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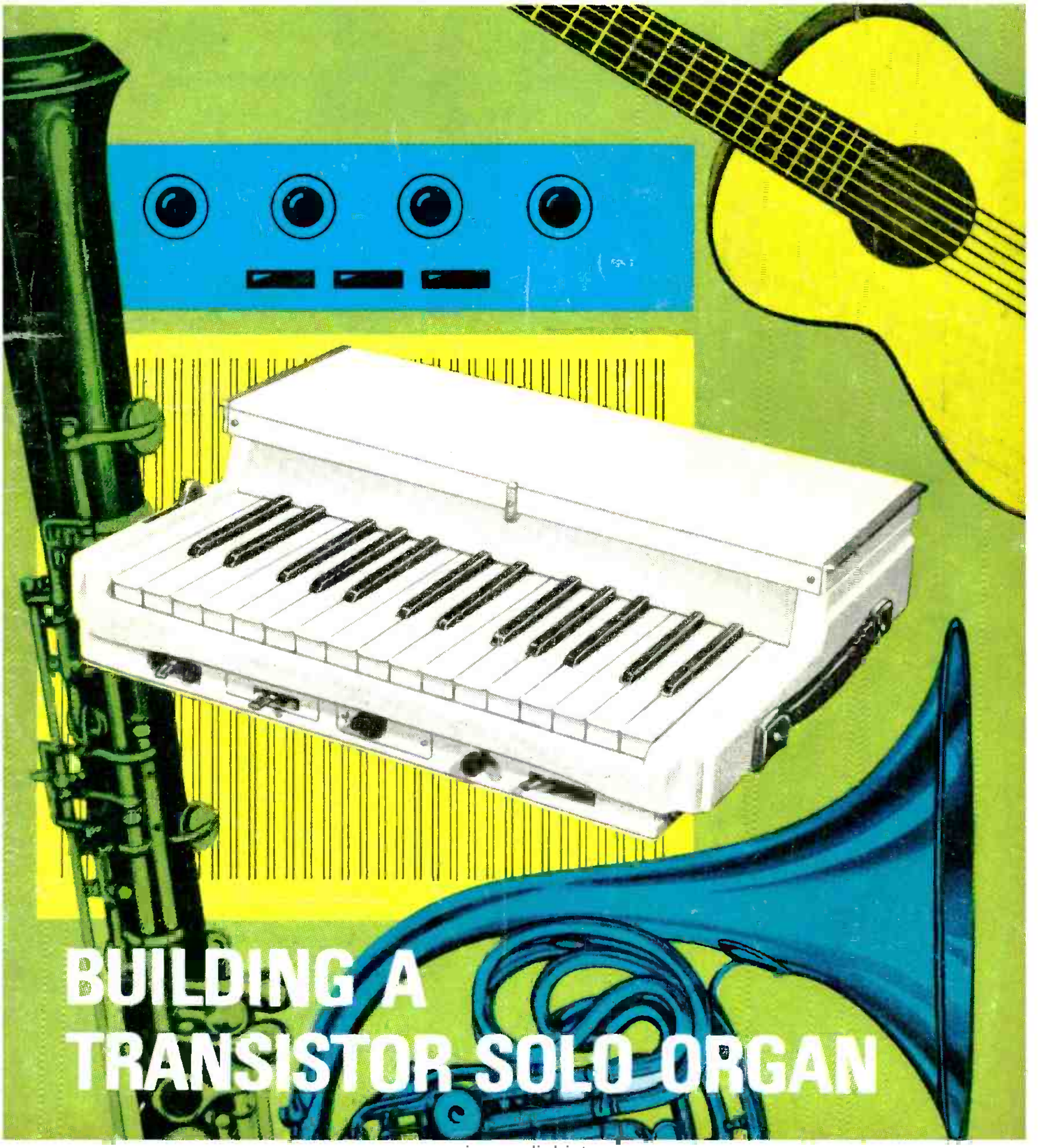

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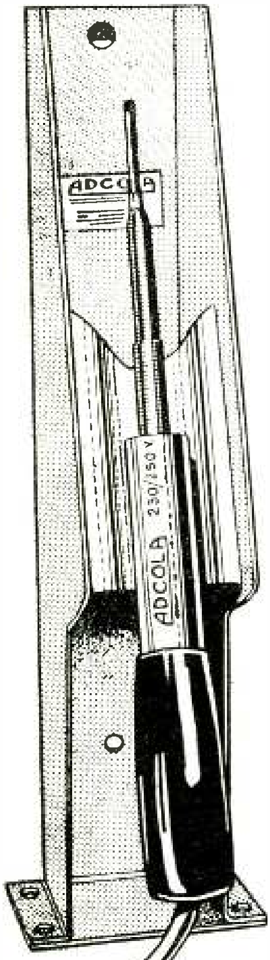

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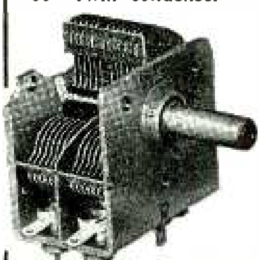

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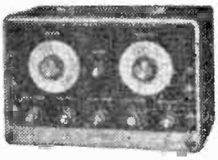

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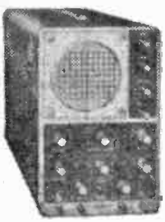

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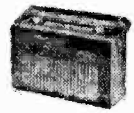

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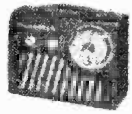

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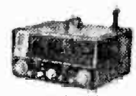

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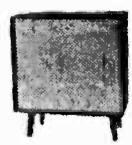

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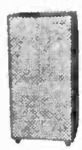

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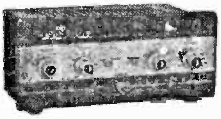
S-33

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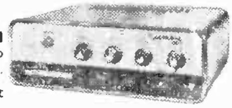

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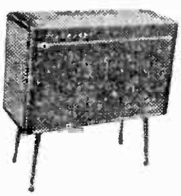

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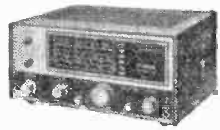
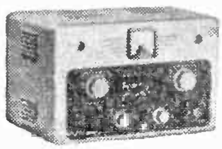
AMATEUR BANDS RECEIVER Model RA-1. Covers all amateur bands from 160-10 m. Half lattice crystal filter. 8 valve, "S" meter, tuned R.F. amplifier stage.
£39.6.6 Kit
Assembled £52.10.0

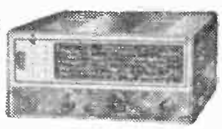

RA-1

AMATEUR TRANSMITTER, Model DX-100U. Covers all amateur bands 160-10M. 150 w. d.c. input, self contained with power supply. Modulator, VFO Assembled £104.15.0 **£79.10.0** Kit


DX-40U

AMATEUR TRANSMITTER Model DX-40U. Covers 80-10 m. Power inputs 75 w. C.W., 60 w. peak C.C. phone. Output 40 w. to aerial. Prov. for V.F.O.
£33.19.0 Kit
Assembled £45.8.0

COMMUNICATIONS TYPE RECEIVER RG-1. A high performance low cost receiver for the discriminating listener. Freq.: cov. 600 kc/s-1.5 Mc/s and 1.7 Mc/s to 32 Mc/s. Send for details. £53.0.0 Assembled **£39.16.0** Kit



Other kits in the amateur range include: **SSB Adaptor SB-10U, £39.5.0 Variable freq. Oscillator VF-1U, £10.17.6. Balun Coil Unit, B-1U, £4.15.6. Grid-Dip Meter GD-1U, £10.19.6. Q Multiplier QPM-1, £8.10.0.** Wide range of models under American Mail Order Scheme.

Please send me **FREE BRITISH CATALOGUE** (Yes/No)
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Terms: C.W.O. or C.O.D. No C.O.D. under £1. Postage 2/9 extra under £2. 4/6 extra under £5. Trade Supplied. S.A.E. with all enquiries please. Personal shoppers welcomed at any of the branches below. Open all day Saturday.

BRADFORD 54 Morley Street, Nr. Alhambra Theatre
Opening early February 1965, spacious new premises at 10 North Parade. (Half-day Wednesday).

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EX. GOV., 2V. ACCUMULATORS, 16 A.H. Size 7 x 4 x 2in. Brand new. 4/9 each. Three for 12/6, carr. 5/-.

MULTI-METERS CABY M1. Sensitivity 2,000 ohms per volt. A.C. and D.C., 54/-. **A.10.** Basic Meter sensitivity 155 micro-amps A.C. and D.C. ranges **£4.11.6. B.40.** Sensitivity up to 10,000 ohms per volt A.C. and D.C., **£6.2.6.** 30,000 ohms per volt, with overload buzzer. **£8.19.6.** Other types in stock from **39/9.**

EX GOVT. SELENIUM RECTIFIERS 12v 15 AMP (BRIDGE) F.W. ONLY 19/9

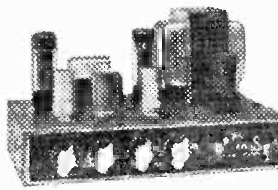
Ex. GOVT. SMOOTHING CHOKES. 200 mA, 3-5 H, 50 ohms. Parmeko **8/9** 150 mA, 10 H, 50 ohms **9/9**; 120 mA, 12 H, 100 ohms, **8/9**; 100 mA, 10 H, 100 ohms, **6/9**; 60 mA, 5-10 H, 250 ohms. **2/11.**

HI-FI 10 WATT AMPLIFIER

Brand New Complete Units **£7.19.6** Carr. 6/6

Manufacturer's discontinued Model. Push-pull output. Latest high efficiency valves Dual separately controlled Inputs for 'Mike' and gram. Separate Bass and Treble Controls. High Sensitivity. Output for 3 or 15 ohm speaker. Guaranteed tested and in perfect working order.

R.S.C. 30-WATT ULTRA LINEAR HIGH FIDELITY AMPLIFIER A10



A highly sensitive Push-Pull high output unit with self-contained Pre-amp. Tone Control Stages. Certified performance figures compare equally with most expensive amplifiers available. Hum level 70 dB down. Frequency response ±3 dB 30-20,000 c/s. A specially designed sectionally wound ultra linear output transformer is used with 807 output valves. All components are chosen for reliability. Six valves are used EF86, EF86, ECC83, 807, 807, GZ34. Separate Bass and Treble Controls are provided. Minimum input required for full output is only 12 millivolts so that **ANY KIND OF MICROPHONE OR PICK-UP IS SUITABLE.** The unit is designed for **CLUBS, SCHOOLS, THEATRES, DANCE HALLS or OUTDOOR FUNCTIONS,** etc. For use with Electronic **ORGAN; BASS, LEAD OR RHYTHM GUITAR, STRING BASS,** etc. For standard or long-playing records. **OUTPUT SOCKET PROVIDES** L.T. and H.T. for **RADIO FEEDER UNIT.** An extra input with associated vol. control is provided so that two separate inputs such as Gram and "Mike" can be mixed. Amplifier operates on 200-250 v. 50 c/s. A.C. Mains and has output for 3 and 15 ohm speakers. Complete Kit of parts with fully punched chassis and point-to-point wiring diagrams and instructions. If required perforated cover with carrying handles can be supplied for 19/9. The amplifier can be supplied factory built with EL34 output valves and 12 months' guarantee, for **14 gns.** Send S.A.E. for leaflet.

11 Gns. Carr. 10/-.

TERMS: DEPOSIT 33/9 and 9 monthly payments of **33/9.**
Suitable microphones and speakers available at competitive prices.

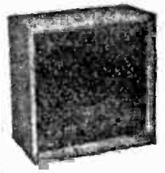
FANE HEAVY DUTY HI-FI SPEAKERS

12in. 15 ohms. Cast chassis. Exceptionally robust 2in. diam. Voice Coil Assemblies.
122/10 20watt, **5** gns. 12 /1 A 20watt, **6** gns.
122/12 20watt, **7** gns. 122/12A 20watt, **8** gns.
122/14 22watt, **9** gns. 122/14A 22watt, **10** gns.
122/17 25watt, **£11.17.6** 122/17A 25watt, **£12.17.6**
15in. 15 ohms. Cast chassis. Exceptionally robust 2in. diam. Voice Coil Assemblies.
152/12 20watt, **12** gns. 152/12A 20watt, **13** gns.
152/14 27watt, **14** gns. 152/14A 27watt, **15** gns.
152/17 35watt, **16** gns. 152/17A 35watt, **17** gns.
"A" indicates dual cone type. 30-17,000 c.p.s. Send S.A.E. for leaflets. Terms available.

GOODMANS QUALITY LOUDSPEAKERS

8in. Axiette 5 gns. 10in. Axiom **£6.5.11.**
12in. Audiom 51 (15 watts) **£9.2.8.**
12in. Audiom 61 (20 watts) **£14.7.8.**
12in. Axiom 201 (15 watts) **£10.17.4.**
12in. Axiom 301 (20 watts) **£15.4.6.**
15in. Audiom 81 (25 watts) **£25.0.0.**
18in. Audiom 91 (50 watts) **£27.10.0.**
Available cash or terms.

12 in. 10 WATT HIGH QUALITY LOUDSPEAKER



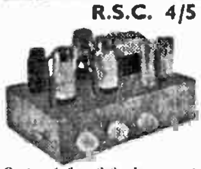
In walnut veneered cabinet. Gauss 12,000 lines. Speech coil 3 ohms or 15 ohms Only **£4.19.6.** Carr. 5/-. Terms: Deposit 11/3 and 9 monthly payments of **11/3.** **12in. 20 WATT HI-FI LOUDSPEAKERS IN CABINETS.** Size 18 x 18 x 10in. Finish as above. Terms: Deposit **17/9** and 9 monthly payments of **17/9.** Only **£7.19.6.** Carr. 8/6. **For larger types see opposite page.**

R.S.C. POWER PACK. 39/9. Louvred metal case only 8 x 5½ x 2½in. Stove enamelled. For 200-250 v. A.C. mains. Output at 4-pin plug and socket 250 v. 60 mA. Fully smoothed at 6.3 v. 2 a. Suitable for power requirements of almost any Pre-amp. or Radio Tuner.

TRANSISTOR SALE

Mullard OC71 3/9. OC45 **4/11.** OC44 **4/11.** OC72 4/9. OC81 **4/11,** OC171 **8/9.** Ediswan XA101 **3/9.** XB102 **3/9.** XA112 **3/9.** XB113 **3/9.** XB104 3/9. XC101A **3/9.** Postage 6d. for up to 3 transistors.

R.S.C. 4/5 WATT A5 HIGH-GAIN AMPLIFIER



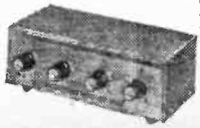
A highly-sensitive 4-valve quality amplifier for the home, small club, etc. Only 50 millivolts input is required for full output so that it is suitable for use with the latest High-Fidelity Pick-up heads in addition to all other types of pick-ups and practically all "mikes". Separate Bass and Treble Controls are provided. These give full long-playing record equalisation. Hum level is negligible being 71 dB down, 15 dB of Negative feedback is used. H.T. of 300 v. 25 mA and L.T. of 6.3 v. 1.5 a. is available for the supply of a Radio Feeder Unit, or Tape-Deck pre-amplifier. For A.C. mains input of 200-230-250 v. 50 c/s. Output for 2-3 ohms speaker. Chassis is not alive. Kit is complete in every detail and includes fully punched chassis (with baseplate) with Gold Hammer finish and point-to-point wiring diagrams and instructions. Exceptional value at only £4.15.0, or assembled ready for use 25/- extra. Plus 3/6 carr., or deposit 22/6 and 5 monthly payments of 22/6 for assembled unit.

TANNOY RE-ENTRANT LOUDSPEAKERS. For outdoor or Factory use. 8 ohms. 8 watts. Only **25/9**

ARMSTRONG RADIOGRAM CHASSIS Stereo and Mono
Full Range in stock at all Branches. Cash or Terms

TRANSISTORISED SOUND MIXER

Enables mixing of up to 4 inputs, i.e., mic., tape, gram., tuner, etc., into single output. Compact and completely self-contained, uses standard 9 volt battery. Four standard jack inputs. PRICE **49/6**



FANE EXTRA HEAVY DUTY LOUDSPEAKERS. Total Flux 375,000 lines. Extremely high sensitivity. Exceptionally robust 3in. Diameter voice coil assemblies. Impedance 15 ohms.
Model 153 15 in 40 watts. Deposit 37/9 and twelve monthly payments of 31/6. **18 Gns.**
Model 183 18 in. 60 watts. Deposit 51/- and twelve monthly payments of 42/9. **24 Gns.**
Send S.A.E. for leaflet.

R.S.C. BABY ALARM or INTER-COMM KIT. Complete set of parts with diagrams, etc. Housed in two polished walnut finished cabinets of pleasing design. High sensitivity. For 200-250 v. A.C. mains. Fully isolated. Controllable at both units. An inter-comm. of this class would normally cost £20-£30. Only **89/6,** carr. 5/- or assembled ready for use **6 gns.**

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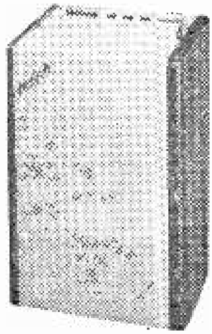
R.S.C. (MANCHESTER) LTD

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

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

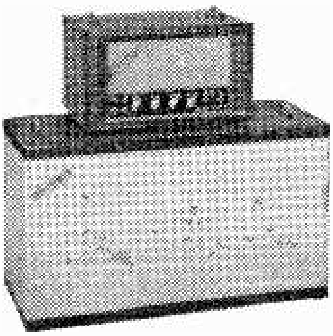
Eminently suitable for BASS, LEAD or RHYTHM GUITAR and all other musical instruments



★ 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 13in. 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. 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 public address

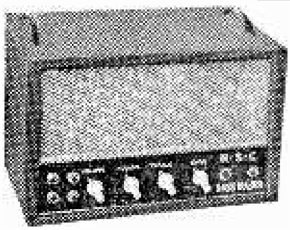
★ UNUSUALLY POWERFUL LOUDSPEAKER COMBINATION consisting of a FANE HIGH FLUX 15 in. 30 watt unit and a FANE 12 in. 20 watt unit with extended frequency response.
★ 4 Jack Socket inputs and two independent volume controls for simultaneous use of up to four instruments, pick-ups, or mikes.
★ Separate Cabinets 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 £4.16.8 and 12 monthly payments of £3.16.8

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

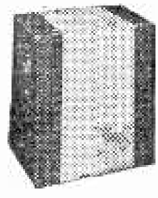
30W. HIGH QUALITY AMPLIFIER



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

HEAVY DUTY LOUDSPEAKERS IN SUBSTANTIAL REXINE COVERED CABINETS

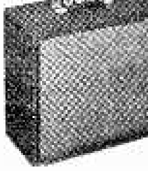


TYPE BG1 Suitable for Bass Guitar. Speaker Unit 15in.. High Flux, 15 ohms, 30 watts. Cabinet size approx. 24 x 21 x 13in. Only **19½ Gns.** Or Deposit 43/- and 12 monthly payments of 34/-.

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 **29 Gns.** Or Deposit £3.7.6. and 12 monthly payments of 50/-.

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

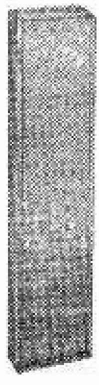
R.S.C. BASS/20 AMPLIFIER

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. Carr. 17/6.

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

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 loudspeaker. Sensitivity 50 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 the home or small club, etc.

£9.19.6 Or DEPOSIT 22/3 and 9 monthly payments of 22/3. Carr. 7/6.

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.**

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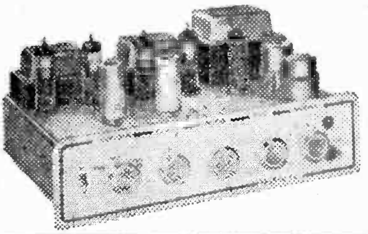
Introducing the R.S.C. STEREO/20 HIGH FIDELITY AMPLIFIER

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. 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.

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.

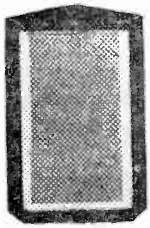
HUM LEVEL 65dB down.

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.

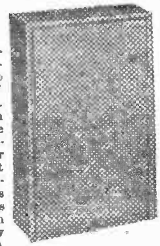


AUDIOTRINE CORNER CONSOLE CABINETS. Strongly made. Beautiful polished walnut veneered finish. Pleasing design. **JUNIOR MODEL.** To take up to 8in. speaker. Size approx. 20 x 11 x 8in. Only £2.9.9. **STANDARD MODEL.** To take up to 10in. speaker. Size 27 x 18 x 18in. £4.11.9. **SENIOR MODELS.** To take up to 12in. speaker and with Tweeter cut-out. Size approx. 30 x 30 x15in. (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 10in. Strongly made. Handsome appearance. Ensures superb reproduction for only £3.19.6.

AUDIOTRINE 3D/1

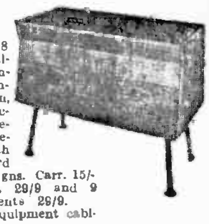


A complete three diaphragm high fidelity loudspeaker unit designed to occupy a minimum of space. Depth is only app. 6in. Height 24in. Width 16in. This has been made possible by the latest developments in loudspeaker design. The 12in. cast chassis. Bass unit has a resonant frequency which is extraordinarily low. It has a second diaphragm which extends the frequency range to 17,000 cps. A further speaker operates only on the middle frequencies and ensures a smooth response from 40-17,000 cps. Rating 20 watts. Imp. 15 ohms. Cabinet finish is either polished walnut veneer, or leathercloth to match stereo/20 cabinet. Highly recommended for any Stereo or Mono Amplifier. Surely the best value ever at 11 gns. Or Deposit 25/9 and nine monthly payments of 25/9.

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 5¼in. Only 12½ gns. Carr. 15/-. Terms: Deposit 29/9 and 9 monthly payments 29/9. 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**

LINEAR L45 MINIATURE 4-5 WATT QUALITY AMPLIFIER. Suitable for any record playing unit and most microphones. Negative feed-back 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.

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

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. Send S.A.E. for illustrated leaflet detailing Cabinets, Speakers, Microphones, etc., with cash and credit terms.

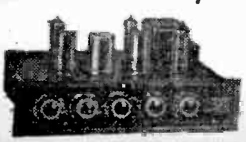
LINEAR TAPE PRE-AMPLIFIER. Type LP/1. Switched Negative feedback Equalisation. Positions for Record 1⅞in., 3¾in., 7½in. and Playback. EM84 Recording Level Indicator. Designed primarily as the link between a Collaro Tape Transcriptor and a high fidelity amplifier, but suitable for almost any Tape Deck,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

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 MICROPHONE, CASH OR TERMS.

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 cost £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.

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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 14½ 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/-. 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.

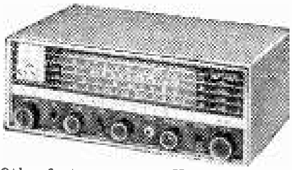
THE SKYFOUR T.R.F. RECEIVER. A design for a 3 valve long and medium wave 200-250 v. A.C. Mains receiver with selenium rectifier. High gain H.F. stage and low distortion detector. Valve line-up 6K7, SP61, 6V6G. Selectivity and quality excellent. Simple to construct. Point-to-Point wiring diagrams, instructions and parts list 1/9, maximum building costs £4.19.6. inc. attractive walnut veneered wood cabinet 12 x 6½ x 5½in.

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 12/6. R.T.C. 19/9. Acos Mic 40 25/9. Acos Mic 45 29/9. Stick type Acos 39-1 39/9. BM3 with neck band 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 2½ x 2½in. Controls: Vol. and Tone with Switch. Only 59/6.

COMMUNICATION RECEIVERS

HE-40 De-Luxe 4 Band. 220/240 v. 50/60 c.p.s. A.C. mains operation. Frequencies covered 550 Kc/s to 30 Mc/s continuous. Incorporates 5in. speaker. Slide rule tuning dial. 'S' meter. Internal ferrite aerial for medium wave. Telescopic whip aerial 59in. 10 section for short waves. Fitted sockets for optional outdoor aerial. Headphone, external speaker socket. Other features are electrical bandspread tuning, 0-100 logging scale. Noise limiter, A.V.C., B.F.O., stand by switch. Size approx. 14 x 8½ x 5½in. Handsome grey crackle finished metal cabinet with chromium fittings. Brand new with full instructions manual. Usual guarantee.

Only 19 Gns. Carriage 7/6



HE-30 4 Band Continuous coverage 550 Kc/s to 30 Mc/s. Illuminated slide rule dial. Edgewise 'S' meter 0-100 logging scale. Built-in 'Q' multiplier aerial trimmer, electrical bandspread, noise limiter, controls are: Function switch, audio gain, selectivity, frequency (B.F.O.), Band selector, I.F. gain, trimmer, A.V.C./M.V.C. Switch, ANL switch, main tuning, bandspread tuning. Output for H/Phones or standard speaker. Provides 1.5 watts output. Size 15 x 10 x 7½in. For 220/240v. 50/60 c.p.s. A.C. mains. A highly efficient receiver representing exceptional value at only

£35.0.0 Carriage 10/-

SENSATIONAL STEREO OFFER

A complete set of parts to construct a good quality Stereo amplifier with an undistorted output total 6 watts. **4 Gns.** 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.

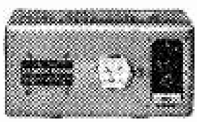
COMPLETE POWER PACK KIT

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/-.

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 15 Ω	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.

SMOOTHING CHOKES

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.

AUTO (Step up/Step down) TRANS. 0-110/120-230/250v. 50-80 watts, 13/9; 250 watts, 49/9; 150 watts, 27/9.

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

R.S.C. (MANCHESTER) LTD. BRADFORD, BRISTOL, BIRMINGHAM, DERBY, DARLINGTON, EDINBURGH, GLASGOW, HULL, LEICESTER, LEEDS, LIVERPOOL, LONDON, MANCHESTER, MIDDLESBROUGH, SHEFFIELD

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DF92	3/-
DF96	6/-
DK92	6/6
DK96	5/6
DL92	5/-
DL93	6/-
DL94	5/9
DL96	5/6

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UBF89	6/6
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UCL83	10/-
UF41	7/-
UL41	6/-
UL84	5/6
UU5	7/-
UU9	8/6
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UY85	5/-
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V1924	20/-
V2023	13/6
VMP45	12/-
VP23	3/-
VP133	9/-
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1A3	8/-
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1B22	30/-
1C5GT	6/-
1D8GT	6/-
1E7G	7/6
1F2	3/-
1G6GT	6/-
1L4	2/6
1LLA6	6/-
1LC6	7/-
1LH4	4/-
1N21B	5/-
1N43	4/-
1N70	4/-
1R4	5/-
1R5	3/6
1S4	5/-
1S5	4/6
1T4	2/-
2A3	5/-
2A5	6/-
2B26	8/-
2C26	7/-
2C26A	3/-
2C34	2/6
2C43	12/6
2C45	22/6
2C46	30/-
2C51	12/-
2D21	5/-
3X2	8/-
3A4	4/-
3A/108A	30/-
3A/146J	35/-
3A/167/M	25/-
3D6	4/-
3B7	5/-
3B24	5/-
3B28	15/-
3E29	50/-
3Q5GT	7/-
3S4	4/-
3V4	5/9
4C27	35/-
4D1	4/-
5A173G	5/-

5A174G	5/-
5R4GY	9/-
5T4	7/-
5U4G	4/6
5V4G	8/-
5X4G	8/6
5Y3G	4/-
5Y3GT	5/-
5Y3WGTB	9/-
5Z4G	6/6
6AB7	4/-
6AC7	2/-
A6G5	2/6
6AG7	6/-
6AH6	10/-
6AJ5	8/6
6AJ7	3/-
6AK5	5/-
6AK7	6/-
6AL5	3/-
6AL5W	7/-
6AM5	2/6
6AM6	4/-
6AQ5	7/-
6AQ5W	9/-
6AS6	4/-
6AS6W	9/-
6AS7G	22/6
6AT6	3/6
6AU6	7/-
6AX4	8/-
6B4G	3/-
6B7	6/-
6B8G	2/6
6BA6	4/-
6BA7	5/-
6BE6	4/3
6BJ7	7/-
6BR7	9/-
6BW6	9/-
6C4	2/-
6C5G	2/6
6C5GT	6/-
6C6	4/-
6C6G	3/-
6C8G	3/-
6CH6	1/6
6C21	80/-
6D6	3/-
6E5	8/-
6F5G	5/3
6F5GT	5/9
6F6G	4/-
6F7	6/-
6F8G	6/6
6F12	4/6
6F13	5/-
6F32	4/-
6F33	3/-
6G6G	2/6
6H1	6/-

6H6M	1/6
6J4	9/-
6J4WA	10/-
6J5	3/6
6J5G	2/-
6J6	3/6
6J6W	6/-
6J7G	5/-
6J7M	8/-
6K6GT	5/6
6K7G	2/-
6K7GT	4/9
6K8G	8/-
6K8GT	8/8
6K8M	8/6
6K25	12/-
6L5G	6/-
6L6	9/-
6L6G	6/-
6L6GA	7/6
6L7G	4/-
6L34	4/6
6LD20	5/9
6N7	6/-
6N7G	5/9
6Q7G	6/-
6R7	5/6
6SA7	7/-
6SA7GT	6/6
6SK7GT	4/-
6SC7 7/-	7/-
6SC7GT	5/-
6SG7	5/-
6SFGT	5/6
6SH7	3/-
6SJ7	5/-
6SJ7GT	5/6
6SJ7G	6/6
6SK7	4/6
6SL7GT	5/6
6SN7	8/6
6SQ7	6/-
6SS7	2/-
6U4GT	9/6
6V6G	5/-
6V6GT	5/6
6V6M	8/-
6X4	3/6
6X5G	5/-
6Z5GT	5/3
6Y6G	6/-
6-30L2	10/-
6Z4	5/-
7B7	7/6
7C5	10/-
7C6	7/-
7C7	6/-
7H7	7/3
7Q7	7/-
7V7	6/-
7Z4	4/6
8D2	2/6
9D2	3/-

9D6	3/6
11E3	37/6
12A6	2/6
12AH7	5/-
12AH8	11/-
12AT7	4/-
12AU7	5/-
12AX7	6/-
12AY7	10/-
12BA6	5/6
12BE6	7/-
12BH7	7/-
12C8	3/-
12H6	2/-
12J5GT	2/6
12J7GT	6/6
12K7GT	2/-
12K8M	10/-
12Q7GT	3/3
12SA7	7/-
12SC7	4/-
12SG7	3/-
12SH7	3/-
12SJ7	5/-
12SK7GT	3/-
12SNTGT	5/9
12SR7	5/-
12Y4	2/-
12L7	7/-
15D2	6/-
19E2	15/-
19G3	10/-
19G6	9/-
19G7	5/-
19H1	6/-
19M1	5/-
20P4	13/-
21B6	9/-
25L6GT	5/6
25Y5	6/-
25Z4G	6/6
25Z5	7/6
25Z6GT	8/6
28D7	6/-
30	5/-
30C15	9/6
30F5	8/6
30FL1	10/6
30P19	12/-
30PL1	8/-
3516GT	7/-
35T	17/6
35W4	5/-
35Z3	8/-
35Z4GT	6/-
35Z5GT	6/-
37	4/-
38	4/-
41MP	4/-
44A/160N	30/-
215SG	6/-
50L6GT	8/-

53A	7/6
57	6/-
58	6/-
59	6/-
75	5/6
76	5/-
77	6/6
78	5/-
80	5/6
81	9/-
82	8/-
84	8/-
85A2	8/-
210VPT 7-pm	2/6
220PA	7/-
220TH	4/-
225DU	9/-
307A	5/6
310C	25/-
350B	8/-
357A	70/-
368A	5/-
393A	15/-
446A	8/-
703A	30/-
705A	10/-
715B	60/-
717A	8/-
724A	15/-
801	6/-
803	22/6
805	30/-
807	8/-
808	8/-
811	17/6
813	68/-
815	35/-
829A	30/-
829B	50/-
830B	4/-
832A	45/-
832	15/-
837	9/-
843	5/-
860	10/-
866A	14/-
884	10/-
954	4/6
955	2/6
956	2/-
957	5/-
958A	4/-
1612	5/-
1616	3/-
1619	5/-
1622	12/-
1625	6/-
1626	3/-
1629	4/6
2051	5/-
4043C	13/6
4063	8/-
4313C	30/-

5704	9/-
5726	6/-
6064	7/-
6065	6/-
6080	22/-
7193	1/9
7475	2/-
8013A	25/-
8020	8/-
9001	3/-
9002	4/6
9003	6/-
9004	2/6
9006	2/6
C.R. Tubes	
CV1596 (09J)	55/-
E4504/B/16	28/-
VCR97	28/-
VCR138	30/-
VCR138A	40/-
VCR139A	35/-
VCR517B	40/-
VCR517C	40/-
5FP7	45/-
5CP1	30/-
5FP7A	12/-
Photo Tubes	
CMG8	5/-
GS16	12/6
931A	55/-
6097C	350/-
Special Valves	
ACT6	£8
ACT9	£12
K301	£4
KRN2A	£3.10.0
1B24	25/-
2J22	£3.10.0
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417A	30/-
3J/92/E	£37.10.0
714AY	£4
723A/B	50/-
725A	30/-
726A	19/-
Transistors	
OC44	6/-
OC45	7/-
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***MANY OTHERS IN STOCK** include Cathode Ray Tubes and Special Valves.* All U.K. orders below £1 P. & P. 1/-; over £1, 2/-; over £3, P. & P. free. Owing to 15% surcharge a few of these valves will be increased by 10%. C.O.D. 2/6 extra. Overseas Postage extra at cost.

MARCONI COMMUNICATION RECEIVER CR 150/2 Frequency coverage 1.5-22 Mc/s in 4 bands. Two IF's 1st 1,600 kc/s, 2nd 463 kc/s. Image signal protecting over 40 dB up to 30 Mc/s and 20-40 dB from 30-60 Mc/s. Self-checking calibration (built-in calibrator). Stabilisation of supply and temperature compensation. Electrical and mechanical bandspread. Metering and visual tuning indicator. Bandpass from 100 cs/ to 10 kc/s in 5 stages. Acoustic filter associated with 100 c/s. Bandpass position for CW reception. Facilities for diversity reception. Excellent checked condition £35. Mains P.S.U. by P.C. Radio £4.10.0. Carr. 30/-.

SEALED HI-SPEED SIEMENS RELAYS 1700 x 1700 ohms 15/- P. & P. 1/6.

P. C. RADIO'S mains PSU for above 90/-.

SIGNAL GENERATOR MARCONI TF 995A-1. Range 1.5-220 Mc/s in 5 bands. Output voltage variable in 1 dB steps from 1μV to 100 mV. Carrier may be unmodulated, frequency modulated, amplitude modulated, or simultaneously frequency and amplitude modulated. Frequency deviation is variable from 25-600 kc/s for FM and modulation (internal or external) up to 50× for A.M. Crystal calibrator for checking frequencies incorporated. Incremental frequency control. Fully checked and guaranteed. Price £88.15.0. Carriage in U.K. 30/-.

VARIOMETER FOR No. 19 SET 17/6 each. P. & P. 3/-.

TELEPHONE HANDSET. Standard G.P.O. type, new, 12/-. P. & P. 2/-.

CARBON INSET MICROPHONE G.P.O. type 2/6. P. & P. 1/6.

WELL PROVEN RELIABLE COMMUNICATION RECEIVER P.C.R.2

(Made by Pye). 120 kc/s-350 kc/s. 525 kc/s-1600 kc/s. 6 Mc/s-22 Mc/s. Overall sensitivity 1-2μV. S/Noise ratio 10 dB at 6μV. Circuit incorporates an RF stage, two I.F. stages, tone control, A.V.C. antenna trimmer. 6V6 output. Set in fully working condition together with headphones and speaker plug.. £7.12.6. Carriage 15/-.

Ditto but with built-in power supply for 210-250v A.C. £9.19.6. Carriage 15/-.

CONNECTORS FOR TCS RECEIVER TRANSMITTER AND REMOTE CONTROL. with original plugs on both ends. New £1.17.6 each. P. & P. 2/6.

P.C. RADIO LTD

170 GOLDHAWK ROAD, W.12

Shepherd's Bush 4946

Open 9-5.30 p.m. Thursday 9-1 p.m.

EVERSHED MEGGER CIRCUIT TESTER. 2 ranges 0 to 1,000Ω, 100Ω to 200,000Ω. With test leads, leather carrying case. Tested £4.19.6. P. & P. 3/6

32/44ft. AERIALS each consisting of ten 3ft. ½in. dia. tubular screw-in sections. 14ft. (7 section) whip aerial with adaptor to fit the ½in. rod, insulated base, stay place and stay assemblies, pegs, reamer, hammer etc. Absolutely brand new and complete, ready to erect, in canvas bag £2.19.6. P. & P. 10/6.

AR88D RECEIVERS. Fully reconditioned, £55; rebuilt models, £85; brand new, £95. Carriage paid U.K.

CHR HIGH RESISTANCE HEADPHONES. New, 14/-. P. & P. 1/6.

PANEL METERS (round)

0-50 microamps	2½"	D.C.**	40/-
0-100 microamps	2"	D.C.**	35/-
0-100 microamps	2½"	A.C.	30/-
0-200 microamps	2"	D.C.	32/6
0-500 microamps	2½"	D.C.	30/-
0-500 microamps	3½"	D.C.	37/6
0-1 mA*	2"	D.C.	19/6
0-1 mA	3"	D.C.	35/-
0-1 mA	3"	D.C.**	35/-
0-5 mA	3"	D.C.	45/-
0-100 mA	3½"	A.C.	22/6
150-0-1,500 mA	3"	D.C.	29/-
0-500 mV	3½"	D.C.	32/6
0-5 V	3½"	A.C.	22/6
0-15 V	2"	A.C.	17/6
0-50 V	2½"	D.C.	28/-
0-150 V	2½"	A.C.	24/-
0-500 V (shunt)	2½"	D.C.	20/-
0-10 kV	2½"	D.C.	63/-

*"Weston", as usually used in H.R.O. as "S" meter. **Projection type.

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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 13¾x8¾x5½in. 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 17x7¼x10in. 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 mths. 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 2¼in. speaker. Socket for personal earpiece. Works from PP3 type batt. tunable over full medium waveband. Supplied comp. with earpiece, carrying purse and 9-volt batt. Ideal present. WIRECOMP'S 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 1⅘ x 1³⁄₁₀ 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 2½in x 1⅝in. x 1in. 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

- 5in. Double play, 1,200ft. 15/-
- 5¾in. Long play, 1,200ft. 15/-
- 5¾in. Double play, 1,800ft. 22/6
- 7in. Stand. play, 1,200ft. 12/6
- 7in. Long play, 1,800ft. 19/6
- 7in. Double play, 2,400ft. 25/-
- 3in. Triple play, 450ft. 12/6
- 4in. Triple play, 900ft. 22/6
- 5in. Triple play, 1,800ft. 42/6
- 5¾in. Triple play, 2,400ft. 55/-
- 7in. Triple play, 3,600ft. 75/-

ACETATE BASE

- 5in. Long play, 900ft. 10/-
- 5¾in. Long play, 1,200ft. 12/6
- 7in. Long play, 1,800ft. 15/-
- 3in.—150ft. 3/6
- 3in.—225ft. 4/11
- 3in.—300ft. 7/6

P.V.C. BASE

- 5in. Standard play, 600ft. 8/6
- 5¾in. Stand. play, 840ft. 11/6

P. & P. 1/- extra per reel. 4 reels and over Post Free.

NEW BRANCH NOW OPEN

Personal callers invited to our new London branch—**323 Edgware Road, W.2** Tel. AMB 7115

Full range of the latest Hi-Fi equipment, components, etc.

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Thousands of bargains: Transistor Radios—Record Players—Tape Recorders—Radiograms—etc.

Stocks constantly changing—Rock Bottom Prices

SUPER TAPE RECORDER OFFER

SIEMENS STEREO TAPE RECORDERS

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 7" 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.

MODEL 12 (illustrated) self contained portable with 2 built in speakers. List price 94 gns.

WIRECOMP'S PRICE **59 GNS.** Carr. and Ins. 15/-

MODEL 10 self contained portable recorder with one built in speaker. List price 89 gns.

WIRECOMP'S PRICE **52 GNS.** Carr. and Ins. 15/-

MODEL 14 built on a contemporary styled wood plinth with one built in speaker. List price 87 gns.

WIRECOMP'S PRICE **49 GNS.** Carr. and Ins. 15/-

THE "REALISTIC" 7

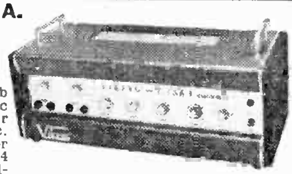
Transistorised Portable Receiver made to the highest professional standard. Comprises 7 Mullard Trans. plus Crystal Diode. 350 milliwatt output to 4in. speaker.—I.F. frequency 470 Kc/s—fully tunable over medium and long wavebands. Two-tone plastic cabinet with handle—size 7 x 10 x 3½in. fitted socket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

MAY BE BUILT FOR **£5.19.6** All parts sold separately Battery 3/9 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.

GUITAR AND P.A. AMPLIFIER

THE VIKING "TRANSISTOR 50"



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.

WIRECOMP'S PRICE **45 GNS.** Carr. and Pack. 10/6

ALSO VIKING SOUND 30—30 watt valve model. 8 inputs, 4 sep. vol. controls plus bass and treble. 15Ω out. PRICE 35 GNS. Carr. and Pack. 7/6.

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Hours of Business: 9 a.m. to 6 p.m. Open all day Saturday. Opposite Paddington General Hospital. Buses 18B and 36 pass the door.

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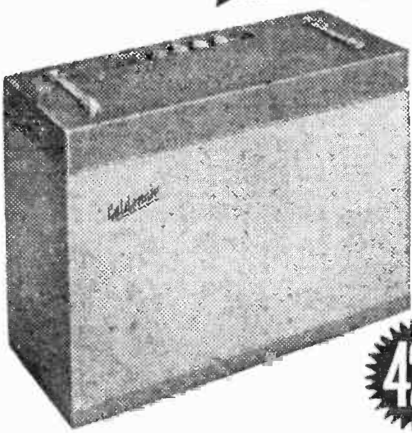
The Goldenair GROUP-MASTER 30 WATT AMPLIFIER



A VERSATILE UNIT FOR INSTRUMENTALISTS AND VOCAL GROUPS
being suitable for clubs and public address

Ideal for bass, lead or rhythm guitar, and all other musical instruments.

- ★ The two 12 inch 25 watt heavy duty loudspeakers are specially designed for this type of amplifier, and give outstanding reproduction.
- ★ Robust attractive two-tone finished cabinet of compact size, 28" x 20" x 10¼" fitted with carrying handles.
- ★ For standard AC mains 50 c/s operation.
- ★ Four inputs provided can be used simultaneously with instrument pickups or mikes.
- ★ Separate Bass and Treble controls are incorporated.

Full 12 months guarantee

GO GOLDENAIR Twice the Quality at Half the Price

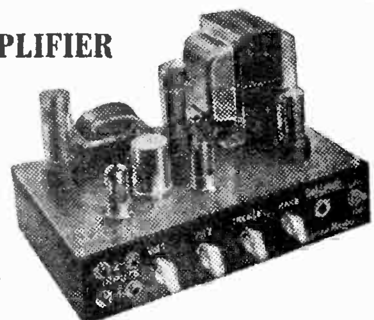
42 GNS

Customers are invited to see and hear this amplifier at our shop premises in Lambert's Arcade. *Send S.A.E. for leaflet.*

or deposit of £4.12.0 and twelve monthly payments of £3.12.5.

Carriage and insurance 25/- to be sent with deposit.

The Goldenair "THIRTY" HI-FI AMPLIFIER



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 pickup.

Valve line-up: two EF86; one ECC83; one GZ34; two EL34.

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.

Perforated cover with carrying handles can be provided if required price **21/-**

Full 12 months guarantee

16 GNS

Customers are invited to see and hear this amplifier at our shop premises in Lambert's Arcade.

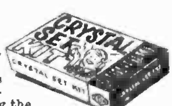
Send S.A.E. for leaflet.

