PRACTICAL WIRELESS

MARCH 1965

2/-

KEYED AUDIO OSCILLATOR

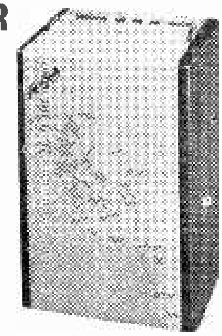
FOR THE EXPERIMENTER

R.S.C. (MANCHESTER) LTD

R.S.C. BASS-MAJOR 30 WATT AMPLIFIER

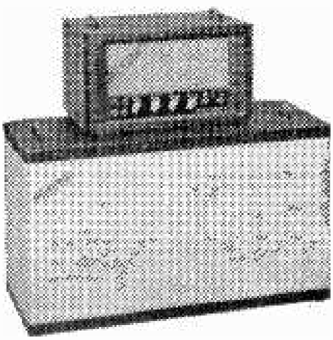
A MULTI-PURPOSE HIGH FIDELITY, HIGH OUTPUT UNIT FOR VOCAL AND INSTRUMENTALIST GROUPS

Eminently suitable for bass, lead or rhythm guitar and all other musical instruments



- ★ Incorporating two 12in. heavy duty 25-watt high flux (17,000 lines) loudspeakers with 2in. diameter speech coils. Designed for efficient handling full output of amplifier at frequencies down to 25 c.p.s.
- ★ Dual Cone in second speaker reproduces frequencies up to 17,000 c.p.s.
- ★ Heavily made cabinet of convenient size 28 x 15 x 13 in. has an exceptionally attractive covering in two contrasting tones of Vynair.
- ★ For 200-250 v. to 50 c.p.s. A.C. mains operation.
- ★ Four jack socket inputs and two independent vol. controls for simultaneous connection of up to four instrument pick-ups or microphones.
- ★ Separate bass and treble controls providing more than adequate "Boost" or "Cut"
- ★ LEVEL frequency response throughout the audible range.
- ★ SUPERIOR TO UNITS AT TWICE THE COST.

39½ Gns. Send S.A.E. for leaflet OR DEPOSIT of £4.3.0 and 12 monthly payments of £3.9.11 (Total £46.2.0) Carr. 17/6.



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

AN EXCEPTIONALLY POWERFUL HIGH QUALITY ALL-PURPOSE UNIT

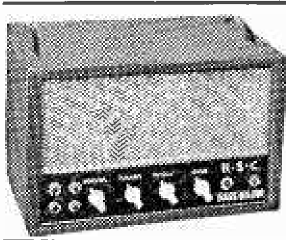
For bass, lead or rhythm guitar and all other musical instruments

For vocalist, gram, radio, tape and general P.A.

- ★ UNUSUALLY POWERFUL LOUDSPEAKER COMBINATION consisting of a FANE HIGH FLUX 15in. 30 watt unit and a FANE 12in. 20 watt unit with extended frequency response.
- ★ 4 Jack Socket inputs and two independent volume controls for simultaneous use of up to four instruments, pick-ups, or mikes.
- ★ Separate Cabinets fully covered with Rexine and Vynair in contrasting tones for Amplifier and Speakers.
- ★ Separate Bass and Treble controls for "Boost" and "Cut".

Send S.A.E. for leaflet. Or call at one of our many branches and compare the Bass-Regent with units at more than 3 times the cost. **44** Cash Price GNS. Carr. 19/6 Or Deposit £4.16.6 and 12 monthly payments of £3.16.8 (Total £50.16.6)

THE BASS-REGENT AMPLIFIER UNIT ONLY CAN BE SUPPLIED SEPARATELY AT 21 Gns. Deposit 48/6 and 9 monthly payments of 48/6. (Total £24.5.0) Carr. 10/-. The speaker unit is not separately available.

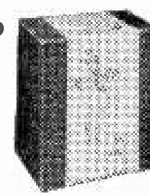


30W. HIGH QUALITY AMPLIFIER

A Four Input, two volume control Hi-Fi unit with separate Bass and Treble "Cut" and "Boost" controls. Designed for vocal or instrumental groups. For Bass, Lead or Rhythm Guitar. Six Mullard or Brimar latest type valves. Housed in strong Rexine covered cabinet with twin chrome carrying handles. Attractive black and gold perspex fascia plate. For 200-250 v. A.C. mains. Output for 3 or 15 ohm speakers. Send S.A.E. for leaflet.

16½ GNS. Carr. 10/- or Deposit £2.1.6 and 12 monthly payments of £1.8.4 (Total £19.1.6).

HEAVY DUTY LOUDSPEAKERS IN SUBSTANTIAL REXINE COVERED CABINETS

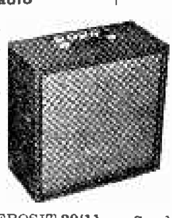


TYPE BG1 Suitable for Bass Guitar. Speaker Unit 15in., High Flux. 15 ohms. 30 watts. Cabinet size approx. 24 x 21 x 13in. Only **19½Gns.** Or Deposit 43/- and 12 monthly payments of 34/- (Total £22.11.0).

TYPE BG3/2 Suitable Bass and Lead Guitar. Two 12in. high flux 15 ohm 25 watt speakers, one with aluminium speech coil and dual cone to provide smooth frequency response from 25 to 17,000 c.p.s. Cabinet size approx. 30 x 21 x 14in. Covered in two contrasting tones of grey Vynair and Rexine. Rating 50 watts. Only **29Gns.** Or Deposit £3.7.6. and 12 monthly payments of 50/-. (Total £33.7.6).

R.S.C. G15 15 WATT AMPLIFIER

for Lead or Rhythm Guitar, 'Mike', Gram, Tape or Radio



High-fidelity push-pull output. Separate bass and treble "Cut" and "Boost" controls. Twin separately controlled inputs so that two instruments or "mike" and pick-ups can be used at the same time. Loudspeaker is a heavy duty high flux 12in. 20 watt model with cast chassis. Sturdy cabinet is covered in pleasing shades of Rexine/Vynair. Model Size approx. 18 x 18 x 8in. Only **19 Gns.** Carr. 10/-

Send S.A.E. for leaflet. Or DEPOSIT 39/11 and twelve monthly payments of 33/4 (Total £21.19.11).

R.S.C. G5 AMPLIFIER

for Guitar, 'Mike', Gram or Radio

5-watt high quality output. Incorporating high flux 12in. 10 watt 12,000 line loudspkr. Sensitivity 30 m.v. High impedance jack input. Handsome strongly made cabinet (size 14 x 14 x 7in. approx.) finished in complementary shades of Rexine/Tygan. 200-250 A.C. mains. Suitable for Lead or Rhythm Guitar in home or small club, etc. £9.19.6 Or DEPOSIT 22/3 and 9 monthly payments of 22/3 (Total £11.2.6) Carr. 7/6.

R.S.C. BASS/20 AMPLIFIER

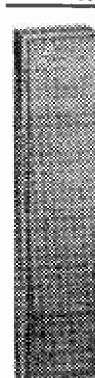
A multi-purpose unit especially suitable for BASS GUITAR

A highly efficient unit incorporating massive 15in. high flux loudspeaker specially constructed to withstand heaviest load conditions. Rating 25 watts. Individual bass and treble controls give ample "Boost" and "Cut". Two high impedance jack socket inputs are separately controlled. All controls are conveniently positioned in a recess on top of the cabinet. Cabinet is of substantial construction and attractively finished in two contrasting tones of Rexine and Vynair. Size approx. 24 x 21 x 13in. Operation from 200-250 v. 50 c.p.s. A.C. mains.

Send S.A.E. for leaflet **29½ Gns.** Or deposit £3.2.0 and 12 monthly payments of 51/8. (Total £34.2.0) Carr. 17/6.

LINEAR TREMOLO/PREAMP. UNIT

Designed for introducing the Tremolo effect to any amplifier which is fitted with a reserve power supply point for smoothed H.T. and 6.3 v. A.C. L.T. The unit plugs into power supply point and any input socket or amplifier. Controls are Speed (frequency of interruptions). Depth (for heavy or light effect). Volume and Switch. Three sockets are for two inputs and Foot Switch. ONLY **4 Gns.**



R.S.C. COLUMN SPEAKERS

Finished in polished veneered walnut. Ideal for vocalists and Public Address. Normally supplied for 15 ohm matching but can be supplied for 100 v. line for 35/- extra.

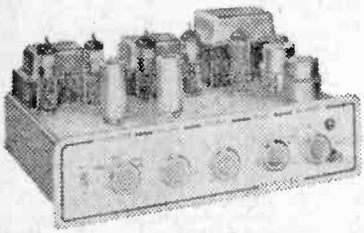
Type C57, 10-15 watts. Fitted five 6 x 4 elliptical speakers. Overall size approx. 26 x 9 x 4in. **9 Gns.** Carr. 7/6

Type C58, 15-20 watts. Fitted five 8in. high flux speakers. Overall size approx. 42 x 10 x 5in. **12 Gns** Carr. 10/-

Or deposit 27/6 and 12 monthly payments 20/10 (Total £13.17.6).

Introducing the R.S.C. STEREO/20 HIGH FIDELITY AMPLIFIER

PROVIDING 10/14 WATTS ULTRA LINEAR PUSH-PULL OUTPUT ON EACH CHANNEL



Features include:
★ Three-position tone compensation switch.
★ Stereo/Mono switch so that peak monaural output of 28 watts can be obtained.
★ Separate Bass "Lift" and "Cut" and treble "Lift" and "Cut" controls.
★ Neon panel indicator.
★ Handsome Perspex Frontplate. **12 Gns.** Carr. 10/-

Send S.A.E. for illustrated leaflet.

Complete set of parts with point to point wiring diagrams and instructions, or Factory assembled, tested and supplied with our usual 12 months' guarantee for 16 gns. or DEPOSIT 37/9 and nine monthly payments of 37/9 (Total £18.17.6). Protective wooden cabinet covered in pleasing shade of leathercloth and fitted carrying handles and plastic feet 59/9 extra or DEPOSIT 6/9 and nine monthly payments of 6/9 (Total £3.7.6).

SUITABLE for "MIKE", GRAM., RADIO OR TAPE. INTENDED FOR THE HOME OR STUDIO BUT SUITABLE FOR LARGE HALLS OR CLUBS.

Based on a current Mullard design and employing valves ECC83, ECC83, ECL86, ECL86, ECL86, ECL86, EZ81. Output transformers are high quality sectionally wound to required specification. Output matchings for 3 and 15 ohm speakers on each channel.

FREQUENCY RESPONSE ± 2dB. 30-20,000 c.p.s.

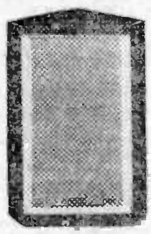
HUM LEVEL 65dB down.

SENSITIVITY: 15 millivolts maximum.

HARMONIC DISTORTION (each channel) 0.2%.

For operation on 200/250v. A.C. Mains.

R.S.C. STANDARD BASS REFLEX CABINET. For 12in. loudspeakers, acoustically lined and ported. Size 20 x 14 x 13in. Beautiful walnut veneer finish. Especially recommended for use with Audiotrine Speaker System £5.19.6. Set of four legs can be supplied with brass ferrules for 19/6.

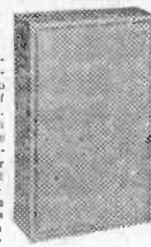


AUDIOTRINE CORNER CONSOLE CABINETS. Strongly made. Beautiful polished walnut veneered finish. Pleasing design.
JUNIOR MODEL. To take up to 8in. speaker. Size approx. 20 x 11 x 8in. Only £2.9.9.
STANDARD MODEL To take up to 10in. speaker. Size 27 x 18 x 18in. £4.11.9.
SENIOR MODEL. To take up to 12in. speaker and with Tweeter cut-out. Size approx. 30 x 30 x 15in. (Recommended for use with Audiotrine speaker system). 7 gns. or terms.

W.B. "STENTORIAN" HIGH FIDELITY P.M. SPEAKERS HF1012. 10 watts rating. Where a really good quality speaker at a low price is required, we highly recommend this unit with an amazing performance. £4.12.0. Please state whether 3 ohm or 15 ohm required.

R.S.C. JUNIOR BASS REFLEX CABINET. Designed for above speaker, but suitable for any good quality 8in. or 10in. speaker. Acoustically lined and ported. Polished walnut veneer finish. Size 18 x 12 x 10 in. Strongly made. Handsome appearance. Ensures superb reproduction for only £3.19.6.

AUDIOTRINE 3D/1

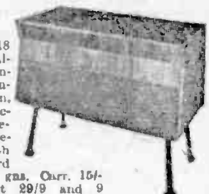


A complete three diaphragm high fidelity loudspeaker unit designed to occupy a minimum of space. Depth is only app. 6in. Height 24in. Width 15in. This has been made possible by the latest developments in loudspeaker design. The 12in. cast chassis Bass unit has a resonant frequency which is extraordinarily low. It has a second diaphragm which extends the frequency range to 17,000 c.p.s. A further speaker operates only on the middle frequencies and ensures a smooth response from 40-17,000 c.p.s. Rating 20 watts. Imp. 15 ohms. Cabinet finish is either polished walnut veneer, or leathercloth to match stereo/20 cabinet. Highly recommended for a Stereo or Mono Amplifier. Surely the best value ever at 11 gns. Or Deposit 25/9 and nine monthly payments of 25/9 (Total £12.17.6).

R.A. 12in. DUAL CONE 3 ohm 8 watt Speakers. Ideal for Stereo. Only 39/9 ea.

LOUDSPEAKERS. 2½in. to 18in. at keen prices. 12in. 6-8 watt 3 ohms 29/11. 12in. 10 watt 12,000 lines 3 ohms or 15 ohms, 59/9. **TWEETERS.** 4in. R.A. 3 ohms 25/9. R.A. 15 ohms 25/9. W.B. 15 ohms 32/3. Fane 15 ohms. Pressure type £3.15.0. Eagle CT 10-15 ohms 27/6.

AUDIOTRINE EQUIPMENT CABINETS



Size 36 x 15 x 18 in. Beautiful walnut veneered finish. Elegant contemporary design. Robust construction. Uncut removable baseboard. Depth above baseboard 5½in. Only 12½ gns. Carr. 15/-. Terms: Deposit 29/9 and 9 monthly payments 29/9 (Total £14.17.6). Full range of equipment cabinets available.

R.S.C. JUNIOR HI-FI REPRODUCER
The very latest Goodmans Axiette 8 High Fidelity loudspeaker (retailing at £5.5.7), fitted in a specially designed Bass Reflex cabinet, size 12 x 18 x 10in. Acoustically lined and ported and finished in polished walnut veneer. Matching impedance 15 ohms. Frequency range 40-15,000 c.p.s. Power handling 6 watts nominal. Ideal for Stereo Carr. 4/6. Deposit £1 and nine monthly payments of £1. **£8.19.6** (Total £10.0.0).

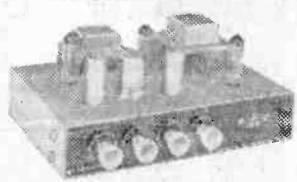
LINEAR L45 MINIATURE 4-5 WATT QUALITY AMPLIFIER. Suitable for any record playing unit and most microphones. Negative feedback 12dB. Separate Bass and Treble Controls. For mains 200-250 v. 50 c/s. Output for 2-3 ohm speaker. Mullard valves EZ80, ECC83, EL84. Size only 7 x 5 x 5½in. high. Guaranteed 12 months. Only 6 gns. Send S.A.E. for leaflet. Terms: Deposit 24/9 and 5 monthly payments of 24/9. (Total £7.8.6).

Jason FMT1 V.H.F./F.M. Radio Tuner design. Total cost of parts including valves, Tuning dial. Escutcheon. etc. £6.19.6.

WE STOCK AT ALL BRANCHES ARMSTRONG, TRUVOX, LINEAR ROGERS, LEAK and JASON EQUIPMENT, GOODMANS, W.B. AND FANE SPEAKERS, GARRARD AND GOLDRING T/TABLES, LUSTRAPHONE, GRAMPIAN, RESLO AND SHURE MICROPHONES, CASH OR TERMS.

HIGH FIDELITY 12-14 WATT AMPLIFIER TYPE A11

PUSH-PULL ULTRA LINEAR OUTPUT "BUILT-IN" TONE CONTROL PRE-AMP STAGES



Two input sockets with associated controls allow mixing of "mike" and gram., as in A10 High sensitivity. Includes 5 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 "Lift" and "Cut". Frequency response ±3 dB 30-20,000 c/s. Six negative feedback loops. Hum level 60 dB down. ONLY 23 millivolts INPUT required for FULL OUTPUT. Suitable for use with all makes and types of pick-ups and microphones. Comparable with the very best designs for **STANDARD or LONG PLAYING RECORDS.** For **MUSICAL INSTRUMENTS** such as **STRING BASS, LEAD OR RHYTHM GUITARS, etc.**
OUTPUT SOCKET with plug provides 300 v. 30 mA. and 6.3 v. 1.5 a. For supply of a **RADIO FEEDER UNIT.** Size approx. 12 x 9 x 7in. For A.C. mains 200-250v. 50 c.p.s. Output for 3 and 15 ohms speaker. Kit is complete to last nut. Chassis is fully punched. Full instructions and point-to-point wiring diagrams supplied. Only **8 Gns.** Carr. 10/-.
(Or factory built 51/- extra.)
If required louvred metal cover with 2 carrying handles can be supplied for 18/9. **TERMS ON ASSEMBLED UNITS. DEPOSIT** 24/9 and 9 monthly payments of 24/9 (Total £12.7.6). Send S.A.E. for illustrated leaflet detailing Cabinets, Speakers, Microphones, etc., with cash and credit terms.

LINEAR TAPE PRE-AMPLIFIER. Type LP/1, Switched Negative feedback Equalisation. Positions for Record 1⅞in., 3¾in., 7½in. and Playback. EM84 Recording Level Indicator. Designed primarily as the link between a Collaro Tape Transcriptor and a high fidelity amplifier, but suitable for almost any Tape Deck. Only 9½ gns. S.A.E. for leaflet.

SUPERHET FEEDER UNIT. Design of a high quality Radio Tuner (specially suitable for use with our Amplifiers). Delayed A.V./C. Controls are Tuning, W/Ch. and Vol. Only 250 v. 15 mA H.T. and L.T. of 6.3 v. 1 amp. required from amplifier. Size approx. 9 x 6 x 7in. high. Simple alignment procedure. Point-to-Point wiring diagrams, instructions and priced parts list with illustrations, 2/6. Total building costs £5.5.0. S.A.E. for leaflet.

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

A complete set of parts for the construction of a stereophonic amplifier giving 5 watts high quality output on each channel (total 10 watts). Sensitivity is 50 millivolts. Suitable for all crystal stereo heads. Ganged Bass and Treble Control give equal variation for "Lift" and "Cut". 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. **8 Gns.**
Full constructional details and price list 2/6. Carr. 10/-.
Kit can be supplied assembled and ready to use for 59/6 extra.

AUDIOTRINE HI-FI SPEAKER SYSTEMS. Consisting of matched 12in. 12,000 line, 15 ohm high quality speaker: cross-over unit (consisting of choke, condenser, etc.) and Tweeter. The smooth response and extended frequency range ensure surprisingly realistic reproduction. Standard 10 watt rating. £4.19.9. Carr. 5/-. Or Senior 20 watt, £6.19.6. Carr. 7/6.

AUDIOTRINE HI-FI TAPE RECORDER KIT 25½ GNS. Carr. 17/6

REALISM AT INCREDIBLY LOW COST, CAN BE ASSEMBLED IN AN HOUR
Incorporating the latest Collaro Studio Tape Transcriptor. The Audiotrine High Quality Tape Amplifier with negative feedback equalisation for each of 3 speeds. High Flux P.M. Speaker, empty Tape Spool, a Reel of Best Quality Tape and a Handsome Portable Carrying Cabinet tastefully covered in two contrasting shades of Rexine and Vynair, size 14¼ x 15 x 8½in. high and circuit. Total cost if purchased individually approximately **£40**. Performance equal to units in the £60-£80 class. S.A.E. for leaflets. **TERMS. Deposit £2.13.9** and 12 monthly payments of **44/-. (Total £29.7.9).** Cash price if settled in 3 months.

ONLY 3 PAIRS OF SOLDERED JOINTS PLUS MAINS

R.S.C. GRAM. AMPLIFIER KIT. 3 watts output. Negative feedback. Controls Vol., Tone and Switch. Mains operation 200-250 v. A.C. Fully isolated chassis, Circuit, etc., supplied. Only **39/9.** Carr. 3/9.

SELENIUM RECTIFIERS

F.W. BRIDGE		H.T. TYPES H.W.	
6/12 v. 1a.	3/11		
6/12 v. 2a.	6/11	150 v. 40 mA	3/9
6/12 v. 3a.	9/9	250 v. 50 mA	3/11
6/12 v. 4a.	12/3	250 v. 60 mA	4/11
6/12 v. 6a.	15/3	250 v. 80 mA	5/11
6/12 v. 10a.	26/9	250 v. 250 mA	11/9
6/12 v. 15a.	35/9		

CONTACT COOLED. 250 v. 75 mA, F.W. (Bridge). **10/11.** 250 v. 50 mA. F.W. (Bridge). **8/11.** H.W. 250 v. 60 mA, **5/11.**

BRADMATIC RECORDING HEADS. High Impedance Record/Playback **22/-.** Low Impedance Erase, **12/6.**
MARRIOTT RECORDING HEADS. High Impedance. Record/Playback, Low Impedance. Erase, **25/-** pair.

THE SKYFOUR T.R.F. RECEIVER. A design for a 3 valve long and medium wave 200-250 v. A.C. Mains receiver with selenium rectifier. High gain H.F. stage and low distortion detector. Valve line-up 6K7, SP61, 6V6G. Selectivity and quality excellent. Simple to construct. Point-to-Point wiring diagrams, instructions and parts list **1/9**, maximum building costs **£4.19.6**, inc. attractive walnut veneered wood cabinet 12 x 6¼ x 5½in.

ARMSTRONG High Quality TUNER AMPLIFIER

127M MONO

- ★ 5 watts output
- ★ Frequency response 40-20,000 c.p.s.
- ★ Volume, Treble and Bass Controls
- ★ Inputs for Pick-up and Tape Play-back

A.M. Tuner—Medium Wave 180—600 metres

F.M. Tuner—87—108 m/cs.

£26.10.0

(Case £3.10.0 extra) or **deposit** 58/4 and 9 monthly payments of 58/4 (Total £29.3.4)

ALL OTHER ARMSTRONG MODELS AVAILABLE

127 STEREO

Details as Mono unit but 5 watts per channel

£37.10.0

(Case £3.10.0 extra)

or deposit £3.15.0 and 12 monthly payments of £3.2.6 (Total £41.5.0)

222 STEREO AMPLIFIER

10 watts push-pull per channel. Frequency response 30-20,000 c.p.s. ± 1 dB. Volume, Treble, Bass and Balance Controls. Input sensitivity 80 m.v.

ONLY **£27.10.0** or **deposit £3.0.7** and 9 monthly payments of **£3.0.7** (Total £30.5.10)

HI-FI CRYSTAL PICK-UP HEADS. (Cartridges.) Acos Standard replacement for Garrard, B.S.R. and Collaro, **16/9.** Acos Stereo-Monaural. **29/9.** Ronette Stereo-Monaural **39/9.** B.S.R. Stereo **39/9.**
PICK-UP ARMS. Complete and with latest Acos/hi-fi Turnover Cartridge **29/11.**
CRYSTAL MICROPHONES. Hand type NP110 **12/9**, R.T.C. **19/9**, Acos Mic 40 **25/9**, Acos Mic 45 **29/9**, Stick type Acos 39-1 39/9, BM3 with neckband and heavy table stand **59/9.** Lapel type **29/9.**
COLLARO JUNIOR. 4-speed Single Player Unit and Crystal Pick-up with hi-fi Turnover head. Only **59/6.**
B.S.R. UA14 4-sp'd AUTO-CHANGERS with hi-fi turnover head. **£5.19.6.** Carr. 4/6.
GARRARD AUTO-SLIM 4-SPEED AUTO-CHANGER with high fidelity pick-up. Latest model. For 200-250 v. A.C. mains, **£7.17.6.** Carr. 4/6.
GARRARD AT6 AUTO-SLIM DE-LUXE 4-SPEED AUTOCHANGERS Turnover GC8 head. for 200-250 v. A.C. mains, **£11.9.0.**
GARRARD 3000LM Autochange Latest Plessey Stereo pick-up cart. **£11.11.11.**
GARRARD 4HF Transcription Unit. With arm and mono cartridge **£16.19.6.**
GARRARD 301 Transcription Unit with stroboscope. As used by BBC. **£22.0.11.**
GL3A MINIATURE 2-3 WATT GRAM AMPLIFIER. For use with any single or auto-change unit. Output for 2/3 ohm speaker. For 200-250 v. A.C. mains. Size 11¾ x 2¼ x 2½in. Controls: Vol. and Tone with Switch. Only **59/6.**

SENSATIONAL STEREO OFFER

4 Gns.

A complete set of parts to construct a good quality Stereo amplifier with an undistorted output total 6 watts. For A.C. mains input of 200-250 v. Sensitivity 180 m.v. Ganged Vol. and Tone Controls. Preset balance control. Full instructions and wiring diagrams supplied. Stereo Pick-up Head **19/9** extra with above only.

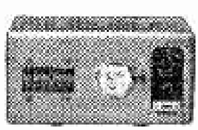
COMPLETE POWER PACK KIT

Consisting of Mains Trans., Metal Rectifier, Double electrolytic smoothing choke chassis and circuit. For 200-250 v. A.C. mains. Output 250 v., 60 mA. 6.3 v., 2 a. **19/11**

R.S.C. BATTERY CHARGING EQUIPMENT

Guaranteed 12 months

All for A.C. Mains 200-250v. 50c/s.



ASSEMBLED 4 amps 6/12 v. Fitted Ammeter and variable charge rate selector. Also selector plug for 6 v. or 12 v. charging. Louvred steel case with stoved grey hammer finish. Fused and ready for use with mains and output leads and battery clips. Carr. 4/6. **59/9**
Terms: Deposit **12/-** and 5 monthly payments of **12/- (Total £3.12.0).**

ASSEMBLED 6/12 v. 2 amps. Fitted Ammeter and selector plug for 6 v. or 12 v. Louvred metal case finished attractive hammer blue. Fused, ready for use with mains and output leads **39/9** Carr. 3/9.
6/12v. 1 amp 27/9 Less meter.

HEAVY DUTY CHARGER KIT 6/12 v. 6 amps., variable output. Consisting of Mains Transformer 0-200-230-250 v.; F.W. (Bridge) Selenium Rectifier; Ammeter, Variable Charge Rate Selector panels, Plugs, Fuses, Fuse-holder and circuit, **59/9.** Carriage 4/6.

BATTERY CHARGER KITS Consisting of Mains Transformer F.W. Bridge. Metal Rectifier, well ventilated steel case. Fuses, Fuse-holders. Grommets, panels, Heavy Duty Clips, circuit. **Carr.** 3/6 extra.

6v. or 12v. 1 amp	22/9
As above with Ammeter	28/9
6v. or 12v. 2 amps	25/9
6v. or 12v. 2 amps. including Ammeter	35/9
6v. or 12v. 4 amps, with Ammeter and variable charge rate selector	52/9

CHARGER AMMETERS 0-1.5 a., 0-4 a., 0-7 a., **8/9** each.

CHARGER KIT, 12v. 10 Amp. with variable charge rate adjustment and ammeter. **£4.19.6.** Carriage 10/-.

R.S.C. MAINS TRANSFORMERS (FULLY GUARANTEED)

Interleaved and Impregnated. Primaries 200-230-250 v. 50 c/s. Screened

TOP SHROUDED DROP THROUGH

250-0-250v. 70mA, 6.3v. 2a, 0-5-6.3v. 2a	17/9
350-0-350v. 80mA, 6.3v. 2a, 0-5-6.3v. 2a	19/9
250-0-250v. 100mA, 6.3v. 2a, 6.3v, 1a	21/9
250-0-250v. 100mA, 6.3v. 3.5a, C.T.	19/9
250-0-250v. 100mA. 6.3v. 4a, 0-5-6.3v. 3a	27/9
300-0-300v. 130mA, 6.3v. 4a, 6.3v. 1a, for Mullard 510 Amplifier	33/9
300-0-300v. 100mA, 6.3v. 4a, 0-5-6.3v. 3a	27/9
350-0-350v. 100mA, 6.3v, 4a, 0-5-6.3v. 3a	27/9
350-0-350v. 150mA, 6.3v. 4a, 0-5-6.3v. 3a	35/9

FULLY SHROUDED UPRIGHT

250-0-250v. 60mA, 6.3v. 2a, 0-5-6.3v. 2a Midget type 2½ x 3 x 3in.	17/11
250-0-250v. 100mA, 6.3v. 4a, 0-5-6.3v. 3a	28/9
300-0-300v. 100mA, 6.3v. 4a, 5v. 3a	28/9
300-0-300v. 130mA, 6.3v. 4a, C.T. 6.3v. 1a, for Mullard Amplifier	35/9
350-0-350v. 100mA, 6.3v. 4a, 0-5-6.3v. 3a	28/9
350-0-350v. 150mA, 6.3v. 4a, 0-5-6.3v. 3a	37/9

FULLY SHROUDED (continued)—

425-0-425v. 200mA, 6.3v. 4a, C.T. 5v. 3a	57/9
425-0-425v. 200mA, 6.3v. 4a, C.T., 6.3v. 4a, C.T., 5v. 3a	59/9
450-0-450v. 250mA, 6.3v. 4a, C.T. 5v. 3a	69/9

OUTPUT TRANSFORMERS

Midget Battery Pentode 66:1 for 3S4, etc.	4/6
Small Pentode, 5,000Ω to 3Ω	4/6
Small Pentode, 7/8,000Ω to 3Ω	4/6
Standard Pentode 5,000Ω to 3Ω	5/9
Standard Pentode 7,000Ω to 3Ω	5/9
10,000Ω to 3Ω	5/9
Push-Pull 8 watts, EL84, or 6V6 to 3Ω or matched to 15Ω	9/9
Push-Pull 10-12 watts to match 6V6 or EL84 to 3-5-8 to 15Ω	19/9
Following types for 3 and 15Ω speakers	
Push-Pull 10-12 watts 6V6 or EL84	18/9
Push-Pull 15-18 watts, 6L6, KT66	22/9
Push-Pull Mullard 510 Ultra Linear	29/9
Push-Pull 20 watts, sectionally wound 6L, KT66, EL34, etc.	49/9

MIDGET MAINS Primaries 200-250 v. 50 c/s.

250v. 60mA, 6.3v. 2a	11/9
250-0-250v. 60mA. 6.3v. 2a.	12/11

Both above size 2¾ x 2¾ x 2½in.

FILAMENT TRANSFORMERS All with 200-250v. 50 c/s primaries 6/3v. 1.5a. **5/9**; 6.3v. 2a, **7/6**; 12v. 1a, **7/11**; 6.3v 3a. **8/11**; 6.3v. 6a, **17/6**; 12v. 1.5a, twice **17/6.**

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150mA. 7-10 H. 250 ohms	11/9
100mA. 10 H. 200 ohms	8/9
80mA, 10 H, 350 ohms	5/9
60mA, 10 H, 400 ohms	4/11

CHARGER TRANSFORMERS All with 200-230-250v. 50 c/s Primaries; 0-9-15v. 1½a, **12/9**; 0-9-15v. 2a, **14/9**; 0-9-15v. 3a, **16/9**; 0-9-15v. 5a, **19/9**; 0-9-15v. 6a, **23/9**; 0-9-15v. 8a. **28/9.**

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MICROPHONE TRANSFORMERS 120:1 high grade, clamped, **8/9.**

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METAL RECTIFIERS. DRM1B 13/-. DRM2B and DRM3B 15/6. LW7 21/-. LW15 26/-. RMO 7/11. RM1 5/3. RM2 6/3. RM3 7/9. RM4 12/9. RM5 17/6. 14A86 17/6. 14A97 19/6. 14A100 23/-. 14A124 26/6. 14A163 35/6. 14B130 31/-. 14B261 11/6. FC101 16/9. 16RC.1.16.1 8/-. FC31 21/-. 16RD.2.2.8.1 11/-. 16RE.2.1.8.1 8/6. 18RA.1.1.8.1 4/-. 18RA.1.2.8.1 11/-. FC116 6/-. FC124 12/6. 8B3 10/6. C2D 9/-. C2H 5/9. C2V 9/-. C3D 11/-. C3B 14/8. C3V 11/-. R3/2D 4/8. Q3/4 3/7.
ELECTROLYTICS. Can types: 32 x 32/450v. 6/-. 50 x 50/350v. 6/-. 64 x 120/350v. 9/-. 60 x 250/275v. 9/6. 100 x 400/275v. 12/6. 100/275v. 3/-. 200/275v. 4/-. 100 x 200/275v. 8/6. Tubular types: 8/450v. 1/9. 16/450v. 2/9. 32/450v. 3/9. 8 x 8/450v. 3/-. 16 x 16/450v. 4/-. 32 x 32/350v. 4/-. 8 x 16/450v. 3/9. 32/350v. 3/-.
MULLARD Midget silicon rectifiers. Types BY100. Output 250 volts ½ amp. No larger than a shirt button 7/- each. Series limiting resistance 1/6.

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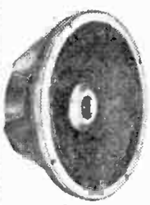
Terms of business—Cash with order or C.O.D. only. Post/Packing 6d. per item. Orders over £3 post free. C.O.D. 3/6 extra. All orders cleared day of receipt. Any parcel insured against damage in transit for 6d. extra. We are open for personal shoppers 8.30—5.30 p.m. Sats. 8.30— 1 p.m. Complete list of modern and obsolete valves, resistors, condensers, transformers, potentiometers, microphones, etc. with terms of business, 6d. Please enquire for any item not listed with S.A.E.

LOUDSPEAKERS



We supply a complete range of Goodmans, Wharfedale, Stentorian, TSL Speaker Units and complete systems. A comprehensive leaflet is available on request this covers technical specifications and prices of nearly 50 types including:—

Celestion Model CX1512 (as illustrated) £11.10.0. Celestion Model CX2012 £16.10.0. Stentorian HF312 5 watts £3.16.0. Stentorian HF1012 10 watts £4.12.0. Goodmans Axiette 8 6 watts £5.5.7. Goodmans Axiom 10, 10 watts £6.5.11. Goodmans Axiom 201, 15 watts £10.17.4. Wharfedale Super 8/RS/12/DD 6 watts £6.14.2. Wharfedale Golden RS/DD 8 watts £7.17.5 Wharfedale RS/12/DD, 15 watts £11.10.0.

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Carr. and Ins. extra

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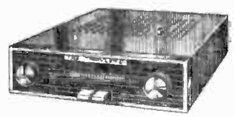
Our ready built transistorised car radio for only

9½ Gns.

P. & P. 5/-



including 7 x 4in. speaker fitted to baffle, fixing brackets, filter unit, all nuts and bolts with fitting instructions.

STAR FEATURES
★ Handsomely Styled ★ Mullard Valves and Transistors ★ Push Buttons. ★ 1½ watts Output. ★ Long and Medium Wavebands. ★ Quality Speaker (E.M.I.). ★ Easily fitted. ★ Radio Luxembourg (and many other foreign stations). ★ 12-volt Positive Earth only (applies to 99.9% of cars on the road). ★ Dimensions: 7 x 2 x 7in. depth. Optional extras: 3-section chromium plated weatherproof telescopic aerials type 1, 17in./44in. 19/6. Type 2 2in./43in. 29/6, both plus p. & p. 2/6 if purchased separately.

THE "HIGHWAYMAN" CAR RADIO
TO BUILD YOURSELF

Similar in appearance to above but with on/off push-button switch. Complete set of parts only **£7.19.6** P. & P. 5/-

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Acos Crystal Model **MIC 45/1 19/6** Acos "Stick" Microphone Crystal. **MIC 39/1 32/6. DM.303** Dynamic High Impedance Desk Microphone complete with Stand, Metallic Green Finish **5 gns. BM.3** Quality Crystal Microphone with Muting Switch. Complete with Lead, Neck Harness and Removable Stand Adaptor **39/6.** Matching Table Stand **12/6** extra. **DX.29** Dynamic High Impedance. Black Crackle Finish with Desk Stand **59/6. DM.301** Dynamic High Impedance with On/Off Switch. Omni-directional. Chrome plated diecast frame **99/6. DM.304** Dynamic Dual High or Low with On/Off Switch. Satin chrome finish **89/6. DM.107.** Dynamic High Imp. with Switch. Chrome and black enamel finish **69/6.**

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MS.4 3 section floor stand **59/6.**
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STERN-CLYNE HI-FI EQUIPMENT
Ready built or Kit of Parts

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Mullard 2 valve Audio Pre-amplifier	£6 6 0	£9 10 0	5/-	2/-
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Mullard "5-10" Amplifier with Tone Control Unit. 10 watts	£12 0 0	£16 0 0	7/6	2/-
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Mullard "10+10" Stereo Amplifier. 10 watts per Channel	£16 0 0	£20 0 0	8/6	3/-
Mullard "10+10" Stereo Amplifier with Passive Control Unit	£20 0 0	£24 0 0	10/-	3/-
Mullard Dual Channel Pre-amplifier	£12 10 0	£15 0 0	7/6	3/-
The above two items purchased together	£27 0 0	£34 0 0	15/-	—
Mullard 4-channel Electronic Mixer Unit Model 2H for 2 Mics. Radio and Gram.	£8 8 0	—	5/-	2/6
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Type "C" Tape Pre-amplifier with Power Unit	£14 0 0	£19 10 0	7/6	3/6
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5in.	600ft.	Standard	8/6
5in.	900ft.	Long Play	10/-
5¾in.	1,200ft.	Long Play	12/6

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3¼in.	600ft.	Double Play	11/6
7in.	1,200ft.	Standard Play	12/6
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5in.	600ft.	Standard	12/6
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7in.	1,800ft.	Long Play	25/-

Postage and Packing 1/- per Reel extra, 4 or more Reels POST FREE.

FULLY AUTOMATIC TAPE SPLICER 14/6. P. & P. 1/6.

PLASTIC TAPE SPOOLS 2¾in. 1/-; 3in. 1/3; 4in. 2/-; 5in. 2/-; 5¾in. 2/3; 7in. 2/6.

