PRACTICAL WIRELESS

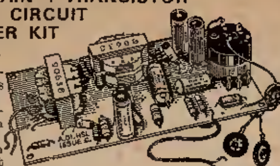
FEBRUARY 1967

2'6

A SHORT WAVE PRESELECTOR...

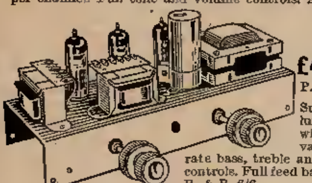
...COVERING THE 10, 13, 15, 19 & 20m. BANDS

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 8½ x 2⅞in.). ● 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; 3½in. 12/6; 7 x 4in., 21/-; P. & P. 2/- per speaker.

Portable CABINET
Size approx. 9½ x 6¾ x 3½in. Suitable for above using 3½in. 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 1⅝"w x ⅝"d x 1⅝"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.I. 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 2½in. d. x 5½in. 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. These 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 3½ x 3⅓ x1½in. **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 1¼" x 3¾" x 3⅜" **27/6.** P. & P. 4/6.

SMOOTHING CONDENSER. 2800 mfd. 25v. 1½" dia. x 3" high **3/-.** P. & P. 1/-.

MATCHED PAIR OF 2½ WATT TRANSISTOR DRIVER AND OUTPUT TRANSFORMERS. Stack size 1½ x 1⅜ x ⅞in. Output trans. tapped for 3 ohm and 15 ohm output. **10/-** pair plus 2/-. P. & P.

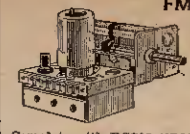
7-10 watt OUTPUT TRANSFORMERS to match pair of ECL 86's in push-pull to 3 ohm output. ONLY **11/-.** P. & P. 2/6.

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.

Dual Purpose Bulk Tape Eraser and Tape Head Demagnetiser, 35/-. P. & P. 3/-.

TWIN TELESCOPIC AERIAL. Comprising two 3-section heavily chromed rods. Closed 12-in. each extending to 32in. Completely adjustable from vertical to horizontal. Supplied complete with universal mounting bracket, coax lead and plug. Suitable for F.M. or TV. **12/6.** P. & P. 2/6.

SPECIAL HARVERSON OFFER!
FM/AM TUNER HEAD



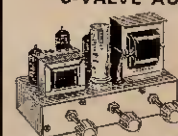
Beautifully designed and precision engineered by Dormer and Wadsworth Ltd. Supplied ready fitted with twin .0005 tuning condenser for AM connection. Prealigned FM section covers 86-103 Mc/s. I.F. output 10.7 Mc/s. Complete with ECC85 (6L12) valve and full circuit diagram of tuner head. Another special 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/-.

MATCHED PAIR AM/FM I.F.'s
Comprising 1st I.F. and 2nd I.F. discriminator (465kc/s /10.7Mc/s). Size 1 x 1½ x 2½in. high. Will match above tuner head. **11/-** pair. P. & P. 2/-.

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

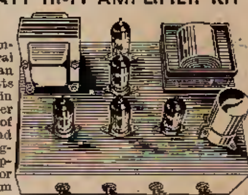


Designed for Hi-Fi reproduction of records. A.C. Mains operation. Ready built on plated heavy gauge metal chassis, size 7½in. w. x 4in. d. x 4½in. h. Incorporates ECC83, EL84, EZ80 valves. Heavy duty, double wound mains transformer and output transformer matched for 3 ohm speaker, separate Bass, Treble 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 7½in. wide x 4in. deep. Overall height 4½in. ● 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.

NEON A.C. MAINS INDICATOR. For panel mounting, cut out size 1¼ x ⅜ 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).

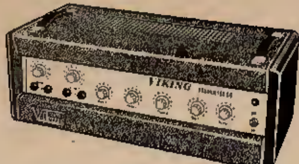
Open all day Saturday
Early closing Wed. 1 p.m.
A few minutes from South Wimbledon Tube Station.

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.

VIKING TRANSISTOR

40-50 WATT AMPLIFIER



OPERATING INSTRUCTIONS GENERAL. An extremely reliable lightweight amplifier capable of giving 40-50 watts of undistorted sound, made possible by the use of the latest semi-conductors (transistors) and techniques which ensure space-age reliability under the most rugged conditions. It is designed as a general purpose amplifier particularly suitable for use with musical instruments that require exceptionally high treble response (not recommended for Bass Guitar). Tremolo facilities are available on Channel 1 only. INPUTS—CONTROLS—CHANNEL 1 (Tremolo): this contains two high gain input jack sockets controlled by **Volume Control 1** which is mounted directly above the two sockets marked tremolo. BASS 1: gives a controlled boost to the lower frequencies on Channel 1 only. TREBLE 1: gives a controlled boost to the high frequencies on Channel 1 only. TREMOLO: this operates on Channel 1 only and the variations of intensity and speed of the Tremolo beat is adjusted by the controls DEPTH and SPEED. A socket is provided in the rear of the amplifier so that the Tremolo may be switched on and off by the use of a footswitch plugged into the socket. If you wish the Tremolo to be used without the footswitch, this is possible as the footswitch is only used to short out the effect. INPUTS AND CONTROLS—CHANNEL 2 (Normal): this contains two high gain input jack sockets controlled by **Volume Control 2** which is mounted directly above the sockets marked **Normal**. TREBLE: gives a controlled boost to the treble frequencies on Channel 2 only. MAINS VOLTAGE: fully adjustable, 200-250 volts, A.C. 50 cycles. POWER OUTPUT: 40-50 watts sine wave British rating. Very little distortion. OUTPUT IMPEDANCE: 3 ohms. Price **21 gns.** plus £1 postage and packing.

WOLSEY U.H.F. AERIAL AMPLIFIER, two stage, gain 23 db, noise factor 8 db, power consumption 6 m/a at 14 volts. Two AF186 transistors, complete with built-in power supply in metal case, list price 9 gns., our price **4½ gns.** plus 2/6 postage and packing.

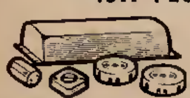
MAINS TRANSFORMER, primary 200/250 volt, secondary 425/425 volt, 250 mA, 6.3 volt 4 amp, 5 volt 3 amp; fully shrouded, chassis mounting. Price **£2.5.0** plus 7/6 postage and packing. Auto transformer step-up-step-down, 240/110 volt 400 watt. Price **£1.5.0** plus 7/6 postage and packing.

MAINS TRANSFORMER 200/250 volt, secondary 250/250 volt, 70 mA, 6.3 volt, 3 amp drop through. Price **12/6** plus 4/6 postage and packing. Elac 10 inch, 10,000 lines ceramic magnet, 3 or 15 ohms, 7 watt, **£1.9.6** plus 4/6 postage and packing.

POCKET MULTI-METER

Size 3¾ x 2½ x 1⅛in. Meter size 2⅛ x 1⅛in. Sensitivity 1000 O.P.V. on both A.C. and D.C. volts. 0-15, 0-150 0-1000. 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.

40W FLUORESCENT LIGHT KIT

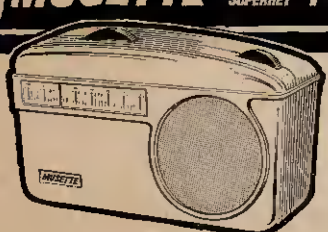


Incorporating **GEC** Choke size 8½in. x 1⅛in. x 1⅛in., 2 bi-pin holders, starter and starter-holder. P. & P. 5/6. **11/6**

Similar to above: 80W. Fluorescent Light Kit incorporating **GEC** choke size 11½in. x 1⅛in. x 1⅛in. 2 bi-pin holders, start 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.

MUSETTE 6 TRANSISTOR SUPERHET PORTABLE RADIO



39/6

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

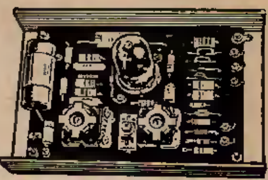
INCLUDING CARRYING STRAP

- 2½" Speaker.
- 6 Transistors Superhet Output 200mW.
- Plastic Cabinet in red, size 4½" x 3" x 1½" 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.

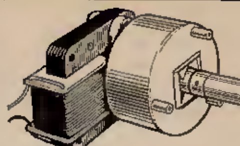
MULTIPLEX DECODER

For receiving Stereo FM

Now is your chance to benefit in full from the new B.B.C. stereo transmissions with our Multiplex Decoder. Design features: Highly efficient Mullard vinkor pot cores. Two semi-conductor diodes. Double purpose valve. Printed circuit type construction high input impedance. Specification: Cross talk minus 20 dB at 1 kc/s. Input requirements 0·5—1·5 RMS. Stability plus or minus 0·1%. Voltage requirements H.T. 190—250 volts. D.C. at 5 mA. heaters 6·3 volts. A.C. at 300 mA. Self powered unit shortly available, price to be announced. Size 5¼" x 3½" x 1". Fully built and tested.



Price **£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.

FIRST QUALITY P.V.C. TAPE

5¾in.	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
5¾in.	L.P.	1200ft.	.. 11/6	5¾in.	T.P.	2400ft.	.. 32/6
7in.	L.P.	1800ft.	.. 18/6	7in.	T.P.	3600ft.	.. 42/6
5¾in.	D.P.	1800ft.	.. 18/6	4in.	T.P.	900ft.	.. 15/-

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

"MAYFAIR" 5-Transistor TAPE RECORDER

Capstan-driven, battery operated 7½ and 3¾ i.p.s. Precision made. Push-button controls. High quality 2¾in. speaker. Push-pull circuit. Output 400mW. Frequency response: 200-7,000 kc/s. Fast rewind. Up to 1 hour twin track playing time. Automatic erasing for re-recording. Dimensions: 8in. x 11in. x 3¾in. Weighs only 7lb. Takes 5in. spools.

£11.11.0 plus 9/-. P. & P.

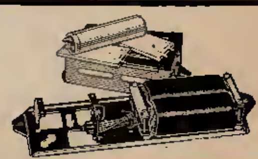
SILICON RECTIFIERS

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

3 to 4 WATT AMPLIFIER

3-4 watt Amplifier built and tested. Chassis size 7 x 3½ x 1in. Separate bass, treble and volume control. Double wound mains transformer, metal rectifier and output transformer for 3 ohms speaker. Valves ECC81 and 6V6. **£2.0.0** plus 5/6 p. & p.
The above in Kit Form, **29/6** plus 5/6 p. & p.
8" x 5" speaker to suit **14/6** plus p. & p. 1/6

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

NEW TRANSISTORISED SIGNAL GENERATOR

Size 5½" x 3¼" x 1½". 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

CYLDON U.H.F. TUNER

Complete with PC88 and PC86 Valves. Full variable tuning. New and unused. Size 4½ x 5½ x 1¾in. Complete with circuit diagram. **35/-** plus 3/6 P. & P.

★ **ALL ORDERS BY POST MUST BE SENT TO OUR ACTON ADDRESS**

★ **Our new branch at**
323 EDGWARE ROAD, LONDON, W.2.
IS NOW OPEN ● *PERSONAL SHOPPERS ONLY*
ALL ENQUIRIES STAMPED ADDRESSED ENVELOPE
OPEN 9 a.m.—6 p.m. INCLUDING SATS. EARLY CLOSING WED. GOODS NOT DESPATCHED OUTSIDE U.K. TERMS C.W.O.

RADIO & TV COMPONENTS (ACTON) LTD

21C HIGH STREET · ACTON · LONDON · W.3

TRS BARGAINS in Modern Quality Kits, Components and Equipment

TRS FM STEREO DECODER

OUTSTANDING T.R.S. VALUE

Based on Mullard's proven circuitry, this is a six transistor, printed circuit unit size 5¾ x 2⅜in. Two stage transistor Stereo Beacon Indicator is incorporated. Operates from 12v. supply. Neg. earth. Basic Kit supplied suitable for Transistor Tuner input and Transistor Amplifier output. With simple mods (data supplied with Kit) the unit is easily adapted for Valve Tuners and Valve Amplifiers. Kit and assembly instructions, complete with Mullard specified Inductors, Type WF2949 and WF2951.

Complete kit as described **£4.19.6**

With coils tested and pre-aligned *Carriage either kit 2/6.* **£5.5.6**

FM DECODER COILS

Designed and made by Mullard, these inductors are as used in T.R.S. Decoder above. TYPE WF2949 and WF2951, each 25/-. Per pair 49/6, post free.

6 VALVE AM/FM TUNER UNIT

In Kit Form with or without Power Pack Med. 190 m., 550 m., V.H.F.—86 Mc/s-103 Mc/s, 6 valves and metal rectifier, Self-contained power unit. Magic-eye, 3 push-button controls on/off, Med., V.H.F. Diodes and high output sockets with gain control. Illuminated 2-colour perspex dial 11½in. x 4in. Chassis size 11½in. x 4in. x 5¾in. Strongly recommended for use with Mullard amplifiers below. For A.C. mains 200/250 v. Unbeatable value. Complete kit, inc. Power Pack as illustrated, 11 gns. Carr. 7/6. Ditto less Power Pack, 10 gns. Carr. 7/6. Circuit and Const. details 4/6. Free with kit.

MISCELLANEOUS

ENAMELLED COPPER WIRE—2 oz. reels 14 g.-20 g. 3/-; 22 g.-28 g. 3/6; 30 g.-34 g. 4/3; 36 g.-38 g. 4/9; 39 g.-40 g. 5/-, etc.
TINNED COPPER WIRE. 16-22g. 4/- 2 oz.
BONDACOUST Speaker Cabinet Acoustic Wadding (1" thick approx.) 18" wide, any length cut, 6/- yd.
VEROBOARD—All sizes including 2½in. x 5in. 3/8; 2½in. x 3¾in., 3/-; 3¾in. x 5in., 5/2; 3¾in. x 3¾in., 3/8; 3¾in. x 17in., 12/6. All accessories and tools in stock.
VOLUME CONTROLS. LOG and LINEAR —5K-2 MΩ 3in. Spindles Morganite Midget Type 1¼in. diam. Guar. 1 year. LOG or LIN ratios less Sw., 3/6. DP. Sw. 5/-. Twin Stereo less Sw., 7/6. DP. Sw., 9/6 (100k to 2 Meg. only).
RESISTORS—Modern ratings full range 10 ohms to 10 megohms 20% ⅛-¼ w. 3d. ea., ditto 1 w., 6d. ea., 2 w, 9d. ea., 10% ⅛-½ w. 4d. ea., 5% Hi-stab., ⅛-½ w., 6d. ea. (below 100 ohms and over 1 meg., 9d. ea.). 1% Hi-stab., ½ w., 1/6 ea. (below 100 ohms, 2/- ea.).
ERSIN MULTICORE SOLDER. 60/40 4d. per yard. Cartons 6d., 1/-, 2/6 etc.
WIREWOUND RESISTORS. 25 ohm to 10 K. 5 w. 1/3. 10 w. 1/6. 15 w. 2/-. **CONDENSERS** Silver Mica. All values 2 pf. to 1,000 pf. 6d. ea. Ditto ceramic. 9d. Tub. 450 v. T.C.C., etc. .001 mfd to .01 10d. and .1/350 v. 10d. .02 MF to 0.1 MF. 500 v. 1/-. .25 T.C.C. 1/9. .5 T.C.C. 2/-.
CLOSE TOL. S/MICAS. 10% 5 pf. 500 pf. 9d. 600-5,000 pf. 1/-. 1% 2 pf-100 pf. 11d. 100 pf.-250 pf. 1/2. 270 pf.-800 pf. 1/4. 800 pf.-5,000 pf. 2/-.
ALUMIN. CHASSIS. 18g. Plain undrilled folded 4 sides, 2in. deep, 6in. x 4in., 4/6; 8in. x 6in., 5/9; 10in. x 7in., 6/9; 12in. x 6in., 7/6; 12in. x 8in., 8/- etc.
ALUMIN. SHEET. 18g. 6in. x 6in. 1/-; 6in. x 9in., 1/6; 6in. x 12in., 2/-; 12in. x 12in., 4/- each.
TYGAN FRET (Contem. pat.) 12in. x 12in., 2/-; 12in. x 18in. 3/-; 12in. x 24in., 4/- etc
FOSTER DYNAMIC MIKE. 600 ohm impedance. Complete with Desk stand, Leads etc. A neat Hi quality Unit, 59/6. Also High Impedance (50K), 59/6.
CONTINENTAL SWITCHED — Popular Stick Type. High Imp., 42/6.
SUPERIOR CONTINENTAL DE-LUXE STICK MIKE WITH SWITCH. Neck Cord suspension, Stand adaptor and Base. Black and Chrome finish. Complete with plug-in Lead and neat presentation box, 59/6.
MICROPHONE INSERTS.
ACOS XTAL Type MIC 14 1¼in. x ¼in. 7/6. MIC 43 1¾in. x 5/16in., 8/6. Continental type 1in. x ¾in., 6/-.

A UNIQUE TRANSFORMER SERVICE

We manufacture Transformers and Chokes of all types. Enquiries invited for Protos and small runs.

MAKE YOUR OWN INSTANT CIRCUITS WITH "CIR-KIT"

Enables you to produce "printed circuits" quickly and cleanly without chemical or elaborate processes. Kit No. 3 inc. baseboard, processed copper strip and sheet as advertised. **15/-**

TAPE BARGAINS

1500ft., 7in. REEL. American professional quality tape. Gives 1½ hrs. playing per track at 3¾ r.p.s. With leader and stop foils. In attractively presented sealed boxes. Ideal for 2 and 4 track machines, mono or stereo. Outstanding value at 17/6 per reel (p/p 1/- for first reel, 6d. each after first when ordered at same time).
UNIQUE DOUBLE SIDED TAPE on 5¾in. reels. Superb quality used in normal way. Ideal for experimenters too. 650ft. 9/-. 900ft. 8/6. (P/p 1/- per single reel. 6d. for each additional).
EMPTY TAPE REELS (Plastic). 3in. 1/3, 4in. 2/-, 5in. 2/-, 5¾in. 2/-, 7in. 2/3.
PLASTIC REEL CONTAINERS (Cassettes) 3in. 1/3, 5in. 1/9, 5¾in. 2/-, 7in. 2/3.

PEAK SOUND STEREO AMP

With integrated pre-amp Uses Cir-Kit for easy building. Model SA-8-8 has 14 matched transistors; 20-20,000 c/s ± 3dB. Specially for use with high quality ceramic P.U.s. For 3-8 ohm speakers. Output 8.5 watts per channel. A high-quality instrument for easy building and reliability. Will fit in safely under motor board to keep your cabinet work looking slim. Complete with instructions £12.19.6. (p/p 4/-)

PEAK SOUND POWER PACK—75/- (p/p 5/6)

DE-LUXE RECORD PLAYER KIT

FOR ONLY £13.19.6 COMPLETE

An elegantly designed quality instrument that builds into a superb reproducer. With 4 speed Garrard Auto-Slim unit and special Mullard high quality 3 watt printed circuit valve amplifier, vol, bass and treble controls, 8 x 5in. 10,000 line speaker. Contemporary styled 2-tone cabinet, charcoal-grey and off-white with matching blue-relief. Size 17¾ x 16 x 8in. A stylish unit capable of quality reproduction. Circuit and construction details 2/6 (free with kit).

COMPLETE KIT **£13.19.6**
Carr. and ins. 12/6

Ready wired 30/- extra. Illuminated perspex control panel escutcheon, 7/6 extra. Four contemporary mounting legs, 6in. 10/6; 9in. 11/6; 12in. 12/6 extra.

Outstanding value and performance

GARRARD UNITS AND PLINTHS

LM.3000 Record Player with 9 T.P. Stereo Cartridge. Limited number available. Brand new as from factory. **8 gns.**

AT.60 De-luxe Auto-changer. 12in. turntable. Superbly engineered. Less cartridge **9½ gns.**

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STYLUS REPLACEMENTS IN SAPPHIRES AND DIAMONDS AT VERY ATTRACTIVE PRICES.

TRS KITS FOR MULLARD AMPLIFIERS

MULLARD 3-3

"3-3" Amp. 3-valve Hi-Fi quality at reasonable cost. Bass Boost and Treble controls, quality sectional output transformer, 40 c/s-25 kc/s ± 1dB. 100 mV. for 3W, less than 1% distortion. Bronze escutcheon panel. Complete Kit only **£7.10.0.** Carr. 7/6. Wired and tested, **£9.10.0.**

MULLARD 5-10

5 valves 10W, 3 and 15 ohms output. Mullard's famous circuit with heavy duty ultra-linear quality output tfr. Basic amplifier kit price **£9.19.6.** Carr. 7/6. Ready built 11½ gns.

Two Valve Pre-Amp Unit (Mullard Design) Kits **£6.12.6.** Built **£8.10.0.** Carriage **5/6.**

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We carry full stocks of these world-famous all-British designs including the very latest as advertised by this famous firm and give prompt delivery.
Z.12 combined 12w. amp and pre-amp., built, 89/6; **STEREO 25** de luxe pre-amp/control unit (stereo) built **£9.19.6; MICRO-6** Six stage vest-pocket receiver (kit). 59/6; **MICRO-FM 7** transistor FM tuner-receiver (kit). £5.19.6. **PZ.3** Mains power supply unit, £3.19.6. **And the newest Sinclair designs as released!**

7 VALVE AM/FM RG CHASSIS

A superbly powerful, high performance instrument for the keenest enthusiasts. Provides tuning on long, medium and F.M. wavebands. 3 wave-band L/M/FM. Permeability tuning on F.M. Large clear dial A.V.C., good neg. feedback. Magic eye. 3 w. output. A.C. 200/250 v. Circuit diagrams available. Aligned, tested and ready for use **£13.19.6.** (Carr. and ins. 7/6.) S.A.E. brings full details.

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Midget I.F. Trans. 9/16in. dia. Weyrad, etc. 1st, 2nd or 3rd IF 5/6. Osc. Coil 9/16in. dia. Med. and Long wave, 5/-. Ditto REPANCO ¼in. x ¼in. x ⅜in. Standard type 1st, 2nd and 3rd IF, Osc. Med and longwave ea., 6/-; Double Tuned. type ea., **6/9.** Miniature Push-Pull Driver Transf. (Type TT45) Ratio 9:1, 6/-. Ditto O/P Transf. (To 3 ohms type TT46) Ratio 8:1 **6/-.** Midget RF Chokes (for M. and L/W 2·5mH, 5mH, 7·5mH 10mH ea., **2/6.**

POLYESTER Mini Condensers —Ideal for P/ct use. 200v. wg. ·01 9d, ·022 **9d.**, ·033 **11d.**, ·047 **11d.**, ·068 **1/-**, ·1 **1/1.**

MIDGET TRANSISTOR ELECTROLYTICS —TCC, etc. Std. range, all values 1 mfd—50 mfd. 12v/15v working each **1/9.** 100mfd 12v, 2/-. 1000 mfd 6v **2/3. Special Electrolytics for Transistor Mains Units.** 1000 mfd. 25v., 3/9. 2000 mfd 50v, **6/6.** 2000 mfd 75v, **7/6.**

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Up to ½ lb. 1/-; 1 lb. 1/9d.; 3 lb. 3/-; 5 lb. 3/9d.; 8 lb. 4/6; except where otherwise stated. PAYMENT. Cash with order or C.O.D.

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MAIL ORDERS TO: 102 Henconner Lane, Bramley, Leeds 13. No C.O.D. under £1. Terms C.W.O. or C.O.D. Postage 3/9 extra under £2. 5/9 extra under £5. Trade supplied. S.A.E. with all enquiries please. **HI-FI CATALOGUE NOW AVAILABLE** price 3/3 post paid. **Personal shoppers welcome. Open all day Sats. except High Holborn branch.**

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for Record Playing units. Teak finish cut for Garrard 1000, 2000, 3000, AT6 Mk 2, AT60, SP25 or Goldring GL68. Available with clear Perspex cover as illustrated £5.19.11. complete. **66/-**

RP2 Consisting of Garrard SP25 fitted Goldring CS90 high compliance ceramic cartridge with diamond stylus, above plinth and cover. Normally £25. Only Carr. 15/- **19½ Gns.**

RP3 As above but with Goldring Lenco GL68 Transcription unit and CS90 Cartridge. Normally over £33. Terms available both units. Only Carr. 15/- **26½ Gns.**

AUDIOTRINE HIGH FIDELITY 'SPEAKERS

Heavy cast construction. Latest high efficiency ceramic magnets. Dual Cone for extended frequency range. Plastic treated surround giving low fundamental resonance. Response 35-20,000 c.p.s., Impedance 3 or 15 ohms. Carr. 5/6.

HF811D	8 in. 10 WATT	4 Gns.
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HF121D	12 in. 20 WATT	£6.15.0
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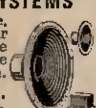
AUDIOTRINE HI-FI 'SPEAKER SYSTEMS

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 7 Gns. Carr. 7/6. Carr. 5/9 **5 Gns.**



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

HI-FI LOUDSPEAKER ENCLOSURES

All types of pleasing modern design acoustically lined and ported and in 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 **£5.17.9**

SE10. For 10in. Hi-Fi speaker with provision for tweeter. Size 24 x 15 x 8in. Carr. 10/- **£6.19.9**

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

FHE8. Folded Horn type. Size 27 x 16 x 10in. Designed for high flux 8in. speaker with which exceptional quality can be obtained. Credit terms available. Carr. 10/- **9 Gns.**

Tweeters R.A. 3 ohm or 15 ohm 25/9

HIGH FIDELITY LOUDSPEAKER UNITS

Cabinets of latest styling Satin Teak or Walnut, acoustically lined (and ported where appropriate. Credit Terms available on all units.

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. 9¾ x 6½ x 7in. Carr. 7/6 **£6/19/11**

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 or 15 ohms. Carr. 7/6 **11 Gns.**

The DORCHESTER Size 24 x 15 x 8in. Fitted Audiotrine HF100D Speaker. Rating 15 watts. Impedance 15 ohms. Frequency Response 30-20,000 c.p.s. Carr. 15/- **12 Gns.**

The GLOUCESTER Handsome "slim-line" cabinet. Size 24 x 20 x 8in. 12in. 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. Carr. 15/- **11 Gns.**

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. Carr. 15/- **12 Gns.**

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 **£5.19.11** Post 5/-. Heat sink and full wiring instructions or with printed circuit fully wired and tested 30/- extra. **Frequency Response:** ± 1dB 20-20,000 c.p.s. **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.

JASON VHF/FM TUNER Complete kit with valves. **£6.19.11**

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

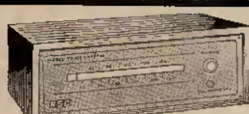
A complete set of parts for the construction of a unit giving 5 watts high quality output on each channel (total 10 watts). Sensitivity is 50 millivolts. Suitable all crystal or ceramic stereo heads. Ganged Bass and Treble Controls. Provision is made for use as straight (monaural) 10 watt amplifier. 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 spkrs. on each channel. Complete set of parts, point-to-point wiring diagrams and instructions. 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). *Send S.A.E. for leaflet.* Carr. 12/6 **19 Gns.**

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

Total cost of parts with detailed wiring diagrams and instructions. Carr. 10/- **12½ Gns.** Or factory built 15¼ Gns. Or in Teak finished cabinet as illustrated 19¼ Gns. Terms: Deposit £5 and 9 mthly payments 39/- Total £22.11.0.



★ **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 of comparable units.

Miniature Transistorised VHF/FM Tuner
Battery operated. In plastic case complete with Telescopic Aerial
£6.19.11
Carr. 5/-

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 —16dB 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. 0.25%.
NEGATIVE FEEDBACK: 52dB.
Complete Kit of parts with full constructional details and point to point wiring diagrams. Carr. 11/- **11 Gns.**
Supplied factory built 15 Gns. Carr. 12/6. Terms: Deposit 49/- and 9 monthly payments 33/9 (Total £17.12.9). Or fitted in beautiful Walnut or Teak veneered cabinet as illustrated, 4 Gns. extra.
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. 13/9 **18½ Gns.**
Unit factory built 25½ Gns. or deposit 83/9 and 9 monthly payments 56/9 (Total £29.14.6). Fitted cabinet as Super 15 29½ Gns. Carr. 15/- or Deposit £4.14.9 and 9 mthly paymts 65/10 (Total £34.7.3). *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. S.A.E. for leaflet.
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. **Deposit 4 gns. and 9 mthly paymts 59/6 (Total 29½ gns.)** **26½ Gns.**
4 Track Model 3 gns. extra. Carr. 19/6

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.**

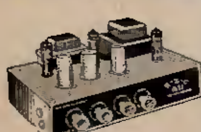
R.S.C. 4/5 watt A5 HIGH GAIN AMPLIFIER

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). Metal cover with 2 handles available 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 of Cabinets, Speakers, Mikes, etc. **£8.15.0** Carr. 11/6

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.
49½ Gns. Carr. 30/- Or deposit **£7.17.6** and 9 monthly payments of **£5.10.10.** (Total 55 gns.)

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 8in. Deposit 3 gns. and 9 monthly payments of 43/7 (Total £22.15.3). S.A.E. for leaflet. **19½ Gns.** Carr. 15/-.

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 **26/11.** Or assembled **39/11.** **22/11**

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 **49/9** or ready for use **59/11.**

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 vocalists, 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

Flux Density 17,000 lines. Fully Guaranteed. Outstanding value at normal price of approx. £12. Or deposit £3/10 and 9 monthly payments of 16/6 (Total £8.3.4). **7 GNS.** Carr. 12/6

HEAVY DUTY SELENIUM RECTIFIERS

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

HEAVY DUTY BATTERY CHARGER KITS 6/12 v.

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. **4a 49/11** **6a 69/11**

LONDON-NEWCASTLE

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R.S.C. COLUMN SPEAKERS

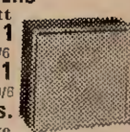
Covered in two-tone Rexine/Vynair. Ideal for vocalists and Public Address. 15 ohm matching.
Type C58. 15-20 watts. Fitted five 8in. high flux speakers. Overall size approx. 42 x 10 x 5in. Or Deposit 44/- and 9 mthly pymts 31/5 (Total £16.6.9) **14 Gns.** Carr. 10/-
Type C412, 40 watts. Fitted four 12in. 12,000 line 10 watt speakers. Overall size 56 x 14 x 9in. approx. Carr. 15/- **21 Gns.**
Or Deposit £3.11.0 and 9 monthly payments of 46/7 (Total £24.10.3).

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. **£4.19.11** Carr. 7/6
20 Watt Model. 15 ohm. Size 18x18x10in. Gauss 12,000 lines. **£7.19.11** Carr. 10/6
30 Watt Model. 15 ohms. Gauss 17,000 lines. Carr. 12/6 **10 Gns.**
Credit Terms available on all above units.

FANE HEAVY DUTY HI-FI SPEAKERS 5 Gns.

12in. 20 watt. Type 122/10. Post 7/6.

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.

HIGH QUALITY 12in. 10 WATT SPEAKERS 59/11

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

TRANSISTOR SALE

Mullard OC71, OC72, OC81, 2/11, OC44, OC45, 3/11, OC75, 7/9, AF117, 6/9. Ediswan XA101 XA112, XC101A, 3/9. Postage 6d. for up to 3 transistors.

INTEREST CHARGES REFUNDED
on H.P. and Credit Sale Accounts settled in 3 months.

R.S.C. MAINS TRANSFORMERS

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

MIDGET CLAMPED TYPE 2½ × 2¾ × 2¼in.
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 67/9
425-0-425v. 200mA, 6.3v. 4a, 6.3v. 4a, 5v. 3a 69/9
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, 0-9-18v. 1½a. 15/9. 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
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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
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150 mA, 7-10H, 250Ω 12/9.
100 mA, 10H, 200Ω 9/11.
80 mA, 10H, 350Ω 7/9.
60 mA, 10H, 400Ω 4/11.

R·S·C HI-FI CENTRES LTD.

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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New!