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

TANK AERIALS

Fully interlocking copper rods, one foot sections. Ideal for car or scooter aerials, will make excellent dipoles. Six sections complete with canvas carrying case. Price 3/6. P. & P. 1/6.

CRYSTAL SET



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 25/- P. & P. 2/6.
An Ideal Christmas present for the children

PLUG-IN DISCRIMINATOR UNITS

Used as pulse count demodulators for FM. Compact and lightweight. Size approx. 4 x 2¼ x ¾in. containing 185 valve F.M. Demod. Coil, tag board with 6 miniature capacitors and 6 miniature resistors. Price 7/6 each. P. & P. 1/6

19 SET TX/RX MAINS POWER PACK

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.

LOUDSPEAKERS

TYPE 1. Model G.G.25. A heavy duty loudspeaker by famous manufacturer. Diameter 12in. Frequency response 60-5,000 c.p.s. Power handling 25 watts. Impedance 15 ohms. Ideally suitable for Bass instruments used with high power amplifiers. Price £9.19.6. P. & P. 5/-. Send S.A.E. for leaflet.

TYPE 2. A 12in. Heavy Duty Loudspeaker unit. 25 watts power handling. Frequency response 30-14,000 c.p.s. Pure aluminium cast frame. British made by famous manufacturer. Price 5 gns. P. & P. 5/-. Send S.A.E. for leaflet.

CONSTRUCTORS PARCEL NO. 1

Ten assorted working valves. 50 assorted resistors. 6 assorted pots. 1 smoothing choke. 5 assorted mains metal rectifiers. 10 assorted valve holders. 6 wafers for making wave change switches. 1, 5-foot copper rod aerial. 2 gov. surplus jack plugs. 2 panel mounting fuse holders. All for 19/11. P. & P. 5/-.

SONA SOUNDMASTER TRANSISTORISED MIXER

A compact, ultra modern, four channel, fully transistorised microphone mixer, which permits the mixing of up to 4 instruments, i.e. Mic., Tape, Gram., Tuner, etc. Self-contained and operating from a standard 9v. battery. Handsomely finished case. Inputs and outputs take standard plugs. Price 47/6. P. & P. 2/6.

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Comprising insulated leads and test prods., insulated croc. clips and meter terminal connectors. All contained in plastic holdall. Price 9/11. P. & P. 1/3.

CONSTRUCTORS PARCEL NO. 2

All brand new items, not Government surplus. Six Phono Plugs, 2 continual plugs 3 and 5 pin. 12 small croc. clips, 12 large croc. clips, 24 assorted new resistors, 3 pointer knobs, 3 coax plugs, 6 sheets of paxolin approx. 6 x 4in., two sturdy panel mounting fuse holders, six multi-cored solder packs, one copper laminate board, one 30 watt lightweight soldering iron. Price 29/11. P. & P. 3/6.

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Two stations for

£9.10.0 Post free

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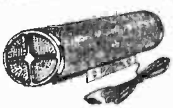

Booster Speaker. Plugs into earpiece socket of most radios and tape recorders. Gives double the volume and a hi-fi stereo effect that will amaze you. Size approx. 9 x 2½in. Price 25/-. P. & P. 2/6.

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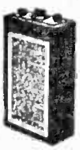

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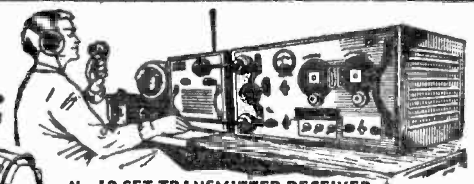

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T.X.: 6K8 mixer. B.F.O., EF50 buffer, EB34 ADC, and output stage which has to be decommissioned to conform with GPO requirements. Transmitter/Receiver 229/241 Mc/s. Local use up to 1 mile. Valve line-up CV5, 6K7 and 6V6. Intercom set 2 valve A.F. amplifier for vehicle crew inter-communication. Valve line-up 6K7 and 6V6. A 2¼in. meter is built in reading L.T. and H.T. voltages. drive etc.

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Whip Aerials 8ft. 6in.	..	7/6 P. & P. 2/6
5ft.	.. ..	4/6 P. & P. 2/6

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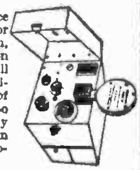

A useful piece of equipment for the radio ham, this precision equipment will produce an oscillatory current of freq. range 20 to 100 Mc/s simply by plugging in one of the appropriate coils that are provided with the set. Contained in a robust metal case. The unit has a built-in 6 to 250 volt Power Pack, plus many items, including valves, tuning condensers, transformers and vibrators. Price 25/- each. P. & P. 10/- or 2 for 55/-, post free.

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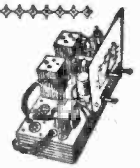

These well-made radio receivers were made for the Government for Forces entertainment. Valve line-up: 6K8, 6K7, 6Q7 and 6V6. Choke smoothing, slow-motion tuning, printed scale 200—550 metres, complete with all valves and 6 v. power pack. Provided with a robust cabinet and an 8in. speaker to fit. Only £3.19.6. P. & P. 10/-. Few only left.

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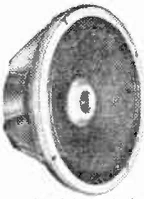

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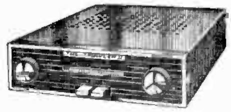

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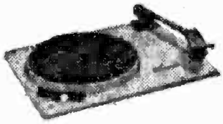

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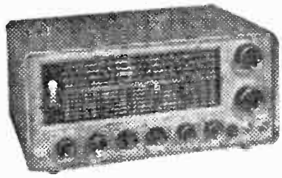

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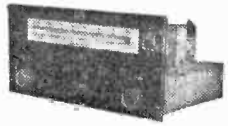

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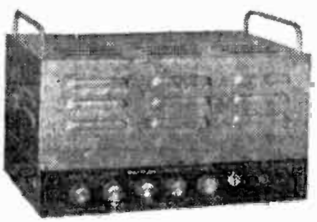

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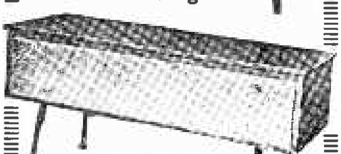

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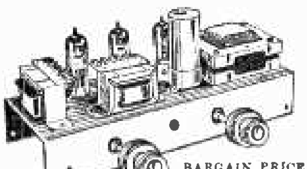

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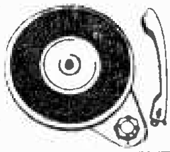

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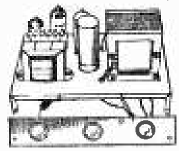

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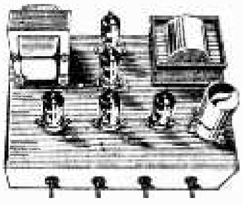

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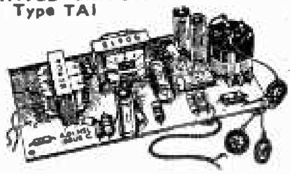

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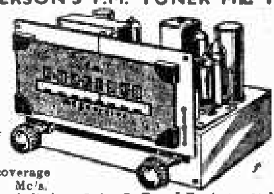

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6BX6 4/-
6C4 2/3
6C5 4/-
6C6 3/-
6C8 3/-
6C9 10/9
6C10 8/-
6C12 6/-
6CD6G 18/-
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6CW4 24/-
6D1 1/6
6D3 9/6
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6E5 9/6
6F1 9/6
6F6G 3/9
6F6GT 7/6
6F7G 5/-
6F8 5/-
6F11 17/9
6F12 3/-
6F13 3/9
6F14 23/3
6F15 6/9
6F17 12/6
6F18 13/5
6F23 6/3
6F24 9/6
6F32 3/-
6F33 3/6
6G6 2/6
6H6 1/6
6J5G 3/-
6J5GT 4/3
6J6 3/-
6J7G 4/6
6J7GT 7/-
6J8 12/6
6K6GT 5/6
6K7G 1/3
6K7GT 4/-
6K8G 3/3
6K8GT 7/9
6K25 24/-
6L1 10/-
6L5G 12/6
6L6G 6/6
6L7GT 4/6
6L18 10/-
6L19 19/-
6LD3 6/6
6LD13 7/-
6LD20 5/6
6N7GT 5/-
6P1 9/3
6P25 6/9
6P26 9/-
6P28 11/6
6Q7G 4/-
6Q7GT 7/9
6R7G 5/3
6R7GT 11/-
6SA7 5/9
6SC7 4/9
6SG7 4/9
6SH7 3/-
6SJ7 4/6
6SK7 4/6
6SL7 5/3
6SN7 4/-
6SQ7 5/-
6SR7 12/6
6SS7 2/-
6U4GT 8/6
6U5G 5/-
6U7G 7/-
6V6G 3/9
6V6GT 5/6
6X4 3/9
6X5 4/6
6Y7G 12/6
6Z4 5/-
6Z5G 15/-

7A7 12/6
7B6 12/6
7B7 7/-
7C5 8/-
7C6 6/9
7C7 5/-
7D3 15/-
7D5 14/6
7D6 14/6
7H7 5/9
7R7 12/6
7V7 5/-
7Y4 5/-
8D2 2/6
9BW6 9/6
9D2 3/-
9D7 7/6
10C1 8/9
10C2 12/3
10D1 7/-
10D2 11/8
10F1 10/-
10F9 9/9
10F18 9/9
10LD3 6/3
10LD11 9/6
10P13 8/3
10P14 11/6
11D3 17/6
11D5 17/6
11E1 15/-
11E3 17/-
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12H6GT 1/6
12J5GT 2/6
12J7GT 7/3
12K5 10/-
12K7GT 3/6
12K8GT 9/-
12Q7GT 3/6
12SA7 6/9
12SC7 4/-
12SG7 3/-
12SH7 3/-
12SJ7 5/-
12SK7 3/-
12SQ7 8/-
12SR7 5/-
12U5G 7/-
13D1 5/-
13D3 5/6
14B6 20/9
14H7 9/6
15D2 6/-
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19 10/6
19AQ5 7/3
19BG6G 20/5
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20L1 12/6
20P1 12/6
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EBF83 7/3
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ECC31 7/3
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EL33 6/9
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EL37 12/3
EL41 7/3
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EY83 9/3
EY84 9/6
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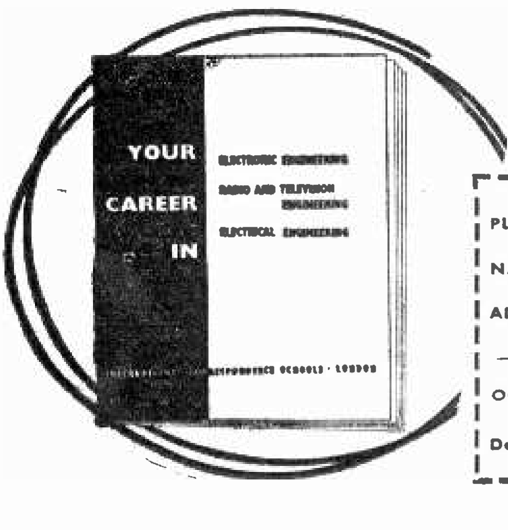

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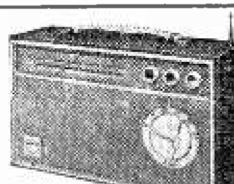
This conversion is suitable for both models that have already been constructed.

The SKYROVER DE LUXE



Tone Control Circuit is incorporated with separate Tone Control in addition to Volume Control. Tuning Control and Waveband Selector. In a wood cabinet size 11½ x 6¾ x 3in. covered with a washable material with plastic trim and carrying handle. Also car aerial socket fitted.
Can now be built for **£10.19.6**
P. & P. 5/-.
H.P. Terms: 25/- deposit and 11 months at 20/-.

Data for each Receiver 2/6 extra. Refunded if you purchase the parcel. Four U2 batteries 3/4 extra.
All components Available Separately.

The "Sixteen" Multirange METER KIT

This outstanding meter was featured by *Practical Wireless* in the Jan. '64 issue. Lasky's are now able to offer the complete kit of parts as specified by the designer.
RANGE SPECIFICATION: D.C. volts: 0-2.5-25-50-250-500 at 20,000 Ω/V A.C. volts: 0-2.5-50-250-500 at 1,000 Ω/V. D.C. current: 0-50μA, 0-2.5-50-250 mA. Resistance: 0-2,000 Ω, 0-200 Ω:c. 0-20M Ω Basic movement: 40μA f.s.d. moving coil. With universal shunt full scale deflection current is 50μA. Size/finish: Black plastic case, 3¾ x 5¾ x 1⅞in. Controls: 12 position range switch: separate slide switch for A.C. volts—D.C. ohms; ohms zero adjustment pot. meter; meter zero. External connections: Two 4mm. sockets for test lead plugs. Power requirements: One 15V. and one 1.5V. batteries. Complete with all parts and full construction details.
Data and circuit available separately 2/6 refunded if all parts bought. Pair of Batteries. 2/5 extra.

LASKY'S PRICE £5.19.6 P. & P. 5/- H.P. Terms: 21/- deposit and 5 months at 21/-.

NEW SINCLAIR SUPER MINIATURES

THE MICRO-6

Self-contained pocket radio. Size only 1⅘ x 1³⁄₁₀ x ½in. A marvel of modern miniaturisation—truly amazing performance. Without a doubt the most advanced transistor circuit ever offered to home constructors—yet may be built in an evening. Complete with earphone and detailed construction data. Mercury cell 1/11 extra (2 required).
Can be built for only **59/6** All parts sold separately.

THE SLIMLINE

The new 2-transistor pocket radio. Size only 2¼ x 1¾ x 1¾in. Micro alloy transistorised and printed circuit. All components available separately. Easy to assemble. CAN BE BUILT FOR **49/6**

THE X10

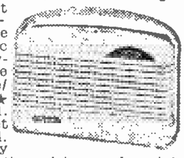
10 watt power amplifier fitted with integrated pre-amplifier. Requires only 1 mV. for an output of 10 watts undistorted. Frequency response is flat ½ dB from 5 c/s. to 20 kc/s. Size only 6 x 3 x ⅞in. Weight 5 oz. Built on printed circuit. Operates from 12 v. D.C. at 75 mA. quiescent. Circuit uses 7 M.A.T.s and 4 RF power transistors. KIT PRICE **£5.19.6** Post Free
AVAILABLE READY BUILT, TESTED AND GUARANTEED, £6.19.6. Post Free.
3 pots. for volume, Bass and Treble. 7/6 the 3 extra. Mains power pack, if required, 54/-

E.M.I. 4-SPEED RECORD PLAYER

New, unused and individually boxed fitted with lightweight pick-up with ACOS G P. 73/2 stereo cartridge. Cabinet space required 13½ x 12¼ x 4½in. A 9in. metal turntable is fitted. For use on 200/250 volt A.C. Mains, with Auto-stop. The stereo cartridge will play all types of Mono Records, 78's L.P.'s etc.
LASKY'S PRICE 79/6 P. & P. 3/6 extra

The "REALISTIC" Seven

★ 7-transistor Superhet. ★ 350 milliwatt output into 4in. high flux speaker. ★ All components mounted on a single printed circuit board. ★ Full medium and long wave cover. ★ Plastic cabinet with carrying handle, size 7 x 10 x 3½in., Blue/Grey or all Grey. ★ Easy to read dial. ★ External socket for car aerial. ★ I.F. frequency 470 Kc/s. ★ Ferrite rod internal aerial. Operates from PP9 or similar battery. ★ Full comprehensive data supplied with each receiver. All coils and I.F.'s etc. fully wound ready for immediate assembly.

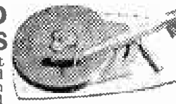


An Outstanding Receiver. LASKY'S PRICE for the complete parcel including Transistors, Cabinet, Speaker, etc., and Full Construction Data. Can be built for **£5.19.6** P. & P. 4/6
PP9 Batt. 3/9. Data and Instructions separately 2/6. Refunded if you purchase the parcel.

REALISTIC Seven DE LUXE

With the same specification as standard model—PLUS a superior wood cabinet in contemporary styling. ALSO a full vision circular dial.
FOR ONLY **£1** EXTRA
P. & P. as std. model.

RECORD PLAYERS



45 r.p.m. 6 volt Batt. operated Complete with pick-up fitted crystal cartridge. Size only 7¼in. x 6in. Fitted auto. stop and start. New and perfect.
45 r.p.m. Model **49/6** P. & P. 2/6
2 speed model for 33 and 45 r.p.m. (as illustrated) **59/6** P. & P. 2/6

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GET S1, GET S5, GET S6, 2/6; 873A, 874P 3/6; OC45, OC71, OC81D 4/6; OC44, OC70, OC76, OC81 (match pair 10/6) 5/6; AF117, OC75, OC170, OC200 6/6; OC42, OC43, OC73, OC82D 7/6; OC201, OC204 15/-; OC205, OC206 19/6; OC28 24/6.

TRANSISTORISED TELEPHONE AMPLIFIER

Powerfully amplifies the incoming call. The pick-up is suction fixed to phone. Battery-operated at negligible cost. Fitted with on/off switch and vol. control. Size: 4½ x 3 x 1⅛in. Complete with PP3 battery. LASKY'S PRICE 69/6. P. & P. 2/6.

GUITAR PICK-UPS

CGM5 Crystal-high imp. Size only 1⅛ x ⅞ x ½in. Clips to finger board—no screws. Complete with cable.
LASKY'S PRICE 15/11. P. & P. 1/-.
CG M35. Fully adjustable pick-up position carrier. Simply fixed. Separate tone and volume control. Heavy chrome finish. Pick-up size 3¾ x 1⅛in., control size 2½ x 1⅛in. Complete with long lead and jack plug. LASKY'S PRICE **59/6** P. & P. 1/6

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SPEAKER OFFERS ! ! !

FANE 12in. Type 122/17

Shown right. Listed at £11.17.6. Power handling 25 watts—15 ohms imp. Flux density 17,000 gauss. Special Aniso-triple magnet. Limited stock.

LASKY'S PRICE £5.19.6 P. & P. 5/-

WHARFEDALE WNA. 12

12"—15 Ω impedance. Flux density 14,000 oer'ds. Max. input 30 watts peak. Frequency range 25—4,000 c.p.s. Cone fitted with roll surround.

WHARFEDALE SUPER 5

5"-mid-range and high frequency speaker. 15 Ω impedance. Frequency range 300-17,000 c.p.s. Aluminium voice coil.

These two speakers provide an ideal matched pair for a full range Hi-Fi speaker system. Both brand new and individually boxed.

LASKY'S PRICE £12.19.6 THE PAIR (P. & P. 10/- extra.)

THE HARROW CV1 VARIABLE CROSSOVER

Gives variable volume control of Woofer and Tweeter. Strong metal construction. Size 4 x 2¾ x 1½in. Screw tag connections.

LASKY'S PRICE 22/6 P. & P. 1/6.

NOW IN STOCK THE NEW STUDIO RANGE OF CELESTION HI-FI SPEAKERS

TRANSISTORISED MICROPHONE MIXER

The Harrow will mix 4 high impedance channels; mikes, tape rec's, tuners, grams, etc. 9 v. battery operated. Neatly styled, size only 6 x 2½ x 2½in. Standard Jack sockets. Complete with PP3 batt., full circuit diagram and operating instructions.

Model TM4 Mono 59/6 P. & P. 2/6

Model SM5 Stereo 72/6 P. & P. 2/6

"HARROW" POWER PACK

Battery eliminator—converts your battery portable to A.C. mains. Replaces 6 v. 4½ v. or 9 v. batteries. State voltage required when ordering. Size only 3 x 2 x 2½in.

LASKY'S PRICE 29/6 P. & P. 1/6

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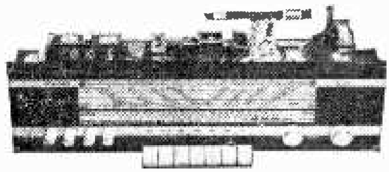
Famous American Brand—Fully Guaranteed

	s.	d.
5in. Double play, 1,200ft., Mylar base	15	0
5in. Long play, 900ft., Acetate base	10	0
5in. Standard play, 600ft., P.V.C. base	8	6
5¾in. Long play, 1,200ft., Mylar base	15	0
5¾in. Double play, 1,800ft., Mylar base	23	6
5¾in. Long play, 1,200ft., Acetate base	12	6
5¾in. Standard play, 850ft., P.V.C. base	11	6
7in. Standard play, 1,200ft., Mylar base	12	6
7in. Long play, 1,800ft., Mylar base	19	6
7in. Double play, 2,400ft., Mylar base	25	0
7in. Long play, 1,800ft., Acetate base	15	0
3in. Message tape, 150ft.	3	6
3in. Message tape, 225ft.	4	11
3in. Message tape, 300ft.	7	6
3in. Triple play, 450ft., Mylar base	12	6
4in. Triple play, 900ft., Mylar base	22	6
5in. Triple play, 1,800ft., Mylar base	42	6
5¾in. Triple play, 2,400ft., Mylar base	55	0
7in. Triple play, 3,600ft., Mylar base	75	0

P.&P. 1/- extra per reel; 4 reels and over Post Free



THE NEW "KUBA" IMPORTED AM/FM STEREO RADIOGRAM CHASSIS

Long, medium and short waveband coverage plus VHF/FM. Piano key wave-change. Separate flywheel tuning on AM and FM Bass, treble and balance controls. Magic-eye tuning indicator. Ferrite rod aerial. The very latest printed circuitry. Provision for multiplex adaptor. 5 valves—line-up: ECC85, ECH801, ECC83, ELL80, EAF801. Full vision tuning scale, size 21 x 6in. Overall dimensions: 21 x 6¼ x 8in. Made to the very highest standards.

LASKY'S PRICE 29½ GNS. Carriage & Insurance 12/6 extra.

SUPER TAPE RECORDER OFFER

SIEMENS STEREO TAPE RECORDERS

High precision machines offering a maximum of facilities for the enthusiast and connoisseur. Exceptional fine performance standards ensuring superb reproduction. All models have the following general specification: ★ Completely self contained. Record, replay and Audio amplifiers built in. ★ All transistorised—no warming up period. ★ Three heads—separate record, replay, erase (also provides sound-on-sound recording). ★ Three speeds—7½, 3¾, 1⅞ i.p.s. ★ 4 tracks. ★ Takes 7" 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 2¼ watts per channel All brand new, boxed and fully guaranteed.

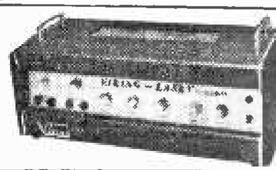
MODEL 12 (illustrated). Self contained portable with 2 built in speakers. List price 94 gns. **LASKY'S PRICE 59 GNS.**

MODEL 10 self contained portable recorder with one built in speaker.. List price 89 gns. **LASKY'S PRICE 52 GNS.**

MODEL 14 built on a contemporary styled wood plinth with one built in speaker. List price 87 gns. **LASKY'S PRICE 49 GNS.**

Carriage and Insurance 15/- extra on each.

VIKING "TRANSISTOR 50"



50 watt amplifier. 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 9in. Output imp. 15 ohms. For operation on 200/250v. A.C. mains.

LASKY'S PRICE 45 GNS. Carr. & Pack. 10/6

VIKING "SOUND 30"

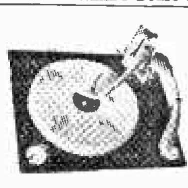
High quality guitar and P.A. amplifier. A.C. Mains operated—30 watt output. 8 inputs. Fitted with 4 separate volume controls for mixing, also Bass and Treble controls. 15 ohms out. British made—highest quality components used throughout—fully guaranteed. In strong portable case, size approx. 20 x 9 x 6in.

LASKY'S PRICE 35 GNS. Carr. & Pack. 7/6 extra.

THE BH-14 AMPLIFIER

High quality 14 watt power amplifier with bass and treble controls and separate volume controls on each input. Output 3 or 15 ohms. Valve line-up: 2 x EL84, 1 x EF86, ECC83 and EZ81. Frequency res. 15 c/s—20 Kc/s. Ideal for the hi-fi enthusiast or for guitar amplifier. Gold hammer finish with Perspex front panel. Complete kit of parts with detailed construction data. Instruction book avail. sep. 1/6. **LASKY'S KIT PRICE 9 GNS.**

AVAILABLE READY BUILT AND TESTED LASKY'S PRICE 11 GNS. Post and Packing 7/6



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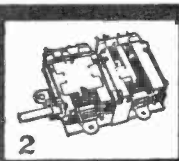
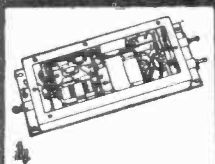
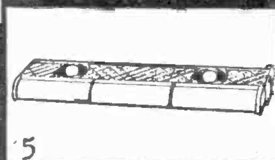
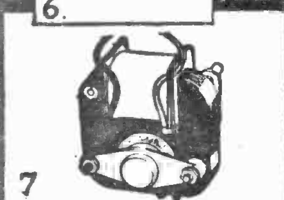


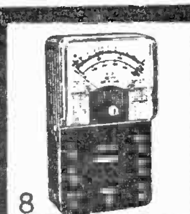


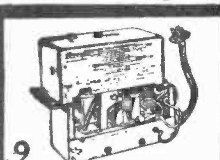
3 to 4 watt Amplifier Kit comprising chassis 8¾ x 2¼ x 1in. Double wound mains transformer, output transformer, volume and tone controls, resistors, condensers etc. Valves 6V6, ECC81 and metal rectifier. Circuit 1/6 free with kit. 29/6 plus 4/- P. & P.

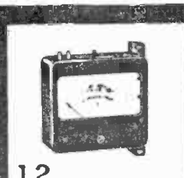
3

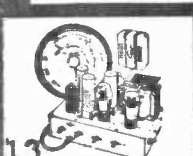


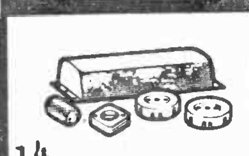


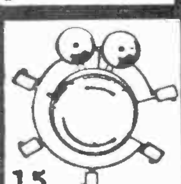


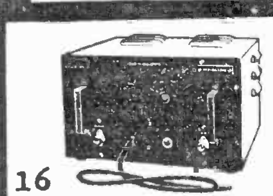












1. **6 VALVE 15 WATT PUSH-PULL AMPLIFIER,** 15 x 17 x 1½in. A.C. Mains 200-250 volts. 4 inputs with controls for same and bass and treble lift controls. Tapped for 3 and 15 ohm speakers. Extra H.T. and L.T. for F.M. Tuner supplies etc. Built and tested. 7 gns. P. & P. 12/6.

2. **CYLDON A.M. F.M. PERMEABILITY TUNER FOR ALL TRANSISTOR OPERATION.** Size 2½ x 2¼in. approx. By famous manufacturer. A.M. I.F. 470 Kc/s. F.M.-I.F. 10.7 Mc/s. A.M. coverage from 1620 Kc/s-525 Kc/s. F.M. coverage 108 Mc/s.-88 Mc/s. Circuit diagrams 2/6. FREE with Tuner, 1st, 2nd and 3rd A.M. I.F.'s, 1st, 2nd, 3rd and 4th F.M. I.F.'s V.H.F. Osc. choke, A.M. I.F. trap, A.F. 114 and A.F. 115. All the above are the R.F. end of an A.M./F.M. receiver car radio etc. The above six items, **£2.10.0.**

3. **AMPLIFIER KIT.**

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5. **FLUORESCENT LIGHT FITTING. Twin 40 watt 200/250 v. less tubes** 59/6. P. & P. 6/-.

6. **SIGNAL GENERATORS: Cash £7.5.0. P. & P. 6/6. Coverage 100 Kc/s** to 100 Mc/s on fundamentals and 100 Mc/s to 200 Mc/s on harmonics. Case 10 x 6½ x 5¼in. Three miniature valves and Metal Rectifier. A.C. mains 200/250v. Internal modulation of 400 c.p.s. to a depth of 30 per cent. Modulated or unmodulated R.F. output continuously variable 100 multivolts, C.W. and mod. switch, variable A.F. output. Magic eye as output indicator. Accuracy 2 per cent.

7. **A.C. MAINS MOTOR.** Can be used for a variety of purposes, silent running, satisfactory in every way. 230/250v. A.C., **9/6.** P. & P. 2/-.

8. **POCKET MULTI-METER.** Size 3¾ x 2½ x 1⅜in. Meter size 2¼ x 1¼in. Sensitivity 1,000 O.P.V. on both A.C. and D.C. A.C. and D.C. volts. 0-15, 0-150, 0-1,000. D.C. current 0-150 mA. Resistance 0-100K Ω. Complete with test prods, battery and full instructions, **39/6.** P. & P. 2/6. **FREE GIFT** for limited period only. 30 watt Electric Soldering Iron value **15/-** to every purchaser of the Pocket Multi-Meter.

9. **CHANNEL TUNER I.F.** 16-19 Mc/s. Continuously tunable from 174-216 Mc/s. Valves required—PCF80 and PCC84 (in series). Cover BBC and ITA ranges. Also Police, Fire and Taxis, etc. Brand new by famous maker, 10/-. P. & P. 3/-.

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 7 in. at 16, 33, 45 or 78 r.p.m. Intermixes 7in., 10in. and 12in. records of the same speed. Has manual play position: colour brown. Dimensions: 12½ x 10¾in. Space required above baseboard 4⅞in., below baseboard 2¾in. 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-up 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/-.

14. **FLUORESCENT LIGHT KIT.** Twin 20 choke instant start, complete with 4 bi-pin 200/250v. holders, **11/6,** P. & P. 4/-. Twin 40 choke instant start with 4 bi-pin 200/250v. holders, **17/6.** P. & P. 4/-.

15. **RINGO BURGLAR ALARM SYSTEM,** A.C. mains, 200/240 volts. Fire salvage slightly tarnished. List price 7 gns., Our price, complete with double gong bell, five micro switches and full instructions, **49/6.** P. & P. 4/-.

16. **FIXED FREQUENCY SIGNAL GENERATOR.** Crystal controls in metal case, size 10 x 6 x 6in. Incorporating two FC13 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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4in. SPEAKER

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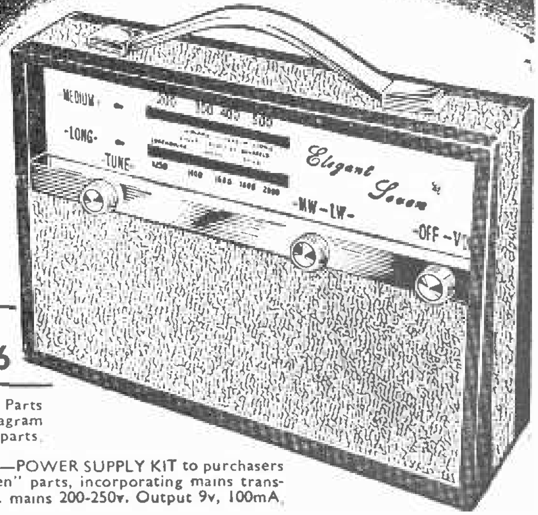
★ Two-tone grey wooden cabinet, fitted handle with silver coloured fittings. Size 12¼x8½x3½in.
★ Horizontal tuning scale size 11¼x2⅝in. in silver with black lettering.
★ All stations clearly marked.
★ Ferrite-rod internal aerial.
★ I.F. 470 K/cs.
★ Operated from PP9 battery.
★ Full comprehensive instructions and point-to-point wiring diagrams.
★ Printed circuit board, back printed with all component values.
★ Fully tunable over medium and long waveband.
★ Car aerial socket.
★ Full after-sale service.



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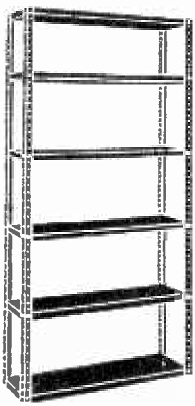

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BRAND NEW

C.W.O. or C.O.D. FREE DELIVERY within 14 days. N. Scotland, Ireland, I.O.M., 10% extra.

60/- 71in. high x 34in. wide 12in. deep with 6 shelves as illustrated.

Each shelf will hold over 3 cwt. Shelves adjustable every 2 in. Stove enamelled dark green. White enamel units 50% extra.

Height	Width	Depth	No. of shelves	Price	Price each 3 or more	Extra shelves
71 in.	34 in.	9 in.	6	58/-	56/-	7/-
71 in.	34 in.	12 in.	6	60/-	58/-	8/-
71 in.	34 in.	15 in.	6	69/-	67/-	9/6
71 in.	33½ in.	18 in.	6	81/-	79/-	11/6
85 in.	34 in.	12 in.	6	68/-	66/-	8/-
85 in.	42 in.	12 in.	6	86/-	84/-	11/-

Contractors to H.M. Govt. and United Kingdom Atomic Energy Authority. Exporters of Steel Shelving.

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Dept. P.W.
WATERFOOT — LANCS
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BARGAINS FROM BROADWAY ELECTRONICS

GARRARD A.T.6 Hi-Fi Autochanger G.C.8 mono cartridge—£.9.19.6, post free.
GARRARD AUTOSLIM 4 speed changer—**£6.10.0.** post free.
12in. ALTHAM SPEAKER with built in tweeter 3 ohm or 15 ohm 7,000 Gauss Magnet. Only **29/6**, postage 3/6.
HAYDON CABINET (17 x 15 x 8in.) designed to take a 12in. Heavy Duty Speaker. **50/-**, postage 7/6.
The Famous **B.M.3 XTAL MICROPHONE** with neck lanyard 30/- table stand for above **3/6** extra. Xtal insert **7/3.**
GUITAR PICK-UP complete with clip and screened lead—**12/6.**
3-WAY PUSH BUTTON UNITS Each button operates a 4-pole 2-way switch—**4/6.**
BARGAINS IN TRANSISTORS Mullard RF Packs OC44 two OC45, **12/6**; AF Packs OC81D two OC81, **8/6**; OC44, **3/6**; OC45, **3/-**; OC71, **2/6**; OC72, **3/-**; OA81 diode **2/3**; OC170, **6/6**; AF 117, **6/6**; ORP12, light cell, **7/6**; OC29, **12/6**; OC35, **12/6.**
TRANSISTOR ELECTROLYTICS 1, 2, 4, 5, 8, 10, 16, 32, 50, 100 Mfd. all at 15 volts—**1/3** each.
McMICHAEL TELESCOPIC TV AERIAL 23in. extends to 45ins. Fitted with coax plug, will suit any set. Only **7/6.**
CARTRIDGES Acos 67-1G Low Output, 67-2G Medium Output, GP59-5 High Output, Garrard GC2 or GC8 all with mounting bracket 15/-.
Ronette Stereo with mounting bracket, **25/-.**
EARPIECES with cord and 3.5mm plug. 8 ohm magnetic **3/-**; 250 ohm, **4/-**; 180 ohm magnetic with clip **6/6**; **Xtal, 4/-**; 3.5mm plugs with nice long shank complete with jack, **3/-.**
3.5mm plugs with nice long shank complete with jack **SCREENED,** 4/-.
TOGGLE SWITCHES Single pole with on/off plate, **2/6.**
NEON PANEL LIGHTS 240v. A.C. Arcolectric, **2/6.**

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QMAX CHASSIS CUTTER

Four parts; a die, a punch, an Allen screw and key

⅜in.	14/6	1⅛in.	18/-	2in.	34/3
½in.	14/6	1¼in.	18/6	2³/₃₂in.	37/9
⅝in.	15/6	1⁵/₁₆in.	20/-	2½in.	44/9
¾in.	15/9	1⅜in.	20/-	1in. sq.	31/6
1in.	18/-	1½in.	20/6	¹¹/₁₆in. sq. 28/-	
1¹/₁₆in.	18/-	1¾in.	22/6		

THE TRIPLETONE HI-FI MAJOR

PRICE ONLY £15.18.9 COMPLETE

Guaranteed 12 Months

A 12 watt amplifier with a pre-amp for mic. and mic./gram mixing. Frequency response ± 1 dB 15-20,000 c/s. Distortion only 0.15%, with noise and hum —80 dB. Separate Bass, Middle and Treble lift controls. Valve line-up, 12AX7, 12AX7, EL84, EL84 and EZ81. Push-pull output to 3 or 15 Ω. Fully isolated power supply from 200/250v. A.C. input. Size 12 x 5¾ x 6in. high.

De Luxe Case: 14in. x 9in. x 7½in., 30/- extra.

New R.C.S. Valves 90 day Guarantee

1R5	6/-	6Q7G	6/-	EBC41	8/-	PCL84	5/-
1S5	6/-	6SN7	5/-	EBC81	5/-	PL81	10/-
1T4	3/-	6V6G	5/-	EBF80	5/-	PL83	8/-
3S4	7/-	6X4	5/-	ECH42	9/-	PY80	7/-
3V4	7/-	6X5	6/-	ECH81	9/-	PY81	8/-
5U4	6/-	12AT7	6/-	ECL80	9/-	PY82	7/-
5Y3	6/-	12AU7	6/-	ECL82	10/-	SP61	3/-
5Z4	9/-	12AX7	7/-	EF183	7/-	U22	7/-
6AM6	4/-	12K7	5/-	EF184	7/-	UBC41	8/-
6AT6	6/-	12K8	14/-	EF86	10/-	UBC81	5/-
6BA6	7/-	12Q7	7/-	EF89	8/-	UBF89	5/-
6BE6	5/-	25Y5G	9/-	EL84	7/-	UCH81	9/-
6H6	3/-	35L6	9/-	EY51	9/-	UCL82	10/-
6J5	5/-	35Z4	5/-	EY86	9/-	EF89	5/-
6J6	5/-	954	2/-	EZ40	5/-	EL41	9/-
6J7G	6/-	DAF96	8/-	EZ80	7/-	UY41	5/-
6K6	5/-	DF96	8/-	EZ81	7/-	UY85	7/-
6K7G	5/-	DK96	8/-	MU14	7/-	UU9	7/-
6K8G	5/-	DL96	8/-	PC97	7/-	VR150	7/-
6N7M	5/-	EABC80	5/-	PCC84	8/-	W81	6/-
		EB91	4/-	PCF80	5/-		

I.F. TRANSFORMERS 7/6 pair
465 K/s Slug Tuning Miniature Can. 3x1¼in. dia. High Q and good bandwidth with Data Sheets.

NEW ELECTROLYTICS

TUBULAR		TUBULAR		CAN TYPES	
1/350V	2/-	50/350V	5/6	8/600V	9/-
2/350V	2/3	100/25V	2/-	16/450V	5/-
4/450V	2/3	350/25V	3/-	16/600V	12/-
8/450V	2/3	500/12V	3/-	16+16/500V	7/6
16/450V	3/-	1,000/12V	3/-	50/450V	6/-
32/450V	3/9	5,000/6V	5/-	32+32/350V	5/-
50/25V	1/9	8+8/450V	3/6	32+32/450V	6/-
25/50V	2/-	8+16/430V	3/9	50+50/350V	7/-
50/25V	2/-	16+16/450V	4/3	64+120/350V	11/6
50/50V	2/-	32+32/350V	4/6	100+200/275V	12/6

TELESCOPIC CHROME AERIALS, 12 to 33in., 6/6. **TRIPLEXERS** Bands I,II,III,12/6, **COAX PLUGS**, 1/-. **LEAD SOCKETS**, 2/-. **PANEL SOCKETS**, 1/-. **OUTLET BOXES** (Surface or flush), 4/- each. **BALANCED TWIN FEEDER** yd. 6d., 80 or 300 ohms. **TWIN SCREENED** per yd. 1/-, 80 ohms only. **Wire-wound Ext. Speaker Control**, 10 Ω 3/-, 25 Ω 6/6 **WIRE-WOUND POTS. 3 WATT.** Pre-set Min. TV Types. All values up to 10 ohms to 25K., 3/- ea. 30K., 4/-. (Carbon 30K to 2 meg., 3/-). **WIRE-WOUND 4 WATTS Pots.** Long spindle. Values from 50 ohms to 50K., 6/6; 100K. 7/6. **PHILIPS TRIMMERS.** 0-10 pF., 3-30 pF., 1/-. **TRIMMERS, Ceramic.** 30, 50, 70 pF., 9d.; 100pF 150pF., 1/3; 250pF., 1/6; 500pF., 750pF., 1/9. **TV etc. TRIMMERS.** 1000pF., with knob, 2/-. **RESISTORS. Preferred Values.** 10 ohms to 10 meg. 20% ¼ w., ½ w., 1 w., 4d.; 1½ w., 8d.; 2 w., 1/-. **High Stability.** ½ w., 1%, 2/-. Preferred values 10 Ω to 10 meg. Ditto 5% 10 Ω to 22 meg., 9d. **BRIMISTORS** CZ1. 3/6; CZ2, 2/6; CZ3, 1/6.

5 watt / 10 watt / 15 watt	**WIRE-WOUND RESISTORS** 10 ohms—10,000 ohms	1/3 / 2/- / 2/-

12.5K to 25K 10 w. 3/-
Toggle Switches. s.p., 2/-; d.p., 3/6; d.p.d.t., 4/-. Min. Slide d.p.d.t., 3/6.

Volume Controls Linear or Log Tracks Long spindles. Midget 5 K ohms to 2 Meg. L.S., 3/-. D.P., 4/6. Stereo L/S 10/6; D.P. 14/6 Lin. log +-Lin-A/log, 7/6.

80 ohm CABLE COAX Semi-air spaced ¼in. 40 yds. 17/6 60 yds. 25/- **6d. yd.** Ideal 625 lines. U.H.F. Low loss 5dB 100ft. 500 Mc/s **1/6yd.**

MAINS TRANSFORMER 200/250 v. A.C.
Postage 2/- each transformer
STANDARD 250-0-250, 80mA 6.3 v. 3.5 a. tapped 4 v. 4 a. Rectifier 6.3 v. 1 a., 5 v. 2 a. or 4 v. 2 a., 22/6, ditto, 350-0-350 29/6
MINIATURE 200 v. 20 mA, 6.3 v. 1 a. .. 10/6
MIDGET, 220 v. 45 mA, 6.3 v., 2 a. .. 15/6
SMALL, 250-0-250, 45 mA, 6.3 v. 2 a. .. 17/6
STD. 250-0-250. 65 mA, 6.3 v. 3.5 a. .. 17/6
HEATER TRANS., 6.3 v., 1½ a. 7/6
Ditto tapped 1.4, 2, 3, 4, 5, 6.3 V. .. 8/6
Ditto, sec. 6.3 v. 4 amp. 10/6
GENERAL PURPOSE LOW VOLTAGE, 2 amp. 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 24, 30 v. 22/6
AUTO TRANSFORMERS. 150 w. .. 22/6
0, 115, 200, 230, 250 v. 500 w. 88/6
MULLARD "510" Mains Transformer .. 32/6
MAINS POWER PACKS. Ready built with Transformers, Rectifiers, Condensers, providing H.T. and L.T. outputs.
200 v. 20 mA. D.C. 6.3 v. 1 a. A.C. .. 25/6
220 v. 50 mA, D.C. 6.3 v. 2 a. A.C. .. 35/6
250 v. 80 mA, D.C. 6.3 v. 3.5 a. tapped 4v and 6.3 v. 1 a. tapped 5 v., 4 v., 2 a. 45/6

INTERVALVE TRANSFORMERS. 3:1 or 5:1, 9/-. **O.P. TRANSFORMERS.** Heavy Duty, 5/6. Multi-ratio, 7/6. Multi-ratio heavy duty push-pull, 10 w. 18/6. Battery, 4/6. Sub min. DL96, 3v4, etc., 6/9. 10 w. output matching trans. 3, 7, 15 Ω, 12/6. **L.F. CHOKES**, 15/10H, 60/65 mA, 5/-; 10H. 85 mA. 10/6; 10H, 150 mA, 14/-.

C.R.T. BOOSTER TRANSFORMERS for heater cathode short or tubes with failing emission. Full instructions, mains input. **PRICE 10/6.** Post 2/-. **Type A optional 25% and 50% boost 2v. or 4v. or 6.3v. or 10.8v. or 12.6v. State voltage required.**

TINNED COPPER WIRE 14 to 24 swg., ½ lb. 3/-. **ENAMEL COPPER WIRE** 16-22, 2/9; 24-30, 3/6; 32-40, 4/6; D.C.C. 28, 34, 36, swg., 2oz., 3/6. **FULL WAVE BRIDGE SELENIUM RECTIFIERS:** 2, 6 or 12 v., 1½ amp., 8/9; 2 a., 11/3; 4 a., 17/6. **CHARGER TRANSFORMERS.** Tapped input 200/250 v. for charging at 2, 6 or 12 v., 1½ amps., 15/6; 2 amps., 17/6; 4 amps., 22/6. Circuit included. **AMMETER** 0 to 5a, 10/6.