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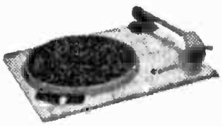
We carry fully comprehensive stocks of Tape Recorders, Decks and Accessories at all Branches or order with confidence by mail.

RECORD PLAYERS



Garrard SRP10 Single Player £5.9.1. Carr. and Ins. 4/6. BSR UA15 Autochanger £5.19.6. Garrard Autoslim Autochanger £6.10.0. Garrard AT6 Autochanger £10.19.6. BSR Super Slim Autochanger £9.19.6. Garrard AT5 LM Autochanger (3000LM) £11.11.11. Philips AG1016 Stereo/Mono Record Player £12.12.0.

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Descriptive leaflet including prices with alternative cartridges, dimensions, terms etc., free on request.

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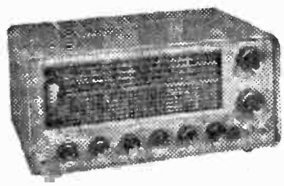

Model HE 40. Frequency range 550 Kc/s-30 Mc/s in 4 bands. PRICE £19.19.0. Carr. 10/-.

Model HE 30. Frequency range 550 Kc/s-30 Mc/s in 4 bands. PRICE £34.13.0. Carr. Paid.

Model KT 320. Specification as HE-30 but offered as complete kit of parts. PRICE £26.5.0. Carr. Paid.

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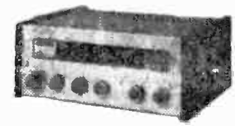
Band coverage 80 - 40 - 20 - 15 and 10 Metres. PRICE £30.9.0. Carr. 15/-. (H.P. Terms available).

Send S.A.E. for fully descriptive brochure.

TUNER UNITS



ARMSTRONG
Mono/Tuner Amp. Model 127M £26.10.0.
Stereo/Tuner Amp. Model 127 £37.10.0
AM/FM Tuner Model 223, £28.15.0.
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STERN FIDELITY Mk. II VHF/FM
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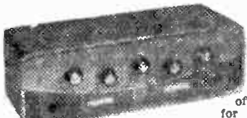
ELECTRONIC HOBBIES ORGANISATION

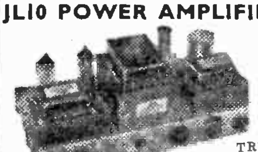
DOUBLE FEATURE PRE-AMPLIFIER



Inputs for microphone, crystal or magnetic pick-ups, tuner unit, and in addition offers full facilities for tape recording and high fidelity replay. This unique feature means that should you wish to include tape in your hi-fi system at a later date all that is required is a suitable tape deck. Push-button switching for 3 tape speeds equalised.

KIT OF PARTS 11 GNS.
BUILT AND TESTED 18 GNS. (Carr. & Ins. 5/-)

JL10 POWER AMPLIFIER



Incorporates the latest diode/pentode ECL86 valves in push-pull PARTRIDGE ultra linear output transformer, PARTRIDGE mains transformer and smoothing choke. 10 watts power output, surplus power output, surplus power available for tuner.

KIT OF PARTS 9½ GNS.
BUILT AND TESTED 12 GNS.
(Carr. & Ins. 7/6)
Prices if both units purchased together:
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BUILT AND TESTED 29 GNS. (Carr. & Ins. 10/-)

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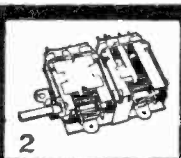
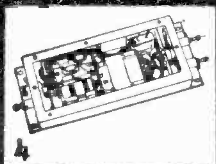


2

3 to 4 watt Amplifier Kit comprising chassis 8¾ x 2½ x 1in. Double wound mains transformer, output transformer, volume and tone controls, resistors, condensers etc. Valves 6V6, ECC81 and metal rectifier. Circuit 1/6 free with kit. 29/6 plus 4/- P. & P.

3



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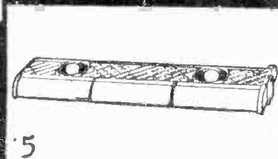

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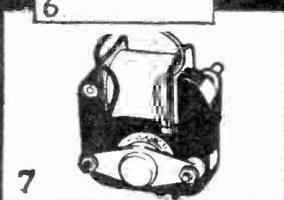

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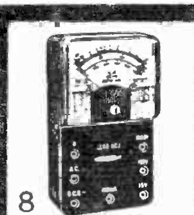

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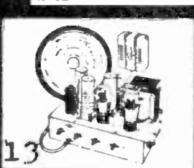

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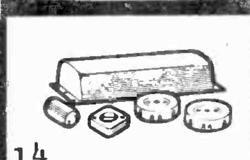

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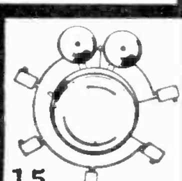

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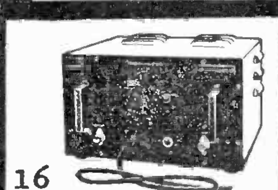

16

1. 6 VALVE 15 WATT PUSH-PULL AMPLIFIER, 15 x 17 x 1¼in. A.C. Mains 200-250 volts. 4 inputs with controls for same and bass and treble lift controls. Tapped for 3 and 15 ohm speakers. Extra H.T. and L.T. for F.M. Tuner supplies etc. Built and tested. 7 gns. P. & P. 12/6.

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3. AMPLIFIER KIT.

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10. The MOTORISTS' REV. COUNTER. Kit of parts comprising 270 degree 3in. moving coil movement. Manufacturer's present price of this movement would be at least £7. Complete with full instructions and circuit diagram. Scale calibrated up to 8,000 r.p.m. Can be used with any 4 or 6 cylinder car. 49/6. plus 3/6 P. & P.

11. B.S.R. MONARCH UA14 WITH FULL FI HEAD. 4-speed, plays 10 records, 12in., 10in. or 7in. at 16, 33, 45 or 78 r.p.m. Intermix 7in., 10in. and 12in. records of the same speed. Has manual play position: colour brown. Dimensions: 12½ x 10¾in. Space required above baseboard 4⅝in., below baseboard 2⅝in. Fitted with Full Fi turnover crystal head, £5.19.6. P. & P. 6/6.

12. 50 MICRO-AMP METER movement by world famous manufacturer. Size 3 x 2¾in., 25/-, plus 1/6 P. & P.

13. 8-watt PUSH-PULL 5 VALVE AMPLIFIER, A.C. mains 200-250v. Size 10½ x 6½ x 2¼in. 5 valves. For use with all makes and types of pick-ups and mike. Negative feed back. Two input, mike and gram. and controls for same. Separate controls for Bass and Treble lift. Response flat from 40 cycles to 15 Kc/s. 2 dB down to 20 Kc/s. Output 8 watts at 5 per cent total distortion. Note level 40 dB down all hum. Output transformer tapped for 3 and 15 ohms speech coils. For use with Std. or L.P. records, musical instruments such as guitars, etc. Suitable for small halls. £3.19.6. P. & P. 7/-. Crystal mike to suit, 15/-, P. & P. 2/-. 8in. P.M. Speaker to suit, 12/6, P. & P. 2/-.

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16. FIXED FREQUENCY SIGNAL GENERATOR. Crystal control in metal case size 10 x 6 x 6in. Incorporating two PC13 valves, mains transformer metal rectifier, choke, indicator, lamp, crystal and numerous components. Modulated and unmodulated output socket. Originally used for I.T.V. frequencies. Brand new. 39/6, plus 6/- P. & P. A.C. mains 200-250 volts.

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	Price	Dep.	&	Mthly. pmts. of
HALF TRACK				
TAPE AMPLIFIER FOR STUDIO DECK with ready wired printed circuit control and input panels, mains and output transformers, knobs, plans, screws, etc. EF86, ECC83, EZ80, EM85 and 2 EL84. 3 watts output. Magic eye. Radio and Mic. inputs. Ex. speaker socket. Tone and Monitor controls. Can be used as an amplifier	£11.11.0	47/-	8	25/0
COLLARO STUDIO DECK. Very latest model, 3 speeds, 3 motors and 7-in. spools	£10.19.6	44/-	8	24/6
CASE for above with 8 x 5in. speaker, two-tone grey	£5. 5.0			
COMPLETE KIT with tape and microphone	£29.19.6	120/-	12	44/-
QUARTER TRACK				
TAPE AMPLIFIER FOR STUDIO DECK as above	£12.12.0	52/-	8	27/6
CASE as above with speaker, two-tone grey	£5. 5.0			
COLLARO STUDIO DECK fitted Marriott "X" series heads	£13.19.6	56/-	12	20/6
COMPLETE KIT with tape and microphone	£33.19.6	136/-	12	49/10
TAPE PRE-AMPLIFIERS				
HALF TRACK for **STUDIO** deck. 400 mV out	£8. 8.0	34/-	6	25/8
QUARTER TRACK as above	£9. 9.0	39/-	6	28/4
TAPE HEADS				
BRADMATIC Half track Record/Playback and Erase on plate	£1.19.6			

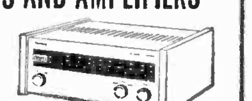
MARTIN AUDIOKITS

	Price	Dep.	&	Mthly. pmts. of
NOW—MARTIN AUDIOKIT F.M. TUNER. Units Nos. 15, 16 and 17 come to	£12.17.6	51/6	12	18/10
We show only the popular units here. Others are available. Leaflet upon request.				
UNIT 1. FIVE INPUT SELECTOR. Size 3¼ x 3in. Mag. P.U., Crystal P.U., Radio, Mic Tape head. 9-15 Volts. Must be used with Unit 4	£2. 7.6			
UNIT 4. PRE AMPLIFIER AND CONTROL. Size 6¾ x 2½in. Volume on/off, Bass and Treble control 9-15 Volts. Must be used with Unit 1	£3. 2.0			
UNIT 7. MAIN AMPLIFIER. 10 watts. 6-transistor Transformerless. Push-pull output. Mounted on Heat sink, 15 ohms output. 40 Volts supply	£6.12.6			
UNIT 8. POWER SUPPLY. Gives 9 and 40 Volts. Heavy duty transformer, rectifier and smoothing	£2.15.0			
CONTROL PANEL for Units 1 and 4	10.6			
ALL FOUR ABOVE UNITS WITH PANEL to make a 10 watt/15 ohms amplifier	£15. 8.0	62/-	12	22/6
UNIT 5. MAIN AMPLIFIER. As Unit 7 but 3 ohms output. 24 Volts	£5.12.6			
UNIT 6. POWER SUPPLY. As Unit 8, use with Unit 5	£2.12.6			
ALL FOUR UNITS 1, 4, 5 & 6 WITH PANEL. 3 ohms	£14. 5.0	57/-	12	20/10

STEREO VERSIONS NOW AVAILABLE, LEAFLET UPON REQUEST.

NEW ARMSTRONG TUNERS AND AMPLIFIERS

Model 222



Model 223

	Price	Dep.	&	Mthly. pmts. of
● **TUNERS, SELF-POWERED**				
224 F.M.	£22.10.0	90/-	12	33/-
223 A.M./F.M.	£28.15.0	115/-	12	42/2
● **TUNER/AMPLIFIERS, MONO**				
127 A.M./F.M. with 5 watt amp	£26.10.0	106/-	12	38/10
227 A.M./F.M. with 10 watt amp	£36.15.0	147/-	12	53/-
● **TUNER/AMPLIFIERS, STEREO**				
127 A.M./F.M. with 5+5 watt amp	£37.10.0	150/-	12	55/-
227 A.M./F.M. with 10+10 watt amp	£52.15.0	211/-	12	77/4
226 As 227 plus Mag. P.U.	£56. 0.0	214/-	12	82/1
● **STEREO AMP 222** 10+10 watt	£27.10.0	110/-	12	40/4

SHELF MOUNTING TEAK CASE £3.10.0 EXTRA ALL MODELS.
SEND FOR NEW LEAFLET GIVING FULL TECHNICAL DETAILS.

MONO AMPLIFIERS

	Price	Dep.	&	Mthly. pmts. of
LINEAR L45/A 3 valve. 3 watt	£6. 6.0			
DULCI GA5 Integrated. 5 watts. ECL86 valve	£13. 2.6	52/6	12	19/3
TRIPLETONE HI-FI MAJOR 10 watts output. 2 EL84	£15.18.9	64/9	12	23/3
LEAK TL12 10 watt **MAIN AMPLIFIER**	£20. 0.0	80/-	12	29/4
LEAK VARISLOPE Mono Pre-amplifier	£15.15.0	63/-	12	23/1
DULCI DPA15 15 watt with 2 valve Pre-amp.	£26.5.0	105/-	12	38/6

STEREO AMPLIFIERS

	Price	Dep.	&	Mthly. pmts. of
ROGERS CADET Mk. II with P.A.	£26.15.0	107/-	12	39/2
LEAK TRANSISTOR STEREO 30 P.A.	£49.10.0	198/-	12	72/7
LEAK STEREO 20 P.A. and main amplifier	£55. 9.0	229/-	12	80/8

HI FI LOUDSPEAKERS

	Price	Dep.	&	Mthly. pmts. of
GOODMANS AXIETTE 8-inch	£5. 5.7			
GOODMANS AXIOM 10 inch	£6. 5.11			
GOODMANS 5K/20/XL Tweeter and crossover	£7. 7.0			
GOODMANS X05000. £2.0.11. **X0950.** £5.10.11				
GOODMANS 210 12in. unit. Full range. 15 watt	£10.17.6	43/6	8	24/3
GOODMANS 301 12in. unit. Full range. 20 watt	15. 4.6	61/-	12	22/4
GOODMANS "MAXIM"	£17.10.0	70/-	12	25/8
W.B.HF1012 10in. unit 3.75, 7.5 & 15 ohms	£4.12.0			
WHARFEDALE SUPER 3 Tweeter	£5.16.8			
WHARFEDALE SUPER 5 Tweeter	£5.19.7			
WHARFEDALE SUPER 8 RS/DD	£6.14.2			
WHARFEDALE SUPER 10 RS/DD. Full range	£10.18.0	44/-	8	24/3
WHARFEDALE RS/12/DD 12in. unit. Full range	£11.10.0	46/-	8	25/6
WHARFEDALE SUPER 12 RS/DD	£17.10.0	70/-	12	25/8

LEAFLETS BY WHARFEDALE AND GOODMANS ON REQUEST.

F.M. TUNERS

	Price	Dep.	&	Mthly. pmts. of
TRIPLETONE F.M. TUNER Less power	£13.19.6	46/-	12	20/6
TRIPLETONE F.M. TUNER, With power	£15.14.6	63/-	12	23/1
JASON JTV/2 F.M. and T.V. sound. Switched, self-powered	£22. 5.0	89/-	12	32/7

GRAMOPHONE UNITS

	Price	Dep.	&	Mthly. pmts. of
NEW BSR UA25 with Mono cart.	£6. 6.0	—	—	—
GARRARD SRP10. Single player. Mono cart.	£5.10.0	—	—	—
GARRARD AUTOSLIM, 4 speed changer, Mono	£6.12.6	—	—	—
GARRARD AT6 AUTOSLIM DE LUXE, Mono	£10.10.0	42/-	8	23/6
GARRARD AT/5/P Imprvd Autoslim (Stereo)	£9. 0.0	36/-	6	17/4
GARRARD AT5/3000 LM as AT 6 with slim arm (Stereo)	£11.12.0	46/6	8	25/9
GARRARD "DECCADEK" Single Player with Decca Deram Cartridge	£15.15.0	63/-	12	23/1
GARRARD 4HF Transcription Unit. Mono	£17. 0.0	68/-	12	24/11
GARRARD LAB "A" Transcription changer	£19.14.9	79/-	12	28/11
GARRARD 301 STROBE Transcription unit	£22. 0.0	88/-	12	32/3
PHILIPS AG1016. Stereo cartridge will change 7in. records with adaptor, 10/- extra	£12.12.0	50/6	12	18/6
GOLDRING GL58 with arm but less cartridge	£17. 1.0	69/-	12	24/11
GOLDRING GL70 with arm but less cartridge	£27. 9.4	111/4	12	40/1
GOLDRING "88" Transcription, less arm	£18.18.5	76/5	12	27/8

GUITAR SPEAKERS

	Price	Dep.	&	Mthly. pmts. of
FANE L 12in. Heavy duty unit, 20 watt	£5. 5.0			
WHARFEDALE W12/EG 12in. 15 watt **LEAD**	£10.10.0	42/-	8	23/6
WHARFEDALE W15/EG 15in. 15 watt BASS	£17.10.0	70/-	12	25/8
GOODMANS AUDIOM 51 12in. 15 watt BASS	£9. 2.8	36/8	6	27/8
GOODMANS AUDIOM 61 12in. 20 watt LEAD or BASS	£14. 7.8	57/8	12	21/1
GOODMANS GUITAR Speaker **Audiom 81**-15in.	£25. 0.0	100/-	12	36/8
GOODMANS AUDIOM 91 18in. 50 watt BASS	£27.10.0	110/-	12	40/4

WRITE FOR GOODMANS LEAFLET "LOUDSPEAKERS FOR ELECTRIC GUITARS."

GUITAR AMPLIFIERS

	Price	Dep.	&	Mthly. pmts. of
LINEAR DIATONIC 12 watt, 2 inputs	£13. 2.6	52/6	12	19/3
LINEAR CONCHORD 30 watt with **COVER**	£19. 4.6	77/-	12	28/2
LEAK TL25 with Pre-amp., 25 watt	£42. 5.0	169/-	12	61/11
LEAK TL50 with Pre-amp., 50 watt	£51. 5.0	205/-	12	75/2

MICROPHONES AND FLOOR STANDS

	Price	Dep.	&	Mthly. pmts. of
RESLO RBH/T Ribbon	£11. 2.6	44/0	8	24/9
RESLO RBH/TS Ribbon with on/off switch	£13.10.0	54/-	12	19/9
RESLO Heavy Duty Floo. Stand	£7. 0.0			
TEISCO DM304 Dual impedance with switch	£4.10.0			
PIEZO BM3 Crystal with switch	£2.10.0			
JAP: FLOOR STAND	£3. 3.0			

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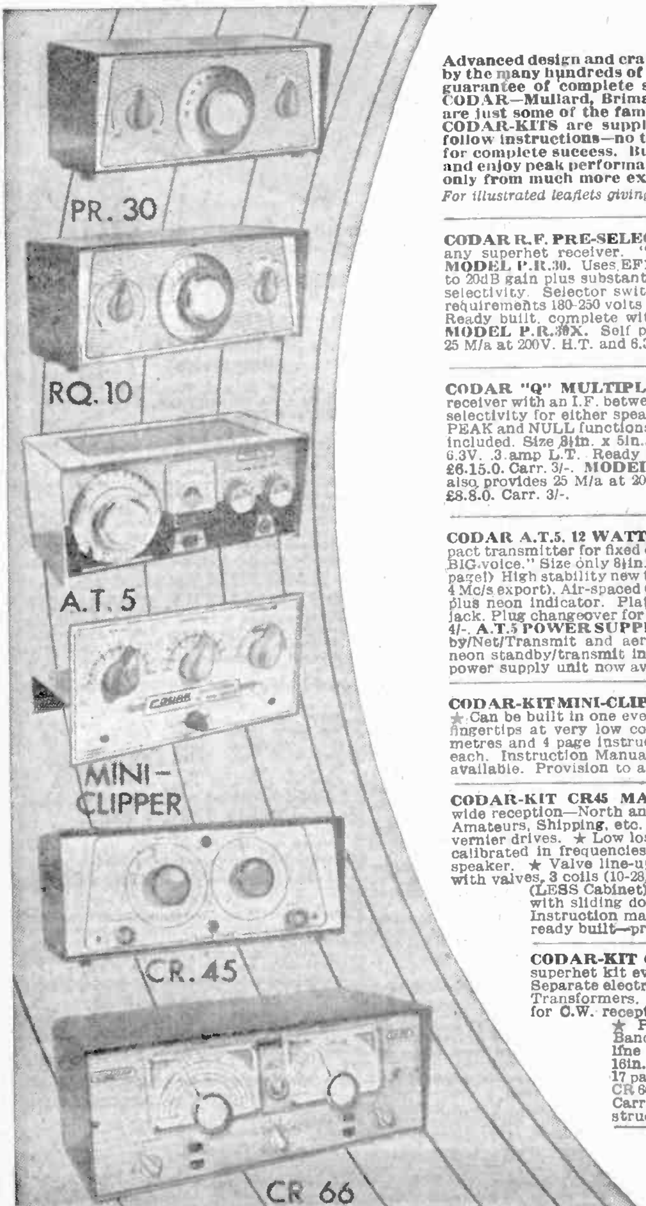

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For illustrated leaflets giving fullest details send 6d. in stamps.

CODAR R.F. PRE-SELECTOR. Will considerably improve the performance of any superhet receiver. "Results are amazing." "Well worth the money." **MODEL P.R.30.** Uses EF183 Frame Grid tuned R.F. Amplifier and provides up to 20dB gain plus substantial image rejection, improved signal/noise ratio and selectivity. Selector switch for either dipole or single wire antenna. Power requirements 180-250 volts 12 M/a H.T. 6.3 volts .3 amp L.T. Size 8¼in. x 5in. x 4in. Ready built, complete with cables, plugs and instructions. **£4.19.6** Carr. 3/-. **MODEL P.R.30X.** Self powered version for 200-250V. A.C. and also provides 25 M/a at 200V. H.T. and 6.3V. 1 amp L.T. for other accessories. **£7.2.0.** Carr. 3/-.

CODAR "Q" MULTIPLIER MODEL R.Q.10. For use with any superhet receiver with an I.F. between 450 and 470 Kc/s. Provides considerable increase in selectivity for either speaking or rejecting a signal on AM, CW or SSB. Both PEAK and NULL functions tunable over receiver, I.F. passband. B.F.O. facility included. Size 8¼in. x 5in. x 4in. Power requirements 180-250V. H.T. at 5 M/a 6.3V. .3 amp L.T. Ready built complete with cables, plugs and instructions. **£6.15.0.** Carr. 3/-. **MODEL R.Q.10X.** Self powered version for 200-250V. A.C. and also provides 25 M/a at 200V. H.T. and 6.3V. 1 amp L.T. for other accessories. **£8.8.0.** Carr. 3/-.

CODAR A.T.5. 12 WATT 2 BAND TRANSMITTER. The newest, most compact transmitter for fixed or mobile use on 160/80 metres. "The tiny TX with the BIG voice." Size only 8¼in. x 5in. x 4in. (Base area is less than two-thirds of this page!) High stability new type calibrated VFO. 1.8-2.0 Mc/s and 3.5-3.8 Mc/s (up to 4 Mc/s export). Air-spaced CODAR-QOIL Pi-net output. P.A. Plate current meter plus neon indicator. Plate/screen modulator. AM/CW switch and Panel key jack. Plug changeover for 6 or 12 volt heater supply. Ready built **£16.10.0.** Carr. 4/-. **A.T.5 POWER SUPPLY UNITS.** Type 250/S. For 200/250 V. A.C. with Stand by/Net/Transmit and aerial changeover switching, stabilised V.F.O. supply, neon standby/transmit indicator £8.0.0. Carr. 5/-. Type 12/MS 12V. Transistor power supply unit now available. (H.P. Terms available).

CODAR-KIT MINI-CLIPPER—OUR FAMOUS SHORT-WAVE RECEIVER ★ Can be built in one evening ready to switch on and bring the World to your fingertips at very low cost. ★ Supplied complete with valve, one coil 25-75 metres and 4 page instruction manual. PRICE 39/6. Carr. 2/6. Extra Coils 4/9 each. Instruction Manual only 2/- (credited on order). Electrical Bandspread available. Provision to add 2 transistor amplifier.

CODAR-KIT CR45 MAINS T.R.F. SHORT-WAVE RECEIVER. World wide reception—North and South America, Russia, India, Australia, Far East, Amateurs, Shipping, etc. ★ Separate electrical bandspread. ★ 3 slow motion vernier drives. ★ Low loss polystyrene plug-in coils, factory aligned. ★ Dials calibrated in frequencies and degrees. ★ Power output 3 watts for 2/3 ohm speaker. ★ Valve line-up: ECC81, EL84, EZ80. **CODAR-KIT CR45** complete with valves, 3 coils (10-28, 25-75, 60-176 metres) and 11 page instruction manual (LESS Cabinet). **£7.5.0.** Carr. 4/6. **CR45 CABINET.** 12in. x 5½in. x 7in. with sliding door for easy coil changing. 35/-. Extra coils 4/9 each. Instruction manual only 4/- (credited on order). (Can now be supplied ready built—price on request). (H.P. terms available.)

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CODAR COILS AIR-SPACED INDUCTORS. A complete range of low loss air-spaced inductors developed by CODAR. Over 40 different sizes from ¼in. to 3in. diameter suitable for all types of circuit application including V.F.O. P.A. Tank, Pi-network, A.T.U., aerial loading, etc. Full data and prices on request.

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A high quality 30 watt amplifier developed for use in large halls and clubs etc. Ideal for bass lead or rhythm guitars, schools, dance halls, theatres and public address. Suitable for any type of mike or pick-up.

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Four separate inputs are provided with two volume controls. Bass and Treble controls are incorporated. Amplifier operates on standard 50 c/s mains. 3 ohm and 15 ohm speakers may be used.

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TWICE THE QUALITY
HALF THE PRICE

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16 GNS or deposit of £1.16.0 and twelve monthly payments of £1.9.2. Carriage 15/- to be sent with order.

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Compactly built to be carried by one man. This has a range of approx. 10 miles and being crystal controlled, tuning is avoided, and operation is as accurate as a telephone. Frequency 3.6-9.1 Mc/s. Complete stations comprising receiver/transmitter, rod aerial. One set of headphones and mike, in canvas carrying bag. Crystal coil unit available for only 35/- per set. Post Free. Brand new in maker's sealed cartons. For authorised use only. Price per station Sale Price **£3.0.0** P. & P. 10/- each. Two stations for **£6.0.0** Post free

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A wonderful educational kit for all children. Provides hours of amusement while following the easy step by step instructions. It is powered entirely by wireless waves, eliminating the expense of batteries. No soldering required. Receives all main stations. Price 29/6. P. & P. 2/6.

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Fully interlocking copper rods. One foot sections. Ideal for car or scooter aerials. Will make excellent dipoles. Six sections complete with canvas carrying case. 3/6. P. & P. 1/6. Additional sections 6d. each. Please send sufficient postage.

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Strong, high quality paxolin sheets. Size 10½ x 8¼ x 1/10in., 3 for 5/-. P. & P. 1/-. 6 for 10/-. Post free.

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Housed in compact metal case. 200/250 v. A.C. mains. Output 250 v. 50mA. Fully smoothed D.C. and 6.3 at 2 amps. Can be used for powering almost any pre-amp. or radio tuner. Price 39/6. P. & P. 2/6.

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TYPE 1. Filament Transformers. 200/250 primary 50 c/s. Secondary 6.3 volts at 2 amps. Price 5/11. P. & P. 2/3.
TYPE 3. Primary 200/250 50 c/s. Secondary tapped as follows: 5 v., 11 v. and 17 v. all at 4 amps. Price 29/6. P. & P. 3/6.
TYPE 4. Primary 200/250 50 c/s. Secondary tapped as follows: 3 v., 4 v., 5 v., 6 v., 8 v., 9 v., 10 v., 12 v., 15 v., 18 v., 20 v., 24 v., and 30 v. all at 2 amps. Price 39/6. P. & P. 3/6.
TYPE 6. A really excellent well-made robust transformer. Fully shrouded and upright. Primary 200/250 50 c/s. Secondary 450-0-450 v. 250 m.a. 6.3 v. at 4 amps. 5 v. at 3 amps. Price 65/-. P. & P. 5/-.

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35 to 40 Mc/s. Power supplies 12 volts and 250 volts D.C., in excellent condition with exceptionally fine slow-motion tuning and clean component layout. Sale Price 39/6. P. & P. 6/-.

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2 volts at 16 A.H. Brand New. Size 4 x 7 x 2in., 4/11 each. 3 for 12/6. P. & P. 3/- per cell.

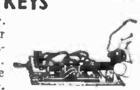
GOLDENAIR SOUND MIXER

This splendid unit enables the mixing of up to 4 inputs, i.e. mic., tape, gram, tuner, etc. Compact and completely self-contained using a standard battery. Four standard jack inputs. Well finished handsome cabinet. Ideal for use with valve or transistor amplifiers. Price 45/-. P. & P. 2/6.

TRANSMITTER/RECEIVER No. 46 and No. 38 SET H.T. POWER PACKS

Power your 46 trans/rec. or 38 trans./rec. set straight from the mains. This valuable unit provides a stabilised D.C. H.T. for these sets. Robustly and compactly made. Sale Price 29/6. P. & P. 5/-.

MORSE KEYS



Morse key assembly. Key with base cover and terminals. Complete with lead. 6/11. P. & P. 2/-. 2 Morse Keys for 12/6 post free.

DOUBLE THROAT MIKES

Double throat mikes. Can be adapted for use with musical instruments. 5/11. P. & P. 9d.

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Operate your 19 set receiver straight off the mains. Ready built power unit complete with modification and fitting instructions. Price 59/6. P. & P. 3/6, *please state model* Mk. II *or* Mk. III. Suitable headphones for 19 set. Price 15/-. P. & P. 2/6.

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12 Pin Connectors 12/6 each. P. & P. 2/6. Headphones and Microphone in good condition mostly new 17/6. P. & P. 2/6. Whip Aerials. 8ft. 6in. 7/6. P. & P. 2/6. 5ft. 4/6. P. & P. 2/6.

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Practical Wireless

Vol. XL No. 697 MARCH, 1965

Editorial and Advertisement Offices:

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Contents

Diversified Interests

WE have all, no doubt, at some time or another been subjected to the frustrating boredom of the man with a one-track mind. There are countless versions: he (or she, come to that!) may be a football fanatic, a motor car maniac, a prattling philatelist, a rabid racing addict. His tastes may be low or high, academic, athletic, scientific, active or sedentary. He lives for only his chosen subject to the exclusion of all else. his pet interest has become an obsession.

Such a person suffers from the sad delusion that everyone else is equally interested, or should be, and he succeeds only in being devastatingly boring and infuriating. He is usually magnificently unloved. Even his best friends won't tell him. And among this population of over-zealous enthusiasts there must be, if only on the law of averages, one or two radio bores!

Many hobbies, and ours is no exception, present limitless opportunities for exploration and exploitation. There are so many basic activities, so many possible diversions, so much to do in so short a time, that the really keen enthusiast can easily find himself so inextricably involved that the hobby becomes the master. The dividing line between a Fan and a Fanatic may be extremely thin!

Most of us, of course, keep a reasonable sense of proportion but the line of thought being pursued does suggest some self-interrogation that might be applied at times.

Unless one is engaged professionally, it is probably better not to become too highly specialised—or too narrow minded. Don't get into a rut by building only valve or only transistor equipment, or only receivers, or only amplifiers. Try something different, even if only occasionally.

"Jack of all trades, master of none" may be a justifiable slur in industry, but surely not in amateur radio, where a diversity of interests is the best way to get the most from the hobby and to avoid becoming a radio bore even to other radio enthusiasts!

A sense of proportion is also advisable in our general approach. Since the hobby is a technical one, it is inevitable (and desirable) that equipment is appraised in a technical manner. But the time to take stock is when you listen to recordings and hear not music but only frequency response, harmonic distortion, wow and flutter percentages. Or when you watch a TV programme in misery because the raster is slightly non-linear or there is a fraction too much overshoot. Or when you are impelled to switch off a radio in the middle of a programme to change a coupling capacitor. Or when you mentally read advertisement posters in morse code!

The search for improvement, if not perfection, is highly commendable, but the place to do this is on the work bench when the equipment is being designed, constructed, aligned or serviced.

It should always be remembered that equipment is built to be *used* and to be *enjoyed*. And if it is in the living room, no doubt other members of the family will be only too pleased to point this out!

Our next issue dated April will be published on March 4th

ROUND THE WORLD of WIRELESS

NEWS AT HOME AND ABROAD

RADIO MASTS FOR ATLANTIC ISLAND

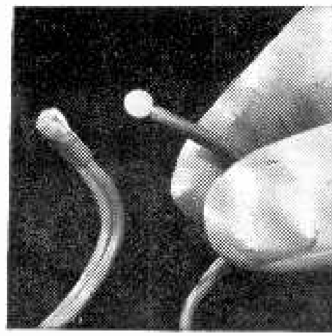
BRITAIN'S Ascension Island in the South Atlantic Ocean is shortly to have nine radio masts erected on it. An order valued at over £90,000 for the masts from the Marconi Company Limited has been received by British Insulated Callender's Construction Company Limited.

Under the contract BICC will supply one 250ft. and eight 325ft. radio masts for use on the island.

Miniature Resistors Protect Motors

NEW protection devices for electric motors recently introduced by Mullard are designed to be incorporated directly in the windings of the motor. The new devices—positive temperature coefficient resistors—will provide cheaper and more effective protection of electric motors than conventional methods.

The miniature resistors (see illustration) are made from doped barim titanate ceramics. In operation they exhibit a high positive temparture coefficient which causes a large and rapid increase in value when an excessive increase in the temperature of the motor windings (above about 110°C) occurs, and this will cut-off the power supply.



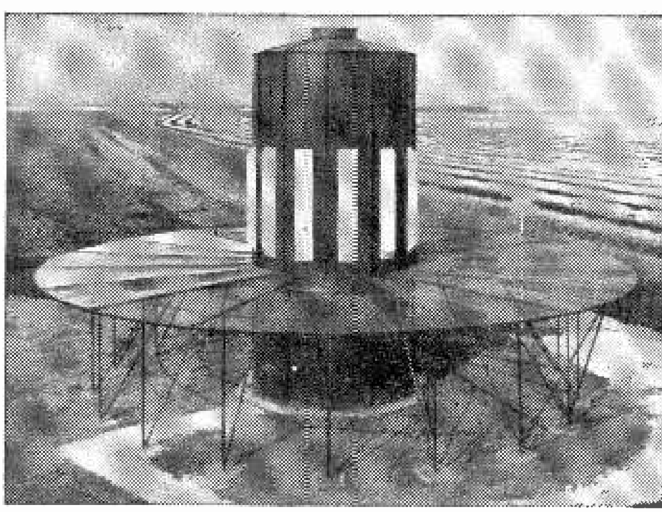
A number of special advantages are presented by the introduction of these resistors and applications in transistor circuits are foreseen.

AIRCRAFT NAVIGATION BEACONS FOR U.S.S.R.

RADIO navigation beacons for aircraft, of the type now covering the Western European air lanes, will shortly be installed in the U.S.S.R. under a contract signed recently in London.

The contract, which is for two high-power long-range VOR beacons (one is shown on the right), is the first ever Soviet order for this type of equipment. Standard Telephone and Cables Limited are to supply the beacons which will be installed on the airway between Moscow and the Baltic coast.

During the negotiations for the contract, which also includes STC airborne equipment, Soviet representatives witnessed the operational procedures of the VOR receiver equipment during a demonstration flight in the Company's aircraft.

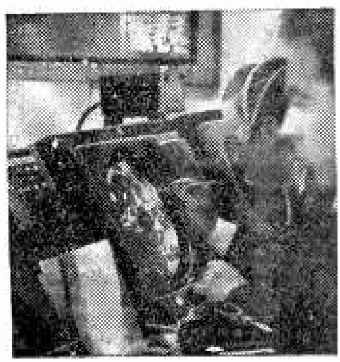


RADAR REFLECTORS FOR HIGH-FLYING GLIDERS

AT Ipswich airport, home of the London Gliding Club, the Marconi Company, on behalf of the Ministry of Aviation, are currently carrying out a series of experiments aimed at reducing the danger of collision between gliders and high-speed aircraft.

Because of their very light construction, gliders do not register on the radar screens of air-traffic control centres and as the modern high-performance glider can easily reach the airways of civil and military aircraft, this danger of collision is increasing.

The experiments carried out by the Marconi Company will investigate possible methods of improving the radar reflective properties of gliders by such means as cheap, light-weight radar reflectors that could be easily fitted in a glider to make it visible to radar. without being in any way detrimental to the performance of the glider.



Marconi engineers recording the radar signals received from a glider fitted with experimental reflectors.

After a series of experiments using scale models at the Marconi Research Laboratories. Great Baddow, a number of radar reflectors have been designed and tested in flight. For these trials a glider with a tug aircraft has been operated by members of the London Gliding Club.

At the Marconi Rivenhall Establishment in Essex, Marconi research engineers have observed these flights and recorded the strength of the reflected radar signals received by three separate radar systems.

Ionosphere Sounders for U.S. Navy

EQUIPMENT which will be used by the United States Navy to ascertain the best operational frequency for long range h.f. radio communications, is to be developed under a contract awarded to EMI-Cossor Electronics Ltd. of Canada, subsidiary of EMI.

The equipment—an ionospheric oblique sounder—will be a sophisticated version of the company's Ionosonde 8000, which is currently being evaluated by several NATO nations.

Due to the physical structure of the ionosphere, quality of reception of short wave radio transmissions varies considerably between one frequency and another. The new sounder will enable the U.S. Navy to detect the best possible wavelength for communications without relying on possibly incorrect forecasts or lengthy trial and error methods.

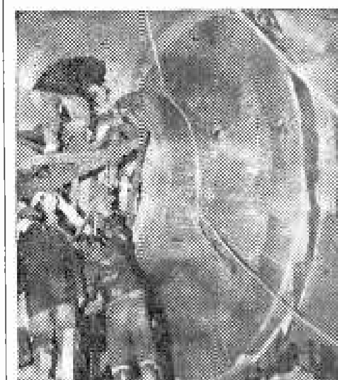
Telegraph System in North Sea

DURING the intensive search for oil and natural gas under the North Sea, a G.P.O. radio telegraph system will be used to provide communications between the many mobile drilling rigs and one of two shore stations at Humber, on the Lincolnshire coast, and Stonehaven, near Aberdeen.

Both shore stations will be fitted entirely with Marconi multichannel telegraph transmitting and receiving systems and will provide up to 30 individual communication channels.

This order was placed by the General Post Office. An accompanying order from the Marconi International Marine Company will provide radio equipment on one of the drilling rigs.