HIGH PERFORMANCE CAR RADIO, CR–1. Superb LW/MW entertainment, wherever you drive. For 12v. pos or neg. earth systems. Tastefully styled to match any car colour scheme. Many special features. Send for details. Kit (less speaker) **£12.17.0.**, L/S 6" x 4" **£1.4.5** extra. Prices incl. P.T.

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.

TRANSISTOR STEREO FM TUNER. Elegantly designed to match the Stereo Amplifier, model AA-22U see above. Many special features include built-in power supply. Available in two units sold separately, can be built for a case built for 6.

TOTAL PRICE KIT (STEREO) **£24.18.0** incl. P.T. Cabinet **£2.5.0** extra. (MONO) version **£20.19.0** Kit.

WELCOME TO OUR LONDON HEATHKIT CENTRE
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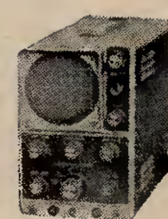
Our wide range includes:

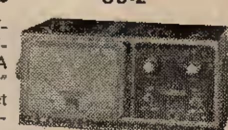
3" LOW-PRICED SERVICE OSCILLOSCOPE: Model OS-2. Compact size 5" x 7⅞" x 12" deep. Wt. only 9¾lb. "Y" bandwidth 2 c/s-3 Mc/s ±3dB Sensitivity 100mV/cm. T/B 20 c/s-200 kc/s in four ranges, fitted mu-metal CRT Shield. Modern functional styling. Kit **£23.18.0** Assembled **£31.18.0**



OS-2

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

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**



VVM, 1M-13U

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**

V-7A

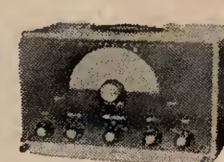
VALVE VOLTMETER. Model V-7A. 7 voltage ranges d.c. volts to 1,500 A.C. to 1,500 r.m.s. and 4,000 peak to peak. Resistance 0·1Ω to 1,000MΩ with internal battery. D.C. input resistance 11MΩ. dB measurement, has centre-zero scale. Complete with test prods leads and standardising battery. Kit **£13.18.6**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

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**

RF-1U

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**

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**



IG-82U

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

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 Rod Aerial. Tone Circuit is incorporated, with separate Tone Control in addition to Volume Control. Tuning Control and Waveband Selector. In a wood cabinet, size 11½ x 6¾ 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: 60/- deposit and 11 monthly payments of 12/9. Total H.P.P. £10.0.3

★ **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 363 TAPE DECKS

The very latest 3 speed model—1⅞, 3¾, 7½ ips, available with either ½ track or ¼ 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 13¼ x 11in. x 5¼in. deep below unit plate. For 200/250v. A.C. mains, 50 cps operation. New, unused and fully guaranteed.

Lasky's Price ½ track model £10.10.0

Lasky's Price ¼ 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.

½ track model.............. LASKY'S PRICE £14.19.6 Carriage and

¼ 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.

INTERNATIONAL TAPE

Famous American Brand—Fully Guaranteed

3in.	Message tape, 150ft.	2 6	5¾in.	Long play, 1200 ft. Acetate	12 6
3in.	Message tape, 225ft.	3 9	5¾in.	Standard play, 850ft. PVC	11 6
3in.	Message tape, 300ft.	7 6	5¾in.	Long play, 1200ft. Mylar	15 0
3¼in.	Triple play, 600ft. Mylar	10 0	5¾in.	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
5¾in.	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

Full range of Philips prerecorded cassettes—send S.A.E. for list.

MICROPHONES

THE VERY LATEST MARVELS OF ELECTRONIC MINIATURISATION

THE TTC MODEL B4002 FM WIRELESS MICROPHONES

Highly sensitive—suitable for either static or mobile use. Signals can be picked up by any FM radio or tuner which receives frequencies between 96—104 Mc/s over several hundred yards. Size only 3 x 2½ x 1in. (in leather case). Operates in one PP3 type battery. Complete with neck cord, clip on dynamic extension mike (½ x ¾ x 5/16in.) and battery. **LASKY'S PRICE 10 Gns.** Post Free anywhere in world.

THE TTC MODEL 13/500. More powerful version of above—size 7½ x 1¾ x ¾ in. Operates on one PP3 type battery. **LASKY'S PRICE 12 Gns.** Post Free anywhere in world.

CONSTRUCTORS BARGAINS

SPECIAL PURCHASE—UHF/VHF TV TUNERS

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 1

Shielded metal case only 3¾ x 1½ x 3in. Fully tunable—complete with two AF139 transistors. LASKY'S PRICE 39/6

TRANSISTORISED UHF MODEL 2

Metal case size 3¾ (plus spindle) x 2¾ x 1½in. Fully tunable with slow motion drive. Complete with two AF186 transistors. LASKY'S PRICE 25/6

VALVE UHF MODEL (illustrated)

In metal case size 4 x 6 x 1½in. Fully tunable—complete with PC86 and PC88 valves. LASKY'S PRICE 29/6 Without valves 12/6

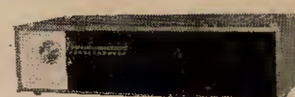
TRANSISTORISED VHF TUNER

Sub-Miniature turret type fitted with 12 sets of coils and 3 Mullard AF102 transistors. In metal case size 3 x 1¾ x 2¼in LASKY'S PRICE 37/6

SURPLUS TV IF AMPLIFIERS

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 11½ x 3¾ 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 29/6 Post 2/6

SPECIAL PACKAGE BARGAIN OFFER!



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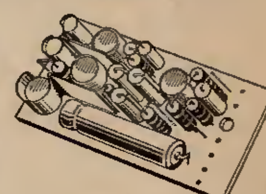

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LASKY'S RADIO

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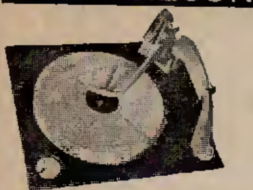

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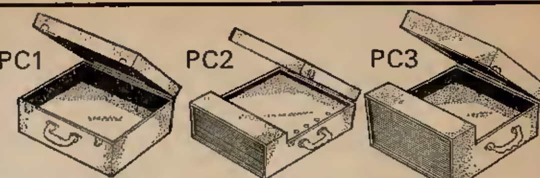

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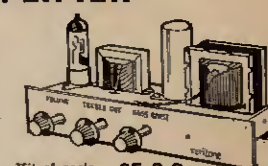
Superb space and cost economy design specially developed by Mullard Research Laboratories and quality constructed by Stern-Clyne. Actually uses only one multi valve but provides an undistorted output from any standard xtal pick-up. Plus features include Bass Boost and Treble controls, panel illumination and specially wound output transformer. Size only 10 x 2¼ x 4in., ⅛in. high Silver hammer chassis finish satin silver finish engraved panel.



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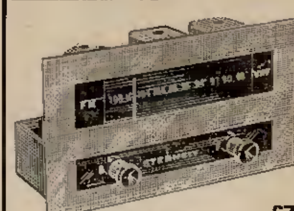

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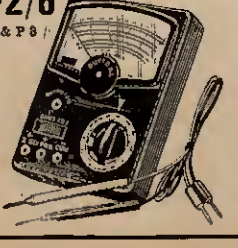

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PRACTICAL WIRELESS

VOL 42 No 10

issue 720

FEBRUARY 1967

TOPIC OF THE MONTH

Troubled Waters

THE first blow was struck against the radio 'pirates' on Friday, 25th November, 1966, when Radio 390 were fined £100 for using a transmitter without a licence, at Red Sands Tower on 16th August, 1966. Mr. Edward Allbeury and Mr. David Beresford Lye, directors of Radio 390, who were found guilty of the same offences, were each given an absolute discharge.

The second blow came just five days after the Radio 390 case, when Mr. Roy Bates, proprietor and operator of Radio Essex (now known as Radio BBMS) was fined the maximum of £100 at Rochford Magistrates' Court, Southend. Both 'pirate' radio stations are to appeal against the findings.

Radio City who also operate from one of the war-time forts in the Thames Estuary have not so far been prosecuted under the Wireless Telegraphy Act of 1949 for illegal broadcasting. On the findings of the Canterbury and Rochford Magistrates (court reports inside), Radio City is within territorial waters and it would appear that the Crown could get a conviction. So why have they been missed? Could it be something to do with ownership, or is it that they are not big enough to worry about?

Radio BBMS has openly defied the Government by continuing to broadcast from Knock John Tower in the Thames Estuary, and Radio 390 admits that it will broadcast from another country on the Continent if it loses the pending High Court appeal.

The Marine and Broadcasting (Offences) Bill will give the Government powers to silence all the 'pirates' in one swoop when it becomes an Act of Parliament. But, how long is this going to take? The Government have many Bills on the Statute Book, a number of which they consider to be of more importance. However, even this legislation cannot prevent commercial operators setting-up high power stations on the Continent, which could be beamed to this country.

Realising that the Marine and Broadcasting (Offences) Bill is already in the pipeline, was it worth prosecuting Radio 390 and Radio Essex? The first case took two days to hear and the second one a full day, and cost us—the tax-payer—hundreds, if not thousands, of pounds sterling.

W. N. STEVENS, Editor.

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MARCH ISSUE WILL BE PUBLISHED ON FEBRUARY 3rd

All correspondence intended for the Editor should be addressed to: The Editor, "Practical Wireless", George Newnes Ltd., Tower House, Southampton Street, London, W.C.2. Phone: TEMple Bar 4363. Telegrams: Newnes Rand London. Subscription rates, including postage: 35s. per year to any part of the world.

Imported Communications Receivers

IT has come to our notice that a letter appeared in the December 1966 issue of PRACTICAL WIRELESS stating that service and spares were not available for imported communication receivers.

We sell considerable amounts of imported communication receivers, many through the medium of advertisements in this magazine, for all of which we carry spares and have full servicing facilities.

G. W. Smith & Co. 3 Lisle Street, London, W.C.2.

[*As you are probably aware, these servicing and spares facilities are not always available from radio dealers, which inspired the letter from a reader. We are glad, therefore, to hear that at least one company is able to offer such facilities.*]—Editor.

Buy British?

I HAVE a Lafayette catalogue which shows several models of the H.E. range of receivers and all are quoted as being "imported" into the U.S. So that those on the U.K. market are presumably re-exports from the U.S.

I have also been called upon to repair a Sharpe radio of Japanese manufacture which was purchased in Hong Kong and have found that the valves used cannot be purchased in the U.K., there are no equivalents and that letters to agents in Japan and Germany have not produced any results.

I agree with Mr Pryse, one must by very careful what one buys. But beggars cannot be choosers; after all, what British sets are available at such moderate cost as the Jap jobs with the same specifications?

A. Parry. South Oxhey, Hertfordshire.

Transistor Terminology

I USED to use valves. However, I have now graduated to transistors. What an utterly wretched mess. Every manufacturer has his own numbering system and, it would appear, his own set of notations. One maker's Ico is another's Alpha dash, and mistaking one manufacturer's beta for another's hybrid pi can cause a very nasty accident. How about all the "big-boys" sitting round a table and settling on a simple standard notation we can all understand?

Martin Jessopp. Leyton, London, E10.

NEWS AND..

A.A. MEMBERS GO ON THE AIR

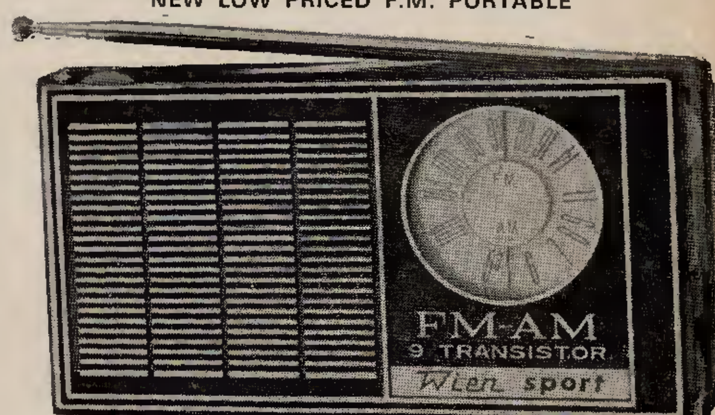
The world's first 24-hour two-way v.h.f. car radio link between a motoring organisation and its members on the road—the A.A. Linkline Service—has been introduced. Under the new service, A.A. members in and around London and Birmingham and travelling up the M1 will be able to keep continuous two-way contact with A.A. operations rooms and will be able to radio direct for the breakdown service, pass urgent messages to and receive messages from anyone, receive warnings of traffic jams etc., obtain weather reports and even find out the correct time. Linkline rental of £180 per year includes all equipment and installation costs, set hire, licence fees, servicing, all radio calls and certain emergency calls connected with a breakdown or accident.

COURSE ON AMATEUR RADIO THEORY AND PRACTICE

Interested persons are invited to find out more about a proposed course on Amateur Radio and Electronics, to begin shortly. The course will be held in the London Borough of Waltham Forest, and is designed for those who missed the beginning of the normal courses, or who find the location of the R.A.E. courses difficult to reach.

The scheme should be suitable for persons wishing to try the Winter 1967 Radio Amateurs' Exam and for persons who would like to brush up on the subject. Young people and beginners will be made very welcome. K. L. Smith, G3JIX, 82 Granville Road, Walthamstow, E.17.

NEW LOW PRICED F.M. PORTABLE



H. O. Thomas Electronics announce two new models, bringing their total range of Wien radios up to six. They are the Wien "Sport" retailing at 7½ guineas and a mains/transistor am/fm set—the M1—at 16 guineas.

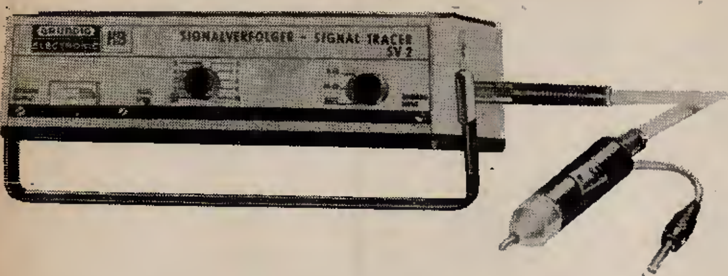
The M1 is a table model in teak cabinet, embodies 8 transistors, covers medium and f.m. bands. The "Sport" (see photograph) covers f.m. and medium waves, has 9 transistors and comes complete with earpiece, strap and batteries. Further information from H. O. Thomas Ltd., 4 Vernon Place, London, W.C.1.

SCHOOLBOYS AND GIRLS EXHIBITION

Opened in the Empire Hall, Olympia on December 27 this exhibition features among its exhibits a TV videotape studio presented by Ampex Ltd., where children are able to mime an action or play a charade and see their performance played back immediately on a TV monitor screen.

...COMMENT

GRUNDIG A.F. SIGNAL TRACER



Among the new Grundig range of test instruments is the SV2 a.f. signal tracer. The use of transistors and battery operation make the instrument ideal for lab. or field work. The test probe type UK2 supplied is switchable between a.f. and r.f. In the r.f. position, it operates as a demodulator for frequencies between 100kc/s and 300Mc/s whilst the low capacity ensures no detuning of the circuit under test.

Frequency response is 200c/s to 8kc/s –3dB. Input for 160mW output in the 0dB position is 1mV and in the –40dB position 100mV. Input impedance is 50Ω on the 0dB position and 5MΩ in the –40dB position. Output voltage is 0·9V and output impedance is 1kΩ. For further details contact Grundig (Great Britain) Ltd., Newlands Park, Sydenham, S.E.26.

SANSUI PRODUCTS

Lasky's Radio Limited have now been appointed sole distributors in the U.K. for Sansui High Fidelity equipment.

The range comprises a complete selection of high quality stereo amplifiers, tuners and combined tuner/amplifiers.

Price list and details are available on application to Lasky's Radio Limited, 3/15 Cavell Street, London, E.1. Demonstrations can be provided at 42 Tottenham Court Road, London, W.1.

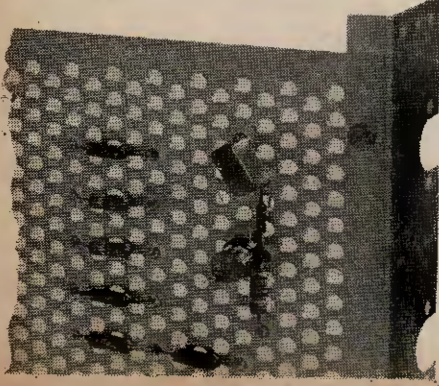
10,000 POLICEMEN TO HAVE POCKETPHONES

A major contract worth £500,000 has been awarded by the Home Office to Pye Telecommunications for the supply of Pocketphone u.h.f transceivers. One hundred police forces will shortly be using these units.

TWO ADDITIONS FOR LEKTROKIT

A.P.T. Electronic Industries Ltd., Chertsey Road, Byfleet, Surrey, announce the availability of Chassis Plate No. 7 and Insulator Lead-through No. 2 in the Lektrokit Chassis Construction System.

Lead-through insulators are connection devices for insertion into the Lektrokit No. 7 chassis plate for circuit wiring. They are made of PTFE high grade insulant and the Sealectro "Clover Leaf" connection insert, which provides a multi-aperture insulated terminal point for use in circuit wiring on metal chassis and provides five connection wires. Price of No. 7 Chassis Plate is 12s. per pack of 2 and No.2 Insulators, 3s. per pack of 6.



Way-Out Style

As a young boy I was always being caught out by my elder sister. She would plague the life out of me with a series of classic "When is a so-and-so not a so-and-so". As the years drifted merrily by I came to be free of these irritating conundrums, and indeed I had forgotten all about the wretched things until I started to read Practical Wireless and then, bless me, there they were again. I refer to these drifting standards which never seem quite what they are supposed to, and vary from one designer or advertiser to another. Take signal to noise ratio. Now there's plain signal-to-noise, or there's signal-to-noise-plus-noise and so it goes on with a few handfuls of dB's thrown in for good measure. Audio amplifiers are notorious for this sort of treatment. Not only do we have noise figures (no mention of the signal now, only the noise), we have hum, input sensitivity, outputs, impedances and Uncle Tom Cobley ad infinitum. Of course all this information may be very useful but the standard references to which all these figures are referred seem to alter with each item one reads about. One manufacturer assures that his amplifier will supply 12 watts output. Now a friend of mine bought one of these and, as he worked as an apprentice in an electronics laboratory, took the unit in for a test. It was found that the unit actually provided four watts output. These results were checked by a senior member of the staff, and I have no doubt that the tests were valid. So how about a definite standard rating on these things to which all units are related. Then when we buy a ten watt audio amplifier we will get ten watts and not five or two. These glowing adjectives beloved by advertising agents should be made to be accurate. Could not the magazine accepting the advert check first? If you raise anything with the advertisers they invariably blind you with science. "Ah, that's under quiescent conditions, and assuming that the signal does not exceed one millivolt, of course you could calculate for the input transistor bottoming but then the hum level will be up by about, Ooh let's see now 25, yes about 25dB so you can't have it both ways can you?" So how about some standards and every one sticking to them. At the moment I'm back in my childhood memories again. When is a 12 watt amplifier not a 12 watt amplifier—when it's advertised as such?

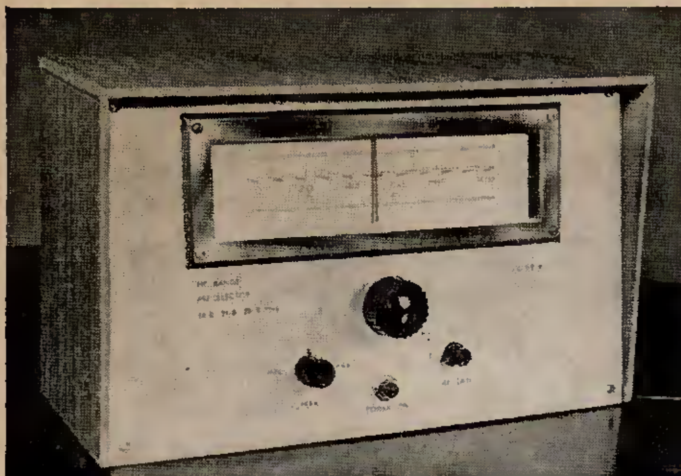
R. Farjohn. Kettering, Northants.

More News and Comment on Page 760

a short wave PRESELECTOR for the HF BANDS

A.S. CARPENTER

G3TYJ



COVER SUBJECT

THE practical preselector design to be described is continuously tunable over the frequency range 14—30Mc/s thereby embracing the three high frequency Amateur bands, viz., 10, 15 and 20 metres.

The prototype preselector is used primarily in c.w. connections; it is attractive physically and may be powered from the station receiver. Tuning is carried out via a slide-rule type drive with '10' and '20' occupying the scale ends. Ample space does exist for the inclusion of a small mains transformer plus rectifier circuit capable of supplying 200-250V d.c. at 20mA and 6·3V a.c. at 1A.

It is desirable to be able to mute the preselector when an associated transmitter is to be used nearby, and a self-shorting jack-socket is fitted via which a muting circuit may be introduced. The preselector may be muted very conveniently, either fully or partially, by arranging for a 50kΩ variable resistor to be automatically switched in and out of circuit by the transmitter 'Send/Receive' switch. No provision is made for bypassing the unit—by means of a switch perhaps—since this is carried out manually.

Some communications-type receivers used at Amateur and SWL stations use valves that are considered to be 'noisy' by modern standards; by using a preselector between the aerial and the receiver a considerable improvement results particularly on the higher frequency bands. This is understandable since when a strong signal is fed to a 'noisy' receiver the a.v.c. system is loaded adequately and the valves are biased back heavily; the received signal then sounds clean and 'punchy'. It should be noted however that a preselector should not be considered as an alternative to a good aerial but merely an addition.

The complete circuit diagram is shown in Fig. 1 where V1 functions as a high-gain r.f. amplifier with V2 operating as a conventional cathode-follower output stage. The station aerial is plugged in at socket Sk1, either direct or via the transmitter/receiver change-over switch or relay, and a *short* screened lead from socket Sk3 is connected to the receiver aerial socket. Band coverage is effected by means of VC1, the shaft of which is in connection with the panel-fitted drive and scale. Variable r.f. gain results from fitment of VR1. Amp-

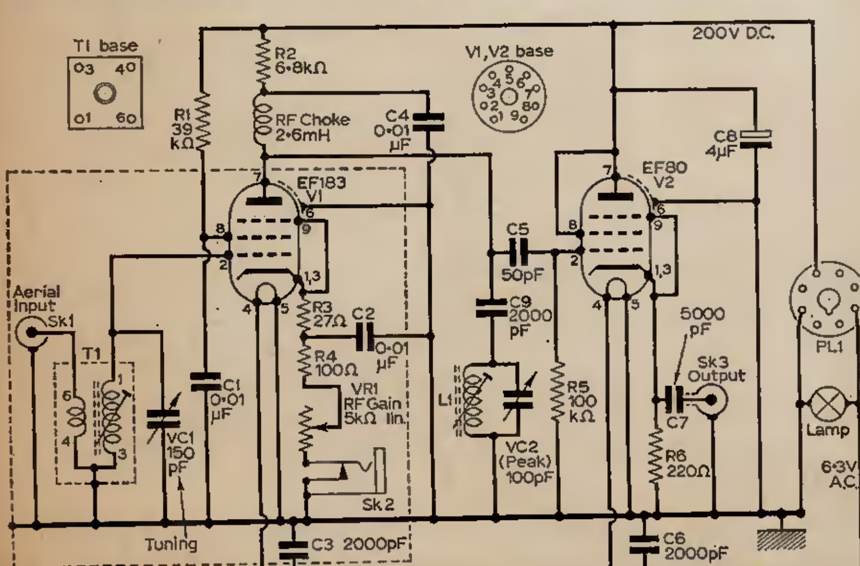


Fig. 1: The theoretical circuit diagram.

lified r.f. appearing at pin 7, V1 'sees' considerable opposition from the r.f. choke whereupon it passes more readily to the cathode-follower output stage via capacitor C5 to re-appear at socket Sk3.

Normally the anode circuit of V1 is operated in a non-resonant state, grid circuit tuning being adopted. Extra gain may be obtained however by resonating the anode circuit close to the operating frequency and to this end coil L1 and panel-fitted VC2 are provided. Although, in theory, maximum gain occurs when both grid and anode circuits are

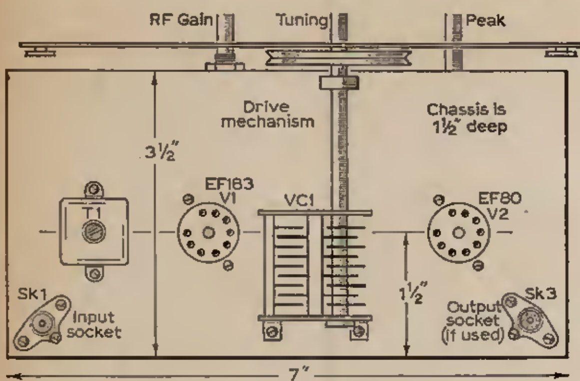


Fig. 2: Above-chassis layout and dimensions.

tuned to the same frequency such exact tuning is rarely practical since oscillation takes over. Under certain conditions—maladjustment of VC2 for example—oscillation can be instigated; it becomes very important therefore to include adequate screening. In the prototype the grid and anode circuits of V1 are well screened from each other; a 'can' is fitted to T1 and the chassis box is also made use of. Screening is indicated by the broken lines in Fig. 1.

Normally VC2 is set to minium capacitance and is used only under difficult copying conditions. The circuit is useful c.w.-wise for as VC2 is manipulated tuning tends to sharpen due to positive feedback. The benefits are somewhat less apparent on 'fone' for the extra gain secured is at the cost of an increased noise level. In this part of the circuit it should be noted that capacitor C9 is a d.c. 'blocker' and it must on no account be omitted!

The layout and most of the wiring is shown in Figs. 2 and 3. No chassis drilling diagram is given since constructors may vary things to suit items to hand. The type of capacitor used for VC1 for example is not over-critical and any small single-gang item of about 150pF maximum capacitance is suitable. Note in Fig. 2 that the lugs of the can associated with T1 are bent outward (not inward) to permit the can to be removed without disturbing the coil itself.

Coil Details

Both T1 and L1 are home-brew dust-cored items. Considering T1, and assuming approximately 30pF for circuit 'strays', a tuned circuit inductance of some 0·9μH used in conjunction with a 150pF variable capacitor will enable the desired band coverage to be obtained. T1 consists of 10 turns 28 s.w.g. enamelled copper wire close wound on a 0·3in. former, and 6 turns of 36 s.w.g. d.s.c. copper wire close wound, for the aerial winding. The two windings are separated from each other by 0·05in. L1 is 12 turns of 28 s.w.g. enamelled copper wire, turns close. Later, a turn per coil may need to be removed to ensure correct band coverage, coils being tested either by using a g.d.o. when they are *in situ*, or via received signals. When finding the frequency range afforded by the T1/VC1 combination with a g.d.o. it will normally be necessary to remove the screening can although it should be remembered that re-fitment of this will cause the circuit to resonate at a slightly different frequency to that measured. Fortunately the dust cores permit considerable inductance variation.

The size of the chassis used is also shown in Fig. 2 but when self-powering items are to be used this should be made 2in. longer.

Details regarding the front panel are given in Fig. 4, matters being so arranged that when the completed assembly is placed on the table the front panel slopes backwards slightly to assist operation of the controls; the appearance also benefits.

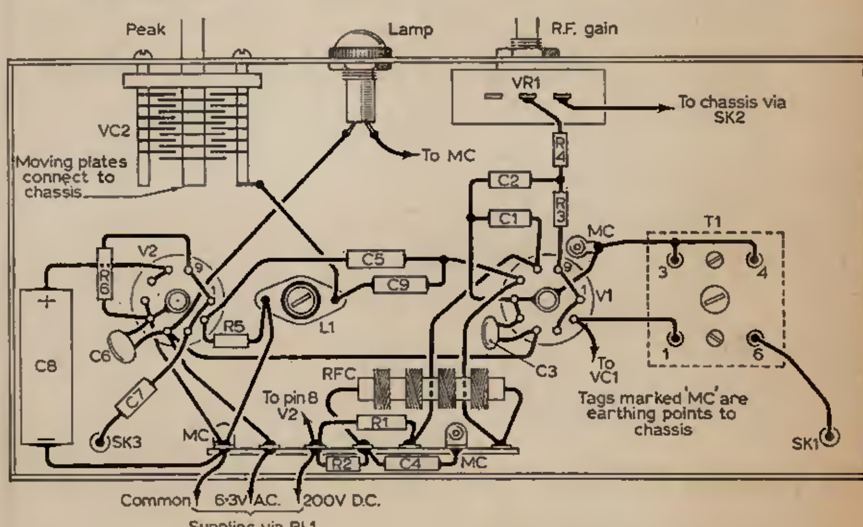


Fig. 3: Wiring and layout below chassis.

Casing details are given in Fig. 5 to agree with the prototype which is fashioned from faced hardboard and held together with pins and impact adhesive.

When the preselector is not self-powered a suitable power pick-up socket should be fitted to the main receiver. An international-octal (I.O.) valve holder is ideal for the purpose rigidly situated so

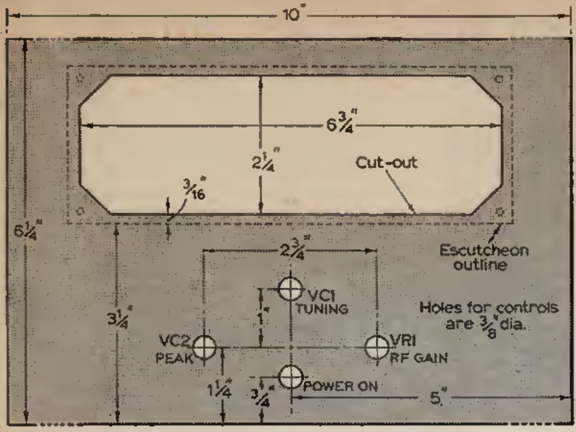
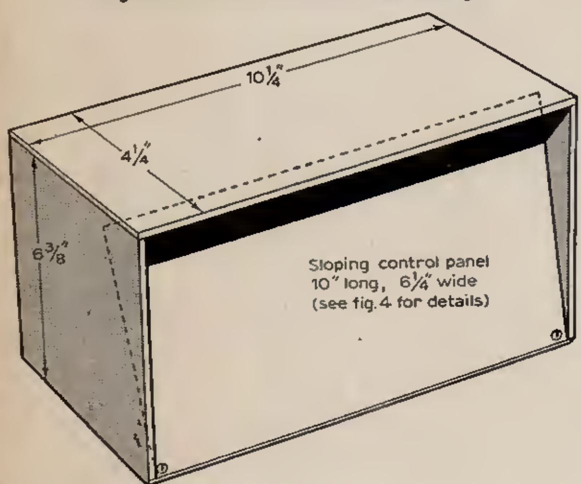


Fig. 4: Panel details.

Fig. 5: Dimensions of the main casing.



that plug P11 carrying the 3-core supply cable from the preselector can be engaged.

Tests should then be carried out, using an ohmmeter, to ensure that no h.t.-chassis short circuit exists after which a short screened lead from socket Sk3 may be connected to the receiver aerial socket. The receiver may have separate aerial/earth sockets in which case the braid of the screened cable should be connected to the earth socket and the lead associated with capacitor C7 connected to the aerial socket. The receiver is then switched on and this will bring the preselector warning lens to life.

Alignment

A weak signal is now sought around 14Mc/s and the preselector pointer moved fully right to completely enmesh the vanes of VC1. The vanes of VC2 should be fully disengaged and the dust core of L1 removed. The core of T1 should next be carefully adjusted to increase the strength of the signal tuned using the receiver 'S' meter as a visual guide.

The receiver is now tuned to the 15-metre band and a weak signal sought, after which the scale pointer of the preselector is moved toward mid-scale—or to where the signal sounds strongest. The same procedure is adopted on the 10-metre band when the preselector pointer should be almost fully to the left of the scale for maximum received signal strength.