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How to receive Foreign T.V. .. 5/-
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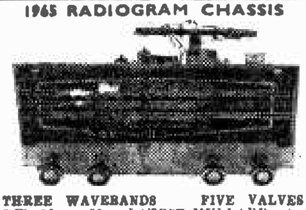
4 TRANSISTOR AMPLIFIER

A ready built miniature push-pull amplifier with Driver and output transformers, 4 transistors, for record players, intercoms., BABY ALARMS. Price **47/6** Complete instructions and circuit. 9v. Batt. 2/3. 2½in. Speaker 15/-.

1965 RADIOGRAM CHASSIS



THREE WAVEBANDS FIVE VALVES
S.W. 16m —50m. LATEST MULLARD, etc.
M.W. 200m —550 m. ECH81, EF89, EBC81
L.W. 800m —2,000m. EL84, EZ80
12-month Guarantee
A.C. 200/250 v. Short-Medium Long/Gram. Ferrite Aerial A.C.V. 3 ohm output 5 watts. **Tape Sockets.** Glass dial, horizontal wording size 13 x 7in. Aligned and calibrated isolated. Chassis size 13½in. x 7in. high x 5½in. deep.
£9.15.6 Carr. & Ins. 4/6.

BAKERS 'Selhurst'

25 WATT 5 Gns. 12" GUITAR HEAVY DUTY
15 OHM VOICE COILS
Response 20-10,000 cps
Bass Resonance 80 cps
Genuine Musical Instrument Loudspeaker

BAKERS 12in. STALWART 15w. 5 gns. 3 or 15 ohms voice coils. Unlimited applications. Response 45-13,000 cps. Magnet 12,000 lines.

BAKERS 12in. STANDARD 20w. 7 gns. More powerful magnet 14,000 lines special suspension. 40-14,500 cps. Recommended wherever a high standard of reproduction is desired.

BAKERS 12in. BASS 25w. 12 gns. New 1965 high power model. Aluminium coil former with magnetic damping 25-15,000 cps. Ideal for all electric guitars.

BAKERS 15in. AUDITORIUM 35w. 18 gns. Improved alcomax magnet with heavy plated assembly weight 16lbs., 17,000 lines, 20-12,000 cps. Heat proofed coil former.
Full repair service. Specials made to order. Older types up-dated. Re-coned. Re-energized.

LOUDSPEAKERS P.M. 3 OHM. 2½, 3, 4, 5in., 7 x 4in., 15/6; 6½in., 16/6; 8in., 17/6; 9 x 6in., 8 x 5in., 21/-; 10 x 6in., 22/6; 10in., 30/-; 12in., 30/-; EMI, Double Cone Ceramic magnet 10w. 13½ x 8in. 45/-. Horn Tweeter 104 dB 2 Kc/s to 16 Kc/s, 29/6. **STENTORIAN HF1012.** 10in., 3 to 15 ohms 10 w. 92/-; 8in. HF812, 76/-; Crossover CX3000, 33/-. **EXTENSION SPEAKER CABINET.** 5in., 15/6; 6½in., 18/6; 8in. 19/6; 10in., 29/6; 12in., 60/-. **TWIN GANG TUNING CONDENSERS.** 365 pF., 1in. x 1½in. x 1½in., 10/-; 500 pF Standard with trimmers, 9/-; midget, 7/6; with trimmers, 9/-. 500 pF slow motion tuning standard, 9/-. Transistor gang 208+176 pF with trimmers, 10/6. **SMALL** 3 gang 500 pF, 17/-. **SINGLE** 365 pF. 7/6. **SINGLE** 10 pF, 25 pF, 50 pF, 75 pF. 100 pF, 150 pF, 5/6. Solid dielectric 100, 300, 500 pF, 3/6.
E.H.T. CONDENSERS. 0.001, 7kV. 6/6; 20kV, 10/6; 0.1, 7kV, 10/6.
CERAMIC CONDS. 500v. 1 pF to 0.01 mfd., 9d.
DISCS. 470 pf to 0.01 mfd., 1/- each.
SILVER MICA CONDENSERS. 10% 5pF to 500pF 9d.; 600 pF to 3,000 pF. 1/-. Close tolerance (+1pF) 2.2pF to 47pF, 1/-. Ditto 1% to 50pF to 515pF. 1/-. 1,000pF to 5,000pF, 1/9.

PAPER TUBULARS
350v. 0.1 9d.; 0.5, 1/9.
500v. 0.001 to 0.05 9d; 0.1 1/-; 0.25 1/6; 0.5 3/6.
1,000v. 0.001, 0.002, 0.005, 0.01, 0.02, 1/6; 0.05, 0.1 2/-; 0.25, 0.5 3/-.
2,000v. 0.005, 0.01, 0.02 2/6; 0.05 3/6.

WAVECHANGE SWITCHES
8 p. 4-way 2 wafer long spindle 3/6
2 p. 2-way or 2 p. 6-way long spindle .. 3/6
4 p. 2-way or 2 p. 3-way long spindle .. 3/6
3 p. 4-way or 1 p. 12-way long spindle .. 3/6

Wavechange "MAKITS". Wafers available: 1 p. 12 way. 2 p. 6 way. 3 p. 4 way. 4 p. 3 way. 6 p. 2 way. 1 wafer switch, 8/6; 2 wafer switch, 12/6; 3 wafer switch, 16/-; additional wafers up to 12, 3/6 each extra. **Valveholders.** EA50, 6d. B12A. CRT. 1/3. Mazda and int. oct., 6d.; B7G, B8A, B8G. B9A, 9d.; Ceramic EF50, B7G, B9A, int. oct., 1/-. B7G, B9A cans 1/- each. Valve plugs B7G, B9A, int. octal, 2/3.

HIGH GAIN TV PRE-AMPLIFIERS
B.B.C. Channel 1 to 5. Gain 18dB. ECC84 valve. Kit price 29/6 or 49/6 with power pack. Details 6d. (PCC84 valve if preferred). Coils only 9/6.
BAND III I.T.A.—Same prices
Tunable channels 7 to 13. Gain 17dB. Circuit and coils only. 9/6. Chassis 4/9.

Post 1/- (unless otherwise stated) C.O.D. 2/- extra. Full list 1/-.

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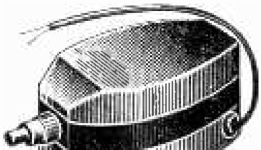
ALL MAIL ORDERS DESPATCHED SAME DAY

OPEN ALL DAY (Wed. 1 p.m.)

www.americanradiohistory.com

THE "INSTANT" BULK TAPE ERASER AND RECORDING HEAD DEMAGNETISER 200/250 v. A.C.

35/-



Post 1/6

Leaflet S.A.E.

PLASTIC RECORDING TAPE

Double Play	7in. reel, 2,400ft.	25/6	Spare Plastic Reels		
	5in. reel, 1,200ft.	15/6			
Long Play	7in. reel, 1,800ft.	15/6	3in.	1/6	
	5¾in. reel, 1,200ft.	12/6	4in.	2/-	
	5in. reel, 900ft.	10/6	5in.	2/-	
Standard	7in. reel, 1,200ft.	12/6	5¾in.	2/-	
	5in. reel, 600ft.	8/6	7in.	2/6	

"EASISPLICE" Tape Splicer 5/-
Leader tape 4/6; Splicing tape 3/-.

CRYSTAL SET BOOKLET 1/-.
CRYSTAL DIODE G.E.C. 2/-. **OA81**, 3/-.
HIGH RES. PHONES, 4,000 ohms, 15/-. 2,000 ohms 12/6. **MOVING COIL PHONES.** 100 ohms, 10/-.
SWITCH CLEANER. Fluid squirt spout, 4/6 tin.

"6+1" TRANSISTOR RADIO
First class components to make a 6 transistor 2 waveband superhet chassis. Ideal for portable or table radio. All parts including BVA transistors, ferrite aerial, *with car aerial coil*, printed circuit, 8¼in. x 2¼in., but EXCLUDING Speaker and cabinet. **£4.5.0**
Speakers, 35 ohms, 6x4in., 21/- 5in., 17/6; 3¼in., 15/6.

BULGIN PLUGS AND SOCKETS. Non-reversible P74, 2-pin, 4/3; P73 3-pin, 4/6; P194, 6-pin, 6/6.
JACKS. Standard open circuit, 2/6. Closed circuit, 4/3, Grundig type, 3-pin, 1/3, 5-pin 1/6. Grundig lead jack, 3/6.
JACK PLUGS. Standard Type screened, 3/-; Grundig 3-pin, 3/6, 5-pin, 4/6. Phono Plugs, 1/-; Sockets, 1/-.
ALADDIN FORMERS and cores, ¼in., 8d.; ⅜in., 10d. 0.3in. **Formers** and cans TV1 or 2, ½in. sq. x 2¾in., or ⅜in. sq. x 1¾in. 2/- with cores.
SLOW MOTION DRIVES. 6:1, 4/3; 36:1, 10/6.
SOLON IRON, 25W, 24/-; 65W, 29/-, 200 or 250 v.
ANTEX SUB MIN IRON. 15w. 200 or 250 v., 32/6.
BENCH STAND for above, 12/6. Spares in stock.
Paxolin Panels, 10 x 8 x 1/16in., 2/-.
Miniature Contact Cooled Rectifiers, 250V, 60mA, 7/6; 250V, 85mA, 9/6. **Selenium Rect.**, 300V, 85ma, 5/-. K3/25, 600V, 5mA, 5/-. RM4, RM5, 14A116, 10/- each. FC31, 20/-. **TV etc. Silicon Sub. Min. Rectifiers.** 250V, 450mA, 10/-; 250V, 150mA, 5/6.

465 kc/s. SIGNAL GENERATORS
Price 10/6, ready made with valve 1S5. **POCKET SIZE** 2¼x4¼x1in. One resistor to change, full instructions supplied. Battery 8/6 extra. Details Free

Coils Wearite "P" Type, 4/- each.
Osmor Midget "Q" type, adj. dust core, from 4/- each. All ranges. List S.A.E.
Repanco DRR2. L. and Med. T.R.F. with reaction, 4/6. Med. wave D.R., 3/6.
Ferrite Aerials. M. 8/9; M. and L., 12/6.
Osmor Ferrite Rod Aerials, L. and M. for transistor circuits, 10/- each.
Ferrite Rod, 8 x ⅜in., 6 x ⅜in., 6 x 5/16in., 3/- ea.
H.F. Chokes, 2/6. **Osmor QC1**, 6/9.
T.R.F. Coils, A/HF, 7/- pair; HAX, 3/6
Screwdriver, 5in., 6d. **Test Prods**, 2/9.
Neoside Trimming Tool, 1/9.
Neon Mains Tester Screwdriver, 5/-.
Multicore Solder, 4d. yd. **Dispenser**, 2/6.
Mains Input Filter ½ amp. 7/-.
Car Radio Suppressors, 2/-.

Blank Aluminium Chassis, 18 s.w.g. 4 sides, riveted corners, lattice fixing holes, 2½in. sides, 7 x 4in., 4/9; 9 x 7in. 5/9; 11 x 7in., 6/9; 13 x 9in., 8/6; 14 x 11in. 10/6; 15 x 14in., 12/6.
Aluminium Panels, 18 s.w.g., 12 x 12in., 4/6; 14 x 9in., 4/-; 12 x 8in., 3/-; 10 x 7in., 2/3; 8 x 6in., 2/-; 6 x 4in., 1/6.

MARTIN TAPE PRE-AMPLIFIERS (PLAY BACK THROUGH YOUR OWN AMPLIFIER)
For Collaro 2 Track Decks 8 gns.
COMPLETE RECORDING & PLAY BACK AMPLIFIERS
For 2 Track Collaro £11.11.0

TAPE DECKS
Collaro Studio 2 Track £10.15.0
BSR TD2 2 Track Tape Deck £7.5.0

Collaro Record/Erase Heads, 2 track Upper or lower 35/- pr. 4 track £5.10.0

MAINS DROPPERS. Midget adjustable slide 0.3A, 1,000 ohms, 6/-; 0.2A, 1,200 ohms, 6/-; 0.15A, 1,500 ohms, 6/-; 0.1A, 2,000 ohms, 6/-.
LINE CORD. 3-way 100 ohms ft., 1/- ft.
MIKE TRANSFORMERS. 50-1, 3/9.
P.V.C. Covered Wire, single or stranded, 2d. yd.
Sleeving, 1, 2 or 4 mm., 3d.; 6 mm., 5d. yd.

B.T.H. TAPE MOTORS. 115 v. A.C., 28w, pair for 230 v. (in series), 12/6. Post Free.

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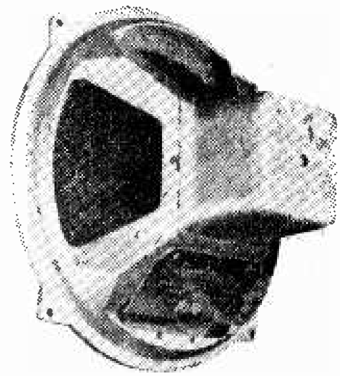

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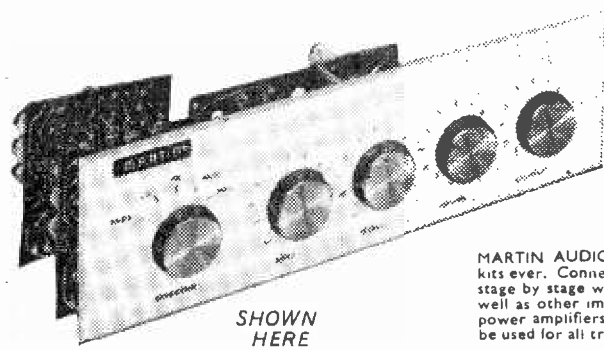

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Practical Wireless

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Contents

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FELLOWSHIP OF AMATEUR RADIO

ONCE again, as we enter another brave New Year, the annual P.W. Film Show is upon us. Now very firmly established as part of the P.W. calendar, it continues to attract "full houses" year after year. There are, of course, a number of obvious reasons why this event is so popular and you can be sure that the social aspect has some bearing on its success.

Which leads us to ponder on the part that social contacts have in this hobby of ours. Amateur radio enthusiasts *are* naturally friendly and sociable and there is no doubt that by its very nature the hobby stimulates this frame of mind, while at the same time depending on it for success.

Other hobbies, we agree, draw their adherents together by the bond of a common interest, yet surely in amateur radio there is more to it than that? The familiar cliches about the Ham Spirit and World Friendship Through Radio may sound trite or naive to the sceptical but there undoubtedly exists an atmosphere of mutual co-operation and camaraderie in the amateur radio movement which is perhaps unrivalled.

One of the firm foundations on which this is built is the great network of local radio clubs—local RSGB groups, clubs affiliated to the RSGB and other societies, those with no particular ties, works radio clubs, school societies, etc. They all present the opportunity to mix with fellow enthusiasts in practically all walks of life, to participate in club activities such as contests, constructional programmes, discussions.

Those who stay with amateur radio (and most do) cannot fail to absorb the spirit which prevails. Those who were glad to receive a helping hand when they were learning the ropes, in turn encourage and advise yet newer recruits.

Visiting a strange town, or having moved home, one can be sure of a welcome at the local club or at the homes of local enthusiasts. A good deal of visiting takes place between amateurs of different countries, including exchange holidays. There are organisations, run by amateurs, to help the less fortunate who are bedridden or disabled. There are schemes, sometimes by groups or even by individuals, to repair radio sets for old age pensioners.

Even the "lone wolf" is never so isolated as might be expected. In the first place he has the choice of a number of lively periodicals to keep him in touch and keep the spark of interest kindled. Many have pen friends or swap tapes. Many more are members of specialised short wave societies, who issue news sheets and organise services—mostly on a non-profit basis.

Those with short wave sets can keep in touch with the whole world. And those who acquire a transmitting licence can not only hear the world but talk to it as well (when the bands are open!).

Yes, the "ham spirit" is a real thing. Whether it really contributes to world peace and fellowship in a materially effective way is perhaps open to dispute. But it certainly does more to bring mutual tolerance and understanding than many activities on a higher level!

And we can be sure that the average amateur radio enthusiast will continue instinctively to promote goodwill in his own quiet way, not as a duty or an obligation but simply because that's the way he is.

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

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ROUND THE WORLD of WIRELESS

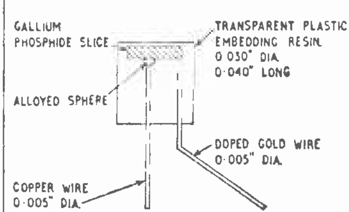
NEWS AT HOME AND ABROAD

New Semiconductor Light Source

SOMETHING new in light sources has recently been placed on the market by Ferranti Ltd. The new device is based on radiative recombination at a p-n junction, and subsequently has been termed a crystal lamp. In fact it is a "semiconductor light" which in operation acts as a forward biassed gallium phosphide diode being suitably doped to produce electroluminescent radiation of 7,000 anstroms (red).

Its physical appearance is of a cylindrical encapsulation of transparent plastic with two wire leads emerging from one end (see accompanying illustration).

Ferranti claim many potential applications for the lamp, in industry generally but particularly in instrument and indicator applications where its small size —typically 0·03in. × 0·04in.— and low operating currents, are particularly advantageous. An obvious environment is transistorised equipment in which the voltage and current levels are suited to its use as, for example, a simple on/off indicating device.



This illustration makes clear the construction of Ferranti's new crystal lamp—a semiconductor light source. The average brightness of this unique lamp is 10-40ft. lamberts and it remains visible under an illumination of 20ft. candles.

P.W. Gift Puts School on the Air

IN response to an appeal for help in choosing a short wave radio set from the headmaster of Pilgrims School for asthmatic boys at Seaford, the Managing Editor of PRACTICAL WIRELESS, Mr. A. T. Collins, and the Assistant Editor, Mr. L. E. Howes, recently made the trip to Seaford to visit the school on behalf of the magazine. With them however, went a new Lafayette communications receiver which, it was decided, would prove of more use to the boys in setting up a short wave receiving station than mere advice.

The headmaster Mr. R. Brooks, had written to PRACTICAL WIRELESS as he felt a set which would receive amateur transmissions would be helpful to his 58 pupils. So early in October, Mr. Collins made the presentation of the receiver to the school and accompanied it by a set of books on basic radio.

Now local radio enthusiasts have volunteered to help in setting up the station so that the boys of Pilgrim School can begin their short-wave listening hobby.

Boys of Seaford's Pilgrims School surrounding the Lafayette receiver donated by "Practical Wireless".

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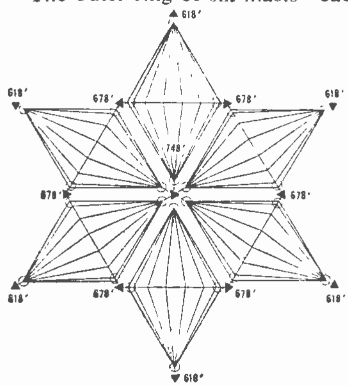
NEW NATO AERIAL IS EUROPE'S LARGEST

THE largest aerial system in Europe has recently been completed at Anthorn, near Carlisle. The aerial has been erected for the North Atlantic Treaty Organisation's Anthorn v.l.f. radio station and consists of 13 masts, arranged as a "six-pointed star" with a centre point, supporting a network of diamond-shaped panels forming the aerial (see illustration below).

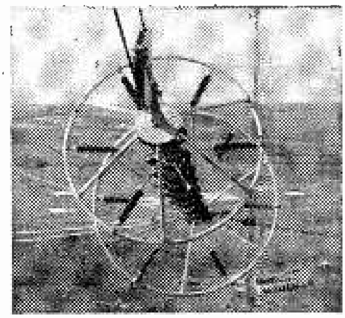
The main contractor for the station was Continental Electronics Systems Inc. of Dallas, Texas, working to the requirements of the British Post Office, with British Insulated Callender's Construction Company Limited undertaking the design, supply and erection of the masts.

The outer ring of six masts—each 618ft. tall—is 2,148ft. in radius, with the inner ring of 678ft. tall masts having a radius of 1,277ft. The central mast from which the aerial panels radiate, has a height of 748ft.



A further impression of the immense size of the system may be gained by considering the specifications for the station earthing system. This is virtually a copper mat covering the whole of the site, 9 to 12in. below ground. Lines of 8s.w.g. soft copper wire radiate from the centre mast with 2° of arc between each, requiring in all, a total of 75 miles of copper wire.

The construction of the aerial panels called for some 20 miles of steel-cored aluminium conductor, which were cut and pre-stressed on the site before their assembly. At each corner of each panel, 40ft. long insulators support the aerial. These insulators are fitted with two corona rings, one 15ft. in diameter, the other 12ft. in diameter.



Looking down on the Anthorn v.l.f. station from one of the outer masts, showing one of the massive insulators in the foreground.

The Radio Show Goes International

FOR the first time ever, this year's Radio Show at Earls Court, London, will be international in scope. Ever since the days of Radiolympia, it has always been a *national* show with a British-made-only policy. Now it is hoped that exhibitors from abroad will help boost attendances.

The promotion and organisation of the annual exhibition has been taken over this year by Industrial and Trade Fairs Limited from the previous organisers, the British Radio Equipment Manufacturers' Association.

The dates of the 1965 Radio Shows have already been announced as 25th August to 4th September.

100kW Transmitters for Malaysia

THE Gates Radio Company, a subsidiary of the Harris-Intertype Corporation of the U.S.A., has recently completed a Government of Malaysia contract for three high powered 100kW short wave broadcast transmitters. The transmitters will be the most powerful in Malaysia, and will be used by Radio Malaysia for long-range international broadcasting to inaugurate its new "Foreign Broadcast Service" to neighbouring South-East Asian countries.

These transmitters are of a new air-cooled design, employing high level plate modulation and utilising conservatively rated components especially chosen for reliable service in areas of extreme temperature and humidity; conditions such as may be expected in Malaysia.

RENOVATIONS AT RUGBY

THE 16kc/s world-wide transmitter at Rugby (callsign G.B.R.) is to be renovated.

This was announced recently by the G.P.O. and now another announcement from the English Electric Valve Company Limited has confirmed that its output stage will be re-equipped with EEV BY1144 triodes. This modification means the replacement of the 54 water-cooled triodes, type CV1600 previously installed in three banks of 18, where two banks provided the 210kW output and the third remained on standby. All these will be replaced by only *three* of the English Electric valves, these being vapour-cooled power triode types, two of which will provide double the original output and leave the third on standby.

HEREFORD'S NEW RELAY STATION

THE sound transmitters at the BBC's v.h.f. sound and television relay station at Hereford were brought into service during November last year. Transmissions of the Midland Home Service is on 94·1Mc/s, the Light Programme on 89·7Mc/s, and the Third Programme/Network Three on 91·9Mc/s. Horizontal polarisation is used.

The new station will improve v.h.f./f.m. reception for the 40,000 people in the City of Hereford and its environs.

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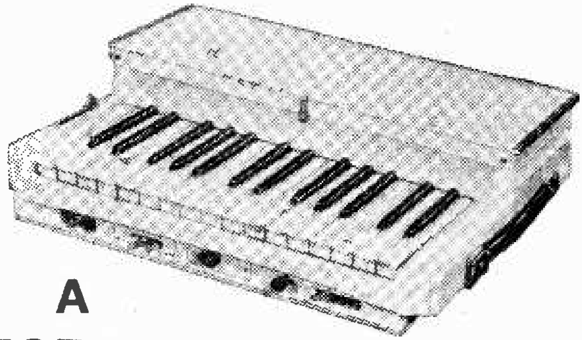
COVER SUBJECT



BUILDING A TRANSISTOR SOLO ORGAN

by G. W. Hardy

AFTER many experiments with various types of audio oscillator, the author decided to build a musical instrument, using the well-known multivibrator circuit. This will be familiar to many readers, as it is frequently used for a signal probe in radio fault finding.

In the instrument about to be described, instead of the usual thin reedy tone, we have a really musical output which can be fed into any amplifier and will provide tones resembling the oboe, horn and cello.

Furthermore the tones can be varied with slow, medium and French or continental vibrato (the latter resembling a French accordion).

Percussion is also provided with (1) fast decay; (2) slow decay; thus simulating plucked strings of banjo, guitar, etc.

Note Generator Circuit

The circuit (Fig. 1b) will now be explained. This is divided into two sections, as recommended in actual construction. Section 2 is the musical note generator—a straightforward multivibrator except that instead of one, we have a series of resistances in the base of Tr4.

R11 is a limiting resistor to protect this transistor. VR2 is a variable resistor used for setting up the tuning to correct pitch. For convenience it is brought out handy to the keyboard.

Playing the highest note on the keyboard connects VR2 to the negative line and sounds the highest note. The remainder of the resistors in the series are tapped off to the key contacts, and when the bottom note on the keyboard is played, the whole series will be in circuit and sound the lowest note.

The range of the author's instrument, as described here, is 29 notes from C in the bass to E in the treble (see Fig. 2).

It will be appreciated from the foregoing why chords cannot be played, and if more than one key is played together, only the uppermost note will sound. This is a very practical advantage in a monophonic organ such as this.

The series tuning has some disadvantage and it is not desirable to extend the range for any single oscillator much beyond the two octaves.

Vibrato Circuit

The base of Tr3 receives the low frequency impulses, generated by the oscillator (Section 1, Fig. 1), which provides vibrato. The 1MΩ variable resistor VR1 is a preset by which adjustment can be made to obtain a slow vibrato.

One turn of the vibrato switch places R3 in parallel with VR1 and we obtain a medium speed; one more turn of the switch and we have a fast speed. It is possible that these two resistors may need some slight alteration of values owing to difference in tolerances; however, it would be easy to experiment here as they are soldered directly on to the switch. Obviously slow speed must be correct before alterations are made.

The vibrato switch S1 (Fig. 1c) is mounted under the keyboard for easy adjustment whilst playing. Another switch S2, cuts out vibrato when not in use.

Buffer Stage Circuit

The output of the note generator is taken from base of Tr3 via the 0·01μF mica coupling capacitor C6. This gives a more useful waveform for our purpose than if taken from the collector of Tr4. A mica capacitor is preferred here for stability.

This output is fed into a buffer stage (Fig. 3a), otherwise changing over of tone circuits would affect the pitch.

Tone Circuit

This is shown in Fig. 3a and follows usual practice except that instead of using three separate stops it was decided to use another 3-way switch (S3).

This way the tones cannot be added as in usual organ practice, but experiments proved that there was nothing to be gained by so doing.

Pre-amplifier and Percussion

The final stage is a pre-amplifier which, with the aid of one extra contact per key, has the

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additional function of providing percussion. This is a trick circuit and with the key action devised by the author works very effectively.

In normal playing L-M (Fig. 3a) is shorted (mid-position S4A—see Fig. 3a). The percussion key contacts, although still working, are now inoperative. Only the key primary contacts (Fig. 1b) are now effective, being normally open and contacting the −3V (No. 1) negative strip when keys are pressed down in playing.

For percussion, short circuit on L-M is removed and replaced by a 1-2μF capacitor. Current is now diverted via the secondary key contacts (Fig. 3a) which are normally closed, at the same time charging up the selected capacitor.

When a key is now depressed, the primary contact is made and sounds the note selected, immediately afterwards the secondary contact is broken and cuts off the sound, which however fades away or decays slowly or fast according to the value of the capacitor now spanning L-M.

When using this device in playing, it will be necessary to use "clean" fingering (staccato) as in fact it will seem natural to do, with the percussive sound produced.

Conversely, with percussion switched off and playing normally, a lingering (legato) touch is desirable but playing technique will be gone into more fully later in this article.

It will be noticed that a 47kΩ resistor R28 is in series with the percussion contacts. This eliminates unpleasant contact noises when playing. Unfortunately it also reduces the volume, so that there is too much contrast when percussion is switched off.

It would seem a good idea to switch in a further stage of amplification when using percussion. However, as this would lead to further complications, it was decided to do the reverse and cut down volume on normal playing—after all we shall have plenty of amplification to spare in the main amplifier which follows.

When changing over from percussion to normal, switch S4B will close and bring R30 in parallel with the lower part of the expression control. This will reduce the volume according to the value of R30 which, in the writer's case, is 20kΩ. This works quite well, once adjusted to a level volume.

VR3 (Fig. 3a) is the expression (volume) control,

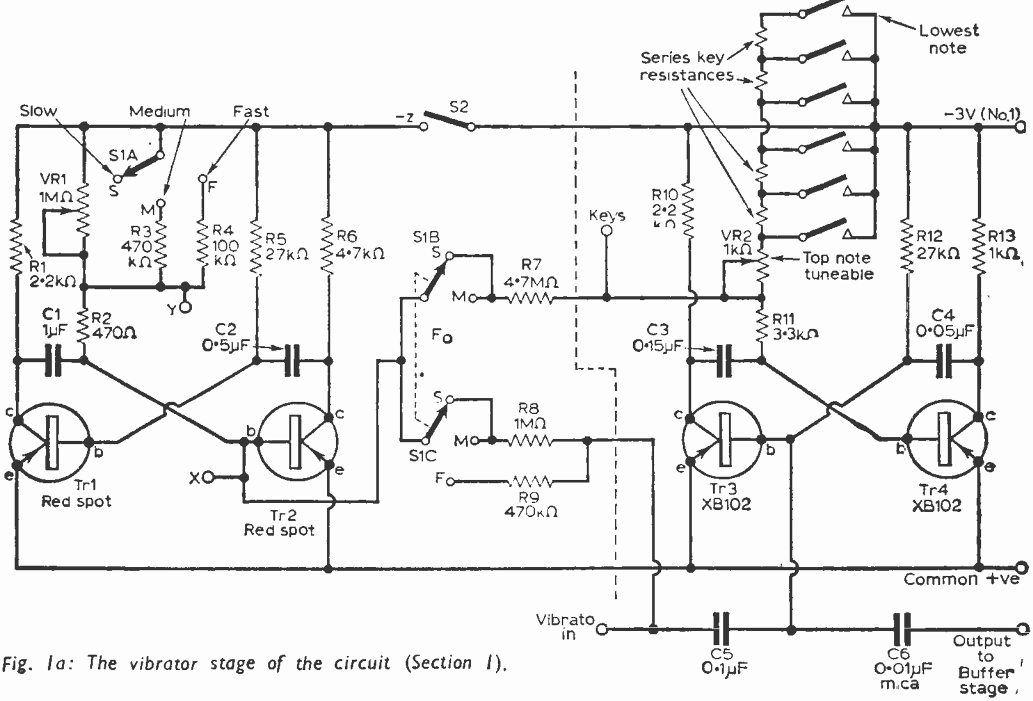

Fig. 1a: The vibrator stage of the circuit (Section 1).

Fig. 1b: The note generator stage (Section 2).

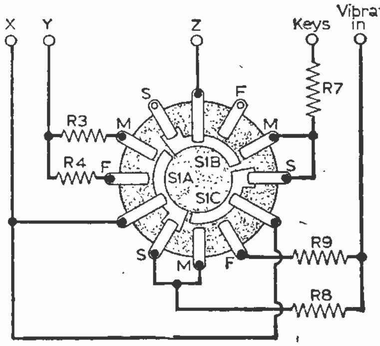

Fig. 1c: Details of the S1 switch connections.

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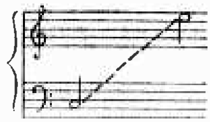

Fig. 2: The tonic sol-fa range of the organ.

in the writer's case controlled by a foot pedal to be described later from which a two yard length of screened cable can be plugged into a socket fitted to the organ case.

Connecting to Main Amplifier

Another screened socket of a different type—to avoid accidental interchange—will receive the screened lead from the constructor's amplifier.

This can be a transistor amplifier, in which case the coupling capacitor C17 can be increased in value to 10μF.

It is not advisable to use an amplifier with live chassis, but if one is used a high voltage 0·005—0·01μF capacitor should be inserted between the organ and chassis. This will probably give rise to some hum, which however slight, will mar the tone of the organ.

Should there be a volume control on the amplifier, this should be set at full volume when the pedal is fully depressed and then left at that setting. A tone control, if fitted, can be adjusted to one's liking.

Design of the Case

The writer's instrument is built around a discarded accordion keyboard of 29 notes. The note generator is designed to sound the notes from C in the bass to F in the treble (Fig. 2).

The case measures 1ft. by 1ft. 2in. and 4½in. deep. A leather strap handle is fitted at one end. The amplifier which contains an 8in. speaker is of similar size also with a handle, so that the outfit is quite portable.

All organ controls are brought out to the front, just below the keys; and each end of the case has a length of ¾in. x ¾in. aluminium angle, so fitted that two flanges can slide upon two runners fitted under the treble of a piano.

The expression control being pedal operated leaves the left hand free for accompanying on the piano. With the cable connected to the amplifier, the outfit is ready for use.

Alternatively the instrument could be designed to play as an accordion. In this case, the controls (including expression) could be arranged for the left hand and then only needing one screened cable to the amplifier.

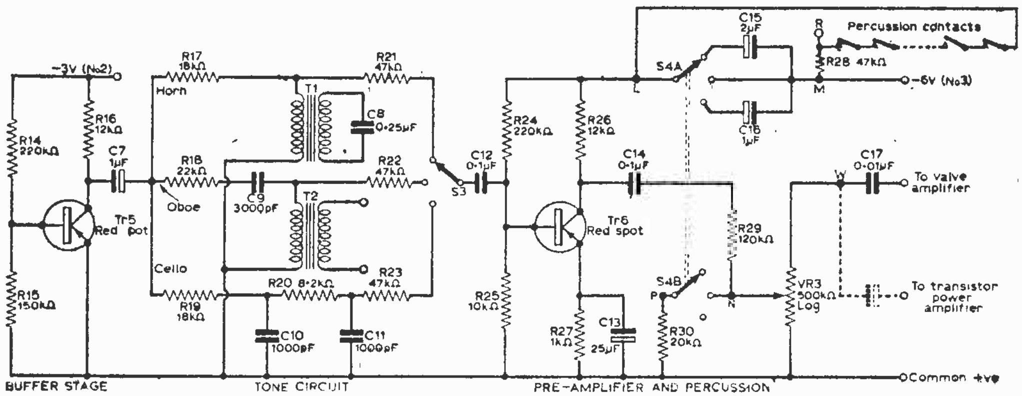

Fig. 3a: The buffer stage, tone and preamplifier and percussion sections of the circuit.

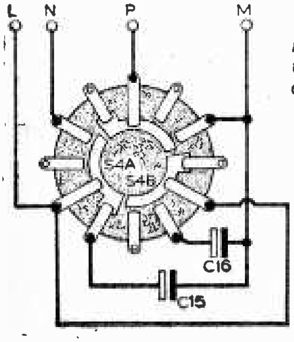

Fig. 3b: Wiring details of the percussion on/off switch, S4.

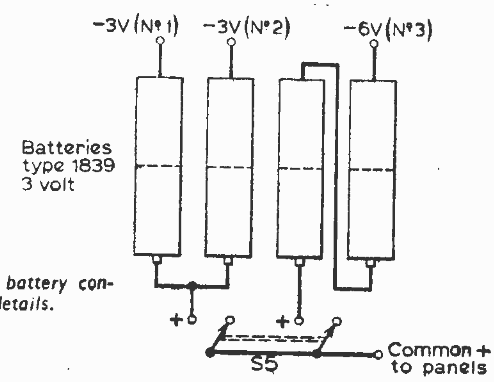

Fig. 4: S5 and battery connection details.

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Also it could be designed as a solo (upper) manual, to use with a single manual electronic or reed organ.

Power Supplies

Battery No. 1 (3V) supplies power for vibrato and note generator. Battery No. 2 (3V) supplies the buffer stage. Percussion and pre-amplifier stage is powered by two similar 3V batteries connected in series to give 6V.

All positives are common and taken to a two-pole on/off switch S5 and wired as shown in Fig. 4. Although they are shown as being together, it is preferred to secure each battery with a clip near each panel.

A two-pole switch is necessary owing to the 3V difference in potential between the batteries. Type No. 1839 3V batteries have been used throughout, and as they last at least a year, all connections are soldered.

It is recommended that the two cells in each battery are pushed out of the case and the negative of one cell connected to the positive of the other with a short length of thin stranded flex and then reinserted into the case.

Remember that the cell case is negative, especially before finally connecting to their respective panel tags, otherwise damage will result to the transistors.

Wiring Note Generator (Fig. 5)

It is advisable to start by wiring up the note generator, for which a $\frac{1}{16}$in. paxolin panel about 3in. x 4¼in. is required.

The components are mounted on this panel, the wire ends being cleaned and bent over at right angles and pushed through holes in the panel for wiring up on the underside.

Thin insulated connecting wire should be used and where a junction has to be made, if a piece of systoflex of a sliding fit has been previously slipped over the connecting wire covering, this can be pushed down over the junction after it has been soldered. Leave transistor leads full length, even if they have to be long routed.

All wires should be cleaned and tinned before soldering. A heat shunt should be applied to the wire between the iron and transistor, as well as wires to small electrolytics.

A common dodge is to use a pair of tapered flat-nose pliers and stretch a rubber elastic-band across the handle, thus leaving both hands free for soldering.

"Red spot" transistors have been used throughout with the exception of this note generator, for which we desire good stability in order that musical pitch will remain reasonably constant with varying temperature. After experiments it was decided to use the Mazda XB102 transistors which were found to be very stable.

Before drilling the panels it is a good idea to lay out the components on a piece of cardboard of same size as the panel, piercing holes where required and trying the layout, which should include space for five soldering tags.

When satisfactory, the card can be used to mark out the holes on the paxolin for subsequent drilling. Five soldering tags should be fitted at one side, convenient for external connecting and with a sharp pointed awl, the following legend

COMPONENTS LIST

Resistors:

R1	2·2kΩ	R16	12kΩ
R2	470Ω	R17	18kΩ
R3	470kΩ*	R18	22kΩ
R4	100kΩ*	R19	18kΩ
R5	27kΩ	R20	8.2kΩ
R6	4·7kΩ	R21	47kΩ*
R7	4·7MΩ	R22	47kΩ*
R8	1MΩ	R23	47kΩ*
R9	470kΩ	R24	220kΩ
R10	2·2kΩ	R25	10kΩ
R11	3·3kΩ*	R26	12kΩ
R12	27kΩ	R27	1kΩ
R13	1kΩ	R28	47kΩ
R14	220kΩ	R29	120kΩ
R15	150kΩ	R30	20kΩ*

All 10% ½W carbon.
* May need slightly different value.

Tuning Resistors:
Recommended list of preferred values, all ¼W.

1 x 680Ω
2 x 820Ω
5 x 1kΩ
4 x 1·2kΩ
4 x 1·5kΩ, 4 x 1·8kΩ, 4 x 2·2kΩ, 4 x 2·7kΩ, 4 x 3·3kΩ — For single and parallel connecting
2 x 4·3kΩ, 2 x 4·7kΩ, 2 x 5·6kΩ, 2 x 6·8kΩ — For parallel connecting to obtain half values

Capacitors:

C1	1μF paper
C2	0·5μF
C3	0·05μF, 0·10μF in parallel
C4	0·05μF
C5	0·1μF 150V
C6	0·01μF mica
C7	1μF electrolitic 12V
C8	0·25μF paper
C9	3,000pF
C10	1,000pF
C11	1,000pF
C12	0·1μF 150V
C13	25μF electrolitic 12V
C14	0·1μF 150V
C15	2μF electrolitic 12V*
C16	1μF electrolitic 12V*
C17	0·01μF 350V

* Subject to experiment—see text.

Transformers:
T1, T2 See text

Potentiometers:
VR1 1MΩ skeleton type pre-set
VR2 1kΩ w.w.
VR3 500kΩ log.

Switches:
S1 3-pole, 3-way wafer
S2 S.P. on/off toggle
S3 S.P. 3-way
S4 3-pole, 3-way
S5 2-pole, 2-way on/off push-pull type

Transistors:

Tr1	Red spot	Tr4	XB102
Tr2	Red spot	Tr5	Red spot
Tr3	XB102	Tr6	Red spot

Sockets:
SK1 Coaxial
SK2 Phono (panel mounting)
SK3 3-pin Continental (panel mounting)

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should be scratched on the paxolin adjacent to the appropriate tag: + VIB.IN. O.P. KEYS—No. 1 3V O.P.; being of course for output from that panel.

Care should be taken that the transistors are wired correctly, as layout is reversed upon turning the panel over for wiring: and it is therefore suggested that the letters C B and E are scratched on the underside of the panel against each hole through which these wires will pass from each transistor.

Assuming that all wiring has been checked and found correct, it will now be possible to try out the oscillator by connecting tags + and O.P. to high resistance headphones.

A variable resistor of about 5kΩ should be connected across tags marked keys and — No. 1 3V. Then connect the positive of a 3V battery to the + tag and if a lead is taken from the battery negative, this when touching the — tag should produce a sound which can be varied in pitch by rotating the variable resistor.

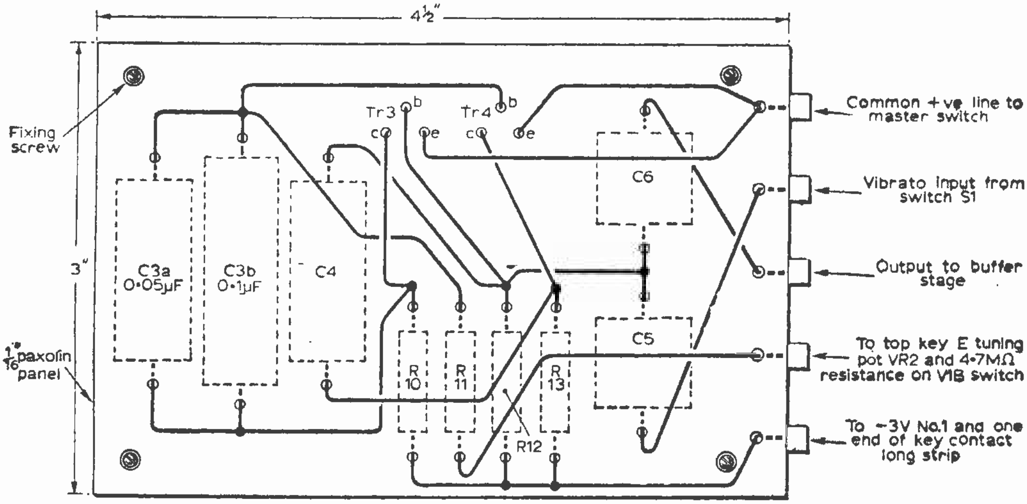

Fig. 5: Wiring and layout of the note generator.

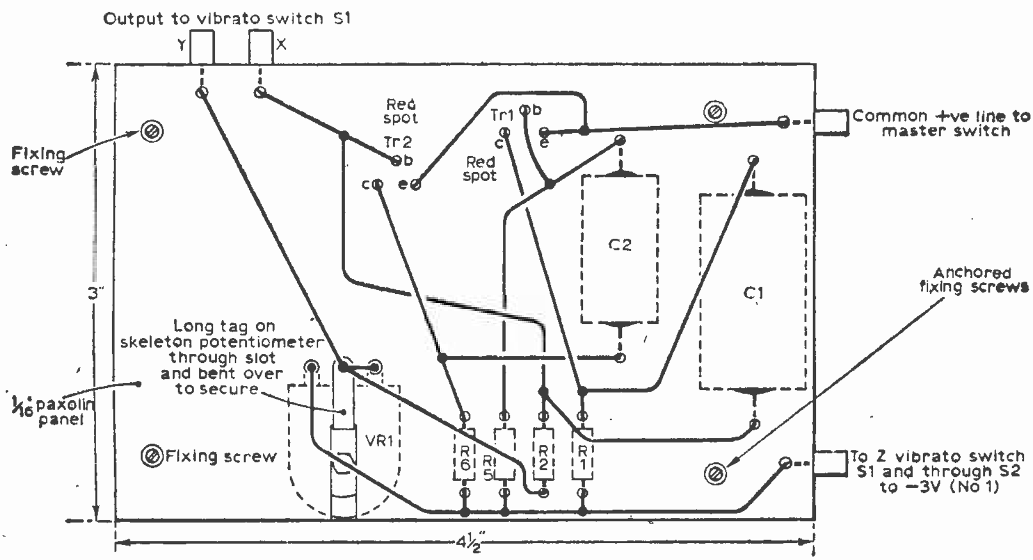

Fig. 6: Vibrator wiring details.