NEW AERIALS FOR RADIO ASTRONOMY

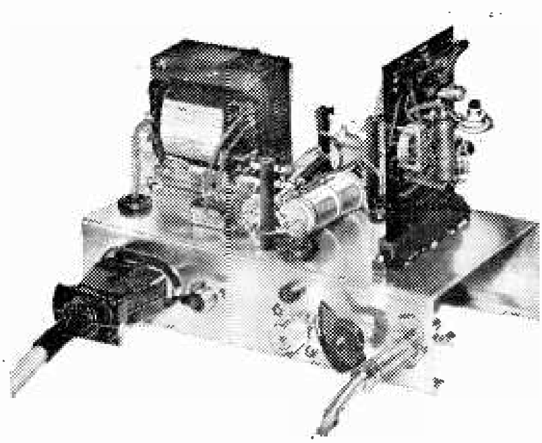


THE contribution of the Commonwealth to the study of radio sources throughout the universe, has advanced on two accounts recently by the installation of a new 15ft. radio telescope at Coxtie Green, near Brentwood. Essex, and the erection at Parkes, New South Wales, Australia of a 60ft. inferometer.

The Coxtie Green telescope (above) has been produced by the Marconi Company Limited for research scientists from Queen Mary College, London University, to examine the brighter planets and radio scources in the sky. The telescope, which operates at wavelengths in the region of one millimetre, has the unusual feature of being moulded in glass fibre reinforced plastic.

The New South Wales inferometer (below) joins a 210ft. radio telescope on the same site. On occasions these two instruments will be used in conjunction for the accurate position fixing of radio sources.

COVER SUBJECT



KEYED Audio Oscillator

By M. L. Michaelis

MODERN electronics practice makes increasing use of small circuit bricks comprising circuitry which can be used in virtually the same form for the most diverse applications. Such arrangements are all the more valuable on account of the tendency to miniaturisation on small circuit boards, using transistorised circuitry. The particular "brick" which is the subject of this article comprises a versatile keyed audio oscillator which has been devised and thoroughly tested by the author. It is built-up on a 4in. x 2·5in. Veroboard (small paxolin sheet with regular rows of holes for affixing components, as described in PRACTICAL WIRELESS, May 1964) and has seven terminals for external connections (Fig. 1).

The basic function of this circuit is to provide an audio output signal, of almost pure sine-waveform, whenever and only as long as the d.c. current or voltage injected at P1 exceeds a certain threshold limit which can be set over a wide range in each case with the help of the sensitivity control VR1 (or VR1a). The three n.p.n. silicon epitaxial

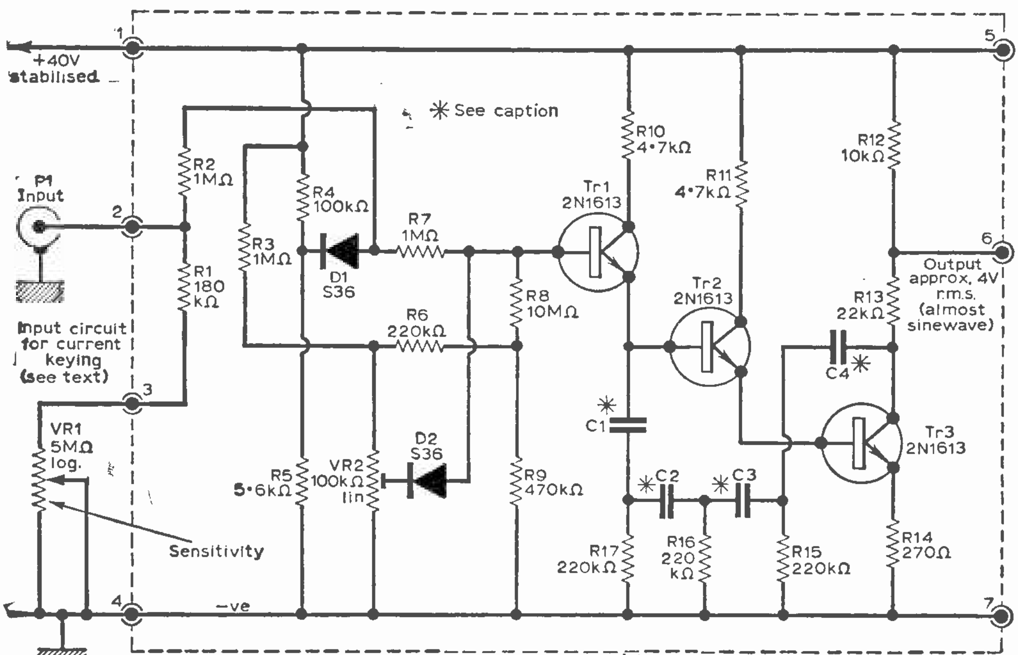


Fig. 1: The oscillator circuit. The output frequency is determined by the capacity of the four (equal) capacitors C1-C4. At 100pF, the frequency is about 5 kc/s, at 250 pF 2 kc/s, at 500pF 1 kc/s, at 1000pF 500 c/s, at 0·01µF 50 c/s, at 0·1µF 5 c/s and at 0·5µF 1 c/s. The relationship is thus strictly linear.

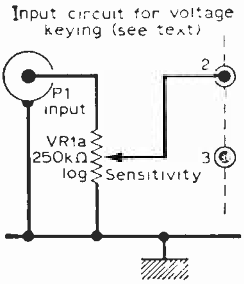


Fig. 2: The P1 input of the circuit of Fig. 1 modified for voltage keying.

transistors are basically in a three-stage emitter follower cascade arrangement and are normally cut-off because the bias applied to the base of Tr1 is just less than the threshold voltage of such an arrangement. A very small current injected via P1 (a fraction of a microamp in the most sensitive setting of VR1) cuts the cascade of three transistors on, whereupon the last two, Tr2 and Tr3, immediately commence to oscillate as a phase-shift oscillator through the feedback network C1—C4/R15—R17.

Uses

This circuit can be used for any purpose requiring this function. The input circuit at P1 is, for example, more than adequately sensitive to operate directly from a vacuum photocell of the 90AV type, whose cathode is then connected directly to P1 and anode to the appropriate positive voltage needed to operate the photocell (in fact, the same +40V line as needed to operate the Veroboard circuit will generally do). Whenever the photocell is illuminated, it draws a tiny current in proportion to the intensity of the illumination. With the sensitivity control VR1, the current at which the transistors "switch on" and the audio oscillation thereupon appears at the output socket, can be adjusted between about 0·5 and 12μA, this being the normal current operating range for most photocells. The sensitivity control VR1 will, in such applications, normally be set so that the photocell current due to the ambient illumination just does not "switch" the oscillator on, response then being obtained only to any "wanted" additional light signal.

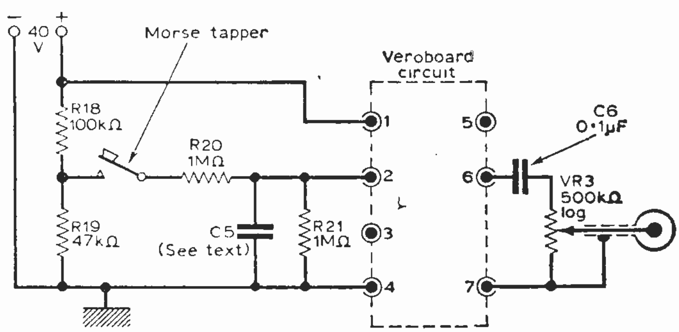


Fig. 3: Input and output connections for m.c.w. telegraphy and model control transmitters, as well as for electronic organs and tremolo insertion on guitar amplifiers.

Regarding the output circuit, this may be connected via a simple blocking capacitor and volume control (Fig. 3) between terminals 6 and 7 to the input of any audio amplifier, transmitter modulator amplifier or to the record-player input sockets on the recording amplifier of any conventional domestic tape recorder. However, if you wish to record the bursts of audio oscillation (in response to the d.c. voltage or current pulses applied at the input) on tape, an additional recording amplifier is not absolutely essential. Fig. 4 shows how a normal type of recording head can be fed directly from the output terminals 5, 6 and 7. R23 here gives d.c. bias for the head in place of the otherwise (for musical recordings) more usual r.f. bias. This is quite satisfactory here, particularly if erase is performed with a powerful permanent magnet over the pole of which the tape passes, which also has the advantage of completely avoiding the need for any form of electronic bias and erase oscillator for such a technical pulse-recording tapedeck, therewith greatly simplifying circuitry. The erase magnet will saturate the tape; the d.c. bias passed into the recording head via R23 must be of opposite polarity, i.e. such as to move the magnetisation of the tape away from saturation again, to the recording operating point on the hysteresis curve. The playback head will function normally, using a normal playback amplifier.

When deciding to build a special tapedeck from scratch the characteristics of the recording head RH1 chosen should be obtained from the makers. These will normally state an (r.m.s.) r.f. bias current and a signal current required for correct operation. Satisfactory performance is obtained, in most cases, with the value of R23 chosen such that the d.c. current obtained as bias is some two-

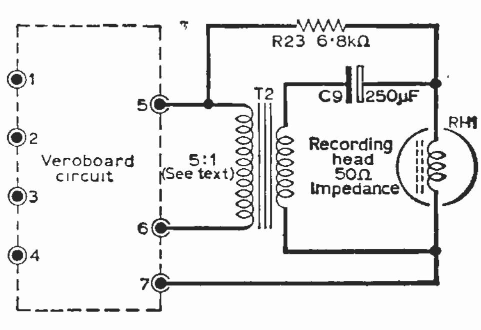


Fig. 4: Output connections for direct tape-recording, without an additional recording amplifier being required.

thirds of the specified r.m.s. value for r.f. bias. The transformer L2 must have a step-down ratio approximately equal to the number of mA signal current specified for the particular recording head. The sub-miniature types sold for interstage coupling in transistorised audio amplifiers will in most cases be found satisfactory; conditions are not very critical.

Practical Uses Requiring Tape Recording of the Output

Apart from numerous applications in the control of industrial machinery which are beyond the scope of this article there are several interesting amateur applications, particularly in the field of remote control of model ships and aircraft. These involve the prerecording of a sequence of pulses tapped in with a Morse key at the input so that, on playback of the tape into the modulator of the model control transmitter, the model can be made to respond to the particular sequence of commands automatically without further manual attention. If a closed loop of tape is used the sequence of commands can be repeated indefinitely as the tape goes round and round until stopped. There is a wide field here for model control experimenters.

A transmitted signal using modulation of the carrier with various audio frequencies is best used here, the receiver on the model employing audio tuned circuits of resonant reed relays to select the individual frequencies and thereupon cause the appropriate responses in the correct control circuits of the model. All necessary components for building such model control receivers, together with profuse technical information, are stocked by good modelmakers' shops and are made by such firms of world repute as, for example, Messrs. Grundig.

The advantage of this method of model control is that as many different commands can be sent *simultaneously* as different audio frequency "channels" are available. Several of the Veroboard circuits described in this article (Fig. 1) can be made, differing solely in the value chosen for the four capacitors (all *must* be equal) C1 to C4, which determines the frequency of oscillation. Alternatively a two-pole, multi-way wafer switch—or a set of push-buttons—may be used to select various similar networks with different C values between the collector of Tr3 and the base of Tr2 on a single circuit. The different "channels" are then merely no longer available simultaneously but only successively in any order.

It is in fact possible to use this Veroboard circuit as a virtually complete multi-channel model-control transmitter, the output signal at terminal 6 generally being of ample power to grid-modulate a conventional transistorised p.a. stage, which is all that will be required in addition on the r.f. side, no additional modulation amplifier being necessary. If a row of suitable press-buttons are used, each having two contacts selecting and connecting different networks between the collector and base of Tr3 and Tr2 respectively, and a third contact in the function of Morse tapper (Fig. 3), then by pressing the appropriate button it will cause the transmitter to send out the associated selective command in each case.

With a tapedeck connected to the output, as shown in Fig. 4, the programme of commands "tapped in" with the buttons can be recorded for subsequent automatic operation of the model according to the predetermined programme on playback into the transmitter modulation input. The great advantage of the d.c. bias shown in Fig. 4 for the recording head and of being able to dispense entirely with an erase oscillator, using a permanent magnet, lies in the extraordinary simplicity of the tapedeck thereby rendered possible. The playback amplifier need only be a perfectly straightforward audio amplifier with an input sensitivity in the region of 1mV, almost any microphone amplifier advertised ready built or as a kit in these pages (e.g. baby alarms) being satisfactory. It is consequently possible to accommodate the sub-miniature tapedeck into the model-control transmitter casing (hand-carried

COMPONENTS LIST

Resistors:

R1	180kΩ	R13	22kΩ
R2	1MΩ	R14	270Ω
R3	1MΩ	R15	220kΩ
R4	100kΩ	R16	220kΩ
R5	5·6kΩ	R17	220kΩ
R6	220kΩ	R18	100kΩ
R7	1MΩ	R19	47kΩ
R8	10MΩ	R20	1MΩ
R9	470kΩ	R21	1MΩ
R10	4·7kΩ	R22	3·3kΩ 2W
R11	4·7kΩ	R23	6·8kΩ
R12	10kΩ		

All 10% $\frac{1}{2}$W carbon, unless otherwise stated

Capacitors:

C1	100pF-0·5μF	To suit desired frequency See caption Fig. 1
C2	100pF-0·5μF	
C3	100pF-0·5μF	
C4	100pF-0·5μF	
C5	10 times C1/C4 value	
C6	0·1μF paper	
C7	100μF electrolytic 125V	
C8	100μF electrolytic 125V	
C9	250μF electrolytic 9V	

Semiconductors:

D1	S36 diode	Brush Crystal Co., Hythe, Southampton
D2	S36 diode	
D3	ZL39 zener diode	
D4	200/250V silicon h.t. rectifier	
D5	200/250V silicon h.t. rectifier	
D6	200/250V silicon h.t. rectifier	
Tr1	2N1613 transistor	Brush Crystal Co.
Tr2	2N1613 transistor	
Tr3	2N1613 transistor	

Potentiometers:

VR1	5MΩ log.	VR1a	250kΩ log.
VR2	100kΩ lin. preset sub-miniature		
VR3	500kΩ log.		

Miscellaneous:

T1	Mains transformer. Secondaries: 50V 30mA (heater transformer with rewound secondary)
T2	Transistor interstage transformer with 5:1 ratio, or to suit recording head (see text)
S1	Mains toggle on/off switch
F1	250mA mains fuse

Plugs, sockets, wire, piece of Veroboard 4in. x 2½in., etc.

portable) with a switch on the panel "auto/direct" being included. In the auto setting the transmitter is modulated with a prerecorded sequence of commands from the tape; in the direct setting the transmitter is modulated directly by the commands. Various combinations are possible, e.g. commands can be recorded simultaneously to direct transmission so that if some hand-controlled acrobatic antic of the model proved particularly pleasing it can immediately or at any later time be repeated by playing back the tape.

It is, of course, immaterial whether several Veroboard circuits are used so that commands such as throttle and rudder control can be given simultaneously or whether only one switched-frequency circuit is used for successive commands as far as the tapedeck and receiver function is concerned. The tape can record all frequencies simultaneously if necessary and the receiver audio tuned circuits will sort them out. There is only one important practical condition, namely that the various audio frequencies associated with the different channels should bear no harmonic relationships, i.e. they should not be simple multiples or other simple ratios of each other but rather as "odd" as possible. This is to avoid the harmonics generated upon distortion of the waveform in any one channel causing spurious responses in one or more other channels. The receiver audio tuned circuits will already be staggered appropriately and it is then merely necessary to trim the Veroboard circuit networks to proper resonance (if necessary wire small trimmers in parallel with C1 to C4).

Geiger Counters

A somewhat more specialised but nevertheless interesting and practical use of the circuit concerns Geiger counters, this also requiring tape recording of the output pulses. In PRACTICAL WIRELESS, December, 1962/January, 1963, an article was published on an advanced Geiger head, followed by a digital register in the April to June, 1963, issues. Finally in the December, 1963, issue, a description was given of the many experiments possible with this equipment which, as readers will remember, involved among other things a study of the natural radium-product activity in rain or snow. This can reach enormous intensities and decay within some three to five hours. The study of these activities in relation to season, location and weather patterns, as explained in the last-named article, can be a most instructive line of experiment for schools and clubs but it is often rather time consuming since the counter must be read off every few minutes after as many rains as possible. More troublesome still is the fact that many of the most interesting rains and thunderstorms occur deep in the night and it is bad enough having to get up and switch the apparatus on then —but having to sit by it for the rest of the night reading off the counter every few minutes is the last straw! A second almost insurmountable problem is involved with the fact that many of the most interesting studies concern quick successions of many showers in a row. A study of the changes of radioactivity with the progress of such weather patterns is particularly interesting but quite impossible with the design already published unless one duplicates the whole set-up as many times as the number of showers in a row to be studied. However, the problem here is that whilst one shower is still being studied to follow the decay of its activity over three to five hours, the next will maybe many more will arrive and the counter will be "engaged". Having come up against this problem the author hit upon the idea of tape recording the signals from the successive showers so that these can be counted out at any later time by replaying the tape through a suitable circuit into the digital register. The circuit described in this article was first designed for this particular application. It is only necessary to duplicate the Geiger head the necessary number of times and associate each head with a Veroboard circuit giving output pulses of a particular (in each case different) audio frequency. All signals can be fed on to one single continuously running tape track, using a perfectly ordinary domestic tape recorder. The Geiger counters will be "started up" one after the other as the successive showers occur and their samples are ready. It is not absolutely necessary even to keep checks of the clock because the relative timing will automatically be indicated later on the tape counter of the recorder! Upon subsequent playback at any later time a tunable audio resonant circuit (choke-coil and switched parallel capacitors to bring it to resonance at the various channel frequencies) is fed from the extension speaker terminals of the tape recorder and in turn feeds a simple rectifier circuit, much the same as an ordinary diode detector arrangement, for reconstituting the original Geiger counter pulses. Each channel, i.e. each shower, can then be played back and registered in detail in the digital register by tuning to each channel frequency on successive runs. Only a single digital register unit, running correspondingly longer, is thereby required. Furthermore, rains and snows occurring at night, even if only single, can be recorded and analysed on the digital register the next day. It is only necessary to get up in the middle of the night to switch the Geiger counter and the tape recorder on!

A different solution would be to use a digital register with facilities for printing out the count at predetermined regular intervals on an automatic basis. This will solve problems of work at night but still not help in the matter of recording many showers whose radioactive overlap in time. Short of duplicating the whole equipment several times there is no other sensible solution apart from the use of the Veroboard circuits described in this article in conjunction with an ordinary domestic tape recorder.

Modulated Continuous Wave (MCW) Telegraphy for "Ham" Transmitters

A useful incorporation for the Veroboard circuit is shown in Fig. 3 which itself again has a variety of specific uses. Bursts of the characteristic audio frequency are obtained at an amplitude which is adjustable with VR3 (as volume control) in rhythm with the tapping of the Morse key. R20, C5 and R21 serve as key-click filter in this

—continued on page 1068

FOR THE BEGINNER

How to Align a Receiver Without Test Equipment

BY GORDON J. KING

IT often happens that the enthusiast finds himself in a spot when it comes to the alignment or realignment of home constructed receivers and receivers in for repair. This is because the service sheet or building instructions stipulate the use of a signal generator for this exercise, such an instrument not always being in the possession of the enthusiast. Indeed, the radio beginner may yet have been able to acquire only the essential multi-range test meter.

Nevertheless, it is possible successfully to align and realign radios, including a.m. and f.m. sets and transistor portables, without any instruments at all, and this article tells how it is done.

Misalignment Symptoms

The term alignment implies the trimming and tuning of the various radio-frequency (r.f.), oscillator and intermediate-frequency (i.f.) circuits for optimum tracking, sensitivity and response. A set which is completely out of alignment will not usually function at all, while a set whose alignment is not right will exhibit various symptoms.

One is an inaccuracy of scale calibration. That is, for example the Light Programme may tune on Radio Luxembourg instead of the correct 1,500 metres. Moreover, the "tracking" may be wrong, giving the correct calibration on stations, say, at the high frequency end of the medium wave band and incorrect calibration on stations at the other end of the band.

Another misalignment symptom is poor sensitivity, the set working only on powerful local stations and being dead to more distant stations and weak signals. Misalignment can also cause poor reproduction owing to a restricted or distorted response, while the breakthrough of adjacent stations can prove troublesome if the response of the tuned circuits is too wide.

Trimming

Let us look first at the tuned radio-frequency (t.r.f.) receiver, which is the simplest of all types so far as alignment is concerned. Such a receiver is shown in the form of a block diagram in Fig. 1. From the tuning aspect we have two stages, the tuned r.f. amplifier and the detector. The detector produces the audio signals which are amplified and applied to the loudspeaker.

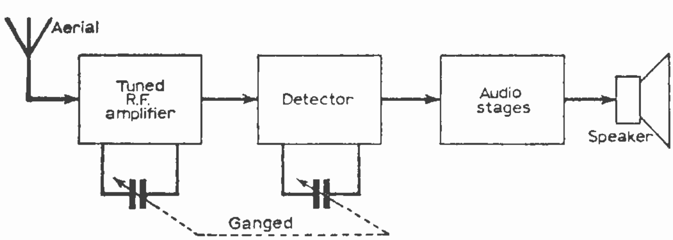


Fig. 1: Block diagram of tuned radio-frequency receiver.

It is the purpose of the r.f. amplifier to receive the very weak aerial signals, to amplify these and then pass them on to the detector. The aerial is supplying the r.f. stage with hundreds of signals, so it is essential for that stage to select or tune the required signal. Likewise the detector stage must tune to the required signal. Thus, both the r.f. amplifier and the detector must tune to the same frequency simultaneously.

Tuning in most cases is accomplished by tuning capacitors. In the early days of radio separate tuning capacitors were used for the r.f. amplifier and detector, the exercise being first to tune the detector to pick up the signal and then tune the r.f. amplifier for maximum sensitivity (to get the signal as loud as possible).

Modern receivers, of course, feature ganged tuning capacitors, as Fig. 1 shows, and it is important that each section of the gang tunes to exactly the same frequency over the whole tuning range.

The design of the ganged capacitor and associated tuning coils ensures that this happens reasonably well but final trimming is necessary for correct dial calibration and optimum sensitivity over the bands. It should be noted that with t.r.f. sets the dial calibration is established by the detector tuning and the sensitivity by the r.f. amplifier tuning.

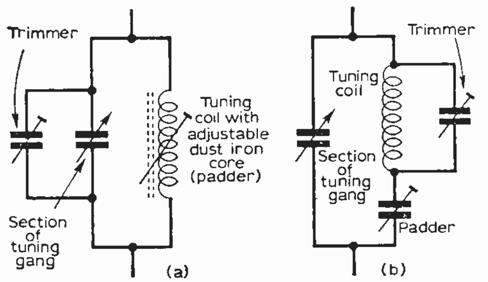


Fig. 2: At (a) trimming is effected by a preset capacitor across the tuning gang and padding by an adjustable dust-iron core in the tuning coil, while at (b) a preset capacitor across the coil serves for trimming and a similar type of capacitor, though larger value, in series with the tuning coil for padding.

Padding

While it is relatively easy to arrange for the two circuits to tune to the same frequency (or wavelength) at one point on the dial it is not quite so easy to arrange for the tuning to be accurately maintained over the whole of the dial. The simultaneous and accurate tuning of more than one tuned circuit is called " tracking ".

To secure good tracking most t.r.f. sets (and all superhet sets) embody what is called a " padding adjustment ". This consists either of a small trimmer-type capacitor or an adjustable dust-iron core in the tuning coil.

In addition there are " trimming capacitors " on each circuit. In inexpensive t.r.f. sets the trimmers consist simply of compression type preset capacitors on each section of the tuning gang, while more expensive versions have separate trimmers (and padders) for each band.

The important points to remember are that the trimmers have the greatest effect on the tuned frequency at the high frequency (low wavelength) end of the band, while the padders have the greatest influence at the low frequency (high wavelength) end of the band. Examples of padders and trimmers are shown at (a) and (b) in Fig. 2.

The idea of trimming and padding then is to adjust the trimmers for correct calibration and optimum sensitivity at a frequency at the high frequency end of the tuning and the padders for like conditions at the low frequency end of the tuning.

T.R.F. Example

Now let us suppose that we have a t.r.f. set that is in need of trimming and no instruments at all. The set should be switched on and allowed thoroughly to warm up. A good aerial should be connected and the volume control turned to maximum. The first thing to do is to get the circuits into approximate alignment. This can be done by carefully listening at the speaker while tuning the set over the band. When the local station is heard the r.f. *trimmer* should be adjusted for maximum output.

Next the calibration should be attended to. Say the local station is the long wave Light Programme and that this is coming in at 1,600m instead of the correct 1,500m. This means that more capacitance is required on the *detector* trimmer. A compression type should be screwed in and the station followed by tuning the set as the trimmer is adjusted until the correct calibration is established. The r.f. trimmer should then be readjusted for maximum output at the correct tuning point on the dial

For final adjustment the set should be tuned to a station (say Radio Luxembourg) at the top end of the medium wave band, *trimmed* first detector and then r.f. wise and then tuned to a station at the bottom end of the band and then *padded* detector and r.f. wise.

It is generally necessary to repeat these adjustments until no further improvement can be obtained at both ends of the band—both for calibration *and* sensitivity. It will then be found that stations between the two alignment points will tune correctly on the dial and that the sensitivity is maintained over the band.

If the station is tuning too low on the dial, say 1,400m for the Light Programme instead of 1,500m, the detector trimmer should be screwed out. In some cases the trimmer on a completely misaligned set may not give the correct calibration over its range. In that case the trimmer should be set to its approximate mid-setting and the padder adjusted to give the correct tuning point. After this, of course, the process as detailed above should be carried out.

For a delicate setting of sensitivity, when the r.f. adjustments are being made, the aerial should be very loosely coupled to the set by winding a few turns of the aerial wire round the aerial socket or lead of the set. This will ensure that the r.f. circuits are not swamped by aerial capacitance.

It is generally best first to align the medium wave band, followed by the long wave band and then the short wave band if fitted.

Superhet Principle

A superhet type receiver is a little more difficult to handle but, once the basic principle is understood, there should be no undue problem. Fig. 3 shows the block diagram of this type of set. Here the signals in the aerial are applied to the mixer along with a signal from the local oscillator. The aerial and oscillator signals are effectively "mixed" in the mixer and the output is either the sum or the difference in terms of frequency of the two signals.

As an example, suppose that the incoming signal is at a frequency of 150kc/s (that is 1,500m—the wavelength of the Light Programme) and the oscillator is producing a signal at 320kc/s. In the mixer these two signals beat together and their sum gives a frequency of 470kc/s, while their difference gives a frequency of 170kc/s.

In practice either the sum or the difference frequency is selected and tuned by the intermediate frequency (i.f.) tuned circuits. The standard a.m. i.f. these days is 470kc/s, so the sum frequency of the example given above would be selected.

If the difference frequency is selected as the i.f. then the oscillator would produce a signal of 620kc/s to beat with the 150kc/s of the Light Programme (i.e. 620 *minus* 150 equals 470).

Clearly then the mixer and oscillator tuning must always be out of step with each other over the whole tuning range by an amount equal to the i.f. This is one thing that the alignment process has to ensure. It also has to ensure that the i.f. tuning is correct and that each i.f. transformer winding is tuned to the same frequency.

Let us assume that we have a completely misaligned set to deal with. What we want is breakthrough of some sort of signal just to get a start on tuning the i.f.s. for as these come into tune so the sensitivity of the whole set rises and the remaining alignment becomes possible using off-air signals.

Peaking the I.F.s

One way found by the author that can be adopted to peak the i.f.s somewhere within their tuning range is to connect the screen of the television aerial's downlead, via a 100pF capacitor, to the signal grid of the mixer section of the frequency changer valve (note that the frequency changer is the valve that performs both functions of mixing and producing a local oscillator signal. Communications type sets and certain domestic models employ separate valves for mixer and oscillator).

When this connection is made and the set's volume control turned fully up, slight clicks and a hiss can be heard in the speaker. If the i.f.s are miles off tune the noise output will be very weak, but as the transformers are brought into tune so the output will increase and a Continental station may be heard in the background.

The idea then is carefully to adjust the i.f. cores in turn, starting from that nearest to the detector (see Fig. 3) and working back towards the mixer (frequency changer) until the background disturbances are at their loudest. When this has been achieved one can rest assured that the i.f. windings are all tuned to the same frequency.

This may not be the exact i.f. frequency but it will not be a long way out if the noise peak is arranged to occur when the trimmers are approximately halfway within their range of adjustment. An adjustment of greater accuracy can be made later if necessary.

Having established a setting for the i.f. tuning the next step is to adjust the local oscillator and mixer tuning on a local station. This time the long wave should be adjusted first and, since the Light Programme puts a strong signal into most areas, this is a good station to work with.

With the television downlead connected still to the mixer signal grid the set should be switched to long wave and the tuning carefully adjusted until the Light Programme is heard. It may be very weak and well off calibration, but if the set is without fault, apart from being misaligned, then it will be found somewhere on the dial.

When it is found the long wave local oscillator *trimmer* should be adjusted step by step to put the Light Programme nearer and nearer the correct point on the tuning dial until eventually the correct tuning point is established. Tests will have to be made to see which way the oscillator trimmer needs to be turned to move the station tuning in the required direction.

The programme should now be coming in very loud, though interference and whistles may be troublesome. At this stage the television downlead should be disconnected and the correct aerial plugged into the proper aerial socket (if fitted). The signal will now be weakened again but it will soon be brought back to its correct volume by adjusting the mixer trimmer. The interference and whistle should then disappear.

Snags

The set is now in approximate alignment on the long wave band but to arrive at that condition several snags may be encountered. It may be found, for instance, that the Light Programme cannot be tuned at the correct position on the dial at any setting of the oscillator trimmer. In that event a check should be made to ensure that the dial drive is working properly and that the cursor (or dial) corresponds to the high frequency (low wavelength) end of the scale when the gang is fully open and to the low frequency (high wavelength) end when fully closed. A check should also be made to ensure that the gang spindle or dial drive is tightly secured and not slipping in any way.

If all is well here a badly misadjusted long wave padder may be responsible. Initially this should be set to the centre of its adjustment. If this is correct then the i.f. is too far away from its correct frequency.

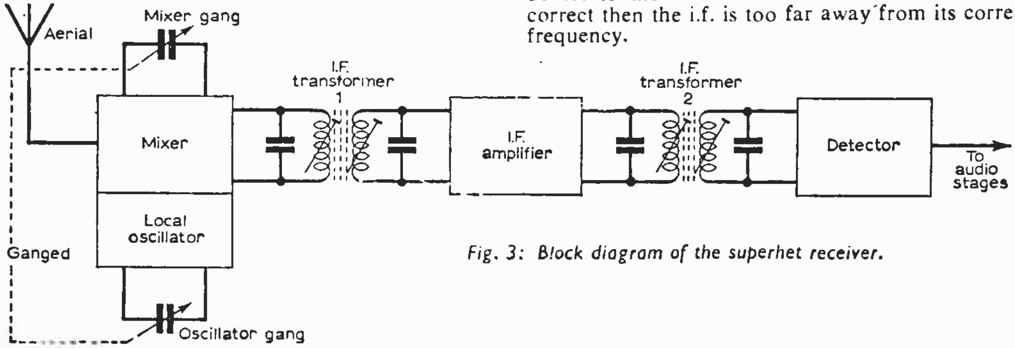


Fig. 3: Block diagram of the superhet receiver.

To correct for this the long wave oscillator trimmer should be adjusted as far as possible to bring the tuning as close as possible to the Light Programme (1,500m) on the dial. It will either be wide open or very tightly compressed. If wide open it should be closed up several turns or if tightly compressed it should be opened a little to give scope for eventual further adjustment. The Light Programme should then be retuned on the dial, the tuning error being a little greater than previously of course.

The idea now is to adjust the i.f. tuning to correct the tuning error. This is not difficult. The core of the winding connected to the detector should first be adjusted—one way and then the other to find out which way the trimmers need to be adjusted to give correction—a little at a time to bring the tuning nearer to the correct point on the dial.

This should be done in stages and after each stage the remaining three i.f. cores should be adjusted for maximum output. Eventually it will be found that the i.f.s will peak when the dial is tuned spot on the Light Programme calibration mark.

One can then be certain that the i.f.s are very closely tuned to their correct frequency, for only if that condition exists will it be possible to establish the correct dial tuning within normal range of the oscillator trimmer.

Once the i.f.s are correctly tuned, alignment of the rest of the set resolves almost to that as explained for t.r.f. sets. Trimmers and padders on all but the most inexpensive receivers exist for each band and these are adjusted respectively on a station marked on the dial at the top of the band and then at the bottom of the band, making repeat adjustments until the best tracking is achieved.

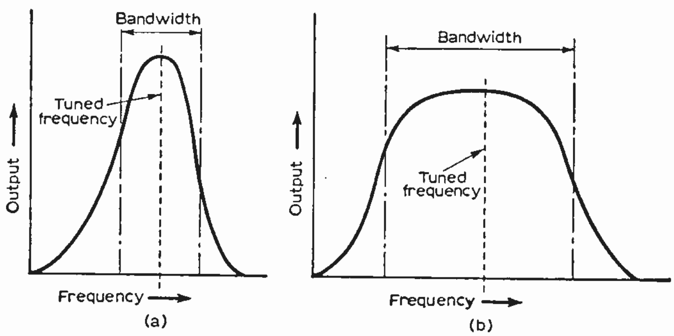


Fig. 4: Response curves. The narrow curve of restricted bandwidth (a) may attenuate the treble response and also aggravate the effects of oscillator drift in f.m. sets, and in f.m. sets the wider response of (b) is often to be preferred. A response of extended bandwidth cannot, however, be used in a.m. sets for fear of adjacent stations breaking into the wanted tuned station.

Trimmer Location

Some mains sets use a bank of trimmers and a corresponding bank of padders and unless the service sheet is available it may be difficult to locate the adjustments for specific bands.

The oscillator trimmers and padders, however, can be discovered by touching the "live" side of the component with the blade of a screwdriver while a finger is resting on the blade *(keep the other hand clear of the chassis to avoid shock).* If, for instance, the set is receiving a medium wave signal, contacting the medium wave oscillator component in the manner described will detune the signal.

The adjusting components for the mixer or r.f. stage (note that some superhets also feature an r.f. stage with a *three-gang* tuning capacitor) when contacted in a like manner will give rise to loud clicks from the speaker. The trimmer or padder which is not in circuit at the time will result in zero response.

Sets using ferrite rod aerials need no special attention and the instrument-less alignment procedures outlined in the foregoing can be adopted with them also.

F.M. Sets

F.M. sets utilise the superhet principle and basically the alignment information already given applies also to this type of set. There are now plenty of f.m. stations on the air and very strong signals are delivered by local stations via correctly cut f.m. (Band II) aerials.

Frequencies of local stations are given in the *Radio Times.* The Light Programme has the lowest frequency and the Home Service the highest frequency. This is easy to remember taking the L of Light for low and the H of Home for high. The Third Programme has a frequency between the Light and Home.

The ratio detector or discriminator may need special attention after the basic alignment process. This should be adjusted for the best quality reception, ensuring that each tuning point has only a single major peak. Two or three peak tuning means that the i.f. response is faulty.

Magic eye tuning indicators can be of considerable assistance for instrument-less alignment. Such indicators increase in deflection for increase in signal strength. Thus they can be used as an output indicator to reveal when, say, the i.f. transformers are tuned to optimum frequency or when the tuned circuits are peaked.

I.F. transformers peaking in f.m. sets may not be desirable, for a sharp response (Fig. 4a) can suppress the higher order sidebands and impair the treble response. After peaking as a preliminary adjustment, slight detuning may be warranted to give a flatter top to the response as shown at Fig. 4b. Insufficient bandwidth can also aggravate oscillator or tuning drift effects on f.m. sets. ■

PART TWO

CABINET AND CHASSIS TECHNIQUES

BY F. L. THURSTON

CABINETS for radio or test gear can be made from a number of different materials and in a range of styles. The principal materials for amateur use are aluminium, wood, and synthetics.

Aluminium Cabinets

The general hints given in Part 1 for making aluminium chassis also apply when making aluminium cabinets, i.e. drilling methods.

Sheet aluminium is best cut with the aid of a hacksaw, large holes with a fret saw using metal cutting blades. When marking out prior to bending, if the drawing shows *external* dimensions of chassis of cabinet, the score lines along which the bends are to be made must be marked *short* of the overall dimensions by the thickness of the metal *for each bend.*

When bending the metal, if a special bending machine is not available, a normal vice can be used. But if a depth of bend greater than about 3in. is required, as it will be for most cabinet making jobs, a carpenter's vice may be used, using a bending technique similar to that already outlined.

If no carpenter's vice is available, use pieces of wood, of suitable size, clamped to the metal with a pair of carpenter's clamps, the wooden blocks being used in a similar fashion to the jaws of the carpenter's vice. The wood used should be of a fairly hard type if a good sharp bend is to be obtained.

Failing all of these alternatives, the bending operation can be performed at reasonable cost by one of the many firms that specialise in this kind of work, some of whom advertise in this magazine.

Several basic cabinet styles are available, and Fig. 7 shows a type made from a single sheet of metal forming an open-ended box into which a complete chassis and front panel assembly may be fitted. The front panel is bolted to the cabinet by means of " clinch " nuts secured into flanges at the front of the cabinet.

Clinch nuts are similar to normal nuts but have a tubular extension on one side which is drilled out to give clearance of the bolt. When the clinch nut is bolted to a piece of metal a hole is drilled of such a size as to just give clearance to the outside diameter of the tube and the hole is then countersunk.

The nut is then pushed into the hole from the blank side of the metal and the tube is peened over into the countersink, securing the nut to the metal panel. The inset of Fig. 7 shows the principle involved. If a suitable peening punch is not available a ball bearing can be used as a substitute.