Should it seem however that the preselector cannot be tuned down far enough to peak the signal then too much inductance is in circuit and the core of T1—or the number of turns—requires adjustment. Without the aid of frequency measuring gear some experimenting is inevitable but the aim should be to get '10' and '20' peakable at the opposite ends of the preselector scale. VC1 plays a major part in the band coverage and an electrically over-large item is undesirable. Where a good quality variable capacitor is to hand but which possesses excess capacitance, a fixed-value item may be wired in series with it. For example a 250pF variable may be suitably 'reduced' by including a 470pF capacitor in series with it—or, alternatively, vanes may be removed.

When the T1/VC1 combination has been dealt with attention may be given to the 'Peaking' circuit, L1/VC2. The core should be lightly inserted in the coil and first tests made on '20' as before. The normally weak signal, already being amplified by the preselector should be further peakable as VC2 is carefully rotated when L1 is of the correct inductance value.

Although signals are likely to be heard at almost any time of day or night on '20' none may materialise on '10', or even '15' for lengthy periods solely due to unfavourable propagation conditions. ■

★ components list

Resistors:
R1 39kΩ
R2 6·8kΩ
R3 27Ω
R4 100Ω
R5 100kΩ
R6 220Ω
VR1 5kΩ pot. (Lin.)

Valves:
V1 EF183
V2 EF80

Capacitors:
C1 10,000pF ceramic
C2 10,000pF ceramic
C3 2000pF ceramic
C4 10,000pF ceramic
C5 50pF silver mica
C6 2000pF ceramic
C7 5000pF ceramic
C8 4μF electrolytic, 350V
C9 2000pF ceramic
VC1 150pF variable (see text)
VC2 100pF variable Jackson 'Air tune'

Sockets:
Sk1, Sk3—Coaxial type, surface mounting
Sk2—Miniature closed-circuit jack type

Dial and Drive:
Jackson type SL16 5191 complete

Miscellaneous:
R.F. choke, 2·6mH (Denco type RFC5), 0·3 in. Bakelite coil former with dust iron core and screening can (Denco Ref. 5000A/4PL), Coil former with dust iron core (Denco—Ref. 351/8BA), Miniature panel lamp (Eagle PL), Octal plug, Knobs (3), Valveholders B9A (2), Chassis 7 x 3½ x 1½in. etc. and casing materials.

EXPERIMENTERS CORNER

TRANSISTORISED COMPUTER

S. BENDA

THIS computer uses 20 transistors and 30 diodes. It adds and subtracts, the number input being fed in by a 'phone dial. The answer is read off 10 light-bulbs, which are mounted on top of the case. The answer is of course in binary form, with which the constructor should become familiar. The unit is small compared to anything else of similar function.

Theory

The computer consists of 10 bi-stable circuits called flip-flops, and the circuit of one is shown in Fig. 1. The circuit works in the following way.

Suppose that Tr1 is conducting and therefore Tr2 is cut off, almost all the supply voltage will be across R1 and B. This means that the collector of Tr1 is nearly at earth potential. However the collector of Tr2 is nearly 12 volts negative. This means that D1 has only a small negative voltage across it in the reverse direction, but that D2 has nearly 12 volts across it in the reverse direction.

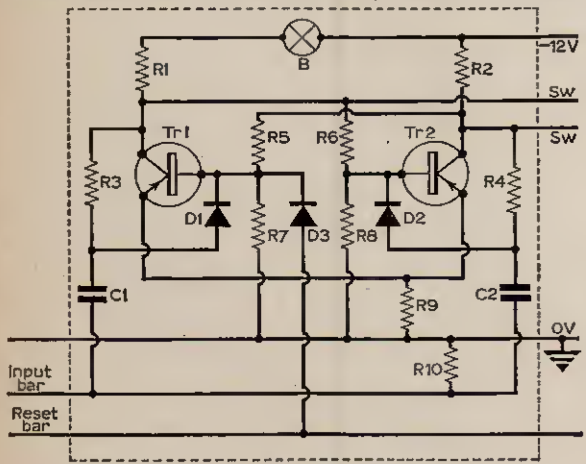
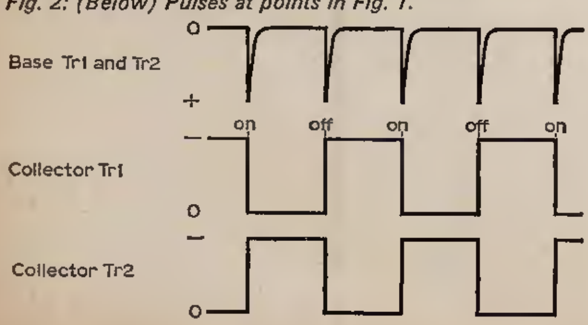


Fig. 1: (Above) Circuit diagram of one flip-flop.
Fig. 2: (Below) Pulses at points in Fig. 1.



Now suppose that a positive pulse appears across the input bar. The pulse will not overcome the 12 volts across D2, but it will overcome the small negative voltage across D1. Thus D1 will conduct

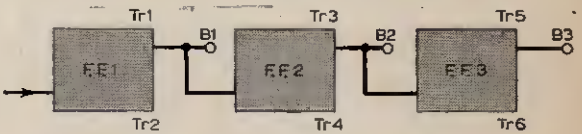
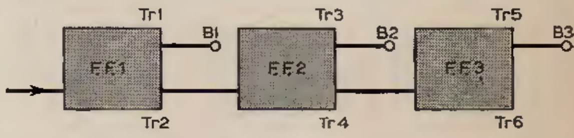


Fig. 3: (Above) Block schematic of "Adding".
Fig. 4: (Below) Block schematic of "Subtracting".



and since the pulse is positive it will reduce the base current of Tr1.

This will reduce the collector current of Tr1 which will make its collector more negative. This increases the base current of Tr1. Thus the collector current of Tr2 increases making the negative voltage on it decrease. This decreases the base current of Tr1, until it is cut off and Tr2 is conducting. Fig. 2 shows the voltage wave forms in the flip-flop.

N.B.: Negative pulses at the input of a flip-flop have no effect upon it, since they reinforce the reverse negative voltage across D1 and D2. In Fig. 2.

To begin with, the bulb B, which is connected to Tr1, is not conducting. A pulse in the base switches it on. Another pulse switches it off and so on. The collector of Tr2 is, of course, always in the opposite state to the collector of Tr1. So it can be seen that a flip-flop can be represented by a little box with a bulb on top of it.

It needs **two** pulses to switch the bulb through a whole cycle. This shows that the number of pulses which can be obtained from either of the collectors of a flip-flop is exactly half those appearing at the input. This can be verified from Fig. 2. Because each flip-flop divides the number of pulses by two, in the computer each flip-flop will represent twice the number of the preceding one.

So if F.F.1 represents one, F.F.2 will represent two, F.F.3 will represent four and so on. In the actual computer there are ten flip-flops so that the last flip-flop will represent 512. In Fig. 3 there are, for the sake of simplicity, only three flip-flops. The input of each flip-flop (except for the

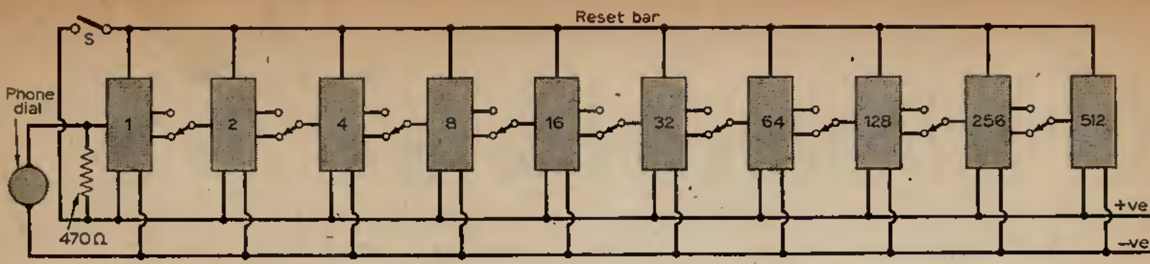


Fig. 5: Block schematic of the computer. Each box represents one flip-flop as in Fig. 1.

first one) is connected to the preceding collector corresponding to Tr2 in Fig. 1.

Suppose we start with all the bulbs off, in other words nought. If we dial a pulse into F.F.1 this will switch on B1. A negative pulse will be sent to F.F.2 (since the input of F.F.2 is connected to Tr2) and nothing will happen to F.F.2. We have added nought plus 1. Now if we dial another pulse into F.F.1 we will switch B1 off. However a positive pulse will be sent to F.F.2 and this will switch on B2 which represents 2. We have added 1 plus 1.

The reader will then be able to work out for himself, that it is possible to add up to 7 on this circuit, but upon adding 7 plus 1, he will get the answer of nought. The actual explanation of this is that if there were a fourth flip-flop a positive pulse would be sent to this, registering the number 8.

Fig. 4 is similar to Fig. 3 except that it is connected for subtracting. The input of each flip-flop is connected to the preceding collector corresponding to Tr1 in Fig. 1. Suppose we start with the number 7, that is all the three bulbs on. If we dial a pulse to F.F.1, B1 will be turned off and a negative pulse will be sent to flip-flop 2, B2 and B3 will be left on corresponding to 2 plus 4 which is 6. We have subtracted 1 from 7.

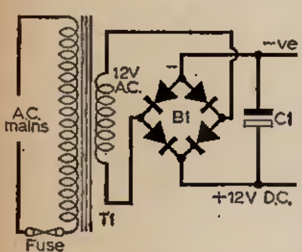


Fig. 6: Suggested power supply.

If we dial in another pulse we will switch on B1. This will send a positive pulse to F.F.2. This will switch B2 off which will send a negative pulse to F.F.3. So B3 and B1 will be left on corresponding to 4 plus 1, which is 5. We have subtracted 1 from 6. Thus, to sum up, we have seen that:

(1) A flip-flop is a circuit which can only be in two states, on and off.

(2) A flip-flop effectively divides the number of pulses appearing at its input by two.

(3) If a number of flip-flops are connected together, the number of each flip-flop is twice that of the preceding one. The total on the computer is of course obtained by adding together the corresponding value of all the bulbs which are on.

(4) The flip-flops can be connected in an adding circuit or a subtracting circuit depending upon whether the input of each flip-flop is connected to the collector corresponding to Tr2 or Tr1, in Fig. 1 of the preceding flip-flop.

Construction

Details of construction are left to the individual constructor since there are numerous variations and these are simple enough to work out. The recommended order of construction is as follows: the case is built, the power-pack is made, the flip-flops are constructed.

Note: A reset bar is included. This makes it possible to set the computer to zero just by pressing a switch. D3, in Fig. 1, is included in each flip-flop so that the flip-flops do not interfere with each other.

The case

It is clear from the size of the bits which ones fit on top of each other. The first step is to glue and nail A, B, C and G together. A, B and C are all made from ⅜in ply, A and B being identical. When these have been assembled, D, E and F are

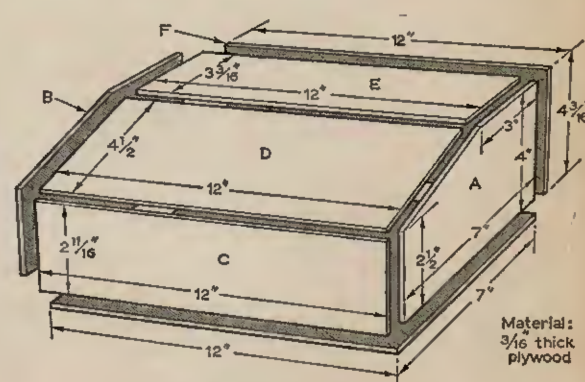


Fig. 7: Constructional details of the case.

bracketed together by aluminium strips to the shape which they will have when screwed to the sides.

Next, two flip-flops are constructed on a single printed circuit board. The lay-out of the flip-flops is left to the constructor. The printed circuit board is divided roughly in half and each flip-flop is constructed in it. The earth bar, the negative supply, the output to the two bulbs, and the reset bar are connected to the connections which go to the sockets.

The sockets which are the mechanical suspensions for the flip-flops are screwed to the back F about an inch apart from each other, starting an inch inside the left side. The bulbs are then mounted on the top E. The connections to the appropriate bulbs are made from the plugs connecting the extreme right plug to the extreme right bulb. This will be the first flip-flop, so that the numbers will go up from right to left as is conventional. All the bulbs are connected to the negative bar. Switch S is a push to test switch, used to reset to zero.

Fig. 5 is a schematic diagram of the computer. When the five plugs have been wired together and to their appropriate bulb connections, only the negative and positive bars which go to the power pack will be left. There will also be the connections to the switch which will be wired later.

The reset switch S and the phone dial circuit are wired in as shown in Fig. 6. The phone dial circuit is so designed that it feeds positive pulses into the first flip-flop by breaking the negative line from the input. (The phone dial is normally shorted but when dialling, it opens.) The reset switch is mounted roughly in the middle of D in Fig. 5.

★ components list

Resistors:

R1	100Ω	R6	1·2kΩ
R2	220Ω	R7	1·2kΩ
R3	10kΩ	R7	1·2kΩ
R4	10kΩ	R9	10Ω
R5	1·2kΩ	R10	33kΩ

Capacitors:

C1	0·05µF, 30V	C2	0·05µF, 30V

Semiconductors:

Tr1	OC81	D2	OA81
Tr2	OC81	D3	OA81
D1	OA81		

Bulbs: 6V 0·06A

The above parts are those required for one flip-flop unit. Therefore, ten of each item listed above are required. The resistors are all ¼W 10%.

Other parts:
Ten bulb holders. Five transistors printed circuit panels (Radiospares). One 12-pole 2-way switch. One telephone dial. One 12V 1A transformer. Four silicon diodes (at least 50V peak reverse voltage and 1 amp). One 1,000µF 15V capacitor. One 1 amp fuse. Five edge connectors for printed circuit panels.

Photograph of the completed prototype computer.

The next thing to do is to construct the power pack in the right hand corner of the case.

The first printed circuit (the first two flip-flops) is plugged in and the input to the first flip-flop is wired up. The power supply is connected and switched on. The bulb of the first flip-flop ought to switch on and off alternately as each pulse is dialled in. If it does not work, the flip-flop should be checked, especially for such things as the polarity of the diodes. When this is working, the second flip-flop should be connected to the first through the switch checking that this works. We should now be able to subtract and add up to two. The rest of the flip-flops are made, plugged in and wired to the switch in a similar fashion. It is important to check that when the switch is in one position all the inputs of the flip-flops are connected to the collectors of the preceding flip-flops corresponding to Tr2 and when it is in the other position all are connected to Tr1 (see Fig. 1).

Conclusion

The computer should function well. The phone dial gave a little trouble and the constructor is advised to be careful in the type which he buys. The wiring should be of thin single core type wire.

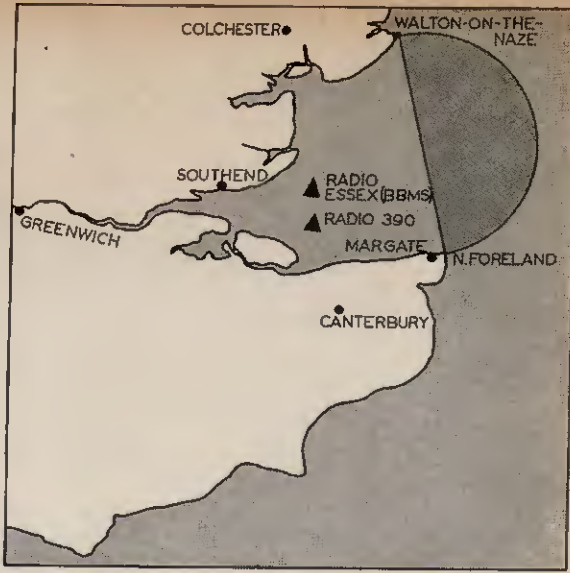
The uses of this computer are mainly demonstrational and educational. It can be used as a counter of pulses, it being able to count up 2,000 pulses a second. However, when it is used as a counter of low repetition frequency pulses, a "squarer" has to be inserted before the input. ■

RADIO 390 & RADIO ESSEX

Both fined £100 for illegal broadcasting

390 switched-off pending appeal

Essex (BBMS) carry-on



ON Friday, 25th November, Nineteen Hundred and Sixty Six, Estuary Radio Ltd., who up to that time operated Radio 390 from a fort in the Thames Estuary, were fined the maximum of £100 at St. Augustine Magistrates' Court, Canterbury, Kent, for unlawfully "using apparatus for wireless telegraphy, namely a transmitter without a licence, at Red Sands Tower on 16th August, 1966". Estuary Radio's managing director, Mr. Edward Allbeury, and company secretary, Mr. David Beresford Lye, were found guilty of the same offences, but were each given an absolute discharge.

BROADCAST ON 773KC/S

The Post Office had no difficulty in proving that Radio 390 had broadcast on approximately 773kc/s on 16th August, 1966, without a licence. Four Post Office engineers were called upon to give evidence: one to substantiate no licence had been allocated, and three to give evidence of monitoring the station and making tape recordings of the transmission—from Shoeburyness in Essex, Morden Point on the Isle of Sheppey and Herne Bay in Kent.

UNDER BRITISH JURISDICTION

Establishing whether the former anti-aircraft tower on Red Sands, from which Radio 390 operates, came under British jurisdiction was an extremely complex matter. Sir Peter Rawlinson, Q.C., representing the defendants, told the court that Radio 390 is situated at least six nautical miles off the Kent coast and is thus well outside British territorial waters. John Newey, prosecuting for the Post Office, in this criminal case, did not agree and gave two main reasons to substantiate his claim.

Firstly, under the terms of the Geneva International Convention of Sea, 1958, which was ratified in September 1964 by the British Government the Thames Estuary may be considered as a bay. But only if the amount of water (in area) within the bay exceeds that in a semi-circle drawn—with a 24-mile base-line—across the indentation in the coast. Lieutenant-Commander P. B. Beasley, head of Territorial Waters in the Hydrographic Department of the Ministry of Defence, told the court that in his capacity as a naval surveyor he had calculated the amount of water in the bay, with a base-line drawn across the indentation from Walton-on-the-Naze to North Foreland, and found that there are 683 sq. miles in the 'bay' and five less in the semicircle. His calculations, however, took in water in the Thames up to Greenwich and to Rochester Bridge in the Medway. Defence was not satisfied that this was permissible and laughter accompanied Sir Peter's suggestion of using Greenwich-on-Sea as a holiday attraction for a town situated in Greater London.

The other factor, also based on the Geneva Convention, concerned low-tide elevations, which includes all islands that are un-covered at normal low water. Prosecution claimed that Middle Bank, one of the sandbanks off the Isle of Sheppey, is one and as such forms the inner limit of territorial waters. Although it is marked on Admiralty charts, Mr. V. Davis, master of the Mallard which has been supplying the forts for some time, stated that he had not seen Middle Sands uncovered for at least twelve months and is only uncovered after an abnormal tide.

CUSTOMS AND EXCISE

Appearing upon a subpoena to give evidence for Radio 390, Mr. R. Stiff, a customs and excise officer based at Whitstable, Kent, told the court that his superiors had ordered the master of the supply ship Mallard to report before and after visiting the forts in the Thames Estuary. This order, he told the court, had been withdrawn in May 1966; under instructions from the Commissioners of Customs and Excise. He also told the court, under cross-examination, that no duty was levied on the transmitting equipment brought to Red Sands Tower from Rotterdam, and that the customs only require masters' to visit them and fill up a form when they are leaving for the high seas.

MARINE & BROADCASTING BILL

Sir Peter Rawlinson, the former Solicitor-General, made reference to the Marine and Broadcasting Offences Bill, which has been introduced by the Goverment to suppress broadcasting from ships, aircraft and certain marine structures. It has not been through all the necessary stages to become an Act, he told the court, but it is a provision to deal with the problem you are faced with today. "If the present laws satisfy you that you have powers to deal with this case, what is the point of wasting the time of the Parliamentary draftsmen?"

Sir Peter explained that territorial waters could be extended by an Act of Parliament. However, The Territorial Waters Order in Council of 1964 had been made under the Queen's prerogative and is not an Act of Parliament. "If you accept that the Order in Council is not good law and is to be treated as if it were in the wastepaper basket, I suggest that you look at the International Convention which says the same thing."

CHANGING THE BOUNDARIES

Summing-up, Sir Peter Rawlinson said that it was a remarkable thing that this matter which affects the sovereignty of the realm should turn on the evidence of a distinguished officer (Lt.-Cdr. Beasley), but who only held the rank of a Lieutenant-Commander in the Royal Navy. He also made reference to the fact that no official map or chart indicated changes in territorial waters, concerning this case, and that under the terms of the Geneva Convention the general public must be informed of such changes.

VERDICT

After a second adjournment of thirty minutes (recall for further technical evidence from Lt.-Cdr. Beasley), Mr. Donald Andrews, Chairman of the Bench, read from a prepared statement: "We find that Red Sands is situated in territorial water. The Wireless Telegraphy Act of 1949 is silent on the question of local jurisdiction, but the territorial waters in question join the coast of Kent and for that reason we are of the opinion that the justices of the County of Kent have jurisdiction in this matter. On the evidence before us, we find the evidence proved."

EQUIPMENT NOT CONFISCATED

The Post Office made application to the court to confiscate the transmitting equipment, worth approximately £12,000, and for costs. John Newey, prosecuting for the Post Office told how easy it is to form a new company and start all over again.

After a third retirement, the Bench passed sentence and refused the Post Office the right to confiscate the equipment, and their application for costs.

NOT GIVEN UP

Immediately after the case had been heard, the Mallard supply ship carried a pre-record tape to Red Sands, on which Mr. Allbeury gave the station's reasons for shut down and notice of appeal. "If we win the appeal", Mr. Allbeury told reporters, "we shall start broadcasting immediately. If it goes against us, we shall operate from another country on the Continent." He would not say which, but indicated the suggestion to be a last resort.

Radio 390 was founded in September 1965 and was not a 'pop pirate', but broadcast—to quote Mr. Allbeury—"sweet music" for housewives. It had a claimed audience of four million and its profits were said to be in the region of £15,000 monthly.

RADIO ESSEX

On Wednesday, 30th November, just five days after the Radio 390 case, Mr. Roy Bates the owner and operator of Radio Essex was summoned under the Wireless Telegraphy Act of 1949 for using a transmitter without a licence at Knock John Tower in the Thames Estuary. He was also found guilty and fined a maximum of £100 at Rochford Magistrates' Court, Southend.

Mr Bates, who now calls his station Radio BBMS (Britain's Better Music Station), appeared without council and pleaded that the court has no jurisdiction over the Knock John Tower, since it is more than three nautical miles off the coast of Essex. John Newey, prosecuting for the Post Office, followed the same lines as he used in the Radio 390 case over the Thames Estuary being a 'bay'. He also introduced low-tide elevations, claiming that West Barrow is one. This lies within three nautical miles of Knock John Tower and is marked as a low-tide elevation on Admiralty Charts.

Mr. R. H. Dalton, Mr. J. F. Woods (Assistant Executive Engineers in the Post Office) and Mr. J. H. Ainley (an Executive Engineer in the Post Office) gave evidence of monitoring Radio Essex on 222 metres and locating the station on 16th August 1966, from Herne Bay in Kent, Shoeburyness in Essex and Morden Point on the Isle of Sheppey respectively. The same three men gave evidence in the Radio 390 case. Also as in the Radio 390 case, Mr. W. Goldsmith, a Higher Executive Officer in the Radio Service Department of the Post Office, stated that although application for a licence had been made, no licence had been issued.

Mr. Bates did not cross-examine any of the witnesses and before the magistrate retired told the court "I do not wish to make any statement at all." He did, however, after the decision (and the Post Office's application to confiscate the equipment and for a portion of the costs), state that he wished to make an appeal against the decision and that the question of forfeiture should not be considered until after the appeal. The court made no order about costs or forfeiture.

STILL ON THE AIR

After the case was heard, Mr. Bates told PRACTICAL WIRELESS that he could not accept the jurisdiction of the court and that he planned to carry on broadcasting from Knock John Tower with his 25kW Medium Wave transmitter.

APPEAL

It is possible that during the interval between going to press and publication of this issue, one or both of these cases will come up before a higher court. Details will, of course, be published in a later issue.

THE MW COLUMN

AS an experiment, we are going to run this column for the next few months, during the main MW DX season.

Over the last few weeks conditions have been good for North America, with occasional West Coast openings—notably KING Seattle on 1090kc/s and KOMO Seattle 1000kc/s. Best times for West Coast is from 0300-0700. As these notes are written, North America is going through a poorer patch, but the South Americans are more prominent and numerous.

Asia has been quite good in the afternoons and late evening periods, examples being Voice of America, Hue (Vietnam), and Lucknow (India) both on 760 between 1600-1700, Kaifeng (China) on 930 and Anwhei (China) on 940 (together with the Brazilian PRF4) around 2130, and Hanoi (North Vietnam) on 1010 at 2200. The best times to listen for Asia are 1330-1730 and 2030-2300 from October to March.

One interesting aspect of MW DX is that you have the opportunity to hear countries you would not normally hear on short waves, such as Bermuda, Bahamas, Gibraltar, Greenland, Jamaica, British Honduras, Liberia, Surinam, Okinawa, and others.

One word of warning to newcomers.. Identification of stations is generally more difficult (apart, of course, from Canadian, USA stations, etc.) since English is not usually employed at all. And since "openings" to certain areas and the reception of particular stations are far less consistent than on short waves, and are therefore far more important in a serious study of propagation, it is *essential* to be absolutely positive when claiming reception from a particular station. Should any doubt exist, it is important to state that the reception claim is tentative.

As in all hobbies there are occasional black sheep. We get them in short-wave listening—the spasmodic appearance of a reporter who claims reception of difficult or virtually impossible stations. Such antics usually betray the "reporter" but in MW work fictitious claims are much more readily apparent. Fictitious reporting is usually obvious to the experienced DX'er and the culprit is made unwelcome in clubs or asked to leave. Equally true is the fact that an innocent reporter making an improbable claim may easily find himself viewed with suspicion. The answer is easy: make sure of the facts and if doubt exists add the word "tentative".

Most MW DX enthusiasts use some form of loop, which has the great advantage of high directivity. Such a loop was described in the November issue of PRACTICAL WIRELESS, but readers without this issue may obtain details of my own loop on request. All I ask is for return postage to be included (or where applicable overseas, an IRC).

Next month we will give details of recent station changes which have come to hand. In the meantime I would like to hear from readers interested in MW activity and in particular from Asia, the Pacific area or Latin America not only in stations heard but news of any important changes or new stations on the air.

Alastair Woodland

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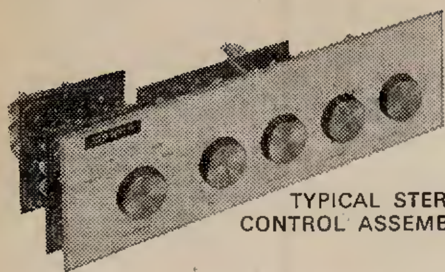

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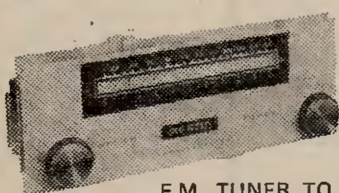

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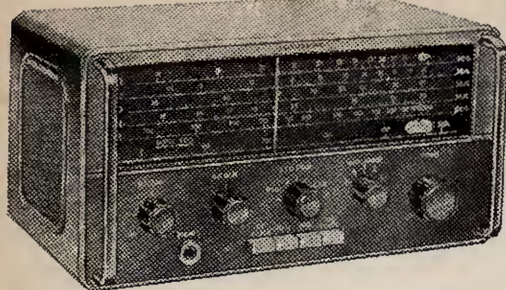

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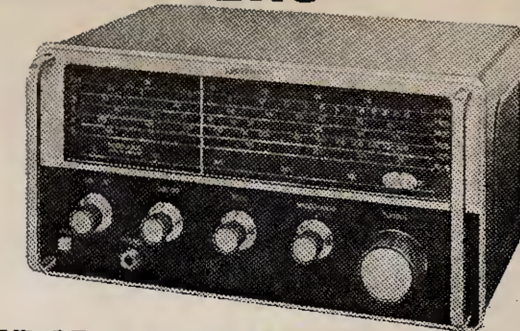

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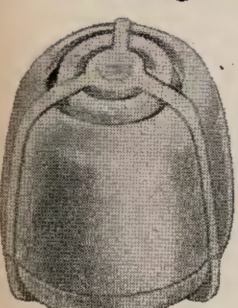

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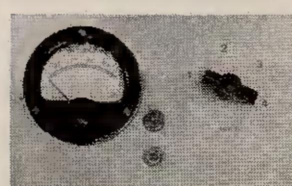

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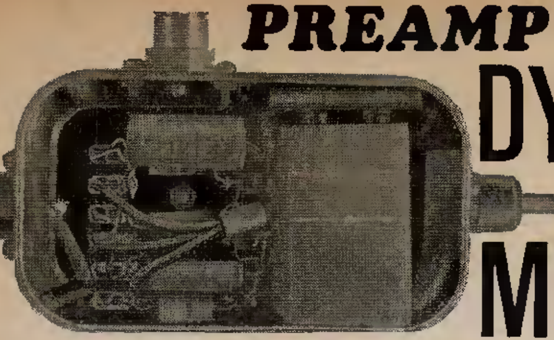


PREAMP DYNAMIC MICROPHONES

A.S.ELLIS

WHEN using a dynamic microphone with a valve amplifier often it is necessary to convert the low impedance signal from the microphone into one suitable for feeding the high impedance valve input circuit. This can be done with a transformer, but good microphone transformers are expensive. The device to be described, however, renders a microphone transformer unnecessary, provides extra amplification, and is both cheap to construct and compact in its construction.

The circuit

The basic circuit of the device is shown in Fig. 1, and consists of a single transistor in grounded-base configuration. A signal from a low-impedance source is applied to the emitter circuit via Cin and the amplified signal, at high impedance, is taken from the collector circuit via Cout.

It is the configuration's ability to function as an impedance transformer which is of particular interest here: the low impedance input is eminently suitable for dynamic microphones, whilst the high output impedance (in the region of a megohm) makes the circuit suitable for connection to the high impedance input circuitry of valve amplifiers. Additionally, the configuration is capable of developing significant and useful power gain when so connected. Since, in the grounded case, the current gain is slightly less than unity, the configuration derives its power gain from the high voltage gain. For driving valve amplifiers, it is voltage gain which is particularly required, since valves are voltage-operated devices.

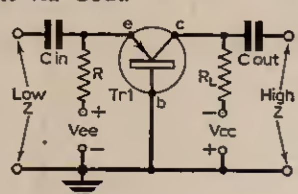


Fig. 1: Simple impedance converter.

The complete circuit (see Fig. 2) is conventional, and required little original thought on the author's part. The device appears to have a fairly flat a.f. response, and an additional point in its favour is its low battery consumption: about 600μA from the 9-volt battery.

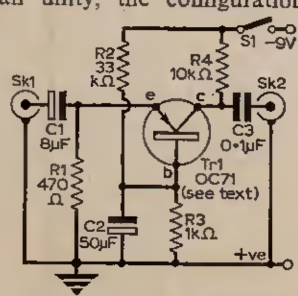


Fig. 2: Circuit diagram of the complete unit.

The choice of Tr1 does not appear to be particularly critical; an OC71 was used in the prototype simply because it happened to be immediately available. Several different a.f. transistors have been tried in this circuit, all with equal success; a few r.f. types have also been tried, but on the whole, these tended to be noisier. Red spot surplus types are not recommended for the same reason.

It is feasible that some improvement in quality would result if a low-noise transistor such as AC107 was to be used in this circuit. However, the expense involved would not necessarily be justified by the slight improvement so obtained.

Construction

The wiring shown is perfectly straightforward and should present no difficulties; details are given in Fig. 3. The transistor is wired into circuit last of all, and its leads must be covered with PVC sleeving. This is so that when the whole unit is finally assembled, the transistor may be bent across the tagboard without fear of causing short circuits.