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Wiring the Vibrato Oscillator (Fig. 6)

This panel can be of same size and wired up in a similar manner. The 1MΩ potentiometer VR1 is a skeleton type preset and is mounted on the upper side of the panel.

Four soldering tags should be conveniently positioned and bear the legend: + O.P.(Y) O.P.(X) −(Z).

The wiring of the three-way switch is clearly shown in Fig. 1c. As drawn it is in the slow clicks should now be heard, if not the 1MΩ potentiometer may need adjustment.

If there are still no clicks, set the potentiometer about halfway and place a fixed resistance of about 470kΩ in parallel with same by spanning —Z and Y, again slowly rotating the track arm.

If no clicks are heard, it is possible that one or both transistors are unsuitable and substitution should be tried. When working properly it should be possible to obtain four to five beats per second, without the fixed resistor in parallel.

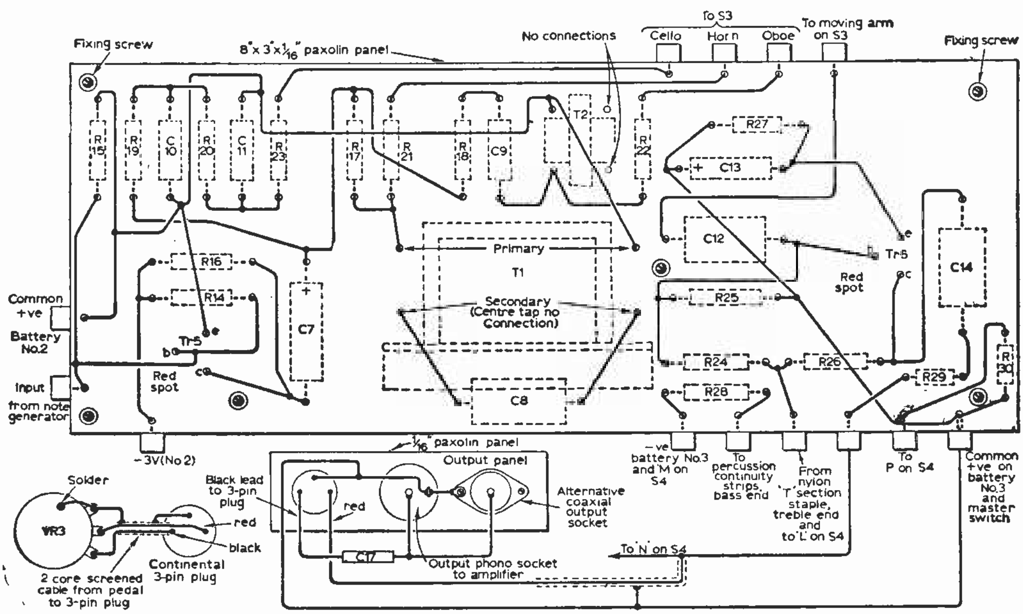

Fig. 7: Layout of components and wiring connections of the buffer stage, tone and preamplifier panel.

position, next is medium and finally fast (French vibrato). The purpose of R7 4·7MΩ) is to increase the amplitude or depth of slow and medium vibrato.

The layout of the wiring in these panels is not critical, but panel inter-connections should be as short as possible and miniature microphone screened cable has been used as much as anything for its tidiness.

This also applies to connecting up switches to panels, including vibrato negative and on and off switch. This latter is in the negative lead from battery No. 1, a lead from the switch going to —(Z) on vibrato panel.

This panel can now be tested (without the three-way switch) in a similar manner to the note generator, but in this case we connect a 0·1μF capacitor to tag O.P.(X) the other side of the capacitor to one side of headphones, and the other side of headphones to + tag.

A 3V positive battery is now connected and a lead from the negative of the battery, preferably with a crocodile clip connected to —(Z). Slow

Buffer Stage, Tone Circuit and Pre-amp (Fig. 7)

This is our last panel (Fig. 7) and for a suggested layout see Fig. 7. The soldering tage are arranged to suit the writer's particular layout and may be found suitable by other constructors.

The buffer stage must have a separate battery as shown. T1 is a driver transformer as used in small transistor radios with push-pull output. A capacitor is wired across one winding and the centre tap ignored. T2 is a small transistor type interstage transformer and one winding is left open.

There is scope for experimenting here, with whatever types one has to hand. Switches S3 and S4 are brought out to the front of the instrument under the keyboard.

R21, R22 and R23 could of course have been wired as a single resistor of 47kΩ between switch arm and C12, but this layout was adopted as these three resistors also serve to level off the volume of each separate tone output as may become necessary with other transformers.

NEXT MONTH — THE KEYBOARD AND CABINET

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PART ONE

CABINET AND CHASSIS TECHNIQUES

BY F. L. THURSTON

IT is the object of this short series to deal with the "non-electronic" side of the hobby; what can be loosely termed the "Ironmongery" side of it—chassis construction, cabinet making and finishing.

The series is aimed primarily at the novice, but more experienced readers may find much of interest, particularly in such matters as glass fibre cabinet construction, chemical finishing of metals, etc.

Chassis Construction

The most elementary type of chassis is the "breadboard", consisting simply of a slab of wood on which components and controls can be easily mounted when making **temporary** hook-ups or testing experimental layouts.

Components such as transformers, chokes, tag strips, terminal blocks, etc., are fixed with ordinary wood screws. Valve bases and controls may be mounted on additional strips of wood or metal at right angles to the breadboard. "Bus-bars" may be used for h.t. and negative return lines.

An improvement on the conventional breadboard is to cover the entire upper surface with a *single* sheet of aluminium or copper foil, glued to the wooden surface with a suitable compound. Such a board provides electrical continuity, for earthing, etc.

These systems should be used *only on temporary lash-ups*, as the boards will be subject to heating and age and will bend or crack after prolonged use, resulting in unstable operation.

For permanent set-ups, excepting for transistor equipment, an aluminium chassis is preferable. A number of manufacturers produce ready-made chassis of excellent quality and reasonable price. Nevertheless, many readers will prefer to make their own, and the following notes may be of some use.

A very simple method of construction, which involves no bending of metal at all, is shown in Fig. 1. Sheets of aluminium are cut to form the top and sides of the chassis and are bolted together with pieces of angle aluminium along the edges of the sheets. Additional lengths of angle may be used where extra rigidity is needed.

The angle should be between $\frac{1}{2}$—$\frac{3}{4}$in. in width for all but the exceptionally large or small chassis, and the aluminium used for the chassis should be 20s.w.g. up to about $2\frac{1}{2}$ x 3in., 18s.w.g. up to about 9 x 7in. and 16s.w.g. for sizes larger than this.

The most generally used chassis is the "single sheet" type, and Figs. 2a 2b show two alternative ways to produce the same size chassis. Fig. 2a is probably the more difficult but more effective of the two methods. As well as bending to form the sides it is also necessary to add the four "lips", marked A, B, C and D.

When the chassis is finally formed, these lips must be on the inside of the two shorter side pieces and should be drilled through and bolted or riveted to make the chassis a rigid structure. In Fig. 2b these lips are not used, but separate pieces of angle or other strengthening fixtures take their place to give almost equal rigidity.

Bending

The actual method of bending the metal will depend on the facilities available to the construc-

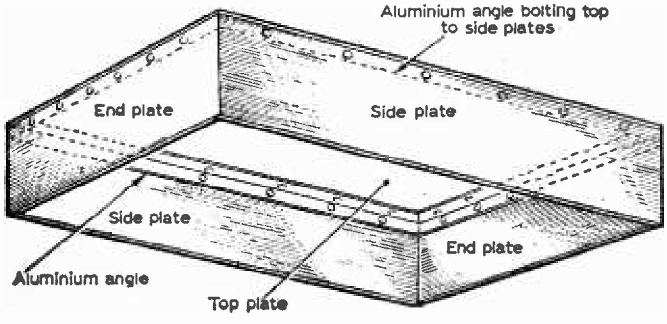

Fig. 1: An underside view of a chassis assembled from flat aluminium plates bolted to aluminium angle. This form of chassis construction involves no bending of metal at all.

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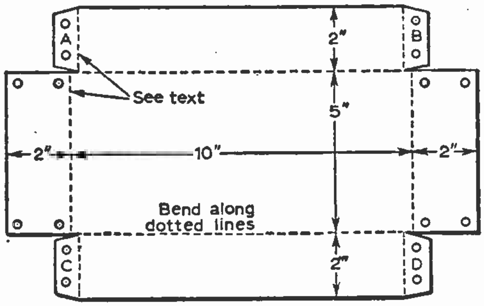


Fig. 2a: With this single-piece chassis all holes are drilled AFTER bending is completed, and the line of bend of lips is set back from main bend—see text.

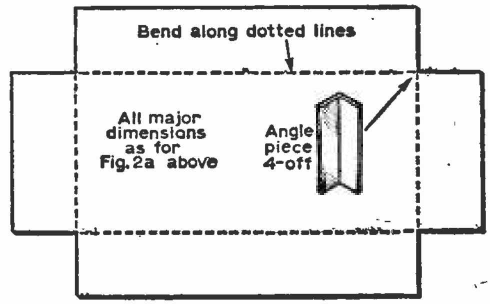


Fig. 2b: With this form of construction, "lips" are replaced by aluminium angle. After bending, the sides of the chassis are secured with the angle pieces.

tor. For those that can afford it, special sheet metal folding machines are available and are a good investment. Those for amateur use range in price from about £6 10s. to £12.

For the average constructor, a good vice may be used as a bending tool. Smooth faced jaws should be used to avoid marking the aluminium unduly when bending it.

First cut the aluminium sheet to size and score with a scribing tool along the proposed lines of bend, on the *underside of the sheet*. The lines should not be scribed too deeply, or it may be found that when the bending is nearly completed fatigue fractures will occur along them.

If, say, the vice is of the 4in. type the bending procedure for Fig. 2a will be as follows: insert lip A into the vice and ensure that the bending line is flush with the top of the vice jaws along the whole of its length, and tighten the jaws.

Note that this bending line falls *behind* the bending line for the short side piece *by the thickness of the basic material.*

Apply pressure and bend the metal over, making sure that the scribed line is on the underside, otherwise the lip will tear away or fracture along the line. A soft mallet can be used to help the bending operation along.

A final sharp corner is obtained by placing a piece of scrap aluminium over the bend area and hammering down on it until the desired result is obtained. Repeat the operation with the remaining three lips.

Next, bend the 5in. sides, and finally the 10in. sides. When the side to be bent is longer than the vice jaws it should be bent in a number of stages, starting with a small angle of bend at the left and then working along the length of the side until the same angle of bend is obtained throughout, returning to the left again with a greater angle of bend, repeating the procedure until the final sharp angle is obtained.

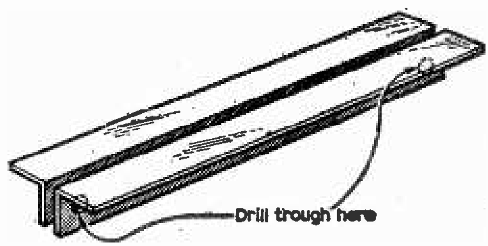
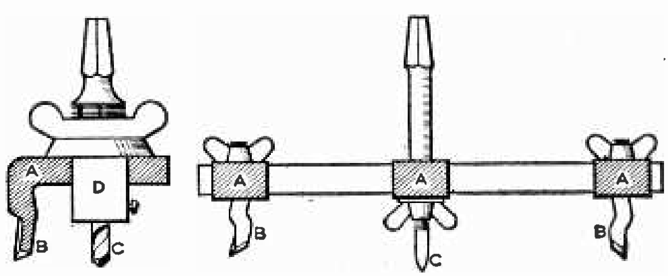


Fig. 3: A simple device for extending the effective length of vice jaws.

The effective length of the vice jaws can be extended with the simple gadget shown in Fig. 3. Made from two lengths of angle iron or steel and held parallel by bolts passing through the two guide holes, the gadget can be made even more useful by filing the top faces flush with each other and case hardening the whole assembly.

The device can then be used when sawing or filing a straight edge along aluminium, etc., as well as for marking out and bending.

Fig. 4: Two types of hole-cutting tools for chassis work. Holes of several inches in diameter down to holes less than one inch in diameter can be cut easily in aluminium sheet with both tools.



A......Cutting tool
B......Cutting edge
C......Pilot drill
D......Body slotted to allow movement of 'A'

A......Carrier
B......Cutting tool
C......Pilot drill or point

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Holes in Sheet Aluminium

A number of manufacturers produce punches that cut holes of fixed size, ranging from about $\frac{3}{8}$in. to $2\frac{1}{2}$in. diameter and ranging in price from a few shillings to a couple of pounds each. Usually of the "screw down" type, with a punch in two parts drawn together by a bolt, a pilot hole must be drilled through the aluminium before the punches can be used.

At least one manufacturer produces a double-ended punch so that one gets, in effect, two punches for the price of one. Punches are available for cutting square as well as round holes.

The advantages of these punches are the ease with which holes can be cut with them and the fact that almost no "cleaning up" is needed with a file afterwards. The major disadvantage is their cost.

Another tool that is available for cutting round holes is shown in Fig. 4. Consisting of a central drill and a bar set at right angles to it, with an adjustable cutting bit on the bar, the device enables holes ranging in diameter from less than an inch to several inches to be cut with a single tool.

Some of these adjustable cutters are provided with a bar extending on both sides of the drill and have a bit on each extension, resulting in a smoother cutting operation (Fig. 4). Both types are available from most radio and tool stores.

With these tools the holes need to be cleaned up with a file after cutting, but they are an excellent investment and are the only tools that will cut large diameter holes reasonably well.

When drilling holes in aluminium the drill will tend to wander and unless care is taken the final hole will be off-centre. It is therefore advisable to start off with a small pilot drilling to reduce this wander as much as possible, and to cut the hole in a series of progressively larger drillings rather than in one single operation. For a similar reason, power drills must not be used unless they are mounted in a stand.

When cutting holes for valve bases, etc., and punches are not to hand, a carpenter's bit makes an excellent alternative. This tool, like the adjustable hole cutter, is best used mounted in a carpenter's brace.

When cutting rectangular holes in sheet metal the method that most text books recommend is shown in Fig. 5. The size of the required hole is carefully marked out with a scribing tool and a second set of scribe lines are drawn about $\frac{1}{16}$in. inside of the first set.

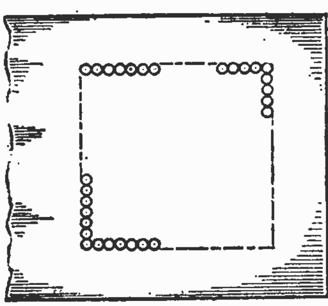
A $\frac{1}{8}$in. drill is then used to drill a complete series of holes along the entire length of the inner lines until the entire strip is cut away and the centre section can be pushed out. The jagged edges of the hole are then carefully filed down to the outer set of scribe lines and the hole is finished off. Note that if a 4 x 4in. hole is cut by this method a total of 128 small holes must be drilled!

A better method is to first drill a $\frac{1}{8}$in. hole in each corner after marking out the outer scribe lines, and then simply cut out the hole using a fret saw with a metal cutting blade, or a "Keyhole" or pad saw. The whole centre section can then be removed within a couple of minutes!

The metal cutting blades can be purchased very cheaply from most tool shops and are surprisingly strong in spite of the fact that they are less than $\frac{1}{32}$in. deep. They could, in fact, be used to cut a hole only $\frac{1}{8}$in. square if required!

The least expensive method of all for cutting large round holes is to make up a template in about $\frac{1}{8}$in. sheet steel which is then case hardened. In use the template is bolted down to the chassis and the hole cut out with the fret saw. Fig. 6 shows such a template, made for cutting $1\frac{1}{8}$in. valve base holes.

Manufacturers of valve bases do not seem to have standardised the radius from the centre hole of the base securing bolts, so provision has been made for three sets of bolts at different radii. A slot could also be used here.



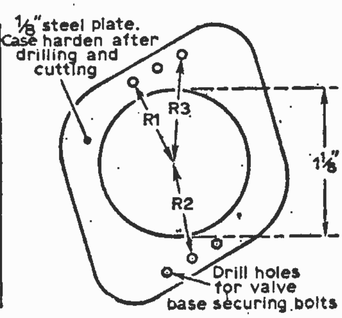


Fig. 5 (left): A simple method of cutting rectangular holes.

Fig. 6 (right): A case-hardened template for cutting $1\frac{1}{8}$in. valve base holes.

Printed Circuit Techniques

Printed circuit boards consist of a sheet of copper foil bonded to a sheet of Paxolin or similar insulating base, surplus foil being removed by etching. Un-etched boards are available from the larger radio stores, but are fairly expensive.

The experimentally minded constructor can make his own boards by bonding a sheet of copper foil to a suitable base, using a waterproof adhesive such as Durofix, Araldite, etc.

The base should preferably be Paxolin or a similar type of insulation, but less expensive materials, such as 3-ply wood, can be used, providing steps are taken to ensure that they are made non-porous. This can be done with plywood by first thoroughly drying it in an oven at a fairly low temperature over a long period of time and then soaking the assembly in a good quality varnish. The base must have very good insulating properties.

An alternative to copper foil is aluminium foil with an electro-plated copper deposit on it. The plating can be carried out with a minimum of facilities. Bond a sheet of aluminium cooking foil to the base, and, after it has throughly dried, clean

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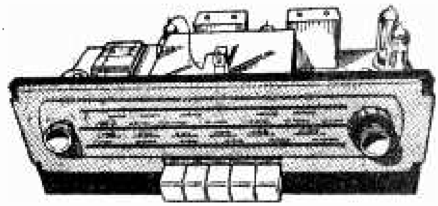

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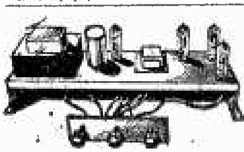

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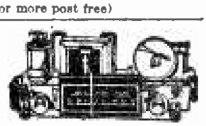

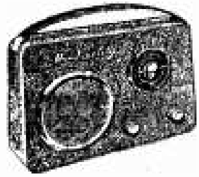

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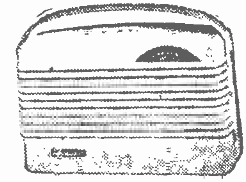

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AVO Multiminor Mark 4	£9.10.0	£1.18.0	12 of 14/4
T.M.K. TP10	£4. 7.6	£1. 7.6	3 of £1. 3.4
T.M.K. TP5S	£6.11.6	£1.11.6	6 of 19/2
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the surface lightly with a piece of fine emery paper, removing all traces of oil and oxidization.

Mix a solution of 2oz. copper sulphate to a pint of water in a shallow dish of glass, plastic or china. Place the board in the solution, face upwards, and connect a lead by crocodile clip between the foil and the negative terminal of a low voltage battery (less than 6V). Connect the positive terminal to a loop of heavy copper wire suspended over the surface of the foil but not in contact with it, the loop to be submerged in the solution.

As soon as the final connection is made, bubbles will rise from the copper, indicating that electrolysis is taking place. After 5 or 10 minutes the foil should be covered with a fine coating of copper and can be removed from the solution and washed under a tap.

The plating should not rub off under normal finger pressure. If it does it will be because either the surface was not cleaned fully at the beginning of the operation or too high a voltage has been used, resulting in excessive current flow and soft plating. After plating, the board is left to dry at room temperature and it is then ready for use.

The printed circuit board, home-made or purchased, is now ready to be prepared for the etching process. When the layout of the board has been decided, it should be carefully marked out with the pattern and the position of the holes for the components determined. A drill, about $\frac{1}{32}$in. diameter, is then used to drill gently through the board *from the copper side.*

The area of the board *not* to be eaten away in the etching process is now painted over with an acid resistant paint, such as Valspar, or with nail varnish, which is very quick drying. Make sure that the paint covers the copper exposed by the hole-drilling process.

A solution of about 3oz. ferric chloride to one pint of water, is now made up or purchased from the chemist, and placed in a shallow dish and the painted board gently immersed in the liquid, face upwards. The untreated metal will slowly dissolve, helped along by rocking of the dish.

When the entire untreated surface is seen to be eaten away the board is removed and washed under the tap to remove all traces of the solution. Finally, the paint is removed with a suitable spirit or paint remover and the board is ready for use.

The above etching process may take as long as an hour or so, depending on the strength of the solution, **which must not be allowed to come into contact with the eyes or clothes.**

When soldering the boards, the iron must not be held against the copper foil for too long, or the foil might become detached from the base.

When the circuit has been finally built up and tested it is often a good plan to dip the entire assembly in a good quality insulating paint or shellac, to protect the circuit from dampness and dust damage.

Encapsulation

A method of construction often used on military equipment is to loosly assemble a circuit in three dimensions using the connecting wires to support it, and then encapsulate the entire assembly in an epoxy resin, so that the finished product is a solid block of resin enclosing the circuit.

Such a circuit is incredibly strong, very compact, can be submerged in water with no ill effect, and is impervious to most acids. The only snag is that servicing is difficult!

If a piece of gear of this type does break down, it is necessary to chip away the resin until the faulty component is exposed, cut it away and replace it with a good part and then re-encapsulate the unit.

The procedure for making home-built units of this kind is as follows. Decide on the dimensional layout, wire the unit up and test it. If valves are used, they must be mounted external to the block, with the top of their valve holders flush with the top of the resin. Transistors may be fully submerged. Coat the whole assembly with varnish: this will facilitate salvaging of components during repairs.

Prepare a mould of tin, cardboard, or similar material to accommodate the wired-up unit, with a little space to spare all round, and line the inner surface with Vaseline, to stop the resin sticking to the mould.

Prepare the resin as per manufacturer's instructions, (Bondaglass "Clear Casting Resin", costing 10s. 6d. for 10 oz., is recommended, available from Bondaglass Ltd., of 53-55 South End, Croydon, Surrey), and pour into the mould to a depth of between $\frac{1}{8}$ and $\frac{1}{4}$in., and allow to set.

When this layer has dried, lower the painted circuit on to it, keeping it central in the mould. The paint should still be wet. Pour in more resin, until the circuit is covered, and warm slightly to remove any air bubbles. The resin is translucent and these will be visible. Place the unit aside to dry. This should take no more than 12 hours. Finally, remove the block from the mould and check that the circuit is still functioning correctly.

The main snag with this type of encapsulation is the expense. An alternative is to use Plasticine in place of resin as the encapsulating medium. The loss in strength can be made up by leaving the block in its mould. Such a technique retains the advantages of compactness, acid resistance, water proofing and ability to withstand hard knocks, without the disadvantage of being very difficult to service.

An alternative method of construction to the printed circuit that has many of its advantages may be used in conjuction with the Plasticine encapsulation technique, the resulting assembly being very cheap to make. Instead of using a piece of printed circuit to hold the components in place, a piece of Paxolin or similar material is used.

Holes are drilled to take the components in the normal way, and the components are pushed through the holes from one side of the board and ordinary connecting wires used to wire them up on the other side.

The components are thus held firmly in one plane, but are still subject to movement in the vertical. By now encapsulating in Plasticine, all movement of the components under natural forces is finally arrested and the unit is complete.

Part Two Next Month

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on the Short Waves

MONTHLY NEWS FOR DX LISTENERS

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

The Broadcast Bands—by John Guttridge

CONDITIONS in the short wavebands are now at their lowest ebb, with even the 11Mc/s band offering very limited openings after about 2100. Things should start improving, though, as winter recedes.

Station observations come from three listeners this month. Firstly up in the Shetlands reports good reception of *Radio Peking's* transmission to Australia from 0800—1030 on 9,457.

In Elgin, Paul Harris has been having some success with the 2100—2150 transmission of *Radio Nederland* on 6,085/9,590. He has also observed *Radio South Africa* in the evenings on 9,525/7,270. The former frequency, he says, is good with close down at 2115.

E. H. Conduit of Wolverhampton sends the schedule of English transmissions from *Radio Berlin International* (the East German state radio) to Europe. These are on the air from 1700—1800 on 6,080/6,115/7,132/7,300/9,730. At 2015—2045 these same frequencies are used with the addition of 1,510 medium wave. The last transmission of the evening is at 2200—2230 on 6,080/6,115/7,300 and 1,430 medium wave.

He also sends the schedule of United Nations transmissions to Europe. These are aired over *Voice of America* transmitters from 1800—1900 on Fridays and consist of ten minute programmes in Arabic, English, French, German, Greek and Turkish. Between 1800—1830 the programme is carried on 21,485 (Bethany), 15,250/17,800 (Greenville) and 9,710 (Tangier). From 1830—1900 frequencies used are 15,315 (Bethany), 15,150/11,780 (Bound Brook), 9,610 (Tangier).

African stations have been giving the best evening reception on 19 metres, Voice of America, Monrovia, being audible until after 2200 with English programmes. A surprise station in this band was *Trans World Radio*, Bonaire, (Netherlands Antilles) which was heard testing, with a weak signal and asking for reports at 1915 on 15,300.

One of the few signals to reach readability 3 in the 25 metre band in the late evening was *Radio Abidjan*, Ivory Coast. This was heard in London in French with Music on 11,820 at 2245.

If you haven't logged a Venezuelan yet try 4,970. If c.w. interference is not too bad you should be able to hear *Radio Rumbos*. Identification is given at 2230. The address for reports, which are verified, is Apt. 2618, Caracas, Venezuela.

The Kuwait Broadcasting Service, P.O. Box 397, Kuwait, currently uses two short wave outlets. These are a 50kW transmitter on 9,520 and a 10kW transmitter on 4,967·5. An English programme is carried on the latter frequency from 1700—1900. An attractive QSL-folder is sent for correct reports by this station.

Extensive changes have been made by *Radio Moscow* in its European English winter schedule valid until June 4th, the only unchanged transmission being that from 1200—1230. Details of the other transmissions are 0700—0730 on 9,590/7,280/7,240/5,980; 1900—1930 on 7,330/7,280/6,100/5,980/1,320; 2000—2030 on 7,330/7,280/6,100/6,200/1,380; 2100—2200 on 7,330/7,280/7,260/6,050/1,490; 2200—2230 as 2100 plus 5,960/1,380/1,320.

Radio Japan, Tokyo, Japan, now uses 7,195 in its 1500—1630, 1645—1845 and 1900—2000 transmissions to South Asia, the Middle East, and Africa respectively. The other frequency used is 9,525 with the addition of 9,705 for the 1500 transmission. General service transmissions between 1200 and 1930 (the first half of each hour) are now on three 31 metre band outlets 9,505/9,605/9,740.

Full verification details are given on the QSL issued by *Radio Voice of the Gospel*, ETLF, P.O. Box 654, Addis Ababa, Ethiopia. Unfortunately it neglected to send a programme shedule. This station transmits 12—13 hours of shortwave broadcasts in 13 languages every day over two 100kW transmitters.

The date is the only verification detail included by all India Radio, Post Box 500, New Delhi, India, on its otherwise colourful QSL Card. Several changes have been made in this station's winter schedule valid until March 6. The English transmission to Australia from 1000—1100 is now on 11,710/15,165 with 9,655/11,700/15,105/17,855 being used at the same time to Asia. The East African English transmission from 1840—1930 is now on 7,180/9,680/11,815/11,940. Although the frequencies—6,130/7,235/9,915—of the European English transmission at 1945—2045 remain unchanged, the relay to West Africa at the same time is now on 7,125/9,690/11,740.

Transmissions to the Caribbean and South America in Portugese from 2331—2400 and Spanish from 0000—0045 from the Canadian Broadcasting Corporation, P.O. Box 6000, Montreal, Canada, are now going out on 11,760/9,625/5,990. This winter this station not scheduled to use a frequency lower than 9,630 to Europe, although it used the 49 metre band last year. Full verification is given by this station to correct reports.

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Monthly programme schedules are not to be distributed by *Radio Nederland*, P.O. Box 222, Hilversum, Holland, in future. Instead schedules will be issued four times a year to coincide with the changes of season and frequencies. During January and February programmes remain basically unchanged with Dx Juke Box on Thursdays. Frequencies are as December.

The winter schedule of the *Voice of America* gives the following frequency usage for English to Europe: 3,980 0300—0730, 1400—2345; 5,995 0300—0730, 1630—2245; 6,040 0500—0730; 6,080 0300—0730; 7,200 0300—0730; 7,205 1500—1800, 1830—2245; 9,545 0500—0730; 9,670 1915—2215; 9,740 0500—0730, 1830—2245; 11,790 0500—0730; 11,825 1900—2215; 15,205 1400—2215; 15,290 1400—1630; 17,780 1400—1800. The medium wave outlet on 1,196 is used from 0400—0430, 0500—0730, 1700—1830, 2200—2345.

Finally, a collective "thank you" to many readers who have sent along news and reports. Sorry we cannot mention you all!

The Amateur Bands—by David Gibson G3JDG

FIRST this month a big "Thank you" to all those SWLs who sent in reports on the various bands.

1·8Mc/s

Top band seems to be rather abandoned by most reporters and no one appeared to listen out very much. I had a couple of very hectic one-hour sessions on November 14-15th in the M.C.C. 1·8 Mc/s contest. Many G stations were worked and the best "DX" was GW6GW at Blackwood in Monmouthshire. A ten-minute listening period, Sunday, November 29th, between 1800 and 1810, logged G2PT, G3SYX, G3TLE, G3OCA, PA0PN, GC3ECC, DJ3JZ.

Master Darrell Earnshaw (Preston) seems to have things pretty well organised in that his sister does a turn at the receiver. They offer the following log for 1·8: G3EXU, G3FIF, G3DMO, G3SSU, G3RFN, G3KE, G3NVN, G3GGS, G3TNN, G3KKU, G3WLQ, G3GEU, G3SWM, G3HFD, G3TFN, G3ERY, G3BES, G3JMA, G3NSW/M, G6ES/M, the stroke M signifying that the station is mobile and operating from a vehicle. All these stations on phone.

3·5Mc/s

This band also seems passed over by most listeners and only one letter offers any log at all. T. Cridland, of Canvey Island, uses a Codar CR45 (TRF) with an 18ft length of wire mounted vertically up the side of the house, heard these on November 14th between 0932—1016: G3PLR, G3HRD, G3SJ, G2WJ, G3MY, G2BSA, G3PZX. November 15th (1220—1342): G3PIX, G3RAO, G3POC, G3GFJ, G3PMC, G3PFT, G2AFR, G3RBF, G3MUW, G3SNI, G3TIZ.

7Mc/s

Forty metres also is sadly bypassed by all and sundry and no one mentioned it this month. It must be confessed that a quick listen most evenings would deter all but the very brave. This is a shame because after a while odd call signs start to appear and a little perseverance can produce quite an interesting log, especially early morning. Ten minutes on November 29th (1800—1810) logged LZ2ANB, G3GJX, YO8KAF, LZ1KBD, YO5KAI, PA0LV, UR2AO, UB5KCE and CR6AI.

14Mc/s

And so to the h.f. bands where 20 and 15m are firm favourites—not surprising considering the volume of traffic, particularly on 20. From 1738—1746 (yes, just eight minutes) W4BV, W1BFA, W2KXV, W2LSW, W2AZS, W3BYX, W4KFC, W2PCJ, I1ZCN, K3JCT, GB2SM, K8IKB, K1BBV were heard and these were only the loud ones.

Immediately after (at 1748) the bandswitch was set to 21Mc/s, same antenna, 60ft long wire, same receiver (r.f., f.c., i.f., det., o-p.), and guess what I heard—nothing, absolutely nothing!

J. R. Hunt (London) has an R1155 into a 67ft long wire, 15ft high, and reports between 0700—0905: 9G1DY, W3KFQ, W2LOY, WA2KIC, ZL3OP, VK6MM, all on 14Mc/s. P. D. Coull (Littlestone, Kent) reports (14Mc/s) VK3VJ, VS9MG; at 1600 VE8ML, VE8RG; at 1800 OX3MN at 1530 and TG9RJ, W2OKM at 1915. On 21Mc/s: 9G1EC, ZB1RM at 1030 and W1ONK at 1410. The gear—a Codar CR66 and a 60ft long wire.

M. Woollin (Leeds) uses a modified 19 set, an RF24 unit and a 100ft long wire. This little set-up raked in KA2RG, VK8KK, VK2JZ on s.s.b. at 1540 on 14Mc/s, while on 21Mc/s he really twists the knife into your poor scribe with ZC4MO, 9Q5YL, 9Q5PN, ZS1AB, SU1DL, VS9APT, 9G1DM, and all on a.m., phone too.

D. Howarth in Bolton, Lancs., uses a PCR3 receiver and a 20ft vertical. However, he also confesses to using a long wire with a 600Ω resistor at the far end. (The wattage is not stated, so don't write in and ask!) Fourteen Mc/s produced SP5ACD, OE6UX, OY7S, OE1HKW, CT1LX, W8RRT, OH1WI, F5KE, OE1GE, OH5NQ, EA3NA.

Down in wild and woolly Wales stations are coming in very well according to M. Carter, who listens at Colwyn Bay. On 14Mc/s VK2KM (s.s.b.) and 21Mc/s KV4CX (a.m.), W6BMG (s.s.b.) received on a 19 set Mk. 3 with a Labgear front end converter. A recently purchased H.R.O. Junior, also with a pre-selector, brought in VK3LN, WA6ZZ (s.s.b.), ZL1AY (a.m.) and KA7CLH (s.s.b.). The twist in the end of this story is that the antenna is an indoor dipole and the house is not more than 50ft a.s.l. Flat-dwellers proceed to the loft immediately with 33ft of wire! Incidentally, Michael says that most Pacific DX was received between 0730 and 0830 hours before going to school or 0730 to 1000 hours at weekends.

Bernard Hughes, BRS25901 (Worcester), runs an Eddystone 840C and a Codar pre-selector with a choice of either a 20m dipole or a 70ft long wire. With this set-up his 20m log is: 5ZHAO,

—continued on page 969

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BOOKS REVIEWED

RADIO SERVICING ("Teach Yourself" Books), by L. Butterworth.
Published by The English Universities Press Ltd.
257 pp. with index. 7½in. x 4½in. Hard cover. Price 10s. 6d.

THE "Teach-yourself" books have come in for a lot of banter. "How to be a physicist in six easy lessons", chaffs the comedian. But, in fact, a remarkable amount of useful information is contained in these 19 chapters, and the student with some access to practical workshop (or kitchen table) facilities would find this book a very inexpensive course on the subject.

The emphasis on the practical approach is evident from the outset. There is no opening gambit of long-drawn theory but an immediate attack on diagrams, soldering and simple measurement, leading to a second chapter which manages to slip a good deal of theory into a practical discussion of resistance and resistors. This is the technique throughout the book: the author demonstrates his theory by practical exercises, much as the lecturer would at technical college. Each chapter has a terminating list of exercises.

After resistance, series and parallel circuits, a.c. is dealt with, in a masterly chapter only a dozen pages in length, yet managing to bring in sine and square waveforms, frequency, measurement and even a description of the oscilloscope. Capacitors, inductances and transformers follow, with the usual protracted electromagnetic theory chopped down to the necessary minimum.

Chapter 7 deals with rectifiers, and this leads naturally to power supplies and thence to amplifiers, bringing in various valves and their characteristics and treating transistors as a natural parallel. Not, as so often, an adjunct to the business of radio servicing. Chapter Ten takes the reader straight from the triode amplifier to the junction transistor a.f. amplifier.

The next chapter, The Output Stage, reverts again to valve operation before leading to the rather special field of output transistorised stages. Here, there is a tendency to gloss over the subject with a remark: "*A number of other arrangements of output transistors may be encountered, . . .*" However, the student who has progressed thus far with the aid of this book should have little difficulty in developing his reading along sound lines.

After a chapter on low frequency amplifiers there is a surprising reversion to tuned circuits and oscillators, and thus to transmission and reception, r.f. circuits, selectivity, bandpass circuits and an introduction to alignment entering at this point, before a discussion of the superhet receiver itself. The book is rounded off with a chapter on workshop equipment and methods, which is, for a work of this nature, quite inadequate. The essence of radio servicing is the alliance of practical testing with theoretical knowledge, which the remainder of the book most admirably presents. This final chapter could have been much more comprehensive.—*H.W.H.*

GUIDE TO BROADCASTING STATIONS—14th EDITION
Compiled by the staff of "Wireless World" magazine.
Published by Iliffe Books Ltd.
128 pp. 7¼in. x 4¾in. Price 5s.

THE greater part of the contents of this extremely useful reference book appear under two main sections: Long and Medium-wave European Stations, and Short-wave Stations of the World, and these two headings almost describe the book's coverage of the subject sufficiently to make further comment superfluous. To elaborate, however, each section gives a comprehensive list of stations in order of frequency, also listing country of origin, power in kilowatts and the wavelength equivalent in metres. In the list of world s.w. stations, call signs are also given, while in the European list, channel numbers are quoted. Each section also provides a separate geographical list of the stations.

The book contains one other list which gives the international allocation of call signs by countries. A short list of the s.w. broadcasting bands precedes the short-wave section and in this section also, stations operated by "extra-territorial" organisations (e.g. British Forces Network, Voice of America) are indicated by abbreviations.

There remains one other contents item to be mentioned, at which can be levelled the only unfavourable comment the book as a whole warrants. A map showing the broadcasting regions of the world in the centre of the book, which would normally have been of much value and interest, is rendered indistinct through the use of poor quality paper. However, as already said this was the only adverse criticism of the book and this, when considered against the reasonable price can amount to no very great objection. Otherwise this book must be considered excellent value to the short-wave listener and the DX-er; cheap enough to discard for a new one as each revised edition appears.—*P.R.R.*

"PRACTICAL WIRELESS" INDEX

Indices for "Practical Wireless" Volume 39 (May 1963 to April 1964) are now available from Post Sales, George Newnes Ltd., Tower House, Southampton Street, London, W.C.2., price 1s. 3d. including postage.

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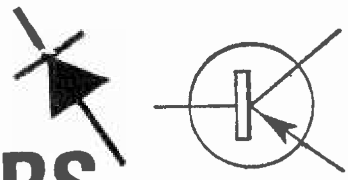
PART 5—FEEDBACK IN TRANSITOR CIRCUITS

Understanding SEMICONDUCTORS



BY LESLIE MOORE

CONTINUED FROM PAGE 890 OF THE JANUARY ISSUE

ANY natural oscillation tends to obey a sine law unless some interference or other, is used to distort that oscillation. Non sinusoidal oscillators exist which produce waveforms that may be square, saw tooth, staircase etc.; these are known as relaxation oscillators. One relaxation oscillator called the "astable multivibrator" or the "free running multivibrator", a fairly common circuit throughout the electronics field, produces an almost perfect square wave.

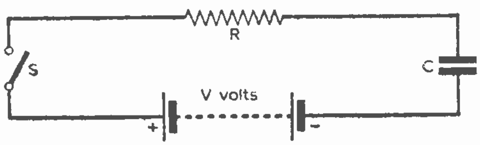


Fig. 33: A C/R series circuit.

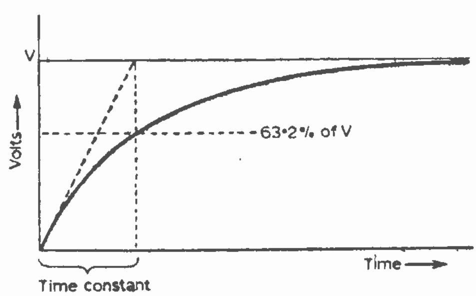


Fig. 34: A graph of the voltage "growth" across a capacitor in a C/R circuit.

An important factor in the design of the free running and other multivibrators, is that of the charge and discharge characteristics of a capacitor in a d.c. circuit.

Fig. 33 shows a series circuit including a capacitor C, resistor R, a battery of potential V volts and a switch S. When the switch is closed an instantaneous value of current would flow equal to R/V Amps. Current flowing in the circuit "charges" the capacitor, the charge acting in opposition to the flowing current; the value of charging current then decreases, the voltage across R will decrease so a potential will appear across C.

Taking this series circuit at face value we could assume three things:

(i) At the first instant there is voltage drop across the capacitor.

(ii) As time passes the capacitor charges hence causing a voltage drop across itself.

(iii) We could assume that finally no current would flow and hence no voltage drop across the resistor.

If the growth of potential drop across the capacitor were drawn on a graph with respect to time the result would be as in Fig. 34. This growth of potential obeys an "exponential" law. The bottom of the curve appears to be linear.

Suppose the rate of change of voltage across the capacitor at the beginning of the operation were sustained until a voltage equal to that of the supply voltage were reached. The time in which this operation would take place is known as the time constant. As the actual rate of change obeys an exponential law, in the first time constant the voltage rises by approximately 63·2% of the supply voltage. If the supply voltage were 100V then after one time constant 36·8V would appear across R. After a second time constant 63·2% of the 36·8V would further be dropped across C. The process is unending; theoretically current never stops flowing in the circuit, but in practice after a few time constants have passed any current flowing can be neglected—depending, of course, on the requirements of the circuit.

The time constant of a circuit is the product of capacitance and resistance.

E.g. If an 0·1μF capacitor were in series with a 1kΩ resistor the time constant would be:

$$0{\cdot}1 \times 10^{-6} \times 1 \times 10^{3} \text{ seconds}$$
$$= 0{\cdot}1 \times 10^{-3} \text{ seconds}$$
$$= 0{\cdot}1 \text{ milliseconds (mS).}$$

A capacitor discharging across a resistive load also loses its voltage exponentially.

The circuit in Fig. 35 is known as a differentiating circuit". If a square wave were to be applied

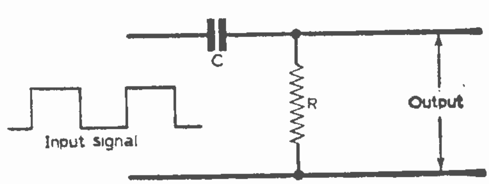


Fig. 35: The differentiating circuit.

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across the input the output would be a function of the combination of capacitive and resistive values. Suppose the time constant is very short compared with the time of existence of any one pulse, the capacitor would be able to charge almost fully to the applied voltage. Fig. 36a shows the output of such a circuit.

A square wave applied to the differentiating circuit with a long time constant compared with the wave time length would produce an output shown in Fig. 36b: this is because the capacitor is not allowed sufficient time to charge fully.

The circuit of a free running multivibrator is shown in Fig. 37. R1 and Tr1 are in series as also are R4 and Tr2. Because these two series circuits are not quite exactly the same in resistive values due to tolerances etc., one transistor may conduct slightly more current than the other. Assume that Tr1 conducts a higher value of current than Tr2, more voltage will be dropped across R1 than R4,

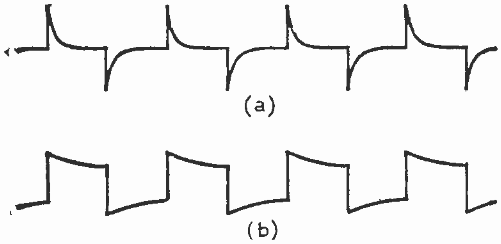

Fig. 36: (a) The output waveform of a differentiating circuit with a short time constant. (b) The output waveform of a differentiating circuit with a long time constant.

then Tr1 collector will be more positive than Tr2 collector. In the first instant of applying the supply voltage, the voltage across R1 will also be seen across R3. The base of Tr2 will be almost the same potential as the emitter, therefore current conduction through Tr2 will reduce, hence the collector of Tr2 will rise towards the negative supply voltage. The base of TR1 also rises towards this value and Tr2 will continue to conduct even more current. This action continues until Tr1 is conducting its maximum value of current (determined by the value of R1) and Tr2 is cut off. The capacitors C1 and C2 begin to charge as soon as current flows to their plates, therefore the base of Tr1 begins to hold a positive going potential and Tr2 a negative going one. A point is reached where conduction through Tr1 and Tr2 is switched due to the changing base potentials. The switching between Tr1 and Tr2 will continue because of the action of capacitors C1, R3 and C2, R2. The values of C1, C2, R2 and R3 are important as their time constants determine the circuit's switching frequency.