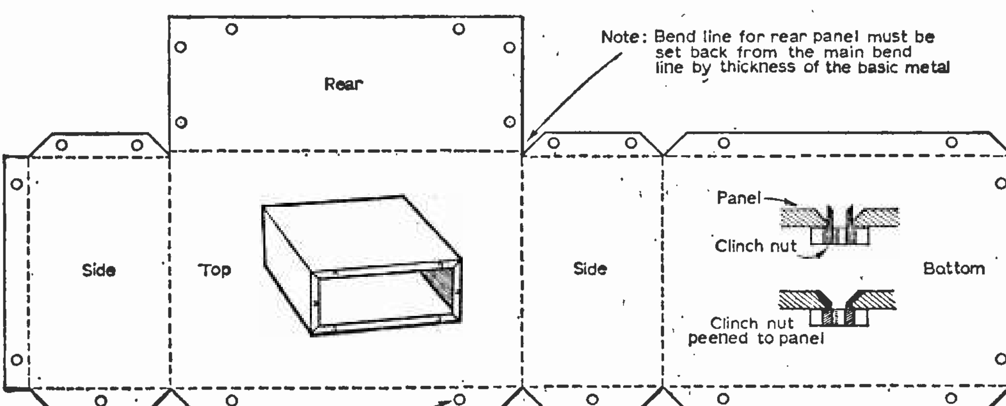
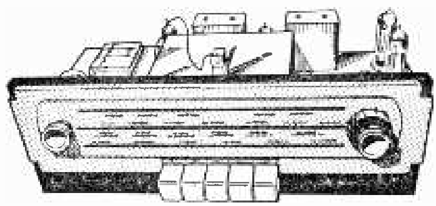


Fig. 7: An open-ended aluminium cabinet, made from a single sheet of metal.

BRAND NEW AM/FM (V.H.F.) RADIO GRAM CHASSIS AT £13.13.0 (Carriage Paid)



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TERMS: (Chassis) £3.10.0 down and 5 monthly payments of £2.4.0. Cheap Room Dipole for V.H.F., 12/6. Feeder 6d. per yard.
ALTERNATIVE DESIGN. L.W. 1000-1900 M.; S.W. (9-15 Mc/s); M.W. 190-475 M.; V.H.F. 87-100 Mc/s.; Gram position. Otherwise similar to above chassis. Price £15.15.0 (carr. paid). **TERMS: £3.10.0 down and 6 monthly payments of £2.4.0.** Circuit diagram 2/6.

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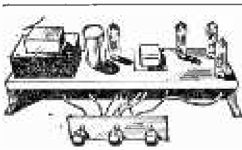

(6/- Carr.)
Brand new 200-240 A.C. mains Bass, treble and vol. controls, with valves EZ80, ECC83 and 2-EL84's giving full 8 w. Chassis 12 x 3½ x 3¼in. With o.p. trans. for 2-3 ohm speaker. Front panel (normally screwed to chassis) may be removed and used as "flying panel."

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7in. Stand. play, 1,200ft.	13/9
7in. Long play, 1,800ft.	21/6
5in. Double play, 1,200ft.	16/6
5¾in. Double play, 1,800ft.	24/9
7in. Double play, 2,400ft.	27/6
3in. Triple play, 450ft. (Plain white boxes)	13/9
4in. Triple play, 900ft. (Plain white boxes)	24/9
5in. Triple play, 1,800ft. (Plain white boxes)	46/9
5¾in. Triple play, 2,400ft. (Plain white boxes)	60/6
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ACETATE BASE		MESSAGE TAPES	
5in. Stand. play, 600ft.	8/10	3in. Stand. play, 150ft.	3/9
7in. Stand. play, 1,200ft.	12/2	3in. Long play, 225 ft.	5/5
5in. Long play, 900ft.	11/-	3in. Double play, 300ft.	8/3
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7in. Long play, 1,800ft.	16/6		

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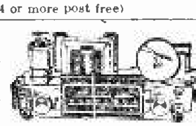
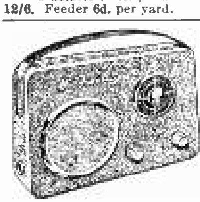


6-TRANSISTOR PORTABLE — Fully Built



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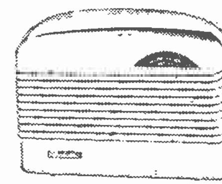

7 Transistor Superhet. 350 Milliwatt output 4-inch speaker. All components mounted on a single printed circuit board size 5½ x 5¼in. in one complete assembly. Plastic cabinet, with carrying handle, size 7 x 10 x 3½in. External Socket for car aerial. Ferrite rod aerial. Price for the complete parcel including Transistors, Cabinet, Speaker, etc. and full Construction Data: P. & P. 4/6. **£5.19.6**

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BSR-UA14	£5.19.6
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Mains input giving 6.2v. 2 amp. Size 2¾ x 2 x 1in. (2¼in. over windings). 5/6 ea. Less 10% for 12, or 20% for 50. P. & P. 2/- for 1 to 4, post free more than six.

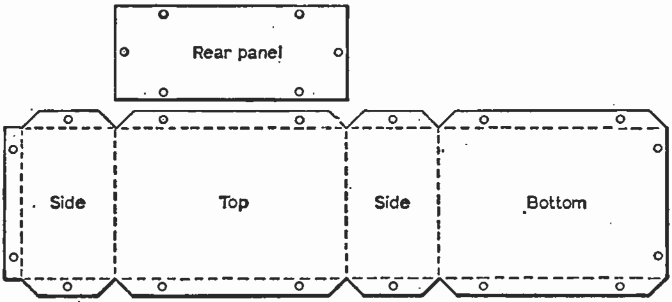
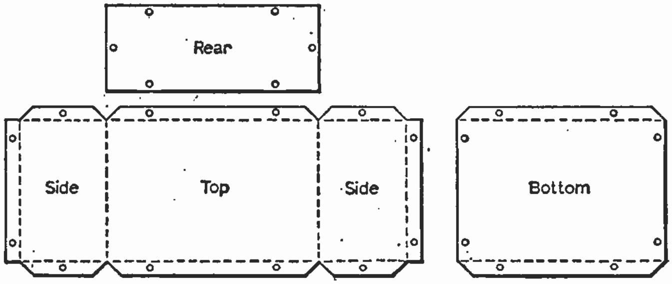


Fig. 8 (above): Another method of constructing a cabinet on the lines of that of Fig. 7, and Fig. 9 (below): an easier method of achieving the same result.



The cabinet of Fig. 7 is very robust but difficult to bend. The same final shape can be obtained by using a number of different methods of construction, as shown in Figs. 8 and 9.

A different style of construction is shown in Fig. 10. The front and rear panels are bolted directly to the chassis and a separate bottom plate and cover unit are used. A pair of clinch nuts are bolted to each side of the chassis and holes drilled in the side of the top cover to line up with them.

Four clamp plates, drilled out and tapped, are secured to the top cover with countersunk screws and line-up holes drilled in the front panel, enabling the whole assembly to be fitted together.

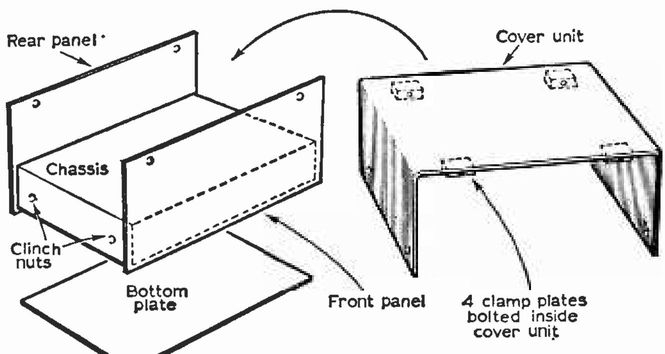


Fig. 10: Another approach to the problem of cabinet construction.

A method of construction which involves no bending of sheet metal at all is shown in Fig. 11. A skeleton frame, made from steel or aluminium angle, is assembled and individual top, bottom, front, rear and side panels bolted to it, using clinch nuts secured to the frame.

An advantage of this method, which is widely used for large commercial equipment, is that the frame can be used as a basic part of the chassis assembly, separate sub-units being bolted to it. Strengthening struts are added where required. When cutting the panels care should be taken to ensure that a good final fit is obtained, i.e., some panels may have to be made larger than the basic frame if unsightly cracks in the finished cabinet are to be avoided.

A variation on this theme is shown in Fig. 12, which shows a close up detail of a frame unit made from a composite assembly of ½in. and 1in. angle. The complete frame assembled in the same way as that of Fig. 11, but the finished article now gives a number of recess areas, available between the ½in. angle, to take each of the main panels, which may be bolted to the 1in. frame.

The advantage of this system is that the panels can be cut to the dimensions of the recesses, without the danger of making expensive mis-calculations when allowing for overlap. Any slight errors will be masked by the recesses, and the complete assembly, when painted, has an attractive appearance, the ½in. framework standing proud of the panels.

If ventilation holes are to be provided in the cabinet, the easiest method is to provide a cut out and bolt one of the commercially available grilles over it. Alternatively, a large number of drill holes can be provided as long as great care is taken in positioning them.

Ventilation louvres can be made by two methods. Fig. 13a shows a "handle" type and the "mould" required for making them. To make the mould, cut out a piece of steel plate, the same thickness as the depth of the louvres, the cut-out being "negative", and, after case hardening, bolt down to a hardwood base. Cut a slot in the panel to be formed, and press the metal slightly outward under finger pressure, then locate the "lip" that results in the lower edge of the recessed mould. A soft mallet is used to force the panel into the shape of the mould.

When making the mould, keep the overall width only slightly greater than that of the louvre, otherwise it will not be possible to space the individual louvres reasonably close together.

The "venetian blind" type of slot (Fig. 13b) required no mould. The positions are marked out and cut, using a metal cutting fret saw after drilling a small pilot hole. Cut only as far as shown, and then, using either finger pressure or a pair of pliers, bend as shown.

Both of the above methods require a certain amount of practice before really good results are obtained, and a few test runs should be made on a piece of scrap aluminium first.

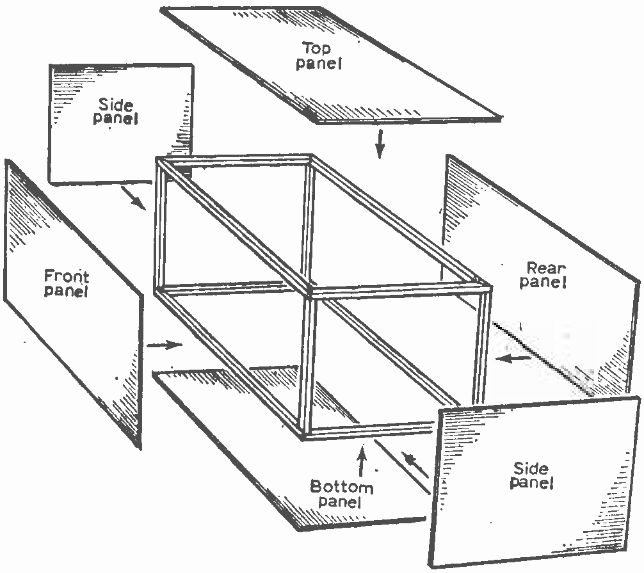


Fig. 11: This method of construction requires no bending of metal.

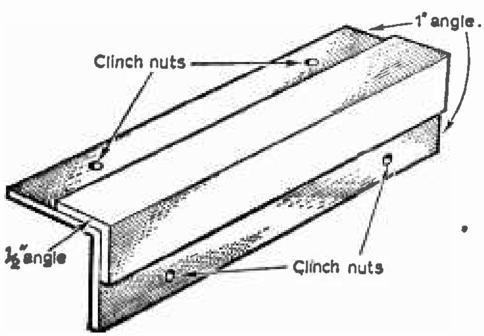


Fig. 12: ½in. and 1in. angled metal bolted together with countersunk bolts can be used to make a cabinet frame.

Plastics and Insulating Materials

Most plastics materials can be bent under the application of heat and thus may be used for some forms of cabinet construction. If sufficient heat is applied the material can be melted. Fittings such as nuts, bolts, hinges, etc., may therefore be heated and moulded permanently into the plastics if needed.

Most plastics are easily worked, and special glues are available for fitting plastics to plastics or to other materials. If only two-dimensional bends are required, the plastics can be heated locally and bent around a wooden former to obtain the required shape. If three dimensional shapes are required, it will be necessary to make a male or female mould and apply heat over a large area when shaping the material on the mould.

Most non-plastics insulating materials are non-malleable but can be cut and drilled fairly easily. Both of the materials mentioned above are best suited for use in the type of construction shown in Fig. 11, where simple panels are used.

Part Three Next Month

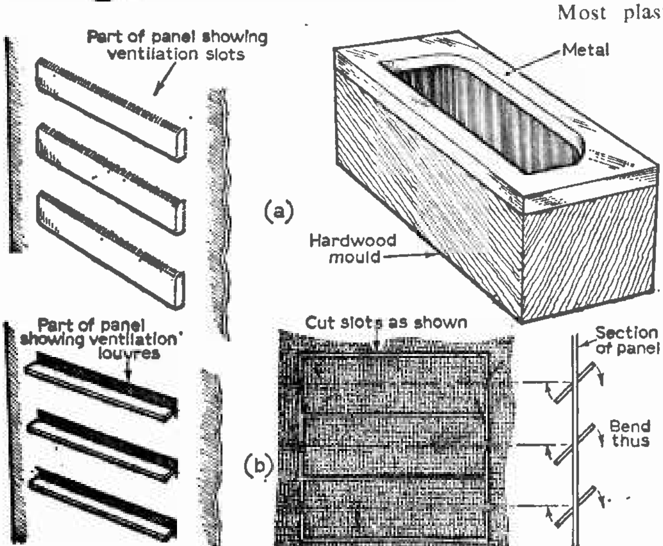


Fig. 13: Methods of forming louvres for ventilation purposes.

Preventing Accidental Tape Erasure

BY J. SCOTT

THERE is no perfect system of preventing accidental erasure of wanted recordings and many recorders have mechanical or electrical "reminders" that the instrument is switched to "record" and, therefore, will erase any previous recording.

An additional precaution which will prevent erasure, unless a microphone plug or other signal source plug is plugged in the appropriate socket, is described below.

Using sockets of the Bulgin J14 type. the grid of the r.f. erase and bias oscillator valve is earthed until a plug is inserted and, of course, with the grid shorted to chassis erasure is impossible, even though the instrument is switched to "record".

This feature is well worth incorporating because if the instrument is being used for playback only and a microphone is not available for plugging-in, then the recordings are safe.

A single screened and insulated lead is taken from the oscillator valve grid pin to the jack socket (see diagram). The outer screen should be taken to the nearest chassis point at the valve socket.

This system cannot be used with recorder amplifiers which use a common output/oscillator valve, however the erase head feed or winding can be shorted via the jack socket but it will be found that the bias current will partially erase. This is better than losing the recording. ■

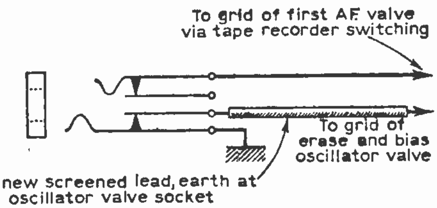


Fig. 1: The input circuit arrangement for the recorder with a single socket.

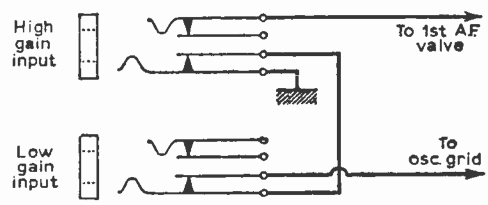


Fig. 2: The arrangement for recorders with two input sockets.

A COMMENTARY BY HENRY

PRACTICALLY WIRELESS

No. 7 The "H" Factor

ANYBODY who watched Prof. Colin Cherry expounding on the telly about Science and Communications, will have been struck by the idea that our boxes of electronic tricks were no more than links between the mysterious forces that direct our existence and the puny grey cells that fill the space between our ears.

The conception of information theory does not concern us here —which is just as well, for my ignorance of the subject is just as remarkable. But the implicit assumption that the means are infallible, given enough time for development, and only the ends matter, is rather alarming.

A recent report from the Equipment Reliability Committee of the Electronic Engineering Association only serves to confirm my view that the boffins are overlooking one vital point in their assessment of the electronic situation.

This report, for example, shows a graph failure rate of electronic equipment against time. As one might have expected, the curve starts high, swoops rapidly, levels out, then creeps up at an ever-increasing rate. Which means that the gear breaks down more frequently, just after it is thrown together, settles to a comparatively trouble-free level for a while, then begins to break down again as it ages.

Maybe one of the girls was mooning...

To some extent, we go along with that view. Too often, brand new sets conk out and investigations prove that the faults could —nay, should—have been foreseen in production. Things like dry joints, wrong components, early mechanical wear, and so on.

You and I, concerned mainly with our own little box of bombs, tend to give the benefit of the doubt to the manufacturer. Maybe one of the girls on the production line was mooning as our set went by and forgot to apply the solder gun. What we overlook is the fact that her lovesick lapse will have affected half a hundred other prospective owners, too.

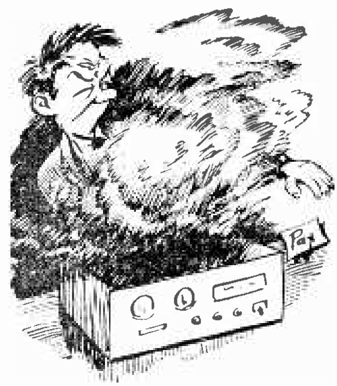
So, in this report, the committee advocate the manufacturer delivering his product *"only after the constant failure rate period has commenced. . ."*.

Doesn't that phrase strike a cold chill? The constant failure rate, mate, is the time you and me are going to be proud users of the equipment.

They have even worked out the probable frequency of breakdown, and computed a "Mean Time Between Failure", which they cleverly abbreviate to MTBF. From this, they work out a formula for reliability, saying, the MTBF over t hours being

$$\bar{T}, \text{ then } P_s = e^{\frac{-t}{\bar{T}}}$$

This gives the frightening calculation that for a chance of successful operation for various multiples of T, the MTBF required to give a 90 per cent chance of fulfilling a two hour mission successfully must be 2/0·1, or twenty hours. It makes you wonder how they ever got Telstar up there, let alone working.



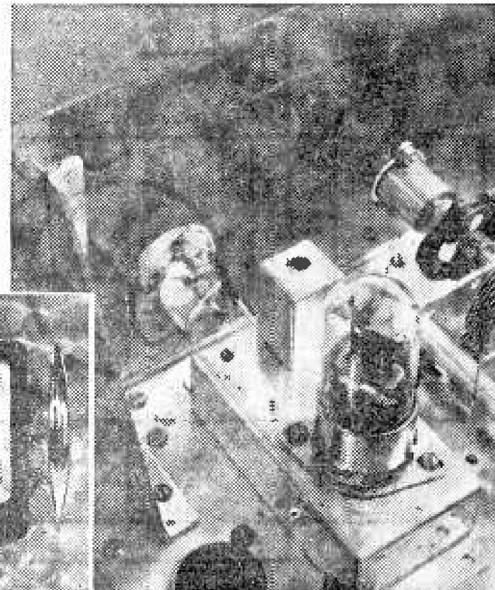
A tendency to give off wild puffs of smoke . . .

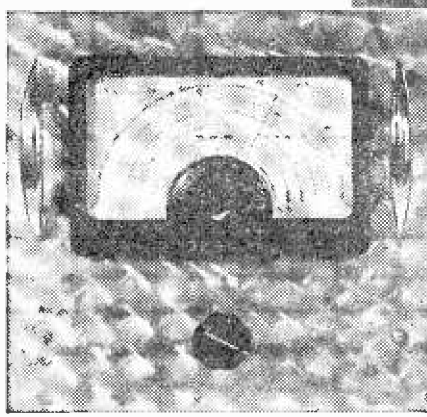
My point is that the boffins have overlooked a vital factor. This elusive parameter, the "H" factor—(H for Henry, I'm after a Nobel Prize)—must be inserted in any formula that attempts to assess reliability. It is the tendency of a piece of electronic gear to give off wild puffs of smoke, or horrid noises, or sudden bouts of unbearable silence, at the most embarrassing moments.

Just at the moment when the Director of the Electronological Institute is passing through, or when those political purseholders who haunt the men at R3 pay a visit, or when Aunt Mabel comes to tea, the "H" factor comes into play.

We have laboriously built the hi-fi rig, planed and glued the cabinetry, tackled all the wires out of sight, assembled our friends and neighbours for the preview and—presto—comes a power cut. Small use citing the Reliability Committee or quoting MTBF then. As your wife passes the coffee and makes with the small talk, you can muse on the "H" factor, and write another failure up to experience.

PRESELECTOR & B.F.O. UNIT





H. WEBSTER

FOR THE BEGINNER'S S.W. SUPERHET

CONTINUED FROM PAGE 968 OF THE FEBRUARY ISSUE

IN a c.w. frequency transmission the carrier wave is unmodulated and means must therefore be provided to render the signal intelligible at the receiver. In the simplest type of receiver such as the detector and l.f. type this is often accomplished by making the detector oscillate at a frequency slightly removed from the incoming frequency. The difference in the two frequencies is equal to the frequency of the beat note. This process whereby the detector itself provides the local frequency is known as the autodyne method. Another and more general method employed in the superheterodyne receiver is to use a separate oscillator. This oscillator, known as the beat

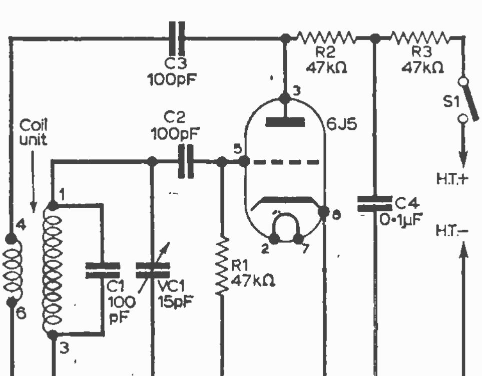


Fig. 7: The one-valve circuit of the b.f.o. unit.

COMPONENTS LIST

Resistors:
R1 47kΩ ½W
R2 47kΩ 1W
R3 47kΩ 1W

Capacitors:
C1 100pF silver mica
C2 100pF silver mica
C3 100pF silver mica
C4 0·1μF tubular
VC1 15pF variable (Jackson C804)

Miscellaneous:
V1 6J5
S1 S.P.S.T. switch
L1, L2 1·6Mc/s b.f.o. coil. Denco BF02
International octal ceramic valveholder. Chassis top plate 4in. x 7in. (Home Radio). Knob, wire, etc.

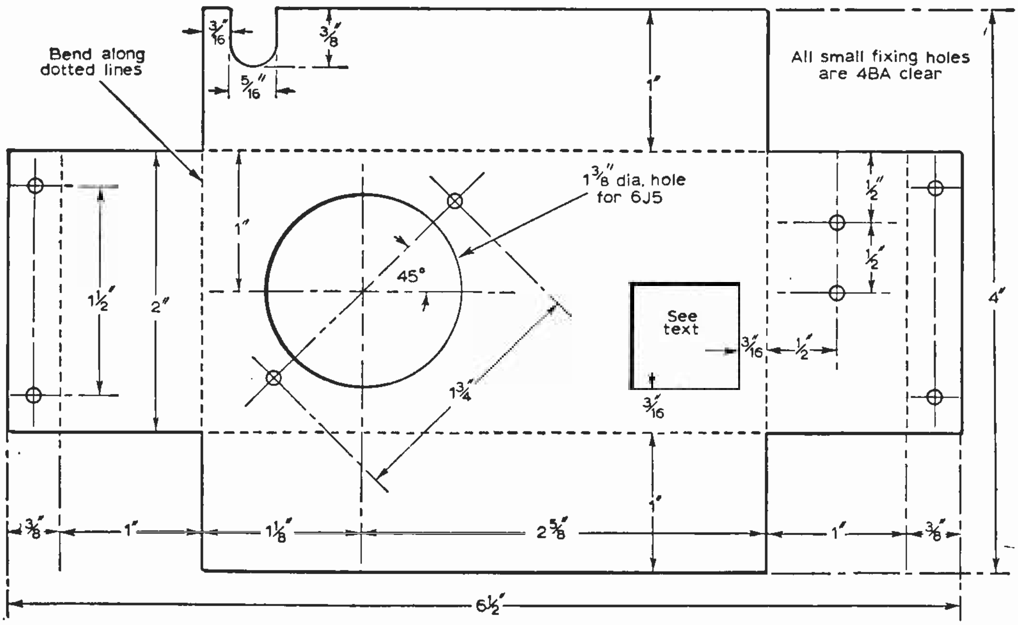


Fig. 8: Details of the b.f.o. chassis which is eventually attached to the main receiver chassis. This arrangement may be seen in one of the heading photographs on page 1055.

frequency oscillator, injects an unmodulated signal into the second detector circuit. The frequency of this oscillation can be varied over several kilocycles each side of the receiver intermediate frequency.

A further and important use for a b.f.o. is in the reception of single side band (s.s.b.) transmissions. Since these signals are generally transmitted with little carrier, means must be provided to insert the carrier at the receiver. A description of this technique will be given later in the article.

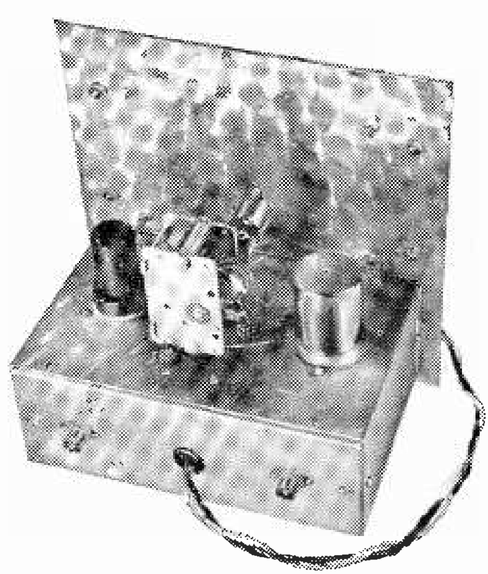
Circuit

The b.f.o. is built round a 6J5 medium impedance triode. The circuit diagram is shown in Fig. 7. L1, L2 is a Denco 1·6Mc/s beat frequency oscillator coil. The frequency of the oscillator can be varied a few kilocycles each side of the 1·6Mc/s i.f. by means of a panel-operated control VC1. Screening of the unit is of importance since harmonics of the b.f.o. may find their way into the front end of the receiver. Although the author did not find this troublesome it may be necessary to screen the 6J5 to reduce the b.f.o. injection.

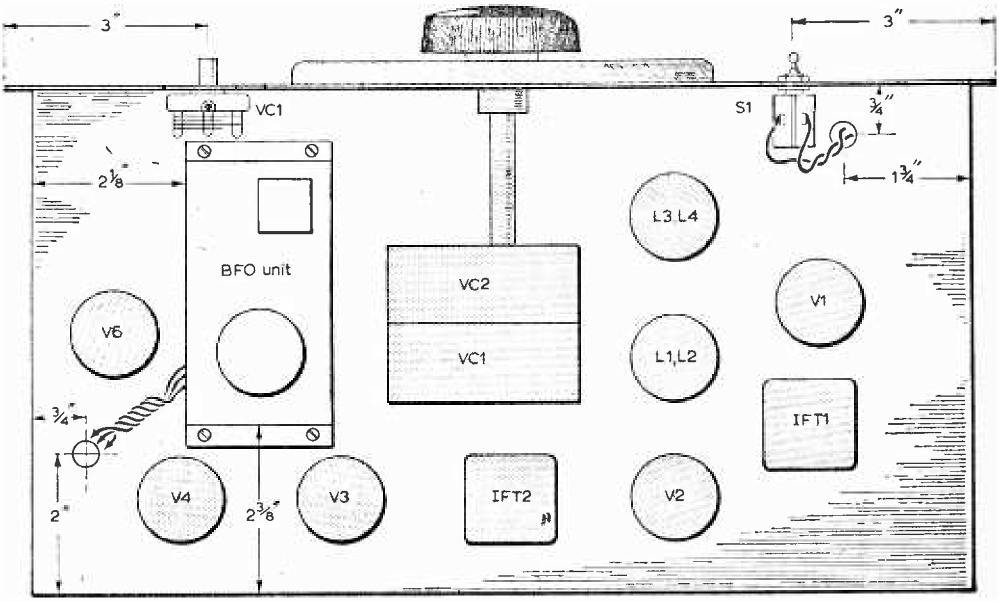
Constructional Details

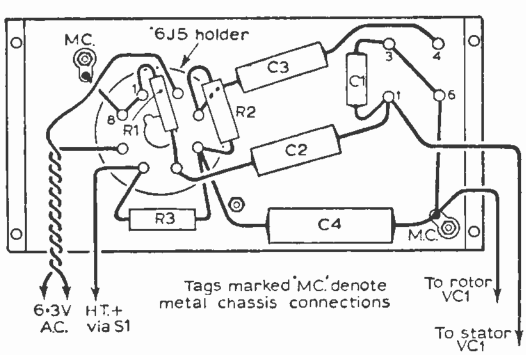
The b.f.o. unit is built on a small sub-chassis which is mounted on the main receiver chassis. Sufficient space is available between the output valve (6V6) and the gang capacitor. The sub-chassis is cut from a 7in. x 4in. piece of aluminium to the dimensions given in Fig. 8. The method for mounting on the receiver chassis is given in Fig. 9.

Since the unit is comparatively small care must be exercised in wiring the components. It will be



A rear view of the completed preselector described in last month's issue.





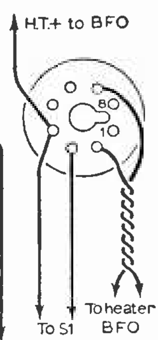


Fig. 9 (above): The position of the b.f.o. unit on the main chassis. The shaded parts indicate components on the original receiver.

Fig. 10 (far left): Under-chassis wiring of the b.f.o. unit.

Fig. 11 (left): Additional wiring from the power input socket of the main receiver, to provide for the b.f.o.

noted that no fixing details are given for the b.f.o. coil unit. Fitting is best done using the unit itself as the template.

A point-to-point wiring diagram is shown in Fig. 10. When wiring is complete the usual routine check is made of the resistance between h.t. positive and chassis. If this is satisfactory the unit may be bolted to the receiver chassis and the heater and h.t. leads taken through the hole in the receiver chassis. The power leads are soldered to the tags of the octal input socket at the rear of the receiver. The relevant details are shown in Fig. 11.

Adjustment and Operation of B.F.O.

Adjustment of the b.f.o. is best done with the aid of a signal generator such as was described in the original article. Inject an unmodulated signal of 1·6Mc/s via the top cap of the frequency changer. Set the b.f.o. panel trimmer to mid-capacity and then carefully adjust the dust core of the b.f.o. coil until zero beat is obtained. The setting is now correct.

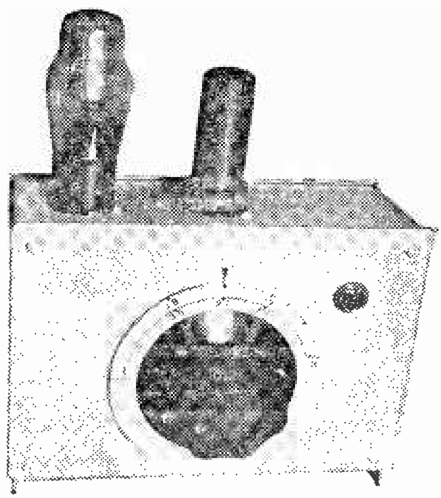
If no signal generator is available the coupling between the grid and anode of the i.f. stage pentode can be increased to the point where the stage breaks into oscillation. A gentle hissing noise will be heard at this point. The b.f.o. is adjusted until zero beat is again obtained.

Single Side Band Reception

S.S.B. signals can be rendered intelligible by the following procedure. The signal is accurately centred on the main receiver. If the preamplifier is used the gain control is set to minimum and the receiver volume control turned to maximum. VR1 is now adjusted until a weak signal is heard. Switch on the b.f.o. and adjust the pitch control until intelligible speech is obtained. A little practice may be needed before the correct setting is obtained. ■

A VOLTAGE STABILISED V.F.O.

HAM FEATURE



BY F. G. RAYER G3OGR

THE variable frequency oscillator described here may be used to control the two-band speech transmitter (January. 1965. P.W.) so that no crystals are needed. It enables the transmitter to be tuned to any frequency in the 1·8 or 3·5Mc/s amateur bands.

The v.f.o. may be employed with other transmitters. The fundamental operating frequency is 1·75-2Mc/s but output may be taken at 3·5-3·8Mc/s if a different transmitter requires this.

Fig. 1 shows the circuit and the VR150 regulates the anode and screen supply for the 6AG7. L1, the oscillator coil, is tuned by VC1 from 1·75-2Mc/s. There is good isolation between L1 and the anode circuit and L2 is tuned to about 1·9Mc/s and needs no further adjustment. A coaxial lead takes r.f. to the transmitter.

Heater and h.t. currents are drawn from the companion transmitter. Heater drain is 0·65A, plus 0·3A for the indicator lamp. For h.t. about 25mA will be needed at 200-500V.

CONSTRUCTION

As the v.f.o. replaces the crystals, rigid construction is needed. An aluminium box about 7in. x 5in. x 3in. is used, completely enclosed, and with a 7in. x 3in. shelf bolted 2in. from the case top. The panel is screwed to this shelf and the box to increase rigidity. L1, TC1, C1 and VC1 are below the shelf with other components in the top compartment.

The valve and voltage regulator stand clear on top of the v.f.o. so that their heat does not cause unnecessary frequency drift in the circuit L1. All components are securely held, with short leads and tag strips where needed. With these precautions the general stability of the unit was found satisfactory.

Fig. 2 shows all internal wiring, including the underside of the box top, to clarify valveholder connections. Stout wire such as 18s.w.g. is used throughout. Two leads pass through the shelf. These go to B on L1 and to R1 and C2. These wires are in thick insulated sleeving which is a push fit in the holes.

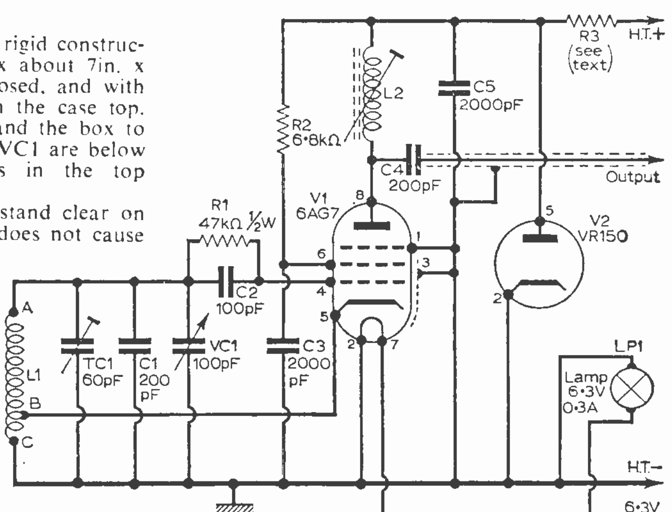


Fig. 1: The v.f.o. circuit. The operation of this simple circuit is described in the text.

It will be seen that L2 is at right-angles to L1. L2 is attached to a bracket on the shelf and is horizontal. All construction must be perfectly solid to avoid random changes in frequency.

V.F.O. COIL

L1 is wound on a strong paxolin tube 1in. in diameter and about 2½in. long. Drill two small holes at A (Fig. 2). About 1in. away drill two further holes for end C.

A length of 26s.w.g. enamelled wire is anchored to some convenient point and threaded through the holes at A. The centre 1in. of the tube is smeared thinly with an adhesive cement. The coil can then be wound by rotating the tube, walking slowly forwards and keeping the wire under

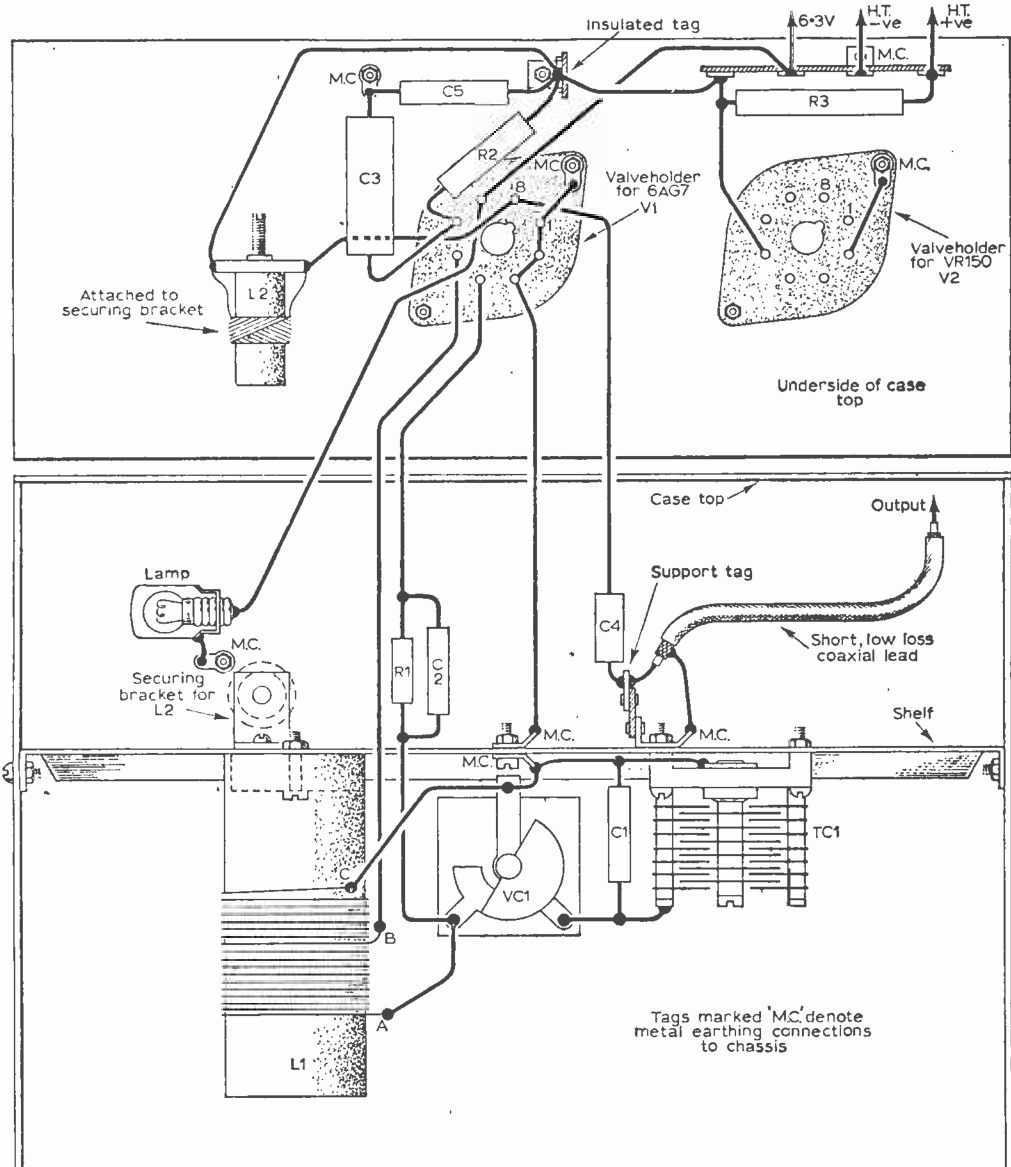


Fig. 2: The complete wiring diagram of the finished unit.

tension. Turns are side by side. After winding 25 turns make the small loop B, then continue for a further ten turns, finishing at C. Scrape and tin B and the winding ends. A disc of wood is cemented in the tube and drilled for a fixing bolt.