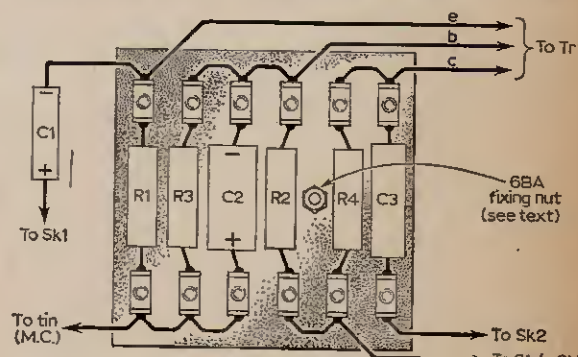
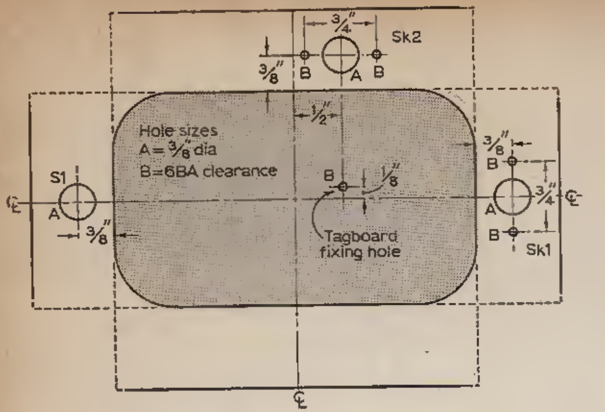
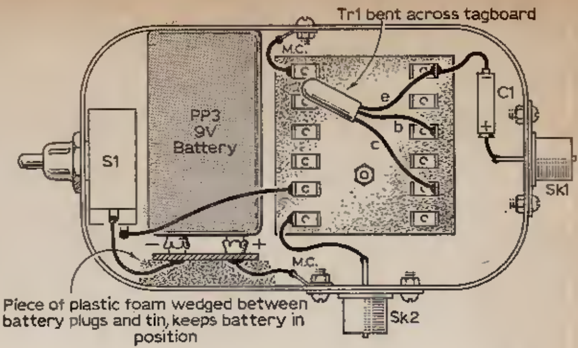
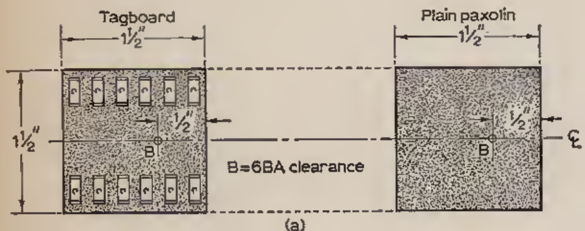


Fig. 3: Component layout on the paxolin board.

The case of the prototype unit was a discarded 2 oz. tobacco tin, measuring approximately 3¾ in. x 2¼ in. x 1 in. This tin was found to be particularly suitable, although any available tin of comparable size may be used and drilled accordingly. The drilling details for the prototype are shown in Fig. 4.







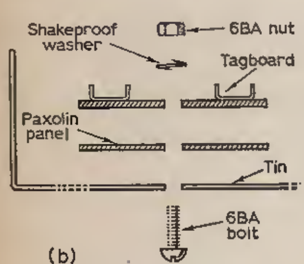


Fig 4: (Top left) Drilling instructions for the case.

Fig. 5: (Above and left) Dimensional data (a) and mounting details (b) of the paxolin panel.

Fig. 6: (Top right) Layout of the finished unit.

★ components list

Resistors:

R1 470Ω R3 1kΩ
R2 33kΩ R4 10kΩ
All 10%, ½W carbon

Capacitors:

C1 8μF, 15V electrolytic C3 0·1μF
C2 25μF, 15V electrolytic

Transistor:

Tr1 OC71 (see text)

Miscellaneous:

Two coaxial sockets; single-pole, single-throw switch; six-way miniature tagboard; paxolin panel measuring 1½ x 1½ x 1/16 in.; 6 B.A. nuts, bolts and shakeproof washers; PP3 or equivalent battery; battery terminals; small piece of plastic foam; and a tin container (such as a tobacco tin) measuring approximately 3¾ x 2¼ x 1 in.

Final assembly

Layout of the major components within the case are shown in Fig. 6. The tagboard is mounted by means of a 6 B.A. nut, bolt and shakeproof washer. A piece of paxolin, the same size as the tagboard (1½ in. x 1½ in.) is suitably drilled to receive the 6 B.A. bolt, and is placed immediately between the tagboard and the tin so as to act as an insulator (see Fig. 5). It may be found that the centre-conductor of SK1 requires shortening by about 1/8 in. in order to prevent it fouling the tagboard.

Once the tagboard has been secured within the tin, the final wiring details shown in Fig. 6 may be completed. Earthing connections to the tinplate casing are easily made by soldering direct. Finally, the transistor is bent across the tagboard (see Fig. 6). Care is essential here to ensure that the leads are not bent too near the transistor envelope.

Testing

Having checked all wiring, and ensured that the battery polarity is correct, a low impedance microphone (between 50 and 200Ω) is connected to SK1 via screened cable (coaxial type), and a similar connection is made from SK2 to the valve-amplifier high impedance input. For those new to the principles of amplifying microphone signals, a loud howling sound may result if the gain control is advanced too far, or if the microphone is too near the loudspeaker. This is known as acoustic feedback, and can be arrested by retarding the main amplifier gain control. However, this is not an altogether satisfactory solution, since to prevent feedback it may be necessary, in extreme cases, to turn the control to such a position that gain is so low as to be of little use. Alternatively, and if space is available, the microphone can be kept well away from the loudspeaker. This is the most generally used solution. The most reliable method of all is to employ a uni-directional microphone which will not pick up signals from the loudspeaker when directed away from it. This, however, is a rather more costly solution.

It will be found that long input leads to the unit will give no trouble, but since the output is at high impedance, the lead joining the unit to the main amplifier should be no longer than is absolutely necessary. Hum troubles may arise if this precaution is not taken. ■

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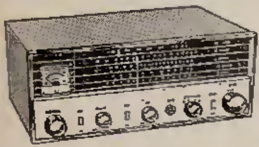

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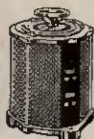

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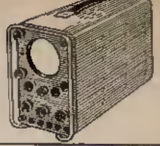

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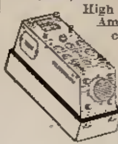

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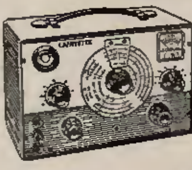

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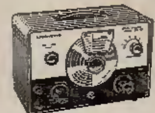

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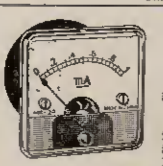

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		1mA	22/6	750mA	22/6	500V D.C.	22/6
		2mA	22/6	1A D.C.	22/6	750V D.C.	22/6
		5mA	22/6	2A D.C.	22/6	15V A.C.	22/6
		10mA	22/6	5A D.C.	22/6	50V A.C.	22/6
50µA	32/6	20mA	22/6	3V D.C.	22/6	150V A.C.	22/6
100µA	29/6	50mA	22/6	10V D.C.	22/6	300V A.C.	22/6
200µA	27/6	100mA	22/6	20V D.C.	22/6	500V A.C.	22/6
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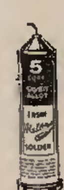

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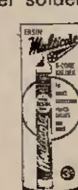

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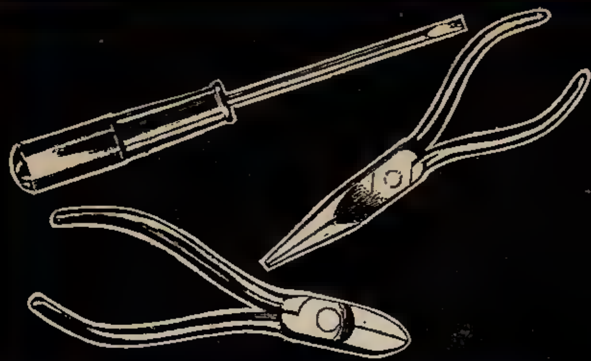


the home workshop

BY G. T. THEASBY

THIS article is intended for the beginner, who needs some idea of how to set out his space and equipment before actually beginning to build, and for the established amateur who feels that perhaps he isn't using the area at his disposal as well as he might, and yet does not quite know where to start. The actual layout is, in the end, dependent on the floor and wall space available, but the ideal is a room apart from the rest of the family, in the interests of peace and quiet, this also offers complete freedom from danger to the rest of the family and any visitors. If a separate room is not available, then half a room, a shed in the garden, or a fold-out bench, built into the wall or an old cupboard. It should offer reasonable comfort all the year round, being neither too warm, too cold, or too damp. It all depends on what use the workshop will get. An amateur using commercial equipment will need less space than one who is building his own, or seeking to improve existing equipment.

This article assumes that the enthusiast will be doing some home building, and consequently deals with power, tools, equipment, light and space.

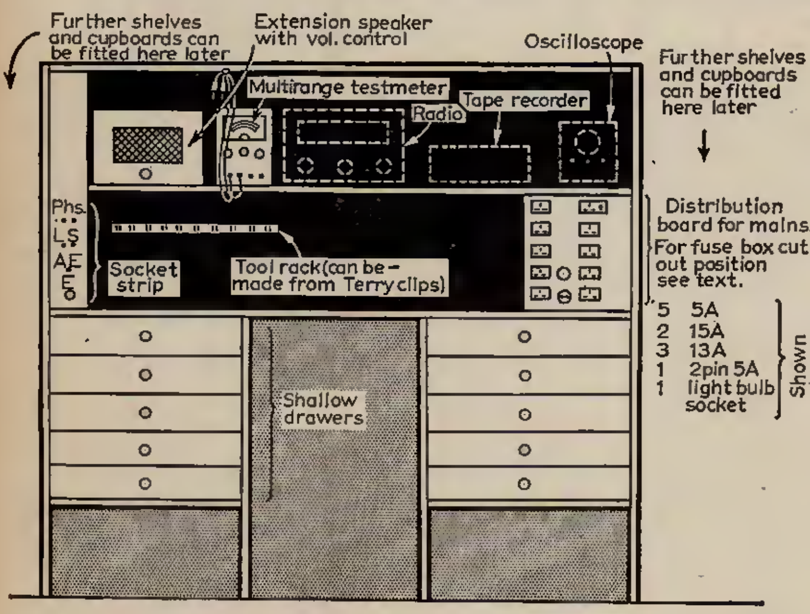


Fig. 1: Suggested layout for the constructor.

Power

Power may be broadly divided into three groups: (1) A.C. mains; (2) D.C., filtered and smoothed; and (3) Low voltage power, (9—12 volts).

First A.C. mains, 15 amps should be enough for most workshops, but make sure the house wiring can stand the load. If the amateur decides to wire his own sockets and distribution board (see Figs. 1 & 2), it should be tested by the local Electricity Board before being connected to the mains. Fit a fuse-box or contact breaker in a prominent position, wired so that it cuts power to all the workshop, so that in case of an accident anyone can shut off the power. (It is suggested at this point that the station is insured against fire, theft, or accident to visitors, and also damage caused by aerial collapse, etc.) Try to fit at least one mains outlet socket on the distribution board with an isolating transformer of adequate rating, suitably fused. All sockets, transformers and built-in equipment should be fitted with individual fuses, in addition to the main cut-out. All equipment should be fitted with indicator lamps to show when they are switched on. Each socket and unit of mains-operated equipment should be efficiently earthed. *NOT* to a gas pipe, or to a water pipe, because many houses now have plastic water pipes, and this plastic will render the water-pipe earthing circuit useless.

To obtain a good and reliable earth, obtain a length of motor car ignition cable, and bolt and solder the wire to a copper spike. This joint is then painted over with bituminous paint to prevent corrosion, and the spike buried in three to four feet of damp soil. The wire is then taken into the workshop in the normal way. It is best not to use the electricity mains earth at all, as it can be dangerous. Instead connect all station equipment to this earth, *except* the receiver and transmitter, if any. Give this a separate earth as far as possible from the first earth, as the earth for a transmitter or receiver can form a part of the aerial system, and thus carry radio frequency power.

A power unit supplying d.c. filtered and smoothed can be provided for equipment without a built-in power pack. Suggested ratings are 250-300 volts and 6·3 volts, at 200mA and 4 Amps respectively. All wiring should be kept neat and tidy. Mains wiring should be as far removed as possible from aerial and earth wires for minimum hum pickup, and test equipment leads should not be left dangling, or one day you may be a test meter short! Wire should be of adequate current carrying capacity, and run underneath shelves where possible.

Lastly, low voltage supplies. These should be completely isolated from the mains, and be suitably fused.

(1) A multirange testmeter. Here, ranges offered is a secondary consideration to the input resistance. No less than 20,000 ohms/volt for accurate readings; better still 50,000 or 100,000 ohms/volt. Best of all is an accurate valve voltmeter, with an input resistance of many megohms/volt.

(2) A signal source. If possible a signal generator with outputs at a.f., r.f. and i.f. frequencies. If not, a microphone for a.f., and an aerial for r.f. will suffice.

(3) A signal tracer, which can be used in conjunction with the above for fault finding is a good (and cheap) piece of equipment.

(4) A gramophone turntable, arm, and loud, quiet, fast and slow music records could be provided for testing audio amplifiers.

(5) Last, but by no means least, a soldering iron. The author uses a 25 watt instrument soldering iron costing 25s. and having interchangeable bits, and a replaceable element. In the author's opinion a "quick-heat" iron rated at about 250 watts is not a good bargain, especially when using it with transistors, and, of course the price is much higher. If a 25 watt iron is thought too light as in the case of constructors making up their own chassis, then a 65 watt iron will be large enough.

Tools

Buy the best tools available; not only will they last longer and keep their edge longer, but will not slip or become loose fitting in their handles. Multiple screwdrivers are not to be recommended, as the quality is sacrificed for the novelty, and the separate blades are soon lost. A basic tool kit could be as follows:—one 8in. screwdriver ¼in. blade; one 4in. screwdriver ⅛in. blade; one neon screwdriver 500 volt rating; three Phillips (crossed head) screwdrivers, small, medium and large tips; one pair insulated electricians' heavy duty pliers; one pair long nose pliers; one pair side cutters; one pair "Bib" wire strippers; one good pocket knife; one set B.A. spanners. These tools should have a rack made for them and should be returned to this rack immediately after use, to stop them rolling under equipment being used, tested or constructed. (See Fig. 1.) An excellent rack can be made from a strip of wood and some Terry clips.

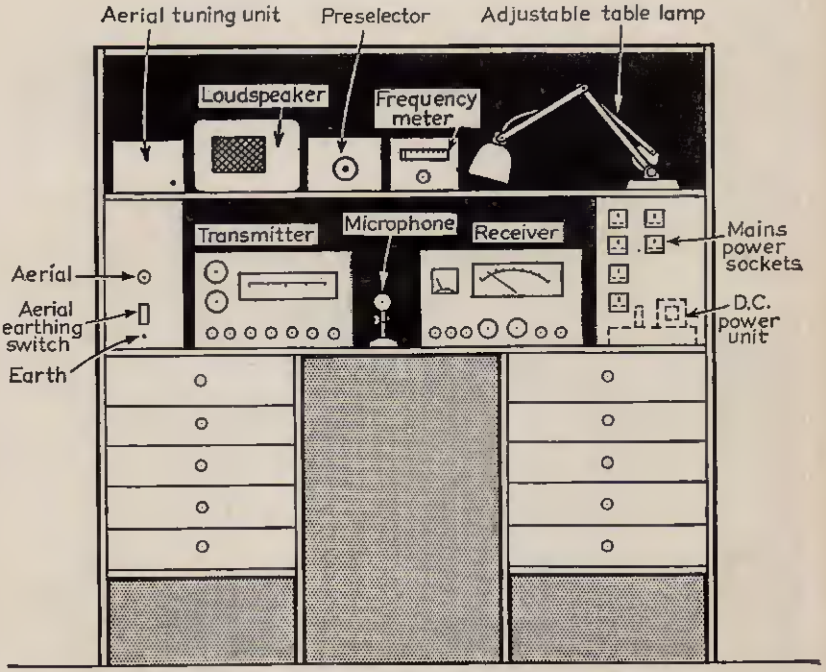


Fig. 2: Possible arrangement for the SWL or "Ham".

Equipment

Here again buy the best available. However in this section price alone is not a good guide to the equipment's quality. Buy a well-known make, and the quality will speak for itself. The actual equipment will depend on what the enthusiast decides to concentrate, so only a basic list is given.

The best position is with the light on one side of the bench to avoid glare, especially with a window. Lighting should not be fluorescent, as this type of lighting can cause severe radio interference. The author considers that a light of the "Anglepoise" type is almost as good as the fluorescent light, as the fact that it will throw a shadow is offset by its "manouvrability". A window along the adjacent wall will give a good light during the day, and, perhaps more important, aerial and earth leads can be taken straight outside instead of trailing round the room to the window, picking up hum on the way. The proximity of a window will be very helpful when trying new aerials.

Space

The efficient use of space requires much thought, and as everyone's taste is different, again only a basic idea is presented. With today's miniature transistor equipment, it may be possible to operate a transceiver from a floor-standing ashtray, but most of us will need more space. Two suggested layouts are in Figs. 1, 2 and 3. Fig. 1 is for the home constructor, and Fig. 2 for the licensed amateur, or, without the transmitter, for the s.w.l. If commercial only gear is used, then the drawers and shelves can be left out, except those needed for books, etc, and the rig placed on a small table against the wall, with enough space for books and charts.

If the bench is to be made from scratch, the best height will be determined by the chair with which it is intended to be used. The chair should be comfortable without causing backache when used for considerable periods! The bench should be well made, as it will have to support a lot of weight, and a few shillings saved now may be pounds spent later when the bench collapses with costly equipment on it. The main point in most stations is the receiver, and this should be placed so that it can be operated for long periods without eye or arm strain. To this end, the receiver tuning dial should be directly in front of the eyes, to avoid parallax error, and should be evenly lit, to avoid eye-strain. The tuning knobs should be about four inches from the bench, and operated with the elbow resting flat on the bench, this position being much less tiring than any other. To make the best of this the receiver should be about one to two feet back on the table. Space should be left for the log, microphone, key, etc., without being cramped. All dials and meters should be within reach while sitting at the bench, and all readable. To achieve this try to get the radio equipment in the right angle of the joint of two walls (see Fig. 3). The bench top should be covered with hard rubber to guard against shock, and should be jointless, to stop dust, bits of solder, and small bolts and screws being lost.

Storage space is most important, and one soon accumulates parts such as nuts, bolts, springs, washers, resistors, coils, switches, etc., and a way must be found to keep them tidy. Small boxes can be stacked on a shelf, a nest of component drawers bought, and stood on the floor or a table, or if the bench is home made, a number of shallow drawers (4in.—6in.) should be constructed. This last method is the method used by the author, and if compartments are added to some drawers, then almost anything can be kept within reach. If the floor space is available, by all means expand outwards, but the only way for many amateurs is up, so make sure all shelving is really safe to carry what is placed on them. Oscilloscopes are cheap compared to the price of human life and limb! Keep the heavy stuff down near the floor, and put only the lighter equipment and boxes on the higher shelves. There is no point in wasting space by having deep shelves and then stacking only at the front, so make the shelves about 6in. wide, bearing in mind what is written above. Some wall space should be left free for charts, maps (great circle maps are best for "DX'ers"), and QSL cards.

Surplus

Spare components can be obtained very cheaply by cannibalising old receivers and ex-Government equipment. Chassis and old parts such as resistors and small capacitators can be re-used, but beware of re-using old electrolytics, these are best bought new. If a use can be found for 3-phase 400c/s motors, all the better, but the experience gained in dismantling old equipment is much more valuable, especially with regard to component layout. If receivers and other equipment are repaired, space should be left in the workshop for these also. Note to the beginners, now. Don't work on a live or even plugged in set, either with soldering iron or screwdriver, it can be dangerous to the extent of killing you!

Secondly, don't be too miserly with cannibalised equipment, or the workshop will look more like a wholesalers than a place for one of the most interesting hobbies there is. ■

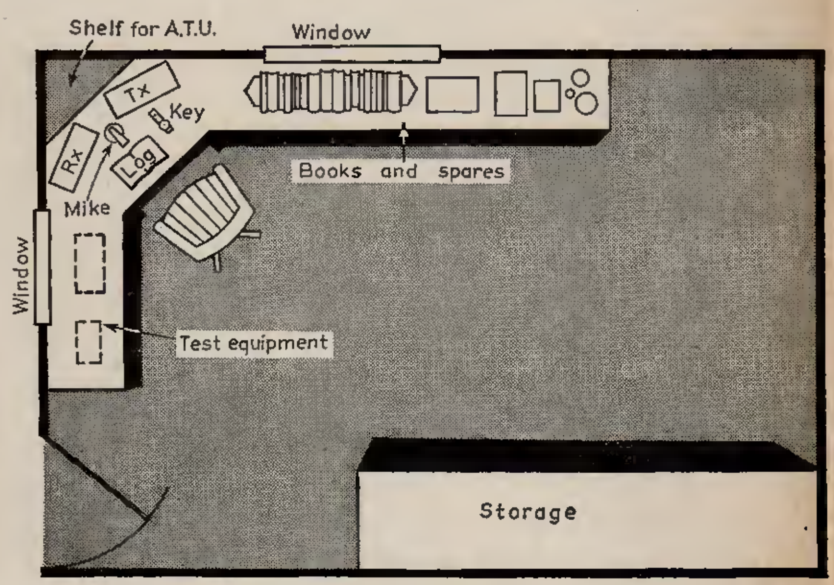
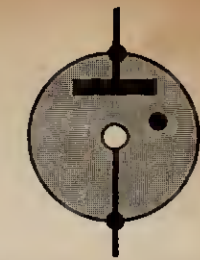


Fig. 3: Layout for a "shack" in the house.

PUSH PULL NEON DRIVER



A. J. BASSETT

SINCE publication of the "Low Voltage Neon Indicator" article in the June, 1966 issue of *Practical Wireless,* several readers have enquired as to the feasibility of a more powerful push-pull transistor circuit whose output would be sufficient to drive a neon bulb. A further suggestion from one reader was that the device should cause a glow around both electrodes of the neon tube. One or two readers sent along their own suggestions for such a circuit and these were quite good, but unlike that submitted here, used capacitive cross-coupling of the transistors, and were thus more expensive to build.

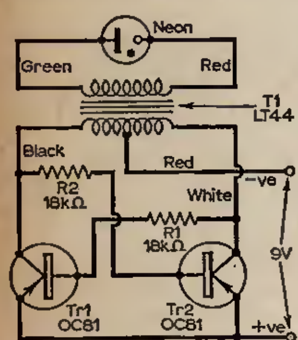


Fig. 1: Complete circuit of the push-pull neon driver.

The device consists of an inductance/resistance tuned oscillator, whose circuit is shown in Fig. 1; no capacitors are necessary for tuning purposes. This type of oscillator is sometimes used for "battery-to-mains" transistor inverters, for which purpose the components used have larger power-handling capacities than those specified in this article.

The output waveform is a square-wave with plenty of overshoot as Fig. 2a depicts. Fig. 2b shows the waveform after it has been "clipped" by the firing of the neon. The small "pip" on the leading edge is due to the fact that the neon does not fire until a voltage is reached which is slightly higher than the steady burning voltage of the lamp.

In comparison with the device described in the June issue, this push-pull neon driver is more powerful, and so consumes a lot more current; 20 to 50 mA or more according to the load and other operating conditions. This is sufficient to light several neon indicators in parallel if series resistors are used, or one neon without a series-resistor will light up quite brilliantly, with illumination provided at both electrodes. By using the circuit of Fig. 3 it is possible to light two neon tubes, each at one electrode. The peak voltage available from the oscillator when off load is over 150 volts; more than adequate to fire most of the miniature neon bulbs which are available.

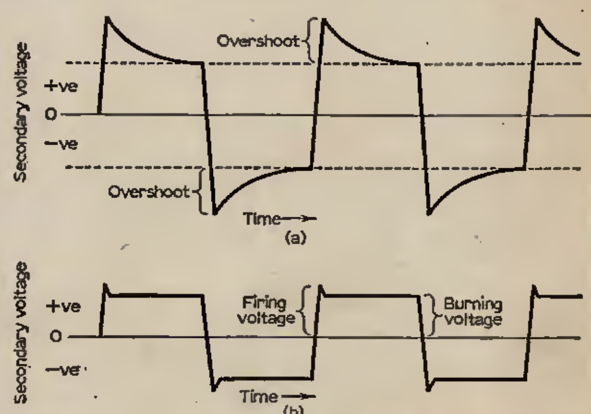


Fig. 2a: Output waveform showing clearly the overshoot on both peaks.

Fig. 2b: The same waveform after clipping.

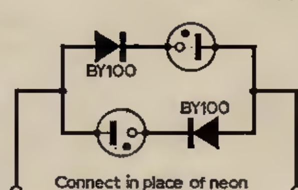


Fig. 3: Modification allowing the use of two neons.

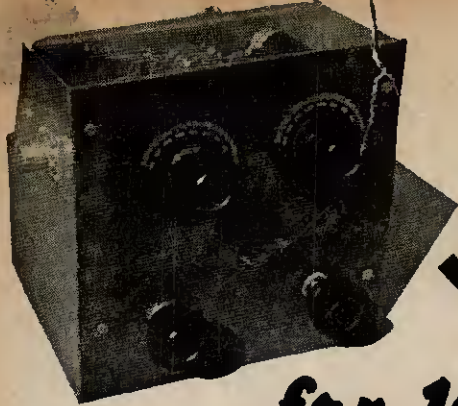
As with the previous article, component layout is left to the ingenuity of the reader, and should present few problems. Due to the simplicity of the circuit, the small size of the components, and the fact that the layout is not critical, the neon driver may be built into quite a small space. ■

RECEIVING THE BBC STEREO PROGRAMMES

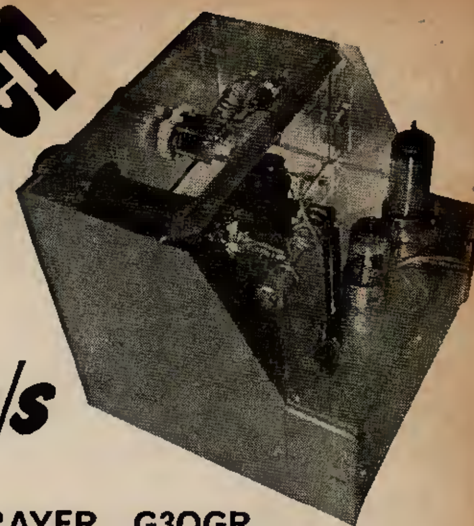
For some inexplicable reason, the grid of the triode of the circuit in Fig. 7 and the collector of Tr4 in Fig. 8 (article of the above title, December, 1966 issue, page 857) are labelled respectively "from collector of Tr4" and "to triode grid of ECF80".

These markings are, of course, incorrect, and the corresponding points relate to suitable connections for a stereo indicator, which in the article are referred to as points "A".

While the error will be obvious to most readers, some may be confused and think that, perhaps, the valve circuit must be partnered with the transistor circuit. This, of course, is not true as the two circuits are entirely separate.—K. Royal.



receiver for 144 Mc/s



F.G. RAYER G3OGR

IN a super-regenerative receiver regeneration is advanced far beyond the point where oscillation commences, but is interrupted at a frequency above audibility. This provides very high sensitivity. The super-regenerative receiver described here uses easily obtainable valves, and tunes approximately 142-150 Mc/s with the coils employed. Coverage can readily be modified by altering the coils.

A 954 acorn valve is used for r.f. amplification, and to help isolate the oscillating stage from the aerial. Output is coupled to L4 by L3. V2 is the detector. Grid rectification causes a negative grid potential which stops oscillation until the charge has leaked away through R3, when oscillation recommences. The values of R3 and C4 allow this to happen at above audible frequency.

VR1 adjusts regeneration by varying the h.t. voltage applied to V2. In a super-regenerative detector a loud hiss is heard when no signal is present, but this almost ceases when a signal is tuned in. V3 is an audio amplifier, and V4 the output stage.

For smooth regeneration and lack of various feedback effects, a separately decoupled h.t. supply was found necessary for V1 and V2. This is preferably obtained from a voltage regulator, but satisfactory results are possible by voltage dropping from the 250V line as shown in Fig. 6.

Chassis layout

The prototype chassis was 6 x 6 x 3 in. deep. The panel is supported by large brackets, and these also brace the vertical screen carrying V1, V2 and VC2 (see Fig. 2). This provides a front section with V1 grid and other circuits, while V1 anode and V2 holder tags are behind. The audio stages V3 and V4 are on the chassis.

The vertical screen can be largely wired in advance. Punch holes for VC2, V2 holder, and a clearance hole for V1 (Figs. 3 and 4). The connections in Fig. 3 are when viewing the acorn valve from its shorter or grid end (also see Fig. 2). Care *must* be taken when soldering, or the valve seal will be broken by heat. Leads are shaped and cut so that there will be no strain on the valve pins, and they are tinned with solder. C1 and C2 have

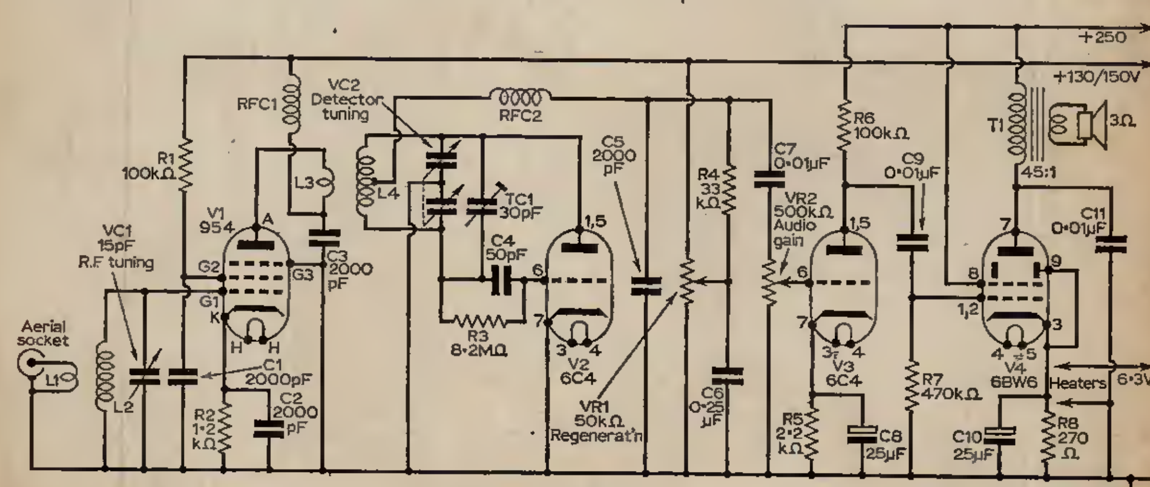


Fig. 1: Circuit diagram of the receiver section.

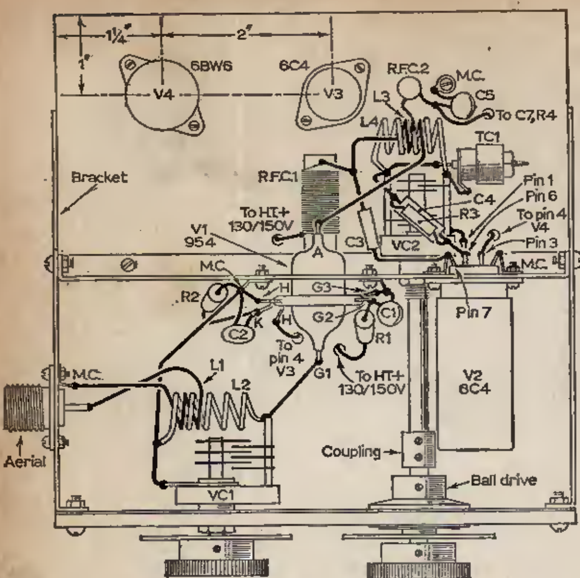


Fig. 2: Top view of chassis layout. Note the positioning of the components. At these high frequencies the shortest possible leads should be used.

the shortest possible wires. Clean the valve pins, if necessary, and tin the *extreme ends* with cored solder and a hot iron, which is removed *immediately* the solder flows. The valve is then soldered in as in Fig. 3, with equal care.