The output of the circuit is taken from any one of the transistor collectors. If a fairly good square wave is required the value of the output capacitor, C, and the resistive value of the load should form as long a time constant as possible.

The free running multivibrator is often used as a signal generator as there are very few components required and can be built very inexpensively.

Conclusion

Semiconductors have been seen to have a variety of uses; as a rectifier enabling the conversion of alternating currents into direct current, as an amplifier in the form of a transistor, as sinusoidal and square wave generators, they can be used as switches to half-pulse frequencies—these are only a few of their applications.

Numerous forms of semiconductor devices exist, the majority of which have not been mentioned in this series, they include the tunnel diode making possible the solving of problems at ultra high speeds, the variable capacity diode which is now used in frequency modulating circuitry replacing cumbersome and inefficient components, the four layer diode and unijunction transistor, each of which can produce saw tooth generations with as

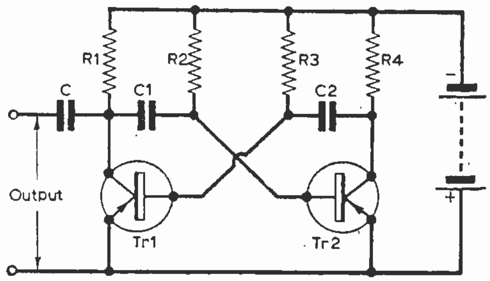

Fig. 37: Free-running multivibrator circuit.

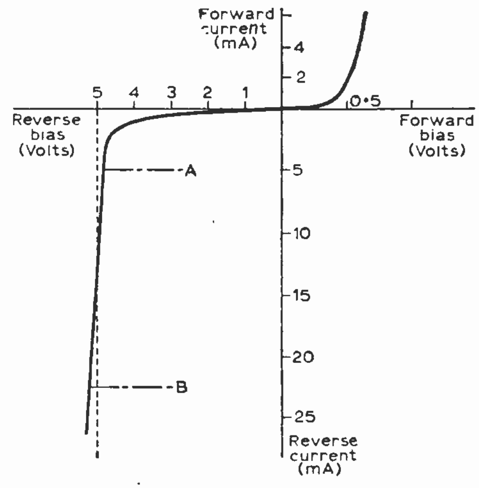

Fig. 38: A typical characteristic curve of a zener diode.

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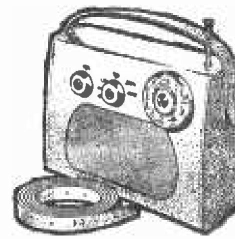

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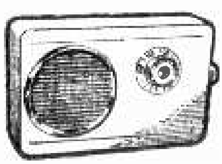

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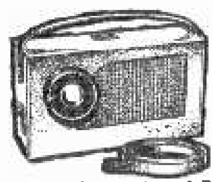

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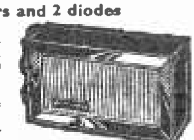

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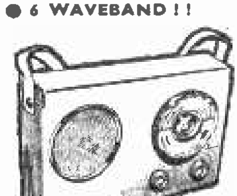

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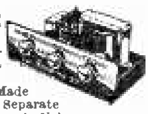

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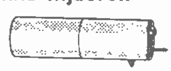

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AZ31	12/6	EBF89	7/6	EF89	8/-	EZ41	7/-	PCL83	9/-	U25	10/-	UL84	6/-	5Y3G/GT		6C5GT	8/-	6U5G	7/6	12AX7	5/6
DAF91	4/6	ECC81	4/-	EF91	4/-	EZ80	5/6	PCL84	7/-	U26	10/6	UY41	7/6		8/6	6C6	6/6	6V6G	4/-	12BA6	7/6
DAF96	6/6	ECC82	5/-	EF92	4/-	EZ81	5/6	PCL85	7/6	U191	13/6	UY85	5/6	6A7	12/6	6CD6G	25/-	6V6GT	7/6	12BE6	7/6
DF91	3/-	ECC83	5/6	EF98	10/-	GZ32	12/6	PCL86	10/-	U301	18/6	VP4B	17/6	6A8	8/6	6CH6	10/-	6X4	4/6	12K7GT	5/-
DF96	6/6	ECC84	6/6	EF183	9/-	HL41DD		PL36	11/6	U801	19/6	VR150/30		6AL5	3/6	6C6	5/6	6X5G	5/-	12K8GT	10/-
DK91	5/6	ECC85	6/-	EF184	8/-		12/6	PL81	7/6	UABC80	5/6		7/-	6AM6	4/-	6F6	5/9	6X5GT	8/6	12Q7GT	6/-
DK92	7/-	ECH35	12/6	EL33	17/6	KT66	17/6	PL82	7/6	UAF42	8/6	W81M	6/-	6AQ5	6/6	6H6	2/-	6/30L2	12/6	12SQ7	12/-
DK96	7/6	ECH42	8/6	EL41	9/-	KT81	10/6	PL83	7/6	UBC41	8/-	X61M	13/6	6AT6	4/6	6J5G/GT		7B6	21/-	19AQ5	8/-
DL92	5/-	ECH81	7/-	EL42	9/-	KTW61	7/-	PL84	7/-	UBF80	7/6	X78	26/-	6B8G	2/6		5/6	7B7	9/6	25Z4	7/6
DL94	7/-	ECH83	5/9	EL84	5/9	MU14	17/6	PY32/3	10/-	UBF89	7/6	X79	40/-	6BA6	5/6	6J7G	5/-	7C5	10/6	35L6GT	8/6
DL96	6/6	ECL80	6/6	EL95	9/6	N78	22/6	PY81	6/-	UCH42	8/6	1R5	5/6	6BE6	5/6	6K7G	2/-	7C6	9/6	35W4	6/6
EABC80	5/6	ECL82	8/6	EM80	8/-	OZ4	5/-	PY82	5/6	UCH81	7/-	1S5	4/6	6BJ6	8/-	6K7GT	2/6	7H7	6/-	35Z4	6/6
EAF42	8/6	ECL86	8/6	EM81	8/-	PCC84	6/-	PY83	7/6	UCL82	8/6	1T4	3/-	6BR7	10/6	6K8G	4/-	7S7	18/-	50C5	8/6
EB91	3/6	EF41	7/6	EM84	8/-	PCC89	8/9	PY800	8/6	UCL83	9/-	3T4	5/-	6BR8	12/6	6K8GT	9/6	7Y4	2/-	80	7/6
EBC41	8/-	EF80	5/-	EY51	7/6	PCF80	7/-	PZ30	12/6	UF41	7/6	3V4	7/-	6BW6	9/-	6L6G	7/6	8D3	4/-	90CG	25/-
EBF80	7/6	EF85	5/-	EY86	7/-	PCF86	9/6	SP61	3/-	UF89	7/-	5U4G	4/-	6BW7	9/-	6Q7G	6/-	10F1	10/-	99CV	25/-
EBF83	8/-	EF86	7/-	EZ40	7/-	PCL82	7/6	U14	9/-	UL41	7/6	5V4G	9/-	6C4	3/6	6Q7GT	10/-	12AU7	5/-	807	9/6

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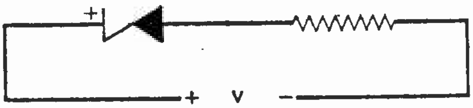

Fig. 39: In this circuit arrangement the zener diode is operating under reverse bias conditions.

few as two other components and a voltage supply, the list is unending.

One particular special purpose semiconductor device of interest to nearly all electronic enthusiasts, is the "Zener diode".

A normal pn junction diode under reverse bias conditions will begin to conduct current when the voltage applied to the diode is in the region of one to two hundred volts. This voltage is known as the breakdown voltage. A scientist named Zener examined this effect and because of his work the Zener diode, which has a breakdown voltage of only a few volts, is now in general use.

Zener diodes are used as voltage stabilisers, several types are in existence, each with a different breakdown voltage. Typical characteristics of a Zener diode are shown in Fig. 38. From the slope of the characteristic curve between points A and B, it is seen that for a large change in current through the diode, voltage across the diode changes only minutely. The Zener diode is worked on this part of its characteristic as a voltage stabiliser.

A Zener diode is shown in Fig. 39 in series with a resistor, a voltage supply is across the series circuit. Any small change in the supply voltage would cause a current variation in the series circuit. Providing the diode is in that part of its working region equivalent to being between points A and B in Fig. 38, for all practical purposes the voltage across the diode would not change: therefore the difference in supply voltage causes an equal voltage difference across the resistor.

If only a small stabilised voltage was required,

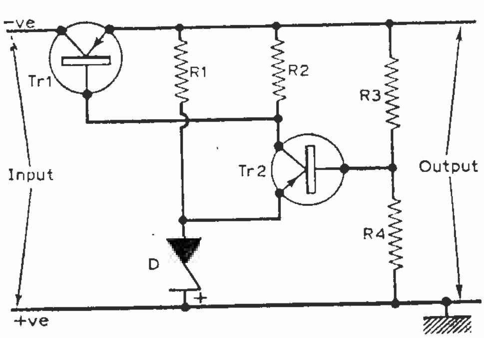

Fig. 40: A voltage stabiliser circuit, employing a zener diode, used as the last stage of a power amplifier. The circuit symbol of the zener diode used in these diagrams is only one of several in general use.

say 5V, a suitable Zener diode would be chosen for a circuit such as that shown in Fig. 39, the output would be taken from across the diode. This is an obvious application of the device, there are many, one of which incorporates the use of further semiconductors, again, as a voltage stabiliser.

The action of a power supply was explained earlier in this series: many circuits require a larger voltage supply than the breakdown voltage of a Zener diode to be stabilised. Fig. 40 shows the type of stabiliser that may be used as the last stage of a power supply.

The stabiliser has two purposes.

(i) to remove any ripple resulting from insufficient smoothing.

(ii) to give a stable d.c. output for any variation of mains voltage to the power supply.

Tr1 is acting as a variable resistor in the form of an "emitter-follower" circuit. D produces a constant emitter bias for Tr2. If the collector voltage of Tr1 were to change, the emitter would try to follow that change, but in doing so the base bias of Tr2 alters. The conductance of Tr2 changes as a result. The change in emitter-collector voltage of Tr2 is directly fed back to the base of Tr1. The conductance change of Tr1 due to this compensates for the change in Tr1 collector voltage and the emitter of Tr1 stays at a steady potential.

The stability of this circuit is due to D as it holds the emitter of Tr2 at a steady bias voltage.

There are many advantages of semiconductors over thermionic devices. They include, the small working voltages required for their operation, their comparatively small physical sizes, no power supply is required for their operation. One disadvantage of domestic type semiconductors (e.g. those found in portable radios) is that they must not be overheated.

Many of the problems encountered in electronics are associated with power supplies, and because of this power supplies have been dealt with fairly fully compared with the other subjects covered in this series, but the subject is not quite complete.

It is quite often required to have more space on a chassis to make minor alterations—a method of providing that space, if not already done, is to convert the thermionic rectifier into one using pn junction diodes. A small mounting on the mains transformer would be sufficient to hold the rectifying circuit, as diodes now exist with ratings of "*peak inverse voltage*" of 800V and "*peak forward current*" of 0·5A and are only as large as a ¼W resistor.

Semiconductors, although they appear to be extremely complicated, have much to offer—there are numerous types doing many operations, there are also many publications explaining in vivid detail the uses of semiconductors, I hope this series has helped you understand them. ■

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TRANSISTOR RECEIVER SERVICING

STEP-BY-STEP

EXPERIMENTERS and enthusiasts brought up on valve equipment sometimes have difficulty in switching their thoughts to transistor circuits and the relatively low voltages that these work with. When dealing with transistor equipment, the author finds it best to forget valve techniques altogether and look upon the transistor circuit as something new.

Although there are several parallels between valves and transistors, as brought out in the classic descriptions of transistor operation, there are often times during a fault tracing exercise when a transistor fault condition has no resemblance whatever to a valve fault condition.

This can complicate matters if one has stuck too rigidly to valve/transistor parallels.

With this in mind, this article is concerned not with how transistors and their circuits work particularly, but what to do when a transistor circuit ceases to function. Fortunately, a transistor is a simple device to work with since it has only three electrodes, these being called the base, the emitter and the collector, as shown on the transistor symbol in Fig. 1.

by Gordon J. King

There are two basic types of transistor, the p-n-p type which is used extensively in all transistor radios and small amplifiers and the n-p-n type which, until comparatively recently, was rarely seen in domestic equipment. However, mixtures of both types are now finding their way into the new radios and amplifiers, particularly in the output stage where their use together forms the so-called "complementary amplifier".

This type of output stage has the great advantage of requiring neither a driver transformer nor an output transformer, the speaker being connected direct to the transistors.

P-N-P and N-P-N Polarities

Symbols p-n-p and n-p-n are shown at (a) and (b) respectively in Fig. 1, and one important point to note at this juncture is that the collector of the p-n-p type is connected to supply negative while the electrode of the n-p-n type is connected to supply positive. If something is done during a servicing operation to cause a reversal of this potential, then it is likely that the transistor will burn out or be impaired considerably in efficiency.

When working as an amplifier, a transistor passes current through its collector/emitter circuit, but the current in the emitter circuit is very slightly higher than the current in the collector circuit since the emitter circuit carries also a little base current.

Collector current will not flow unless a little base current is flowing, and in order to satisfy this latter requirement the base of a p-n-p transistor must be connected to a negative potential while that of an n-p-n transistor must be connected to a positive potential.

Both the collector and base potentials are relative to the emitter, as shown in Fig. 2 at (a) for p-n-p transistors and (b) for n-p-n transistors..

The input signal may be applied either at the emitter or the base and extracted from either from the collector or emitter. The three resulting methods are shown in Fig. 3. That at (a) is the "common-emitter", at (b) the "common-base" and at (c) the "common-collector". Note that the common electrode in each instance is that which carries both the input and output signals.

Circuit Configurations

The common-emitter circuit has the highest power gain and is the most frequently used. The input impedance is medium and the output impedance medium to high.

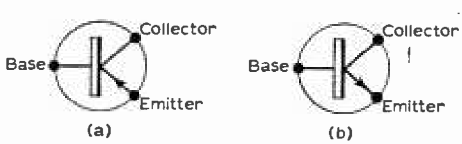

Fig. 1: Transistor circuit symbols; (a) p-n-p and (b) n-p-n. Note change in direction of emitter arrow head.

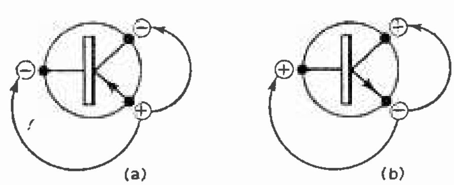

Fig. 2: Transistor polarity; (a) p-n-p and (b) n-p-n Voltages are relative to emitter.

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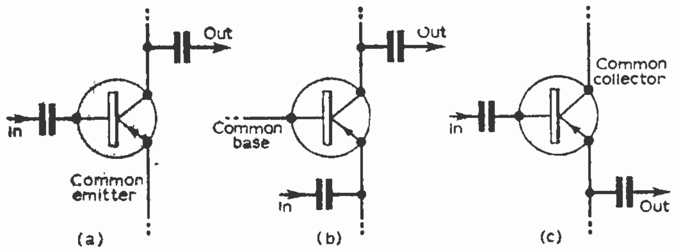

Fig. 3: Transistor configurations; (a) common-emitter, (b) common-base and (c) common-collector.

Transistor amplifiers can be subjected to both negative and positive feedback by applying from the output out-of-phase or in-phase signals to the input. In the latter respect, therefore, coupling for positive feedback turns the amplifier into an oscillator, the frequency of which is controllable either by CR or LC circuits in the usual manner.

The most usual method of applying the base and collector potentials to an amplifier is shown at (a) in Fig. 4. The potential-divider R1/R2 allows the base to be biased from the same supply source as feeding the collector. It also stabilises the base bias.

The emitter resistor R3 also serves to stabilise the transistor against an increase in collector current which can otherwise arise due to temperature increase, this being a characteristic of the transistor.

With R3, if the collector current rises, the emitter current also rises and the increase in volts drop across the resistor pulls back the base voltage and thus reduces the collector current.

D.C. Feedback

This gives d.c. feedback, but a.c. feedback is avoided in the common-emitter configuration by bypassing the emitter resistor with a capacitor having a low reactance at the signal frequency. In the common-collector configuration the basic stage is subjected to full negative feedback, since the emitter resistor cannot be bypassed as it represents the signal load.

Fig. 4(b) shows an alternative method of biasing the base by the use of a single, higher value resistor between base and the supply line. This, unfortunately, suffers from the misfortune of rather poor d.c. stability. A better arrangement is shown in Fig. 4(c), where the base resistor is returned to the collector end of the load instead of to the supply line.

Now armed with the basic facts of transistor circuits, we can investigate a few fault conditions.

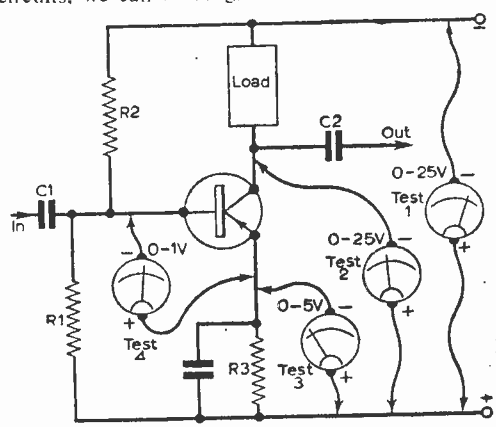

Fig. 5: Four major voltage tests which avoid breaking the circuits to insert a current meter. These are fully described in the text.

Let us suppose that we have a single stage amplifier, as shown in Fig. 5, that fails to work. What should be done first? The obvious thing, of course, is to ensure that the supply voltage is present. A voltmeter with a full-scale deflection of about 25V connected as for Test 1 in Fig. 5 will soon prove this possibility.

Open-circuit Collector Load

If the supply is correct, the negative lead of the voltmeter should be transferred to the collector as shown by Test 2 in the diagram. The load whether it be inductive or resistive, should have continuity, so this time we should read something a little

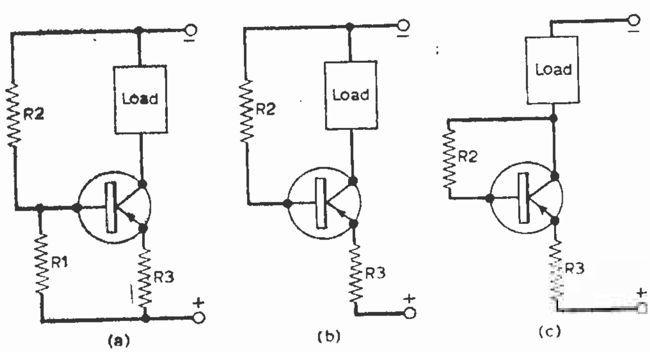

Fig. 4: Base biasing and stabilising arrangements; (a) base potential-divider R1/R2 (this is the most popular and effective), (b) with a single resistor to the supply line (stability poor) and (c) single base resistor returned to collector (improved stability).

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less than the supply voltage, depending upon the resistance of the load and on the current in it. If there is no collector voltage, then the fault is due simply to an open-circuit load.

If the collector voltage is about the same as the supply voltage and the load is resistive, this would indicate very little or no collector current. On the other hand, if the volts drop across the load is excessive one may conclude that the collector current is abnormally high. The best way of checking the collector current is to measure the voltage across the emitter resistor, as shown by Test 3 in the diagram.

If, for instance, the emitter resistor is 1,000Ω and 2V is measured across it, then we know from Ohm's law (current equals the voltage divided by the resistance) that the emitter current is 2mA.

The collector current is a little less than this calculated value, of course, since base current also flows in the emitter resistor. However, as the base current is only a matter of 100μA or so, the current difference between emitter and collector can usually be ignored when making simple tests.

If there is zero volts drop across the emitter resistor, then either the transistor is faulty or there is no base current (always remember that there must be base current to produce collector/emitter current of measurable magnitude). It could happen, of course, that the emitter resistor bypass capacitor has a short-circuit, but this is unlikely.

How, then, would one ascertain whether the trouble lies in the transistor or in the base bias circuit? One way would be to test the transistor either on a tester or by substitution. This is a time-consuming exercise and is not always easy on a densely-mounted printed circuit board.

There is also the danger of ruining the transistor or nearby components by excessive and prolonged heat from the soldering iron. By far the best idea is to ensure that the transistor is faulty *before* contemplating its removal from the circuit.

Final Test

If we have followed all the tests up to date, a final test, shown as Test 4 in Fig. 5, should verify the matter one way or the other. Here we are measuring base voltage pure and simple relative to the emitter. The voltage will be very small, for it needs only a fraction of a volt to give a base current of 100μA or thereabouts.

However, if there is a deflection on the test meter, one can be reasonably sure that the lack of collector current is due to transistor fault, as distinct from a fault in one of the associated components.

There are two important points. One is that the polarities given in Fig. 5 are for a p-n-p transistor. With a n-p-n transistor, the tests would be the same but the meter polarity would need to be reversed. The second, concerns test meter application and sensitivity.

Voltage and current transients can spoil a good transistor, so to avoid such happenings the meter should be connected and removed for the various tests with the circuit disconnected from the power supply. Also, the very small voltages, especially emitter and base voltages, call for a test meter with a full-scale deflection not exceeding about 2·5V. A f.s.d. of 1V is to be preferred.

It is important that the meter has a sensitivity of at least, 10,000Ω/V, otherwise the loading effect of the connected meter will disturb the circuit voltages and probably lead to incorrect interpretations.

So far we have considered very low or zero voltage across the emitter resistor. What do we do if the voltage here is abnormally high? It is true that this condition does arise, and an abnormal voltage on a small transistor would be considered in excess of that produced by a maximum current of 2mA.

For example, if 4V is measured across a 1,000Ω emitter resistor, the current would be 4mA, which is abnormally high for a small signal transistor.

High Base Current

This condition can be brought about by two major factors. One is excessive leakage in the transistor itself and the other a too high value of base current. Thus, it would be best to check first on the base voltage, as in Test 4, Fig. 5.

Make sure that the meter clip is actually contacting the base wire, for should the base end of R1 develop a dry joint on the printed wiring, the meter connected to that point would register zero volts, when in actual fact the base of the transistor proper would be highly negative. This is because the potential-divider effect would be destroyed (with R1 disconnected from the base wire) and base current would be limited only by the value of R2. It would thus rise to a far higher value than is normal when held down by the connected R1.

This, incidentally, is a frequent cause of high emitter current, not so much by R1 actually going open-circuit but by a dry-point developing at one end.

Capacitor Leak

It sometimes happens that the base and collector potentials are affected by a leak in the input or output coupling capacitors—C1 and C2 respectively in Fig. 5. This can be proved easily enough simply by disconnecting one end of the component and measuring the electrode voltages again.

A significant difference between the original reading and that made with the coupling capacitor disconnected, should lead to replacement of that capacitor. In audio circuits electrolytics are used extensively in these positions, and these tend to leak with age or when connected round the wrong way.

With p-n-p transistors, the negative side of an interstage coupling capacitor should be connected to the collector of the preceding transistor and the positive side to the base of the following transistor. The polarity is reversed, of course, with n-p-n transistors.

Self-oscillating Mixer

Basically, the majority of transistor stages can be resolved to that in which the tests are shown in Fig. 5. Fig. 6 gives the basic circuit of a self-oscillating mixer, as is found in most transistor portables. This has all the basic features. We have the base potential-divider comprising R1 R2, the emitter

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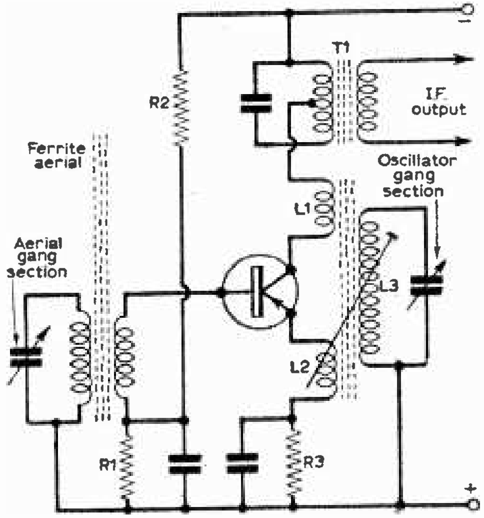

Fig. 6 (left): Basic self-oscillating mixer, as used in the majority of transistor portables.

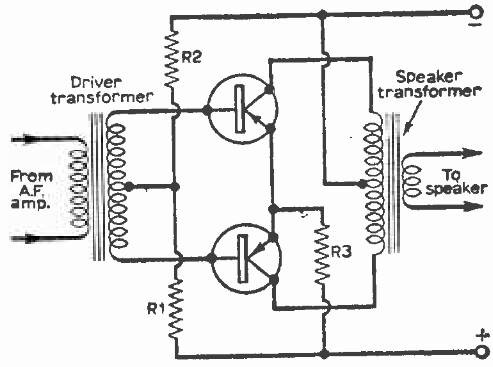

Fig. 7: The basic class B output stage.

resistor R3 with its bypass and the collector load which, in this case, consists of L1 and the primary of the i.f. transformer T1.

This, then, amplifier-wise, is a common-emitter circuit with the aerial signal applied to the base. Both the collector and emitter are loaded by L1 and L2 of the oscillator coil respectively. Positive feedback is thus applied from the collector to the emitter, causing the stage to oscillate. The difference-frequency (that is, the i.f.) is developed across the i.f. transformer which also acts as a second load in the collector circuit.

The transistor is biased by R1/R2 to approximate class A conditions, but when oscillation commences the transistor is driven towards class B conditions. This is because the base/emitter junction of the transistor rectifies the oscillatory signal.

Oscillator Test

Test 3 of Fig. 5 would give a slightly higher reading when the stage is oscillating than when it is quiescent. Here, then, is a test for oscillation. If there is a small decrease in voltage across the emitter resistor when the oscillator gang section of the tuning capacitor is shorted, then one can be sure that the stage is oscillating, at least.

By following the reasoning given in this article almost any transistor circuit fault can be diagnosed without having a great deal of experience in the servicing of transistor equipment.

Output stages have the same basic set-up, but here it is usual to find them biased towards class B conditions. Fig. 7 reveals a typical class B output stage, in which R1 and R2 form the potential-divider which biases both transistors and R3 is the common-emitter resistor. The bases are biased not exactly to cut-off, since this produces an unpleasant noise, called "crossover distortion", but to a small quiescent current.

Note that the emitter resistor is not bypassed in this circuit, and a thermistor may be employed instead of an ordinary resistor to enhance the thermal stability. The voltage across this component would normally be very low at zero signal due both to the low resistive value and the small quiescent current. However, the current rises to high values, as does the voltage across the emitter element, with increase in sound output.

Distortion

Excessive distortion can be caused by (i) unbalance in the transistors, (ii) incorrect biasing (due, for instance, to alteration in value of R1 or R2) and (iii) low battery voltage. ■

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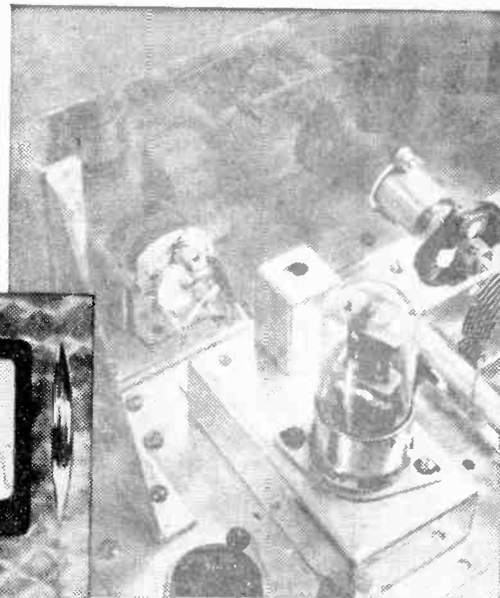

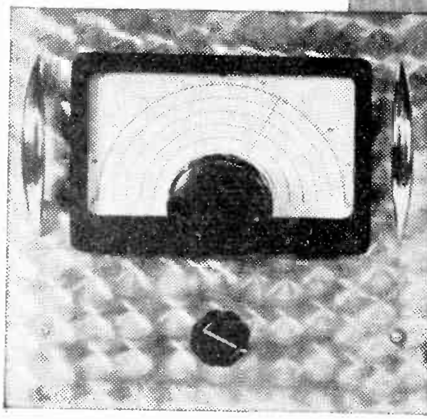

FOR THE BEGINI

IN the December, 1964, issue of PRACTICAL WIRELESS the author described the construction of a short wave superhet receiver particularly suited to the beginner. The receiver has now been in use for several months and has given an extremely good account of itself. In the interests of simplicity several desirable features were omitted from the original receiver. The chief among these were a stage of radio frequency amplification prior to the frequency changer and a beat frequency oscillator (b.f.o.) to enable continuous wave (c.w.) transmissions to be received.

The author has now incorporated these features in the original design and achieved a worth-while increase in performance. For the benefit of the

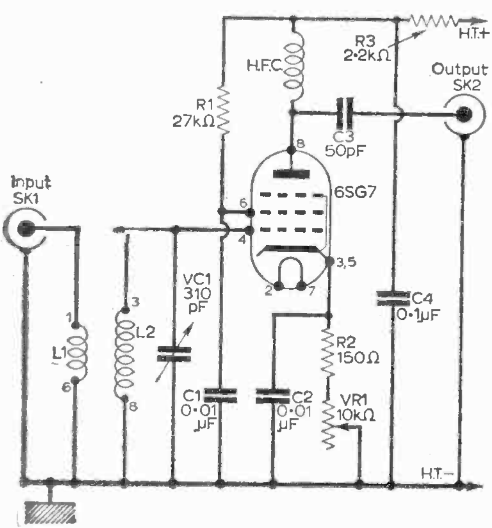

Fig. 1: The preselector unit circuit diagram.

COMPONENTS LIST

Resistors:

R1 27kΩ
R2 150Ω
R3 2·2kΩ
All 1W carbon
VR1 10kΩ w.w. potentiometer

Capacitors:

C1 0·01μF tubular
C2 0·01μF tubular
C3 50pF silver mica
C4 0·1μF tubular
VC1 310pF (Jackson E1)

Miscellaneous:

V1 6SG7
L1, L2 Aerial coil. Denco Maxi-Q, Blue. Ranges 3, 4, 5
SK1, SK2 Coaxial sockets

Two international octal ceramic valveholders. H.F. choke (Eddystone 1066). Universal chassis 8in. x 5in. x 3in. (Home Radio) and chassis top plate 9in. x 9in. 7-way tag strip. Flexible shaft coupler (Eddystone 50), dial (Eddystone 598), handles, knob, etc.

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beginner and particularly for those who built the receiver a full description of these adjuncts is given.

The Radio Frequency Amplifier

For peak performance over 10Mc/s or so, a stage of amplification at the signal frequency is a desirable feature in any receiver. Not only does it improve the signal-to-noise ratio but also a distinct reduction in second channel interference is obtained. For a brief discussion of this effect the reader is referred to the original article in the December issue. Noise in a receiver arises not only from man-made and natural interference but also from the receiver itself. Generally most of the noise is contributed by the first stage of the receiver and then principally by multi-electrode valves such as the frequency changer. Since this noise in the preliminary stage is amplified by the later stages then in effect only this early noise is of importance. A weak signal presented to the mixer would obviously be largely masked by the noise arising in this stage. An improvement in the signal-to-noise ratio would therefore be obtained by a stage of r.f. amplification prior to the mixer. Although such a stage is correctly called a preamplifier, frequently it is referred to as a preselector, the two terms being regarded as synonymous. A preamplifier increases the sensitivity of a receiver, while a preselector has for its objective an increase in selectivity. Although the author has freely used both terms in the text the distinction should be borne in mind.

The r.f. amplifier described in this article enhanced the performance of the original receiver, particularly on the 14 and 30Mc/s bands. With the amplifier in circuit hitherto weak signals were easily resolved.

Circuit Description

The circuit diagram of the instrument is given in Fig. 1. As will be seen, the circuit is quite simple and consists of a single-ended semi-variable mu pentode which is a 6SG7, used in conjunction with the Denco series of octal-based plug in coils. Tuning of the unit is by means of a 300pF variable capacitor C1. Since this is the value of the variable capacitor in the main receiver, excellent agreement between the unit and receiver dial readings is obtained. The gain of the amplifier is regulated by VR1, which is a wire-wound component. The r.f. output is fed via C4 to the output socket SK2.

A variable mu 6SK7 may be used in place of the 6SG7 with a slight loss in gain. The author also found that with VR1 set at maximum both the 6AC7 and 6SH7 types gave an extremely good performance. Both these types are, of course, non-variable mu.

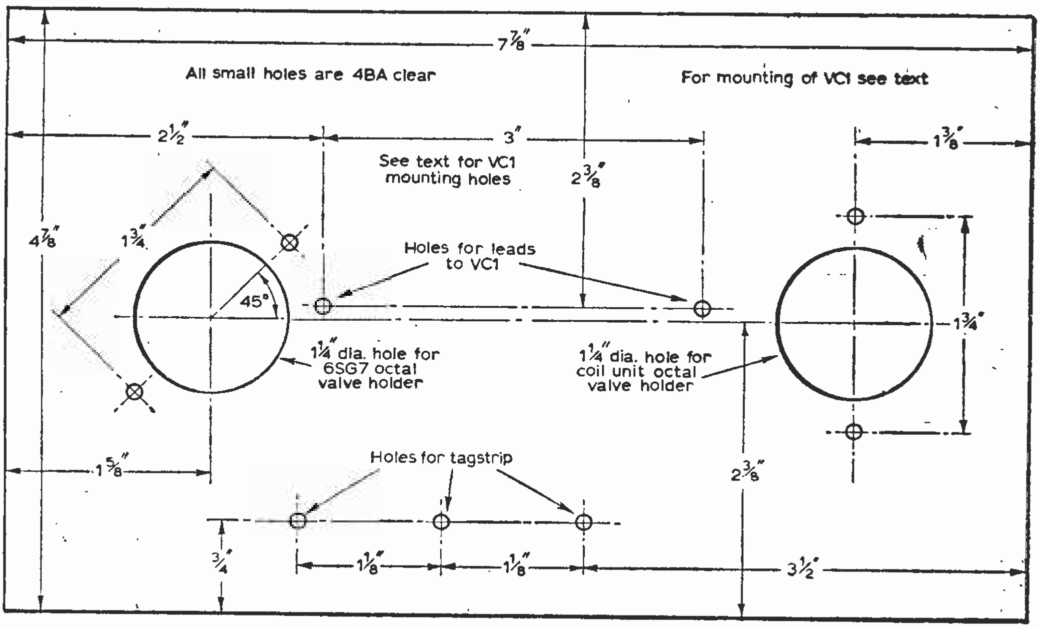

Fig. 2: Above-chassis drilling details for the preselector.

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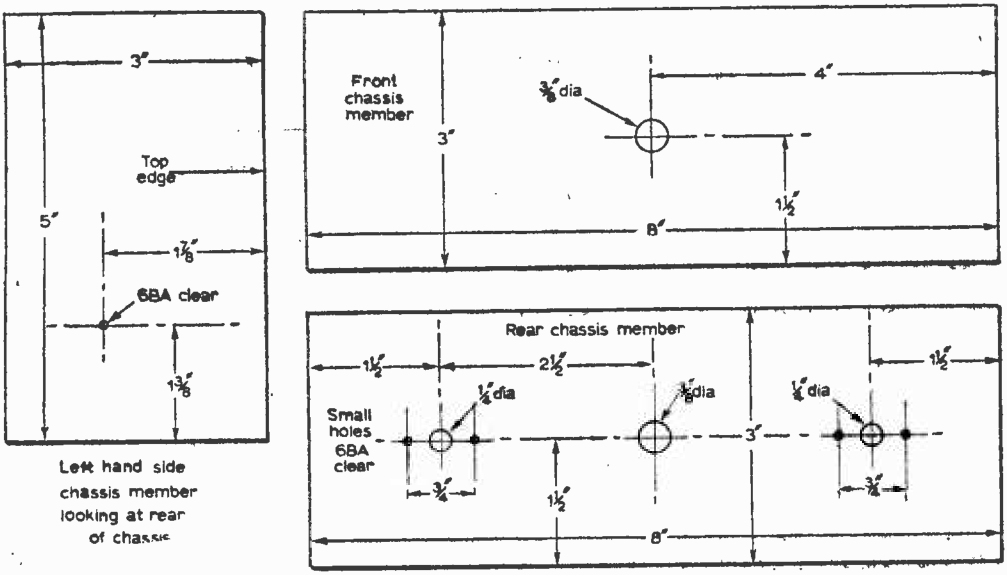

Fig. 3: Drilling details of the chassis members.

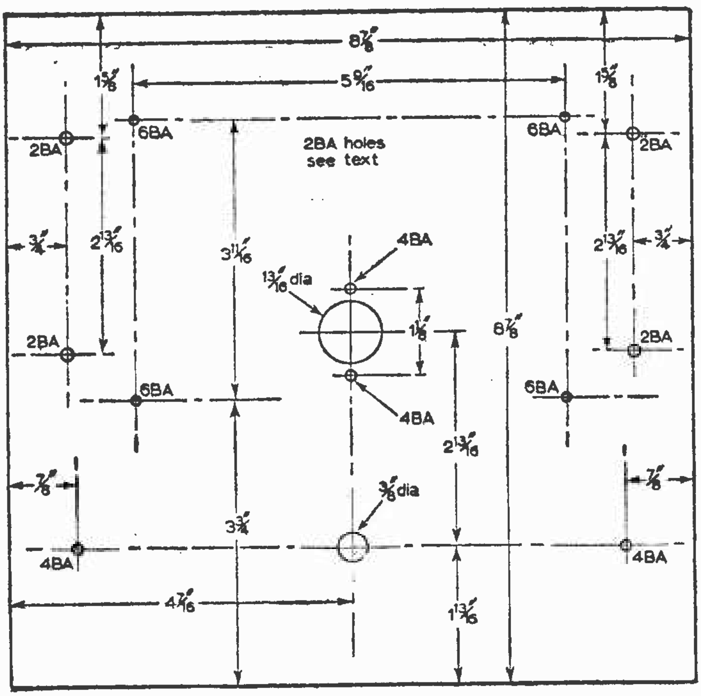

Fig. 4: Dimensions of the preselector front panel, showing layout adopted by the author. This may also be seen from one of the heading illustrations on page 964, the other photograph being of the b.f.o. unit mounted on the receiver chassis.

Constructional Details

The unit is constructed on a 5in. x 8in. x 3in. chassis and the front panel is a nominal 9in. x 9in. chassis top plate taken from the same chassis range. Full drilling details for the chassis and panel are given in Figs. 2, 3 and 4. It will be noted that no dimensions are given for the fixing of the variable capacitor. The author recommends that the holes for this component are drilled after the dial unit is fixed to the front panel. A further important point also concerns the variable capacitor mounting. The panel drilling details are applicable to the specified capacitor, which is a Jackson type E1. If another make of capacitor is used slight alteration of the dial height may be necessary. Careful attention to this point must be made before drilling the front panel.

Although tuning of the unit is relatively easy an Eddystone slow-motion dial was chosen for two reasons: first to provide calibration points identical with those on the main receiver and secondly to match up with the appearance of the main receiver. The drilling details of

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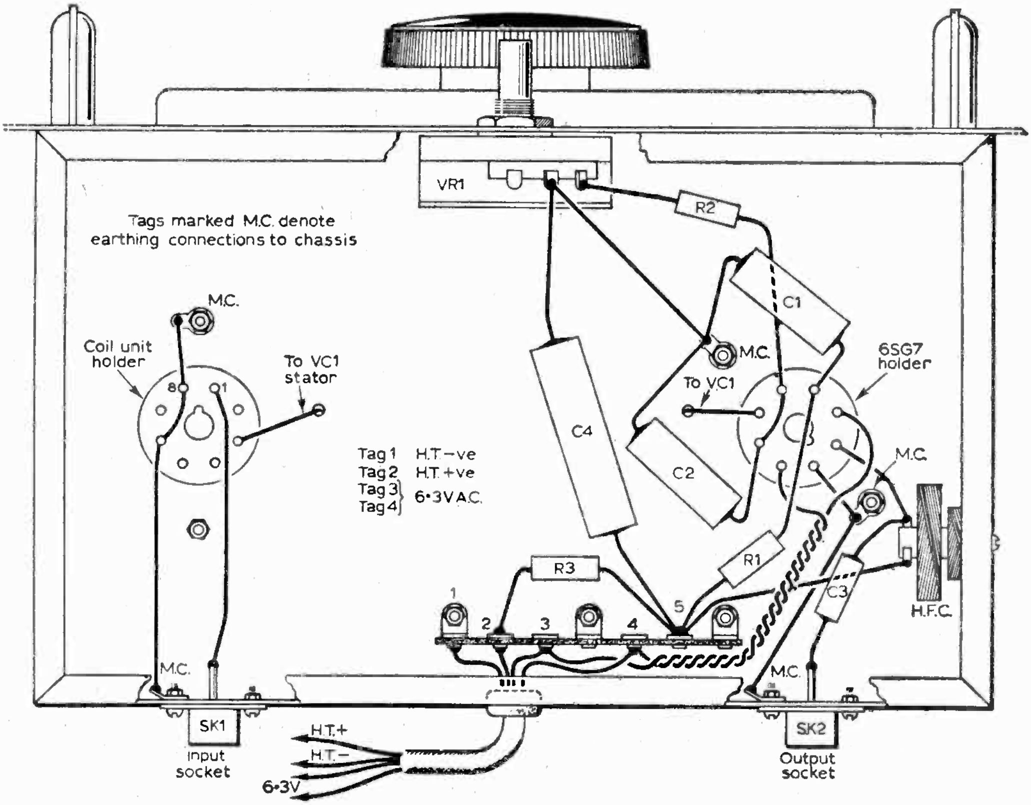

Fig. 5: Underchassis wiring diagram of the preselector.

the front panel are applicable to this dial.

When drilling of the front panel and chassis is complete the unit is temporarily assembled. The flexible coupler is placed on the dial shaft and the variable capacitor offered up to the coupler. Ensure that the capacitor shaft is in exact alignment with the dial spindle. Spacing washers under the mounting feet may be found to be necessary to achieve an accurate fit. When alignment is satisfactory the chassis holes are marked by pricking through the capacitor mounting feet. The panel and chassis may now be dismantled and the holes for the variable capacitor bored at the appropriate points. The fitting and wiring of components is facilitated by working on the dismembered chassis. The ceramic coil and valve holders are mounted, making sure the holders are correctly orientated. The mounting of the screening can for L1, L2 is described in the leaflet which accompanies the coils.

Great care is necessary when cutting the screening can base, since slight distortion of the thin gauge metal will cause an unsatisfactory fit. It is recommended that cutting of the base is done with a sharp razor blade of the singled-edged type. As an aid to easy coil changing the author found that a preliminary polish of the threaded portions of the can and base with metal polish greatly facilitated the removal of the can. The remaining components are assembled as shown in Figs. 5 and 6. Since the frequency stability of the unit is important, all wiring should be carried out in heavy gauge copper wire. Wiring of the gain control, coaxial sockets and high frequency choke is completed when the chassis is assembled. A short piece of copper braid stripped from a piece of coaxial cable is used to earth the frame of the variable capacitor to the fixing screw on the holder of L1, L2. Do not rely on the fixing feet of the capacitor as being a sufficient earth.