ANODE COIL

L2 was a small medium wave coil of unknown manufacture. Coils of this kind with adjustable cores can be tuned to about 1·9Mc/s. Tuning is by adjusting the core to suit stray circuit capacity.

The correct tuning of L2 can be found by placing a wavemeter near the coil or by observing grid current in the transmitter. For the latter purpose a 0-5mA meter is convenient. After calibrating the v.f.o. set it to about the middle of the band. When the core of L2 is rotated a broadly resonant peak will be found corresponding to maximum grid current. There is little change in grid drive when tuning the v.f.o. across the band, so L2 can be left peaked at about the middle of the band.

If a different transmitter requires an input in the 80m band L2 should be adjusted to about 3·65Mc/s. A suitable coil can be 65 turns of 32s.w.g. enamelled wire side by side on a ¼in. diameter dust-cored former. For the 160/80m speech transmitter the v.f.o. output is 1·8-2Mc/s for 160m and 1·75-1·9Mc/s for 3·5-3·8Mc/s (80m band).

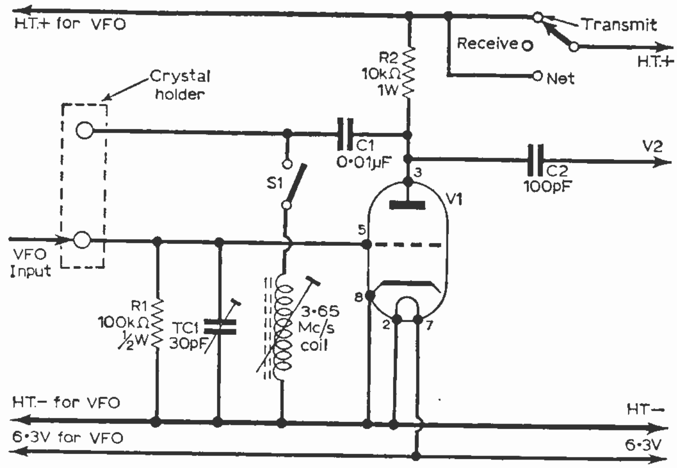


Fig. 3: Using V1 of the original transmitter circuit (page 855, January issue) as a frequency doubler.

Should the v.f.o. be employed with a different transmitter it is generally best to have the v.f.o. output on one-half the frequency of the first stage of the transmitter as this avoids instability. The 160m output is then used for 80m, but a 80m output would be handy for doubling to 40m. If a two-way switch is fitted in place of the lamp both 160m and 80m anode coils may be used to give output on either band.

COMPONENTS LIST

Resistors:

R1 4·7kΩ ½W
R2 6·8kΩ 1W
R3 4·7kΩ 2W, see text

Capacitors:

C1 200pF silver mica
C2 100pF silver mica
C3 2,000pF silver mica
C4 200pF silver mica
C5 2,000pF silver mica
TC1 50, 60, 75 or 100pF air-spaced trimmer
VC1 100pF s.w. variable; high quality

Miscellaneous:

V1 6AG7
V2 VR150
L1, L2 See text for details
LP1 6·3V 0·3A lamp

Two octal valveholders and indicator lamp holder. Two insulated tags and tag strip. Universal chassis 5 in. x 7 in. x 3 in. with 5 in. x 7 in. plate and extra 7 in. x 3 in. runner (Home Radio). Paxolin tube, dial drive, wire, etc.

POWER SUPPLIES

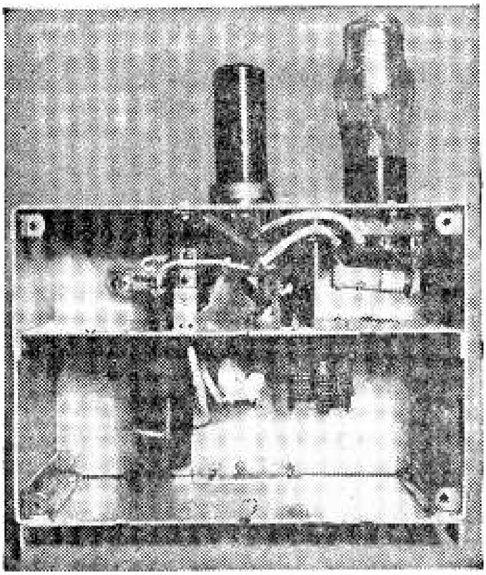
These are drawn from the transmitter, h.t. being required at net and transmit positions of the function switch but not at receive. To arrange this take the h.t. connection from S1 as in Fig. 3.

For easy interconnection a valveholder or three-way socket is fixed to the transmitter panel. A matching plug or old valve base wired to the tag strip in Fig. 2 allows the v.f.o. to be brought into use at once.

The coaxial cable is fitted with a plug which is inserted in the crystal socket going to R1 (Fig. 3). The other crystal socket is unused.

RESISTOR R3

For the 160/80m transmitter with a 250/0/250V transformer R3 is 4·7kΩ, 2W. This gives a regulator current of about 20mA. In other transmitters the h.t. voltage may be greater and R3 must then be increased. This is readily done by taking 150V from the actual potential available, then using Ohm's Law to find R3 for this voltage drop with about 25-30mA flowing, e.g. 7kΩ would do for 350V supply, etc. Alternatively connect a



A rear view of the completed prototype v.f.o. unit.

meter in series with the voltage regulator and adjust R3 until the regulator draws about 25mA.

TRANSMITTER DOUBLER

When operating on 160m the original crystal oscillator valve acts as an untuned buffer. No changes at all are needed except to plug the v.f.o. in instead of a crystal.

When working in the 80m band the first transmitter stage must operate as a doubler. This is done by fitting an on/off switch on the chassis and panel near the crystal socket and wiring it to a 3·65Mc/s coil as in Fig. 3. This coil can be 65 turns of 32s.w.g. enamelled wire, side by side, on a ½in. diameter former provided with an adjustable dust core.

For 160m the switch is left open. For 80m set the v.f.o. to roughly 1·8Mc/s and adjust the new coil core for maximum grid current with the switch closed. The switch must be open if crystals are inserted.

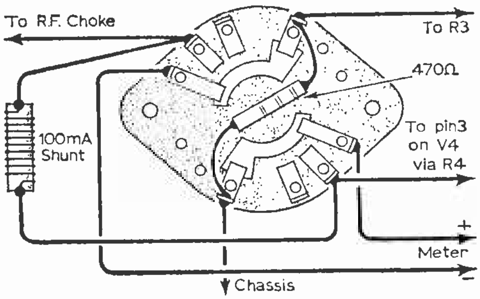


Fig. 4: Connections for a two-pole, three-way switch to be incorporated in the transmitter meter circuit to provide indications of grid and anode currents.

GRID/ANODE SWITCH

For the above adjustments a fairly accurate indication of small changes in grid current will be necessary. It may thus be felt worth while to change the transmitter meter circuit to show grid and anode currents at will.

A three-way, two-pole rotary switch can be mounted on the transmitter panel near the meter and wired as in Fig. 4. With the switch in the position shown, grid current is read. The 470Ω resistor is only to complete the grid circuit when reading anode currents. The most convenient meter is a 0-5mA model.

With the switch fully turned to its other position the meter reads anode current, the shunt changing the range to 0-100mA. It is necessary to use a three-way switch so that the contacts clear the grid circuit before completing the anode circuit. But if a *break-before-make* two-way switch is to hand this is perfectly suitable.

In use grid current is checked as necessary and the meter is then used to show anode current as previously described.

V.F.O. CALIBRATION

VC1 has a large knob with dial, a reduction drive being optional. It is only necessary to calibrate for one band as 80m coverage is obtained by the second harmonic.

A crystal calibrator or marker is ideal for calibration. Open VC1, tune a receiver to 2Mc/s from the marker and adjust TC1 until the v.f.o. is at zero beat. Mark the dial 2Mc/s. The process can then be repeated at 1·95, 1·9, 1·85, 1·8 and 1·75Mc/s.

Divisions are filled in between the calibrated points. The 160m band is indicated from 1·8-2Mc/s on one scale. Each frequency is then multiplied by two and placed on a second scale for 80m. Only frequencies from 3·5-3·8Mc/s (1·75-1·9Mc/s fundamental) should be shown on the 80m range.

V.F.O. WORKING

The method of loading up and tuning the transmitter for crystal operation has already been described. V.F.O. working is similar except that any required frequency can be selected.

If a CQ call is to be made find a vacant channel with the receiver and tune the v.f.o. to this, using the net position of the switch. Then switch to transmit and tune the p.a. as described.

If a CQ is to be answered the v.f.o. is tuned to zero beat with the transmission heard, again using the net position. The p.a. is then quickly tuned with the function switch at transmit. The switch is then returned to receive until the calling station stands by for replies. The switch is then turned to transmit and a reply made. ■

THE 'Cadet' 7 WATT HYBRID AMPLIFIER

THE amplifier to be described was built to fulfil the requirements of a medium power amplifier at the lowest possible cost. Although it could not be placed in the hi-fi class by any stretch of the imagination, it gives a good output for a wide range of inputs.

When originally designed, careful consideration was given to parts available from the junk box, and many constructors will probably find that they already have the majority of the parts. There are no critical values in the amplifier at all, and even starting from scratch, with careful buying from the columns of this magazine it should be possible to make the amplifier for about £2 10s. (excluding case).

The original amplifier had two low level inputs (actually for two guitar pick-ups) and a treble cut control but it can easily be modified to give up to ten low level inputs, with or without the treble cut control, and also a socket can be brought out to give a high level input (i.e. from a gramophone or carbon microphone). It can therefore be built for virtually any application which requires a maximum output of approximately 7W.

CIRCUIT DESCRIPTION (FIG. 1)

The amplifier is a hybrid design: that is, it uses transistors for low level amplification, and valves for the driver and the output stage. Both valves and transistors derive their power from a mains power pack.

This arrangement was decided on because modern transistors are well suited to low level amplification and are also cheaper than their valve counterparts: a wholly transistorised amplifier could have been designed, but transformers for transistorised amplifiers are still quite expensive items.

Direct coupling is possible, but can be difficult to set up properly without an oscilloscope. A hybrid amplifier offers the best compromise between cost and simplicity compatible with performance.

TRANSISTOR PREAMPLIFIER

The transistor preamplifier uses two OC71 Mullard transistors (or equivalents) in a conventional R—C coupled circuit. The two inputs are wired so that the operation of one control does not effect the other control. R1 and R2 in series with the inputs ensures that the microphone or pick-up is not completely short circuited when the associated volume control is turned down to its minimum position.

The volume controls are coupled to the base of the first transistor by C1; R3 and R4 determine the base bias for the transistor. R5 and R6 are chosen to give a collector current of approximately 1mA in the first stage, and R9 and R10 give a

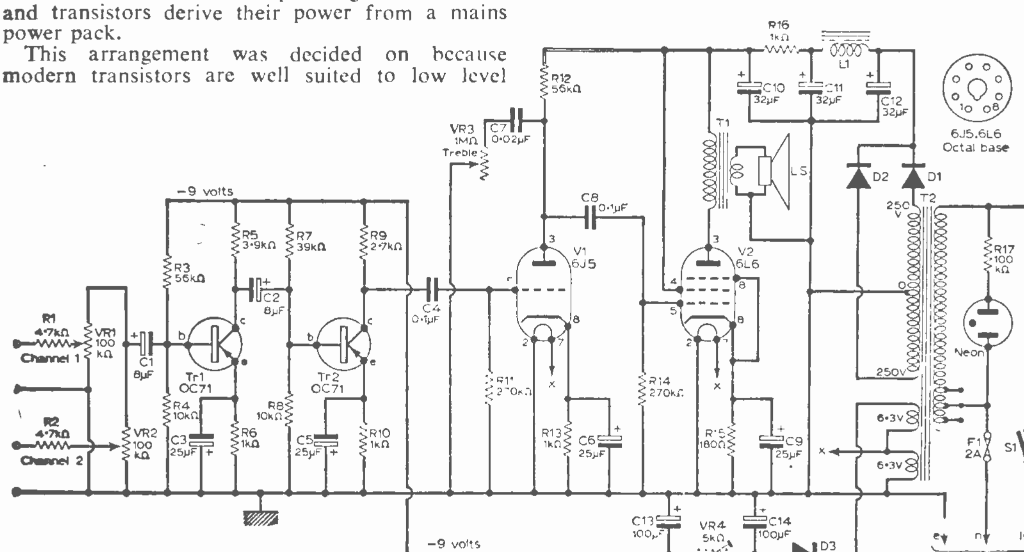
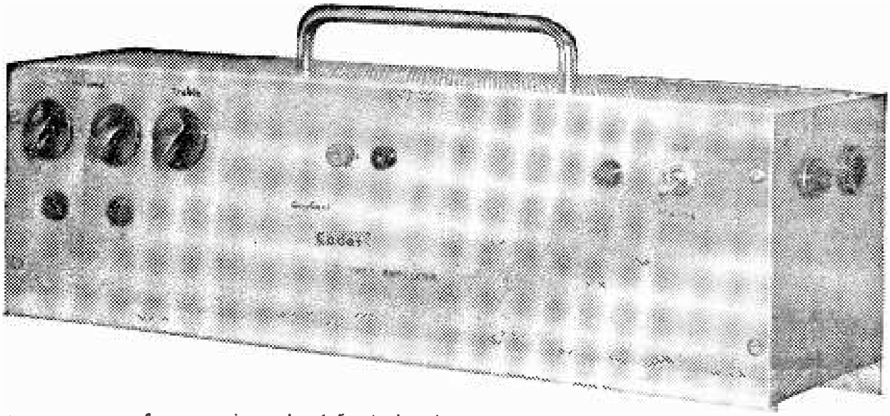


Fig. 1: The basic hybrid circuit of the "Cadet", complete with preamplifier stage and power supply.



CHRISTOPHER P. GUY

collector current of approximately 1·5mA in the second stage.

The preamplifier will work satisfactorily with a supply voltage between 4·5 and 15V, though a certain amount of gain will be lost at the lower voltages, and the circuit may be rather noisy at the higher supply voltages (depending on the transistors used).

A nominal supply voltage of 9V was chosen, obtained by using two 6·3V windings on the mains transformer, and the voltage is set for optimum performance when the amplifier is tested by means of a 5kΩ preset potentiometer (VR4) in the power supply.

MAIN AMPLIFIER

The output from the preamplifier is taken via C4 to the grid of a 6J5 triode. This feeds a 6L6 beam tetrode operating in class "A". A treble cut circuit is provided between the two valves. The h.t. for the valves is approximately 275V with the values specified.

As with the preamplifier, the main amplifier was tested with voltages between 180—400V, and again, the output was somewhat lower with the lower voltages and a bit noisier at 400V.

One side of the secondary of the output transformer should be earthed, not only from a safety point of view, but also to prevent parasitic oscillations which can occur when a long lead is used to the speaker.

THE POWER SUPPLY

The power supply uses a full wave transformer and modern silicon rectifiers which are available at a reasonable price through the columns of this magazine. These are very efficient and have a very low voltage drop across them: but because they have such a low impedance they can be destroyed by switching-on surges.

Some suppliers suggest that a resistance of approximately 50Ω is connected in series with the rectifier. However, most, if not all, of the resistance is supplied by the windings of the transformer, so the series resistors have not been included in this design, but 2W 47Ω resistors may be wired between the rectifier and the transformer for safety if required. Alternatively, metal rectifiers may be used if they are to hand or more easily obtainable.

The negative 9V supply is obtained by wiring two of the low voltage secondaries of the transformer together, and using a simple half-wave rectifier circuit with a smoothing consisting of 5kΩ preset potentiometer and two 100μF 25VW electrolytics. Most transformers have at least two 6·3V windings,

COMPONENTS LIST

Resistors:

R1	4·7kΩ	R10	1kΩ
R2	4·7kΩ	R11	270kΩ
R3	56kΩ	R12	56kΩ
R4	10kΩ	R13	1kΩ
R5	3·9kΩ	R14	270kΩ
R6	1kΩ	R15	180Ω 1W
R7	39kΩ	R16	1kΩ 5W
R8	10kΩ	R17	100kΩ (for neon)
R9	2·7kΩ		

All 10% ½W carbon unless otherwise stated

Potentiometers:

VR1	100kΩ	VR3	1MΩ
VR2	100kΩ	VR4	5kΩ

Capacitors:

C1	8μF electrolytic 25V
C2	8μF electrolytic 25V
C3	25μF electrolytic 25V
C4	0·1μF paper 350V
C5	25μF electrolytic 25V
C6	25μF electrolytic 25V
C7	0·02μF paper 350V
C8	0·1μF paper 350V
C9	25μF electrolytic 25V
C10	32μF electrolytic 450V
C11	32μF electrolytic 450V
C12	32μF electrolytic 450V
C13	100μF electrolytic 25V
C14	100μF electrolytic 25V

Valves and Semiconductors:

V1	6J5 V2 6L6
Tr1, Tr2	OC71 or equivalent
D1, D2	400 p.i.v. 100mA silicon rectifiers (see text)
D3	30V 5mA surplus diode (see text)

Miscellaneous:

T1	Output transformer: ratio 3·5kΩ: 3Ω 8W
T2	Mains transformer. Secondaries: 250-0-250V, 80mA; 6·3V, 3A; 6·3V, 1A (see text)
L1	10H, 100mA choke (see text)
F1	2A fuse

70/90V neon, tag strips, aluminium, etc.

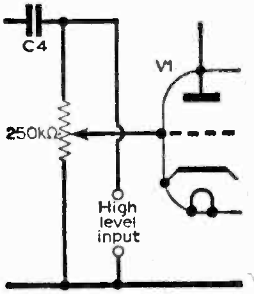


Fig. 2: The modification to the V1 circuitry to provide a high level input. This allows for the use of record player, carbon microphone and similar inputs with the amplifier.

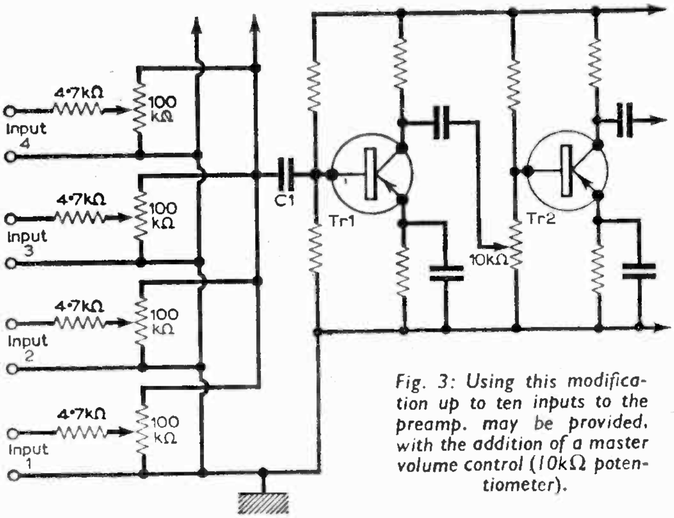


Fig. 3: Using this modification up to ten inputs to the preamp. may be provided, with the addition of a master volume control (10kΩ potentiometer).

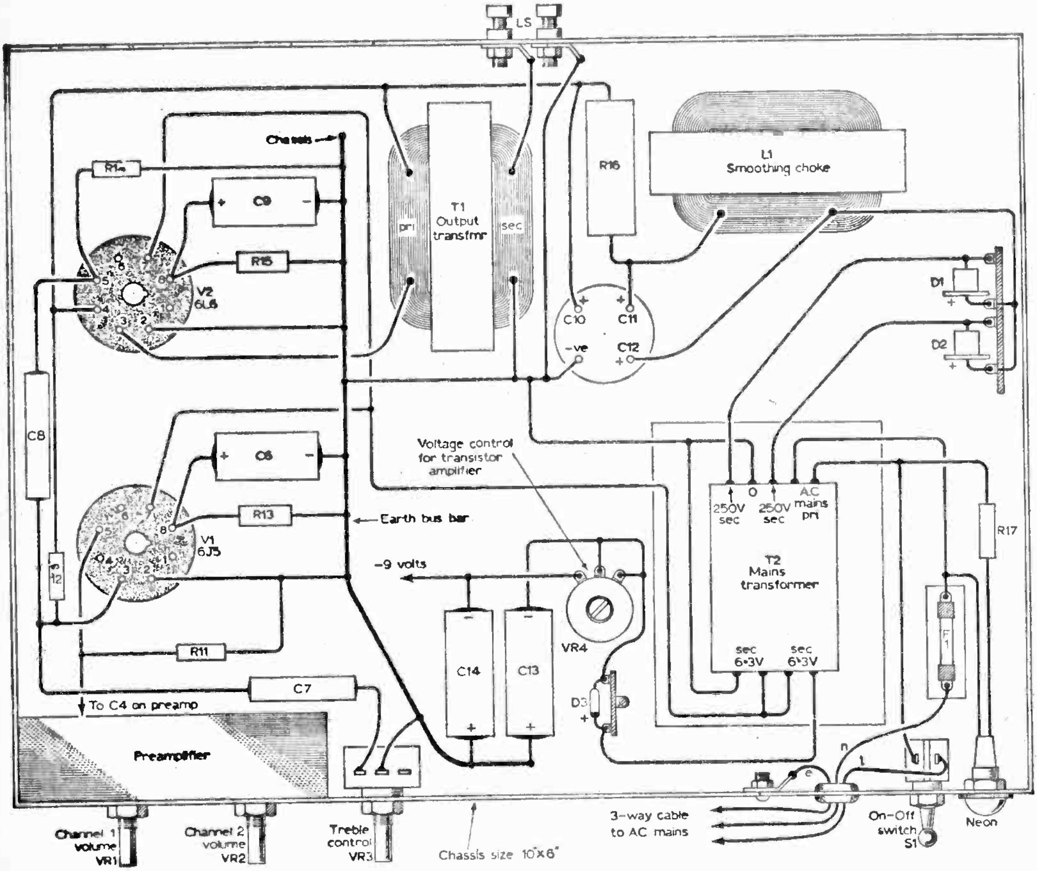


Fig. 4: Complete wiring details of the main amplifier and power pack chassis.

or one 6·3V winding and a 5V winding for the rectifier.

The 6·3V winding (with the larger current capacity if there is more than one winding) has one side connected to the chassis: this also supplies the heaters of the valves. The other winding is connected in series with the first winding.

It must be connected the right way round otherwise the two windings will be 18° out of phase and the total output voltage will be zero. To check the sense of the connections, connect the transformer to the mains, and connect the two low voltage windings together and measure the output voltage.

A 12V bulb can be used for this purpose if no a.c. meter is available. The bulb will glow brightly with the windings connected one way round, and the windings should be connected in this sense when building the amplifier.

Virtually any diode can be used for the 9V supply since it is only required to supply about 2·5mA. One of the diodes obtainable at about 1s. 6d. will be adequate. Note that the black end goes to the smoothing circuit and the red end goes to the transformer.

The 250V supply is smoothed by a choke—resistor—capacitor arrangement: this was found to be more than adequate. If required, the choke could be replaced by a 1,000Ω 10W resistor with consequent economy but slight degradation of performance.

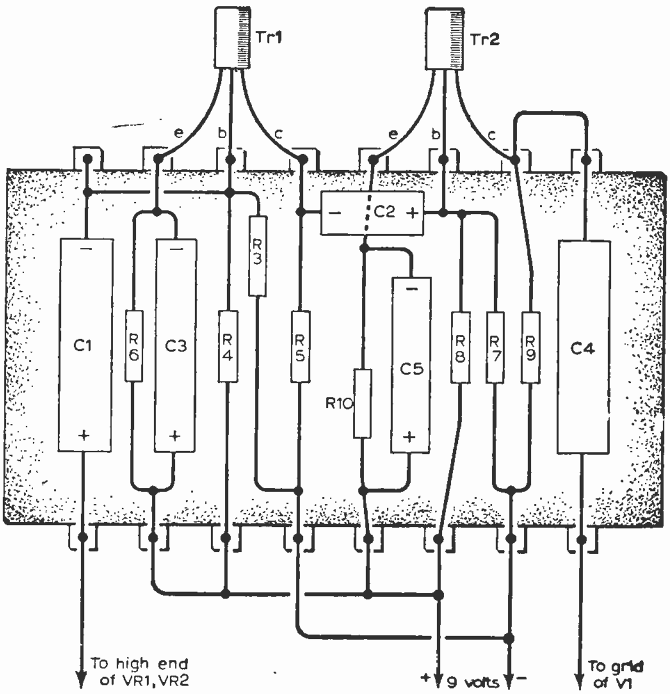


Fig. 5: Construction details of the preamplifier chassis which is built separately and fitted to the underside of the main chassis when complete.

MODIFICATIONS

As has been previously stated, a number of modifications can be introduced in to the amplifier to increase its usefulness while it is being built. The treble cut control may be omitted by removing C7 and VR3.

A high level input socket may be added simply by bringing out the grid of V1 via a length of screened cable to a suitable socket. It is not very simple to provide a volume control at this point however, because the output impedance of the transistor amplifier will effect the use of such a control.

However, the circuit of Fig. 2 would work since the volume control has been "turned round". R1 is made a variable component, and the slide is taken to the grid of V1.

The real limit to the number of channels is the layout, since the more channels there are, the greater the problems of hum pick-up and control interaction become. There is no reason why 10 channels should not be possible so long as efficient screening and the shortest possible lead between the input socket and the potentiometer are used. A master volume control may be built in between the two transistors by making R8 a variable component.

CONSTRUCTION

The author's original amplifier was constructed to fit in a case 17in. x 5in. x 5in. This gave plenty of room (except that a 6L6M had to be used instead of 6L6G, since the 6L6G was taller than 5in.!). The layout is by no means critical providing the usual rules are followed such as wiring the heaters first of all and keeping the leads carrying a signal as short as possible.

The output transformer, smoothing choke and mains transformer should have their cores in opposite planes to avoid interaction. No wiring carrying 50c/s (such as mains or heater supplies) should pass anywhere near the preamplifier.

It is suggested that the main amplifier and the power pack are constructed on the same chassis and the preamplifier is constructed on a tag board and fixed under the main amplifier chassis. It is a good idea to use transistor sockets so that different transistors can be tried to select one for good noise characteristics.

The cabinet is left to the constructor's ingenuity (don't forget that the 6L6 gets fairly hot in operation). If required the cabinet can be dispensed with and the amplifier left as a plain chassis with the controls on the front. A neon bulb was used as a pilot light; a low voltage bulb wired across the heater winding would be equally sufficient. A mains fuse of 1A should be included in the live mains lead.

TESTING

When the amplifier has been completed and the wiring checked the amplifier should be connected to the mains supply. The chassis should always be earthed when the amplifier is in use, not only because this is safer but it also cuts down hum and noise.

The preamplifier should be left disconnected at this stage. When the main amplifier has warmed up and a loudspeaker has been connected a pronounced hum should be heard when the grids of the valves are touched with a screwdriver.

Assuming that the main amplifier works, check that the transistor supply is giving a negative output and turn the preset potentiometer down to its minimum voltage setting. This voltage may be quite high, since there is no load connected across it.

Switch off the mains and connect the preamplifier. Turn on the mains and adjust the preset potentiometer to give approximately 9V. (If no meter is available set it for minimum noise.) An input, such as a low impedance microphone, can now be connected and the whole amplifier tested.

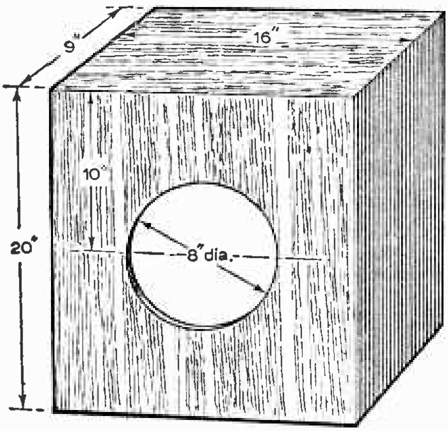


Fig. 6: Basic details of a suggested cabinet for the loudspeaker.

LOUDSPEAKER AND ENCLOSURE

An 8in. 10W loudspeaker was used with the original amplifier. This was mounted in a shallow box with the dimensions shown in Fig. 6. A single piece of wood (say) 20in. x 16in. would have been just as efficient acoustically but it is well worth the trouble involved in making the baffle board into a shallow box, since it not only makes it more convenient to stand up but it also protects the speaker from accidental damage to the back of the cone.

Finish of the case depends on how much money and time the constructor is prepared to allow. The box itself should be solidly made ½in. ply or chipboard to avoid resonances at the lower frequencies to be handled. If the box does resonate it may be necessary to include one or more braces to increase the rigidity.

The dimensions given should serve as a guide: actual measurements can be decided by the individual. If required the main amplifier and power pack chassis could be mounted at the bottom of the box and the preamplifier and controls could be mounted at the top. ■

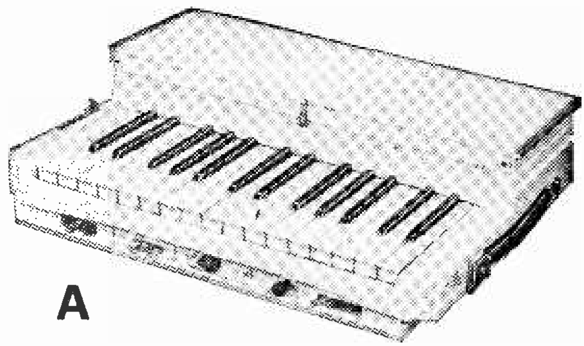
KEYED AUDIO OSCILLATOR

—continued from page 1043

arrangement, causing the audio oscillation to rise and fall at the beginning and end of each pulse respectively, smoothly over about one cycle. The capacitor C5 should have ten times the capacity of the capacitors C1 to C4 determining the audio frequency to realise this condition correctly. Since the audio output has an amplitude of some 4V r.m.s. with VR3 turned full up, only simple audio amplifiers are required for even the most powerful transmitters met with in amateur transmitters. The output can alternatively be plugged in in place of the mike of an existing telephony transmitter, giving immediate conversion to m.c.w. operation without any other alterations of any kind.

A few words about the advantages of m.c.w., for which the carrier runs uninterrupted as in telephony, the Morse characters being impressed as corresponding bursts of a.f. modulation as if these were music or speech signals. Apart from the fact that no b.f.o. is required in the receiver and some loss of signal-to-noise ratio the greatest outstanding advantage is the available multiplicity. Several Morse operators at the one transmitter can each key their own Veroboard circuit with their own particular audio frequency output. All outputs are used to modulate the one transmitter simultaneously. At the receiver each receiving operator interposes a tuned circuit resonant to the audio frequency of his intended signal in front of his phones. Alternatively the entire signal can be tape recorded and a single receiving operator can read each message successively on successive playbacks with his audio resonant circuit tuned to the m.c.w. channels one after the other. Ordinary carrier-keyed c.w. cannot transmit more than one message per r.f. channel. When it is remembered that with the m.c.w. technique single sideband (s.s.b.) modulation techniques can be combined therewith, the upper and lower sidebands containing completely different sets of multiplex m.c.w. signals, it is clear that the total information which can be modulated on to a single r.f. carrier frequency without exceeding the conventional bandwidth is quite enormous. It is little wonder that these types of communications systems are very popular with the GPO nowadays! They provide some measure of solution to the increasing congestion of the communications wavebands.

CONTINUED NEXT MONTH



BUILDING A TRANSISTOR SOLO ORGAN

by G. W. Hardy

CONTINUED FROM PAGE 945 OF THE FEBRUARY ISSUE

THE layout of the three panels—the wiring of which was detailed last month—the controls, batteries and sockets viewed from underneath the cabinet, is shown in Fig. 8.

Keyboard Switches

For ease of manipulation from the keyboard it was decided to adapt the three-way switches so that they are moved by levers instead of knobs.

The levers were made from ½in. wide strips of brass about $\frac{1}{16}$in. thick and 2in. long. For half the length, width is reduced to ¼in. At the end of the wide portion a ¼in. clearance hole is drilled and the surface adjacent to this hole tinned.

We now need bosses (with grub screws) to which the levers can be soldered. A brass ¼in. spindle coupler sawn in half will provide us with two. The circular ends are tinned and placed on the tinned portion of the levers, with holes correctly aligned, and heat with pressure applied with a large soldering iron, when they should unite.

The case under the keys is recessed back ¾in. The switches are fixed so that the ends of the levers project out 1⅝in. from centre of spindles and come level with front of keyboard.

Coloured plastic adhesive tape is now bound around the ends of levers to form a neat handle.

The Keyboard and Case

Assuming the constructor has an accordion keyboard, and the rest of the instrument has been dismantled, we should now have the keyboard with its keys sticking up in the front and at the end of each a spike with leather covered pallets attached.

Care must be taken now as we cannot level the keys until a baseboard has been fitted. This should be of plywood the width of the keyboard plus 1in. and 12in. from back to front and about ½in. thick.

Any plastic covering should be removed and the keyboard now placed so as to be level with the front of the baseboard, ½in. spacing either side, and fixed to it with countersunk screws.

As the front of the keys are sticking up it can be seen that under them is a shallow compartment containing key guides and springs. It is the bottom of this compartment which is fixed to the baseboard and any screws coming through from baseboard will need to be carefully positioned or kept short. The strongest fixing will be into the key blocks at each end.

Having fixed the keyboard we can attend to the keys. The pallets should be removed and the malleable spike on each key carefully pressed back and downwards to form an extension of the key whilst the front of key is held down firmly.

The spikes should now rest on a felt-covered piece of wood the length of the 29 keys. Height of wood is by experiment (see Fig. 9). The keys can now be levelled and adjusted to give a ½in. deep touch at the front.

The idea now is to build up a compartment at the back of the keys and another under the baseboard. The bottom compartment need only be 1¼in. deep and will accommodate all the panels, batteries and switches (Figs. 8 and 9).

Planed wood 1¼in. x ¾in. is cut to length and mitred or butt-jointed in the form of a frame and fixed with countersunk screws level with back and sides of baseboard. The front part of the frame should be fixed ¾in. from the front of baseboard. A piece of hardboard cut to the size of the frame and fixed with countersunk screws will form a cover.

The top compartment is built up in a similar manner with ½in. wood. Depth must be obtained by measuring from top of highest spike and, with the key down, adding 1⅝in. for hopper and another

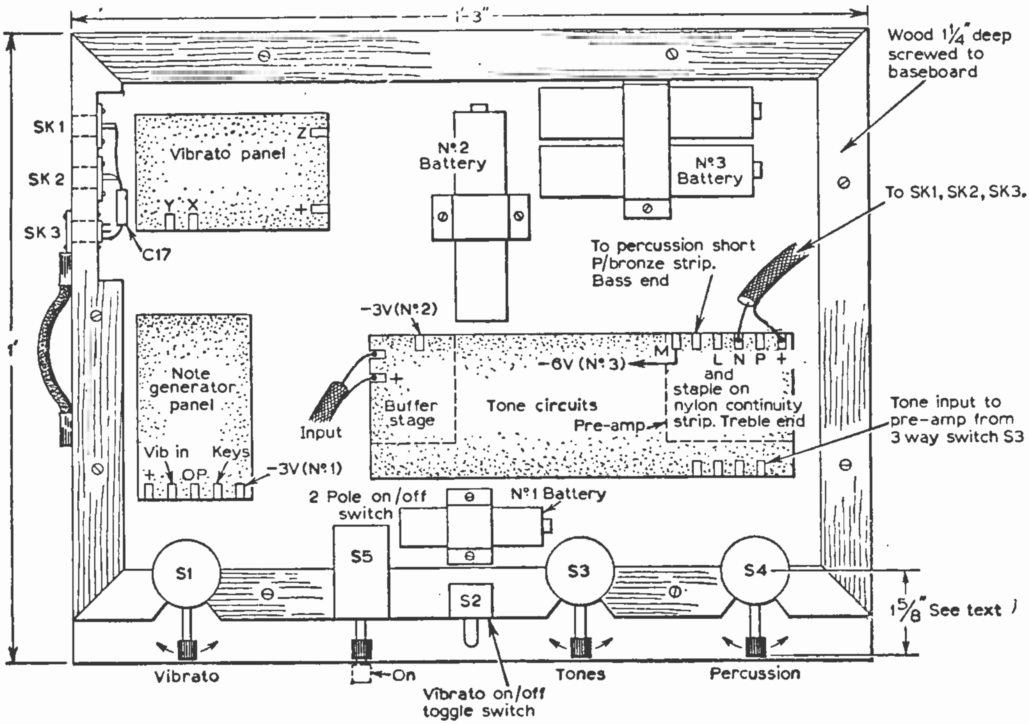


Fig. 8: The layout of the bottom compartment which accommodates the three panels, batteries and controls.

¼in. for clearance; this height to the baseboard is the width of wood required.

The planed wood is now fixed on the baseboard level with the back and two sides. The sides, which finish level with the front of the keyboard, are shaped and levelled down to the original key blocks, to which a fixing can be made.

Fig. 10 shows the author's method of fixing the panels to the interior casework. The screws remain captive and wiring always held clear.

Using Piano Keys

These can often be obtained from a piano dealer as old instruments taken in part exchange are always being broken up. They are slightly larger than accordion keys and for the same compass of 29 keys would need another 2½in. or one could make do with 25 notes (two octaves).

They would need to be shortened from the back and each one fitted with a coil tension spring. The upward thrust of the keys would be taken by a felt-covered wooden bar situated over the keys just at the back of the black notes. From then on they could be adapted as later described for accordion keys.

Making Action for Key Contacts

The action to be described uses spring brass sliding contacts which are self-cleaning and found

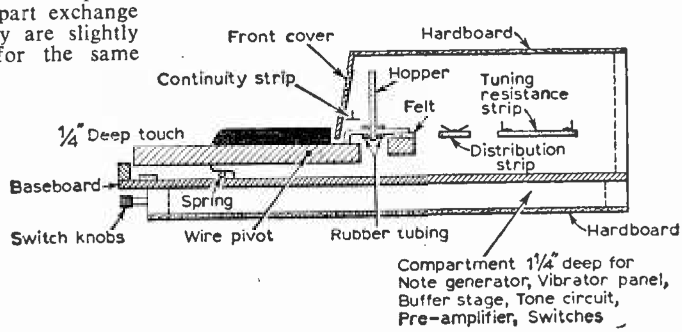
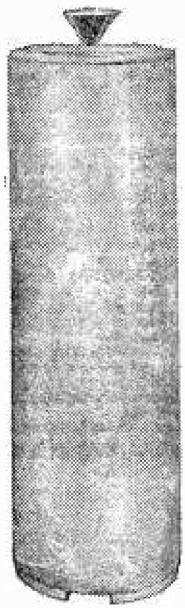


Fig. 9: This drawing illustrates how keys, hoppers, distribution strips, etc., are arranged within the cabinet.

UNUSUAL SINGLE SPEAKER SYSTEM



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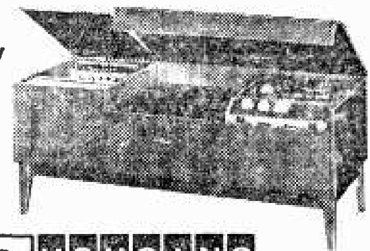

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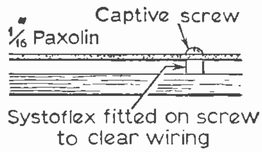


Fig. 10: The method of fixing the panels to the case-work.

reliable in use. Twenty-nine vertical strips of $\frac{1}{16}$in. paxolin $\frac{1}{4}$in. wide and $1\frac{3}{4}$in. long will now be required as drawn in Fig. 11.

These will now be referred to as hoppers and each one is drilled with a hole just large enough to go on the key spike. The holes should only have very slight clearance in the direction required in keeping the hoppers upright throughout the movement of the key.

A $\frac{1}{4}$in. length of cycle valve rubber tubing is pushed on to each spike, followed by the hoppers and another piece of rubber tubing. The hoppers can now be lined up level by adjustment of the tubing, which also prevents undue movement of the hoppers. These can now be roughly checked by moving each key while holding the hopper vertically between the fingers

Paxolin ($\frac{1}{16}$in. thick) is used throughout and if two pieces are laid side by side on a flat surface it is possible to feel if one is slightly thicker than the other. A small piece of the thicker should be put aside for guide pieces and will save having to stick on gummed paper to allow hoppers to work freely.

Two strips of paxolin are now required, one $\frac{9}{16}$in. wide and one $\frac{11}{16}$in. wide; length is a clearance fit between the two cheeks of the top compartment and in line with the hoppers.

Place the two strips together with edges level on a flat surface, clamp together with both ends level. Measure $\frac{1}{4}$in. from each end on the narrow strip and mark for drilling a 4BA. hole centrally.

Drill the two holes, turn the assembly so that the level edges are top and overlapping edge bottom back, unclamp and mark each one on the front for identification and right way up.

The action supports should now be made from $\frac{1}{16}$in. aluminium angle (see Fig. 11). Drill with two holes each so that they can be fixed, one on each key block, after being lined up exactly with the hoppers.

From now on it will be easier to work with the organ case on its back and the hoppers straightened out. The widest long strip is placed under the tops of the hoppers and brought up to the underside of action supports. The other, narrower, long strip is now placed on top of the hoppers and action supports.

Spring paper grips or clothes pegs will be found useful here to temporarily hold things together. The exact spot can now be marked for drilling a hole in each support. One 4BA. bolt and nut each end will be sufficient.

Correct height is ascertained by seeing that none of the hoppers project beyond the top of the two long strips when keys are held down. Drill the 4BA. holes in each support, bolt together and check that everything is in line. Proceeding, with organ still on its back, the guides can now be made —from the thicker paxolin if any.

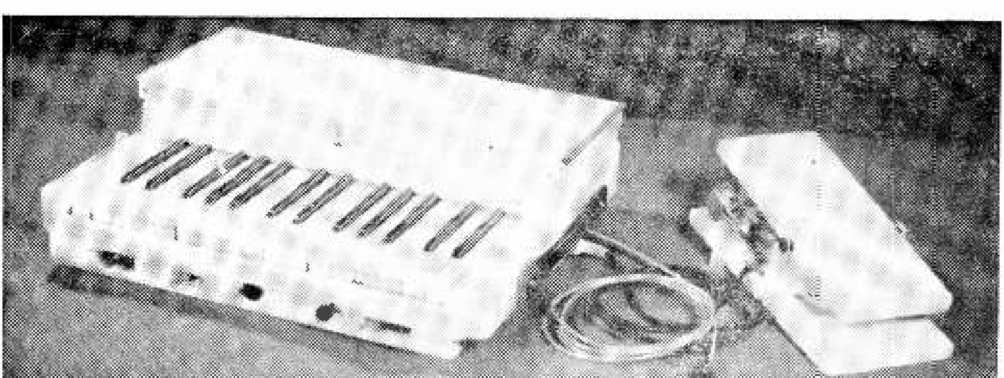
From now on each note is treated individually. Guides may vary from $\frac{3}{32}$in. to $\frac{1}{4}$in.; the main concern now is that each hopper will be truly vertical when playing.

Each part, including the hoppers, must be numbered on the front. Start by making the first guide against the metal support, filing down where necessary so that adjoining hopper would be truly vertical. Each one is now cut down to $\frac{11}{16}$in., numbered on front and reinserted, and process repeated throughout.

It will facilitate later assembly if the bottom corners of each guide are slightly rounded, also tops of hoppers.

A supporting piece of wood along the wide strip and wedged up from back of case would now help. Check that each guide is in place and level with top edges, mark for drilling on strip dead centre between hoppers and $\frac{1}{8}$in. down from top of strip. Mark bottom of each guide $\frac{1}{32}$in. up.

While the guides are in place mark off where the short contact strips are to be fixed on the front paxolin strip as in Fig. 11. Take out guides,



The finished instrument comblete with the exbression bedal.

numbering if not already done, place aside in order. Unbolt and remove long strips and bolt them together.

Drilling Guides and Strips

All holes are $\frac{1}{32}$in. diameter. Care must be taken with this small drill and all work should be clamped or weighted down to ease withdrawal.

An archimedean drill is best but if a hand machine drill is used it may be necessary to pad out the stem of drill so it can be gripped in the chuck.

A sharp-pointed awl pushed down hard on the work will assist in starting the drill at the correct point. Drill holes through the two long strips while bolted together and clamped down. Drill one hole at bottom of each guide (Fig. 11).

With organ again on its back reassemble as before and with each guide correctly in place mark each through the holes in top strip. Drill these holes and lay guides aside. Remove strips from supports.

Thoroughly clean and cut one strip of phosphor-bronze, as used in draught excluders, 13in. long and $\frac{1}{4}$in. wide for rear contact strip. For front strip 15 pieces $\frac{1}{4}$in. wide are needed. They are measured off as in Fig. 9, allowing for bending each end at right-angles to fit into saw cuts. Remove and trim ends to just under $\frac{1}{16}$in. so as not to project inside. Put aside in order.

Drill holes to take $\frac{3}{16}$in. x No. 1 brass countersunk screws where the centre of each short strip will come. Countersink so that the screw head is level with paxolin, cut off threaded end, make a slight countersink at the back, put screws in from front, place and hold firmly on a piece of flat iron, tap end of screw until it is tight, finally see none project at back. Lightly tin each screw head.

Fit contact strips into saw cuts, hold down near centre with a screwdriver and correct if not laying flat. Still holding down firmly, apply a hot iron just over the screw head and hold down with screwdriver for a moment to cool.

The 13in. long bronze strip can now be fitted to the rear paxolin strip. Scratch a line $\frac{3}{8}$in. from the top—this will give position of the bronze strip working edge (see Fig. 11). Fixings can be made as before with a tinned screw positioned over each guide.

Assembly of Action

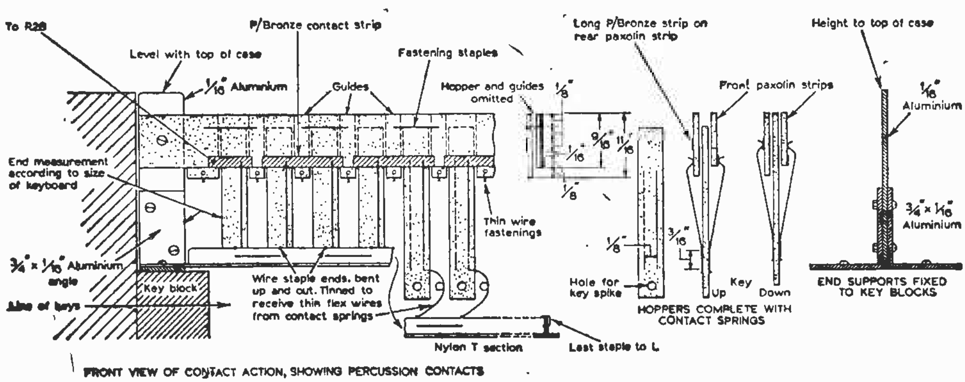
Wire staples are made from copper wire, a good fit in the holes. Bend at right-angles to match length between each pair of holes, commencing with guide against the metal support. Push through the two strips and guide, bend over to fasten.

When completed place assembly on the two supports and gradually push down whilst inserting the hoppers between their guides.

This done check that all work freely and, if necessary, remove any guide by undoing the staple and easing or packing as required.

The bottom holes in guides are drilled through into the wide strip. With care it is possible to do this without removing the assembly. A thinner wire is pushed through each drilling, given one twist and snipped off. It is an advantage that there should be a little sideplay here.

CONCLUDED NEXT MONTH



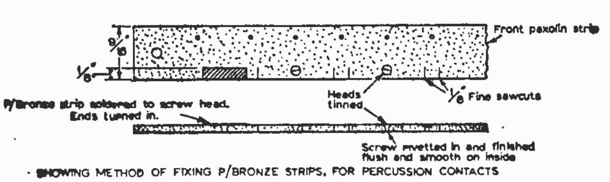
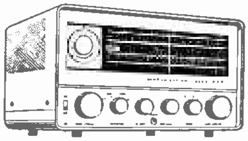


Fig. 11: Illustrating the making action of the key contacts and their construction details.



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7 valves + Rectifier. 4 Bands 550 Kc/s—31 Mc/s. 'S' Meter-BFO-ANL-Bandspread Tuning 200/250v A.C. Brand New. **24 Gns. carr. paid.**

LAFAYETTE TE-46 RESISTANCE CAPACITY ANALYZER

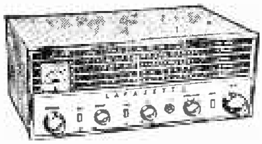
2 pF, 2,000 mFd. 2 ohms, 200 megohms. Also, checks impedance. Turns ratio. Insulation 200/250v. A.C. Brand New **£15.** carr. 5/-.

LONDON AGENTS FOR CODAR EQUIPMENT

LAFAYETTE HE-40 COMMUNICATION RECEIVER

4 Bands 550 Kc/s—30 Mc/s. 'S' Meter-BFO-ANL-Bandspread Tuning - Built in speaker. 200/250v A.C. Brand New. **19 Gns.** Carriage 10/-.

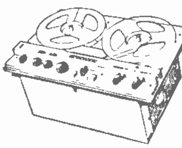
S.A.E. FOR DETAILS OF ALL EQUIPMENT



LAFAYETTE HE-30 RECEIVERS. 9 valves, 550 Kc/s—30 Mc/s. Semi Kit form. **25 Gns.** Carr. paid.

TE-22 SINE SQUARE WAVE AUDIO GENERATORS

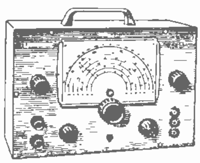
Sine: 20 c.p.s. to 200 Kc/s. Square: 20 c.p.s. to 25 Kc/s. 200/240 v. A.C. Brand new Guaranteed. **£15.** Carr. 5/-.



Transistor 4-channel Microphone Mixer 49/6

RK140 STEREO TAPE DECKS WITH BUILT-IN PREAMPLIFIER

4 Transistors. 4 Valves. Will record or playback ¼ Track Stereo or Mono at 7½ or 3¾ IPS. 7in. spool size. Twin meter level indicators. 4 inputs. Output 500 MW. 40-18,000 CPS., response. Size 15 x 10 x 6½in., 200/250 volt A.C. operation. Brand New **42 Gns.** P. P. 15/- .



LAFAYETTE TE-20A R.F. SIGNAL GENERATOR

120 Kc/s—390 Mc/s on 6 ranges. Variable R.F. and A.F. outputs. Large clear scale. Size 7½ x 10½ x 4½in. 200/250v. A.C. Operation. Brand New **£12.19.6.** Carr. 5/-.

Mullard OC81 Two for 5/-

VARIABLE VOLTAGE TRANSFORMERS

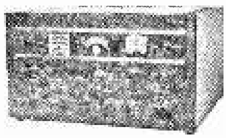
Brand New Guaranteed. Fully Shrouded, input 230v. 50/60 c/s output 0-230v.

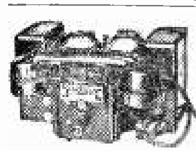
1 Amp **£4.10.0.**	8 Amp **£4.10.0.**
2.5 Amp **£5.17.6.**	10 Amp **£16.10.0.**
5 Amp **£9.10.0.**	12 Amp **£18.15.0.**
2.5 Amp Portable	20 Amp **£32.10.0.**

Metal Case with Meter Fuses etc. **£9.17.6.**

RCA AR.88 RECEIVERS

L.F. Model 75-550 Kc/s and 1.5-30.5 Mc/s Guaranteed Perfect Order **£35.** carr. 30/-. D. Model 550 Kc/s—32 Mc/s. Guaranteed 'As New Condition'—**£65.** carr. 30/-.





ARMY FIELD TELEPHONES TYPE F

Generator Bell Ringing. 2 Line Connection. With Wood Carrying Case. Fitted Batteries. Supplied Fully Tested **£4.19.6.** Pair Carr. 5/-.

CLEAR PLASTIC PANEL METERS

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

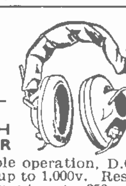
		2mA	22/6	10V. DC	22/6
		5mA	22/6	20V. DC	22/6
		10mA	22/6	50V. DC	22/6
		50mA	22/6	100V. DC	22/6
		100mA	22/6	150V. DC	22/6
		150mA	22/6	300V. DC	22/6
50µA	32/6	200mA	22/6	500V. DC	22/6
100µA	29/6	300mA	22/6	750V DC	22/6
200µA	27/6	500mA	22/6	15V. AC	22/6
500µA	25/-	750mA	22/6	50V. AC	22/6
50-0-50µA	29/6	1-0-1mA	22/6	150V. AC	22/6
100-0-100µA	27/6	1A. DC	22/6	300V. AC	22/6
500-0-500µA	22/6	5A. DC	22/6	500V. AC	22/6
1mA	22/6	3V. DC	22/6	"S" Meter 1mA	29/6

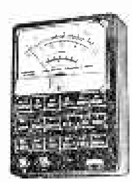
POST EXTRA. Larger sizes available—send for lists.

ILLUMINATED "S" METER. 1 21/32in. square front. Cal. in S units. 6V. lamp. **29/6.** P.P. 1/-. Ditto 2 5/16in. square **39/6.** P.P. 1/-.

LAFAYETTE HI-FI STEREO HEADPHONES

16Ω —25-15,000 Cycles. Air Cushioned Headband with cables and overload Junction Box. Brand New Guaranteed. **82/6.** P. & P. 2/6.





TS-76 20,000 O.P.V. PUSH BUTTON MULTI-TESTER

Large clear plastic scale, simple operation, D.C. volts up to 1,000v. A.C. volts up to 1,000v. Resistance up to 10 megohm. Current up to 250mA. Decibels, 20 to + 36dB. Size 6in. x 4 3/16in. x 2¼in. Complete with leads, batteries and instructions. ONLY **£5.5.0.** P. & P. 2/-.

TYPE 13 DOUBLE BEAM OSCILLOSCOPES

Perfect order. **£27.10.0.** Carr. 20/-.

AMERICAN TAPE

First grade quality American tapes. Brand new and guaranteed. Discounts for quantities.

3in. 200ft. L.P. mylar	4/-
3¼in. 600ft. T.P. mylar	10/-
5in. 600ft. std. plastic	8/6
5in. 900ft. L.P. acetate	10/-
5in. 1200ft. D.P. mylar	15/-
5¾in. 1200ft. L.P. acetate	12/6
5¾in. 1800ft. D.P. mylar	22/6
7in. 1200ft. std. mylar	12/6
7in. 1800ft. L.P. acetate	15/-
7in. 1800ft. L.P. mylar	20/-
7in. 2400ft. D.P. mylar	25/-

Postage 2/-. Over £3 post paid.

RECORDING HEADS

Reuter: ½ track. set of 2.	19/6
Miniflux: ½ track. set of 3.	29/6
Bradmatic: ½ track. set of 2	99/6

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HEADSETS

D.L.R.5. LOW IMP	10/6
R.C.A. LOW IMP	15/6
Chamois padded moving coil with jack plug	22/6
Ditto with Mic.	25/-

All New—Post Extra

MULTI-METERS

Brand New—Fully Guaranteed. Lowest ever prices. Supplied with leads, batteries and instructions.

MODEL TE-12
20,000 o.p.v.
0/.6/6/30/120/600/1,200/3,000/6,000V. D.C.
0/6/30/120/600/1,200V. A.C.
0/60µA/6/60/600mA
6/6K/600K/6 Meg/60 Meg Ω
5pF—.2mFd
£5.19.6. P.P. 2/6.

MODEL NH-201
30,000 o.p.v.
0/.25/1/10/50/250/500/1,000V. D.C.
0/10/50/250/500V. A.C.
0/50µA/10/250mA
0/5K/500K/5 Meg Ω
99/6. P.P. 2/6.

MODEL AR-620
20,000 o.p.v.
0/10/50/250/500/1,000V. A.C. and D.C.
0/500µA/10/250mA
0/10K/100K/1 Meg Ω
250pF—.02mFd
0-500 Henrys
92/6. P.P. 2/6.

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

MODEL NH-400
10,000 o.p.v.
0/.3/3/30/120/300/600/1,200V. DC.
0/12/60/120/300/1,200V. AC.
0/120 Ω A/30/300mA DC
0/2K/200K/2 Meg Ω
100pF—.2mFd
79/6. P.P. 2/6.

MODEL 250J
2,000 o.p.v.
0/10/50/500/2,500V. DC
0/10/50/500/2,500V. AC
0/2 Meg Ω
0/250mA
—20 to +36dB
49/6. P.P. 2/6.

MODEL ITI-2
20,000 o.p.v.
0/5/25/250/500/2,500V. DC.
0/10/50/500/1,000V. AC
0/50 Ω A/25/250mA DC
0/60K/6 Meg Ω
.01—.3mFd
82/6. P.P. 2/6.

MARCONI TF144G/4 STD SIGNAL GENERATORS

85 Kc/s-25 Mc/s. Perfect order. **£25.** Carr. 30/-.

SILICON RECTIFIERS

250 P.I.V.	750mA	3/-
200 P.I.V.	6 amp	5/6
1,000 P.I.V.	650mA	7/6
800 P.I.V.	500mA	5/6
400 P.I.V.	3 amp	7/6
400 P.I.V.	500mA	3/6
150 P.I.V.	165mA	1/-
70 P.I.V.	1 amp	3/6
95 P.I.V.	3 amp	5/6

Post extra

MINE DETECTOR No. 4A

Will detect all types of metals. Fully portable. Complete with instructions. **39/6** each. Carr. 10/-. Battery **8/6** extra.

BEST BUY!

Send 1/- P.O. for full catalogue and lists.
Open 9 a.m. to 6 p.m. **Every day. Monday to Saturday.** Trade supplied.

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3-34 LISLE STREET, LONDON, W.C.2

on the Short Waves

MONTHLY NEWS FOR DX LISTENERS

All times are in G.M.T. All frequencies are in kc/s.

The Broadcast Bands—by John Guttridge

ALTHOUGH this feature is called "On the Short Waves", it is interested in DX (long distance) reception news of all sorts. News is given therefore this month of some recent loggings in the medium waveband.

For the beginner to medium wave DX the best station to try for is the Trans World Radio—Radio Nederland transmitter at Bonaire in the Netherlands Antilles. From 2330—0020 it carries the Spanish programme of Radio Nederland followed by the English programme from 0040—0130. From 0130 the programmes of Trans World Radio can be heard. The frequency is 800kc/s. In London a SINPO rating of 34343 was recorded at 0130 recently. Another very reliable one is the Canadian CBA (Maritime) on 1070kc/s.

Two listeners who have been "working" North America on medium waves between 2200 and 0200 are J. Fitzgerald (Great Missenden) and D. Walsh (Ballylynch, Ireland). Some of those logged were—640 CBN St. John's, Newfoundland; 660 WNBC New York; 710 WOR New York; 860 CJBC Halifax, Nova Scotia; 880 WCBS New York; 930 CJON St. John's, Newfoundland; 940 CBM Montreal; 960 CHNS Halifax, Nova Scotia; 1,010 WINS New York; 1,010 CFRB Toronto; 1,050 WHN New York; 1,090 WBAL Baltimore; 1,130 WNEW New York; WMEX 1,510 Boston; 1,520 WKBW Buffalo; 1,560 WQXR New York.*

Now let's take a look at changes in the Short Wavebands. First comes news from E. H. Conduit (Wolverhampton) of the introduction of English and Spanish transmissions by *Radio Algerie*. They are aired from 2200—2230 and 2230—2300 respectively on 11,835.

According to R. Coates, of Burton-on-Trent, the schedule of AFRS New York is now 1430—1900 on 15,225; 1430—1800 21,645; 1430—2245 15,280; 1815—2245 11,920; 1900—2245 11,905. The transmitters used are those of the *Voice of America* at Bound Brook (WBOU) and Greenville. Reception in London is usually good on most frequencies. Mailing address of the station is Armed Forces Press, Radio and Television Service, 250 West 57th Street, New York 19, U.S.A.

** This season, the DX has been extremely good on the M.W. Band. My own log includes over 100 stations from U.S.A. and Canada (including a few from the West Coast). Also many Caribbean and South Americans, Africa, Iran, Iraq, India, Pakistan, Philippines, Okinawa, Formosa, China, Aden, Kuwait, etc. Some East Coast Canadians have been heard as early as 2000 G.M.T!*—EDITOR.

News of test transmissions by Saudi Arabia Broadcasting comes from Roy Patrick (Derby) who says reports are wanted and should be sent to the Deputy Minister, Ministry of Information, Jeddah, Saudi Arabia. He has heard the transmissions from 1500—1700 on 9,670. Frequencies of 7,170 and 11,890 are also used according to the International Short Wave Club.

Radio Nacional de Espana now has a 50kW transmitter at Teneriffe in the Canary Islands, says Roy Patrick. Transmissions are from 1400—1600 on 9,660. This frequency is given as 9,640 by the ISWC which also mentions a transmission from 0000—0300 on 11,800.

This year the Far East Broadcasting Company, Box 2041, Manila, Philippines, hopes to put the first of several new high power transmitters into operation. At present English programmes are aired at the following times. 2200—2330 on 15,300/17,810; 0330—0100 on 11,850/15,380/17,810; 0100—0200 on 15,380; 0230—0300 on 9,710/11,740/15,380/17,810 (also 0300—0830 Sundays plus 15,300); 0830—0900 on 9,710/11,920/15,380/17,810; 0900—1200 on 15,380/17,810; 1200—1430 on 15,300; 1230—1300 on 9,505/15,300; 1330—1400 and 1530—1630 on 9,505. There is also an 0900—1000 transmission on 11,850.

On March 7, 9,520 replaces 15,165 for the 0630—0700 and 0900—1000 transmissions from *Radio Denmark*. At the same time 15,165 replaces 9,520 for the 1600—1630 transmission.

Special English language programmes for the Caribbean are carried by the B.B.C. from 2230—2245 on Mondays to Fridays. The frequencies used are 6,110/9,580/11,750.

English language programmes are now transmitted as follows by *Radio New York Worldwide*, 4 West 58th Street, New York 19, N.Y., U.S.A. From 1200—1615 on 17,760/15,440/15,135/11,940; 1615—1730 17,760/15,440/15,135/11,940/11,840; 1730—1745 17,760/15,440/11,840; 1745—2000 17,760/15,440/11,840/9,640; 2000—2015 15,440/9,640; 2015—2140 15,440/11,940/11,855/9,640; 2140—2200 11,940; 2200—2400 6,015/11,940. The transmissions are beamed to Northern South America, the Caribbean, Africa, Continental Europe, the British Isles and Scandinavia.

Radio Moscow announces that the following frequencies are being used for its English transmission to North America starting at 2300: 9,660/9,620/9,570/7,360/7,310/7,290/7,250/7,200/7,150. Reception in London is good.

At present one of the most frequently heard 19 metre band transmitters is that of the *Voice of America* at Greenville.

From 1300—1400 15,235 can be heard with Spanish for Latin America. At 1400 the beam switches to Europe with a consequent jump in signal strength and a programme in Georgian begins. The signal is good and programmes include Ukranian at 1530, Armenian at 1600 and Latvian at 1900. The Europe English outlet of 15,205 has been heard at good strength at 1600 and 1900. CW interference spoils the 15,250 outlet which is beamed to Africa. Swahili is carried at 1830 with Arabic from 1900—1930. One of the last channels to fade out in the evenings is 15,415 which carries French and English to Africa. At close down at 2215 it returns SINPO 35333.

The Amateur Bands—by David Gibson G3JDG

SUCCESS, success!! At last my ageing eardrums have been stimulated by signals heard on 21Mc/s. At 1140 G.M.T. on the 16th December I heard G3TMA, OH1WF, SM5LH, SM5BKY, EL8AF and 6W8BL, all on c.w.

Now an important point: readers sending in reports must make clear whether the stations logged were on 'phone or c.w. In order to avoid confusion 'phone stations can be given a two digit signal report, and c.w. three digits. These digits are, of course, the standard amateur Readability, Signal strength, and Tone. For instance: G3TMA (579)—R5 S7 T9. Therefore, the station was c.w. Or G3TMA (57), i.e. R5 S7, the station was on 'phone. Better still, keep 'phone and c.w. separate.

Top Band

160 metres is going like a bomb! G-DX is about almost nightly and many Europeans are popping up. December 10th raised VO1FB (Newfoundland) 459, GM3FXM, GW3TOW, GW3HUM GW3DRV, GW3PMR and GW3SPA, all between 2300—2330 G.M.T. December 16th gave 9L1TL (Sierra Leone) 569. VO1BD 459, VO1FB 559, OK100 579.

It may not be generally appreciated, but at the moment the 160 metre Transatlantic and Worldwide DX tests are being held. Accepting a kind invitation from SWL Frank Videan I went along to his QTH to listen in on one of these test dates (December 20). The receiver was an Eddystone 888A, but the antenna was only 30ft of wire running from the bedroom window to the fence. We heard all these:

DJ8GR, DL7AA, PAØPN, 9L1TL, OK1AFN, OK1KLX, OK1AGB, VO1BD, GW3CW, GW3SPA, PAØVB, OK1IQO, VO1FB, GM3TMK OK1KIT, W1BB/1, W2IU, W1WY, DL1FF, W2GGL, W1HGT, VE3DDR, W1BU, VE2UQ, W8HRV, GI3PDN, VE3AGX, W2UWD, W1BHQ, VE2LI.

The next test dates are February 7th and 21st from 0500 to 0730. I would be interested to know what you hear.

Other Bands

This month ten metres has been very dead, and twenty, usually good for some DX, failed to oblige. At the time of writing, it dies a natural death around 1900. Forty metres, however, is quite lively now and again. On December 13th most of Europe was there on c.w., including DJ9SQ, OK2KHF, LZ1KPG, SP8AJK, UA6CP, IT1AGA, YU1LM, YO5THY.

And at 1845 two real pieces of DX came out of nowhere.— VK2EO (449) and VK7SM (459) in QSO with YO8KAE. Just goes to show that besides sharp ears the magical gifts of patience and persistence are a requirement for DX winkling. Two virtues not possessed by your scribe!

Eighty was disappointing. Early evenings produced Europeans only, but later around 2330 the best that came in was W1PKW.

Readers' Reports

From Renfrewshire, Gillies Wylie sends in the following report:

21Mc/s. *SSB:*—9M4LX, ZE4JZ, MP4TBJ, ZS7R, XE1FSV.

A.M. — VK6QL, VK3AZY, CR4AJ, CR7GM, 9JZMI, 9L1WN, VE3CQG, CT2AL. *C.W.*—ZD3TJ, W8AMO, WA1AGO, all between 1005 and 1830 hrs.

14Mc/s. *SSB:*—ZB2AK, FM7WQ, VK6MK, HC1MX, HK5ACI, VE1AJR/SU, W6MWF, VE6CJ.

3·5Mc/s. *SSB:*—WA2EVH, W1ONK. *A.M.*—VE2SX, VO1FX, SM7BSE/MM.

SWL Coull in Littlestone, Kent, has a recently acquired HRO with an end fed 60ft. antenna. This set up is working extremely well as the following list shows:—

3·5Mc/s — VE1IE (57), W1FRR (58), K1KDA (54/5), W2ZDL (56/7) all round 2200 and all SSB.

14Mc/s:—VE8ML (59), VE8RG (48), OX3MN (58), TG9RJ (57), all SSB from 1500—2000.

21Mc/s:—VK2NN (57), VK3AZY (58), ZC4TJ (56), 9J2W (58), 9J2DT (58), ZS1AB (56), WØYDB (58), KØFPZ (56), ZS6U (57).

R Collins writes in to query Z6AP/KC4 heard on 20 metres at 2330 and claiming the QTH as Queen Maud Land, Antarctica. Anyone else heard this one?

Maurice Curtis in Sheffield with an EA12 receiver found the following on 14Mc/s 'phone between 1345 and 1845:—

K5ZVP, W2RNV, W2RAV, UO2GC, W2ONV, W4SHP, UH8BO, HB9JO, W2BLF, W4RJO, VO8AF, K8AIR, W4FZE, K1DRE, W5AZI/MM (Marine Mobile) I1FW, W8TF, W4BHU, W1KJ, W9DPI, DJ5JI.

News in General

People puzzled by the prefix SPØ will be pleased to note that the Ø prefix was issued to SP stations instead of their numeral i.e. 9 and was authorised for the duration of the International Marathon DX scheme which was in operation from May to September last year. VK3TL reported loose on Norfolk Island with s.s.b. and c.w. while CEØAG also s.s.b. and c.w. is keeping Easter Island on the radio map. In case you think its cold at your QTH, spare a thought for KC4USN who is in Antarctica. He runs s.s.b. into a Rhombic antenna pointed at

—*continued on page 1093*

New list of Bargains

Transistor ferrite rod aerial with medium and long wave coils with circuit, 7/6.

Oscillator Coil and set of 3 I.F. transformers for transistor set with circuit. 12/6. **Tuning Condenser** to suit air-spaced with trimmers. 9/-. Ditto but min. 10mm., 12/6 the set; two gang Condensers to suit, 8/6 (request sub. min. circuit).

Midget 3in. P.M. Loudspeaker 3 ohm 12/6. 80 ohm 18/6.

Midget 208 pF + 176 pF two-gang Tuning Condenser with trimmers for transistor set Price 9/-.

Push-Pull Transformer. Sub-miniature 8/6. .0005 mfd. Single Tuning Condenser. Solid dielectric ¼in. spindle for transistor or Crystal set, with spindle tapped 6 BA, 2/6

46 Sets (Receiver/Transmitter pack set). Unused sets complete except for crystals. Packed with parts and easily rebuildable into other gear. **19/6** each. Post 3/-.

Mains Transformer. 250-0-250 at 80 mA, 6.3 volts, 5a (normal mains input), 12/6 each. Carriage 2/6.

Output Transformer. Standard pentode matching type, 3/6 each. 36/- per doz.

Slide Switch. Sub-miniature but dpdt, 2/- each, 18/- per doz.

other gear. 19/6 each. Post 3/-.

Battery Charger Kit. Comprises 5 amp. transformer, 5 amp. rectifier, metal case and meter to charge 6 or 12 volt batteries up to 5 amps. With variable charge rate, 39/6 each. Post and insurance, 3/6.

T.C.C. or Dubilier Tubular Condensers.

.5 mf 500 v.	10/- doz.
.25 mf 500 v.	7/6 doz.
.25 mf 350 v.	6/- doz.
.05 mf 500 v.	5/- doz.
.0001 mf 1,000 v.	5/- doz.
.001 mf 1,000 v.	6/- doz.
.002 mf 1,000 v.	7/6 doz.
.005 mf 1,000 v.	9/- doz.
.02 mf 750 v.	8/6 doz.
.01 mf 1,000 v.	10/- doz.

Battery Charger Rectifier—selenium 12.15 v. 5 amp. 9/6.

Metal Chassis—punched for Mullard 510 Amplifier, complete with inner screening sections and stove enamelled, 12/6 set.

Filament Transformer, 6.3 v. 1½ amps., 6/6.

Neon Lamp—midget wire ended. Ideal mains tester, etc., 2/-. Ex. Govt., 1/6.

Philips Trimmers—0.30pF 1/- ea., 9/- doz.

Tag Panels. Ideal for constructors, experimental circuits, etc. 3 of each of 12 different types, 5/-.

Slydlok Panel Mounting Fuses with carrier, 5 amp., 2/- each. 15 amp., 2/6 each.

Metal Rectifier. 250 v, 60-80 milliamps, ideal for mains set or instrument or to replace that expensive valve, 4/6.

Piano Key Type Switches, 3 key type 3/-, 1 key type 3/9, 5 key type 4/6, post and packing 1/- regardless of number ordered.

Ozone Outfit, for removing smells and generally improving any oppressive atmosphere. Kit consists of Philips ozone lamps and mains unit, only needs box. 19/6 + 3/6 postage and insurance.

Black Light Unit, 125 watt intensity, comprises quartz lamp, adjustable lamp holder and 125 watt choke. Only 29/6 + 6/6 carriage and insurance.

Packard Bell Pre-Amp. Contains a relay push-pull input and output transformers and many useful spares. Less valves 6/6 each + 2/6 post and insurance.

Fridge Handles, with Yale-type locking mechanism, two keys and striking plate, 3/9 + 2/- post, 8 for 30/-, post free.

0-1mA Meter made by the American Westinghouse Co. 3in. diameter, flush mounting scale calibrated in volts. 25/- + 2/- post and insurance.

Ferranti Fire Bar. 500 watt 10in., 3/6 each + 1/6 post. Three or more post free.

B7G Valve Holder. Best make (Amphenol). 8/- dozen. post 1/6. 3 dozen, post free.

Precision Wheatstone Bridge, opportunity occurs to build—100k wire wound 15 watt potentiometer, price 5/- + 1/- postage.

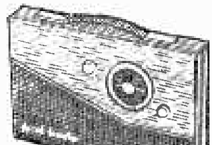
Cydon Turret Tuner, 35 Mc/s. with band 1 and band 3 coils. Brand new, 9/6 each post 2/6.

Hi-Fi Speakers

Hi-Fi Speakers—E.M.I. Ceramic magnet 12,000 lines, size: 13 x 8in. (roughly equivalent to 12in. round speaker). Bass frequency 40-30 c/s. Handles up to 10 watts. Price 38/6 plus 5/- carriage and ins. State whether 15 ohm or 3 ohm.

Where postage is not definitely stated add 2/- all orders under £3.

GOOD COMPANION Mark III



The 6 transistor set with the 8 transistor performance.

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Fine looking cabinet, size 11 x 8 x 3in. Q.P.P. Output approx. 750 mW. Excellent reception of difficult stations like 208.

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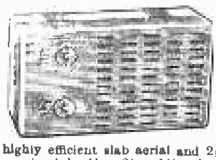

A complete kit of parts to build 6 transistor 2 wave superhet receiver at only 45/-. Post and Ins. 3/6.

"CORONET" Mk. IV

It fully covers the medium waveband and that part of the long waveband to bring in B.B.C. Light. The circuit includes a highly efficient slab aerial and 2½in. P. M. speaker. Overall size approximately 4¼ x 2¼ x 1¼in. Supplied complete with carrying case.

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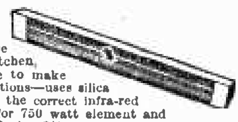


Make up one of these latest type heaters, ideal for bathroom, kitchen, bedroom, etc. They are simple to make from our easy to follow instructions—uses silica enclosed elements designed for the correct infra-red wavelength (3 microns). Price for 750 watt element and metal casing as illustrated 19/6 plus 2/6 post and insurance. Pull switch, 3/- extra.

THIS MONTH'S SNIP

AIRCRAFT RADIO RECEIVER

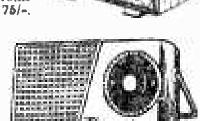
Type CW 0460 48 D

This is part of the equipment RU19. American made equipment for the Navy. It is a 5-valve receiver with a really beautiful precision tuning mechanism. Brand new and in original packing but less coil units. Limited quantity only. **19/6** plus 3/6 P. & P.

INTERCOM BARGAIN

Cabinet as illustrated, less knobs, ideal if you are making small radio, office intercom, amplifier, etc. Has the modern look; originally sold at 20/6 limited quantity available at 15/-, plus 2/6 postage. All components to make two of the intercoms described in "Practical Electronics." 75/-.

£5.10.0 Radio for only 27/6



Originally sold at £5.10.0, we now offer the "Pimpernel" 5/ Transistor Pocket Radio at only 27/6. The sets are complete but are "line rejects" so there will be some small faults to find. Components are all new and unused, and their retail value, even at today's lowered price, is over £4. Parts you will get include:—Jackson "OO" Tuning Condenser, 9/-, Plessey Driver Transformer, 8/6. Goodman's or Plessey 3in. speaker, 12/6. Morganite Volume Control with switch 4/6. Philco RF Transistor, 12/6. S.T.C. matched output transistors and driver 15/-. Plastic case with carrying handle, 7/6. 5 Electrolitic Condensers, 7/6. 10 Resistors, 3/6. Ferrite Aerial, 5/- and printed circuit board, trimmer, battery connectors, r.f. choke, etc., etc.

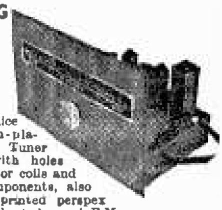
All this fine equipment offered this month at only 27/6 plus 2/6, post and insurance.

FLUORESCENT LIGHTING BARGAINS

Complete 40 watt Slimline white enamelled fitting, ready for use with choke control gear, radio suppressed starter and tube. Originally intended to sell at £3.15.0, offered at only 39/6, plus 5/- carriage and insurance; two or more carriage free.

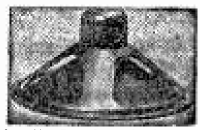
Ditto 5ft. 80 watt 49/6, plus 7/6 carriage and insurance, two or more, carriage free.

MAKING AN FM TUNER



Available at present is a very nice cadmium-plated F.M. Tuner chassis with holes punched for coils and other components, also a nicely printed perspex front, calibrated usual F.M. frequencies. Real bargain 6/6 + 2/- or with two-gang tuning condenser 10/- + 2/- postage.

Speaker Bargains



12in. High-fidelity loudspeaker. High flux permanent magnet type with either 3 ohm or 15 ohm speech coil. Will handle up to 10 watts. Brand new by famous maker. Price 27/6 + 3/6 post and insurance.

Waterproof Heater Wire

16 yds length. 70 watts. self regulating temperature control. 10/- post free

TRANSISTOR SET CASE

Very modern cream cabinet, size 5¼ x 3 x 1¾in. with chrome handle, tuning knob and scale. Price 4/6 plus 1/6 postage.

Building a 'Scope

3in. oscilloscope tube. American made type No. 3PF7, 6.3 v. 0.6 amp. heater electrostatic deflection, brand new and guaranteed with circuit diagram of 'scope, 15/- each. Plus 2/6 post and insurance.

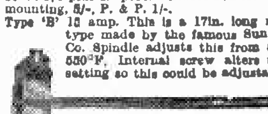
Simmerstat Heater Regulator

Suitable to control elements, heaters, soldering irons and boiling rings up to 2,500 watts. Complete adjustable, normal price 55/- each, special snip price 12/6, plus 1/6 postage and insurance.

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 1,000°F. Suitable for controlling furnace, over, kiln, immersion heater or to make flamestat or fire alarm. 8/6 plus 2/6 post and insurance.

Type 'C' is a small porcelain thermostat as fitted to electric blankets etc. 1½ amp. setting adjustable by screw through side, 3/6, P. and P. 6d.

Type 'D'. We call this the Ice-stat as it cuts in and out at around freezing point, 2-6 amps. Has many uses, one of which would be to keep the loft pipes from freezing, if a length of our heater wire (16 yds. 10/-) is wound around the pipes, 7/6, P. & P. 1/-.

Type 'E'. This is a standard refrigerator thermostat. Spindle adjustments over normal refrigerator temperatures, 7/6 plus 1/- post.

Timer Kit

Special offer of all components except metal box to make mains operated interval timer for photography etc. 12/6 plus 2/6 post.

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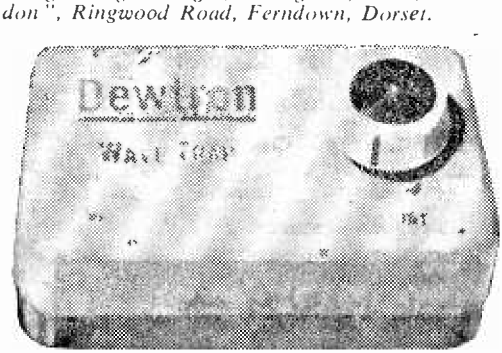
Transistor Set Inductive Amplifier

FROM Design Engineering Wokingham Ltd., comes the "Dewtron" Wave Trap, designed to improve reception on medium wave stations when used in conjunction with any transistor or portable radio.

Basically the circuit comprises an r.f. stage, which contains a ferrite tuned circuit capable of receiving m.w. signals. The amplification of this stage is very high, and its output is fed into an inductive element on the end of a length of screened cable. This element is termed the "injector", because when placed near to the ferrite rod in the portable radio, its output is injected into the aerial by direct induction.

On distant stations, the Wave Trap injects a boosted signal in such a way that the mean level of received signal at the set is of sufficient order to ensure that the a.v.c. circuit operates, and will then ensure that any variations in the mean received signal level will not be noticed in the loudspeaker. When used in place of a car aerial on reasonably local stations, the high factor of amplification afforded by the Wave Trap's circuit makes sure that the inherent directional characteristic of the Wave Trap receiving ferrite aerial is cancelled, since the receiver is once again fed with a signal of sufficient strength to make it operate well beyond the a.v.c. threshold, even when the vehicle turns so that the Wave Trap aerial is in the "null" position. Battery voltage is 9V and the current drain is 4mA. Price is 39s. 6d., p. and p. 1s. 6d. *Design Engineering (Wokingham) Ltd., "Caledon", Ringwood Road, Ferndown, Dorset.*



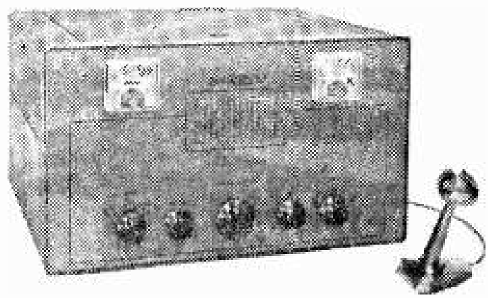
Above: The "Dewtron" Wave Trap inductive amplifier.

SSB Transmitter/Receiver

THE Hammarlund Manufacturing Company, a Giannini Scientific Company, has announced the CSB—125C s.s.b. transmitter/receiver. The power output of this unit is 125W s.s.b.-p.e.p., and six channels can be provided (two of these supplied and the other four optional), to cover the frequency range 2 to 30Mc/s.

The CSB-125C features sensitivity of less than 0·5μV for s.s.b./c.w. and 1μV for 10dB s.n./n ratio. 30% modulation on a.m. The separately housed power supply is designed for 115/230V, 50/60c/s operation.

The U.K. agents for this range of equipment are *K.W. Electronics Ltd., Vanguard Works, 1 Heath Street, Dartford, Kent.*

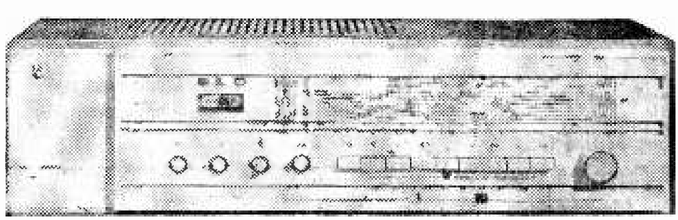


Hammarlund's CSB-125C s.s.b. transmitter/receiver.

Mains/Battery/Table Radio

A NEW model in the Bang and Olufsen range is the Beo Box battery operated transistor table radio, having a separate power unit for mains operation. It covers v.h.f., medium, long and two short wave bands (1·45—4Mc/s and 7—16Mc/s), and has 14 transistors and 8 diodes. Weighing 16lb., and measuring 19¾in. x 8¾in. x 6in., this receiver has the feature of providing a high standard of reproduction without a mains supply. The output is 2W when operating from the mains and 1W when working from batteries. There is an 11in. x 7in. elliptical speaker, and separate treble and bass controls are provided. A 500μA moving coil indicator gives visual indication of accurate tuning, and the aerial is detachable and rotatable and can be used for the improvement of v.h.f. and short wave reception. Finished in teak, the Beo Box retails at 39 guineas. *St. Aldate Warehouse Limited, Innsworth Lane, Gloucester.*

Right: The BEO BOX fully transistorised battery/mains table radio.



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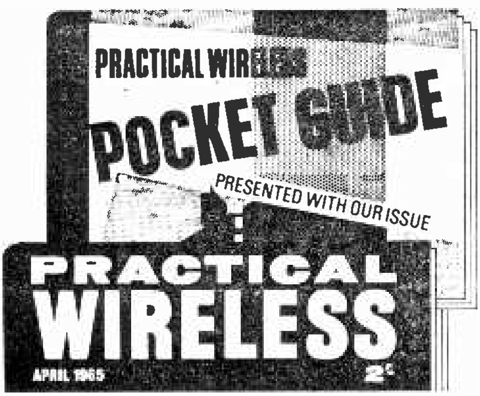

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5: THERMIONIC VALVES

5.1 The Emission of Electrons from a Filament

WHEN a hot wire or FILAMENT is enclosed in an evacuated glass bulb it will give off "particles". These particles are called ELECTRONS. If a plate of metal is introduced into the bulb it will be found that electrons from the filament will strike the plate. Many more electrons will be attracted to the plate if a POSITIVE potential is applied to it as this will attract the negatively charged electrons. The higher the positive potential applied to the plate the greater will be the electron flow from the filament to the plate. In the diagrams shown in Fig. 38 the electrons emitted by the filament are represented by arrows.

As we saw when dealing with simple d.c. circuits a current can only flow in a circuit when the circuit is complete. Therefore to show the current flowing from the filament to the plate a milliammeter must be connected between the filament and the plate.

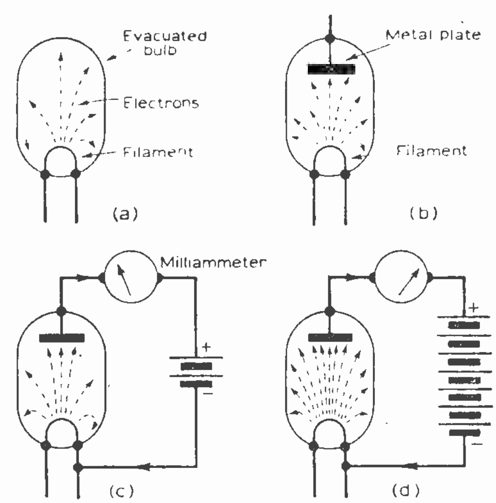


Fig. 38: A heated filament in an evacuated bulb emits electrons (a), some of which strike the metal plate (b). When a positive potential is applied to the plate, more electrons are attracted to it (c) and the greater the potential, the greater the electron flow (d).

The flow of electrons from the filament to the plate or ANODE is the principle on which the operation of the radio valve is based. The valve is so called because it will allow electrons, which enable a current to flow, to travel in one direction only—i.e. towards the plate or anode. If a negative potential were applied to the anode no current would flow as this would only repel the negatively charged electrons.

5.2 The Diode

This is the simplest type of valve and it has only two ELECTRODES, the FILAMENT or CATHODE and the PLATE or ANODE. The two electrodes are generally arranged concentrically so as to increase the area of the anode.

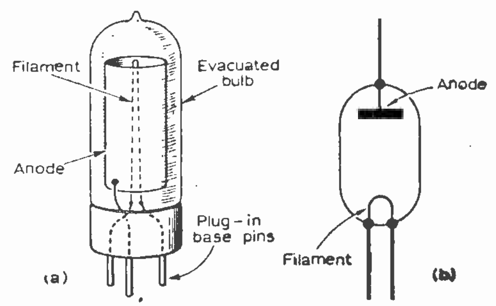


Fig. 39: The diode: (a) practical representation; (b) theoretical representation.

In the diagrams shown in Fig. 39 the type of diode shown is called a *directly heated* diode. This is because the electrons which travel to the anode come directly from the filament. However, the surface area of the filament is very small and the current which could be drawn from it would also be small. The current could be increased by increasing the temperature of the filament but an easier way is to encase it in a sheath of metal which will emit many electrons at a low temperature. In this case the filament now becomes the HEATER (i.e. it heats the sheath) and the sheath is called the CATHODE. This type of valve, which has the heater enclosed by the cathode, is called an INDIRECTLY HEATED type as the electrons come from the cathode and not the heater.

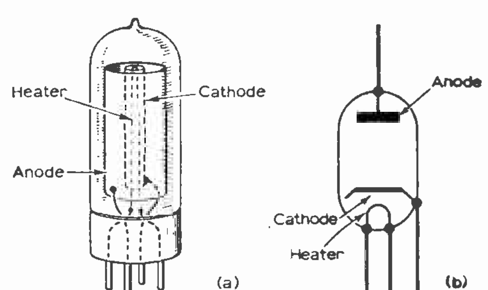


Fig. 40: The indirectly heated diode, practical construction (a) and theoretical representation (b).

Practical and theoretical representations of an indirectly heated diode are given in Fig. 40 (N.B.: The cathode in an indirectly heated valve is generally made of a base metal with a coating of barium oxide, strontium oxide, etc.).

5.3 Characteristic Curve of the Diode

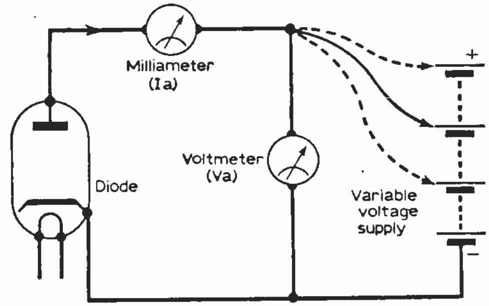


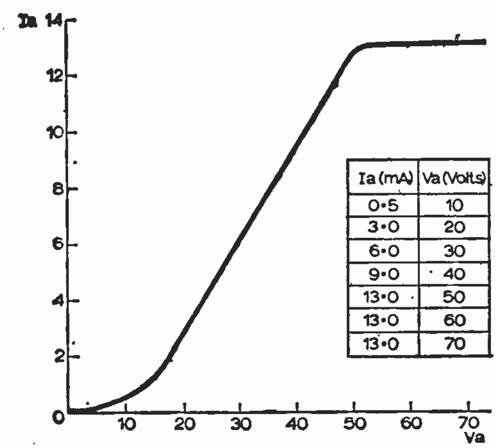
Fig. 41: Circuit to determine the characteristic curve of a diode.

If the circuit shown in Fig. 41 is set up the anode voltage can be varied and for each value of anode voltage the corresponding value of the anode current can be found. It would be suitable to start the anode voltage at 0 and increase this in 10V steps until no further increase in anode current is noted.

Typical results obtained using the circuit shown in Fig. 41 are shown in Fig. 42 and the graph which results when these are plotted is shown in Fig. 43.

It can be seen from the graph that there is a fairly long, STRAIGHT LINE portion and the valve is generally operated within the limits of this portion of the graph—e.g. in this case the valve would be operated with anode voltages between 20 and 50V and anode currents of between 3 and 13mA. It can be seen that on the graph the anode current has been represented by Ia and the anode voltage by Va. This type of graph is therefore usually called an Ia/Va graph and, as its name suggests, it shows the relationship between anode current and anode voltage.

If the graph shown in Fig. 43 is studied it can be seen that after a certain value of anode current is reached any further increase in anode voltage will not cause it to rise any further. When this occurs the value of anode current noted is called the SATURATION CURRENT and the valve is said to be SATURATED. The point on the graph where saturation first occurs is called the SATURATION POINT.



Ia (mA)	Va (Volts)
0·5	10
3·0	20
6·0	30
9·0	40
13·0	50
13·0	60
13·0	70

Fig. 42: (inset table): Typical values obtained using the circuit in Fig. 41.

Fig. 43: Graph obtained by plotting Va against Ia.

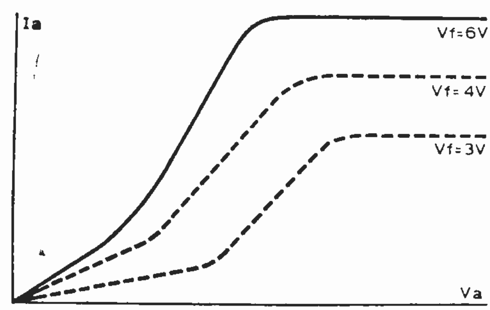


Fig. 44: Characteristic curves using different heater voltages.

If the characteristic curve for a diode were taken with heater voltages less than the recommended value the curve(s) would be of the type shown in Fig. 44.

5.4 The A.C. Resistance or Impedance of a Diode

We know from Ohm's Law that $R = \dfrac{E}{I}$ therefore if we find the limits of the straight line portion of the characteristic curve of a diode we could express the SLOPE of this portion of the graph as being from, say, 20—50V and from 3—13mA. This is represented on Fig. 45. We can see that the line AB extends over 30V and the line BC extends over 10mA. Knowing that $R = \dfrac{E}{I}$ the a.c. resistance of the valve could be expressed as being

$$\frac{30}{0{\cdot}01} \quad (\text{"I" must be in AMPS})$$

or 3,000Ω.

Therefore the a.c. resistance of this particular diode would be expressed as being 3,000Ω. The a.c. resistance of a valve is sometimes called the IMPEDANCE or DIFFERENTIAL RESISTANCE of the valve. The valve used as an example

in the above calculation would normally be operated with anode voltages of 20—50V and anode currents of 3—13mA.

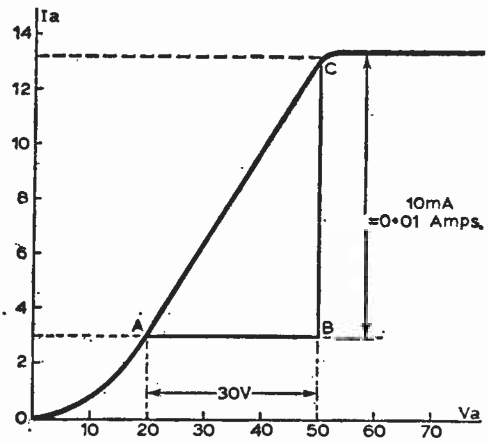


Fig. 45: Determination of the a.c. resistance of the diode.

5.5 The Diode as a Rectifier

From the section which dealt with a.c. theory it will be remembered that an alternating current could be represented graphically in the form shown in Fig. 48; this would also. of course, be the same shape as a graph of an alternating voltage (both graphs being drawn with respect to time, of course). However, it can be seen that the current (or voltage) starts at zero, reaches a maximum positive value, returns to zero, reaches a maximum negative value and returns to zero once more. This is a complete CYCLE for an alternating current or voltage.

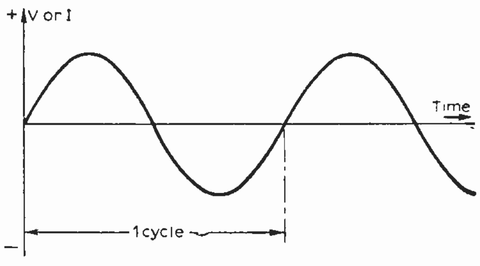


Fig. 46: Typical a.c. waveform.

The mains supply in most areas is an alternating supply and if d.c. is required for any particular purpose then this a.c. has to be changed to d.c. or, to use the correct term, it has to be rectified.

We already know that a diode will allow a current to pass through it only when a positive voltage is applied to the anode, therefore if an alternating voltage were applied to the anode of a diode a current would only flow on the POSITIVE HALF-CYCLE. The current flowing in the circuit would therefore be no longer a.c. as it would now not have a negative component.

The current could be said to be an UNSMOOTHED DIRECT CURRENT. The diode has then changed the a.c. shown in Fig. 46 into the type of d.c. shown in Fig. 47, i.e. the diode has acted as a RECTIFIER.

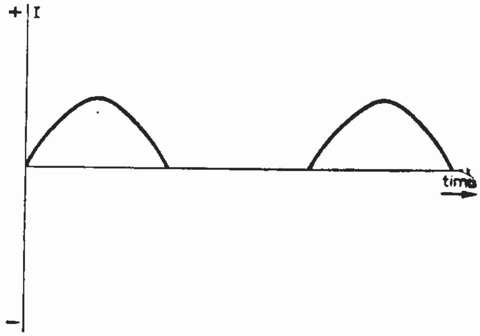


Fig. 47: Current flowing in the anode circuit of a simple diode rectifier.

In the diagram shown in Fig. 48 it will be seen that the alternating current has been supplied by a TRANSFORMER and that the D.C. OUTPUT of the rectifier has been connected to a LOAD which has been represented by " R ".

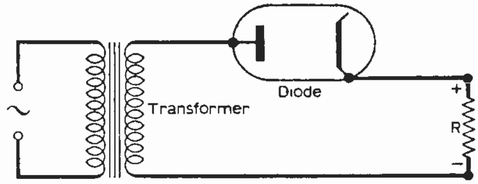


Fig. 48: Typical circuit using a diode as a simple rectifier.

5·6. Smoothing the Output from a Simple Diode Rectifier

Where a steady current of the d.c. type is required it is obvious that a current of the type shown in Fig. 47 will be unsuitable. This current has then to be SMOOTHED. We know that a CAPACITANCE is an electrical device which can be used to "store" a current. If we were to connect a large capacitor across the load R in Fig. 48 what would be the effect? Well, between A and B the capacitor would be charging and between B and C

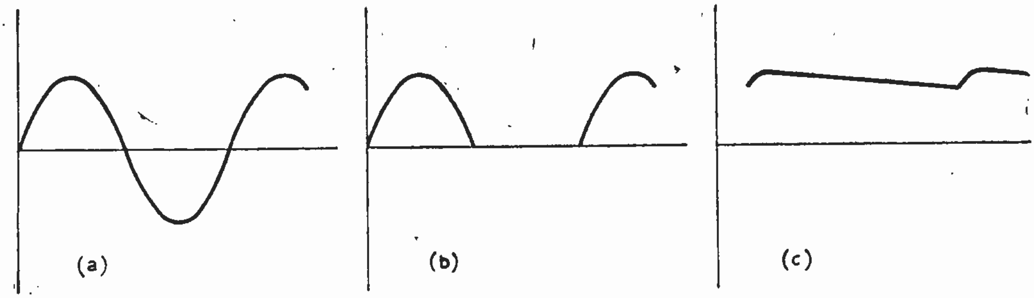


Fig. 49: The a.c. waveform: (a) before rectification; (b) after rectification and (c) with smoothing capacitor.

the capacitor would be discharging. Thus the capacitor would be a current to the circuit where previously no current had been flowing. The capacitor would in fact be acting as a RESERVOIR for the current and is in fact called a RESERVOIR CAPACITOR. The larger the value of the capacitor the greater the smoothing effect. The three stages mentioned in the rectification of a.c. by a simple diode circuit are shown in Fig. 49. (It is often said that a SMOOTHING CAPACITOR "absorbs the peaks and fills in the troughs" of the type of waveform shown in Fig. 47.)

The type of rectifier which only rectifies one half of the a.c. cycle, i.e. a single diode, is called a HALF-WAVE RECTIFIER.

Question

Attempt to answer the following questions which relate to the graph given in Fig. 50.

1. Mark with an "X" the point where saturation occurs.
2. Between what values of Va and Ia would the valve be normally operated?
3. Using the graph, calculate the a.c. resistance of the valve.
4. In practice would you expect the graph to pass through the points Va=0, Ia=0?

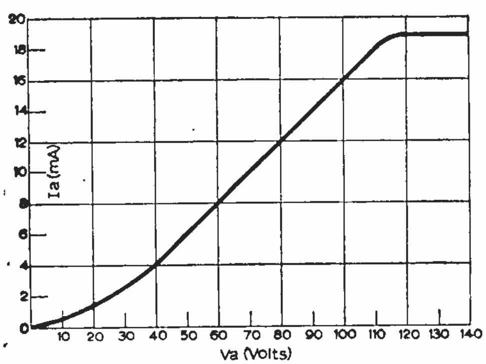


Fig. 50: The graph relating to this month's problems.

Answer to last month's question

$$f=\frac{10^6}{2\pi\sqrt{LC}}$$

$$=\frac{10^6}{6{\cdot}28\sqrt{10\times100}}$$

$$=\frac{10^6}{198{\cdot}6}$$

$$=5{,}035\text{kc/s or }5{\cdot}035\text{Mc/s.}$$

New frequency is 2,517kc/s.

$$\therefore\ 2517=\frac{10^6}{6{\cdot}28\sqrt{10\times C}}$$

$$\sqrt{10C}=\frac{10^6}{6{\cdot}28\times2517}$$

$$=\frac{10^6}{15810}$$

$$\therefore\sqrt{10C}=63{\cdot}25$$

$$\therefore\sqrt{10C}=63{\cdot}25^2$$

$$=4000$$

$$C=\frac{4000}{10}$$

$$=400\text{pF.}$$

Part 6 Next Month

SEE ALSO PAGE 1094 THIS MONTH

THE KEENNEST TAPE RECORDER BARGAIN OF THE YEAR!

A 24 gns. Tape Recorder offered at the bargain price of only **15 gns.** plus 10/- carr. Supplied in 3 Units already wired and tested. A modern Circuit for quality recording from Mike, Gram or Radio, using latest B.S.R. Twin Track Monardeck Type TD2. valve line up—EF86, ECL82, EM84, EZ80 and Selenium Diode. **Send for detailed list—3d. stamp.**

Complete Kit comprising items below.

BARGAIN PRICE 15 Gns. +10/- Carr.

2-tone Cabinet and 3in. x 5in. Speaker. Size 14in. x 10½in. x 7¼in.	**£3.10.0**	+ 5/- Carr.
Wired Amplifier complete with 4 Valves, front Panel. Knobs, etc.	**£5.15.0**	+ 3/6 Carr.
B.S.R. Monardeck Type TD2	**£7.7.0**	+ 4/6 Carr.
Accessories: Mike, Tape, empty Reel, screened Lead and Plugs, Instructions, etc.	**£1.0.0**	+ 2/- Carr.

RECORDING TAPE

Famous American Columbia (CBS) Premier quality tape at **NEW REDUCED PRICES.** A genuine recommended Quality Tape—TRY IT Brand new, boxed and fully guaranteed. Fitted with leader and stop foils.

Standard		Double Play		Long Play	
5" 600'	**13/-**	1,200'	**31/6**	900'	**17/6**
5¾" 900'	**16/-**	1,800'	**37/6**	1,200'	**19/6**
7" 1,200'	**21/-**	2,400'	**47/6**	1,800'	**28/6**

Post & Package per reel, 1/- plus 6d. each for additional reels.

SPECIAL OFFER. 3" Message tape 150', **3/9**; 3" L.P. 225', **4/9**; 3" D.P. 300', **6/6.** P. & P. per reel 6d.

TAPE REELS. Mnfrs. surplus 7", **2/3**; 5¾", **2/-**; 5", **2/-**; 3", **1/3**; Plastic spool containers, 5", **1/9**; 5¾", **2/-**; 7", **2/3.**

Condensers—Silver Mica. All values 2pF to 1,000pF, **6d.** each. Ditto, Ceramics **9d.** Tub. 450V T.C.C. etc. 0.001 mFd to 0.01 and 0.1/350V., **9d.** 0.02-0.1/500V., **1/-.** 0.25 Hunts **1/6,** 0.5 T.C.C. **1/9,** etc., etc. **Close Tol. S/Micas**—10% 5pF-500pF **8d.** 600-5,000pF, **1/-.** 1% 2pF-100pF, **9d.** 100pF-500pF, **11d.** 575pF-5,000pF, **1/6.** **Resistors**—Full Range 10 ohms-10 meg. ohms 20% ¼ and ½W, **3d.** ¾W, **5d.** (Midget type modern rating) 1W, **6d.,** 2W, **9d.** **Hi-Stab.** 5% ¼W, ½W **6d.** (100 ohms-1 meg). Other values **9d.** 1% ½W. **1/6.** etc., etc.

JASON FM TUNER UNITS Designer-approved kits of parts. **FMT1, 5 gns.** 4 valves. **20/-. FMT2, 7 gns.** 5 valves, **35/-. JTV MERCURY 10 gns.** 3 valves **22/6. JTV2 £13.19.6.** 4 valves, **28/6. NEW JASON FM HANDBOOK, 2/6.** 48 hr. Alignment Service **7/6.** P. & P. 2/6.

TRIMMERS. Ceramic (Compression Type)—30pF, 50pF, 70pF, **9d.**; 100pF/150pF **1/3**; 250pF, **1/6**; 600pF, **1/9.** **PHILIPS. Bee Hive Type** (conc. air-spaced)—2-8pF, **1/-**; 3-30pF, **1/-.** **KNOBS**—Modern Continental types Brown or Ivory with Gold Ring; 1" dia., **9d.** each; 1¾", **1/-** each; Brown or Ivory with Gold Centre, 1" dia., **10d.** each; 1⅞", **1/3** each, LARGE SELECTION AVAILABLE. **METAL RECTIFIERS, STC Types**—RM1, **4/9**; RM2, **5/6**; RM3, **7/6**; RM4, **16/-**; RM5, **21/-**; RM4B, **17/6.**

Volume Controls—5K-2 Meg. ohms, 3in. Spindles. Morganite Midget Type 1⅛in. diam. Guar. 1 year. LOG or LIN. ratios less Sw. **3/-.** DP. Sw. **4/6.** Twin Stereo less Sw. **6/6.** DP. Sw. **8/-.** **Specials to order.**

WAVECHANGE SWITCHES. 1 p. 12-way 2 p. 2-way, 2 p. 6-way, 3 p. 4-way, 4 p. 2-way, 4 p. 3-way, long spindle. **3/6 ea.**

TUB-ELECTROLYTICS-CAN

25/25v. 50/12v. 1/9; 8+8/450v. 4/6; 50/50v. 100/125v. 2/-: 32+32/275v. 4/6 8/450v. 4/350v. 2/3; 50/50/350v. 6/6 16+16/450v. 5/6; 60/250/275v. 12/6 32+32/450v. 6/6; 100+200/275v. 12/6

RECORD PLAYER CABINETS 59/6

Carr. & Ins. 5/-.

Contemporary style, rexine covered cabinet in two-tone maroon and cream. Size 15¾" x 14¾"x8½", fitted with all accessories including baffle board and Vynair fret Space available for all modern amplifiers and auto-changers etc. Uncut record player mounting board 14¼" x 12½" supplied.

2 VALVE 2 WATT AMPLIFIER EZ80 and Twin stage ECL82 with vol. and neg. feedback tone control. A.C. 200/250v with knobs, etc., ready wired to fit above cabinet. **£2.17.6.** P. & P. 1/6. 7" x 4" Speaker and trans., **22/-.** P. & P. 2/-.

COMPLETE R/PLAYER KIT. As ill. inc. BSR UA14 Unit. New Bargain Price. Now only £11.10.0. 7/6 carr. **Double wound mains Tfr, no live chassis.**

BONDACOUST Speaker Cabinet Acoustic Wadding (1in. thick approx.) 12in. wide, any length cut, **1/6** fy., **4/-** yd. **TINNED COPPER WIRE,** 16-22g., **2/6** ½lb. **ERSIN MULTICORE SOLDER.** 60/40 **4d.** per yard. Cartons **2/6** etc.

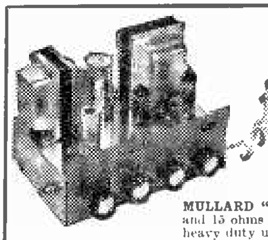
TYGEN FRET(Contem. pat.), 12 x 12in. **2/-**; 12 x 18in. **3/-**; 12 x 24in. **4/-**, etc.

EXPANDED ANODISED METAL. Attractive gilt finish ¼in. x ¼in. diamond mesh **4/6** sq. ft. Multiples of 6in. cut. Max. size 4ft. x 3ft., **47/6** plus carr. Do., finer patterned mesh, **4/6** sq. ft., multiples of 12in., max. size 3 ft. x 2 ft., **27/6** sheet.

ENAMELLED COPPER WIRE—¼lb reels 14g-20g, **2/6**; 22g-28g, **3/-**; 30g-34g, **3/9**; 36g-38g, **4/3**; 39g-40g, **4/6**, etc.

MULLARD "3-3" & "5-10" HI-FI AMPLIFIERS

3 ohm & 15 ohm output



"3-3" Amp. 3 valve, 3 watt hi-fi quality at reasonable cost. Bass Boost and treble controls quality sectional output transformer, 40 c/s–25 kc/s + 1 dB, 100mV for 3W, less than 1% distortion. Bronze escutcheon panel **Complete Kit only £6.19.6.** Carr. 5/-. Wired and tested **8 gns.**

MULLARD "5-10" AMPLIFIER. 5 valves 10W 3 and 15 ohms output. Mullard's famous circuit with heavy duty ultra-linear quality output transformer

Basic amplifier kit price **£9.19.6** Carr. and Ins. 7/6.
Ready built 11½ gns.

CONTROL PANEL KIT. Bass, Treble and Volume controls with **4-position** selector switch for radio tape and 11in. x 4in. escutcheon panel.

AMPLIFIER KIT AND CONTROL PANEL KIT, £11.19.6. Ditto, **ready wired. £14.19.6.**

2-VALVE PRE-AMP. UNIT. Based on Mullard's famous 2-valve (2xEF86) circuit with full equalisation, with volume, bass, treble and 5-position selecter switch. Size 9x6x2¼in. Complete Kit **£5.19.6**, carr. 3/6. Ready Built **£7.19.6.**

6 VALVE AM-FM TUNER UNIT

Med. and VHF 190 M-550 M, 85Mc/s-103Mc/s 6 valves and metal rectifier. Self contained power unit, AC 200-250v. operation. Magic eye indicator, 3 push-button controls, on/off, Med., VHF diode and high output sockets with gain control. Illuminated 2-col. perspex dial 11½ x 4in. Chassis 11⅛ x 4 x 5¾in. A recommended Fidelity Unit for use with Mullard 3/3 5-10 amplifiers. Available only at present as built-up units, aligned and tested ready for use. Bargain price **£12.10.0** Carr. 5/-. We hope to produce this popular unit in kit form very shortly.

DE-LUXE RECORD PLAYER KIT

Incorporating 4 Sp. Garrard Auto-Slim unit and Mullard latest 3 watt printed circuit amplifier (ECL 86 and EZ 80), vol., bass and treble controls, with 8" x 5" 10,000 line speaker. Contemporary styled 2-tone cabinet, charcoal-grey and off-white with matching blue relief. Size 17½" x 16" x 8". A stylish unit capable of quality reproduction. Circuit and const. details 2/6 (free with kit)

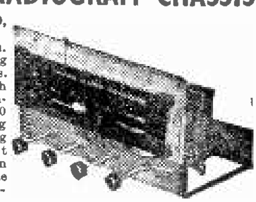
COMPLETE KIT *Carr. and ins. 10s.* **£13.19.6**

Illuminated perspex control panel escutcheon, 7/6 extra. Ready wired 30/- extra. Four contemporary mounting legs (6 or 13in.) 12/6 per set.

TRANSISTOR COMPONENTS

Midget I.F.'s—465 Kc/s 9/16in. diam. **5/3**
Osc. Coil M. & L.W. **5/9**
Midget Driver Trans. 3.5:1 .... **6/9**
Midget Output Trans. Push-Pull—3 ohms **6/9**
Elect. Condensers—Midget Type 1 mFd.-50 mFd. ea. **1/9,** 100 mFd. **2/-,** 12V.
Condensers 150 v. working: .01 mFd., .02 mFd., .03 mFd., .04 mFd. **9d.**; .05 mFd., .1 mFd., **1/-** .25 mFd., **1/3**; .5 mFd., **1/6,** etc.
Midget Tuning Condensers. J.B. "OO" 208 pF and 176 pF, **8/6,** ditto with trimmers, **9/6.** J.B. 220 pF and 105 pF conc. slow motion **10/6.** 365pF single **7/6.** Sub. min. ⅞in. Dilemin 100 pF, 300pF, 500pF, **7/-** each.
FERRITE AERIALS, M. & L.W. car aerial coil **9/3.**
Midget Vol. Control with edge control knob, 5 K/ohms, with switch **4/9**; Ditto less switch **3/9.**
Speakers: P.M.; 2in. Plessey 75 ohms **15/6.** 2½in. Continental 8 ohms, **13/6.** 7 x 4in. Plessey 35 ohms, **23/6.**
Ear Plug Phones—Min. Continental type 3ft. lead, jack plug and socket. High Imp., **8/-.** Low Imp., **7/6.**
Brand New, Mfrs. 1st grade, 1 OC44 & 2 OC45, **15/6.** 1 OC81D & 2 OC81, **15/6.** All above and OA81, **32/6. Post Free.**

7 VALVE AM/FM RADIOGRAM CHASSIS



Valve line-up ECC85, ECH81, EF89, EABC80, EL84, EM81, EZ80. Three Waveband and Switched Gram. positions. Med. 200-550 m. Long 1,000-2,000 m. VHF/FM 88-95 Mc/s. Philips Continental Tuning Insert with permeability tuning on FM and combined AM/FM IF transformers. 400 Kc/s. and 10.7 Mc/s. Dust core tuning all coils. Latest circuitry including AVC and Neg. Feedback. Three watt output. Sensitivity and reproduction of a very high standard. Chassis size 13½ x 6½in. Height 7½in. Edge illuminated glass dial 11½ x 3½in. Vertical pointer. Horizontal station names. Gold on brown background. A.C. 200/250v. operation. Magic-eye tuning. Circuit diagram n w available. Aligned and tested ready for use **£13.10.0.** Carr. & Ins. **7/6**
Complete with 4 Knobs—walnut or ivory to choice. Indoor FM aerial **3/6 extra.** 3 ohm P.M. Speaker only required. Recommended Quality Speakers 10in. R.A. **27/6**; 13½ x 8in. E.M.I. "Fidelity" **37/6**; 12in. **R.A.** with conc. Tweeter, **42/6,** Carr. 2/6.

We manufacture all types Radio Mains Transf., Chokes. Quality O/P Trans., **etc.** Enquiries invited for Specials. Prototypes for small production runs. **Quotations** by return. Send for detailed bargain list, 3d. stamp

Est. 1949

RADIO COMPONENT SPECIALISTS

70 Brigstock Rd., Thornton Heath, Surrey. *Hours: 9 a.m.-6 p.m.. 1 p.m. Wed.* THO 2188. *Terms C.W.O. or C.O.D. Post and Packing up to ½ lb. 9d.; 1 lb. 1/3; 3 lb.* **2/3**; 5 *lb.* **2/9**; 8 *lb.* **3/6.**

LETTERS TO THE EDITOR

Whilst we are always pleased to assist readers with their technical difficulties, we regret that we are unable to supply diagrams or provide instructions for modifying commercial or surplus equipment. We cannot supply alternative details for receivers described in these pages. WE CANNOT UNDERTAKE TO ANSWER QUERIES OVER THE TELEPHONE. If a postal reply is required a stamped and addressed envelope must be enclosed with the coupon from page iii of the cover.