Fig. 4 shows the rear of the screen, leads to V2 and the items in the tuned circuit are kept as short as possible. Fit soldering tags so that tags 4 and 7 of V2 holder may be soldered to them without wire, (Fig. 2). Tag 1 goes to VC2 at its nearest point (Fig. 2).

Capacitor modification

VC2 has four moving plates, and two fixed plates, isolated from each other. It was made from a 75pF short wave variable capacitor. The spindle retaining clip was pulled out with a pointed tool, and the spindle and moving plates withdrawn. Unwanted plates were removed from the spindle by bending them from side to side with small flat nosed pliers. If the capacitor has plates assembled on threaded rods, with spacers, it should be taken apart to remove the plates. The rotor had nine moving plates. Counting from the back, leave plates 1, 3, 6 and 8, and remove the others. Remove all the fixed plates one at a time, and note that the capacitor is not a type with the two fixed plates supports joined by a metal strip in front. Replace the spindle. Prepare two fixed plates by cutting off one lug of each. Put one such plate between the front pair of moving plates, and solder it to one support. Put the other plate between the rear moving plates, and solder it to the other support. Each section of VC2 is thus a single fixed plate between two moving plates, double spaced. The capacity is approximately 5pF each section.

The screen is bolted as in Fig. 2. A coupling and piece of ¼ in. rod couples VC2 to the ball drive, which occupies a hole in the panel. The latter was varnished hardboard backed by aluminium sheet. VC1 has no reduction drive.

Details of winding the coils are as follows: L1; 2 turns of 18 or 20 s.w.g. insulated wire, and placed between the turns of L2. L2; 4½ turns of 16 s.w.g. enamelled or bare wire, spaced to ¾ in. long. L3; 2 turns of insulated wire at the centre of L4. L4; 5 turns of 16 s.w.g. wire spaced ⅞ in. long. All coils are 7/16 in. outside diameter.

To make L2 and L4, straighten the wire and wind turns side by side on a suitable object. Run a small tool round and round between turns, or stretch the coil to the required length. Shape and cut the ends and solder them to the appropriate points. L1 and L3 are made in the same way and fitted as in Fig. 2.

RFC1 is 70 turns of 34 s.w.g. enamelled wire, close wound on a 5/16 in. diameter former. It was a push fit on a bolt attached to the vertical screen. Adhesive is applied to the ends of the winding only.

RFC2 is wound on a 2½ in. piece of ¼ in. diameter insulated rod. Secure 34 s.w.g. enamelled wire near the top. Wind 70 turns side by side and again secure with adhesive or tape. Bind the extreme bottom of the rod with a few turns of bare wire, and solder on a tag bent at right angles. This tag is bolted to the chassis, and is an earthing point for C5 (Fig. 2). Solder the top choke lead to the centre of L4. Other v.h.f. type chokes should be satisfactory.

Audio amplifier

The audio and output stages are wired as in Fig. 5. Any slight leakage in C7 or C9 will upset the audio stage grid voltages, therefor these capacitors should be tested if not new. A tag strip anchors the two h.t. positive supply leads. Insulated leads for power supplies and speaker pass through a

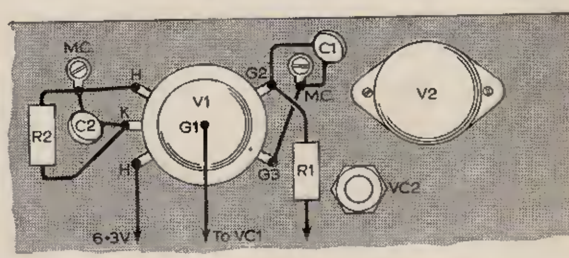
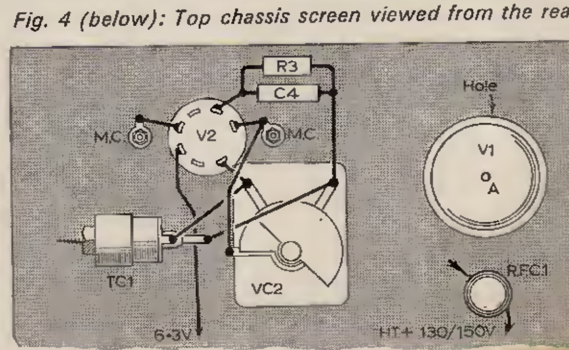


Fig. 3 (above): Top chassis screen viewed from the front.

Fig. 4 (below): Top chassis screen viewed from the rear.



hole in the chassis. If the speaker transformer is separate, and not attached to the speaker, the transformer could be bolted to the chassis underneath, near V4. When using a speaker with transformer attached, remember that the h.t. voltage is present on connections from receiver to transformer primary.

Current can probably be taken from an existing power pack. The heaters require 0·9A at 6·3V. The audio stages draw approximately 60mA at 250V. Current required at the 130-150V point is small, depending on the setting of VR1, and averages about 4—6mA.

Power supply

A suitable power supply circuit is shown in Fig. 6, and can be modified in some cases to suit items to hand. The 6·3V winding may be rated at more than 1A. If this winding can supply 2A or more,

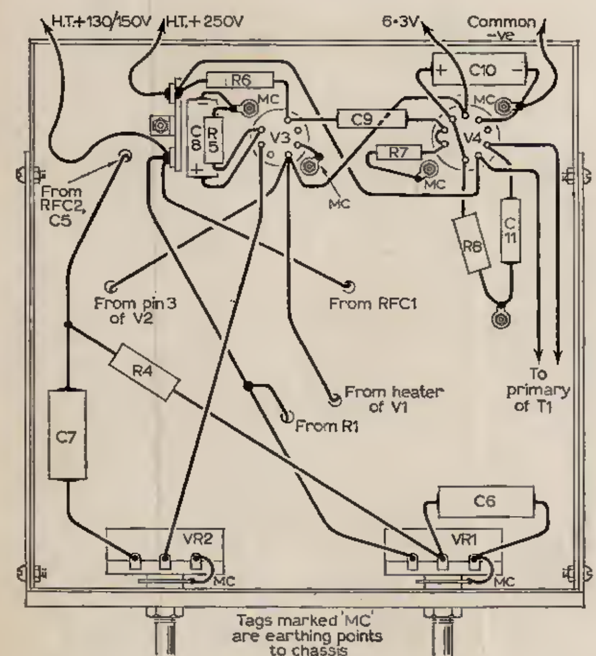
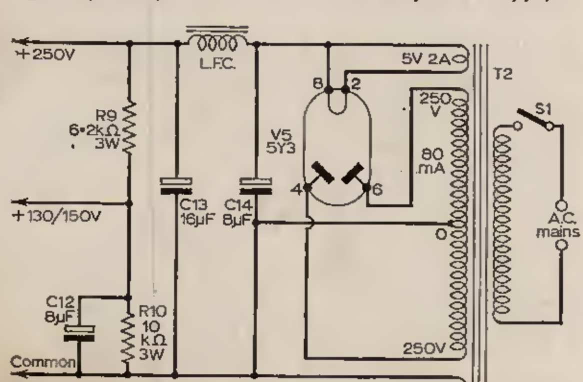


Fig. 5 (above): Under chassis wiring of the receiver.

Fig. 6 (below): Circuit of a suitable power supply.



★ components list

Capacitors:

C1	2000pF 150V disc ceramic
C2	2000pF 150V disc ceramic
C3	2000pF 250V disc ceramic
C4	50pF mica
C5	2000pF 250V disc ceramic
C6	0·25μF 250V paper tubular
C7	0·01μF ceramic or mica
C8	25μF 12V or similar electrolytic
C9	0·01μF ceramic or mica
C10	25μF 25V or similar electrolytic
C11	0·01μF 350V
C12	8μF 350V electrolytic
C13	16μF 350V electrolytic
C14	8μF 350V electrolytic
VC1	15pF variable
VC2	5+5pF variable (see text)
TC1	30pF air spaced concentric trimmer
VR1	50kΩ linear pot.
VR2	500kΩ log pot.

Resistors:

R1	100kΩ ½W	R6	100kΩ ½W
R2	1·2kΩ ½W	R7	470kΩ ½W
R3	8·2MΩ ½W	R8	270Ω 1W
R4	33kΩ ½W	R9	6·2kΩ 3W
R5	2·2kΩ ½W	R10	10kΩ 3 watt

Valves:

V1	954 acorn	V4	6BW6
V2	6C4	V5	5Y3
V3	6C4		

Miscellaneous:

Two B7G holders, One B7G screen, B9A holder, L1, L2, L3 and L4, RFC1 and RFC2, see text, Ball drive, Co-axial socket, 10H 80mA choke, Mains transformer 250-0-250 at 80mA, 5V at 2A, 6·3V at 1A, Switch 1 pole 2 way, 4-sided chassis 6 x 6 x 3in., 6 x 3in. flanged runner (Home Radio), 6 x 6in. panel, Two panel brackets about 5 x 5in., Knobs, tag strip, etc.

and there is no 5V winding, a 6·3V rectifier such as the EZ81 can be used, in which case the rectifier cathode is taken to the h.t. smoothing choke only, and all heaters are then in parallel.

H.T. drain can be kept down to a suitable level for a 60mA transformer by using 12kΩ and 20kΩ resistors instead of 6·2kΩ and 10kΩ, and by increasing R8 to 330Ω. Smoothing capacitors need not be the values shown, and can be 350V or 450V. The choke is any small 60mA or 80mA smoothing type. The power supply is built on a separate chassis, size to suit individual components.

Receiver adjustment

With L4 wound as described, TC1 is almost completely open for the 144Mc/s. band. A very small adjustment of TC1 has considerable influence on waveband coverage. Later, it can be rotated

—continued on page 773

WIDE RANGE SIGNAL

95 KC/S — 85 Mc/s

THIS generator is suitable for receiver calibration and alignment, and for quick stage-by-stage checks of r.f., i.f. and audio circuits. Unmodulated (c.w.) or modulated r.f. output is available on fundamentals through all frequencies from 100kc/s to 80Mc/s, and harmonics may be used up to 160Mc/s.

Figure 1 shows the circuit, which is for a.c. mains operation. The 6-way switch S1A and S1B selects any of six coils (L1 to L6) which are tuned by VC1. The coverage obtained by the author was as follows, but the extreme ends of each band are unused: Band 1, 95-360kc/s; Band 2, 280-1050 kc/s; Band 3, 890kc/s-3·3Mc/s; Band 4, 2·4-10·5Mc/s; Band 5, 7·25-36Mc/s; and Band 6, 30-85Mc/s. All ranges are with the full 180-degrees rotation of VC1, except for Band 6, which is covered by approximately half-capacity (90-degrees rotation). All the coils are of fixed inductance, to avoid possible loss of calibration.

One triode section of the 12AU7 acts as r.f. oscillator, with output from the cathode via C3 to the 6BA6 amplifier and mixer. The remaining triode section functions as an audio oscillator, with injection to the 6BA6 suppressor grid; VR1 allows control of the output. The 3-way switch S2A and S2B provides oscillator switching.

A small convertor type mains transformer supplies h.t., the drain being about 20mA at 165V. The two heaters need 6·3V, 0·6A. The h.t. line voltage is not too important, but oscillation may cease on Range 6 if this is much under 160V.

Case

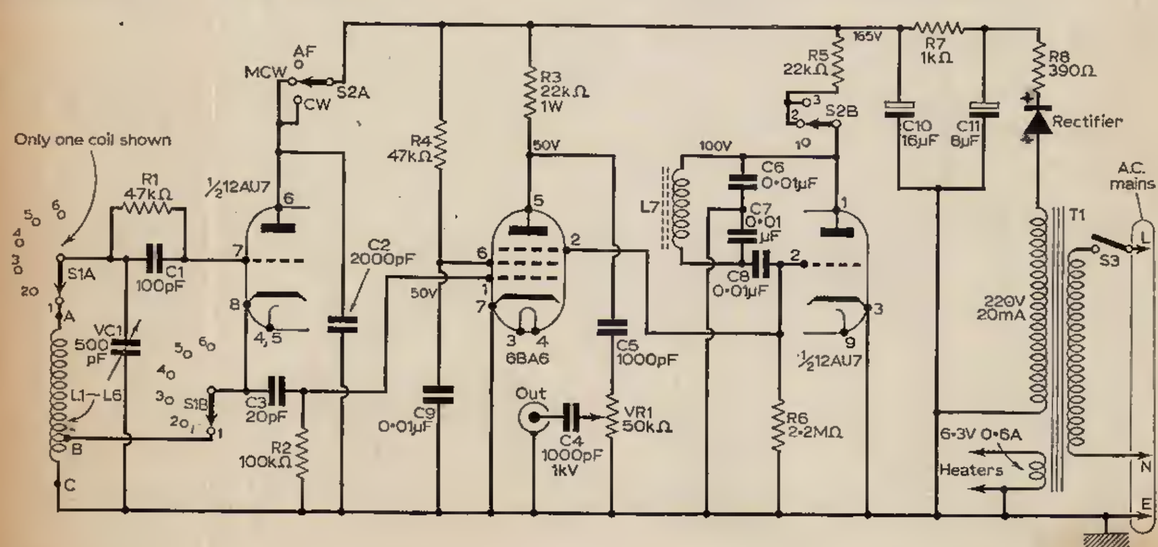
A neat, strong and inexpensive aluminium case was made by the author from "Universal Chassis" members; using two 10 in. x 3 in. runners, two 8 in. x 3 in. runners and two 10 in. x 8 in. plates. Assembled, these provide a cabinet measuring 10 in. x 8 in. x 3 in. A further 10 in. x 3 in. runner acts as chassis.

A different cabinet or case already to hand could probably be used and the layout is not likely to prove critical except for the r.f. oscillator.

The 10 in x 3 in. runner has its corners cut so that the case sides will fit (Figs. 2 and 3) and it is bolted to the panel so that its surface is 2¼ in. from the lower edge. The valveholders and mains transformer are fixed as in Fig. 2. VC1 is attached to the panel with three countersunk bolts; spacers being placed between panel and capacitor. A well insulated lead is soldered to the lower fixed plates tag before mounting the capacitor, and this passes directly through a hole in the chassis. A short lead also connects the rotor contact tag to another bolted to the chassis. Nearly all wiring is done before fixing the case sides.

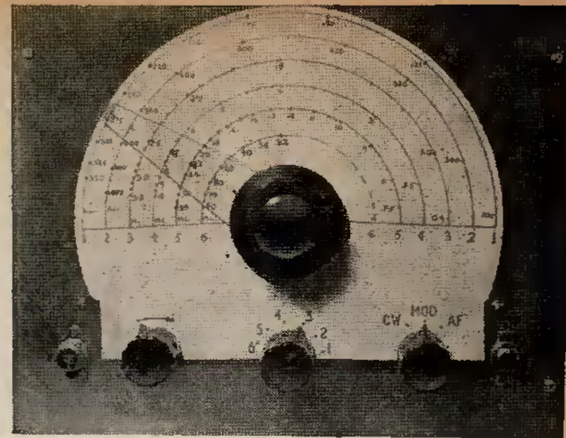
Under the chassis

Wiring and components are shown in Fig. 3. Place the bandswitch so that the shortest possible leads may be used from S1A to R1, C1, and tag 7 of the valveholder. Leads to C2 should be very short, and also from tag 8 (cathode) to S1B.



GENERATOR

R. F. GRAHAM



Heater and h.t. lines can run against the chassis. A tag strip was used as anchor points for C7 and the leads from L7. All wiring should be rigid, the coils being left until last.

The function switch can be wired from Fig. 4. Section S2A applies h.t. to the r.f. oscillator in both "CW" and "MOD" positions. Section S2B supplies the audio oscillator with h.t. in both "MOD" and "AF" positions.

Audio choke

L7 is an audio choke, the capacitors C6 and C7 providing an effective centre-tap. A small transistor receiver output coupling transformer was used by the author, whilst almost any transistor driver transformer or other small audio choke or transformer could be employed. The winding carries no direct current.

If the component has more than one winding, each winding can be tried separately, or both can be used in series, reversing connections to one if necessary. This allows the tone produced to be modified. It is also possible to lower the pitch by increasing the values of C6 and C7, or raise it by reducing these values. When first testing the generator, it is best to listen to the audio output with headphones.

Coils

In view of the large number of turns, ready-made coils were used for Bands 1 and 2. The coils for Bands 3 to 6 were home wound. Each coil has a single winding (or easily-arranged equivalent) with A going to S1A, tapping B to S1B, and the end to chassis (see Fig. 5).

As it is difficult to tap small ready-made coils, extra turns were added for Bands 1 and 2. These extra turns can be looked on as a continuation of the main winding, and are in the same direction. Therefore the earth end of the original winding is now joined to the beginning of the extra coil, and forms the cathode tap B. The end of the new winding C goes to chassis.

Band 1 (100-350kc/s) This was a surplus long wave aerial type coil, with 6 turns added to provide a tapping, as already described. A piece of ferrite rod 3/8 in. in diameter and $1\frac{1}{2}$ in. long was pushed into the coil and cemented. Another coil was also found suitable, with tuned and coupling windings connected in series to increase the inductance. An unmodified l.w. coil can be expected to give coverage to about 150kc/s.

Band 2 (300-1,000kc/s) This was also an old long wave aerial coil with the coupling winding and core removed, and some turns unwound until suitable coverage was obtained. Five turns are re-wound to give a tapping five turns from earth.

Band 3 (Calibrated 0·9Mc/s to 3·3Mc/s) This is 74 turns of 32 s.w.g. d.s.c. wire, found in a compact pile on a $\frac{1}{2}$in. diameter former (Fig. 3); tapping B is six turns from C.

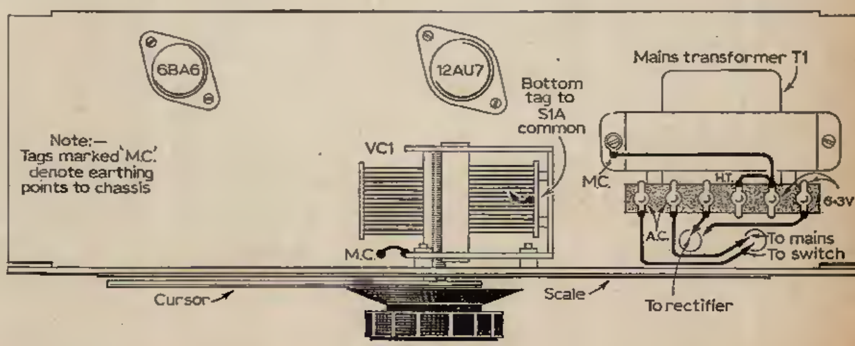
Band 4 (2·5-10Mc/s) This coil has 50 turns of 32 s.w.g. enamelled wire, side by side on a $\frac{1}{2}$ in. diameter former, with tapping B two turns from C.

Band 5 (7·5-34Mc/s) This is also on a $\frac{1}{2}$ in. former, and has seven turns of 24 s.w.g. enamelled wire side by side, with tapping B one turn from C.

Band 6 (32-80Mc/s) This is $3\frac{1}{2}$ turns of 16 s.w.g. wire $\frac{1}{2}$ in. outside diameter and $\frac{5}{8}$ in. long. End A

Fig. 1: (Left) Complete circuit diagram of the wide range signal generator.

Fig. 2: (Right) Top view of the chassis.



is ¼in. long and end C is ½in. long, soldered directly to switch and a tag bolted to the chassis (Fig. 5); tapping B is 1½ turns from C.

All the coils, except that for Band 1, are air-cored. Various ready-made coils are likely to be satisfactory. If those with cores are employed, it makes it easier to obtain correct coverage, but the cores must be sealed before calibrating the generator.

Bandswitching

Connections are shown in Figs. 3 and 4. Leads to the Band 5 coil should be as short as possible. For Band 6, the coil is placed and connected as shown in Fig. 5. The switch has two wafers, and should be connected as in Fig. 4 so that the shortest possible circuit is obtained for Band 6.

It was found that with a smaller coil for Band 6, giving coverage up to 100Mc/s, r.f. oscillation tended to cease towards the top end. Oscillation was maintained up to over 85Mc/s with the coil shown and thus the second harmonic allows output up to 170Mc/s.

Each coil is electrically separate from the others, so can be checked or modified individually, if necessary. No changes should be made after calibration, of course, and the whole instrument should be kept in its case.

Scales and cursor

A semicircular scale of thin white card (7¾ in. in diameter) cemented to the panel was used by the author. The cursor was cut from perspex and fixed to a *large* knob by three self-tapping screws. A hair-line was scribed along the underside of the cursor and six equally-spaced 1/16th in. holes drilled on this line, so that calibration marks could be made by placing a pencil point in them.

The knob, with cursor, is locked to the capacitor spindle. The six semicircles can then be drawn by placing a pencil or "Uno" type pen in the appropriate holes. Mark with dots maximum and minimum settings on the outer scale, so that the cursor can be replaced correctly if removed.

The holes were also found very helpful when calibrating the generator. Markings were made in pencil, then in ink after a final check. With care, the accuracy should be at least equal to that of the popular type of "off-the-shelf" generator. There are several methods of providing calibration, depending on the equipment to hand.

Use of harmonics

Calibration of the generator (or a receiver) may be aided by employing generator harmonics; multiples of frequency. If a receiver is tuned to the long wave Light Programme, this is 200kc/s. With the switch at CW, tune the generator until its output heterodynes with the Light Progamme signal. This is easily done by using Range 1, closing VC1 from minimum position. The heterodyne whistle on the receiver falls in pitch towards the correct generator tuning point, rising again as this point is passed. This will also happen with harmonics. The receiver merely compares the generator and Light Progamme (or other frequency standard) signals. The generator can thus be calibrated at 200kc/s. Further rotation of VC1 will produce a similar heterodyne. This is 100kc/s (VC1 nearly closed) and can be marked.

With the generator returned to 200kc/s (zero beat with Light Programme) its output can be tuned in on the receiver at multiples. That is, 400, 600, 800kc/s, and so on. If the generator is tuned to 100kc/s as described, its harmonics appear at 200, 300, 400, 500, 600, 700kc/s, and so on. This allows accurate calibration of a receiver at 100kc/s points.

By tuning the generator to 200kc/s (zero beat with Light Programme) 1Mc/s can be found accurately on the receiver (5th harmonic, 300 metres on medium waves). If receiver tuning is then left untouched, the generator can be tuned to 1Mc/s in Ranges 2 and 3. This can be marked. So can generator frequencies providing harmonics on 1Mc/s. That is, 500kc/s, 250kc/s and 125 kc/s. The receiver can also be tuned to harmonics 1Mc/s, allowing calibration at 2, 3, 4, 5, 6Mc/s, and so on.

When proceeding in this way, an all-wave receiver with a large dial is very useful. A t.r.f. receiver with regeneration just sufficiently advanced to cause a heterodyne is perfectly satisfactory. A superhet should have some form of tuning indicator, or a b.f.o.

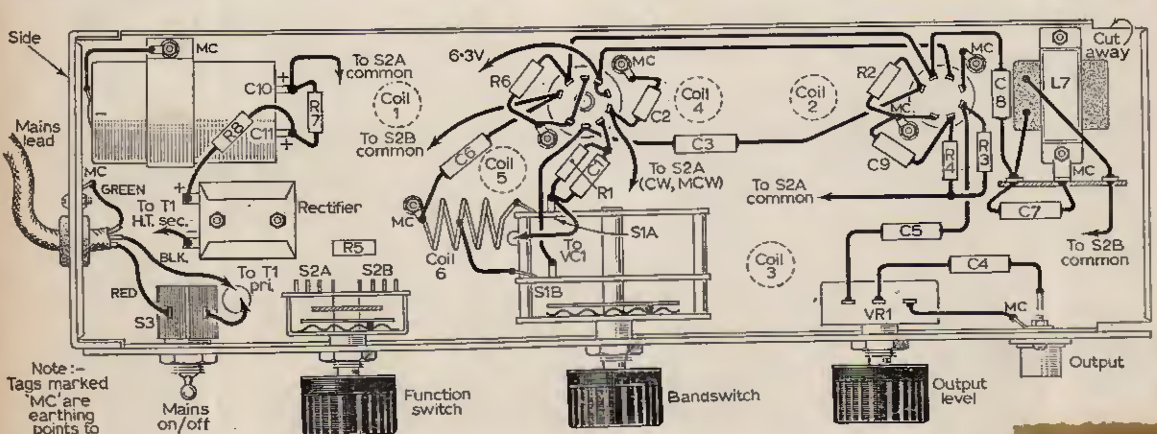


Fig. 3: This drawing shows the underside wiring.

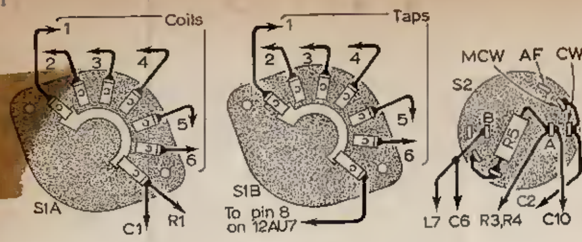


Fig. 4: S1A & S1B switch connections.

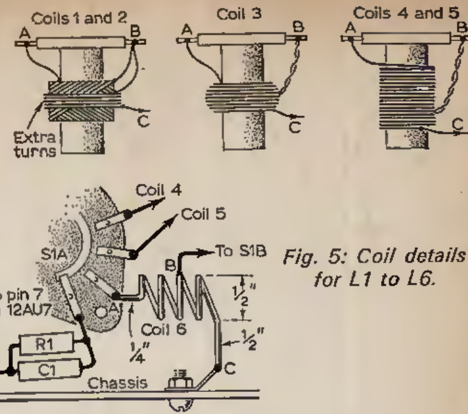


Fig. 5: Coil details for L1 to L6.

To avoid errors, calibrate the generator by beating its output (at a harmonic, if necessary) with a known signal. Working from 200kc/s as described will locate 2·5Mc/s so that M.S.F. on this frequency can be heard (most of the transmission is one second pulses). This allows 2·5Mc/s to be confirmed on the generator, and with its tuning untouched allows, 5 7·5, 10Mc/s and other harmonics to be found on the receiver with great accuracy.

Crystal marker

A 100kc/s or 1Mc/s crystal marker is used by many short wave enthusiasts, and permits quick calibration. Adjust the receiver to marker pips in turn, tune the generator, and mark its scale. By beating generator harmonics with marker harmonics, the scale can be sub-divided as necessary. For example, 50kc/s markings may be found with a 100kc/s crystal if the receiver is tuned to the generator's 2nd harmonic. Then 150kc/s on the generator is 300kc/s on the receiver, while 250 kc/s on the generator is 300kc/s on the receiver, while 250kc/s on the generator is 500 kc/s on the receiver, and so on, the 100kc/s multiples being from the crystal.

To avoid counting off 100kc/s intervals over high frequency bands if a 1Mc/s crystal is not available, the 1Mc/s point can be found from the 100kc/s crystal, then used to mark 1Mc/s points, later confirmed if necessary with the 100kc/s harmonics.

★ components list

Resistors: (½-watt except where stated)

R1 47kΩ	R5 22kΩ
R2 100kΩ	R6 2·2MΩ
R3 22kΩ (1-watt)	R7 1kΩ
R4 47kΩ	R8 390Ω
VR1 50kΩ potentiometer	

Capacitors:

C1 100pF	C7 0·01μF
C2 2000pF	C8 0·01μF
C3 20pF	C9 0·01μF
C4 1000pF, 1kV	C10/C11 16/8μF or
C5 1000pF	similar 350V electrolytic
C6 0·01μF	
VC1 500pF air spaced	

Switches:

S1A/S1B 2-wafer, 2-pole 6-way
S2A/S2B 2-pole 3-way

Valves:

12AU7 (or ECC82) and 6BA6

Miscellaneous:

L1-L7 as described, B9A holder, B7G holder, coaxial socket, mains on/off switch, 250V 25mA contact cooled or similar rectifier (½-wave), mains transformer (220V 20mA HT ½-wave, 6·3V 0·6A), Universal Chassis box 10 x 8 x 3 in., 10 x 8 in. back plate, 10 x 3 in. extra runner, mains cord, tag strip, etc.

Accuracy

Any equipment should be switched on for 20 minutes or so, before using it to calibrate the generator, which should have also thoroughly warmed up. As the calibration procedure only has to be done once, care should be exercised. There is usually no need to rely on visual re-setting of the receiver or generator, during calibration, because settings are found by heterodyning the signal or its harmonics.

Wavemeter or G.D.O.

Various surplus and other wavemeters of good accuracy are available. If one is to hand, and has a milliammeter indicator, it can be used by coupling it as loosely as possible to the generator coil. This gives a quick method of calibrating the scales lightly in pencil, as a useful guide to subsequent more accurate calibration as previously described.

A grid dip oscillator can be used in the same way, the signal generator being switched off. Couple the g.d.o. lightly to the appropriate coil. If this is done carefully, with an accurate g.d.o., results will agree very nearly with final calibration, and are thus a useful guide to avoid counting harmonics.

Calibrated generator

If a calibrated generator of sufficient accuracy can be brought into use, tune it in on a receiver, and tune the home-built generator to the same frequency, marking the scale. Remember that the

—continued on page 769

Imported Receivers

WITH reference to Mr. Pryse's letter on page 564 of the December issue of PRACTICAL WIRELESS, I should like to clarify a few points.

Lafayette receivers are NOT manufactured in New York, they are made in Tokyo, Japan, for their own subsidiary in New York which merely acts as an outlet to the trade. However, I do feel that the retailers in the U.S. could have replied though Mr. Pryse states to the contrary. This may be due to his letter having been referred to Japan.

Further to the above remarks, I think that the British dealers who sell knowingly Japanese products under the guise of American ones deserve exposure, and do not accept ignorance of facts as an excuse. No self-respecting dealer buys from an unknown source—though with what I think is junk being offered in the way of so-called kits, I do not believe that there can be many self-respecting radio component dealers in this country.

Cpl. T. K. Offord. Shrewsbury, Shropshire.

Communications through the ground

SOME time ago I made some experiments with 4 watt amplifiers for ground communications. I found that 200 yards was about the limit of these amplifiers. I then tried using a pair of AC2PEN DD valves in push-pull; this being little better. When I added a d.c. bias to the signal, I was received slightly more than half a mile away. (My earths are about 30 yards apart.)

I then thought of discarding my equipment which was made up of bits and pieces from the junk box and investing in some new components with which to build a somewhat more powerful circuit suited better to ground communications.

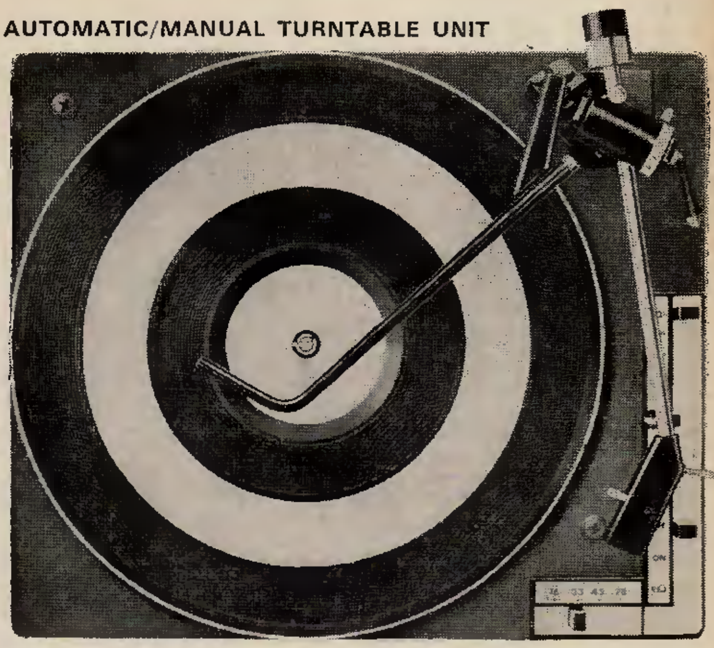
Before taking this step, I thought it wise to make sure that the use of high-power transmitters would not contravene any of the GPO licensing laws, so I wrote to the GPO at St. Martin's-Le-Grand, who informed me, and I quote, "that this particular system is licensable under the Wireless Telegraphy Act of 1949. Before we could consider an application for a licence authorising its use, we should need to know the purpose of the installation and the type of messages you would propose to pass."