When wiring is complete a range 3 coil is plugged into the holder and a check made of the resistance between h.t. positive and chassis This, of course, is a wise precaution before connecting any new equipment to a power supply. A slight reading will be obtained initially due to C2 and C5. After a little time the meter should register practically infinite resistance. The unit is connected to the receiver power pack. In the author's unit an additional octal valve holder was

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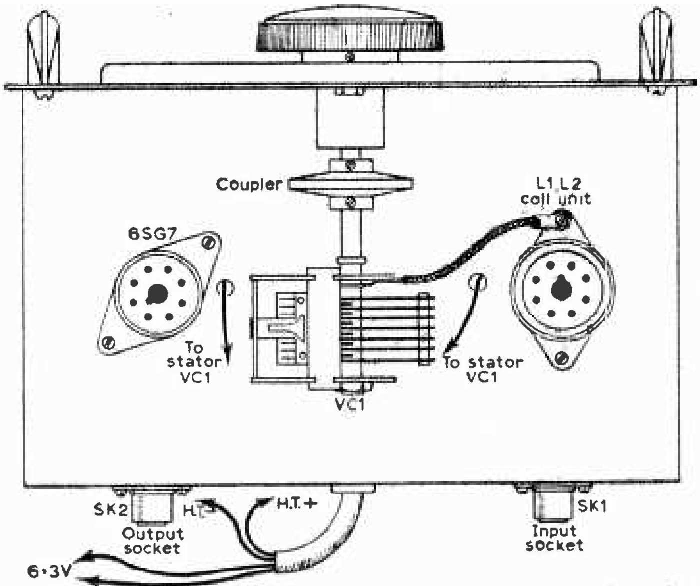
Fig. 6 (right): Layout and wiring above-chassis.



fitted to the power unit and the amplifier power leads terminated in an octal plug. The same wiring convention used in the main receiver was adopted for the wiring to the plug and socket. A short length of coaxial cable which terminates in a coaxial plug at each end is connected between SK2 and the main receiver aerial socket. A set of range 3 coils is plugged into the main receiver and the power unit switched on. When steady conditions are obtained the following voltage readings should be obtained. The author used a 10,000Ω/V meter set to the 1,000V range for h.t. measurement and the 10V range for bias voltage measurement.

Voltage Readings at 6SG7. Gain Control Maximum:

Anode Pin 8	Screen Pin 6	Cathode Pins 3, 5
205V	110V	2·1V

The aerial is connected to SK1 on the amplifier and the amplifier and receiver dials set to 85°. After setting the gain control to maximum the iron core of L1, L2 is adjusted until a marked increase in noise level occurs. The core of L1, L2 may now be secured either with a blob of sealing compound or by running a 6BA nut down the free end of the thread. If this latter device is adopted the core must be held securely by a screwdriver while the lock nut is tightened.

The remaining coils (ranges 4 and 5) are dealt with in a similar fashion. It will be found that simultaneous adjustment of the unit and receiver is very simple. Over a small range of frequencies such as an amateur band the amplifier may be peaked in the centre of the band and fine tuning done on the main receiver. Slight adjustment of the amplifier will only be necessary at the band edges.

With VR1 set for maximum gain it may be found that oscillation occurs on the highest frequencies. A slight reduction in the setting of VR1 will therefore be necessary. The author found that the unit was quite stable and no trouble should be experienced on this score. If the constructor encounters this effect a 10Ω resistor wired in series with the grid leak of the 6SG7 should provide a cure. This resistor should be mounted as near as possible to the grid pin.

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"WALKIE-TALKIES"

A CLARIFICATION OF THE POSITION

FOLLOWING our recent editorial comments on the subject of amateur radio pirates, which touched upon the question of the various walkie-talkie transceivers being sold in this country, we feel it would be helpful both to readers of this magazine and to advertisers to print below a communique issued by the GPO. This makes clear any doubts which may exist concerning the use of such equipment.

"WALKIE-TALKIES"

Any use of radio communication in the United Kingdom must be licensed by the Postmaster-General, and the Post Office has recently conducted successful prosecutions for the unlicensed use of "walkie-talkie" radio equipment operating on frequencies around 27·12Mc/s. It may not be generally known that the Postmaster-General will not license the transmission of *speech* on these frequencies as the band has been designated for industrial, scientific and medical use.

Transistorised transmitter/receivers are also available working on slightly higher frequencies, e.g. 28·5Mc/s, but this frequency falls in one of the bands assigned for use by licensed radio amateurs. Before an amateur licence is granted the applicant has to pass the Radio Amateur (Technical) Examination and the Post Office 12-words-per-minute Morse sending and receiving test.

Dealers would therefore be well advised to bear in mind, when offered "walkie-talkie" equipment using a frequency of 27·12Mc/s or thereabouts, that the Post Office will not issue licences to purchasers of this equipment and any use, including that for demonstration purposes, without a licence would be contrary to the law. Furthermore, equipment operated by licensed amateurs in the 28·0—29·7Mc/s band must be capable of operating within the terms of the Amateur (Sound) Licence—for example, a satisfactory method of frequency stabilisation must be employed in the sending apparatus and frequency measuring equipment must be provided capable of verifying that the sending apparatus operates within the frequency band of 28·0—29·7Mc/s.

Facilities are available for private mobile radio services using speech in the 80, 160, 170 and 460Mc/s bands and suitable equipment which conforms to the relevant Post Office specification can be obtained through the trade.

It is also worth mentioning that most of the ex-Service mobile radio equipment on the market operates on frequencies not available for private mobile radio services in the United Kingdom and could not be adapted to operate satisfactorily within the narrow v.h.f. channel available. The use of such equipment is therefore not permitted by the Post Office on private mobile radio services.

On the Short Waves

—continued from page 953

9X5GG/P, K4ASR/MM, WA2EZJ/M, W1EQP/4, VK2AHT, OX3JD, ZB1RS, EL1H, OX3LP, K1JTN/P4, 5H3JR, ZB1RM, ZS6U, CR7CO, all s.s.b. or a.m.

A. H. Trickey (Bristol) has an R208 and on erecting a 20m dipole found he only had a 15m garden, so a "bit" was lopped off each end. Although it now resonates at about 17Mc/s and is bridged across for other bands, 21Mc/s proved lively with F5BV, G3OYF, W5PFY/MM, W3UGW, WA4FWN, W3KFK, PY1SZ, W4SUF, G5FS, KV4CX, W1BNH/MM, OH5SM, YO2DZ, UA3KND, W2AWD, K3CMH, W1NRK, K4BIY, W2WLI, W2JY, W1ZER, W2KLN and W4ZLB.

E. Conway (Exeter), using the antenna I described in the November issue, heard PJ2NA and VP7NT in Nassau. M Opie (Dorset) uses a domestic receiver, HMV model 511446, with an end-fed long wire. A one and a-half hour session one Sunday raised WA4TLI, WA4SAN, W4TUQ, W2BLQ, K1IJF, K3MBF, WA0HHX, all on 21Mc/s. While on 14Mc/s: OH5NQ, I1PAD, VE3ATU, TF3WJC, W8GZL, W4BBW, WA5KBO, WB2LRN. A week later another period of one and threequarter hours on 21Mc/s: KV4CX (Virgin Islands), EL5LA, ON4PH, W8RLT, K2JDW, K3HQM, and on 14Mc/s: I1VK, I1RT, OH5RZ, VO1VR, VE2AKZ.

In General

W1BB is definitely "at it" on 160m and if you are set on hearing something special on top band then the early mornings are well worth a try.

Gough Island is reported active under a ZD9 call sign and there is a lonely soul in Antarctica signing OR4VN. If you should hear UA1KED don't pass him over as just another Russian station—he's located in Franz-Joseph Land

Contest enthusiasts have the affiliated societies contest on January 23rd-24th and on January 30th-31st, the ether will really be humming for this period with three contests. There's a C.W. contest on 2m, while at the other end of the scale is the CQWW 1·8Mc/s contest. The French REF contest C.W. section is also on for Morse fans, so all in all this period should give SWLs quite a busy period.

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PREPARING FOR THE R.A.E.

BRIAN ROBINSON.

4: IMPEDANCE, RESONANCE—COUPLED CIRCUITS

4.1 Impedance

If a circuit contains not only resistance but also reactance (either capacitive or inductive) the combined effect of the two is called *impedance*. Although impedance strictly refers to a combination of resistance and reactance, the terms "resistive impedance" "capacitive impedance" and "inductive impedance" are often met. Impedance is represented by the letter Z.

4.2 Reactance and Resistance in Series

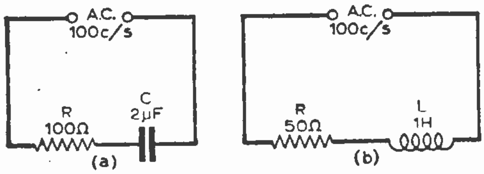

Fig. 30—Resistance in series with (a) capacitance and (b) inductance.

When reactance and resistance are connected in series, as shown in Fig. 30, the impedance will be given by—

$$Z=\sqrt{R^2+X^2}$$

—where X is either the reactance of the capacitance in Fig. 30a, or the reactance of the inductance in Fig. 30b.

To find the impedance of the series circuit in Fig. 30a, firstly find the reactance of the capacitance—(f in cycles per sec. and C in farads)

$$X_c=\frac{1}{2\pi fc}$$

$$=\frac{1}{6{\cdot}28\times100\times0{\cdot}000002}$$

$$=796\ \Omega\ \text{(approx.)}$$

Therefore the impedance Z equals—

$$\sqrt{R^2+X_c^2}$$

$$=\sqrt{100^2+796^2}$$

$$=\sqrt{643{,}590}$$

$$=802\ \Omega$$

or in Fig. 30b firstly find the value of the inductive reactance—
(f in cycles per sec. and L in henrys)

$$X_L=2\pi fL$$

$$=6{\cdot}28\times100\times1$$

$$=628\ \Omega$$

Therefore $Z=\sqrt{R^2+X_L^2}$

$$=\sqrt{50^2+628^2}$$

$$=\sqrt{396{,}870}$$

$$=630\ \Omega$$

(Remember that in a series reactance/resistance circuit where two or more reactances are connected in series the total reactance is)—

$$X=X_1+X_2+X_3$$

4.3 Resistance, Capacitance and Inductance in Series

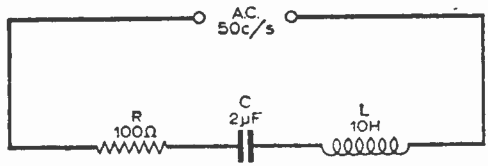

Fig. 31—Inductance, capacitance and resistance in series.

When resistance, inductance and capacitance are connected in series as shown in Fig. 31, the impedance of the combination will be given by—

$$Z=\sqrt{R^2+(X_L-X_c)^2}$$

For example, in Fig. 31, the value of X_c is 1,592 Ω and that of X_L is 3,140 Ω.

Therefore $Z=\sqrt{100^2+(3{,}140-1{,}592)^2}$

$$=\sqrt{10{,}000+2{,}396{,}600}$$

$$=1{,}551\ \Omega$$

4.4 Resistance and Inductance or Capacitance in Parallel

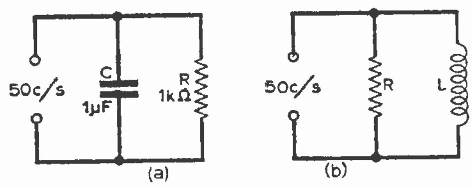

Fig. 32—Resistance in parallel with (a) capacitance and (b) inductance.

In the circuits shown in Fig. 32, the impedance is given by the expression—

$$Z=\frac{RX}{\sqrt{R^2+X^2}}$$

—where X is equal to X_c in Fig. 32a and X_L in Fig. 32b.

In Fig. 32a, R=100 Ω and X_c=3185 Ω.

Therefore $$Z=\frac{100\times3185}{\sqrt{100^2+3185^2}}$$

$$=\frac{318500}{3186}$$

$$=99{\cdot}9\ \Omega\ \text{(approx.)}$$

4.5 Impedance applied in Ohm's Law

Impedance, current and voltage can be connected by the form of Ohm's Law

$$I=\frac{E}{Z}\ \text{or}\ E=IZ\ \text{or}\ Z=\frac{E}{I}$$

For example, if in Fig. 32a the applied voltage was 250, the current flowing in the circuit would be given

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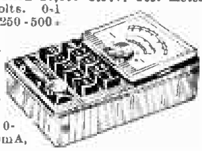

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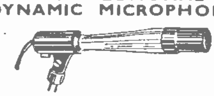

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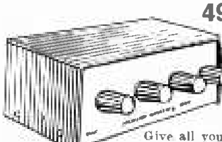

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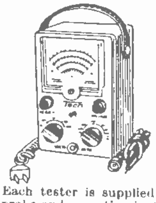

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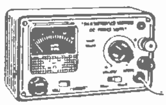

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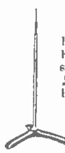

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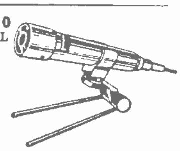

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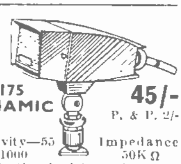

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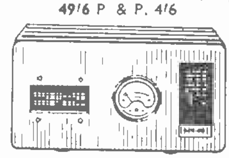

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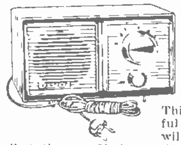

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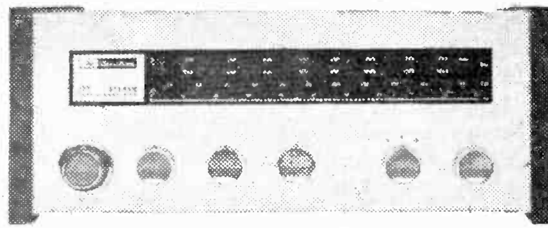

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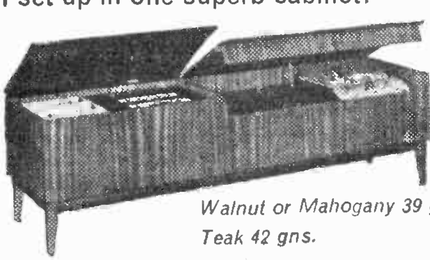

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$$I=\frac{E}{Z}=\frac{250}{99\cdot9}$$
$$=0\cdot25 \text{ amps (approx.)}$$

4.6 Power Factor

In a circuit containing resistance and reactance, only the resistance actually consumes power. The *power factor* of a circuit in which an alternating current is flowing is the ratio of the *actual power* consumed to the *apparent power* consumed.

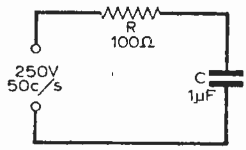

Fig. 33—Resistance and capacitance in series with a 250V a.c. supply.

In Fig. 33 the applied voltage is 250 and the impedance of the circuit is 3186 ohms. The current flowing in the circuit is given by

$$I=\frac{E}{R}=\frac{250}{3186}$$
$$=0\cdot0638 \text{ amps.}$$

Therefore the *apparent power* consumed is

$$W=EI$$
$$=250\times0\cdot0638$$
$$=15\cdot9 \text{ watts.}$$

Only the resistance actually consumes power however and this is given by

$$W=I^2R$$
$$=0\cdot0638^2\times100$$
$$=0\cdot41 \text{ watts.}$$

Therefore the *power factor* will be—

$$\frac{\text{Actual Power}}{\text{Apparent Power}}=\frac{0.41}{15.9}$$
$$=0.026$$

The Power Factor may also be expressed as a percentage—and remembering that for a *purely resistive* circuit the power factor is 1 (or 100%)—the power factor in the above example would be 2.6%.

4.7 Resonance

The frequency at which the inductive reactance and capacitive reactance are equal, in a radio frequency circuit, is called the *resonant frequency.*

$X_L=X_c$ substitute in the expression, $2\pi fL$ for X_L and $\frac{1}{2\pi fc}$ for X_c and we obtain—

$$f=\frac{1}{2\pi\sqrt{LC}}$$ where f is in cycles per second, L is in Henrys and C is in Farads.

For *radio frequency* work it is often much easier to use the expression

$$f=\frac{10^6}{2\pi\sqrt{LC}}$$ where f is in kilocycles

L is in microhenrys ($L\times10^{-6}$) and C is in microfarads ($C\times10^{-12}$). Resistance does not affect the resonant frequency of a circuit.

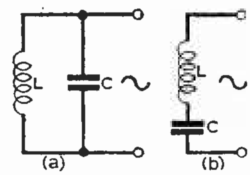

Fig. 34—Resonant circuits; (a) parallel and (b) series.

The above formulae for finding the resonant frequency of a circuit are true for both series and parallel circuits at the resonant frequencies—however the two circuits shown in Fig. 34 behave differently at frequencies other than the resonant frequency. The reader is urged to study further the differences between series and parallel resonant circuits and also to look into the *quality factor* (*Q*) of a coil or capacitance which is basically the ratio of the reactance of the component to its resistance.

4.8 Coupled Circuits

If energy from one circuit is transferred to a second circuit the two circuits are said to be *coupled.* Coupled circuits may be used also to match the impedance of one circuit to that of another so that maximum power can be transferred. The circuit receiving power is called the *secondary circuit* and that supplying power is called the *primary circuit*.

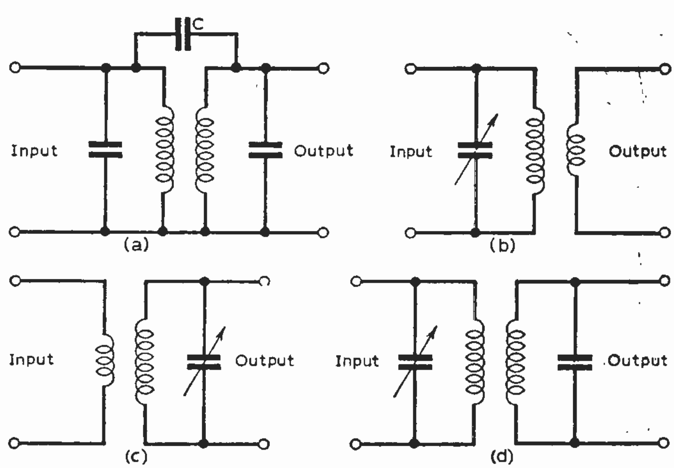

Fig. 35—Four examples of coupled circuits.

Four methods of coupling circuits are shown in Fig. 35. In (a) the capacitance C is used as a common feature to both circuits and therefore permits a transfer of power. In (b) the primary circuit only is

—continued on page 990

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Hints for improved f.m.

BY K. ROYAL

NOW that it is becoming increasingly more difficult to use the medium-wave band after dusk, due to the rising whistles and "monkey chatter" from closely adjacent and "on-frequency" interfering stations, especially at the top end of the band, more and more serious listeners are turning their attention to the possibilities of achieving improved results on the f.m. (frequency modulation) band.

In the v.h.f. Band II spectrum—from 87.5 to 100 Mc/s—the BBC transmit at relatively high quality the Home, Light and Third programmes and also regional progammes in some areas. Under normal reception conditions these signals are totally immune from the interference troubles of the medium waves.

However, a listener going over to f.m. for the first time may be sadly disappointed in the results, for instead of the clear reception expected he may find the programmes badly disturbed by things like crackles from passing cars, by a peculiar warbling note effect marring the tuned programme, and in some cases by a distortion of a kind that leaves the impression of an incorrectly centred loudspeaker speech coil.

These apparent shortcomings, coupled with the possible difficulty of tuning in the required station, may cause the listener to abandon the f.m. service and resort back to the medium frequencies with the "monkey chatter" and whistles.

In the majority of cases of this nature investigated by the author, greatly improved results on the f.m. service have been obtained by a little attention to detail and by one or two simple adjustments, which this article sets out to describe. Firstly, however, it should be remembered that the vast majority of the British Isles is now adequately embraced by the f.m. service, either from main transmitters or from booster or relay stations. Table 1 gives a complete list of such stations, existing and projected.

Signal Propagation

Secondly, to understand the v.h.f. system, an elementary idea of how the signals are propagated is desirable. Under normal conditions the v.h.f. signals from the transmitting aerial follow a very slight curve over the local surface of the earth, as shown in Fig. 1(a). This means that at distances exceeding the curved path length the receiver is virtually outside the range of the transmitter.

This gives the service area of a v.h.f. station which, rarely, for consistent reception, exceeds 50 to 60 miles from transmitter to receiver, though height of the receiving aerial above sea-level will, of course, have some bearing on this, as would be expected.

The v.h.f. service is thus a "local" service, for consistent use of listeners only within the range of the service area. This is the reason for the large number of transmitters required to cover the country as revealed in Table 1.

Now, the signal propagation at medium

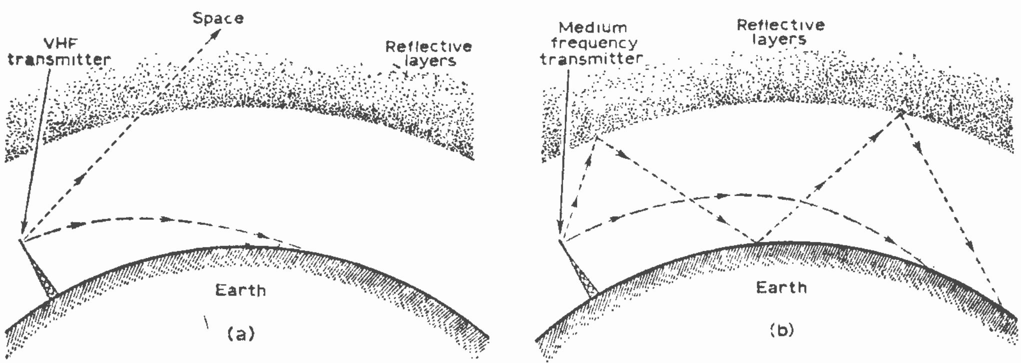

Fig. 1: Signal propagation. (a) Here the v.h.f./f.m. signal follows a slightly curved path from transmitter to set, while sky signals pass through the reflective layers. At (b) is shown that at medium frequencies the ground wave hugs the earth over a greater distance while the sky signals are reflected back to earth from the upper atmospheres. Thus, while the range of a v.h.f. signal is limited, medium frequency signals are propagated over far greater distances.

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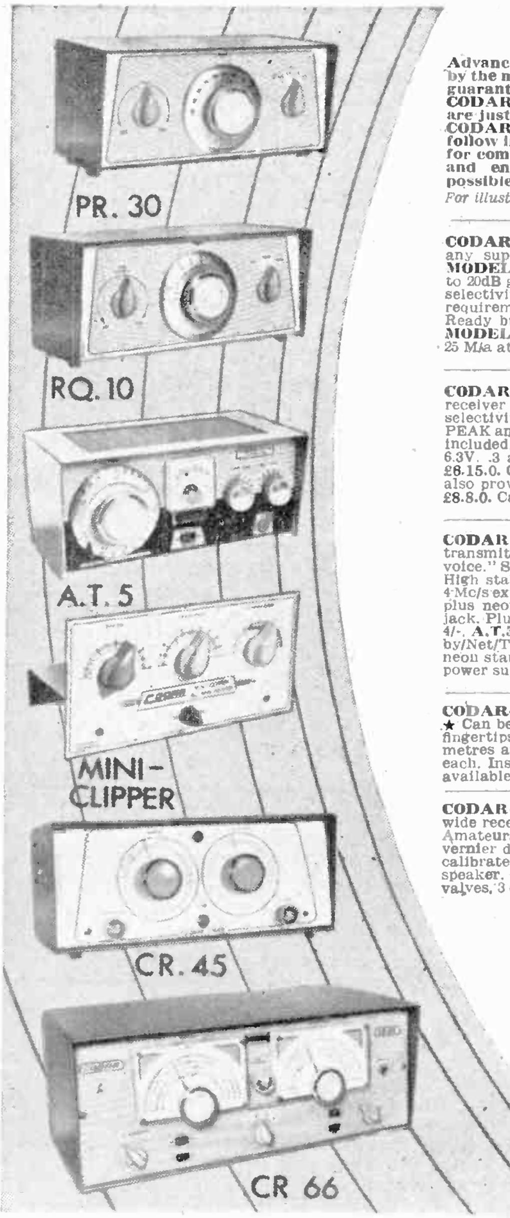

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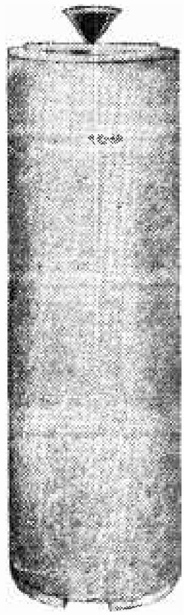

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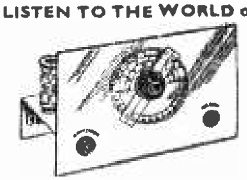

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TABLE I

Station	Main	Relay Booster	Frequency Mc/s		
			Light	*Third*	*Home*
Ashkirk (S.E. Scotland)		*	89·1	91·3	93·5
Blaen-plwyf (W. Wales)	*		88·7	90·9	93·1
Divis (Belfast)	*		90·1	92·3	94·5
Douglas (Isle of Man)	*		88·4	90·6	92·8
Dover	*		90·0	92·4	94·4
Enniskillen		*	88·9	91·1	93·3
Fort William		*	89·3	91·5	93·7
Haverfordwest (Pembrokeshire)		*	89·3	91·5	93·7
Holme Moss (Huddersfield)	*		89·3	91·5	93·7
Kinlochleven		*	89·7	91·9	94·1
Kirk o' Shotts	*		89·9	92·1	94·3
Les Platons (Channel Islands)	*		91·1	94·75	97·1
Llanddona (Anglesey)	*		89·6	91·8	94·0
Llandrindod Wells		*	89·1	91·3	93·5
Llangollen (N.E. Wales)	*		88·85	91·05	93·25
Londonderry		*	88·3	90·55	92·7
Meldrum (Aberdeen)	*		88·7	90·9	93·1
North Hessary Tor (S. Devon)	*		88·1	90·3	92·5
Oban		*	88·9	91·1	93·3
Orkney	*		89·3	91·5	93·6
Oxford		*	89·5	91·7	Mid 93·9 West 95·85
Peterborough	*		90·1	92·3	94·5
Pontop Pike (Newcastle)	*		88·5	90·7	92·9
Redruth (Cornwall)		*	89·7	91·9	94·1
Rosemarkie (N. Scotland)	*		89·6	91·8	94·0
Rowridge (Isle of Wight)	*		88·5	90·7	92·9
Sandale (Carlisle)	*		88·1	90·3	Nth 94·7 Scot 92·5
Sheffield		*	89·9	92·1	94·3
Skye		*	—	—	93·9
Sutton Coldfield	*		88·3	90·5	92·7
Tacolneston (Norwich)	*		89·7	91·9	94·1
Thrumster (Wick)	*		90·1	92·3	94·5
Wenvoe	*		89·95	96·8	Welsh 94·3 West 92·125
Wrotham	*		89·1	91·3	93·5

NOTE—"Relay Booster" indicates a transmitter which derives its signals "off-air" from a main transmitter and re-radiates them on different frequencies into the "screened" area locally. Stations indicated "Main" may be high or low power transmitters.

frequencies differs substantially from that at v.h.f. as shown in Fig. 1(b). Here one transmitter covers large slices of country because the signal not only follows a curvature closely analogous to that of the earth itself for a relatively greater distance than the v.h.f. signal, but also because the signal rises skywards and is reflected earthwards by "reflective" layers in the ionosphere and troposphere so that great laps of the earth are embraced.

The reflective effect is influenced by time of the day (and night), and after dusk distant stations which do not cause interference during the hours of daylight start putting strong signals into receivers which are tuned to local stations having frequencies close to or the same as those of the interfering stations.

There is nothing that can be done about this by the listener: it is just the result of the crazy congestion which has been developing steadily over the years and must, unfortunately, be accepted by those whose desire it is to tune to the top end, in particular, of the medium-wave band after dusk.

There is no need for listeners of the local programmes to suffer the disturbances, however, for the v.h.f. service, launched at very great expense by the BBC for the purpose of improving local reception, can solve the problem.

As is shown in Fig. 1(a) skyward signals from a v.h.f. transmitter normally fail to be reflected by the layers in the upper atmosphere, which means that distant stations cannot normally affect local reception, even though frequency sharing may be adopted.

Capture Effect

There are times, however, when the v.h.f. signals are reflected due to abnormal weather conditions and during settled periods during the spring and summer months. The f.m. system can handle this problem, nevertheless, and this it does because of an f.m. characteristic—called the "capture effect"

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—which causes the f.m. set to lock on to the strongest signal and almost completely reject the weaker interfering signal, even though this may be on the same frequency as the wanted signal.

Thus, listeners to the f.m. service are pretty well assured of good interference-free reception under all conditions. That is, provided their receiving installations are correctly tuned and adjusted.

One of the reasons why good v.h.f. reception is not achieved in practice in some cases is that the signal applied to the set from the aerial is far too weak. Nearly all commercial f.m. and a.m./f.m. receivers contain an internal compressed dipole for Band II operation, and while this may deliver sufficient signal when the set is operated reasonably close to a transmitter and in a building and local area which is not unduly screened, it is far from adequate at distances in excess of about 10 miles from the station.

Modern sets are remarkably sensitive, and even on a very weak signal they will give some sort of results, and quite loud signals at full volume, but operated under this condition any local interference will almost certainly be stronger than the signal itself.

Unless the set (or tuner) is a very elaborate type, the interference will break through as crackles on sound, and this applies especially to car ignition and electrical interference from domestic appliances.

Amplitude Limiting

Given a reasonably high level of wanted signal, all but the very poorly designed and inexpensive receivers will automatically suppress normal electrical interference due to the amplitude limiting action which is inherent to f.m. sets.

All interference of this kind is amplitude modulated. Thus, it follows that a set which is sensitive only to f.m. signals and considerably insensitive to a.m. signals will give interference-free results even when operated in an interference-infested area that would render ordinary a.m. reception almost impossible.

Assuming, then, that the f.m. set is in good order and correctly tuned (for incorrect tuning will affect the pick-up of interference, as we shall see later), a high level of interference should lead immediately to a check of the aerial system.

If nothing more than the internal aerial is used, one could be fairly safe to expect a "dramatic" improvement in reception by the use of an external aerial. Unless one happens to reside in an area outside the range of an f.m. station (see Table 1), the external aerial need not be too elaborate.

Often a simple room or loft type aerial is sufficient, provided it is cut to the optimum length, turned for maximum signal pick-up and connected to the receiver through the type of cable (twin feeder or coaxial) as recommended by the manufacturer.

Basic F.M. Aerial

Fig. 2(a) shows the basic f.m. aerial. This consists of a dipole, comprising two lengths of conductor each of dimension l, giving an overall length of 2 times l plus the length of the insulator. In practice, the distance between the holes in the insulator, carrying the two halves of the dipole, is about 1in., but this is not critical.

For all areas in Great Britain, the overall length of an f.m. dipole is 5ft. 2½in. Thus, the length of each half will depend upon the length of the insulator employed.

To the centre of the two conductors is connected the feeder cable to the set. The diagram shows the connection to coaxial cable, but the connection to twin feeder would be similar; that is, one conductor to each half of the dipole.

If screened twin feeder is used, the outside screening braid should be dressed back and left disconnected.

Now, an aerial of this nature, when mounted horizontally, as is required by the horizontally polarised signal from the f.m. stations, is bidirectional. It has two directions of maximum response, and two directions of minimum response, as shown in Fig. 2(b).

For the best results, then, the aerial should be positioned so that it looks broadside on towards the station. If necessary, a map should be used to establish the direction of the station relative to the receiving site.

Two practical aerials which can easily be constructed by the enthusiast are shown in Fig. 3. At (a) the dipole is formed by two lengths of insulated wire supported between a pair of insulated hooks in the roof-space, while at (b) the dipole is made of ¼in. diameter tube supported on a wooden frame and mounted on insulators. Both types will give good reception up to distances of about 25 miles from a station.

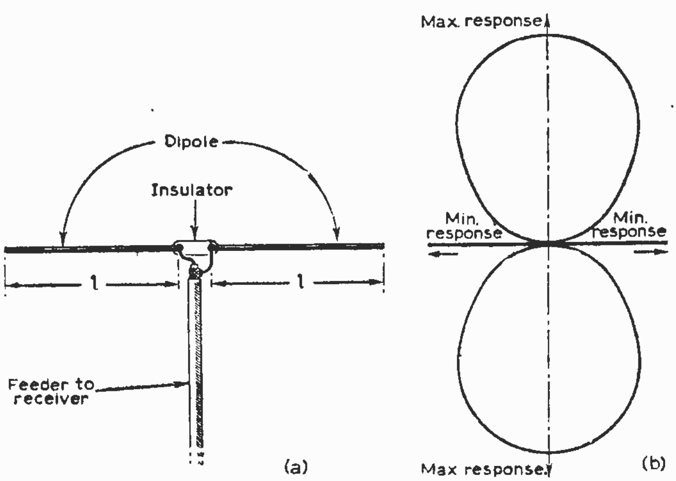

Fig. 2: The basic f.m. aerial at (a) and its polar diagram at (b).

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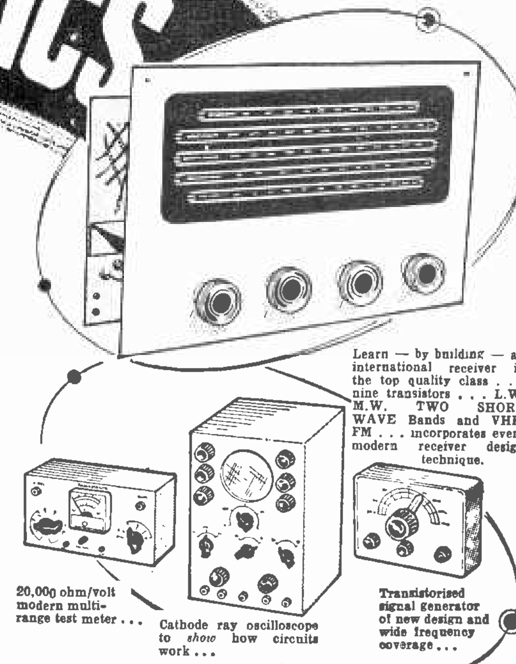

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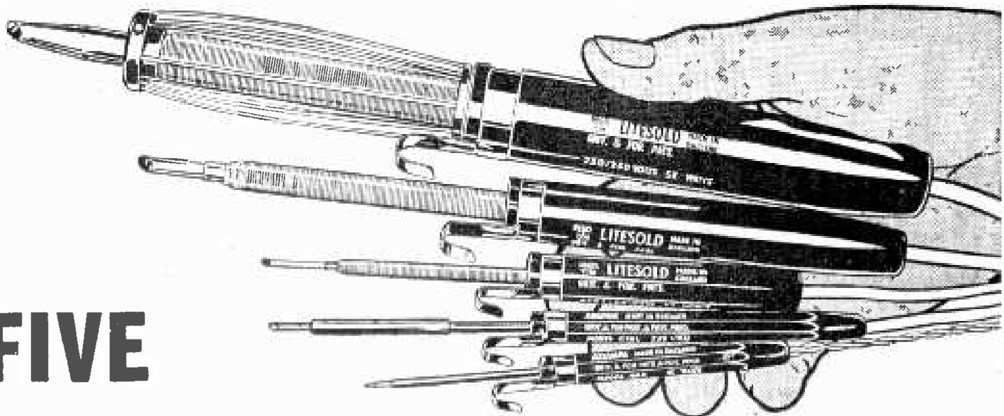

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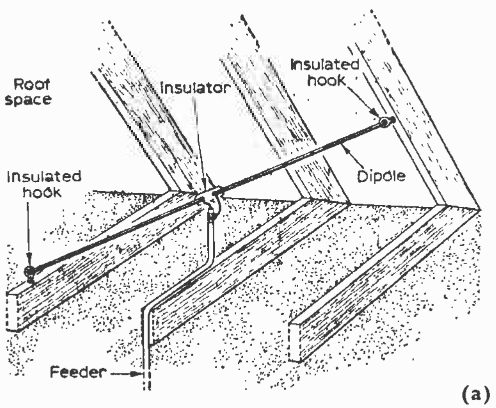
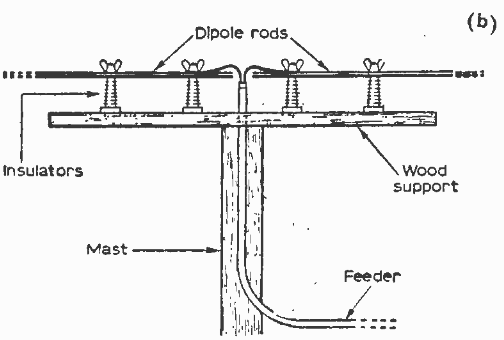


Fig. 3: Practical aerials. (a) Roof-space type. (b) Self-supporting on wooden frame.



When installing the aerial in the roof-space it is desirable to keep it as clear as possible from metal pipes and water tanks, as these can affect the pick-up efficiency and tend to encourage instability at the set.

Multipath Interference

A cause of poor f.m. reception not generally known is multipath interference due to the v.h.f. signal being reflected from a nearby hill or large building and arriving at the receiving aerial a very small fraction of a second after the arrival of the direct signal. Readers versed in the arts of television reception will know that such reflections of the television signals produce ghost pictures on the screen.

The direct and reflected signals at the f.m. aerial produce a characteristic distortion which, as already intimated, sounds not unlike a badly adjusted loudspeaker. Should this trouble be experienced, a check should first be made to ensure that the set itself is free from blame, and the best way of doing that is either to run it on records, if a radiogram, or to switch to a.m. reception if of the a.m./f.m. variety. If the effect is present on an f.m.-only set or f.m. tuner, it may pay to try it out at a different location, on a friend's aerial, for example.

However, the cure for the multipath interference is cutting out the reflected signal or, at least, making the strength of the direct signal about 100 times that of the reflected signal. This discrimination can only be handled at the aerial—there being no way of tackling the problem at the set itself.

With a directional aerial, the orientation can be arranged so that the reflected signal arrives along the axis of minimum response, assuming, in the case of a simple dipole, that the direct signal is arriving approximately at right-angles to this.

Multi-element Aerials

In severe cases of multipath interference, an aerial of greater directivity than given by the simple horizontal dipole may be required. This would comprise the dipole and a director—or a dipole, director *and* reflector (or a dipole and reflector). The director and reflector are called "parasitic elements" because they are not connected electrically to the dipole.

Their purpose is to strengthen the pick-up of the signal along the axis of maximum response and further to reduce the pick-up along the axis of minimum response. What happens is that the aerial becomes responsive to signals arriving essentially along one major axis, as shown in Fig. 4.

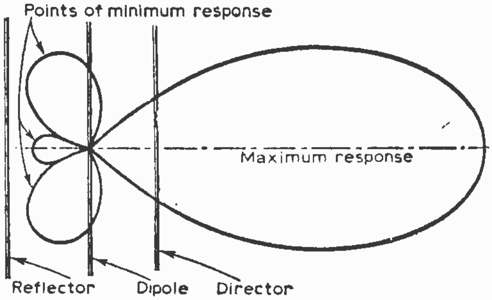


Fig. 4: The addition of a director and reflector increases the forward pick-up and reduces the pick-up at the rear. This type of aerial may be required where multipath interference is troublesome. (Dimensions in text.)

This improved directivity makes it more feasible for the aerial to discriminate between the direct and reflected signals, especially if the reflected signals are arriving at an angle close to that of the direct signal.

Note from Fig. 4 that the director is placed in front of the dipole and the reflector at the rear. The reflector is always a little longer than the dipole and the director a little shorter, optimum lengths being 5ft. 6in. and 4ft. 10½in. respectively. The spacings are also critical, being 32¼in. from reflector to dipole and 19½in. from dipole to director.

Distortion due to multipath interference can often be reduced simply by altering the direction of the aerial. Sometimes this will result in a decrease in pick-up of the direct signal, but provided the signal is still sufficiently strong to overcome car and electrical interference this does not matter much.

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However, if the direct signal is greatly reduced at the point of minimum distortion, a small transistorised booster could be used to restore the level of the signal.

Signal Strength Indication

Most tuners and receivers have some sort of tuning indicator for f.m., and this is useful for giving a rough idea as to how the signal pick-up has been increased or decreased by orientation of the aerial, by the use of a booster and by the use of different aerials.

Not only multipath interference, but interferences of other types are aggravated by the use of an incorrect aerial. For example, one may be tempted to use the television aerial on f.m. This invariably works. but optimum results are obtained only if the aerial system has Band II facilities. Television sets equipped with f.m. are often expected to work from the television aerial without an f.m. attachment.

This compromise is bad because the television aerial is not cut to the lengths required for Band II reception and also because the f.m. signal is horizontally polarised (needing a horizontally mounted aerial) while the TV signal in many areas is vertically polarised (with the aerial mounted as a vertical "H" for instance).

It then often happens that at times when interference from distant stations is troublesome, as explained earlier, the interfering signal picked up on the incorrect aerial is stronger than the wanted local signal! This causes the "warbling" interference effect on top of one (or more) of the local f.m. programmes.

Combined Aerials

Fig. 5(a) shows how an f.m. aerial can be connected along with the TV aerials, so that all the signals pass through the common coaxial downlead. If it is required to separate the signals at the set end of the downlead, the arrangement shown in Fig. 5(b) should be employed. At (a) the signals are combined by a triplexer while at (b) they are separated by an f.m. diplexer (passing the TV signals at one outlet and the f.m. signals at the other).

Where installation is on a main road and passing traffic interference is troublesome in spite of a good aerial system, use of one of the small transistorised f.m. boosters can be of great assistance. This is because the greater the signal applied to many sets, the better the amplitude limiting.

Thus, if the signal without the boost is just about strong enough to commence the limiting action, heavy car interference will cause trouble. The extra boost, however, often pushes the set well into limiting and considerably reduces the interference effect.

A little extra attention should also be given to the tuning-in of an f.m. set, for unless the tuning is accurate the full attributes of the f.m. system will not be realised, and both distortion and interference could cause trouble. There are usually three tuning points close to where the station is tuned, two small responses either side of the main, maximum response.

It is imperative that the set is tuned to the maximum response. Always tune for maximum deflection as shown on the tuning indicator, where fitted.

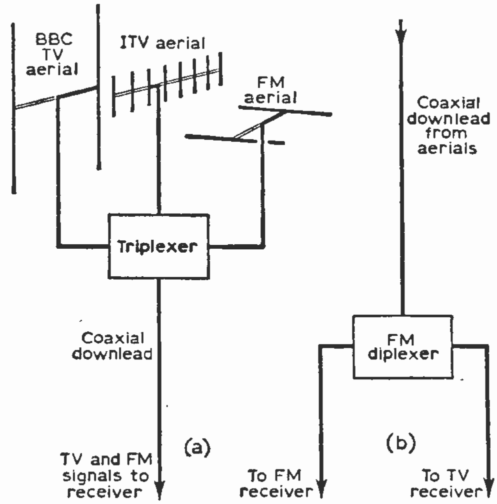

Fig. 5: A triplexer is used at the top of the downlead to connect an f.m. aerial (a). An f.m. diplexer, or similar device, must be used at the bottom of the lead if it is required to separate the signals, as shown at (b).

If there seems to be two major tuning points close together, the set or tuner itself may be out of alignment, and this, again, is a fundamental cause of poor f.m. reception. A f.m. set is not easily aligned properly without instruments and since so much relies upon correct alignment, it often pays to have a good radio dealer perform the necessary trimmer adjustments.

Since the many f.m. stations are placed with both geographic and frequency consideration, interference from adjacent channel signals does not occur under normal conditions. This means that full expansion can be given to the sidebands of the higher audio frequencies, and treble cut and passband cutting, which are essential on medium frequencies, are not required on f.m.

Thus, the quality of reception on a correctly working installation is far above that of the a.m. system. However, incorrect alignment can suppress the treble and make tuning difficult. Moreover, if the i.f. passband is restricted, excessive tuning drift will be noticed as the set warms up and as its temperature rises during use.

Tune to the Local Station

One final point, and that is since pretty well every local area has its own f.m. transmitter now, it is possible to pick up the signals from transmitters in adjacent areas. These signals, being weaker than the local signals (although carrying the same programmes), will be more prone to interference.

One should always ensure, therefore, that the receiver is, in fact, tuned to the local transmitter and not to an adjacent area one. ■

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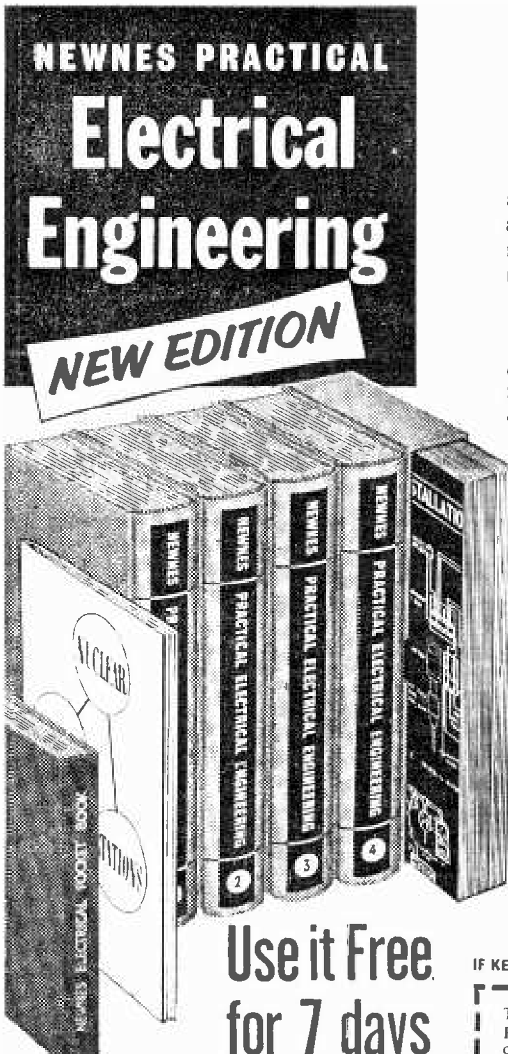

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IMPROVED COMMUNICATIONS THROUGH THE GROUND

Some further notes on this novel method of transmission and reception previously described in P.W.

BY C. R. BRADLEY

IN the May 1964 issue of PRACTICAL WIRELESS, an article of mine was published on a system of communication through the ground. I was quite unprepared for the tremendous response I received to this article and wish to thank all readers who wrote to me—if replies have been delayed it does not mean your letters have not been appreciated.

Well over a hundred letters arrived in the first week and they are still coming in from abroad! Most of the letters have been from readers who have had success with the method—a few thought the whole thing was a hoax!

I have received many practical results and much historical information from readers on the subject, some of which I take the liberty of reproducing here.

The kind of ground communication described in my article was used extensively during the 1914-1918 war for morse communication through heavily shelled areas. The equipment was bulky and often in poor repair, yet ranges of up to 8,000 yards were achieved!

It seems however, from readers' letters, that the greatest distance practical with hi-fi or guitar amplifiers is about two miles. Results with amplifiers with power ratings below 8W have been disappointing; this is not surprising considering the tiny fraction of the transmitted signal which reaches the receiver.

The resistance from point to point of the ground varies so much with locality that no convenient formula giving the maximum achievable distance for a particular transmitter power can be found. The strength of the received signal will depend on a multitude of factors, including soil moisture, temperature and type.

Generally however, best performance is obtained by having both transmitter and receiver earths as far apart as possible and set in roughly the positions shown in Fig. 1b.

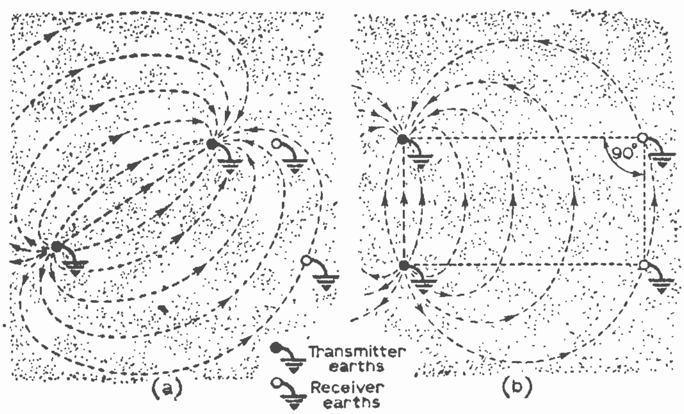

Fig. 1: Reception is better with the arrangement of transmitter and receiver earths in (b) than in (a) as the transmitting earths have a distinct "radiation pattern".

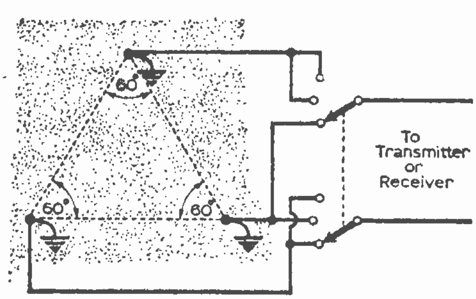

Fig. 2: A multi-directional earth system. The two-pole three-way switch selects different pairs of earths and hence different directions.

A certain amount of mains hum is always received; this is caused by a.c. currents flowing through the ground, due mainly to the earthing of mains equipment. This hum limits the weakest signal that can be received but is only prominent in built-up areas. There is no way of reducing it.

Some readers have encountered interference from nearby radio stations and even wired relay systems. In one case, ground communication experiments were found to interfere with a neighbour's telephone—unfortunately no cure could be found and they were terminated.

Because of the limited (but useful) range of ground communication there seems no need for a national "Ground Ham" club although it may prove an interesting sideline for existing local radio clubs. I am pleased my article has stirred up so much enthusiasm for a long forgotten idea which shows how far from "dead" the ground can be! ■

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A COMMENTARY BY HENRY

PRACTICALLY WIRELESS

No. 6 Trouble Aloft

THE Fill-Dyke month: when gutters are full of sleet, gales howl about our ears, and Henry feels as old as his children imagine him. The time, in short, when the aerial blows down.

Aerials—yes, those remote and spindly refugees from a modern art show that so many radio users still believe they are simply an adjunct to television. Aerials—the first, most important, and most often neglected link in the chain of radio reception. Many of us continue to believe that a few microvolts in the hand are worth any amount of watts in the bush. Consequently, our eaves groan in the gales, and the ice on the insulators makes a climb up the mast a daunting prospect.

Which reminds me of a story, which really I should not tell you, for it concerns a television aerial—and my spies tell me there is another magazine across the way which specialises in that upstart offshoot.

The adventure happened in the very early days, when there was only one Dimbleby and folks used to tune to the morning test signal for the fun of watching the Palio horse-race. I was called to investigate a set with no modulation, and immediately jumped to the obvious. Sure thing, a dead short across the aerial.

An enthusiastic teenager and a hint of the Big Beat.

Defying the gales and risking everything on the sleety tiles, I shinned up to the chimney and began to unship what seemed like half the GPO tower. It was not until the ladder was shaking beneath my descending clod-hoppers that I realised what I was carrying. One of the original Duplex aerials, no less. A Band I folded dipole, which even Henry should have known would give a dead short reading on the ohmeter—if he had only taken the trouble to look.

How many riggers, I wonder, fit a small resistor across the remote terminals of an open dipole for future bad-weather checks on possible open circuits?

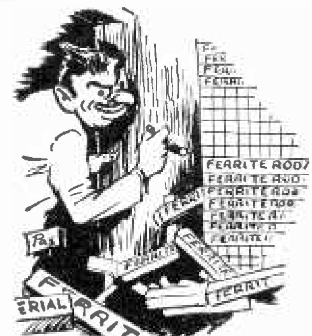
It's a bit difficult, however, when one is using the length of the garden for an old-fashioned receptor, and the weight of the snow, aided by the gathering of our feathered population, and augmented by ravages of rust at the staybolts has torn the whole contraption from the garage wall and left a drooping trail of destruction through the cabbages.

Even the dinky, but effective ferrite rod has its drawbacks: mainly the extreme brittleness of the material. Aided by so many manufacturers' designs, where a long, thin rod is supported by a couple of barely padded clamps about a third of the way along.

Given an enthusiastic teenager and a hint of the Big Beat and the end of the rod droops dismally, like the end of a comedian's cigar. Even where the rod is supported more adequately, its dimensions and its brittleness make it vulnerable to shock.

Where so many folk get caught, we regret, is in writing the broken rod off as a dead loss. this device is a magnetic, not an electrical, circuit. Thus, we need only reassemble the parts, particularly if the break was clean, to regain the flux concentration.

Provided the rod can be put together really well, with split ends butting, splinted like a C.D. experiment and tightly bound, there should be very little loss in aerial gain. Such loss as is apparent can often be overcome by slightly repositioning the coils. As any reader with a loose coil will have found, the positioning is quite critical.



Some wicked manufacturer, with a warehouse full of replacement rods.

One day, we presume, the boffins will come up with a material less prone to stress failure. They may have done so already, for all I know. Maybe some wicked manufacturer, with a warehouse full of replacement rods, is sitting on the patent rights.

In my pocket I have a useful aid to tape recordings, a piece of magnetic rubber. This is what it says it is — rubber with magnetic properties, made by impregnating the rubber in the forming stage with tiny magnetic particles. As a similar process is used in the manufacture of ferrite rods, but with ceramic instead of rubber as the base, perhaps some genius will think of a way of making them more flexible

In the meantime, I must return to my frozen-fingered efforts to splice steel wire through the egg insulator before the 20 metre band re-opens.

End of Febrifuge—over and out.

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Pioneers in build it yourself tuners and test equipment

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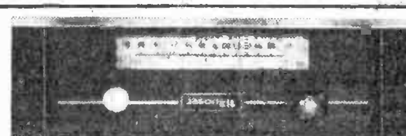

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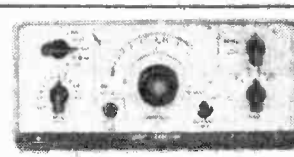

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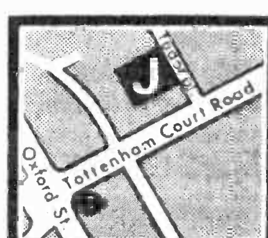

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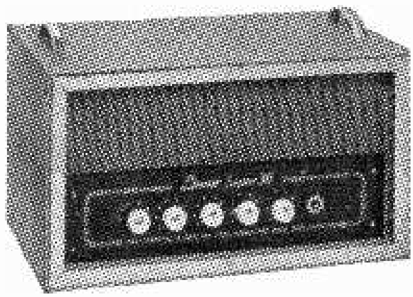

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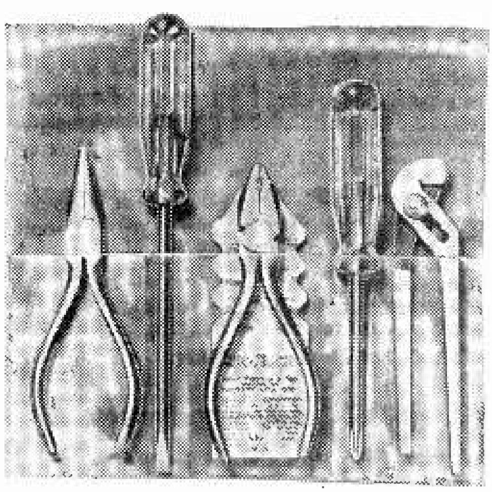
New 5in. Oscilloscope Tube

MULLARD announce the D13-27GH, a further addition to their range of oscilloscope c.r.t.s. The new D13-27GH is an inexpensive 5in. tube with an overall length under 14in., and this compactness enables it to be substituted with advantage for the small screen types often employed in monitor applications.

This tube has a flat faced, medium persistence green phosphor screen with a helical post deflection accelerator. In common with other recently introduced Mullard tubes, a separate electrode arrangement permits direct beam blanking to be accomplished. The deflection blanking voltage required to blank the tube is 60V maximum under 3kV operating conditions.

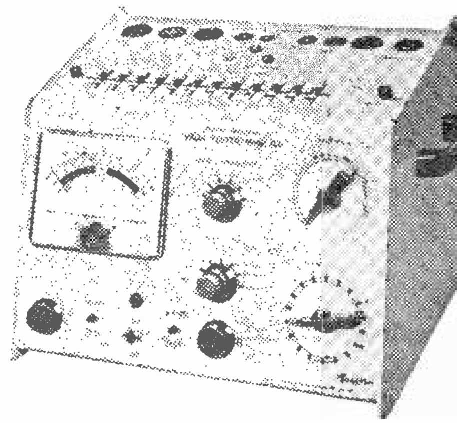
The deflection sensitivity, also under 3kV operating conditions, is better than 27V/cm for the X direction and 13V/cm for the Y direction. *Mullard Ltd., Mullard House, Torrington Place, London, W.C.1.*



W. K. & C. Peace's handy tool kit in plastic roll-pack wallet.

Compact Tool Kit

FROM W. K. & C. Peace Ltd., comes a new kit of small hand tools. Made from drop forged carbon steel, the kit consists of three of the most universally used pliers (the handles of which are un-insulated) and two screwdrivers—one for conventional slotted screws and a Phillips-type recessed head driver. These tools come complete with a card of 5, 10 and 15A fusewire in a roll-pack wallet, and retail at 28s. *W. K. & C. Peace Ltd., Templeborough Works, Sheffield,* F.



Model 45D valve tester from Taylor Electrical Instruments Ltd.

New Valve Tester

TAYLOR Electrical Instruments (M. I. Group) has introduced a new modern styled valve tester, Model 45D. This supersedes the Model 45C.

Main features of the 45D are the ten valve bases which enable tests to be carried out on the latest types of valves.

A valve chart which is included gives testing data for over 7,000 British, American, Continental and Russian valves. The manufacturers of this instrument are *Taylor Electrical Instruments, Montrose Avenue, Slough, Buckinghamshire.*

Amateur Radio Equipment

NEW additions to the American Heathkit range of amateur radio equipment are: single sideband receiver, model SB-300E at £133 14s., single sideband transmitter SB-400E at £165 4s., and 80m s.s.b. transceiver HW-12 at £60 1s., and a single monitor oscilloscope HO-10E priced at £34 10s.

Instruments in the Heathkit range that have been re-styled are the 5in. oscilloscope 10-12U for £32 12s. 6d., television alignment generator HFW-1 at £34 18s., and the 6in. valve voltmeter IM-13U priced at 18 guineas. *Daystrom Limited, Gloucester, England.*

Tape Splicer Kit

MASTERTAPE announce the introduction of a new and improved Mastertape splicer kit retailing at 21s., and containing a tape splicer and cutter, five different coloured leader tapes, metallic strip and jointing tape. Full operating instructions for the splicer are printed inside the lid of the distinctive carton. *MSS Recording Company Limited, Poyle Trading Estate, Colinbrook, Slough Buckinghamshire.*

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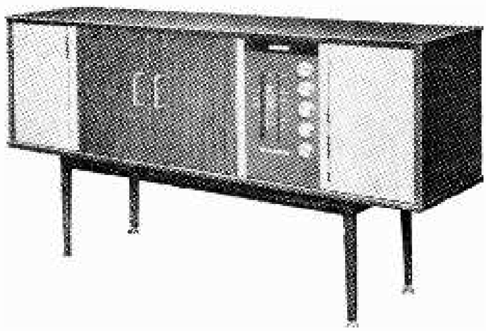

Baird's model 100 transistorised stereo radiogram.

Stereo Radiogram

MODEL 100 is Baird's first stereophonic radiogram. It is completely transistorised and power is obtained via a mains transformer so isolating the chassis.

Separate bass and treble controls are incorporated and there is a balance control for equalising the volume of the two audio outputs. Waveband selection is by push-button control.

There is provision for connecting extension speakers separately to each audio channel so that, where required, full stereo reproduction is available at an extension position. A tape recorder socket is incorporated to provide facilities for recording from radio or records, and tape recordings can be replayed through the stereogram amplifier/speaker system.

Built-in aerials are fitted for both a.m. and f.m. and there is provision for rotating the ferrite a.m. aerial. There is also provision for the connection of an external f.m. aerial.

The cabinet is finished in high gloss polyester and adjustable glides are fitted to the legs.

The circuit embodies 19 transistors and 4 crystal diodes. The record changer is a B.S.R. UA15 fitted with a B.S.R. stereo dual stylus.

The overall size of the Model 100 is 50¼in. wide, 28in. high and 14½in. deep, and the price is 70 guineas including purchase tax. *Baird TV Distributors, Ltd., Empire House, 414 High Road, Chiswick, London, W.4.*

Morse Records

RECENTLY released by The Morse Centre is "The Beginners' Course", a new addition to their range of morse records. The Beginners' Course consists of two records, one 12in. instruction record plus one 7in. EP containing two simulated GPO amateur morse tests. Each is available at 9, 12 and 21 words per minute, plus an instruction book. The cost of this course is £3. 0s. 6d.

Also available is the Complete Course which consists of three records as well as instruction books, a Beginners' 12in. LP, an Advance Students' 12in. LP and a 7in. EP, all of which are played at three speeds. The overall cost, including postage in the UK is £4 4s. *The Morse Centre, 45 Green Lane, Purley, Surrey.*

PREPARING FOR THE R.A.E.

—continued from page 973

resonant—the secondary circuit being a *link winding*. In C the secondary circuit only is resonant—the primary being a link winding and in (d) both circuits are resonant. (a), (b), (c) and (d) couple the circuits in different ways but (b), (c) and (d) are all coupled because of the *mutual inductance* between the coils.

4.9 Acceptor and Rejector Circuits

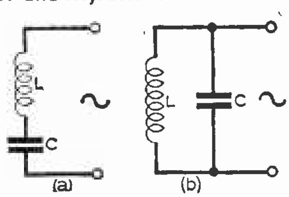

Fig. 36—Acceptor and rejector circuits.

A series connected circuit, as shown in Fig. 36a is called an *acceptor circuit*, because if two equal voltages, at different frequencies, one of which was the same as the resonant frequency of the circuit, were applied to the circuit the *maximum* current would flow for that voltage at the resonant frequency, i.e. the resonant frequency is more readily accepted.

Conversely in Fig. 36b the circuit is a *rejector circuit*, because at the resonant frequency of the circuit the current in the circuit is *minimum.*

Question

In Fig. 37 find at what frequency the circuit would be resonant and calculate the value of the capacitance

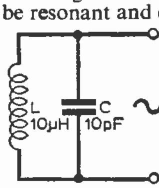

Fig. 37—Inductance and capacitance in parallel across an a.c. supply.

which would have to be placed in parallel with C to make the circuit resonate at half this frequency.

Answers to last Month's Problem

(a)

$$X_c=\frac{1}{2\pi fc}=\frac{1}{6{\cdot}28\times50\times0{\cdot}000002}$$

$$=\frac{1}{0{\cdot}000628}=1592\,\Omega$$

$$I=\frac{E}{R}=\frac{E}{X_c}=\frac{250}{1592}$$

$$=0{\cdot}157 \text{ amps.}$$

(b)

$$X_L=2\pi fL$$

$$1592=6{\cdot}28\times50\times L$$

$$1592=344{\cdot}00\ \ L$$

$$\therefore L=\frac{1592}{344}$$

$$=L4{\cdot}63$$

Value of Inductance is 4·63 Henrys.

Part 5 Next Month

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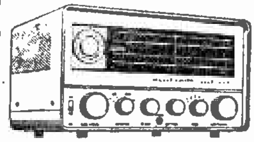

LAFAYETTE HA 63 COMMUNICATION RECEIVER

7 valves + Rectifier. 4 Bands 550 Kc/s—31 Mc/s. 'S' Meter-BFO-ANL-Bandspread Tuning 200/250v A.C. Brand New. 25 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/-.

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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/-.

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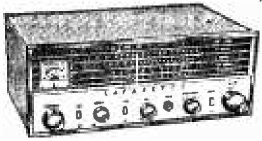

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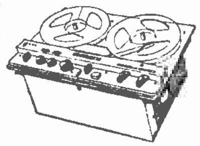
Sine: 20 c.p.s. to 200 Kc's. Square: 20 c.p.s. to 25 Kc/s. 200/240 v. A.C. Brand new Guaranteed. £.5. Carr. 5/-.



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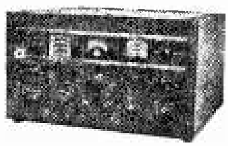

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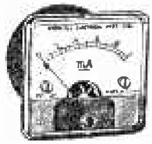

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First grade quality. Moving Coil panel meters' available ex-stock. S.A.E. for illustrated leaflet. Discounts for quantity. Available as follows. Type MR. 38P. 1 21/32in. square fronts.

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

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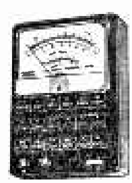

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5¾in.	1200ft. L.P. acetate		12/6
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Ditto with Mic. 25/-
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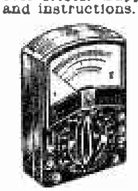

MODEL TE-12
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0/.6/6/30/120/600/1,200/3,000/6,000V. D.C.
0/6/30/120/600/1,200V. A.C.
0/60μA/6/60/600mA
6/6K/600K/6 Meg/60 Meg Ω
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£5.19.6. P.P. 2/6.

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
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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
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0/120 Ω A/30/300mA DC
0/2K/200K/2 Meg Ω
100pF—.2mFd
79/6. P.P. 2/6.

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0/50 Ω A/25/250mA DC
0/60K/6 Meg Ω
.01—.3mFd
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95 P.I.V.	? amp	5/6

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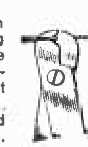

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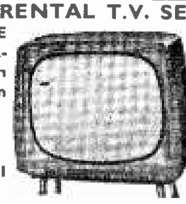

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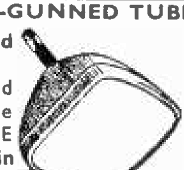

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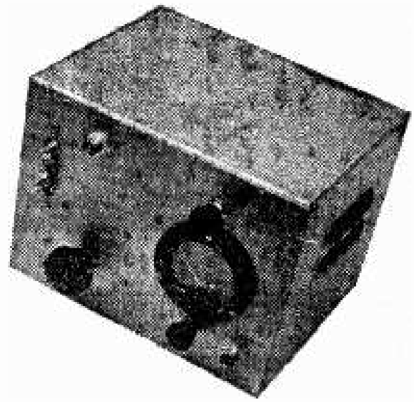

IT is sometimes said that an amateur station can be judged by its auxiliary equipment. The station operator who has transmitter, receiver, and frequency meter as the sum total of his possessions can barely claim to be a "ham".

The subsidiary equipment mostly consists of small easily built units and any excuses such as lack of time or ready cash are, to say the least, a little thin. A grid dip meter is no more than a single valve oscillator with its grid current metered. An absorption wave meter consists of even less.

When it comes to loading the aerial and radiating r.f. the need for a means of tuning and loading accurately is definitely desirable. At this point, our tyro with minimum equipment will triumphantly exclaim that his pi-tank matches most things he feeds it into, That the meter situated in the h.t. to the p.a. gives all the indication that is needed as regards loading, and that by using the "tuning for a slight dip" technique, contacts have been made.

Since the proof of any pudding is in the eating, it should, therefore, surely follow that the p.a. is working efficiently, loading is correct and that the radiated r.f. furnishes all the necessary proof of this. Unfortunately, tuning for the proverbial slight dip does *not* mean that everything is working efficiently.

It is possible to tune a rig by this method and have a standing wave ratio much higher than is either desirable or necessary, and the higher the s.w.r. on the line, the less efficient the whole thing becomes. It is not proposed to split technical hairs over this business of s.w.r., nor is it proposed to launch into a discussion on transmission lines, as books exist which already do this.

However, whenever experts meet, the first thing they usually do is to define terms to make sure that they all mean the same thing, and that they are all "talking the same language". What is good enough for the experts is good enough for us.

When we say that a standing wave ratio exists we shall take it to mean that some of the power which should have radiated into space from the aerial is, in fact, being reflected back down the feeder, and thus the efficiency of the aerial system is not 100%. In other words, we are wasting power, heating the coaxial, or warming the worms.

Obviously, a device which can give a direct indication of this s.w.r. is very desirable because it would allow things to be adjusted until a minimum was obtained. Fig. 1 shows a simple arrangement used by many amateurs and SWL's. It is a half-wave dipole, and is fed at the centre with 75Ω co-ax, thus offering a good match.

The centre of the dipole, has an impedance of around 75Ω; the coaxial has an impedance of 75Ω so any r.f. proceeding up the coaxial "sees" no difference of impedance, and we have a perfect match. (For the purpose of simplifying matters we are ignoring the fact that the dipole is a balanced system and that coaxial is not.) The s.w.r. is said to be 1:1.

Our dipole is only a perfect match, however, at one frequency, the frequency for which it is cut, and directly the rig is tuned up the band a few kc/s we have a mis-match. The dipole no longer exhibits a pure resistance of 75Ω. It now shows reactance as well, and this reactance will either be capacitive or inductive depending on whether we are above or below the original frequency. All this boils down to the fact that now, we have a s.w.r. on the line.

NOTE:—Tuning our pi-tank for the above mentioned dip will not tell us much. As far as the meter is concerned it merely indicates a dip in p.a. current. An r.f. ammeter in the feeder is of little

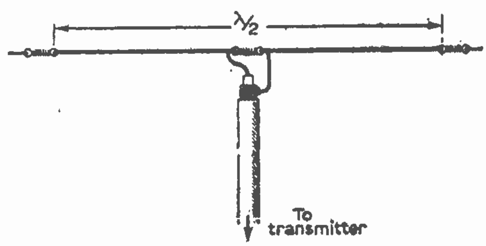

Fig. 1: A simple half-wave dipole.

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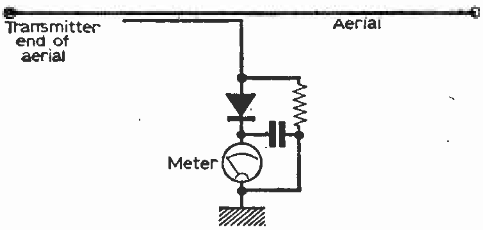

Fig. 2: This arrangement although favoured by some does not, however, provide much information about the s.w.r.

use in informing us of any s.w.r. and its reading would vary depending on where it was situated in the feed line.

This, of course, applies to odd lengths of wire tuned up by our faithful pi-tank on different bands. On one band it may be at a point in the system of high current and indicate a reading of say " 7 " and on another band it may be at a point of high voltage where very little current exists, and the maximum reading on this band may well be only 1 or 2.

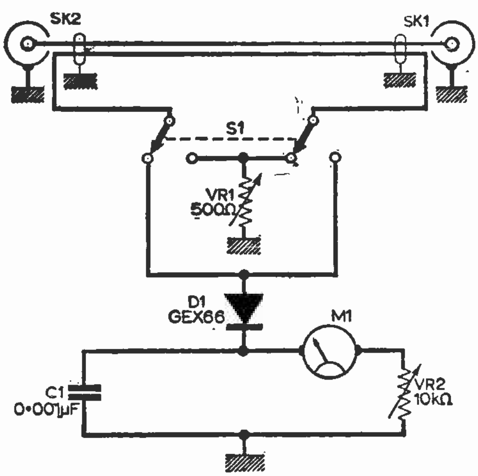

Fig. 3: The complete circuit of the instrument, representing a considerable improvement on Fig. 2.

COMPONENTS LIST

VR1	500Ω *carbon* pot.
VR2	100kΩ *carbon* pot.
C1	0·001μF
M1	0-500μA f.s.d.
D1	GEX66
S1	2-Pole, 2-way switch

SK1, SK2 Coaxial socket chassis mounting
19 inches coaxial cable } See Fig. 4
24 inches 34 s.w.g. enamelled wire } See Fig. 4
Case. Messrs. H. L. Smith, Edgware Road

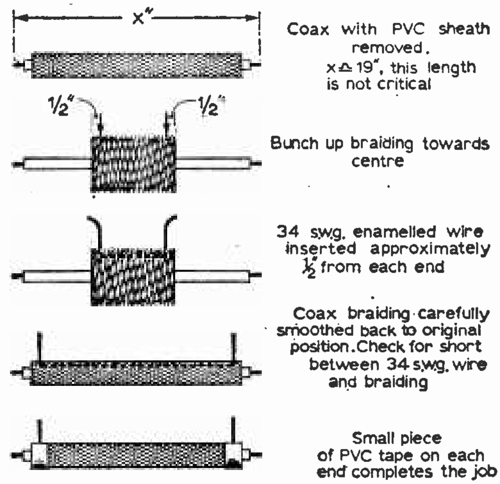

Fig. 4: Stages in the construction of the coaxial+conductor element of the circuit.

One possibility is to construct an r.f. voltmeter to pick up a " sniff " of r.f. off the line, rectify it, and apply the resultant voltage to a suitable meter. This circuit can be very simple, and also very small in size (Fig. 2). This method is favoured by some, but once again although it now indicates output, and not just p.a. current it still tells us very little about the s.w.r.

If we are still determined to have some means of visual indication of s.w.r. we may well delve into the appropriate text books and find that a circuit exists which will perform this elusive function. It is referred to by the very grand name of an " H.F. Reflectometer ".

The arrangement seen by the writer, required that " the concentric line be converted to a parallel plate line ". It then went on to describe how the various strips of the conductors were mounted with pieces of perspex spacers and lengths of 16s.w.g. wire. The setting up of the monster so frightened the writer that it was thought that perhaps our tyro has a point. So long as sufficient r.f. was radiated to bring contacts why worry?

It was not until a circuit appeared which was a brilliant piece of simplicity called the Moni Match that things really appeared interesting. This circuit suggested that instead of two diodes and attendant " Meccano " of the concentric/parallel plate line business, why not use an ordinary piece of coaxial and add to it a length of ordinary thin enamelled copper wire and switch the r.f.? Result—super simplicity, compactness, and a reduction in the number of components required.

The circuit of the entire instrument is shown in Fig. 3. Note that it is not unlike Fig. 2 but with a very great advantage that it can read the output or reflected wave (s.w.r.) merely by flicking a switch. It uses components, which are easily obtainable and inexpensive, and the entire instrument might perhaps be constructed in one of the sloping fronted meter cases available.

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THE KEENEST TAPE RECORDER BARGAIN OF THE YEAR!

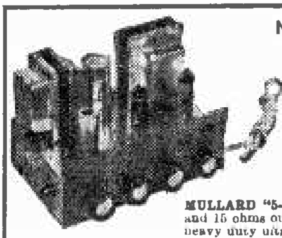
A 24 gns. Tape Recorder offered at the bargain price of only 15 gns. plus 10/- carr. Supplied in 3 Units already wired and tested. A modern Circuit for quality recording from Mike, Gram or Radio using latest B.S.R. Twin Track Monardeck Type TD2. valve line up—EF86, ECL82, EM84, EZ80 and Selenium Diode.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

Complete Kit comprising items below.

BARGAIN PRICE 15 Gns. +10/- Carr.

2-tone Cabinet and 8in. x 5in. Speaker. Size 14in. x 10½in. x 7½in.	£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.

MULLARD "3.3" & "5.10" HI-FI AMPLIFIERS "3.3" Amp., 3 valves, 3 w.



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. Power take-off available. 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.

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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'	12/-	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 container, 5" 1/9; 5¾", 2/-; 7", 2/3.

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 11½ x 4 x 5½in. 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 £12.19.0 Carr. 5/-. We hope to produce this popular unit in kit form very shortly.

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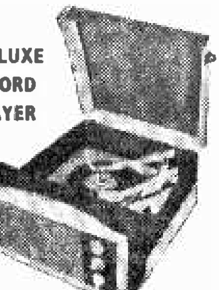
25/25v. 50/12v. 1/9; 8+8/450v. 4/6; 50/50v. 100/125v. 2/-; 32+32/275v. 4/6 8/450v. 4/350v. 2/3; 50/50/350v. 6/6 16+16/450v. 5/6; 60/250/275v. 12/6 32+32/450v. 6/6; 100+200/275v. 12/6

DE-LUXE RECORD PLAYER KIT



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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. ¾in. 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.

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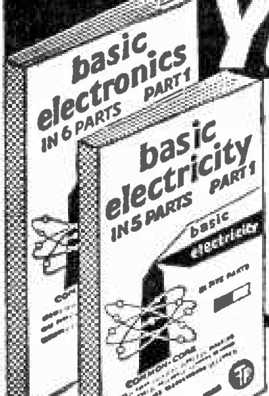

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WHAT THIS MONTH'S ENTHUSIASTIC READERS SAY

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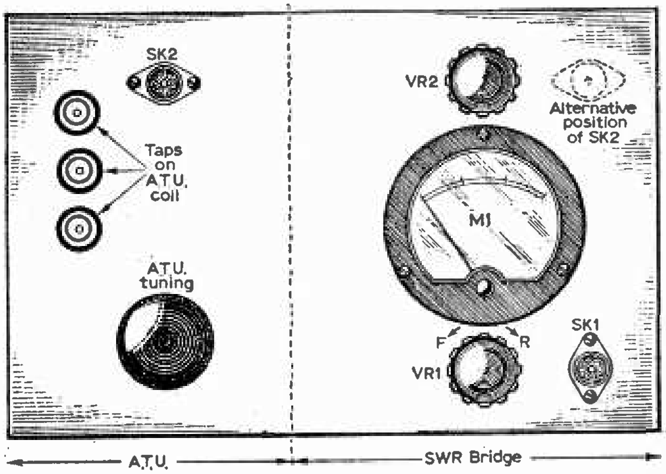
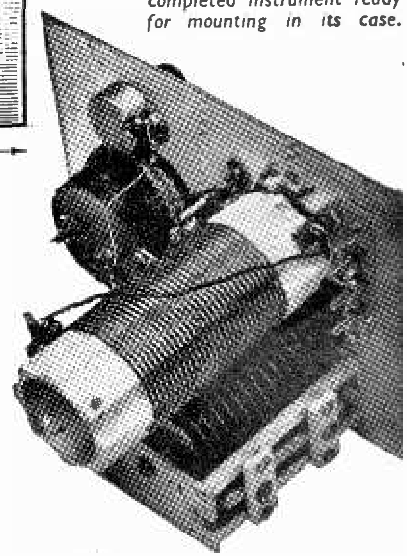


Fig. 5: The front panel of the controls, sockets, etc. SK2 could take the alternative position indicated.



Below: A rear view of the completed instrument ready for mounting in its case.

The unit shown was constructed in an aluminium case because an a.t.u. was also built into the same case. The a.t.u. is nothing more than a coil and capacitor both purloined from one of the T.U. series. The meter used is a 0-500μA and is from the ex-Govt. 19 set. These are freely available at 15s. or less on the market, although any similar meter would be suitable.

The only part of the unit requiring any special treatment is the length of the coaxial with its added conductor, and this is really quite a simple matter when it comes down to actual construction.

Take a piece of 75Ω coaxial as shown in Fig. 4 and bunch up the braiding a little. Next take one of the XYL's sewing needles and thread a length of 34s.w.g. enamelled wire. Push the needle under the co-ax braiding about ½in. from the end and work the needle along and out of the coaxial ½in. from the other end (By means of a magnet perhaps?).

Warning:—Work the needle along, don't work the wire, you might accidentally scratch off some of the insulating enamel.

Next, check with the meter that there is no short between the piece of enamelled wire and the coaxial braiding. A small scrap of p.v.c. tape around each end completes the job. Apart from keeping all leads (especially around the switch) as short as possible the wiring-up requires no further comment.

When the unit is completed, it has to be calibrated, and to do this a dummy load is required. A carbon resistor of the same value as the line is required i.e. for 75Ω coaxial a 75Ω resistor is required. It should be capable of withstanding the power output of the transmitter, and a number of resistors may be wired in series/parallel if desired or the transmitter power may be reduced.

For those who are unable to obtain a 500Ω carbon pot. (R1), a number of carbon resistors may be substituted one at a time until a good null has been obtained (See notes on setting up). Although this method may take a little longer it is an improvement on using a pot., since any slight reactance offered by the pot. is then eliminated.

Setting-up

The actual setting up follows a logical pattern, and if taken a step at a time the whole process is fairly straightforward.

1. Plug transmitter output into **SK1 and** connect dummy load to SK2.
2. Switch S1 to forward and tune transmitter. This is best done on the highest band to be used.
3. Adjust R2 so that M1 reads f.s.d. or highest reading on its scale, which ever is the greater.
4. Turn S1 to reflected and again adjust R2 for maximum reading or f.s.d. whichever is the greater.
5. Adjust R1 for minimum reading.
6. Switch back to forward and readjust R2 slightly for maximum reading on M1.
7. Switch S1 to reflected and check that the null is still there.
8. Swap the transmitter and dummy load i.e. plug transmitter into SK2 and dummy load into SK1.
9. The readings should still tally near enough with the previous ones obtained in 6 and 7.
10. The unit is now ready for use, the transmitter is plugged back into SK1 and the dipole or a.t.u. etc., into SK2. ■

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CLUB NEWS

BRADFORD RADIO SOCIETY
Hon. Sec.: Eric G. Barker, G3OTO, 63 Woodcot Avenue, Baildon, Nr. Shipley, Yorkshire.
On 15th December there was a Ladies' Night, and members brought along their colour slides for a film show.
At an informal meeting held on 5th January, the guests were members of the Spen Valley Amateur Radio Society and the Leeds Radio Society.

BROMSGROVE AMATEUR RADIO CLUB
J Harvey, 22 Elm Grove, Bromsgrove, Worcestershire.
A meeting will be held in the Co-operative Rooms (corner of High Street and Stratford Road, Bromsgrove) on Friday, 8th January, at 8 p.m.
As this was an inaugural meeting, radio amateurs and short wave listeners were invited to attend with suggestions and comments.

CHESTER AND DISTRICT AMATEUR RADIO SOCIETY
Hon. Sec.: P. J. Holland, Field House, 19 Kingsley Road, Great Boughton, Chester.
A technical film show was seen by members on 8th December, and on the 15th there was a Christmas Surprise Night. On 22nd December there was a general discussion and the month's activities concluded with a Net Night on 29th December.

CLIFTON AMATEUR RADIO SOCIETY
Hon. Sec.: J. Rose, G3OGE, 63 Broomfield Road, Beckenham, Kent.
The annual Constructional Contest was held on 4th December, and an informal social was held later on in the month.
Workshop improvements have now been completed, thanks to a handful of members, and meetings are held on Wednesday and Friday evenings.

COVENTRY AMATEUR RADIO SOCIETY
Hon. Sec.: E. E. Snow, G3TKO, 11 Lupton Avenue, Coventry.
On 7th December there was a film show, and on the 14th there was a demonstration and lecture on construction of the Club top band transmitter. On 21st December there was a social evening, and on the 28th, A Night on the Air. A film show was seen by members and friends on 4th January.

DERBY AND DISTRICT AMATEUR RADIO SOCIETY
Hon. Sec.: F. C. Ward, G2CVV, 5 Uplands Avenue, Littleover, Derby.
There was a surplus sale on 2nd December, and on the 9th there was a constructors' contest for the Founder Members' Trophy, with a contest for the G5YY Trophy on the 13th.
The 16th December was an Open Evening with a Juniors' meeting and a members' committee meeting. The Annual Christmas Party was held on 23rd December and on the 30th there was a film show entitled "The Year in Retrospect" when members brought along transparencies which they had taken during the year.

GOSPORT AND DISTRICT RADIO CLUB
Hon. Sec.: J. T. Nightingale, 9 Beatty Drive, Alverstoke, Gosport.
This Club's meetings are held every Monday evening at 7 p.m. at the Gosport Community Centre, Bury House, Bury Road, Gosport. Local radio enthusiasts and would-be enthusiasts are welcome to go along and join in the numerous activities.

GUILDFORD AND DISTRICT RADIO SOCIETY
Hon. Sec.: D. H. Mead, G3OXI, 41 Egley Road, Woking, Surrey.
The speaker on 11th December was Mr. M. Childs, F.S.A., President, who spoke on "The Operation of Practical Equipment from 1900–1922".
On 19th December there was a Christmas Social Evening at "The Otter". This was a light-hearted evening in the seasonal spirit to which all members, their ladies and friends were invited.

HALIFAX AND DISTRICT AMATEUR RADIO SOCIETY
Hon. Sec.: J. Ingram, G3RMQ, Lambert House, Greetland, Halifax, Yorkshire.
On 29th December, members brought along their receivers and held a general discussion on their equipment.
On 26th January, there will be a talk entitled "Radio a long time ago", given by Mr. J. J. Platt, G2VO.

HUDDERSFIELD AMATEUR RADIO CLUB
R. Higton, 5 Brian Avenue, Dalton, Huddersfield, Yorkshire.
Meetings are held fortnightly on Thursday evenings, beginning at 7 p.m. The evening usually begins with c.w. practice for the short wave listeners, followed by lectures. Field days and outings are held regularly. Members were very pleased with GB3CMS which was the "Jamboree on the Air" station.

MELTON MOWBRAY AMATEUR RADIO SOCIETY
Hon. Sec.: D. W. Lilley, G3FDF, 23 Melton Road, Ashfordby Hill, Melton Mowbray, Leicestershire.
On 31st December, Mr. L. Fisher, G4MK, and Mr. D. Fisher, gave a talk on the use of test gear. There will be a lecture on 28th January, by Mr. J. L. Warrington, G2FNW, entitled "Flat Line Equipment for 23 cms."

MID-WARWICKSHIRE AMATEUR RADIO SOCIETY
Hon. Sec.: T. Inkester, 13 Dormer Place, Leamington Spa, Warwickshire.
The 2nd November meeting saw the inauguration of a series of informal lectures on the fundamentals of radio. These lectures will alternate with evenings at which the newly acquired A/T gear will be operated by G3HBX/A.

NORTHERN HEIGHTS AMATEUR RADIO SOCIETY
Hon. Sec.: A. Robinson, G3MDW, Candy Cabin, Ogden, Halifax, Yorkshire.
The Club's Annual Dinner was held on 9th December, and a ragchew was held on the 23rd.
On 6th January A. W. Walmsley, G3ADQ, gave a talk entitled "SSB Trends".

PLYMOUTH RADIO CLUB
Hon. Sec.: R. Hooper, G3SCW, 2 Chestnut Road, Peverell, Plymouth, Devon.
On Saturday, 19th December, the Club supported the Torbay Amateur Radio Society Christmas Party and Quiz.
Saturday, 6th February, is the Club's Annual Dinner and Social Evening.

READING AMATEUR RADIO SOCIETY
Hon. Sec.: R. G. Nash, G3EJA, "Peacehaven," 9 Holybrook Road, Reading.
The meeting held on 19th December was devoted to the judging of the Constructional Contests.
The Annual Dinner will be held at the White Hart, St. Mary's Butts, Reading, on 9th January.

SLADE RADIO SOCIETY
Hon. Sec.: D. T. Wilson, 177 Dower Road, Four Oaks, Sutton Coldfield, Warwickshire.
An annual Fun and Games Evening was held on 11th December. The evening included the annual Cricket Match between the President's and Secretary's teams.

WELLINGBOROUGH RADIO CLUB
Hon. Sec.: J. Baker, 34 Essex Road, Rushden, Northamptonshire.
On 3rd December, members heard a talk on Radio Control. There was a General Meeting on the 10th and the annual Christmas Dinner on the 17th. On 7th January members saw a film show entitled "The Race for Space".

MR. M. A. TRICKETT, G3SAT, and licensee of club radio G3SOH is attempting to obtain a concession in the licence conditions of Club Radio Stations so that anyone may speak into the microphone under the supervision of the licensee or authorised additional operator, provided that the aforesaid actually operates the apparatus.

Mr. Trickett seeks the support of other club members who may be interested in this cause and will forward further information if they will write to him at: *15 Egerton Road, Bembridge, Isle of Wight.*

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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 sub. min. 7mm., 10/- the set; two gang Condensers to suit, 8/6 (request sub. min. circuit).

Midget 3in. P.M. Loudspeaker 3 ohm 12/6, 80 ohm 13/6.

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/-.

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.

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.

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.

Phillips 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). 3/- 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.

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

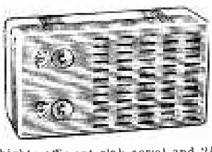
Where postage is not definitely stated add 2/- all orders under £3.

GOOD COMPANION MARK IIIB

The 6 transistor set with the 8 transistor performance. Incorporating all the latest requirements. Anyone who can solder can make it. Many thousands already in use all over the country. Full coverage of Long and Medium wavebands. Fine looking cabinet, size 11 x 8 x 3in. Q.P.P. Output approx. 750 mW. Excellent reception of difficult stations like 208. Variable feedback gives excellent tone. ONLY **£5.19.6**

Plus 4/- post and insurance.

OUR BARGAIN OF THE YEAR



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 wave band to bring in B.B.C. Light. The circuit includes a highly efficient slab aerial and 2½in. P. M. speaker. Overall size approximately 4½ x 2¼ x 1½in. Supplied complete with carrying case.

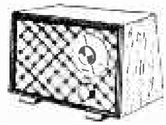
Infra Red Heater

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

Superhet Heart comprising a three waveband coil pack, 3 465kc I.F. transformers, valves types 6K8 frequency changer, 6K7 IFT and 6Q7 D.D.T. and 3 octal valve-holders with circuit diagram showing how to make superhet receiver or tuner unit, to drive amplifier, tape recorder, etc., etc. Retail value over £4 this month's snip offer, all for **19/6** plus 3/6 post and insurance.

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 29/6, limited quantity available at 15/-. plus 2/6 postage. All components to make two of the intercoms described in "Practical Electronics." 75/-.

LAST OF THESE CABINETS & PICK-UPS

Made for a famous company intending to make a Battery Record Player but changing their minds. This is an extremely fine looking cabinet must have cost at least £2 to make. It is complete with handle and fasteners as illustrated. Also included in the parcel is a Cosmocord pick-up with crystal cartridge and sapphire stylus. Both items new and perfect. only **19/6.** plus 4/6 post and insurance.

POWER PACK FOR TRANSISTORS

Designed to operate transistor sets and amplifiers. Adjustable output 6v—9 to 12 volts for up to 500mA (class B working). Takes the place of any of the following batteries: PP1-PP3-PP4-P6-PP7-PP9 and others. Kit comprises: mains transformer-rectifier, smoothing and load resistor 5000 and 500 mfd condensers, zener diode and instructions. Real snip at only **14/6,** plus 2/6 post.

FLUORESCENT LIGHTING BARGAINS

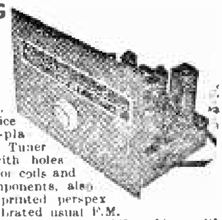
Complete 40 watt Slimline white enamelled fitting, ready for use with choke control gear, radio suppressed starter and tube. Originally intended to sell at £3.15.0. offered at only **39/6.** plus 5/- carriage and insurance; two or more carriage free.

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

400 WATT FLUORESCENT LIGHTING OUTFIT

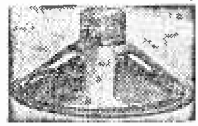
Bulb type 400 watt lamp to hang from ES lampholder. Intended for street-lighting, ideal large open space, yard etc. Complete with choke, **40/-,** plus 7/6 carriage and insurance.

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 Bargain



12in. High-fidelity loud-speaker. 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.

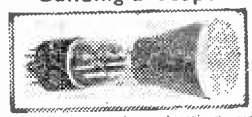
Waterproof Heater Wire

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. 3FP7. 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.

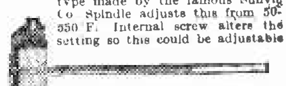
Simmerstat Heater Regulator

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, oven, kiln, immersion heater or to make flame-stat 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. 2-3 amps. Has many uses, one of which would be to keep the loft pipes from freezing, if a length of our blanket 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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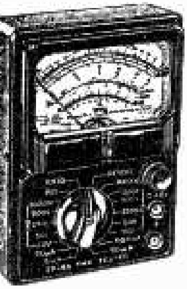
TEST METERS



20,000 O.P.V. MODEL TP 5B. Reads voltage up to 1,000 D.C. at 20,000 ohms per volt and A.C. at 10,000 O.P.V.; D.C. Current to 500mA; Resistance to 10 Megs.; Capacitance to 0.1µF; Decibels from —20 to +36. Size 3½in. × 5½in. × 1½in., £5.19.6.

2,000 O.P.V. MODEL TP 10. Reads A.C. and D.C. Volts up to 1,000; D.C. Current to 500mA; Resistance to 1 Meg; Capacitance to 1µF; Decibels from —20 to +36; Output jack for Audio Measurements. Size 3½ × 5 × 1½in., £3.19.6.

30,000 OHMS PER VOLT MODEL 500. Reads voltages up to 1,000 D.C. at 30,000 ohms per volt and A.C. at 15,000 O.P.V.; D.C. current to 12 amps. Resistance to 60 Megs.; Decibels from —20 to +56; Incorporates internal buzzer for audible warning of direct shorts and blocking condenser for A.F. output measurements. Size 3⁵/₁₆ × 6⁵/₁₆ × 2½in., £8.19.6.

LINEAR AMPLIFIERS. LG34, 4 watts, size 8½ × 4½ × 2½in. high, £5.5.0. L45A 5 watts, size 7 × 7 × 5in. high, £5.19.6. Protective cover, 12/9. L5/55 5 watts stereophonic, size 10½ × 8 × 6in., £12.12.0, cover with carrying handles 25/-. "Diatonic" 10 watts Hi-Fi Ultra Linear Push-Pull, size 9 × 7 × 6½in. high, £12,12.0. Cover with carrying handles, 19/6. L1/10 10 watts Hi-Fi Ultra Linear size 9 × 7 × 5in. high, £13.13.0. Cover with carrying handles. 19/6. "Conchord" 30 watts Hi-Fi Ultra Linear size 12½ × 9 × 7½in. high, £16.16.0. Cover with carrying handles. 25/-, L50 50 watts Hi-Fi Ultra Linear, size 14 × 10 × 8in. high, £23.2.0. Cover with carrying handles, 32/6. All amplifiers for normal A.C. mains, and ex stock. Details on request.

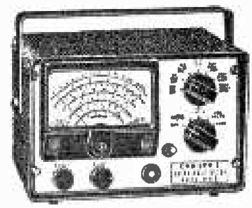
"Tripletone" Convertible Amplifier. Size 10 × 3 × 4½in. high. 4 watts output matched for 2-3 ohms, OR 2 amplifiers can be coupled together for STEREO £6.19.6. each.

"Tripletone" F.M. Tuner, size 11 × 6 × 3in. high. Coverage 86-104 Mc/s. £13.19.6 (unpowered), or £15.14.6 (self powered). Details on request.

SPEAKERS. Special heavy duty 15 ohms 12in. £5.5.0. Wharfedale 15 ohms 12in. for Lead Guitars £10.10.0, 15in. for Bass Guitars £17.10.0. 3 ohms 10in. 29/6, 3 ohms 8in. 22/6.

MICROPHONES. Crystal Types. Guitar 12/6. Desk. with built-in stand 15/-. Acos 39/1 Stick, and Table Stand 32/6. Super Stick, with heavy Desk Stand 49/6. Moving Coil Types. Stick, with heavy Desk Stand 59/6. "Slimline" Stick, 50K impedance, with switch 75/-. Omni-directional, chrome plated die-cast frame. 50K. with switch 99/6.

VALVE VOLTMETER



D.C. Input Impedance 11 Megohms. 7 Voltage ranges, D.C. to 1,500, A.C. to 1,500 R.M.S., 4,200 Peak to Peak. Resistance .2 ohm to 1,000 Megohms. Centre zero setting for receiver alignment. Complete with A.C./D.C. probe and leads. Full illustrated details on request. ONLY

£3.19.6

(Post 3/6).

TRANSISTORISED TEST EQUIPMENT. Fully guaranteed, brand new. By NOMBREX:
150 Kc/s.—350 Mc/s. Signal Generator, £9.10.0. Resistance-Capacitance Bridge, £8.5.0. 1-15 volts D.C. Power Supply, £8.10.0. Audio Generator 10/100,000 c/s., £16.15.0. Inductance Bridge, £18.0.0.

By T.M.K. **INSULATION TESTER.** Measures up to 500 megohms at 3 testing voltages, 100, 250 and 500. Supplied with leather case and leads, £17.10.0.
Illustrated details on any of the above sent on request.

HETERODYNE FREQUENCY METERS, TYPE LM14. Frequency range 125-20,000 kc/s. in 2 band. This is the United States Navy Model of the well-known BC221 Frequency Meter, but has many additional features which increase its usefulness. Voltage stabilisation circuits and Crystal control ensure extreme accuracy and in addition it is fitted with an Internal Modulation switch to allow use as a Signal Generator. Size only 8½ × 8 × 8½in. Perfect working order, £25.0.0.

ADJUSTABLE MIKE STANDS, with heavy bases and plated stems Table type 29/6, floor type 55/-.

20/- CONSTRUCTOR'S PARCEL. Assorted colours wiring wire, solder, resistors, condensers, volume controls, tag panel. ALL NEW (post 2/6).

SPRAGUE CONDENSERS. Metal cased, wire end. New .01 mFd. 1,000 volt and 0.1 mFd. 500 volt, 7/6 per dozen. Special quotes for quantities.

CONDENSERS. 100 assorted mica and silver mica. NEW 10/-.

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SILICON RECTIFIERS. Type BY100 (½in. x ½in.) will handle 250 volts at up to 500 mA. Replaces any TV metal rectifier. BRAND NEW—not seconds, 7/-.

VHF COMMUNICATIONS RECEIVER R-1949. This is the Air Force version of the well-known Hallicrafters S-27 or S-36. Covers 27 to 145 Mc/s. in three wavebands. It is complete with all valves, stabiliser. "S" meter etc., but requires an external power supply to give 250 volts HT and LT. Picks up police, amateurs etc. and could easily be used for mobile operation. Tested and in good condition. £17.10.0. Carr. 10/-.

AR 88 VIBRATOR PACKS. For 6V. operation. Complete with vibrator and OZ4 rectifier. NEW in original cartons, 15/-. P. & P. 5/-.

AR 88 SPARE VALVES. Complete Set of BRAND NEW individually boxed original valves (1-4), 50/-. Plus 2/6 P. & P.

MOVING COIL PHONES. Finest quality Canadian with Chamois ear muffs and leather covered headband. With lead and jack plug. Noise excluding, supremely comfortable BRAND NEW .... 22/6, post 1/6

MAGNETIC COUNTERS (ex G.P.O.). 4 figures to 9,999. Coils 500Ω for 24V. operation. Tested. (No reset), 5/- each. P. & P. 1/6. SPECIAL OFFER! 10 for 30/-. P. & P. 6/-.

MICRO AMMETER. 0-500µA. Made by R.C.A., Weston Westinghouse and other famous American manufacturers. Circular 2½in. flush panel mounting. Dials are engraved 0-15 0-600 volts. As used in the American version of the "19 SET". TESTED AND GUARANTEED 15/-.

HEAVY DUTY TRANSFORMER. Input 220 to 250 volts A.C. mains (tapped every 5 volts). Output 50V. at 15 amps. A really rugged job, very conservatively rated. Size 7½ x 5½ x 7in. Weight 28 lbs. ONLY £5.19.6. Carr. 7/6.

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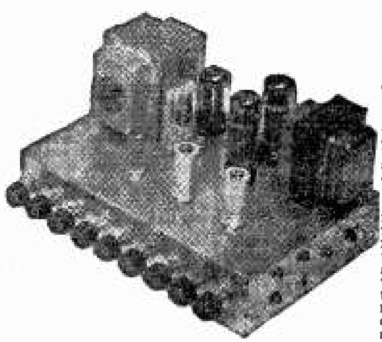
GUITAR AMPLIFIERS WITH TREMOLO



Five jack socket inputs, four with separate mixing volume controls, and one input "straight through." All inputs are of very high sensitivity, only 10 millivolts input is required for full output, making them suitable for all types of guitars and microphones. Separate Bass and Treble controls, giving a wide range of lift and cut. Separate master gain control. Tremolo speed and depth controls. Jack socket for remote tremolo switching. Outputs for 3 and 15 ohms speakers. Valves used in the 30 watt and 50 watt amplifier ECC83, ECC83, EL34, EL34, GZ34. In the 15 watt amplifier ECC83, ECC83, EL84, EL84, EZ81. An extra valve ECC83 is used in the tremolo circuit. The chassis is complete with baseplate and is solidly made of 18 gauge steel, finished silver grey hammer. Size 12 x 8 x 6½ inches high.

PRICES—

50 watt with tremolo	£20.10.0
50 watt less tremolo	£19.10.0
30 watt with tremolo	£15.10.0
30 watt less tremolo	£14.10.0
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Add carriage 10/- any amplifier. Send for free descriptive leaflet.

STROUD AUDIO

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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 RSGB AND PIRATES

SIR,—I have followed with interest your recent editorials on pirate operation.

I agree there is no excuse for operating a transmitter without a licence—the qualifications should not be beyond the capabilities of anyone who is really keen. In this connection I am particularly pleased to see that you are currently publishing a series of articles designed to help the newcomer pass the Radio Amateurs' Examination.

This society has itself been very active in this sphere for many years and publishes in August and September each year extensive lists of centres at which courses in preparation for the R.A.E. are being held. In addition, the society publishes a "*Radio Amateurs' Examination Manual*". More recently, an education and training committee has been set up, one of the objects of which is to foster the dissemination of information intended to help people to take part in amateur radio to the full.

Your practical efforts in this field are therefore particularly welcome. — J. A. ROUSE (General Manager, Radio Society of Great Britain).

NATIONAL FRATERNITY

SIR.—We were interested in the letter concerning Boys' Clubs, written by Mr. Overbury in the January issue. Our society and club has been forwarding just such a movement for about four years now. We have had great success in the field of exhibitions and social work. As a society, we have links with boys in Brighton, Welwyn, H.M.S. Ganges (Ipswich) and Australia, and correspondents in India and Nigeria. Work in co-operation with other bodies such as the British Association and, of course, the R.S.G.B. proceeds internationally together with the "Science Service" of the USA.

However, a club is vital to this work, and forms a focal point for all concerned. Boys in our locality have a club room and equipment, regular meetings, lectures and other club activities. It is vital to set up *local* activity, and let a larger organisation grow.

Because of the nature of work with young people, their particular outlook, lack of resources and responsibility, recognition under the Law, the difficulties are, and always have been, peculiar to this type of work.

It is important to have skilled, dedicated leadership. Also, assistance from all those who can give it is absolutely vital.

We are preparing one or two articles for publication with information on Boys' Radio Club formation. See also "QUA Associates", *R.S.G.B. Bulletin*.

We shall be delighted to hear from anybody keen on this social work, and any offers of help, advice, views will be welcome from lads wherever they are.—KEN SMITH B.Sc., G3JIX (82 Granville Road, Walthamstow, London, E.17).

QSL CARDS BETTER THAN WALLPAPER

SIR.—Correspondent C. P. Finn, of Yorkshire (P.W. January 1965 issue), asks about Electronic patterned wallpaper for his shack/bedroom.

When I had my shack/bedroom in 1932, we didn't worry about wallpaper. The main trouble was insufficient number of walls for QSL cards, blueprints, pencilled QSO's etc.

There are plenty of abstract patterns which could soon be converted to the "Electronic" theme, but for my choice, the old-type shack is unbeatable.—P. O. HUBBART (West Croydon, Surrey).

COMPETENT CONSTRUCTORS

SIR,—I wonder how many readers of this magazine pride themselves on being competent constructors of electronic equipment? Probably the majority, but there is, nevertheless, an increasing number of people who, having assembled some transistor set, half of which has already been made in the factory and which has been prefabricated, pre-cut, pre-aligned etc., insist on calling themselves competent radio constructors.

Furthermore, many of these people are not even interested in how their apparatus works, but merely in the noise that it produces, and an increasing number of manufacturers are catering for the person with this type of outlook.

Naturally, this seems rather a snobbish attitude to take, but it would be nice to know, for the benefit of our status as radio constructors, that we are not confused with the "step-by-step" man who only buys an f.m. tuner kit because it is cheaper than commercially available ones of the same quality.

I leave readers of this letter with a quote from George Orwell. "The boards I buy are ready planed, and the legs are ready turned by the lathe. I can even go to the woodshop and buy all the parts of the table ready-made and only needing to be fitted together; my work being reduced to driving in four pegs and using a piece of sandpaper . . . Making a table will be easier and duller than peeling a potato".—C. J. COLLISTER (Cheltenham, Gloucestershire).

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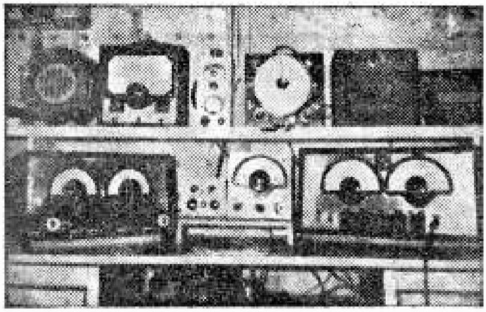
LATE PASS

SIR,—As a reader of your journal since the days of *Amateur Wireless* (I am now 66) I fully endorse every word you say about "pirates". As you say, the RAE never stopped the real enthusiast. I know an amateur who has passed the RAE, passed the morse test, and has been on the air for a year. He is in his 70's! If this doesn't shame some of those who want the "freedom of the air", it ought to. Thank goodness these are only a minority.

I am all for encouraging the youngsters. And what a goldmine of knowledge these young people of today have in their local library—enough for them to take the MIRE examination, let alone the RAE!

Enclosed is a photograph of my den, which might be of interest. — T. W. MIDDLETON ex-G2FTM (Gravesend, Kent).



Mr. Middleton's den, where equipment based on P.W. designs is still providing him with a hobby in his enforced retirement.

P.W. SIGNAL INJECTOR

SIR,—With reference to the signal injector described in the August issue of PRACTICAL WIRELESS, after having difficulty in obtaining a 35mm film cassette tin, I found that an "Anadin" aspirin tin was ideal for the job.—J. H. BORROWDALE (Hounslow, Middlesex).

CORRESPONDENTS WANTED

SIR,—I would like to correspond with other radio enthusiasts of my own age (13).—EDWARD TWEEDLY (27 Orchard View Drive, Kirkfieldbank, Lanark, Scotland).

SIR,—I would like to correspond with someone of my own age (14) who is interested in radio. —G. JACKSON (50 Bury Street, off Sandy Lane, Stockport, Cheshire).

SIR,—I would like to hear from readers in any country who have an interest in radio and television.—S. A. ARIYASENA ("Sirisewana" Nawagamuwa, W.P., Ranala, Ceylon).

SIR,—I am a regular reader of P.W. and interested in radio technology. I would like to correspond with any radio technician from Great Britain. I will answer all letters received promptly. —T. HENRY C. PEIRIS (Watinapaha, Dewlapola, Ceylon).

REQUESTS FOR INFORMATION ARE INSERTED IN THIS COLUMN ON THE UNDERSTANDING THAT READERS USING THE SERVICE UNDERTAKE TO REPLY TO ALL OFFERS RECEIVED AND TO RETURN ALL DATA NOT REQUIRED. BECAUSE OF THE LARGE NUMBER OF REQUESTS RECEIVED, ILLEGIBLE WRITING WILL AUTOMATICALLY DISQUALIFY LETTERS FROM PUBLICATION. FOR THE SAME REASON, WE CANNOT GIVE SPACE FOR REQUESTS FOR PAST ISSUES OF "PRACTICAL WIRELESS."

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

. . . circuit diagram or any information on ex-army receiver R1466, Ref. No. 10D/1409.—BRIAN WOOD, 99 Kinnaird Road, Sheffield 5.

. . . information and circuit values of ex-government photocell 0/33281 CV243 and how to make it work a relay when the light beam is cut off.—M. GARDINER, 15 Windmill Fields, Four Marks, Nr. Alton, Hampshire.

. . . the circuit or service sheet or any details of the Ultra Ultrascope oscilloscope Mk. 1.—D. CHADWICK, 40 Abbots Road, Abbots Langley, Watford, Hertfordshire.

. . . any information, circuit diagram, etc., concerning the R 1392 v.h.f. receiver.—H. A. FORRESTER, 58 Bede Avenue, Sherburn Road Estate, Durham.

. . . any details whatsoever on the American receiver type BC624—C.—E. R. LISLE, Red Hill School, East Sutton, Nr. Maidstone, Kent.

. . . service sheet for the Veritone "Venus" tape recorder.—D. POTTERILL, 30 Dryden Crescent, Stevenage, Hertfordshire.

. . . the schematic diagram or any information on the wireless set 38 A.F.V.—W. B. NEEL, Landguard Lodge, Manor Terrace, Felixstowe, Suffolk.

. . . circuit and service details of the Delco Remy Hyat car radio, model 342.—J. STONEMAN, 46 South Hall Drive, Rainham, Essex.

. . . the circuit diagram or manual of transmitter type 1154M.—A. MAWHINNEY, 11 Donaghadee Road, Millisle, Co. Down, N. Ireland.

. . . a circuit diagram and operating manual for a No. 38 Mk. 2 set, and a manual for a 1132A Receiver.—S. G. BARNES, 13 Surrey Grove, Sutton, Surrey.

. . . information concerning the modifications of the R109 Receiver (year 1943).—S. ALDERTON, 2a Goldings Road, Loughton, Essex.

. . . information on fixing a tunable oscillator in a Bendix Receiver, BC 624A type R5019.—R. C. HART, "Brookmead", Rudwick Close, Felpham, Nr. Bognor, Sussex.

. . . the operating manual for the Geloso 209 Receiver.—R. BUNTOCK, 38 Bittell Road, Barnt Green, Nr. Birmingham.

. . . any information on the Marconi No. 9 Transmitter-receiver, and any information on the No. 46 Transmitter-receiver.—R. J. SHAWE, South Supplies, 71 High Street, Poole, Dorset.

. . . the circuit and/or manual of the R116A communications receiver.—A. D. COUCHMAN, 3 Manor Grove, Sittingbourne, Kent.

. . . the circuit diagram and/or any other details regarding the No. 19 Set.—T. BRIGGS, Lindfield School, Slinden House, Slindon, Sussex.

. . . circuit details of the Hallicrafter S77.—C. CLARK, 94 Pensby Road, Heswall, Wirral, Cheshire.

. . . the circuit for the PCR2 receiver.—W. BURKE, GM3TQH, 6 Belgrave Terrace, Glasgow W2.

. . . the circuit diagram or details of the PCR2 receiver.—G. DARLING, 80 Seaton Gardens, Ruislip Manor, Middlesex.

. . . the handbook on the communication receiver DST100.—R. A. ELLIS, 32e Abbey Road, St. John's Wood, London N.W.8.

. . . information regarding the conversion of communication receiver 1392/62H from v.h.f./a.m. to v.h.f./f.m.—J. A. STIMSON, 236 Fullwell Avenue, Clayhall Ilford, Essex.

. . . any information, service manual and circuits for the ex U.S. army transmitter/receiver BC620F and p.s.u.—D. W. VITOU, 169 Worthing Road, Laindon, Basildon, Essex.

. . . the valve line-up for the Perth radio.—C. L. DIBBLE, c/o The Exchange Telegraph Co. Ltd., 17-21 Curtain Road, London E.C.2.

. . . any information regarding the "Hersteller" b.o. type R2, battery/mains portable radio, also the circuit, etc., for the Pye 47X a.c./d.c. receiver.—R. H. JACKSON, Braithwaite, Summerbridge, Harrogate, Yorkshire.

. . . the circuit diagram and any other information regarding the BC-624-A v.h.f. receiver.—J. S. MORTLOCK, 36 Valleyfield Road, Streatham, London S.W.16.

. . . the circuit for a P104 v.h.f. receiver. I cannot get this set to oscillate, and any advice on this would be most welcome.—G. SPICER, 186 St. William's Way, Rochester, Kent.

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TRANSISTOR DESIGNS BY SINCLAIR 1

SINCLAIR X-10

COMBINED 10 WATT AMPLIFIER AND PRE-AMP

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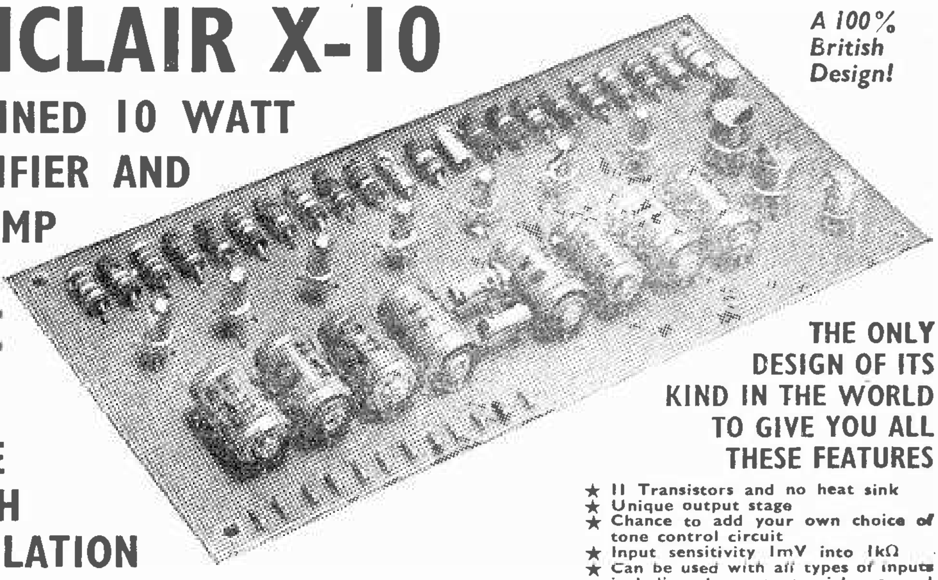

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AND SUPERB STANDARDS OF PERFORMANCE

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- ★ 11 Transistors and no heat sink
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- ★ Can be used with all types of inputs including low-output pick-ups and microphones
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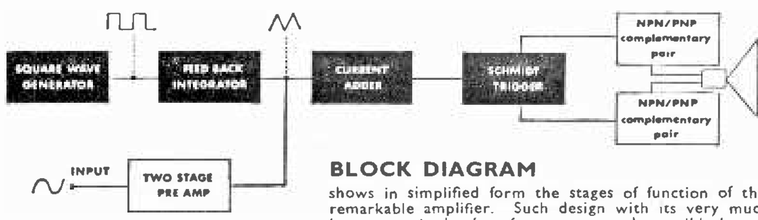
- ★ Speaker impedance 15Ω
- ★ Damping factor—greater than 100
- ★ Supply voltage 12 volts from batteries or mains supply unit
- ★ Size 6" x 3"

SINCLAIR X-10 MANUAL

Included with every X-10, it explains how the amplifier functions and how you can add the correct tone and volume control system to suit your precise requirements. A variety of systems is shown, none of which will add more than a few shillings to the original cost of your Sinclair X-10, be it for **MONO** or **STEREO.** Obtainable separately, price 1/-.



BLOCK DIAGRAM

shows in simplified form the stages of function of this remarkable amplifier. Such design with its very much better standards of performance is made possible by use of the very latest transistors and high quality components.

Guarantee, Order form and more Sinclair Designs on pages following

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SINCLAIR MICRO-6

The smallest radio set in the world

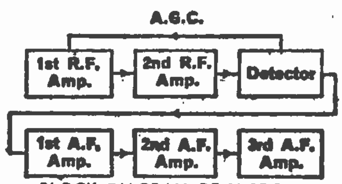
SIZE-$1\frac{4}{5}$" x $1\frac{3}{10}$" x $\frac{1}{2}$"
WEIGHT-LESS THAN 1-oz.

ACTUAL SIZE

EVERY CONSTRUCTOR SHOULD BUILD IT!

It's the ultimate in personal radio, as thousands of constructors can tell you. For power, range and robustness, the Micro-6 is out of all proportion to its minute size, and it is found to function excellently where other sets cannot be used at all. That is why it is the one radio set you will be glad to have with you always, indoors or out. It will never intrude upon the privacy of other people no matter where you are using your Micro-6 and you can even wear it like a wrist watch. This world famous British receiver cannot be too highly recommended both as an intriguing design to build and a most practical set to use—IT PLAYS ANYWHERE.

- ★ *AMAZING POWER AND RANGE*
- ★ *TUNES OVER MEDIUM WAVEBAND*
- ★ *BANDSPREAD FOR EASY LUXEMBOURG RECEPTION*



BLOCK DIAGRAM OF MICRO-6

The Micro-6 uses three special Sinclair Micro-Alloy transistors (MATs) in an original and very efficient circuit. Two stages of R.F. amplification are 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.

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All parts including MAT transistors, diodes, printed circuit board, lightweight earpiece, case and dial, and well-printed instructions come to **59/6**

Sinclair "Transrista" well-styled, strong black nylon wrist strap **7/6**

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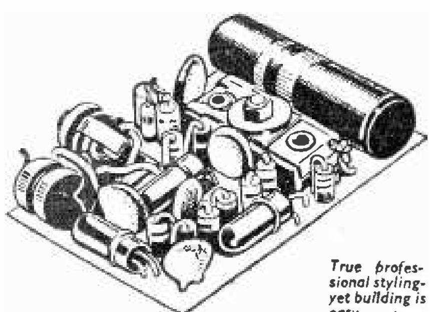
Pack of 6 ... ... 10/6



True professional styling-yet building is easy.

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TRANSISTOR DESIGNS BY SINCLAIR 3

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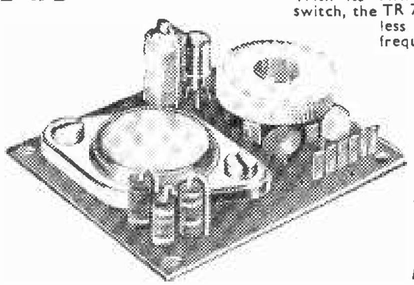
SINCLAIR TR750 AMPLIFIER

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.



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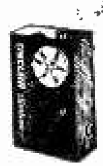
Ready built and tested **45/-**

SINCLAIR SLIMLINE

The ideal Sinclair design for beginners

4-STAGE POCKET RECEIVER



Here's a fine performing set which is ideal for newcomers to transistor building. It has a self-contained aerial and takes a standard PP5 battery. Measures only $2\frac{15}{16} \times 1\frac{11}{16} \times \frac{3}{4}$in. Tunes over medium waveband by means of vernier type control.

The Slimline has great power and quality and will bring in B.B.C. and European programmes with great ease. Countless thousands have been built by enthusiasts ranging from schoolboys to their grandfathers!

All parts including royal blue and gold case, earpiece and easy to follow instructions come to **49/6**

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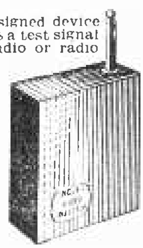
This ingeniously designed device generates and injects a test signal into any part of audio or radio equipment at any frequency from 1 kc/s to 30 Mc/s by means of which it becomes easy to locate faults rapidly and accurately. Measures $1^4/_5 \times 1^3/_{10} \times \frac{1}{2}$in. excluding probe. With full instructions.

No constructor should be without a Micro-Injector.



Parts and instructions come to **27/6**

Ready built and tested **32/6**

SINCLAIR MICRO-AMPLIFIER

- Makes an F.M. Transmitter
- Makes an Audio or Broad Band R.F. Amplifier
- Smaller than a 3d. piece

This fantastically small amplifier gives phenomenal performance. Its exceptionally wide frequency coverage enables it to be used in many interesting and original ways. Frequency response 30 to 50,000 c/s ± 1dB. Power gain 60dB (1,000,000 times). Instructions show you how to make a broadband R.F. amplifier, F.M. transmitter or a sub-miniature hi-fi amplifier with an output suitable for any earpiece or even loudspeaker. A fascinating design for experimenters, modellers etc. Parts and instructions come to **28/6**

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Speakers, Ex-TV. 5in. round. 6 x 4in. 3/6; 8in. round, 6/-; post 2/-.

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(continued)

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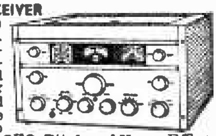
NEW VALVE TESTERS £12. Molineux, Lowfield Heath, Sussex.

RCA AR88D RECEIVER



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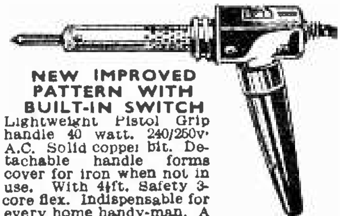

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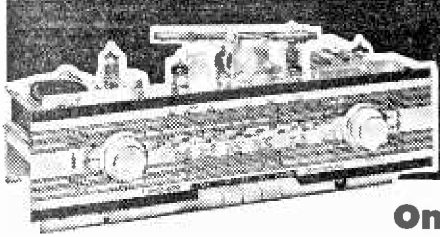

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2½	7000	50	8/6
2½	7000	80	8/-
3	8500	3	10/-
3	6000	5	8/6
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3¾	9500	8	10/6

Diameter in inches	Gauss in lines	Imped. in ohms	Price
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3¾	9500	50	10/6
4	7000	25	11/6
4	6000	35	10/6
4	7000	35	11/-
4	9500	35	11/6
4 Twtr.	10000	3	11/6
4	9500	15	12/-
5	6000	3	8/-
5	6000	5	8/-

Diameter in inches	Gauss in lines	Imped. in ohms	Price
5	7000	3	8/6
5	7000	5	8/6
5	7500	3	9/-
5	8500	3	9/6
5	9500	3	10/6
5	9500	5	10/6
5	9500	15	12/6
5	8500	25	10/6
5	9500	35	11/6
6½	6000	3	11/-

Elliptical Size	Gauss in lines	Imped. in ohms	Price
5 × 3	6000	3	7/6
5 × 3	7000	3	8/-
5 × 3	9000	3	8/6
5 × 3	9500	35	11/-
5 × 3	9500	3	9/-
6 × 4	6000	3	8/6
6 × 4	7000	3	9/-
6 × 4	8500	3	9/6
6 × 4	9500	3	10/-

Elliptical Size	Gauss in lines	Imped. in ohms	Price
6 × 4	9500	35	12/-
7 × 3¾	7000	3	9/6
7 × 3¾	9500	3	10/6
7 × 4	9500	3	11/-
7 × 4	9500	30	12/6
7 × 4	9500	35	12/6
8 × 2¾	6000	3	8/6

Elliptical Size	Gauss in lines	Imped. in ohms	Price
8 × 2¾	7000	5	9/-
8 × 2½	8500	5	9/6
8 × 2¾	9500	3	10/-
8 × 2¾	9500	4	10/-
8 × 2¾	9500	5	10/-
8 × 5	8500	3	11/-
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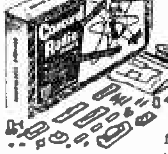

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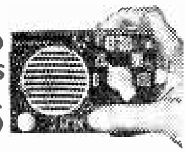

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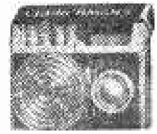

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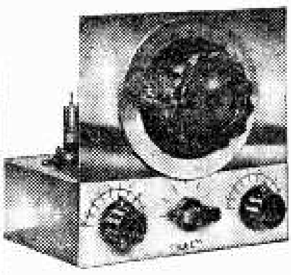

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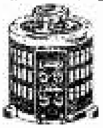

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10C2	12/-
10D1	7/-
10F1	14/-
10F3	8/-
10F9	10/-
10F18	9/-
10L1	7/6
10LD11	10/-
10P13	12/6
10P14	12/6
12AH7	5/-
12AH8	11/-
12AQ5	7/-
12AT6	5/-
12AT7	4/-
12AU6	6/-
12AU7	5/-
12AX7	6/-
12BA6	6/-
12BE6	5/-
12BH7	8/-
12J7GT	7/6
12K7GT	7/-
12K8	10/-
12Q7GT	5/-
19AQ5	5/-
20F2	15/-
20L1	14/-

20P1	14/-
20P3	12/-
20P4	14/-
20P5	12/-
25A6G	5/-
25L6GT	8/-
25Z4G	7/-
25Z5	7/6
25Z6GT	8/6
30C15	10/-
30C17	12/-
30F5	9/-
30FL1	11/-
30L17	13/-
30P12	10/-
30P19	14/-
30PL1	11/6
35A5	11/-
35L6GT	7/-
35W4	5/-
35Z4G	4/-
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50C5	6/6
50CD6G	25/-
50L6GT	6/6
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AZ12	9/-
AZ41	6/6
C1C	5/-
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CL33	9/-
CY31	6/6
DAC32	7/-
DAF70	7/-
DAF91	4/6
DAF92	6/-
DAF96	6/-
DF66	6/-
DF72	7/-
DF91	3/-
DF96	6/-
DK91	5/-
DK92	7/6
DK96	7/6
DL66	12/-
DL68	10/-
DL69	12/6
DL70	7/-
DL73	12/-
DL92	5/-
DL95	5/6
DL96	6/6

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DY80	7/-
DY86	8/-
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EABC80	7/-
EAF42	8/6
EB41	5/-
EBC33	7/-
EBC41	7/-
EBC81	6/6
EBF80	6/6
EBF83	7/6
EBF89	6/9
EC53	12/6
EC80	8/-
EC88	12/-
EC90	2/6
ECC31	5/-
ECC32	4/-
ECC40	9/-
ECC84	6/6
ECC85	6/6
ECC88	10/-
ECF80	7/6
ECF82	7/6
ECF86	10/-
ECH21	10/-
ECH35	13/-
ECH42	8/-
ECH81	6/-
ECH83	7/6
ECL80	6/6
ECL82	7/6
ECL83	9/-
ECL86	8/6

EF36	4/6
EF37A	8/-
EF39	5/-
EF40	9/-
EF41	7/6
EF42	6/-
EF54	6/-
EF55	8/-
EF80	5/-
EF83	10/-
EF85	6/-
EF86	7/-
EF89	4/6
EF91	4/-
EF93	4/9
EF94	6/-
EF95	5/-
EF98	10/-
EF183	8/-
EF184	8/-
EFP60	10/-
EL33	12/6
EL34	10/-
EL38	17/6
EL41	8/-
EL42	9/-
EL81	8/6
EL84	5/-
EL85	8/-
EL86	7/6
EL821	6/-
EL822	8/-
EM31	5/-
EM34	9/6
EM80	6/6
EM81	7/6
EM84	8/-
EM85	9/-
EM87	7/-
EN31	10/-
EN32	10/-
EY51	7/-
EY81	8/-
EY83	9/6
EY86	6/6
EZ80	5/6
EZ81	4/6

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GZ34	10/-
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KT88	20/-
N78	15/-
NP81	25/-
NSP2	22/-
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ORP60	10/-
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PCC85	7/-
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PCL84	8/-
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PL81	7/-
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PL83	6/6
PL84	6/6
PL500	15/-
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PY33	9/-
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PY82	6/-
PY83	6/-
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U26	11/-
U191	11/-
U251	12/6
U281	13/-
U282	14/-
U301	12/-
U403	7/-
U801	18/-
U4020	7/6
UABC80	6/-
UAF42	8/-
UBC41	7/-
UBC81	7/-
UBF80	6/6
UBF89	7/-
UBL21	11/-
UCC84	9/-
UCC85	7/-
UCF80	9/6
UCH21	8/6
UCH42	8/-
UCH81	7/-
UCL82	8/-
UCL83	10/-
UF41	7/6
UF42	8/-
UF80	6/6
UF85	7/-
UF86	10/-
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UL41	8/-
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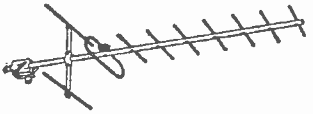

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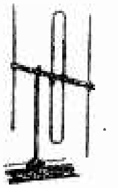

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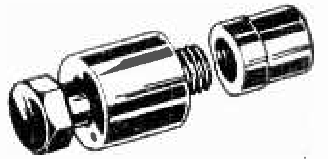

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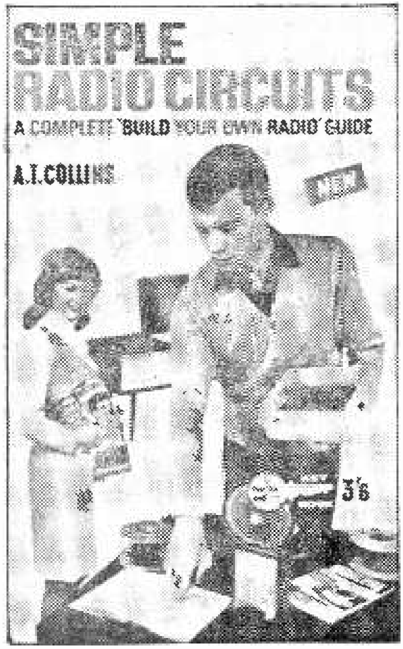

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6F19	6/-	12SH7	3/6	DF97	7/6	EL91	3/9	PY801	7/9	Z63	4/9
6F32	4/9	12SJ7	5/6	DH63	5/6	EL95	6/-	PZ30	9/6	Z66	8/6
LF33	4/-	12SK7	4/6	DH76	4/6	EM34	8/9	R19	9/6		
6M6	1/6	12SN7GT	6/9	DK32	9/6	EM80	7/6	RL18	11/-		
6J5	4/3	12SQ7	8/6	DK91	5/6	EM81	8/9	SP41	2/3		
6J5G	3/-	13D8	6/6	DK92	7/-	EM85	9/6	SP61	2/-		
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6J6	3/6	19BG6	14/-	DL33	7/6	EY51	7/6	SU2150	4/6		
6J7	8/6	20D1	8/9	DL35	7/6	EY86	7/3	T41	6/9		
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14in. **£2.19.0** 17in. **£4.19.6**

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1% to 5% 100 Ω to 5 M Ω.

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(p.p. 3/6 any type)

All Decks Complete with Cartridges

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Fully guaranteed. P. & P. 3/-

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Multi-range test meters featuring easy to read scales and provided with full operating instructions, lead and batteries. Suitable for amateurs, designers repair shops, all domestic uses. Full details and specification in our catalogue.

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7-Transistor Zephyr	79/6
6-Transistor MW/LW	£5.19.6

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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

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

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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.

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LA1	12/6	LA5	17/6	LA45	15/-
LA2	15/-	LA6	22/6	LA2503	15/-
LA3	19/6	LA9	17/6	LA2504	15/-
LA3	19/6	LA10	17/6	LA2505	17/6
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30 watt Soldering Iron	14/6 P.P. 1/-.
Tape Demagnetiser	29/6
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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 ½ watt amplifiers. Kit, 39/6. P.P. 1/6. Built 49/6. P.P. 1/6.

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

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●SINCLAIR X10 AMPLIFIERS

in stock. Kit £5.19.6. Built £6.19.6.

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.
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Complete Systems

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● **Complete in Every Detail** ●

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All transistor portable units supplied with full instructions.

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★ Resistance/Capacitance Bridge, £8.5.0.
★ Transistorised Power Supply, £6.10.0.
★ Audio Generator, £16.15.0.
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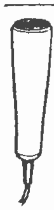
Fully Guaranteed.



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●MINIGRAM PORTABLE TRANSISTOR RECORD PLAYER KIT, as

previously advertised.
79/6 P.P. 3/6 (Battery) 3/9.

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100 kc/s 15/-; 500 kc/s 15/-; 455 kc/s 12/6; 456 kc/s 15/-; 27.255 Mc/s 15/-.
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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 these 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.

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The Mini-amp *	5/-
The PT Olympic *	7/6
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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.

QUERY SERVICE

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.

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This coupon is available until 4th February, 1965 and must accompany all queries in accordance with the rules of our Query Service.
PRACTICAL WIRELESS, FEBRUARY, 1965

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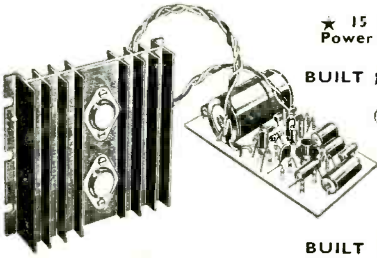
● TRANSISTOR HIGH FIDELITY EQUIPMENT

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

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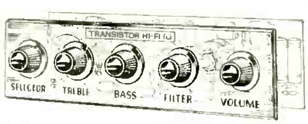
★MAINS UNITS 59/6 for one amplifier, or 69/6 to power two amplifiers

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 × 3¾ × 1⅝in.

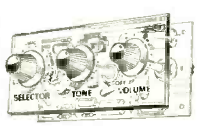
PRICE BUILT **£10.19.6** P.P. 3/6

★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

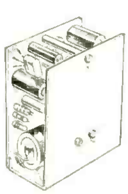


★Front Panel Plate 6/6.

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 plus music power or 20 watts peak 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 SIZES: 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!

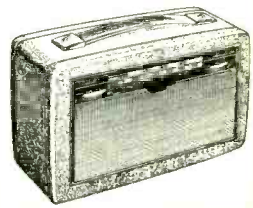
● **MEDIUM and LONG WAVE POCKET SUPERHET RADIO**

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-January

'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 wave bands. Quality push-pull output up to 1 watt. Attractive portable cabinet, size 10 × 7 × 3½", with horizontal slow motion tuning 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 tuning 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 available separately.

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

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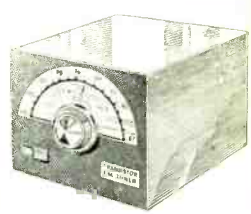

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