The Editor does not necessarily agree with the opinions expressed by his correspondents

THE PRICE OF GENEROSITY

SIR,—I think that you and many readers of PRACTICAL WIRELESS and *Practical Television* may be interested in the response to my letter in the October issue of P.W. (page 577) in which I offered free all my past issues of the two magazines.

I had 256 letters requesting copies, and in order to be as fair as possible I selected letters at random; within ten days I had dispatched all my copies to 88 readers by post and the half dozen local ones I delivered personally.

I had (in my simple way), expected about six requests and was staggered, to say the least, by the amount of mail that descended on me. On three days there were as many as 60 letters per day!

The pleasant task of reading so many friendly letters was enjoyable. I am so sorry to have had to disappoint many, many readers, but I could easily have distributed 50 copies of each issue had they been available.

The one unpleasant aspect of my "give-away" scheme was the out-of-pocket expense it caused me, principally by the thoughtlessness of so many people who enclosed crossed P.O.'s, loose cash, stamps, cheques and paper money etc., and in some cases not even a threepenny stamp!

Only twelve readers enclosed an s.a.e.; to them many thanks, they were a great help in what proved to be a gigantic task of replying to everyone.

Incidentally, only ten readers out of nearly 90 to whom I sent copies, bothered to send a word of thanks.

So may I warn any other reader who might be considering the same offer as mine, that my out-of-pocket expenses have been:— 212 threepenny stamps—(£2 13s.), 136 P.O.'s (3d. poundage)—(£1 14s.) and 200 envelopes, writing paper, wrappers etc.—(9s. 3d.) totalling £4 16s. 3d. — J. F. HITCHCOCK (Sutton, Surrey).

UNUSUAL MICROPHONE

SIR,—Having built my tape recorder from a kit, I was very dissatisfied with the peaky result from my crystal mike. This led me to thinking that a more expensive one such as a ribbon type may be the answer to my problem but the price of such an instrument stopped my progressive thoughts. It was then that I decided to experiment with a small 2½in. loudspeaker with an 80Ω voice coil, but alas, my junk box did not reveal a matching output transformer. All that could be found was an old 230V in 230 + 6·3V out mains transformer removed from an old TV converter. Nevertheless, it was all that was available and I subsequently connected my speaker (now to be called microphone) to the 6·3V winding, feeding the 230V winding to my tape recorder input.

The result was most surprising, a very fair all-round response and my "tapespondent" friend feels certain that I am using an expensive ribbon-type mike!

Should any other readers be interested in similar experiments they may care to bear in mind the fact that the actual cone diameter of the speaker should be no less than 2½in., as this would probably result in loss of bass response.—JOHN B. COX (Brighton).

CORRESPONDENTS WANTED

SIR,—I am interested in transistor circuitry and radio in general. I would like to correspond with anyone who is interested in radio and who is about my own age (16). — DONALD GABRIEL (43 Oliver Plunkett Street, Blandon, Co. Cork, Ireland).

ON THE SHORT WAVES

—continued from page 1078

America, and you never know he may spray a little r.f. in your direction (listen at the high end of 20m band).

Part One of the 1965 ARRL DX contests are scheduled for February and could provide something interesting. There are two sections: 'phone a.m. and s.s.b. and c.w. In February there is one section of each with another in March. The full list of contest dates this month is as follows:—

6th—7th QCWA Party.
13th—14th ARRL DX Contest, 'Phone section.
14th 70 Mc/s Contest.
20th—21st BERU Contest.
20th—21st YL/OM 'Phone Contest.
27th—28th ARRL DX Contest, c.w. section.
27th—28th REF Contest, 'Phone section.

The ARRL contest by the way, starts at 0001 G.M.T. Saturdays and ends 2400 Sundays.

My thanks to listeners who sent in logs. We are hoping to provide report forms to make it easier to send in a log. If you would like to send in a regular report drop me a line with your address (printed please) and I'll forward them if and when they become available.

CLUB NEWS

ACTON, BRENTFORD AND CHISWICK RADIO CLUB
Hon. Sec.: W. G. Dyer, G3GEH, 188 Gunnersbury Avenue, Acton, London, W.3.
At the meeting to be held on 16th February at 8 p.m. at 66 High Road, Chiswick, the Club will be having a show of mixed films, to which all those interested in amateur radio are invited.

CHESTER AND DISTRICT AMATEUR RADIO SOCIETY
Hon. Sec.: P. J. Holland, Field House, 19 Kingsley Road, Great Boughton, Chester.
The only function arranged for January by the outgoing committee was the A.G.M. held in the Y.M.C.A. hall, Chester

CLIFTON AMATEUR RADIO SOCIETY
Hon. Sec.: J. Rose, G3OGE, 63 Broomfield Road, Beckenham, Kent.
Winner of the 1964 Constructional Contest was SWL Dave Reed, with a 430 Mc/s. transistor convertor.

COVENTRY AMATEUR RADIO SOCIETY
Hon. Sec.: E. E. Snow G3TKO, 11 Lupton Avenue, Coventry.
On 11th January there was an evening of construction on the Club top band transmitter, and on the 18th there was a Frequency Measurement symposium. On 25th January there was a lecture aimed at SWLs, entitled H.F. Bands Convertor.

DERBY AND DISTRICT AMATEUR RADIO SOCIETY
Hon. Sec.: F. C. Ward, G2CVV, 5 Uplands Avenue, Littleover, Derby.
The R.S.G.B. Affiliated Societies' Contest was held on 23rd and 24th January, and on 3rd February the Annual General Meeting took place.

DURHAM CITY AMATEUR RADIO SOCIETY
Hon. Sec.: M. Allenson, G3TGD, Physics Department, University of Durham, South Road, Durham.
The Society is now one year old and can look back on a prosperous year with average attendances of thirty or more members. Meetings are held every alternate Thursday at 7 p.m. at the Bridge Hotel, North Road, Durham.

FAREHAM AMATEUR RADIO CLUB
Hon. Sec.: C. A. Gledhill, G3LGX, 113 Oak Road, Fareham, Hampshire.
Meetings of this club take place fortnightly at 39 Nicholas Crescent, Fareham, and full details can be obtained by writing or telephoning the Hon. Secretary at the above address.

HALIFAX AND DISTRICT AMATEUR RADIO SOCIETY
Hon. Sec.: J. Ingram, G3RMQ, Lambert House, Greetland, Halifax, Yorkshire.
The speaker on 26th January was J. J. Platt, G2VO, whose topic was "Radio a long time Ago". On the 30th and the 31st January, there was the CQ Worldwide 160 meter Contest.

MID-WARWICKSHIRE AMATEUR RADIO SOCIETY
Hon. Sec.: T. Inkester, 13 Dormer Place, Leamington Spa Warwickshire.
The New Year activities commenced on Monday, 11th January with an Open Meeting. The meeting on 25th January was devoted to a film show, and will be followed on 8th February by the Annual General Meeting.

NORTHERN HEIGHTS AMATEUR RADIO SOCIETY
Hon. Sec.: A. Robinson, G3MDW, Candy Cabin, Ogden, Halifax, Yorkshire.
With the permission of Stew W1BB, a copy of his tape-recorded talk entitled "Top Band DXing", along with slides has been made and any club wishing to borrow it may do so, provided that the club concerned agrees to registered postage both ways. Application should be made to G3MDW.

READING AMATEUR RADIO SOCIETY
Hon. Sec.: R. G. Nash, G3EJA, 'Peacehaven", 9 Holybrook Road, Reading Berkshire.
The Annual General Meeting was held on 30th January at the Palmer Hall, West Street, Reading, and new officers were appointed to take over from those retiring this year.

SLADE RADIO SOCIETY
Hon. Sec.: D. T, Wilson, 177 Dower Road, Four Oaks, Sutton Coldfield, Warwickshire.
On 8th January there was a General Discussion on d.f. arrangements for 1965 with special reference to Harcourt rules and technical organisation. A talk entitled "The Early Days" was given by H. Wilson, on 22nd January.

SPEN VALLEY AMATEUR RADIO SOCIETY
Hon. Sec.: N. Pride, 100 Raikes Lane, Birstall, Near Leeds.
The subject under discussion on 21st January was, "Aerials for Radio Astronomy". On 4th February, there was an evening for Model Control enthusiasts.

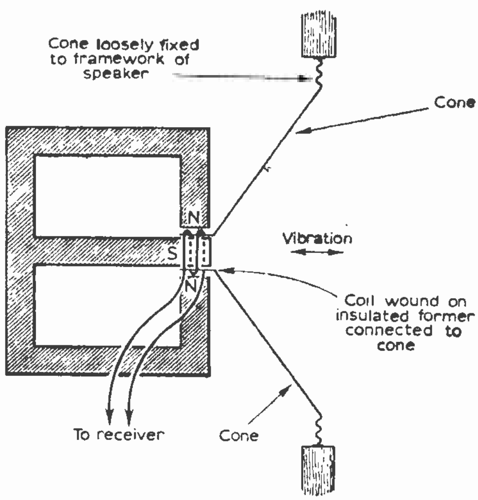
UNIVERSITY OF SHEFFIELD AMATEUR RADIO SOCIETY
Hon. Sec.: J. P. Billingham, G8AAC, 2 St. Andrew's Way, Ardsley, Barnsley, Yorkshire.
On 8th December, Messrs. G. Harris and M. Taylor of Whitley Electrical Radio Co. Ltd., gave a demonstration of High Quality Sound Reproduction Seven of the Club's members sat the R.A.E. at the University on 10th December.

WELLINGBOROUGH RADIO CLUB
Hon. Sec.: J. Baker, 34 Essex Road, Rushden, Northamptonshire.
At the meeting held on 14th January, P. Elderkin gave a talk on Home Made Gadgets. On 21st January there was a junk sale and on the 28th G. Abrams gave a talk on Transistors. The General Meeting was held on 4th February.

WEST KENT AMATEUR RADIO SOCIETY
Hon. Sec.: H. F. Richards, 17 Reynolds Lane, Tunbridge Wells, Kent.
On 8th January there was a Gossip Group in which the AFS Contest arrangements came under discussion. At the meeting on the 22nd G6SSE/T and friends gave a lecture and demonstration on Colour Television.

Preparing for the R.A.E.

The loudspeaker diagram of Fig. 12 (page 740, December '64 issue) was considered, by some readers, over-simplified and ambiguous. Below we reproduce a more explanatory diagram.

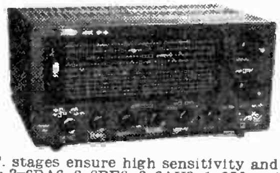


Also in this issue. the meter coil of Fig. 14 was shown in the mid-deflection position, and therefore the pointer also should have been set mid-way on a *linear* scale. Fig. 17 should have shown the two coils wound in opposite directions, so as to produce one North and one South pole uppermost, for maximum attraction.

WIRECOMP ELECTRONICS BARGAINS FOR THE RADIO ENTHUSIAST

NEW COMMUNICATION RECEIVERS

MODEL HE30



Covers range from 540 Kc/s to 30 Mc/s. Ham Band is provided with a scale for direct reading, and can also be band spread. Facilities: A.N.L., A.V.C. and M.V.C. Q Multiplier also serves as B.F.O. H.F. stage and two I.F. stages ensure high sensitivity and selectivity. Valve line up: 3x6BA6, 2x6BE6, 2x6AV6, 1x6Q5 and 5Y3. 2 Aerial Sockets. Standby position for use with a transmitter. S meter fitted. 200-250v. A.C. mains. Brand new and unused. Boxed with full instruction manual, in attractive steel cabinet, grey crackle finish. Cabinet size 15x8x10in. Dial 12x4in.

WIRECOMP'S PRICE 33 GNS. Carr. and Pack free

Available in KIT Form, 25 GNS. Carr. and Pack free.

H.P. Terms (Ready Built): £6.13.0 deposit and 11 monthly payments of £2.16.0.

MODEL HE40

Covers medium wave band and 1.6-4.4 Mc/s., 4.5-11.0 Mc/s. 11.0-30.0 Mc/s. in separate switched band spread ranges. Controls include B.F.O. Sensitivity. A.N.L., Receiver—Stand-by-Switch, Tone Switch, S-Meter. For 200/250v. A.C./D.C. Internal loop and telescopic antennae fitted. Valve line-up: 12BE6, 12BA6, 12AV6, 50C5 and metal rectifier. Size 13¼ x 8¼ x 5½in. Instruction manual included. No Kits available.

WIRECOMP'S PRICE 19 GNS. Carr. and Pack 10/-.

H.P. Terms £4. dep. and 11 months at £1.12.0.

MODEL HE 80

14-valve super sensitive communication receiver. Freq. range 540 Kc/s.-30 Mc/s. and 144-146 Mc/s. Dual conversion on 2 metres with extra R.F. stage. Single R.F. stage, two I.F. stages on all other bands. B.F.O. and Q-multiplier circuits. Improved A.N.L. and voltage regulated power-pack. "S" meter, band spread on amateur bands, large illuminated dial with logging scale. All controls fitted. Outputs for speaker and phones. Valve line-up: 4x6AQ8, 3x6BA6, 2x6BE6, 1x6BL8, 6AL5, 6AQ5, 6CA4 and OA2. Steel case 17 x 7½ x 10in. For 200/250v. A.C. mains. Brand new with full instruction manual. No Kits available.

WIRECOMP'S PRICE 59 GNS. Carr. and Pack free.

H.P. Terms £12.19.0 dep. and 11 months at £4.18.0.

Ready Built BOY'S TRANSISTOR RADIOS

2-transistor pocket radio. In plastic case. Size only 4in. x 2½in. x 1in. Fitted with 2½in. speaker. Socket for personal earpiece. Works from PP3 type batt. tunable over full medium waveband. Supplies comp. with earpiece, carrying purse and 9-volt batt. Ideal present. **WIRECOMPS' PRICE 42/-** Post Free

6 transistor model available only 69/6. Post Free.

NEW SUPER MINIATURE POCKET RADIOS

THE SINCLAIR MICRO-6. Self-contained pocket radio. Size only $1^{1}/_{5}$ x $1^{3}/_{10}$ x ½in. A marvel of modern miniaturisation—truly amazing performance. May be built in an evening. Complete with earphone and detailed construction data. **Can be built for only 59/6**

Mercury cell 1/11 extra (2 required).

THE SINCLAIR SLIMLINE. The new 2-transistor pocket radio size only 2¼in. x 1⅞in. x 1⅛in. Micro alloy transistorised and printed circuit. All components available separately. Easy to assemble. **Can be built for........................ 49/6**

SUPER AMERICAN TAPE

INTERNATIONAL BRAND, FULLY GUARANTEED

MYLAR BASE	
3in. Triple play, 450ft.	12/6
4in. Triple play, 900ft.	22/6
5in. Double play, 1,200ft.	15/-
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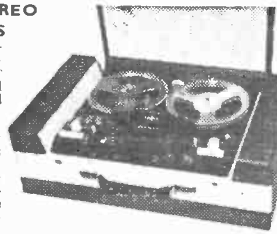

High precision machines offering a maximum of facilities for the enthusiast and connoisseur. General specification ★ Completely self contained. Record replay and Audio amplifiers built in. ★ All transistorised. ★ Three heads—separate record, replay, erase (also provides sound-on-sound recording). ★ Three speeds—7½, 3¾, 1⅞ i.p.s. ★ 4 tracks. ★ Takes 7in. reels. ★ Record level indicators on both channels. ★ Remote control facilities. Other facilities on these exceptional machines include: push button controls; tape end stop; separate switched bass boost and treble cut; sep. inputs for 2 microphones—2 radios and 2 pick-ups with provision for mixing 3 inputs. Outputs provided are 2 at 4 ohms; 2 sets headphones; 2 external amplifiers. Power output 2½ watts per channel. All brand new, boxed and fully guaranteed.

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Transistorised Portable Receiver made to the highest professional standard. Comprises 7 Mullard Trans. plus Crystal Diode. 350 milliwatt output to 4in. speaker.—I.F. frequency 470 Kc/s—fully tunable over medium and long wavebands. Two-tone plastic cabinet with handle—size 7 x 10 x 3½in. fitted socket for car aerial. Complete with full instructions.

MAY BE BUILT FOR £5.19.6 All parts sold separately. Battery 3/6 extra.

P. & P. 4/6 extra. (Circuit diagram 2/6, free if all parts bought. **Also De Luxe Model** with superior PVC covered wood cabinet and full view tuning dial. **ONLY £1 EXTRA. All parts sold separately. Battery 3/9 extra. P. & P. 4/6.**

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50 watts output. Superb amplifier for all music and P.A. work—ideal for guitars, groups, etc. Fully transistorised for maximum efficiency. 4 inputs with mixing facilities plus reverberation/echo chamber. Bass and treble controls. Fully built and guaranteed. In strong wood cabinet covered in washable material. Size approx. 22 x 10 x 6in. Output imp. 15 ohms. For operation on 200/250v. A.C. mains.

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Will handle up to 50 watts. In floor standing enclosures styled to match the above amplifiers. Fitted with two 12in. Goodmans Full Range speakers.

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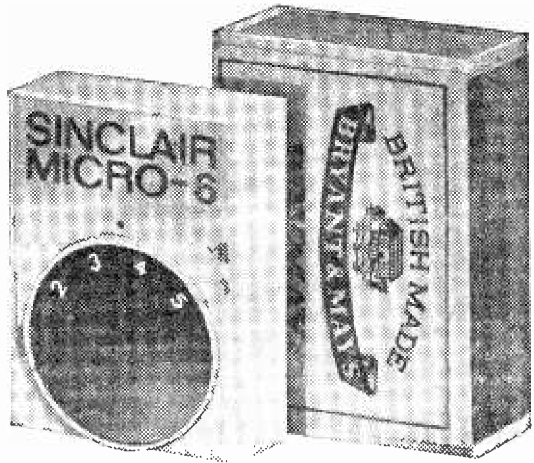
TRANSISTOR DESIGNS BY SINCLAIR 1

Have you built the smallest set in the world yet?



ACTUAL SIZE

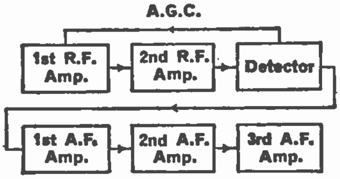
It brings in stations from all over Europe. It is completely self-contained, including batteries which give about 70 hours working life and built-in aerial. It works in cars, buses, trains and many places where other sets cannot be heard at all. Yet the Micro-6 measures only $1\frac{4}{5}'' \times 1\frac{3}{10} \times \frac{1}{2}''$ and weighs less than 1oz. Wherever you listen with your Micro-6, it will never intrude into other people's privacy, and you can even wear it like a wrist watch. So build yours now—it costs so very little to enjoy radio the Micro-6 way.

IT'S THE SINCLAIR MICRO-6

THOUSANDS ARE IN DAILY USE ALL OVER THE WORLD

Amazing circuitry!

Only three special Sinclair Micro-Alloy 'transistors' (MATs) are used to provide two stages of R.F. amplification, followed by an efficient double diode detector which drives a high-gain 3-stage A.F. amplifier. Powerful A.G.C. applied to the first R.F. stage ensures fade-free reception from the most distant stations tuned in. Tuning is by means of a unique vernier control which extends over the medium wave-band and has bandspread for easy Luxembourg reception.



BLOCK DIAGRAM OF MICRO-6

Easy to build, too!

You can build the Micro-6 in an evening. All parts including transistors, case, lightweight earpiece and instructions come to

59/6

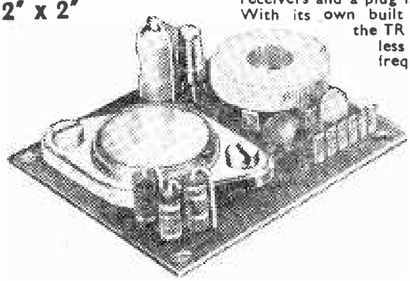
Mallory Mercury Cell
Type ZM312 (2 required)

Each	1/11
Pack of six	10/6
'Transrista' Black nylon wrist strap	7/6

SINCLAIR TR750 AMPLIFIER

Designed specially for Micro-6 and Slimline Users

SIZE 2" x 2"

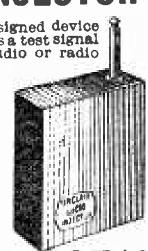


Another highly original Sinclair design which enjoys enormous popularity. The TR750 amplifier makes a powerful car, portable or domestic radio used with the Micro-6 or Slimline receivers and a plug is included for connecting to these sets. With its own built in volume control and on-off switch, the TR 750 has a full 750 milliwatt transformer-less output for 10mV into 10K ohms and a frequency response from 30 to 20,000 c/s ± 1dB. It will also make an efficient hi-fi record reproducer used singly or paired for stereo and there are many other uses for the TR 750 which is available for building or ready built.

All parts with instructions come to **39/6**

Ready built and tested **45/-**

Trace that fault with a Sinclair MICRO-INJECTOR



This ingeniously designed device generates and injects a test signal into any part of audio or radio equipment at any frequency from 1 kc/s to 30 Mc/s by means of which it becomes easy to locate faults rapidly and accurately. Measures $1\frac{4}{5} \times 1\frac{3}{10} \times \frac{1}{2}$in. excluding probe. With full instructions.
No constructor should be without a Micro-Injector.

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COMBERTON Cambridge

Telephone COMBERTON 682

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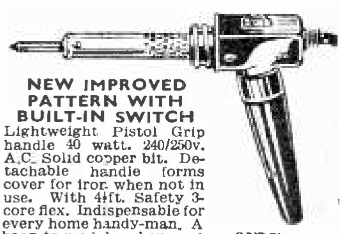

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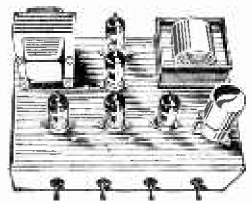

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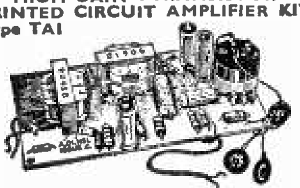

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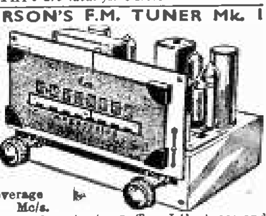

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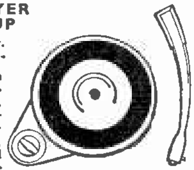

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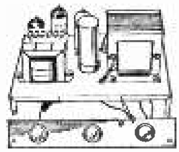

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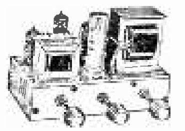

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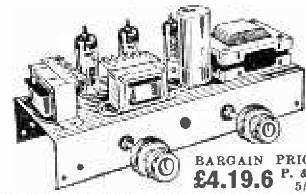

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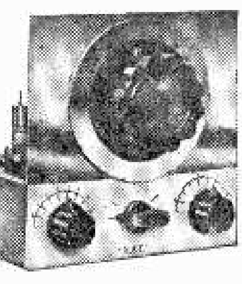

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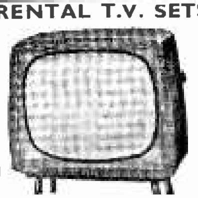

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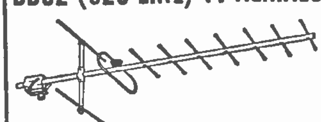

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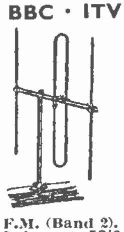

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RECORD/REPLAY/ERASE TAPE HEADS

Marriot Type R/RP/3 ¼ track record/replay head and Mullard type TS erase head with mounting post. Bargain offer 15/- pair P.P. 9d.

TRANSISTOR POCKET RADIOS

Ready to use complete with Battery. Leather Case. Earphone. P.P. 2/- any type. Fully Guaranteed.

6-Transistor De Luxe	69/6
7-Transistor Zephyr	79/6
6-Transistor MW/LW	£5.19.6

TRANSISTOR PORTABLE TRANSCEIVERS

9-transistor Portable Transceivers. Supplied complete with leather cases, batteries, aerials, etc. in presentation case. Range up to 5 miles in favourable conditions. Sizes 6½ x 3 x 1½ inches. Superhet crystal controlled on transmit and receive. Price £21 Per Pair. P.P. 3/6

TRANSISTOR TRANSCEIVER

3-transistor crystal controlled version of above. Range up to ½ mile. Price £8.19.6 Per Pair. P.P. 2/6.

A SELECTION FROM OUR STOCKS—NEW PRICES

See Catalogue for full details.

Sinclair Micro-6 (to build) ...	59/6
Sinclair TR 750 amps. (to build) ...	39/6
Sinclair Micro Injector (to build) ...	27/6
PP3 9 volt Battery Eliminator ...	18/6
Tape Jack Tuner ...	29/6
10-Watt Horn Tweeter ...	27/6
20-Watt Super Tweeter ...	69/6
Two-channel Mixer ...	15/-
1 to 200 Mc/s F/str. Meter ...	59/6
¾-Watt 4-transistor 9 v. 3 ohm ...	49/6
5-hole Chassis Punch Kit ...	49/6
Headphones 2 K ohm 12/6; 4K ohm	14/6
Stereo Headphones 8 x 8 ohm ...	3 gns.
Stereo Stethoscope Headset 8 x 8 ohm ...	25/-
Resistor Substitution Box ...	32/6
Crystal Mono Stethoscope Headset	10/6
Magnetic Mono Stethoscope Headset ...	12/6
Transistor Signal Injector ...	35/-
Fully Disappearing Car Aerial ...	39/6
Test Lead Kit with Pouch ...	8/6
Capacitor Substitution Box ...	22/6
De Luxe Stereo Headsets with junction box ...	£6
4-channel transistor mixer ...	49/6
★ 3-Transistor MW Superhet tuner ...	67/6
★ 4-Transistor Superhet MW/SW Tuner ...	£7.9.6
Transistor Telephone Amplifier	59/6

FM VHF TUNING HEART

Printed circuit-construction. RF stage and osc./mixer stage, fully tunable 85 to 105 Mc/s. Completely screened. Requires UCC85 (8/6). Brand new in maker's cartons 15/-. P.P. 1/-. Supplied with circuit.

MULLARD PORT CORES

LA1	12/6	LA5	17/6	LA45	15/-
LA2	15/-	LA6	22/6	LA2503	15/-
LA3	19/6	LA9	17/6	LA2504	15/-
LA4	12/6	LA10	17/6	LA2505	17/6

30 watt Soldering Iron	14/6 P.P. 1/-.
Tape Demagnetiser ...	29/6
2 K ohm 1 in. diam. mag. mic ...	15/-
Antex 15 watt min. soldering iron	29/6
Earphones Mag. or Crystal ...	5/-
Telephone Recording attachment ...	9/6
Crystal Guitar contact mic ...	12/6

★ 7-transistor Record Player or tuner amplifier with treble/bass and vol. controls, £5.19.6.
★ 4-transistor ¾ watt amplifiers. Kit, 39/6. P.P. 1/6. Built 49/6. P.P. 1/6.

RECORDING TAPE

5in. 600ft., 12/6; 5in. 900ft., 15/-; 7in. 1,200ft., 18/6; 7in. 1,800ft., 25/-; 7in. 2,400ft., 27/6. Excellent quality.

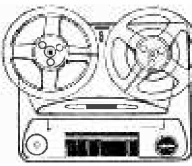
● SCOTCH BOY TAPE. 3¼in., 300ft. L.P. complete with spare spool. 5/6 P.P. 9d.

● SINCLAIR X10 AMPLIFIERS

in stock. Kit £5.19.6. Built £6.19.6. Also Mains Unit 54/-.

BUILD A QUALITY TAPE RECORDER

Leaflet on request



★ 6 Valve Printed Circuit designs. 2-track or 4-track units. 11 gns. 2-track, 12 gns. 4 track.
★ Collaro Studio Decks. 2-track 10 gns. P.P. 3/6. 4-track £14. P.P. 3/6.
★ Portable cabinets with Speakers, 5 gns. P.P. 3/6.

Complete Systems
2-track £26. P.P. 8/6. 4-track £30, P.P. 8/6.
● Complete in Every Detail ●

NOMBREX TEST EQUIPMENT

All transistor-portable units supplied with full instructions.

Leaflets on Request.

★ 150 Kc/s to 350 Mc/s generator. RF Mod. AF, 8 ranges. Leads, batteries, instructions, £9.10.0.
★ Resistance/Capacitance Bridge, £8.5.0.
★ Transistorised Power Supply, £6.10.0.
★ Audio Generator, £16.15.0.
★ Inductance Bridge, £18.
Fully Guaranteed.

CRYSTAL MICROPHONES

(See Catalogue for Full Range)

Acos 39-1 Stick Microphone	32/6
Acos 60-1 Stick Microphone	19/6
Acos 40 Deck Microphone	15/-
Acos 45 Hand Microphone	19/6
Lapel/Hand Microphone ...	12/6
100C Stick with Stand ...	32/6
BM3 Stick with Stand ...	49/6
Lapel/Hand Magnetic ...	8/6

● MINIGRAM PORTABLE TRANSISTOR RECORD PLAYER KIT,

as previously advertised.
79/6 P.P. 3/6 (Battery) 3/9.

QUARTZ CRYSTALS

100 kc/s 15/-; 500 kc/s 15/-; 455 kc/s 12/6; 456 kc/s 15/-; 27.255 Mc/s 15/-; 1 Mc/s B76 25/-.
Twin Crystal, 1 Mc/s, and 100 kc/s 22/6.
Over 800 frequencies in stock.

Henry's Radio Ltd.

PADdington 1008/9
303 EDGWARE RD., LONDON W.2
Open Monday to Sat. 9-6. Thurs. 1 o'clock.

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MOST of these blueprints are drawn full-size and although the issues containing descriptions of these sets are now out of print, constructional details are available free with each blueprint except for those marked thus (*).

Send (preferably) a postal order to cover the cost of the Blueprint (stamps over 6d. unacceptable) to PRACTICAL WIRELESS, Blueprint Dept., George Newnes, Ltd., Tower House, Southampton Street, London W.C.2.

DOUBLE-SIDED BLUEPRINTS

The Strand Amplifier ... ... / The PW Signal Generator	*	5/-
The Savoy VHF Tuner ... ... / The Mayfair Pre-amplifier	*	5/-
The Berkeley Loudspeaker Enclosure / The Luxembourg Tuner	*	5/-
The PW Troubadour ... ... / The PW Everest Tuner		7/6
The PW Britannic Two ... ... / The PW Mercury Six	*	6/-
The PW Regency ... ... / The PW International Short Wave Two	*	5/-
Beginner's Short Wave Two ... ... / S.W. Listener's Guide	*	5/-
Beginner's 10-watt Transmitter ... / Transmitting and Aerial Data... ...	*	5/-
P.W. "Sixteen" Multirange Meter ... / Test Meter Applications Chart ...	*	5/-
The Celeste 7-transistor Portable Radio / The Spinette Record Player	*	5/-
The P.W. 35-watt Guitar Amplifier ...	*	5/-
Transistor Radio Mains Unit ... ... / 7 Mc/s Transceiver	*	5/-

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The Citizen *		5/-
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Modern One-valver	PW96	2/6
All-dry Three	PW97	3/6
Modern Two-valver	PW98	3/6
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A.C. Coronet-4	PW100	4/-
A.C./D.C. Coronet	PW101	4/-
The PW Pocket Superhet		5/-

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The PW 3-speed Autogram	8/-
The PW Monophonic Electric Organ ...	8/-
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The PT Olympic *	7/6
The PT Multimeter *	5/-

PLEASE NOTE that we can supply no blueprints other than those shown in the above list. Nor are we able to supply service sheets for commercial radio, TV or audio equipment.

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The P.W. Query Service is designed primarily to answer queries on articles published in the magazine and to deal with problems which cannot easily be solved by reference to standard text books. In order to prevent unnecessary disappointment, prospective users of the service should note that:

(*a*) We cannot undertake to design equipment or to supply wiring diagrams or circuits, to individual requirements.

(*b*) We cannot supply detailed information for converting war surplus equipment, or supply circuitry.

(*c*) It is usually impossible to supply information on imported domestic equipment owing to the lack of details available.

(*d*) We regret we are unable to answer technical queries over the telephone.

(*e*) It helps us if queries are clear and concise.

(*f*) **We cannot guarantee to answer any query not accompanied by the current query coupon and a stamped addressed envelope.**

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This coupon is available until 4th MARCH, 1965 and must accompany all queries in accordance with the rules of our Query Service.

PRACTICAL WIRELESS, MARCH, 1965

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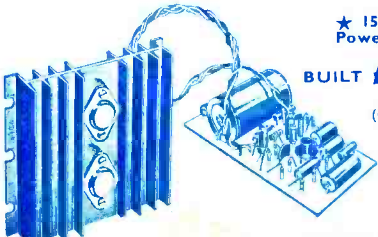
CALL IN FOR DEMONSTRATION

● TRANSISTOR HIGH FIDELITY EQUIPMENT

MONO or STEREO 10 WATTS and 20 WATTS



★ 15 ohm 10 watt Power Amplifier

BUILT **£5.19.6** P.P. 2/6

(OR KIT £5.10.0 P.P. 2/6)

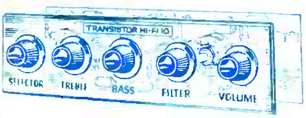
★ 3 ohm 10 watt power amplifier

BUILT **£5.10.0** P.P. 2/6

(OR KIT 99/6 P.P. 2/6)

★MAINS UNITS 59/6 for one amplifier, or 69/6 to power two amplifiers

PREAMPLIFIERS



●Mono full function pre-amplifier with 8 input positions. Low noise, high quality and sensitivity. Gives 10 watts with one power amplifier or 20 watts with two amplifiers. Size 9 × 2½ × 2in.

BUILT **£5.10.0** P.P. 2/-

(KIT **99/6** P.P. 2/-)

★Brown and Gold detailed front panel plate 8/6

● **STEREO PREAMPLIFIER**

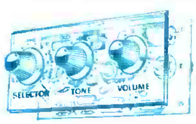
For use with two power amplifiers.

Size: 9 × 3¼ × 1⅝in.

PRICE BUILT **£10.19.6** P.P. 3/6

★Dark Brown with Gold front panel 12/6

● **MULTI-INPUT PREAMPLIFIER**



Simplified preamplifier for use with one or two power amplifiers, 8 inputs.

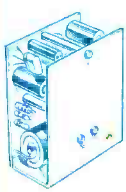
PRICE BUILT **65/-** P.P. 1/6

★ Front Panel Plate 6/6.

All the above preamplifiers can be used with any valve or transistor power amplifier requiring 250mV plate for full output. They can be operated with two 9 volt batteries in series or from the power amplifiers.

● **10 Watts R.M.S. music power or 20 watts peak power per amplifier.**

TWO NEW PACKAGED TRANSISTOR QUALITY AMPLIFIERS



4 WATT and 1½ WATT

● 6-Transistor printed circuit designs. Push-pull output for 3 to 5 ohm speakers. Can be battery operated. 6mV into 1 Kohm sensitivity Response 30 c/s to 15 kc/s. Input suitable for mics., pick-ups, tuners, etc.

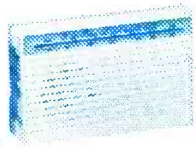
Can be used with above preamplifiers for mono or stereo in any application requiring a low distortion low cost amplifier.

OVERALL SIZE: 2½ × 2 × 1¼ inches.

● 4-watt version operates from 12 to 18 volts. PRICE BUILT **79/6** P.P. 1/6

● 1½ watt version operates from 9 to 12v. PRICE BUILT **65/-** P.P. 1/6

"REGENT-6" New!



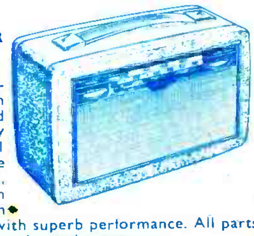
● **MEDIUM and LONG WAVE POCKET SUPERHET RADIO**

A New 6-transistor printed circuit designed with full coverage on both wavebands. Features "Cleartone" push-pull speaker output, geared tuning and complete set of 1st grade components. Moulded two tone cabinet size 5 × 3 × 1¼". Easy to follow building details. All parts sold separately.

● Total cost of all parts **85/-** P. & P. 2/- (Battery 2/6 extra)

Available mid-February

'CONVAIR' PUSH-BUTTON PORTABLE/CAR RADIO



● **UNBEATABLE FOR PERFORMANCE AND DESIGN**

Printed circuit 6-Transistor 2-Diode superhet radio with full tuning on medium and long wavebands. Quality push-pull output up to 1 watt. Attractive portable cabinet, size 10 × 7 × 3½", with horizontal slow motion turning dial and push button wave change. Easy to build with superb performance. All parts sold separately. After sales service and guarantee.

● Total cost of all parts. **£7.19.6** P.P. 3/6.

(Batteries 6/- extra) ★ The finest portable available.

ALL TRANSISTOR CAR RADIO

● **1 HOUR TO BUILD WITH PRE-ASSEMBLED CHASSIS AND PANELS**

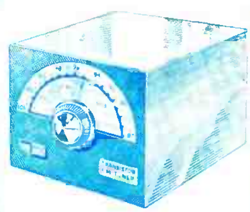
6-Transistor 3 diode med. and long wave superhet design. Features double tuned IFTS, AVC, permeability turning with geared drive. Push-pull car filling volume. Full tuning on both wavebands. A high sensitivity printed circuit professional design to fit any type of vehicle. Case size 7 × 4 × 2". For 12 volt positive earth or dry battery. All parts vailable separa-ely.

THE "ROADSTER"

● Total cost to build **£8.19.6** P.P. 3/6

7 × 4" Hi-Flux speaker with baffle and car fixing kit 20/- extra.

VHF TRANSISTOR FM TUNER



● **HIGH STABILITY— HIGH SENSITIVITY** ●

Features 5-Mullard transistors with 4-diodes, compact printed circuit, high gain, low distortion, superhet design. Full tuning from 87 105 Mc/s with geared tuning. AVC and AFC. 9 volt 9 mA operation. 50 dB S/N. Output up to 1 volt audio. Easy to build and align. Overall size in cabinet 3½ × 2¼ × 4in. All parts sold separately.

● Total cost with front panel:— **£6.19.6** P.P. 2/6

(Cabinet Assembly 20/- extra)

HENRY'S RADIO LTD.

PADdington 1008/9.

303 EDGWARE ROAD, LONDON, W.2.

(Open Monday to Saturday all day 9 a.m. to 6 p.m. Half-day Thursday 1 p.m.)

● *Trade and export enquiries invited* ●

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