I hope that this information may be of use to those readers who may dabble in the fascinating subject of Ground Communication.

A. J. Clapton. Trowbridge, Wiltshire.

NEWS AND..

AUTOMATIC/MANUAL TURNTABLE UNIT



The UA70 is a new auto/manual unit designed by BSR. The 11in. diameter turntable is driven from a dynamically balanced, four pole induction motor located on butyl rubber mountings. The low mass pickup arm, supported on horizontal ball bearing pivots, is of lightweight tubular aluminium and is counter-balanced vertically and laterally. After balancing, the stylus pressure is set by a rotary stylus pressure control calibrated from 0—6 grammes. A mechanical cueing device allows the pickup to be raised or lowered at any selected point on a record when it is played manually.

Another feature is the automatic pickup lock which secures the arm to its rest when a record has been played.

Any standard mono or stereo cartridge may be fitted but the BSR C1 ceramic cartridge is ideally suited to this unit. Wow is below 0·2% r.m.s. Flutter, below 0·06% r.m.s. and rumble is −29dB at 1kc/s. Finish is in satin black with black turntable mat inlaid with brushed aluminium rings. Price is £12.18s.3d. without cartridge.

"BUYING SECONDHAND"

"Buying Secondhand" is one of the newest in the Consumers' Association paperback Consumer Publications series. It suggests where to look and what to look for when you are buying anything from a camera to a sewing machine and from a television set to a golf club. The section that deals with the buying of secondhand radios and TV's is of great value to the non-technical as it points out all the snags and pitfalls that one may fall into. It makes clear all the points that one may not at first look for and think of when making a purchase and we think that this book would be an invaluable addition to most people's bookshelves. The price is 8s. and it is obtainable from any bookseller or from the Consumers' Association, 14 Buckingham Street, London, W.C.2.

...COMMENT

THE EXHIBITION THAT WASN'T!

Britain's first National Hobbies Fair opened at the Royal Horticultural Society's Hall in London on November 12th. The exhibition terms of reference was hobbies in general—collecting of coins, stamps, models, etc., stands for the do-it-yourself enthusiast; boat building; pottery; marquetry; orchid growing—and amateur radio.

Fired with enthusiasm we went along, principally to have a look at two exhibits of particular interest—the British Amateur Television Club and the Paddington Amateur Radio Society. When we arrived, on the afternoon of November 16, we found that the BATC had fled the scene due, so we were told to "lack of interest by visitors", leaving behind nothing but an empty stand. Shaken but philosophical we looked in on the display of the Paddington radio club. The stand was there all right, complete with the club transmitting station G3PAD/A, but the stand was unattended and draped in a shroud!

Instead we went to see a demonstration of hand-operated printing machines which, if not of radio or TV interest, was at least still alive and kicking.

A NOTE FROM MARTIN ELECTRONICS

Martin Electronics Ltd., regret that they have fallen rather behind with replying to letters from customers.

They apologise for any inconvenience that this may have caused readers and hope the delay will not be too long.

NAVAL OFFICER WINS FOURTH PLACE

Sub. Lt. D. Davies, R.N. won fourth place in an international amateur radio contest organised by the Certificate Hunters Club. In addition to winning fourth place, he won the European title in the contest, open to amateur radio operators throughout the world. During the 54 hours of the contest, Sub. Lt. Davies made contact with 348 stations. The photograph shows Sub. Lt. Davies operating his radio station at his home in Msida, Malta.

S.W. Broadcast Stations

I REFER to Mr. R. Ronai's letter in the December issue on page 588 attacking my letter.

In my opinion he appears to have got hold of the wrong end of the stick. I was not talking about non-broadcast assigned frequencies when referring to Radio Moscow and the like.

The point is that Radio Moscow and others are deliberately filling up the Broadcast Bands with distorted modulation jammers which instantly wipe out stations on at least two adjacent channels—in Cyprus, for most of the time the 25m band was completely useless.

I do not care what frequency a s.w. broadcast station uses so long as it is not in any Amateur Band and in this respect I boycott the 7·0—7·1Mc/s frequencies of Radio Pakistan, Radio Peking, Cairo Radio and any others who have the nerve to use Amateur Band frequencies.

As for the 18150 and 12095kc/s frequencies of the BBC, I immediately spring to their defence as I find in winter that these are the only channels usable.

I am not demanding that you should stop mentioning these stations, but I feel that if you really cared you would.

N. D. Mugford, A4713 Anglesey,
(ex ZC4) North Wales.

Ancient and Modern

I WOULD be interested to learn if any other readers have successfully fitted a modern pickup to an early cylinder-type gramophone. I have an Edison model *circa* 1890 with a number of wax cylinders, most of which are in mint condition.

A.W. Jenner. 53 Clifford Way,
Hounslow,
Middlesex.

Wireless Set 31

I WILL shortly be getting a 31 set, and I would like to ask other readers if they have any useful data on this unit that they could lend me. These sets are advertised as breakdown units, but I would like to get one working rather than break it down for spares.

Charles Cawley. 15 Willow Walk,
Dog In Tree Estate,
Huntington Cannock,
Staffordshire.

practically wireless commentary by HENRY

No. 30

"Whobody did it"

THE prime advantage of sitting on a fence is the all-round view one gets. A service mechanic who is also an inveterate spare-time dabbler treats with greater sympathy the customer bringing electronic oddments for repair after having had a go—and failing. He knows too well the pitfalls and frustrations of kitchen-table surgery.

Not so sympathetic the super-professional, with his spot-checks, stock faults and instant diagnosis. Between him and the amateur there is a constant love-hate relationship. From his position on the rails, like a cowpoke at the rodeo, Henry watches them react with an air of detachment.

The pathetic, defunct receiver lands on the workshop bench

Like a cowpoke at the rodeo.

and A. sniffs around it like a mongrel who scents an unwelcome visitor. He removes the back as if expecting some pop-eyed golliwog to spring up and surprise him. He glares at the works then: "Someone's been at it," he yells.

True enough. Very often someone *has;* the unfortunate owner, in an attempt to circumvent the crippling charges that service carries in these times.

Without test equipment, spares and experience he is handicapped. While he may make his preliminary tests with confidence, there comes a stage when he is beaten. It is easy enough in a well-equipped workshop to whip a valve from the rack to make a proving test—not so simple for the chap who has to justify the inroads into the family budget. And then discover the fault lies a lot deeper and the expense was not justified after all!

* * *

It sometimes seems that the chief enemy of A. is the bloke who ultimately pays his wages, the customer. He is angered by the substitute component dangling precariously from a tag-strip, affronted by an obviously "surplus" valve, offended by crystalline solder joints while one of those emergency circuit alterations (which may even be an improvement on original design) he regards as a personal insult.

But while A. is aggrieved at the outsider's attempts, B. is almost apoplectic. He has the "Whobody did it?" complex developed to a fine degree. At the first sign of tampering, he is likely to threaten to down tools. Something of a perfectionist himself, he cannot bear the sight of someone else's bungling. It takes all the Service Manager's diplomatic guile ("Get at it, mate!") to make him deal with a radio set that has "bounced".

For the benefit of innocent readers who imagine that the radio workshop is a magic cave whence issue perfectly rejuvenated receivers it should be explained that the "bouncer", the "reject", the "comeback" the "second complaint" or "twicer" is the repair job that has been delivered and subsequently fails. It does happen—yes, really, even in the best organised department. Knowing the bits and pieces that go into the average item of electronic equipment, it is not surprising that the occasional failure crops up. But the customer whose precious tune-box develops apparently similar symptoms is likely to be querulous when bringing the bouncer back.

'B' is almost apoplectic.

Listening to B. argue that the trouble is an Act of God is a treat the rest of the workshop rarely likes to miss. But hearing his remarks afterwards, when he discovers that the knobs are screwed on askew, the fastening bolts cross-threaded and maybe the valves plugged into the wrong sockets is a banquet of outraged invective. "The blighter isn't getting this done for nothing," he fumes.

Again for the benefit of the innocent, remember that repairs carry a limited guarantee. Limited, that is, to the work that has actually been done. When you take your car to the garage for a carburettor job and get a puncture as you drive home, you would hardly expect a sympathetic response if you rang up the mechanic to complain.

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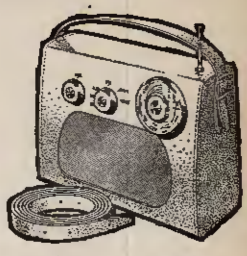

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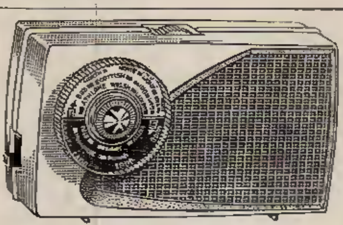

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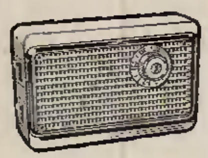

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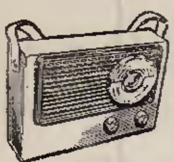

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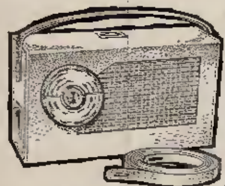
MELODY SIX



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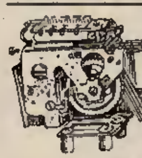

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MONTHLY NEWS FOR DX LISTENERS

Times in GMT
Frequencies in kc/s

THE BROADCAST BANDS by JOHN GUTTRIDGE

IF you want the real DX contact you will have to work for it this month, especially after dark. From 1900/2000 onwards you can forget the 13, 16, 19 m. bs. If you wait for the late evening the 49 m.b. can produce surprising results with low-powered South Americans breaking through the strong European signals. If your ears can stand straining through c.w. the 90 m.b. is providing some rare catches.

MIDDLE EAST

Israel: *Kol Israel* (Broadcasting House, Jerusalem), has dropped its Sunday morning English transmissions. The evening transmission to the U.K. has been re-timed to 2115-2120 on 9,009/9,725. The African English transmission remains 2015-2030 on 9,009.

Turkey: *Radio Ankara* (Ankara), has been heard signing on at 2330 on 9,745 in an unidentified language.

ASIA

Afghanistan: *Afghan Broadcasting System* (Ansari Wat, Kabul), has restarted its evening English transmission after a lapse of several years. The transmission from 1900-1930 has been reported on 15,225 and 11,865 although some say the 25 m.b. outlet is 11,760. Other reports say the 19 m.b. has been replaced by one in the 31 m.b.

Indonesia: *Radio Republik Indonesia* (P.O. Box 157, Djakarta) now appears to use only 9,865 between 1615 and 2000. English is at 1900-2000.

Korea (P.D.R.): *Radio Pyongyang* (Pyongyang), has replaced 6,650 by 6,480 for its 1100-1200 and 1400-1500 English transmissions. The other frequency for these transmissions remains 7,580. The station's home service may be faintly heard during the evening on 6,290/6,600.

Malaysia: *BBC Far Eastern Relay Station* (P.O. Box 716, Johore Bahru), now has its own QSL card which is far superior to that issued by the BBC, London. Indeed this BBC relay outlet will give full verification details on the card if asked, something that London will not do.

Philippines: *Far East Broadcasting Company* (Box 2041, Manila), now using 11,855 instead of 15,385 from 2330-0030. In the morning DZH8 has been heard signing on in English before 0900 on 11,855.

NORTH AMERICA

U.S.A.: *Voice of America* (U.S. Information Agency, 330 Independence Avenue, S.W., Washington 20547, DC), now has the following English schedule to Europe: 0300-0730 3,980/5,965/5,995/7,200/7,250/9,540/9,635/9,740/11,790; 0500-0730 6,040/15,295/1,196; 1400-2330 3,980/7205/9,760; 1500-2215 5965; 1900-2215 9,710/11,760; 1830-2330 11,805; 1400-2215 15,205; 1400-2000 15,290; 1400-1830 17,780; 1600-1800, 2100-2130, 2200-2330 1,196. On Sundays read 2345 for 2330. A new programme format is being used by the V.O.A.

U.S.A.: *Radio New York Worldwide* (485 Madison Avenue, New York, N.Y., 10022), now uses the following frequencies to Europe in English: 1200-1400 15,265/17,845; 1400-1600 15,440/17,845; 1600-2100 15,440/17,755; 2100-2130 15,440/11,970; 2130-2330 (-0030 Sundays) 9,655/11,970; 0030-0100 Sundays 9,655.

CENTRAL AMERICA

Cuba: *Radio Habana Cuba* (Apartado Postal 7026, Habana), now transmits in English as follows: 2010-2140 (Northern Europe) 6,015; 2050-2150 15,270/15,300; 0100-0600 11,760/6,170; 0330-0600 6,135; 0630-0800 9,655; 1800-1900 15,340.

Netherlands Antilles: *Trans World Radio* (SC Zoutpannenweg, Bonaire) has English as follows: 0035-0105, 0230-0400, 1105-1235 (-1530 Sundays) on 11,815 or 11,820; 2100-2130 (Europe) 15,130 or 15,245 or 11,815 or 11,820.

Windward Islands: *Windward Islands Broadcasting Service* (St. George's, Grenada). The European frequency used from 2000-2145 has been variously reported as 11,895 or 11,920.

SOUTH AMERICA

Brazil: *Radio Ailtina de Bahia* (Avenue 7 de Setembro 311, Salvador, Bahia), has reactivated ZYN30 on 15,225. Has been heard from around 2300-0130.

Ecuador: *La Voz de los Andes* (HCJB), (Casilla 691, Quito), is again using 15,115 during its 1845-2000 and 2100-2130 English transmissions. The parallel frequency is 17,890.

EUROPE

Austria: *Osterreichischer Rundfunk* (Wien IV, Argentinierstrasse 30a). Frequency schedule valid to 0100 on 5th March is as follows: on 6,000 0430-2300; 6,155 0500-1100, 1700-2200, 2300, 0430; 7,245 0500-1300, 1800-2000; 9,525 0000-0300; 9,610 1700-1900; 9,770 0500-0800, 1100-1700, 2300-0400; 11,760 0300-0400; 11,895 1200-1400; 11,900 1100-1400; 15,210 1900-2100; 15,410 0600-0900; 15,430 0000-0200; 17,730 1400-1600; 17,750 1600-1800; 17,755 1000-1200; 17,855 0400-0500, 0800-1000.

Belgium: *Belgian National Broadcasting System* (Overseas Service, 18 Place Eugene Flagey; Brussels 5), has replaced 17,860 by the new outlet of 11,715 from 1600-1715. At this time 9,740 is also in use. Another new outlet heard is 9,660 from 1830-2100.

Thanks go this month to the Swiss Broadcasting Corporation, A. B. Thompson, the World Communications Club of G.B., B. Bunting, Roy Patrick, A. E. Roxburgh, the International Short Wave Club, B. Lowe, J. D. Ashworth, J. W. Smith, B. Garvey and D. G. Hobro.

AUSTRALIAN and New Zealand hams at 5 and 9 plus on topband or just a few local G stations? Well, your guess is as good as mine for the coming year. Theoretically 28Mc/s should be really something and 21 should also provide hoards of DX. Fourteen will doubtless continue to provide most distant signals at one time or another, and of course 7Mc/s will seem noisier than ever. Topband and Eighty may well go down into the doldrums with the seasonal changes and the sunspot activity increase.

What about those New Year resolutions? All those not making any are banished to 7Mc/s. Still stuck for ideas? How about the station itself. Does your antenna go to ground when you switch off? How about fuses, and those mains plugs, are they 100%? Has the earth lead corroded? This can be a source of noise. First resolution then, check the entire installation from mains right through to the aerial itself. If you do this just once a year it will avoid your wondering why you don't hear the DX too well, only to find when you do check, that the antenna wire broke off at the window, giving you an effective length of 3½ft. (Pauses, titters behind fan, and remembers case of the '3JDG "longwire" which wouldn't load.) This month there appears to be a mass migration to ten metres. Certainly the band has been wide open most days although it does fall off at night. If things continue we will doubtless end up with the spottiest sun for decades. In view of the many very fine logs which arrived I propose to move on to my New Year resolution—cutting of the cackle.

TEN

Reports from all over, from Scotland to Worcestershire, all reporting the same story, DX on Ten. All modes, all continents too, with the best time to listen still during daylight hours.

C. Clarke (Surrey), 12 valve single conversion s/het, phased verticals logged — K2RFZ/MM, K3BEQ, K8ERD, LU7ABV, MP4BBA, MP4TBO, OD5CN, PY2ARV, SV1AN, SVØWL, UA1AVM, UA3AJT, UA6LIV, UA9FFB, UB5APK, UW9CR, VE3FIT, VK3AHT, VK3HW,VK6CF, VP9FB, VS9AJC, WIFQA, W8CNC, W9ARK, WØGYM, ZC4MO, ZS4OI, ZS5DC, 4X4HJ, 9J2BK. Chris reckons it won't be long before we start hearing JA and UAØ on ten metres. Anyone been lucky yet?

P. Baker (South Wales), HE30, 45ft. l.w. raised—CR4BC, many CR6's, CR7DS, CT3AM, EA6BH, EA8AE, JA1TRD (sorry I spoke!), K2GL, MP4BBA, OD5BU, PY1LW, SV1AL, UA9FB, UF6DV, UG6AZO, UY5HF (Ukraine—new prefix issue), VO1HB, VS9APW, W5GQG, WØIMC, XE2BM (Mexico), ZB2AJ, ZC4KF, ZE1JA, ZS1JH, ZS8L, ZS9G, 5A1TK, 5N2AAF, 9H1A, 9Q5EB.

George Owen (Somerset), GC1U, Joystick, heard—CR4BC, CT3AM, CX1AAM, EA8EV, IT1ALD, K3AAG, LU2DED, PY8MA, PZ1BK, VE2BT, WICLP, W5GQG, ZE1BP, ZS1BS, 9Y4VS, all these on a.m.

Colin Morris (Worcestershire), double s/het homebrew, Joystick, hooked — CR6HF, CX2CO, CX4AW, ET3AC, FH8CD, HK3AVK, KR6LL, KG6AAY, KV4CX, KP4BJM, LU1DAB, MP4TBO, OA4PQ, UL7JA, VK4HC, VK5QR, VK6GP, VKØKM (Antarctica), VP5RB, VS9AJC, all W prefixes, YV9AA, ZB2AM, numerous ZC4's and ZS's, 4X4GV, 4Z4HQ, (new prefix — State of Israel), 5A3TN, 5N2AAF, 5R8CQ, 5Z4AA, WØGTA/8F4 (Sumatra), 9Q5BD. Colin informs that Don Miller has permission to operate from Albania, Rio de Oro, and Annobon Island. Also reported is great activity anticipated on Easter Island (CEØ). WØGTA/8F4 is also trying topband.

Many more logs for 28Mc/s but the picture can be seen from those quoted, so let's wander downscale to—yes, the dreaded l.f. bands, 80 and 40.

L.F. END

C. Claydon (Scotland), 840C + preselector, 12ft. vertical groped in the 7Mc/s darkness for—EA4CR, K1HVV, SV1CX, UL7QG, 9X5MH (Rwanda), W1FJJ, WB2NDS.

D. Harvey and **T. Cowpe** (Salop), R107, 80ft. wire, both assure that persistent scanning of the dreaded segment brings rewards. Proof offered—HB9ABM, 1ØRB/4U, JA4BJO (yes, Japan), JA6YB, K8ARW, KP4BRX, LX4JB, OA3KCB, OX3KV, UA3KBD, UA6KE, UD6BV, VP6KL, VK2AVA (nearly always on 40), VK3BM, WØGTA/A, ZC4MO.

F. Simpson (Yorkshire), claims that 40 is like someone sawing an endless plank. (I wooden be surprised!). On the other hand 80 proved very fruitful with—KG4AA, OA8V, OX3JV, TF3EA, VO1FG, VE1IE, VE2XO, VE3WV, VP1PV, VP2AA, VP7DL, VP9BO, VS9AJC, VS9ALV, W1HKK, W2ZPO, YS1DHE, YV5BOI, ZF1GC, 6Y5EM. It's almost as good as my 21Mc/s log!

N. Henbry (Sussex), strikes again! Armed with an EA12 and a 20 metre dipole on 3·5Mc/s, Norman logged K2DXV, K8YWG, VE1ADA, VE3AYS, VS9AJC, W1AQH, W2APU, W3BMS, W4SIB, W9JLH, YV5BTS, ZB2AJ, ZL3ACJ, ZL3GS, ZL4KE, ZL4LM, 7XØAH. On 7M/cs the best were CN8AW, CR6IV, PY1BDX, VE3LZ, VK2AVA, VKØAA, VP2AA, W3BMS, W4BYB, WA8DNQ, WØGTA/8F4, 5A1TS.

14 AND 21

Very, very few reports for the favourites, everyone seems split into two groups. The "let's listen on ten" brigade, and the real expert DXers trying their skills on 3·5 and 7.

R. Garvey, back from Cyprus (get the umbrella out of pawn again, Bob) had a quick listen with his S640 and heard VK's on 14Mc/s at 589. His best for the session—EP2RV, JT1KAA, OY3L, TA2AC, VK2EO, VKØNB, W6MQT/OX3, ZA1BB.

CONTESTS

Sparse month for contest types. Only two down in my diary—14-15th, Affiliated Societies' Contest (quite lively this one), 29th, 144Mc/s c.w. Contest. Many thanks for the fine logs, deadline for January is the 24th.

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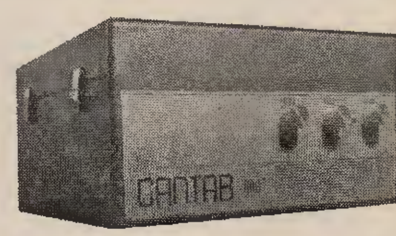

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Wide Range Signal Generator

—continued from page 759

receiver will respond if tuned to the same frequency. But there is no response if the generator is tuned to multiples of the receiver frequency. So the fundamental frequency is the first one causing a response if the generator is tuned from a high frequency downwards.

HARMONIC STRENGTH

Harmonics grow progressively weaker. With a sensitive receiver, 1Mc/s harmonics may be heard up to 30Mc/s or higher, while 100kc/s harmonics can be tuned in up to about 5Mc/s.

With a t.r.f. receiver, any response will be at the generator frequency, or multiples of this frequency.

When using a superhet, various spurious responses arise. They can usually be identified because they are weaker. Second channel effects are heard at a frequency which corresponds to an error of *intermediate frequency x 2* (940kc/s for an i.f. of 470kc/s). This is likely to be noticed at high frequencies, but not at medium or low frequencies.

Weak spurious responses also arise from receiver oscillator harmonics beating with the generator signal. This is also usual.

VR1 is used to adjust signal strength as required, but ceases to be wholly effective at high radio frequencies. This is unavoidable with a simple potentiometer. Enough signal is often secured merely by placing an unscreened generator output lead near the receiver aerial.

TESTING and ALIGNMENT PROCEDURES

The wide range signal generator can be used for many purposes, such as the quick location of faulty stages in audio amplifiers, or complete receivers. If an audio amplifier gives no results, for example, the source of the fault can often be found quickly by injecting an a.f. signal. A typical two-stage amplifier is shown in Fig. 6.

With battery-operated valve receivers, or those having heater and h.t. from a transformer, a direct connection can be made to the chassis or earth line at A by clipping on a lead from the generator earth, or coaxial outer conductor. With a.c./d.c. or other sets alive to the mains, first check that the chassis goes to mains Neutral. Also include an isolating capacitor in the earth mentioned.

AUDIO STAGES

Then set the generator to give an audio output, and feed it into point B. If the signal is not heard, the output transformer or speaker is defective or disconnected.

If the signal is heard, transfer the generator prod to C. If there is a considerable increase in volume, the output stage is obviously working. Then transfer the prod to D. If the signal disappears, the coupling capacitor or connections here are defective.

Should output be obtained from injecting at D, take the prod to E. Volume should again increase greatly, if the triode amplifier stage is functioning correctly. Then take the prod to F. If the signal disappears, the 1MΩ volume control or a connection to it is suspected. If results are in order, move the prod to take in any pick-up or other lead included.

Thus, the method is to work backwards stage by stage, until results cease. The last part of the circuit just introduced is then faulty. When the faulty stage is found, a meter is generally brought in to check resistors and other items in the defective stage. Generator output is reduced as necessary with the output control. Pre-amplifier and other stages can be dealt with in the same way.

I.F. CIRCUIT TESTS

Exactly the same method can be used to locate a faulty stage in an intermediate frequency amplifier, the generator being adjusted to deliver modulated r.f. at the intermediate frequency. With many receivers the i.f. is around 470kc/s. First test the audio amplifier as described, if necessary. Audio is also injected at points A and B, Fig. 7, to check the anode coupling capacitor. Then inject audio at C, D, E and F in turn, to check the triode section of the double-diode-triode, grid capacitor, potentiometer and 33kΩ diode filter resistor.

Modulated r.f. can now be injected at G, and the generator tuning swung around the i.f. Output at one frequency shows that i.f.t.2 is in order. Lack of output shows this component, or connections to it, are faulty.

With output obtained, move to point H, to check the i.f. stage. Output should be much increased. Taking the prod to I tests i.f.t.1. Results should also be obtained with a signal at the i.f. injected at J.

When a faulty stage is found, a meter test will show if normal voltages are present. If not, the connection or resistor in circuit should be checked.

I.F. ALIGNMENT

With a new home built receiver, set the generator at the specified intermediate frequency (modulated). Should the i.f.t's. be pre-aligned or not badly off tune, inject at J and adjust their cores for best results.

If the cores are badly off tune, often it is necessary to inject at G and tune i.f.t.2, then at I and deal with i.f.t.1. Afterwards inject at J (to remove stray capacity from i.f.t.1) and re-adjust both i.f.t.1 and i.f.t.2.

R.F. STAGES

If a defective receiver has been tested as far as I and J, Fig. 2, this shows that the i.f. and a.f.

sections are working. Modulated r.f. of the frequency to which the receiver is tuned can then be injected at J. Lack of results shows that the mixer stage is defective. Moving the prod to K (with results from injecting at J) allows the individual coils to be checked.

When an r.f. amplifier is present, this can be checked with the appropriate r.f., exactly as with the aerial circuit of the mixer, Fig. 7.

To align aerial and oscillator circuits of a newly made receiver it is usually convenient to set band coverage, adjust the aerial circuit to agree, then trim and adjust cores for best sensitivity. For a typical medium waveband of about 550-1500kc/s this could be done as follows:

(1) Switch to medium waves, inject 1500kc/s at aerial and adjust oscillator trimmer for correct dial reading.
(2) Roughly adjust aerial trimmer for best results.
(3) Inject 550kc/s and adjust oscillator coil core for correct dial reading.
(4) Roughly adjust aerial core for best results.
(5) Inject at 1300kc/s, and adjust oscillator and aerial trimmers for best sensitivity.
(6) Inject at 750kc/s and adjust oscillator core and aerial core for best sensitivity.

Steps (5) and (6) are repeated until no further improvement can be obtained. The actual trimming point (5) and tracking point (6) will vary somewhat in actual receivers, but are generally a little clear of the extreme ends of a band. At these steps the oscillator trimmer and core need not be altered unless a compromise is needed with the accuracy of dial readings.

Any r.f. stage coils can be dealt with in the same way as the mixer aerial coils, Fig. 7. With completely separate coils for each waveband, deal with each band individually, afterwards checking all bands. With long/medium wave coverage by dual-band coils or ferrite aerials, it is usually necessary to adjust medium waves first.

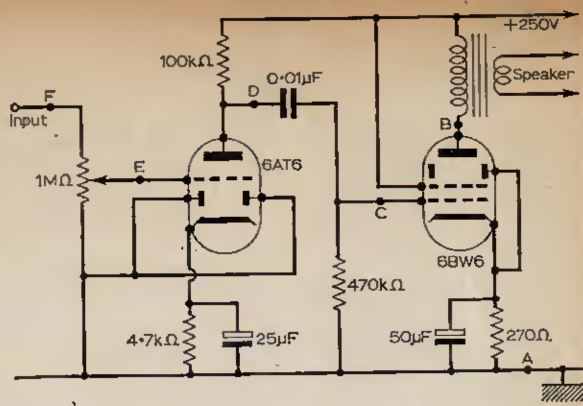

Fig. 6: Test points on a typical audio amplifier.

OUTPUT INDICATION

If tuning is by ear, keep the generator output as low as possible for final adjustments, with the receiver audio gain at maximum. Otherwise the any a.g.c. circuits will mask the effect of adjustments.

An audio output meter is often handy. The simplest comprises a crystal diode in series with a multi-range meter, which is connected across the output transformer primary or secondary. Set the meter to a suitable d.c. range. Some meters can be used without the diode by switching to an a.c. range.

It is sometimes convenient to adjust tuning or i.f.t's. for minimum anode current in an a.g.c. operated stage. To avoid interrupting permanent wiring, a multi-range meter can be clipped across one of the cathode resistors in Fig. 7. Either 2·5, 5 or 10V range is usually satisfactory, according

—continued on page 773

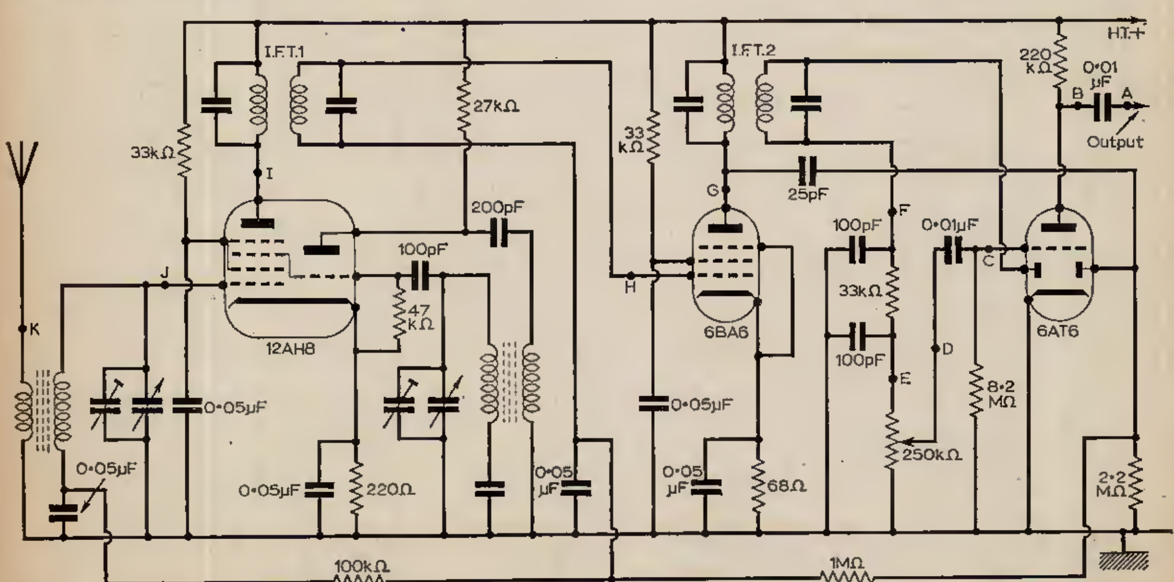

Fig. 7: Test points on a typical radio receiver. See text for details.

