OCTOBER 1961

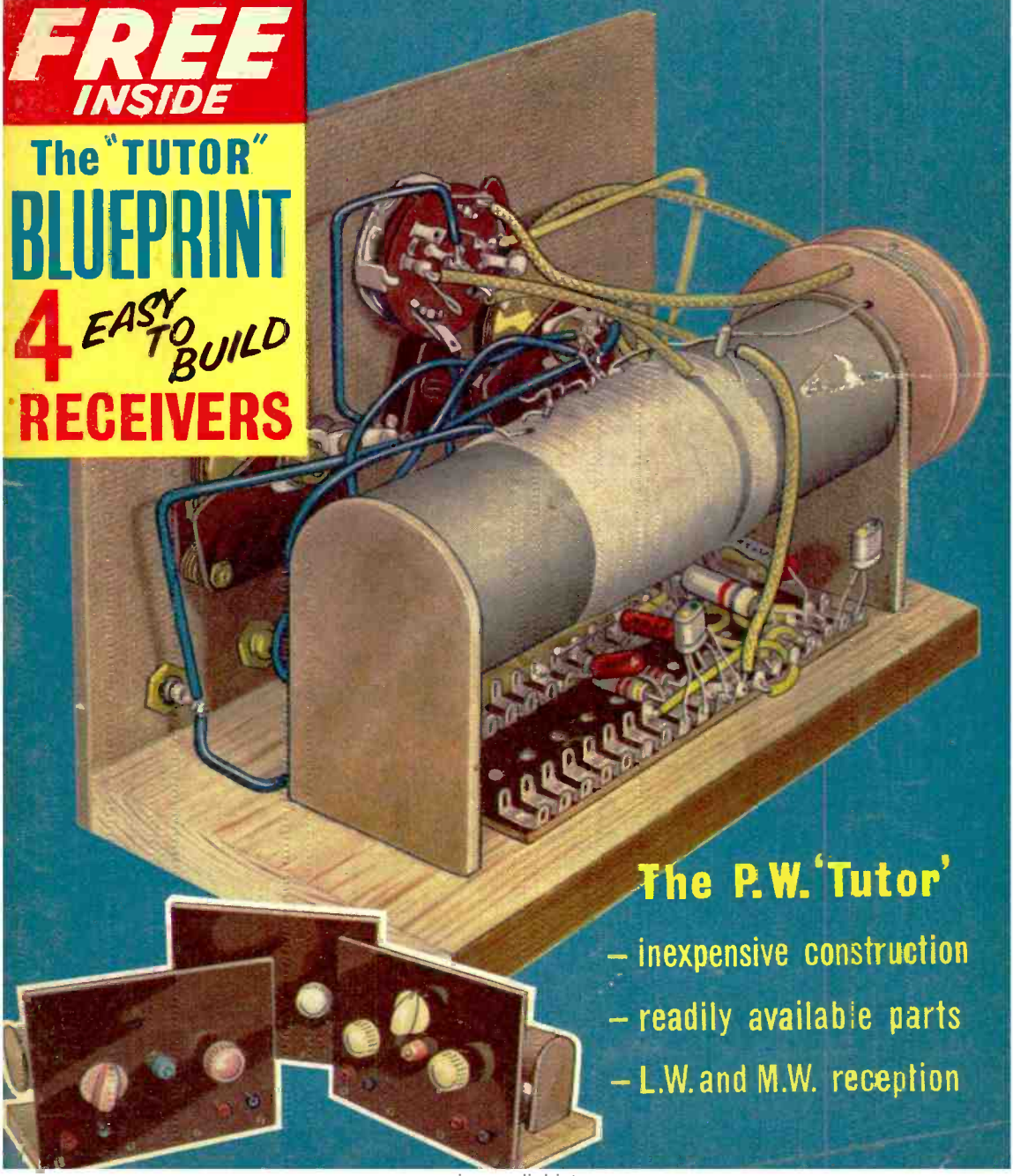
Practical WIRELESS

2/-

FREE INSIDE

The "TUTOR" BLUEPRINT

4 EASY TO BUILD RECEIVERS



The P.W. 'Tutor'

– inexpensive construction

– readily available parts

– L.W. and M.W. reception

R.S.C. HI-FI TAPE RECORDER KIT

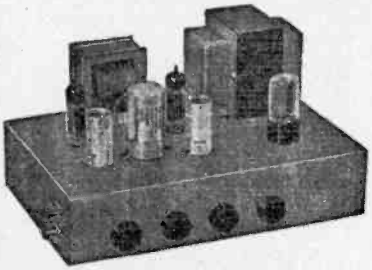
REALISM AT INCREDIBLY LOW COST, CAN BE ASSEMBLED IN HALF AN HOUR The Recorder incorporates the Latest Collaro Studio Tape Transcriptor. The Linear LT45X High Quality Tape Amplifier listed £12.12.0 High Flux P.M. Speaker listed 30/-, empty Tape Spool, a Reel of Best quality Tape listed 22/6, and a Handsome Portable carrying Cabinet with latest attractive two-tone polychrome finish, size 18 x 13 x 9in. high, listed £4.10.0, and circuit. Total cost if purchased individually approximately £40. Performance equal to units in the £60-£80 class. S.A.E. for leaflet.

25½ GNS. Carr. 17/6

H.P. TERMS. Deposit £5.7.6 and 12 monthly payments of 2 gns. Cash price if settled in 3 months.

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, 5Y3. 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 D.B. 30-30,000 c/cs. Six negative feedback loops. Hum level 60 D.B. 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, 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. 12-9-7in. For A.C. mains 200-250 v. 50 c.p.s. Output for 3 and 15 ohms speakers. 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 Ready-to-assemble Cabinets, Speakers. Microphones, etc., with cash and credit terms.

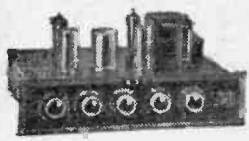
TELEVISION RECTIFIERS 250 v. 200 mA. small size. Only 6/9 each. **COLLARO CONQUEST 4-SPEED AUTO-CHANGER.** with high fidelity Studio pick-up. Latest model. For 200-250 v. 50 c.p.s. A.C. mains. Our price **£6.19.6.** Carr. 5/6.

COLLARO RC 457 4 SPEED MIXER AUTO-CHANGERS. Turnover Studio Pick-up head, for 200-250 v. A.C. **£7.19.6.** Carr. 4/6.

THE SKYFOUR T.R.F. RECEIVER A design of 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.

G13A 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 11½ x 2½ x 2½in. Controls: Vol. and Tone with switch. Only 59/6.

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 Controls give equal variation of "lift" and "cut". Provision is made for use as straight (monaural) 10 watt amplifier. Valve line-up ECC83, ECC83, 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/-.

R.S.C. BATTERY CHARGING EQUIPMENT

All for A.C. Mains 200-250v., 50 cca. Guaranteed 12 months.

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, Fuseholder and circuit. 59/9. Carr. 4/6.

DEAF AID EARPIECES. Low Impedance with lead. 8/9. High Impedance Crystal 8/9.

MICROPHONE INSERTS. Crystal type 6/9.

Assembled 6 v. or 12 v. 4 amps.

Fitted Ammeter and variable charge rate selector. Also selector plug for 6 v. or 12 v. charging. Louvred steel case with stoved blue hammer finished. Fused and ready for use with mains and output leads. Terms: Deposit 13/3 and 5 monthly payments 13/3. **69/6** Carr. 5/-

ASSEMBLED CHARGER

6 v. or 12 v. 2 amps.

Fitted Ammeter and selector plug for 6 v. or 12 v. Louvred metal case finished attractive hammer blue. Ready for use With mains and output leads. Double Fused. Carr. 3/9. **49/9**

BATTERY CHARGER KITS

Consisting of Mains Transformer. F.W. Bridge. Metal Rectifier, well ventilated steel case. Fuses, Fuse-holders. Grommets, panels and circuit. Carr. 3/6 extra.

6v. or 12 v. 1 amp.	24/9
As above, with Ammeter..	32/9
6 v. 2 amps.	25/9
6 v. or 12 v. 2 amps.	31/6
6 v. or 12 v. 2 amps. inclusive of Ammeter	42/9
6 v. or 12 v. 4 amps.	53/9
6 v. or 12 v. 4 amps. with Ammeter and variable charge rate selector	59/9

CHARGER AMMETERS. 0-1.5 a., 0-3 a., 0-4 a., 0-7 a., 0-25 a., 0-60 a. 8/9.

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

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

TOP SHROUDED DROP THROUGH

250-0-250 v. 70 mA, 6.3 v. 2 a, 5 v. 2 a..	17/9
350-0-350 v. 80 mA. 6.3 v. 2 a, 5 v. 2 a..	18/9
250-0-250 v. 100 mA. 6.3 v. 2 a, 6.3 v. 1 a	19/9
250-0-250 v. 100 mA, 6.3 v. 3.5 a, C.T...	19/9
250-0-250 v. 100 mA. 6.3 v. 4 a, 5 v. 3 a..	25/9
300-0-300 v. 100 mA, 6.3 v. 4 a, 6.3 v. 1 a, for Mullard 510 Amplifier	29/9
300-0-300 v. 100 mA. 6.3 v. 4 a, 5 v. 3 a..	26/9
350-0-350 v. 100 mA, 6.3 v. 4 a, 5 v. 3 a..	26/9
350-0-350 v. 100 mA, 6.3 v. 4 v. 4 a, C.T. 0-4-5 v. 3 a..	26/9
350-0-350 v. 150 mA. 6.3 v. 4 a, 5 v. 3 a..	29/9

FULLY SHROUDED UPRIGHT

250-250 v. 60 mA, 6.3 v. 2 a, 5 v. 2 a, Midget type 2½-3-3in.	17/11
250-0-250 v. 100 mA, 6.3 v. 4 a, 5 v. 3 a..	27/9
300-0-300 v. 100 mA. 6.3 v. 4 a, 5 v. 3 a..	27/9
350-0-350 v. 100 mA. 6.3 v. 4 a, 5 v. 3 a..	27/9
350-0-350 v. 150 mA, 6.3 v. 4 a, 5 v. 3 a..	35/9
425-0-425 v. 200 mA, 6.3 v. 4 a, C.T. 6.3 v. 4 a, C.T., 5 v. 3 a	49/9

FILAMENT TRANSFORMERS

All with 200-250 v. 50 c/s, primaries 6.3 v. 1.5 a, **5/9**; 6.3 v. 2 a, **7/6**; 0-4-6.3 v. 2 a, **7/9**; 12 v. 1 a, **7/11**; 6.3 v. 3 a, **8/11**; 6.3 v. 6 a, **17/6**; 12 v. 1.5 a twice, **17/6.**

OUTPUT TRANSFORMERS

Midget Battery Pentode 68:1 for 3S4, etc.	3/9
Small Pentode, 5000Ω to 3Ω	3/9
Small Pentode 7/8,000Ω to 3Ω ..	3/9
Standard Pentode 5,000Ω to 3Ω ..	5/9
Standard Pentode 7/8.000 to 3Ω ..	5/9
10,000Ω to 3Ω	5/9
Push-Pull 8 watts, EL84, or 6V6 to 3Ω	9/9
Push-Pull 10-12 watts 6V6 or EL84 to 3Ω or 15Ω	18/9
Push-Pull 10-12 watts to match 6V6 or EL84 to 3-5-8 or 15Ω ..	19/9
Push-Pull 15-18 watts, 6L6, KT66 ..	22/9
Push-Pull for Mullard 510 Ultra Linear	29/9
Push-Pull 20 watts, sectionally wound. 6L6, KT66 etc., to 3 to 15Ω ..	49/9

MIDGET MAINS

Primaries 200-250 v. 50 c/s.

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

Both above size 2½ x 2½ x 2½ins.

SMOOTHING CHOKES

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

CHARGER TRANSFORMERS

All with 200-230-250 v. 50 c/s Primaries: 0-9-15 v. 1½ a, **11/9**; 0-9-15 v. 2 a, **14/9**; 0-9-15 v. 3 a, **16/9**; 0-9-15 v. 5 a, **19/9**; 0-9-15 v. 6 a, **23/9**; 0-9-15 v. 8 a, **28/9.**

AUTO (Step up/Step down) TRANS 0-110/120-230/250 v. 50-80 watts. **13/9**; 1-110/120-200/230/250 v. 150 watts. **27/9.**

MICROPHONE TRANSFORMERS 120:1 high grade, clamped. **6/9**; 120:1 Potted. Mu-metal screened. **9/9.**

R.S.C. (Manchester) Ltd. LIVERPOOL, LEEDS, BRADFORD, MANCHESTER

R.S.C. A12 STEREOPHONIC AMPLIFIER KIT

A complete set of parts to construct a Stereo amplifier with an undistorted output total 6 watts. For A.C. mains input of 200-250 v. Outputs for matched 2-3 ohm speakers. Sensitivity 130 m.v. Ganged Vol. and Tone Controls. Preset balance control. Full instructions and point-to-point wiring diagrams supplied. Only good quality components and latest high grade valves used. Exceptionally realistic reproduction can be obtained at ample volume for the home, as can be demonstrated in typical surroundings at our County Arcade premises. A really sensational offer.

4 Gns.

Carr. and pkg. 5/-

STEREO EQUIPMENT OFFER- Comprising A12 Kit, 2 matched 8in. L/Speakers, and Acos T/O Stereo head suitable most pickups. **£6.19.6** Carr. 7/6.

PICK-UP ARMS complete with Hi-Fi turnover crystal head. Acos GP54. Limited number brand new, perfect at approx. half price. Only **29/11.**

ACOS CRYSTAL MICROPHONES. Mic40 stand or desk. Listed 45/-. Only **27/9.** 39-1 Stick type. Listed 5 gns. Only **39/6.**

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. 30-30,000 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. GZ33. 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, GUITAR, STRING BASS** etc. For standard or long-playing records. **OUTPUT SOCKET PROVIDES** L.T. and H.T. for a **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/cs. 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 cover as for A11 can be supplied for 18/9. The amplifier can be supplied, factory built with EL34 output valves and 12 months guarantee, for **14 Gns...**

11 Gns.

Carr. 10/-

TERMS: DEPOSIT 33/9 and 9 monthly payments of **33/9.**

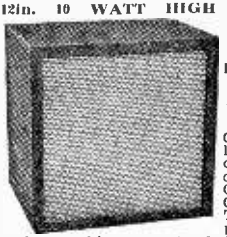
FULL RANGE OF LINEAR AMPLIFIERS ALWAYS IN STOCK.

COLLARO JUNIOR 4-speed single player units and Hi-Fi crystal pick-up with turn-over head. **£3.19.6.**

B.S.R. UA8 4-SPEED AUTO-CHANGERS with Hi-fi turnover pick-up head. **£6.19.6.** Carr. 5/-.

LINEAR L45 MINIATURE 4/5 WATT QUALITY AMPLIFIER. Suitable for use with any record playing unit, and most microphones. Negative feed-back 12db. Separate Bass and Treble Controls. For A.C. mains input of 200-250 v. 50 c/cs. Output for 2-3 ohm speaker. Three miniature Mullard valves used. Size of unit only 7-5-5¼in. high. Guaranteed for 12 months. Only **£5.19.6.** Send S.A.E. for illustrated leaflet. Terms: Deposit **22/6** and 5 monthly payments of **22/6.**

12in. 10 WATT HIGH QUALITY LOUDSPEAKER IN POLISHED WALNUT FINISHED CABINET



Gauss 12.000 lines.Speech coil 3 ohms or 15 ohms. Only **£4.19.6** Carr. 5/-. Terms: Deposit **11/3** and 8 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.

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 71db. down 15db. of Negative feedback is used. H.T. of 300 v. 25 mA. and L.T. or 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 ohm speaker. Chassis is not alive. Kit is complete in every detail and includes fully punched chassis (with baseplate) with Blue 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.

R.S.C. PORTABLE GUITAR AMPLIFIERS

Junior 5 watts High Quality output. Separate Bass and Treble "Cut" and "Boost" controls. Sensitivity 15 m.v., Twin inputs. High Flux 8in. Loudspeaker "built-in". Handsome, strongly made Cabinet (size approx. 14 x 14 x 7in.) finished in attractive and durable policrome, and fitted carrying handle. H.P. Terms. Deposit £1 and 9 monthly payments of £1.

£8.19.6

Carr. 7/6

Senior 10 watts High Fidelity output. Separate Bass and Treble "Cut" and "Boost" controls. Twin separately controlled high gain inputs so that two instruments such as Guitar and String Bass can be used at the same time. Two loudspeakers are incorporated, a high Flux 12in. for Bass notes and a 7 x 4 m. elliptical for Treble. Cabinet is well made and finished as Junior model. Size approx. 18 x 18 x 18in. H.P. Terms. Deposit 34/9 and 9 monthly payments of 34/9. Both models for 200-250 v. Carr. 10/- A.C. mains.

15 Gns.

Above model fitted Linear Tremolo Unit 5 gns. extra. Or Deposit **11/6** and 9 monthly payments **11/6.**

R.S.C. BASS REFLEX CABINETS, JUNIOR MODEL. Specially designed for W.B. HF1012 Speaker, but suitable for any good quality 10in. speaker. Acoustically lined and ported. Polished walnut veneer finish. Size 18 x 12 x 10in. Handsome appearance. Ensure superb reproduction for only **£3.19.6.**

STANDARD MODEL. As above but for 12in. speakers. Size 20 x 15 x 13in. Especially recommended for Plessey Dual Concentric Speaker. **£5.19.6.** Suitable legs with brass ferrules. **25/-** per set of 4.

PLESSEY DUAL CONCENTRIC 12in. 15 ohms HIGH FIDELITY SPEAKER (12,000 lines) with built-in tweeter (completely separate elliptical speaker with choke, condensers, etc.) providing extraordinarily realistic reproduction when used with our A11 or similar amplifier. Rated 10 watts. Price only **£5.19.6.**

P.M. SPEAKERS. 2-3 ohm. 2¼in. Perdio **21/9.** 5in., **17/9.** 6¼in., **16/9.** 8in., **19/9.** 8 x 5in. **25/9.** 10in. **26/9.** 10 x 6in. **29/9.** 12in. **29/11.** 10in. W.B. "Stentorian" 3 or 15 ohms type HF1012 10 watts. hi-fidelity type. Recommended for use with our A11 Amplifier. **£4.10.9.** 12in. R.A. 3 ohms 10 watts (12,000 lines). **59/6.**

TWEETERS. Plessey 3Ω 19/9, 15Ω 25/9.

HI-FI CRYSTAL PICK-UP HEADS. (Turnover type with sapphire stylus.) Acos. Standard replacement for Garrard and B.S.R. B.S.R. Ful-fi. Garrard GC2. **19/9.** B.S.R. Stereo-Monaural **39/11.**

R.S.C. EQUIPMENT CABINET. Dimensions and outer appearance identical with Standard Bass Reflex Cabinet. Top hinged. Bass board adjustable. Will take Tape Deck or Player Unit, and Amplifier plus F.M. or A.M./F.M. Unit. Only **6 gns.**

SUPERHET FEEDER UNIT. Design of a high quality Radio Tuner Unit (specially suitable for use with any of 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 of unit approx. 9-6-7in. high. Simple alignment procedure. Point-to-Point wiring diagrams, instructions and priced parts list with illustration. **2/6.** Total building cost **£4.15.9.** For leaflet send S.A.E.

R.S.C. BATTERY TO MAINS CONVERSION UNITS

Type BM1. An all-dry battery eliminator. Size 5½ x 4½ x 2in. approx. Completely replaces battery supplying 1.4 v. and 90 v. where A.C. mains 200-250v 50 c/s is available. **Suitable for all battery portable receivers requiring 1.4 v. and 90 v.** This includes latest low consumption types.

Complete kit with diagrams, **39/9,** or ready to use. **46/9.**

Type BM2. Size 8 x 5½ x 2½in. Supplies 120 v. 90 v. and 60 v., 40 mA. and 2 v. 0.4 a. to 1 amp. fully smoothed. Thereby completely replacing both H.T. batteries and L.T. 2 v. accumulators when connected to A.C. mains supply 200-250 v. 50 c/s. **SUITABLE FOR ALL BATTERY RECEIVERS** normally using 2 v. accumulator. Complete kit of parts with diagrams and instructions, **49/9,** or ready for use. **59/6.**

LINEAR TAPE PRE-AMPLIFIER Type LP/1. Switched Negative feedback equalisation. Positions for Record 1in. 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 9 gns. S.A.E. for leaflet.

TERMS: C.W.O. or C.O.D. No C.O.D. under £1. Post 1/9 extra under £2. 3/3 extra under £5. Open 9 to 6. Weds. until 1 p.m., except Manchester open all week. Trade supplied. S.A.E. with all enquiries.

R.S.C. (Manchester) Ltd.

Mail Orders to 29-31 Moorfield Road, Leeds 12.
Personal shoppers to any of branches below—

73 Dale Street, Liverpool 2 | 5-7 County (Mecca) Arcade, Briggate, Leeds 1 | 8-10 Brown St. (Market St.), Manchester 2 | 56 Morley Street, (Above Alhambra Theatre), Bradford

PORTABLE RADIOPHONES MODEL MK II

Brand New British Army Portable Transmitter Receivers

Designed for reliable voice intercommunication operating up to 10 miles depending upon obstructions and elevation. The combined Transmitter Receiver covers the whole frequency range between 7.4-9 Mc/s. and is fully tunable on both Transmitter and Receiver. Simple and a delight to operate as all controls are mounted on the front panel of the set and clearly marked. Operates from standard dry batteries 3 v. L.T. and 120 v. H.T. Incorporates 5 valves: R.F. Amplifier, I.F. Amplifier, Second Detector, Output and Power Amplifier.
All sets are supplied complete with all accessories comprising dynamic sound powered headphones, electro magnet supersensitive microphone, 4ft. aerial, junction box, battery connection details and full circuit diagram.

PRICES:
60/- EACH (P. & P. 4/-).
TWO FOR £6.0.0 (Post Free).
Batteries 20/- per set.

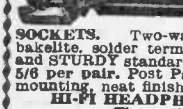
P.217A. **MINIATURE 2½in. SPEAKER.** A miniature Hi-Fi speaker that outperforms all others. Designed to meet today's requirements for transistor, miniature and sub-miniature applications. Size 2½in. sq. x 1in. deep. Voice coil impedance: 8 ohms. Freq. range: 150-5000 c/s. Power: 200mW. 16/6. P. & P. 1/-.

HOOVER ROTARY TRANSFORMERS 12 v. input, 500 v. output at 65 mA. or 6v. input, 250 output at 75 mA. **Only 10/6 each.** P. & P. 2/-

SPARE VALVE KIT. Here's a gift for all 38 and 18 Set owners! Case containing 4 ARP12 & 1 ATP4 valves. Only 10/- P. & P. 2/6.

SLIM RADIO PLUGS AND SOCKETS. Two-way, black bakelite, solder terminal PLUG and STURDY standard SOCKET, **5/6 per pair.** Post Paid. Panel mounting, neat finish.

HI-FI HEADPHONES



These miniature Hi-Fi phones use high quality permanent magnetic speakers with regulated voice coil. The soft rubber ear mouldes give correct spacing for optimum acoustic load. Each unit has a built-in miniature Hi-Fi transformer to ensure the finest music and voice reproduction. Supplied free is a small transformer unit which steps impedance up to 4000 ohms. Only 15/- P. & P. 2/6.

BC-221 HETERODYNE CRYSTAL CONTROLLED FREQUENCY METERS

Frequency range: 125 Kc/s to 20 Mc/s. Calibration. Individual Calibration Books and numerous Crystal Check Points. Accuracy: 0.01% or 25 cycles. Power supplies: 6 v. and 135 v. batteries. Size 14 x 10½ x 9½in. Weight 43 lbs.

Offered for the first time at the ridiculous price of only **£16** CARR. PAID.

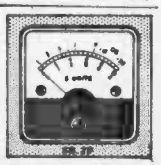
NEW DYNAMIC MICROPHONE

MODEL DM-175 Beautifully designed and attractively finished, lightweight dynamic microphone complete with stand. Output impedance 1K ohm, frequency response 150-9000 c.p.s. ± 3db. Sensitivity:—73db. Perfect for almost all applications and offered at only 49/6, complete post and packing 2/6d.

A.R. 88D RECEIVERS

Frequency coverage 550 kc/s to 32 Mc/s supplied fully reconditioned and in perfect working order. ONLY **£39.10.0** Carr. 30/-

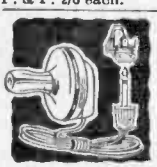
MINIATURE CLEAR PLASTIC PANEL METERS



"S" METER MODEL SR. 2P. Standard "Ham" Signal strength indicator. Calibrated in "S" units from 0-9 with scale terminating in + 10 to + 30 db calibrations. Additional full scale calibrations of 0-5 + 0-10 in linear scale divisions. A "must" for radio amateurs for conversion of any Communication Receivers with A.V.C action to give calibrated signal strength action. **35/-.**

VU METER MODEL VR. 1P. Calibrated and damped in accordance with standard VU Meter Practice. Upper scale reads —20 to +3VU. Lower scale 0-100% modulation. Uses precision carbon film multiplier resistor and full wave rectifier. **42/6.**

DC MICROAMMETERS Model MR.25 0 to 50 uA 39/6
Model MR.250 0 to 500 uA. 32/6
DC MILLIAMMETER Model MR.21 0 to 1mA. 27/6
All Models Individually Boxed and Fully Guaranteed. P. & P. 2/6 each.



MINIATURE EARPHONE

A really sensitive dynamic earphone of exceptionally fine quality. Provides clear reproduction of music as well as speech. Fully Guaranteed and complete with transparent ear insert. 3 feet cord, sub-miniature plug and socket.

CR-5 High imp. crystal
MR-4 Low imp. magnetic **8/-** Each Post 1/-

RH-20 RADIO HEADPHONES

Hi-impedance-2,000 ohms-general use headset. Black and ivory plastic cased electro-magnetic units with adjustable headband for comfortable fit. Individual listening for all types of applications. Individually packed, with flexible cord attached. **14/6.** post paid.

ACCUMULATORS. 2 volts 16 A.H. (unspillable). Ideal for 6 and 12 volts supply, etc. Brand new. Original cartons. Size 4in. x 7in. x 2in. **5/6 each.** P. & P. 1/6, 3 for **15/-.** P. & P. 3/6. 6 for 27/6. P. & P. 5/-.

AERIAL VARIOMETERS

These magnificent instruments will enable you to receive maximum signal strength on all S.W. receivers. Precision calibrated control **12/6.** P. & P. 2/6.

MINIATURE DUBILIER CONDENSER SPECIAL!

Minimum lots of one dozen from these assorted values: .002; .04; .01; .005; .001; all at 100 volts A.C. and 300 volts D.C. Recent Manufacture ONLY 5/- per dozen. P. & P. 6d. **(Please state values required).**

PS.35. SUB-MINIATURE PLUG AND SOCKET

Two-way bakelite barrel Jack plug only 1in. long. Socket only ¾in. long. 3/6 per pair. Post paid.

NEW! 10,000 O.P.V.
MULTI-TESTER ON BOTH AC & DC

MODEL EP-10K OUTPERFORMS INSTRUMENTS MANY TIMES ITS SIZE AND PRICE!

UNBELIEVABLE BARGAIN!
A revolutionary new Multi-Tester. A complete wired and tested instrument (not a kit) incorporating extra large 3½in. meter face and unique slide range switch. Can be conveniently carried in the pocket and features unusually sensitive 10,000 ohms per volt AC-DC meter. 1 per cent precision resistors, and largest meter ever placed on an instrument this size. Single, easy to use range selector switch, can be appreciated by the novice and engineer alike. Complete with colour coded test leads and battery.
Size: 4½ x 3½ x 1in. Model EP-10K **ONLY £5.19.6** P. & P. 3/6.

FULL SCALE RANGES:
D.C. VOLTAGE: 0-6-30-120-600-1200v. (10,000 o.p.v.).
A.C. VOLTAGE: 0-6-30-120-600-1200v. (10,000 o.p.v.).
D.C. CURRENT: 0-120 uA, 0-12-300mA.
RESISTANCE: 0-20K, 0-2 Meg. (150 ohm. 15K at centre scale).
CAPACITANCE: 0.005 to 0.15 uF. (at A.C. 6v.).
DECIBELS:—20 to +63db. (600 ohm, 1mW. 0dbm—0.755 v.).
ACCURACY: D.C. Voltage and Current ±2% f.s. A.C. Voltage ±4% f.s. Resistance ± 3% of total scale length.

MAIL ORDERS TO
(DEPT. P.), 82a COPTIC STREET, LONDON, W.C.1

Relda Radio ltd

CALLERS WELCOME AT
87 TOTTENHAM COURT ROAD, LONDON, W.1 MUS9606

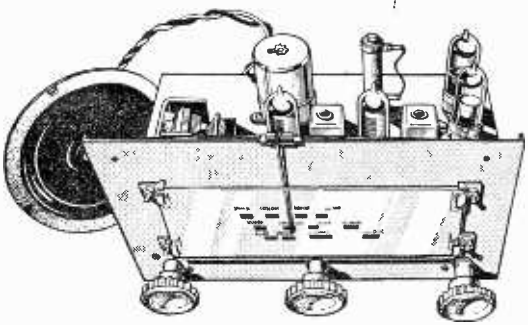
HARVERSON SURPLUS CO. LTD.

PLEASE TURN OVER FOR ADDRESS AND MORE BARGAINS ▶

2 BAND SUPERHET CHASSIS with Speaker

ONLY £5.17.6

Plus 6/6 Post & Packing.



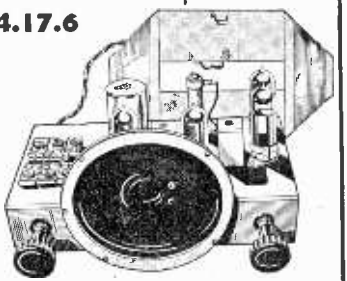
A quality 4 valve AC/DC superhet chassis made by a world famous manufacturer. Long and Medium wave coverage. Fitted with a cord and drum reduction tuning drive and attractive illuminated glass dial (size 6½ x 2½in.). Controls: Volume on/off, tuning and wave change. The receiver is self-powered, employing a mains dropper and a valve rectifier. Chassis dimensions 6½ x 9 x 5½in. high. Supplied complete with a good quality 5-inch loudspeaker, valves (UCH42, UAF42, UL41, UY41), AC/DC mains input lead, ivory knobs, etc.

DON'T HESITATE, ORDER NOW! This unbeatable bargain is bound to sell out quickly at only £5.17.6, plus 6/6 post and packing.

4 STATION PRESET CHASSIS with Speaker

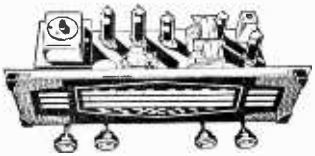
ONLY £4.17.6

Plus 6/6 P. & P.



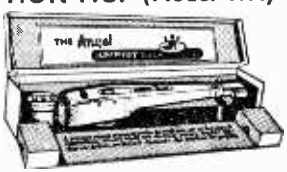
A compact, 4 station preset mains transportable receiver for operation from AC/DC mains. Two simple controls, volume on/off and 4 position station selector. The latter is set to Light Programme (Long Wave), Third Programme, Home Service and Light Programme (Medium Wave), but may of course be adjusted to alternative selections if required. A frame aerial with throw-out extension is supplied, making this receiver ideal as a general purpose transportable set for the home. A fully smoothed power supply is provided from AC/DC mains input by a mains dropper and a valve rectifier. The good tonal qualities are assisted by the provision of a quality 5in. speaker, which is ready-mounted on the chassis (this is easily detachable if alternative positioning is required). Valve line up, UCH, UAF42, UL41, UV41. This chassis (size 9 x 6½ x 5½in. high) is supplied complete with valves, knobs, mains lead, aerial, etc. It is beautifully made by a famous maker, and is a first-class buy at the rock bottom price of only **£4.17.6,** plus 6/6 post and packing.

A.M. RADIOGRAM CHASSIS



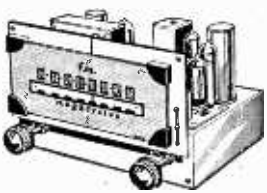
A chassis of distinction, by a famous maker. Covering Long, Med. and Short Waves, plus gram position, this chassis (size 15½ x 7 x 6½in. high) incorporates the latest circuitry, using fully delayed A.V.C., and negative feedback. Controls: Tone, Vol. On/Off, W/Change (L.M.S. and Gram), Tuning. Tapped input 200-250 v. A.C. only. An attractive brown and gold illuminated dial with matching knobs, make this one of the most handsome, in addition to being one of the best performing chassis yet offered. Complete with valves (ECH81, EF89, EBC81, EL84, EZ81), knobs, output transformer, leads, etc. OUR PRICE ONLY **£9.19.6** plus 4/6 post & packing.

THE WORLD FAMOUS E.M.I. ANGEL TRANSCRIPTION P.U. (Model 17A)



A Pick-up for the connoisseur originally priced at £17.10.0. The last remaining few offered at **£5.15.0,** plus P. & P. 5/-.

HARVERSON'S F.M. TUNER KIT



At last a quality F.M. Tuner Kit at a price you can afford. Just look at these fine features, which are usually associated with equipment at twice the price.

★ F.M. Tuning Head by famous maker. ★ Guaranteed Non-drift. ★ Permeability Tuning. ★ Frequency coverage 88-100 Mc/s. ★ OA81 Balanced Diode Output. ★ Two I.F. Stages and Discriminator. ★ Attractive maroon and gold dial (7 x 3in. glass). ★ Self powered, using a good quality mains transformer and valve rectifier. ★ Valves used ECC85, two EF80's, and EZ80 (rectifier). ★ Fully drilled chassis. ★ Everything supplied, down to the last nut and bolt. ★ Size of completed tuner 8 x 6 x 5½in. ★ All parts sold separately.

£4.19.6 Plus 8/6 P.P. & Ins.

Circuit diagram and illustrations, 1/6, post free.

OUTPUT STAGE & SPEAKER FOR F.M. TUNER UNIT

All parts, including speaker, ECL82 valve, and simple instructions to make two-stage output unit for converting F.M. tuner into F.M. receiver. ONLY 45/-, plus 4/6 P. & P.

E.M.I. 4-speed Player and P.U.

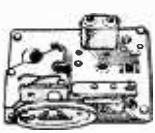
Heavy 8¾in. metal turntable. Low flutter performance 200/250V shaded motor with tap at 80V for amplifier valve filament if required. Turnover LP/78 head. Price 89/6. Plus 4/6 P. & P.

SUPER STEREO KIT MK. II

A kit of ready-built units only requiring interconnection. Comprising two midget 3W amplifiers, push button switch, transformer, control unit (bass, treble and vol.), power pack, two speakers, indicator light, valves (ECL82, EZ80 range), and comprehensive instructions.

£3.19.6 Plus 6/6 P. & P.

F.M. TUNER HEAD



A permeability tuned tuner head by a famous maker, supplied without valve (ECC85) 18/6 plus 1/9 P. & P. Valve 8/6 extra.

HARVERSON SURPLUS CO. LTD.

Introducing HARVERSON'S Monaural Amplifier Kit 39/6

In response to numerous requests from delighted purchasers of our "SUPER STEREO KIT" we have produced a "MONAURAL AMPLIFIER" on similar lines.

★ A UCL 82 valve provides a triode amplifying stage, and a pentode output stage (3 watts), enabling good amplification and sparkling reproduction to be combined with physical compactness (amplifier size, 7 x 3½ x 6½in. high).

★ Modern circuitry design, good quality O.P. transformer (to match ★3Ω) keep hum and distortion to a low level.

★ The controls, volume on/off, and tone, are complete with attractive cream and gold knobs.

★ The amplifier has a built-in fully smoothed power supply, using a good quality mains transformer (A.C. mains only) and metal rectifier.

★ All you need is supplied including easy to follow instructions which guarantee good results for the beginner and expert. All components, leads, chassis, valve, knobs, etc., are first grade items by prominent manufacturers.

OUR PRICE 39/6
Plus 4/6 Post and Packing.

5in. LOUDSPEAKER TO SUIT 14/6 EXTRA
ALL PARTS SOLD SEPARATELY

CHILD'S NURSERY LAMP

A child's night light of unusual design. Contemporary styled lampholder of robust construction finished in either red or yellow. Entirely safe (bulb socket shielded from "prying fingers"), complete with flex and a push-button switch. 200/250 volts A.C. only. The low-consumption bulb element is made in the shape of either flowers or angel fish, and when switched on, glows in fluorescent colours (the flowers pink with green leaves, or the fish green with purple weed). Made by a famous manufacturer and originally priced at 29/6. *Please state lampholder colour preference, and whether fish or flower element is required.*

OUR BARGAIN PRICE ONLY **10/9**
plus 9d, post and packing.

SUPERHET CHASSIS—less Valves & Cabinet

Modern AC/DC chassis with printed circuit and ferrite rod aerial. Although not completely built, the main components are mounted. L. & M. wave coverage. 4 valves (UBF89, UCL83, UCH81, UY85). Everything supplied except valves and cabinet. With speaker and simple instructions. **£3.6.6** plus 3/6 P. & P.

TRANSISTOR AMPLIFIER KIT

A complete kit of parts to build a compact 4-transistor amplifier, with volume control and printed cct. board. Two GT3 driver transistors, transformer coupled. 1 watt output from matched pair GT15. Supplied with output transformer and 2½in. 3 ohm speaker. Ideal for record player, etc. **59/6** plus 4/6 P. & P.

CONDENSER/RESISTOR PARCEL

50 mixed P.F. Condensers and 50 mixed Resistors. An assortment of useful values. All popular sizes—all new—a must for the serviceman and constructor ONLY **10/-** P. & P. 1/-

AT ½ PRICE WHILE THEY LAST!
GOLDRING MU-METAL CASED CARTRIDGES

Sapphire styli. Brand new and boxed

Our Price £2.15.0 P & P 1/6 including Ins.

BARGAIN MONTH FOR TRANSISTORS

POWER

OC36	10/-
OC44	9/-
OC45	8/-
OC71	5/-
OC75	6/6
OC76	6/6
OC78	6/6
OC78D	6/6
GET15	9/-
GET15 (matched pr.) ...	16/6

GET102...	7/6
XA103	8/6
PXA101	9/6
PXA102	9/6

AMERICAN

2N388	6/6
2N1485	6/6
2S712	7/6

DIODE

OA81	3/-

Please add 6d. postage for each transistor.

TRANSISTOR SPEAKER
Weston Electric 3Ω speaker. Size 2½ × 1¼in. deep. 12/6 p.p. 1/-

THE HARVERSON COMPLETE F.M./V.H.F. RECEIVER KIT £6.19.6

AT LAST—A COMPLETE F.M. RECEIVER IN KIT FORM!

Specially designed with the home constructor in mind, this kit enables the construction of a completely self-contained V.H.F. receiver, at fraction of the normal cost of comparable equipment. This is basically a quality self-powered F.M. tuner plus 2 separate audio amplifier stages, and output transformer and speaker.

★ F.M. Tuning Head by famous maker.
★ Guaranteed Non-drift.
★ Permeability Tuning.
★ Frequency coverage 88-100 Mc/s.
★ OA81 Balanced Diode Output.
★ Two I.F. Stage and Discriminator.
★ Self powered using a good quality mains transformer and valve rectifier.
★ Valves used ECC85, two EF80's, ECL82 and EZ80 (rectifier).
★ Fully drilled chassis.
★ Good quality speaker.
★ Well designed output transformer.
★ Attractive maroon and gold glass dial.
★ Two output stages (using ECL82).
★ Everything supplied, down to the last nut and bolt.
★ Compact size.
★ All parts sold separately.

OUR PRICE **£6.19.6** Plus 4/6 P. & P.

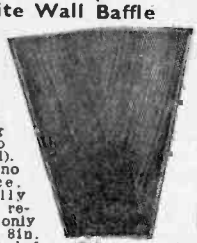
Transistorised Stethoscope

Trace signal right through: Radio, TV, Tape amplifier, Hi-Fi, etc.—simplest way to fault-find—carry it like a fountain pen—all parts including transistor barrel crystal, everything except battery, 12/6 plus 1/6, data included or separately 1/6. Or complete with dear aid type earphone, 20/-.

Speaker Bargain

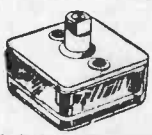
12in. Hi-fidelity loudspeaker. High flux permanent magnet type with standard 3 ohm speech coil. Will handle up to 12 watts. Brand new by famous maker. Price 32/6, plus 3/6 post and insurance.

Hi-Fi Snip Infinite Wall Baffle



Nicely Veneered and polished. Corner fitting (attaches to picture rail). Takes up no floorspace. Gives really fantastic results with only low-priced 8in. speaker fitted for tweeter. Only 45/- each, carriage and insurance 3/6.

Smallest Possible 2-gang

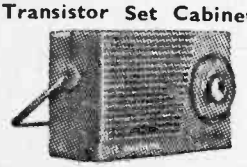


With built-in trimmers, polystyrene cased, size only 1 x 1 x 7/16in., price 17/6. Smallest IF and oscillator to match, 21/-. P.P. input and P.P. output transformers, 12/6. Circuit diagram free with any of above.

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 1/6 post and insurance.

Transistor Set Cabinet



Very modern cream cabinet, size 5¼ x 3 x 1¼in. with chrome handle, tuning knob and scale. Price 7/6, plus 1/6 postage and packing.

BATTERY CHARGER BARGAIN

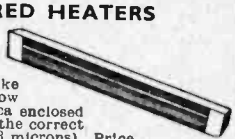
Components Would Cost More

Car Battery Charger—ready-made high output battery charger in stove enamelled sheet steel louvred case. New, complete and ready to work. Rated at 12 v. 5 amps. and variable rate selector for trickle charging, also a meter to show charging rate. Suitable for 230/250 A.C. mains. Special snip price of 65/-, plus 3/6 post and ins.

MOTOR SNIP

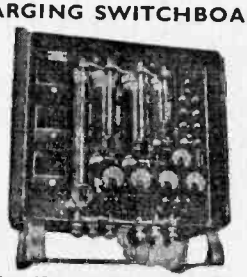
Miniature motor 2¼in. long x 1¼in. diameter, laminated poles and armature, separate winding for reversing. Operates off 20-30 v. D.C. or off A.C. mains through stepdown transformer. Original cost at least £3 each. Snip price for one month only 8/6, plus 1/6 postage and insurance.

INFRA-RED HEATERS



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 instructions 15/6, plus 2/6 post and insurance.

CHARGING SWITCHBOARDS

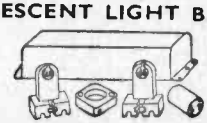


Type A. 550 w. 18 v.—contains three reverse current relays, one voltmeter rated 25 v. f.s.d., one main ammeter rated 40 amps. f.s.d., one secondary ammeter rated 15 amps. f.s.d. and two secondary meters rated 20 amps. f.s.d., one 2 ohm variable resistor, one 11 ohm variable resistor and two 1.2 ohm variable resistors. Complete in metal case 2ft. 6in. x 2ft. 8in. approx. Price £2.15.0, carriage and ins. 15/-.

Type B. 1260 w. 50 v., 0.12 amps.—contains one 14 ohm variable resistor and four 1 ohm variable resistors, one main ammeter rated at 40 amps. f.s.d., four secondary meters rated at 20 amps. f.s.d. and one voltmeter rated at 50 volts, and two reverse current relays. Complete in metal case—size approximately 2ft. 6 in. x 2ft. 8in. Price £4.15.0, carriage 15/-.

Connecting Leads for these switchboards, with Nifam plugs 30/- each.

FLUORESCENT LIGHT BARGAIN



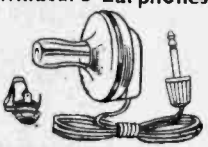
Kit of Parts comprising: choke, two lamp holders, starter holder and starter, 40 watt, 19/6; 80 watt, 23/6. Plus 2/- post and insurance.

THIS MONTH'S SNIP

A fully-built, tested and ready to work pocket radio using six semiconductors and tuning over the long and medium wave bands. An excellent performer and a real bargain at £5/15/- post free.

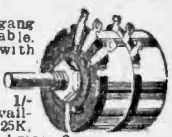
Seven days approval. Send for one today. If you are not 100% pleased then return it within seven days and your money will be refunded.

Miniature Earphones



For Transistor Circuits or Deaf Aid Very lightweight and easy to wear, cord almost invisible, good quality production of music and voice, complete with miniature plug and socket, ready to use—correct impedance OK for red spot and similar transistors. Crystal and Magnetic, 6/-. Post and Insurance 1/-.

Morganite Potentiometers



Single and 2-gang types available, standard size with good length spindle, all new and boxed. **Single types,** 1/- each, values available: 5K, 10K, 25K, 50K, 100K, 250K, 1 meg., 2 meg. **Gang type** 3/- each—values available: 5K + 5K, 100K + 100K, ½ meg. + ½ meg., 2 meg. + 2 meg.

The Taylor Meter Model 127A

A pocket size meter but with a big scale and a sensitivity of 20,000 ohms per volt D.C., therefore an ideal unit for television servicing—robustly made and complete with leads and prods—20 ranges as follows:

D.C. current 50 microamps. to 1 amp.

D.C. voltages—0-1,000 volt in seven ranges (25 kV.) with external probe, optional extra. Volts A.C.—0.2,500 in six ranges. Ohms—0.20 meg. ohm in three ranges (self-controlled). Self-contained, 3½in. movement. Price £10 or 10/- deposit and 23 fortnightly payments of 10/-. Non-callers add 5/- carriage and insurance.

"Dim and Full" Switch

Particularly useful for controlling photoflood lamps which have only a short life at full brilliance. This switch has three positions; the first position puts two lamps in series at half brilliance for setting up, the second position is off and the third position full brilliance for the operation shots. Also useful for controlling night lights, heaters, etc., etc. Price 3/9 each, post 9d. Circuit diagram included.

Ditto but without the off position, i.e. d.p.d.t., 10 amp. 2/9.

Miniature Microphone

American made. Dynamic type, real bargain at 2/6, plus 6d. postage.

Transistor Amplifiers

2 x CX71's direct coupled cascade drive to 2 precision matched OC74's in Class B push-pull provide up to 1 W undistorted output from 5 mV. in at 1.5 K-ohm Frequency response, 60-16,000 c/s ± dB. Overall size 3 x 2.2 x 1.2in. 92/6. Post and ins. 2/6.

750 M/WATT AMPLIFIER. Similar specification. £2.2.6

SUB-MINIATURE COMPONENTS

1. **Ferrite aerial** with Long and Medium Wave Coils, 4½in. long, for pocket superhet, complete with circuit showing component values, etc., **7/6.**
2. **Ferrite aerial,** as above, but 1in. diameter, 8in. long, for table model receiver or portable. **10/6.**
3. **Three I.F. Transformers** with oscillator coil and circuit details to work with item 1. **19/6.**
4. **Three I.F. Coils** and oscillator to work with item 2. **23/6.**
5. **Smallest possible electrolytics.** 1MFD, 2MFD, 4MFD, 6MFD, 8MFD, 10MFD, 20MFD, 30MFD, 50MFD, 100MFD, 200MFD, all **1/9** each.
6. **Smallest ½ watt resistors,** all 10 per cent values. **5d.** each.
7. **Miniature condensers,** .1, **1/-**; .05, .04, .02, .01, all **8d** values, below this **7d.**
8. **Miniature slide switch** double pole change over. **2/6.**
9. **Edgewise volume controls,** 2K, 5K, 10K and 20K. **2/6** each.
10. **Small edgewise controls** with switch, 2K, 5K, 10K and 20K, **4/9** each.
11. **Red Spot Transistors,** tested and suitable all A.F. applications, **2/6.**
12. **White Spot Transistors** tested and suitable as I.F. or mixer. **3/6.**
13. **Set of six Mullard transistors** for superhet in original packets, fully guaranteed, comprising OC44, OC45, OC81D and matched pair OC81. **£2** the set.
14. **Special 500 sub-miniature diodes, 1/6** each.
15. **Surface Barrier transistors,** 5-10 Mc/s, **6/6** each; 10-15 Mc/s, **8/-** each; 20-30 Mc/s, **9/-** each; 40-50 Mc/s, **15/-** each.
16. **Push-Pull Driver and Push-Pull output transformers** for pocket superhets, 150 mW, **10/-** pair; 400 mW, **15/-** pair; 750 mW (driver only, no o.t. needed), **8/6,** all complete with circuit details.
17. **Smallest Tuning Condenser,** size approx. ½in. sq., 165pF and 65pF, with trimmers, **17/6** each.
18. **Oscillator coil** to suit the above, **6/-.**
19. **Three I.F.s,** 455 k/c sub-miniature to suit items 17 and 18. **18/-** the set.
20. **Jackson 00 2-gang tuning condensers,** 208pF plus 176 pm, spindle tapped 6BA, with trimmers, **10/6,** less trimmers **9/6.**
21. **Tuning condensers** for items 1 and 3, **9/6.**
22. **Tuning condensers** for items 2 and 4, **10/6.**
23. **Printed circuit** for items 1 and 3, **6/6.**
24. **Printed circuit** for items 2 and 4, **7/6.**
25. **2½in. speaker,** 3 ohm, **19/6;** 80 ohm, **19/6.**
26. **3in. speaker,** 3 ohm, **18/6;** 80 ohm, **18/6.**
27. **5in. speaker,** 3 ohm, **18/6;** 35 ohm Hi flux, **19/6;** 35 ohm Super Hi flux. **22/6.**
28. **Elliptical speaker,** 7 x 4. 3 ohm, **19/6;** 35 ohm, **19/6.**
29. **Battery connectors,** large. **1/-** pair; miniature, **1/-** pair.

NOW THE MARK IV

Pocket '5' Transistor Radio

Read these Testimonials

D. A. Hilton, Leigh, Lancs.
"I received Pocket 4 on Christmas Day. I made it up on Boxing Day and I am very pleased with the results. It brings in local stations and many foreign stations including Luxembourg at good strength. I am 13 years old".

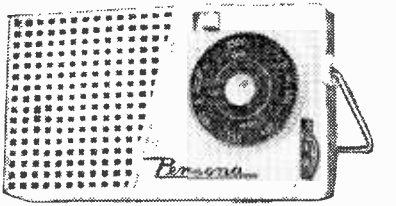
Mr. J. Bell, Wolverhampton.
"I am writing to express my satisfaction at the standard of your kit for your Pocket 4 Transistor set and also to state that it has come up to my expectations in regard to performance".

Mr. R. Belt, Newcastle-on-Tyne.
"I have built your Pocket 5 Transistor set. I am very pleased with it."

Mr. F. Jackson, Ickenham, Middx.
"I have built the Pocket 4 and am more than pleased with the results."

Mr. G. Bamford, Ramsgate
"I find this set even better than you claim it to be and most certainly up to your usual standard of quality. I feel that nobody could fail to build it and get results. Even the first-time-ever novice, as your circuit diagrams and instructions are so clear and precise."

Mr. A. J. Simmonds, Welling, Kent.
"I purchased from you a week ago the Pocket 4 Transistor Kit. I put it together last night in 1¼ hours, on switching on the set I was right on Radio Luxembourg. I must say thank you because not only has the set a very attractive appearance, it also behaves fantastically".



Our famous Pocket "4" which is doing yeoman service all over the country has been modified and improved to make it an even better receiver. The new features include:—

- New elegant dial graduated for Long and Medium Waves.
- Switched Long and Medium Waves.
- Slide switch on/off control.
- Printed circuit.
- Ferrite Rod Aerial.
- Improved reaction circuit.
- Positive spindle coupling to tuner.
- Battery containers.

The Pocket "5" of course retains its original r.f. circuit which means still no aerial or earth needed.

The Pocket "5" Mark IV uses 4 transistors, crystal diode, miniature loud speaker and has all the above refinements, complete in case as illustrated (less motif) **52/6,** battery **10d.,** post and insurance 2/6. Motif **2/-.**

Pocket "8" as Pocket "5", but with Moving Coil Speaker and Q.P.P. output stage **95/-.**

Seven days approval.
Order in confidence. We allow you seven days to decide whether or not to make the set, you may return the parcel as received within this time and your money will be refunded in full.

Read some of the testimonials, over 1,000 of which have been received about our Pocket Receivers.

NOW THE "GOOD COMPANION" CAR RADIO AND PORTABLE

Largely due to the helpful criticisms and suggestions received from purchasers of our previous set "The Real Companion" we have improved and now supersede this with a new set which we call "The Good Companion". We feel confident that this new set is one of the finest of its kind available. The design is the combined efforts of our technicians and of those of several of the leading manufacturers in the country, and the resulting set has a performance as good as if not superior to those selling at £20 and more. *It has the eight transistor set performance.*

Features include **American Philco R.F. transistors** and **Mullard A.F. transistors**—Q.P.P. output giving 750 mW—full coverage on Medium and Long—very fine tuning arrangement—excellent reception of difficult stations like 208—variable feed-back control—full tonal qualities—really superior looking cabinet size 11 x 8 x 3in. approximately—or aerial attachment—several months operation from battery costing only **3/6.**

Circuit employs six transistors and two diodes, it incorporates all latest refinements, and oscillator I.F. Transformer are pre-aligned so no instruments are necessary. Anyone who can solder competently can make this set. The instructions are fully comprehensive with plenty of illustrations. Service is available in the unlikely event of your getting into difficulties. All components fully guaranteed.

Price of all components and cabinet to make set as illustrated **£9.19.6.** Post and insurance **5/-.** Battery **3/6** extra.

AGENTS REQUIRED
to make up this receiver

ELECTRONIC PRECISION EQUIPMENT LTD.

post orders are dealt with from Eastbourne, so for prompt attention please post your orders to 66 Grove Road, Eastbourne, marked Department 7. Callers may use any one of the Companies below.

266 London Road, Croydon. Phone: CRO 6558 Half day Wednesday	**29 Stroud Green Rd., Finsbury Park, N.4.** Phone: ARChway 1049 Half day Thursday	**520 High Street North Manor Park, E.12.** Phone: ILFord 1011 Half day Thursday	**42-46 Windmill Hill, Ruislip, Middx.** Phone: RUIslip 5780 Half day Wednesday	**248 High Street, Harlesden, N.W.10.** Phone: ELGar 4444 Half day Thursday

STERN'S MULLARD DESIGNS

Designed by MULLARD—presented by STERN'S strictly to specification

COMPLETE KIT OF PARTS
MULLARD "5-10" MAIN AMPLIFIER

For use with the MULLARD 2-valve pre-amplifier with which undistorted power output of up to 10 watts is obtained. We supply **SPECIFIED COMPONENTS AND NEW MULLARD VALVES**, including **PARMEKO MAINS TRANSFORMER** and choice of the latest Ultra-Linear **PARMEKO** or the **PARTRIDGE** Output Transformer.
COMPLETE KIT OF PARTS (**PARMEKO** Output Trans.). **£10.0.0**
Alternatively we supply **ASSEMBLED** and **TESTED**. **£11.10.0** **INCORPORATING PARTRIDGE OUTPUT TRANSFORMER, £1.6.0 EXTRA.**

MULLARD'S PRE-AMPLIFIER TONE CONTROL UNIT

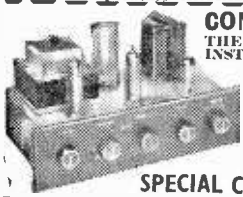
Employing two EF86 valves, and designed to operate with the MULLARD **MAIN AMPLIFIERS**, but also perfectly suitable for other makes.
PRICE COMPLETE KITS OF PARTS **£6.6.0** ASSEMBLED AND TESTED **£8.0.0**
Supplied strictly to **MULLARD'S SPECIFICATION** and incorporating:

- Equalisation for the latest R.I.A.A. characteristics.
- Input for Crystal Pick-ups, and variable reluctance magnetic types.
- Input (a) Direct from High Imp. Tape Head. (b) From a Tape Amplifier or Pre-amplifier.
- Sensitive Microphone Channel. ● Wide range **BASS** and **TREBLE** Controls.

COMPLETE MULLARD "5-10" AMPLIFIER

The popular and very successful complete "5-10" incorporating Control Unit providing up to 10 watts high quality reproduction. Only Specified Components and new **MULLARD VALVES** are supplied including **PARMEKO MAINS TRANSFORMERS** and choice of the latest **PARMEKO** or **PARTRIDGE** ULTRA-Linear Output Transformers.
KIT OF PARTS **£11.10.0** OR ASSEMBLED and TESTED **£13.10.0**
H.P. (Assembled Amp. only). DEPOSIT £2.14.0 12 months at 19/10.
ABOVE incorporating PARTRIDGE OUTPUT TRANS. £1.6. extra.

COMPLETE MULLARD "3-3"



THE IDEAL AMPLIFIER FOR A SMALL HIGH QUALITY INSTALLATION PROVIDING EXCELLENT REPRODUCTION OF UP TO 3 WATTS OUTPUT
COMPLETE KIT OF PARTS **£7.10.0** OR ASSEMBLED and TESTED **£8.19.6**
(plus 6/6 carriage and insurance) H.P. Terms: Deposit £2.0.0 and 8 Months at £1.0.0. Complete to MULLARD'S SPECIFICATION including Mullard valves and a **PARMEKO OUTPUT TRANSFORMER.**

SPECIAL CASH OFFER

This very attractive **PORTABLE AMPLIFIER CASE** together with a good quality **GRAM AMPLIFIER** and a matched **P.M. SPEAKER.**
ALL for ONLY **£8.7.6** (Plus 7/6 Carr. & Ins.)
The Amplifier consists of a 2-stage design incorporating 3 modern B.V.A. valves and has separate BASS and TREBLE CONTROLS.
The Portable Case will also accommodate almost any make of Autochanger and is attractively finished in Mushroom Grey Rexine.
WE ALSO SUPPLY SEPARATELY—
(a) The 2-stage (plus Rectifier) **AMPLIFIER** **£4.2.6**
(b) The **PORTABLE CARRYING CASE** **£3.17.6**
(c) 6½in. **P.M. SPEAKER** 18/9 Carriage and Insurance 4/- extra.

STERN'S INTER-COMM or BABY ALARM

A small versatile Unit employing the new MULLARD ECL86 valve and designed to provide two (or three) way conversation up to extreme distances. Operates from A.C. mains 200 to 250 Volts.

PRICES . . . MASTER UNIT and ONE EXTENSION

KIT OF PARTS **£6.17.6** ASSEMBLED AND TESTED **£8.0.0**

Consists of a MASTER UNIT, size only 8¼ x 5¼ x 6in. and ONE EXTENSION (a second extension may be added to any time). The Master Unit incorporates switching and power supply and with the chassis completely isolated from the mains is operated in absolute safety. Cases covered in quality leatherette.

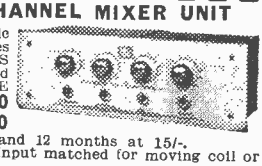
PRICE REDUCTIONS

(a) The KIT OF PARTS to build both the "5-10" Main Amplifier and the 2-valve PRE-AMP CONTROL UNIT. **£15.15.0**
(b) The "5-10" and the 2-stage PRE-AMP both ASSEMBLED and TESTED H.P. Dep. £3.16.0 and 12 months of £1.7.8. **£18.18.0**
(c) The KIT OF PARTS to build the DUAL-CHANNEL "3-3" AMPLIFIER and the DUAL-CHANNEL PRE-AMPLIFIER CONTROL UNIT. **£21.10.0**
(d) The DUAL-CHANNEL "3-3" AMPLIFIER and the DUAL-CHANNEL PRE-AMPLIFIER CONTROL UNIT BOTH ASSEMBLED and TESTED. **£25.0.0**
H.P. Terms: Deposit £5 and 12 months of £1.16.6.
(e) THE KIT OF PARTS to build one "5-10" MAIN CHANNEL and the DUAL-CHANNEL PRE-AMP CONTROL UNIT **£21.10.0**
(f) ONE "5-10" AMPLIFIER and the DUAL-CHANNEL PRE-AMPLIFIER both ASSEMBLED and TESTED. **£25.0.0**
H.P. Terms: Deposit £5, 12 months of £1.16.8.
(g) KIT OF PARTS to build Two "5-10" MAIN AMPLIFIERS (incorporating Parmeko Output Transformers) and the DUAL-CHANNEL PRE-AMPLIFIER CONTROL UNIT. **£31.0.0**
(h) TWO "5-10" AMPLIFIERS and the DUAL-CHANNEL PRE-AMPLIFIER CONTROL UNIT BOTH ASSEMBLED & TESTED **£36.0.0**
H.P. Terms: Deposit £7.4.0, 12 months £2.12.0.
Carriage and Insurance 7/6 extra. Prices quoted are subject to £1.6.0 extra for Partridge Transformer.

STEREO PRE-AMPLIFIER

This model incorporates two Mullard 2-valve Pre-Amplifiers combined into a Single unit enabling it to be used for both **STEREOPHONIC** or **MONAURAL** operation. It is designed primarily to operate with our range of **MULLARD MAIN AMPLIFIERS** but will also operate equally well with any make of Amplifiers requiring an input of 250m/volts.
COMPLETE KIT OF PARTS **£12.10.0** ASSEMBLED AND TESTED **£15.0.0**
H.P. £3 Dep. and 12 mths. at £1.2.0

MULLARD FOUR CHANNEL MIXER UNIT



Self powered with Cathode follower output. Incorporates Two inputs for MICROPHONES One for CRYSTAL PICK UP and a fourth for RADIO or TAPE
Complete Kit of Parts **£8.8.0**
Assembled and Tested **£10.0.0**
TERMS: Deposit £2 and 12 months at 15/-.
MODEL I.I. one microphone Input matched for moving coil or Ribbon Mike. £1.17.0 extra.

RECORD PLAYERS

THE LATEST MODELS ARE IN STOCK, MANY AT REDUCED PRICES
SEND S.A.E. FOR ILLUSTRATED LEAFLET

B.S.R. MONARCH UA8 4-speed mixer Autochanger with Crystal Pick-up. **£6.19.6**
The **NEW COLLARO MODEL RP594** 4-speed Single Record Player. Studio Cartridge. **£9.18.9**
The **NEW COLLARO C60** 4-speed Autochanger unit with Studio "O" Pick-up. **£7.19.6**
The **E.M.I.** 4-speed Single Record Player with crystal Pick-up. **£6.9.6**
B.S.R. MODELS UA12 and UA14. Each a 4-speed mixer autochanger with Crystal Pick-up. **£7.19.6**
Both available incorporating the **B.S.R. STEREO** Pick-up, plays L.P. and 78 Records. **£8.13.10**
GARRARD MODEL TA/MkII 4-speed Player fitted high output Crystal Pick-up. **£8.10.0**
GARRARD MODEL RC/209. Autochanger 4-speeds. High output. Crystal Pick-up. **£8.19.6**
Carriage and Insurance on each above, 5/- extra.

PRE-ANNOUNCEMENT TO STEREO ENTHUSIASTS

In response to the growing demand for Stereophonic equipment we have completed the design of a

HIGH FIDELITY STEREO TAPE PRE-AMPLIFIER

Incorporates the latest circuitry, the design is based on the popular Mullard "Type C" Unit and employs a sensitive meter for accurately setting record level.

STERN RADIO LTD.

Stern's "fidelity" TAPE EQUIPMENT

ADD "HI-FI" TAPE RECORDING TO YOUR EXISTING AUDIO INSTALLATION WITH

MULLARD TYPE "C" TAPE PRE-AMPLIFIER—ERASE UNIT

The "Hi-Fi" link to add full tape recording facilities to High Fidelity home installations. Incorporates FEROXCUBE POT CORE PUSH PULL OSCILLATOR and 3-speed treble equalisation by FEROXCUBE POT CORE INDUCTOR FOR WEARITE-COLLARO-TRUVOX OR BRENELL TAPE DECKS. Includes separate power Supply Unit. OR ASSEMBLED KIT O F PARTS **£14.0.0** H.P. £3.8.0 Deposit and 12 months £1.4.11 **£17.0.0**

(Excluding power unit £11.15.0 and £14.10.0 respectively).

SPECIAL "COMBINED ORDER" PRICES

(a) The COLLARO "Studio" Deck with the Model "C" Preamplifier and POWER SUPPLY UNIT ASSEMBLED AND TESTED **£29.10.0**
Deposit £5.18.0. 12 monthly payments of £2.3.3

(b) As above but the TYPE "C" Unit and POWER UNIT supplied as COMPLETE KIT OF PARTS. **£26.10.0**
Deposit £5.6.0. 12 monthly payments of £1.18.10

(c) The TRUVOX MkV1 Deck (incorporating Pause Control and Rev. Counter) with the Model "C" PREAMPLIFIER and POWER UNIT ASSEMBLED AND TESTED..... **£40.0.0**
Deposit £8.0.0 and 12 months at £2.18.8

(d) As above but the Model "C" PREAMPLIFIER and POWER UNIT supplied as a COMPLETE KIT OF PARTS **£36.10.0**
Deposit £7.6.0. 12 monthly payments of £2.13.6

(e) The BRENELL MkV Deck with the Model "C" PREAMPLIFIER and POWER UNIT. ASSEMBLED and TESTED **£46.0.0**
Deposit £9.4.0 and 12 months at £3.7.6.

(f) As above but the Model "C" PREAMPLIFIER and POWER UNIT supplied as a COMPLETE KIT OF PARTS **£43.0.0**
Deposit £8.12.0. 12 monthly payments of £3.3.1

(g) The WEARITE MODEL "4" DECK with ASSEMBLED and TESTED Model "C" PREAMPLIFIER AND POWER UNIT incorporating WEARITE HEADLIFT TRANSFORMER, Etc... **£56.0.0**
Deposit £11.4.0 and 12 months at £4.2.1.

(Carriage and Insurance on above is 10/- extra)

A NEW DESIGN!!!

MULLARD'S STEREOPHONIC POWER AMPLIFIER

A high fidelity design based on the famous Mullard "5-10". Provides up to 10 watts (per channel) Superb reproduction. Frequency response flat to within 3 db from 3c/s. To 60 Kc/s at 50Mw. Total Harmonic Distortion at 10 watts 0.1%. PRICE:

(a) ASSEMBLED COMPLETE AMPLIFIER, including CONTROL UNIT (as Illustrated)..... **£21.0.0**
Deposit £4.4.0, 12 months of £1.10.10.

(b) A complete KIT of PARTS will be available in OCTOBER for **£18.10.0**

Built to the very highest technical standards and presented strictly to MULLARD'S specification. Incorporates complete Mullard valve line-up including two of the new valves, type ECL86, in each channel. Two specially designed GILSON OUTPUT TRANSFORMERS with 20% taps are used for ultra linear operation.

The matching CONTROL UNIT is designed to be either attached to the Amplifier (as Illustrated) or can be detached for separate mounting on a Cabinet panel. Provides inputs for CRYSTAL PICK UPS, RADIO TUNING UNIT, and also for replaying from our STEREO TAPE PRE-AMPLIFIER (Briefy mentioned opposite).

AS AUDIO SPECIALISTS WE CONFIDENTLY RECOMMEND THIS DESIGN it is a MUST to the serious minded sound enthusiast.

We can also supply the assembled MAIN AMPLIFIER only (excludes control unit) for operation with our DUAL CHANNEL PRE-AMPLIFIER, this provides for a more versatile or elaborate installation and would be essential if a low output Magnetic Pick Up, such as the Decca, is to be used.

(a) THE ASSEMBLED MAIN AMPLIFIER with the ASSEMBLED DUAL CHANNEL PRE-AMPLIFIER ..... PRICE: **£30.0.0**
Deposit £6.0.0. 12 months of £2.4.0.

(b) A complete KIT of PARTS for both Units will be available in October for **£26.0.0**

Dept. P.W. 109 FLEET ST., LONDON, E.C.4

Telephone: FLEET STREET 5812/3/4

HOME CONSTRUCTORS BUILD A HIGH FIDELITY TAPE RECORDER LIKE THIS

for £35.0.0

Deposit £7.0.0., 12 months at £2.11.4.

FOR THIS WE SUPPLY

- Complete Kit of Parts to Build the HF/TR3 Tape Amplifier.
- The New Collaro "Studio" Tape Deck.
- Portable Carrying Case (as illustrated).
- Rola/Celestion 10 x 6in. p.m. Loudspeaker.
- ACOS Crystal Microphone and 1,200ft. Spool E.M.I. Tape.

Alternatively for those who prefer another make of Tape Deck—we will supply precisely as above—but in place of the Collaro "Studio" Deck. We will include:
The New Truvox Mk. V1 Deck **£45.0.0**
Deposit £9.0.0, 12 months at £3.6.0.

For Constructors with their own cabinet—WE OFFER—

(a) COMPLETE KIT to build the HF/TR3 Mk.II Amplifier together with the COLLARO "STUDIO" DECK **£26.0.0**
Deposit £5.4.0. 12 monthly payments of £1.18.2

(b) As above but with the HF/TR3 Mk.II supplied ASSEMBLED and TESTED..... **£29.10.0**
Deposit £5.18.0. 12 monthly payments of £2.3.4.

(c) COMPLETE KIT to build the HF/TR3 Mk.II together with the TRUVOX Mk. V1 TAPE DECK .. **£36.10.0**
Deposit £7.6.0. 12 monthly payments of £2.13.6.

(d) As above but with HF/TR3 Mk.II supplied ASSEMBLED and TESTED **£40.0.0**
Deposit £8.0.0. 12 monthly payments of £2.18.8.

(e) COMPLETE KIT to build the HF/TR3 Mk.II AMPLIFIER with the BRENELL Mk.V. TAPEDECK **£42.0.0**
Deposit £8.8.0 12 monthly payments of £3.1.7.

(f) As above but with HF/TR3 Mk.II supplied. ASSEMBLED and TESTED **£45.10.0**
Deposit £9.2.0. 12 monthly payments of £3.6.9.

(g) THE ASSEMBLED and TESTED HF/TR3 Mk.II AMPLIFIER with the WEARITE MODEL 4A DECK, incorporates Wearite Head Lift Transformer etc. **£56.0.0**
Deposit £11.0.0. 12 monthly payments of £4.0.8.

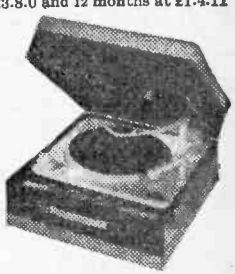
(Carriage and Insurance on each above is 10/- extra)

MODEL HF/TR3 MK.II TAPE AMPLIFIER

(Mullard Type "A" design)

A very high quality Amplifier incorporating 3-speed treble equalisation, by the latest FEROXCUBE POT CORE INDUCTOR, FOR COLLARO-TRUVOX-BRENELL WEARITE Tape Decks, has GILSEN Output Transformer. Includes separate Power Supply Unit. OR ASSEMBLED KIT OF PARTS **£13.13.0** H.P. Deposit £3.8.0 and 12 months at £1.4.11 **£17.0.0**

STEREOPHONIC RECORD PLAYER FOR SIMPLE UNIT ASSEMBLY



A most compact portable design consisting of TWIN CHANNEL AMPLIFIER based on the latest design by MULLARD LTD., incorporating top grade Output Transformers, and the new audio Triode-Pentode Valves Mullard E.C.L.86. Separate Bass and Treble controls. Suitable for use with Crystal Pick Ups, and capable of genuine high quality reproduction up to 3 Watts per channel. An attractive and contemporary portable Case in two tone colours. The unique feature of the design is the loudspeaker mounting. Two 8 x 5in. p.m. elliptical loudspeakers are separately baffled and mounted in the lid, which is detachable, allowing for each speaker to be individually positioned in any part of the listening area.

We offer a very versatile stereo arrangement tested and guaranteed which can be assembled in the minimum of time, at a comparatively Very Low Cost.

PRICE for the ASSEMBLED AMPLIFIER, Two 8 x 5in. ROLA SPEAKERS and PORTABLE CASE **£14.0.0**
Deposit £2.16.0.. 12 months of £1.0.6. **£7.15.0**

ASSEMBLED AMPLIFIER, supplied for..... **£1.1.0**

8 x 5in. ROLA LOUDSPEAKERS (3 ohms) each. **£5.0.0**

PORTABLE CASE **£5.0.0**

A CHOICE OF SINGLE RECORD PLAYERS and AUTOCHANGERS are available from Stock (Send S.A.E. for details)

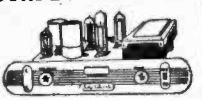
DELUXE RECORDER CABINET

79/6

Beautifully styled rexine covered cabinet in Red or Beige. Size 14¼ x 13 x 9¼in. Storage comp. in lid for tapes and mike. Easily adapted to Record Player Cabinet. Ins., Carr. 4/6.

TAPE RECORDER AMPLIFIER

£7.19.6



Compact, well designed 5 valve amplifier. Output 3.5W. Input for Microphone, Radio and Gram. Size 8¼ x 3 x 4¾in. Ins., carr. 4/6. 12 months' guarantee. Terms available. Extras: Dial plate, including sockets and superimpose switch, 3/6. Knobs 2/6.

TAPE RECORDER AMPLIFIER £9.15.6

By famous manufacturer. Superb 4-valve amplifier. Two controls and superimpose switch. Sockets for Mike and Gram. Size 11 x 4 x 6in. Ins., Carr. 4/6. Drawings FREE with Order.

SCOTCH BOY TAPES

19/9 5¼ inch. 7 inch. **25/-**

Limited quantity. POST FREE.

MINIATURE SPEAKERS

16/9 Brand new 2½ and 3in. P. & P. 1/.

ELLIPTICAL SPEAKERS

15/9 Brand new slot type. 8 x 3in. and 7 x 4in. P. & P. 2/9.

EXTENSION SPEAKERS

19/9

8in. P.M. Speaker fitted into polished cabinet. Complete. Switch and flex included. P. & P. 3/9.

REPLACEMENT REBUILT

TV TUBES

12 Months' Guarantee

HP Terms available

21in.	99/6
17in.	90/-
15, 14, 12in.	70/-

Ins., Carr. 15/6

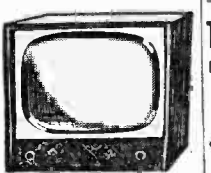
£1 extra without old bowl, refundable if same received within 14 days.

14in. TV TUBES 35/-

14KP4 and 36/24. Due to purchase of Rental replacement stocks. Carriage 5/-.

COMPLETE 17in. TV

£11.10.0



An excellent Ex-Rental Table Model. Famous manufacturer. Tuned ITA/BBC. Guaranteed 12 months. Terms available. Personal collection advised. Special delivery rate by arrangement up to 50 miles, or despatched in 3 parcels for easy assembly. Carr. & Ins. 25/-.

COMPLETE 14in. TV £7.10.0

ITA/BBC. As above. Ideal for Caravans—Chalets—Weekend Bungalows etc. Carriage and Insurance 20/-.

VALVES

Salvage Guaranteed

2/9d. each **30/- Dozen**

ECC31, ECC34, ECC81, ECC82, ECC85, ECC91, ECH42, EF80, EF92, EL32, EL36, EY51, KT36, L63, N18, N37, PL33, U22, U31, U35, U151, U281, U282, 6LI8, 6U4GT, 10D1, 10F1, 12AT7, 27SU,

5/9d. each **60/- Dozen**

EBC33, EBF80, ECF80, ECL80, EL33, EL38, EL41, EY85, GZ32, KT63, LN152, LN309, PCC84, PCF80, PCF82, PL81, PL82, PL83, PY80, PY81, 6F6, 6K8, 6Q7, 6V6, 7AN7, 9BW6.

POSTAGE

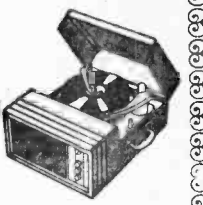
1 Valve—7d. 6 Valves—1/6. 12 Valves—2/6.

DUKE & CO.

(LONDON) LTD.
621/3 Romford Road,
MANOR PARK, E.12.
ILF 6001/3
9 a.m.—6 p.m.
Half Day Thursday
STAMPS FREE CATALOGUE

RECORD PLAYER CABINET

69/6



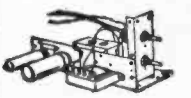
Luxury cabinet in two tone coffee colour. Size 15½ x 17 x 9½in. Takes all popular record player units and amplifiers. Position for 8in. Speaker. Detachable lid for Stereo conversion. P. & P. 4/6.

"ARGOSY" RECORD PLAYER CABINET 19/6

Exceptional offer. A lightweight portable player Cabinet by famous manufacturer. Size 14½ x 11½ x 6in. Takes our single player; 2 control Amplifier; 5in. Speaker. Post, packing and Insurance, 5/6.

TAPE RECORDER AMPLIFIER

12 months' guarantee MK. D.2



79/6

Latest design incorporating negative feedback, giving 4 watts undistorted output. Valves: ECL82, and metal rectifier. Tone and volume control panel on flying leads. P. & P. 3/6.

TRANSISTORS

Complete Set **47/6**

POST FREE

MULLARD

1—OC81D 6/9 2—OC81 6/9
1—OC44 9/9 2—OC45 8/9
1—Diode 1/9

EDISWAN

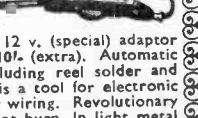
XC121 8/9 XB113 8/9

G.E.C.

114 6/9 873 8/9
2—874 9/9

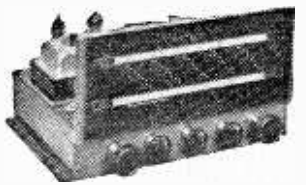
SOLO SOLDERING TOOL

ONLY **12/6**



110 v., 6 v. or 12 v. (special) adaptor for 200/250 v., 10/- (extra). Automatic solder feed including reel solder and spare parts. It is a tool for electronic soldering or car wiring. Revolutionary in design. Cannot burn. In light metal case with full instructions for use. Post 3/6.

ARMSTRONG AF208 AM/FM RADIOGRAM CHASSIS



★ Full VHF Band (87–108 Mc/s and Medium Band, 187–570M ★ 7 Valves ★ 5 Watts Output ★ 15db Negative Feedback ★ Separate wide range Bass and Treble Controls ★ 2 Compensated Pick-up Inputs ★ Frequency Response 30-22,000 c.p.s. ±2db ★ Tape Record and Playback Facilities ★ Continental Reception of Good Programme Value ★ For 3, 7½ and 15 ohm speakers. Send S.A.E. for leaflet.

PRICE 22 GUINEAS Carr. Free

LATEST "E.M.I." 4 SPEED SINGLE RECORD PLAYER

Acos Hi-Fi Pick-up for LP, and/or 78, 7, 10 and 12in. records. Silent motor, heavy turntable, auto stop.

Special offer **£6.5.0** post free.
Stereo/Monaural £6.19.6.

BUILD THIS REPRODUCER BARGAIN

SPECIAL SINGLE PLAYER KIT

B.S.R. TU9 4-speed Gram-Pick-up Unit £4.5.0
Handsome portable case, 13½ x 15 x 8in. £2.9.6
Ready-built 3-watt, printed circuit, amplifier with two valves and speaker £3.12.6

or £9.9.0 complete kit, post free.

I.F. TRANSFORMERS 7/6 pair
465 kc/s slug tuning miniature can 1½ x ½ x ½in. High Q and good band width. Data sheet supplied.

New Boxed VALVES 90-day Guarantee

1R5	7/6	6K8G	7/6	EA50	1/6	EZ80	7/6
1S5	7/6	6L6G	10/6	EABC80	8/6	F1148	1/6
1T4	6/-	6N7M	6/6	EB91	6/-	HABC80	
2X2	3/6	6Q7G	8/6	EBC33	8/6		12/6
3S4	7/6	6S4 7	6/-	EBC41	8/6	HVR2A	6/6
3V4	7/6	6SJ7M	6/6	EBF80	10/-	MU14	9/-
5U4	7/6	6S8N7	6/6	ECC84	9/6	P61	3/6
5Y3	7/6	6V6G	6/6	ECF80	9/6	PCC84	9/6
5Z4	9/6	6X4	7/6	ECH42	10/6	PCF80	9/6
6AM6	5/-	6X5	6/6	ECL80	10/6	PCL82	11/6
6B8	5/-	12A6	7/6	ECL82	10/6	PEN25	6/6
6BE6	7/6	12AT7	8/-	EF39	5/6	PL81	12/6
6BH6	9/6	12AU7	8/-	EF41	9/6	PL82	10/6
6BW6	9/6	12AX7	8/-	EF50	5/6	PY80	7/6
6D6	6/-	12BE6	8/6	EF80	8/-	PY81	9/6
6F6	7/6	12K7	6/6	EF86	12/6	PY82	7/6
6H6	3/6	12Q7	6/6	EF92	5/6	SP61	3/6
6J5	5/6	35L6	9/6	EL32	5/6	UBC41	9/6
6J6	5/6	35Z4	7/6	EL41	9/6	UCH42	9/6
6J7G	6/8	80	9/6	EL84	8/6	UF41	9/6
6K6GT	6/6	807	5/6	EY51	9/6	UL41	9/6
6K7G	5/-	954	1/6	EZ40	7/6	UY41	8/-
			U22	8/-			

DK96, DF96, DAF96, DL96, 8/6 each or 80/- set.

NEW ELECTROLYTICS

TUBULAR		TUBULAR	
1/350V	2/-	50/350V	5/6
2/350V	2/3	100/25V	3/-
4/450V	2/3	250/25V	3/-
8/450V	2/3	500/12V	3/-
8/500V	2/9	8+8/450V	3/6
16/450V	3/-	8+8/500V	5/-
16/500V	4/-	8+16/450V	3/9
32/450V	3/9	8+16/500V	5/6
25/25V	1/9	16+16/450V	4/3
50/25V	2/-	16+16/500V	6/-
50/50V	2/-	32+32/350V	4/6

FAMOUS MAKES

CAN TYPES	
16/45V	5/-
32/350V	4/-
100/270V	5/6
2,500/3V	4/-
5,000/6V	5/-
32+32/350V	5/-
32+32/450V	6/-
32+32+32/350V	7/-
50+50/350V	7/-
64+120/350V	11/6
100+200/275V	12/6

C.R.T. BOOSTER TRANSFORMERS

For Cathode Ray Tubes having heater cathode short circuit and for C.R. Tubes with failing emission, full instructions supplied.

Type A. Optional 25% and 50% Boost. 2V or 4V or 6.3V or 10.8V or 13.3V. Mains input. **12/6**

TYPE A2. High quality, low capacity. 10/15pF. Optional boost 25%. 50%. 75%. Mains input. **16/6**

Type B. Mains input. Low capacity. Multi output 2, 4, 6.3, 10 and 13V. Boost 25% and 50%. This transformer is suitable for all TV tubes, 21/- each.

QMAX CHASSIS CUTTER

The cutter consists of three parts: a die, a punch and an Allen screw.

Sizes	Prices	Key
¼in.	12/9	1/-
⅜in.	12/9	1/-
½in.	13/9	1/-
⅝in.	13/9	1/-
1in.	16/-	1/6
1⅛in.	16/-	1/6
1¼in.	16/-	1/6
1⅜in.	18/-	1/6
1½in.	18/-	1/6
1⅝in.	10/6	1/6
2in.	30/-	2/3
2 3/32in... ..	33/6	2/3
2¼in.	38/6	2/3
1in. square hole ..	29/-	1/6

O.P. TRANSFORMERS. Heavy Duty 50 mA, 4/6. Multiratio, push-pull, 7/6. Ditto, 10 w, 15/6. Miniature, 3S4, etc., 4/6. **L.F. CHOKES** 15/10 H. 60/65 mA, 5/-; 10 H. 85 mA, 10/6; 10 H., 150 mA, 14/-.

MAINS TRANSFORMERS 200/250 v. A.C.
STANDARD, 250-0-250, 80 mA, 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. ditto, 350-0-350 .. 22/6
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, 220-0-220, 50 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 amp. .. 7/6
Ditto, tapped sec. 2, 4, 6.3 v., 1½ amp. 8/6
Ditto, sec. 6.3 v. 3 amp. .. 10/6
GENERAL PURPOSE LOW VOLTAGE. 2a, 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 24, 30 v. .. 22/6
AUTO TRANS. 110-240 v. 150 w. .. 22/6
Ditto, 500 w. 82/6

TELEVISION REPLACEMENT Line Output Transformers from 45/- each, New Stock

and other timebase components
Most makes available
S.A.E. with all enquiries.

FULL WAVE BRIDGE SELENIUM RECTIFIER: 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. **4 AMP CAR BATTERY CHARGER** with amp meter Leads, Fuse Case, etc., for 6 v. or 12 v., 69/6.

BOOKS

40 Circuits for Germanium Diodes 3/-.
"W.W" Radio Valve Data, 6/-.
High Fidelity Speaker Enclosures, 5/-
Valve and TV Tube Equivalents, 9/6.
TV Fault Finding, 5/-.
Quality Amplifiers, 4/6.
Radio Valve Guide. Books 1, 2, 3 or 4, 5/- each.
Transistor Superhet Receivers, 7/6.

CRYSTAL MIKE INSERT
by Acos 8/6
Precision engineered.
Size only 1¼in. dia. x ½in.
ACOS CRYSTAL MIKE 40 .. 25/-
DE LUXE STICK MIKE .. 35/-

LOUDSPEAKER P.M. 3 OHM. 5in. Rola, 17/6; 8in. Plessey, 19/6. 7in. x 4in. Plessey, 18/-; 6½in. Rola, 18/6. 10 x 6in. 27/6. 10in. Rola, 30/-. 4in. Tweeter, 25/-. 12in. R.A., 30/-. 14 x 8in. 45/-. **STENTORIAN HF1012.** 10in. 3 to 15 ohms, 10 w., 95/-.

BAKER SELHURST LOUDSPEAKERS

12in. Baker 15w. Stalwart, 3 or 15 ohms .. 90/-
12in. Baker ditto, foam suspension, 15 ohms .. £6
12in. Baker Ultra Twelve, 20 c.p.s. to 25 kc/s £17.10
15in. Auditorium, 35 w., £15

CRYSTAL DIODE G.E.C., 2/-. GEX34, 4/-.
HIGH RESISTANCE PHONES. 4,000 ohms, 15/- pr.
MIKE TRANSF. 50 : 1, 3/9 ea.; 100 : 1, Potted, 10/6.
SWITCH CLEANER, Fluid squirt spout, 4/3 tin.
TWIN GANG TUNING CONDENSERS. 365 pF miniature 1in. x 1¼in. x 1¼in., 10/-. 500pF Standard with trimmers, 9/-; midget, 7/6; with trimmers, 9/-.
SINGLE, 50 pF, 2/6; 75 pF, 100 pF, 160 pF, 5/6. Solid dielectric 100, 300, 500 pF, 3/6.
CONDENSERS. New Stock. 0.001 mfd. 7 kV; T.C.C., 5/6; Ditto, 20 kV., 9/6; 0.1 mfd., 7 kV., 9/6. Tubular 500 v. 0.001 to 0.05 mfd., 9d., 0.1, 1/-; 0.25, 1/6; 0.5/500 v., 1/9; 0.1/350 v., 9d.; 0.01/2,000 v. 0.1/1,000 v., 1/9; 0.1 mfd., 2,000 volts, 3/6.
CERAMIC CONDS. 500 v., 0.3 pF to 0.01 mfd., 9d.
SILVER MICA CONDENSERS. 10% 5 pF to 500 pF, 1/-; 600 pF to 3,000 pF, 1/3. Close tolerance. (±1 pF) 1.5 pF to 47 pF, 1/6. Ditto 1% 50 pF to 815 pF, 1/9; 1,000 pF to 5,000 pF, 2/-.

465 kc/s SIGNAL GENERATOR. Total cost 15/-. Uses B.F.O. Unit ZA 30038 ready made. **POCKET SIZE** 2½ x 4½ x 1in. Slight modifications required, full instructions supplied. Battery 7/6 extra 69V+1½V. Details S.A.E.

Wavechange Switches, 2 p. 2-way, 3 p. 2-way, short spindle, 2/6; 6 p. 4-way 2 wafer, long spindle, 6/6; 2 p. 6-way, 4 p. 2-way, 4 p. 3-way, long spindle, 3/6; 3 p. 4-way, 1 p. 2-way, long spindle, 3/6;

Wavechange "MAKITS". Wafers available: 1 p. 12 wafer. 2 p. 6 wafer, 3 p. 4 wafer, 4 p. 3 wafer, 6 p. 2 wafer, 1 wafer, 8/6; 2 wafer, 12/6; 3 wafer, 16/-; additional wafers up to 14, 3/6 each extra.

Toggle Switches, s.p., 2/-; d.p., 3/6; d.p.d.t., 4/-.

JASON FM TUNER COIL SET, 29/-. H.F. coil, aerial coil, oscillator coil, two i.f. transformers 10.7 Mc/s, detector transformer and heater choke. Circuit and component book using four 6AM6, 2/6. **Complete Jason FMT.1 Kit,** Jason chassis with calibrated dial, components and 4 valves, £6.5.0.

Valveholders, Pax, int. oct., 4d. EA50, 6d. B12A, CRT, 1/3. Eng. and Amer. 4, 5, 6, and 7 pin, 1/-. MOULDED Mazda and int. oct., 6d.; B7G, B8A, B8G, B9A, 9d. B7G with can, 1/6. B9A with can, 1/9. Ceramic, EF50, B7G, B9A, int. oct., 1/-. B7G, B9A cans, 1/- each.

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RADIO COMPONENT

Our written guarantee with every purchase. Bus 133 or 68 pass door S.R. Station Selhurst.

Volume Controls

Long spindles. Midget 5K ohms to 2 Meg. No. Sw. D.P.Sw. 3/- 4/6
Linear or Log Tracks.

80 ohm CABLE COAX

Semi-air spaced ¼in. Stranded core. **6d. yd.**
40 yds. 17/6.
60 yds. 25/-.
Fringe Quality Air Spaced. **1/- yd.**

COAX PLUG .. 1/- **LEAD SOCKET** .. 2/-
PANEL SOCKETS 1/- **OUTLET BOXES** .. 4/6
BALANCED TWIN FEEDER yd. 6d. 80 or 300 ohms.
DITTO SCREENED per yd. 1/6. 80 ohms only.
WIRE-WOUND POTS. 3 WATT. Pre-set Min. TV Type. All vaues 10 ohms to 25 K., 8/- ea. 30 K., 50 K., 4/-. (Carbon 30 K., to 2 meg., 8/-.)
WIRE-WOUND 4 WATT Pots. Long Spindle. Values, 50 ohms to 50 K., 6/6; 100 K., 7/6.

TRIMMERS, Ceramic. 30, 50, 70 pF., 9d.; 100 pF., 150 pF., 1/3; 250 pF., 1/6; 500 pF., 750 pF., 1/9.
RESISTORS. Preferred values. 10 ohms to 10 meg., ½ w., 4d.; 1 w., 6d.; 1½ w., 8d.; 2 w., 1/-.
HIGH STABILITY. ½ w., 1%, 2/-. Preferred values. 10Ω to 10 meg. Ditto, 5%, 100Ω to 5 meg., 9d.

WIRE-WOUND RESISTORS

5 watt..	..1/3
10 watt.. 25 ohms—10,000 ohms	..1/6
15 watt..	..2/-
12.5K to 50K 10 w	3/-

AMERICAN "BRAND FIVE" PLASTIC RECORDING TAPE

Double Play	7in. reel, 2,400ft	60/-	Spare Plastic Reels 3in. 1/6 4in. 2/- 5in. 2/- 5½in. 2/- 7in. 2/6
	5in. reel, 1,200ft	37/6	
Long Play	7in. reel, 1,800ft	35/-	
	5½in. reel, 1,200ft	23/6	
	5in. reel, 900ft	18/6	
Standard	7in. reel, 1,200ft	25/-	
	5in. reel, 600ft	16/-	

"Instant" Bulk Tape Eraser and Head Defluxer. 200/250 v. A.C., 27/6. Leaflet. S.A.E.

Neon Mains Tester Screwdriver. 5/-.
Solder Radiograde, 4d. yd., ½lb 5/-. 1lb 9/-.
Black Crackle Paint. Air drying. 3/- tin.

HIGH GAIN TV PRE-AMPLIFIERS
BAND I B.B.C.
Tunable channels 1 to 5. Gain 18db. ECC84 valve. Kit price 29/6 or 49/6 with power pack. Details 6d. (PCC84 valves if preferred.)
BAND III I.T.A.—Same prices. Tunable channels 8 to 13. Gain 17dB.

Paxolin Panels, 10 x 8in.. 1/6.
Miniature Contact Cooled Rectifiers, 250V 50mA. 7/6; 250V 60mA. 8/6; 250V 85mA. 9/6; 200mA. 21/-; 300mA. 27/6.
Selenium Rect. 300V 85mA. 7/6.
Coils. Wearite "P" type. 3/- each. Osmor Midget "Q" type, adj. dust core. from 4/- each. All ranges.
Teletron D.W.R. L. and Med. T.R.F. with reaction. 3/6.
Ferrite Rod Aerials. M.W., 8/9; M. and L.. 12/6.
Osmor Ferrite Rod Aerials. L. and M. for transistor circuits. 10/- each.
Ferrite Rods, ⅜ x ½in., 2/6.
H.F. Chokes, 2/6.
T.R.F. Coils, A/HF, 7/- pair; HAX, 3/-, DRR2, 4/-.

Aluminium Chassis. 18 s.w.g. Plain, undrilled, 4 sides, riveted corners, lattice fixing holes, 2½in. sides. 7 x 4in., 4/6; 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; 18 x 16 x 3in., 16/6.
Aluminium Panels. 18 s.w.g., 12 x 12in. 4/6; 14 x 9in.. 4/-; 12 x 8in., 3/-; 10 x 7in., 2/3.

AUTOCHANGER ACCESSORIES
Suitable player cabinets (except 4 H.F.) 49/6
Amplifier player cabinets (except 4 H.F.) 63/-
2-valve amplifier and 6½in. speaker 79/6
3-valve amplifier and 6½in. speaker 95/-
Wired and tested ready for use with above.

QUALITY 2-STAGE HI-FI AMPLIFIER. A.C. only. 200-250V. Valves ECL82 and EZ80. 3 watt quality output. Mullard tone circuits, bass boost, treble and volume controls. Separate engraved Perspex front-panel with de luxe finish. Heavy duty output transformer 3 ohm. Shrouded mains transformer. Stove enamelled chassis size 8 x 5 x 3in. **Bargain price £4.10.0.** Circuit supplied.

Wirewound Ext. Speaker Control, 100. 3/-.
ALADDIN FORMERS and cores, ½in., 8d.; ¾in., 10d.
0.3in. FORMERS 5937 or 8 and cans TV1 or 2, ½in. sq. x 2½in. or ½in. sq. x 1½in., 2/- with cores.
SLOW MOTION DRIVES. Epicyclic ratio 6-1, 2-3.
SOLON IRON, 25W, 200V or 230V. 24/-.
MAINS DROPPER. 3 x 1½in. With adjustable sliders. 0.3A, 1,000 ohms. 4/3; 0.2A. 1,000 ohms. 4/3.
LINE CORD. 0.3A 60 ohms per foot. 0.2A 100 ohms per foot. 2-way, 1/- per foot; 3-way, 1/- per foot.
MIKE TRANS. 50-1, 3/9; 100:1. potted. 10/6
P.V.C. Conn. Wire, 8 colours, single or stranded, 2d. yd. Sleeving, 1.2mm, 2d.; 4mm, 3d.; 6mm. 5d. yd.
Speaker Fret. Gold cloth, 17 x 25in., 5/-; 25 x 35in., 10/-. **Tygan,** 52in. wide, 10/-; 26in. wide, 5/- ft. Samples. S.A.E. Expanded Metal, Gold, 12 x 12in.. 6/-.

"REGENT" 4 VALVE "96" RANGE VALVES
KIT PRICE £6.6.0.
carr. 4/-

PRINTED CIRCUIT BATTERY PORTABLE KIT

Medium and long wave. Powerful 7 x 4in. high Flux Speaker. T.C.C. Printed Circuit and condensers. Components of finest quality clearly identified with assembly instructions. Osmor Ferrite Aerial Coils. Rexine covered attache case cabinet. Size 12in. x 8in. x 4in. Batteries used B126 (L5512) and AD35 (L5040). 10/- extra. Instructions 9d. (free with kit). Mains Unit ready made for above 39/6. Sold separately. Details free.

with CABINET, AMPLIFIER and SPEAKER
£12.10.0 Carr. 5/-

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4 Speed Autochangers:	
BSR, U.A.14	£7.10.0
Collaro Autochanger ..	£7.19.6
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Garrard TA Mk. II	£8.0.0
Model 4SP	£6.17.6
Garrard 4 HF Transcription	£17.19.6

Garrard Stereo Heads £2 extra.
All Sapphire Stylli available from 6/-.

ARDENTE TRANSISTOR TRANSFORMERS

Type D3035. 7.3 CT: Push Pull to 3 ohms for OC72, etc., 1 x ½ x ½in.. 9/6.
Type D3034. 1.75: 1 CT. Push Pull Driver for OC72, etc., 1 x ½ x ½in., 9/6.
Type D3058, 11.5:1 Output to 3 ohms for OC72. etc., 1 x ½ x ½in., 9/6.
Type D167, 18.2:1 Output to 3 ohms for OC72, etc., ½ x ½ x ½in., 12/-.
Type D239, 4.5:1 Driver Transformer, ½ x ½ x ½in., 10/-.
Type D240, 8.5:1 Driver Transformer, ½ x ½ x ½in.. 10/-.

ARDENTE TRANSISTOR VOLUME CONTROLS

Type VC1545. 5K with switch, dia. 0.9in.. 8/-
Type VC1760. 5Kwith switch, dia. 0.7in.. 10/6

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COILS AND TRANSFORMERS FOR A 2-WAVE TRANSISTOR SUPERHET WITH PRINTED CIRCUIT AND FERRITE ROD AERIAL
Long and Medium Wave Aerial—RA2W. On 6in. rod. 7/16in. diameter. 208pF tuning. 12/6.
Oscillator Coil P50/1AC. Medium wave. For 176pF tuning. 5/4.
1st and 2nd I.F. Transformers—P50/2CC, 470 kc/s, 11/16in. diameter by ½in. high.. 5/7.
3rd I.F. Transformer—P50/3CC. to feed diode detector. 6/-.
Driver Transformer—LFDT2. 1 5/16 x ½ x 1½in.. 9/6.
Printed Circuit—PCA1. Size 2½ x 8½in. Ready drilled and printed with component positions, 9/6.
7 x 4in., 35 ohm Speaker, 25/-.
These components are approved by transistor makers and performance is guaranteed.
Constructor's Booklet 2/-.

NEW MULLARD TRANSISTORS
Audio OC71 6/- R.F. OC44 10/6
OC72 8/6 OC45 9/6
Sub-miniature Electrolytics (15V). 1µF., 2µF., 4µF. 5µF. 8µF. 25µF, 50µF. 100µF. 2/6.

B.B.C. Pocket 2 Transistor. M.W. and L.W. Radio Kit, 32/6. Phones 7/6 or deaf aid earpiece, 12/6.

"PW" ROADFARER AM/FM RADIO KIT
Transistorised throughout. Advanced design, operated from internal batteries or direct from mains. **Four Sections all on printed circuit.** AM Tuner, FM Tuner, Audio Amplifier. Mains Supply Unit.
Attractive Plastic Cabinet. Ferrite Rod Aerial for AM. Telescopic Aerial for FM. Order now. **Lowest price £15.**

"PW" Pocket 6. Transistor kit. All parts, printed circuit and cabinet. Osmor designed kit. **£8.15.0.**

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SPECIALISTS

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Telephone: THO 1665

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Practical Wireless

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Contents

The Editor will be pleased to consider articles of a practical nature. Such articles should be written on one side of the paper only, and should contain the name and address of the sender. Whilst the Editor does not hold himself responsible for manuscripts, every effort will be made to return them if a stamped and addressed envelope is enclosed. All correspondence intended for the Editor should be addressed: The Editor, PRACTICAL WIRELESS, George Newnes, Ltd., Tower House, Southampton Street, London, W.C.2. Owing to the rapid progress in the designs of wireless apparatus and to our efforts to keep readers in touch with the latest developments, we give no warranty that apparatus described in our columns is not the subject of letters patent.

The "Tutor" Blueprint

WITH each copy of this issue of PRACTICAL WIRELESS, we are giving away another blueprint: the "P.W. Tutor", as it is called, has been designed for absolute beginners to radio construction, those who are, perhaps, new readers of this magazine, or those who have for some time wished to know more of the basic principles from which many of the more advanced designs appearing in these pages obtain their origin. This blueprint then does not only constitute details of simple radio receivers which anyone can build, confident that successful sets will result from their efforts, but it has also been designed by our experts—leaders in the field of technical journalism—to provide also a foundation of the principles of radio reception and receiver construction. This surely is the only way to begin a satisfactory association with this hobby—from a sound knowledge of the absolute fundamentals.

The article relating to the "Tutor", on pages 504 to 509, shows, by easy stages, how four simple radio receivers may be built by anyone who is prepared to follow the step-by-step instructions, learn the meaning of the various circuit symbols (page 508), and spend a few minutes reading and practising the "Hints on Soldering" given on page 509.

The components used in all the sets are inexpensive and readily obtainable and most of them are mounted on a group-board which greatly simplifies the construction.

The first receiver is a crystal set. This type of circuit has long been recognised as the ideal introductory circuit for the newcomer to the ranks of the amateur radio enthusiasts. It is for this reason that we feel justified in describing, in detail, the construction of a simple crystal set as the starting point for the beginner.

Three other sets follow this first receiver, each being progressively more advanced than the one before, and incorporating long and medium waveband coverage, transistor amplifying stages, as well as regeneration to improve volume and selectivity. The construction of a simple cabinet is also described which will be suitable for any of the four sets, and will give the final receiver a professional appearance.

Many of the more experienced readers of PRACTICAL WIRELESS may feel that in publishing this blueprint for the beginner, we have neglected our responsibility to those who have already established themselves as radio enthusiasts. We can but hope that any such readers will be patient, for this blueprint is the first of three; the other two are to be published in the November and December issues. The November blueprint will be of a transistorised amplifier, using the group-board method of construction, which will be capable of operating a loudspeaker from a battery record player or radio tuner. The December blueprint will give details of a superhet receiver, again built on a group-board, and designed to operate with the amplifier of the November issue, to form a complete radio set which the experienced constructor and the beginner alike will find to be a useful domestic receiver with an excellent performance.

Our next issue, dated November, will be published on October 6th.

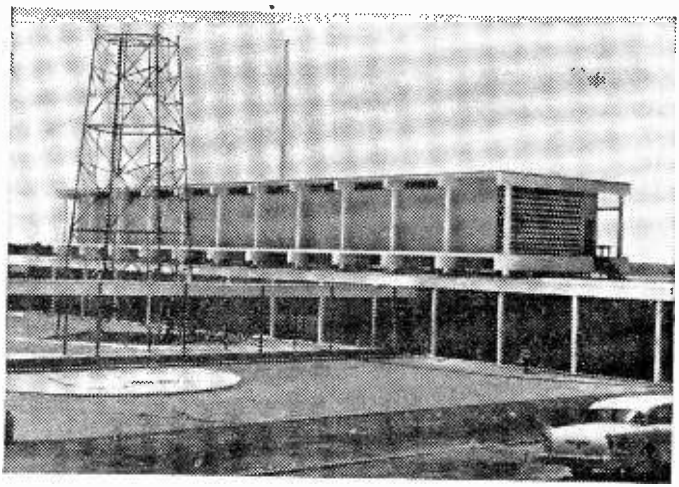
Round the World of Wireless

POTENTIAL AND CURRENT NEWS

Broadcast Receiving Licences

THE following statement shows the approximate number of Broadcast Receiving Licences in force at the end of June, 1961, in respect of wireless receiving stations situated within the various Postal Regions of England, Wales, Scotland and Northern Ireland. The numbers include Licences issued to blind persons without payment.

Region	Total
London	688,067
Home Counties	648,049
Midland	469,169
North Eastern	508,102
North Western	437,436
South Western	387,442
Wales and Border Counties	225,973
Total England and Wales	3,364,237
Scotland	375,848
Northern Ireland	116,799
Grand Total	3,856,884



The transmitter hall and partially completed tower of a new broadcasting station at Tema, Ghana, which is being constructed by Marconi's Wireless and Telegraph Co. Ltd.
(Picture by courtesy of "Radio Review and TV Times", Ghana.)

International Trade Fair

THIS year's Pacific International Trade Fair is to be held in Lima, Peru, during October.

The British pavilion will be of modern design and will be one of the main attractions for visitors. The Board of Trade and the British delegation, in designing the pavilion, have ensured that British products will be exhibited to best advantage. Exhibitors' and general trade 16mm films will be shown to visitors in a fully equipped cinema, with projection equipment from the RCA Great range.

President Nkrumah Visits New Broadcasting Station

PRESIDENT Nkrumah recently visited the new external broadcasting station at Tema, near Accra, Ghana, which is being constructed by Marconi's Wireless Telegraph Co. Ltd. This station will give Ghana a modern high-power short-wave broadcasting system.

Under the contract Marconi's have designed and erected the transmitting station buildings and supplied and installed four 100kW high frequency radio transmitters. Marconi's will also supply technical staff for the supervision and maintenance of the station for a period for four years and train personnel of the Ghana Broadcasting System.

New BBC VHF Sound Broadcasting Station

THE BBC's new VHF sound broadcasting station on the site of the Air Ministry radio station on the cliffs some 400ft above Dover, was brought into service on 8th August.

The Home Service is transmitted on 94·4Mc/s, the Light Programme on 90·0Mc/s, and the Third Programme with Network Three on 92·4Mc/s, each with a mean effective radiated power of 3·5kW. A large number of listeners in South-East Kent, including Deal, Ramsgate, Broadstairs and Margate, Dover and Folkestone, are now able to receive greatly improved BBC sound broadcasting services.

The new station is of the translator type and will operate unattended. It will receive its programmes from the Wrotham VHF sound station by radio and make a direct frequency change on each without demodulation.

Weather Ship Improvements

FOLLOWING the completion of an Air Ministry contract for the supply and installation of new radio communication and automatic direction finding equipment, and the modernisation of the radar on two ocean weather ships the Marconi Company has been awarded a similar contract for a third ship. The Marconi equipment at present being installed includes four 1kW independent sideband transmitters, eight receivers, a medium frequency direction finder and a VHF automatic direction finder and displays.

Ionising Radiations in Industry

A SAFETY code for workers exposed to ionising radiations in industry is laid down in the Ionising Radiations (Sealed Sources) Regulations, 1961, made by the Minister of Labour, Mr. John Hare, and presented to Parliament on 3rd August.

The regulations impose requirements for safeguarding the health and safety of persons employed in factories and other places to which the Factories Acts apply, who may be exposed to ionising radiations from sealed radio-active substance, and from certain machines, such as X-Ray apparatus. They require the restriction of the exposure of workers to such radiations, the adequate shielding of sources of ionising radiations and instructions for workers likely to be

exposed to them, about the hazards involved and the precautions to be taken.

Maximum permissible doses of radiation are laid down, and the regulations include requirements for the medical supervision of workers, and for the wearing of film badges to measure personal doses received.

Valve Manufacturers' Interests Merge

ON the 1st August this year, Thorn-AEI Radio Valves and Tubes Ltd. began trading.

It was announced on 16th June that Associated Electrical Industries Ltd., were to merge their respective interests in the manufacture and sale of cathode ray tubes and radio valves. The productive capacities of both companies in this field have been pooled and include factories at Sunderland, Harlow, Rochester and Footscray.

AEI and TEI are both represented on the board and have equal shareholdings. TEI is responsible for management.

From 1st August all AEI's interests in radio valves and cathode ray tubes for the entertainment industry were transferred to Thorn-AEI Radio Valves and Tubes Ltd., but AEI is continuing to manufacture valves and cathode ray tubes for industrial purposes.

Radio Equipment for New Aircraft

THE "Sixty Series" of airborne radio equipments and navigation aids, made by Marconi's, has been specified by British European Airways for use in their fleet of de Havilland Tridents.

The principal design aim in the "Sixty Series" has been for greatly improved reliability through new concepts of mechanical and circuit design. The units are transistorised, are very small and light and have an extremely low power consumption.

The equipment will include VHF communication equipment, VHF navigation and approach guidance equipment, automatic direction finder or radio compass and an aircraft selective calling system.

The "Sixty Series" has also been specified by BOAC for their fleet of Vickers VC 10's.

The Centre of Sound

IN June this year, the Centre of Sound was opened in London and established as the national headquarters of the British Recording Club. The Centre also aims at promoting the growth of the audio industry in this country and on the ground floor is housed a permanent exhibition of audio equipment. This exhibition is open to the public every day except Sunday, from 9.30 a.m. to 11.00 p.m.

Also for the benefit of the general public there is an Information Bureau on the ground floor which will give advice on all audio problems. It is staffed by a team of experts and is open every day from 9.30 a.m. to 5.30 p.m. For the benefit of evening visitors a skeleton staff is employed from 5.30 p.m. to 11.00 p.m.

Full club members of the Centre of Sound automatically become members of the British Recording Club. Facilities for members include a small theatre with a bar, a cinema, a library, a restaurant and television lounges.

The Centre of Sound is in Archer Street, Piccadilly, London W1.

Engineering Division Appointments

THE BBC recently announced the appointment of Mr. J. A. G. Mitchell as Scottish engineer. He succeeds the late Mr. F. W. Endicott and becomes responsible for the engineering services of the BBC's sound and television studios and outside broadcast units in Scotland.

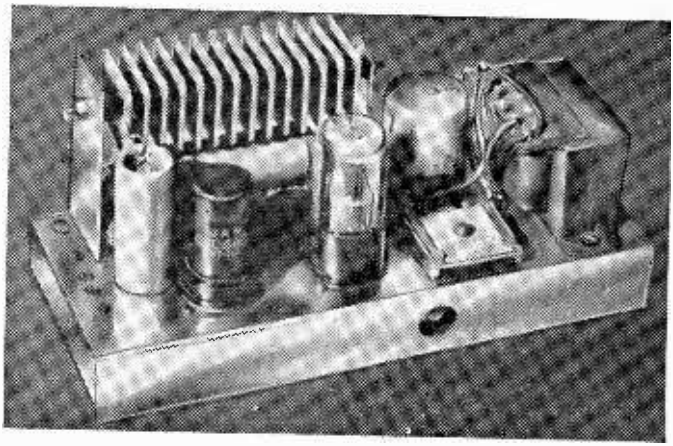
Audio Avenue at the Radio Show

AN extensive display tracing the history of sound recording from 1888 to 1961 was a feature of the Audio Avenue at the Radio Show this year. Occupying some 500 sq. ft. this feature, "Milestones in Recording", was presented in conjunction with the E.M.I. group of companies.

Among the many vintage instruments featured in this display was one of the earliest weight-driven acoustic recording machines, an Edison phonograph and the microphones used exclusively by the Royal Family from 1924 to 1945. The modern era of recording was represented by the latest type of studio tape recorders, stereo mixer consoles and other high-fidelity equipment.

The Centre of Sound; headquarters of the British Recording Club.

Remote Control Unit



THIS INSTRUMENT WAS DESIGNED TO OPERATE AN AUTOMATIC MECHANISM OVER A SHORT RANGE

By V. E. Holley

THIS apparatus was designed so that the door of a garage could be made to open automatically on receipt of a command signal from the driver of an approaching vehicle. It is, of course, suitable for any other control service where only a short range is required. While the mechanical part of the installation is rather outside the scope of these pages, it must be said briefly in explanation that the controlled door is of the roller shutter type which, when the retaining bolt is withdrawn, rises under the influence of springs incorporated in the roller. The bolt is in fact the armature of a solenoid which the apparatus here described is designed to energise. It requires a current of 0·25A at around 240V D.C.

Command Signal

The more obvious methods of control by photo-electric circuits, contact pads laid in the approach road, etc., suffer from the defect that they can be operated by unauthorised persons. They were therefore rejected in favour of the following arrange-

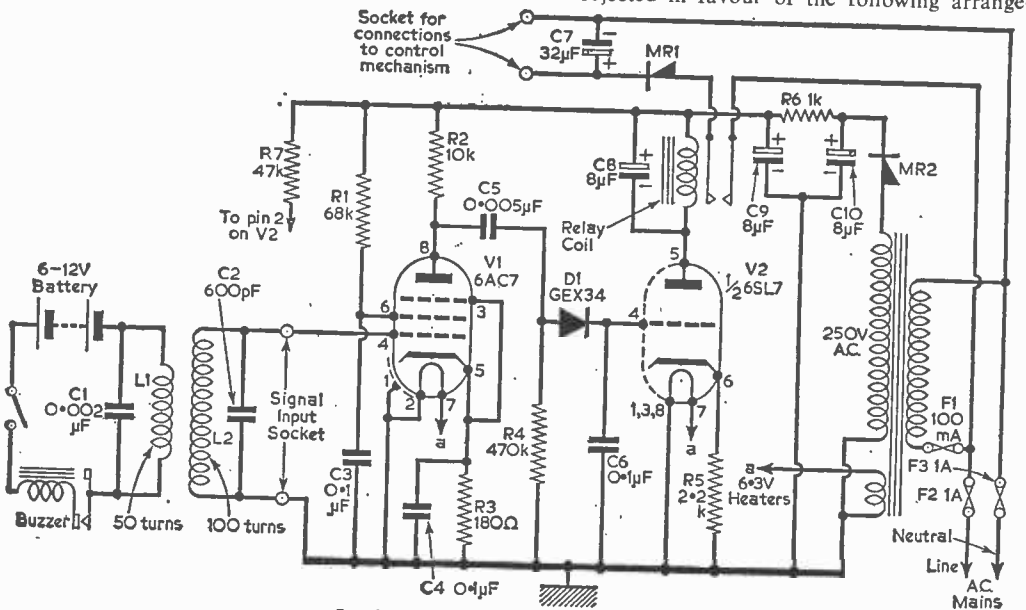


Fig. 1.—The circuit of the instrument.

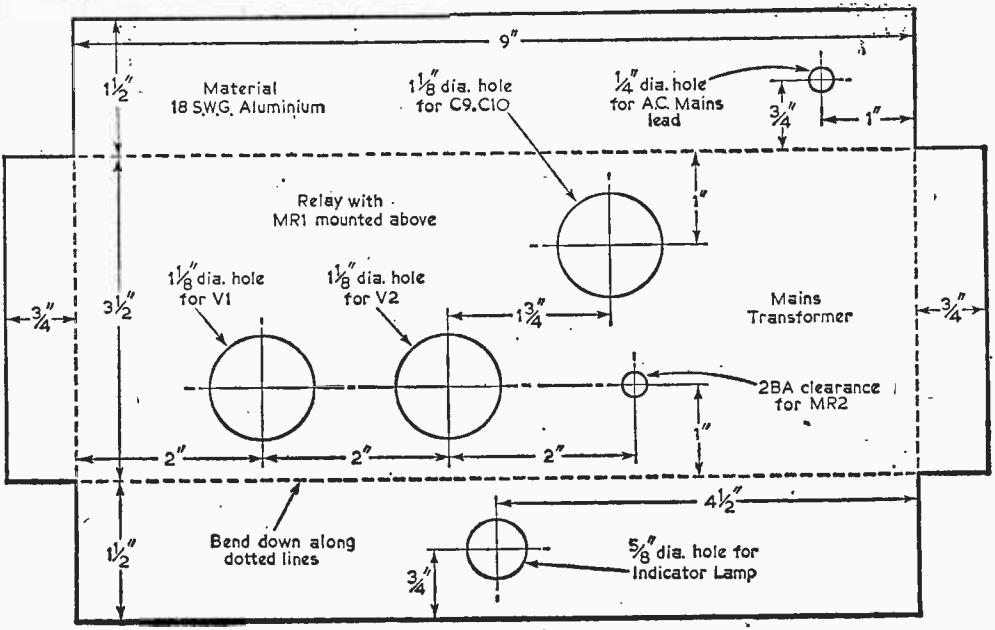


Fig. 2.—The drilling dimensions of the aluminium chassis.

ment which depends upon a secret signal given by the driver of the car. Referring to Fig. 1, the tuned circuit L1/C1, is carried on a bracket beneath the car and the buzzer and switch or bell-push in some convenient operating position inside. The second tuned circuit L2/C2 is buried several inches below the surface of the approach road in such a position that the car must pass over it to enter the garage. Operation of the buzzer energises L1 at its resonant frequency and the signal is transferred inductively to L2; the two coils may in fact be regarded as the two windings of an R.F. transformer with a step-up ratio of 1:2. With the circuit shown, sufficient signal transference is obtained with the coils three or four feet apart and, as the service operating distance is less than 18in., there is sufficient sensitivity in hand. It is not necessary that L1 should pass exactly over L2; satisfactory operation is obtainable with a divergence of up to 18in. either side.

Signal Amplification

The signal induced in L2 is taken by underground cable into the garage and presented to the grid of the valve V1. This is a high-gain pentode, 6AC7, arranged as an R.F. amplifier. An inductive load in the anode circuit would no doubt increase the gain considerably but the 10k resistor R2 is adequate provided the screen and cathode resistors are efficiently bypassed. The amplified signal is transferred via C5 to the diode, D1, where it is rectified and the resultant voltage is applied to the grid of the valve V2. Any other high-gain R.F. pentode can be used for V1, the values of the associated components being adjusted as necessary.

Output Stage

The function of V2 is to operate the relay and both valve and relay must be selected for compati-

COMPONENTS LIST

Resistors ½W (unless otherwise stated)

R1	*68k*	*R4*	*470k*
R2	*10k*	*R5*	*2·2k*
R3	*180Ω*	*R6*	*1k, 1W*

Capacitors 350VW (unless otherwise stated)

C1	*0·002μF*	*C4*	*0·1μF*
C2	*600pF*	*C5*	*0.005μF, 1000VW*
C3	*0·1μF*	*C6*	*0·1μF*
C7	*32μF (electrolytic)*		
C8	*8μF (electrolytic)*		
C9	*8μF (electrolytic)*		
C10	*8μF (electrolytic)*		

Valves
V1 6AC7 (octal base)
V2 6SL7 (octal base)

Diode
GEX34

Relay
See text

Rectifiers
MR1 RM4, 250V, 300mA
MR2 Contact-cooled, 250V, 20mA (minimum)

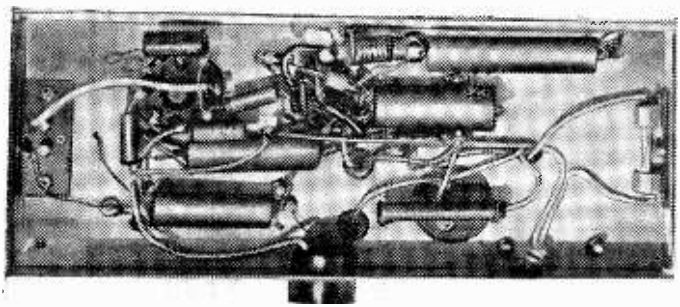
Mains Transformer
250V, 20mA, half-wave; 6·3V, 1A

Fuses

F1	*100mA*	*F2*	*1A*
F3	*1A*		

Sockets
Two (dissimilar) for external circuits
Buzzer and bell push
Any type

bility. The relay in the original equipment is of a simple type which is obtainable for a few shillings; the energising coil has a D.C. resistance of 4k and the operating current is 3mA. This fits in well with a high-μ triode valve and the prototype uses one half of a double triode, 6SL7. In the quiescent condition, the valve is biased by the resistor R5 so that the anode current is 2mA. Diode D1 is connected so that the arrival of a signal produces a positive voltage on the grid of the valve which



An underchassis view of the unit.

increases the anode current and operates the relay. The capacitor C6 acts as a reservoir and removes any R.F. which might otherwise be present on the grid. The anode of V2 is decoupled by the 8μF capacitor C8 to ensure clean make and break. Note that the decoupling is to H.T. +, since if it were taken to chassis, the flow of charging current into C8 would operate the relay when the equipment is switched on.

(Note that R7 is used to feed H.T. to the spare, or unused, half of the 6SL7 to prevent cathode poisoning.)

Power Supply

The H.T. requirement is about 15mA at 250-300V, while the heaters and indicator lamp need a little under 1A at 6·3V. This is supplied by a miniature mains transformer of the type used in television converters. The 250V half-wave secondary feeds a contact-cooled rectifier and smoothing is provided by R6 in conjunction with the 8μF capacitors C9 and C10. No mains switch is included as it is convenient to control the supply to the prototype from the mains outlet to which it is connected.

Controlled Circuit

The direct current for operating the door control mechanism is produced by the rectifier MR1 and its associated reservoir capacitor, C7. The supply is taken direct from the mains and the relay contacts are included in the A.C. portion of the circuit. The connection to the mains should be made as in Fig. 1 so that, in the quiescent condition, line voltage is present in the controlled circuit only as far as the relay contact. The three fuses are a necessary precaution since the equipment will be switched on for long periods unattended *and they should not be omitted.* In the prototype, F2 and F3 are at the mains connection and F1 is on the chassis.

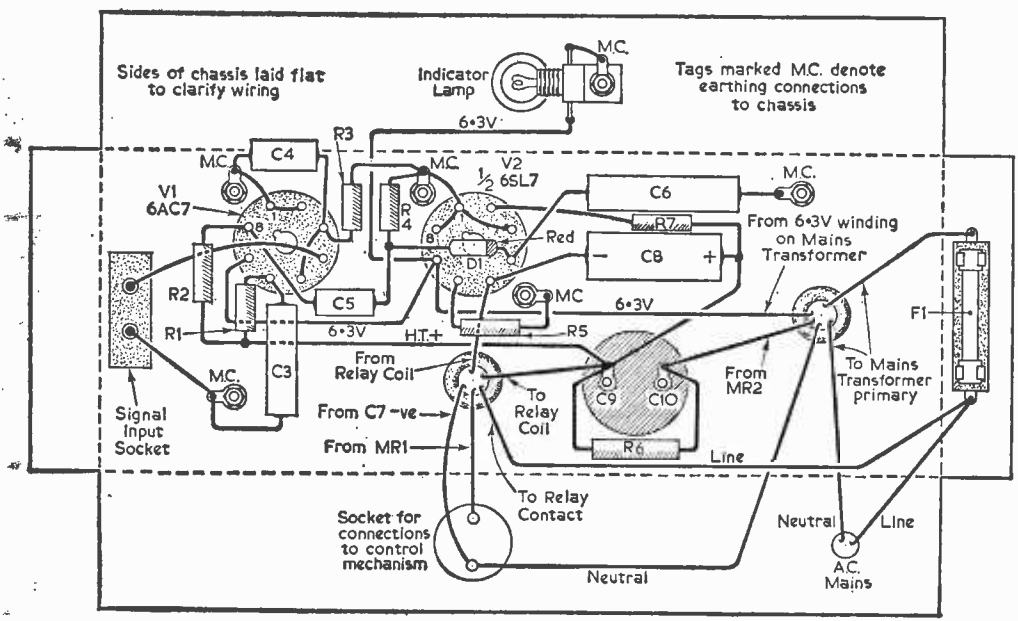


Fig. 3.—The underchassis wiring diagram.

Construction

The unit may be constructed in any desired form. A chassis about 9in. x 3½in. x 1½in. of 18s.w.g. sheet aluminium is convenient with the drilling dimensions given in Fig. 2. A point-to-point wiring diagram with the wiring and components opened out for clarity, is given in Fig. 3.

Coils

The coils L1 and L2 are wound with enamelled copper wire of 30s.w.g. on identical formers made from three layers of ⅛in. plywood glued together as a "sandwich". The centre layer is 6in. x 6in. and the outers 6½in. x 6½in. so as to form a slot ¼in. deep all round in which the winding can be laid; the corners of the centre layer should be rounded off. The ends of the windings are brought through holes in the cheeks and soldered to two small wood screws which serve also to anchor the tuning capacitor. The details are shown in Fig. 4. Fifty turns are required for L1 and 100 for L2, giving a step-up ratio of 1:2.

When the construction is complete and the unit is operating satisfactorily, the coils should be thoroughly dried out and immersed in molten pitch or bitumastic paint to make them impervious to moisture. If pitch is used it should be heated very slowly to a temperature at which it is just sufficiently viscous to coat the coils thoroughly and the immersion should not be prolonged unduly. Waxed paper capacitors do not take kindly to this treatment and ceramics should be used for C1 and C2. The bracket for securing L1 beneath the car should of course be fitted before immersion.

Other Components

The relay must suit the valve as already mentioned and the contacts must be capable of carrying the current of the controlled circuit. Nothing is required of the buzzer except that it should buzz heathily and any type will do; the prototype uses an electric door bell with the gong removed. The diode should be suitable for low radio frequency operation and a GEX34 performs very well. The resistors may be half watt except R6 (1 watt) and the capacitors 350VW except C5 for which a 1000VW component is advisable because breakdown or leakage here would cause the relay to operate. Sockets are required for connection of the signal circuit. L2/C2. and the circuit to be controlled. They should be dissimilar to avoid accidental wrong connection.

Testing

The completed unit should be set up on the bench with the coils L1 and L2 facing each other and about 3ft apart. If consistent and reliable operation is obtained at this range, it can be assumed that the equipment will be satisfactory in service. A range of 5ft was obtained with the prototype by tuning L2 accurately to the signal and capacitors of values between 500pF and 1000pF can be tried across the coil for optimum results if maximum range is required.

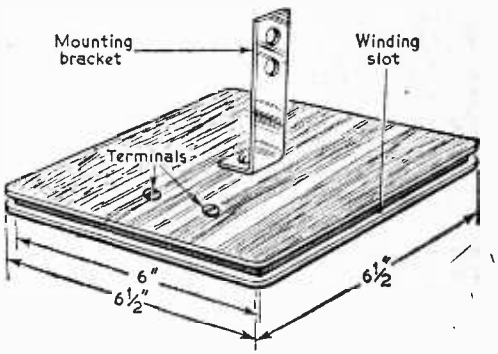


Fig. 4.—The constructional details of the former for L1.

A 9V grid bias battery is suitable for operating the buzzer, or power can be taken from the car battery. The orignal equipment is designed for operation from a 12V car system but satisfactory operation will be obtained from a 6V system provided that the buzzer does not require too much current. ■

MULTIRANGE INSTRUMENT PROTECTION DEVICE

By J. B. Ayer

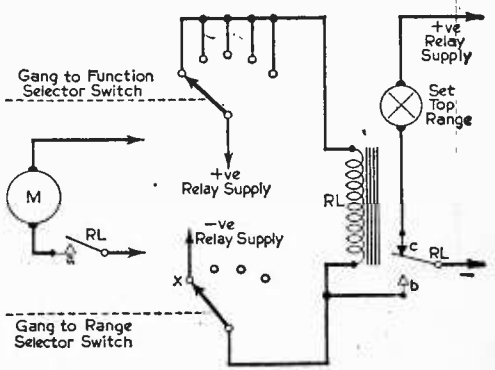
The protection system described here approaches the ideal; it consists of a relay (6V to 28V D.C.), two switch banks ("break before make" types), a lamp (6V to 28V D.C.), and a D.C. supply.

One switch bank is ganged with the range selector switch of the instrument and the other ganged with the function selector switch.

The protection system provides the following facilities.

(i) The instrument will be switched on only if the range selector switch is on the top range position initially.

(ii) It will disconnect the instrument instantaneously if the function selector switch is operated without previously setting the range selector switch on top range. ■



Note: x is position of Range Selector Switch on top range

Fig. 1.—The circuit of the unit. Relay contact (a) is wired in series with the meter leads.

TROUBLE in the LOCAL OSCILLATOR

RECOGNISING AND CURING SOME FAULTS TO BE FOUND IN SUPERHET RECEIVERS

By G. J. King

IN a superheterodyne receiver the local oscillator section of the frequency changer stage often gives trouble and results either in complete failure of the receiver, lack of sensitivity or apparent misalignment. In effect, the local oscillator is the heart of a superhet receiver. If the frequency is incorrect or the heterodyne signal voltage too high or too low, then the performance is impaited.

Operation

In spite of its importance, the local oscillator is probably the section of the receiver which is most taken for granted. Should the oscillator fail to produce a heterodyne signal of any kind, the receiver will not tune signals since the operation of a superhet depends on the mixing of a locally generated signal with the incoming signal to produce an intermediate-frequency signal in the anode circuit of the mixer section of the frequency changer valve, this being subsequently amplified to the required degree before being applied to the detector stage.

The difference between the frequency of the incoming signal and that of the local oscillator gives the intermediate frequency, a common value nowadays being 470kc/s. The oscillator frequency may be 470kc/s (or whatever the I.F. is) above or below the incoming signal frequency, depending on the design of the receiver or, sometimes, on the waveband to which the receiver is adjusted.

I.F. Pick-up

It is clear that if the local oscillator fails, no I.F. signal will be produced. Nevertheless, the receiver may not be totally dead. The receiver will not tune stations, of course, but it may pick up odd morse signals or even a Continental station. The reason for this is that the I.F. stages are still operative and sensitive and if any signal appears on the aerial at a frequency within the I.F. passband, and if the signal is strong enough, it may well break through the first stages of the receiver and undergo amplification in the I.F. channel, where it will be detected in the normal way and give a signal from the loudspeaker.

If the tuning is operated, the station will occur over the entire tuning range, though it may be slightly stronger when the tuning is set to one extreme end of its range. This is because at one end of the range the first tuned circuits are brought closer to the intermediate-frequency and the attenuation which they offer at the I.F. is progressively reduced. If the receiver features an I.F. trap in the aerial circuit, then this may afford sufficient attenuation to prevent such I.F. pick-up.

What usually happens, however, is that when a receiver fails the experimenter or service technician endeavours to locate the faulty section by removing the aerial lead from the aerial socket and applying it to various internal points around the frequency changer stage. If the local oscillator is responsible for the failure, when the aerial lead is connected to the signal grid of the mixer or to an associated lead or component (point A in Fig. 1), I.F. pick-up may occur loud and clear. This is because the signal (or signals) in the range of the I.F. is applied direct to the I.F. amplifier stage, which then acts as a fixed-tuned TRF section.

Partial Failure

In some cases the oscillator may not fail com pletely ovei the whole of the tuning range, but may suddenly burst into life at certain critical points on the dial, while at other points the symptoms already described may occur. This is typical local oscillator trouble, but which may occur only on some bands and not on others.

Low sensitivity of the receiver, if not due to any other cause, may be the result of low heterodyne voltage. This would point either to coil trouble or to alteration in value of an associated oscillator component. Sometimes in old sets, the oscillator coil or coils lose their "goodness"—their Q-value probably diminishes—and this results either in intermittent operation or complete failure.

On the other hand, if the oscillator is operating too strongly, as may be caused by a feed resistor decreasing in value, the sensitivity may in some cases also be reduced. In addition, harmonics of the oscillator fundamental frequency may be generated. and these may well cause spurious I.F. signals which could possibly cause disconcerting

whistles and interference on certain signals tuned in the normal way.

In order to obtain the best results, the local oscillator must produce a signal voltage within a certain range, usually between 5 and 15V. and for any given signal level there is a heterodyne voltage which provides optimum conversion conductance in the frequency changer valve. Fortunately this optimum value is not highly critical, and deviations to either side of the optimum will not normally impair the operation of the frequency changer by any marked degree. However, if the oscillator voltage deviates considerably from the optimum value, then poor results are bound to occur.

The tuning gang for the oscillator is usually of smaller capacitance (and size) than those sections used for tuning the aerial and R.F. circuits.

The signal output or attenuator of the signal generator should be adjusted to give reception comparable to that obtained with the oscillator of the receiver, and then the signal strength should be increased and decreased so that the effect of too much and too little oscillator voltage may be noted.

Too little voltage will mostly cause a hiss on reception as well as decreasing the sensitivity, while too much voltage will cause whistles and if further increased will also cause a fall-off in sensitivity, as already described.

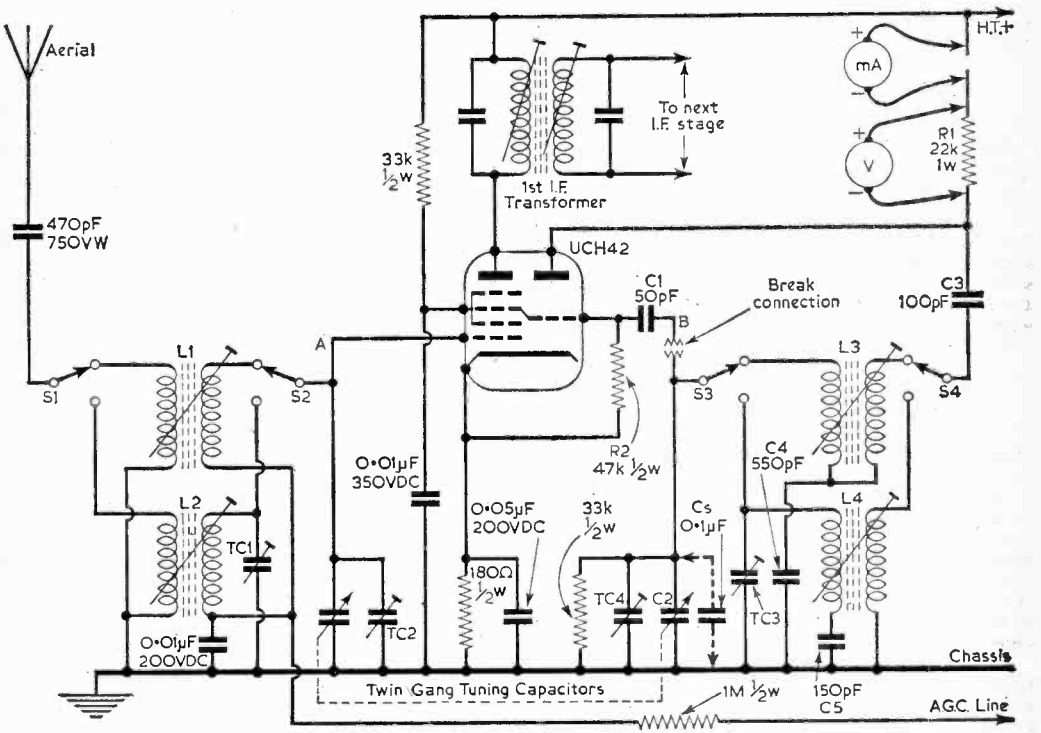


Fig. 1.—The local oscillator or frequency changer stage of a superhet receiver.

Worthwhile Exercise

The effects of changes in oscillator voltage can easily be observed by the experimenter and service technician by first tuning the receiver to a medium power transmission, making the local oscillator inactive and then injecting into the mixer section a signal of correct frequency from a signal generator—unmodulated, of course!

The correct frequency for the signal generator can be found first by tuning it to a frequency equal to the incoming signal frequency minus the I.F. and if this does not bring back the station, then tuning it to a frequency equal to the incoming signal frequency plus the I.F. In sets where the local oscillator is above the signal frequency, this exercise is well worth while for it may be practised as a test procedure when a receiver is in for repair with a suspect local oscillator. This will quickly prove whether or not the oscillator is responsible for lack of signals.

It is best to inject the generator signal at the grid of the oscillator valve after first breaking the connection between the oscillator coupling capacitor and the oscillator coils or switch. The oscillator coupling capacitor is C1 in Fig. 1 and the point of injection is shown at B.

Checking Oscillator Voltage

One of the best ways of checking quickly whether an oscillator is working is by breaking

the connection from the anode feed resistor (R1 in Fig. 1) to the H.T. line, inserting a milliammeter in circuit, as shown, making a note of the current reading and then purposely making the oscillator inactive. One way to do this is to put a short-circuit across the oscillator tuning capacitor section of the gang or, preferably, to swamp the oscillator tuner circuit by a large value capacitor. This latter method is shown in Fig. 1 by the 0·1μF capacitor Cs. A change in oscillator anode current should be observed; if it is not, then one can be almost certain that the oscillator was not working before the short or swamp was applied.

The oscillator current may fall or rise, depending on the characteristics of the oscillator circuit. The main factor to observe, however, is a change in current, and this should be very marked when a healthy oscillator is temporarily put out of action.

Voltage Method

Another method is to put a voltmeter across the oscillator anode load resistor, R1, as shown. This will avoid having to break the oscillator feed circuit, but the voltmeter should be of the high resistance type to prevent the normal circuit conditions from being appreciably disturbed. When this method is adopted the change in current will be reflected as a change in voltage across the load resistor.

It should be noted that the oscillator voltage rarely remains constant over a waveband as the tuning capacitor is swung from one end of its travel to the other There may also be a difference in voltage between wavebands. In an endeavour to keep the heterodyne voltage reasonably constant, the design engineer may find it necessary to damp the feedback on one band relative to the other bands. This is often achieved by switching a resistor in the oscillator circuit of the band requiring damping, this action being accommodated by a separate switch section on the wavechange switch.

The primary elements of the oscillator circuit given in Fig. 1 are C1 the oscillator grid coupling capacitor; R2 the oscillator grid resistor; R1 the oscillator anode load resistor; C3 the oscillator anode coupling capacitor; C2 the oscillator tuning section of the gang; L3 the L.W. oscillator coil; L4 the M.W. oscillator coil; S3 and S4 (which are ganged to S1 and S2): C4 the L.W. padding capacitor. C5 the M.W. padding capacitor; TC3 the L.W. oscillator trimmer, and TC4 the M.W. oscillator trimmer.

The components most likely to break down and cause oscillator failure are C1, C3 and R1. For weak oscillation, or oscillation which cuts off at certain points on the band. C1 should be checked by substitution, for this may have gone high in value. R1 should also be checked if necessary. Across C3 and the padding capacitors. C4 and C5 an appreciable R.F. voltage exists and this sometimes causes one or more of these components to go intermittent or noisy.

A noisy component in the oscillator circuit will give rise to background crackles which may be weak but progressively build up to quite a loud noise, and may then suddenly go weak again. Should this occur on only one waveband, the associated padding capacitor should be an immediate suspect Poor insulation on the associated oscillator coil is another frequent cause of this symptom. Should the trouble be present on all wavebands, C3, C1 or R1 are likely suspects and each should be checked by substitution in turn.

It should be noted that similar crackling effects sometimes originate in the I.F. amplifier stages owing to a noisy capacitor across one of the I.F. transformer windings. To prove this, the oscillator should be made inactive temporarily as already described, and if the crackling ceases, then the oscillator section is almost certainly to blame.

Frequency Change

If one of the padding capacitors alters in value, not only will the oscillator voltage change from optimum, but the frequency of oscillation will also change. The local programme will no longer tune in at the correct point on the dial. but if the frequency change is not too great, will occur at a point somewhere on the dial, depending upon the extent of capacitance change. For example. if the trouble occurred on, the L.W. band of the receiver in Fig. 1, the fault would either be in L3 or in C4. Coils which contain dust-iron cores in their formers should also be checked to ensure that the cores have not shifted.

The valve itself should not be overlooked, of course. and if there is any doubt a substitution test will prove the matter conclusively. The triode section of the valve in this circuit works as the local oscillator, while the hexode section constitutes the mixer, the valve as a whole being known as a frequency changer. ■

Thermal Tests on Transistor Miniatures

INTERMITTENT performance on transistor portables in the form of increasing distortion with time, cessation of local oscillator and cone warping of speaker, can often be due to heat action. This accounts for trouble on a hot beach. and fade-outs in the hot dash pockets of motor vehicles. The thermal lag between exposure to heat and the slow heating of the components can cause the radio to work in the car, but to remain dead for an hour or so after the removal from the hot surroundings. This is due to a period of time elapsing while the circuit cools down again—although the case exterior seems cool enough. Tests made in normal air temperatures fail to show the fault condition.

To avoid the favourite dodge of using a hot hair dryer (450W), it has been found that gentle heat radiated from the bench lamp (75W) on an exposed printed circuit of a transistor portable, the lamp being placed within 3-6in. of the open back of the radio, brings on the fault after a short period without the risk of overheating.

ABOUT LOUDSPEAKERS

CURING ELECTRICAL AND MECHANICAL FAULTS

By P. J. Good

Loudspeaker faults can be divided into two primary classes, mechanical and electrical. An electrical fault usually causes either complete failure or intermittent operation, while a mechanical fault can produce a diversity of symptoms. Some of which may not immediately be associated with the loudspeaker, but may be put down to distortion in the A.F. stages of the receiver.

Electrical Faults

Electrical faults are few, as a modern loudspeaker simply comprises a coil of wire, called the speech coil, which is arranged to move in a magnetic field. The output transformer is sometimes included on the loudspeaker chassis, and for this reason the transformer will be considered as part of the loudspeaker in this article. It should be noted, however, that the output transformer may not, in fact, be on the loudspeaker itself, but on the chassis of the receiver.

The transformer serves to match the impedance of the speech coil to the output valve, and thus has two windings; a low resistance winding which is connected across the loudspeaker's speech coil, and a high resistance winding which is connected to the anode circuit of the output valve. The transformer has a step-down ratio from the output valve to the speech coil, and this ratio is computed in relation to the impedances of the anode circuit and the speech coil.

In Fig. 1 is given the basic loudspeaker circuit, and it is fairly obvious that there are four main possibilities of failure. These are a break in the speech coil winding, a break on one of the windings of the transformer, a disconnected or broken wire in the loudspeaker circuit and, possibly less obvious, shorting turns in the output transformer.

Complete Failure

The first hint that the loudspeaker may be responsible for the failure of a receiver is complete absence of the residual mains hum which is normally detected on any receiver by holding an ear close to the loudspeaker. In this event, the speaker should be unplugged from the transformer and the speech coil connected across a 1·5V battery in series with a resistor of about 100Ω. The resulting 15mA of current in the speech coil should produce quite loud clicks and crackles as the battery connection is scraped (see Fig. 2). If this happens, then the speaker can safely be said to be electrically sound. The resistor is included to limit the current, for without it, a relatively high current can flow in low resistance speech coils and damage the winding on low-power units.

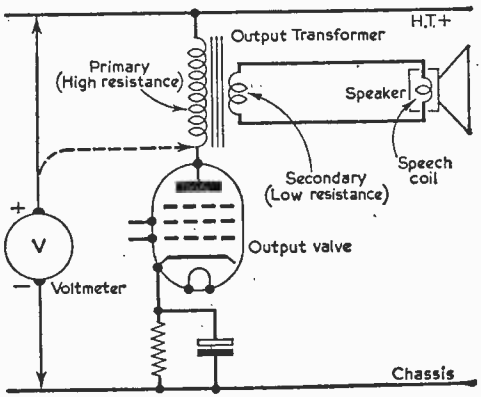


Fig. 1.—A typical output stage of a receiver, showing the loudspeaker circuit.

If the speaker remains dead, then there is a break somewhere in the speech coil circuit. Very flexible wire is used to connect the speaker terminals to the speech coil and a break sometimes occurs at one of the terminations, which can usually be mended by skilful soldering. If these wires are in order, a check should be made of the soldered connections or small wire tags in the centre of the cone which anchor the ends of the speech coil. Although these wires are held by cement, they can be traced to the soldered blobs with a pin or pointed tweezers. If the break is located, the wire should be freed from the cement, cleaned of enamel, resoldered and finally re-cemented in position to avoid vibration. If there is no break at these points, the trouble lies in the

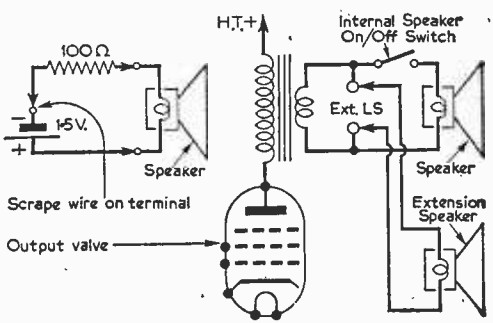


Fig. 2 (left).—A method of checking loudspeakers.

Fig. 3 (right).—Here, an extension speaker is used and an on/off switch is incorporated in the circuit.

speech coil winding and, apart from replacing the cone and speech coil assembly complete, there is little that can usually be done.

If the test given in Fig. 2 produced crackles, the wires connecting the loudspeaker unit to the secondary of the output transformer should be checked for continuity. On some sets a switch is incorporated in the speech coil circuit to switch on and off the internal speaker if an extension speaker is connected, as shown in Fig. 3. The switch may simply be a plug and socket arrangement or something more elaborate, but in either case it should be checked for continuity.

Output Transformer Test

There are two methods of checking the output transformer complete with speaker. One is to connect a voltmeter between the anode of the output valve and the chassis of the set, after first checking that H.T. voltage is in fact present on the H.T. line, as shown in Fig. 1. If the primary of the transformer is in order, a voltage slightly lower than the H.T. line voltage will be registered at the anode of the valve (assuming that the anode circuit is taking current). If the speaker circuit is normal, slight crackles should be heard from the

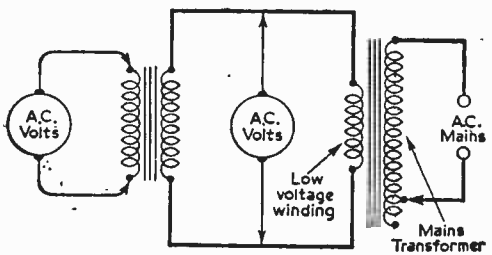


Fig. 4.—A method of determining the turns ratio of an output transformer.

loudspeaker as the voltmeter test probe is scraped on the anode tag. An alternative method is to disconnect the primary of the transformer from the valve anode and H.T. line and connect the winding across a 1·5V battery. If all is in order, crackles should again be heard from the loudspeaker as the battery connection is scraped.

Transformer Turns Ratio

The turns ratio of the output transformer is governed by the "optimum load" of the output valve and the impedance of the speech coil, both in ohms. Optimum load values are given in valve data booklets and the speech coil impedance is sometimes marked on the loudspeaker chassis. It should be noted that the impedance is generally taken at 1,000c/s, and is, therefore, slightly higher numerically than the D.C. resistance of the speech coil. As a rough guide, the impedance is a little over twice the D.C. resistance value.

The turns ratio is equal to the square root of the optimum load divided by the speech coil impedance which, put in mathematical terms is:—

$$Tr = \sqrt{(Lo/Zs)}.$$

where Tr is the turns ratio, Lo the optimum load and Zs the speech coil impedance. The expression may be altered to find Lo or Zs.

For example,

$$Lo = Tr^2 \times Zs,$$

and

$$Zs = Lo/Tr^2.$$

Thus, given any two factors, the third or unknown can always be found.

If, for instance, the optimum load were 2,000Ω and the speech coil impedance 5Ω, then 5 divided by 2,000 is 400, and the square-root of 400 is 20. The required transformer in that case would have a turns ratio of 20 : 1, which is a fairly common value.

The same reasoning applies to any loudspeaker matching problem. Some transformers have tapped primaries or secondaries or both to enable the best match to be obtained from any optimum load to any speech coil impedance. Tapped transformers of a similar nature are also available to match a low impedance loudspeaker into a low impedance source. For example, a matching transformer would be required to match, say, a 15Ω loudspeaker to a 3Ω extension loudspeaker socket on a radio or radiogram, or vice versa.

Checking the Turns Ratio

An approximate idea of the turns ratio of an output transformer can be obtained by applying low voltage A.C. across the secondary winding (low resistance winding) and measuring the voltage appearing across the primary winding, as shown in Fig. 4. About 2V A.C. should be used, and this can be obtained from a step-down mains transformer. It should be measured as accurately as possible on an A.C. voltmeter, as also should the voltage across the primary winding. The ratio of the two voltages is approximately equal to the turns ratio of the transformer. For example, if 2V were applied and 60V appeared across the primary winding, then the turns ratio would be 60 : 2, or 30 : 1.

Shorting Turns

An output transformer with shorting turns may not cause total failure of the set or amplifier, but will most certainly cause low volume and distortion, with loss of bass frequencies. By using the set-up shown in Fig. 4, shorting turns will give an obviously low output voltage and the transformer will quickly heat up.

Mechanical Faults

Mechanical faults rarely cause total failure of the set, but they produce noises, such as buzzes, rattles and distorted reproduction. A distinct buzz may be caused by the speech coil being out of centre and touching the magnet pole pieces, or by a damaged or broken centring device, a split or tear in the cone, loose turns of wire on the speech coil, loose mounting bolts, holding the loudspeaker in the cabinet, vibrating connecting leads, etc.

Such faults can usually be located by operating the set with the loudspeaker in its normal position and touching the various parts of the loudspeaker in an endeavour to pin-point the source of the noise. If the speech coil is out of centre, lightly pressing a finger at a certain point on the cone will often either clear the effect or, at least modify it.

Eventually, it will be necessary to remove the loudspeaker from the cabinet in order to effect a

(Continued on page 502)

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by Armstrong

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(Illustrated)

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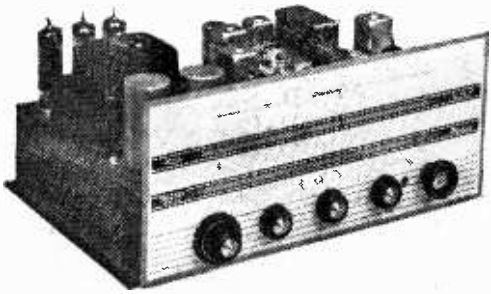

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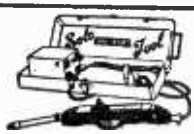

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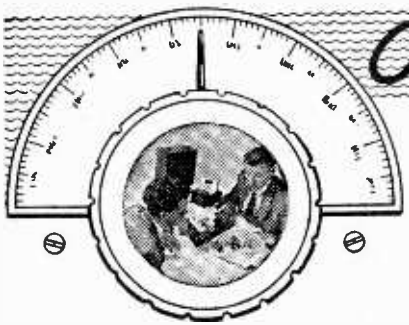


On Your Wavelength

BY THERMION

Transistorised Organ

IN the August issue I commented on the apparent absence of a commercial transistorised organ, and I must thank the many readers who sent me letters and details of one such instrument which is on sale in South Africa. Mr. Marks of Johannesburg sent me a brochure of this very interesting instrument which, he tells me, is completely transistorised and delivers an output in the region of 25W. According to the literature this is a most fascinating instrument and shows that the transistor can be used to give results probably better than the valve. Of course, there is also the point that the overall weight becomes so very much less. Apart from the interesting circuitry, the case for this instrument has the back enclosed with timber so that it can be pushed out into the middle of a room, if desired (the back is actually hand-rubbed satin finish), and this prevents any tampering with the essential adjustments. In addition to the normal organ features, this instrument includes chimes, built-in reverberation which is adjustable, and percussion. It appears to be a very noteworthy development of the application of the transistor and I hope to have an opportunity of hearing one some time. Incidentally, it is apparently manufactured in S. Africa under licence from an American company.

Constructor Difficulties

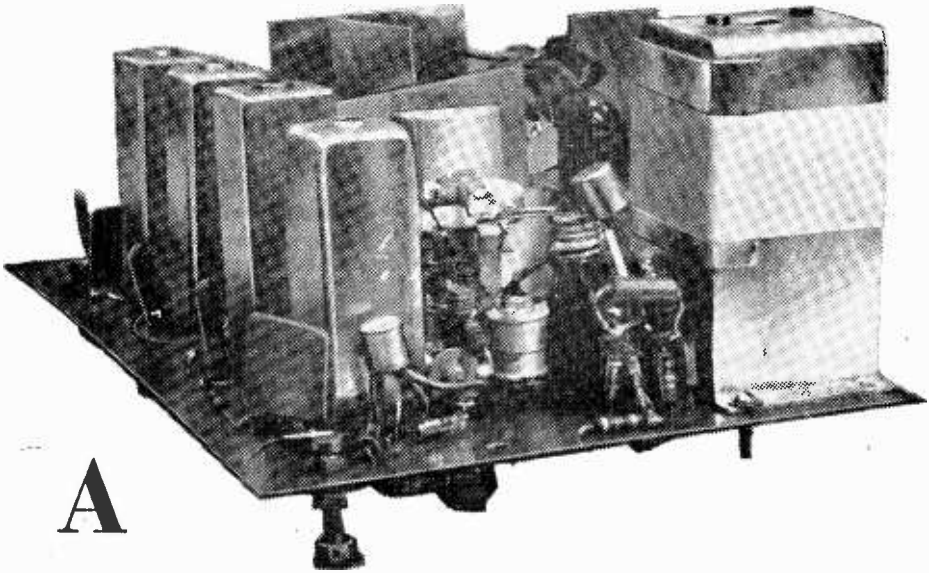
I know that the constructor often experiences difficulties and disappointment in his hobby, but I recently heard from a reader who has, apparently, met all the troubles in the world. He contends that the amateur cannot possibly build a satisfactory transistor superhet unless he has the most expensive test gear. He says that he has spent over £200 during the past two years and has built thirty-four of these sets, not one of which has worked satisfactorily—if at all. He also says that many of his workmates experience similar difficulties, but I do feel that this is a very exceptional case. It is true that a superhet, even of the valve type, needs some care in aligning and it is always an advantage to have a signal generator. But I do know of many amateurs, even those who have never built a set before, who have attempted these modern pocket type receivers, and have been most successful. Perhaps the new Beginner's series which begins in this issue will offer some assistance to any others who find difficulty in building transistor sets.

A Recording Problem

I have not yet got round to owning one of the modern tape recorders—mainly because I feel that I have no need for one. I have a very good record reproducing installation and this fills all my requirements so far as "mechanical" music is concerned. But I recently heard of a recording problem which seems to be rather mysterious, and perhaps one of my readers may be able to offer a suitable suggestion as to the cause and, perhaps the cure. An enthusiast had a recorder of well-known make and one day purchased a used spool of tape, but successfully made a recording of his own over the existing recording. When played back this was perfectly satisfactory (it included many of his own remarks and he was able to recognise his voice perfectly). The record was put away with others, but next time he played it, his voice had dropped several tones. The speed was correct but his voice was definitely much lower, although the speed was correct, and he wonders whether the molecular structure of the tape deposit could have altered in some way to produce this variation in reproduction. If so, of course, then tape will require special care if it is saved, as it may give a false impression when played at a later date. I suggest that there must have been some magnetic material near the tape where it was stored, and that he was lucky that the recording was not completely erased. Has anyone any other opinions?

Revenge!

I recently commented on the increasing outdoor use of transistor portables and, apart from many letters agreeing with my dislike of this form of abuse, and the many boroughs and districts which have so far enforced a ban on their use, one reader has suggested a neat form of counter-attack. I am afraid the Post Office would not look kindly on his suggestion, but I feel that this is something which needs thinking about. He suggests the use of a low power R.F. oscillator, switched on when the offending receiver is audible. If the oscillator were tuned to the same frequency, the R.F. would tend to swamp the AVC and reduce the output. Failing that, modulation of the R.F. at 1kc/s would effectively jam the receiver. Two transistors would do the job, tuned over the medium waveband or operating at 465kc/s ± 10kc/s to cause I.F. break-through. The range required, the reader says, would be about 20ft. He adds, in rather a sarcastic vein, "Keep clear of G.P.O. detector vans." I would be interested to know whether such a device would be contrary to the Post Office regulations, and if not, what steps could be taken by anyone with an offending portable who might be annoyed at the "interference"?



A Transistorised VHF Superhet

HEAT SINKS, I.F. TRANSFORMERS AND COILS

By D. R. Bowman

(Continued from page 397 of the September issue)

MENTION was made last month of the very thorough decoupling which was found to be necessary in the audio section of the receiver. However, layout is not at all critical and no difficulty should be experienced with instability.

Negative Feedback

With the transformers specified, leakage inductance is low enough for quite a large amount of negative feedback to be applied if desired. Here however, a moderate amount only is used, approximately 6dB.

Overall Gain

Moderate amounts of gain per stage have been designed for, in the interests of stability, except in the R.F. stage where the maximum feasible has been required. The R.F. stage gives about 15dB, the frequency changer 10dB, the I.F. stages 25dB each, and the audio amplifier about 70dB. The total is thus 170dB, from which has to be deducted approximately 8dB per stage (as far as the detector) as transformer insertion loss, and about 20dB for loss in the detector stage. This, with 6dB negative feedback in the audio section, gives a total of approximately 112dB overall gain.

Power Supplies

A 9V supply is required. The DT9 is a convenient battery, and will last a reasonable time—about a month or six weeks if the receiver is used

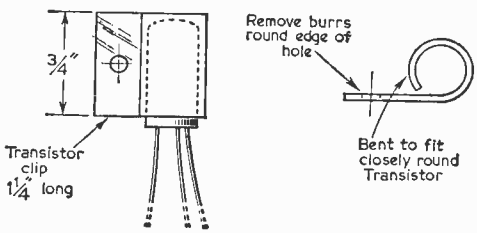


Fig. 2.—The construction of the clips for the output transistors—these clips are used to fasten the transistors to their heat sinks (which are described in the text).

COIL WINDING DATA

All formers are bakelite 0·27in. diameter Screening cans required for transformers T2, T3, T4 and T5 are $\frac{17}{32}$in. x $\frac{17}{32}$in. x 2$\frac{3}{8}$in. All dust cores are VHF (purple-coded) type

L1 *3¾ turns 18s.w.g. bare, spaced 0·3in. outside length. Unscreened; one core required*

T1 *Primary—6 turns 18s.w.g. bare, spaced 0·6in. outside length*
Secondary—1½ turns PVC-covered connecting wire interleaved each side of last (H.T.) end of primary; one core is required

All the following coils are wound in the same direction. The primary and secondary would thus form a winding of continuous direction but for the interruption at the "middle"

T2 *Primary—28 turns 28s.w.g. enamelled, close-wound*
Secondary—12 turns 24s.w.g. enamelled, close-wound
Spacing: ¼in. between winding ends
(Note: The secondary is tapped 3 turns from the earth end of the winding; this tapping is the base connection to V3.)
Two cores are required

T3, T4 *Primary—12 turns 24s.w.g. enamelled, close-wound, tapped 3 turns from "inner" end*
Secondary—12 turns 24s.w.g. enamelled, close-wound, tapped 9 turns from "inner" end of winding
Spacing 0·4in. between ends of winding
Two cores are required for each transformer

T5 *Primary—28 turns 28s.w.g. enamelled, close-wound, tapped 7 turns from "outer" end*
Secondary—8+8 turns 24s.w.g., close-wound, bifilar; Spacing 0·3in. between ends of winding
Tertiary—9½ turns 28s.w.g. enamelled, close-wound, wound over 10 turns of primary nearest the tap. 1 turn Sellotape as insulation
Three cores are required

for about 4 hours daily. The receiver gives good output even when the battery voltage has dropped to 6, and continues to provide a useful signal, at much reduced output quality, down to a battery voltage of 4. The oscillator section continues to operate down to 2·6V with the particular transistor used, though, of course, overall receiver gain at this voltage is negligible.

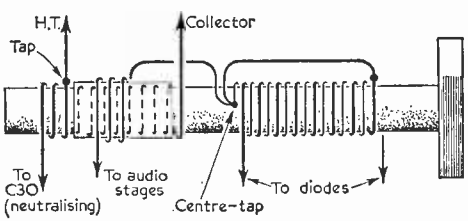


Fig. 3.—The discriminator transformer windings (T5 in the circuit). The method of winding the bifilar secondary has been shown by using thick and thin lines to represent the two halves, but, of course, the same gauge of wire is used for both.

Heat Sinks

Before fixing, the driver and output transistor heat sinks should be prepared as follows. Three pieces of sheet aluminium, 16s.w.g., measuring 3in. x 2½in. are sawn out of a flat sheet. Snipping with tin-snips causes curvatures which must be avoided. A ¼in. flange is turned over on one short side. Then a flat is filed, very lightly, on the middle of the sheet. It is most important to see that this flat is really accurate. A ⅛in. hole is now drilled in the flat portion and burrs carefully removed. Three pieces of 22s.w.g. aluminium, ¾in. x 1½in. are sawn out of a flat sheet and bent round over the shank of a $\frac{5}{32}$in. drill. The final curvature has to be $\frac{3}{16}$in. to accommodate the OC81 transistors, and the natural springiness of soft aluminium sheet, with a very little force, will enable the transistors to be inserted firmly and closed into these cooling clips. Fig. 2 shows the arrangement. The assembly should be inspected against a strong light to ensure that no gaps occur between the transistors and the cooling clip. If small gaps appear, silicone grease—a smear only—may be used to assist dissipation of heat, but gaps should be avoided even if it means making six clips to get three good ones. Before assembly, the tuning condenser should be inspected. If the bearings carry an appreciable amount of grease it should be wiped away, and if at all slack the bearings should be tightened up. This precaution is mentioned here because in the prototype receiver some considerable trouble was found in obtaining electrical contact of the required effectiveness; the capacitor tuned very noisily through stations. This instability was removed partly by tightening up, partly by soldering to a side pillar of the capacitor an additional phosphor-bronze leaf-spring contact which was arranged to press heavily on the spindle

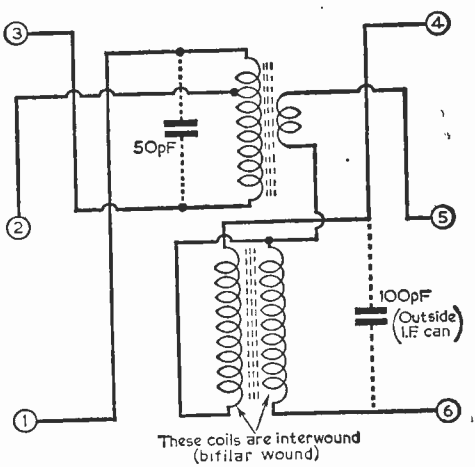


Fig. 4.—The connections of the windings of the discriminator transformer—the numbers refer to the coil base connections given in Fig. 6 overleaf.

between R.F. and F.C. sections. This spring was connected to chassis through a short length of copper braid. The capacitor had seen previous service, and it is not expected that a new component would cause trouble.

The R.F. and F.C. Stages (see table, page 493)

The coils for R.F. collector and oscillator are wound on 0·3in. bakelite formers, and the direction of winding is immaterial. The wire is 18s.w.g. bare and, preferably silver-plated, for the collector and oscillator coils; these coils are first wound on a ¼in. drill shank and then slipped, with some force, on to the former. The F.C. emitter winding, of 22s.w.g. copper wire, in thin sleeving (or PVC-covered connecting wire) is added between the "earthy" turns of the R.F. collector winding. The spacing is adjusted to the specified value, and then the whole windings are covered with contact adhesive (clear) and allowed to dry thoroughly. The properties of this adhesive have not been measured but appear to be not markedly inferior to polystyrene cement, and the job is much more reliable than when polystyrene cement is used with thick wire.

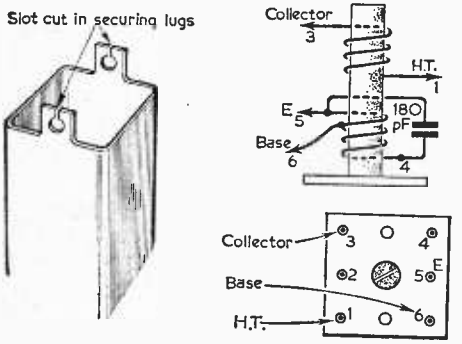


Fig. 5.—The mounting lugs of the transformers are cut as shown to enable them to be passed over the fixing bolts (see text).

Fig. 6.—The I.F. transformer windings and the numbering of the base connections.

The I.F. and Discriminator Transformers (see Figs. 3, 4, 5, 6 and 7).

The I.F. transformers could be constructed in the normal way, and for mounting, the lugs of the can slipped through slots in the printed circuit board ready for bolting down. However, cutting neat slots in the laminated board is not a simple matter, and in the prototype the following method of canning the I.F. transformers was adopted.

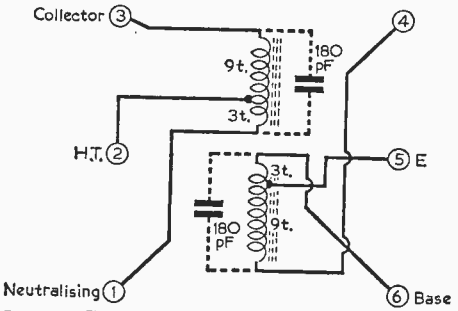


Fig. 7.—The connections of the I.F. transformer windings.

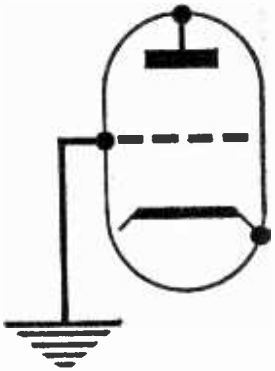
When the transformers have been wound, all cement is thoroughly dry and all exposed metallic surfaces are covered with Sellotape, the ¼in. 6B.A. bolts are screwed through the fixing holes from the "inside" and are tightened up. The can is then slipped over the assembly. The lugs are then snipped through so that, on bending over, the halves can be worked round the 6B.A. bolts and flattened against the underside of the bakelite former. A brass washer is placed over the bent-over lugs and then a brass nut is screwed down firmly. Nearly ¼in. of bolt will stand proud for insertion through holes in the laminated board, and when these in turn are screwed down, with washer and nut, against the copper surface of the printed circuit board a good electrical earth to the can is achieved.

(To be continued)

LIST OF COMPONENTS

Capacitors and resistors are as shown in the circuit diagram.
All resistors are of ¼W rating and of 10 per cent tolerance, except as shown below:
R38 5 per cent
R37 5 per cent
R39 3 x 10Ω 10 per cent, in parallel
Volume control: 10k with D.P.D.T. switch, log or semi-log
Capacitors: All 180pF capacitors are 5 per cent silver-mica types
C5, C10 are type N750K (Erie)
Capacitors C2, C3, C4, C8, C11, C14, C15, C19, C20, C21, C23, C25, C28, C29, C31, C40 are of the ceramic miniature type (Erie)
CC1 and CC2 are 10pF±10 per cent silver-mica
C37, C39, C43 are 8μF electrolytic 6VW sub-miniature types
C38, C45 are Plessey type CE 7037
C42 is Plessey type CE205
C46 is 0·25μF tubular (TCC)
C41, C44 are TCC type CE100DE
The tuning capacitor is Jackson Bros. type C808 (catalogue number 5103)
Transformers (Gilson):
Driver transformer: type WO.1806
Output transformer: type WO.929/6v (3Ω)
Speaker: 7in. x 4in. elliptical, 3Ω
Battery: DT9 or equivalent

An Earthed Grid R.F. Amplifier



By E. A. Parker

ATMOSPHERICS and other interference generated outside the receiver limit its useful sensitivity on the communications bands below about 20Mc/s, but at higher frequencies they are much less intense and interference (except that generated by motor car ignition systems, of course) is virtually non-existent. At these high frequencies, then, receiver noise is very important, and the noise level of the receiver and the associated aerial will set the level below which signals will be inaudible. Since noise generated in the earlier stages of a receiver will undergo far more amplification than that generated in the later stages, any effort made to reduce receiver noise must be concentrated on the first R.F. stage, and to a progressively lesser degree on any subsequent R.F. or frequency changing stages.

In the case of an average communications receiver using one R.F. stage, the addition of a low noise pre-amplifier will give a most marked improvement in the signal-to-noise ratio. The existing R.F. stage has now been moved one stage away from the aerial, and the noise which it generates receives less amplification than before for a given signal output at the speaker or 'phones. The writer modified his R208 receiver in this way, using the grounded grid triode unit to be described. It was also found that the replacements of the original octal based R.F. valve — an EF39 — with an EF50 or the more recent EF91 or EF80 miniature valves again improved the performance of the set. Octal-based valves are unsuitable for use above 40-50Mc/s owing to their inherent noise and the fact that their gain tends to fall off fairly rapidly above this frequency range.

Valves

Triode valves are much less noisy than pentodes or tetrodes, but they cannot be used in normal amplifying circuits at radio frequencies owing to their high anode-grid capacitance, which permits positive feedback at R.F. and so causes instability and oscillation. In the early days of wireless, this problem was overcome by introducing a further electrode—a grid was placed between the control grid and anode and maintained at earth potential with respect to the R.F. signal. This shielded the input to the valve from the output and prevented positive feedback. Thus was born the tetrode valve, but, the extra electrode increased the inherent noise of the valve. However, methods were found where by the triode could be used as an amplifier at R.F. The most important of these was to earth the grid and apply the R.F. signal between cathode and earth. The amplified signal was in effect taken from anode and earth, as indicated in Fig. 1.

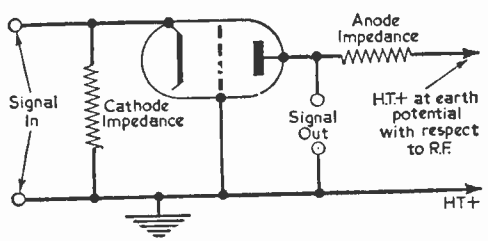


Fig. 1.—The effective circuit of an earthed grid triode.

The cathode impedance should have a value of about 150Ω at D.C. and the voltage drop across it provides bias for the valve. At R.F., the cathode impedance is conveniently provided by an R.F. choke, and a glance at Fig. 2 will indicate that in the actual unit, a choke and resistor are used in series. The anode impedance may be an R.F. choke or a tuned circuit.

Screening

The earthed grid mode of operation thus provides shielding of output from input in the form of an earthed grid, and the arrangement functions well with remarkably high signal-to-noise ratio. Valves designed for earthed grid operation differ from normal triodes in that care is taken to ensure that the grid extends along the whole length of the cathode, thereby totally screening it from the anode. Examples of such valves are types CV66, EC91 and 6C4. Any of these valves will work well in the circuit of Fig. 2—the circuit used by the writer. To lessen the effects of lead inductance, the grid is brought out to four pins each of which is then separately earthed; the anode is brought out to two pins for the same reason. (The inductance of inductors in parallel is less than the smallest.)

Yet another advantage of the addition of this unit was the fact that the aerial damping was removed from the first tuned circuit of the receiver, enabling the associated trimmers to be peaked sharply. This in itself resulted in an increase in gain. In addition, the input impedance of the circuit was low and matching the aerial to the receiver no longer presented any problems. Matching was far from critical. It will be noted that the circuit is aperiodic—untuned or non-

resonant—which has the advantage that no extra gang is demanded on the main tuning capacitor.

Constructional Details

Turn again to Fig. 2; the radio frequency choke in the aerial circuit is best made by winding in one layer a length of fine wire [about 40s.w.g.] (equal in length to one third of the wavelength of the lowest frequency to be received) on to a glass or ceramic former, so that the length of the solenoid is about twice its diameter. However, the writer had several radio frequency chokes of miscellaneous design in his junk box, and these

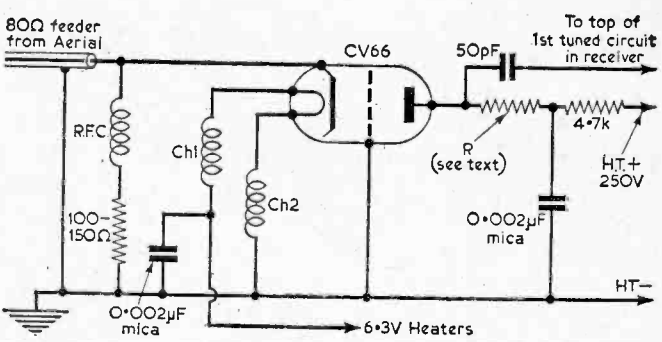


Fig. 2.—The circuit diagram of the unit.

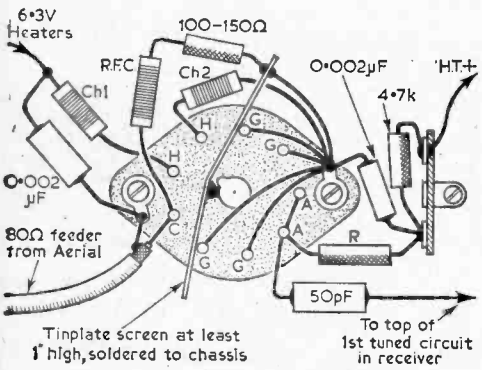


Fig. 3.—The layout of the R.F. preamplifier.

were found to function equally as well as that specified above. The value of the resistor in series with this choke should be adjusted so that the D.C. resistance of the combination is 150Ω approximately — the value required will be found to lie between 100 and 150Ω. The chokes in the heater leads are not very critical and it was found that 40 turns of 26s.w.g. wire on a ½in. diameter paxolin former was all that was required for satisfactory operation between 10 and 60Mc/s. It has been found that this circuit will function readily at all frequencies up to 400Mc/s; and the inductance and consequently the number of turns required on the choke decreases with increasing frequency. At frequencies above 100Mc/s, however, ceramic or glass formers are essential. The chokes and capacitor in the heater circuit form a filter which eliminates mains-borne noise, and the chokes tend to isolate the heater and cathode from earth at radio frequencies. (The heater-cathode capacitance may be great enough to bypass to earth the signal applied to the cathode in the absence of the chokes.)

Anode Load

A point of interest is that the anode impedance (R) was derived from a 3W wire-wound resistor of D.C. resistance 4·7k—the D.C. resistance of R limited the anode voltage of the triode to within safe bounds, and the inductance of the component presented an additional impedance to R.F. signals which increased with frequency. This tended to offset the effects of stray capacitance elsewhere in the receiver, and sensitivity at all frequencies was much greater than expected.

Fig. 3 indicates the arrangement of components used by the writer. The unit was built on a subchassis made from aluminium and measuring 2in. x 3½in. x 1½in. Although the layout was not found to be very critical (a welcome point at high frequencies), all leads should be kept as short as possible. Most components can be wired directly to the valveholder. The chassis should first be drilled to take the valveholder (ceramic)— a 1¼in. hole if a CV66 type valve is used (B9G base)—which should then be bolted in position. The tinplate screen should be soldered firmly to the valveholder as shown in Fig. 3, and the various components may then be mounted. "Tin" boxes provide a convenient source of tinplate—which is very easily soldered. Any paint should be removed for appearance's sake.

When the unit has been completed it should preferably be bolted securely inside the communications receiver as near as possible to the first tuned circuit. In many receivers it will be possible to mount it so that the anode pin of the earthed grid triode lies fairly close to the top of the first gang on the main tuning capacitor. The output lead may then be kept very short.

The unit consumes very little power, and may be run without trouble from the existing power supplies of most communications receivers. ■

COMPONENTS LIST

Earthed grid triode valve, e.g. CV66 or EC91
Ceramic valveholder to suit
Resistors (see text)
100-150Ω ½W; 4·7k, 3W w.w.; 4·7k, ½W
Capacitors
50pF, two 0·002μF, mica.
Single layer R.F. choke, or 40s.w.g. wire to wind and former
Two heater chokes, 26s.w.g. wire to wind and formers

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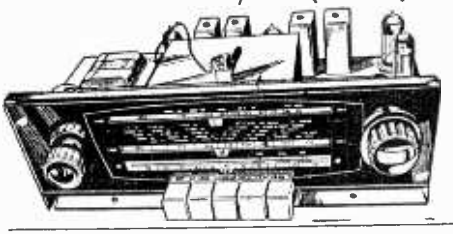

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Covers 1,000—1,900 M.; 200-300 M.; 88-98 Mc/s.
Valves EZ80 rect., ECH81, EF89, EABC80, EL84, ECC85.
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B-20—10K ohms/v. on 0.5 v. and 2.5 v.; 4K ohms/v. on 10, 50, 250 500 and 1000 v. A.C. and D.C. Resistance, 2K, 200K, 2 M and 20M ohms; D.C. current, 100 microA. 2.5 mA, 25 mA, 250 mA. Size: 5½ x 3½ x 2¼in. Weight 24 oz.

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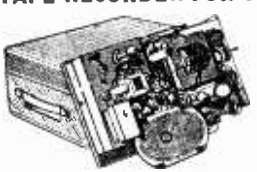

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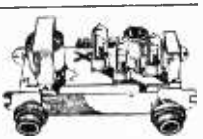

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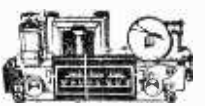

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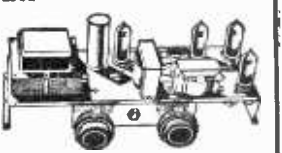

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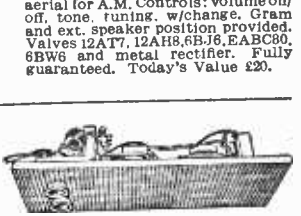

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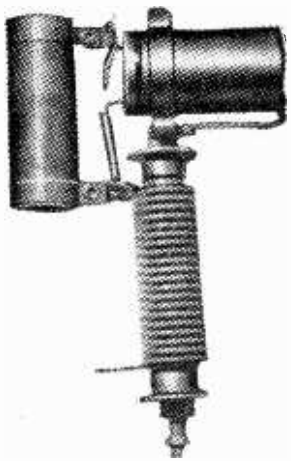
See additional advert, page 532.

A Compact Power Supply

By J. C. Flind

A PROBLEM which frequently confronts the constructor is the provision of power supplies to equipment which has been built up on a chassis which "happened to be handy"—all too often, after a series of modifications and improvements there is insufficient space left for the rectifier and associated smoothing components. The rather neat assembly described here was evolved to meet just such an emergency which arose when a battery receiver had to be converted to mains operation, and the idea is offered in the hope that it will help other constructors who may come up against the same difficulty.



Above—The completed unit.

Layout

The unit requires only a single ⅛in. hole for fixing to the chassis, and the space taken up at chassis level is no more than the diameter of the metal rectifier—say one square inch at the most. The smoothing components are carried some inches above the chassis where there is usually some spare space and where risks of overheating are reduced.

The diagrams are almost self-explanatory; the main feature of the design is the familiar Westinghouse-type air-cooled metal rectifier, obtainable from surplus dealers for a few shillings. The screwed rod which forms the "backbone" of the rectifier is used to carry a Terry spring tool-clip, which in turn holds a metal-cased twin electrolytic smoothing condenser of suitable capacity and rating; the case of the condenser, forming the negative pole, is effectively earthed through the metal rod, the other end of which is passed through the fixing hole in the chassis and secured by a nut. (In the illustration at the top of the page the capacitor employed had a polythene covering—hence the earthing wire which is visible, running to a solder-tag just under the Terry clip.)

Construction

Soldered to the red or positive terminal of the rectifier is a suitable dropper resistor, chosen according to the current demands of the equipment; a useful value for general purposes is a wire-wound 2,000Ω 10W resistor, with a ceramic former and having substantial lugs. One of the "positive" wire leads from the condenser is also connected to this terminal of the rectifier, and the other end of the resistor goes to the second positive tag of the condenser, the thick wire lead giving adequate mechanical strength. This is point B (see Fig. 2), the output lead, and the unit is now ready to be connected up.

The simple circuit is shown in Fig. 1. A small eliminator-type transformer, having a single H.T. winding, is employed, thus isolating the chassis from mains and increasing safety.

This power pack can be made up in a few minutes, usually from odd components which can be found in the spares-box, and one or two kept ready-built will be found invaluable when power supplies are wanted in a hurry during experiments. ■

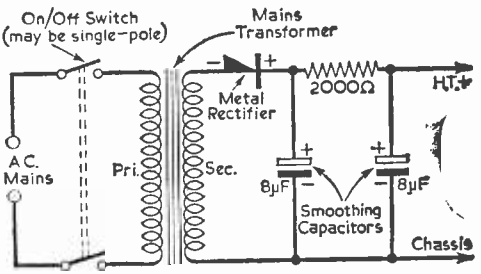
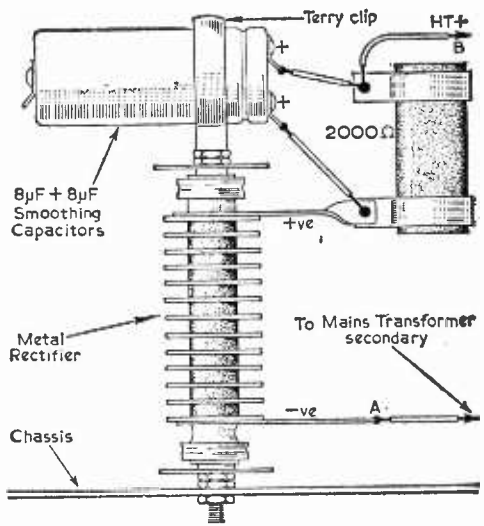


Fig. 1 (above).—The simple circuit of the unit.

Fig. 2 (below).—The straightforward construction of the power pack.



CALCULATING π-NETWORKS

DETERMINING COMPONENT VALUES FOR THESE COUPLING CIRCUITS

By G3OGR

THE common use of a π-network is to couple a transmitter to the line feeding the aerial. In these circumstances, the network is nearly always required to provide an impedance transformation from a fairly high impedance to a much lower impedance. When it cannot do this satisfactorily, various difficulties in tuning and loading arise and it is hoped that means of arriving at suitable values may be useful, together with ways of overcoming the troubles which can arise when values are not suitable.

With circuits of reliable design, difficulties of this nature may not be encountered, unless an attempt is made to operate outside the conditions originally intended (e.g., with a very high impedance aerial). But, with converted or home-built equipment, or the pressing into service of unsuitable components which may be to hand, trouble may be experienced.

A typical π-network is shown in Fig. 1. The amplifier will probably be working Class C, which means it is provided with bias beyond cut-off, and anode current flows for only about 120° to 150° of the excitation. In these circumstances, the anode voltage can be expected to reach about twice the H.T. voltage. If a 600V supply were used, the isolating condenser should thus be rated at 1200V or higher. A 2kVW or 3kVW condenser would serve. If anode modulation drives the anode voltage from zero to 1200V, the isolating condenser should be for at least twice this figure—2400V. A 4kVW or 5kVW condenser would probably be used. As the capacity is not large, a component of adequate rating can easily be fitted. The choke is usually 1mH or larger, and needs to withstand the R.F. voltage developed. A receiver type choke is only suitable for low power.

The π-network consists of C1, L1 and C2. For a low output impedance, C2 is large. The anode or plate load R1 for the Class C amplifier can be found by dividing the plate resistance by 2. The plate resistance can be taken as E/I. If the valve is loaded to 100mA at 600V, this is 600/0·1 = 6,000Ω. One half of this is 3,000Ω.

It would be usual to employ a minimum Q of about 12, for such purposes. The capacitive reactance Xc of C1 is given by:

$$Xc = \frac{\text{Plate load}}{Q} = 250\Omega.$$

Assume the circuit is to be used for 3·6Mc/s. The capacitor reactance $Xc = 1/2\pi fC$. From the above, Q may be expressed as R1/Xc. The coil reactance may be expressed by:

$$\frac{Q.R1 + (R1.R2/Xc2}{Q^2 + 1}$$

Approximate values are suitable, because both C1 and C2 will be variable, for tuning and load adjustment. This gives approximately 170pF for C1, 12·5μH for L1, and 1,000pF for C2, where R2 is to be about 70Ω.

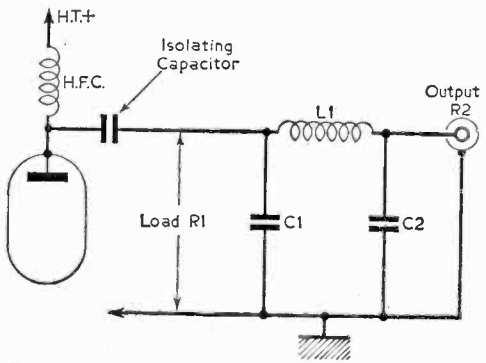
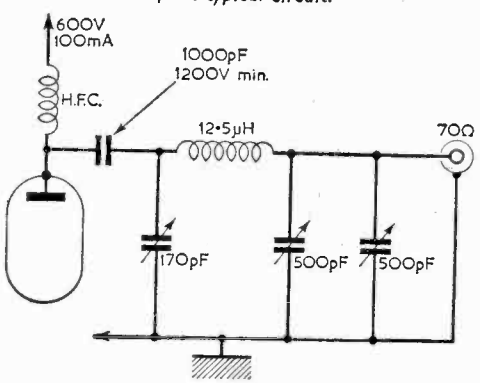


Fig. 1 (above).—A typical π-network output circuit.

Fig. 2 (below).—The values of components determined for a typical circuit.



Practical Circuit

These values are inserted in Fig. 2. A 2-gang 500pF condenser is used for C2, with sections in parallel. If an output impedance higher than about 70Ω is to be matched, C2 has to be reduced in value. This is readily carried out by adjusting it as necessary. If a very high impedance is wanted, it may be found that C1 is too small, or L1 too low, for resonance.

A symptom of this fault is that C1 is nearly closed, while C2 is still at too high a capacity. As

C2 is opened further, C1 has to be closed, and reaches maximum capacity, with loading still insufficient. This indicates that the network was not designed to operate into so high an impedance, on that frequency. If so, one solution is to use an impedance matching circuit in such a way as to allow the π-network to operate into a lower impedance. This is preferable when the π-network is already correctly arranged. But if it has been made on an experimental basis, it may merely indicate that the condenser actually in the C1 position is too small, or the coil inductance is too low.

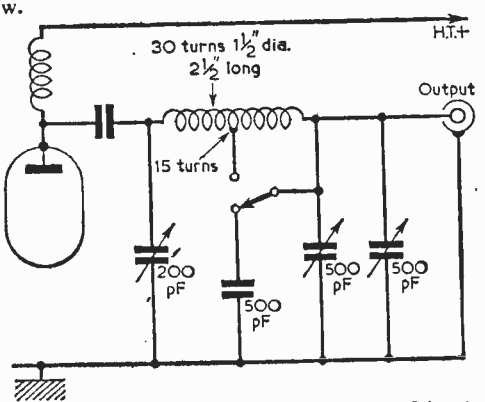


Fig. 3.—A π-network output circuit for 2-band operation.

When obtaining an output of very low impedance, it will be seen that C2 requires to be larger, if C1 and L1 remain unchanged. An indication of this type of fault arises when it is impossible to load up correctly into a low impedance circuit, even with C2 fully closed. The solution is to increase the value of C2 (e.g., employ a 3-gang condenser with all sections in parallel) or wire additional fixed capacity across it.

In Fig. 2, C1 is the approximate total capacity. The valve capacity, etc., will be in parallel with this, but can be neglected in the example given, because C1 is variable, and can be opened slightly to secure resonance.

Coil Windings

When an approximately suitable inductance has been found, a satisfactory number of turns may be calculated, so that the network coil L1 can be wound. A formula suitable for this purpose is:

$$N = \frac{5L}{na^2}\left\{1+\sqrt{\left[1+\frac{0{\cdot}36n^2a^3}{L}\right]}\right\}$$

where "a" is the radius of coil in inches, "n" is the number of turns per inch, "L" is the required inductance in μH, and the result (N) is the number of turns. A typical coil could thus have 30 turns on a 1¼in. diameter former 2½in. long, for the 3·5Mc/s to 3·8Mc/s band.

It will be apparent that other values of C1 and L1 could give resonance, but that these values would not also provide the correct impedance match or Q. The fact that C1 and C2 are adjustable allows the network to perform effectively over the band required.

For 2-band operation, it is usual to tap a coil, so that a lower inductance is available for one band. This can be arranged by fitting a switch. If additional capacity is required to obtain a sufficiently low impedance output on the lower frequency band, a 2-way switch may be used to introduce this as well, as in Fig. 3.

The 170pF condenser used for C1 can readily be adjusted to the value shown in Fig. 2. For 7Mc/s, all values will be approximately one half those given for 3·6Mc/s. Resonance will thus be obtained with C1 at approximately 100pF (including circuit capacity) and C2 at 500pF. For lower

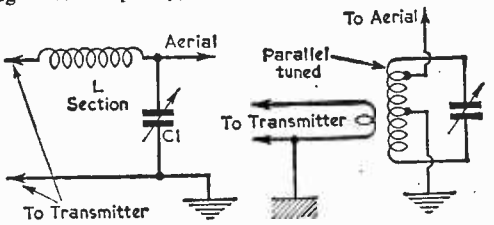


Fig. 4.—Two methods of impedance matching.

impedance transformation (e.g., higher impedance output) C1 will be increased, and C2 reduced. For higher impedance transformation (e.g., lower impedance output) C1 will be reduced in value, and C2 increased. It will thus be possible to load into low-impedance circuits with the 2x500pF capacity at C2, and the extra fixed condenser, switched in for the lower frequency band, is not required on the 7Mc/s band.

Impedance Matching

When the π-network is correctly built, but it is impossible to load up the transmitter correctly, the impedance being fed is outside the range for which the network was designed. A frequent example of this arises with a high impedance aerial, such as an end-fed half-wave type. In these circumstances, no adjustment of C1 and C2 will give adequate loading. In addition, the voltage across C2 may become too high, and the spacing of the condenser used here is not intended for the high voltage swing in a circuit of high impedance. If so, both the inability to load sufficiently, and the

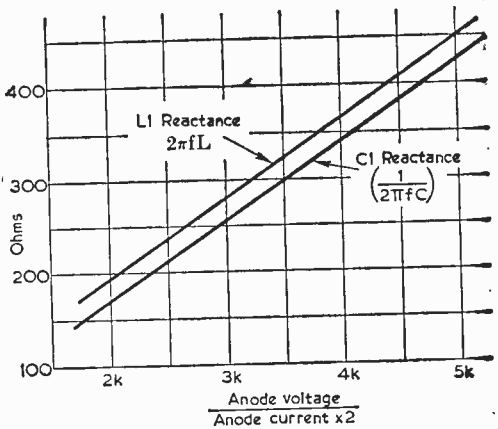


Fig. 5a.—Values for reactance of C1 and L1 for a Q of approximately 12

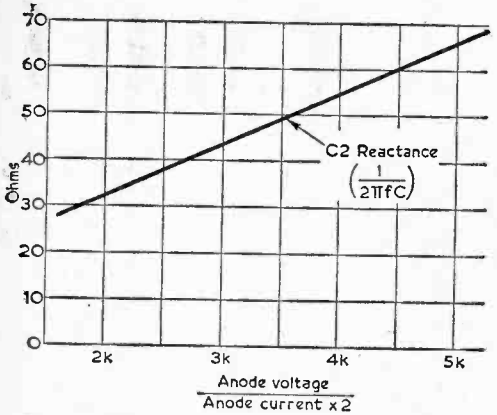


Fig. 5b.—Values for outputs in the region of 50Ω

flash-over, may be avoided by an impedance matching circuit such as those in Fig. 4.

The L-section circuit allows the transmitter condenser C2 to be adjusted for a low impedance output, while C1 in Fig. 4 is of small capacity and wide spacing, for the high impedance aerial. C1 may easily be chosen by using a component of similar spacing and capacity to C1 in Fig. 3.

The parallel tuner produces a similar result, but in this case the coil is parallel tuned by a condenser of about 150pF to 200pF, and with adequate spacing. The coil can resemble that in the transmitter. Only a few turns are required for the link, and loading can be adjusted by modifying the link coupling, and the tapping of the aerial on the coil, as well as by adjusting the π-network output condenser.

In the case of a commercially made transmitter which cannot be loaded into an end-fed aerial, one of the circuits in Fig. 4 will provide a solution. The parallel tuned circuit may also be used to feed twin high impedance lines.

Chart Values

To simplify working, the figures required may be taken from Fig. 5, which is for a Q of approximately 12. The load is found as already explained, for the anode voltage and anode current required.

It will be more convenient to express values directly in Mc/s, μH, and pF, to simplify calculation. For example, if the frequency is expressed in Mc/s, inductance will automatically be obtained in μH, which is more convenient than employing cycles per second and Henries.

With C2, the actual reactance required for a 50Ω output would be lower than for a 75Ω output, so that the condenser values would be greater for 50Ω, than 75Ω. However, except for the cases previously described, this can be accommodated by the adjustment of the condenser.

For a given load and frequency, lower reactances may be used for C1, L1 and C2, when a higher Q is required. It would normally be satisfactory to take a Q of 12 as near the lowest to be used. In some circuits it will be possible to plan the π-network for a Q of 15, or even 20, but when the load R1 is fairly low, it will be found rather impracticable to provide the values of capacity needed, because they will become so large. ■

ABOUT LOUDSPEAKERS

(Continued from page 488)

permanent repair. If the fault is due to the speech coil being out of centre and the centring device has not shifted, the centring "spider" may have come loose from the cone or the speech coil former may have warped. A centring device which has cracked or parted from the cone can usually be repaired without difficulty, and repairs have been carried out successfully when the speech coil has actually broken away from the centre of the cone. The cone and speech coil assembly should be removed from the loudspeaker chassis and a cellulose cement should be applied between the coil former and the cone and allowed to set hard before reassembling. Loose turns on the speech coil can also be locked with a similar cement applied in a very thin layer.

If the speech coil former has warped, there is usually little that can be done, for even if the former is squeezed back to approximate its original shape, it very often warps again as soon as it warms up in the set. This trouble, in fact, often happens in small mains-type radio receivers, which become very hot inside and use a small loudspeaker. When the set is first switched on the reproduction may be normal, but after a warm-up period loudspeaker distortion becomes apparent, owing to warping of the speech coil. The only cure here is to replace the loudspeaker.

Speaker Centring

To re-centre a loudspeaker, the retaining screw or screws of the centring device should be slackened. Pressure should then be applied to the cone as required and the retaining screw or screws tightened. The process may have to be repeated several times in order to achieve the best results. The speech coil must, of course, operate within the magnet gap without touching the pole pieces.

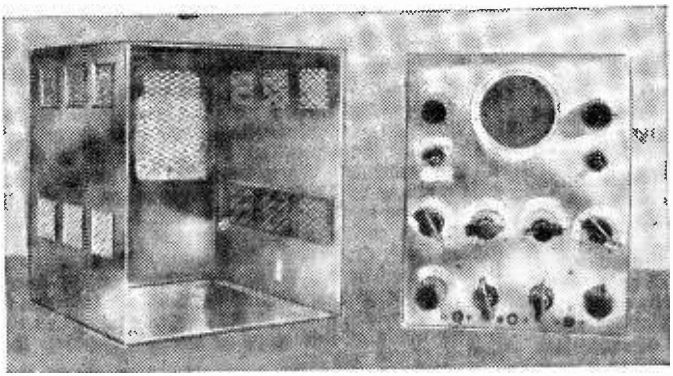
Gauges for pushing between the coil former and the magnet to hold the former in the correct position while tightening the centring screws are available, but if these are used care should be taken to avoid using too much pressure, otherwise the former may spring out of centre when the gauges are removed. One way of checking whether the speech coil is correctly centred is to apply about 2V A.C. via a 100Ω current limiting resistor, to the speech coil terminals on the loudspeaker chassis. If all is well, the cone will vibrate freely without harshness or obvious fouling. The correct centring position can be established, if necessary, by adjusting the centring device with the loudspeaker connected to the A.C. supply, but the speech coil should not be allowed to rub on the pole pieces for any length of time, otherwise the coil winding may be damaged.

Metallic particles of a ferrous nature, or even rust, sometimes reduce the magnetic gap or stick to the pole pieces. These can be removed by pressing a piece of Plasticine or soft wax on the pole pieces and magnet assembly. ■

HOW TO KEEP RADIO EQUIPMENT COOL

VENTILATING HOME-CONSTRUCTED INSTRUMENTS PRONE TO OVERHEATING

By W. Cleland



Left.—Expanded aluminium was used in this oscilloscope for ventilation.

ONE factor that can be overlooked in home-constructed equipment is the necessity of adequate ventilation. The problem hardly arises with transistors except in output stages handling heavy currents, but in valve equipment (some valve heaters dissipate as much as 4W each) it can make the difference between a successful or an unsatisfactory design

Temperature Stability

For example, in an A.F. oscillator of the phase-shift, Wien Bridge, or similar type, the calibration may be unreliable owing to frequency drift with heating. Similarly, in an R.F. signal generator where the oscillator has to be well screened, it is still necessary to provide ventilation, with suitable precautions against R.F. radiation through the openings. Lack of sufficient ventilation would cause the frequency to drift for a lengthy period before reaching a steady value. Radio receivers are normally well ventilated by openings at the rear, and this enables the local oscillator rapidly to settle down to a steady condition. The use of components of low temperature coefficient may prove necessary especially at VHF.

Local "hot spots" also require careful consideration. A wire-wound resistor that is too hot to touch should not be situated in close proximity to carbon resistors, as the latter would be liable to become faulty. Nor should capacitors be placed close to hot components, as capacitors of the waxed type would melt, and their electrical characteristics would be impaired at such high temperatures. Metal-cased capacitors can be used up to the temperature of boiling water, but their voltage rating is reduced by some 30% under these conditions.

Electrolytic capacitors should not be used at all above 70°C (158°F), and above 60°C (140°F), their working voltage rating has to be taken as 50VW less than at lower temperatures. Metal rectifiers require still lower ambient temperatures to work in, and their current ratings are decreased by 25per cent or more at 55°C (131°F).

Equilibrium

Usually electrical apparatus should be capable of continuous working. Laboratory equipment is sometimes kept switched on permanently to maintain steady conditions. This means that thermal equilibrum must be reached at a reasonable temperature. Cooling only begins to take effect as the temperature rises sufficiently above that of the surrounding air. Heat loss then increases rapidly until it balances heat production, and a steady temperature level above ambient is then maintained.

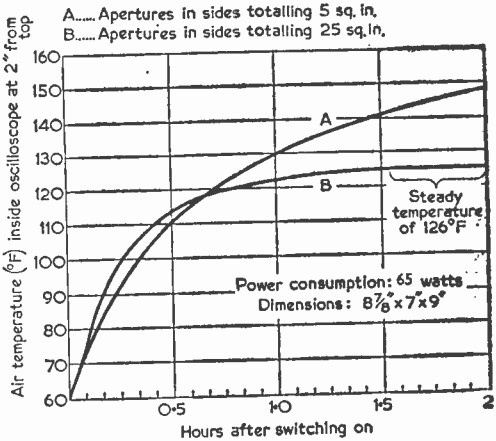


Fig. 1.—The curve "A" represents the result of inadequate ventilation, curve "B" with more ventilation.

Provision of ample ventilation not only ensures a lower ultimate temperature, it also considerably shortens the heating up period, and allows the heat to be distributed evenly in a shorter time. When numbers of valves are involved with an appreciable wattage dissipation in a confined space,

(Continued on page 534)

PRESENTED FREE WITH "PRACTICAL WIRELESS" OCTOBER 1961

THE Practical Wireless 'TUTOR'

PRICE 3/-

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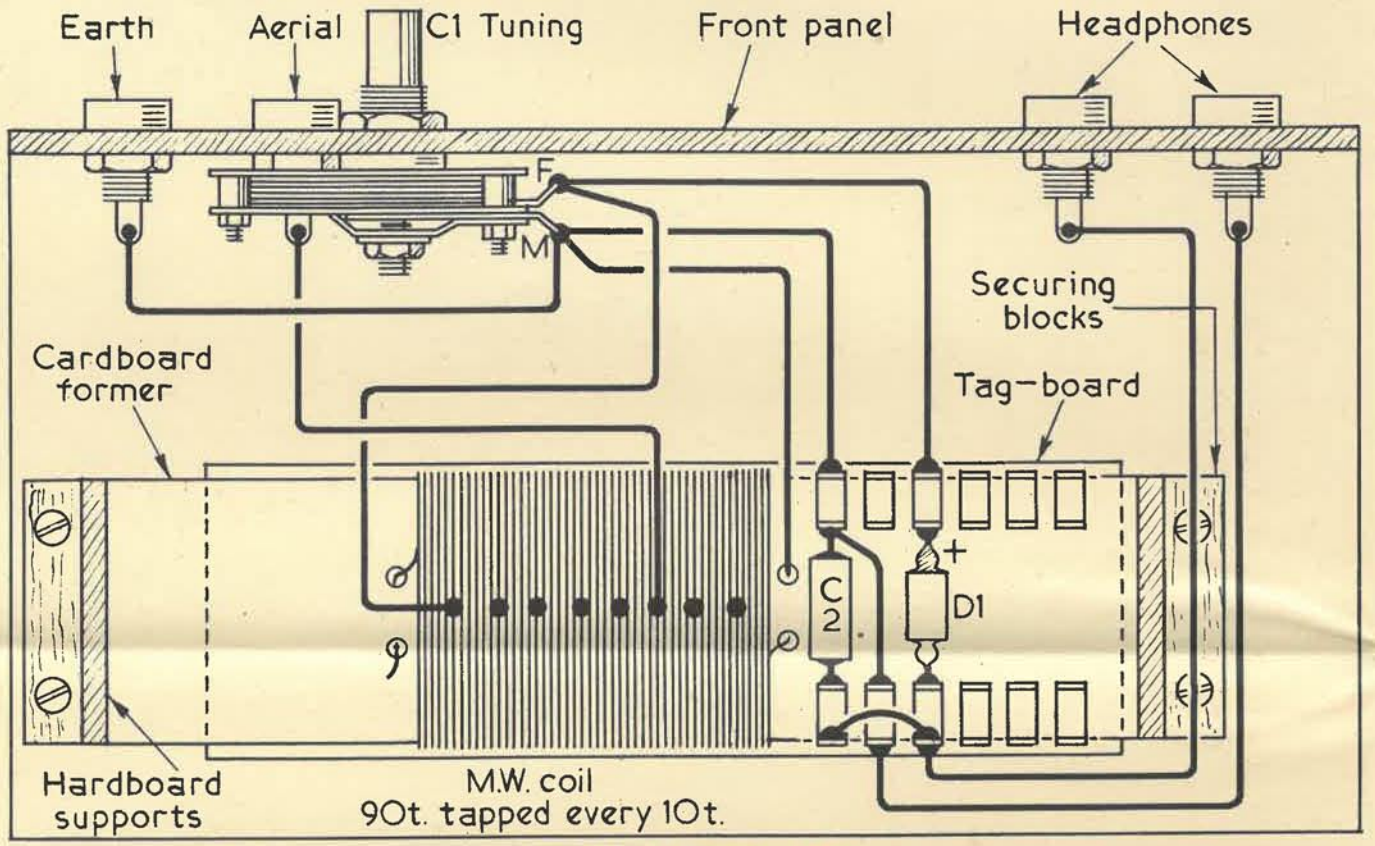
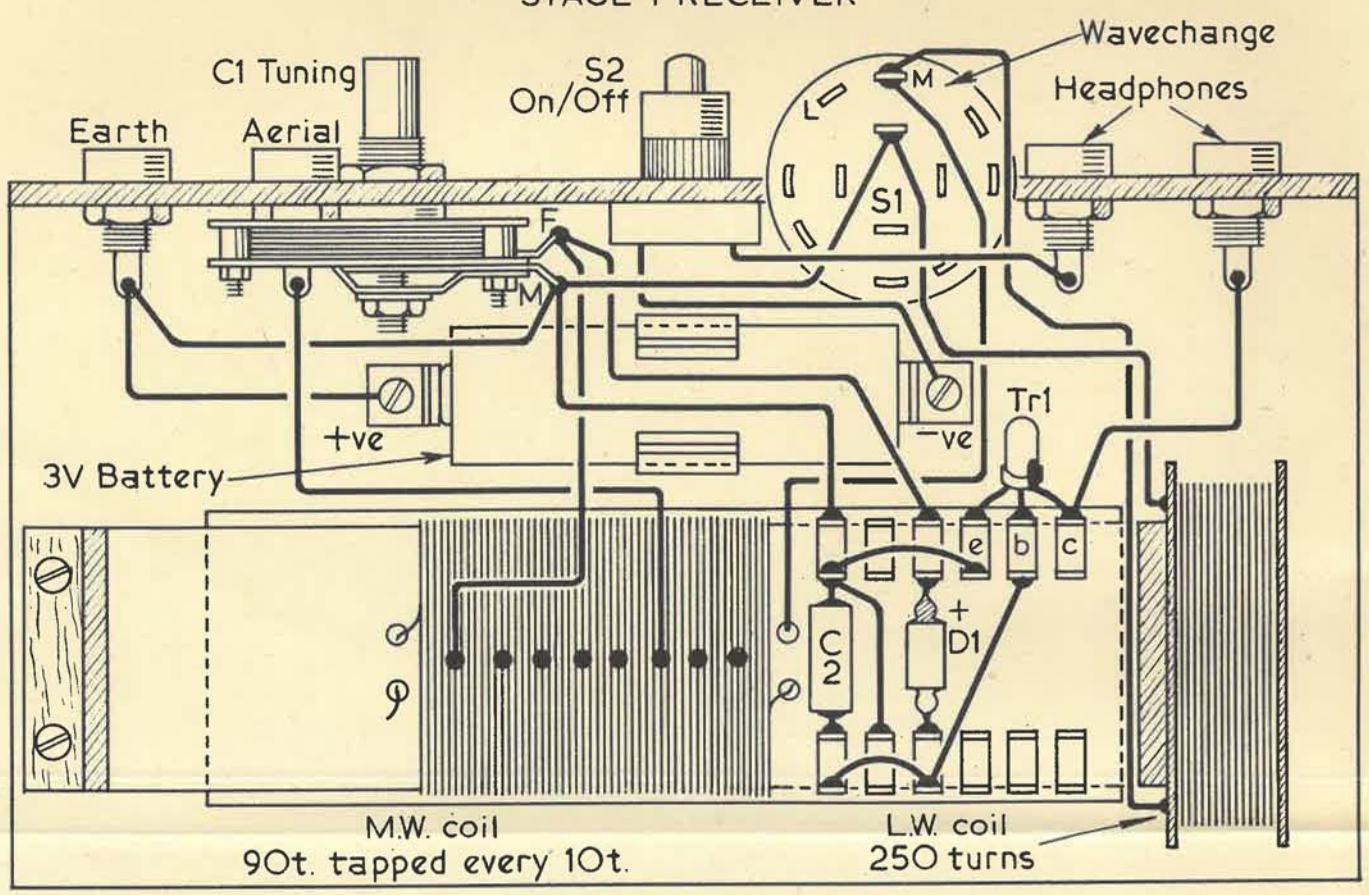
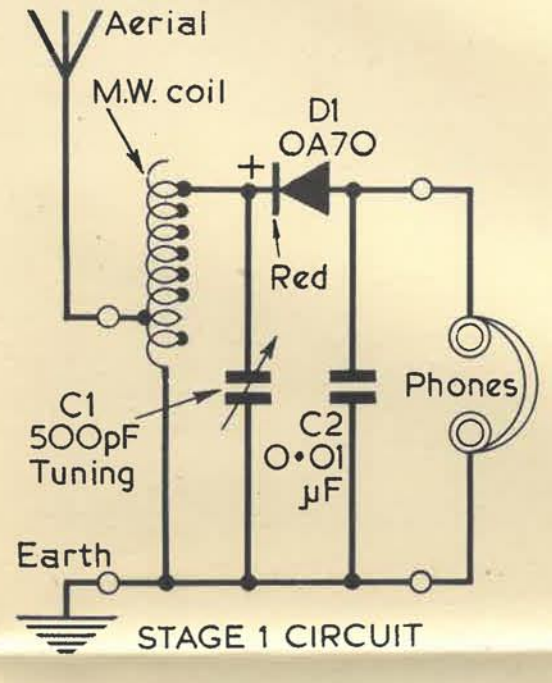


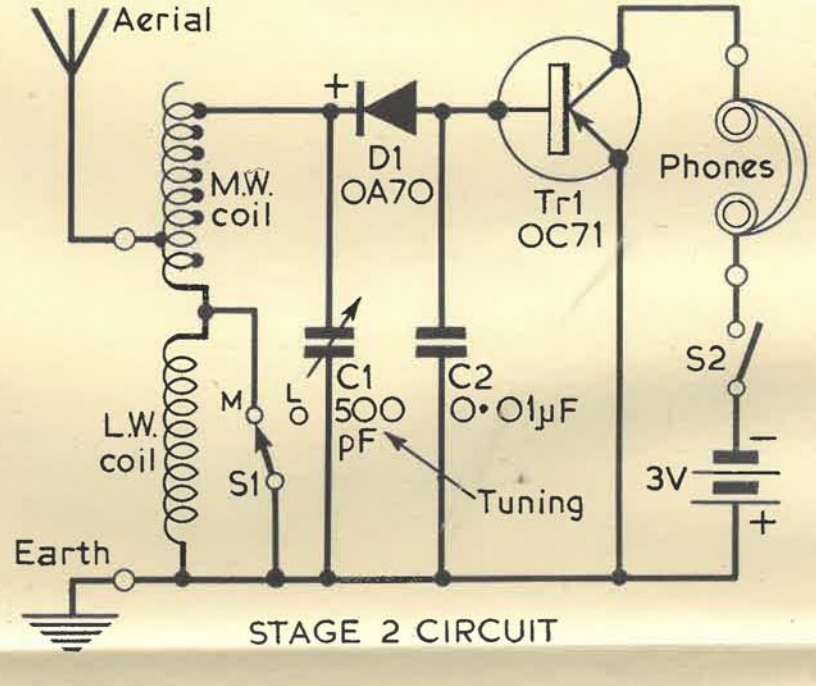
STAGE 1 RECEIVER



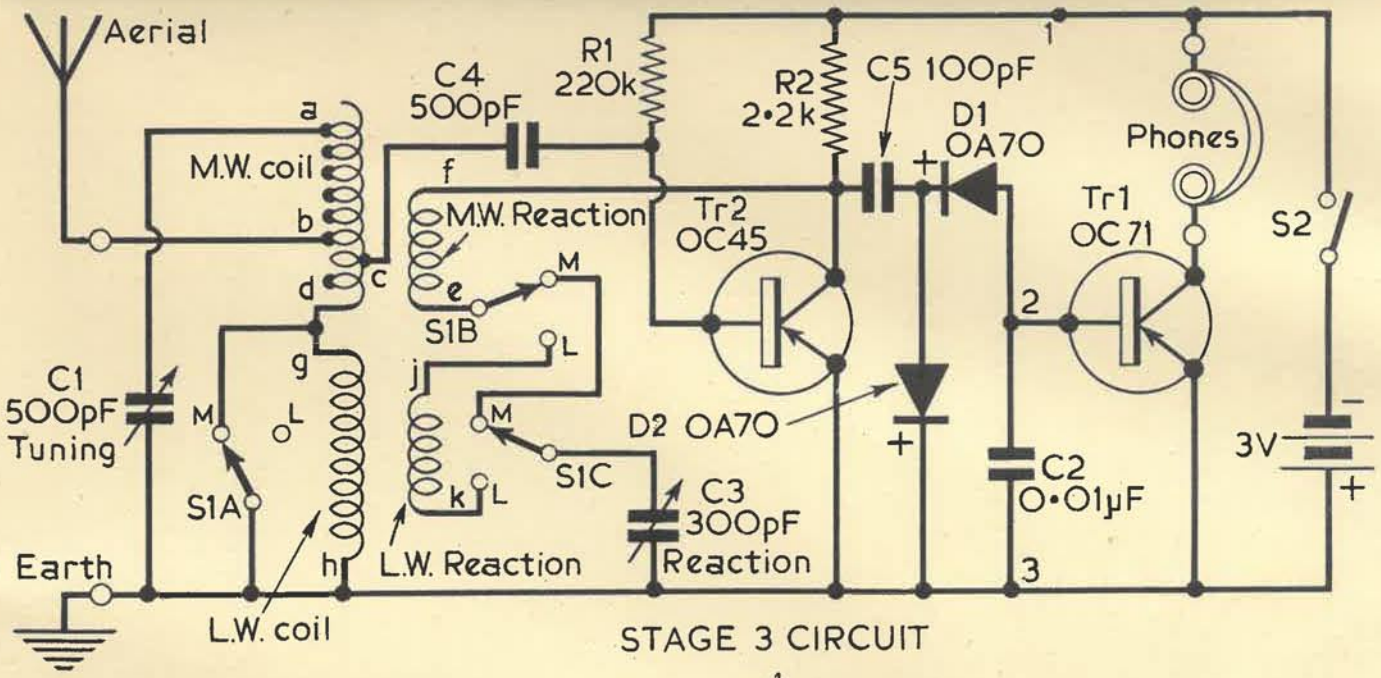
STAGE 2 RECEIVER



STAGE 1 CIRCUIT



STAGE 2 CIRCUIT

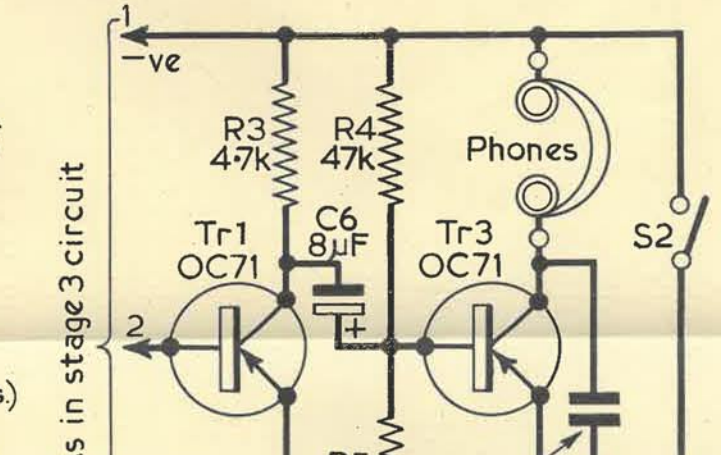


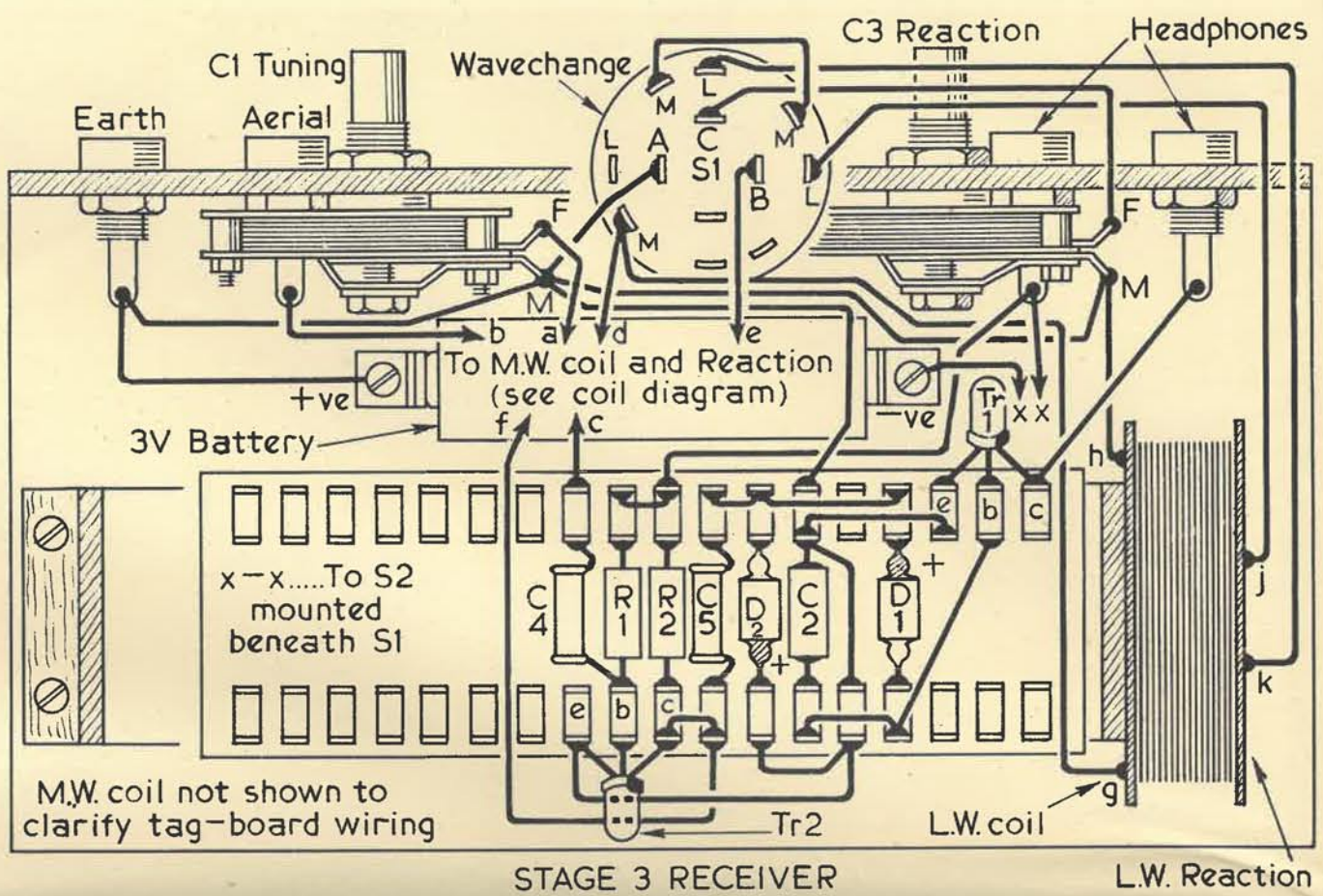
STAGE 3 CIRCUIT

LIST OF PARTS

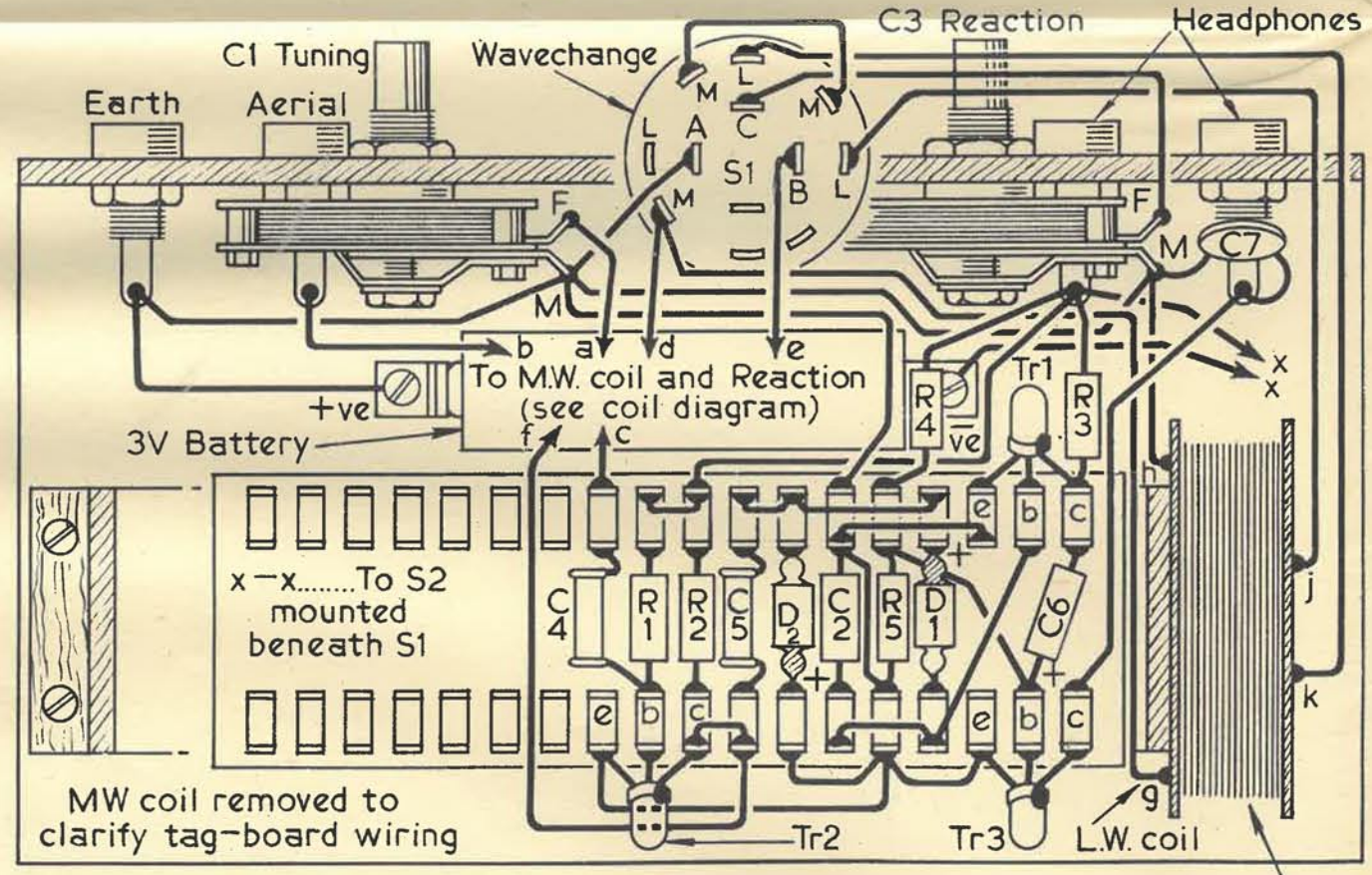
For Stage 1

Cardboard coil former, about 1½ in. in diam. × 5½ in. in length
2 oz. of 34s.w.g. copper wire (DCC)
Hardboard panel 7 in. × 5¼ in.
Baseboard 7 in. × 3⅝ in. × ½ in.
High impedance headphones
4 wanderplugs and 4 sockets to match (Radiospares)
Crystal diode (Mullard OA70)
500pF tuning capacitor ("Dilecon"—Jackson Bros.)
0·01µF capacitor (miniature type)





STAGE 3 RECEIVER



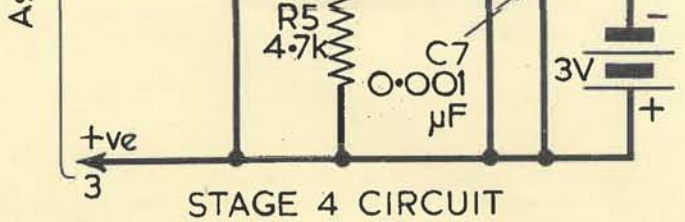
STAGE 4 RECEIVER

12−way or 18−way tag−board (Radiospares)
Connecting wire, solder, Balsa cement etc.

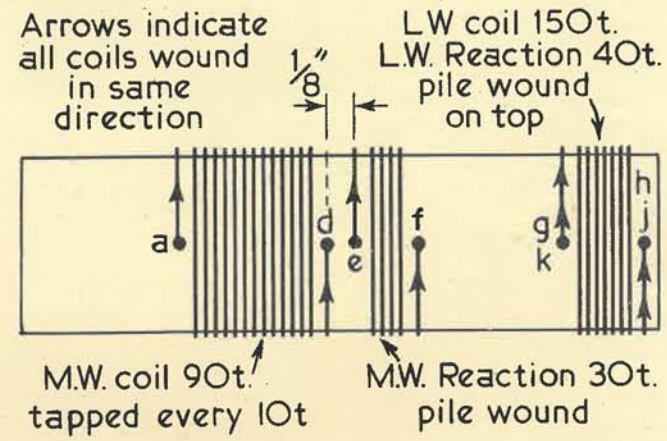
Additional parts for Stage 2
OC71 transistor (Mullard)
4−pole, 2−way rotary switch (Radiospares)
Push−button on off switch
3V battery (Ever−Ready No. 8)
3 tool clips to hold battery (Terry's)
2 oz. of 36s.w.g. copper wire (DCC)

Additional parts for Stage 3
300pF reaction capacitor ("Dilecon"−Jackson Bros.)
OC45 transistor (Mullard)
500pF and 100pF capacitors (ceramic or mica)
220k and 2·2k resistors (¼W or ½W)
Crystal diode (Mullard OA70)

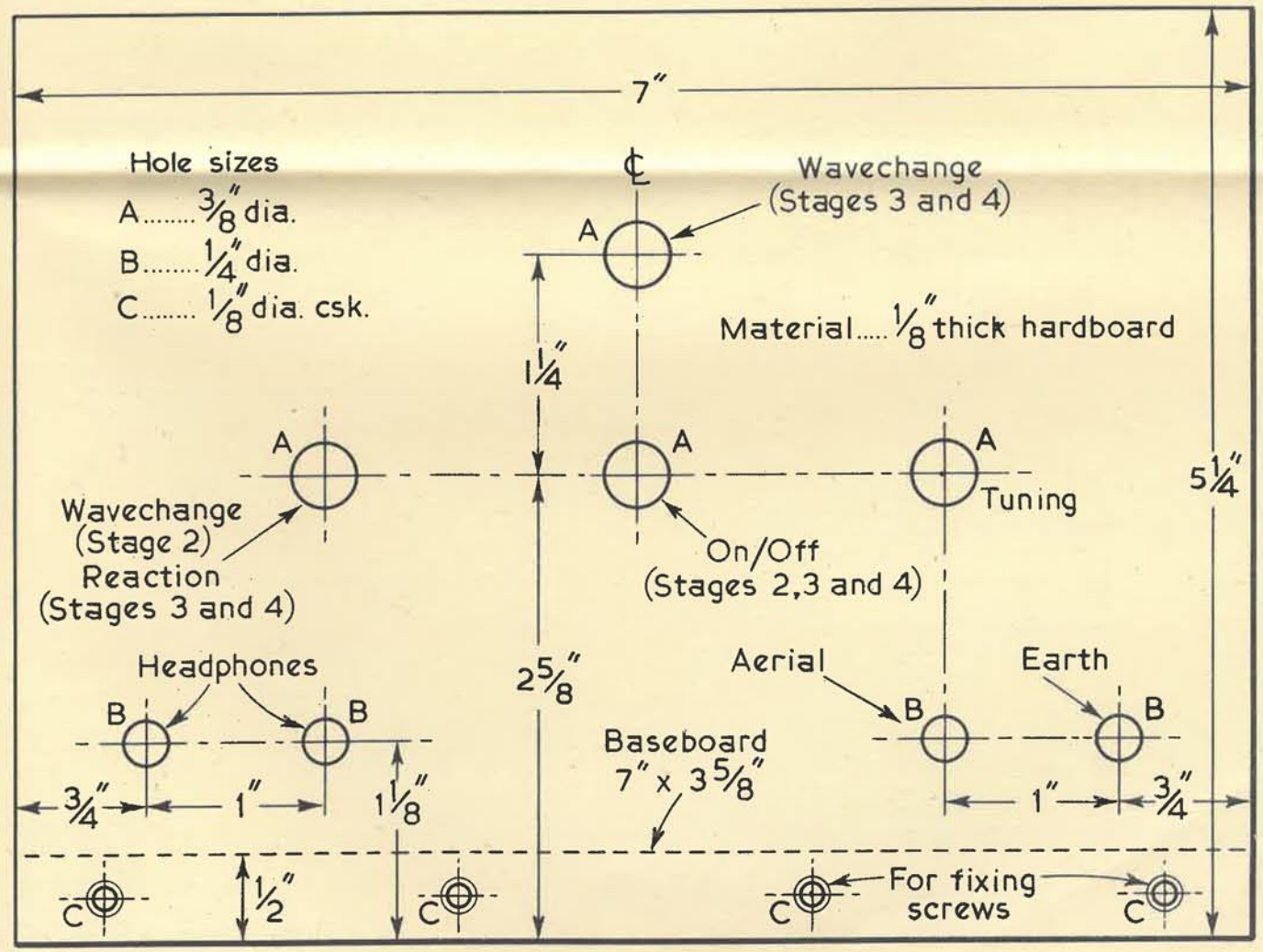
Additional parts for Stage 4
OC71 transistor (Mullard)
8µF 6VW electrolytic capacitor
(miniature type)
47k and two 4·7k resistors
0·001µF capacitor (ceramic)



STAGE 4 CIRCUIT



COIL DETAILS OF STAGES 3 AND 4



PANEL DRILLING VIEWED FROM FRONT

Practical Wireless TUTO

WITH each copy of this issue is included a PRACTICAL WIRELESS "Tutor" blueprint. This blueprint has been designed to give the complete beginner to radio construction a graded course to introduce him to the techniques and theory of wireless. The "Tutor" describes four simple receivers, each complete in itself, which can be built by the complete beginner with certainty of good results. The instructions for building the first receiver are more detailed than those for the remaining three as the constructor will gain proficiency and will need less guidance as he works his way through the course. The main difficulty which the beginner will encounter is the art of soldering. A second difficulty will be in recognising circuit symbols. Both of these difficulties will, however, be overcome by a study of pages 508 and 509 where circuit symbols are given together with illustrations of the components concerned. Details of the soldering process are also given together with illustrations.

The First Receiver

The first receiver consists of a crystal set using the modern equivalent of the old "crystal and cat's whisker" of the early days of radio. The results from this set are very good, particularly if a good aerial and earth are used. The results obtained will encourage the constructor to build the second and subsequent receivers.

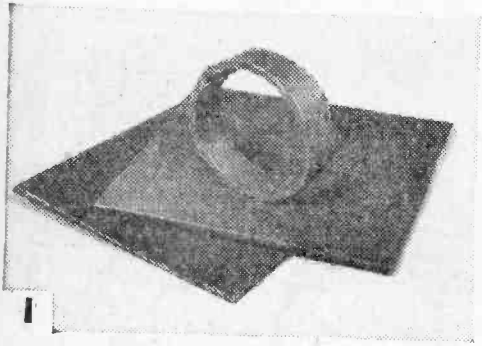
Construction

The set is built on a wooden baseboard and this is the first part to be made. The baseboard is cut from inexpensive timber and is 7in. long and about 3¾in. wide—the nearest stock width of wood is quite suitable although it is better to err on the larger side. A hardboard front panel is then cut 7in. x 5¼in. and drilled with the holes required for the first set (see blueprint)—the other holes can be made at the same time if it is intended to build all four receivers. When the panel has been drilled, it is screwed to the front of the baseboard. A case can then be made as shown in Fig. 1 on page 507, but if the width of the timber of the baseboard differs from that given, then some dimensions will have to be altered. When the wood for the baseboard is bought, it should be possible to have it cut to the width given at little extra cost. The case is best made at this stage to avoid disturbing the wiring of the sets later.

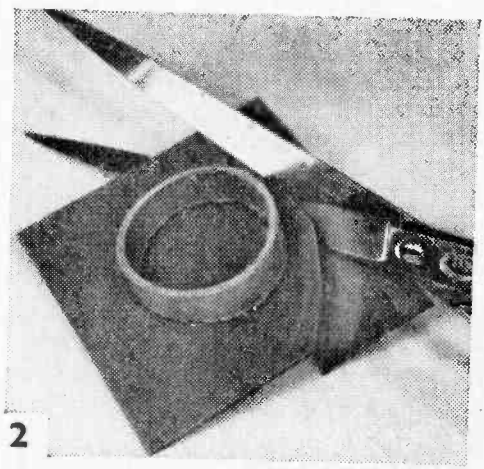
The case may be given a coat of varnish or paint and the baseboard a coat of clear varnish before starting construction.

Construction

First, the components concerned are mounted on the front panel: four terminals and the tuning condenser (C1). Then the coil must be made. The former for the coil is made from a 5¼in. length of cardboard tube about 1½in. in diameter. Pierce a small hole (with a sewing needle) at a point 1¼in. from one end and pass the end of the 34s.w.g. DCC (double cotton covered) wire through it. The wire may be passed through another hole to anchor it securely as shown on the blueprint. Now wind on ten turns of the wire side by side in the direction shown on the blueprint. Now, double the wire back on itself for about 2in. and twist the doubled-back portion together quite tightly so that does not come untwisted when it is pulled gently.



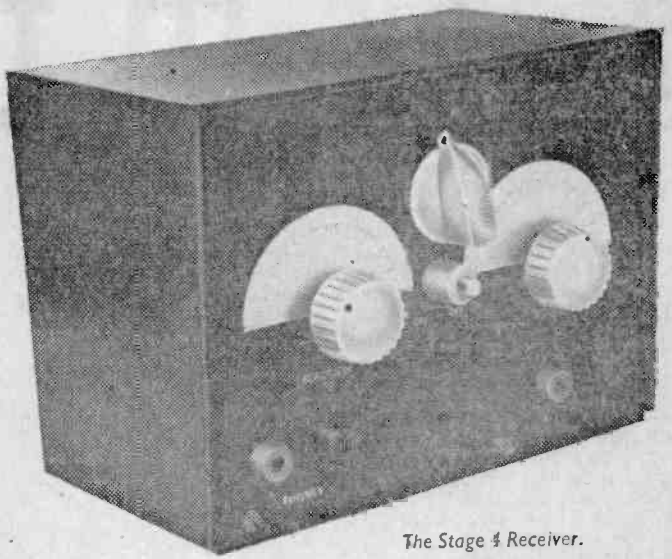
Making the Long Wave coil for the Stage 2 Receiver—two squares of cardboard are required together with a ¼in. length cut from the cardboard tube used to make the Medium Wave coil, and a tube of Balsa Cement. The cardboard ring is glued to one of the cardboard squares and when the cement has set, the excess cardboard is cut away to within a ¼in. of the ring—see 2. The remaining square of cardboard is then glued to the other side of the ring. These two pieces of cardboard eventually form the cheeks of the former. The corners of this square are bent (3) so that the 36s.w.g. wire may be wound on to the former more easily. When winding the coil, pin holes are made in one cheek of the former and



the wire passed through to anchor it. Balsa Cement may be applied where the wire passes through the cheek. When the coil has been completed, the remaining square of cardboard is cut to leave a circle of the same diameter as the first.

O R

By R. E. F. Street



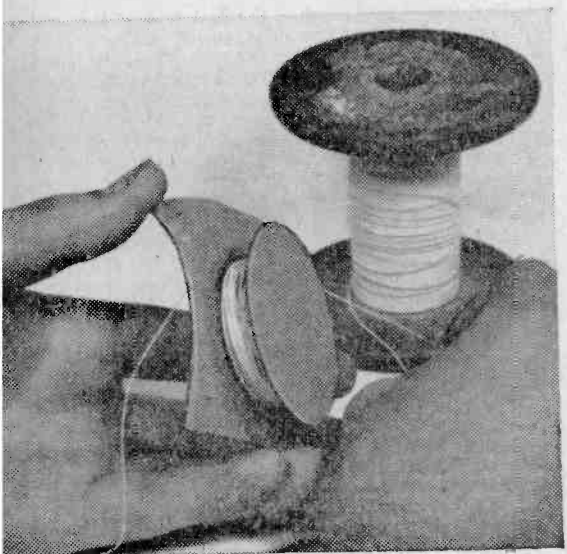
The Stage 4 Receiver.

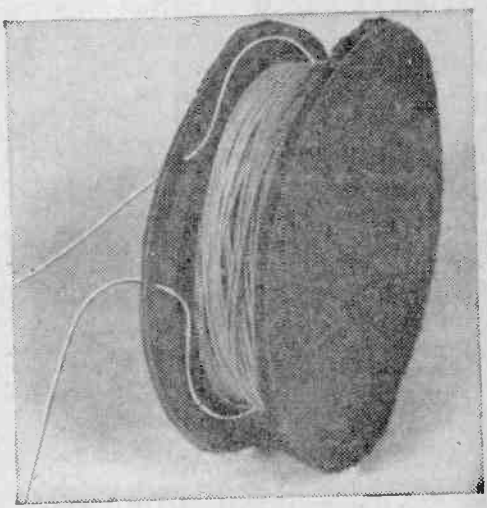
Wind on another ten turns and again double the wire back on itself for about 2in. and twist it as before. Arrange the twisted portion so that it is in line with the first as indicated on the blueprint. Wind on another ten turns and make another twist. Carry on winding, ten turns at a time and twisting until 90 turns have been wound on altogether. Then, pierce another small hole at the "finishing" end of the winding, and wedge the wire in it, using a piece of wood—a sharpened match-stick is ideal. The wire does not pass through the hole, but is only anchored there. Cut the wire to leave about 6in.

Balsa cement can now be used to fix the wire to the former securely. Spread it liberally around the twists of wire and the two end wires of the coil. Allow the cement to dry and cut the wire at each twisted loop. Two ends will thus be formed at each twist. Unravel the cotton covering at each of these ends or remove it by scraping gently with a knife. Twist each pair of bare wires together and in such a way as to form a small "bunch" of copper wire at each twist or "tap". These taps can now be tinned with solder—apply the soldering iron to each in turn together with the solder and leave a small blob of solder at each tap.

The supports for the coil are next to be made. Cut two pieces of hardboard 2¼in. long and as wide as the diameter of the cardboard tube. Place the tube at one end of each and mark a semicircle to be cut away so that the supports are circular at one end. One of the supports may now be cemented to the tube on which the coil is wound (so that the taps on the coil will be in the position shown on the blueprint). When the cement is dry, the other support may be glued in place—the two supports must, of course, be parallel.

The group-board may now be mounted and components C2 and D1 soldered in position. These are the only ones to be mounted on the group-board in this receiver. Note the position of the red, or positive, end of the diode D1. When soldering, remember not to overheat the compo-





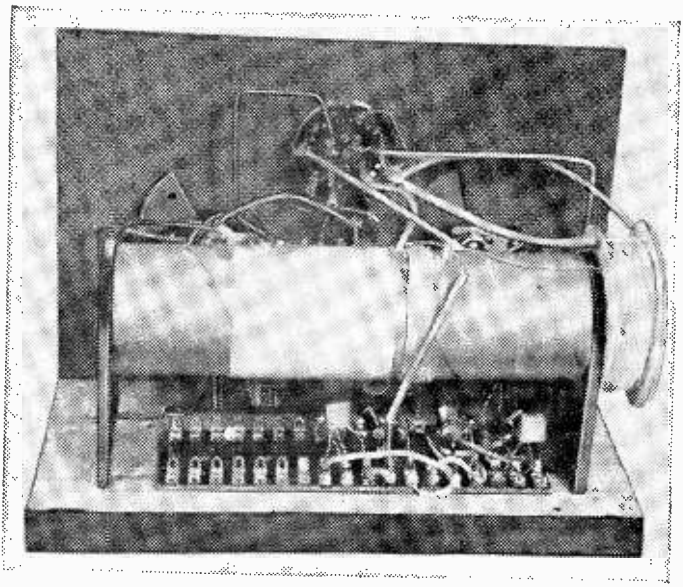
The completed L.W. coil.

nents, especially the diode. Leave the leads of the diode long—do not cut them at all—and conduct the heat away when soldering with a damp cloth or with pliers as shown on page 509.

Solder in the two wire links on the group-board which are shown on the blueprint. Connect the earth terminal to the moving plates connection of the variable condenser C1 (M) and take a wire from there to C2. Keep this wire near to the baseboard—the battery will be fixed over this wire in the three other stages. Connect the fixed plates of the condenser (F) to D1. Connect the headphone terminals to the tags indicated on the group-board. Two pieces of thin plastic-covered flex will now be required: one of these is connected to the aerial socket and the other to the fixed plates connection of the variable condenser.

Mount the coil—the end at which winding was begun should be on the left (viewed as shown on the blueprint). Connect the right hand end of the coil (6in. of wire was left) to the moving plates connection of the condenser. Connect the flex lead from the aerial terminal to the third tap from the right on the coil, and the one from the fixed plates to the first tap from the left. The end wire of the coil is, of course, not used.

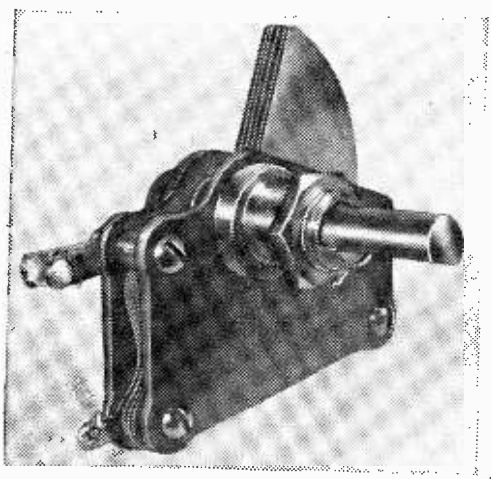
Connect the aerial and the headphones, rotate the variable condenser (C1) and at least one programme should be heard. If not, check the connections and if still no results can be obtained, connect the aerial to the same tap as the wire from the fixed plates to the condenser. The signal should now be heard. If a programme was obtained before the aerial tap was moved, then it will be noticed that although the signal is louder, it spreads over the full range of the condenser C1. The set is now not so selective—it does not tune so sharply—but it is more sensitive—the signal is louder.



The Stage 4 Receiver.

Note that a good aerial and earth are essential for a crystal set of this type and poor results will often be due to insufficient signal reaching the set.

The tapping of the aerial on the coil can be altered to improve results and the best position will soon be found.



A variable condenser of the type used in all four 'Tutor' receivers. (The fixed plates connection is the lower of the two soldering tags.)

The Stage 2 Receiver

Disconnect and remove the coil so that it is not damaged when the new parts are being added. Mount one of the Terry clips as shown to hold the battery. Cut off one "arm" from each of two Terry clips (to leave the holes for mounting). Each clip is then screwed to the baseboard to contact the two ends of the battery when it is in position. Use ½in. brass screws to mount the clips for ease of soldering later. Connect the left hand—positive—battery terminal to the earth socket, and the right hand—negative—battery terminal to one side of the on/off switch (S2). Connect the other side of S2 to the left hand headphone terminal. At the same time, remove the wire already there, shorten it and solder it to the tag marked b on the group-board of the Stage 2 receiver. Join tag e to C2 as shown. Remove the wire linking the other headphone terminal to the group-board and connect this terminal to tag c.

Now make the Long Wave coil as shown in the illustrations (pages 504 and 505). 250 turns of the 36s.w.g. wire are needed. Note that both ends of the wire should be anchored through holes in the same cheek—the left hand one, and the direction of winding should be the same as for the M.W. coil, i.e. as shown on the blueprint.

Now join one of the inner tags of the wave-change switch S1 to the moving plates connection of the variable condenser C1.

Solder the transistor to tags e, b and c, with the emitter to tag e, base to b and collector to c. Do not cut the wire short and use pliers or a piece of wet cloth to conduct away the heat when soldering the leads. The procedure is described and illustrated on page 509. Make sure that the transistor is soldered in the correct way round. A diagram is given on page 508. Great care should be taken where transistors are concerned or these expensive components will be ruined.

Remount the coil, and connect the M.W. winding as before, except that the right hand wire goes to an outer tag of S1—corresponding to the inner tag used. To this outer tag is also connected the inner end (or starting end) of the L.W. coil—the other end goes to the inner tag in use on S1.

Replace the battery and switch on. Turn C1 with S1 in the M.W. position. The same stations as in the Stage 1 Receiver should be heard, but much louder and the aerial may be moved more to the right to reduce volume and improve selectivity. Several programmes should be audible, particularly at night.

Move S1 to the L.W. position and the Light Programme should be received. To improve results the tappings on the M.W. coil may be altered as required.

By now, even the complete beginner should have an idea of the meaning of the circuit diagrams and how they constitute a short way of describing receivers. It is a useful exercise to compare the circuit of the set just completed with its actual physical layout.

The Stage 3 Receiver

Remove the battery and then disconnect and remove the coil. Mount components C4, R1, R2, C5, D2 as shown on the blueprint. Note the position of the red, or positive, end of D2. Wire in the associated links on the group-board and mount C3, the other variable condenser, on the front panel, moving S1 to the new fixing hole.

Coil alterations

An ¼in. to the right of where the M.W. coil finishes, pierce a small hole and anchor the end of the 34s.w.g. wire, leaving a 6in. end. Wind on 30 turns in the same direction as the M.W. coil over a length of about ¼in. Pierce another hole and anchor the wire and leave a 6in. end. Now *remove* 100 turns from the L.W. coil (leaving 150 as shown on the blueprint) and rewind 40 turns on top of the 150 turn coil as a separate coil. The ends of this coil are passed through the *right hand* cheek.

Solder in transistor Tr2—take great care not to damage it by incorrect connections or by excessive heat. Connect the wave-change switch to C3 and C1 as indicated, and also wire in the link shown (the one which joins two of the outside tags). Now remount the coil and connect it as shown. Note that if the windings have been made exactly as given on the blueprint, the letters on the diagrams can be used to assist wiring in of the coil.

Finally, insert the battery and switch on with S1 in the M.W. position. Stations should be heard, and if C3 is rotated, should become louder until an oscillation is heard. Adjust C3 so that it is just short of the point at which oscillation begins and it should be found that selectivity is much greater than with the Stage 2 Receiver.

If it is found that closing C3 makes results worse, reverse the connections to the M.W. reaction coil. When results are satisfactory on M.W., try L.W. If reaction cannot be obtained, reverse the connections to the L.W. reaction coil. It should be noted once again that if the blueprint is followed exactly, the reaction will be obtained on both wavebands from the start.

The Stage 4 Receiver

The Stage 4 Receiver is the circuit of the Stage 3 Receiver with an extra transistor amplifier added to increase volume.

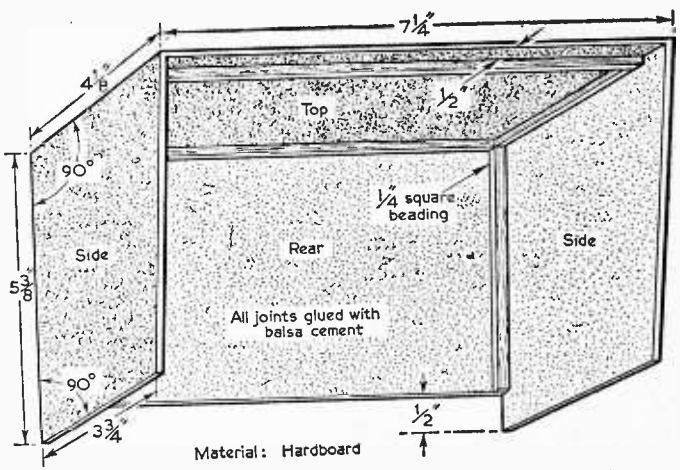
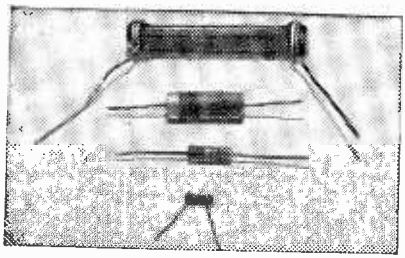


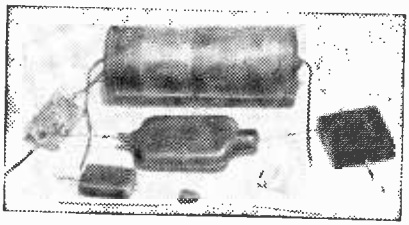
Fig. 1.—The dimensions of a suitable cabinet for any of the receivers.

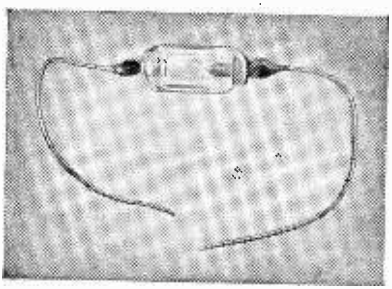
Remove the coil and add the extra components to the group-board, adjusting the wiring accordingly. Add R3, R4, R5, C6 and C7. Note that with C6 the red end or the end which has a rubber washer (which may be black) is connected to b (Tr3) and the other end—plain metal—is connected to c on Tr1.

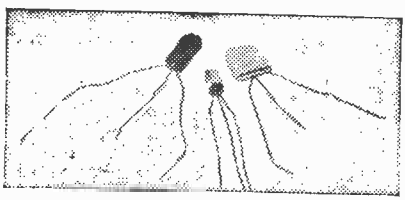
Finally, connect Tr3, taking the usual precautions. Remount the coil as it was for Stage 3, and replace the battery and switch on. The signal should now be much louder and may be too loud. If this is so, add a condenser in series with the aerial lead—a value of 20pF to 200pF will be suitable. Alternatively, it may be necessary to try using an indoor aerial or to alter the tappings of the aerial on the coil.

to help the beginner build the 'Tutor'







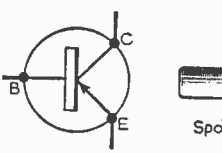


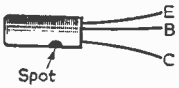
Fixed resistors.

Capacitors (condensers).

Headphones.

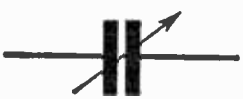
Crystal diode.



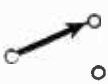


E....Emitter
B....Base
C....Collector

Transistor



Tuning condenser—the type used in the 'Tutor' is shown on page 506.



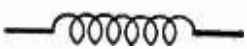
Switches.

Battery.

CIRCUIT SYMBOLS

The four 'Tutor' receivers described in this issue were designed especially for the absolute beginner to radio construction. It is therefore probable, that to some readers intending to build these sets, the circuits diagrams relating to them (on the Blueprint) appear too complicated for them to comprehend. These circuits are, in fact, very simple and with the help of the diagrams, illustrations, and hints on soldering given in these two pages, even those with no previous knowledge of radio should be able to build any or all of the four sets satisfactorily.

The diagrams on this page of the various circuit symbols, and the accompanying photographs of actual components, are, on the whole, self-explanatory. For instance, no one would mistake the symbol for a pair of headphones, but the sign for a tuning condenser (bottom left of this page) might prove confusing until it was pointed out that in circuit diagrams, a component crossed with an arrow usually means it is variable, e.g. variable resistors and condensers. The circuit symbol for a battery is given, without an illustration as it is felt that of all the components used in making these receivers, this, at least, is likely to be recognised by those unfamiliar with radio construction. Similarly, no photograph is given of a switch but the physical appearance of the two types used in the 'Tutor' may be seen from the Blueprint. The dimensions and construction of the tuning coil may be obtained from the article on the receivers and from the Blueprint.



Tuning coil.

HINTS ON SOLDERING

It is essential in radio construction to be able to make good soldered joints. If poor joints are made, then the receiver or other apparatus may not work at all or may work for only a short period. The beginner may think that good soldering is difficult: it is not. Soldering consists of coating the parts to be joined with a thin layer of molten solder and allowing it to solidify over the join.

THE TEMPERATURE OF THE IRON

The first essential is that the soldering iron should be at the correct temperature—if the iron is electric, then it will automatically be at the correct heat, but if it has to be heated in the gas or in a fire, then it may easily be too hot or too cold. The correct heat is shown when the iron causes a green coloration to the flame of the source of heat.

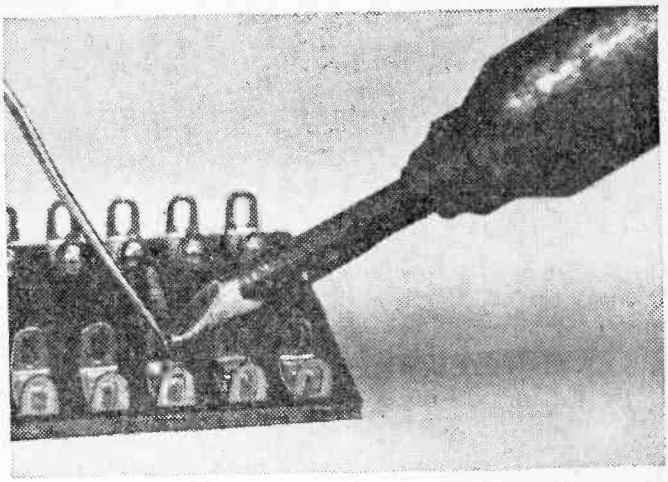
The second essential is that the iron should be clean and tinned—if a new iron is bought, then before it is used for the first time, it should be heated to the correct temperature, cleaned with a file or sandpaper, and solder applied to the tip. This action will give a coating of solder on the tip or bit of the iron. **Note that this is the only time that solder is applied direct to the iron.**

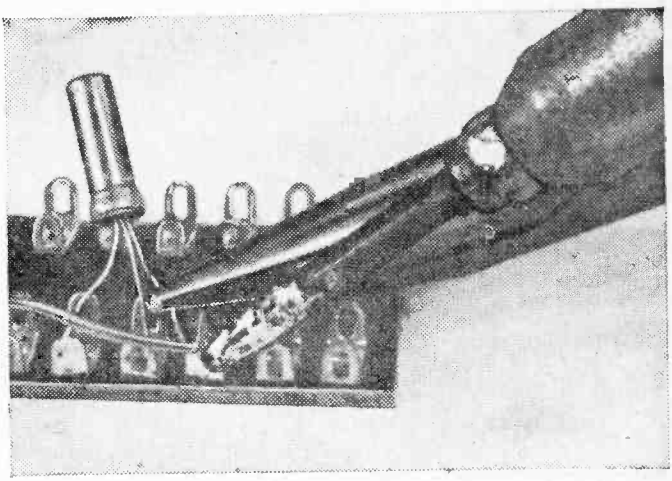
THE CORRECT SOLDER

The third essential is that cored solder should always be used—preferably "Multicore Savbit" which contains a non-corrosive flux and also prevents erosion of the copper bit of the iron.

When soldering, heat the surfaces to be joined and apply the solder direct rather than carry it to the joint on the tip of the iron. This procedure is clearly illustrated on the right. If the solder is not applied direct to the parts to be joined, then the flux which is included in the solder to make good joints easier serves no purpose and dry joints, which can be pulled apart easily, will result.

Transistors and diodes need very careful soldering if the heat of the operation is not to ruin them. The best method of conducting the heat away from transistors and diodes is shown in the illustration on the right. A pair of long-nosed pliers is used to hold the lead to be soldered and provided that the joint is made quickly, the pliers will conduct the heat away from the transistor. This procedure will also be found useful for other parts. Note that if the soldering iron is not sufficiently hot, it will take a long time to make joints, and the parts being soldered will become very hot.



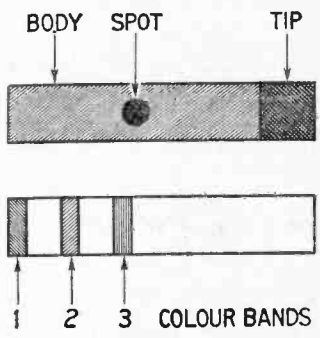


(Above) Soldering a resistor to a tag-board, and (below) using pliers as a heat shunt when soldering transistor leads.

RESISTOR COLOUR CODE

0. Black
1. Brown
2. Red
3. Orange
4. Yellow
5. Green
6. Blue
7. Mauve
8. Grey
9. White

First Number—Body or Band 1 } Yellow = 4
Second Number—Tip or Band 2 } Mauve = 7
Number of Noughts—Spot or Band 3 } Orange = 3
} 47,000 Ω(47k)



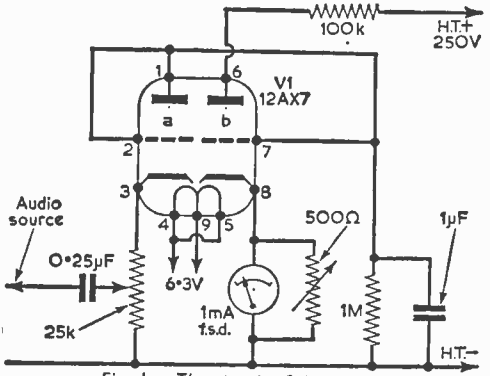


Fig. 1.—The circuit of the meter.

A Recording-level Meter

By R. Dowling

A USEFUL ADDITION TO ANY TAPE RECORDERS

TAPE RECORDERS are at present enjoying an unprecendented popularity owing to their versatility and ease of use. This has made it possible to produce tape recorders at prices much below those of a few years ago. Despite the high sales, however, manufacturers have to make one or two economies in order to produce machines at the lowest possible price. For example, some decks have only one motor (with ingenious pulley switching to carry out the various functions); most decks have a combined record/playback head; and very few of the cheaper tape recorders have anything other than a simple "magic-eye" in order to estimate the optimum recording-level.

The purpose of this article is to describe a single-valve recording-level meter constructed in such a way that it makes an easy "add-on" unit to any tape recorder. It will be found that the mean recording-level may be determined with much greater accuracy than the average "magic-eye", resulting in a much improved signal-to-noise ratio on the recordings made.

General Circuit Description

The circuit of the unit is quite straightforward, and is shown in Fig. 1. The valve used is a 12AX7 double-triode, one half of which is strapped as a diode. The audio signal from the tape recorder is fed to the cathode of V1a through an isolating capacitor (0·25μF) and the "set-level" potentiometer (25k). The rectified output of V1b is then fed to the grid of V1b. Between this point and earth is connected a CR combination (1μF and 1M) giving a one-second time constant. This prevents the meter from trying to follow the audio signal peaks too closely, and accordingly gives a better measure of mean audio level. It should be noted, however, that if a milliammeter is used which is inherently rather sluggish, better results will be obtained with a rather smaller time constant (say, 0·5μF and 1M).

The indicating milliammeter is connected in the cathode circuit of V1b. It should have a f.s.d. of 1mA, and is shunted by the "set-zero" potentiometer (500Ωww).

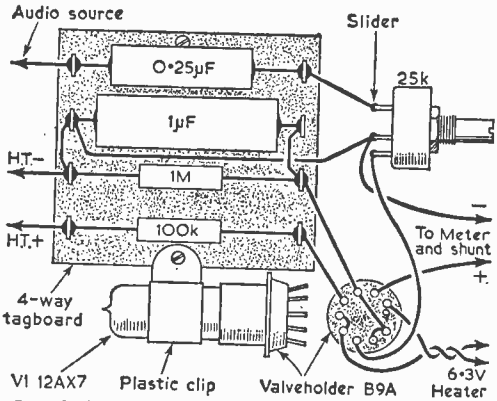
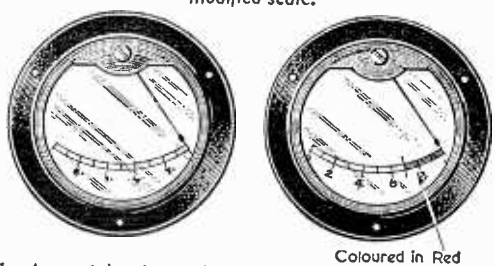


Fig. 2 (above).—The component layout: the 25k potentiometer may be mounted on any small bracket.
Fig. 3 (below).—A method of modifying the milliammeter scale; left, the original scale; right, the modified scale.



The power supply required for the unit is only about 1mA at 250V and 0·3A and 6·3V. The tape recorder will itself usually be able to provide this light extra load with no difficulty. The whole unit may be built up on a small tag-board as suggested in Fig. 2.

Calibrating the Meter

In the zero-signal condition, the meter will read full scale deflection: this is the reason why the milliammeter is shown mounted upside-down in Fig. 3. It is seen that the face of the meter is renumbered from 0 to 10, the portion from 7 to 10 being painted in red. A good plan is to unscrew the original meter dial and paint over the back with white paint. Then a new scale may be easily marked out, using ink-compasses and Indian ink.

The meter is set to the new zero by means of the set-zero potentiometer, and a signal (preferably a continuous tone) applied to the input of the tape recorder. The recording-level control on the machine is then slowly advanced in the normal way until the correct level is indicated on the "magic-eye". The set-level potentiometer is now adjusted until the needle of the meter reads about 7, and thus the 7 to 10 portion in red will indicate over-modulation.

Finally, a word about the actual audio take-off point in the tape recorder. A satisfactory point on most small machines is the "magic-eye" grid; in the unlikely event of the signal voltage level at this point being too low, one may alternatively take off a signal at the grid of the output valve. ■

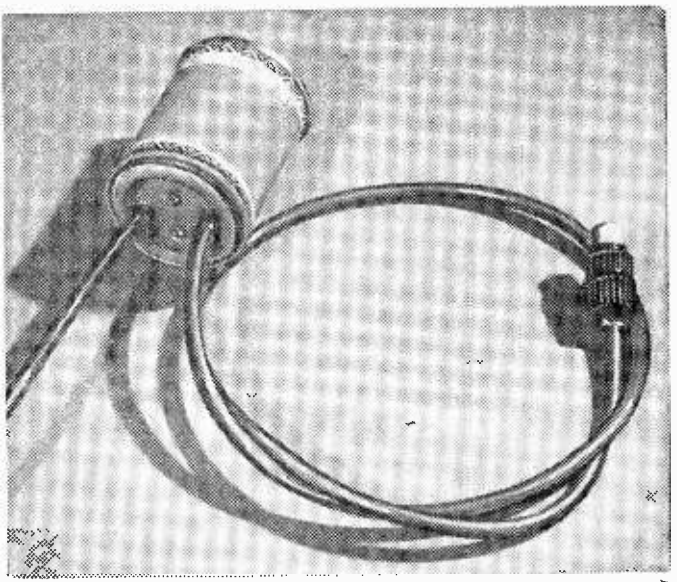
THE CABINET, POWER OUTPUT METER AND DUMMY AERIAL

THE P.W. SIGNAL GENERATOR

By E. V. King

(Continued from page 391 of the September issue)

LAST month, Chassis No. 4 was constructed. This unit was the crystal check oscillator, and if the construction was completed and the multivibrator set on 10kc/s as described, the unit should give marker, or check frequencies at intervals of 100kc/s or 10kc/s according to whether switch S11 is on or off. The complete circuit of Chassis No. 4 is given in Fig. 32a on this page so that the constructor will have a diagram of the unit as a whole if a fault should develop and repairs become necessary.



A dummy aerial unit.

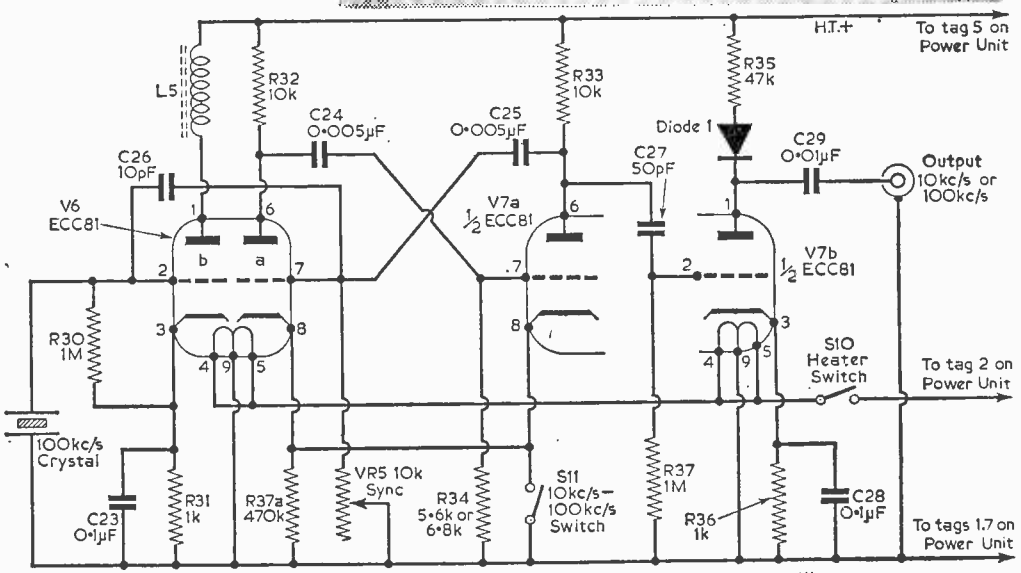
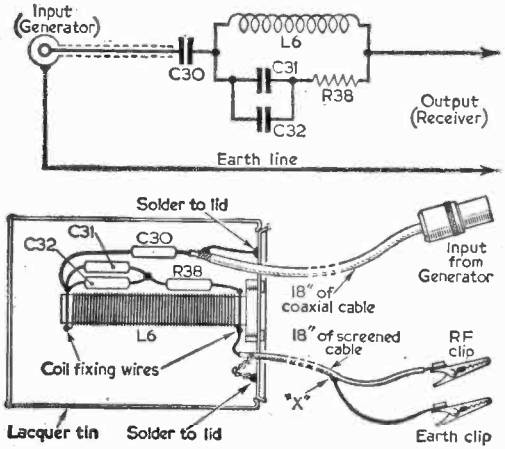


Fig. 32a.—The complete circuit of Chassis No. 4—the crystal check oscillator.



Figs. 33 and 34.—The circuit and construction of the dummy aerial unit.

The Dummy Aerial

When an R.F. signal generator is connected to a receiver instead of the ordinary aerial, it is best, though not absolutely essential, to connect it through a device which has approximately the same characteristics as the original aerial. This is particularly necessary when dealing with radio frequency amplifiers as in TRF receivers.

A special lead is therefore made which plugs in to the R.F. output socket of Chassis No. 2. It passes through a small can containing the

(Continued on page 517)

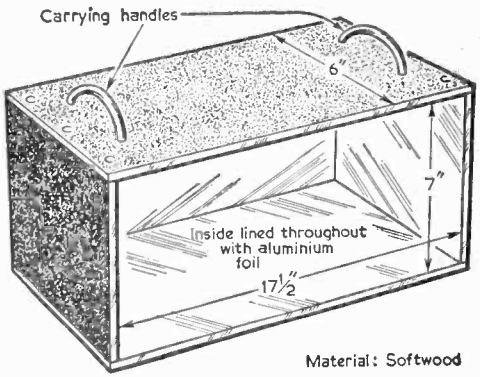
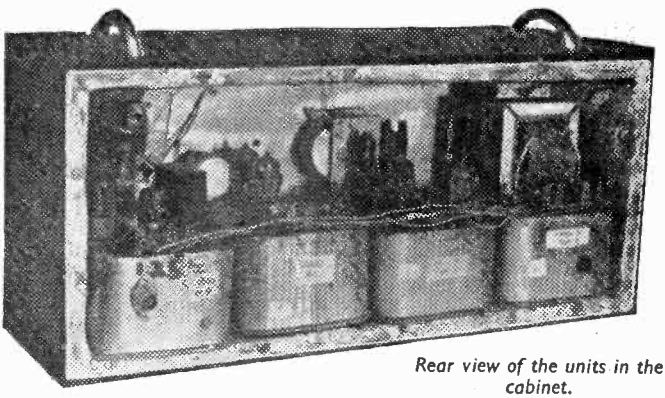


Fig. 35.—The construction of the cabinet of the generator.



Rear view of the units in the cabinet.

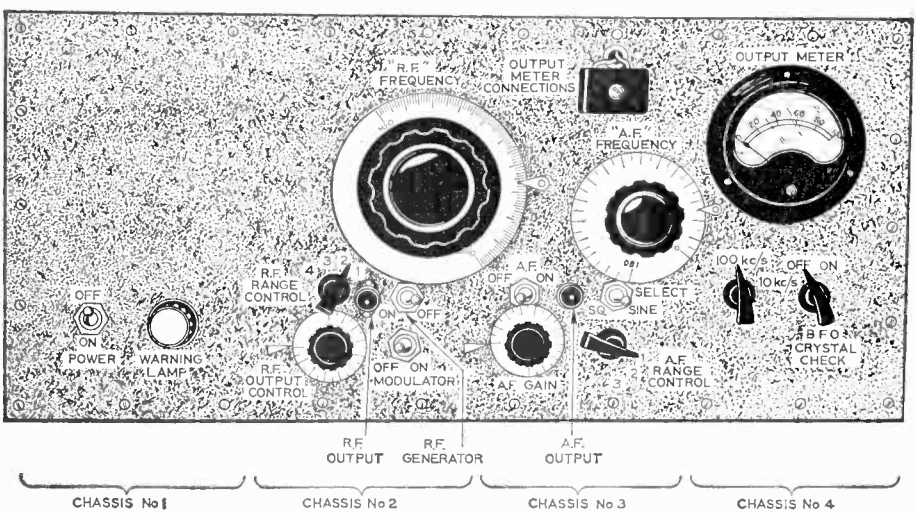


Fig. 36.—The front panel of the completed signal generator.

(continued from page 514)
components of Fig. 33 and passes out to the receiver under test.

Making the Dummy Aerial

Obtain a suitable "tin" can of 1¼in. diameter or more, and 2¼in. or more long. The lid may be clipped on or screwed on. The prototype uses a tin which contained Chinese Lacquer.

Refer to Figs. 33 and 34. Make L6 by winding 32s.w.g enamelled copper wire on the 2¼in. former in a single layer for 100 turns. Apply cellulose cement and let it set. Fix the coil in the centre of the lid and remove any dust cores from the former. Fix one band of wire (about 26s.w.g) at each end by twisting and soldering and solder the ends of the coil to these "bands" (Fig. 34).

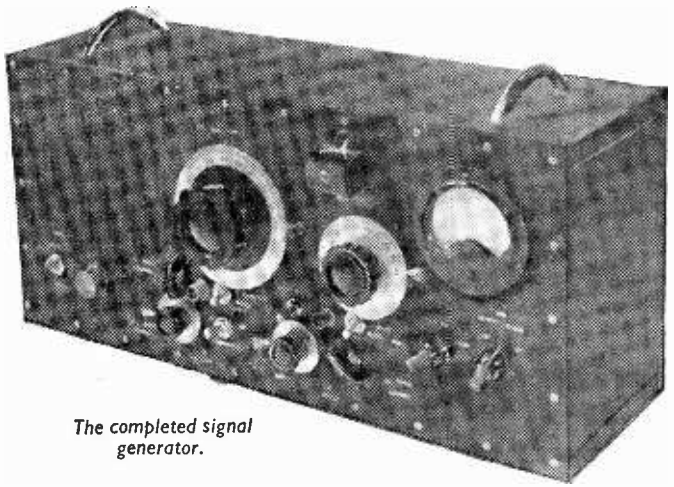
Drill two ¼in. holes in the lid to take the two screened cables, and if necessary file away a little of the base of the coil former. Prepare the screened cable so that it can be fixed on the inside of the can by soldering the metal braiding to the can. Use rubber grommets to protect the cable where they pass through the can.

Connect the centre lead of one of the cables to the bottom of the coil, and attach crocodile clips to the ends of this lead as shown. The best method is to cut off the outer plastic covering for a few inches and twist the copper braiding into a "pigtail" and solder a length of single flex to it as shown. The joint can then be bound with insulating tape so that the lead does not break off with use.

The coaxial lead is taken through C30 to the top coil connection. Between the top and bottom of the coil attach R38, C31 and C32 as shown (Fig. 34). A single condenser of 400pF may be used instead of C31 and C32. The other end of this second coaxial lead is taken to a plug for the R.F. socket. Be careful to connect this plug correctly. Check with a battery and bulb that the braiding and centre conductor are not shorting.

Testing the Dummy Aerial

Connect the unit between the generator and any type of receiver. Switch on R.F. (modulated) for the correct waveband, and tune the receiver or generator until a note is heard. Even with comparatively simple receivers. the dial positions for certain "wavelengths" should still be about the same as when used with the normal aerial.



The completed signal generator.

Making the Cabinet

The three units are placed side by side with the power unit (Chassis No. 1) on the left and finishing with No. 4 (Crystal Check) on the right. The necessary wires are connected at the back, keeping to definite colours for the various connections in case servicing is required later. Verify that all the units still work as they did when tested separately. Note that all units must not be switched on at once or the mains transformer will be overloaded. When the crystal check unit is switched on, then the R.F. unit may also operate, but not the audio oscillator as well.

Four square-cut pieces of planed soft wood are purchased and assembled as shown in Fig. 35. Verify that the units will all fit in it and then cut out a piece of aluminium sheet from which to make the front panel. Another may be used, with ventilation holes for the back. Fix this aluminium sheet to the front of the case.

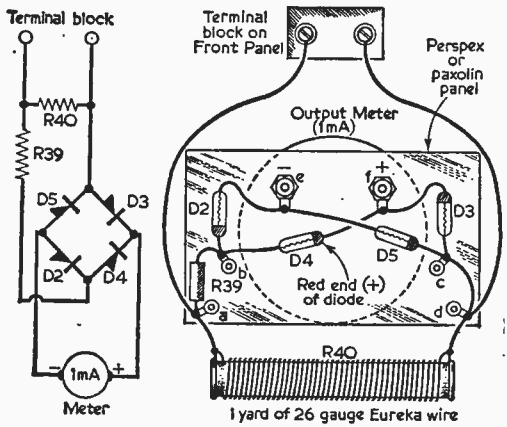
Place the four units *inside* the cabinet shell, and put a little Vaseline on the tip of each control spindle and switch. Offer the aluminium sheet

COMPONENTS LIST FOR THE DUMMY AERIAL

- *1yd of coaxial cable; about 1ft of single flex*
- *One coaxial plug (Belling-Lee)*
- *Two crocodile clips*
- *1¼in. x ½in. diameter coil former (no cores are required)*
- *A few yards of 32s.w.g. enamelled copper wire*
- *Three 220pF condensers—mica or ceramic*
- *One resistor—390Ω ½W*

COMPONENTS LIST FOR THE POWER OUTPUT METER

- *1mA moving coil meter—the prototype used a meter having a 2½in scale, but a smaller type would be suitable. The internal resistance is immaterial*
- *Four diodes—'surplus' types are suitable*
- *R39 about 8·2k—see text*
- *R40 Any physically large, high-valued, resistor wound with one yard of 26s.w.g. Eureka wire (see Fig 38)*
- *Two pole terminal block for fixing to the front panel of the completed generator*
- *Nuts and bolts, soldering tags, Perspex etc.*



Figs. 37 and 38.—The circuit and construction of the power output meter.

carefully to the cabinet shell. The longest control knob will leave a Vaseline mark on the panel. This point is then drilled to take the spindle or switch concerned. The sheet is then offered up again with *that spindle* hole only cut. Another mark will then appear; this is then drilled out. The remaining holes are drilled in the same manner. A round file will be necessary and the actual switch holes must be sufficiently large so that the threaded portion of the switch may project right through the panel to receive a nut on the outside. This connects the panel (electrically) with the four chassis.

Remove the drilled panel.

Screening

All of the inside of the cabinet is now screened with aluminium foil as is used for cooking purposes and obtainable from household stores. A few drawing pins will hold it in position. Bend it over so that when the panel is fixed, it will clamp the aluminium screen in place. Likewise the back will also clamp it and make the screen continuous.

The back may be of hardboard covered with aluminium foil, but be careful that it does not touch the terminal strips on each unit. Aluminium sheet (18s.w.g.) will also be suitable, and in either case ventilation holes will be necessary—four or five 1in. holes along the bottom *and* top. For good screening, these will have to be covered with wire gauze as is obtainable, for petrol filters, from a garage.

Marking the Panel

The units are placed in position and extra nuts are then put on to hold the units in place. The assembly is tested.

The panel now has to be marked in some way. First roughen the surface of the panel with sandpaper and then give it a coat of cellulose or lacquer. When the paint is dry, mark the panel. The following methods may be used:—

1. white paper, paste and Indian ink. Cover each piece with Sellotape.
2. white ink and cover the lettering with clear spirit varnish (*not* cellulose varnish) afterwards.
3. transfers obtainable from most radio shops. shops.

Control knobs of any type may be used, but the diagrams show types which are very suitable. The following Bulgin types are suggested:

Main R.F. Frequency, 1/K403
Main A.F. Frequency, 2/K402 (this has to be modified as explained later).
R.F. Output Control, 4/K400
A.F. Output Control, 4/K400.
All other controls use types 38.

It must be stressed that large diameter knobs are essential for the two frequency controls.

The Power Output Meter

It will be very useful to have a power output meter in the completed generator so that receivers may be tested and aligned without disturbing other members of the household. Various possibilities will occur to readers, but in this design a 3Ω dummy load is used with a meter fitted with a bridge rectifier working as a voltmeter. The meter is arranged to read directly up to 10V, but it could be calibrated easily in Watts. "Wattage" is equal to the voltage multiplied by itself (i.e. squared) and divided by 3. For instance, if the dummy load were connected to a receiver instead of its 3Ω loudspeaker and the reading was 6V, the wattage or power would be (6 × 6)/3—12W. Readers will note that the meter is not *very* sensitive, but this is purely in the interests of safety and R39 (Figs. 37 and 38) may be reduced. However, if the amplifier under test overloads the meter it will burn out, or the rectifiers will be ruined or both. The meter will not give a true power reading on a 15Ω loudspeaker, but will still be useful as an indicator when trimming receivers.

Making the Output Meter Assembly

Refer to Fig. 38. A small sheet of Perspex or paxolin is drilled to take the meter terminals (e and f). Four other holes are also drilled at a, b, c and d. Soldering tags are bolted at each of these four holes and the panel is then fixed to the meter as shown.

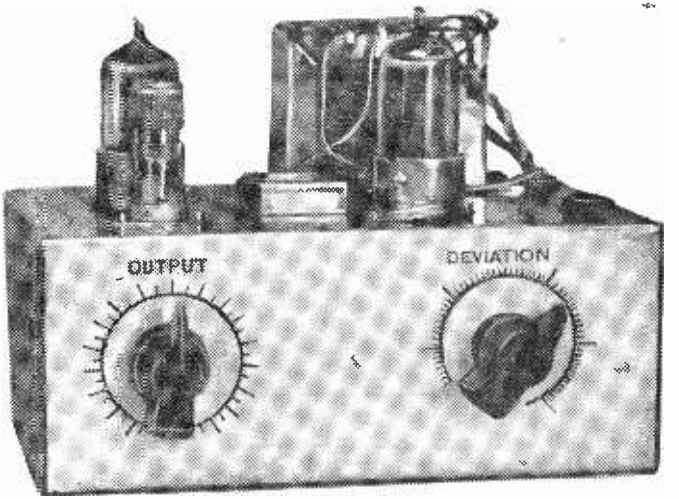
Take the output leads from a and d, make up the resistor R40 and solder it to a and d—if R40 burns out or is open-circuited in any way the meter will be ruined. Solder R39 (½W) from a to b.

Now, wire in the diodes: hold the wires in cold pliers when soldering so that the diodes are not heated. The red or positive ends must be wired as shown in Fig. 38. Tag e has a diode wired to c and one to b, and f has one wired to c and one to b. Check that tag e has two uncoloured ends connected to it and that f has two red ends connected to it. If the meter used has the positive terminal on the right, reverse all the diodes and check the wiring against Fig. 37. Fix the unit to the front panel and wire the leads from d and a through a grommet to the terminal block.

Next month the calibration of the R.F. and A.F. oscillators will be explained in detail so that the frequencies corresponding to various settings of the dial are known quite accurately.

(To be continued)

VISUAL DISPLAY OF I.F. AMPLIFIER AND DISCRIMINATOR CHARACTERISTICS



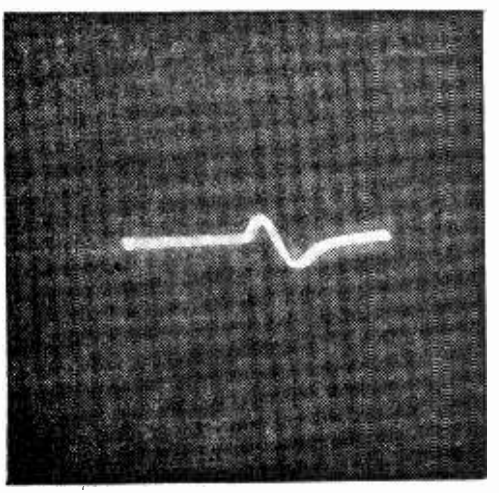
A WOBBULATOR for F.M. I.F. Alignment

(Continued from page 430 of the September issue)

AS mentioned last month, the centre frequency of 10·7Mc/s is set by moving a dust core in the former of L1. This method of setting the centre frequency ensures that the ratio of inductance-to-capacity in the oscillator tuned circuit is as high as possible—the only capacity in the oscillator tuned circuit consists of "strays" and that contributed by the valve. (It is advantageous to have a high L/C ratio so that the variations in the capacity of the diode have maximum effect on the frequency of operation of the oscillator.)

The second half of V2 functions as another cathode-follower and enables the output of the unit to be controlled by the variable control VR2.

Layout of the unit is not unduly critical, apart from that of the R.F. oscillator section where the aim should be to keep leads as short as possible—the layout shown in Fig. 3 should be followed carefully.



Discriminator response of an F.M. receiver.

Using the Unit

In use, the unit and the F.M. set to be aligned are switched on and allowed to reach their final operating temperature. A lead is connected from the X-deflecting plate of the oscilloscope to the input terminal provided. This lead can be of coaxial cable but at the oscilloscope end the outer sheath may be left unconnected; the earth connection will be made by way of the cable from the receiver to the oscilloscope. Coaxial cable will also be needed for the lead from the unit to the receiver. At the receiver end, the braiding of the coaxial cable is twisted together and soldered to a crocodile clip which is used to connect it to the chassis of the set under test. Another length of coaxial cable is needed for the input lead to the oscilloscope. One end is terminated with plugs suitable for the oscilloscope and the other end with a crocodile clip to form the chassis connection from the outer of the coaxial cable. At the receiver end, the inner of the cable is terminated

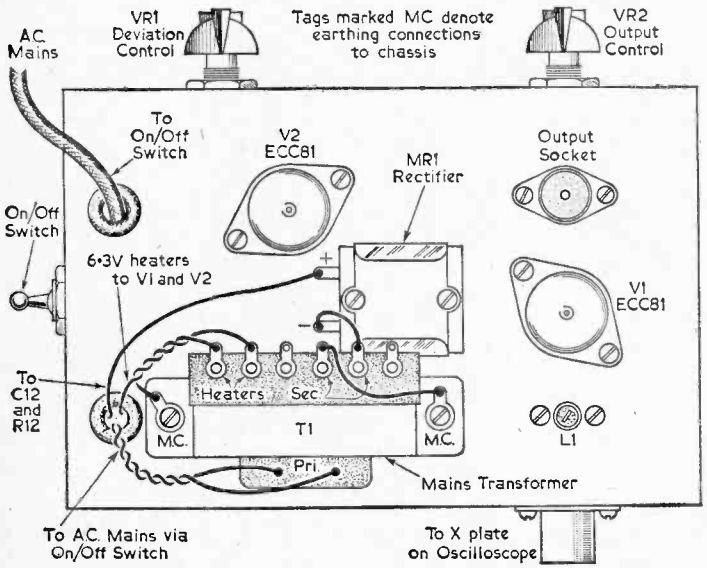


Fig. 4.—The above chassis view, showing the layout of components.

with a resistor of about 10k, to act as a stopper to prevent instability. This resistor should be soldered as near to the point where the inner leaves the outer as possible. In use the other end of the resistor is soldered to the desired point in the receiver. This lead is connected between earth on the 'scope and the Y-amplifier input—if one of these connections has to be long, be sure that it is the "earthy" one and keep as much of the inner wire screened as possible.

For the alignment, the oscillator valve of the set is removed or the oscillator is prevented from working—methods of doing this can be determined from the circuit diagram. The output from the unit is fed into the grid of the mixer—a stopper resistor may be required to avoid instability and may have a value of 33 to 470Ω, the exact value being determined by experiment.

During alignment, it is an advantage if the output of the set can be heard, and this should be fed to an audio amplifier. The oscilloscope is switched to a low sweep speed—10 to 20 per second—and the voltage at the grid of the limiter valve, of the receiver, fed to the Y-amplifier of the oscilloscope. The deviation control on the unit is set to maximum and a hum may be heard from the loudspeaker. If not, the setting of the dust core in L1 is altered until a hum is heard and a trace is obtained on the screen. When some evidence of the response is seen, the various controls on the unit and the oscilloscope may be altered for best results, bearing in mind that the input to the set should be kept as low as possible.

Marker Signals

The shape of the trace may be altered to give the optimum characteristic by altering the cores on the I.F. transformers. If another signal generator is available, a signal may be injected in parallel with the main signal and this will give a marker on the trace which will enable the I.F. to be set correctly. Note that when once the unit has been set to give a centre output frequency of 10·7Mc/s, the open, underside, of the chassis may be fitted with a metal bottom plate to prevent unwanted radiation from the oscillator circuit—the core of the oscillator coil will still be accessible from the top of the chassis. If further screening is thought, or found, necessary, then the unit as a whole may be fitted into a perforated metal case. Radiation from the oscillator should then take place only from the centre conductor of the output coaxial socket.

If the trace is observed to pulsate at a definite frequency, the effect is probably due to hum voltages from the mains and it may be removed by using the sync control on the oscilloscope to lock the sweep to a submultiple of the internal (mains) sync frequency—say 12½c/s, which is also a good sweep frequency.

When the I.F. amplifier has been aligned satisfactorily, the output to the oscilloscope may be taken from the audio take-off point, but before the capacitor which feeds the audio to the output socket of the tuner or the A.F. stages of the receiver. This is essential if a distorted trace is not to result.

The deviation control should be set so that the response curve occupies the centre of the trace; in this way, the none-linearity of the frequency-sweep circuit may be ignored for most purposes.

Of necessity, an outline only has been given of the method of using the unit and for a more detailed explanation, the reader is referred to the article by R. Brown in the September 1960 issue of *Practical Television* entitled "Using the Wobbulator", and to "Semi-conductor Diodes as Variable Capacitors" by R. B. Archer in the November 1960 issue of *Practical Television*.

Another Pye Installation

THE Airfield at Bahrein in the Persian Gulf has been fitted with a Pye Instrument Landing System.

This internationally specified approach aid incorporates a directional localiser and is now being used at over 100 airfields throughout the world. It gives accurate and safe guidance to airliners in their approach to landing, especially under conditions of low visibility.

The excellent quality of the information provided by the Pye system enables the "aid" to be coupled to the Auto Pilot which gives automatic approach to landing, thus relieving the pilot of much of the manual and mental effort of safely bringing in a 'plane.

Trade News

L.F. SIGNAL GENERATOR

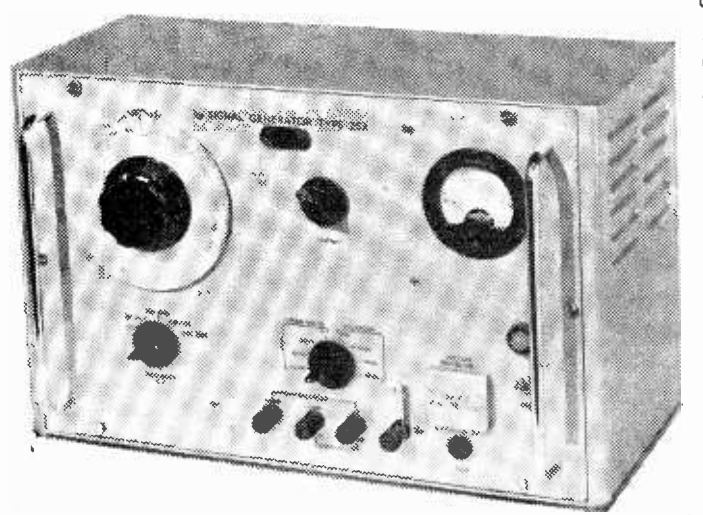
THE Airmec L.F. signal generator, type 252 is designed for the generation of pure and highly stable sinewave signals in the frequency ranges 30c/s to 300kc/s.

The oscillator consists of a Wien Bridge network with thermistor feedback amplitude control, followed by a negative feedback push-pull amplifier; tuning is by means of a variable capacitor and covers the frequency band in four decade ranges.

A screened and balanced output transformer provides either balanced or unbalanced outputs at an impedance of 600Ω; circuit design is such that the output impedance remains constant regardless of frequency and attenuator setting, and the output is monitored by a crystal diode voltmeter.

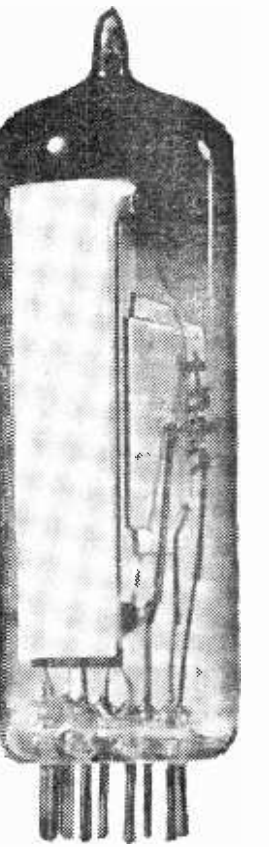
An output control provides smooth variation of output over the meter range; in conjunction with a step attenuator, it enables the output level to be set to any value from less than 1mV to 15V open circuit.

This signal generator is made by *Airmec Limited, High Wycombe, Buckinghamshire.*



An L.F. signal generator made by Airmec Limited.

Right.—The EM87 valve; a new voltage level indicator for tape recorders. It is manufactured by Mullard Ltd.



VOLTAGE LEVEL INDICATOR

THE EM87 is a new Mullard voltage indicator valve primarily intended for use as a recording level indicator in tape recorders.

In many recorders the A.F. voltage appearing at the anode of the recording output stage is about 10V, which is insufficient to close the display of currently available level indicators. The EM87 has a grid base of only 10V and in addition it has a high sensitivity in the initial region of the control characteristic (Vg=0V).

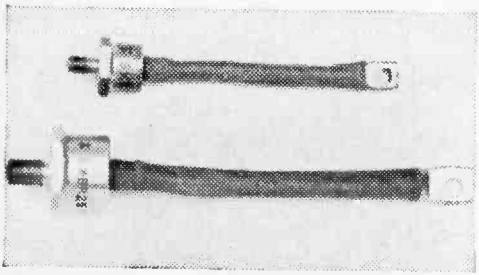
Over modulation of the tape is immediately apparent, since A.F. signals greater than 10V in amplitude cause the luminous areas to overlap, giving a brighter centre portion to the display.

Maximum ratings are: anode voltage 300V, anode dissipation 600mW, cathode current 5mA. and deflection electrode voltage 300V. The heater draws a current of 300mA at 6·3V.

The EM87 has the same overall physical dimensions (72·8mm overall length, 22·2mm diameter) and the same pin connections as the EM84. The fluorescent strip is 32·6mm in length by 4mm in width. This new valve is made by *Mullard Limited, Mullard House, Torrington Place, London, W.C.1.*

2-BAND POCKET PORTABLE RECEIVER

THE Ajax TR-220 de luxe portable receiver is now available in this country for £13 17s. 6d., which includes the battery (9V), leather carrying case and magnetic earpiece for personal listening. This receiver covers the long and



The two new silicon diodes now available from Westinghouse Brake and Signal Co. Ltd.

medium wavebands and supplies a 2½in. loudspeaker with a 200mW output. The TR-220 is housed in a plastic case, measuring only 4⅞in. x 2⅞in. x 1¼in.

Six transistors are employed in the circuit which uses a ferrite rod aerial. The Ajax TR-220 is distributed in this country by *Acme Electric Co. (Finsbury) Ltd., 63 Great Eastern Street, London, E.C.2.*

DOMESTIC RADIOS AT EARLS COURT

A COMPLETE range of radio, television, record players, etc, were on show at the Pam stand at the Radio Show this year.

The model 222 portable transistor radio, which was shown, incorporates a printed circuit chassis and is presented in a cabinet of cream and royal blue. It costs 13 guineas.

Model TB.77 is a fully transistorised table radio. It covers four wavebands and operates from an internal aerial. It is finished in a high gloss walnut veneer and costs 28 guineas.

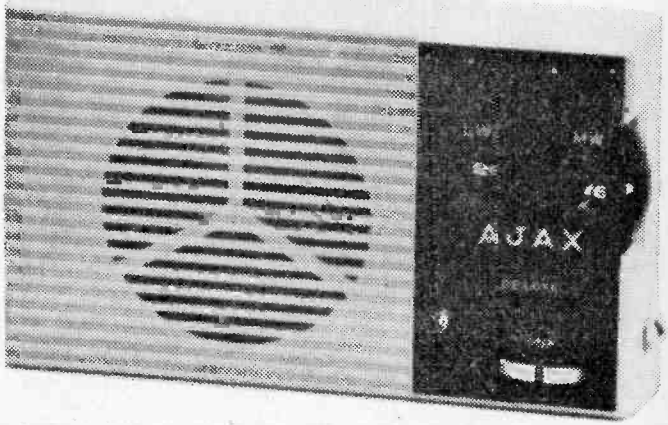
Two car radios were shown this year; one of them, the model CR.40, is operated from a 12V D.C. supply. It covers two wavebands and will fit any make of car. It costs 18½ guineas.

A stereophonic radiogram (model RG.630) was also on show. This instrument includes a two waveband VHF receiver and a four-speed autochange for monaural or stereo record reproduction. The loudspeakers are fixed into swing doors for better stereo reproduction. This model, which costs 69 guineas, and the three other radios mentioned are all made by *Pam Radio and Television Ltd., 295 Regent Street, London, W.1.*

MEDIUM POWER SILICON DIODES

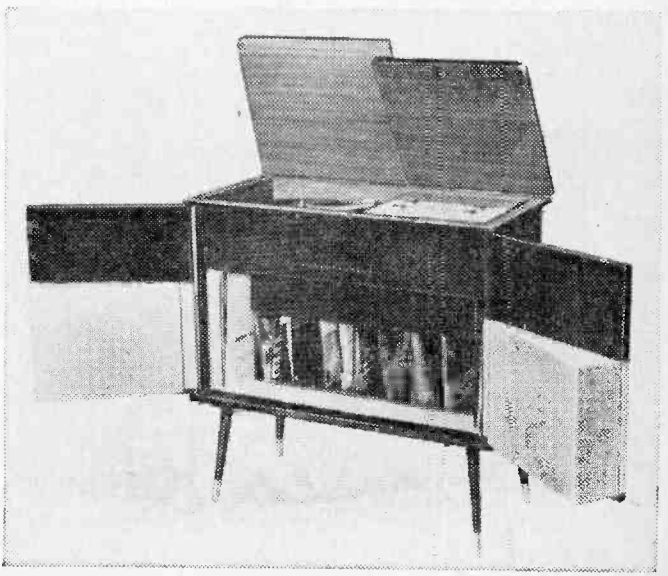
TWO new ranges of high voltage, medium power silicon diodes are available from Westinghouse Brake and Signal Co. Ltd. The SxBR8 is rated at 18A and may be used at case temperatures up to 140°C, whilst the SxBR25 is rated at 30A and may be used at similar case temperatures. Both ranges are available in voltage ratings of 100 to 1500V peak, with ten intermediate voltages.

The diodes are hermetically sealed, using glass/metal seals and the latest press seal techniques. Mounting is by means of a stud base which also serves as the anode connection. The cathode connection is made by means of an insulated flexible lead through the glass/metal seal. These diodes are manufactured by *Westinghouse Brake and Signal Co. Ltd., 82 York Way, King's Cross, London N.1.*



(Above).—The Ajax portable receiver, distributed in this country by Acme Electric Co. (Finsbury) Ltd.

(Below).—A stereophonic radiogram by Pam Radio and Television Ltd.



PORTABLE RADIO OR CAR RADIO

PUSH-PULL SIX

(6 Ediswan Transistors plus 2 Diodes)

MEDIUM, LONG WAVE AND TRAWLER BAND EXTENDING TO 80 METRES WITHOUT COIL CHANGING

350 Mw XC101's push-pull output Transistors. Powerful magnet 3in. high grade speaker. Miniature push-pull transformers. This is a top performing receiver. Nearly 30 stations listed in one evening including Luxembourg loud and clear. A pleasure to listen to. **FERRITE ROD AERIAL.** All parts sold separately, including pale blue gleaming polystyrene case with duo-diffusion grilles in red. Uses 9 volt battery. Sockets for car aerial.

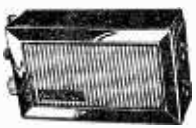
Total building cost **£6.19.6** Size 6½ x 4½ x 1½in.

"Agreeably surprised with Trawler Band reception. Luxembourg as loud as local. Your easy build diagram helped a lot . . . my first attempt."—H.S., *Penzance, Cornwall (poor reception area).*
"Super car radio."—L.B.V., *Liverpool.*

ALL PARTS SOLD SEPARATELY

TRANSONA-4

(4 Ediswan Transistors, plus 2 Diodes)

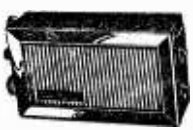


Miniature speaker. **FERRITE ROD AERIAL.** MW/LW and Trawler Band coverage down to 80 metres On test tuned in nearly 30 stations inc. Luxembourg. This sensational new radio is simple to build with our easy-build plans. Handsome pocket case.

May be built for **65/-** P.P. 2/6

NEW! POCKET RADIO

(5 Ediswan Transistors and 2 Diodes)



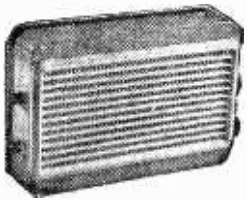
MEDIUM, LONG WAVE AND TRAWLER BAND TO 80 METRES. Designed round super sensitive ferrite rod aerial and 3in. speaker. Attractive 2-tone pocket size case in gleaming polystyrene. No aerial required. On test Home, Light Radio Lux. and many others. Easy-build plans for beginners. Powered by 4½ volt battery.

Total cost of parts required. **£4.19.6** P.P. 2/6

ALL PARTS SOLD SEPARATELY

NEW PUSH-PULL FIVE

(MW/LW and TRAWLER BAND)
(5 Ediswan Transistors)



Now greatly improved. Sensitive FERRITE ROD AERIAL. Pale blue polystyrene case with speaker grilles in red. Volume/sensitivity control. Miniature push-pull transformers. 350 Mw XC101's in push-pull. Sensitivity R.F. stage for station selection.

Total building cost **£5.7.6** P.P. 2/6.

ALL PARTS SOLD SEPARATELY

Push-Pull Pocket Six

MEDIUM AND LONG WAVES AND 400 TO 750 METRES WITHOUT COIL CHANGING.

Sensitivity of a superhet, tonal quality of a TRF. Volume control. Tuning condenser. Latest type switches. Handsome two tone-pocket case. Ferrite rod aerial. 3in. quality speaker. Easy build diagrams. **6 Transistors** (including Ediswan and Semiconductors) **plus 2 diodes.**

Total cost of all parts **£5.19.6** P.P. 2/6

ALL PARTS SOLD SEPARATELY

NEW! Easy Build Three Radio

(3 Ediswan Transistors plus 2 Diodes)

Easy to build, easy to operate. This transistor radio operates over the M.W. and L.W. extending down to 80 metres without coil changing. Ferrite rod aerial, volume-sensitivity control. Sonotone high fidelity miniature earpiece.

May be built for **49/6** P.P. 2/6

Ferrite Rod Aerial, M/L wave (7in.)	8/6
Ferrite Rod Aerial, M/W (4in.)	5/-
Transformers: 300 ohms primary, 5 ohms secondary Brand new boxed	3/6
High Fidelity Headphones with miniature earpieces and transformer with lead and jack plug for high or low impedance, matching. Brand new. Boxed	25/-
Sensitive balanced Armature Headphones. Boxed. Brand new	pair 9/-
Sensitive 2½in. Speakers. Only ⅞in. deep, 3 ohm	16/6

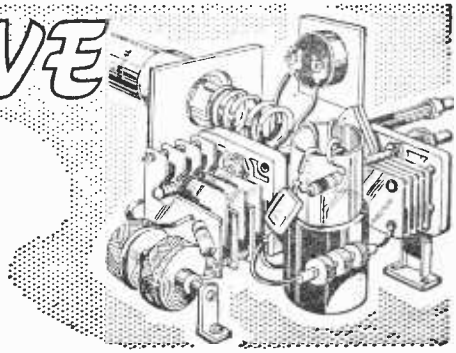
DATA SHEETS AND PARTS PRICE LIST FOR THE ABOVE 1/3 EACH
ALL PARTS SOLD SEPARATELY
AFTER SALES SERVICE YOUR PROTECTION

RADIO EXCHANGE COMPANY

27 HARPUR STREET, BEDFORD

PHONE 2367 (Opposite Co-op) CLOSE 1 p.m. SAT.

SHORT-WAVE SECTION



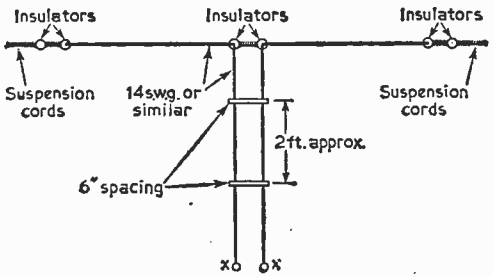
MAKING A TUNED DOUBLET

An All-band Aerial for Receiving and Transmitting

By "Amateur Transmitter"

THE use of a tuned doublet for transmitting purposes is quite well known, but the efficiency of this type of aerial for receiving can be overlooked by short-wave listeners who have not yet used anything except the simplest form of aerial. An ordinary dipole with coaxial feeder has the advantage that no tuning is required, but such aerials only work effectively on frequencies which give a fairly accurate impedance match to the feeder. As a result they are usually cut for one band only, and not used on other bands. The tuned doublet requires a tuned circuit (which may be regarded as part of the system) but this is easily arranged, and the aerial will work effectively over a very wide range of frequencies. A single aerial may thus be used for harmonically related bands, such as 80m, 40m, 20m etc., and also for 49m, 31m, 25m, 19m and other short-wave broadcast bands. On all bands it is tuned to resonance, a coil and condenser being used for this purpose. This tuning can compensate for modifications in the length of the aerial top, or feeder, and so exact dimensions are not necessary for these items.

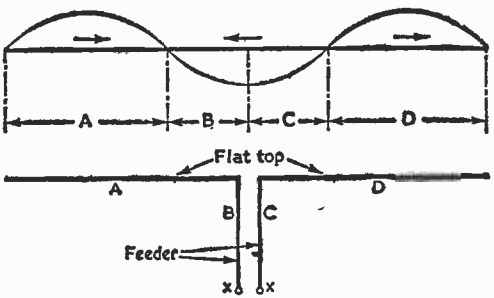
Fig. 1.—A doublet with two half-waves in phase.



A balanced aerial can also give a considerable reduction in static and similar noise, compared with a single wire or end-fed or end-coupled aerial. This reduction in noise is somewhat similar to that achieved with a coaxial feeder.

Fig. 1 shows the approximate current distribution in an aerial wire which is three half-waves long at operating frequency. Section A is one half-wave; B and C, each one quarter-wave, make up the centre half-wave, and D is the final half-wave. If the portions B and C are brought down to make a feeder, parts A and D will form the flat top, and this part of the aerial will consist of two half-waves in phase.

When a station is received, the current flow in parts B and C will be in opposite directions, and thus provide a signal at the tuning coil connected to the feeder ends X. A static impulse will, however, flow down B and C in the same direction, and thus cancel out at the tuning coil. This explains the reduction in static interference. Cancellation will not in fact be complete, owing to lack of exact balance, but will usually be worthwhile.



When the aerial is used on other frequencies, A and D will not be a half-wave each, but this has little effect on results. In the same way, the feeders B and C will no longer be a quarter-wave each, but this is unimportant because of the tuned circuit attached to the ends X. It is thus possible to use a wide range of lengths, for both the flat top, and the feeder. For the same reasons, one aerial will work over a wide range of frequencies.

Fig. 2.—Practical construction of the aerial.

Doublet Construction

Fig. 2 shows how the doublet, with tuned feeder, can be made. Single 14s.w.g. copper wire is often used for aerials, but other types of aerial wire can be employed instead. Hard-drawn wire is satisfactory for the flat top, but soft-drawn or stranded wire will be more convenient for the feeder.

Each end of the flat top has one or two aerial insulators, and suspension cords or wires are taken to suitable supports. The leads forming the feeder are roughly 6in. apart, and spacers can be obtained for this purpose, or made. The spacers will be needed at about 2ft intervals: A pair of insulators in the flat top enables each feeder to be attached as shown. At this point the feeders should either be parallel, or fan out slightly. They should not run closer, as might be so if only one short insulator were used. If the top and feeders are not made with single lengths of uncut wire, joints should be soldered to avoid noises in the receiver.

The top of the aerial should be as high and in the clear as possible, and especially removed from local interference. Long distance results may easily be achieved with an indoor aerial, but when space is available outside, indoor erection is pointless, and reduces signal strength.

If the top of the aerial slopes, because the supports are of unequal height, this will modify the directional pattern. The latter also depends on the aerial length. However, the position of the aerial usually depends on the available supports, so there is little point in being too concerned about directional effects.

Top and Feeder Lengths

When the system is operating as in Fig. 1, and the feeder is just short of an odd number of quarter-waves, parallel tuning is needed at the ends X. When the feeder is just short of an even number of quarter-waves, series tuning is necessary. For all-band operation, it is thus necessary that the tuner condenser can be placed either in parallel, or series with, the coil.

It will be noted that parallel tuning can be used with anything up to one quarter-wave; that is, with very short feeders. Approximate quarter-wave lengths for 160m, 80m, 40m and 20m are 132ft, 66ft, 33ft and 16ft. Some typical top and feeder lengths, with the tuning to be expected, are given in Table I

TABLE I

Top	Feeder	Frequency	Tuning
66ft	66ft	7 and 21 Mc/s	Series
		3·5, 14 and 28M/cs	Parallel
106ft	82ft	3·5, 7 and 14Mc/s	Parallel
67ft	42ft	3·5Mc/s	Series
		7 and 28Mc/s	Parallel
134ft	70ft	3·5, 7, 14 and 28Mc/s	Parallel

The top is the total overall length. Except when the aerial is very high, or a long way from the receiver or transmitter, the feeder will often be shorter than the examples.

A suitable aerial for reception can be an aerial with a 66ft top (A and D each 33ft) and a feeder of any length. The type of open feeder described may, if desired, be replaced by 300Ω twin flat ribbon. This is slightly less efficient than the 600Ω open-wire line, but the losses are not particularly great if the feeder from flat top to receiver is not too long.

If it is desired to find out the particular top and feeder lengths for special bands, this can be found

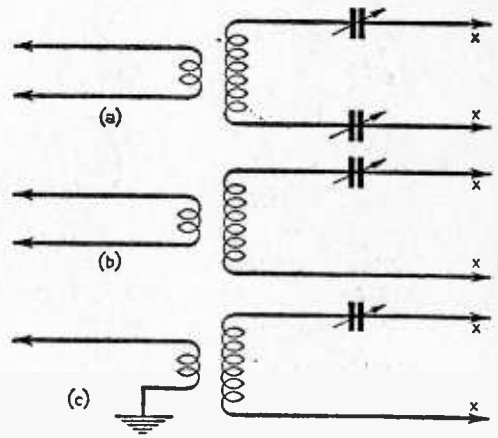
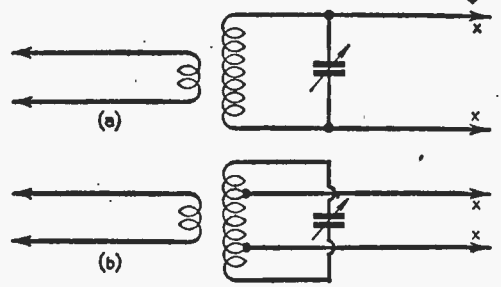


Fig. 3.—Series tuning of the feeder.

Fig. 4.—Parallel tuning of the feeder.



directly in feet, for a half-wave, from:—

$$\frac{468}{\text{frequency in Mc/s}}$$

It will have been seen that the tuning varies from band to band. When the system of tuning for a band has been found, it should be noted down, so that it can be returned to at once, when necessary.

Feeder Tuning

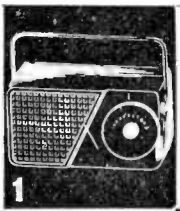
Circuits for this purpose are shown in Fig. 3. At "a" one variable condenser has been included in each feeder. In practice, one condenser is sufficient, if near the coil, and this can be included as at "b". In both "a" and "b" a coupling loop is taken to the dipole input of the receiver. When the receiver has no dipole input, but only a single aerial terminal, the coupling loop is connected to aerial terminal and earth, as at "c".

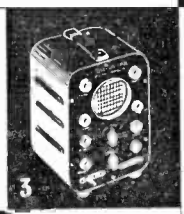
For parallel tuning, the condenser is placed across the coil, as shown at "a" in Fig. 4. Either of the receiver coupling methods shown in Fig. 3 may be used.

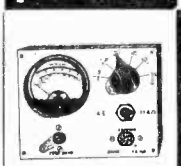
When the aerial is used for transmitting, it may be necessary to tap the feeders in an equal number of turns from each end, as at "b" in Fig. 4, to secure proper loading. In some cases where the impedance is improved by this, tapping in the feeders can also give improved reception.

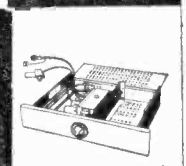
(Continued on page 533)

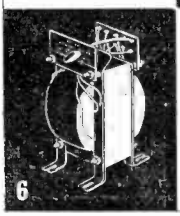
CHECK with these BARGAINS

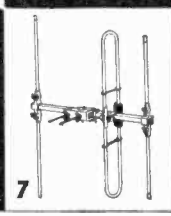












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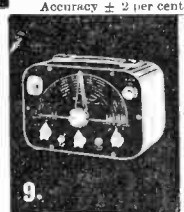

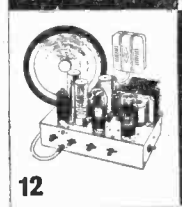

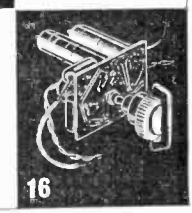

10. **SIGNAL GENERATORS.** Cash £4.19.6 or 25/- deposit and 4 monthly payments of 21/6, P. & P. 5/-. Coverage 120 kc/s to 84 Mc/s. Case 10 x 6½ x 4¼in. Size of scale 6½ x 3¼in. 2 valves and rectifier. A.C. mains 230-250 v. Internal modulation of 400 c.p.s. to a depth of 30 per cent, modulated or unmodulated R.F. output continuously variable 100 millivolts. C.W. and mod. switch variable A.F. output and moving coil output meter. Accuracy ± 2 per cent.
11. **BATTERY RECORD PLAYER AND AMPLIFIER.** 45 r.p.m. "Star" motor "Acos" crystal pick-up, 3 transistor push-pull amplifier complete with transistors. Output 500 milliwatts, 49/6, P. & P. 3/6.
12. **8-watt PUSH-PULL 5 VALVE AMPLIFIER.** A.C. mains 200-250 v. Size 10½ x 6½ x 2½in. 5 valves. For use with all makes and type of pick-up and mike. Negative fee back. Two inputs, 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; 4 db down to 20 kc/s. Output 8 watts at 5 per cent total distortion. Noise 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. 6/-. Crystal mike to suit 15/-, P. & P. 1/6. 8in. P.M. Speaker to suit 12/6. P. & P. 1/6.
13. **B.S.R. MONARCH UA8 WITH FUL-FI HEAD.** 4-speed, plays 10 records, 12in., 10in., or 7in. at 16, 33, 45 or 78 r.p.m. Intermixes 7in., 10in. and 12in. records of the same speed. Has manual play position; colour, brown. Dimensions: 12½ x 10½in. Space required above baseboard 4½in., below baseboard 2½in. Fitted with Ful-Fi turnover crystal head. £6.19.6, P. & P. 5/-. With Stereo Head £7.19.6, P. & P. 5/-.
14. **TRANSISTOR TESTER.** For both P.N.P. and N.P.N. transistors incorporating moving coil meter. In metal case, size 4½ x 3½ x 1½in. Scale marked in gain and leakage. 19/6, P. & P. 2/6.
15. **PUSH-PULL OUTPUT STAGE** inclusive of transistors with input and output transformers to match 3 ohms speech coil, suitable for use with the POCKET RADIO. Kit of parts, including transistors. 19/6, P. & P. 1/6. Wiring diagram 1/6, free with kit.
16. **PORTABLE AMPLIFIER.** On printed circuit for A.C. Mains 200/250 v. Size 4 x 3in. with tone and volume control. Valves: ECL82 and EZ80. 39/6, P. & P. 2/6.

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(Continued from page 530)

With parallel tuning, the effect of taking an earth connection to a centre-tap on the coil can be tried, as this can further reduce static interference.

A suitable tuning coil is shown in Fig. 5. If this is wound with 20s.w.g. or similar wire on a ceramic former, it will do for both receiving and transmitting purposes. When the aerial is to be used for receiving only, the ribbed former is still convenient, as clips can easily be attached to the coil turns. There is, however, no need that the coil be of the dimensions given, provided it has a number of turns which allow it to be tuned to resonance on the bands required. Tinned copper wire will allow easy tapping, and tags or leads can be soldered on when the tapping points are found. Adjoining turns must not be shorted.

The loop consists of 2 or 3 turns of well insulated wire wound round the centre of the coil. The number of turns has to be a compromise for all bands, and more turns may well be used if the higher frequency bands are not of much interest.

For receiving purposes, almost any air-spaced tuning condenser will be satisfactory. A value of about 200pF will generally be convenient. Smaller condensers may be used, but it will be necessary to move tappings on the coil more frequently. A receiver type condenser will be suitable. For transmitting, a condenser with wide spacing may be required, except for low power.

If the feeder is taken to terminals equipped with short lengths of flex, and clips, this will allow easy adjustment. The condenser may also have flexible leads and clips, so that it can be placed in series or parallel with the coil, as required, and to permit changing the number of turns.

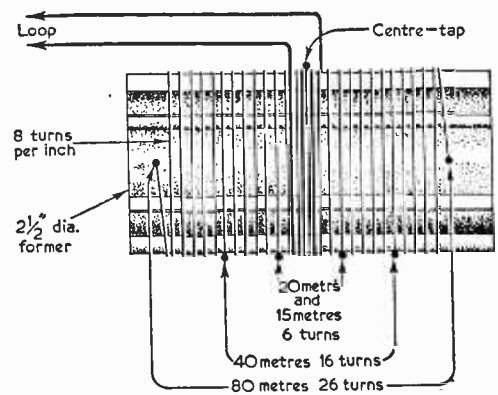
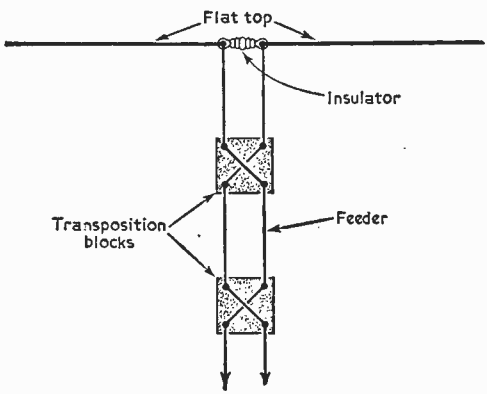


Fig. 5.—Details of the tuning coil for the feeder.

Fig. 6.—Transposing the feeder to reduce the effects of interference.



Tuning Method

If the receiver has a signal strength meter, the tuning condenser is simply rotated to obtain best signal strength on the required band. The correct tuning point should show an improvement of several times in signal strength, but is not very critical as the circuit tunes flatly. If the condenser cannot be adjusted to give a definite peak in results, the number of turns in circuit may need adjusting. If results improve with the condenser fully open, too many turns are in use. On the other hand, if results are improved when the condenser is fully closed, more turns are required in circuit.

Once tapping points, method of tuning, and tuning condenser settings have been noted, they can be returned to easily.

When the receiver has no tuning meter or indicator, weak transmissions should be tuned in, and the aerial tuner adjusted for best results. Settings should then be noted, for future reference.

For transmitting purposes, the aerial can be tuned up roughly on the receiver, by noting the signal strength meter. The loop can be coupled by a short length of coaxial cable to the π-output of a transmitter, the coaxial sheath and one end of the loop being earthed as at "C" in Fig. 3. Meters may be included in one or both feeders, to show feeder current. Current will be fairly large for series tuning (low impedance), and fairly small with parallel tuning (high impedance).

Transposed Line

When the aerial is used for receiving, the line may be transposed, as in Fig. 6, as a further aid to reducing interference. For reception in such circumstances, there is no need for the spacers to be so long, and the feeder leads can thus be closer together. The wires cross at each transposition block. The blocks may be cut from perspex or other insulating materials. To avoid contact between the leads where they cross, one lead can be each side of the block.

Local interference is less likely to cause trouble with a transposed feeder, because the interference strength will be more nearly equal in each wire, and will thus cancel out better at the ends of the feeder. The aerial may be used untuned by taking its feeders directly to a receiver dipole input, or by omitting the tuning condenser, so that the coil merely acts as a coupler. ■

Short-wave Listeners' Log

MOST Dx reception of amateur stations is usually on the 20m and 15m bands, these bands being from 14·00Mc/s to 14·35Mc/s and 21·00Mc/s to 21·45Mc/s respectively. Circumstances may make it difficult for some S.W. listeners to erect an extremely efficient or high aerial. Fortunately, however, a half-wave aerial for either the 20m or 15m band does not have to be particularly long. The actual lengths are 33ft for the 20m band, and 22ft for the 15m band. In very many cases it should be possible to erect an aerial of this length.

Tests with a simple dipole of this kind show that it can give excellent reception. Good results are obtainable even if the aerial is not at all high. A few listening periods with such an aerial, at a height of about 12ft to 15ft above ground, enabled many Amateur stations to be logged.

For a centre-fed dipole, the length of aerial wire mentioned is cut in half, a few inches extra being allowed to attach to the insulators. A low impedance feeder of any length is then taken from the centre. This feeder may be of 75Ω twin flat lead, or of twin twisted flex, or may be a co-axial cable. In the case of the 15m aerial, for example, the aerial itself would have two sections, each 11ft long, with the feeder descending from the centre, so that the whole resembles the letter "T".

Confined Spaces

If space is limited, it is in order to turn down vertically a few feet at each end, to accommodate the correct length. It is interesting to note, in this, that the HP9 station (Panama) was heard on two days at very good strength. As a transmitter was available, this station was called, and when describing his equipment he said that space was so limited that he was using a 20m indoor dipole, with both ends turned down in the way explained.

It is not necessary that the dipole top should be horizontal, so supports of unequal height may be used. The slope does, however, change the directive pattern. This is not usually of much importance, unless the best possible reception is wanted from one area, or unless experiments are to be made with directivity. ■

How to Keep Radio Equipment Cool

(Continued from page 503)

it may be difficult to make the heating-up period take less than an hour, and quite often the apparatus may be in use for a shorter time, so it is desirable that it should have a stable performance as independent of temperature changes as possible.

Curve

The heating-up curve is easily plotted if an accurate mercury thermometer is inserted to measure the air temperature inside the case, an inch or two from the top. The thermometer can be inserted through a hole with a rubber grommet for protection. If it is of the total immersion type, the stem can be covered to avoid cooling of the projecting part of the thermometer. The thermometer must of course have a sufficient range, e.g., up to 240°F, to ensure that it will read up to the maximum temperature reached without breaking. Over the first part of the curve, readings can be taken at intervals of five minutes. After half an hour, less frequent readings would suffice. All that is really important, however, is to check that a steady and not excessive temperature is reached in a reasonable time. If 140°F is exceeded, the test should be discontinued before any damage to components can occur, and the ventilation arrangements will require improvement.

This was well-illustrated by a small home-made oscilloscope contained in an aluminium case measuring 8¾in. x 7in. x 9in. The case had not been painted black, and this was an additional factor in retaining the heat, as unpainted aluminium will not radiate heat so well. Reliance was placed on convection via 24 small louvres pressed in the sides. These provided apertures only ¼in. wide, and the total area of the openings was only 5sq in. The louvres proved to be ornamental rather than efficient.

65W Dissipation

The oscilloscope contained seven valves and a cathode ray tube, and there was a total dissipation of 65W inside the cabinet. The heating-up curve (A) shows no sign of a steady temperature being reached even after two hours (see Fig. 1 on page 503). It was obvious that worked for long periods under these conditions, the oscilloscope would soon break down, and the only way to avoid this was to provide larger apertures. Experiments however were first made in separating the top and bottom of the case from the sides by ¼in. spacers, but such a small gap had a quite negligible effect, and the original louvres had to be replaced by rectangular openings measuring 1⅞in. x 1¼in., covered with expanded aluminium material of the type used for loudspeaker grilles—which reduced the effective area of the openings by about 50% (see the illustration on page 503).

Six of these openings were made in each side, and two at the back of the case, giving a total estimated area of aperture of roughly 25sq in., or about five times the previous amount.

The ventilation now proved to be reasonably effective (Curve B) and the final working temperature did not quite reach 130°F in a room temperature of 60°F. ■

Valves by return post

AZ1	10/-	ECF80	12/6	EF183	15/-	KT61	10/-	TH30C	5/-	VP23	5/-	5Z4G	9/-	6K7G	3/6	7C6	8/-	25L6GT	10/-
AZ31	10/-	ECF82	10/6	EF184	15/-	KTW61	6/6	TP22	8/-	VR105/308	7/-	6A7	10/-	6K7M	6/9	7H7	8/-	25Z4	9/6
DAF96	8/-	ECH42	9/-	EK32	7/-	MX40	12/6	U10	9/6	VR150/307	7/6	6A8G	9/-	6K8G	6/6	7S7	9/6	25Z5	7/-
DF96	8/-	ECH81	9/6	EL33	10/-	OZ4	4/6	U25	13/6	VU39 (MU		6AK5	5/-	6K7GT	5/9	7Y4	6/6	25Z6	10/-
DK96	8/-	ECL80	9/6	EL41	9/-	PCC84	12/-	U26	12/-	12/14)	8/9	6AL5	4/-	6K8GT	10/-	10F1	12/6	30FL1	10/6
DL96	8/-	ECL82	10/	EL84	9/-	PCC85	8/6	U50	8/-	Y63	7/6	6AM5	7/6	6L6G	8/-	10P13	22/3	30L15	23/3
EABC80	9/-	ECL83	15/-	EL91	4/6	PCF80	8/9	UABC80	9/-	1A7GT	13/6	6AM6	4/-	6L6M	9/6	12A6	5/-	30P4	15/-
EAF42	9/6	EF36	3/6	EM34	9/6	PCF82	11/6	UAF42	9/6	1C2	11/6	6AQ5	7/6	6L18	11/6	12AH8	12/-	30P12	12/6
EB91	4/6	EF41	9/6	EM80	9/6	PCL83	13/6	UBC41	8/6	1C5GT	12/6	6AT6	8/6	6N7GT	7/6	12AT7	7/6	30PL1	12/6
EBC3	5/-	EF50	5/-	EM81	10/6	PCL84	10/-	UBC81	11/4	1H5GT	9/-	6BA6	7/6	6Q7G	7/6	12AU7	8/-	35L6GT	10/-
EBC33	6/9	EF50SYL	7/-	EY51	9/6	PL36	13/6	UBF80	9/-	IN5	10/6	6BE6	7/6	6Q7GT	9/6	12AX7	8/-	25Y5	9/-
EBC41	8/9	EF80	7/-	EY86	10/-	PL81	11/-	UCC84	10/11	IR5	7/6	6BH6	9/-	6SK7	6/-	12BA6	9/-	35Z4GT	8/-
EBF80	9/9	EF85	7/-	EZ40	7/6	PL82	8/6	UCC85	9/6	IS5	6/6	6BJ6	9/-	6SL7GT	8/-	12BE6	9/-	42	8/-
EBF89	9/6	EF86	12/6	EZ41	7/6	PL83	9/6	UCH42	9/6	IT4	5/6	6BW6	9/-	6SN7GT	7/6	12C8	7/-	35Z5GT	9/6
ECC81	8/-	EF89	8/9	EZ80	7/0	PL84	9/6	UCH81	9/6	3D6	5/-	6C4	4/6	6SQ7	9/3	12J7GT	10/6	50L6GT	8/6
ECC82	7/6	EF91	5/9	EZ81	7/6	PX25	12/6	UCL82	11/6	3Q4	7/6	6C5GT	6/6	6U4GT	12/-	12K7GT	6/6	75	10/6
ECC83	9/-	EF91(BVA)		FC13	5/6	PY80	7/6	UCL83	13/6	3Q5GT	9/6	6C6	5/-	6V6G	5/-	12K8GT	13/6	80	8/6
ECC84	10/-		7/6	FW4/500		PY81	8/6	UF85	9/-	3S4	7/6	6D6	5/-	6V6GT	7/9	12K8M	13/-	142BT	3/6
ECC85	9/6	EF92	6/-		10/-	PY82	7/-	UF89	9/-	3V4	8/-	6CH6	7/6	6X4	7/6	12Q7GT	6/6	210DDT	4/6
				GZ32	11/6	PY83	8/6	UL41	9/-	4D1	3/-	6F6G	7/-	6X5G	7/-	12SK7	6/-	210VPT	3/6
				HL23DD	8/6	PEN4VA		UL84	9/-	5R4GY	9/6	6F6M	7/6	6X5GT	7/-	12SL7	8/-		
				HL42DD			10/-	UU6	19/3	5U4G	5/-	6J5GT	5/-	6/30L2	12/6	12SN7GT			
					10/-	PEN25	5/-	UY1N	12/6	5V4	11/6	6J5M	6/6	7B6	10/6		10/-		★
				KT2	5/-	PEN45	8/-	UY41	6/6	5Y3G	8/-	6J6	4/-	7B7	8/6	15D2	7/9		
				KT33C	6/-	SP4	5/-	UY85	7/-	5Y3GT	7/6	6J7G	6/6	7C5	8/-	25A6G	8/-		

MULLARD TRANSISTORS

OC19	48/-	OC77	10/-
OC35	25/6	OC78	8/-
OC44	11/-	OC78D	8/-
OC45	10/-	OC81	8/-
OC70	6/6	OC84	11/-
OC71	6/6	OC170	13/6
OC72	8/-	OC171	14/6
OC72pr	16/-	OC201	12/6
OC73	16/-	OC202	36/-
OC75	8/-		

A SPECIAL OFFER OF SIX MULLARD TRANSISTORS

1 OC44, 2 OC45, 1 OC81D, 2 OC81. Only **37/6** set.

EDISWAN TRANSISTORS

XA104 **12/-**, XA103 **10/-**, XB102 **6/6** ea.

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Special Offer of Top quality recording tape, 3½in. spool 200ft, **5/3**, 5in. spool 600ft, **13/9**, 5¾in. spool 850ft, **18/6**, 7in. spool 1200ft, **23/-**. Extra-play tape, 3½in. spool 300ft, **7/-**, 5in. spool 900ft, **21/-**, 5¾in. spool 1275ft, **26/6**, 7in. spool 1800ft, **37/6**. Empty spools, 3½in., **1/6**, 5in., **2/-**, 7in., **3/-**.

RECTIFIERS

RM1 **5/3**, RM2 **6/9**, RM3 **7/6**, RM4 **13/6**, RM5 **19/6**, 14A86 **19/6**, 14A97 **19/6**, 14A100 **19/6**, LW7 **17/6**, 18RA 1-1-16-1 **6/-**, FC31 (14RA 1-2-8-3) **22/6**, FC101 (14RA 1-2-8-2) **16/6**.

Hi-Fi Transistor FM Tuner for the Home Constructor, complete kit **£18.18.0.** Fully illustrated booklet with diagrams, full shopping list etc., **3/6**.

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All brand new

2½in. square Rola C25 ..... **26/10**
2½in. square EMI ... **18/6**
4in. square Elac Tweeter **12/6**
5in. round Plessey with O.P.T. **16/6**
6½in. round Celestion **17/6**
8in. round Richard Allen **18/6**
10in. round Elac ... **25/-**
12in. round Plessey **29/6**
6in. x 4in. Plessey ... **19/6**
7in. x 4in. Plessey ... **19/6**
8in. x 4in. Celestion and Richard Allen **19/11**
10in. x 6in. Celestion and Plessey **21/6**

LOUDSPEAKER CABINETS

Type suitable for an 8in. unit **21/-**
Type suitable for a 10in. unit **25/6**
Type suitable for a 7 x 4in. unit **17/6**

CRYSTAL CALIBRATOR No. 10

Crystal controlled. Directly calibrated. Functions: Crystal, controlled oscillator providing fixed frequency signals of 500kc/s and all harmonics of 500kc/s up to 30mc/s variable oscillator from 250kc/s to 500kc/s enabling all intermediate frequencies between 250 kc/s to 500kc/s to be produced and modulated. Complete in carrying case/bag with all valves, leads and instruction book. **£4.10.0** ea.

MICROPHONES

★ **Acos Mic., 39/1.** Crystal stick microphone for use as a hand, desk or floor stand unit. Listed at 3 gns. OUR PRICE **37/6.** Table Stand **7/6** extra. Floor stand adaptor, **12/6** extra.

★ **Acos Mic. 40,** as supplied with modern tape recorders with a folding rest and 8ft. lead. Listed at £1.15.0. OUR PRICE **19/6.**

★ **GBS Microphone,** pencil stick type fitted with muting switch, **42/-.**

★ **T.S.L. Crystal "Stick" Microphone,** Model MX3, for general purpose use, complete with table stand, **45/-.**

★ **T.S.L. Moving Coil Microphone,** for high or low impedance. Brown and cream plastic case with a fold-in table rest, 6ft. cable and a standard 3-way connecting Continental plug, **£4.4.0.**

★ **Acos Mic. 45,** dual purpose, designed to fit into the hand, has built-in stand for desk use, die-cast case for a variety of applications from music to dictation, with lead, **25/-** each.

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Can be built absolutely complete for **£11.19.6.** (Post **3/6**).

★ Small size. Will fit any car. ★ 12 volt operation. ★ New Hybrid circuit. ★ Transistor output. ★ New Type Brimar valves. ★ No Vibrator, 12 volt H.T. and L.T. ★ T.C.C. Printed Circuit and Condensers. ★ Tuned R.F. stage. ★ Medium and long waves. ★ Permeability tuning. ★ 7 x 4in. elliptical speaker.

Instruction Booklet giving full details, illustrations, dimensions, circuit diagram and shopping list, **2/6.**

SPECIAL OFFERS

Paxolin sheet, $\frac{1}{16}$in. thick, 6 x 6in., **1/-**; 12 x 6in., **2/-**; 12 x 12in. **4/-** each

Set of Mullard Transistors, comprising 1 OC44, 2 OC45, 1 OC81D, 2 OC81 ... ... **37/6 set**

Special Purchase, ex-Government Rectifiers, 250v., 45mA ... ... **3/9 each**

TELEFUNKEN STEREO HIGH FIDELITY AMPLIFIER

Five watts total output (2½ watts each channel), size 12in. wide x 9in. deep 2in. high, weight 9 lbs. Hammered enamel finish in green/grey with gold trim, control and press buttons in cream with black, blue and red lettering. Provision made to feel the amplifier from radio, tape recorder, FM tuner, etc. Listed at £16.16.0. Special Alpha Offer. **£12.12.0**

CATALOGUE

OUR 1962 CATALOGUE IS NOW AVAILABLE. PLEASE SEND 1/- IN STAMPS FOR YOUR COPY. TRADE CATALOGUE ALSO AVAILABLE. FOR WHICH PLEASE ATTACH YOUR BUSINESS LETTER HEADING.

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TERMS: Cash with order or C.O.D. Postage and Packing charges extra; as follows: Orders value 10/- add 1/-; 20/- add 1/9; 40/- add 2/6; £5 add 3/6. Minimum C.O.D. fee & postage 3/-. For full terms of business see inside cover of our catalogue. Personal Shoppers 9 a.m. to 5 p.m. Mon. to Friday; Saturday 10 a.m. to 1 p.m.

Club News

REPORTS OF CURRENT ACTIVITIES

AMATEUR RADIO MOBILE SOCIETY
Hon. Sec.: G3FPK, 79 Murchison Road, London E.10.

At the Longleat Mobile Rally many A.R.M.S. members were present to enjoy the many attractions of this event, held in this local beauty spot. There were five notable rallies during August; the Derby Mobile Rally and Hamfest, held as part of this Society's Golden Jubilee Year celebrations; the Hetton Show and Mobile Rally, which included show jumping in its attractions; the Stamford Rally Fest; the Luton Mobile Rally and the South Manchester and Stockport Amateur Radio Rally, the main event of which, was a navigation and mobile contest.

Future Events:
September 10th—National Mobile Rally.
September 17th—Lincoln Hamfest and Mobile Rally.

BLACKWOOD AMATEUR RADIO SOCIETY
Hon. Sec.: P. M. Fulton, GW3MMU, 36 Sunnybank Road, Blackwood, Monmouthshire. Wales.

For the past three months members have been helping to transform an old cottage into new headquarters for the society. Both inside and outside the cottage have been subjected to alterations and it is hoped that it will be officially opened quite soon. New members are still wanted urgently.

BURSLEM AMATEUR RADIO CLUB
Hon. Sec.: W. Luscott, 36 Rothsay Avenue, Sneyd Green, Hanley, Stoke-on-Trent.

Meetings are held at Burslem Town Hall on the third Wednesday of each month and start at 7.30 p.m. A morse class is included at each meeting.

A series of lectures and demonstrations have been planned for the winter months—commencing in September. New members are always welcome.

DUDLEY AMATEUR RADIO CLUB
Hon. Sec.: D. H. W. Pratt, G3MHS, 23 Kent Street, Upper Gornal, Dudley, Worcestershire.

This newly formed club held its first general meeting on the 18th August. Until a headquarters can be found all meetings will be held at 23 Kent Street, Upper Gornal, Dudley, Worcestershire.

GUILDFORD AND DISTRICT RADIO SOCIETY
Hon. Sec.: J. R. Barker, 35 Banders Rise, Merrow, Guildford, Surrey.

The July meeting was designed to give younger members experience in setting up a portable station. On the 28th July, Ken Orford gave a talk on "Propagation—Past, Present and Future."

Future Event:
October 1st—A Car Treasure Hunt.

LEEDS AMATEUR RADIO SOCIETY
Hon. Sec.: D. