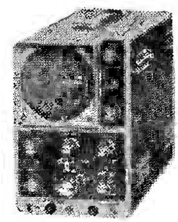
## TEST INSTRUMENTS

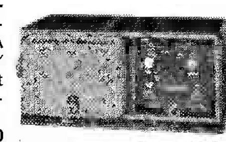
**Our wide range includes:**



OS-2

**3″ LOW-PRICED SERVICE OSCILLOSCOPE. Model OS-2.** Compact size 5″ x 7⅜″ x 12″ deep. Wt. only 9⅞lb. "Y" bandwidth 2 c/s-3 Mc/s, ±3dB. Sensitivity 100mV/cm. T/B 20 c/s-200 kc/s in four ranges, fitted mu-metal CRT Shield. Modern functional styling. Kit **£23.18.0** Assembled **£31.18.0**

**5″ GEN.-PURPOSE OSCILLOSCOPE. Model 10-12U.** An outstanding model with professional specification and styling. "Y" bandwidth 3 c/s-4·5 Mc/s ±3dB. T/B 10 c/s-500 kc/s. Kit **£35.17.6** Assembled **£45.15.0**



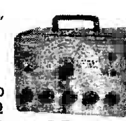
VVM, IM-13U

**DE LUXE LARGE-SCALE VALVE VOLTMETER. Model IM-13U.** Circuit and specification based on the well-known model V-7A but with many worth-while refinements. 6″ Ernest Turner meter. Unique gimbal bracket allows operation of instrument in many positions. Modern styling. Kit **£18.18.0** Assembled **£26.18.0**

V-7A

**AUDIO SIGNAL GENERATOR. Model AG-9U.** 10 c/s to 100 kc/s, switch selected. Distortion less than 0·1%, 10V sine wave output metered in volts and dB's. Kit **£23.15.0** Assembled **£31.15.0**

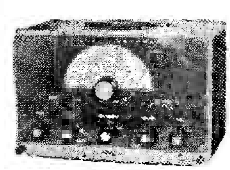
**VALVE VOLTMETER. Model V-7A.** 7 voltage ranges d.c. volts to 1,500. A.C. to 1,500 r.m.s. and 4,000 peak to peak. Resistance 0·1 Ω to 1,000MΩ with internal battery. D.C. input resistance 11MΩ. dB measurement, has centre-zero scale. Complete with test prods, leads and standardising battery. Kit **£13.18.6** Assembled **£19.18.6**



RF-1U

**MULTIMETER. Model MM-1U.** Ranges 0–1·5V to 1,500V a.c. and d.c.; 150μA to 15A d.c.; 0·2Ω to 20MΩ 4½″ 50μA meter. Kit **£12.18.0** Assembled **£18.11.6**

**R.F. SIGNAL GENERATOR. Model RF-1U.** Up to 100 Mc/s fundamental and 200 Mc/s on harmonics. Up to 100mV output. Kit **£13.18.0** Assembled **£20.8.0**



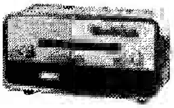
IG-82U

**SINE/SQUARE GENERATOR. Model 1G-82U.** Freq. range 20 c/s–1 Mc/s in 5 bands less than 0·5% sine wave dist. less than 0·15μ sec. sq. wave rise time. Kit **£25.15.0** Assembled **£37.15.0**

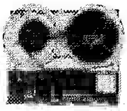
**TRANSISTOR POWER SUPPLY. Model IP-20U.** Up to 50V, 1·5A output. Ideal for Laboratory use. Compact size. Kit **£35.8.0** Assembled **£47.8.0**

Prices and specifications subject to change without notice

# TAPE AMPLIFIERS — TAPE DECKS — CONTROL UNITS



FM TUNER FM-4U

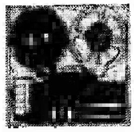


STUDIO-MATIC DECK

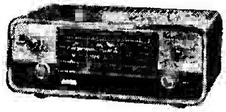
**HI-FI FM TUNER. Model FM-4U.** Available in two units. R.F. tuning unit (£2.15.0 incl. P.T.) with I.F. output of 10·7 Mc/s and I.F. amplifier unit, with power supply and valves (£13.13.0). For free standing or cabinet mounting. Total Kit **£16.8.0**
**(Multiplex adaptor available shortly, as extra).**

**STUDIOMATIC "363" TAPE DECK.** The finest buy in its price range. Operating speed: $1\frac{7}{8}$", $3\frac{3}{4}$" and $7\frac{1}{2}$" p.s. Two tracks, "wow" and "flutter" not greater than 0·15% at $7\frac{1}{2}$" p.s. **£13.10.0**
With TA-1M Tape Pre-amplifier kit **£31.5.6**

**HI-FI AM/FM TUNER. Model AFM-1.** Available in two units which, for your convenience, are sold separately. Tuning heart (AFM-T1—£4.13.6 incl. P.T.) and I.F. amplifier (AFM-A1—£22.11.6). Printed circuit board, 8 valves. Covers L.W., M.W., S.W., and F.M. Built-in power supply. Total Kit **£27.5.0**
**(Multiplex adaptor available shortly, as extra).**



TRUVOX DECK



AM/FM TUNER

**TRUVOX D-93 TAPE DECKS.** High quality stereo/mono tape decks. **D93/2**, $\frac{1}{4}$ track, **£36.15.0** **D93/4**, $\frac{1}{2}$ track, **£36.15.0**

**TAPE RECORDING/PLAYBACK AMPLIFIER.**
Mono Model TA-1M Kit **£19.18.0** Assembled **£28.18.0**
Stereo Model TA-1S Kit **£25.10.0** Assembled **£35.18.0**
Available shortly. **MULTIPLEX ADAPTOR KIT**, SD–1.
Kit **£8.10.0** Assembled **£12.5.0**

**MONO CONTROL UNIT. Model UMC-1.** Designed to work with the MA-12 or similar amplifier requiring 0·25V or less for full output. 5 inputs. Baxandall type controls. Kit **£9.2.6** Assembled **£14.2.6**

**STEREO CONTROL UNIT. Model USC-1.** Push-button selection accurately matched ganged controls to ±1dB. Rumble and variable low pass filters. Printed circuit boards. Kit **£19.19.0** Assembled **£27.5.0**

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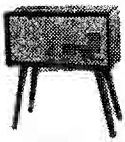
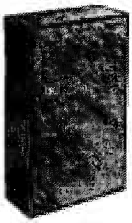
Heathkit DAYSTROM

## SPEAKER SYSTEMS



SSU-1



Berkeley

**HI-FI SPEAKER SYSTEM. Model SSU-1.** Ducted-port bass reflex cabinet "in the white". Two speakers. Vertical horizontal models with legs, Kit **£12.12.0**, without legs, Kit £11.17.6 incl. P.T.

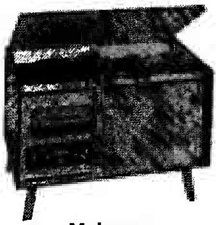
**The BERKELEY SLIM-LINE SPEAKER SYSTEM,** fully finished walnut veneered cabinet for faster construction. Special 12" bass unit and 4" mid/high frequency unit. Range 30-17,000 c/s. Size 26" x 17" only $7\frac{3}{8}$" deep. Modern attractive styling. Excellent value.
Kit **£19.10.0** Assembled **£24.0.0**

**COTSWOLD SPEAKER SYSTEMS.** Outstanding performance for price.
*MFS:* Size 36" x $16\frac{1}{2}$" x 14" deep.
Kit **£25.12.0** Assembled **£33.17.0**
**STANDARD:** Size 26" x 23" x $14\frac{1}{2}$" deep.
Kit **£25.12.0** Assembled **£33.17.0**

## HI-FI CABINETS

A wide range available including kits, ready assembled cabinets or assembled and fully finished cabinets, for example:

**GLOUCESTER.** Kit **£18.10.0** incl. P.T.
**MALVERN.** Kit **£18.1.0** incl. P.T.
**CHEPSTOW.** Kit **£11.18.6** incl. P.T.



Malvern

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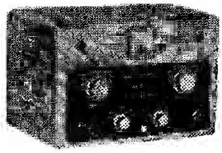
## "AMATEUR" EQUIPMENT

**80-10m TRANSMITTER, DX-40U.** Power inputs 75W. C.W., 60W peak CC phone. Output 40W tp aerial. Provision for VFO.
Kit **£29.19.0** Assembled **£41.8.0**

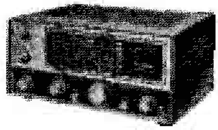
**SSB ADAPTOR, SB-10U**
Kit **£39.5.0** Assembled **£54.18.0**



DX-40U

**AMATEUR BANDS RECEIVER Model RA-1.** To cover all the Amateur Bands from 160-10 metres. Many special features, including: half-lattice crystal filter; 8 valves; signal strength "S" meter; tuned R.F. Amp. stage.
Kit **£39.6.6** Assembled **£52.10.0**

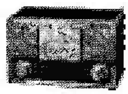
**160-10M TRANSMITTER. Model DX-100U.** Careful design has achieved high performance and stability. Completely self-contained.
Kit **£81.10.0** Assembled **£106.15.0**



RA-1

**COMMUNICATIONS TYPE RECEIVER. Model RG-1.** A high performance, low cost receiver for the discriminating listener. Frequency coverage: 600 kc/s–1·5 Mc/s and 1·7 Mc/s–32 Mc/s.
Kit **£39.16.0** Assembled **£53.0.0**

**REFLECTED POWER METER and SWR BRIDGE. Model HM-11U.** Indicates reliably, but inexpensively, whether the RF power output of your TX is being transferred efficiently to radiating antenna. Kit **£8.10.0** Assembled **£10.15.0**



HM-11U

**OUTSTANDING "AMATEUR" EQUIPMENT**
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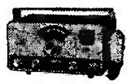
**Model HW-32** (20M) } price inc. duty, etc.



80M Transceiver HW-12

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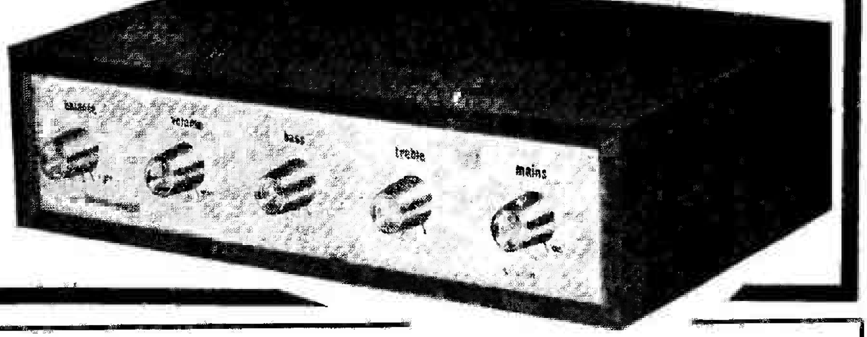


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TRADE MARK

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## Stereosound

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| 1S5 | 3/3 | 6C4 | 1/9 | 6L6G | 7/- | 10F18 | 9/- | 25Z4 | 6/3 | 813 | 80/- | DL94 | 5/9 |
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| 5R4G | 8/9 | 6D6 | 2/9 | 6SH7 | 2/6 | 12AU6 | 5/9 | 30F5 | 10/- | 7475 | 2/6 | EA50 | 2/- |
| 5U4G | 4/- | 6E5 | 5/9 | 6SJ7 | 5/- | 12AU7 | 4/9 | 30FL1 | 10/6 | ATP4 | 1/9 | EABC80 | 5/9 |
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| 5Y3GT | 5/- | 6F5G | 5/- | 6SL7GT | 4/9 | 12BA6 | 6/- | 30L17 | 11/- | ATP7 | 4/6 | EB41 | 4/6 |
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| 6/30L2 | 9/9 | 6F8G | 4/6 | 6SQ7 | 6/- | 12C8GT | 7/6 | 30P19 | 14/- | AU5 | 6/- | EBC33 | 6/- |
| 6A7 | 15/- | 6F8G | 4/6 | 6U4GT | 10/- | 12E1 | 19/6 | 30PL1 | 11/- | AZ1 | 8/9 | EBC41 | 8/3 |
| 6A8G | 18/6 | 6F11 | 12/6 | 6U5G | 7/6 | 12J5GT | 2/3 | 30PL13 | 12/- | AZ31 | 7/9 | EBC90 | 3/9 |
| 6AC7 | 3/- | 6F13 | 5/- | 6V6M | 8/- | 12J7GT | 7/3 | 30PL14 | 12/- | CBL31 | 15/- | EBF80 | 6/6 |
| 6AK5 | 4/6 | 6F14 | 12/6 | 6V6G | 3/6 | 12K7GT | 3/- | 35A5 | 17/- | CK502 | 5/- | EBF83 | 7/- |
| 6AL5 | 3/- | 6F23 | 10/- | 6V6GT | 7/- | 12K8GT | 8/- | 35L6 | 5/9 | CL33 | 12/6 | EBF89 | 6/6 |
| 6AM5 | 2/6 | 6G6 | 2/6 | 6X4 | 3/6 | 12Q7GT | 3/- | 35W4 | 4/6 | CY31 | 10/- | EBL1 | 17/6 |
| 6AM6 | 3/3 | 6H6 | 1/3 | 6X5G | 4/9 | 12SA7 | 6/6 | 35Z3 | 10/- | DAC32 | 7/6 | EBL21 | 10/6 |
| 6AQ5 | 5/6 | 6J5M | 6/6 | 6X5GT | 7/6 | 12SG7 | 3/6 | 35Z4GT | 3/9 | DAF91 | 8/3 | EBL31 | 27/6 |
| 6AS7G | 19/6 | 6J5G | 2/6 | 7B6 | 11/- | 12SH7 | 2/9 | 35Z5 | 5/6 | DAF96 | 6/- | ECC81 | 3/9 |
| 6AT6 | 3/9 | 6J5GT | 4/6 | 7B7 | 7/- | 12SJ7 | 3/9 | 37 | 5/- | DCC90 | 8/- | ECC82 | 4/9 |
| 6AU6 | 6/- | 6J6 | 3/- | 7C5 | 10/- | 12SK7 | 2/9 | 42 | 4/6 | DF33 | 8/- | ECC83 | 5/9 |
| 6B8G | 2/- | 6J7M | 8/6 | 7C6 | 6/- | 12SR7 | 5/- | 50B5 | 6/6 | DF70 | 5/- | ECC84 | 5/6 |
| 6B4G | 10/- | 6J7G | 4/3 | 7D5 | 8/- | 12S7 | 20/- | 50C5 | 5/9 | DF91 | 2/6 | ECC85 | 5/- |
| 6BA6 | 4/6 | 6J7GT | 8/6 | 7H7 | 5/- | | | 50CD6G | 32/6 | DF92 | 2/6 | ECC88 | 7/- |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ECF80 | 7/- | EM81 | 7/- | PCC189 | 10/- | S130 | 12/6 | UM80 | 7/- | | | | |
| ECF82 | 7/- | EM84 | 7/- | PCF80 | 6/6 | SP4 | 9/- | UU6 | 18/6 | | | | |
| ECH21 | 19/- | ESU150 | 27/6 | PCF82 | 6/- | SP41 | 1/6 | UU7 | 13/6 | | | | |
| ECH35 | 11/- | EY51 | 7/- | PCF84 | 8/- | SP61 | 1/- | UU9 | 8/- | | | | |
| ECH42 | 9/- | EY86 | 6/6 | PCF86 | 8/- | SU25 | 19/6 | UY21 | 7/6 | | | | |
| ECH81 | 5/3 | EZ35 | 4/9 | PCF801 | 9/9 | SU2150 | 12/6 | UY41 | 6/3 | | | | |
| ECH83 | 7/- | EZ40 | 7/- | PCF802 | 9/9 | T41 | 9/- | UY85 | 5/- | | | | |
| ECL80 | 6/6 | EZ41 | 8/- | PCF805 | 10/9 | TDD4 | 7/- | VMP4G | 17/- | | | | |
| ECL82 | 6/6 | EZ80 | 5/- | PCF806 | 12/- | U10 | 7/- | VP4B | 27/6 | | | | |
| ECL83 | 9/- | EZ81 | 5/- | PCF808 | 11/6 | U14 | 7/- | VR105/30 | | | | | |
| ECL86 | 8/9 | GZ30 | 8/6 | PCL82 | 7/- | U19 | 30/- | | 5/- | | | | |
| EF9 | 20/- | GZ32 | 9/6 | PCL83 | 8/6 | U25 | 9/6 | VR150/30 | | | | | |
| EF36 | 3/- | GZ34 | 10/- | PCL84 | 7/3 | U26 | 8/6 | | 5/- | | | | |
| EF37A | 7/6 | KT36 | 22/6 | PCL85 | 8/6 | U78 | 3/6 | VT25 | 29/- | | | | |
| EF39 | 6/- | KT61 | 17/6 | PCL86 | 8/6 | U191 | 11/- | VT31 | 59/- | | | | |
| EF41 | 8/6 | KT66 | 20/- | PENA4 | 20/- | U251 | 11/6 | VU111 | 6/- | | | | |
| EF50 | 2/- | KT81 | 10/- | PENB4 | 20/- | U301 | 12/- | VU120 | 12/6 | | | | |
| EF80 | 5/- | KT88 | 27/6 | PEN45 | 6/- | U403 | 6/6 | VU508 | 30/- | | | | |
| EF85 | 6/6 | KTW61 | 4/3 | PEN46 | 2/9 | U801 | 16/6 | W81M | 5/- | | | | |
| EF86 | 6/3 | KTZ41 | 8/- | PL36 | 9/- | UABC80 | 5/6 | X79 | 41/- | | | | |
| EF89 | 5/6 | ML4 | 17/6 | PL81 | 6/6 | UAF42 | 8/9 | XH1-5 | 5/- | | | | |
| EF91 | 3/3 | ML6 | 12/6 | PL82 | 6/6 | UBC41 | 8/- | XP1-5 | 5/- | | | | |
| EF92 | 2/6 | MSP4 | 12/6 | PL83 | 6/- | UBC81 | 7/6 | XSG1-5 | 10/- | | | | |
| EF98 | 9/- | MU14 | 4/- | PL84 | 6/6 | UBF80 | 5/9 | Y63 | 7/6 | | | | |
| EF183 | 6/6 | MX40 | 12/6 | PL500 | 14/6 | UBF89 | 6/6 | Tubes | | | | | |
| EF184 | 6/6 | N37 | 10/- | PX4 | 18/6 | UCC84 | 8/6 | 3EG1 | 40/- | | | | |
| EL32 | 3/- | N78 | 15/- | PY33 | 8/6 | UCC85 | 6/6 | 3FP7 | 12/6 | | | | |
| EL33 | 17/6 | N108 | 15/- | PY81 | 6/- | UCF80 | 8/6 | 5CP1 | 30/- | | | | |
| EL34 | 9/6 | NGT1 | 3/- | PY82 | 5/6 | UCH42 | 8/6 | CV1526 | 40/- | | | | |
| EL41 | 8/6 | NGT7 | 25/- | PY83 | 6/- | UCH81 | 6/3 | ACR13 | | | | | |
| EL42 | 7/6 | OZ4 | 4/- | PY800 | 7/- | UCL82 | 7/6 | | £3.0.0 | | | | |
| EL84 | 4/6 | PC86 | 9/- | PY801 | 7/- | UCL83 | 8/9 | VRC97 | 35/- | | | | |
| EL90 | 5/6 | PC88 | 9/- | R2 | 4/- | UF41 | 8/- | VRC517B | | | | | |
| EL95 | 6/- | PC97 | 7/6 | R19 | 7/- | UF89 | 6/- | | 30/- | | | | |
| EM34 | 12/6 | PCC84 | 5/6 | RG5/500 | | UL41 | 8/9 | VRC517C | | | | | |
| EM80 | 7/- | PCC89 | 10/- | | 59/- | UL84 | 6/- | | 30/- | | | | |

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|---|---|---|---|---|---|---|---|---|---|
| AC127 | 8/- | OC25 | 11/- | OC71 | 4/6 | OC81 | 4/- | OC82D | 6/- |
| AF114 | 7/- | OC28 | 16/- | OC72 | 6/- | OC81m/pr | | OC83 | 6/- |
| AF115 | 7/- | OC35 | 9/6 | OC75 | 6/- | | 12/6 | OC170 | 7/6 |
| AF116 | 7/- | OC44 | 4/6 | OC76 | 6/- | OC81D | 4/- | OC171 | 7/- |
| AF117 | 5/- | OC45 | 3/6 | OC77 | 8/- | OC82 | 6/- | OC200 | 8/- |

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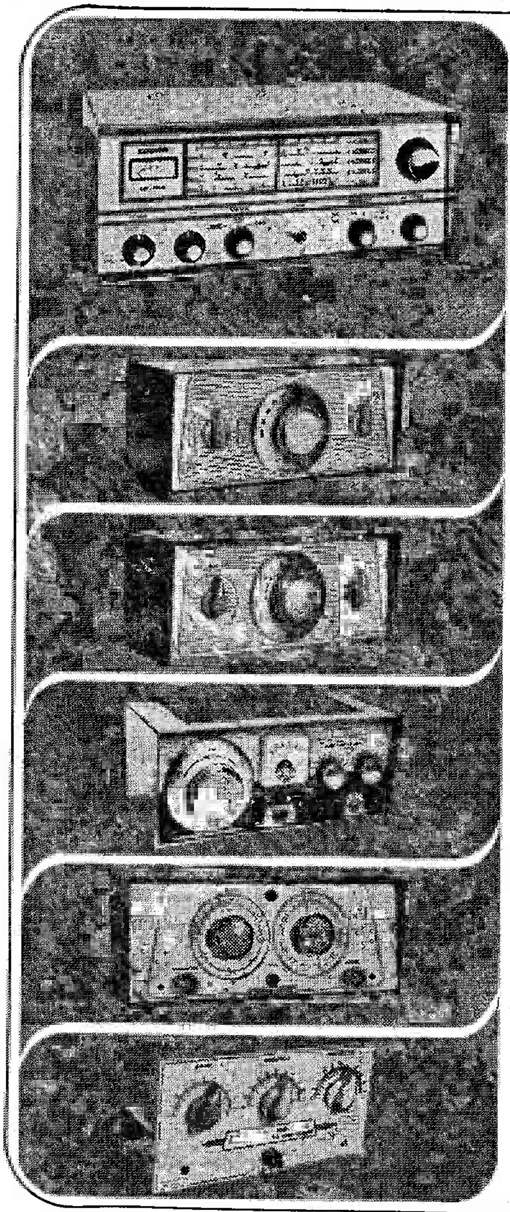
# CODAR — QUALITY



## ANOTHER CODAR TRIUMPH!

**THE NEW 1966 CR.70A COMMUNICATION RECEIVER.**

This completely new receiver sets a new high standard for performance and finish unequalled at the price, and is a worthy addition to the outstanding range of **CODAR** quality communication equipment. Frequency range: 560 Kc/s-30 Mc/s (540-10 metres) in four ranges; 560 Kc/s-1.5 Mc/s; 1.5 Mc/s-4.2 Mc/s; 4.2 Mc/s-11.5 Mc/s; 11.5 Mc/s-30 Mc/s. Slide rule scales for each band calibrated in frequencies plus an additional logging scale in degrees. Two speed vernier tuning control with reverse slow tune action. Unique aerial input stage exclusive to the CR.70A employing High 'Q' Air-spaced **CODAR-QOIL** Inductor giving extremely high gain with low noise level. Panel aerial trimmer for peaking weak signals. Double tuned I.F. Iron cored transformers. 470 Kc/s with EF183 frame grid valve for maximum gain and selectivity. 5 valves (including two twin triodes) giving 7 valve line-up. Separate B.F.O. stage for CW and SSB reception. Calibrated signal strength 'S' meter, illuminated. Automatic Volume control. Panel phone jack for 'private' listening. 2-3 ohm output for external speaker. (Matching unit optional extra.) Superb styling, metal cabinet in the new Organasol Satin lustre finish. Size: 13" x 5¼" x 7¼". For A.C. 200/250v. Ready built. **Not a Kit** at the fantastic low price of **£19.10.0.** Carr. 7/6.

**CODAR R.F. PRE-SELECTOR MODEL P.R.30.** Considerably improves the performance of any superhet receiver over 1.5-30 Mc/s. Uses EF183 Frame Grid Valve, and provides up to 20dB gain plus substantial image rejection, improved signal/noise ratio and selectivity. Selector switch for either dipole or single wire antenna. Power requirements 180-250 volts 12mA H.T. 6.3 volts, .3 amp L.T. Size 8½ x 5 x 4in. Ready built, complete with cables, plugs and instructions. **£5.10.0.** Carr. 3/6. **MODEL P.R.30X.** Self powered model for 200-250v. A.C. Also provides 25mA at 200v. H.T. and 6.3v. 1 amp L.T. for other accessories **£7.4.0.** Carr. 3/6.

**CODAR "Q" MULTIPLIER MODEL R.Q.10.** For use with any superhet receiver with an I.F. between 450 and 470 Kc/s. Provides considerable increase in selectivity for either peaking or rejecting a signal on AM, CW, or SSB, BFO. Size 8½ x 5 x 4in. Power requirements 180-250v. H.T. at 5mA 6.3v. .3 amp L.T. Ready built complete with cables, plugs and instructions. **£6.15.0.** Carr. 3/6. **MODEL R.Q.10X.** Self powered version for 200-250v. A.C. and also provides 25mA at 200v. H.T. and 6.3v. 1 amp. L.T. for other accessories **£8.8.0.** Carriage 3/6.

**CODAR A.T.5. 12 WATT 2 BAND TRANSMITTER.** The newest most compact transmitter for fixed or mobile use on 160-80 metres. "The tiny TX with the BIG voice". Size only 8½ x 5 x 4in. (Base area is less than two-thirds of this page!) High stability new type calibrated VFO. 1.8-2.0 Mc/s and 3.5-3.8 Mc/s (up to 4 Mc/s export). Air-spaced CODAR COIL Pi-net output, P.A. Plate current meter plus neon indicator. Plate-Screen modulator. AM/CW switch and Panel key jack. Plug change over for 6 or 12 volts heater supply. Ready built **£16.10.0.** Carr. 4/-. **A.T.5 POWER SUPPLY UNITS.** For 200-250v. A.C. and 12v. Solid state for Mobile use, complete with all Transmit/Receive changeover switching available.

**CODAR-KIT CR.45K MAINS T.R.F. SHORT-WAVE RECEIVER.** World wide reception—North and South America, Russia, India, Australia, Far East, Amateurs, Shipping, etc. ★Separate electrical bandspread. ★ 3 slow motion vernier drives. ★ Low loss polystyrene plug-in coils, factory aligned ★ Dials calibrated in frequencies and degrees. ★ Power output 3 watts for 2/3 ohm speaker. ★ Valve line-up: ECC81, EL84, EZ80. Size 12 x 5¼ x 7in. **CODAR-KIT CR.45K** complete with valves, 3 coils (10-28, 25-75, 60-176 metres) and 11 page instruction manual, **£9.10.0.** Carr. 5/6. Extra coils **5/-** each. Instruction manual only **4/-** (credited on order). (Can also be supplied ready built—price on request).

**CODAR-KIT MINI-CLIPPER—OUR FAMOUS SHORT-WAVE RECEIVER** ★ Can be built in one evening ready to switch on and bring the World to your fingertips at very low cost. ★ Supplied complete with valve, one coil 25-75 metres and 4-page instruction manual. PRICE **39/6.** Carr. 3/-. Extra Coils **5/-** each. Instruction Manual only **2/-** (credited on order). Electrical Bandspread available. Provision to add 2 transistor amplifier.

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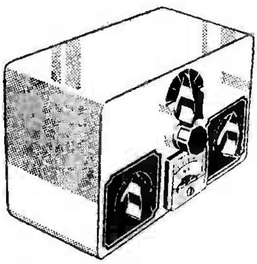
The revolutionary JOYSTICK ANTENNA SYSTEMS presents a satisfactory solution to all the problems of restricted space transmission and reception antennae. A completely new range of tuning units have been designed to allow the maximum possible efficiency with absolute simplicity of tuning and operation. For transmission on all amateur bands from 1·8 Mc/s to 30 Mc/s, for general short wave and broadcast reception and for commercial application (static and mobile). This *variable frequency antenna* system has been acknowledged as the most successful solution to a host of aerial problems. Over 5,500 are in use all over the world (as at July 1966).

Hundreds and hundreds of terrific testimonials may be seen at the Joystick Office—the selection shown here will prove the point.



*Above: One of the new JOYMATCH 'EASY-TO-USE' units with built-in RF indicator*

JOYSTICK VFA CAN BE HEARD ON THE BANDS EVERY DAY. START THE NEW SEASON WITH A POTENT SIGNAL. ORDER YOURS TODAY!

**James C. Cox—Hull** "I find it successful in all ways . . . am an avid SWL."

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**B.B. St. V. Moullin—Guernsey** "Truly satisfied . . . GC-1U Mohican Rx performs with greater selectivity."

**Raymond F. Bence—Cardiff** "Joystick system certainly does its stuff."

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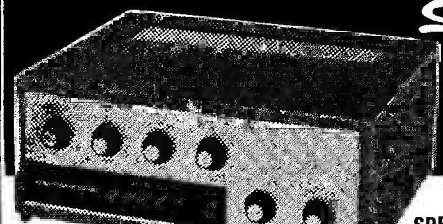
# stern-clyne ELECTRONIC CENTRES

MEMBER OF THE PANTIYA GROUP OF COMPANIES

## Announcing the stern-clyne SULTAN Solid State Integrated Stereo Amplifier



The Stern-Clyne SULTAN represents a considerable advance in solid-state, high fidelity stereo amplifiers. Outstanding performance is allied to meticulous construction, comprehensive facilities, installation simplicity, and attractive functional styling.
SULTAN performance is a natural result of superb design incorporating the most advanced fully proved semi-conductors, and modular substage construction that permits searching quality control and precise matching at every stage of assembly. Particular attention has been given to the provision of all the additional input, output, and power take-off facilities ever likely to be required. The compact sized, craftsman finished teak cabinet and restrained styling ensures unobtrusive, harmonious matching with almost any decor.

**38 Gns.** Complete. Carriage & Insurance **8/6**

### SPECIFICATION & PERFORMANCE

| | |
|---|---|
| Power Supply | A.C. only. 200–250V, 50—60 c/s. (Alternative ratings to special order) |
| Power Consumption | 48 watts maximum. |
| Power Output | 13 watts per channel RMS into 15 ohm load. Combined channels 20 w. |
| Speaker Matching | 8–16 ohms (for 3–5 ohms use 2/3 ohm wire wound resistors in series with each L/S. |
| Distortion | Total harmonic distortion less than ·25% at full output. |
| Frequency Response | at 1 watt ± 2 dB, 30–25,000 c/s. at 10 watts ± 3 dB, 40–15,000 c/s. |
| Cross Talk | Better than 50 dB at 1B Kc/s. |
| Hum and Noise | Better than 52 dB below full output. |
| Inputs; P.U.1. | 3·5 mV. 47K ohms impedance } R.I.A.A. compensated |
| P.U.2. | 20 mV, 47K ohms impedance } R.I.A.A. compensated |
| Radio | 100mV, 220K ohms impedance—Flat |
| Tape | 100mV, 220K ohms impedance " |
| Aux. | 250mV, 430K ohms impedance " |
| Aux. | 250mV, 430K ohms impedance " |
| Dimensions | 13" x 11" x 5½" Panel 12" x 4" |
| Bass Control | Boost 14 dB at 40 Kc/s. Cut 15 dB at 40 Kc/s. |
| Treble Control | Boost 12 dB at 14 Kc/s. Cut 18 dB at 14 Kc/s. |

## Only from STERN-CLYNE The Unique GRAMSTAND

**£10.7.6**
Carriage 10/-

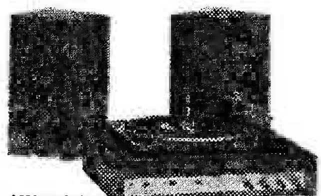
GRAMSTAND is a superb BSR Autochanger—with many added facilities—already assembled on a handsome, specially designed hardwood plinth.
GRAMSTAND is made exclusively for Stern-Clyne to meet the requirements of modern bookshelf mounted and space limited Hi-Fi systems.

Features include:
- LIGHTWEIGHT TUBULAR ARM.
- LATEST MONO/STEREO CERAMIC CARTRIDGE
- DIAMOND STYLUS.
- HEAVY BALANCED 10½in. TURNTABLE.
- BUILT-IN P.U. PLUG AND SOCKET AND INTEGRAL 6ft. MAINS LEAD.

## STERN-CLYNE MERCURY

### *Brilliant NEW Modular Hi-Fi Reproducer*

With Garrard Autochanger, Solid State Amplifier, Free-Cone Speaker Systems.
The Stern-Clyne Mercury is an important new approach to Hi-Fi sound reproduction in the home. One compact, modular system embodies the latest advances in solid-state amplifier design, loudspeaker system miniaturization, and pick-up cartridge development to provide superb stereo performance with exceptional installation facility. Combined Player Unit/Amplifier Console and identical speaker systems are superbly housed in matching teak veneer cabinets, specially designed to fit existing furniture or shelf space, and match any decor.



### MERCURY SYSTEM

AUTOCHANGER AND PICK-UP
Garrard High-grade, Model 3000, specially equipped with high-compliance, ceramic cartridge fitted with Diamond stylus to ensure superb, wide range reproduction, and extremely low tracking weight.

AMPLIFIERS
Identical, 5-watt, 7-transistor amplifiers designed round the latest, fully-proved semi-conductors. Each is independently constructed on a modular circuit board and subjected to searching inspection and precise matching at each stage of assembly.

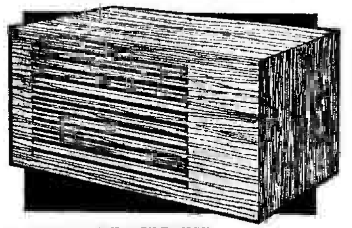
LOUDSPEAKER SYSTEMS
Bookshelf size, acoustically designed speaker system enclosures contain bass speakers and matching high frequency units with crossover network. Specially developed bass speaker employs enormously powerful magnet and free suspension cone to provide the full blooded bass response usually associated with much larger units.

### SPECIFICATION

| | |
|---|---|
| Power Supply | 200/250 volts. 50 cycles AC (other standards to special order) |
| Output (Amplifiers) | 5 watts per channel |
| Output Impedance | 15 ohms (other speakers of 8 to 16 ohms may be used) |
| Frequency Response (Amplifiers) | 30 c/s to 35 kc/s flat (2 dB) at 1 watt, tone controls level |
| Harmonic Distortion | Less than 1% |
| Hum and Noise | —55 db below full output, tone controls level |
| Cross talk between channels | 48 dB at 1 kc/s. |
| Bass Compensation | ± 15 dB at 40 c/s. |
| Treble Compensation | ± 15 dB at 14 kc/s. |
| Balance Control | Ganged potentiometer; either channel can be faded to zero without affecting the other. |
| Tape Record Outlets | 200 mV average, each channel |
| Dimensions | —Player Unit 16½ x 14 x 8½ in. overall —Loudspeakers 13 x 7 x 8 in. (each). |

**49 Gns.** Complete. Carriage & Insurance **15/-**

## Only from STERN-CLYNE New bookshelf size MEGAMITE Speaker System



- FULL FREQUENCY RANGE.
- EMPLOYS SPECIALLY DESIGNED FREE-CONE BASE UNIT.
- INCLUDES MATCHING TWEETER AND CROSS-OVER.
- HANDLES 10 WATTS OUTPUT.

Special 5in. free-cone bass unit uses enormously powerful Feroba magnet to obtain the exceptional cone movement needed to get clean, deep-down bass response equal to much larger speaker performance. Matching 4in. tweeter and crossover is housed with bass unit in heavily lagged, handsome teak veneered cabinet, size only 13 x 7 x 8in. deep. Mounts vertically or horizontally. Ideal for modern Hi-Fi systems where clean, unobtrusive appearance with high performance is required.

**£8.19.6** Carriage 7/6

**72/6**
P & P 3/-

## OUR FINEST EVER METER VALUE! DUVIDAL IT1-2 MULTITESTER

### With Built-in Meter Protection!

Pocket size with wide-angle, jewelled meter movement, ceramic long-life, low-loss switching, tough impact resisting case. Sensitivity 20,000 ohms/volt DC. 10,000 ohms/volt AC.

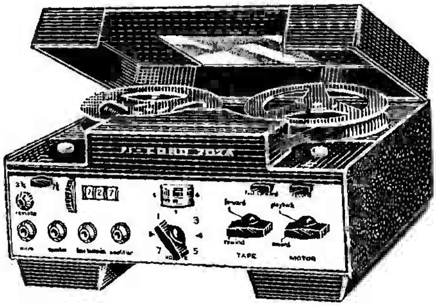
**19 Ranges measure:**
0—5—25—250—500—2500 volts DC. 0–10–100–500–1000 volts AC. 0–50 uA–2·5 mA–250 mA DC. 0–6000 ohms—6 megohms. 10 uuf–0·001 mA—1 mfd. –20 to + 22 dB.

## TEST 7 Pocket Multimeter

**39/6**
Carr. 2/-

A really versatile instrument that makes a handy pocket-size tool. Measures AC or DC voltage in three ranges of 0-15-150-1000v. Resistance 0-1000,000 ohms and Current 0-150 mA. DC. Size only 3½ x 2¼ x 1¼in., with ingenious dial design providing a clear, easily read scale. Complete with battery and test leads.

# EXCEPTIONAL OPPORTUNITY!




## Fabulous FI-CORD 202A TAPE RECORDERS

**Current List Price £69.6.0**
**Only from STERN-CLYNE**

**39 Gns.** H.P. terms available

Complete. Suitable Microphones available.

World renowned Fi-Cord. Recognised as one of the finest Hi-Fi battery recorders obtainable. The choice of professional sound engineers for serious outdoor work. Use it for true reproduction of sound—anywhere. Ideal for home film making, and all business and travel work. Magnificently engineered and constructed. Features include: frequency range 50–12,000 c/s (+3 dB) 2 speeds—7½ and 3¾ i.p.s., level meter/battery tester tape counter, and plug-in provision for external services. Input <0·2 mv. for fully modulated tape. Built-in 3 in. speaker. Output 180 mW and 1V at outlet socket. Size: 9 x 6½ x 4¼in. **Weight: 6¾ lb. including batteries.**

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- **TENSILIZED**—prestretched, extra strong.
- Full frequency spectrum response.
- Guaranteed playing times.

STERN-CLYNE make huge bulk purchases of recording tapes from the world's biggest manufacturers—and hand on the enormous price advantage to their customers. The quality is unequalled: Tensilized to ensure the most permanent type of base. Highly resistant to breakage, moisture, heat, cold or humidity. Highly polished, splice-free finish. Smooth output throughout entire audio range. Ideal for your most treasured recordings.

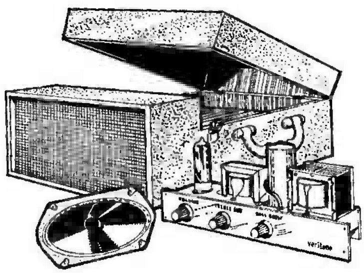
**TENSILIZED P.V.C.**

| | | | | |
|---|---|---|---|---|
| 3in. | 250ft. | Long Play | 5 | 6 |
| 5in. | 600ft. | Standard | 8 | 6 |
| 5in. | 900ft. | Long Play | 10 | 0 |
| 5¾in. | 1,200ft. | Long Play | 12 | 6 |
| 7in. | 1,200ft. | Standard | 12 | 6 |
| 7in. | 1,800ft. | Long Play | 15 | 0 |

**TENSILIZED POLYESTER**

| | | | | |
|---|---|---|---|---|
| 3¼in. | 600ft. | Double Play | 11 | 6 |
| 5in. | 1,200ft. | Double Play | 15 | 0 |
| 5¾in. | 1,800ft. | Double Play | 22 | 6 |
| 5¾in. | 2,400ft. | Triple Play | 37 | 6 |
| 7in. | 2,400ft. | Double Play | 25 | 0 |
| 7in. | 3,600ft. | Triple Play | 50 | 0 |

## MONOGRAM AMPLIFIER



Superb space and cost economy design specially developed by Mullard Research Laboratories and quality constructed by Stern-Clyne. Actually uses only one multi valve but provides an undistorted output from any standard xtal pick-up. Plus features include Bass Boost and Treble Cut controls, panel illumination and specially wound output transformer. Size only 10 x 2½ x 4in., ¾in. high Silver hammer chassis finish satin silver finish engraved panel.

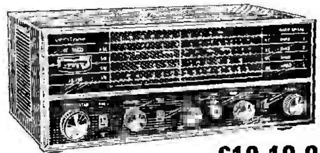
Kit of parts **£4.10.0**
Carriage 4/6.

Assembled and tested **£6.0.0**
Carriage 4/6.

### MONOGRAM ACCESSORIES

Specially designed PC3 Carrying case takes Monogram Amplifier, 8 x 5 Elliptical Speaker (illustrated) and any standard turntable or Autochanger. Size overall 18 x 16, 1/2 x 8, 1/2in. Handsomely finished in dark grey fabric weave.
PC3 Case **£3.5.0.** Carriage 5/6d. 8 x 5 Speaker **£1.** Carriage 2/6d.

## CR150 COMMUNICATIONS RECEIVER

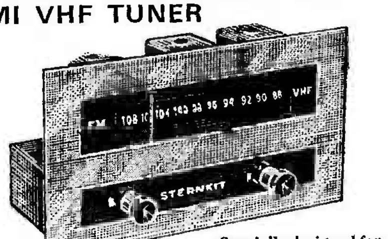


**£19.10.0**

Carriage and Insurance 15/-

Compact and attractive as a drawing-room radio but packed with communications engineering features to bring in the most distant stations loud and clear. Continuous coverage from 540 Kc/s to 30 Mc/s rakes in all broadcast bands, shipping, world-wide short wave and Ham radio. Built-in features include extra large tuning dial, extending rod aerial, "S" meter, B.F.O., Noise Limiter, extra quality loudspeaker, etc. Meticulously constructed, handsomely finished. Essential for superb reception but cheaper than many domestic radios. Size only 13½ x 5 x 8 in. Standard mains operation.

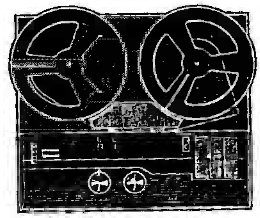
## SUPERB NEW STERN-CLYNE FMI VHF TUNER




**Specially designed for the Amateur builder, a new sensitive tuner unit that provides stable, interference-free reception of BBC FM transmissions. High quality output signal ensured optimum performance from any Hi-Fi audio system; superb styling makes for harmonious installation with existing equipment. Reliable easily aligned circuit employs RF stage, tuned anode tuned grid freq. changer, 2 IF's Noise Limiter and Ratio Detector. Input sens. 100mV for 40 db. Distortion less than 1% at full deviation. Power req. 200v at 20 mA and 6.3v at 1.8A. Panel black and silver grey, size 8 x 5in.**

**FMI Kit of parts £7.9.6** Carr. 4/-
**FMI Assembled and tested £10.9.6**, Carr. 4/-
**Optional Power Pack Type D Kit of parts £2.15.0** Carr. 3/6
**Power Pack Type D assembled and tested £3.10.0** Carr. 3/6
*Handbook only 3/- Post Free. Descriptive leaflet on request.*

## MAGNAVOX 363 TAPE TRANSPORTER



**Manufactured to precise limits that permit recording and tape playback to the highest standards set by the Music industry.** Simple reliable design employs a single high-duty motor with heavy flywheel. Features include fast wind on and rapid rewind, pause control, 3-speed selection with interlock, built-in revolution indicator, piano key controls. Speeds 1⅞, 3¾ and 7½ i.p.s. Wow and flutter 0.15% on 7½ i.p.s. Max. spool size 7in. Playing time up to 120 min. per track from 1,200ft. standard tape. Size 13½ x 11in. plus 5¼in. below mounting board.

**With ½ track heads £10.10.0**
**With ¼ track heads £13.19.6**
*Add 10/- carriage and insurance.*

## MAIL ORDER & ALL ENQUIRIES TO STERN CLYNE DEPT. PW, 3-5 EDEN GROVE HOLLOWAY, LONDON N.7 Tel. NORth 8161/5

**LONDON:**
18 Tottenham Court Rd., W.I. **MUS 5929/0095**
23 Tottenham Court Rd., W.I. **MUSeum 3451**
309 Edgware Road, W.2. **PADdington 6963**
109 Fleet Street, E.C.4. **FLEet Street 5812/3**
162 Holloway Road, N.7 **NORth 7941**
9 Camberwell Church St., S.E.5. **RODney 2875**
220 Edgware Road, W.2. **PADdington 5607**

**CROYDON:**
12 Suffolk House, George St. **MUNicipal 3250**

**BRISTOL:**
26 Merchant Street, Bristol 1. **Bristol 20261**

**LIVERPOOL:** 52 Lord Street. **Royal 7450**

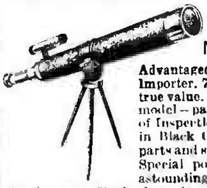
**MANCHESTER:**
20/22 Withy Grove, Manchester 4. **Blackfriars 5379/5246**

**SHEFFIELD:** 125 The Moor. **Sheffield 29993**

**NOTTINGHAM:**
Eastown House, Lincoln St. **Nottingham 45889**

# SENSATIONAL SELECTION OF BARGAINS . . . .

## HIGH POWERED TRIPOD TELESCOPE



ONLY **45/-**
NO MORE TO PAY

**Advantageous Purchase Direct from Importer. 750 only at fraction of the true value.** Special grade A.1 De Luxe model—passed by Japanese Board of Inspection. All Metal construction in Black Crackle finish with plated parts and simulated leather covering. Special polished optical lens gives astounding **magnification** power of 900-1 areas. Single draw focusing tube enables you to study the **MOON, PLANETS & STARS.** Independent view finder permits you to focus on subjects miles away or just across the road. Brand new complete with collapsible tripod at unbelievable price of only 45/- plus 5/- post and **SAFE PACKING.** Satisfaction or your money back.

Shipment of newest Optical Development
NOW A HIGH POWERED
10-25 x 30 mm.

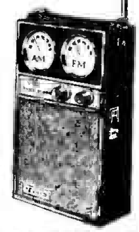
at a price lower than ordinary models.

## ZOOM TELESCOPE

YOURS FOR **54/6** NO MORE TO PAY

Limited number only available at this price. Japanese high grade optical lenses give **staggering magnification**, simply focus on the object you wish to view (moon, stars, boats, horses, etc.) turn the **ZOOM CONTROL** and see the object shoot towards you. Strong all-metal construction. Gives hours of constant enjoyment to all—**A REALLY WONDERFUL BARGAIN.**—Send only 54/6 plus 4/6 p. & p. for 7 days' home trial. *Money refunded if not delighted.*

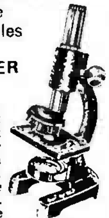
10 Transistors, 3 Diodes, 2 Wavebands
## AM/FM PORTABLE. By reputable Manufacturer at fraction of original price. 500 only at **£10.19.6**




You've never seen such quality as this superb 1967 luxury model—large size, 7" x 4" x 2", in permanent hand stitched real cowhide case magnificent silver and black finish, retractable 6 section telescopic rod aerial. It also covers F.M. waveband 88 108 megacycles *—overhear many interesting and important broadcasts.* Interference-free tone, high sensitivity, fantastic range brings in dozens of stations incl. B.B.C.. Continentals, etc. Slashed price for cash—only £10.19.6 + 4/6 registered p. & p. (personal phone, 4 batteries, etc., 7/6 ex.)

Profit from the credit squeeze
Importers stock bought at miles below actual value

## WIDE RANGE HIGH POWER MICROSCOPE only 37/6



**not a penny more to pay. Grade A.1 De Luxe model, all** *metal* construction in black crackle with plated parts. Accurate rack and pinion focusing gives crystal clear definition. 3 *optically polished lenses on revolving turret, giving* **100x, 200x and 300x magnification powers.** Adjustable mirror light, reflector and tilting joint. Ideal for students, hobbyists, nature study, etc. Should last a lifetime—Passed by Japanese Board of Inspection. **Brand new in box,** *complete with set of slides at fraction of real worth*—**ONLY 37/6 plus 3/6 post & safe packing.** *Money back guarantee. Demonstrations daily.*

3500 Bought at "Rock Bottom" Off Leading British Maker

## REAL EPISCOPE PROJECTOR

ONLY **45/-**

No more to pay! Projects **FULL SIZE** Magnified **PICTURE** onto your wall or screen in **BLACK & WHITE OR COLOUR** with **CRYSTAL CLARITY ANY PHOTOGRAPH, DOCUMENT,** picture drawing, stamp etc. Entertaining and educational—hundreds of uses in home, office, schoolroom, etc. **A FULL SIZE** precision made scientific instrument **WITH REAL GLASS REFLEX LENS.** *Sturdy, reliable.* So simple even a child can use it—plugs into standard mains. **BRAND NEW** complete with cable, lamp, etc. *Offered at fraction of real worth at 45/- plus 4/6d. P. & P. Satisfaction or money back.*

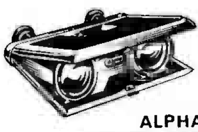
Large Bulk Purchase—Thus Large Cash Saving 1967 Model ALL

## TRANSISTOR CAR RADIO

7 Semi-Conductors
5 Push Buttons
2 Full Wavebands

INCREDIBLY SLASHED PRICE **£11.19.6** including Extras

Leading manufacturers high specification—Full 2 watts output, superb tone from dynamic 6" x 4" elliptical speaker, uncannily sensitive, latest drift transistor, full med. & long waves, all-metal construction—*not plastic*, exquisite black and silver finish, precision slide rule tuning brings in all B.B.C. and dozens of Continentals WITHOUT FADING. Utterly simple to install to any 12 volt system. Complete with all accessories, WRITTEN GUARANTEE. Simple instructions, size $6\frac{1}{4}$" x 6" x 2". Amazing price, cash £11.19.6 + 6/6 registered post/safe packing. Order confidently, your money back immediately if not 100% satisfied.



Scoop Purchase by our Overseas Agent. Exact source cannot be disclosed due to drastically reduced price.

## THE LATEST ALPHA HIGH POWERED SECRET AGENT CIGAR CASE BINOCULARS

**Not repeatable at our price. NOW ONLY 39/6**

The miniaturisations of modern technology and the increased activity of secret agents in every field have combined to produce these remarkably ingenious cigar case binoculars. At first glance the simulated leather case with plated fittings seems quite normal but press the button and **PRESTO!** the case springs quietly open to reveal a **POWERFUL** pair of lenses—rotate a concealed focusing wheel and you have an amazing pair of binoculars. Limited number available in this country so rush your order. Send only 39/6 plus 4/6 p. & p. for free home trial. *Full written guarantee—money refunded in full if not the most intriguing purchase of a lifetime.*


Price barrier smashed by this amazing purchase

## New 35 mm. Automatic Light SLIDE VIEWER

ONLY **34/6**
No more to pay.

To our knowledge the lowest price ever.

This is really a remarkable bargain—just compare our price. The precision made viewer lights up automatically as slide moves into viewing position and is then highly magnified by the extra large viewing panel. **BRAND NEW in MAKER'S CARTON, RUSH YOUR ORDER—WE EXPECT TO SELL OUT VERY QUICKLY.** Send only 34/6 plus 3/6 p. & p. *Examine at home, money back if not delighted.*

New to Great Britain—Just arrived at the Docks

## THE LATEST AUTOMATIC SELF SHARPENING PORTABLE ELECTRIC RAZOR

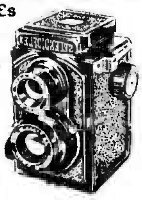
Complete shipment purchased at amazingly low price.

ONLY **39/6**

**PORTABLE ELECTRIC RAZOR**—Shave anywhere at any time. Long life blades sharpen themselves automatically. Circular shaving surface is designed to give the closest possible shave. Power unit and shaver fits neatly into the zip-up case which is beautifully lined to give that luxury finish. **LIMITED QUANTITY** so rush your orders whilst stocks last. **FULLY GUARANTEED.** Send only 39/6 plus 3/6 p. & p. for 7 days' home trial. *Money back is not the bargain of a lifetime.*

Scoop purchase, save ££s

## NEW DOUBLE LENS REFLEX CAMERA



ONLY **19/6** Plus 3/6 P. & P.

**You'll never get another bargain like this!** Advantageous purchase from distressed importer offered **at fraction of real worth—unrepeatable once this batch sold.** Full size double lens reflex camera that even a child can use. Takes 12 full size 127 pictures in **Full colour or black/white. You'll marvel at your professional pictures.** Beautifully made and finished, size $4\frac{1}{4}$in. high (6in. high with focusing hood raised) x $3\frac{1}{4}$in. x $3\frac{1}{4}$in. Speeds 1/30th sec. F8. Should last a lifetime. Brand new in makers' cartons—our give-away price 19/6 + 3/6 p. & p.

500 only bought from Importer hard pressed by credit squeeze.

## Gold Plated AUTOMATIC Self Winding LEVER WATCH

**£7.19.6** *not a penny more to pay*

Save Pounds—*check prices locally yourself!* High specification by internationally acclaimed Swiss Manufacturer (whose name we've promised not to mention due to unprecedented price slashing). 25 jewelled **LEVER** movement—don't confuse with inferior pin pallet movements. Ten micron **GOLD PLATED CASE.** Automatic self-winding. Automatic calendar. **GENUINE INCABOC.** Unbreakable mainspring. Waterproof S'steel back. *Chronometer mathematical accuracy.* **DON'T HESITATE** *at our once sold never repeatable price*—£7.19.6 inc. 6 months guarantee + 4/6. P. & P. + Insurance. (22ct gold plated bracelet 15/- ex. or strap 7/6 ex.) **ORDER WITH CONFIDENCE—YOUR MONEY REFUNDED IF NOT 100% DELIGHTED.**

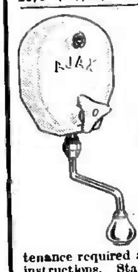
The latest development in

## TRANSISTORISED TELEPHONE AMPLIFIERS with Fingertip Control

New Low Price

ONLY **69/6**

The superb new streamlined desk consol houses a remarkably powerful two-way telephone amplifier. Fits easily to any standard telephone in seconds and enables anyone in the room or office to hear the telephone conversation if required. Leaves both hands free for taking notes—always hear every word. **LIMITED QUANTITY AVAILABLE.** only 750 left at 69/6 plus 4/6 p. & p. *Full satisfaction or your money refunded in full.*




Amazing Bulk Purchase of Famous

## AJAX INSTANT WATER HEATERS

*You profit from credit squeeze.*

Our Price Only **£6.19.6** Complete 500 only

Save yourself pounds. **Now instant hot water costs less than 1d. per day with this fantastic electric water heater. Overall height 12in.** Beautifully designed white, easy clean casing with brilliant chrome swinging nozzle. Red pilot light glows when on. Completely safe, reliable. no maintenance required and simply installed with step-by-step instructions. Standard fitting for A.C. mains. Fully Guaranteed and boxed in maker's carton. 500 only at the Lowest Ever Price £6.19.6, plus 6/6 P. & P. Money instantly refunded if not delighted.

Direct import of manufacturers stocks. Purchase at "give away" price. 950 only.

## Amazingly accurate Multi-Jewelled Gent's WRISTWATCH

At our crazy 'lowest ever' price you can't go wrong.

Only **49/6** No more to pay

This is the chance of a lifetime to own a really beautifully designed and finished watch with all the latest luxury features. **THIS UNREPEATABLE BARGAIN** is multi-jewelled with stainless steel back, diamond tooled. antimagnetic, electrically timed for accuracy, water and dust resistant, wide sweep second hand, luminous hour and minute hands. Slim Evergold case complete with matching strap in reputable maker's box. Positively our finest ever bargain at this price. Send only 49/6 plus 4/6 p. & p. for 7 days' free trial—*money refunded if not delighted.*

This is truly a wonder purchase Limited quantity Only of

## FABULOUS EVERGOLD POCKET WATCHES

Now at the lowest ever price. ONLY **25/-** No More To Pay

Now offered at well below clearance price these remarkably reliable EVERGOLD pocket watches. Designed to withstand years of constant use with high resistant unbreakable glass. Luminous face markings—so easy to see the correct time at a glance. **DON'T MISS THIS ONCE IN A LIFETIME BARGAIN.** Send only 25/- plus 3/6 p. & p. for 7 days' free home trial. *Money back if not your best ever bargain.*

**CONCORD ELECTRONICS LIMITED** (P.W.33) 87-89 TABERNACLE ST., LONDON, E.C.2. (Callers Welcome)

# FOR MONEY SAVING CHRISTMAS GIFTS ! ! ! !

## SOLID STATE "7"

**Direct Import Scoop. 2 complete crates only with 1750 of these amazing 7 TRANSISTOR full variable waveband radios.**

You could pay 6 gns. for this performance.

**OUR CRAZY PRICE 58/6**

Your chance to own this remarkable FULL SIZE 7 TRANSISTOR PORTABLE at the lowest ever price. The improved internal ferrite aerial—works in car, boat or plane—pulls in loud and clear all the programmes—B.B.C., Luxembourg, Pirates etc. the full sized speaker gives high sensitivity and room filling volume. Brand New and Boxed in Maker's carton—1750 only at 58/6 plus 4/6 p. & p. (Carrying case, Battery and Earpiece 7/6 extra).

## *New Sensational Price Breakthrough* DIRECT IMPORT 1000 only High powered PORTABLE TAPE RECORDERS

**You've seen recorders at more than twice our price**

**NOW ONLY £5.19.6**

At last a highly sensitive full-sized tape recorder at a price you can afford. "NOT A TOY" — but a beautifully designed instrument which is solidly assembled on a rigid steel chassis. You'll be amazed at the fine reproduction of sound for all purposes including dictating, notes, party fun, etc. Fingertip control for volume and selector switch. Hand Microphone has unique REMOTE CONTROL on/off switch for accurate recording and playback. 1000 only at £5.19.6, plus 5/6 p. & p. (Tape, Spare Spool, Microphone, Batteries and Earphone 15/- extra.)

## Miraculous Scoop from Swiss Mnfr.

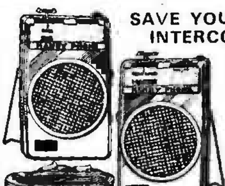
Limited Shipment NEW

## 23 JEWELLED DIVER'S WATCH

**with Rotating Timing Bezel. Staggering price reduction—compare prices locally, 950 only at £5.2.6**

Make a genuine LARGE CASH SAVING on this high-quality watch, 200 vacuum tested for depth. 23 Jewelled movement. Shock-proof, electronically timed, lum. dial and hands. Ideal for skin-divers, sailing, motoring, research work for accuracy. FULLY GUARANTEED. Send only **£5.2.6 plus 4/6 p. & p.** TES TA THOME. Money back guarantee. (Rot-proof strap 7/6 extra.) STAINLESS STEEL expanding bracelet 12/6 extra.

## SAVE YOUR LEGS! INTERCOM OUTFIT & BABY ALARM

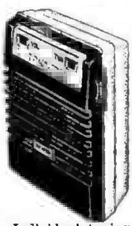


**Ready Built**

**Only 52/6**

Robustly made, brand new current models. You get 2 separate fully transistorised intercommunicating sets—each can speak or listen to the other—complete with 60ft. connecting wire. **Fixed in a flash.** Ends baby-crying worries. Ideal for Workshop to House, Sickroom, hundreds of uses! Hangs on wall or stands up. Our absurd price 52/6, battery 2/6 extra. Post, etc. 3/6.

## NEW FULLY TRANSISTORISED PORTABLE RADIOS

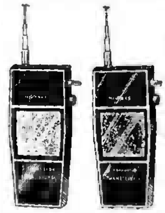


**with Full Variable waveband. NOW A FRACTION OF THE NORMAL PRICE**

**ONLY 39/6**

**WHY PAY MORE?** All the latest refinements are packed into this new MULTI-STATION ALL Transistor radio—the internal aerial picks up even the remote stations and the powerful built-in speaker gives room filling volume. Individual tuning, first-class reception. Purchase with confidence—packed in original manufacturer's cartons. (*Personal earpiece and battery* 4/6). Send 39/6 plus 4/6 p. & p.

## Frustrated Import Shipment OFFERED BELOW HALF PRICE TO CLEAR 500 only 5 TRANSISTOR PERSONAL TRANS-CEIVER SETS

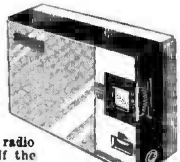


**OUR PRICE £7.19.6**

You've heard about them—You've read about them. NOW YOUR CHANCE TO OWN THEM. Highly sensitive two-way transistor transceiver sets have individual volume control and talk-listen switch. Telescopic aerial pulls in the voice from the other set over tremendous distances—no wires—a genuine transceiver as used by official bodies and forces. 500 sets only at £7.19.6 plus 5/6 p & p. (Batteries, leather cases, etc. 10/6 extra.) Money back if not delighted with the performance. These cannot be operated in the U.K.

**Limited Import Shipment**

## INTERNATIONAL SATELLITE 8 PORTABLE Transistor RADIO



**2 Full Wave Bands**
**Why Pay 12 gns.?**

**NOW ONLY 85/-**

**Famous Satellite portable radio** now offered well below half the price of comparable models. **Pulls in your favourite stations.** (Pirates, B.B.C., Luxembourg, etc.)—even International. Internal aerial, larger speaker, combine to give crystal clear reception INDOORS and OUT. **Why pay 12 gns.?** Send 85/- plus 4/6 p. & p. (Cowhide carry case, earpiece, battery etc. 8/6 extra.)

**Complete unopened crate of 1,000 only superb 1966 full variable waveband 6-transistor full-size portables worth £6.**

**Half Price Offer 1,000 Only 44/6**

Your chance to own one of these famous RADIOS—as make recommended on TV April 7th. Amazing new-type internal ferrite aerial—works in car, boat or plane—pulls in all your favourite programmes, B.B.C., Pirates and Luxembourg. Gives room-filling volume and amazing tone from famous "Foster" speaker. 1,000 only. Brand New with 6 Months Guarantee at 44/6 plus 4/6 p. & p. for 7 days' free trial—*your money back if it doesn't out-perform sets costing treble.* (Carrying case, etc. Battery, Earpiece, etc. 7/6 extra). Demonstrations Daily.

*Don't be put off by amazing low price—we bought bankrupt stock.*

## NAVAL (Pattern) BINOCULARS

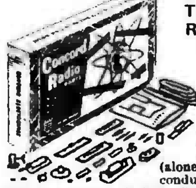
**40mm. O.G. lens**

**45/-**

**NO MORE TO PAY**

including real pigskin case. Superb area magnifications of 15 times. Brand new. Grade A.2 de luxe model by leading optical manufacturer. **Full size, metal construction, lightweight,** precision ground and polished optical lenses for wide angle, needle sharp definition. *Telescopic draw tubes with smooth action centre focusing and inter-pupilary pivot.* Takes you into space or just across the road. Save £ £ £'s—**ONLY 45/-, incl. real pigskin case and shoulder strap, plus 4/6 p. & p.** Order quickly while limited stocks last. *Money back guarantee.*

## Make 5 different TRANSISTOR RADIOS for 39/6



**No Experience Necessary**

**No soldering. Only 8 connections for first radio to work.** Just look, you get **Easy ABC Plans, Cabinet, Loudspeaker (alone 17/6). Earphone, 4 Semi-conductors, Coils, Condensers, Resistors, Tuner, Switch, Screws, etc. YES—EVERYTHING.** Loud clear English and Foreign reception. As supplied to Educational Authorities, H.M. Forces, etc. **TESTIMONIALS GALORE. Mr. R. O'D of Londonderry, writes:** "*. . . I received your components and I must say that I am very satisfied with them, I have it already set up! . . .*" **COMPLETE HOME/RADIO COURSE.** Originally £6 **SEND ONLY** plus 39/6, 3/6 post etc. Parts available separately.

## NO SOLDERING AMAZING CIGARETTE RADIO

**ONLY 25/-**

**Yes a perfectly ordinary packet of cigarettes! But** watch your friends astonishment on hearing it fetch in station after station, loud and clear! **Still holds 10 cigarettes—yet cleverly conceals highly sensitive, fully transistorised circuit (including tiny battery). Even a young boy can assemble it in under 2 hours. No soldering. No experience necessary. Only 16 connections to make. Ideal for taking to work with you. From our bulging testimonial file. Mr. D. B. of Huddersfield, writes:** "*. . . I have fitted the parts in it and it is working wonderfully . . .*" ALL PARTS including Semi-Conductors, ABC Plans, etc. ONLY 25/-, plus 2/6 post, etc. *Parts Available Separately.*

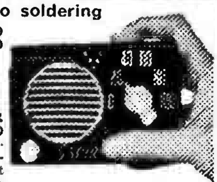
## Scoop at the Docks—a Complete Unopened Crate FULLY AUTOMATIC SELF-WINDING 21 JEWELLED DATE WATCHES

*Fraction of real worth*

**NOW ONLY 98/6** *compare prices locally*

**1,500** only to be cleared at below half price. Gent's calendar watch by reputable Swiss maker. Luxurious gold finish, stainless steel screw back—shock resistant, anti-magnetic, water resistant. Unbreakable mainspring—21 Fully Working jewels. Electronically timed. Send 98/6, plus 4/6 p. & p. Matching expanding bracelet 10/6 extra. **Brand New with guarantee.**

## NEW RADIO No soldering



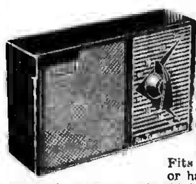
**VOLKSRADIO ANYONE CAN BUILD IN 2-3 HOURS**

**ONLY 25/-**

**EVEN THE OLDER CHILDREN BUILD THEM!** . . . no soldering—only 16 connections! then hear it reach out bringing in station after station, loud and clear. Palm-of-hand size 4¾ x 2¾ x 1¼in. Many Testimonials: **M. H. of Bradford writes:** "*. . . I have just completed one of your sets successfully, it is the first time I have ever tackled anything like radio, and I must state here and now, I am amazed how easy it is to a layman like me. Your instructions and plan have obviously been very carefully thought out so that even the most dim can follow them . . .*" **Direct from Manufacturers to You. Send 25/- plus 2/6 post, etc.**

*PARTS AVAILABLE SEPARATELY.*

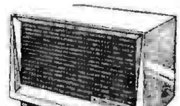
## TRANSISTOR POCKET RADIOS with Loudspeaker. Bulk Purchase Enables us to Make this Fantastic Offer



**Only 32/6** *No more to pay*

The "SAN REMO" so tuned that it brings the voices of star vocalists dramatically to life — in your home, office, etc. **Only 4¾ x 2¾ x 1¼in.** Fits easily into your pocket or handbag. Works for months off 1/2d. battery. Should last a lifetime, **anyone can assemble it in an hour or two with our easy plan.** Miniature speaker—everything, only 32/6. 2/6 p. & p. (Parts can be bought separately). Limited supply—so rush your order before it's too late.

## Miraculous Import Purchase 200 Only NOW HAVE MUSIC IN EVERY ROOM Extension speaker



**More than doubles the value of your radio.**

**For Only 29/6 Complete**

Just place this ultra modern extension speaker in any room and tune in to your favourite programmes—Now you can relay even from HI-FI radiograms down to transistor portables. Simply place in position or fix on wall and plug in the long lead supplied. What could be easier? **DON'T MISS THIS AMAZING BARGAIN,** remember 200 only at this price 29/6, plus 3/6 p. & p. Money instantly refunded if not worth more than double.

# CONCORD ELECTRONICS LIMITED

(P.W.33) 87-89 TABERNACLE ST., LONDON, E.C.2.
**CALLERS WELCOME—DEMONSTRATIONS DAILY**

**R·S·C** HI-FI CENTRES LTD.

**MAIL ORDERS TO:** 102 Henconner Lane Bramley, Leeds 13

Terms: C.W.O. or C.O.D. No C.O.D. under £1. Postage 3/6 extra under £2. 5/6 extra under £5. Trade Supplied. S.A.E. with all enquiries please. — **Personal shoppers welcome at the following branches. Open all day Sats.**

**BRADFORD** 10 North Parade. Tel. (Half-day Wed.) 25349

**BRISTOL** 14 Lower Castle St. Tel. (Half-day Wed.) 22904

**BIRMINGHAM** 30/31 Gt. Western Arcade, opp. Snow Hill Station. CENtral 1279. No half-day

**DERBY** 26 Osmaston Rd., The Spot (Half-day Wed.) Tel.: 41361

**DARLINGTON** 13 Post House Wynd (Half-day Wednesday) Tel.: 68043

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**GLASGOW** 326 Argyle St. Tel.: (No half-day) CITy 4158

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**MANCHESTER** New large store. (No half-day) 60A-60B Oldham St. Tel.: CENtral 2778

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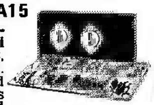
**SHEFFIELD** 13 Exchange Street Castle Market Bldgs. Tel.: 20716 (Half-day Thursday)

**ALL LEADING MAKES OF HI-FI EQUIP. STOCKED Cash or Terms**

## 15 watt HI-FI TRANSISTORISED AMPLIFIER TYPE A15



**with integral pre-amp tone control stages.** Output for 3, 7.5 and 15 ohm spkrs. Kit includes Printed Circuit and all parts including 9 Mullard or Newmarket latest type semi-conductors **£6.19.9** Post 5/- Heat sink and full wiring instructions or with printed circuit fully wired and tested **30/- extra. Frequency Response:** ± 1dB 20-20,000 cps. **Harmonic Distortion:** 0.1% measured at 1000 c.p.s. **Hum and Noise:** —80dB. **Sensitivity:** 2mV. **Bass Control:** +9dB to —14dB at 40 c.p.s. **Treble Control:** +8dB to —13dB at 10 Kc/s. Suitable Power Pack Kit 39/6 or ready built 59/6.

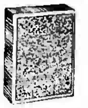
Total cost of parts with detailed wiring diagrams and instructions. **12½ Gns.** Or factory built 15½ Gns. Or in Teak finished cabinet Carr. 10/- as illustrated 19½ Gns. Terms: Deposit £5 and 9 mthly payments 39/- Total £22.11.0.

# LONDON-NEWCASTLE

New branches now open — see addresses

## HI-FI LOUDSPEAKER ENCLOSURES

**All types of pleasing modern "slimline" design acoustically lined and ported and in alternative finishes of light Teak or medium Walnut.**



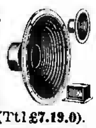
**SE8.** For optimum performance with any Hi-Fi 8in. speaker. Size 22 x 15 x 7in. Carr. 7/6 **£5.15.0**

**SE10.** For 10in. Hi-Fi speaker with provision for tweeter. Size 24 x 15 x 7½in. **£6.19.9** Carr. 10/-

**SE12.** For outstanding performance with any 12in. Hi-Fi speaker. Cut for tweeter. Size 24 x 20 x 7½in. Or Deposit 27/- and 9 monthly payments of 18/2 (Total £9.10.6.) **8 Gns.** Carr. 10/-

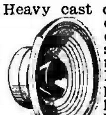
**FHE8.** Folded Horn type. Size 27 x 16 x 10in. Designed for high flux 8in. speaker with which exceptional quality can be obtained. Terms Deposit 21/- and 9 monthly payments 21/-. (Total 10 Gns). **9 Gns.** Carr. 10/-

## AUDIOTRINE HI-FI 'SPEAKER SYSTEMS



Consisting of matched 12in. 12,000 line, 15 ohm high quality speaker; cross-over unit and Tweeter. Smooth response and extended frequency range ensure surprisingly realistic reproduction. Standard 10 watt rating. Or **Senior 20 watt** inc. Fane 122/10 speaker £6.19.9. Carr. **5 Gns.** Carr. 5/6 7/6. Or Dep. 21/- and 9 mthly pmts of 15/4 (Ttl £7.19.0).

## AUDIOTRINE HIGH FIDELITY 'SPEAKERS



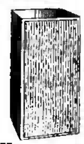
Heavy cast construction. Latest high efficency ceramic magnets. Dual Cone for extended frequency range. Plastic treated surround giving low fundamental resonance. Response 30-20,000 c.p.s., Impedance 3 or 15 ohms. Carr. 5/6.

| | | | |
|---|---|---|---|
| **HF811D** | 8 in. | 10 WATT | 4 Gns. |
| **HF1010D** | 10 in. | 15 WATT | £5.15.0 |
| **HF121D** | 12 in. | 20 WATT | £6.15.0 |
| **HF127D** | 12 in. | 30 WATT | 9 Gns. |

**TWEETERS R.A. 3 ohm 25/9. 15 ohm 25/9**

## HIGH FIDELITY LOUDSPEAKER UNITS

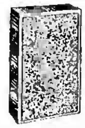
**Cabinets of latest styling finished Satin Teak or Walnut, acoustically lined (and ported where appropriate.)**



**MINI-8** 8 WATT rating. 3 or 15 ohm. Frequency response 50-13,000 c.p.s. Specially designed high flux 5in. speaker with low fundamental resonance. Handsome Teak veneered cabinet. 10½ x 6½ x 7½in. Carr. 7/6 **£6/19/6**

**THE 'PETITE'** Really astounding performance. Size only 10½ x 6½ x 7½in. **Rating 10 watts. Frequency** range 45-20,000 c.p.s. Fitted specially designed Heavy cast 5in. speaker with large pole pieces, extra long voice coil and rubber cone surround. Impedance 3 ohms or 15 ohms. Or Deposit 36/- and 9 monthly payments of 25/- (Total £13.1.0). **11 Gns.**

**The GLOUCESTER** Handsome "slimline" cabinet. Size 24 x 20 x 6½in. 12 in. high flux 12,000 line speaker. Cross-over unit and Tweeter. Rating 10 watts. Smooth response 40-20,000 c.p.s. Impedance 15 ohms. Or Deposit 36/- and 9 monthly payments 25/- (Total £13.1.0). **11 Gns.** Carr. 15/-



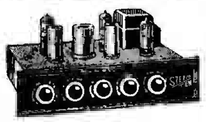
**The BRONTE** Size 22 x 15 x 7½in. Fitted Wharfedale Super 8 RSDD Speaker, with Roll surround and dual cone. Rating 6 watts. Impedance 15 ohms. Or Deposit 39/- and 9 monthly payments 27/3 (Total £14.4.3.). Carr. 15/- **12 Gns.**

## AUDIOTRINE PLINTHS

for Record Playing units. Teak finish for Garrard 1000, 2000, 3000, AT60, SP25 or Goldring GL68. Available with clear Perspex cover as illustrated £5.19.11. complete **66/-**

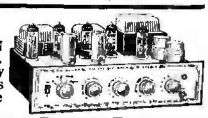
**LINEAR TAPE PRE-AMPLIFIER.** Type LP/1 **Switched Equalisation. Positions for Recording at 1⅞in., 3¾in., 7½in. per sec., and Playback. EM84 Recording Level Indicator. Designed primarily as the link between a Magnavox Tape Deck and Hi-Fi amplifier, suitable most Tape Decks.** Terms available. **10½ Gns.**

## R.S.C. STEREO/TEN HIGH QUALITY AMPLIFIER



A complete set of parts for the construction of a unit giving 5 watts high quality output on each channel (total 10 watts). Sensitivity is 50 millivolts. Suitable all crystal or ceramic stereo heads. Ganged Bass and Treble Controls. Provision is made for use as straight (monaural) 10 watt amplifier. Valve line-up ECC83, ECC83, EL84, EL84, EZ81. Outputs for 2-3 ohm speakers. Point to point wiring diagrams and instructions supplied. Send S.A.E. for leaflet. Or supplied factory assembled with 12 months' guarantee for 11 gns. **Terms:** Dep. 36/- and 9 monthly payments 25/5 (Total £13.4.9). Carr. 11/6 **£8.15.0**

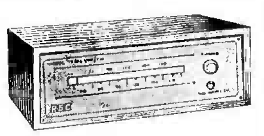
## R.S.C. STEREO/20 HIGH FIDELITY AMPLIFIER



**PROVIDING 10/14 WATT ULTRA LINEAR PUSH-PULL OUTPUT ON EACH CHANNEL. SUITABLE FOR "MIKE", GRAM, RADIO OR TAPE.** Employing valves ECC83, ECC83, ECL86, ECL86, ECL86, ECL86, EZ81. **Frequency Response:** ±2dB 30-20,000 c.p.s. **Hum Level:** 65dB down. **Sensitivity:** 5 millivolts maximum. **Harmonic Distortion:** (each channel): 0.2%. ★ **Four-position tone compensation and Input Selector Switch.** ★ **Stereo/Mono switch.** ★ **Will amplify direct from Tape Heads.** ★ **Neon panel indicator.** ★ **Handsome Perspex Frontplate.** ★ **Separate Bass "Lift" and "Cut" and treble "Lift" and "Cut" controls.** Output transformers are high-quality sectionally wound to required specification. Output matching for 3 and 15 ohm speakers on each channel. Complete set of parts with point-to-point wiring diagrams and instructions. Send s.a.e. for leaflet. Carr. 12/6 **14 Gns.**

Or factory assembled, tested and supplied with our usual 12 months guarantee. Or Deposit £3 and 9 monthly payments 43/2 (Total £22.4.6). Carr. 12/6 **19 Gns.**

## R.S.C. TFM1 TRANSISTORISED VHF/FM RADIO TUNER



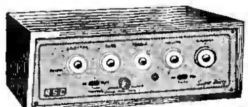
★ **High-sensitivity** ★ **200-250v. A.C. Mains operation.** ★ **Sharp A.M. Rejection.** ★ **Drift-free reception.** ★ **Output ample for any amplifier (approx. 500 m.v.).** ★ **Simple alignment instructions.** ★ **Output available for feeding tuning meter.** ★ **Output for feeding Stereo Multi-plexer.** ★ **Tuner head using Silicon Planar Transistors.** ★ **Designed for standard 80 ohm co-axial input.**

Made to visually match 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 first grade transistors and components used. Our latest product giving you the best at half the cost.

## R.S.C. SUPER 15 HI-FI AMPLIFIER

**FULLY TRANSISTORISED** 200/250v. A.C. Mains.
**OUTPUT 10 WATTS R.M.S.** cont. into 15 ohms.
**15 WATTS R.M.S.** cont. into 3-4 ohms.
Maximum instantaneous Peak power output 28 watts.
**PRINTED CIRCUIT CONSTRUCTION.**
**LATEST MULLARD TRANSISTORS.** AD149, AD149, OC127Z, OC81Z, OC44, OC44, OC81Z, OC44, AC107.
**5 POSITION INPUT SELECTOR SWITCH**
**EQUALISATION** to Standard R.I.A.A. and C.C.I.R. Characteristics for Gram and Tape Heads.
**FULL TAPE MONITORING FACILITIES.**
**SENSITIVITIES:** Magnetic P.U. 4 mV. Crystal or Ceramic P.U. 400 mV. Microphone 4.5 mV. Tape Head 2.5 mV. Radio/Aux or Ceramic P.U. 110 mV.
**FREQUENCY RESPONSE:** ± 2dB 20-20,000 c.p.s.
**TREBLE CONTROL:** +15dB to —14dB at 10 Kc/s.
**BASS CONTROL:** +12dB to —15dB at 50 c/s. **HUM LEVEL:** —75dB.
**HARMONIC DISTORTION** at 10 Watts R.M.S. 1.000 c.p.s. 0.3%.
**NEGATIVE FEEDBACK:** 52dB. Carr. 10/-
Complete Kit of parts with full constructional details and point to point wiring diagrams. **10½ Gns.**
Supplied factory built 14½ Gns. Or fitted in beautiful Walnut or Teak veneered cabinet as illustrated, 18½ Gns.
Or Deposit £3.9.0 and 9 mthly pmts 40/6 (Total £21.13.6). Carr. 12/6.
**ALL COMPONENTS ETC. ARE OF A HIGH STANDARD AND SUPPLIED BY LEADING BRITISH MANUFACTURERS.**

**TECHNICAL SPECIFICATIONS COMPARE MORE THAN FAVOURABLY with SIMILAR AMPLIFIERS AT TWICE THE COST**



## R.S.C. SUPER 30 STEREO AMPLIFIER

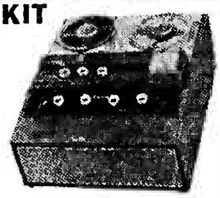
**A DUAL CHANNEL VERSION OF THE SUPER 15.** Employing Twin Printed Circuits. Close tolerance Ganged Pots. Matched Components.
**CROSS TALK:** —52dB at 1,000 c.p.s.
**CONTROLS:** 5 position Input Selector, Bass Control, Treble Control, Volume Control, Balance Control, Stereo/Mono Switch, Tape Monitor Switch, Mains Switch.
**INPUT SOCKETS** (Matched Pairs). (1) Magnetic P.U. (2) Ceramic or Crystal P.U. (3) Radio/Aux. (4) Tape Head/Microphone.
Operation of the Input Selector Switch assures appropriate equalisation.
Rigid 18 s.w.g. Chassis. Size approx. 12in. Wide, 3in. High and 8in. Deep. Neon Panel Indicator. Attractive Facia Plate and Spun Silver Matching Knobs. Above facilities, etc., except for Ganging and Balance Control, apply also to Super 15.
**THESE UNITS ARE EMINENTLY SUITABLE FOR USE WITH ANY MAKE OF PICK-UP OR MICROPHONE (Crystal, Ceramic, Magnetic, Moving Coil, Ribbon) CURRENTLY AVAILABLE. SUPERB SOUND OUTPUT QUALITY CAN BE OBTAINED BY USING WITH FIRST RATE ANCILLARY EQUIPMENT.** All required parts, point to point wiring diagrams and detailed instructions. Carr. 12/6 **18 Gns.**
Unit factory built 25 Gns. or deposit 81/- and 9 monthly payments 55/9 (Total £29.2.9). Fitted cabinet as Super 15 29 Gns. Carr. 15/- or Deposit £4.12.0 and 9 mthly paymts 64/10 (Total £33.15.6). *Send S.A.E. for leaflet.*

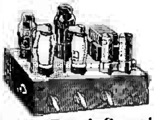
## AUDIOTRINE HI-FI TAPE RECORDER KIT

**REALISM AT INCREDIBLY LOW COST. CAN BE ASSEMBLED IN AN HOUR. ONLY 4 PAIRS OF SOLDERED JOINTS PLUS MAINS.**

Incorporating the latest Magnavox Tapedeck. The Audiotrine High Quality Tape Amplifier with switched equalisation for each of 3 speeds. High Flux P.M. Speaker, empty Tape Spool, a Reel of Best Quality Tape and a handsome Portable Cabinet of latest styling finished dark grey leathercloth. Size 14½ x 17 x 8½in. and circuit. Purchased separately would total approx. £34. Performance equal to units in the £50-£60 class.

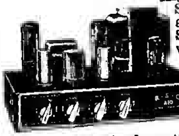
**26½ Gns.** Carr. 19/6. S.A.E. for leaflet. Or **Deposit** 4 gns. and 9 monthly payments of 59/6 (Total 29½ gns.). 4 Track Model 3 gns. extra.





## R.S.C. 4/5 watt A5 HIGH GAIN AMPLIFIER

**A highly-sensitive 4-valve quality amplifier for the home, small club, etc. Suitable for all crystal or ceramic P.U. heads and practically all "mikes". Separate Bass and Treble controls giving "lift" and "cut". Hum level 71dB down. Negative Feedback 15dB. Reserve power supply 300v 25 m.a., 6.3v 1.5 a. for Radio Tuner or Tape Pre-amp. For A.C. mains 200-250v. Speaker output 3 ohms. Complete in every detail with fully punched enamelled chassis, point-to-point wiring diagrams and instructions. Or assembled ready for use 6 gns. plus 5/6 carr.** **£4.17.9**



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

Highly sensitive. Push-Pull **high** output, with Pre-amp./Tone Control Stages. Performance figures equal to most expensive amplifiers available. Hum level—70dB. Frequency response ±3dB 30-20,000 c/s. Specially designed sectionally wound ultra linear output transformer with 807 output valves. All first grade components. Valves EF86, EF86, ECC83, 807, 807, GZ34. Separate Bass and Treble Controls. Sensitivity 12 millivolts so that **any kind of Microphone or Pick-up is suitable.** Designed for **Clubs, Schools, Theatres, Dance Halls or Outdoor Functions,** etc. For use with **Electronic Organ, Guitar, String Bass,** etc. Gram, Radio or Tape. Reserve L.T. and H.T. for **Radio Tuner.** Two inputs with associated volume controls so that two separate inputs such as Gram and "Mike" can be mixed. 200-250v. 50 c/s A.C. mains. For 3 and 15 ohm speakers. Complete kit of parts fully punched chassis, point to point wiring diagrams and instructions. **12 Gns.** Carr. 12/6. Supplied factory built with EL34 output valves, 12 months guarantee for 15 gns. If required perforated cover with carrying handles can be supplied for 21/-. Send s.a.e. for leaflet. **TERMS: Deposit 48/- and 9 monthly payments of 33/7 (Total £17.10.3).**

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

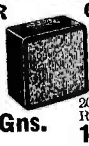
**PUSH-PULL ULTRA LINEAR OUTPUT "BUILT-IN" TONE CONTROL PRE-AMP** Two input sockets with associated controls allow mixing of "mike" and gram. etc., etc. High sensitivity. **Valves ECC83, ECC83, EL84, EL84, EZ81. High quality** sectionally wound output transformer specially designed for Ultra Linear operation and reliable small condensers of current manufacture. INDIVIDUAL CONTROLS FOR BASS AND TREBLE. Frequency response ±3dB 30-20,000 c/s. Six negative feedback loops. Hum level —60dB. SENSITIVITY 23 millivolts. Suitable for Crystal or Ceramic P.Us. all types "mikes". Comparable with the very best designs. **For Musical Instruments** such as **String Bass, Electronic Guitars,** etc. **Reserve Power** provides 300v. 30mA. and 6.3v. 1.5a. for **Radio Tuner** or **Tape Pre-amp.** Size approx. 12 x 9 x 7in. For A.C. mains 200-250v. 50 c.p.s. Output for 3 and 15 ohm speakers. Kit complete to last nut. Chassis fully punched. Full instructions and point-to-point wiring diagrams (or factory built **£11.15.0**). ONLY **£8.15.0** Carr. 11/6. Metal covers with 2 carrying handles can be supplied for **21/-. TERMS ON ASSEMBLED UNITS: Deposit** 36/6 and 9 monthly payments of 25/9 (Total £13.8.3). Send S.A.E. for illustrated leaflet detailing Cabinets, Speakers, Mikes, etc.

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

**AN EXCEPTIONALLY POWERFUL HIGH QUALITY ALL-PURPOSE UNIT For lead, rhythm, bass guitar and all other musical instruments. For vocalists, gram, radio, tape and general public address**

★ UNUSUALLY POWERFUL LOUDSPEAKER COMBINATION consisting of a FANE HIGH FLUX 15in. 30 watt unit PLUS a FANE 12in. 20 watt unit with extended frequency response. ★ 4 Jack Inputs and two Volume Controls for simultaneous use of up to 4 pick-ups or "mikes". ★ Cabinets covered in two-tone Rexine/Vynair with gold trimming. Fitted carrying handles. ★ Separate Bass and Treble Controls giving "lift" and "cut". Send S.A.E. for leaflet. Or call at one of our many branches and compare the Bass-Regent with units at three times the cost. Or deposit **£7.17.6** and 9 monthly payments of **£5.10.10.** (Total 55 gns.)

**49½ Gns.** Carr. 30/-



## B20 MULTI-PURPOSE AMPLIFIER especially suitable for Bass Guitar

Incorporating massive 15in. high flux loudspeaker. Rating 25 watts. Individual bass and treble controls. Two jack inputs separately controlled. Substantial cabinet attractively finished in Rexine and Vynair. Size approx. 24 x 21 x 11in. Send S.A.E. for leaflet. Or Deposit £4.14.6 and 9 monthly payments of 66/- (Total £34.8.6). Carr. 17/6. **29½ Gns.**

## G15 15 WATT AMPLIFIER for Lead or Rhythm Guitar, Mike, Gram or Radio

High-fidelity output. Separate bass and treble controls. Twin separately controlled inputs so that two instruments or "mike" and pick-ups can be used at the same time. Heavy Duty 12in. 20 watt Speaker. Cabinet covered in attractive Rexine/Vynair. Size 18 x 18 x 18in.

**19½ Gns.** Carr. 15/-. Or deposit 3 gns. and 9 monthly payments of 43/7 (Total £22.15.3). S.A.E. for leaflet.

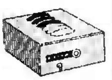
## LINEAR TREMOLO PRE-AMP UNIT

Suitable for use with any of our Amplifiers. Controls are Speed (frequency of interruptions). Depth (for heavy or light effect). Volume and Switch. **4½ Gns.**

## POWER PACK KIT

Consisting of Mains Transformer, Metal Rectifier, Electrolytics, smoothing choke, chassis and circuit. 200/250v. A.C. mains. Output 250v. 60mA, 6.3v. 2a supplied with case in lieu of chassis for 26/9. **22/9**

## R.S.C. BATTERY/MAINS CONVERSION UNITS



Type BM1. An all-dry battery eliminator. Size 5½ x 4½ x 2in. approx. Completely replaces batteries supplying 1.5v. and 90v. where A.C. mains 200/250v. 50 c/s is available. Complete kit with diagram 44/9 or ready for use 59/6.

## SELENIUM RECTIFIERS F.W. (Bridged)

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

## G20 SUPER TWIN AMPLIFIER

Rating 20 watts (max.) for Lead or Rhythm Guitar etc. Twin separately controlled inputs. Two 12in. High Flux Speakers (Total rating 30 watts). Attractive Rexine/Vynair covered cabinet. Terms: Deposit £4.6.8 and 9 monthly payments 50/- (Total £26.16.8). **23 Gns.** Carr. 17/6

## SPECIAL PURCHASE! 12in. 30 WATT HEAVY DUTY 15 ohm LOUDSPEAKERS

**7 GNS.** Carr. 12/6

Flux Density 17,000 lines. Fully Guaranteed. Outstanding value at normal price of approx. £12. Or deposit 23/10 and 9 monthly payments of 15/6 (Total £8.3.4).

## HEAVY DUTY SELENIUM RECTIFIERS

12v. 15 amps. F.W. (Bridge). Only **19/9**

## HEAVY DUTY BATTERY CHARGER KITS

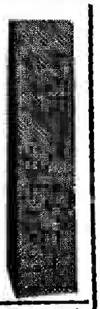
Consisting of Mains Trans. 200-250 v., Rectifier, Ammeter, Variable Charge Rate Selector, Panels, Plugs, Fuses and Holders. Fully punched stove enamelled case and circuit. 6/12 v. 4 a. **49/11** 6/12 v. 6 a. **69/11**

## FANE HEAVY DUTY HI-FI SPEAKERS

12in. 20 watt. Type 122/10. **5 GNS.** Post 5/6.

**R·S·C HI-FI CENTRES LTD.**

## R.S.C. COLUMN SPEAKERS



Covered in two-tone Rexine/Vynair. Ideal for vocalists and Public Address. 15 ohm matching. **Type C58, 15-20 watts.** Fitted five 8in. high flux speakers. Overall size approx. 42 x 10 x 5in. Or Deposit £2 and 9 mthly pmts 28/- (Total £14.12.0) **12½ Gns.** Carr. 10/-

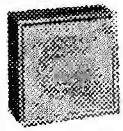
**Type C412, 40 watts.** Fitted four 12in. 12,000 line 10 watt speakers. Overall size 56 x 14 x 9in. approx. Carr. 15/- **19½ Gns.** Or Deposit 3 gns. and 9 monthly payments of 43/7 (Total £22.15.3).

## 30 WATT HI-FI AMPLIFIER

**for Guitar, Vocal or Instrumental Group**

A Four Input, two volume control Hi-Fi unit with separate Bass and Treble "cut" and "boost" controls. Latest type valves. Housed in strong Rexine covered cabinet with twin carrying handles. Attractive black and gold perspex facia plate. For 200-250v. A.C. mains. Output for 3 or 15 ohm speakers. Send S.A.E. for leaflet. Deposit £3 and 9 monthly payments of 37/5 (Total £19.16.9). **17 Gns.** Carr. 12/6

## 12in. HIGH QUALITY LOUDSPEAKERS



In walnut veneered cabinet. **10 Watt Model.** Gauss 12,000 lines. Speech coil 3 or 15 ohms. **£4.19.6** **Terms:** Deposit 15/- and 9 monthly payments of 11/2 (Total £5.15.6) Carr. 7/6

**20 Watt Model.** 15 ohm. Size 18x18x10in. **Terms:** Deposit 24/6 and 9 monthly payments of 17/3 (Total £8.19.9). **£7.19.6** Carr. 10/6

**30 Watt Model.** 15 ohms. Or Deposit 32/- and 9 monthly payments of 22/4 (Total £11.13.0). **10 Gns.** Carr. 12/6 **Any of above in extra heavy Rexine covered Cabinets, £1 extra.**

**R.S.C. GRAM AMPLIFIER KIT.** 3 watts output. Negative feedback. Controls: Vol., Tone and Switch. Mains operation 200-250v. A.C. Fully isolated chassis. Circuit, etc. supplied. Only **44/9.** Carr. 3/9.

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Flux Density 12,000 lines. 3 or 15 ohms.

## TRANSISTOR SALE

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

**MIDGET CLAMPED TYPE 2½ × 2½ × 2½in.**

| | |
|---|---|
| 250v., 60mA, 6.3v. 2a | 14/11 |
| 250-0-250v., 60mA, 6.3v. 2a | 15/11 |

**FULLY SHROUDED UPRIGHT MOUNTING**

| | |
|---|---|
| 250-0-250v. 60mA, 6.3v. 2a, 0-5-6.3v. 2a, 2½ × 3 × 3in. | 19/9 |
| 250-0-250v. 100mA, 6.3v. 4a, 0-5-6.3v. 3a. | 33/9 |
| 300-0-300v. 100mA, 6.3v. 4a, 0-5-6.3v. 3a. | 33/9 |
| 300-0-300v. 130mA, 6.3v. 4a c.t., 6.3v. 1a. For Mullard 510 Amplifier | 41/9 |
| 350-0-350v. 100mA, 6.3v. 4a, 0-5-6.3v. 3a. | 33/9 |
| 350-0-350v. 150mA, 6.3v. 4a, 0-5-6.3v. 3a. | 42/9 |
| 425-0-425v. 200mA, 6.3v. 4a, c.t., 5v. 3a | 63/9 |
| 425-0-425v. 200mA, 6.3v. 4a, 6.3v. 4a, 5v. 3a | 65/9 |
| 450-0-450v. 250mA, 6.3v. 4a, c.t., 5v. 3a | 79/9 |

**TOP SHROUDED DROP-THROUGH TYPE**

| | |
|---|---|
| 250-0-250v. 70mA, 6.3v. 2a., 0-5-6.3v. 2a | 19/9 |
| 250-0-250v. 100mA, 6.3v. 3.5a | 21/9 |
| 250-0-250v. 100mA, 6.3v. 2a, 6.3v. 1a | 22/9 |
| 350-0-350v. 80mA, 6.3v. 2a, 0-5-6.3v. 2a | 23/9 |
| 250-0-250v. 100mA, 6.3v. 4a, 0-5-6.3v. 3a | 32/9 |
| 300-0-300v. 100mA, 6.3v. 4a, 0-5-6.3v. 3a | 32/9 |
| 300-0-300v. 130mA, 6.3v. 4a, 0-5-6.3v. 1a. Suitable for Mullard 510 Amplifier | 39/9 |
| 350-0-350v. 100mA, 6.3v. 4a, 0-5-6.3v. 3a | 32/9 |
| 350-0-350v. 150mA, 6.3v. 4a, 0-5-6.3v. 3a | 39/11 |

**FILAMENT or TRANSISTOR POWER PACK** Types 6.3v. 1.5a 6/9, 6.3v. 2a 7/9, 6.3v. 3a 9/9, 6.3v. 6a 19/9, 12v. 1a 8/9, 12v. 3a or 24v. 1.5a 19/9, 0-25-35-42v. 2a 27/9.

**CHARGER TRANSFORMERS** 0-9-15v. 1½a, 13/9, 0-9-15v. 2½a, 16/9, 0-9-15v. 3a, 18/9, 0-9-15v. 5a, 21/9, 0-9-15v. 6a, 25/11, 0-9-15v. 8a, 31/9.

**AUTO (Step UP/Step DOWN) TRANSFORMERS** 0-110/120v.-200-230-250v.

| | | | |
|---|---|---|---|
| 50-80 watts | 14/9 | 250 watts | 49/9 |
| 150 watts | 29/11 | 500 watts | 99/9 |

**OUTPUT TRANSFORMERS**

| | |
|---|---|
| Standard Pentode 5,000Ω to 3Ω or 7,000Ω to 3Ω | 7/9 |
| Push-Pull 8 watts EL84 to 3Ω or 15Ω | 11/9 |
| Push-pull 10-12 watts 6V6 to 3Ω or 15Ω | 19/9 |
| Push-pull 10-12 watts to match 6V6 to 3, 5, 8 or 15Ω | 21/9 |
| Push-pull EL84 to 3 or 15Ω 10-12 watts | 19/9 |
| Push-pull Ultra Linear for Mullard 510, etc. | 35/9 |
| Push-pull 15-18 watts, sectionally wound 6L6, KT66, etc., for 3 or 15Ω | 22/9 |
| Push-pull 20 watt high quality sectionally wound, EL34, 6L6, KT66, etc., to 3 or 15Ω fully shrouded | 55/9 |

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

# PRACTICAL WIRELESS

VOL 42 No 7

issue 717

NOVEMBER 1966


## TOPIC OF THE MONTH

### *What happened to NFD?*

THIS year, as in previous summers, the English countryside was besieged by groups of radio amateurs on the occasion of National Field Day. The object of the exercise is to erect a portable station and make as many contacts as possible in 24 hours.

The idea was conceived in the early 1930's by J. W. Mathews, G6LL, and since then has been a regular event in the calendar of the Radio Society of Great Britain. The original purpose was to demonstrate that the radio amateur could be ready and on the air in an emergency; this, and the enjoyment of a day in the field with fellow amateurs, ensured its success.

But what of NFD 1966—does the same spirit and purpose prevail? In place of the home-built transmitters, receivers and attendant spiders webs of interconnecting wires, one finds gleaming commercial transceivers and diesel generators. One group is rumoured to boast fluorescent lighting!

The power limits are questioned not only in this column, but by many participants themselves. In the earlier days, when the rig developed a fault the designer-builder was almost certainly to hand for emergency repairs. Today, we hear of one club who, when their commercial TX went sick, simply changed it for another similar model.

Can the original concept of NFD be revived, or will this event continue to degenerate into a collection of commercial stations on wheels operated under conditions of comfort and blasting their way through by sheer brute force of r.f.?

Much of the fun used to be in the unpredictability, in the improvised operating conditions, in the general atmosphere, and in the sense of achievement that contacts *could* be made despite everything! One would have thought that with semiconductors, groups would be stimulated to design and use more compact stations, but the 6V6 and 807 still reign supreme.

Perhaps the rules need changing, or maybe the event should be replaced by something else? NFD has clearly wandered off course and many amateurs would like to see it revitalised and reorganised on lines more in keeping with the original idea.

Otherwise, we will soon arrive at the day when the station is left on site permanently and worked once a year by a link station from the bar in the club room!

W. N. STEVENS, Editor

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**DECEMBER ISSUE WILL BE PUBLISHED ON NOVEMBER 3rd**

## The Broadcast Bands

WITH reference to letters from Messrs. Mugford (July issue) and French (September issue) concerning disregard for s.w. frequency allocations, I must say that I am inclined to agree with both of them. The present state of affairs in the broadcast bands encourages flouting of the Geneva agreements in order for stations to obtain more satisfactory reception outside the allotted bands.

However, I most certainly oppose Mr. French's implication that apart from a few exceptions the short-waves are a "dry and uninteresting territory". High power transmitters are being introduced because stations naturally want people to obtain better reception of their programmes; this is a development with which DX-ers must live. I accept the presence of Radio Free Europe and Radio Liberty, with accompanying jammers, as one of the difficulties to be found in listening to more distant stations. Such difficulties are, I am sure, cursed by many a DX-er but, judging from reports in various bulletins and in "The Broadcast Bands", at least some listeners have overcome the obstacles and received some very good DX under unfavourable conditions. This, to my mind, is what the hobby of short-wave listening is all about.

Uninteresting? Never!

**P. Charlton.** Middlesbrough, Yorkshire.

## Counter Assistance

IN AN effort to buy an intercom unit that would work on 150 yards of wire, I decided to accept the advice that is so often given to your readers—I would seek the technical advice of the supplier!

Supplier No. 1, when asked the exact meaning of his advertisement in PRACTICAL WIRELESS, said his equipment would work up to 100 yards: beyond that, he didn't know and didn't offer to find out.

And so to another shop, where supplier No. 2 thought his unit *might* work at 150 yards, but he wasn't sure and the manufacturer's literature gave no clue.

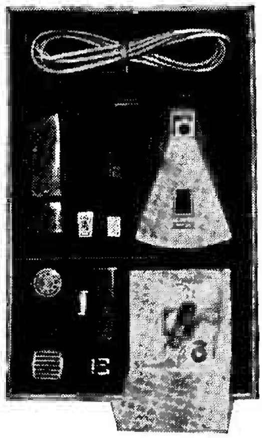
On, then, to retailer No. 3. Well, it just wasn't possible to be definite—it all depended on the number of bends the wire had to go around, as bends made it more difficult for the signal to get through! In a daze, I departed.

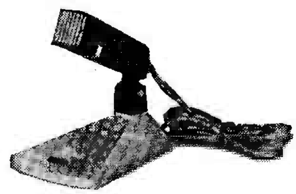
In one last gallant effort, I phoned the manufacturer's agent for a unit I had seen advertised in a trade journal. His "Technical Department" assured me that their intercom would work over any distance "because the flex is so thin there's nothing to stop the electricity"—So, after all that, I think I'll use a piece of wet string and two cocoa tins!

**J. T. Dungan.** Chislehurst, Kent.

# NEWS AND..

### NEW MICROPHONE ASSEMBLY KIT



*Radio hams and tape recording enthusiasts who are looking for a sensitive, versatile microphone and enjoy a spot of do-it-yourself will welcome the first kit-mike by Philips, available from Peto Scott of Weybridge.*

*It takes approximately 3 hours to assemble and costs 7 guineas.*

*The kit contains everything needed to assemble and use the microphone, including a stand for table or desk use, and a cord and clip for wearing around the neck. The microphone can also be hand held, hung from an overhead bracket or fitted onto a professional stand. The mic has an unobtrusive on-off switch on one side.*

*Directions for assembly are illustrated, step by step, in a well-designed booklet.*

### PORTUGUESE AIRLINE SELECTS MARCONI DOPPLER

*Transportes Aereos Portugueses (TAP), the Portuguese international airline, have selected the Marconi Doppler Navigator as the primary en-route navigational aid for their Boeing 707/320B aircraft which have recently come into service.*

*The aircraft are flying principally on routes covering the west coast of Africa and across to South America. Over the majority of these routes, ground aids to navigation are almost non-existent and the Doppler equipment, which provides accurate navigational information without any need for ground aids, will be of vital importance in keeping the aircraft accurately on course.*

### FORTHCOMING EVENTS

THE INSTITUTION OF ELECTRICAL & ELECTRONICS TECHNICIAN ENGINEERS

| | |
|---|---|
| October 12 | First Annual Dinner, at the Savoy Hotel, LONDON. |
| October 12 | Development and Research in Control Engineering, at the University of Aston, Gosta Green, BIRMINGHAM at 7 p.m. |
| October 17 | Technical Education in the Modern World, at the I.E.E. Lecture Theatre, Savoy Place, LONDON, at 6 p.m. |

# ...COMMENT

### LEARNING THE MORSE CODE

Readers wishing to learn the Morse code but who have been putting it off for various reasons, will be pleased to hear that they can now memorise it in record time for a total outlay of 3/6d.

This sum buys the book "Parry's Morse Method" which claims that "all the persons tested learned the alphabet within a couple of hours, and retained what they had learnt." It also claims that one boy of thirteen learned the alphabet in 18 minutes flat, and subsequently called it back perfectly.

The method used is visual, and interested parties can learn more about this fascinating method by obtaining a copy of the book from their local bookshop or from the publishers—The Doppler Press, 85 Grove Park, London, S.E.5.

### NEW BREMA SECRETARY

Mr. H. Kenneth Jolly, M.A., has been appointed Secretary of the British Radio Equipment Manufacturers' Association. This took effect on 1 September 1966. He succeeds Mr. A. K. Edwards.

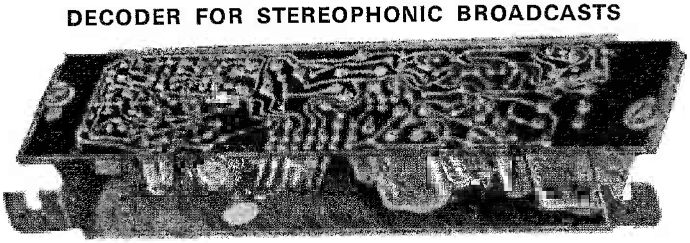
### START OF VHF SOUND SERVICE FROM THE BBC OKEHAMPTON RELAY STATION

Test transmissions began on 31 August of the BBC's three sound services on v.h.f. from a relay station at West Hook, about one mile north of Okehampton. The transmissions are horizontally polarized on West of England Home Service 93·1 Mc/s, Light Programme 88·7 Mc/s, Third Network 90·9 Mc/s.

The test transmissions are for engineering purposes and are liable to interruption or variation in power without notice.

The new station provides better BBC-1 coverage of Okehampton and its environs than the old one and, by the transmission of the three sound services on v.h.f., will make available improved reception of these services to some 4000 people in this area.

### DECODER FOR STEREOPHONIC BROADCASTS



*Following the extension of stereophonic radio broadcasting by the BBC Mullard is making available to set manufacturers a compact stereophonic decoder unit for incorporation in transistor receiver designs.*

*The unit, LP1167, the latest in the range of Mullard circuit modules, is fully screened and requires only to be fed by a 14V power supply to give the necessary separation of the left and right channel information contained in the stereophonic signal. It is suitable for use with most types of ratio detector or similar circuits. The module has negligible insertion loss, very low noise and distortion, and may be left in circuit during normal monophonic reception.*

## More Key Men

May I be allowed to comment on the Editorial in the August issue of Practical Wireless. Contrary to the views expressed in it, there is still an urgent need for a pool of skilled morse operators to be available in the event of a national emergency. Owing to the end of National Service, the only available pool of any size would be from the radio amateur movement, but such a pool would only be of use if it could provide a considerable number of operators able to handle traffic at speeds in excess of 15 w.p.m. A certain number of "phone only" men might be suitable for employment as technicians, but the ratio of operators to technicians is rarely less than six-to-one. It is worth noting that a number of amateurs already give part of their spare time to service in the various reserve forces. They are highly regarded by their Regular colleagues *especially for their morse skill.*

In conclusion, it is worth noting that the U.S. Army Signal Corps, a Corps that probably is more lavishly equipped than any other in the world, recently started a large programme to extend and improve its morse operating capability. Official sources stated that in many military situations morse was the *only* reliable means of communication and that it would remain of prime importance for many years to come.

**Major A. D. Taylor, GW8PG,** Wirral,
**Royal Signals Army** Cheshire.
**Emergency Reserve.**

[*Since the licensed amateur has to reach a speed of* 12 *words per minute to obtain a licence, it should not be too difficult to find enough 'phone' operators, who can send and receive at* 15 *w.p.m. One will, of course, find it much more difficult to get them into uniform, even on a part-time basis.*—Editor]

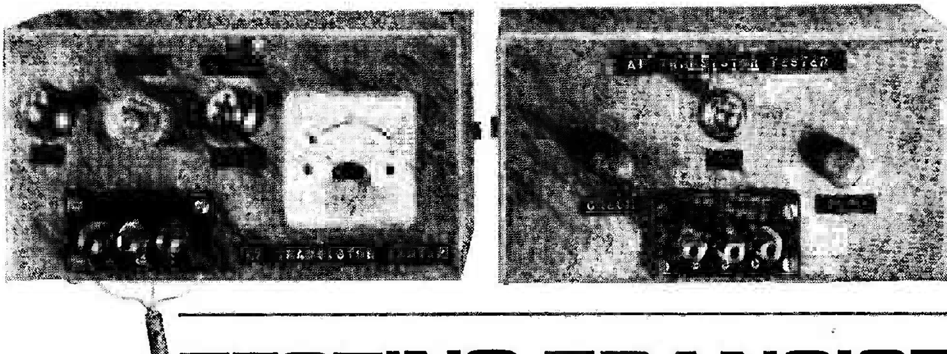
## A Question of Phonetics

It would be a good idea for all radio amateurs to adopt the phonetic alphabet contained in the Radio Regulation, Geneva 1959 and used by the NATO Services. This would make interpretation of the callsigns of weak stations much easier. I will not quote it here because it is clearly set out in your "Short Wave Data" guide, presented in the January issue of Practical Wireless, which of course, all conscientious readers will have preserved.

**Charles Mitchell.** Oxford.

[*Might it not be easier for NATO Services to adopt the phonetic alphabet used by amateurs. A quick count could well reveal more amateurs than NATO operators. America boasts well over a hundred thousand hams and Great Britain some twelve thousand for a start.*—Editor]

***More News and Comment on Page 504***




# TESTING TRANSISTORS

D.A.A. LAMB, B.Sc., A.M.I.E.R.E.*

*This article sets out, in easy-to-understand terms, basic principles and methods of testing semiconductor devices. Details of two instruments are included; a 'go—no go' tester and a more refined unit on which high frequency transistors can be checked.*

A LARGE number of transistor testing procedures have been evolved. Almost monthly the popular journals carry yet another suggestion for a 'simple to make' and 'easy to operate' tester device. The purpose of this article is to present in a unified manner a number of testing methods which have not been published elsewhere. They were evolved in an establishment which carries out both development work and instructional classes for employees. The methods have all been in use for over a year and have been found to be most satisfactory.

Before any attempt is made to test a transistor one must be quite sure of what one is doing. The circuit must be fully understood to assess the suitability of a given transistor for operation in that circuit. This understanding presupposes a certain familiarity with transistors and their associated circuits. This familiarity, although essential to a comprehension of the principles and practices of transistor testing need not be of a very high standard. The following section contains much of the essential information.

### Review of Operation of Transistors

This article is limited to p-n-p transistors since few n-p-n types are currently in use. Fig. 1a shows in schematic form a p-n junction diode which is forward biassed; the positive pole of the supply being connected to the p region. In this condition a large current flows round the circuit. Fig. 1b shows the same diode, but the supply has been reversed. In this condition the diode passes a very small current due to only the minority carriers in the semiconductor material. This leakage current in diodes is usually negligible: however, it increases with rises in temperature.

Fig. 1c shows in schematic form a p-n-p transistor consisting of two p-n diodes connected back-to-back. Observe that the polarity of the applied voltages is such as to forward bias the left hand diode, and reverse bias the right hand one. We might expect the currents to be as shown, viz. large in the left hand diode and zero in the right hand one. This is not the case however. The density of impurities in the several regions is carefully adjusted during manufacture of the transistor so that the central n region has a small number of carriers compared to the other regions. The effect of this is that the current in the forward biased diode consists of say 50 holes going from the p region to the n, and only one electron going the other way. Of these 50 holes, very few (probably only one) may recombine in the sparsely populated n region. Thus the current in the forward biased diode corresponds to one electron-hole annihilation. The other 49 holes, momentarily in the n region, will be attracted across the other junction by the applied voltage. Thus, the current in this second diode will be high.

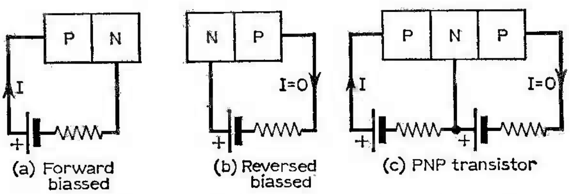



*Fig. 1: Junction diode and transistor biassing.*

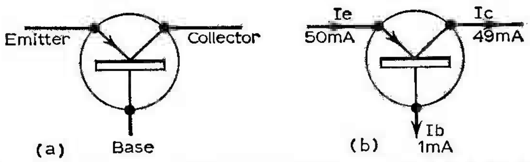



*Fig. 2: (a) Symbol for p-n-p transistor, and (b) typical current flows.*

From this action come the names of the three terminals of the transistor. The central n region is called the BASE, as the mechanical construction of the device begins with this piece. The left hand p region is called the EMITTER for it emits holes into the base. Most of these holes are collected by the right hand p region, which is therefore called the COLLECTOR. The transistor symbol, together with these names is shown in Fig. 2.

* *Lecturer in Telecommunications, Basic Group, School of Signals.*

Notice that the arrow on the emitter points along the direction of flow of conventional current.

We may now refer to the various currents by the letter I, with a subscript referring to the terminal in question. From the above it will be seen that $I_e = I_b + I_c$ and that $\frac{I_c}{I_b} = \frac{49}{1}$ and $\frac{I_c}{I_e} = \frac{49}{50}$ (app.) with the numbers used here. These ratios will be referred to later. Notice that $I_c$ flows only when $I_b$ flows. The transistor is said to be 'on' or 'off' depending on whether or not $I_c$ flows. The transistor may be biassed into either of these states by the application of appropriate voltages.

Before using a transistor, for example to provide gain, an input and output must be connected to two of the terminals. The third terminal will be common to input and output circuits. There are three ways of doing this, and these three modes of connection are called the CONFIGURATIONS. For example the common emitter configuration is a connection in which the emitter is common to both input and output circuits.

Any text-book on transistors will give all the required details on the configurations, and it is therefore not proposed to examine them in detail. Table 1 on the right, gives the principal features of the three configurations. Most circuits in equipments are common emitter, a lesser number being common base and common collector. These latter are often associated with the voltage supplies to an equipment. A transistor in any circuit can be only used in one of the three configurations. As explained above, these are called common base, common emitter and common collector. The configuration of a transistor in any circuit may be easily determined by looking for the electrode which is short circuited to the supply rail, as far as signal voltages are concerned. The properties of a transistor amplifier vary greatly, depending on the configuration used. For this reason, an appreciation of the configuration is necessary to testing.

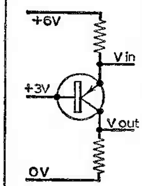
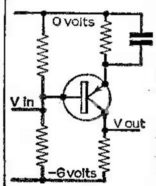
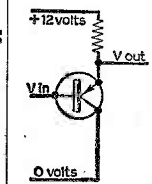
The current ratios deduced above may now be more accurately defined. $\frac{I_c}{I_e}$ is the CURRENT AMPLIFICATION FACTOR in common base configurations and is normally referred as $\alpha$. It usually has a value just less than unity; 0·98 in the example quoted being typical. Similarly $\frac{I_c}{I_b}$ is the current amplification factor in common emitter configurations and is referred to as $\alpha'$, or sometimes as $\beta$. It is typically 50, though values of 20 to 200 are encountered. These values of current gain are for standing d.c. In practice one is more interested in signal gains, i.e. response to a.c. Thus $\alpha'$ is properly defined as $\frac{I_c}{I_b}$, viz. the ratio of signal current out, to that in.

It is general to make measurements on a transistor in the particular configuration in which it is used in the circuit being tested. Sometime though, this is difficult. For example, $\alpha$ is quite difficult to measure as $I_e$ and $I_c$ are not greatly different. Secondly a very small, and hence difficult to measure, change in $\alpha$ may render a transistor unserviceable, whereas large changes in $\alpha'$ (more easily measured) are needed before operation becomes unsatisfactory.

Remember that transistors do not just fail for no reason. They may have been subjected to slight over loading for long periods. They may suddenly be exposed to surge conditions. A failing device is often not noticed before it fails completely, thus giving the impression that it has failed suddenly. Such methods as temperature cycling, and marginal voltage testing may be used to spot failures in time. We have tried some temperature cycling tests by putting transistors on long leads into a test tube immersed in a bath of oil. The device itself may then be temperature cycled.

Let us now proceed to some tests which one may apply to semiconductor devices.

**TABLE I**

| Feature | Configuration | | |
|---|---|---|---|
| | CB | CE | CC |
| Typical Circuit |  |  |  |
| $R_{IN}$ | Low | Medium | High |
| $R_{OUT}$ | High | Medium | Low |
| Current gain | 1 | High | High |
| Voltage gain | High | High | 1 |
| Power gain | Medium | High | Medium |
| Phase change | 0 | $\pi$ | 0 |
| Typical uses | Coupling between unlike Z's Circuits working at h.f. | Amplifiers and oscillators | Coupling between unlike Z's |

## Ohmeter Tests

Almost any ohmeter, may be used to measure the forward and reverse resistance of diodes. (Remember that the positive pole of the internal battery is connected to the negative—black—lead of the meter.) The diode passes conventional current in the direction of the arrow head on the conventional symbol for the diode. That is the current flows in the diode towards the end identified with a red spot, or red band, when forward biased. The current passed in the opposite direction is extremely small—a few microamps.

Typical figures for forward and reverse resistance are as follows:

| Diode Type: | Ge Junction OA47–CV7076 | Si Junction ZR11–CV7018 | Ge Point Contact OA81–CV448 |
|---|---|---|---|
| Forward | 350Ω | 1kΩ | 500Ω |
| Reverse | 20kΩ | 50MΩ | 1MΩ |

In Fig. 3, two transistors are shown connected across a supply line. Each has an ammeter in its collector to measure $I_c$. The one on the left is turned on as the resistor makes the emitter-base junction forward biassed and allows $I_b$ to flow. $I_c$ would then be $\alpha' \times I_b$, and would be registered in the meter. The other transistor is turned off, or almost so, for the emitter base

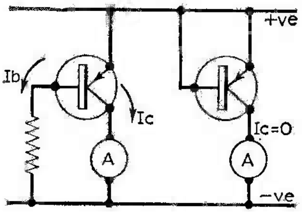



*Fig. 3: A transistor with bias applied to turn it on and off.*

has no forward bias and $I_c$ will be very small, viz. leakage current only. This simple circuit forms the basis of a most useful test which may be carried out with a conventional Avometer. It is switched to the 'Ohms' range and then used as the voltage supply and the ammeter as in Fig. 3. The base resistor is omitted as it is one less complication. Fig. 4 shows the arrangement. Remember again, that the positive pole of the

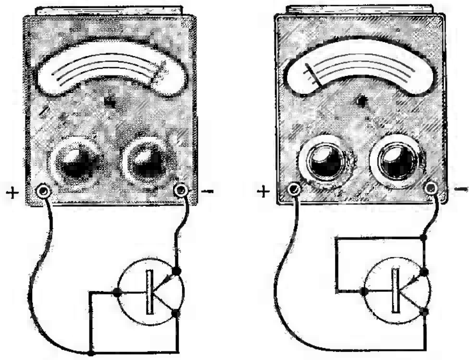



*Fig. 4: A simple Avometer test.*

internal battery is connected to the negative—black—lead of the Avometer. Observe how the transistor offers low resistance when on, and high resistance when off.

| Transistor Type: | Germanium Junction GET103–CV7074 | Silicon Junction OC200–CV7043 |
|---|---|---|
| $R_{ON}$ | 200Ω | 1kΩ |
| $R_{OFF}$ | 200kΩ | 50MΩ |

A low value of $R_{OFF}$ indicates a high collector leakage current. This may be investigated further by really turning the transistor off, for example by returning the base to a supply more positive than that to the emitter. This may be conveniently done by putting a silicon diode in series with the emitter. A high value of $R_{ON}$ indicates a low gain transistor, or one with a high impedance emitter-base diode.

**Transistor Gains and Leakage**

Fig. 5 shows the circuit for a simple tester which will allow these two parameters to be measured. The circuit is constructed in a small box containing the battery, switches and resistors. Additional switching could be provided to allow it to cater for n-p-n transistors. For convenience an Avometer (Model 8 or 9) is used to measure currents and is only connected when needed.

This tester will allow two measurements to be made on the transistor—the current gain in the common emitter configuration, $\alpha'$, and the collector leakage current, $I'_{co}$. The leakage current is simply measured by putting the supply across the transistor, open-circuiting the base and measuring the resultant current. It will be recalled that this current is due to minority carriers and is therefore highly dependent on temperature. It can be shown that $I'_{co}$ doubles for every 7 degrees Centigrade increase in temperature. At 25° C $I'_{co}$ for a typical general purpose audio frequency transistor e.g. GET103 should not exceed 200 microamps.

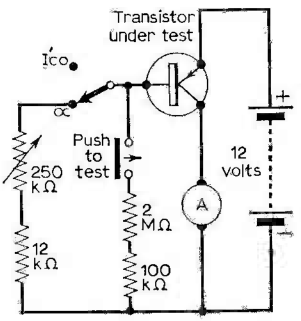



*Fig. 5: Gain and leakage tester.*

In order to measure $\alpha'$ some elaborate setting-up procedures are needed. The idea is that base current is provided by the 250kΩ potentiometer and the 12kΩ resistor. Compare with the 'on' transistor in Fig. 3. This base current allows a much greater current to flow in the collector and be registered on the meter. Now, by operating the push button, a little more base current is passed and the collector current rises accordingly. This change in collector current, divided by the extra base current gives a value of $\alpha'$ which corresponds quite well to the small signal value of this parameter.

The setting up procedure is as follows: First, connect the transistor. Secondly, connect a micro-ammeter between the base and the contact of the changeover switch. Now, vary the 250kΩ potentiometer and mark the pointer positions for values of $I_b$ of up to, say 500μA, in steps of 100μA. Finally connect the micro-ammeter across the push button, and mark the position on the potentiometer to give currents of say, 5, 10 and 20μA. The tester is now ready for use.

Set $I_b$ at say 100μA and the other potentiometer to give say 10μA' Note the value of $I_c$. Now push the test button and note the increased value of $I_c$. Divide the difference in the two readings for $I_c$ by 10μA to give a value of $\alpha'$. The 250kΩ potentiometer allows $\alpha'$ to be measured at different values of $I_b$, or $I_c$. It will be found that $\alpha'$ is not constant. It is in fact a parameter, not a constant. Fig. 7 shows how $\alpha'$ varies with $I_c$ for a sample germanium transistor.

The disadvantage of this tester is the lengthy setting up procedure required. This procedure should ideally be gone through for each new transistor to be tested for the potentiometer settings depend on the forward characteristic of the emitter-base diode. This will vary slightly of course, from one transistor to another, and considerably from one type of transistor to another.

**Transistor Parameters**

From the measurement of two parameters we proceed logically to the measurement of many more. This is best accomplished using a ready made test set such as the AVO Transistor Analyser. This equipment will enable measurements to be made of $I_b$, $I_c$, $V_c$ and $I'_{co}$, also, $\alpha'$ for d.c. and for a.c. signals. Another useful indication of the condition of a transistor which it will measure, is that of noise. Often the first indication of a ruptured junction is that there is a marked increase in the noise developed within a transistor.

Measurement of $I_b$, $I_c$, $V_c$ and $I'_{co}$ are direct measurements of d.c. voltage and current. The metering methods used are conventional, the necessary switching being provided to enable the internal meter to register appropriately. The small signal value of $\alpha'$ is measured (at 1kc/s) from a calibrated dial. Noise is measured with a 1kc/s reference signal and amplifier. All the necessary circuitry is internal. The Transistor Analyser may be used for p-n-p or n-p-n transistors.

We have found it to be a very useful instrument. The range of controls is such that it takes a little getting used to, but this should present no difficulties to a regular user. We have found it particularly useful for making up matched pairs of transistors for Class B circuits: $\alpha'$ may be measured at the exact $V_c$, $I_c$ conditions under which the transistor will eventually operate.

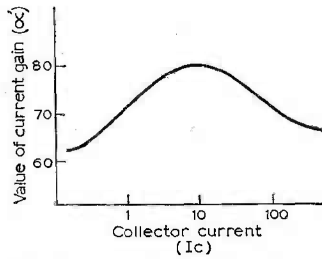
Known commercially as the AVO Transistor Analyser, it comes complete with the 'AVO International Transistor Data Manual' which gives the principal characteristics of many transistors. Parameters of transistors vary widely, much more so than valves and for this reason, equivalences are much less critical.

### Transistor Characteristics

A further test is to measure all the characteristics of the suspect transistor! This is obviously not on for a workshop which just wants to know whether a transistor is functioning or not. It is not proposed, in this article, to detail any method of measuring transistor characteristics, since most standard text books on transistors give circuits that may be used for these measurements. The most useful characteristics will be found to be the input and output voltage current relationships in each configuration. It is of interest to note that this test is applied to transistors by the manufacturers; usually by this mean, transistors in the same range are allotted type numbers. An automatic device is used to display the family of curves on an oscilloscope. Fig. 7 shows the general form of a useful characteristic; the common emitter output one, for a range of base currents. Tetronix Inc. make a Transistor Curve Tracer (type 575) which costs about £500. It looks like an expensive oscilloscope and displays on a c.r.t. any chosen characteristic curve of a device connected to it. Elliott's make, for £100, a simpler device which needs an oscilloscope to go with it.

### Substitution Testing

A very satisfactory method of testing any active device is to see whether it works in a circuit similar to the one in which it is required to work. For example we had a problem in selecting transistors to work in a tuned amplifier circuit operating at frequencies up to 1Mc/s. It was decided that the best way of assessing the suitability of a transistor was to give it two tests. First of all the simple AVO test was applied. This detected any obviously faulty transistor. Of course it does not follow that devices which pass this test are suitable for operation at 1Mc/s. The second test, therefore was to insert the transistor into a circuit which would oscillate at 3Mc/s. The d.c. operating conditions were adjusted so that they reproduced as closely as possible the conditions of the actual circuits employing the transistors. An oscilloscope was used to check the existence of the oscillation, and its amplitude.



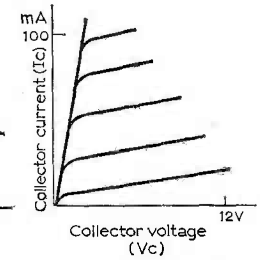




*Fig. 6: (left) Graph showing variation of current gain $\alpha'$ with collector current Ic for CV7074.*

*Fig. 7: (right) Typical family of common emitter output characteristics.*

This was found to be a satisfactory test as devices which failed to operate in the final circuit operated in the test oscillator in a noticeably different way from the rest: that is they usually did not oscillate at all, or perhaps with decreased amplitude.

Substitution tests are the best ones to perform on a transistor which is about to be used, or is already in service and is suspect. Measurement of a few parameters is a worthwhile effort, but still does not guarantee subsequent satisfactory operation in the way which a substitution test does.

There are three problems in making a satisfactory substitution tester. First, the working conditions must be selected. These should be, as pointed out above, similar to those to be met in service. Care should be taken that these conditions are not too selective in order that other types of transistors may usefully be tested. Secondly, the tester must be made very easy to use. Thirdly, it must give clear indications that it is working, and of the state of the transistor, under test. Only if these problems are resolved satisfactorily will it be worth constructing a particular style of tester. The two testers to be described satisfy these conditions.

### Substitution Tester for R.F. Transistors

This tester was finalized into a very handy form. It was required to be completely self contained and therefore power supplies and a means of indication had to be built in. Fig. 8 shows the circuit arrangement. The

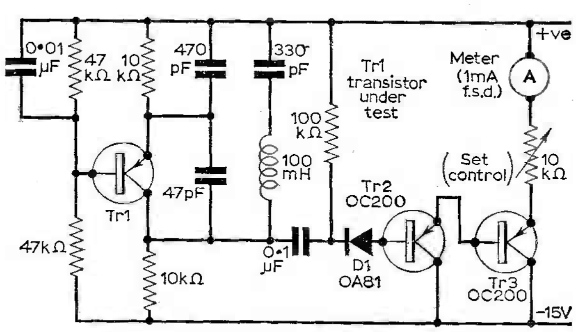



*Fig. 8: Circuit for substitution tester.*

transistor Tr1 is a common base amplifier which maintains oscillations in the Colpitts tuned circuit. A wide range of frequency adjustment is obtained by varying the 330pF capacitor. The r.f. output is coupled into a simple detector. The d.c. output from the detector is amplified by the cascaded emitter follower (Tr2 and Tr3) to produce about one milli-amp through the meter. It is essential that Tr2 and Tr3 should be low leakage types, Silicon transistors are ideal. Transistor Tr1 is either the transistor under test, or a transistor known to be up to the specification. The existence of oscillation is detected by rectifying the output from the oscillator and passing the current through a sensitive moving coil meter, as explained earlier. After a little experimenting it was possible to establish a certain meter reading which was to become the 'threshold of acceptability'. That is, if a certain transistor in this test circuit gave rise to a meter reading below this figure, then it was unlikely to operate in the final circuit. On the other hand, a much higher meter reading indicated a transistor with such a high gain that it would cause instability in the final circuit. (This happened with only two transistors in a batch of 60!).

The layout of the front panel is shown in Fig. 9. The transistor under test, an OC45 is connected to the spring contacts on a block, as shown. One toggle switch closes the battery circuit and puts –9 volts onto the collector side of the oscillator. This switch is spring loaded to guard against it being left on. The other toggle switch connected into the oscillator, either the internal transistor (known to be good!) or the one connected externally. This facility allows the operator to see that the device is working, and secondly to adjust the meter current slightly as the battery ages. A pre-set potentiometer, labelled SET is provided for this.

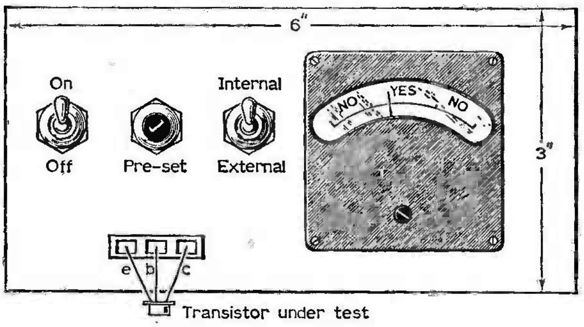



*Fig. 9: Panel layout of substitution tester.*

This tester then, assesses the suitability of transistors for subsequent incorporation into a known circuit. Such transistors would also, of course, operate satisfactorily in different though similar conditions. Secondly, similar but different types of transistors may be tested. (The SET control may then have to be adjusted to make the meter read correctly. A measurement on a 'known to be good' transistor of the type in question, would show what adjustment was necessary). Generally, substitution testers should impose on the tested transistor, conditions similar to, or more rigorous than, those it will eventually meet in service. Transistors which pass the test would certainly work under the less rigorous conditions. Those which do not pass, may be suitable for other applications and should not be completely rejected. As an example of these 'more rigorous conditions', observe that the tester described makes the transistor oscillate at 3Mc/s.

**Substitution Tester for General Purpose Transistors**

Most of the standard laboratory transistor experiments carried out by students use low frequency general purpose transistors. Different devices may be used in in different experiments, and requirement existed for a tester which would handle a fairly wide range of transistors. The r.f. oscillator type was unsuitable for these types of transistor.

This tester had to be suitable for use by technicians

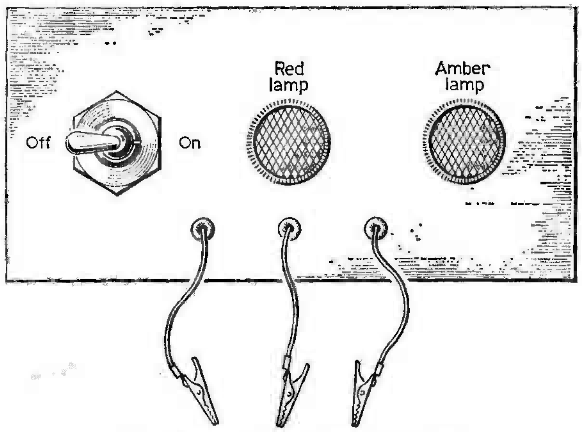



*Fig. 10: Front panel of flasher tester.*

who put out and check apparatus for lab work. It also has to be suitable for busy students eager to work their way through dozens of experiments. In short it had to give a clear indication that, first of all, it is working and secondly that the transistor under test is, or is not, working. Fig. 10 shows the front panel of the finalized device. It carries only an on/off switch, a red lamp and an amber lamp. The transistor under test may be connected by three coloured wires with crocodile clips at the end.

Operation is extremely simple. On switching on, the red lamp flashes on and off at about 1 cycle/second. This show that the battery is healthy and that all the internal circuitry is working. Now connect up the transistor and the amber lamp will flash—if the transistor works that is.

The circuit is given in Fig. 11. The slow running multivibrator, transistors Tr1 and Tr2, drive the red lamp through an emitter follower, Tr3. The amber lamp is driven through a simple current amplifier, using the transistor under test, Tr4. Notice that this lamp will only flash if the transistor turns on and off. The diode in its emitter ensures that its base is taken more positive than it emitter. The amber lamp will indicate two specific fault conditions—open circuit (or very low gain) transistors, and short circuit transistors. In these two cases the lamp will not come on at all, or will remain on, respectively.

It may be argued that this tester is just another substitution tester. The substitution in this case being into a low speed switching circuit. This is true, but it has been found that devices which pass this test are

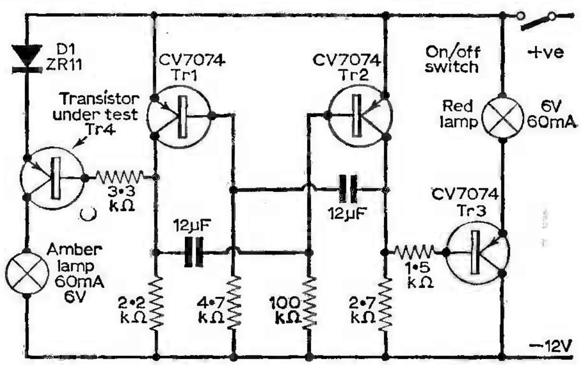



*Fig. 11: Circuit of the flasher tester.*

—continued on page 485

# Modernising
## PORTABLE RECORD PLAYERS

*by M. L. Michaelis, M.A.*

MANY mains-operated portable record players using valves have been sold over the past years and are only slowly giving place to fully transistorised units of similar function. A disadvantage of the transistorised units, especially in the lower price class and particularly if battery operated, is their lower output power. On the other hand, even quite simple valve circuits develop ample power for good reproduction. For example, a popular circuit employs a single valve, an ECL82. The triode section is used as straightforward voltage amplifier, driving the pentode section as output stage. This circuit develops upwards of 2·5 watts output power and the gain is adequate for full drive from a crystal pick-up as used in simple portable record-players. But there is generally one reservation here, in that only mild tone control is possible without leading to a weak muffled reproduction. Many of these record-players tend to give shrill reproduction when set to give the maximum undistorted volume they are capable of. This disadvantage, could be overcome if slightly increased gain were available, so that an optimum tone control network could be employed whilst maintaining full drive of the amplifier in spite of the considerable attenuation inevitably produced by such a tone control circuit.

### *Hybridisation*

Preamplifiers using germanium transistors are not advisable, because the interior of small record-players is likely to run rather hot, under which conditions germanium transistor circuits may be unstable. In general, when building hybrid equipment, or when hybridising formerly valve-only equipment, it is very desirable to use silicon transistors wherever possible. It is then not necessary to take any special measures of temperature stabilisation beyond those familiar from pure transistor circuit practice.

### *The Input Booster*

Fig. 1 shows the theoretical circuit of a well-tried silicon transistor input booster which has been fitted by the author into many portable valve-operated record players. The circuit and layout of these amplifiers were of the most varied form, with various valve line-ups such as ECL82, or EF86/EL84, etc. In no case was the slightest difficulty encountered in adding the input booster according to Fig. 1.

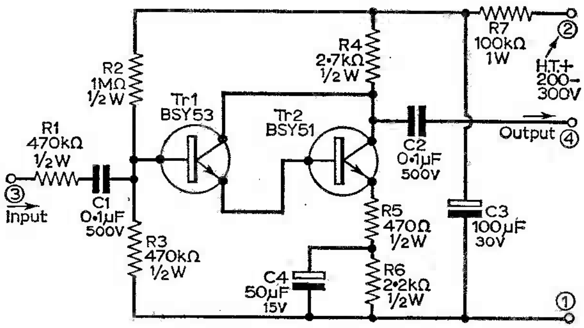



*Fig. 1: Input booster circuit.*

The circuit of Fig. 1 should first of all be built-up as a "flying huddle" of components, using the existing leads of the individual components, cut short where necessary and covered with insulating sleeving. C3 and R7, as the two largest components, must first of all be connected in series and the remaining components then wired around them in "christmas-tree-fashion". The final compact huddle of components will be left with the four connecting leads marked 1 to 4 in Fig. 1. Solder lead 1 to a chassis tag as close as possible to the pickup input terminal or point of connection of the pickup leads in the existing amplifier and solder lead 2 to some h.t. point. It is quite unimportant whether connection here is made ahead of or beyond the main smoothing circuit, because R7 and C3 provide very high smoothing anyway. The voltage must be between 200 and 300 volts at the chosen point.

Disconnect the "hot" pickup lead, or the "hot" wire from the pickup input socket of the existing amplifier, leaving the "cold" lead (screening) connected to chassis. Connect the "hot" pickup lead, or the "hot" pin of the input socket, to point 3 of Fig. 1. Finally, connect the input lead of the existing amplifier to point 4 of Fig. 1. The input booster assembly will already be strung rigidly in position as soon as point 1 is anchored to chassis and point 2 to h.t.; connections 3 and 4 may thus be thin flying leads. If anchorage tags are not available, slip a piece of sleeving over the individual flying connections, and bend all components slightly, such that short-circuits are definitely impossible even in the face of vibration during normal portable use of the unit.

The arrangement of connections now corresponds to Fig. 3b, whilst Fig. 3a sketches the record player prior to the modification. The total space required by the input booster components is so small that an odd corner in the under-chassis wiring is normally always available for them, and there are no holes to drill.

### *Tone Controls*

After completing this modification, switch the record-player on. It should be found that the existing volume control need only be turned up to a much smaller extent than previously, whilst heavy overloading should take place with the volume control turned full up, indicating that plenty of gain reserve is now in hand. Now try the effect of the existing tone control. Set this to maximum bass and minimum treble, and turn up the volume control until overloading is just not commencing. If this setting, now gives the desired rich tone, then alterations to the tone control circuit are no longer required. If the gain is excessive, increase the value of R1 in the input booster (to 1MΩ or more if necessary) until overloading of the output stage does not commence until just before maximum volume in the bass-boost setting (overloading will, of course, commence earlier in a shrill treble setting of the tone control).

## Tone Control Modifications

If checks described in the last section reveal that the tonal reproduction is still unsatisfactory, then the tone control circuit must be modified. The circuit to be used is shown in Fig. 2. This is a three-terminal network, with point C connected to the same chassis point as point 1 of the input booster, and points A and C connected such that the tone control network is interposed between the output point 4 of the input booster, and the input terminal of the existing amplifier. If space does not permit the addition of two further potentiometers, or if such a multiplicity of controls is undesirable for aesthetic reasons, proceed as follows. Disconnect and remove the existing volume and tone control of the amplifier and replace them with fixed components equivalent to the maximum volume setting and to the "inactive" setting (normally maximum treble) of the tone control. Replace mechanically with potentiometers VR1 and VR2 of Fig. 2 in the same positions on the panel. Wire the remainder of Fig. 2 behind these new potentiometers, and connect-up to the input booster and to the existing amplifier according to Fig. 3c.

## No Separate Volume Control

A volume control is not required as a separate control, because the arrangement of Fig. 2 is seen to be such that VR1 and VR2 respectively control bass and treble *from zero*, i.e. with both controls at minimum, volume is also zero. It is evident that this arrangement

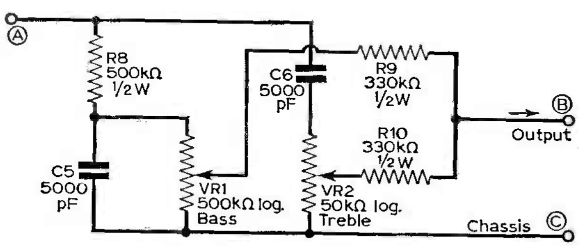



*Fig. 2: Tone control circuit.*

allows any relative mixture of bass and treble. One reservation in this respect is that as R8 is of much higher value than the track of VR2, there will always be some net attenuation of medium frequencies relative to bass and treble. This is to a certain extent essential to compensate acoustic shortcomings of a small speaker in a small portable cabinet. If the sound is lacking in middle frequencies, reduce the value of R8 by trial and error. Alternatively, make R8 in the form of a miniature 500 kΩ pre-set carbon potentiometer in the under-chassis wiring and adjust with a screwdriver for optimum range of the tone controls VR1 and VR2.

## Loudspeakers

After completing any modifications to the amplifier circuitry, it is advisable to pay some attention to the

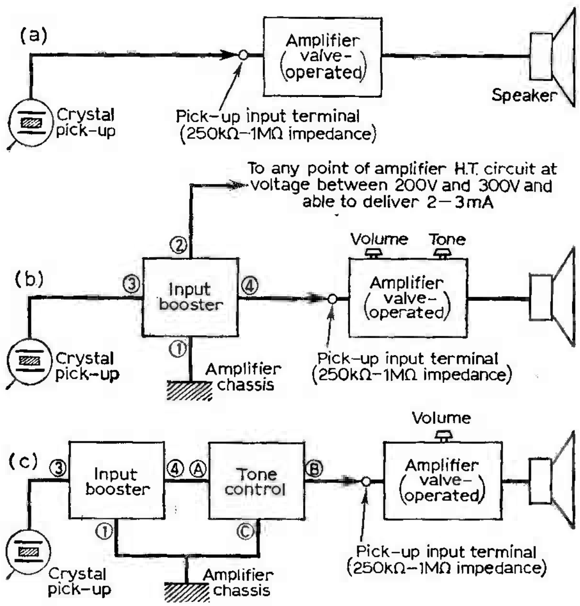



*Fig. 3: Connections between units.*

loudspeaker itself. Many small loudspeakers used in portable record-players have too stiff a cone mounting. Carefully feel the speaker cone from the front side (unscrew the speaker off the panel for the purpose). It should be possible to move the cone through a visibly large distance with very little applied pressure. If this is not possible, then it is advisable to replace the speaker with one of the same size but looser cone mounting (e.g. Goodmans 5-inch round has been used as replacement by the author in several such cases). The improvement in bass to treble ratio for a given feed from the amplifier can be quite profound. A lower value may well be necessary for R8 now, some value between 100kΩ and 270kΩ often being optimum with a resilient speaker in an average record-player cabinet.

## Some Circuit Details

In conclusion, a few words regarding the action of the input booster circuit (Fig. 1). The two transistors act as cascaded emitter followers which essentially reproduce the input signal from the junction of R2/R3 at unity gain across R5. The input impedance is equal to R5 multiplied by the *product* of the current gains of the individual transistors (at least 30 x 30 for the specified transistors under the given operating conditions), so that values familiar from valve input circuits are reached, the input terminal 3 behaving essentially in the same manner as the grid-circuit input terminal of a valve amplifier. R5 produces 100 per cent negative feedback (thus gain unity with respect to output emitter), cancelling all distortion in the input booster. The voltage gain is produced through the ratio of the collector load resistor R4 and the emitter load resistor R5. This gain factor is free of distortion and independent of transistor characteristics and temperature effects because the same current, essentially, flows through R4 and R5 in flowing through R5 it is corrected by 100 per cent negative feedback.

R6 produces d.c. stabilisation of the operating point in conjunction with R2 and R3. The circuit will tolerate heating up to any temperature likely to be encountered underneath the chassis of congested valve-operated equipment within limits not endangering other components.

R1 is a series resistor necessary for proper operation of a crystal pick-up. Crystal pick-ups behave as generators in series with small capacitors (one or two thousand pF). Thus they must operate into a high load resistance if severe bass loss is to be avoided. If a dynamic or magnetic pick-up is used, R1 will have to be discarded and replaced by whatever input network the makers specify.

An outstanding advantage of the transistorised input booster, which would recommend its adoption even in cases where there would be sufficient space for a valve-operated preamplifier stage, is that it inherently contributes nothing to the hum level of the amplifier. R7 and C3 represent such an enormous smoothing factor rejecting mains ripple, that negligible ripple is transferred via R4 and C2 to the input grid of the main amplifier, even if point 2 of the booster is connected to a raw unsmoothed h.t. line. The question of hum increase is much more problematic when adding-on valve preamplifier stages, because much smaller decoupling resistors must be used to maintain sufficient h.t. voltage at the preamplifier anode. In the transistorised booster, on the other hand, we must deliberately drop the h.t. voltage to a low value, calling for the large series resistor R7. Incidentally, there is no possibility of endangering the transistors, for it is not high voltage as such, but *excessive current* which would destroy a transistor. Excessive current is here impossible, because R7 cannot pass more than 2 to 3 mA even if the circuitry at its bottom end were to represent a dead short circuit. Stabilisers are unnecessary, because the transistor electrode voltages automatically adjust themselves to the correct low values in this arrangement and even switch-on surges are fully avoided because of the very long time constant (10 seconds) of C3 and R7. The latter is no disadvantage, because by the time the valves of the main amplifier have warmed up (about 30 seconds), C3 has also established the correct operating voltage for the transistors. ■

## TESTING TRANSISTORS

*—continued from page 482*

suitable for the purposes for which we require them. This tester, although we have found it most useful, is not a universal panacea for transistor users. The range of transistors it will handle, however, can be made sufficiently wide by selecting the bulb, the collector resistor and the base drive resistor to reproduce the working conditions under which the device will be required to function. For example, for testing transistors of low currents, drive the transistor with $I_c$ = say 1mA, and drive the amber lamp from the collector, but through an emitter follower.

### Testing Suspect Transistors

Finally when testing suspect transistors, study the circuit in which the transistor is connected and determine the configuration of the circuit. Decide why that configuration was used, i.e. what particular properties of the transistor are required in order to make the circuit function. Use a high impedance voltmeter to check that the transistor is biassed correctly. For example, the emitter-collector voltage of a transistor in a small signal Class A stage should be about half the supply voltage in the quiescent condition. Check all electrolytic capacitors to see that they are doing their job properly. An easy way is to measure their 'resistance' on the Ohms x 100 range. After initial polarization—be careful with polarities— the leakage current should be very small. Then decide how best to test the transistor. How can the conditions in the circuit be accurately reproduced in the test circuit? Is there a parameter, easily measured which will indicate the functional state of the device? Will a simple test with Avometer or FLASHER tester suffice? Is a substitution test possible?

Now remove the transistor carefully and apply the chosen test to it. Be particularly careful not to cause any damage to the already suspect transistor when removing it. This is particularly important when printed circuits are involved, for the leads of the transistor are always cut quite short after insertion. Use the smallest soldering iron available and put a heat shunt on the leads. The bit of a larger iron (normally 5/16 in. diam.) can be turned down to 1/8 in. diameter. A pair of surgical tweezers for holding transistor leads makes a very effective heat shunt.

### Constructional Data

For convenience, both testers may be assembled in boxes having the same dimensions. Fig. 13 gives all the dimensions and drilling data to make the boxes which can be made out of 1/16 in. sheet. Observe that the base of the box is removable to allow the internal battery to be changed. The circular cut-out is, of course, only used for the r.f. tester; to accommodate the meter.

The layout of the circuit is not critical and it is for this reason assembly diagrams are not included. The only component that may cause difficulty is the 100μH inductor in the r.f. tester. This may be made up by winding about 100 turns of 38 s.w.g. enamelled copper wire on to the body of a high value resistor. The resistor's leads then become the leads to the inductor.

The semiconductor devices used are not critical. Cheap, low grade transistors are suitable, since the frequency of operation of either tester is not important.

The following transistors were used by the author:

| | | |
|---|---|---|
| | R.F. Tester | |
| Tr1 | General purpose r.f. type | GET875, OC45 |
| Tr2 & Tr3 | Silicon l.f. type | OC200 |
| D1 | Signal type | OA81, CG83 |
| | Flasher Tester | |
| Tr1—Tr3 | General purpose l.f. types | GET103, 2N1302 |
| D1 | Silicon, any type | ZR11 |

**Acknowledgment:** The author wishes to thank the Commandant of the School of Signals for permission to publish this article. ■

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# EXPERIMENTERS CORNER

## DIODE OSCILLATORS

D. BOLLEN

MANY general purpose germanium diodes will oscillate well, and efficiently, providing a surprisingly inexpensive way of generating an audio tone or signal up to around 10K/cs. Far from being just an interesting novelty, these two terminal oscillators can be made to serve a variety of useful purposes, and fit in extremely well with valved equipment, where suitably high voltages are already to hand.

### *Operation*

The curve of Fig. 1 will be familiar to many readers as it shows the typical forward and reverse characteristics of a germanium point contact diode. The region of interest lies at the extreme of reverse voltage where the curve turns over on itself and becomes a negative resistance slope. That is to say, paradoxically, with an increase of current the voltage across the diode falls.

To explain how oscillation may be obtained, the basic circuit, stripped of refinements, is given in Fig. 2, Capacitor C charges at a rate dependent on R and applied voltage V. The shunt resistance presented by diode D is initially high, typically 60kΩ, but when the turnover point is reached the diode is swept into heavy conduction, discharging C rapidly until the voltage across D is low enough to cause it to switch back to its high resistance state.

The cycle repeats as C commences to charge again through R. With suitable diodes a voltage swing in excess of 100 and power outputs, into a resistive load, of up to $\frac{3}{4}$W can be realised.

Whereas the majority of diodes, including the "surplus" variety, will oscillate only specially selected diodes yield high outputs and good efficiency. Naturally enough, because intended for other roles, manufacturers do not specify in detail the negative resistance characteristics of their diodes, and even matched pairs will differ in this respect.

Normally a diode is expected to work at levels well below its reverse voltage turnover point and in ordinary applications an excessive peak inverse voltage would destroy or seriously damage the diode. Even with the circuits given here, care must be exercised to ensure that a diode is not overloaded or worked at too high a temperature

Several types were tried and the whole area of negative resistance plotted for three of them. Results are given in Fig. 3. By far the best all-round performer was the GD15, which has a manufacturer's rating of 60 p.i.v. Diodes with a higher reverse rating, such as the OA81, are efficient oscillators but are more critical as to their working point and ability to withstand overloads and the GD15 seems to represent a reasonable compromise.

As there are a very large number of diodes listed and at present available, there is considerable scope for experiment in finding the best of the bunch. Both the GD13 and OA73 proved suitable for lower supply voltages and sometimes functioned well with as little as 75 volts.

In this mode, all diodes can be expected to run fairly hot and the heat sink of Fig. 4 ensures that as much heat as possible will be conducted away from the body of the diode. For continuous operation, currents in excess of 10 milliamps should be avoided and 5 milliamps can be taken as a reasonable average working point for prolonged service. Many diodes, particularly the OA81, will require less to sustain oscillation.

The turnover point and leakage current are both dependent on temperature. Like valves, the germanium diode oscillator requires a warm-up period before it will begin to function, thereafter stability

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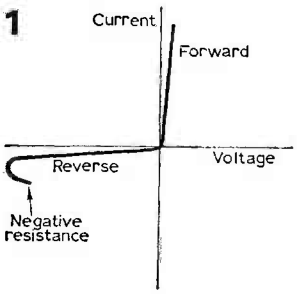


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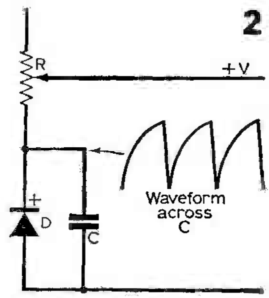


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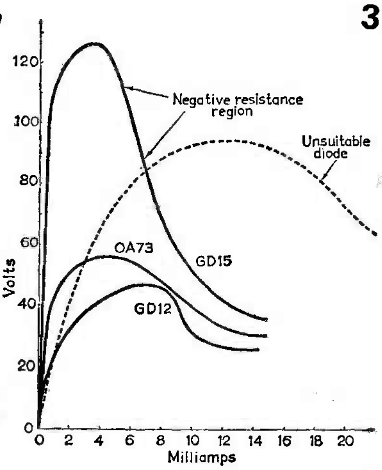



*Fig. 1: Germanium diode characteristics*

*Fig. 2: Circuit of basic diode oscillator.*

*Fig. 3: Reverse voltage characteristics of typical diodes.*

will depend on thermal equilibrium being attained, hence the need for a heat sink.

Alternatively, the oscillator may be switched on immediately, provided that the supply voltage is afterwards reduced to prevent excessive dissipation.

## Test oscillator

The circuit of Fig. 5 is an ideal "test bed" for evaluation of diode negative resistance performance and will also serve as a high output audio oscillator, variable in frequency by switched selection of different values for C1, supplying more than 30V r.m.s., at over $\frac{1}{2}$W.

When testing diodes with a low p.i.v., the rail voltage may, if desired, be reduced to 100 and a 3kΩ resistor substituted for R1. The approximate frequency of operation will also depend on the diode, but is in the region of 600c/s with the values shown.

With VR1 and VR2 in the maximum resistance position, connect to an h.t. supply and observe the meter reading, which should be about 2mA. If there is any doubt about the diode it is better to check its reverse resistance with a testmeter beforehand, and reject if low.

Slowly decrease VR1 until the meter pointer suddenly jumps to a higher reading, typically 7 mA. An output meter, or pair of high resistance headphones, isolated to d.c. by a capacitor in series, may be used to check for oscillation. Inadvertent shorting of the output is not likely to have any ill effect.

Finally, when the diode has warmed up, VR1 may be backed off to give the lowest current reading consistent with a good steady note. VR2 determines the rate at which the capacitor is discharged, and to a limited extent the level of output. Under favourable load conditions, adjustment of VR2 will give a waveform approximating to a sine wave.

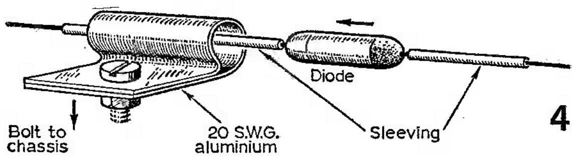
## Tone generator

Where a loud audible note is required, with the minimum of complication, such as the morse practice oscillators or warning devices, an oscillating diode can supply an attractive way of powering a speaker without the extra refinement of a valve and its heater supply.

In Fig. 6, the load, consisting of transformer primary and R2, is placed in series with C1. C2 may be omitted but was found to improve the performance very slightly with the original. The bulb is included to act as a fuse when the unit is left unattended for long periods. If the note is to be keyed, the key can be placed in series with the output winding of the transformer.

Additional uses may be found for this oscillator. If the diode is remotely placed near a source of heat and R1 adjusted so that the circuit is just on the verge of oscillation any increase of heat will sound a warning note, useful for greenhouses, or monitoring for thermal runaway in experimental transistorised equipment. The diode with its heat sink should be mounted in a suitable position so that any increase of temperature is immediately sensed.

Another application is where voltage fluctuations of power supplies give cause for concern. Here the diode is maintained at a steady temperature, just out of oscillation, consequently any increase in the diode supply will trigger the circuit and give a loud note, demanding immediate attention.



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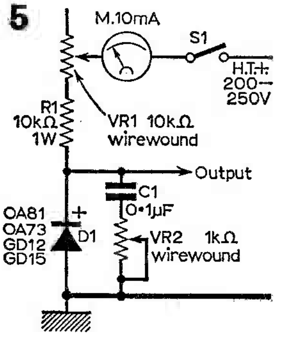
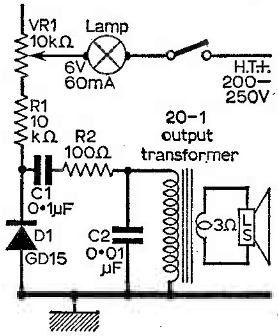


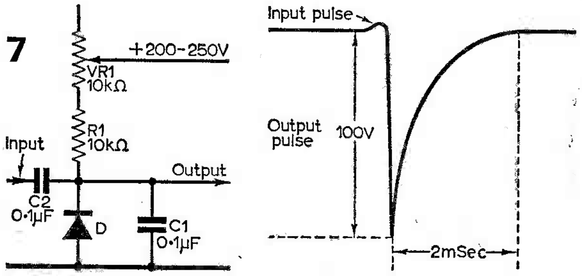




*Fig. 4: Details of suggested diode heat sink.*
*Fig. 5: Circuit of test oscillator.*
*Fig. 6: Circuit of tone generator.*
*Fig. 7: Circuit and characteristic of triggered oscillator.*

Inherent backlash prevents the oscillator switching off if the voltage should, meanwhile, drop to its previous value, thus providing positive indication of short-lived surges.

## Triggered oscillator

With the arrangement shown in Fig. 7, a small amplitude pulse, of irregular shape, or a sine wave, triggers the diode to give a steep-sided output pulse of much larger amplitude, similar to a blocking oscillator. In addition, if VR1 is set for continuous oscillation, the output may be locked to a lower, injected synchronizing frequency. Fixed multiples of, for example, the mains frequency, may be obtained in this way.

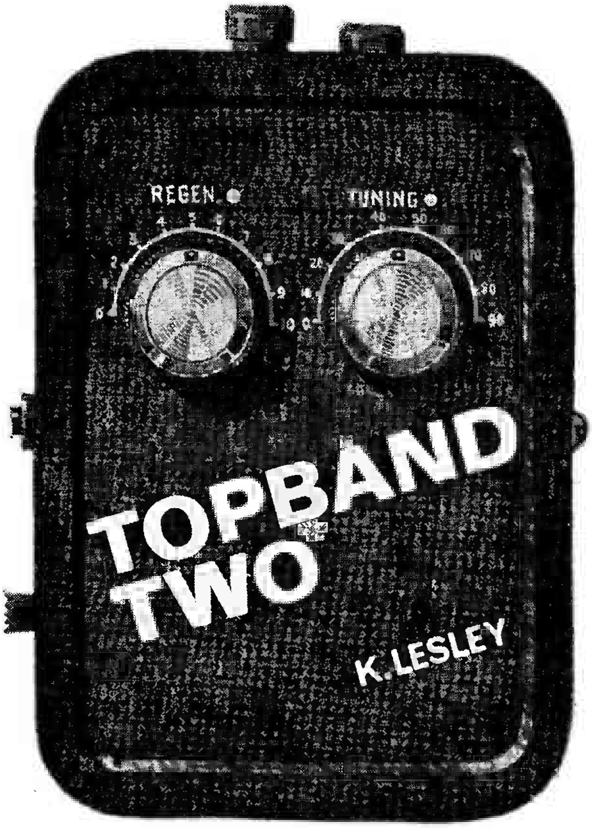
If the voltage across the diode is, say, 10 volts below its turnover peak, pre-set by VR1, then an input of +10 volts will cause the diode to swing over into heavy conduction and rapidly discharge C1, while emitting a 100 volt pulse.

The values given in Fig. 7 are representative. If a pulse of shorter duration is required, C1 and C2 should be reduced accordingly.

## Other uses

The diode oscillator, being so simple, lends itself to uses where large numbers of tones are required,

*—continued on page 522*




THERE are many people who have an interest in receiving short wave commercial and amateur stations yet hesitate to build a suitable receiver. Often this is due to the complexity of the circuits to hand. Cost is another factor, and some designs which no doubt perform very well must be excluded because of the high price of the many components.

A double conversion superhet with its b.f.o., Q multiplier and other refinements is perhaps the obvious choice for the serious short wave listener (s.w.l.). However, for the purpose of "getting one's feet wet", high expense is not essential.

The Topband Two was evolved for the express purpose of providing this stepping stone in short-wave listening. The frequency coverage chosen was 180—57 metres or 1·67—5·3Mc/s. This provides two amateur bands 1·8—2·0Mc/s which is 160 metres and is called topband. Also included is 3·5—3·8Mc/s—eighty metres. In addition to these two ham bands it is also possible to receive on the trawler band, plus a few of the more powerful commercial stations.

The cost is small and the components are standard, easy-to-obtain items currently advertised in component suppliers' catalogues.

This is *NOT* a pocket portable in the popular interpretation of the term. It has no ferrite rod aerial and requires a good outside antenna. A single length of wire as long and high as possible is preferable, together with a good earth.

## Circuit Fig. 1

A glance at Fig. 1 will reveal the simplicity of the circuitry which consists of a regenerative detector Tr1, and an audio amplifier Tr2. The antenna feeds the r.f. signal to the tuned circuit which consists of C2, VC1, and L1. Regeneration is controlled by VC2. After detection the resultant a.f. (audio frequency) signal is fed via C3 to the base of Tr2, where, after amplification by Tr2 the signal is fed from Tr2 collector to the headphones. A number of modifications to the circuit are possible, and for those who might like to experiment, some suggested lines of pursuit are offered in Fig 3.

The transformer coupling should give improved amplification on the audio side. The electrolytic capacitor and resistor in the emitter lead of Tr2 is usually employed as a means of stabilisation, and their inclusion should not produce any startling improvement. The extra trimmer wired in parallel across the regeneration capacitor is to improve control. This is explained later.

## Construction

The case consists of a two-ounce tobacco tin. This is ideal for the project since it is cheap, also it is tinplate, which means that it is possible to solder directly to it.

All holes for the controls, etc., should be drilled first. Note that four of these, SK1, VC1, VC2, SK3, are insulated from the case. For SK1, VC2, SK3 drill a hole a little larger than needed and fit insulating washers either side of the case. The writer used small pieces of a polythene bag for this purpose. VC1 is already insulated and does not need this treatment. The phone socket SK3 requires slight modification. The bottom thick L shaped bar makes contact with the smaller springy curved upper bar when the phones are removed. This bottom bar should be bent away from the socket until there is no contact between the two.

Switch S1 has two small tapped holes for mounting, but these were ignored and the component was

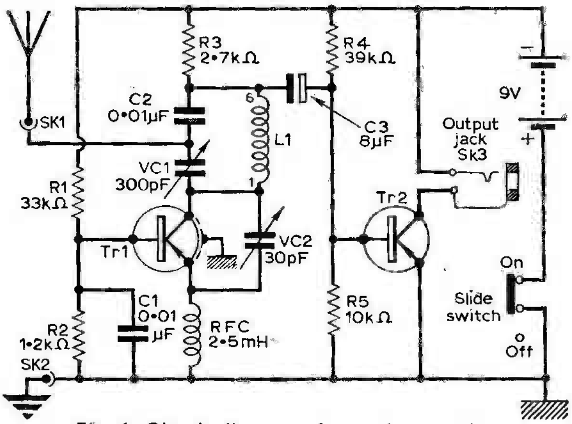



*Fig. 1: Circuit diagram of complete receiver.*

soldered directly to the case. File and tin the lugs on S1 first, and tin the case around the hole where S1 is to be mounted. Place S1 in position and press the hot iron on the lugs. The solder on the two tinned surfaces will melt, immediately this happens remove the iron. Repeat the process for the other lug making sure that the sliding knob is accurately lined up in the hole provided for it.

The coil L1 has a threaded end with a locking

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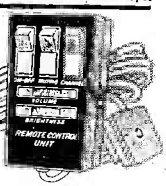


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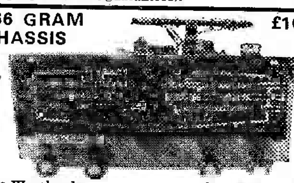

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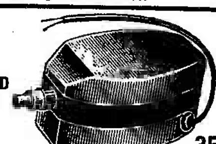

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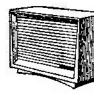

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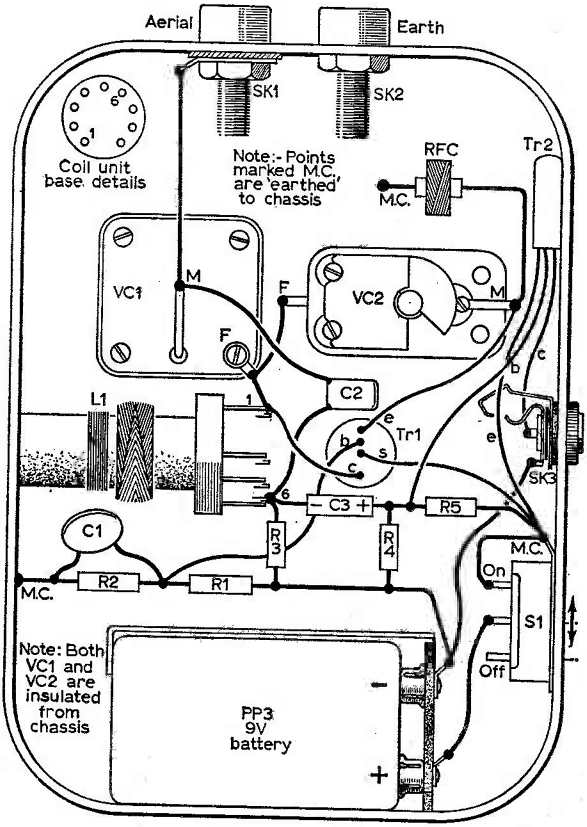



*Fig. 2: Wiring diagram showing position of components.*

nut. This is removed by purposely tightening the nut until the threaded column breaks off. Remove the slug inside the coil by unscrewing it. The small threaded hole which this leaves is used to mount the coil in the position shown with a 6BA bolt.

A small scrap of tinplate is soldered directly to the case as shown in Fig. 2 to hold the battery in position. At this stage the case should have VC1; VC2; SK1; SK2; SK3; S1; L1; and the battery holder mounted in position.

## Wiring

Clean and tin all tags and solder a wire from the right-hand terminal of S1 to the case. The centre terminal is wired to the *positive* terminal of the battery clip. The left-hand tag on VC1 is taken direct to the insulated aerial terminal, and C2 is connected from this junction to pin six on the coil. This is the sixth pin counting clockwise from the gap. Pin 1 on L1 is gently bent sideways and soldered directly to the right-hand tag of VC1. This tag on VC1 is also bent sideways to connect directly to the left-hand tag of VC2.

Solder RFC1 to the right-hand tag of VC2, the other end of RFC1 is soldered to the case at any convenient point. In all cases, tin the case first at the point of soldering prior to making a connection. Wire R2 directly across C1. Solder one end of these components to the case, and the other end to R1. The free end of R1 is soldered to R3, R4, a wire to one side of SK3, and the *negative* terminal of the battery clip. The *negative* end of C3 may now be connected to pin six on the coil L1, and thence to the free end of R3. Solder one end of R5 directly to the case, and the other end to the free end of R4 and the *positive* end of C3.

## Fitting Tr1, Tr2

In the prototype the transistors were wired directly into the circuit, gripping the lead wires with a pair of long-nosed pliers to prevent the heat of the soldering iron travelling up the lead into the transistor, with the consequent risk of damaging the delicate internal junctions. If this procedure is duplicated then the following hints are offered. Do *NOT* cut the transistor leads short. Fit sleeving over these leads to prevent accidental shorting. When fitting, place the transistor in position, grip the appropriate lead fairly close, about ½ in. from the transistor itself with a pair of pliers and bend the wire as required.

Another possibility and perhaps a safer method is to use transistor holders in which case the leads can be cut quite short and the transistor plugged in when all wiring has been completed. This also avoids the risk of heat from the soldering iron affecting the transistor. If this method is used, it is advisable to mark the transistor holder at one end and call this the collector end. This will help prevent the transistor from being plugged in the wrong way round, a mistake very easy to make.

The OC71 has three lead out wires all in line, and the red spot on the case is closest to the collector. The middle wire is the base, and the other wire the emitter. The OC170 has four leads in line, three fairly closely spaced and one with a gap away from the other three. With this gap on the right-hand side, the wires from left to right are emitter, base, screen (gap), collector.

Solder the base of Tr1 to the junction of R1, C1, R2; the emitter to the junction of VC2, RFC1; and the collector to the junction VC1, VC2 and pin 1 on L1. The screen is connected directly to the case.

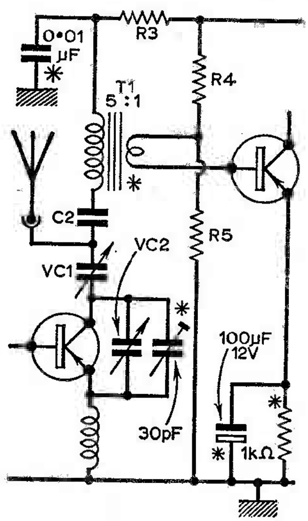



*Fig. 3: Skeleton circuit, added components marked with asterisks.*

The emitter of Tr2 is soldered to the case; the base to the *positive* end of C3 and the junction it makes with R4, R5. The collector is wired directly to the remaining free terminal on SK3.

At this point it is strongly advised that all constructors carefully check the wiring twice! Once against the circuit diagram Fig. 1, and again a second time checking with the wiring diagram shown in Fig. 2.

It is particularly important to check the connections to the transistors as a mistake here might well ruin them.

Also very important is the polarity of the battery. Fitting of this should be left until the very last thing.

—continued on page 513

TV & Radio 66

# RADIO SHOW NOTES

LOOKING back at this year's Television and Radio Show, the most noticeable thing was its smallness and the ease with which one could walk round the stands. Only part of the ground floor of Earl's Court was occupied by the exhibitors and the few members of the public who came along were turned back—the show being restricted to the trade. Most exhibitors were not in favour of barring the public and, we understand, the general public will be allowed in next year.

In the presence of a selected audience, F. C. Mclean, C.B.E., Director of Engineering of the BBC, opened this year's show. He spoke at length on the Corporation's television activities (a summary appeared in last month's issue of our sister journal *Practical Television*) and also on the BBC's stereo broadcasts.

"At the present time," he said, "this is limited to a few hours a day from two transmitters in south-east England, but work is in hand to extend these transmissions to other parts of the country. Stereo will probably never be a service of wide popular appeal, but it does appeal to a limited discerning audience and is highly valued by them."

## STEREO BROADCASTING

The BBC plan to extend stereo transmissions to the Midlands using the Sutton Coldfield v.h.f. station in the summer of 1967 and to the North of England a few months later. Further extensions of the service, both in relation to coverage and to the number and character of the stereo programmes transmitted, will be considered in the light of public reaction and of the economic resources available.

In common with many other European radio and television organisations, the BBC use the pilot-tone system to radiate stereophonic sound programmes. This system works quite well and is relatively simple. The left- and right-hand microphone outputs are alternately switched, at a rate of 38,000 times per second, to form a composite audio signal which is then radiated in the usual way. This composite signal is separated at the receiving end by a similar switching process; the switching is kept in synchronism by a pilot-tone, hence the name of the system. The actual frequency of pilot subcarrier is 19kc/s.

In past issues we have given technical details of the pilot-tone system and of associated receiving equipment, and it is hoped to run another series in the future.

Stereo decoders, which are necessary for the reception of the BBC's stereo broadcasts, are now fitted to many v.h.f. tuners and v.h.f. receivers.

## SOUND RECEIVERS

A wide selection of sound receivers, ranging from inexpensive, mass-produced transistor portables to sophisticated, multi-waveband models costing £100 or so, were on display. The majority of these receivers employed solid state circuitry and were of a very high quality, both in performance and styling.

The foreign made receivers, if anything, seemed to have the edge on our own models; particularly in regard to styling.

**Telefunken** exhibited a fine range of receivers which were nicely styled, performed well and had many noteable features. The automatic frequency control on their receivers, for example, was extremely effective—having a pull-in of 300kc/s and a pull-out of 400kc/s.

Other features of Telefunken's car-portables included bandspreading on the short wavebands, remote control and facilities for pre-setting four f.m. stations and one station from one of the other wavebands (LW, MW, SW) Varactor diodes have been used to pre-set three of the f.m. stations and also in the remote control unit. These devices, which have been in use in industrial and military equipment for some time, are capacity conscious when reversed biased. In fact, with these devices it is possible to change the capacity of a tuned circuit simply by increasing or decreasing the d.c. level.

A novel method of bandspreading the short wavebands is employed by Telefunken on their Model TS101 de luxe car-portable. They have, in fact, strapped a padder to the inductive f.m. tuner which is separate from the a.m. section, thus making it possible to use the whole f.m. scale for fine tuning on the short wavebands. The price is £77 14s. 2d.

**Grundig** also exhibited a range of quality multi-waveband portables. The latest addition is the Concert Boy transistor portable. This receiver, which covers the usual medium and long wavebands and the v.h.f. band, should be of particular interest to short wave listeners since it additionally covers 5·9 to 16Mc/s in two wavebands. One of these wavebands is devoted to the 49 metre band (5·9 to 6·2Mc/s). The price of this 2-watt receiver is 56 gns.

A receiver with similar coverage, yet much smaller and specifically designed as a car radio was also shown by Grundig. This is claimed to have an output of five watts which should be sufficient for the most discerning motorist. Installation kits, containing a speaker, are available for most motor cars; prices ranging from £11 7s. for the Alfa Romeo 1600 Sprint to 5 gns. for the Wolseley 6/99. The price of the receiver is 49 gns.

**Blaupunkt (Blue Spot)** had a very fine range of car radios on display, ranging from simple long and medium waveband receivers costing about 20 gns. to multiple waveband a.m./f.m. sets costing a good deal more. Short wavebands are included on most of their receivers and to cater for the enthusiast, they offer a short wave adaptor which will work with all the radios in their current range. This costs 18 gns. and covers nine short wavebands: 13, 16, 19, 25, 31, 41, 49, 60 and 90 metres.

One of their car radios, the Köln (79 gns.), is fitted with an electronic station finder which, when operated, hunts the tuning scale to find the next "good reception" station which is then tuned-in just as accurately as with manual tuning. A sensitivity switch is provided so that the "station finder" can either tune-in all stations or those of sufficient strength to ensure good reception during the journey.

**Sony,** at the other end of the price scale, exhibited two a.m./f.m. car-portables retailing at 29 gns. These Japanese receivers are car radios fitted with a carrying handle and a telescopic aerial and not like their British counterparts which—at a push—can be used in a car. Special car radio brackets containing a power amplifier and fitted with a lock are available for these radios. The external transistor amplifiers work off the car battery and boost the output from about half a watt to three watts: cost 9½ gns. A speaker system containing an eight-ohm unit is also offered for these inexpensive car radios which will operate from 6 or 12 volt, positive or negative supplies.

British manufacturers seem reluctant to add v.h.f. to their portable receivers: one could almost count on the fingers of one hand the number at the show. Our correspondents could not find a British car radio at the show with an f.m., v.h.f. band. Nor could they find a definite reason for this. The foreign manufacturers exhibiting such receivers all claimed that f.m. reception inside a motor car was superior, so what is the answer? Could it be that our motorists want pop music, something which at present is not offered by the BBC who have exclusive use of the v.h.f. sound broadcast frequencies.

In Germany and several other countries, v.h.f. services are very popular, but they are not, as in this country, identical in content to those radiated on medium waves.

**Monogram Electric:** The General Electric Company of the U.S.A. have formed a company, called Monogram Electric, to market a range of G.E. transistor radios, clock radios, record players, radiograms and tape recorders in the United Kingdom. The products the new company exhibited at the show aroused a lot of interest and particularly their range of transistor portables housed in robust 'military styled' leather cases. Prices seemed to be competitive, an example being the P1720 a.m./f.m. ten transistor portable costing 10½ gns. This includes carrying case, batteries and an earphone for personal listening. The address of the Monogram Electric Company is 296 High Holborn, London, W.C.1

**Hacker, Roberts, Dynatron, Pye, Ekco, Bush, Murphy, Philips, RGD and all,** exhibited a selection of sound receivers. They were all much of a muchness, differing slightly in the facilities offered and in appearance. In fact, they were very much the same as last year.

Stereo f.m. tuners were very much in evidence. The trend here was wood, usually teak especially for the speaker housing. Particularly good, both from aesthetic and technical aspects were the continental units. **Loewe Opta** offered a typical installation using this Scandinavian low slim style suitable for a book shelf set up. The stereo a.m./f.m. tuner/amplifier in one cabinet, with two separate units for the speakers. **Saba** also preserved this attractive styling and of particular note was their Automatic Stereo, with a remote control unit for armchair tuning and adjustment. Typical claims for the set ups were 10–12 watts per channel with response from 30 c/s to 20 kc/s.

## AUDIO EQUIPMENT

In the tape recorder and hi-fi section there was very little which could be described as new, and certainly no major revolution in technique or design. A walk up Tottenham Court Road and Edgware Road after the show revealed many of the units already well established in dealers' windows.

Trends indicated that manufacturers were using the slogan "Plane-a Plank-a Wood-a Day", and teak appeared the firm favourite with walnut and rosewood in hot pursuit. This trend which one could appreciate in speaker cabinets and radiograms etc., has now infiltrated into the tape recorder ranks. Even one of the record pick-ups had its tone arm carved from some once-happy tree. The **Van Der Molen** VR4 was completely clothed in a smart teak jacket and this extended to the lid too. Also quite marked was the number of tape recorders which preferred to work in an upright position with the tape spools vertical. No manufacturer was able to give any technical reason why this should be so and one can only assume this to be a whim of the tapes themselves.

The use of cassettes was catered for and with the advent of pre-recorded cassettes this could prove popular. The **Elizabethan** LZ.612 portable mains/battery unit with recess for six cassettes looked and sounded attractive. It also sports a 10in. speaker. Many tape recorders had their tape spools enclosed.

Stereo was well represented—at a price. The **Akai** X-IV portable with the unique "Cross-field" head had performance specifications representative of a large number. A 15 transistor unit suitable for mono or stereo; 4 track—4 speed; frequency response at 7½ i.p.s. 40 c/s—20 kc/s; wow and flutter less than 0·16%. The damage to your cheque book—99 gns.

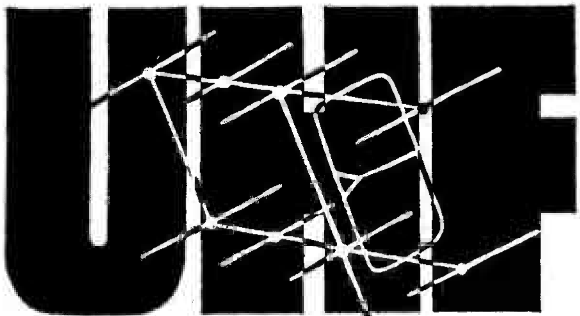
Semiconductors are in, especially the silicon devices, and even the larger units, radiograms etc., boasted solid state circuitry. The advertising gimmicks fought for attention, two of the best were—"electronic brain controls perfect recording", and "deviationless d.c. micro-motor". Speaker cabinets appeared to be shrinking fast, yet the frequency response from the units remains the same or better, even in the base tones. Motorists will be pleased to know that a stereo cassette loading unit, the size of a small car radio, is available.

Record players varied from cheap and cheerful to polished and pricey. The cheaper models were all much the same and can be seen in most dealers windows. Of note was the **Ajax Majestic** which offers a stereo record player for 22½ gns.

The **Hacker** Constellation RG50 stereo claimed attention. Not only was it all transistor, but had a grand total of six speakers. The "high note" speakers being fitted in panels at the side which were pulled out like two square ears when in use.

To sum up the show from the audio point of view, go and hear it yourself. After all, you buy for your ears' pleasure, let them be the judge. ■

# GETTING GOING ON UHF



J.P. BILLINGHAM G8AAC

THE portions of the radio frequency spectrum from 300-3,000Mc/s (1m to 10cm) and 3-30 Gc/s are officially known as the Ultra High Frequency (u.h.f.) and Super High Frequency (s.h.f.) bands respectively. However, for the purposes of this article, any frequency greater than 300Mc/s is considered to be u.h.f.

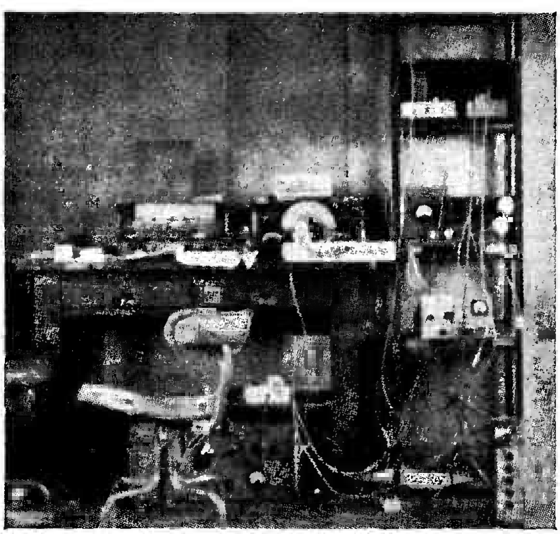
The u.h.f. bands require special techniques which will be discussed briefly, later in this article. Up to 1,000Mc/s, we get the transition away from h.f. and v.h.f. techniques. Up to 3,000Mc/s, microwave techniques are introduced. Above 3,000Mc/s, microwave techniques are used exclusively.

At one time, any amateur who ventured on to u.h.f. was regarded as a pioneer who could expect very few contacts. Three factors have recently changed this.

First, the introduction of the Sound 'B' licence meant that there were now some amateurs who were obliged to go on to the u.h.f. bands to use their own call signs. Also the knowledge that there was now likely to be some activity in this field stimulated other amateurs to become active on these bands. In some areas this effect has avalanched so that a CQ call will nearly always get a reply.

The second factor was the introduction of Bands IV and V (BBC-2) television services. This brought components suitable for operation at frequencies around 1,000Mc/s on to the market at reasonable prices.

Finally, in recent years a considerable amount of government surplus radar equipment has been released and at times units suitable for centimetric transceivers have been offered for a few shillings.



*A corner of the station at G8AAC.*

***Seventy centimetres***

The 70cm band is the Sound 'B' licencee's "top band". Although this band is 23Mc/s wide, the majority of transmissions occur in the 2Mc/s wide section from 432-434Mc/s. This section is used internationally for crystal controlled sound transmissions. In Britain there is a band plan for this section, organised by the RSGB. This is similar to the 2m band plan. In some areas this plan is not adhered to, partly due to the low level of activity, partly due to the difficulty of obtaining suitable crystals. The remainder of the band is used for amateur TV transmissions.

Propagation characteristics in this band are very similar to 2 metres except that sporadic 'E' is highly improbable. This is, at present, the most popular band for moonbounce. With tropospheric refraction, QSO's have been held over distances exceeding 1,000 miles.

***Twenty-three centimetres***

The 23cm band covers the range 1,215-1,325Mc/s, but like 70cm a small section only is used the most. This is in harmonic relationship to the 70cm section. Initially this portion was from 1,296-1,298Mc/s, but activity now extends to 1,300Mc/s in some areas.

There is not a great deal of activity on this band yet, but there is increasing interest in it now that many sound 'B' licensees are looking for a second band to work on. The propagation characteristics are similar to 70cm except that reflection from upper atmosphere ionisation become increasingly unlikely at these frequencies.

12cm and below has little general activity but there are small groups active. Some amateurs are conducting radar experiments on these bands.

***Receivers***

There are two main types of receiver in use at u.h.f., both employ frequency conversion to a lower frequency. Super-regenerative receivers are not popular, either with amateurs or the authorities.

The first type of receiver uses a crystal controlled local oscillator, with tuned i.f. output, the i.f. tuner being generally a short wave communications receiver. This type of receiver is usually narrow band, with the operating frequencies restricted to 432-434Mc/s. It is suitable for DX working, and is essential if c.w. and s.s.b. signals are to be read. Such a receiver is costly in the first instance, the bulk of the cost being, of course, the communications receiver. This type of receiver gives the best performance and is essential if serious DX work is contemplated.

The second type of receiver has a free-running oscillator, and a fixed i.f. which is almost invariably broad band to cover oscillator drift, detection usually taking place at a frequency between 30 and 40Mc/s. This is undoubtedly the cheapest way to receive 70cms.

U.H.F. television tuners can be easily modified to tune the whole of the 70cm band. Surplus valve tuners can be obtained complete for under £2. One of these fitted into a BBC only TV which can be bought in working order for £1 or so provides a complete 70cm receiver for only £3.

The i.f. output from the tuner is fed directly to the i.f. strip of the TV, which should, of course, have its carrier frequency in the region 34-38Mc/s. The h.t. and l.t. supplies are taken from the main receiver. Modifications to the tuner consist of connecting a 4·7 pF ceramic capacitor across the larger of the two trimmers on each tuned line. Such a receiver has the advantage of being able to receive sound and vision from amateur television stations, most of whom use the 405 line system. Another advantage of this system lies in the fact that Band IV and Band V sound can still be received, and by monitoring relatively distant stations, DX conditions can be recognised immediately they occur.

The disadvantage of this sytem is that two stations close to each other in frequency may be heard together, so that any DX may be swamped by local stations. Also, c.w. and s.s.b. signals cannot be read. However DX of several hundred miles has been worked using these receivers.

Because of the high level of mixer noise, most stations usually have at least one stage of r.f. amplification. Since feeder losses are high, the amplifier is sited as near to the aerial as possible. Now that u.h.f. transistors are available giving better performance than valves, at lower prices, the amplifier can be attached to the aerial itself and the d.c. power is sent up the coaxial cable.

**TABLE I—BRITISH LICENCE CONDITIONS FOR U.H.F.**

| Band | Frequency |
|---|---|
| 70cm | 427— 450Mc/s |
| 23cm | 1,215—1,325Mc/s |
| 12cm | 2,300—2,450Mc/s |
| 9cm | 3,400—3,475Mc/s |
| 5cm | 5,650—5,850Mc/s |
| 3cm | 10— 10·5Gc/s |
| $1\frac{1}{2}$cm | 21— 22Gc/s |

Notes: The maximum allowed d.c. input power to the final stage is 150W. The following modes of emission are allowed:— a.m., s.s.b., d.s.b., n.b.f.m. (for which no GPO morse test has to be taken) and c.w., m.c.w., f.s.k. (for which the morse qualification is necessary).

Pulse modulation techniques can be used on the following bands, provided that the d.c. input power does not exceed 25W mean or 2·5kW peak:—2,350—2,400Mc/s, 5,700—5,800Mc/s, 10·05—10·45 Gc/s, 21·15—21·85Gc/s.

**TABLE II—RSGB VOLUNTARY BAND PLAN FOR 70cm.**

| Frequency range (Mc/s) | Areas |
|---|---|
| 432·00—432·10 | Cornwall, Devon and Somerset. |
| 432·10—432·25 | Berks., Dorset, Hants., Wilts. and the Channel Is. |
| 432·25—432·50 | South Wales, Glos., Herefordshire and Worcs. |
| 432·50—432·70 | Kent, Surrey and Sussex. |
| 432·70—433·10 | Beds., Bucks., Essex, Herts., London and Middx. |
| 433·10—433·30 | Cambs., Hunts., Leics., Norfolk, Northants., Oxon., Rutland, Suffolk, Warks. |
| 433·30—433·50 | North Wales, Cheshire, Salop. and Staffs. |
| 433·50—433·80 | Derbys., Lancs., Lincs., Notts. and Yorks. |
| 433·80—434·00 | Scotland, N. Ireland, Isle of Man, Cumbs., Co. Durham, Northumbs. and Westmorland. |

### *Transmitters*

For 70 and 23cm crystal controlled transmitters are used. Many stations use a 2m transmitter driving a tripler followed by a p.a. for 70cm, and for 23cm an additional tripler and p.a. Although quite a few stations operate at powers of 100W or more on 70cm, very few use more than about 10W on 23cm. This is due to the non-availability of valves at a reasonable price for the higher frequency.

For the remaining bands, free running oscillators are generally used. Klystrons are often used, feeding the aerial directly. Typical power levels for a Klystron transmitter are:—7W d.c. input for 100m.w. of r.f. power output. Because of the higher aerial performance obtainable at shorter wavelengths, the equivalent radiated power (e.r.p.) is maintained at a reasonable level.

### *Aerials*

At 23cm and 70 cm horizontally polarized Yagi arrays are often used. As the frequency goes higher the tendency is towards the use of paraboloid dishes with either a dipole or a waveguide horn at the focus. The main feature of u.h.f. aerials compared with h.f. aerials is the very directional characteristics. At 70cm beam widths of less than 20° are not uncommon, while at $1\frac{1}{2}$cm beam widths of less than 1° are easily obtained. Since u.h.f. aerials are physically small, they can be constructed and erected quite easily, and an impressive aerial farm can be put into a loft.

### *Techniques and components*

Since the wavelength is small and many components have dimensions an appreciable fraction of a wavelength, there can be voltage and current variations across the component. Also, as the frequency is so high, the time interval is extremely small between successive cycles. Because of this, the time taken for an electron to travel from a cathode to a control grid may be such a large portion of a cycle that the grid can exercise no control on the anode current. As the frequency increases, coils in tuned circuits get smaller and smaller, so that other techniques using standing wave patterns, are developed and used.

## TABLE III—VALVES SUITABLE FOR U.H.F. RECEPTION

### PIN BASED VALVES

| Maker's No. | CV No. | Type | Base | Use at 70cm | Use at 23cm | Equivalents |
|---|---|---|---|---|---|---|
| A2521 | 2453 | T | B9A | A | A | |
| A2744 | 4105 | T | ,, | A | A | |
| EC86 | | T | ,, | M | M | E86C, 6CM4 |
| EC88 | | T | ,, | A | M | E88C, 6DL4 |
| ECC88 | 5358 | DT | ,, | A | — | E88CC, CV2492 |
| PC86 | | T | ,, | M | M | |
| PC88 | | T | ,, | A | M | |
| 6AF4A | 5074 | T | ,, | M | — | |
| 6AM4 | 5073 | T | ,, | A | M | |
| 6CW4 | | NT | TWELVAR 5-PIN | A | | |
| 6DS4 | | NT | ,, | A | | |
| 6J6 | 858 | DT | B7G | M | | ECC91, M8081, 6101 CV4031 |
| 12AT7 | 455 | DT | B9A | M | | 6060, CV4024 |

### SPECIAL VALVES

| Maker's No. | CV No. | Type | Use at 70cm | Use at 23cm | Use at 12cm | Use at 9cm | Equivalents |
|---|---|---|---|---|---|---|---|
| DET22 | 273 | DST | A | A | A | — | TD03-10 |
| DET23 | 354 | ,, | A | A | M | — | TD03-5 |
| DET29 | 2397 | ,, | A | A | A | M | VX3263 |

**Notes.** In type column: DST—Disc seal triode, DT—Double triode, NT—Nuvistor triode, T—triode.
In **use** column: A—Amplifier, M—Mixer. Where a valve is suitable as an amplifier it is also useful as a mixer.

In general, the remarks made about components at v.h.f. apply, only in some cases, more so. Ceramic capacitors can be used in signal circuits up to 5Gc/s but above this frequency they are usually air spaced parallel plates. D.C. and a.c. power is brought through screens using feedthrough capacitors which give adequate decoupling. Cavities, lines and wave-guides are used in place of coils.

Some conventional valves and transistors will work at the lower frequencies in these bands. Some of these are listed in Tables III, IV and V with the possible applications. Special valves such as magnetrons and klystrons have been used for some decades now, but new types of semi-conductor are beginning to displace them for low and medium power work. Silicon diodes were used in microwave work during the second world war. New types of diode such as the varactor diode, and the tunnel diode are achieving prominence, and are now beginning to appear in amateur equipment.

### *Materials*

At high frequencies conduction takes place only in the surface of the conductor. As the frequency rises, this layer becomes thinner. At 432Mc/s it is less than 0·001″ thick. This involves careful choice of material and also of component shape. Copper and brass are suitable for frequencies up to 2000Mc/s, above this frequency they must be silver plated. The layer of plating need not exceed 0·001″ thick, and is usually satin rather than shiny finish.

Insulators must be non-hydroscopic, otherwise they are too lossy. Glazed ceramic and PTFE are suitable, and where structural strength is not of major importance, the latter is preferable. Whatever materials are used, absolute cleanliness is essential, and finished assemblies should be mechanically rigid.

### *Operation*

T-R switches for u.h.f. have to use co-axial relays in the aerial circuit, but these can present major difficulties, especially at frequencies above 1000Mc/s. There are commercial T-R units capable of operation in any of the amateur bands, but these are extremely expensive. The simplest method of T-R operation is to plug the aerial lead into whichever unit is in use. This does not lead to slick working, and precludes the use of a mast head amplifier. A popular method is to use two aerials, one for receiving, the other for transmitting, and changeover is reduced to single switch (the transmitter h.t. supply) operation. One interesting feature of this type of operation is that duplex working is possible in a band if there is sufficient separation between one's own frequency and that of the station being worked.

Where waveguide techniques are used, and klystrons provide the power, the transmitter is also used as the receiver local oscillator, thus allowing duplex operation with a single aerial.

### *Activity*

On these bands, portable operation is popular, where a complete station is set up on high ground with a good outlook towards areas of high activity.

Since the number of signals that can be received under normal conditions at most stations is small compared with, say, 20m. or 80m., activity tends to be concentrated on "activity nights". These vary in different areas. Monday night is activity night in the Home Counties, Wednesday night in the West Riding area, and Thursday night in the Birmingham area. Saturday night is the general activity night.

Other times of high activity are during contests, details of which are published by the RSGB.

## TABLE IV—VALVES USEFUL FOR U.H.F. TRANSMISSION

### RECEIVING VALVES

| Maker's No. | CV No. | Type | Base | R.F output power (W) at 70cm | R.F output power (W) at 23cm | Equivalents |
|---|---|---|---|---|---|---|
| A2521 | 2453 | T | B9A | 2 | 1 | A2744 |
| EC86 | | " | " | 2 | 1 | E86C, 6CM4 |
| EC88 | | " | " | 2 | 1 | E88C, 6DL4 |
| EF95 | 850 | P | B7G | 1 | | 6AK5 |
| PC86 | | T | B9A | 2 | 1 | |
| PC88 | | " | " | 2 | 1 | |
| 6AF4A | 5074 | " | " | 2 | 1 | |
| 6AM4 | 5073 | " | " | 2 | 1 | |
| 6J6 | 858 | DT | B7G | 2(PP) | | ECC91, M8081, 6101, CV4031 |
| 12AT7 | 455 | " | B9A | 2 | | 6060, CV4024 |

### TRANSMITTING VALVES

| Maker's No. | CV No. | Type | Base | R.F. output power (W) at 70cm | at 23cm | at 12cm | at 9cm | Equivalents |
|---|---|---|---|---|---|---|---|---|
| DET22 | 273 | DST | — | 4 | 2 | 1 | — | TD03–10 5861 |
| DET24 | 397 | " | — | 12 | 8 | — | — | TD04–20 |
| DET29 | 2397 | " | — | 4 | 4 | 3 | 2 | VX3263, TT23, 6939 |
| QQV02–6 | 2466 | DBT | B9A | 6(PP) | — | — | — | CV5473 |
| QQV03–20A | 2799 | " | B7A | 30(PP) | — | — | — | TT20, 6252 |
| QQV06–40A | 2797 | " | " | 60(PP) | — | — | — | TT25, 5894 |
| 2C39A | 2516 | DST | — | 25 | 20 | 12 | — | TD1–100A CU5430 |
| 4X150A | 2519 | BT | B8F | 150 | — | — | — | |

**Notes.** Valve types: BT—Beam tetrode, DBT—Double beam tetrode, DST—Disc seal triode, DT—Double triode, P—Pentode, T—Triode. Power output: PP—Both halves of the valve used in push-pull.

## TABLE V—TRANSISTORS SUITABLE FOR USE AT U.H.F.

### AS AMPLIFIERS OR MIXERS IN RECEIVERS

| No. | Type | Highest frequency band for use | No. | Type | Highest frequency band for use |
|---|---|---|---|---|---|
| AF139 | Ge p-n-p | 70cm | 2N2273 | Ge p-n-p | 70cm |
| AF186 | " " | " | 2N2708 | Si n-p-n | " |
| AFY34 | " " | 9cm | 2N2857 | " " | 23cm |
| GM0290 | " " | 23cm | 2N3478 | " " | 70cm |
| 2N917 | Si n-p-n | 70cm | 2N3600 | " " | " |
| 2N918 | " " | " | | | |

### AS OUTPUT STAGES IN TRANSMITTERS

| No. | Type | Power output at 70cm (Watts) | No. | Type | Power output at 70cm (Watts) |
|---|---|---|---|---|---|
| ASZ21 | Ge p-n-p | 0·05 | 2N709 | Si n-p-n | 0·25 |
| BSX12 | Si n-p-n | 0·3 | 2N2475 | " " | 0·25 |
| BSX26 | " " | 0·3 | 2N2938 | " " | 0·25 |
| BSX27 | " " | 0·25 | 2N3261 | " " | 1·0 |
| BSX28 | " " | 0·5 | 2N3373 | " " | 10 |
| BSX29 | " p-n-p | 0·3 | 2N3375 | " " | 3 |
| BSX35 | " " | 0·25 | | | |

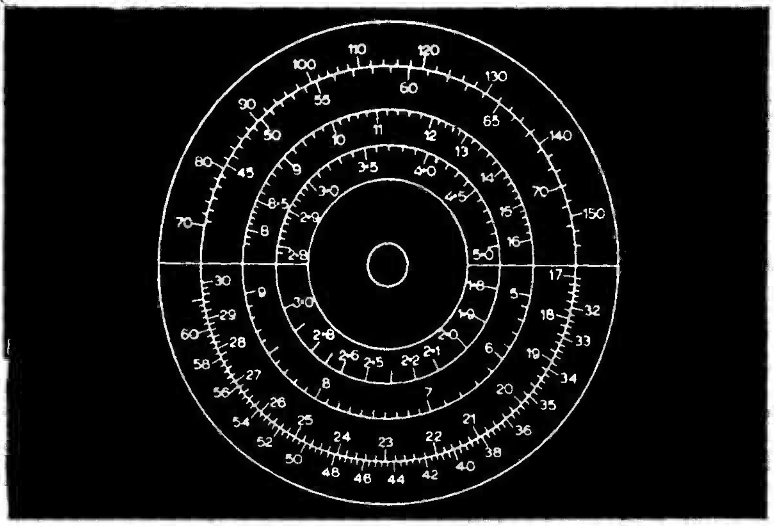
**Notes.** Ge—Germanium, Si—Silicon.
Most transistors can be used as oscillators or frequency multipliers or power amplifiers at frequencies six times or higher their transit frequencies ($f_t$) up to a limit of about 2·5Gc/s.

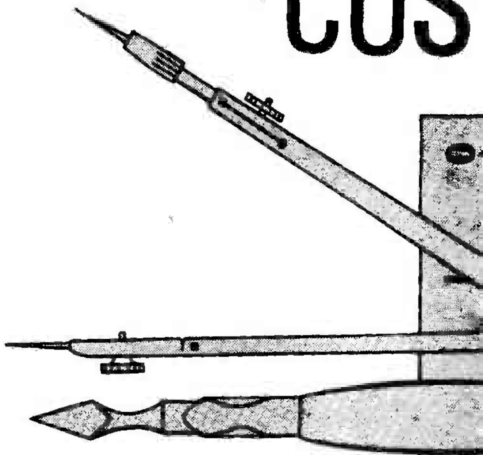
### *Conclusions*

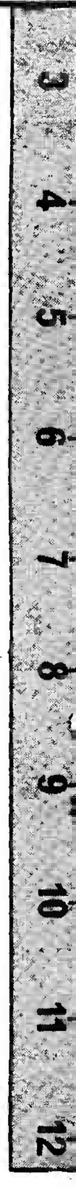
The u.h.f. bands present certain technical problems, but these can quite easily be overcome. Maximum performance, particularly for receivers, can be very expensive, but on the other hand, equipment for local working can be very cheap indeed.

There is an enormous bandwidth available to the amature on u.h.f., he has over 2,000Mc/s he can use. This huge spectrum space coupled with the relatively short working distances and highly directional aerial systems, means that the u.h.f. bands are unlikely ever to become congested. ■

# CUST








ONE of the biggest problems facing the amateur constructor is making the finished article look professional. There are now many types of knob available in various sizes, shapes and colours, and many units can be improved merely by purchasing a matching set.

However, there still remains the problem of labelling these knobs in order to indicate their function and, more often than not of finding a suitable dial. If a ready made dial is purchased it will probably be marked 0—180 or 0—100 and in order to calibrate this it is necessary to draw an accompanying graph to convert dial reading to frequency, etc.

Labelling the control knobs is made somewhat easier by the various transfers available, but the snag here is that often the particular word required is either not on the sheet or has already been used. If the "individual letter" type of transfers are used they can be very awkward to handle, often resulting in a rather fiddling job to fix each letter separately, getting it in line with the other letters and ensuring constant spacing.

## Method ...

With the method to be described you can have any type of dial you wish, any word you care to name and in almost any language, too! Not only can you have these advantages to fit your requirements exactly, but it works out very cheaply.

The method is summed-up in one word—scraperboard, available from practically any artists' suppliers. Scraperboard is a black sheet of card. By scraping it, the white board underneath the surface layer of black shows through. With each packet of scraperboard a special scraping tool, rather like a pen nib is issued. This tool will fit into any standard "school type" pen, and makes an ideal implement for the job.

By using varying pressure, the thickness of the line can be changed, thus for those able to write reasonable script, this offers an excellent opportunity to scribe some really attractive lettering for the various controls on the equipment.

Shading is also possible, and some artists use scraperboard to produce some very fine results. Since the price of a small packet is very low, readers might like to purchase some and try their hand, with the safe knowledge that if by chance their efforts do not prove entirely satisfactory, then the cash lost is very small. Also, since a scraping nib is provided with each packet, there is no extra expense wasted on special scribers and tools.

Scraperboard is sold in various sizes, a very convenient one to start with is a 2s. 6d. packet. This contains three sheets of black board, each $4\frac{1}{2}$ x $5\frac{7}{8}$ in. Also included is a sheet of white board suitable for use with indian ink. Larger sizes are available up to 24 x 19 in.

## Dials...

The dial on a receiver can often make or mar the appearance of the finished unit. An example of a dial using scraperboard can be seen at the top of this page. The making of such a dial is quite simple but requires patience and cannot be rushed.

Adjust a pair of compasses to the correct radius of the dial required. Draw or scribe a line to form a base line. Stick the pivot point of the compasses in the centre of the base line and carefully scribe a semicircle, or a complete circle if the dial is to cover 360°. To mark the calibration lines first mark their position carefully around the semicircle with the point of a sharp pencil. This can be divided up accurately with the aid of a protractor and a rule. When this preliminary calibration is complete, insert the point of the compasses back into the central hole, this gives a firm edge against which the ruler is placed. The other end of the ruler is lined up with the appropriate calibration mark and a line scraped with a sharp point. The preliminary pencil marks should be made very lightly as a sharp pencil point can quite easily act as a scraper.

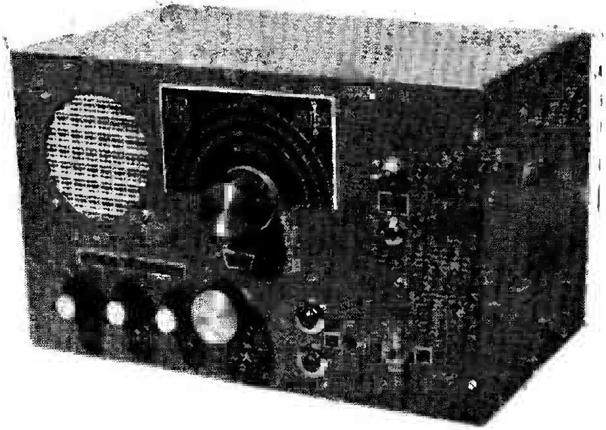
Other semicircles for the various wavebands, etc. are made by reducing the spacing between the compass points to suit and repeating the process outlined above.

If the dial is required to calibrate an oscillator,

# TOM BUILT

# DIALS

**T. SIMON**



*Note the neat finish of the author's communications t.r.f. receiver which was described last month.*

then it is best to mark an inside semicircle 0—180° and use the outside semicircle as the calibrated dial. This suggestion is for two reasons. It is always useful to have an extra dial available for calibration marks which can be made without marking the main dial. Secondly, the outside semicircle will be the larger of the two and the calibration points will be further apart and easier to read.

To calibrate, the dial is fixed or held lightly in position and the calibration marks made lightly with a sharp pencil. The dial may then be removed and the marks scraped. After this the dial is held in position and the calibration checked at either end of the scale. When all is correct the dial is fixed permanently.

Small dials and plates for volume controls, i.f. gain, etc., are made in exactly the same way except that they are usually marked 0—10. As will be appreciated any division is possible on the dial to suit the whim of the constructor. Heavy pressure may be used for the main divisions with light pressure and therefore finer lines for the intermediate points.

## Labels ...

The labelling or lettering is quite easy, although it does help if the person is artistic, and particularly if he is the possessor of a steady hand.

The technique is the same as for dials. The exact size of the label is ruled very lightly in pencil. Next, the lettering or wording is drawn in very lightly with a very sharp pencil. It is best to subdivide the area of the label into equal sections, the same number of divisions as there are letters in the word required. This is a great help in ensuring equal spacing and consistency in the size of the letters. Before commencing with the lettering on the actual label itself it is a good idea to devote a small piece of the scraperboard for a trial run.

It is important not to attempt making scraperboard dials or labels immediately after doing any heavy work which requires any great physical effort. This is because the hands have a definite tendency to tremble and working with a fine point is almost impossible. Try half an hour's gardening with a spade and see for yourself. The writer made this very mistake, and the first attempts looked suspiciously like the work of a drunken spider! A ruler may be used to advantage for capital letters ensuring a good clean straight edge.

An extremely useful tool for very fine lettering and thin divisions on a dial is a large needle. The writer claims some success with the sharp point of a pair of compasses. These are not the easiest of things to hold, but most readers should have no trouble in purchasing a packet of needles of varying sizes and fitting them into a small wooden handle, probably doweling around $\frac{1}{8}$ in diameter would suit ideally.

This method opens up new horizons for the home constructor. For instance it is not necessary to be bound by lettering. A loudspeaker socket can be marked with the whole word, or just L.S. or the symbol used in circuit diagrams can be drawn in. On oscilloscopes the square, sine, or sawtooth waveform can be actually drawn on the label. In the case of a square or sawtooth wave this is extremely easy with the aid of a ruler. A sine wave is more difficult unless a flexible curve is available.

The board will take white Letraset and is a possibility for those who prefer to make and calibrate a dial to exactly suit their requirements, yet feel unable to "scratch" the letters sufficiently neatly.

The finished board is easily accidentally scuffed or scratched and to prevent this it is strongly recommended that the finished work be sprayed with clear varnish. Aerosols of clear varnish are easily obtainable from most artists' supply shops and large stationers. Two thin coats are usually sufficient. The finished article may be held in position by ordinary glue and almost any adhesive is suitable. Only a thin even coat is necessary but ensure that no adhesive gets on to the front. Scraperboard should be cut with a razor blade on a flat surface, scissors tend to crack it. If the board is accidentally cracked or scratched, then it is possible to repair the damage by painting the scratch sparingly with indian ink.

For custom built dials and labels scraperboard is hard to beat. For just 2s. 6d. you can prove it for yourself. ■

# CONVERTING THE R1392

C. G. ELLIOTT, G8ADP

THE 62H is the Navy version of the R.A.F. R1392 the main differences being their intermediate frequencies of 9·72 and 4·86Mc/s respect'vely. Their range is 95–150Mc/s, however the oscillator is controlled by a crystal which means for every receiving channel a separate crystal is required. The formula for calculating the correct crystal frequency is given as

$$\frac{f\ \text{xtal} - f\ \text{signal} - \text{I.F. Mc/s}}{18}$$

Even if one could stock all the appropriate crystals for every channel between 95–150Mc/s, it would be awkward to tune over the band. The modification described in *Practical Wireless July 1960* enabling the whole frequency range to be covered without crystals was carried out and it worked well. But for use as a 2 metre receiver it was far from adequate, the 2 metre band only being spread across a few millimetres of dial. It was decided to modify the receiver to enable 2 metres (144—146Mc/s) to be spread across the whole dial. Various attempts were made to modify the oscillator further, but it was found more satisfactory to construct a new oscillator using only one valve.

## New Oscillator

The three-valve oscillator unit was completely removed leaving a hole in the front panel and three square holes in the main chassis providing ample space for the new oscillator and a mains power supply.

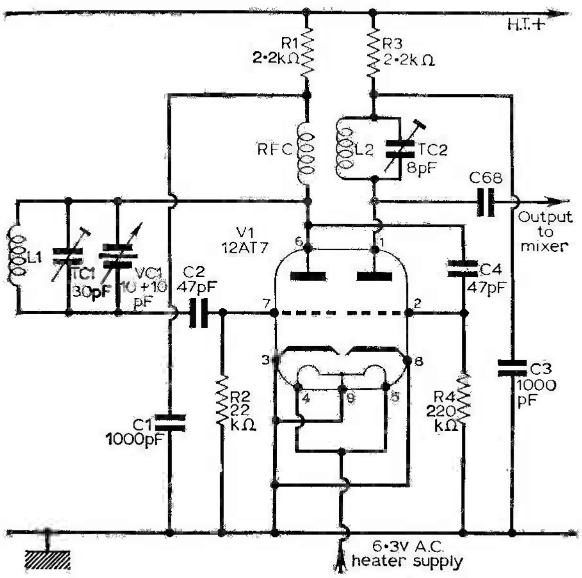
The circuit of the new oscillator is shown in figure 1. The first section of the 12AT7 tunes around 70Mc/s and second section doubles it to around 140Mc/s. The frequency of the oscillator will depend on whether the i.f. is 4·86Mc/s (R1392) or 9·72Mc/s (62H). The use of a grid dip meter to check the frequency of the oscillator is invaluable, though not essential. With VC2 fully meshed (i.e. at maximum capacity), VC1 is adjusted to resonate the circuit at 69·97Mc/s for the R1392 and at 67·14Mc/s for the 62H. VC3 is adjusted for resonance at 140Mc/s for the R1392 and 135Mc/s for the 62H. The output from the oscillator is taken via C68 (3·3pF) to the grid of the mixer (V3). This connection is easy to find as when the old oscillator unit is removed a small connection to V3 is revealed on the side of the r.f. amplifier unit. Since C68 is already contained in the mixer unit, it is only necessary to connect a short rigid wire from pin 1 of the 12AT7 to this terminal. The ball drive and dial were removed from the old unit and the lugs off the ball drive were fixed to a metal plate (with suitable hole for spindle) and this was bolted behind the front panel thus the tuning control was in its original position. A flexible coupler was fitted to the spindle of the ball drive via a rod to the spindle of VC1.

## Construction

The oscillator was constructed on a rigid chassis as shown in figure 3. It must be emphasized that all wiring be done with thick wire all connections rigid and short.

The power supply is shown in figure 2, this was mounted under the chassis where there is ample room. The voltage regulator (OA2) provides 150 volts stabilized for the oscillator, the valve of R5 was about 2KΩ this may need some adjustment if the neon does not strike. It should be noted that H.T. negative is not connected to earth, but to pin 9 of the power socket at the rear of the receiver which is then earthed via R67 (680Ω) to provide bias for the A.V.C. The smoothing condenser (C6) should be of the type having an insulated can. A small panel light was mounted in the circular hole where the crystal retaining dip was. The on/off switch was mounted on a small paxalin sheet and bolted to the front panel where the crystal socket was.

Before carrying out any modifications it is advisable to make sure that the receiver is working in its original state. This may be done by simply using a crystal and receiving a signal from a generator. Or by making up the equivalent circuit of a crystal. This could be done



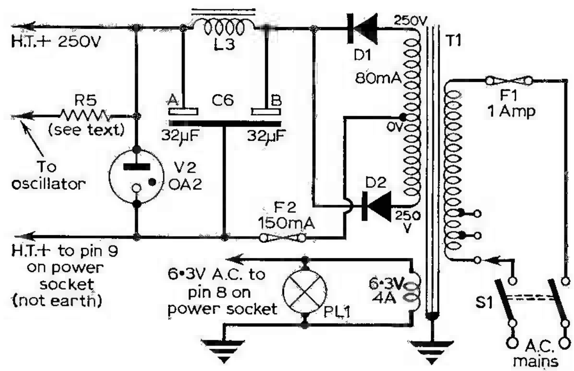




*Fig. 1: (left) Circuit of new oscillator.*

*Fig. 2: (above) Circuit of new power supply.*

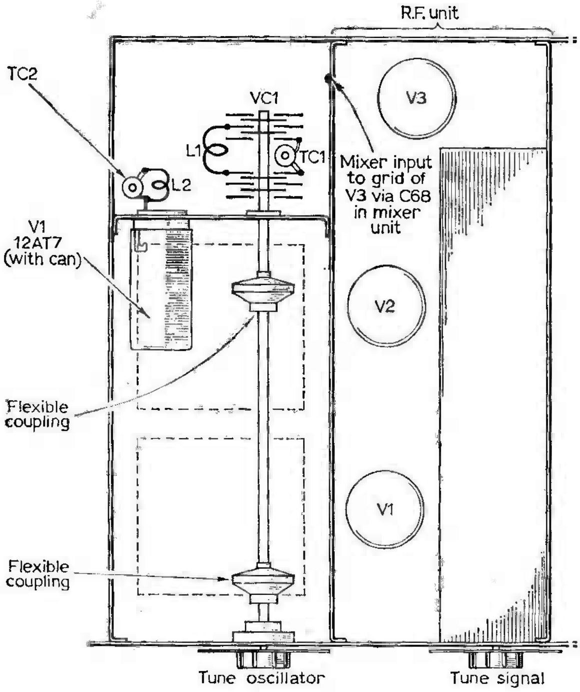
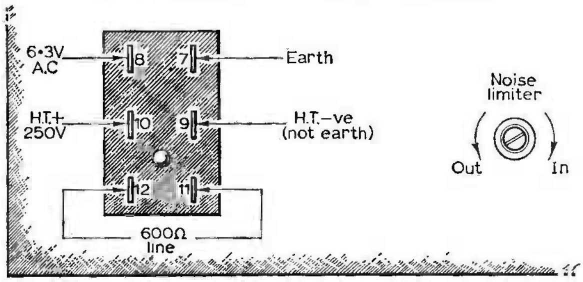



*Fig. 3: (above) Topside view of receiver front end.*
*Fig. 4: (below) Power supply connections.*




by winding some 24 s.w.g. enamelled copper wire on a ½in. former 2½ inches long and connecting this across a 150pF tuning capacitor, this then being plugged in the crystal socket. Set the meter switch to "tune Osc" set "Tune Osc" and "Tune Sig" to the desired frequency, now tune the 150pF capacitor until there is a dip in the meter. The receiver should now be functioning on that frequency.

The R.F. stages are tuned by the "Tune Signal" control for maximum noise or minimum "Tune Signal" current.

The power supply connections are shown in figure 4, the potentiometer near this plug is a noise limiter. Although effective on some ignition interference it also attenuates weak signals, and it is therefore advisable to put this control fully anti-clockwise.

## ★ components list

### The Oscillator

| | | | |
|---|---|---|---|
| R1 | 2·2kΩ ¼W | C1 | 1000pF ceramic |
| R2 | 22kΩ ¼W | C2 | 47pF ceramic |
| R3 | 2·2kΩ ¼W | C3 | 1000pF ceramic |
| R4 | 220kΩ ¼W | C4 | 47pF ceramic |
| R5 | 2kΩ 1W (see text) | VC1 | 30pF trimmer |
| | | VC2 | 10+10pF split-stator |
| V1 | 12AT7 | | |
| V2 | OA2 | VC3 | 8pF trimmer |

L1 Three turns of 16 s.w.g. copper wire, ½in. dia., ½in. long.
L2 Three turns of 18 s.w.g. copper wire, ½in. dia, ½in. long.
RFC 40in. of 28 s.w.g. enamelled copper wire close-wound on a 3/16in. former.
One B9A and one B7G valveholder with screening can.

### The Power Supply

C6 32+32μF 350V d.c. electrolytic, with isolated can.
F1 1A fuse. F2 150mA fuse
L3 Smoothing choke, about 10 Henry.
P1 6V panel-mounting lamp
SR1 and SR2 BY100 (or similar) silicon rectifiers.
T1 Mains transformer, 250–0–250V at 80mA and 6·3V at 4A.

### R1392 Valve Functions

| | | | |
|---|---|---|---|
| V1 | 1st r.f. amplifier | CV1136 | EF54 |
| V2 | 2nd r.f. amplifier | CV1136 | EF54 |
| V3 | Mixer | CV1136 | EF54 |
| V4 | Crystal oscillator/trebler | CV1065 | SP61 |
| V5 | Frequency multiplifer (crystal frequency X18) | CV1136 | EF54 |
| V6 | Buffer amplifier | CV1136 | EF54 |
| V7 | 1st i.f. amplifier | CV1053 | EF39 |
| V8 | 2nd i.f. amplifier | CV1053 | EF39 |
| V9 | 3rd i.f. amplifier | CV1053 | EF39 |
| V10 | Beat frequency oscillator | CV1935 | 6J7G |
| V11 | Detector/a.f. amplifier | CV587 | 6Q7G |
| V12 | A.G.C. rectifier/d.c. amplifier | CV587 | 6Q7G |
| V13 | Audio output | CV1932 | 6J5G |
| V14 | Pulse interference limiter | CV1092 | EA50 |
| V15 | Muting valve | CV1092 | EA50 |

A list of the original valves and their functions are given in the table. Their commercial equivalents are given in brackets after each type.

Although by no means the ultimate in 2 metre reception, this unit provides a cheap means of getting going on 2 metres. ■

## Representing Electronics

My colleagues and I in the Ministry of Defence feel that we are poorly represented in the political sphere. There are too many staff associations dividing the electronics profession internally. Our field is an exciting, new world so why should it be marred by attitudes which are as old as the Preston Guilds? New skills are evolving and new representational groups should be formed to cope with them.

At work, we have formed a steering committee to look into the possibility of forming one staff association which will embrace everyone working in the electronics field. What we need to know initially, is what our contemporaries feel about this proposal. At this early stage, good ideas are worth more than gold. If you or any of your readers are interested and want to find out more about this scheme, we look forward to hearing from you, and receiving your points of view. We shall endeavour to answer your questions and give fuller details.

**E. C. Jennings.** Flat No. 4, 24 Aigburth Drive, Liverpool 17.

## Old Radio Mags Wanted

If any readers have radio magazines or books dating back to the twenties, they would be very much appreciated, as we are trying to create a museum of old sets at our local Radio Society's clubroom.

Crystal or bright-emitter valve sets are also being collected, but most of these have probably already gone into the dustbin.

Postage paid, or we will try to arrange collection.

**Douglas S. Byrne, G3KPO.**
Hon. Secretary,
Peterborough Amateur Radio Society.
Jersey House, Eye,
Peterborough.

## Sell or Loan

***Sir, I would be grateful if any reader could sell or loan me . . .***

. . . the April and May 1966 issues of PRACTICAL WIRELESS.—Puran Singh, c/o Control Room, All India Radio, Lucknow, U.P., India.

. . . details on the Geiger tube CV 2147 also any relevant circuits or other details.—J. S. M. Whitaker, Suetts Farm, Bishops Waltham, Hampshire.

. . . a suitable circuit for a 20m converter "outboard oscillator".—Noel Evans, Killyberry, Castledawson, Co. Derry, N. Ireland.

. . . the characteristics and base diagram of the Mazda valve ME41 which is a magic eye with an International Octal base.—John Ellis, Treflan, Llanrug, Caernarvon, North Wales.

# NEWS AND..

### GRUNDIG DE-LUXE CAR RADIO

*Grundig (GB) Ltd., announce the AS40 car radio. It has long, medium and short wave (49 metre bandspread) and v.h.f. wavebands with an efficient switchable a.f.c. circuit ensuring crystal clear reception on v.h.f. Waveband selection is by simple press-button control and a speech/music control is also provided. It can be powered by either a 6V or 12V car battery and is fitted with a lead for connection of multiple loudspeakers.*

*Transistors used are 2 x AF106, 3 x AF185, AF121, AF126, 2 x BSY80b and 2 x AD156. Current consumption is 80mA at no signal and measured at 7V is 1·4A at 5W output. Dimensions are $7\frac{1}{8}$ x $6\frac{3}{8}$ x $2\frac{1}{8}$in, and the price is 46 guineas plus PT surcharge of 13s. 4d. The car mounting kit is an extra.*

### RADIO HONG KONG MOVE

**Between now and January 1st 1968, Radio Hong Kong's medium wave transmitting station at Hung Hom in Kowloon, will be moved to Smuggler's Ridge in the New Territories.**

**The Hung Hom site is required for the development of access roads to the projected cross-harbour tunnel linking Kowloon and Hong Kong Island. It is hoped that testing of the new station will begin in October next year.**

### MILITARY RADAR AT FARNBOROUGH

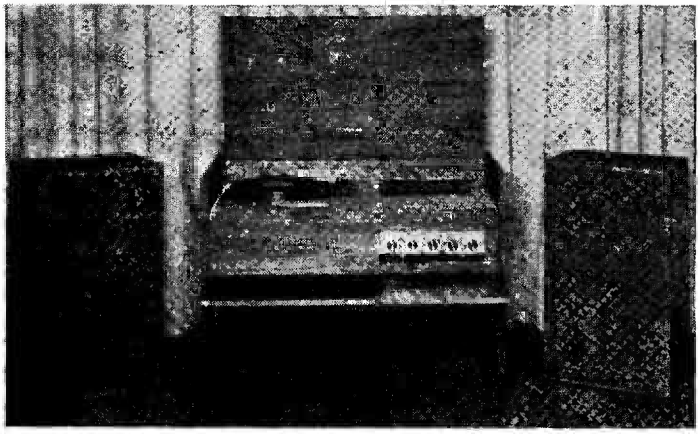
*This mobile Marconi radar system was on show to the public at the Farnborough Air Show. It can be employed in early warning or air traffic control applications. Fully mobile and designed to travel across rough country, the system can be fully operational within two hours of arriving at an unprepared site. It combines both surveillance and height finding radar, controlled from a central, mobile operations vehicle. Photograph shows the surveillance radar unit being prepared for action.*

# ...COMMENT

## RADIO COMMUNICATIONS EXHIBITION

*Don't forget that the "Hobbies Exhibition" opens on the 26th October at Seymour Hall, Seymour Place, London W.1. This is perhaps the only real show for the amateur that takes place in the South and is well worth the 3s. admission fee. The show runs for four days and is open to the public from 10 a.m. to 9 p.m.*

## CABINET BY DESIGN FURNITURE LTD.



*At the beginning of the year, Design Furniture Ltd., Calthorpe Manor, Banbury, Oxon, ran a competition for the design of hi-fi equipment cabinets. From the results of that competition their own design team has evolved this new compact cabinet measuring 36½ x 27½ x 18¾in. Designated the EQC 18, it will accommodate the majority of popular hi-fi equipment. The motor board and amplifier top are interchangeable from left hand to right hand and can be mounted in any position—flat, stepped or sloped.*

## RADIO SHOW ATTENDANCE

**Almost 23,000 retailers, wholesalers, distributors, manufacturers representatives and others connected with the trade, attended the 1966 Television and Radio Show at Earls Court.**

**The majority of exhibitors appear to be in favour of opening the TV and Radio 1967 Exhibition to the public with perhaps three or four days exclusive to the trade. A definite decision will be made known following consultations with the industry.**

## COURSES OF INSTRUCTION

At Hendon College of Technology, The Burroughs, Hendon, London, N.W.4. "Transistors and Transistor Circuit Design"—17 lectures on Wednesdays, commencing 12th October. The fee is 4 guineas and the content is basic theory of semiconductors and semiconductor devices, design of circuits incorporating semiconductors and recent developments in semiconductor design.

"High Fidelity Sound Reproduction"—9 lectures on Wednesdays commencing 12th October. The fee is £2 5s. and the content is frequency modulation, tape recorders, turntables and pick-ups, amplifiers, loudspeakers, room acoustics, stereo and recording techniques. Lectures are from 7—9 p.m.

## Broadcast Band Interference

D. MUGFORD, in his letter in the July issue of PRACTICAL WIRELESS claims that certain stations in the Communist countries cause "deliberate interference" by using 98% of all the available channels from 16m–75m. He mentions among others, Radio Moscow, Radio Berlin International and Radio Prague.

I think it would be advantageous to compare the abovementioned stations with three Western stations—The Voice of America, Deutsche Welle (West Germany) and the BBC—on a factual basis. As sources of information. I have used the 1966 "World Radio and TV Handbook" and the thirteenth edition of the Wireless World publication "Guide to Broadcasting Stations", in an attempt to reach as high a degree of accuracy as possible. The following figures refer to the most commonly used short wave bands, those in the range 11–50 m.

Voice of America: 146 frequencies (+ 65 transmitters on frequencies used by other V.O.M. stations). Radio Moscow: 144 frequencies (+ 47 frequencies outside the recognised bands). BBC: 137 frequencies (+ 11 frequencies outside the recognised bands and a further 29 transmitters on frequencies used by other BBC stations). Radio Prague: 13 frequencies (+ 4 frequencies slightly outside the recognised bands). Radio Berlin International (East Germany): 25 frequencies. Deutsche Welle (West Germany): 55 frequencies.

The above figures include the relays abroad as used by the Western stations. Stations in Communist countries do not use such relays.

The only station that Mr. Mugford mentions which is listed in the abovementioned sources as having transmitters on an amateur band is Radio Peking (on the 40m band). Other stations which broadcast in this band include Radio Karachi, Radio Jeddah (Saudi Arabia) and Radio Cairo. This practice is certainly to be condemned but I feel that many of Mr. Mugford's charges are unjustified. I trust that they have no political slant; our hobby after all, should be used to increase the understanding between the peoples of the world.

**B. Young.** Banffshire, Scotland.

## Correspondent Wanted

I WOULD like to correspond with anyone of my own age (13) who is interested in radio and electronics. I have made many transistor radios and am now making a modified version of the Ten-Five.

**J. Davies.** 26 Wyburns Avenue, Rayleigh, Essex.

F. G. RAYER G3OGR

HAM FEATURE

# 3·5 Mc/s Phone Transmitter

THIS transmitter was built originally to be used at a /A location on 80 metre phone.

Figs. 1 and 4 show the r.f. and modulator. V1 is the v.f.o., V2 a buffer-amplifier, driving V3, which normally runs with about 10 watts input. V4 is a high gain double triode, V5 and V6 being the push-pull modulators, giving anode and screen modulation of V3.

It is probably easier to construct the transmitter stage by stage, checking the sections when finished. The chassis is 7 x 4 x 2½ in. deep, and the panel is 7 x 5½in. Valveholder and other large holes should be cut before mounting any components. Fig. 2 shows where items are placed, and a number of ¼in. or ⅜in. holes should also be made for ventilation.

The v.f.o. in Fig. 1 tunes 1·75–1·9 Mc/s for doubling into the 3·5–3·8 Mc/s band. A 100V to 150V supply is used. When the "V.F.O. On" switch Sx is closed, the v.f.o. only is operating, and can be picked up by the receiver, so that the transmitter frequency can be adjusted to net on another transmission, or to fall in an unoccupied channel. Section S1 of the transmit/receive switch applies h.t. to the v.f.o. in the transmit position.

By using 1% capacitors, suitable coverage is obtained without trimming. L1 is a miniature dust-cored medium wave aerial coil, with the coupling section removed. Adjustment of the core allows 1·75–1·9 Mc/s to be covered, or 1·8–2·0 Mc/s, if top band is required instead. R.F.C.1 is a miniature transistor type wire ended r.f. choke as used in medium and long wave receivers. To save space, no reduction drive is used with VC1. This capacitor must be free from wobble and should employ a large knob, with pointer or indicating mark.

Wiring must be rigid. It is best to omit the screen in Fig. 2 until construction is otherwise completed. Adjust L1 core until the v.f.o. tunes 1·75–1·9 Mc/s, and check with the receiver at twice frequency through the 3·5–3·8 Mc/s band. This will make sure the core is not too far in, so that the v.f.o. is tuning about 1·16–1·26 Mc/s in error.

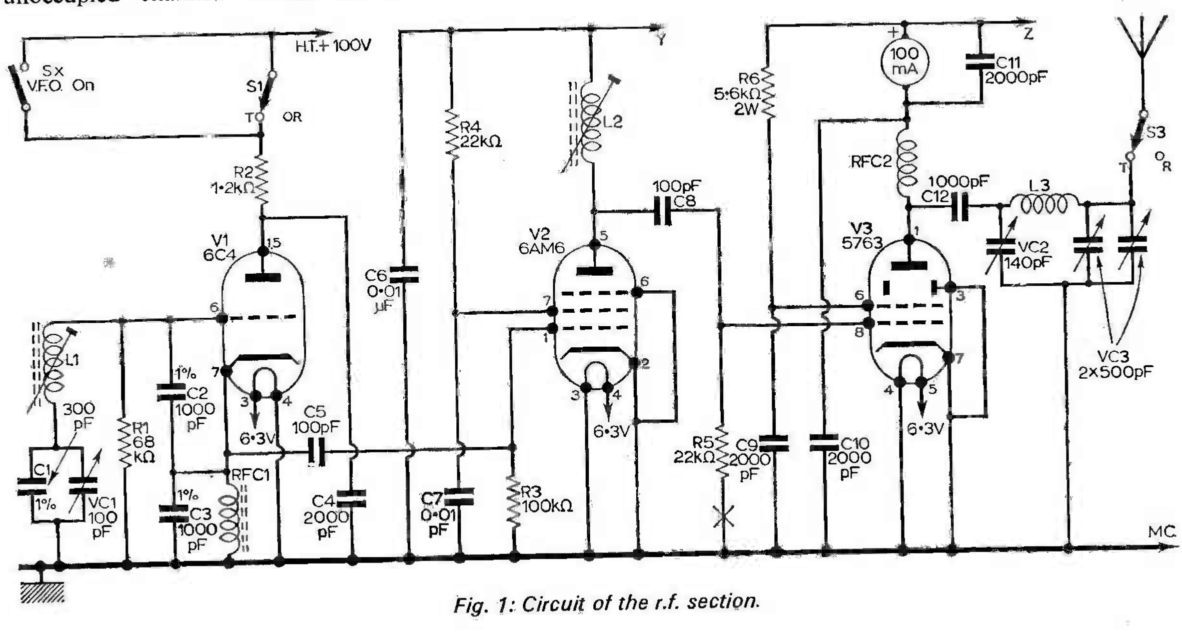
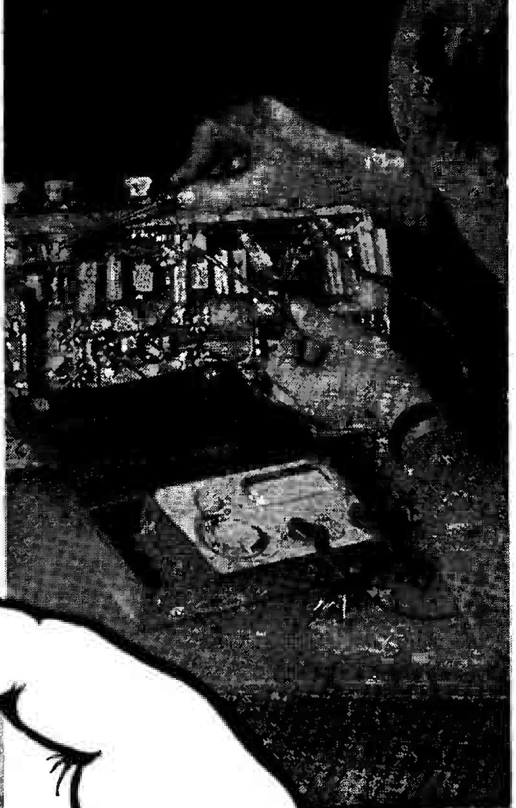



*Fig. 1: Circuit of the r.f. section.*

# AVO MULTIMINOR Mk4

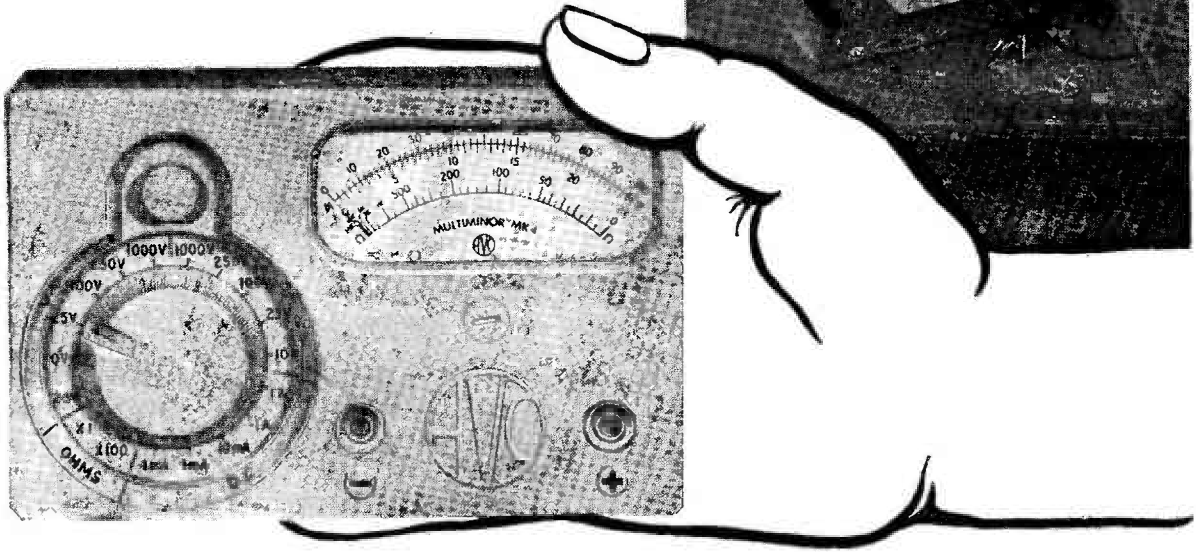
# Inexpensive Easy-to-use Pocket Size



The Avo Multiminor Mk4 is the latest version of this well-proven multi-range measuring instrument. Designed and assembled to high standards of reliability, the Avo Multiminor offers simple yet instant range selection with a single rotary switch. There is only one pair of sockets for all measurements, and the scale plate is clearly marked for easy reading.

Accuracy is within the limits laid down in B.S.S. 89/1954 for up to 3¼″ scale length industrial portable instruments.

*Panclimatic construction enables the Multiminor to be used in all types of climatic conditions. The instrument is supplied in an attractive black carrying case, complete with interchangeable test prods and clips, and a multi-language instruction booklet.*




*Write for full details.*

**AVO LIMITED** AVOCET HOUSE · DOVER · KENT *Telephone: Dover 2626*

MM 19

Final calibration can be made when all construction is finished. For exact calibration, a 100kc/s crystal marker is handy. If 1·8–2·0Mc/s is in view, a 150pF or 140pF capacitor is recommended, and a few plates can be taken off to achieve a suitable band coverage.

When coverage is satisfactory, and construction finished, seal the core of L1.

## Buffer

The buffer/doubler V2 has a broad-banded coil L2, resonant at 3·65Mc/s. This consists of 54 turns of 32 s.w.g. enamelled wire, pile wound on a ½in. diameter cored former. The coil is fixed to a bracket bolted to the chassis.

The coverage of L2 can be checked with a wavemeter. Apply h.t. to V1 and V2, and with the v.f.o. set at about the middle of the band adjust the core of L2 until maximum indication is obtained with the wavemeter tuned to 3·65Mc/s. Alternatively, a grid dip oscillator can be used to tune L2, with no h.t. applied. Check that resonance here actually is in the 3·5–3·8Mc/s band, and not around 1·75–1·9Mc/s.

If the transmitter is to be used for 1·8–2·0Mc/s, L2 should be removed, and a 2·5mH short wave r.f. choke wired in its place.

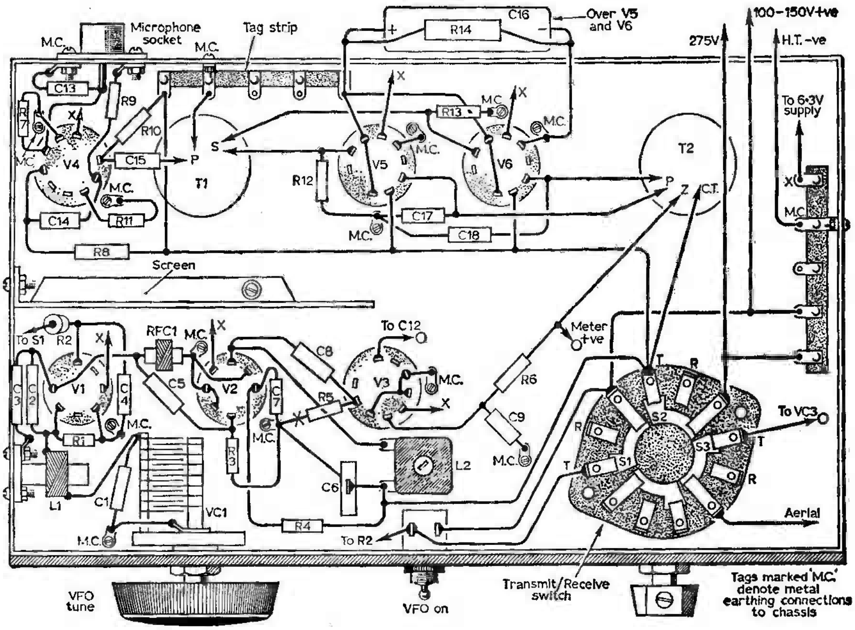



*Fig. 2: Underchassis wiring.*

## Power Amplifier

A check for grid current is made by inserting a meter at X, before h.t. is applied. Take meter positive to the chassis. R5 is connected to the chassis at the rear tag strip, (Fig. 3), so that this test is easily carried out.

Grid current should be 2mA to 3mA over the band. In the transmitter described, grid current was 2·8mA at the centre of the band, falling to about 2·6mA at the band edges. If L2 has not been adjusted, rotate the core for maximum grid current at 3·65Mc/s. It was found that considerable control over the grid current at X was obtained by changing the value of R4. Reduce R4 to increase grid current, but note that the 6AM6 maximum screen grid ratings are 0·8W dissipation and 275V.

The anode lead of V3 must pass immediately through to the top of the chassis. VC2 is an Eddystone 600V variable capacitor, but a non-midget receiver type capacitor can be tried. A higher maximum capacity here could be of advantage. VC3 needs to be of compact type, and may be 2 x 400pF, 2 x 500pF, or anything similar.

Winding details for L3 are 40 turns of 26 s.w.g. d.c.c. close wound on a 1 in. dia. former. R.F.C.2 stands vertically and is supported by stiff leads.

A standard size meter was fitted but one of the popular midget meters, easily obtainable, would be better as there is not much space. The actual maximum input is about 40mA, so a 100mA instrument is convenient.

Section S2 of the t/r switch applies h.t. to the buffer, modulator, and p.a. Switch section S3 transfers the aerial from receiver to transmitter, as required.

The completed r.f. section can be tested by connecting a 25watt 240V or similar household lamp across VC3. With VC3 closed, adjust VC2 for minimum anode current, as shown by the panel meter. The input

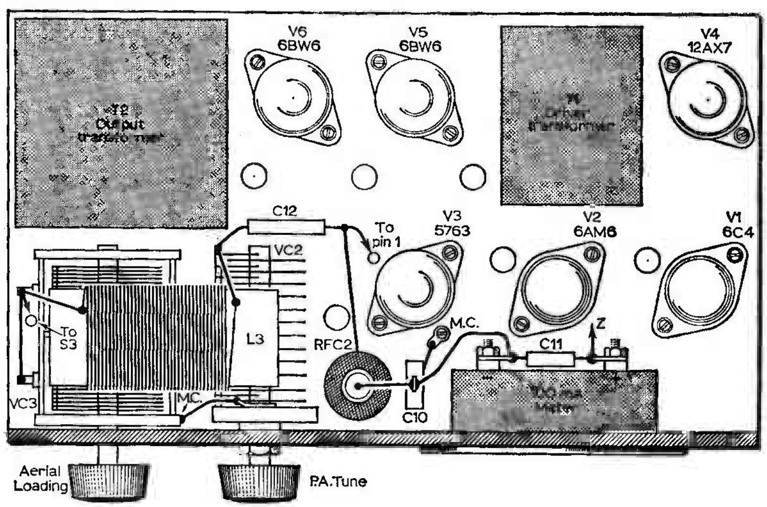



*Fig. 3: Top chassis layout.*

will be quite small, and is increased by opening VC3, at the same time closing VC2 slightly, so that VC2 is always tuned for *minimum* current. Continue this procedure for 30mA to 40mA or so anode current, when the 25W lamp should light with moderate brightness. Check that suitable grid current is being obtained. The meter can then be removed and the lead from R5 is soldered to the chassis tag.

For top band, L3 can be about 85 turns. Input on top band should not exceed 10 watts and with 275V at the anode of V3, current may be about 35mA. This limit is not present with the 80m band, so an increased input is possible. An input in excess of 15 watts, or 50mA at 300V, is not recommended as this would exceed the valve rating.

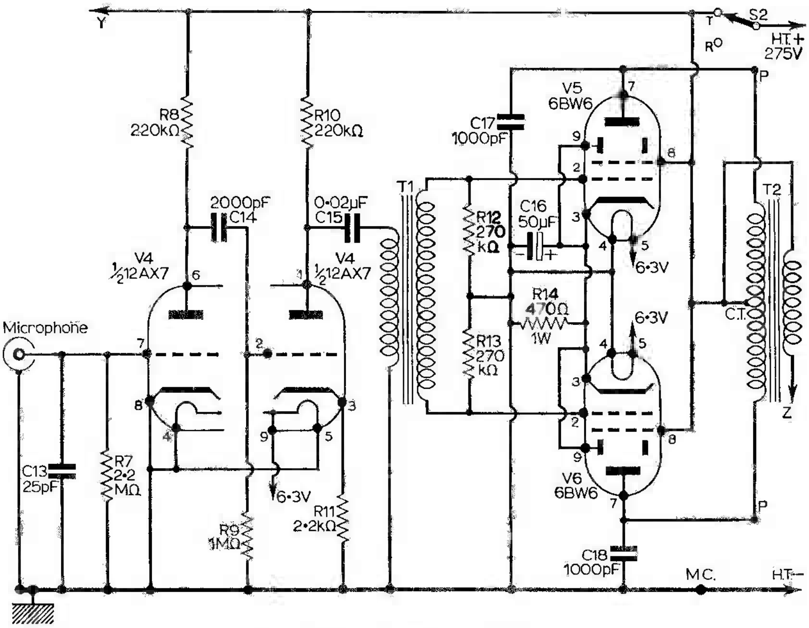



*Fig. 4: Circuit of the modulator.*

## Audio Amplifier

This was arranged for adequate modulation with fairly close talking to a popular crystal microphone, and no audio gain control is included. R9 could be a 1MΩ potentiometer, with pin 2 of V4 taken to the slider. C13 is an r.f. by-pass capacitor, and C14 is fairly small to lift the upper frequencies.

For simplicity and gain, a transformer is used for phase-splitting. Various push-pull driver transformers may be obtained. The transformer listed does not have a tapped secondary, but is easily obtained. If a transformer with a tapped secondary is to hand, omit R12 and R13 and connect the centre-tap to chassis.

The cathode bias resistor R14 is somewhat higher in value than usual, because the 2 x 6BW6's can provide much more audio than actually needed, and more bias results in some h.t. economy. Specified operating conditions with a 250V supply permit 9W output, or 12W with a 285V supply. If an increase in gain should be wanted, R14 can be reduced somewhat so that the valves work more nearly in Class A and require less drive. R11 may also be shunted by 25μF capacitor.

The modulating impedance of V3 is around 5,000Ω, and the optimum load for V5 and V6 around 8,000Ω to 10,000Ω, anode-to-anode. In view of the high cost of modulation transformers, it was decided to fit the nearest easily obtainable substitute. This is a 60–75mA 250–0–250V mains transformer, with the centre tap going to h.t. positive, and 250V tags to anodes. The mains winding (primary) is employed as the secondary. The actual overall ratio is thus about 2 : 1. A Woden UMO would allow more exact matching. In tests made by a diode detector feeding into a tape recorder, it was almost impossible to find any difference in the quality of transmission, when connections were transferred from the mains transformer to a modulation transformer.

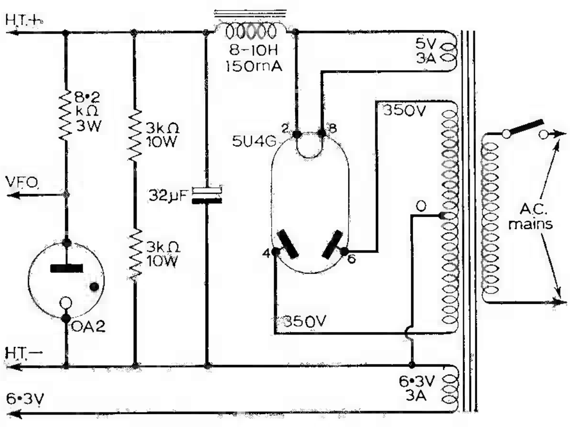



*Fig. 5: Power supply circuitry.*

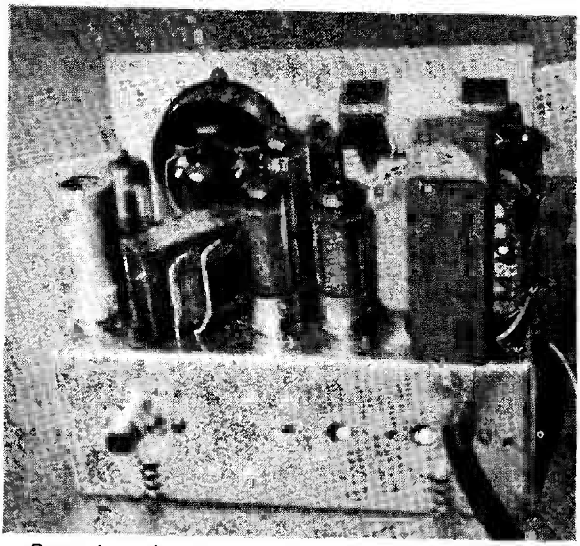
## Transmitter Operating

This follows the normal procedure. Tune the v.f.o. to the required frequency by closing the v.f.o. switch Sx. Then open Sx and turn the transmit-receive switch to transmit, to tune the p.a.

Loading into an aerial always commences with VC3 closed, in the manner described for the lamp test. The pi network will operate directly into many aerials. On other occasions it may be necessary to load the aerial, employ a tuner, or adopt one of the other usual methods of coupling.

## Power Pack

A power pack supplying about 100mA at 250V could be used, if to hand. If the pack is to be constructed, it is better to have in view 150–200mA at 300V, to obtain 275V or so on the p.a. anode. The circuit in Fig. 5 will maintain an output near 300V with a drain of about 50mA to 150mA. A voltage regulated supply for the v.f.o. is not essential, provided the v.f.o. receives about 100–150V from a supply point decoupled by a 8μF or 16μF capacitor.



*Rear view showing close grouping of components.*

## Results Achieved

The /A location was about 150 miles distant. No earth was available. The aerial was 22 s.w.g. single insulated bell wire, passed through a window (about 15ft high) and over a roof (about 12ft high) to a support about 7ft high. The wire was 120ft. long, about one-fifth being left coiled up.

The equipment was used five days here, usually for periods of about half an hour. About twenty stations were worked. Clearly this number could have been increased easily, and on only one occasion was a CQ call put out for more than five minutes with no reply. Most stations were copied easily, and only one report on the transmission was under 5/8. ■

## ★ components list

| | | | |
|---|---|---|---|
| **Capacitors:** | | **Resistors:** | |
| C1 | 300pF 1% | R1 | 68kΩ |
| C2 | 1000pF 1% | R2 | 1·2kΩ |
| C3 | 1000pF 1% | R3 | 100kΩ |
| C4 | 2000pF | R4 | 22kΩ |
| C5 | 100pF | R5 | 22kΩ |
| C6 | 10,000pF | R6 | 5·6kΩ 2W |
| C7 | 10,000pF | R7 | 2·2MΩ |
| C8 | 100pF | R8 | 220kΩ |
| C9 | 2000pF | R9 | 1MΩ |
| C10 | 2000pF | R10 | 220kΩ |
| C11 | 2000pF | R11 | 2·2kΩ |
| C12 | 1000pF 1kV | R12 | 270kΩ } 5% |
| C13 | 25pF | R13 | 270kΩ } 5% |
| C14 | 2000pF | R14 | 470Ω 1W |
| C15 | 20,000pF | | |
| C16 | 50μF 50V electrolytic | **Valves:** | |
| | | V1 | 6C4 |
| C17 | 1000pF | V2 | 6AM6 |
| C18 | 1000pF | V3 | 5763 |
| | | V4 | 12AX7 |
| VC1 | 100pF Air spaced S.W. type | V5 | 6BW6 |
| | | V6 | 6BW6 |
| VC2 | 140pF 600v Eddystone | **Coils:** | |
| VC3 | Jackson 2-gang midget (see text) | L1 | See text |
| | | L2 | See text |
| | | L3 | See text |

**Miscellaneous:**
Two B7G valveholders, Four B9A valveholders, B9A screen, 100mA meter, On/Off toggle switch, 4 pole 2 way rotary switch, chassis 4 x 7 x 2½ in Knobs, co-ax socket, nuts, bolts, etc. RFC1 Midget cored type. RFC2 2·5mH 60mA. T1 1 : 3 Radiospares. T2 See text.

## TOPBAND TWO

*—continued from page 493*

Fit the knobs at this point, as it is difficult to rotate the spindles of the tuning and regeneration controls by hand without anything to grip. Connect a good earth to the appropriate terminal, and the aerial wire to the insulated aerial socket. Connect up the battery and switch S1 to the ON position. The receiver is now ready for operation.

## Operation and Modification

Plug high resistance phones (2000Ω) into SK3, switch S1 to ON, tune VC1 for a signal. Adjust VC2 until signal is heard clearly and continue to tune VC2 for maximum signal.

In the original unit VC2 would not allow oscillation at the extreme end of the band, and a larger value here would probably improve this, say 60pF. A 30pF postage stamp trimmer connected directly across VC2 and adjusted with a screwdriver might also be considered.

The original intention was that the set should be used for topband only in order to monitor the local ham net, and to pick up mobile stations in the area. These functions it performs well without the inclusion of any extra capacity or modification to VC2. It might also prove useful for the local reception of the slow morse transmissions put out weekly by various members of the RSGB.

For the experimentally minded Fig. 3 is provided. Modifications as shown are: transformer coupling between Tr1 and Tr2 via T1. The emitter resistor and decoupling capacitor shown is an arrangement often used but was not found necessary in the prototype, however, its inclusion would do no harm. The extra capacity mentioned for VC2 is also depicted.

For the beginner, or those wanting a cheap and easy way to listen on topband, the above unit has much to offer. Being such a simple circuit it has its limitations. One is that VC2 needs adjustment each time VC1 is varied and needs careful tuning for best results. However, for price and simplicity it does offer an easy way to a good deal of fun on the short waves. ■

## ★ components list

| | | | |
|---|---|---|---|
| **Capacitors:** | | **Resistors:** | |
| C1 | 0·01μF | R1 | 33kΩ ¼watt |
| C2 | 0·01μF | R2 | 1·2kΩ ¼watt |
| C3 | 8μF 25V electrolytic | R3 | 2·7kΩ ¼watt |
| VC1 | 300pF Jackson | R4 | 39kΩ ¼watt |
| VC2 | 30pF air spaced | R5 | 10kΩ ¼watt |
| **Semiconductors:** | | **Inductors:** | |
| Tr1 | OC170 | L1 | Denco plug in 3T Blue |
| Tr2 | OC71 | T1 | 4·5 : 1 interstage |

**Miscellaneous:**
Two terminals, Jack socket, 2 pole 2 way slide switch, PP9 battery, Terminal clip, 2oz. tobacco tin, 2 knobs, tin plate, 6BA bolt, Aerial and Earth wire, plugs to suit.

# practically wireless commentary by HENRY

No 27

## What's Yttrium?

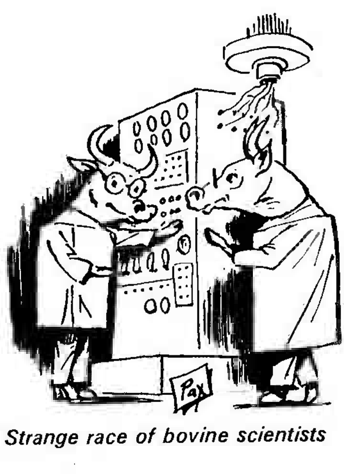
SOME time ago, in a "top" paper, we came across the startling headline: *"Oxo Men launch the Agaroid Sausage"*.

What visions that conjured up! Britain's contribution to the Space Race. Under the rolling weald of some soporific county a vast cave of way-out electronics, tended by a strange race of cubic, bovine, yet not unsavoury scientists, especially bred for their concentrated think-power. A stir of excitement as lunching—sorry, launching—day approaches. Slices of hillside silently open and a rocket-like monster pivots skywards. It is camouflaged a neutral dun and beneath its stretching skin what mysteries of Oxoid invention are packed. Countdown . . . three, two, one . . . blast-off—and the banger whips into orbit.

At last, we know why the early breeds of computer insisted on playing noughts and crosses. This was the training ground for the fiendish Oxo men. Now they have achieved their triumph and Agaroid bangers join the space clutter that orbits around our shrinking planet.

What would Fred Hoyle say?

Then, to spoil the vision, Henry took in the report and learned that the Agaroid sausage is a nine-inch banger stuffed with meat broth in agar—a gelling agent derived from seaweed. Yet the mystery is not entirely cleared, for this toad in the Oxoid hole is to be used: *". . . to track down, detect and identify disease-producing bugs."*



*Strange race of bovine scientists*

Before we get more involved, let us return to things electronic, and mention another news report that hit us with the catch-line: *Yttrium and europium make colour TV brighter.*

Again, we dream of strange happenings — Mittel-European producers doing avant-garde things at White City, or a brace of imported Greek decorators painting baseball pitches green and ice-hockey rinks blue, as is currently being done for trans-Atlantic viewers.

But reading further, the truth outs. Yttrium and europium are being used in research laboratories at Widnes, Lancs., to replace the zinc sulphide base that has so far proved best for colour-tube phosphors. This should give a 40 per cent brighter picture than most sets now operating in America, we are told. As we are already 50 per cent brighter with programme material, that should give "decadent Britain" something of a moral boost—even if the parent research company is Dow Chemical, of the U.S.A.

Is it significant that the rare earth so strangely named is a by-product from the uranium mining field at—of all places—Blind River?

Trouble about being so ignorant is that Henry never knows whether the reports he reads are genuine or the sort of elaborate leg-pull that the Editor of *Systems and Communications* loves to pull. After the celebrated "Yak-Yak", he came out with a request for descriptions of the "Whirley".

Henry waited anxiously for the explanation in the August issue and was disappointed to learn that the thing was an 833-ton crane that operated from a barge as long as a football field.

*Another startling disclosure*

After which let-down, it came as no surprise to see a paragraph about a Chipper-Chopper. Skipping the technical data, we come to the summarised description by Transitron Electronics Ltd. and are brought up with a jerk by the sentence: *"The mechanical construction of the 'Chipper' features an ultra-sonic aluminium wire-bonding to completely eliminate purple plague at the chip."*

Is this another leg-pull? We can accept the Agaroid sausage, will bow westwards to Yttrium and are beginning to understand that a monolithic circuit is nothing to do with a run around Stonehenge—where, incidentally, the brainy boys are arguing about the stone placings being a kind of primitive computer to predict the dates of eclipses!

But purple plague—what next? Dare we ask our more erudite readers for an explanation, or shall we receive a Dinwiddy special that leaves us even more up Blind River?

Perhaps Henry had better leave the bewildering sphere of modern technology and stick to simple kit-building. Next month: some dry joints I have known.

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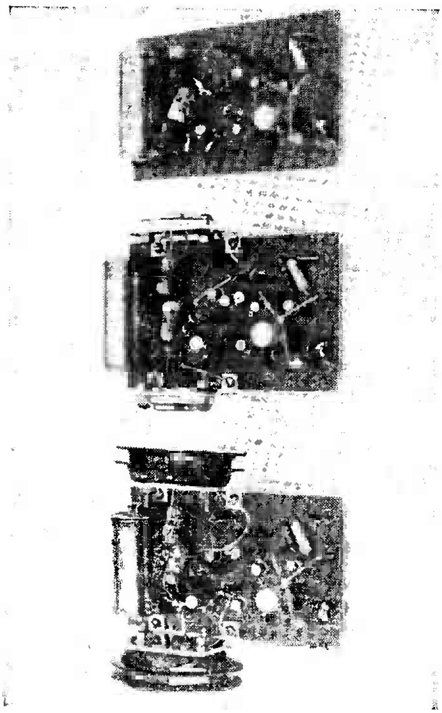

6/12

12/12

20/24

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# ON THE SHORT WAVES

## MONTHLY NEWS FOR DX LISTENERS

Times in GMT
Frequencies in kc/s

## THE BROADCAST BANDS

by JOHN GUTTRIDGE

**Australia:** *Radio Australia* (P.O. Box 428G, G.P.O., Melbourne). With the end of British Summer Time the English U.K. transmission will revert to 0815—0915. Frequencies will remain 9,560/11,710. The station may also be heard around 2330 on 15,220. Station VNG (c/o Assistant Director General, Radio Section, Postmaster-General's Department, 57 Bourke Street, Melbourne C.I.). The 12,005 outlet of this time signal station has been audible between 0915—0945 and 2245—2300.

**Canada:** *Canadian Broadcasting Corporation* (P.O. Box 6000, Montreal). The European service is now transmitted as follows: 0555—0630 5,955; 1055—1214 11,720/15,320; 1215—1313 15,320; 1316—1344 15,320/17,820; 1345—1830 11,720/15,320/17,820; 2000—2152 9,630/11,720/15,320.

**Ceylon:** *Radio Ceylon* (Department of Broadcasting, P.O. Box 574, Colombo 7). The commerical service transmission to Europe is now at 0600—0745 on 15,327.

**China:** *Radio Peking* (Broadcasting Administration, Fu Hsin Men, Peking) has English to Europe 2030—2230 on 6,610/7,075/9,640.

**China (Taiwan):** *Broadcasting Corporation of China* (53Sec., Jen Ai Road, Taipei) now uses 7,130/9,685/9,767/11,725/11,825/15,125/17,890 from 1530—1800 with English 1530, Arabic 1615, French 1645, and Cantonese 1715. Reception is possible on 9,767/11,725 (spoiled by Radio Peking) and 15,125.

**Cyprus:** *B.B.C. East Mediterranean relay* (C.E.X.B., Bush House, London, W.C.2., England) carries the World Service on 17,885 0900—1800. Reception is good around noon. Cyprus Telecommunications Authority (P.O.B. 1929, Nicosia) has point to point transmissions on JBC94 19,940. Reports are requested and verified by letter.

**India:** *All India Radio* (P.O. Box 500, New Delhi). The English General Overseas Service now transmits to Europe 1745—2230 on 7,215/9,915/11,905; to Africa 1745—2045 9,690/11,715/11,740 and North-east Asia at 1000—1100 over 15,105/17,855/21,615.

**Indonesia:** *Radio Republik Indonesia* (P.O. Box 157, Djakarta) transmits in English at 1100—1200 and 1430—1530 on 9,865/11,795 and 1900—2000 on 9,865/11,715.

**Iran:** *Radio Iran* (Ministry of Information, Meydan Ark, Tehran) now uses 11,745 for 1730—2130 foreign service (English 2030) but suffers heavy QRM. This frequency has also been reported as 11,755. It is believed that 15,135 has replaced 7,135.

**Israel:** *Kol Israel* (Broadcasting House, Jerusalem) has changed the time of the European English transmission to 2100-2115 on 9,009/9,725. The African transmission is now at 2015—2030 on 9,009. On 20th October is to have a programme about having a £50 holiday in Israel. Reception reports are wanted.

**Jordan:** *Jordan Broadcasting Service* (P.O. Box 909, Amman) now starts its 15,170 foreign service transmission at 2330 instead of 2300.

**Korea (North):** *Radio Pyongyang* (Korean Central Broadcasting Committee, Pyongyang) now transmits English at 0400—0500, 0800—0900 on 6,540/15,520; 1100—1200, 1400—1500 6,650/7,580; and 1900—2000 6,540/7,580.

**Kuwait:** *Kuwait Broadcasting and Television Service* (P.O. Box 193, Kuwait) uses 9,520 0200—0700 and 0900—2100 with 4,967.5 from 1900—2100.

**Lebanon:** *Radio Lebanon* (Ministry of Orientation, Information and Tourism, Beirut) now uses 15,200 for the 1830—2030 and 15,235 for the 2300—0100 foreign service transmissions. The home service has been reported on (new) 7,380 with English at 1500.

**Morocco:** *Radiodiffusion Television Marocaine* (I Pierre Parent, Rabat) transmits its foreign service on 11,735/15,408 as follows: Arabic 1830-2030, English 2030—2130, French 2130—2230. The Arabic home service is relayed on 15,333 0630—1100, 1600—1800 and additionally on 11,735, 1200—1600.

**Panama:** *Tropical Radio Telegraph Co.* (Roosevelt Avenue, Panama City) gives full QSL verification for its point-to-point transmissions. May be heard over HOD 23, 13,510 at 2350 with English/Spanish test tape.

**Rwanda:** *Deutsche Welle* relay (Kigali) has replaced 17,805 by 17,765 for English 1745, Hausa 1830 and French 1900—1945. From 1500—1730 9,735 is now used with Kiswahili 1500, French 1615 and English 1645.

**Saudi Arabia:** *Saudi Arabian Broadcasting* (Ministry of Information, Airport Road, Jeddah) has just fully verified a reception report after 1 year 5 months!

**Senegal:** *Radiodiffusion du Senegal* (Boite Postale 1765, Dakar) uses 7,210 at 100kW from 0600—1000.

**South Africa:** *South African Broadcasting Corporation* (P.O. Box 8606, Johannesburg) has replaced 7,270 by 11,900 for 2200—2255 English transmission to the U.K. 9,525 remains as a parallel frequency.

**Vietnam (North):** *Voice of Vietnam* (No. 58, Quan-Su Street, Hanoi). The home service may be heard very faintly around 2200 on 15,044.

**Zambia:** *Radio Zambia* (P.O. Box RW15, Ridgeway, Lusaka) gives full verification. Has moved its English outlet from 3,270 to 3,275 from 1430—2100.

Help this month has come from Roy Patrick, I. Perry, D. Simmonds, P. Charlton, M. P. Itter, Ian Tayl T. Davis, A. B. Thompson, M. W. Barraclough, G. Roberts, Swiss Broadcasting Corporation, and the International Short Wave Club.

# THE AMATEUR BANDS by DAVID GIBSON, G3JDG

LIKE wow man! What a month, all those little earholes probing the inner depths of 7Mc/s.

My admiration and congratulations to all those who listened l.f.—both pork chopped and un-pork chopped! Funnily enough my remarks last month about receiving more l.f. than h.f. logs has proved perfectly true. The favourite band was forty metres, but many logs arrived with 80 and 160 metre lists too. Many hints, tips and advice came in with the logs including one suggestion from a disgusted s.w.l. who, after listening for an hour and hearing nothing but QRM, wrote sending detailed instructions as to what I could do with 7Mc/s. Presumably it would be twice as painful with 14Mc/s! Best times for 40 appear to be late evenings from around 2100—2400 G.M.T. Also the stations appear to congregate in little pockets, 7040kc/s is one mentioned by several s.w.l's. The two main modes are s.s.b. and c.w. so a good b.f.o. is a must.

## 1·8/3·5/7·0

**Colin Morris** (Worcs.), 12 valve homebrew, Joystick, 1·8Mc/s—DJ4SS, DJ8HF, OL—1ACJ, 4AFI, 5ADK, 6AAF, 6ACO, OK1—KLX, ARM, KZJ, KNG, OK2—BHT, FJ, OK3KNM. **3·5Mc/s**—G, GM, GW, DJ, DL, DM, OK, F, PAØ, SP3, OH6. **7·0Mc/s**—CN8AW 59, IS1DMN 59, PX1IE 57, PY's at 2100—2200, TF3EA 58, YV1PW 57, ZS1JA 34, 9H1R 24, 9V1NT 589. Figures standard r.s.t. All these s.s.b. except 9V1NT on c.w. **N. Rutt** (Sussex), No. 52 set, "wire oddments", CN8AW DJ1SV, DJ8SW, DL7TF, G3AX, GM3GVJ, GW3MTL LA1SH, OH2BQ, OH9FH/P, OK1VK, OX3BX, OZ4FA, PAØPEW, PY—1CLI, 1CW, 2BUE, TF3EA, 9V1NJ, all **7·0Mc/s** s.s.b. except 9V1NJ on c.w. All between 2030—2200. **Colin Shackleton** (Halifax), CR52, 25ft. wire, **1·8Mc/s**—G3UGF/GI, GI6PK, GW3NNF. **3·5Mc/s**—F, SM, DJ, DL, OZ6ZF, ZL2AZK, ZL3FTA. **7·0Mc/s**—CN8AW, PY1CAD, VP6KL, and a goodie—VP8CW, s.s.b. (Falkland Is.). **P. Murray** (S. Wales), H.M.V. domestic rx, 130ft. wire. **7·0Mc/s** all a.m.—38 G's, 14 GW's, DJ—7XP, 8RC, 9KV/G3JYF, DL—5XS, 8UE, 9RT, F—2PI, 2WW, 9QG, 9SR/M, ON—4LG, 5EC, 5IH, PAØCD, I1SRR. **C. Lloyd** (Notts.), Eddystone 940, 90ft. plus a.t.u. **7·0Mc/s** s.s.b.—CN8AW OH2SB, OZ4FA, PX1IE, PY1CLI, PY2DUE, PY6WA, PY7APS, TF3EA, real DX—VK2AVA, ZS1JA. All between 2030—2145. **David Douglas** claims best prize for 160 metre DX with XV5AA. David also queries SV1DL as being unlicensed. On 80 his best were KX6BQ, ZS8M, ZS9H. **G. Morgan** (Monmouth), HA230, 50ft. NW-SE. **7·0Mc/s**—CN8AW, LX1BW, OX3BX, OA4KY, PY—1CLI, 7MP, 7AOT, UW9AF, UB5KKA, VK2AVA, YV5BPJ, ZS1JA. **M. Levy** (Yorks.), S38E, "bit of wire". **7·0Mc/s**—CNA8W, DM9AHH, HB9IT, LA1KI, LX1DW, PY1CLI, PY2DUE, PY7LAK, PX1JS, UB5KKA, YO9CN, 4U1ITU, all s.s.b. **F. Simpson** (Yorks.), RX80, long wire. **80**—FP8DB, VE1AX, VO1EL, ZB2AO, plus lots of W's on 75 metres. 40—CN8MR, K1MVH, K4ZAW, K8UHX/KG4, PY1MIN, PY4ND, PY7ND, UW9AF, W2AW, W2LXV, W3TTE, W4NTU, W8OSC, WA2 DVU, WA4DVY.

## Higher up

The popularity of 14 and 21Mc/s is always a close tie, but this month, counting up the votes plus a bit of bias from my own ageing eardrums I proclaim 21Mc/s a clear winner.

As many people pointed out, the EU's on twenty who blot out the DX is quite alarming. It's very irritating to catch the odd couple of letters in a rare bit of DX, only for the rest to be blasted out by a DL rookie calling to his mates in W-land or a T3 note from you-know-where arc-welding the cans to your ears. **John Meade** (Kent), R107T, 15ft. long? wire, 20 fags and a quart of brown. **20 Metres**—CP5EB, CX9AAK, ET3WH, FH8KD, HP1VE, HS1AK/P, HZ1AB, JA2IA, KC4USV, KR6MM, OD5BA, TG9RR, VE1AED/P/SU, VQ9AK, VS6AJ, W3HUR/P/VQ9, YA1BAN, YS2RV, YV5ACP, YV5AEB, ZS6PP, 6Y5VV, 9J2W2, 9M8DH. **M. Davies** (Northumberland) 52 set, 165ft. long wire. **20 Metres**—AC5AM, CN8NG, CR5SB, CT1LU, CX3KI, EA9CVU, ET3USA, HI8 JSM, HS1AK/P, JA1PWZ, JA4CNS, JA6AK, K3CBX/ MM, K4RSH/MM, KH6OR, KH6EPW, KL7BJC, KP4CKX, KR6MV, KR6DF, KZ5BW, LA8FG/P, LA1EE/P, LA7OS/MM, LU2UF, LU3BU, LZ1DF, OA3QE, PI1FA, PX1JQ, PY2PE, VK3SKC, WB2 NMW, W2NSP/P1, W9QQR/P/M1, XE1FZ, XW8AZ, YV5AIP, ZB2FNV, ZD9BE, ZL1HW, 4U1ITU, 4X4VB, 5A5TJ, 5Z4IR, 7X2AH, 8J1JF, 9H1H, 9K2CZ, 9L1W, 9Q5Z. **D. Harvey** (Warks.), no receiver! ground plane. **21Mc/s**—CE2AV, CM7CWF, CO1BM, CR4XD, CR5FY, CR6AR, CR7GC, CT2AC, CT3AM, CX1BY, DJ, DL, EA8EM, EL5IJ, EP1JQ, F, FM7VV, G's, HA3MH, HB2JB, HB9BBA, HC1WF, HE4EM, HK3AXW, HP1HP, I1, IT1, IS1DMN, JA1MHV, KA5IS, KL5JQ, KZ5AW, LA, LU5AG, LX1YL, LZ2KKZ, MP4BBA, OA4DB, OD5CA, OE, OH, OK, ON, PY's 1-7, PZ1CJ, SM, SP, SU1AL, SV, TU2AE, UB5KNH, VE2XN, VP2DAA, W's 1-9, YU, YV1SA, ZC4GY, ZE6JL, ZP1UP, ZS1BV, 3A2, 4X4HF, 5A1TK, 6Y5KS, 6W8DQ, 9G1AK, 9H1X, 9K2AD, 9Q5IL, 9U5DL. **G. Owen** (Bristol), GC-1U, dipole as per this column, "take 16 ft. 8 in. of wire, cut it in the middle, etc. . . ." **28Mc/s**—DJ—Ø, 1, 2, 4, 5, 7, 8, 9, DL 2, 6, 7, 8, DM—2, 4, HK3AOC 1928, HB9T 2053, HB9WQ 2121, I1BCA 1935, I1BIL 1711, PAØKOR 1724, SM6OH 1726, UB5BEM 2032, UP2TAS 1709, UQ2KKE 1415, YV5BPJ 1927, 9J2DT 1853, 9J2VX 1843. **C. Clarke** (Surrey), 12 valve homebrew, 2 phased verticals. **28Mc/s**—CX9AAN, DJ6JV, DL2KT, DM4JI, EA3FP, F5JJ, F9TL/M, many G's, GB3LER, GI3OZW, GW3OSV, HB9ZM, I1LN, KZ5JW, LA8WI, OE6UX, SM6OH, UB5BEM, UP2ADZ, UQ2KKD, VP6JC, YO2VA, 5H3JJ, 9J2DT, 9J2MM.

## News

ZB2AX rumoured to be going wandering in Africa. Quasars reported active, anyone want to listen or interested in radio astronomy send s.a.e. to F. Bright, 9 Sutherland Road, London, W.13, for details of the Society for Amateur Radio Astronomers.

W9WNV is reported to be on the air as PYØXA from St. Peter and St. Paul Rocks. MP4MAW should be on from Muscat—all bands, c.w. and s.s.b. CR3KD is on 21Mc/s c.w. from Portuguese Guinea.

Contests this month, 15th—16th, VU/4S7 phone 15th—16th, second 432Mc/s; 16th, second 1296Mc/s; 29th—30th, VU/4S7 c.w.; 29th—30th, RSGB 7Mc/s DX phone.

## LAFAYETTE HA-63 COMMUNICATION RECEIVER

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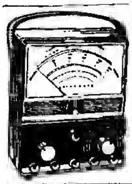
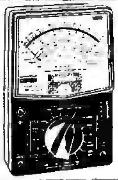


**TE-900 20,000Ω/VOLT GIANT MULTIMETER** 6in. full view meter. 2 colour scale. 0/2.5/10/250/1,000/5,000 V. A.C. 1/25/12.5/10/50/250/1,000/5,000 V. DC. 0/50μA/110/100/500 mA/10 amp D.C. 02K/200K/20 MEG. OHM. **£12/19/6.** P. & P. 5/-.



**MODEL U50D MULTIMETER** with meter protection. 20,000 o.p.v. 0/.1/.5/5/50/250/1000V D.C. 0/2.5/10/50/250/1000 V D.C. 0/.05/.5/5/50/250 mA. 0/5K/50K/500K/5 meg ohm. .0001— .2 mfd —20— + 22 db. **£5.19.6.** P. & P. 3/-.

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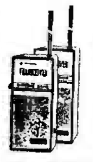

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*These cannot be operated in U.K.*

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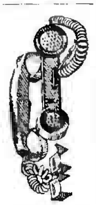

Operative over amazingly long distances. Separate call and press to talk buttons, 2-wire connection. 1000's of applications. Beautifully finished in ebony. Supplied complete with batteries and wall brackets. **£6.10.0 pair.** P. & P. 3/6.

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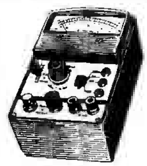

It has the fullest capacity for checking on A, B and Ico. Equally adaptable for checking diodes, etc. Spec.: A: 0-7.0-9967, B: 5-200. Ico: 0-50 microamps, 0-5 mA. Resistance for diode 200Ω—1 MEG. Supplied complete with instructions battery and leads. **£6.19.6.** P. & P. 2/6.

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Brand New Condition—Fully Tested and Checked before despatch. 3 Waveband with RF Stage—Wonderful value. 860-2080 metres 190-570 metres 5.6-18 Mc/s. with internal speaker **£8.19.6.** Carr. 10/6 with circuit. Plug in external power units. 230V A.C. **35/-**, or 12V D.C. **19/6.**

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| 5in., 900ft. L.P. acetate | 10/- |
| 5in., 1,200ft. D.P. mylar | 15/- |
| 5in., 1,800ft. T.P. mylar | 35/- |
| 5¾in., 1,200ft. L.P. acetate | 12/6 |
| 5¾in., 1,800ft. D.P. mylar | 22/6 |
| 5¾in., 2,400ft. T.P. mylar | 45/- |
| 7in., 1,200ft. std. mylar | 12/6 |
| 7in., 1,800ft. L.P. acetate | 15/- |
| 7in., 1,800ft. L.P. mylar | 20/- |
| 7in., 2,400ft. D.P. mylar | 25/- |
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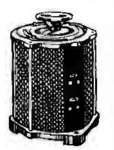
Brand New—fully Shrouded. Input 230v. 50/60 c/s. Output 0-260 Volts.



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| 1 Amp | £4.10.0 |
| 2.5 Amp | £5.17.6 |
| 5 Amp | £9.0.0 |
| 8 Amp | £13.10.0 |
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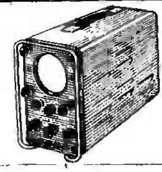
| 150v. PIV, 165mA | 1/- |
| 150v. PIV, 25 amp | 19/9 |
| 700v. PIV, 100 amp | 49/6 |

Discounts for quantities. Post extra

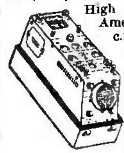
# TEST EQUIPMENT

## PORTABLE OSCILLOSCOPE CT-52



A compact (9in. x 8in. x 16½in.) general purpose 'scope T/B 10c/s-40 kc/s. Band width 1 M/cs. Mullard DG 7/5 2¾in. CRT. For operation on 200/250v. A.C. Supplied complete with metal transit case, strap, test leads, and visor hood. Brand new, **£22.10.0.** Carr. 10/-. Supplied complete with instructions.

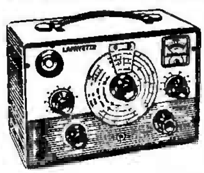
## OS/8B/U OSCILLOSCOPES



High quality Portable American Oscilloscope, 3in. c.r.t. T/B 3c/s-50kc/s X Amp: 0-500 kc/s Y Amp: 0.2 Mc/s. Power requirements 105-125v. A.C. Supplied in brand new condition. Fully tested. **£25.** Carr. 10/-. Suitable 230-115 v. Transformer, 15/6.

## ERSKINE TYPE 13 DOUBLE BEAM OSCILLOSCOPE

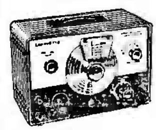
Time base 2 c/s-750 kc/s. Calibrators at 100 kc/s and 1 Mc/s. Separate Y1 and Y2 amplifiers up to 5.5 Mc/s. Operation 110/230 volt A.C. Supplied in perfect working order. Carriage 20/-. **£22.10.0**



## LAFAYETTE TE-46 RESISTANCE CAPACITY ANALYSER

2 PF—2,000 MFD, 2 ohms—200 Megohms. Also checks impedance, turns ratio insulation 200-250 v. A.C Brand New **£15.** Carr. 7/6.

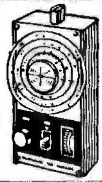
## TE-20 RF SIGNAL GENERATOR



Accurate wide range signal generator covering 120 kc/s-260Mc/s on 6 bands. Directly calibrated. Variable R.F. attenuator. Operation 200/240v. A.C. Brand new with instructions. **£12.10.0.** P. & P. 7/6.

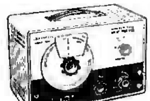
S.A.E. for details.

## LAFAYETTE NUVISTOR GRID DIP METER



Compact, true one hand operation. Frequency range 1.7 - 180 Mc/s. 230v. A.C. operation. Supplied complete with all coils and instructions. **£12.10.0.** Carr. 5/-.

## TE22 SINE SQUARE WAVE AUDIO GENERATORS

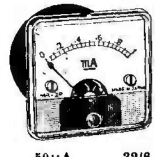


Sine: 20 cps to 200 kc/s. on 4 bands. Square: 20 cps to 30 kc/s. Output impedance 5,000 ohms. 200/250v A.C. operation. Supplied Brand New and Guaranteed with instruction manual and leads. **£15** Carr. 7/6.

## NOMBREX EQUIPMENT

Transistorised Audio Generator 10-100,000 c/s. Sine or square wave. **£16.15.0.** Transistorised Signal Generator 150 kc/s. 350 Mc/s. **£10.10.0.** Transistorised resistance capacity bridge 1Ω. 100 MegΩ. 1pF-100μF. **£9.0.0.** Transistorised Induction bridge, 1μN-100H. **£18.** Mains operated Transistor power supply unit, output 1-15v. up to 100mA. **£6.10.0.** All above post paid with battery.

## CLEAR PLASTIC PANEL METERS



First grade quality, Moving Coil panel meters, available ex-stock. **SA.E.** for illustrated leaflet. Discounts for quantity. Available as follows: Type MR, 38P, 1 21/32in. square fronts.

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| 500-0-500μA | 22/6 | 300mA | 22/6 | 150V D.C. | 22/6 |
| 1-0-1mA | 22/6 | 500mA | 22/6 | 300V D.C. | 22/6 |
| 1mA | 22/6 | 750mA | 22/6 | 500V D.C. | 22/6 |
| 2mA | 22/6 | 1A D.C. | 22/6 | 750V D.C. | 22/6 |
| 5mA | 22/6 | 2A D.C. | 22/6 | 15V A.C. | 22/6 |
| 10mA | 22/6 | 5A D.C. | 22/6 | 50V A.C. | 22/6 |
| 20mA | 22/6 | 3V D.C. | 22/6 | 150V A.C. | 22/6 |
| 50mA | 22/6 | 10V D.C. | 22/6 | 300V A.C. | 22/6 |
| 100mA | 22/6 | 20V D.C. | 22/6 | 500V A.C. | 22/6 |
| 150mA | 22/6 | 50V D.C. | 22/6 | 'S' Meter 1mA | 29/6 |

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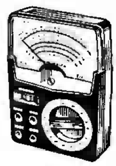
|---|---|
| 50μA | 32/6 |
| 100μA | 29/6 |
| 200μA | 27/6 |
| 500μA | 25/- |
| 50-0-50μA | 29/6 |

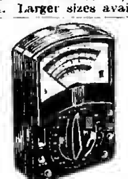
POST EXTRA. Larger sizes available—send for lists.

## TE-51 NEW 20,000Ω/VOLT MULTIMETER



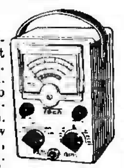
0 / 6 / 60 / 120 / 1,200V. A.C. 0 / 3 / 30 / 60 / 300 / 600/3,000V. D.C. 0 / 60μA / 12 / 300 MA. D.C. 0 / 60K / 6 Meg.Ω **85/-.** P. & P. 2/6.

## MODEL TE-12

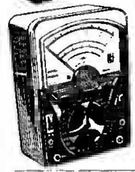


20,000 O.P.V. 0/.06/6 /30 /120 /600 /1,200 / 3,000/6.000v. D.C. 0/6/30/120/600/1,200 v. A.C. 0/60μA/6/60/600 mA. 0/6K/600K/6 Meg./60 Meg.Ω. P.F. —.2 MFD. **£5.19.6.** P. & P. 3/6.

## MODEL PV-58 VALUE VOLTMETER



11 meg. input. 7 D.C. volt ranges. 1.5-1,500 v. 7 A.C. volt ranges. 1.5-1,500 v. 4,000 Peak to Peak. Resistance .2 ohm to 1,000 megohm. Decibels — 10db to +65db. Supplied brand new with instructions, leads and probe. **£12.10.0.** P. & P. 3/6.



**MODEL 500.** 30,000 opv. 0/.5/1/2.5/10/25 / 100 / 250 / 500 / 1,000 v. D.C. 0 / 2.5 / 10 / 25 / 100 / 250 / 500 / 1,000v. A.C. 0 / 50μA / 5 / 50 / 500mA. 12 amp D.C. 0 / 60K / 6 Meg. / 60 MegΩ. **£8.17.6.** Post paid.

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# LOOP AERIAL

## FOR MEDIUM WAVE DX

By KEN BROWNLESS

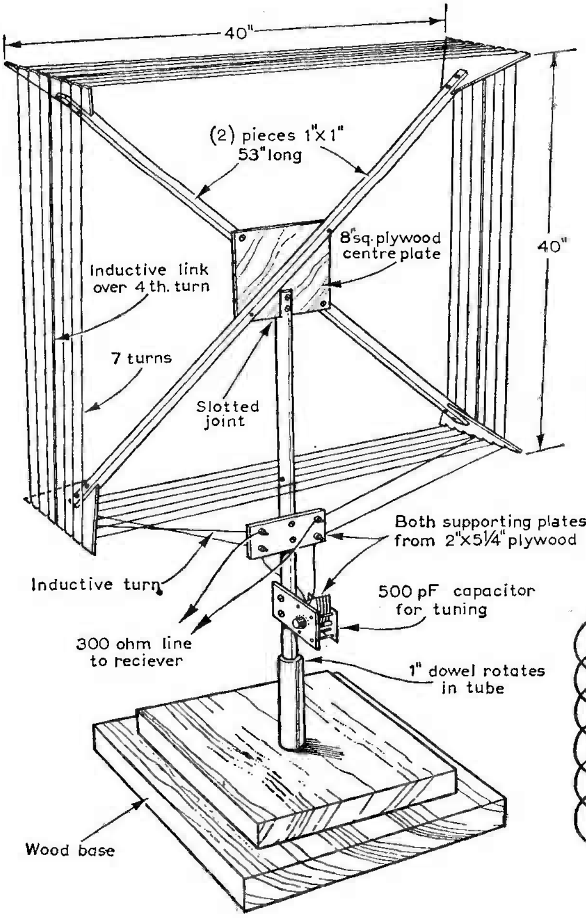
A CONSIDERABLE number of the leading Medium Wave DX'ers in the U.K. use loop antennae for their DX activity, most of them using the 40-inch square box-shaped loop. The frame is in the shape of a letter 'X'; seven main turns at half-inch spacing are used plus one inductive link turn with the windings in a straight line around the square and each turn the same length. The advantage of this system is an improved signal-to-noise ratio due to the loop's directional characteristics. A loop of this size has a signal pick-up of a 30ft. wire, 20ft. high, and though a weaker signal may be fed to the receiver it will have a 35% reduction in noise level due to the directional characteristics of the loop. Increase of the a.f. gain control will counteract the effect of the lower signal strength.

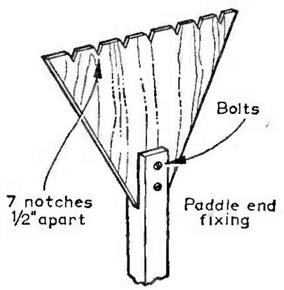
The directional properties make it possible to cut down on static, t.v.i. and some forms of electrical interference. The antenna system consists of a simple tuned circuit somewhat similar, though larger, than the "frames" used in the early days of radio. Theoretically, a normal wire antenna with a length much less than a wavelength behaves like an open capacitor picking up the electrical component of the electro-magnetic waves. A loop, being a wide coil, picks up the magnetic part. Most man-made noise contains only a weak magnetic component; a loop, therefore, is less sensitive to this kind of noise.

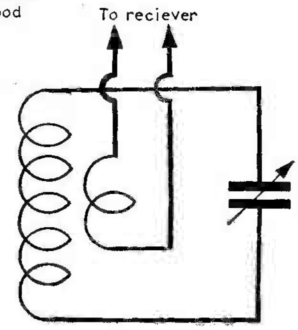
### CONSTRUCTION DETAILS

To make the frame, take the four pieces of 3-ply ($4\frac{1}{2} \times 5\frac{1}{4}$in.). cut them to a triangular shape. Cut seven notches in the ends at half-inch spacing and then anchor these spacers into the centres of the ends of the main cross-pieces of the frame so it looks like a letter 'X'. Place the length of one inch dowel in position to support the frame. To hold the frame and dowel in position, fix the two pieces of 3-ply (8in. square) in the centre of the frame, this should give a diagonal length of approximately 58 inches. Secure the cross-pieces and dowel with either screws or glue. To complete this part of the job take the remaining two pieces of three-ply ($2 \times 5\frac{1}{4}$in.) and in the first piece drill four holes in the wood to serve as anchors for the ends of the main and inductive turns. In the second piece of 3-ply drill one hole to take the tuning capacitor and two holes to hold the ends of the inductive link and connect it to the feeder. Mount the wood at right angles to the first piece. Drill a small hole in the dowel to allow the centre turn of the main winding to pass through. This completes the frame.

Wind the seven main turns first, beginning and ending



at the lower piece of 3-ply on the dowel, allowing sufficient length to make the connections to the tuning capacitor and remember to pass the wire ends through the drilled holes when you begin and finish the windings. Next wind the inductive turn *over* the fourth of the main turns (the centre one).

## THE FINAL STAGES

Connection is from the ends of the seven main turns direct to the tuning capacitor; the ends of the inductive turn should be soldered to the coaxial or flat twin feeder cable. If you are using a communications receiver the connections are made to the dipole terminals; on a domestic-type receiver one connection goes to the "A" terminal and the othert to the receiver chassis.

Operating the loop is simple. Tune in a station and adjust the loop capacitor and rotate the loop for peak strength. Rotating the loop through 90 degrees will give a null on the signal. The foregoing remarks especially apply when tuning a signal without QRM. If there is QRM trouble, rotate the loop so that it gives minimum interference. It will be found that a loop is fairly useful when listening to European stations but its greatest advantage is when DX'ing. The benefit of the signal-to-noise properties becomes apparent and also the fact that the loop when rotated may allow logging of North American and a South American station clearly on the same channel. As an example of an excellent piece of loop reception the following have been heard on 850kc/s: Ahmedabad in India, Radio Carve in Uruguay and Emisora Nuevo Mundo in Colombia. This does show how useful a loop can be in rejecting unwanted signals, as the three stations were all audible at the same time. The loop used by the writer in conjunction with an Eddystone S680X receiver covers 550 to 2100kc/s. To increase the l.f. range to, say, 480kc/s, either add a 300pF fixed mica capacitor in series with the 500pF tuning capacitor with a switching arrangement to cut the mica capacitor out from 550kc/s upwards. If this is omitted, the h.f. tuning range will be affected. Another method is to add an extra main turn to the loop but this definitely cuts the h.f. range. The coverage down to 480kc/s can also be obtained by using 354 and 500pF tuning capacitors in series. This system has been tested and found to be satisfactory. The loop itself is best placed near to the receiver.

## OTHER APPLICATIONS

The loop serves as an excellent Antenna Tuning Unit with the lead-in from an outdoor antenna attached to one of the two connections on the tuning capacitor. Using the capacitors, as mentioned in the previous paragraph, the range covered on the S680X is 480 to 1600kc/s. A transistor portable can be used in association with a loop by placing the set in the centre of the frame with the ferrite rod winding and loop winding in parallel. The loop tuning capacitor used with the rotating loop will give improved results. Only the seven main turns of the loop are used in this case. No direct connection is made from the loop to the transistor receiver. ■

## ★ components list

**Frame**

Wood: One piece 53 x 1 x 1in. } Frame
Two pieces 26 x 1 x 1in. } cross-pieces
One piece 30 x 1in. dowel or broomhandle.

3-ply: Four pieces $4\frac{1}{2}$ x $5\frac{1}{4}$in. (spacers)
Two pieces 8 x 8in. (frame centre)
Two pieces 2 x $5\frac{1}{4}$in. (capacitor and winding supports)

**Miscellaneous**

120ft. aerial wire (plastic, silk or cotton covered), 15ft. coaxial cable or 300Ω flat twin feeder, 500pF variable tuning capacitor, screws, glue, etc.

# DIODE OSCILLATORS

*—continued from page 489*

as in electronic organs, or sound synthesisers. The stability of germanium diode oscillators leaves much to be desired, but with efficient heat sinks can be improved. There might be a case here for experiments with water cooling or forced ventilation. However, very stable working may also be achieved by locking the oscillators to a standard frequency.

If the series resistors VR1 and R1 are replaced by a pentode valve, linear charging of the diode's parallel capacitor will result and the saw-tooth output utilised as a simple time base for a c.r.t. indicator, with enough voltage swing to drive the tube directly, without additional amplification.

The upper frequency limit of the oscillators mentioned was not much above 10kc/s, and seemed to depend very much on the diode used. It may be possible, with a suitable diode, to increase this to the limit of the audio range, together with the usefulness of the device. ■

CLUB SPOT

# No. 11 LUTON AND DISTRICT AMATEUR RADIO CLUB

G3SVJ

THE scene was a lonely school, the time—late one dark evening. A session of the Luton A.R.C. was in progress. Great concern was being shown at the first item on the agenda—falling membership. It was agreed that a change of QTH was the only hope of salvation.

A visit to the Luton club today would dispel any rumours of shrinking minions. With a ledger listing well over 100 members and a weekly meeting with an average of thirty or more, the future looks very bright. The ledger also shows that around 60 licensed amateurs are associated with the club and the number looks like rising.

At the new QTH, which has housed them since 1964, your reporter found a very lively debate in progress—s.s.b. versus the rest! The committee consists of a keen group of amateurs under the chairmanship of A. W. Morgan G8ADS; H. Gadsden, R. Crawley G3TLE, S. Down G3USE (hon. sec.), D. Pinnock, and Mr. Fanning (hon. treasurer).

Difficulty in finding local lecturers is a problem common to all radio clubs. Luton get round this thorny one by having debates and discussions on various topical and often controversial subjects. The most popular lecture last season was "S.W.L. to Amateur". Other items included a visit to the ITA transmitter at Sandyheath, and a "mobile" evening.

Contests rate high in interest value and the club now has a Competitions Manager in D. Pinnock G3HVA. Most contests are entered, including of course NFD. This year a single station entry brought the club 7th place. The site for most contest work is at Stockwood Park aptly described as the local Mont Blanc, and the C.W. kings who mountaineered up to the site were A. Webb G3KCJ, J. Latham G3LNC, and L. Cutting G3KAA. A bit of close team work with the local scout troop produced a great deal of assistance on this occasion.

Short wave listeners are helped as much as possible, and S.W.l reports on local signals are encouraged. To make the encouragement concrete and worth while the committee plan to run elementary theory and morse tuition this season. Ironically, the club has amongst its members G3TXP who is the RAE instructor at the local technical college.

Initiative and alertness are evident at Luton. An example of this is the following story about a local junk dealer who offered for sale a pile of i.f. strips. These were spotted by a member and the club then bought these up. Unlike many people who buy junk without any purpose other than to acquire a bargain, the club promptly converted these units to make very fine DF sets. One DF hunt has already been held, and another is planned.

This season's programme looks extremely interesting. Items taken at random include—Antenna brains trust, Scopes, TVI, Semiconductors, and a s.s.b. homebrew rig. If you see anything here that interests you, or you live in or around Luton, then you will be pleased to hear that visitors are welcome.

The club is often on the air on club nights (Tuesdays at 2000 hrs.) with the callsign G3SVJ. The transmitter, aerial, and Hon. Sec. on these occasions are all to be found at the A.T.C. Headquarters, Crescent Road, Luton. See you at the meeting next Tuesday OM?

# R.S.G.B. NATIONAL MOBILE RALLY

## Woburn Abbey, Bletchley, Buckinghamshire

*by permission of His Grace the Duke of Bedford*

SUNDAY 11th September saw the 1966 R.S.G.B. National Mobile Rally at Woburn Abbey. Although the weather in the morning was not too good, it soon brightened and things really got under way.

As the PRACTICAL WIRELESS car came over the rise, the Hams' car park could be seen and it was very interesting to note the variety of mobile aerials that had been fitted. They ranged from an "E-type" with a professional-looking v.h.f. antenna to an "old banger" with a home-made whip.

Talk-in stations, GB2VHF, and GB3RS were ably manned by G3UNP, G3NBO, G3LXP and our own G3JDG on 160m; G3UFP, G3VAV, G3VAX and G3PAO on 4m; G3KWH, G3LUY, G2BLA and G30ZH on 2m; G3GJX, G3RXA, G3LVP and G3NBO on 80m s.s.b.

G3JFH won the 160m Pedestrian D/F Hunt in the record time of 16 minutes; one of the hidden transmitters being operated by G3RXA from a laundry basket (rumoured to be working /B for Basket) hidden well in the depths of the parkland at Woburn.

In the grand marquee were some displays of equipment by manufacturers and a large surplus sale where one could purchase anything from a co-ax socket for 1d. to a transistor superhet chassis for 12s. 6d.

While the OM's were pottering about with their gear and swapping radio yarns and ideas, the YL's, XYL's and the kids were able to walk round the grounds which cover more than 3,000 acres, or to hop on the Woburn Safari Service and see many of the 2,000 wild animals.—*CRR.*

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| CV102 | 1/- |
| CV103 | 4/- |
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| CV4014 | 7/- |
| CV4015 | 5/- |
| CV4025 | 10/- |
| CV4049 | 6/- |
| CY31 | 6/6 |
| D1 | 1/6 |
| D41 | 6/- |
| D61 | 6/- |
| D77 | 3/3 |
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| DH63 | 5/- |
| DK92 | 8/- |
| DK96 | 6/6 |
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| DL93 | 4/- |
| DL94 | 5/9 |
| DL96 | 7/- |

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| EA50 | 1/- |
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| EA91 | 3/6 |
| EAF42 | 8/- |
| EB34 | 1/6 |
| EB91 | 3/- |
| EBC23 | 6/- |
| EBC41 | 8/6 |
| EBC81 | 5/- |
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| EC91 | 3/- |
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| ECC82 | 5/- |
| ECC83 | 6/- |
| ECC84 | 5/6 |
| ECC85 | 6/6 |
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| EF37A | 7/- |
| EF40 | 8/- |
| EF50 | 2/6 |
| EF52 | 6/- |
| EF53 | 4/6 |
| EF55 | 8/- |
| EF71 | 7/6 |
| EF72 | 5/- |
| EF73 | 5/- |
| EF74 | 4/- |
| EF80 | 5/- |
| EF81 | 6/- |

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|---|---|
| EF85 | 4/6 |
| EF86 | 6/6 |
| EF89 | 5/- |
| EF91 | 3/6 |
| EF92 | 2/- |
| EF95 | 5/- |
| EF183 | 8/- |
| EF184 | 8/- |
| EH90 | 7/6 |
| EHT1 | 300/- |
| EL32 | 3/9 |
| EL34 | 10/- |
| EL36 | 5/- |
| EL38 | 17/6 |
| EL41 | 8/- |
| EL42 | 8/- |
| EL50 | 8/- |
| EL81 | 8/- |
| EL84 | 5/- |
| EL85 | 8/- |
| EL91 | 4/6 |
| EL95 | 5/- |
| EL360 | 20/- |
| EM80 | 6/- |
| EM81 | 7/6 |
| EM84 | 6/3 |
| EN31 | 10/- |
| ESU74 | 80/- |
| ESU208 | 6/- |
| EY51 | 5/6 |
| EY86 | 6/6 |
| EY91 | 3/- |
| EZ40 | 6/6 |
| EZ41 | 6/6 |
| EZ80 | 5/6 |
| EZ81 | 4/6 |
| F/6057 | 5/- |
| F/6061 | 5/- |
| F/6063 | 4/- |
| FW4/500 | 6/6 |
| FW4/800 | 8/6 |
| G1/236G | 9/- |
| G1/370K | 20/- |
| G50/2G | 5/- |
| G180/2M | 15/- |
| GM4 | 45/- |
| GZ32 | 10/- |
| GZ34 | 10/- |
| HK54 | 22/6 |
| HL2K | 2/6 |
| HL23 | 6/- |
| HL23DD | 5/- |
| HL41 | 4/- |
| HVR2 | 9/- |
| K3A | 60/- |
| KT8C | 22/- |

| | |
|---|---|
| KT32 | 8/- |
| KT44 | 5/9 |
| KT33 | 4/- |
| KT66 | 16/- |
| KT67 | 15/- |
| KY76 | 8/6 |
| KT88 | 22/- |
| KTW61 | 4/6 |
| KTW63 | 2/- |
| KTZ41 | 6/- |
| KTZ63 | 5/- |
| M8100 | 9/- |
| M8141 | 12/- |
| M8161 | 7/- |
| MH4 | 5/- |
| MHLD6 | 10/- |
| ML6 | 6/- |
| N78 | 15/- |
| NE17 | 7/- |
| OA2 | 5/9 |
| OB2 | 6/- |
| OB3 | 7/- |
| OC3 | 5/- |
| OD3 | 5/- |
| OZ4A | 5/- |
| PC86 | 9/- |
| PC88 | 9/- |
| PC97 | 9/6 |
| PC900 | 12/- |
| PCC84 | 6/- |
| PCC89 | 10/- |
| PCC189 | 9/6 |
| PCF80 | 7/- |
| PCF82 | 6/6 |
| PCF84 | 6/- |
| PCF86 | 8/- |
| PCF802 | 11/- |
| PCF805 | 11/- |
| PCL81 | 9/- |
| PCL82 | 7/- |
| PCL83 | 8/6 |
| PCL84 | 7/- |
| PCL85 | 8/6 |
| PCL86 | 8/- |
| PEN25 | 4/6 |
| PEN46 | 3/- |
| PEN200A | 3/- |
| PFL200 | 17/6 |
| PL36 | 9/- |
| PL38 | 16/- |
| PL81 | 7/- |
| PL82 | 6/6 |
| PL83 | 6/- |
| PL84 | 6/6 |
| PL500 | 15/- |
| PM24A | 5/- |
| PT15 | 10/- |
| PT25H | 7/6 |
| PT25M | 7/6 |
| PX4 | 14/- |
| PX25 | 9/- |
| PY33 | 6/- |
| PY80 | 5/6 |
| PY81 | 5/6 |
| PY82 | 5/6 |
| PY83 | 6/- |
| PY800 | 8/- |

| | |
|---|---|
| PZ1-35 | 9/- |
| PZ1-75 | 12/- |
| QP21 | 6/- |
| QP25 | 5/- |
| QP230 | 5/- |
| QS95/10 | 5/6 |
| QS150/15 | 10/- |
| QS1202 | 8/- |
| QV04/7 | 8/2 |
| R3 | 8/- |
| R10 | 9/- |
| RG4/1250 | 60/- |
| RK72 | 6/- |
| SL30P | 15/- |
| SL30 | 12/6 |
| SP2 | 8/6 |
| SP41 | 1/6 |
| SP61 | 1/6 |
| SP210 | 6/6 |
| STV280/40 | 12/6 |

| | |
|---|---|
| U801 | 17/- |
| UABC80 | 6/- |
| UAF42 | 9/- |
| UBC41 | 6/- |
| UBF80 | 5/6 |
| UBF89 | 6/6 |
| UBL21 | 10/- |
| UCC85 | 6/6 |
| UCH42 | 8/- |
| UCH81 | 6/- |
| UCL82 | 8/- |
| UCL83 | 9/- |
| UF41 | 8/6 |
| UF89 | 6/- |
| UL41 | 7/6 |
| UL84 | 5/6 |
| UU5 | 7/- |
| UU9 | 8/6 |
| UY21 | 7/6 |
| UY41 | 6/6 |
| UY85 | 5/- |
| V1120 | 4/- |
| V1507 | 5/- |

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|---|---|
| Z801U | 10/- |
| 1A3 | 8/- |
| 1A5GT | 5/- |
| 1B22 | 30/- |
| 1C5GT | 6/- |
| 1D8GT | 6/- |
| 1E7G | 7/6 |
| 1F2 | 3/- |
| 1G6GT | 6/- |
| 1L4 | 2/6 |
| 1LA6 | 6/- |
| 1LC6 | 7/- |
| 1LH4 | 4/- |
| 1N21B | 4/- |
| 1N43 | 4/- |
| 1N70 | 4/- |
| 1R4 | 5/- |
| 1R5 | 3/6 |
| 1S4 | 5/- |
| 1S5 | 4/6 |
| 1T4 | 3/- |
| 2A3 | 5/- |
| 2C26 | 7/- |

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|---|---|
| 5A174G | 5/- |
| 5B251M | 40/- |
| 5B/253M | 15/- |
| 5B254M | 40/- |
| 5B255M | 35/- |
| 5R4GY | 9/- |
| 5T4 | 7/- |
| 5U4G | 4/6 |
| 5V4G | 8/- |
| 5X4G | 8/6 |
| 5Y3G | 4/6 |
| 5Y3GT | 5/- |
| 5Y3WGTB | 9/- |
| 5Z4G | 6/6 |
| 5Z4GT | 8/- |
| 6AB6 | 4/- |
| 6AC7 | 2/- |
| 6AG5 | 2/6 |
| 6AG7 | 6/- |
| 6AH6 | 10/- |
| 6AJ7 | 2/- |

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|---|---|---|---|---|---|---|---|
| OC16 | 20/- | OC81D | 5/- | OC201 | 12/6 | XC141 | 10/- |
| OC22 | 23/- | OC81M | 7/- | OC202 | 15/- | XC142 | 15/- |
| OC26 | 12/- | OC82 | 10/- | OC203 | 12/6 | XC155 | 20/- |
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| OC44 | 6/- | OC83 | 5/- | OC206 | 22/6 | 2N247 | 9/6 |
| OC45 | 5/- | OC83B | 5/- | AAZ12 | 6/- | 2N412 | 7/6 |
| OC71 | 4/6 | OC122 | 16/- | AC128 | 7/6 | 2N502 | 47/- |
| OC72 | 6/- | OC170 | 6/- | BCZ11 | 7/6 | 2N585 | 10/6 |
| OC73 | 10/- | OC200 | 10/6 | BY38 | 7/6 | 2N1090 | 20/6 |
| OC81 | 5/- | | | | | 2N1091 | 29/- |

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|---|---|
| SU2150A | 10/- |
| S11E12 | 10/- |
| T41 | 10/- |
| TDOX-20 | 70/- |
| TP22 | 5/- |
| TP25 | 15/- |
| TT11 | 5/- |
| TT15 | 35/- |
| TTR31 | 45/- |
| TZ0520 | 4/- |
| TZ20 | 16/- |
| U81 | 18/- |
| U12/4 | 8/- |
| U17 | 5/- |
| U18 | 6/- |
| U25 | 11/- |
| U26 | 11/- |
| U27 | 8/- |
| U50 | 4/6 |
| U52 | 4/6 |
| U191 | 11/6 |

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|---|---|
| V1924 | 20/- |
| VP23 | 3/- |
| VP133 | 9/- |
| VR99 | 8/- |
| VR105/30 | 5/- |
| VR150/30 | 5/- |
| VU33A | 4/- |
| VU39 | 6/- |
| VX3208 | 5/- |
| VX3256 | 4/- |
| VX8122 | 5/- |
| VX8124 | 5/- |
| W21 | 5/- |
| W118 | 10/- |
| W119 | 8/- |
| X66 | 7/6 |
| X81M | 18/- |
| X118 | 8/- |
| X145 | 8/- |
| Y63 | 5/- |
| Y65 | 4/- |
| Y66 | 8/- |
| Z800U | 20/- |

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|---|---|
| 2C26A | 3/- |
| 2C34 | 2/6 |
| 2C45 | 22/6 |
| 2C46 | 30/- |
| 2C51 | 12/- |
| 2D21 | 5/- |
| 3A4 | 4/- |
| 3A/108A | 20/- |
| 3A/46J | 35/- |
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| 3D6 | 4/- |
| 3E29 | 50/- |
| 3Q4 | 6/- |
| 3Q5GT | 7/- |
| 3S4 | 5/- |
| 3V4 | 5/9 |
| 3X2 | 3/- |
| 4C27 | 35/- |
| 4D1 | 4/- |
| 5A173G | 5/- |

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|---|---|
| 6AK5 | 5/- |
| 6AK7 | 6/- |
| 6AL5 | 3/- |
| 6AL5W | 7/- |
| 6AM5 | 2/6 |
| 6AM6 | 4/- |
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| 6AT6 | 4/- |
| 6AU6 | 7/- |
| 6AX4 | 8/- |
| 6B4G | 16/- |
| 6B7 | 6/- |
| 6B8G | 2/6 |
| 6BA6 | 5/- |
| 6BA7 | 5/- |
| 6BE6 | 6/- |
| 6BJ6 | 7/6 |
| 6BJ7 | 7/- |
| 6BQ7A | 8/- |

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|---|---|
| 6BR7 | 9/- |
| 6BW6 | 8/- |
| 6C4 | 2/- |
| 6C5G | 2/6 |
| 6C5GT | 6/- |
| 6C6 | 4/- |
| 6C6G | 3/- |
| 6C8G | 3/- |
| 6CH6 | 4/6 |
| 6C21 | 80/- |
| 6CL6 | 9/- |
| 6CW4 | 12/- |
| 6D6 | 3/- |
| 6E5 | 6/- |
| 6F5GT | 5/9 |
| 6F6G | 4/- |
| 6F7 | 6/- |
| 6F8G | 6/6 |
| 6F12 | 4/6 |
| 6F13 | 5/- |
| 6F14 | 5/- |
| 6F32 | 4/- |
| 6F33 | 3/- |
| 6G6G | 2/6 |
| 6H6M | 1/6 |
| 6J4WA | 10/- |
| 6J5 | 6/- |
| 6J5G | 2/- |
| 6J6 | 3/6 |
| 6J6W | 6/- |
| 6J7G | 5/- |
| 6J7M | 8/- |
| 6K6GT | 5/6 |
| 6K7G | 2/- |
| 6KJGT | 4/9 |
| 6K8G | 3/- |
| 6K8GT | 8/3 |
| 6K8M | 6/6 |
| 6L5G | 6/- |
| 6L6GA | 7/6 |
| 6L6M | 11/- |
| 6L7G | 4/- |
| 6L34 | 4/6 |
| 6LD20 | 5/9 |
| 6N7 | 6/- |
| 6N7G | 5/9 |
| 6P25 | 12/6 |
| 6Q7G | 5/- |
| 6R7 | 5/6 |
| 6SA7 | 7/- |
| 6SA7GT | 6/6 |
| 6SC7 | 7/- |
| 6SG7GT | 5/- |
| 6SFGT | 5/6 |
| 6SH7 | 6/- |
| 6SJ7 | 5/- |
| 6SJ7G | 6/6 |
| 6SK7GT | 4/- |
| 6SK7 | 4/6 |
| 6SL7GT | 5/6 |
| 6SN7 | 3/6 |
| 6SQ7GT | 6/- |
| 6SS7 | 2/- |
| 6U4GT | 9/6 |
| 6V6G | 5/- |
| 6V6GT | 7/6 |
| 6V6M | 8/- |

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|---|---|
| 6X4 | 3/6 |
| 6X5G | 5/- |
| 6Z5GT | 5/3 |
| 6Y6G | 6/- |
| 6-30L2 | 10/- |
| 6Z4 | 5/- |
| 7B7 | 7/6 |
| 7C5 | 10/- |
| 7C6 | 7/- |
| 7C7 | 6/- |
| 7H7 | 7/3 |
| 7Q7 | 7/- |
| 7S7 | 18/- |
| 7V7 | 5/- |
| 7Y4 | 8/- |
| 7Z4 | 4/6 |
| 8D2 | 2/6 |
| 9D2 | 3/- |
| 9D6 | 3/6 |
| 10F9 | 9/- |
| 12A6 | 2/6 |
| 12AH7 | 5/- |
| 12AT6 | 5/- |
| 12AT7 | 4/- |
| 12AV6 | 5/6 |
| 12AU7 | 5/- |
| 12AT7WA | 5/6 |
| 12AX7 | 6/- |
| 12AY7 | 10/- |
| 12BA6 | 5/- |
| 12BE6 | 7/- |
| 12BH7 | 7/- |
| 12C8 | 3/- |
| 12H6 | 2/- |
| 12J5GT | 2/6 |
| 12J7GT | 6/6 |
| 12K7GT | 2/- |
| 12K8M | 10/- |
| 12Q7GT | 3/3 |
| 12SA7 | 7/- |
| 12SC7 | 4/- |
| 12SG7 | 3/- |
| 12SH7 | 3/- |
| 12S7J | 5/- |
| 12SK7 | 5/- |
| 12SN7GT | 5/9 |
| 12SR7 | 5/- |
| 12Y4 | 2/- |
| 12L7 | 7/- |
| 14S7 | 18/- |
| 15D2 | 6/- |
| 19E2 | 15/- |
| 19G3 | 20/- |
| 19G7 | 5/- |
| 19H1 | 6/- |
| 19M1 | 5/- |
| 20P4 | 12/6 |
| 21B6 | 9/- |
| 25L6GT | 5/- |
| 25Y5 | 6/- |
| 25Z4G | 6/6 |
| 25Z5 | 7/6 |
| 25Z6GT | 8/6 |
| 25D7 | 6/- |
| 30 | 5/- |

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|---|---|
| 30C15 | 9/6 |
| 30C18 | 11/- |
| 30F5 | 8/6 |
| 30FL1 | 10/6 |
| 30L15 | 11/- |
| 30P12 | 10/- |
| 30P19 | 15/- |
| 30PL1 | 8/- |
| 30PL13 | 27/6 |
| 3516GT | 7/- |
| 35T | 17/6 |
| 35W4 | 5/- |
| 35Z3 | 10/- |
| 35Z4GT | 6/- |
| 35Z5GT | 6/- |
| 37 | 4/- |
| 38 | 4/- |
| 2158G | 6/- |
| 50CD6G | 27/6 |
| 50L6GT | 8/- |
| 53A | 7/6 |
| 57 | 6/- |
| 58 | 6/- |
| 59 | 6/- |
| 75 | 5/6 |
| 76 | 5/- |
| 77 | 6/6 |
| 78 | 5/- |
| 80 | 5/6 |
| 81 | 9/- |
| 84 | 8/- |
| 85A2 | 8/- |
| 210VPT 7-pin | 2/6 |
| 220PA | 7/- |
| 220TH | 4/- |
| 225DU | 9/- |
| 307A | 5/6 |
| 310C | 25/- |
| 350B | 8/- |
| 357A | 7/- |
| 368A | 5/- |
| 393A | 15/- |
| 446A | 8/- |
| 703A | 30/- |
| 705A | 10/- |
| 715B | 60/- |
| 717A | 8/- |
| 724A | 15/- |
| 801 | 6/- |
| 803 | 22/6 |
| 807 | 8/- |
| 808 | 8/- |
| 813 | 65/- |
| 815 | 35/- |
| 829B | 50/- |
| 830B | 4/- |
| 832A | 45/- |
| 843 | 5/- |
| 866A | 14/- |
| 884 | 10/- |
| 954 | 4/6 |
| 955 | 2/6 |
| 956 | 2/- |
| 957 | 5/- |
| 958A | 4/- |

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|---|---|
| 1612 | 5/- |
| 1616 | 3/- |
| 1619 | 5/- |
| 1625 | 6/- |
| 1626 | 3/- |
| 1629 | 4/6 |
| 2051 | 5/- |
| 4043C | 13/6 |
| 4063 | 8/- |
| 4313C | 30/- |
| 5704 | 9/- |
| 5726 | 6/- |
| 6060 | 5/- |
| 6064 | 7/- |
| 6065 | 6/- |
| 6080 | 22/- |
| 6146 | 25/- |
| 7193 | 1/9 |
| 7475 | 2/- |
| 8013A | 25/- |
| 8020 | 8/- |
| 9001 | 3/- |
| 9002 | 4/6 |
| 9003 | 6/- |
| 9004 | 2/6 |
| 9006 | 2/6 |

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| | |
|---|---|
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| VCR97 | 28/- |
| VCR138A | 40/- |
| VCR517 | 35/- |
| VCR517B | 40/- |
| VCR517C | 40/- |
| 3FP7 | 45/- |
| 3EG1 | 40/- |
| 5PC1 | 30/- |
| 5FP7 | 12/6 |
| 88D | 44/- |

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| | |
|---|---|
| GS16 | 12/6 |
| 931A | 55/- |
| 6097 | 350/- |

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| | |
|---|---|
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| K301 | £4 |
| KRN2A | £3.10.0 |
| 1B24 | 25/- |
| 2J22 | £2.10.0 |
| 2J54 | £3 |
| 417A | 30/- |
| 3J/92/E | £37.10.0 |
| 714AY | £4 |
| 725A | 30/- |
| 726A | 19/- |

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|---|---|---|
| 0-3 amp RF | 2in. square | 20/- |
| 100mA AC | 3½in. round | 25/- |
| 15v AC | 2½in. round | 20/- |
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**2 KW ULTRASONIC GENERATOR** together with power supply unit for 200-250 v. A.C. Complete two chassis with interconnecting cables. Frequency 37 to 43 kc/s adjusted by fine control. Peak output 2 kw., average output 500 w Completely new with valves and manual £65, carriage paid U.K.

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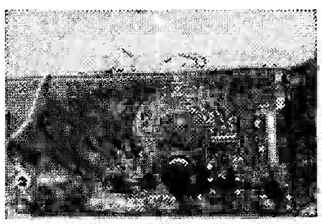

**(Made by Pye).** 3 bands, 1: medium wave, 2: 120-43m 3: 43-13m. Overall sensitivity 1-2μV. S/Noise ratio 10 dB at 6μV. Circuit incorporates an RF stage, two I.F. stages, tone control, A.V.C. antenna trimmer. 6V6 output. Set in new condition together with headphones and speaker plug, **£9.5.6.** With vibratory supply unit, 12v, **£10.4.0.** With specially built-in P.S.U. for 210-250v. A.C., **£11.17.6.** Carriage either set 10/-.

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**ULTRA MODERN POWER SUPPLY UNIT.** Supply voltage A.C.: 105, 110, 115, 200, 205, 210, 220, 225, 230, 240, 245, 250 v. Available voltages D.C.:
(a) 1700-1900 v. Stabilised, adjustable approx. 1 mA.
(b) HT2 approx. 45mA.
(c) 260-350 v. stabilised, adjustable, approx. 45 m.
(d) 450 v. approx. 30 mA.
(e) 50 v. approx. 150 mA.
(f) 4.5 v. A.C. amp. common earth.
(g) 6.3 v. A.C., 4.5 amp. common earth.
5 valves, 7 silicon rectifiers, 4 Selenium HV rectifiers. Brand new, **£9.10.0.** Carriage 12/-.

**PHASE MONITOR ME-63/U.** Manufactured recently by Control Electronics Inc. Measures directly and displays on a panel meter the phase angle between two applied audio frequency signals within the range from 20-20,000 cps to an accuracy of ±1.0°. Input signals can be sinusoidal or non-sinusoidal between 2 and 30v peak. In excellent condition together with handbook and necessary connector **£45.** Carriage 30/-

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### THE WORLD'S FIRST POCKET TV

THE SINCLAIR MICROVISION POCKET TV RECEIVER provided a world wide sensation when shown for the first time at the 1966 Radio and TV Exhibition. This fantastic British set tunes over 13 channels on bands 1 and 3, operates from six self-contained "Penlite" batteries and measures only 4in. x 2½in. x 2in. Despite the minute proportions of this 30 transistor receiver, quality from the exclusively designed tube and loudspeaker is superb. This amazing Sinclair triumph will be available early in 1967 at a cost of 49 gns.

**SINCLAIR MICROVISION**

*Available early 1967*

## A revelation in quality and economy

THE SINCLAIR STEREO 25 has been designed specially to ensure the highest possible standards of reproduction when used with two Z.12s or any other first class stereo power amplifier. Best possible components are used in the construction of this superb unit, whilst its appearance reflects the professional elegance characteristic of all Sinclair designs in hi-fi, radio and TV. The front panel of the Stereo 25 is in solid brushed and polished aluminium with beautifully styled solid aluminium control knobs. Mounting the unit is simple, and power is conveniently obtainable from the Sinclair PZ.3 which can also be used to supply two Z.12s to make a complete stereo assembly. Hi-fi enthusiasts seeking the ultimate in domestic listening will find all they want from this combination of Sinclair units. With a Micro FM for tuner, they will have an installation to compare favourably with anything costing from four to five times as much.

**IDEAL FOR USE WITH TWO Z.12s AMPLIFIER**

### TECHNICAL SPECIFICATIONS

*Performance figures obtained with the Stereo 25 fed to two Z.12s and a PZ.3 mains power supply unit.*

- **SENSITIVITY** for 10 watts into 1.5 ohms load per channel.
  Mic.—2 mV into 50K ohms.
  Pick-up—3 mV into 50K ohms.
  Radio—20 mV into 4.7K ohms.
- **FREQUENCY RESPONSE** (Mic. and Radio)—25 c/s. to 30 kc/s. ± 1dB extending to 100 kc/s ±3dB.
- **EQUALISATION**—Correct to within ±1dB on RIAA curve from 50 c/s to 20 kc/s
- **TONE CONTROLS**
  Treble +12dB to —10dB at 10 kc/s.
  Bass +15dB to —12dB at 100 c/s.
- **SIZE**—6¾in. x 2¾in. x 2¼in. overall, plus knobs.
- **FINISH**—Front panel sectioned in brushed and polished solid aluminium with solid aluminium knobs. Black figuring on front panel.

BUILT, TESTED AND GUARANTEED **£9.19.6**

**FULL SERVICE FACILITIES AVAILABLE TO ALL SINCLAIR CUSTOMERS ● ALL PURCHASES GUARANTEED**

sinclair

**SINCLAIR RADIONICS LTD, 22 Newmarket Rd., CAMBRIDGE**

Telephone 52996 (STD Code OCA3)

Order form and more Sinclair designs on pages following

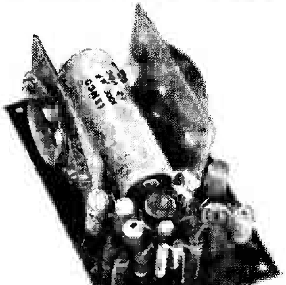

# SINCLAIR Z.12

## COMBINED 12 WATT HIGH-FIDELITY AMPLIFIER AND PRE-AMP

**12 WATTS R.M.S. OUTPUT**
CONTINUOUS SINE WAVE (30W. PEAK)

**8 TRANSISTOR CIRCUIT WITH CLASS B ULTRALINEAR OUTPUT**

IDEAL FOR HI-FI (STEREO OR MONO) CAR RADIO, ELECTRIC GUITAR, P.A., INTERCOM, ETC.



The amazing adaptability and rugged construction of this very powerful and exceptionally compact amplifier make it possible to use just one type of unit with outstanding success in an unusually wide variety of applications. Eight special H.F. transistors are used in a highly original circuit to achieve the characteristics demanded of any quality amplifier irrespective of price, yet this Sinclair unit costs well under £5, including its own integrated pre-amplifier. The Z.12 accepts radio, microphone and pick-up inputs. Detailed instructions for connecting these in mono and stereo are given in the manual supplied with every unit. A number of different control networks are also shown. The Z.12 will operate efficiently from any supply between 6 and 20 v.d.c., making it very convenient to run the amplifier from a car battery. Where it is required to run the Z.12 from mains supply, the PZ.3 is recommended. Those wishing to have a ready made pre-amp control unit can feed inputs via the Stereo 25, which, with two Z.12s will provide the finest stereophonic hi-fi possible—and the saving in cost is fantastic.

## TECHNICAL SPECIFICATIONS

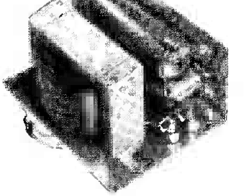
- Size 3 in. x $1\frac{3}{4}$in. x $1\frac{1}{4}$in.
- Class "B" ultralinear output
- **RESPONSE** 15–50,000 c/s $\pm$ 1 dB.
- Suitable for 3, 7·5 or 15$\Omega$ speakers. Two 3$\Omega$ speakers may be used in parallel
- **INPUT**—2mV into 2k$\Omega$.
- **OUTPUT**—12 watts R.M.S. continuous sine wave (24 w. peak); 15 watts music power (30 w. peak)
- Signal to noise ratio better than 60dB.
- Quiescent current consumption—15mA.

*Built, tested and guaranteed. Ready for immediate use. With Z.12 manual.*

**89/6**

**YOUR SINCLAIR GUARANTEE**
**If you are not completely satisfied when you receive your purchase from us, your money will be refunded at once in full and without question.**
**If you prefer not to cut this page, please mention PW11 when writing your order.**

## SINCLAIR PZ.3
## POWER SUPPLY UNIT



This special power supply unit uses advanced transistorised circuitry to achieve exceptionally good smoothing. Ripple is a barely measurable 0.05 v. The PZ.3 will power two Z.12s and a Stereo 25 with ease.

**79/6**

*Sinclair Stereo 25*

DE-LUXE PRE-AMP. AND CONTROL UNIT
PLEASE TURN TO PAGE 527

To: **SINCLAIR RADIONICS LTD.,** 22 **NEWMARKET ROAD, CAMBRIDGE**

*Please send items detailed below:*
..............................
..............................
..............................
..............................
*For which I enclose cash/cheque/money order.*

*NAME*..............................
*ADDRESS*..............................
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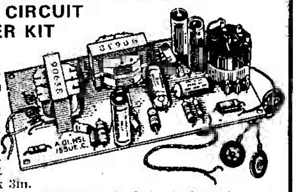
..............................
.............................. PW.11

## 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 x 3in. ● Generous size Driver and Output Transformers. ● Output transformer tapped for 3 ohm and 15 ohm speakers. ● Transistors (GET 114 or 81 Mullard OC81D and matched pair of OC81 o/p). ● 9 volt operation. ● Everything supplied, wire, battery clips, solder, etc. ● Comprehensive easy to follow instructions and circuit diagram 1/6 (Free with Kit). All parts sold separately.

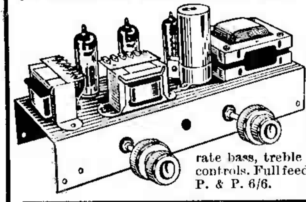
**SPECIAL PRICE 45/-**. P. & P. 3/-.

Also ready built and tested, **52/6**. P. & P. 3/-.

A pair of TA1s are ideal for stereo.

## STEREO AMPLIFIER

Incorporating 2 ECL86s and 1 EZ80, heavy duty, double wound mains transformer. Output 4 watts per channel. Full tone and volume controls. Absolutely complete.



ONLY **£4.19.6** P. & P. 6/6

Super De-luxe version with ECL86 valves separate bass, treble and balance controls. Full feed back. **8 gns.** P. & P. 6/6.

## 6 TRANSISTOR AND DIODE SUPERHET

A first-class 2 waveband transistor superhet. ● Printed circuit panel (size 8¾ x 2¼in.). ● 3 pre-aligned IF transformers. ● High-gain Ferrite Rod Aerial. ● All First-grade transistors. ● Car aerial winding. ● Push-pull output. ● All parts supplied with simple instructions. **All parts sold separately.** Set of parts if purchased at one time ONLY **£4.5.0.** P. & P. 2/6 (Circuit diagram 2/-. Free with set of parts.)

## 35 OHM SPEAKERS

*Suitable for use with above.* 2in. Goodmans. Ideal replacement for most pocket portables, **8/6**; 3¼in. **12/6**; 7 x 4in., **21/-**; P. & P. 2/- per speaker.

## Portable CABINET

Size approx. 9¼ x 6¾ x 3¼in. Suitable for above using 3¼in. speaker, **25/-**. P. & P. 2/6.

## COIL AND TRANSFORMER SET FOR TRANSISTOR SUPERHET

3 IF transformers one oscillator coil one driver transformer and wound Ferrite aerial (med. long and car aerial coupling). **32/6** complete post 2/-. 6 transistor printed circuit board to match **8/6**. Post 1/-. Circuit diagram 1/6 extra.

**MINIATURE PRECISION AIR-SPACED TWO GANG TUNING CONDENSER.** 176+176 p.F. size 1½"w x ⅞d x 1¼"h with vanes open. Built in trimmers **5/-**. P. & P. 1/-.

## BRAND NEW TRANSISTOR BARGAINS

GET 15 (Matched Pair) **15/-**; V15/10p, **10/-**; OC71 **5/-**; OC76 **6/-**; AF117 **7/6**.

Set of Mullard 6 transistors OC44, 2—OC45 OC81D matched pair OC81 **25/-**. ORP12 Cadmium Sulphide Cell **10/6**.

**EDISWAN MAZDA**

PXA101 **6/6**; XA103 **6/6**.

R.F.1. Pack: 1—PXA102 Mixer; 2—PXA101 I.F. Amp. (Equiv. OC44 and OC45) .......... **10/6**

R.F. 2 Pack: 2—PXA101 I.F. 1—PXA102 Osc.1—PXA102 Mixer .......... **12/6**

L.F.6 Pack: Consisting of PXB113 Driver Matched pair. PX171 mounted complete with heat sinks (Equiv. OC81D and OC81) .......... **12/6**

ALL TRANSISTORS POST FREE.

## TAPE DECKS

**B.S.R. MONARDECK** (Single speed) 3¾in. per sec., simple control, uses 5¾in. spools, **£6.15.0** plus 7/6 carr. and ins. (Tapes extra).

**LATEST COLLARO MAGNAVOX 363 TAPE DECK DE LUXE.** Three speeds, 2 track, takes up to 7in. spools. **10 gns.** Plus 7/6 Carr. & ins. on each (Tapes extra).

## PORTABLE TAPE RECORDER CASE

Beautifully made and expensively finished in dark grey heavy grade rexine. Satin Chrome metal grille front and chrome fittings. Speaker aperture 9" x 4". Overall size 15½" w. x 15" d. x 7½" h. Will take any standard tape deck or single record player. Limited number only. Worth at least **£5.** OUR PRICE **49/6.** P. & P. 5/-. Brand new and unused.

**ACOS CRYSTAL MIKES.** High imp. For desk or hand use. High sensitivity, **18/6.** P. & P. 1/6.

**TSL CRYSTAL STICK MIKE.** Listed at 45/-. Our price **18/6.** P. & P. 1/6.

## QUALITY RECORD PLAYER AMPLIFIER

A top-quality record player amplifier. This amplifier (was used in a 29 gn. record player) employs 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. w. x 2¼in. d. x 5¼in. h. Ready built and tested. **PRICE 69/6.** P. & P. 4/9.

ALSO AVAILABLE mounted on board with output transformer and 6in. speaker ready to fit into cabinet below. **PRICE 89/6.** P. & P. 5/9.

## QUALITY PORTABLE R/P CABINET

Uncut motor board. Will take above amplifier and B.S.R. or GARRARD Autochanger or Single Record Player Unit. Size 18 x 14 x 8½in.

**Price £3.9.6.** Carr. 7/6.

## 4-SPEED PLAYER UNIT BARGAINS

All brand new in maker's original packing.

**SINGLE PLAYERS**

B.S.R. TU/12 .......... **£3.9.6** Carr. 5/6.

GARRARD SP25 De Luxe .. **£12.10.6.** Carr. 5/6.

B.S.R. GU7 with unit mounted pickup arm. **£4.18.8.** Carr. 5/6.

**AUTO CHANGERS**

Latest B.S.R. UA25 Super slim .......... **£6. 2.6**

GARRARD 1000 with special Hi-Fi cartridge .. **£6.19.6**

GARRARD AT6 .... **£9.10.0.** Carr. 6/6 on each.

All the above units are complete with t/o mono head and sapphire styli or can be supplied with compatible stereo head for 12/6 extra.

## BRAND NEW CARTRIDGE BARGAINS!

**ACOS GP67-1.** Mono complete. List price **21/-**. Our price **13/6.** P. & P. 1/-.

## BRAND NEW 3 OHM LOUDSPEAKERS

5in., **12/6**; 6½in., **15/-**; 8in., **21/-**; 10in., **25/-**; 7in. x 4in., **15/-**; 10in. x 6in., **26/-**.

E.M.I. 8" x 5" with high flux ceramic magnet, **23/6.**

E.M.I. 13½ x 8in with high flux ceramic magnet, **42/-** (15 ohm, **45/-**). P. & P. 5" 2/-, 6½" & 8" 2/6, 10" & 12" 3/6 per speaker.

**SPECIAL OFFER!**

Limited number of 12in. 10 watt "R.A." Speakers: 3 ohm **25/-**; 15 ohm, **27/6.** P. & P. 3/6.

**E.M.I. PLASTIC CONED TWEETERS.** 2½" 3 ohm. Limited number **12/6** each. P. & P. 1/6.

**BRAND NEW HEAVY DUTY 12in. SPEAKERS** Response 45 c/s-13 Kc/s. 1½in. voice coil. Available in 3 or 15 ohms. Guaranteed full 15 watts British rating. Heavy cast aluminium frame. There are current production by world famous maker and as they are offered well below list price we are not permitted to disclose the name. LIMITED NUMBER ONLY. UNREPEATABLE at **89/6.** P. & P. 5/-. Also 25 watt Guitar Model available at **£5.5.0.** And 35 watt Guitar Model **£8.8.0.**

**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.

**SPECIAL OFFER!**

GENUINE HIGH QUALITY TYGAN FABRIC. 48in. wide. Our price **10/-** per foot run. P. & P. 1/6. **30/-** per yard run. P. & P. 2/6.

**SEMI SHROUDED DROP THRO' MAINS TRANSFORMER.** Tapped pri 200/250 v. Sec. 300-0-300 v. at 110mA. and 6.3 v. at 3 amp. (E/S screen). Stack size 3¾ x 3¼ x 1¾in. **30/-**. P. & P. 3/6.

**MAINS TRANSFORMER.** For Transistor power supplies. Pri. 200/240v. Sec. 9-0-9v. at 500mA. **11/-**. P. & P. 2/6.

**MAINS TRANSFORMER** For transistor power supplies. Tapped pri 200-250v. Sec. 40-0-40 at 1 amp (with electrostatic screen) and 6.3v at .5 amp for dial lamps etc. Drop thro mounting. Stack size 1¾" x 3¾" x 3¼" **27/6.** P. & P. 4/6.

**SMOOTHING CONDENSER.** 2800 mfd. 25v. 1¼" dia x 3" high **3/-**. P. & P. 1/-.

**MATCHED PAIR OF 2½ WATT TRANSISTOR DRIVER AND OUTPUT TRANSFORMERS.** Stack size 1¼ x 1¼ x ⅞in. Output trans. tapped for 3 ohm and 15 ohm output. **10/-** pair plus 2/- P. & P.

**7-10 watt OUTPUT TRANSFORMERS** to match pair of ECL 86's in push-pull to 3 ohm output. ONLY **11/-**. P. & P. 2/6.

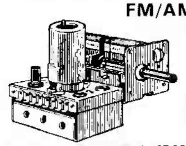
**7-10 watt ULTRA LINEAR OUTPUT TRANSFORMERS** to match pair of ECL 82's in push-pull to 3 ohm output. ONLY **15/-**. P. & P. 2/6.

**HEAVY DUTY NON-INDUCTIVE D/P MICRO SWITCH.** Conservatively rated 10 amps at 250v. Standard one-hole fixing. Body size 1½ x ⅞ x 1in. deep inc. terminals **3/-** each. P. & P. 1/- (6 or more post free).

**NEON A.C. MAINS INDICATOR.** For panel mounting, cut out size 1⅛ x ⅝ x ⅞in. deep inc. terminal. White case with lens giving brighter light. For mains 200/250v. **2/6** each. P.P. 6d. (6 or more post free).

**Dual Purpose Bulk Tape Eraser and Tape Head Demagnetiser. 35/-**. P. & P. 3/-.

## SPECIAL HARVERSON OFFER! FM/AM TUNER HEAD



Beautifully designed and precision engineered by Dormer and Wadsworth Ltd. Supplied ready fitted with twin .0005 tuning condenser for AM connection. Prealigned FM section covers 86-102 Mc/s. I.F. output 10.7 Mc/s. Complete with ECC85 (6L12) valve and full circuit diagram of tuner head. Another special bulk purchase enables us to offer these at **27/6** each. P. & P. 3/-. Order quickly! Limited number also available with precision geared 3:1 reduction drive, **30/-**. P. & P. 3/-.

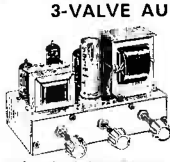
## SPECIAL PURCHASE! TURRET TUNERS

By famous maker. Brand new and unused. Complete with PCC84 and PCF80 valves 34-38 Mc/s IF. Biscuits for Channel 1 to 5 and 8 and 9. Circuit diagram supplied. **ONLY 25/-** each. P. & P. 3/9.

## GORLER F.M. TUNER HEAD

88-100, Mc/s 10.7 Mc/s I.F., **15/-**, plus 2/- P. & P. (ECC85 valve 8/6 extra).

## 3-VALVE AUDIO AMPLIFIER MODEL HA34

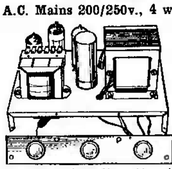


Designed for Hi-Fi reproduction of records. A.C. Mains operation. Ready built on plated heavy gauge metal chassis, size 7¼in. w. x 4in. d. x 4¾in. h. Incorporates ECC83, EL84, EZ80 valves. Heavy duty, double wound mains transformer and output transformer matched for 3 ohm speaker, separate Bass, Treble and volume controls. Negative feedback line. Output 4½ watts. Front panel can be detached and leads extended for remote mounting of controls.

The HA34 has been specially designed for us and our quantity order enables us to offer them complete with knobs, valves, etc., wired and tested for only **£4.5.0** P. & P. 6/-.

## HSL 'FOUR' AMPLIFIER KIT

**A.C. Mains 200/250v., 4 watt, using ECC83, EL84, EZ80 valves.**

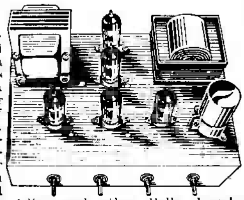


● Heavy duty double-wound mains transformer with electrostatic screen. ● Separate Bass, Treble and Volume controls, giving fully variable boost and cut with minimum insertion loss. ● Heavy negative feedback loop over 2 stages ensures high output at excellent quality with very low distortion factor. ● Suitable for use with guitar, microphone or record player. ● Provision for remote mounting of controls or direct on chassis. ● Chassis size only 7¼in. wide x 4in. deep. Overall height 4¾in. ● All components and valves are brand new. ● Very clear and concise instructions enable even the inexperienced amateur to construct with 100% success. ● Supplied complete with valves, output transformer (3 ohms only), screened lead, wire, nuts, bolts, solder, etc. (No extras to buy.) PRICE **79/6.** P. & P. 6/-.

Comprehensive circuit diagram, practical layout and parts list 2/6 (free with kit).

*This kit although similar in appearance to HA34 employs entirely different and advanced circuitry.*

## 10/14 WATT HI-FI AMPLIFIER KIT



A Stylishly finished monaural amplifier with an output of 14 watts from 2 EL84s in push-pull. Super reproduction of both music and speech, with negligible hum. Separate inputs for mike and gram allow records and announcements to follow each other. Fully shrouded section wound output transformer to match 3-15Ω speaker and 2 independent volume controls, and separate bass and treble controls are provided giving good lift and cut. Valve line-up 2 EL84s, ECC83, EF86, and EZ80 rectifier. Simple instruction booklet 1/6. (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.

Carrying case for above **28/6.** P. & P. 7/6.

## WELL-KNOWN MAKERS SURPLUS!

**ONE TRANSISTOR PRE-AMP**

Suitable for use with Medium or High Impedance mikes, guitars, gram pickups, tape decks etc. For operation from 200/300 volt H.T. rail or 9 volt battery. Gain approx 14:1. Fully isolated input by Mu-Metal screened transformer. Size 4¾" x 1" x 1". Ready built complete with full circuit diagram and instructions. ONLY **15/-**. Post free.

*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, S.W.19** CHErrywood 3985

*SEND STAMPED ADDRESSED ENVELOPE WITH ALL ENQUIRIES*

*(Please write clearly)*

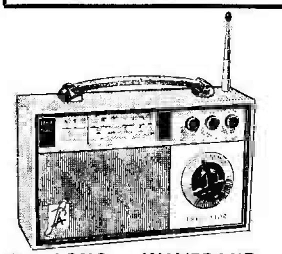
**PLEASE NOTE: P. & P. CHARGES QUOTED APPLY TO U.K. ONLY. P. & P. ON OVERSEAS ORDERS CHARGED EXTRA.**

# LASKY'S RADIO

# FOR THE FINEST VALUE AND TO HOME CONSTRUCTORS

## TRANSISTOR PORTABLES

*We consider our Construction Parcels to be the finest value available on the home construction market. If on receipt you feel not competent to build the set, you may return it as received within 7 days, when the sum paid will be refunded less postage.*



### THE SKYROVER De Luxe

7 transistor plus 2 diode superhet, 6 waveband portable receiver covering the full Medium Waveband and Short Waveband 31-94M and also 4 separate switched bandspread ranges, 13M., 16M., 19M., and 25M., with Band Spread Tuning for accurate Station Selection. The coil pack and tuning heart is completely factory assembled, wired and tested. The remaining assembly can be completed in under three hours from our easy to follow, stage by stage instructions. Superhet, 470 Kc/s. All Mullard Transistors and Diode. Uses 4 U2 batteries. 5in. Ceramic Magnet P.M. Speaker. Easy to read Dial Scale, 500 MW Output. Telescopic Aerial and Ferrite Road Aerial. Tone Circuit is incorporated, with separate Tone Control in addition to Volume Control. Tuning Control and Waveband Selector. In a wood cabinet, size $11\frac{1}{4}$ x $6\frac{1}{2}$ x 3in. covered with a washable material, with plastic trim and carrying handle. Car aerial socket fitted.

Can now be built for **£8 . 19 . 6** Post 5/- extra

H.P. Terms: 45/- deposit and 11 monthly payments of 14/2. Total H.P.P. £10.0.10

**★ LONG WAVEBAND COVERAGE IS NOW AVAILABLE FOR THE SKYROVER**

A simple additional circuit provides coverage of the 1100/1950M. band (including 1500M. Light programme). This is in addition to all existing Medium and Short wavebands. All necessary components with construction data.

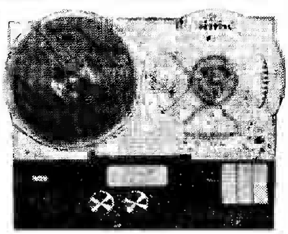
Only **10/-** extra Post Free.

This conversion is suitable for receivers that have already been constructed.

**Data 2/6 extra:** Refunded if you purchase the parcel. **Four U2** batteries 3/4 extra. All components available separately.

## TAPE RECORDERS

### MAGNAVOX-COLLARO 363 TAPE DECKS



The very latest 3 speed model—$1\frac{7}{8}$, $3\frac{3}{4}$, $7\frac{1}{2}$ ips. available with either $\frac{1}{2}$ track or $\frac{1}{4}$ track head. Features include: pause control; digital counter: fast forward and rewind; new 4 pole fully screened induction motor. interlocking keys. Size of top plate $13\frac{1}{2}$ x 11in. x $5\frac{1}{4}$in. deep below unit plate. For 200/250v. A.C. mains, 50 cps operation. New, unused and fully guaranteed.

Lasky's Price $\frac{1}{2}$ track model **£10.10.0**

Lasky's Price $\frac{1}{4}$ track model **£13.9.6**

Carriage and Packing 7/6 extra.

### NEW MARTIN TAPE RECORD/REPLAY AMPS.

Now available from stock—for use with the Magnavox 363 Tape Deck.

$\frac{1}{2}$ track model............. LASKY'S PRICE £14.19.6 Carriage and

$\frac{1}{4}$ track model............. LASKY'S PRICE £15.19.6 Packing 4/6 extra.

Optional extra: Control panel escutcheon to take deck and amplifier controls.

LASKY'S PRICE 12/6 Post & Packing 2/6.

### THE "ARROW" DICTATION TAPE RECORDER

High Quality British Manufacture: Fully transistorised ● Battery operated ● Simple Cassette loading and single control lever (cassette takes 3in. spools giving 2×22 mins. twin track recording and $3\frac{1}{4}$in. spools giving up to 2×30 mins.) ● Volume control ● Accidental erasure safety device ● Fast rewind ● Operates on 4 U2 type batts. ● Strong two-tone plastic case size 9in.×6in.×$3\frac{1}{2}$in., with transparent cover. ● Fully guaranteed ● *Complete with all these accessories:* * Cassette with 3in. spools and tape. * Microphone with lapel clip and remote pause control (doubles as speaker on replay). * Stethoscope type headset. * Telephone adaptor. * Foot Switch. * Desk speaker. * Reference pad, List price £31.

**LASKY'S PRICE £7 . 19 . 6**

Carriage 5/-. 4 long life Rayovac batteries 6/- extra.

### INTERNATIONAL TAPE

**Famous American Brand—Fully Guaranteed**

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

P. & P. 1/- extra per reel. 4 reels and over Post Free

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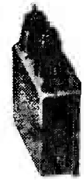
Well known British makers surplus stocks. Now available for the first time to the Home Constructor. **Add 2/6 Post and Packing on each.**



**TRANSISTORISED UHF MINIATURE MODEL**

Shielded metal case only $3\frac{1}{2}$ x $1\frac{1}{2}$ x 3in. Fully tunable—complete with two AF139 transistors. LASKY'S PRICE 39/6

**VALVE UHF MODEL (illustrated)**

In metal case size 4 x 6 x $1\frac{1}{2}$in. Fully tunable—complete with PC86 and PC88 valves. LASKY'S PRICE 29/6 Without valves 12/6

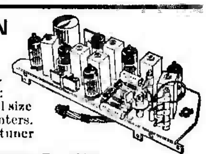
**TRANSISTORISED VHF MODEL 1**

Miniature turret type fitted with 12 sets of coils and 3 Mullard AF102 transistors. In metal case size 4 x 2 x $3\frac{1}{2}$in. LASKY'S PRICE 29/6

**TRANSISTORISED VHF MODEL 2**

Sub-Miniature turret type fitted with 12 sets of coils and 3 Mullard AF102 transistors. In metal case size 3 x $1\frac{1}{2}$ x $2\frac{1}{4}$in LASKY'S PRICE 37/6

### MAKER'S SURPLUS TELEVISION IF AMPS



38 Mc/s. Contains a large number of components, IF transformers, resistors, capacitors etc., and the following valves: 2 x PCF80, 1 x EB91, EF80, EF183 and EF184. Overall size $11\frac{1}{2}$ x $3\frac{1}{2}$ x 4in. deep. Ideal for servicemen and experimenters. This IF amp. when used with the valve model UHF tuner (above) provides a suitable conversion for BBC2. No circuit available. LASKY'S PRICE 39/6 Post 2/6

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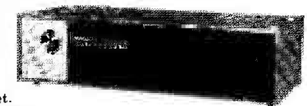

Free standing table cabinet, size $19\frac{1}{2}$ x 9 x $5\frac{1}{4}$in., finished in medium Mahogany. Scale marked 21 to 68 (UHF band). Designed to accept the above IF Amplifier with space for a Valve UHF Tuner.

**Special Package Offer:** IF Amplifier, UHF Tuner with valves and Table Cabinet.

LASKY'S PACKAGE PRICE £4.9.6.

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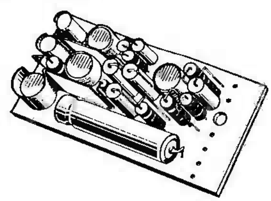
### NEW—LASKY'S MINIATURE TRANSISTOR AMPLIFIER MODULES



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**TYPE LRPC 5.** 6 transistor. Input sens. 8mV, output 3W. output imp. 3Ω. size $5\frac{1}{2}$ x $1\frac{3}{4}$ x 1in. .............................. PRICE 59/6

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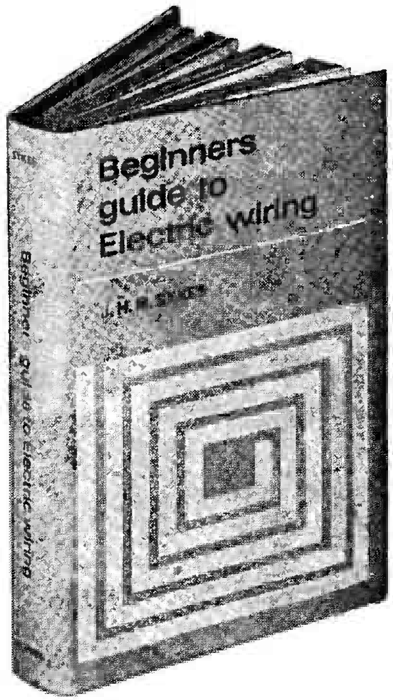


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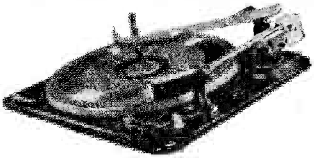

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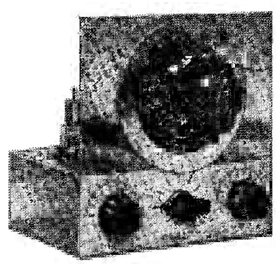

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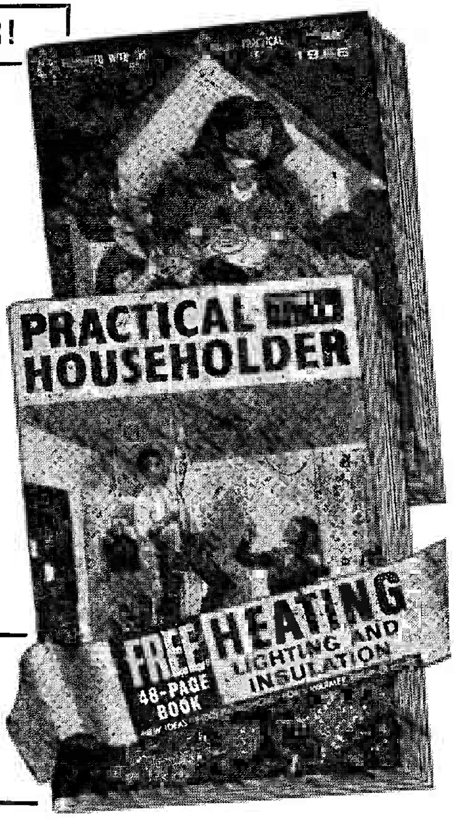


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The PW Query Service is designed primarily to answer queries on articles published in the magazine and to deal with problems which cannot easily be solved by reference to standard text books. In order to prevent unnecessary disappointment, prospective users of the service should note that:

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*(b)* We cannot undertake to supply detailed information for converting war surplus equipment, or to supply circuitry.

*(c)* It is usually impossible to supply information on imported domestic equipment owing to the lack of details available.

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PRACTICAL WIRELESS, NOVEMBER 1966

Published on or about the 7th of each month by GEORGE NEWNES LIMITED, Tower House, Southampton Street, London, W.C.2, and printed in England by WATMOUGHS LIMITED, Idle, Bradford; and London. 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 £1.16.0.

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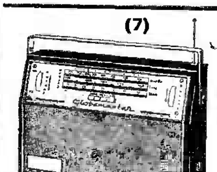

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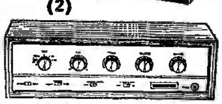

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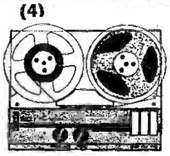

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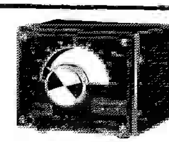

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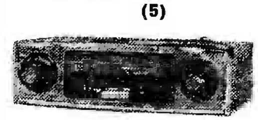

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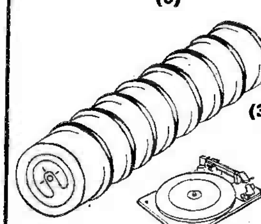

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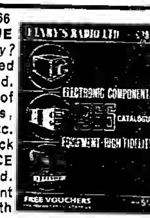


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