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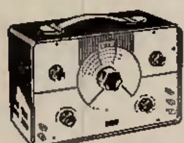

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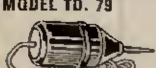

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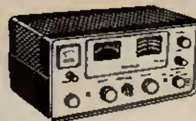

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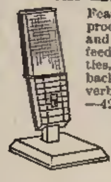

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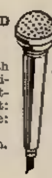

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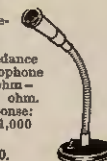

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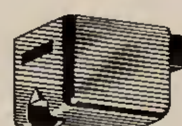

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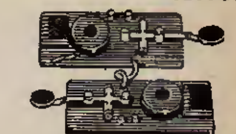

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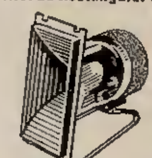

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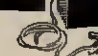

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Wide Range Signal Generator
—continued from page 770

to the valve and bias resistor. All trimming, core and i.f.t. adjustments are then directed towards minimum anode current, corresponding to minimum voltage on the meter. Unnecessarily strong signals should not be used.

When a.g.c. is from the i.f. anode, as in Fig. 7, the secondary of i.f.t.2 does not usually peak for maximum a.g.c. voltage (minimum i.f. stage anode current). It should then be peaked for maximum audio output. With some circuits this agrees with a slight *dip* in a.g.c. voltage.

COUPLING TO RECEIVER

For accurate alignment, coupling must be very loose. Enough input may be obtained for final adjustments by placing the output lead near the receiver aerial. Some receivers are supposed to be aligned with particular aerial pads or loads, such as a 400Ω carbon resistor. Or the aerial trimming can be touched up, if necessary, when the aerial is connected. The generator lead should not be taken directly to any i.f.t. or tuned circuit which is being finally adjusted because the stray capacity will cause errors. Proper trimming tools should be used, not screwdrivers having only an insulated handle.

DIAL CALIBRATION

Tuning scales can be marked up for home built receivers by setting the generator to various frequencies, adjusting the receiver to them, and marking the dial. If the procedure detailed for calibrating the generator originally is noted, there will be little chance of errors from tuning in harmonics, or similar mistakes.

It is sometimes required to calibrate a narrow band on the receiver with great accuracy. This can be done by tuning the generator to a much lower frequency, and multiplying its output by the appropriate figure.

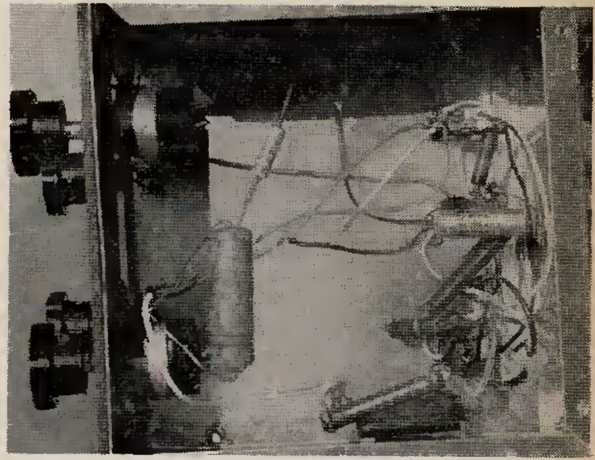
The 80 metre Amateur band provides an example of this method. This band is 3·5-3·8Mc/s. Locate 3·5Mc/s on the receiver by setting the generator to this frequency. Some error, due to visual reading, is most likely, but this 3·5Mc/s point is only temporary. The generator can then be tuned to 100kc/s so that its second harmonic is at zero beat with the BBC Light Programme on 200kc/s. A transistor portable or any convenient receiver can be used for this comparison of generator harmonic and BBC. The generator is now providing 100kc/s to a high degree of accuracy (so long as it remains at zero beat with the Light Programme) and harmonic marker pips will be tuned in at 3·5, 3·6, 3·7 and 3·8Mc/s with the Amateur band receiver, and can be written on its scale.

The upper limit to which low frequency harmonics may be detected depends on the receiver. For normal accuracy, harmonics need not be employed and the generator is tuned directly to the wanted frequency. ■

RECEIVER FOR 144 M/cs
—continued from page 755

slowly with an insulated tool, while checking coverage.

With VR2 near maximum, slowly turn up VR1 from its minimum position. When super-regeneration commences, a loud hiss will be produced. Turning back VR1 a little reduces this hiss, but if VR1 is rotated too far, super-regeneration will cease. With VR1 in the best position, VC1 can be peaked for maximum noise even with no aerial connected. With an aerial on, tuning VC1 should give quite a high noise level. With TC1 nearly open,



Under chassis view of the completed receiver.

resonance with VC1 can be expected around minimum capacity, increasing slightly as VC2 is closed.

When a usable signal is tuned in, the hiss should almost completely cease, and in these circumstances, peaking VC1 for maximum signal strength corresponds to minimum noise. With careful adjustment, very weak signals can be resolved.

If super-regeneration is not satisfactory, it may be worth changing R4 since surplus 6C4 valves seem to vary somewhat. If super-regeneration is absent, reduce R4 slightly in value. Alternatively, slightly increase the h.t. voltage by increasing the value of R10, or reduce the value of R9. On the other hand, should super-regeneration be difficult to control, slightly increase R4 in value, or reduce the h.t. voltage.

For a range of some miles, a vertical ¼-wave aerial will do. This is about 19in. long. Signal strength at other than short range will be much improved by using a dipole. It may be wire supported from convenient points, or attached to insulators on a strip of wood, or self-supporting rods. The overall length is about 38in. In view of the very small size, a simple "X" or "H" aerial is also easily constructed, but some means of rotating it will then be needed. Various ready made or adjustable aerials, and multi-element aerials giving increased signal strength, can be obtained. At first, a dipole may be preferred. This is less effective, but has little directivity, so signals can be picked up from all directions. ■

PULSE COUNTING VHF RECEIVERS

DURING the past few years a number of circuits have been published describing the detection of f.m. signals using pulse counter discriminators. The purpose of this article is not to go over the already well trod ground of theoretical considerations, but to put forward a practical front-end. Figure 1 shows in block form the various stages needed for a pulse counting type of v.h.f. receiver.

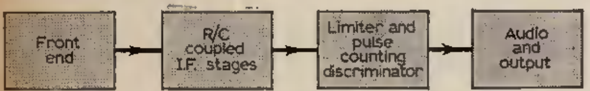


Fig. 1: Block schematic diagram of a pulse counting type of v.h.f. receiver.

Most of the circuits that have already been published employ crystal controlled oscillators in the front ends. These come rather expensive for the amateur—and for that matter the author. However, a circuit employing an autodyne frequency changer was located and found to be successful. This is shown in Figure 2.

FREE RUNNING OSCILLATOR

In simple terms, the autodyne frequency changer mixes the incoming signal with oscillations generated within the valve itself to produce an intermediate frequency. One of about 150 kc/s is required and is obtained fairly easily, since the bandwidth of most f.m. transmissions is in excess of this. As far as the operator is concerned, it's a matter of de-tuning to one side of the centre frequency. It is, of course, much easier to tune-in a receiver with a slow-motion drive. The reason for selecting a low i.f. is that one can employ direct coupled amplifiers and dispense with all the usual tuned circuits.

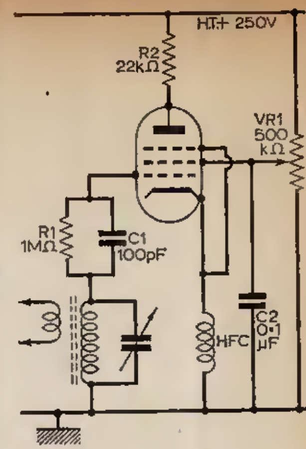


Fig. 2: Autodyne frequency changer.

The circuit shown in Figure 2 hooked-up to a direct-coupled amplifier worked first time and gave a good account of itself on all three v.h.f. sound transmissions put out by the BBC.

A small amount of drift did occur during the initial warming-up period but subsequently the oscillator held very firmly. The degree of oscillation controlled by VR1 is critical and may require a little patience to find the optimum point of working, but once set it can be forgotten.

It is possible that the oscillator could set up interference with neighbouring sets, although no trouble has been experienced in this direction by the author. Should this occur, a buffer r.f. amplifier ought to be fitted to isolate the oscillator from the aerial.

PROTOTYPE CIRCUIT

For the sake of completeness, the original prototype circuit is shown in Figure 3. From a quick glance, one can see inexpensive EF91 valves have been used and tuned circuits have been kept to a minimum.

The inductance which may cause a little trouble is the main tuning coil. The author used a quarter-inch former, with an iron dust core, upon which he wound six turns of 20 s.w.g. enamelled copper wire. Due to the stray capacities, which play such an important part at these frequencies, it may be necessary to experiment by adding an extra turn or subtracting one to obtain the correct coverage. The r.f. choke in the cathode of V1 has a value of 1·5mH.

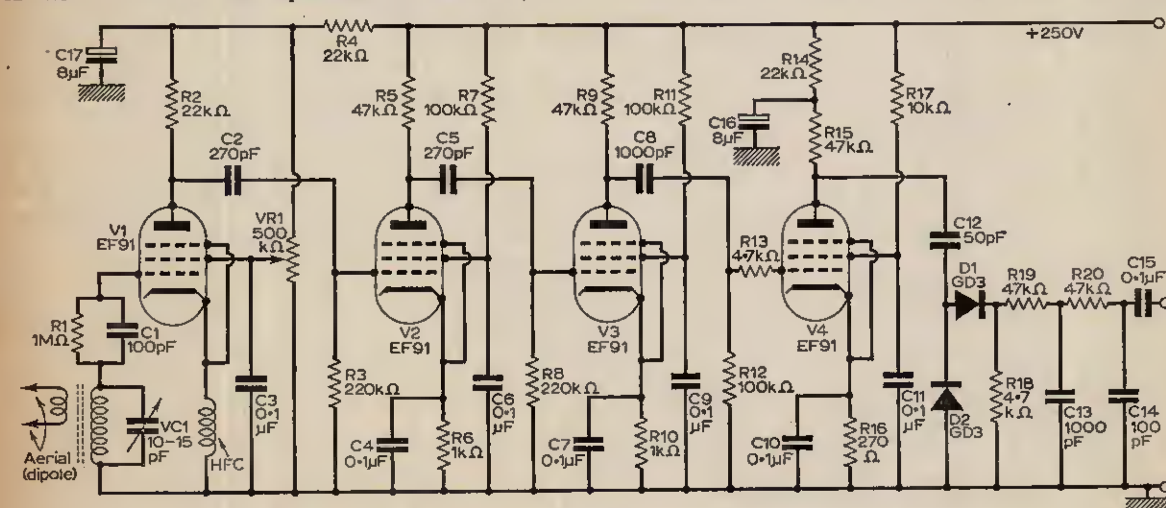


Fig. 3: Complete circuit of a pulse counting type of v.h.f. tuner.

D. V. Debbage ■

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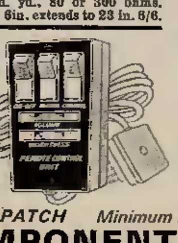

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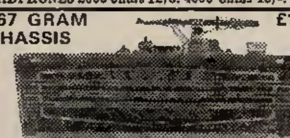

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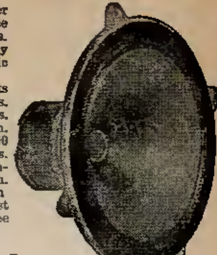

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C.R.T. BOOSTER TRANSFORMERS

for heater cathode short or failing emission. 25% and 50% BOOST, 200/250v. A.C. input. STATE TUBE VOLTAGE REQUIRED. 2 or 6 or 13v. PRICE **15/6**

BRAND NEW QUALITY EXTENSION LOUDSPEAKER

In tough cream plastic cabinet with 20ft. lead and adaptors. For any transistor radio intercom, mains radio, tape recorder, etc. 3 to 15 ohm matching Size: 7½ × 5½ × 3in. **30/-** POST FREE

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POWER SUPPLIES

by H. T. Kitchen

SECOND AND FINAL PART

SEPARATE HEATER LINE

There is a limit to the voltage that can be applied to the cathode of a valve when the heater is at chassis potential. In the case of the series regulator valves, the cathodes will be several hundred volts above chassis potential, and any attempt to run the heaters of these valves from an earthed heater supply is doomed to failure as the heater to cathode insulation will break down, leading to premature, and possibly violent, valve failure. It is therefore customary to run the heaters of such valves from a separate heater winding, well insulated from chassis and all points having a PD differing from the cathode. If this separate winding is centre tapped it can be connected to the cathode of the regulator valve. If not, it can be left floating or one side connected to a potential divider across the h.t. supply so that the heater is at or near the same potential, above chassis, as the cathode of the regulator valve. The cathode of the error amplifier will be from 85V to possibly 100V, or fractionally higher, above earth potential, a figure that is within the heater cathode rating of most valves likely to be used in this position, so that a separate heater winding will not be required.

E.H.T. SUPPLIES

The high e.h.t. voltages required by many oscilloscopes cannot always be supplied by voltage multiplying circuits. For instance, a common e.h.t. value is 2kV, and a common h.t. transformer secondary voltage is 350V, so that a X6 voltage multiplier would be necessary. Higher e.h.t. and/or lower transformer voltages would require even more multiplying elements, an uneconomical situation both electrically and financially. Under these circumstances alternative methods have to be adopted. The use of a mains transformer having the requisite voltage output is one possibility, but such transformers are not only expensive but potentially dangerous, in more ways than one. Although the smoothing capacitors rarely exceed 1μF, they are capable of delivering a considerable amount of instantaneous power which is measured in joules, a joule being equal to $\frac{1}{2}$ CV^2 where C is capacity in farads and V the voltage they are charged to. The initial shock would be severe enough, but unfortunately, in this context, the current delivered by the transformer is sufficiently high to speedily recharge the capacitors. Continued contact with such a supply would cause local burning of the flesh and possibly death. Considerable care *must* be exercised when dealing with such a supply, and it should be carefully discharged before being handled. The discharging of capacitors by means of a screwdriver should be avoided if at all possible, because the resulting bang is not good for people's nerves—and it certainly isn't good for the capacitor, as it is liable to fracture the dielectric. Instead, capacitors should be discharged by means of a resistor connected across them, values from a few kohms to a few hundred kohms being suitable. It is an excellent idea to fit high resistance bleeder resistors across all high voltage capacitors to automatically discharge them when the supply is disconnected. The working voltage—not current—of such resistors must be adequate. If in doubt, a number of series connected resistors could be used.

R.F. HIGH VOLTAGE SUPPLIES

The use of r.f. e.h.t. supplies have much in their favour, for although the voltage levels are comparable with transformer supplies, the current levels are very much lower. Although the initial shock will be as unpleasant as before, the r.f. oscillator will either cease working or, if it continues working, will do so at a much reduced efficiency. Continued contact with such a supply will therefore be far less hazardous than from a mains transformer supply. The r.f. supply will either consist of two valves, an oscillator and a power amplifier stage, or just one valve functioning as a self-oscillating power output stage, and this is the circuit shown in skeleton form in Fig. 11. The transformer for this consists of three coils, L1, L2, L3, which are usually wound on a Ferrox cube core. L1 and L2 comprise the anode to grid feedback windings which cause the valve to oscillate, L3 is the e.h.t. winding. The inductance of L1 in conjunction with C1 determines the oscillator frequency. The number of turns of L2 and their spacing from L1 determines the feedback voltage which should not be excessive, otherwise severe waveform deformation will occur. The number of turns for L3 determine the e.h.t. voltage. The operating frequency is a matter of compromise. The efficiency of the Ferrox cube transformer falls with decreasing frequency, whilst too high a frequency is liable to cause interference with nearby receivers. It is usual to choose a frequency in the 50kc/s to 100kc/s range and to enclose the e.h.t. unit in a screened box, with adequate decoupled h.t. and heater feeds. The valve must be a power type; EL84, EL34, 6L6 types being commonly used.

The components in a power supply are amongst the hardest working of any and it is therefore essential to devote care when selecting these components and assembling them together.

The smoothing capacitors are often electrolytics, because these offer a greatly increased capacity, size for size, than paper capacitors, which makes them an attractive proposition where space is restricted. In some other respects they are inferior to paper capacitors, particularly where polarity and internal noise level is concerned. Connecting an electrolytic with reversed polarity or across an AV supply is almost certain to end in the capacitors explosive destruction. The leakage current of electrolytic capacitors is appreciably greater than paper capacitors, but even worse, from some aspects, is that the leakage current is not constant, but varies sporadically—hence the "noisy" capacitor. This current also increases with increasing voltage across the capacitor, with the result that the DV output contains not only a percentage of mains ripple, but also a percentage of capacitor noise. Capacitors that have been stored for any length of time are apt to have a low internal resistance, and will pass excessive current, which causes overheating, if connected across a source of high DV potential. This excessive current/overheating phenomenon is likely to be cumulative, culminating in another explosion. Such capacitors should be "formed" for a short while by connecting them to the DV potential via a moderate resistance of 10kΩ or so. This resistor will limit the flow of current so that the capacitor cannot overheat due to passing excessive current. An interesting way of demonstrating this would be to connect a high resistance (20kΩ/V) voltmeter across the capacitor and note the voltage across it on switching on, and then at fairly frequent intervals. At first the capacitor would pass a fairly heavy current (this could also be monitored by connecting a milliameter in series with the capacitor) and the voltage would be low. As the capacitor was "formed", its current leakage would decrease, and the voltage would increase, until a state was reached when the voltage and/or current remained constant. At this stage the capacitor could be considered to be fully formed. The practice of using an expensive multimeter to measure leakage current directly is fraught with danger, because should the capacitor suddenly go s/c or pass an excessive leakage current, the chances are that the meter movement will suffer.

WATCH THE CAPACITOR RIPPLE RATING

One aspect of capacitors that is often overlooked is that in the process of smoothing the pulsating or raw DV from the rectifier, they have to pass what may easily be an appreciable AV current. In this respect, the reservoir capacitor, i.e. the capacitor following the rectifier, has to pass the greatest current, and the smoothing capacitor, i.e., the capacitor on the load side of the smoothing choke or resistor, the least current. This can be easily visualised if one remembers that the unwanted ripple voltage has to be "lost" somehow, and the only way of doing this is to short circuit it to earth via the reservoir and smoothing capacitors. These components must therefore possess an adequate a.c. ripple rating which will be greater than the mean DV current by a factor of $\sqrt{2}$.

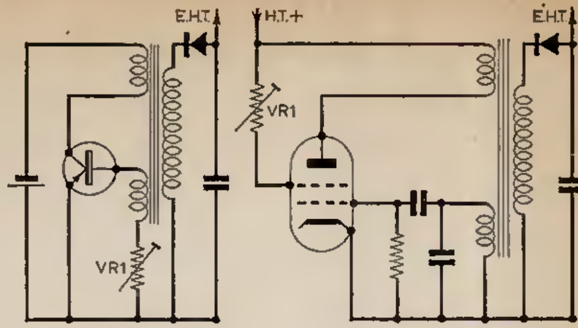


Fig. 11: Transistor and valve e.h.t. oscillators.

In the part of the article dealing with stabilised power supplies it was stated that the series regulator valve could consist of several valves in parallel if the current capacity of a single valve was inadequate. This, of course, is perfectly true, but needs a little further elaboration. Since the combined slope of a number of valves in parallel is the sum of the individual valves' slopes, the chances of instability increase with every additional valve. Generous use of grid stoppers around 1kΩ to 10kΩ plus anode and screen stoppers at 10Ω and 100Ω or thereabouts respectively would minimise the chances of instability. It is essential that these stoppers are wired as close to their respective pins as possible.

SITING COMPONENTS

The positioning of components on a chassis must also be considered. Rectifiers in common with other valves have an aversion to being in a strong magnetic field and should therefore be positioned as far from the mains transformer as is practicable. Failing this they should be positioned where the magnetic field is least, i.e. at right angles to the core. Wherever possible other inductors should be positioned with their cores at right angles so that mutual coupling is at a minimum.

Finally, we come to heat, and lots of it, too, for

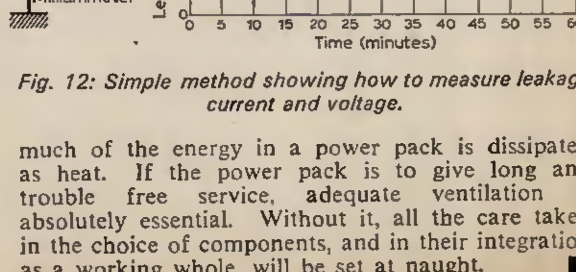
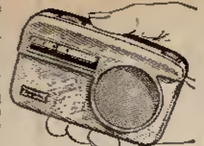


Fig. 12: Simple method showing how to measure leakage current and voltage.

much of the energy in a power pack is dissipated as heat. If the power pack is to give long and trouble free service, adequate ventilation is absolutely essential. Without it, all the care taken in the choice of components, and in their integration as a working whole, will be set at naught. ■

STUPENDOUS OFFER—£11 for £2



Only recently sold for £10.19.6. Note these features: ● Long & Medium Wave ● Long dial ● Push pull output ● A.V.C. and feed back ● Ferrite aerial ● Six transistors ● Cabinet size 4⅞in. x 3in. x 1½in. with carrying strap. You get everything you need and instructions **39/6** plus 3/6 P. & P. Battery 1/9 extra. Data separately 2/6.

PP3 Eliminator—play your pocket radio from the mains! Save £'s. Complete component kit comprises 4 rectifiers—mains dropper resistances, smoothing condenser and instructions. Only **6/6** + 1/- post.

HI-FI SPEAKER BARGAIN

12in. High fidelity loudspeaker. High flux permanent magnet type with either 3 or 15 ohm speech coil. Will handle up to 10 watts. Brand new by famous maker. Price **29/6** with built-in tweeter **35/-** plus 3/6 post and insurance.

2½ kW FAN HEATER

3 heat positions to suit changes in weather: 1kW, 1¼kW and 2½kW; also blows cold for summer, has thermostatic safety cut out "Proper" price £5.17.6. **Yours for only £3.15.0.** Plus 7/6 post and insurance.

MAINS TRANSFORMER. Upright mounting with primary tapped 200, 220, 240 v. H.T. secondary is 250-0-250 v. at 100 mA. and it has two L.T. secondaries of 6.3 v. 1½ amp.—unused (removed from equipment), **15/-** plus 3/6 post and insurance.

"C" CORE POTTED OUTPUT TRANSFORMER. Made by the famous "Parmeko" company these are the best money can buy, we can offer a bargain 15 watt rating, centre tapped primary with secondary for 3 ohm speaker. Potted and in black stove enamelled case for upright mounting these will make your amplifier or rig look perfect at only **12/6** plus 3/6 carriage and insurance—hurry for these.

½ MEG. POTS. By Erie, standard ¼in. spindle, 1in. long. **7d.** each in doz. lots, otherwise **10d.**

½ MEG. POTS WITH D.P. SWITCH. Again by Erie. Standard size spindle 1in. length. **10d.** each in doz. lots, otherwise **1/3** each.

MINIATURE PICK-UP. For pop records—this is made by Cosmocord—has a crystal cartridge and long play sapphire stylus—offered for less than the wholesale price of the stylus only—namely **3/9** each or **36/-** doz.

MINIATURE RELAYS with removable covers. Very sensitive (will close on only 20 mA). Coil resistance 10,000 ohms—contacts are three sets; triple set for change over pair to open circuit and the third pair to close circuit—perfect order unused (removed from equipment), **7/6** each.

CAR CHARGER OUTFIT ¾ amp. transformer and selenium full wave rectifier only **27/6** plus 3/6 post.

FLUORESCENT LIGHT KITS. Comprising choke, lampholders, starter and two chrome tube clips. 20 watt **19/6.** 40 watt **11/6.** 80 watt **17/6.** 65 watt **19/6** plus 4/6 p. & p.

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2N1742	25/-	MAT121	8/6	OC75	6/-
2N1747	25/-	OA5	5/-	OC76	5/-
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AC107	9/-	OA47	3/-	OC78	5/-
AC127	9/-	OA70	2/-	OC78D	5/-
ACY17	8/6	OA79	2/6	OC81	5/-
ACY18	5/6	OA81	2/6	OC81D	5/-
ACY19	6/6	OA85	3/-	OC82	5/-
ACY20	5/6	OA90	2/6	OC83	5/-
ACY21	6/-	OA91	2/6	OC84	6/-
ACY22	4/6	OA200	3/3	OC139	8/6
AF114	7/-	OA202	4/3	OC140	12/6
AF115	6/6	OC22	10/-	OC170	5/-
AF116	7/-	OC23	17/6	OC171	6/-
AF117	5/-	OC24	22/6	OC200	9/-
AF118	12/6	OC26	7/6	OC201	12/6
AF139	17/6	OC28	15/-	OC202	13/6
AF186	19/6	OC29	17/6	OC203	12/6
AFZ12	15/-	OC35	12/6	OCP71	19/6
ASZ21	15/-	OC36	15/-	ORP12	8/6
BC107	14/6	OC42	6/6	ORP60	5/-
BY100	5/6	OC44	5/-	SB078	6/6
BYZ13	7/6	OC45	4/-	SB305	8/6
MAT100	7/9	OC70	4/-	SB251	10/-

The above is a list of the more popular types in stock—we can also supply almost every semi-conductor made—please send **1/6** for comprehensive list and equivalent data.

HEAT AND LIGHT UNIT

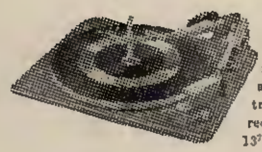
Bring luxury to your bathroom—have comforting heat where you now only have light—all the parts to build a full size (16in. diameter) model are now available—you will build it in an hour—12in. 750 watt circular silica glass encased element—opal bowl for up to 100 watt lamp—non-rust spun reflector—white enamelled base heat shield—pull switch magnificent unit as sold normally at £4.5.0 only **49/6** plus 7/6 carr. and insurance.

SUPERTONE G.C.V.

Saves you work—
It's partly built
Like its predecessors this latest Companion has full fi performance—such as only a good wooden cabinet and biflux speaker can give, and due to its being partly built you will have it going in an evening. Note these features:

- All Mullard Transistors including 3 x AF117.
- Two-tone Cabinet, size 11 x 8 x 3in.
- All circuit requirements—Push-pull output—A.V.C. and feed back, etc.
- Printed circuit board all wired only connections, e.g. to Volume control—W.C. Switch and Tuning Condenser.
- Pre-aligned IF stages complete with full instructions. Price only **£8.19.6** plus 6/6 post and insurance.

THIS MONTH'S SNIP

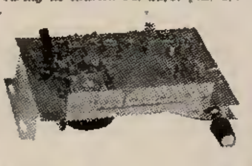


This month's snip is the famous Garrard model 3000 complete with ceramic cartridge. The outstanding feature of this record player is its low mass arm which facilitates excellent tracking characteristics and reduces record wear to the minimum. Size 13⁷/₁₆ in. wide x 11⅞ in. front to rear clearance, 4³/₁₆ in. above and 2¾ in. below deck. Supplied complete with template if required and service sheet. Price **£7.9.6,** plus 7/6d. carriage and insurance.

INFRA-RED HEATERS

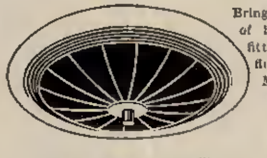
Make up one of these latest type heaters. Ideal for bathroom, etc. They are simple to make from our easy-to-follow instructions—uses silica enclosed elements designed for the correct infra-red wavelength (3 microns). Price for 750 watts element, all parts, metal casing as illustrated, **21/6,** plus 3/6 post and insurance. Pull switch 3/- extra.

F.M. TUNER



of exceptional quality, giving really fantastic results with virtually no noise. Suitable for mains or battery operation. 6 transistors—three IF stages—double tuned discriminator. Complete, new, and built up all ready to work on chassis. Size 6in. x 4in. x 2in. with tuning scale and slow motion drive. A £12.12.0 tuner for only **£8.10.0.**

NOW INSTANT START
CIRCULAR FLUORESCENT



Brings sunshine into your home. 150 watts of light but uses only 40 w. Beautiful fittings with glass, non-plastic centre, fluorescent tube and choke control. Made by Philips. Regular price £4.15.0. Special budget price **65/-,** plus 8/6 c. and ins. Please state colour of glass centre, white, pink, blue, red, black, yellow or cream. Also whether plug into lamp holder or ceiling mounting model. 80 watt model **99/6.**

3M SCOTCH TAPE

Brand new, unused and guaranteed perfect and not second in anyway—a connoisseurs tape on normal spools.

Standard Play	5in.	600ft.	9/-	**Long Play**	5in.	900ft.	11/6
	5¾in.	900ft.	11/6		5¾in.	1,200ft.	16/-
	7in.	1,200ft.	16/-		7in.	1,800ft.	23/-

£3 post free otherwise add 2/- post and insurance.

MAINS TRANSISTOR POWER PACK

Designed to operate transistor sets and amplifiers. Adjustable output 6 v. 9 v. 12 volts for up to 500 mA (class B working). Takes the place of any of the following batteries: PP1, PP3, PP4, PP6, PP7, PP9, and others. Kit comprises: mains transformer-rectifier, smoothing and load resistor, 5,000 and 500 mfd. condensers, Zener diode and instructions. Real snip at only **14/6,** plus 3/6 post.

BATTERY CHARGER — FREE

9v. Nickel Cadmium Battery type PP3 (fits all popular pocket transistors.) *Can be recharged 800 times.* Price with transformer type battery charger, only **37/-,** p. & i. 3/-. Chargeable replacements also in stock for U7 **12/6;** U12 **32/-.**

SNIPERSCOPE

Famous war-time "cat's eye" used for seeing in the dark this is an infra-red image converter cell with a silver caesium screen which lights up (like a cathode ray tube) when the electrons released by the infra-red strike it. A golden opportunity for some interesting experiments. **5/-** each, post 2/-. Date will be supplied with cells, if requested.

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Your opportunity to install non-flicker strip lighting at silly price—this month we offer the famous A.E.I. (Mazda) instant start lighting transformer suitable for one 4ft. 40 watt tube. This transformer is listed at over **£7** but this month you can buy the complete kit comprising instant start choke/transformer, two tube ends and two Terry clips to hold tube. Special snip price only **14/6,** plus 4/6 post and insurance—don't miss this tremendous bargain.

TUBULAR HEATERS

New and unused made by G.E.C. rated at 60 watts per ft.—these are ideal in airing cupboards, bedrooms, offices, stores, greenhouses, etc., curtains or papers can touch them without fear of scorching or fire. Supplied complete with fixing brackets and available in the following sizes. Prices which are about ⅓ of list price includes carriage by B.R.S. 8ft. **30/-;** 10ft. **36/-;** 12ft. **42/-.**
Also in twin assemblies (one pipe above the other) 4ft. **40/-;** 5ft. **46/-;** 6ft. **52/-.**

THERMOSTATS

Type "A" 15 amp. for controlling room heaters, greenhouse, airing cupboard. Has spindle for pointer knob quickly adjustable from 30-80°F., **9/6,** plus 1/- post. Suitable box for wall mounting, **5/-.** P. & P. 1/-.
Type "B" 15 amp. This is a 17in. long rod type made by the famous Sunvic Co. Spindle adjusts this from 50-550°F. Internal screw alters the setting so this could be adjustable over 30° to 1000°F. Suitable for controlling furnace, oven kiln, immersion heater or to make flame-start or fire alarm. **8/6** plus 2/6 post and insurance.
Type "D". We call this the Ice-stat as it cuts in and out at around freezing point. 2/3 amps. Has many uses, one of which would be to keep the loft pipes from freezing, if a length of our blanket wire (15 yds. **10/-**) is wound round the pipes, **7/6.** P. & P. 1/1.
Type "E". This is standard refrigerator thermostat. Spindle adjustments cover normal refrigerator temperatures, **7/6,** plus 1/- post.
Type "F". Glass encased for controlling the temp. of liquid—particularly those in glass tanks, vats or sinks—thermostat is held (half submerged) by rubber sucker or wire clip—ideal for fish tanks—developers and chemical baths of all types. Adjustable over range 50° to 150°F. Price **18/-,** plus 2/- post and insurance.

750mW TRANSISTOR AMPLIFIER

4 transistors including two in push-pull input for crystal or magnetic microphone or pick-up—feed back loops—sensitivity 5 m/v.

Price 19/6

Post and insurance 2/6. Speakers 3in. **12/6;** 5in. **13/6;** 6 x 4 in. **14/6.**

PHOTO ELECTRIC KIT

All parts to make light operated switch/burglar alarm/counter, etc. Kit comprises printed circuit, Laminated Boards and chemicals, Latching relay, Infra-red sensitive Photocell and Hood. 2 Transistors, cond., Terminal block. Plastic case. Essential data, circuits and P.C. chassis plans of 10 photo electric devices including auto. car parking light, modulated light alarm. Simple invisible ray switch—counter—stray light alarm—warbling tone electronic alarm—projector lamp stabiliser, etc., etc. Only **39/6** plus 2/- post. and insurance.

MULTI PURPOSE NEON TEST UNIT

Robust, useful and instructive—test insulation — capacity — continuity — resistor — volume controls—also acts as signal injector and L.T. fault finder—kit comprises neon indicator, 4 way wafer switch, ebonite tubes, resistors, condensers, terminals, etc., with diag. only **9/6** plus 2/- post and insurance.

Where postage is not definitely stated as an extra then orders over **£3** are post free. Below **£3** add 2/9.

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CLUB SPOT No. 14 FAREHAM & DISTRICT AMATEUR RADIO CLUB

G3VEF

FAREHAM'S radio club was formed, like so many others, by two or three amateurs meeting informally and "chewing the rag". Just two years ago an inaugural meeting was arranged and well over a dozen potential members crammed into the lounge of the first elected Secretary's QTH. From this encouraging response it was obvious that there was sufficient local interest to put things on a proper basis and so the Club was born.

Just one week later saw the first activity in the form of a world wide contest for which a station was set up on the stage of a disused school hall. This venture, apart from being the first introduction to "ham radio" for several members, was nearly a full scale disaster. Hooligans tore down the antenna, the weather was bitterly cold and the mains power supply all but melted. Far from being disheartening, the experience cemented all those who froze through the night into a club with spirit.

The first problem was that of accommodation and it was decided to hold monthly meetings in the back room of one of the local hostelries. With an equal membership of licensed amateurs and SWL's the pattern of these enjoyable evenings was soon established with slow morse for beginners, talks by the older hands on some of the mysteries, or perhaps a demonstration of someone's latest acquisition, followed by the inevitable natter over a "jar".

The Sunday morning net helped a good deal in the early days to catch many SWL's and others so that within a few short months the membership exceeded thirty. Biggest trouble was the provision

The club station in action. Left to right—G3VEL, G3TZM, and SWL Jack.

Club President G2QK directs operations. Left to right—G3PMM, G3VFI, Junior Op, G3VLY, G3TZM, G3VOR, SWL Brian.

of transmitting facilities and more suitable accommodation was sought by the Club's President.

After much negotiation and effort the club found its permanent QTH at the Portchester Community Association. This meant a move away from the town centre and it was decided to change the Club's name to one more in keeping with the new circumstances. Meetings were now held every Sunday and before long such was the demand that an additional evening for practical work was arranged. Once again members rallied to the cause and workshop facilities were obtained together with an adequate supply of the usual tools.

Sundays are now set aside for more organised activities and a full and varied winter programme is under way. This takes the form of a monthly lecture or demonstration, the remaining evenings being reserved for discussions, informal talks and quizzes.

Memorable occasion recently was when a new call-sign broke into the Sunday morning net. The newcomer turned out to be not only a club member but the Chairman himself.

Regular features in the club calendar are the Fareham Fair and the local Gymkhana. These give club members the opportunity to set up a temporary station, younger members looking after the usual tree climbing.

The Club now has a membership of over 40 with 16 licences, interests ranging from Top Band DX to the technicalities of u.h.f. Now with its own AR88D, a respectable antenna system almost completed and a newly acquired all band transmitter, the club is well and truly "on the air".

new books

TAPE RECORDING YEARBOOK—1966
Published by Print and Press Services Ltd.
128 pages, 9 × 5¾in. paperback. Price 7s. 6d.

FOR those who, like the reviewer, spend their working days immersed in the technicalities of tape recording, this annual collection of facts and figures is an indispensable reference. The current issue is no simple reprint, but has been brought as nearly up-to-date as publication times allow, thus providing current information on tape recorders, decks, mixers, microphones, radio tuners and miscellaneous accessories. In addition, the important section on manufacturers and agents has been revised and is a directory of real value.

For the ordinary enthusiast, the Yearbook offers comprehensive data on many different machines, plus articles of interest by well-known writers in this field dealing with recording, using microphones and tape-plus-cine respectively.

The catalogue section follows the same form as in previous years. The only omission we would like to see rectified is the input and output impedance and sensitivity specification—but, after all, for 7s. 6d., one cannot expect everything. As it is, we certainly get our money's worth.—*HWH*.

TAPE RECORDERS—HOW THEY WORK
By Charles G. Westcott and Richard F. Dubbe
Published by Foulsham-Sams Technical Books Ltd.
177 pages, 8¾ × 5½in., hard covers. Price 24s.

SLIMMER, neater, and two shillings cheaper, this is the latest edition of the successful volume reviewed in the September 1965 issue of *Practical Wireless*.

To achieve the fining down, the publishers have used a cleaner type, omitted the final chapter on Special Applications, and small parts of other chapters, whittled the less necessary diagrams and applied the blue pencil to some of the text.

One could argue with the choice of material to be omitted: Chapter 5, on Recording Level Indicators, renamed *Volume Indicators* has some useful information expunged and five whole pages on preamplifier design have been dropped from Chapter 8. It is perhaps fortunate that the excellent chapter on motors has been tidied and retained.

More serious is the information that should have found its way into a new edition to bring it more up-to-date. There is still no admission that alternative systems to NARTB exist. DIN/CCIR would seem to be a myth, and in the chapter on equalisation this error is compounded by a complete avoidance of explanation of the time-constant specification of recording characteristics; quite unforgiveable in a semi-technical work such as this. Again, quarter-track recording and the various facilities it affords are not mentioned, neither is videotape, and a passing reference to head-gaps gives a limitation of 0.00025in., now regarded as "barn-door" dimensions by the better manufacturers.

This is a pity, for the book as a whole is a commendable addition to the enthusiast's library. Despite which, this reviewer will cling to his original copy and hanker after the book that some British authority will some day produce along the same lines. Recommended—but with reservations. —*HWH*.

INSTRUCTIONS TO RADIO CONSTRUCTORS.
By R. H. Warring. Second edition, published by Museum Press Ltd. 144 pages. Size 8½ × 5in. Price 15s.

WHEREAS the first edition covered basic radio theory and the design and construction of simple receivers, the second edition is more ambitious and includes quite a lot more information. For instance, a chapter on the design and construction of home printed circuts has been added. Another new chapter deals with the design and construction of the smaller transistor receivers. The original series of circuit designs have been retained, as these are—to quote the author—well proven in performance.

Some thirty pages of this book are devoted to appendices, which range from broadcast frequency details and how to calculate circuit component values to data on the valves and transistors specified in the various circuits. An appendix is also included on receiver faults, but is not very comprehensive.

This book would make suitable reading for those who would like to begin constructing, yet have no knowledge whatever of the subject.—*JRC*.

TRANSISTOR ETCHED-CIRCUIT PROJECTS
By James Kyle. Published by W. Foulsham & Co. Ltd.
144 pages. Size 8½ × 5in. Price 24s.

THIS novel publication deals with the use of printed circuits in home constructed gear and contains a number of actual negatives for the boards used in the various circuits given in the body of the book. These circuits range from an extremely simple potential divider network—called the volter—to an 80 metre c.w. transmitter.

The first chapter contains a lot of information on printed circuits, from which the average home constructor should be able to knock-up his own circuits at little expense. The following chapters deal with various projects, some very simple and which could be put together with a minimum of knowledge.—*JRC*.

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TECHNICAL DESCRIPTION

Double-purpose FM unit using 7 transistors and 2 diodes. R.F. amplifier is followed by a self-oscillating mixer and three stages of I.F. amplification. The low I.F. employed in this set enables the problems of I.F. transformers and alignment to be eliminated. A pulse-counting discriminator ensures better audio quality. One output is for feeding to amplifier or recorder and the other enables the Micro FM to be used as a pocket receiver. A.F.C. "locks" the programme tuned in. The telescopic aerial included is sufficient in all but the worst signal areas.

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Here is a pre-amp/control unit designed for the exacting enthusiast wishing to have the very best. It incorporates the finest possible matched components in circuitry developed specially by Sinclair Radionics own research laboratories. The SINCLAIR STEREO 25 Pre-amplifier and Tone Control Unit is ideal in any stereo system where it is intended to take fullest advantage of today's best amplifier and auxiliary equipment systems. When the output from the stereo 25 is fed to two Z.12s, there is even great advantage in the appreciable saving in what you need spend to get first class hi-fi. In appearance, the Stereo 25 reflects the professional elegance which characterises all Sinclair designs. The front panel is in solid aluminium brush finished and polished in horizontal sections. Solid aluminium knobs are fitted. Mounting the unit is simple and it will enhance any hi-fi furnishing scheme in which it is used. A PZ.3 is recommended for powering the Stereo 25 and two Z.12s stereo assembly. For complete hi-fi coverage a Sinclair Micro FM should be used for the radio section.

TO BRING THE BEST OUT OF ANY HI-FI EQUIPMENT

TECHNICAL DESCRIPTION

Performance figures obtained with the Stereo 25 fed to two Z.12s, powered by a PZ.3.

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79/6

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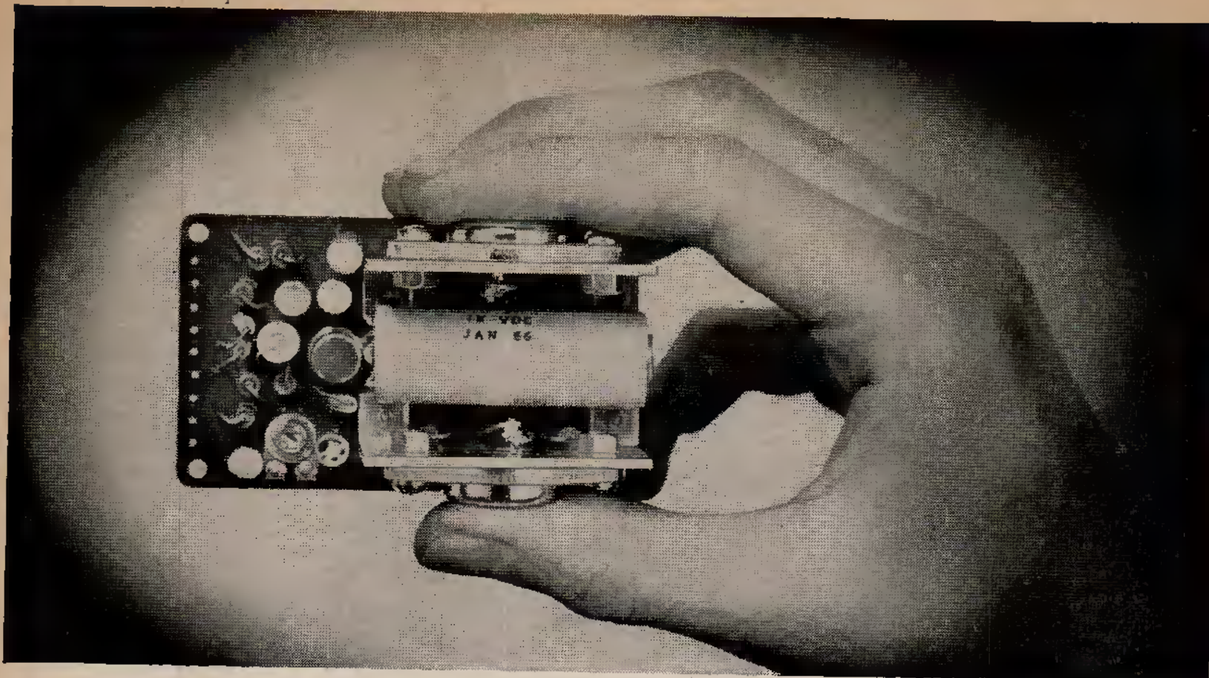

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89/6

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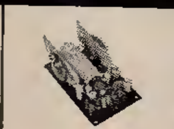
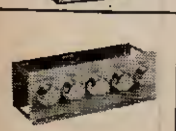


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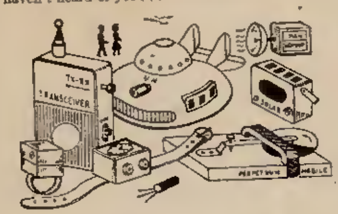

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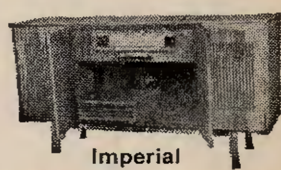

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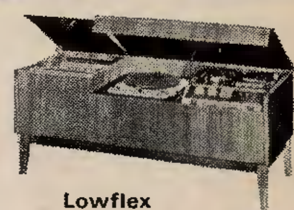

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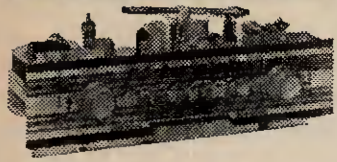

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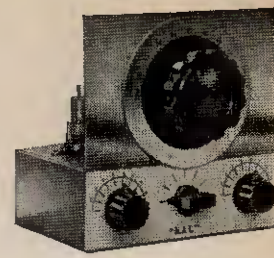

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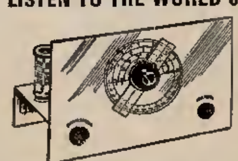

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2C51	12/-
2CW4	12/-
2D21	6/-
2E24	40/-
2E26	22/6
3A4	4/-
3A5	7/-
3A8GT	8/-
3AV6	6/6
3B7	5/-
3B28	40/-
3D6	4/-
3E29	60/-
3Q4	7/-
3Q5GT	6/6
3S4	5/-
3V4	6/-
4-65A	80/-
4E27	60/-
4THA	8/-
4T8P	8/-
4X150A	100/-
4X250B	120/-
5R4GY	9/-
5U4G	5/-
5U8GB	6/6
5U8	8/-
5V4G	8/6
5Y3GT	5/-
5Z3	7/6
5Z4G	7/-
6/30L2	8/6
6A8	8/-
6AB4	6/6
6AB7	4/-
6AC5GT	10/-
6AC7	4/-

6AF4	10/-
6AF6G	11/-
6AG5	2/6
6AG7	6/-
6AH6	10/-
6AK5	5/-
6AL5	3/-
6AM5	2/6
6AM6	4/-
6AN8	10/-
6AQ4	5/-
6AQ5	5/6
6AR5	6/-
6AR6	6/-
6AR8	17/6
6AS5	5/-
6AS6	6/-
6AS7G	15/-
6AT6	4/6
6AU6	5/6
6AU6A	6/6
6AC8	9/-
6AV5GTA	11/-
6AV6	5/-
6AW8A	12/6
6B4G	17/-
6B8	7/-
6B8G	2/6
6BA6	4/6
6BA7	15/-
6BE6	4/6
6BF6	6/-
6BF7	15/-
6BG6G	16/-
6BH6	7/6
6BJ6	7/6
6BK4	22/6
6BK7A	9/-
6BL7GTA	10/-
6BN6	7/6
6BQ7A	7/-
6BR7	11/-
6BR8	5/-
6BS7	17/-
6BW6	7/-
6BW7	10/-
6BZ6	6/-
6BZ7	11/-
6C5	8/-
6C5GT	6/-
6C6	4/-
6C9	11/-
6C31	12/-
6CB6	5/-
6CD6GA	17/-
6CG7	10/-
6CH6	8/-
6CL6	9/-
6CU6	11/-
6CW4	12/-
6CY5	10/-
6CY7	11/-
6D4	15/-
6D6	3/-
6DC6	12/6
6DK6	8/-
6DQ6G	11/-

6DS4	15/-
6E5GT	8/-
6EA8	11/-
6F1	14/-
6F4	30/-
6F5G	8/-
6F6G	5/-
6F7	5/-
6F8G	5/-
6F11	6/-
6F12	4/-
6F13	6/6
6F14	15/-
6F15	11/-
6F17	6/-
6F18	7/6
6F23	10/-
6F24	12/-
6F25	12/-
6F28	10/6
6H6	2/-
6J4	8/-
6J5G	4/-
6J6	3/6
6J7G	5/-
6K6G	6/-
6K7GT	5/-
6K8	8/-
6K8G	4/-
6L6GC	7/6
6L17	9/-
6L18	6/-
6LD20	5/-
6N7GT	7/-
6P25	12/-
6P28	12/6
6Q5G	15/-
6Q7	7/-
6SA7	7/-
6SC7	9/-
6SF5	8/-
6SF7	7/-
6SG7	6/-
6SH7	4/-
6SJ7	7/-
6SK7	6/-
6SL7GT	6/-
6SN7GT	4/6
6SQ7	7/-
6SR7	7/-
6T8	6/6
6U4GT	10/6
6U8	7/6
6U8A	9/6
6V6GT	6/6
6X4	4/-
6X5GT	5/6
6Y6G	9/-
7B6	11/-
7B7	7/-
7B8	8/-
7C5	11/-
7C6	6/6
7C7	5/-
7H7	8/-
7S7	22/-
7Y4	8/-
7Z4	6/-
9BW6	7/-

10C1	12/-
10C2	13/-
10D1	7/-
10F1	9/-
10F3	8/-
10F9	10/-
10F18	9/-
10L1	7/6
10P13	15/-
10P14	15/-
11D3	7/-
11D5	7/-
12AC6	8/-
12AD6	9/-
12AE6	7/6
12AL5	7/-
12AQ5	7/-
12AT6	5/-
12AT7	4/-
12AU6	6/-
12AU7	5/6
12AV6	5/6
12AV7	8/-
12AW6	20/-
12AX7	6/-
12AY7	10/-
12B4A	9/-
12BA6	5/6
12BE6	5/6
12BH7	6/-
12BY7	10/-
12C8	4/6
12E1	20/-
12K5	10/-
12K5	10/-
12K7GT	7/-
12K8	8/-
12Q7G	4/-
12SA7	7/-
12SC7	4/-
12SG7	5/-
12SH7	4/-
12SJ7	4/-
12SK7	5/-
12SL7GT	7/6
12SN7GT	7/6
12SR7	5/-
14S7	18/-
20D1	9/-
20F2	13/-
20L1	13/-
20P1	12/-
20P3	12/-
20P4	13/-
20P5	11/-
25L6GT	6/6
25Z4G	8/-
25Z5	8/-
25Z6GT	11/-
28D7	7/-
30A5	7/-
30C1	6/3
30C15	11/6
30C17	11/6
30C18	11/-
30F5	10/-
30FL1	14/-
30FL12	10/-
30FL13	6/-

30FL14	13/-
30L1	6/6
30L15	15/-
30L17	15/-
30P12	9/-
30P16	7/-
30P18	6/6
30P19	13/-
30PL1	15/-
30PL13	15/-
30PL14	15/-
35A3	10/-
35A5	10/-
35B5	12/-
35C5	6/6
35D5	12/-
35L6GT	6/-
35W4	4/6
35Z3	10/-
35Z4G	4/-
35Z4GT	8/6
35Z5GT	5/6
42	6/-
431U	8/-
50A5	12/-
50B5	6/3
50C5	6/-
50CD6G	27/6
50L6GT	6/-
52KU	7/-
55CG	30/-
58CG	45/-
75C1	13/-
80	6/-
83A1	12/-
85A1	25/-
85A2	7/6
85A3	5/6
90AG	46/-
90AV	46/-
90C1	12/-
90CG	25/-
90CV	25/-
117N7	30/-
150B2	10/-
150B3	8/-
211	30/-
310A	25/-
311A	35/-
807	9/-
811	40/-
812A	57/6
815	35/-
832	20/-

866A	14/-
872A	40/-
884	15/-
955	3/-
956	2/-
957	5/-
958A	4/-
959	8/-
991	7/-
1267	20/-
2050	12/-
4313C	20/-
5651	7/6
5654	8/-
5670	10/-
5718	10/-
5749	10/-
5751	12/-
5763	5/-
6080	25/-
6146	25/-
6159	32/-
6293	60/-
6360	30/-
6939	45/-
7551	30/-
8136	15/-
9002	5/6
9003	9/-
A1820	20/-
AC/HL/DD	8/-
AC/HL/DDD	10/-
AC/SG	13/-
AC5/PEN	10/-
AC6/PEN	8/-
AR8	6/-
ARP12	3/6
AT825	9/-
AW6	5/-
AZ11	6/-
AZ12	9/-
AZ31	9/-
AZ41	7/-
CBL31	15/-
DA90	4/-
DAC32	7/6
DAF40	10/-
DAF91	4/6
DAF92	6/-
DAF96	6/6
DC90	7/-

DCC90	7/-
DF33	8/-
DF64	5/-
DF91	3/-
DF92	2/6
DF96	7/-
DH63	6/-
DK32	8/-
DK40	11/-
DK91	6/-
DK92	8/-
DK96	7/-
DL33	6/6
DL35	5/-
DL66	10/-
DL69	12/6
DL91	5/-
DL92	6/-
DL93	4/-
DL94	6/-
DL95	7/-
DL96	7/-
DM70	5/6
DY30	8/-
DY86	6/6
E88CC	12/6
E90CC	10/-
E92CC	7/-
E180CC	8/-
E180F	17/6
E182CC	23/-
EA50	2/-
EABC80	6/6
EAC91	4/-
EAF42	8/6
EBC33	7/-
EBC41	8/6
EBC81	6/3
EBC90	4/6
EBC91	5/-
EBF80	7/6
EBF83	8/-
EBF89	7/-
EBL31	20/-
EC86	12/-
EC88	11/-
EC90	2/6
EC91	5/-
EC93	6/6
ECC35	17/-
ECC40	9/6
ECC70	15/-
ECC81	4/-
ECC82	5/-

ECC83	6/-
ECC84	6/6
ECC85	5/-
ECC86	7/-
ECC88	8/-
ECC91	3/6
ECC189	11/-
ECC804	10/-
ECF80	7/-
ECF82	7/6
ECF82	12/-
ECF86	9/6
ECH35	11/-
ECH42	9/6
ECH81	5/3
ECH83	7/6
ECH84	9/-
ECL80	7/-
ECL81	7/6
ECL82	6/3
ECL83	9/6
ECL84	12/-
ECL85	11/6
ECL86	9/-
EF36	5/-
EF37A	8/-
EF39	6/-
EF40	9/-
EF41	8/6
EF42	11/-
EF54	6/-
EF55	8/-
EF80	5/-
EF83	10/-
EF85	6/6
EF86	6/3
EF89	5/6
EF91	4/-
EF93	4/6
EF94	5/6
EF95	5/-
EF96	2/6
EF97	10/-
EF98	10/-
EF183	6/6
EF184	6/6
EF800	8/-
EF804	21/-
EF811	12/-
EF812	10/-
EF814	12/-
EH90	7/6
EK90	4/6

EL22	15/-
EL33	12/6
EL34	8/6
EL35	5/-
EL36	8/6
EL38	17/6
EL41	8/6
EL42	7/6
EL81	9/-
EL82	8/-
EL83	7/-
EL84	4/3
EL85	7/6
EL86	8/-
EL90	5/6
EL91	2/6
EL95	5/-
EL360	22/-
EL821	6/-
EL822	16/-
EM34	13/-
EM35	8/-
EM80	7/-
EM81	7/-
EM84	7/-
EM85	11/-
EN91	6/-
EN92	6/-
EY51	7/-
EY81	7/-
EY83	9/-
EY84	7/6
EY86	6/6
EY87	8/-
EZ22	6/-
EZ35	5/6
EZ40	7/6
EZ41	8/-
EZ80	5/-
EZ81	5/-
EZ90	4/-
GS10H	40/-
GTE175M	12/-
GU50	25/-
GZ30	7/6
GZ32	10/-
GZ34	10/-
GZ37	12/-
HABC80	8/-
HBC90	5/-
HBC91	5/6
HF93	6/-
HF94	6/-
HL2	4/-
HL2K	4/-
HL23	6/-
HL23DD	6/-
HL41	4/-
HL92	6/6
HL94	7/-
HL132D	4/-
HL133DD	10/-
HN309	15/-
HY90	4/6
KT2	7/-
KT32	6/6

KT36	17/6
KT41	7/6
KT44	5/-
KT45	15/-
KT66	16/-
KT67	45/-
KT76	8/-
KT88	23/-
LP2	7/-
MH4	5/-
MH41	9/-
MHL4	5/-
MS/PEN	8/-
MS/PENT	10/-
N78	16/-
PABC80	7/6
PC86	11/-
PC88	11/-
PC97	7/6
PC900	9/-
PCC84	5/6
PCC85	7/-
PCC89	11/-
PCC189	11/-
PCC805	11/-
PCC806	11/-
PCE800	10/6
PCF80	6/3
PCF82	6/6
PCF87	11/6
PCF800	10/-
PCF801	9/6
PCF802	9/6
PCF805	11/-
PCF806	12/-
PCF808	11/-
PCL80	10/6
PCL81	9/-
PCL82	7/-
PCL83	8/6
PCL84	7/6
PCL85	9/-
PCL86	8/6
PCL88	10/6
PCL800	12/-
PCL801	10/6
PEN25	5/-
PEN36C	8/-
PEN45	7/-
PEN45DD	12/-
PEN46	6/-
PEN220A	7/-
PEN383	10/-
PEN384	7/-
PEN453DD	10/-
PENA4	7/6
PF86	7/6
PF818	10/-
PFL200	14/-
PL36	9/-
PL38	16/-
PL81	6/-
PL82	7/-
PL83	6/6
PL84	6/6

PL302	13/-
PL500	13/6
PT15	15/-
PX4	20/-
PX25	15/-
PY32	8/6
PY33	8/6
PY80	5/6
PY81	6/-
PY82	5/6
PY83	6/-
PY88	8/-
PY301	11/-
PY800	6/-
PY801	6/-
PZ30	8/6
QP21	5/-
QP25	5/-
QP230	5/-
QQV02-6	45/-
QQV03-10	30/-
QQV06-40	90/-
QS83/3	7/6
QS92/10	4/-
QS95/10	5/6
QS150/15	8/-
QS1200	10/-
QS1202	8/6
QS1203	8/6
QS1215	12/-
QVO3-12	10/-
QVO5-25	9/-
R1	8/-
R2	8/-
R10	15/-
R18	7/6
SP2	4/-
SP41	5/-
SP61	4/-
SU45	15/-
SU2150A	12/-
TP22	7/-
TP25	5/-
TP2620	7/6
TT21	35/-
TZ40	40/-
U10	8/-
U12/14	8/-
U17	5/-
U18/20	8/6
U21	7/-
U22	6/-
U25	13/-
U26	13/-
U27	7/6
U37	20/-
U50	5/-
U52	6/6
U70	4/6
U76	4/-
U78	4/-
U191	11/-
U193	7/-
U251	6/-

U281	12/-
U282	12/-
U301	11/-
U403	7/-
U404	5/-
U801	17/-
UABC80	5/3
UAF42	9/-
UB41	10/-
UBC41	8/-
UBC81	8/-
UBF80	6/6
UBF89	7/-
UBL21	10/-
UC92	6/-
UCC84	9/-
UCC85	6/6
UCF80	9/6
UCH21	9/6
UCH42	9/-
UCH43	8/-
UCH81	6/3
UCL81	9/-
UCL82	7/3
UCL83	9/-
UF9	10/-
UF41	8/-
UF42	9/-
UF43	8/-
UF80	7/-
UF85	7/6
UF86	9/-
UF89	7/-
UL41	9/-
UL84	6/6
UM4	10/-
UM80	5/-
UM81	10/-
UU5	8/-
UU7	10/-
UU8	7/-
UU9	7/-
UU10	8/-
UY1N	9/-
UY21	9/-
UY41	6/6
UY82	9/6
UY85	6/-
VP23	3/6
VP41	5/-
VU39	8/-
W81M	6/-
W729	10/-
X76M	7/6
XC12	6/6
XC15	4/6
XC16	7/-
Y63	8/-
Y65	5/-
Z22	5/6
Z62	5/-
Z63	9/-
Z66	10/-
Z759	23/-
Z803U	15/-
Z900T	13/-

POWER UNITS TYPE 234

19in. rack mounting fully smoothed and fused for 230v. A.C. input. H.T. output adjustable from 180 v. to 270 v. at 80mA, by means of primary taps and high-low switch in the secondary winding. L.T. output 6.3 v. A.C. at 4 amps. Fitted with M.I meter to read A.C. input and D.C. output volts. Second-hand, tested, in good condition **£3.19.6.**

DITTO model without meter, **£3.10.0.**
Packing and carriage 15/-.

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DLR5, Low Impedance, balanced armature. Earpieces can be used as sound powered Microphone, **10/-.**
No. 10 Assembly. Moving Coil Headphones with moving coil Hand Microphone fitted with press-to-talk switch. Rubber earpads. Cord terminated with army type 5-point moulded connector. Low impedance. Brand new. **20/-** ea. Small quantity available if second hand assemblies, checked, in perfect order. **8/6** ea. P. & P. 3/6 per set.

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Scaled 0 to 1 AMP, 2½in. round projecting **12/6**
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DG7–5 General Purpose, Green medium persistence tube. Double electrostatic deflection, for symmetrical deflection only. Typical EHT–800v. Focus voltage 200–300v. Deflection sensitivity X–0.13 to 0.19mm/v.; Y–0.21 to 0.28mm/v. Base B9G.

DG7–6—identical with DG7–5 but with 'X' plates intended for asymmetrical deflection only, **80/-.** Suitable sockets B9G, 1/6.

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TYPE MF15

A.C. and D.C. voltage ranges: 0-10-50-250-500-1000V.
D.C. current ranges: 500µA-10-100mA.
Resistance ranges; 100MΩ-1MΩ. The meter is also calibrated for Inductance (10-1000H), capacity (0.6µF) and output level measurements. Sensitivity 2000ΩV. Accuracy ±2.5% for D.C. and ±4% for A.C. measurements.
Dimensions: 5⅜ x 3⅞ x 1⅝in. Price **£3.3.0.**

Type 108-IT: 24 range precision portable meter, 5000 o.p.v. D.C. Volts: 2.5-10-50-250-500-2500V. A.C. Volts: 10-50-100-250-500-2500V; D.C. current 0.5-5-50-500mA Resistance 2000-20,000 ohms; 2-20 megohms. Power output calibration in A.C. for 600 ohms line. Complete with prods and batteries, **£5.5.0.** P. & P. 5/-.

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24µF at 275 V.	2/-	100-400µF at 275 V	3/6
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250mW 5%:			
BZY11, 60.0V ..	6/6	BZY13, 80.0V ..	6/6
280mW 5%:			
OAZ200, 4.7V ..	10/-	OAZ204, 6.8V ..	7/-
OAZ201, 5.1V ..	9/6	OAZ205, 7.5V ..	7/-
OAZ202, 5.6V ..	7/-	OAZ206, 8.2V ..	7/-
OAZ203, 6.2V	7/-	IAZ207, 9.1V ..	9/6
280mW 15%:			
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OAZ209, 4.7V ..	6/6	OZA212, 9.1V ..	6/6
OAZ210, 6.2V ..	6/-	OAZ213, 12.0V ..	6/6
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VR425B (4.25V)	6/6	VR575B (5.75V) ..	6/6
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VR7A (7.0V) ..	8/-	VR13A (13.0V) ..	8/-
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P50/2CC, 470 kc/s., 1st and 2nd I.F.	5/7
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PRACTICAL WIRELESS, FEBRUARY 1967

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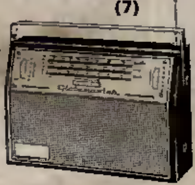

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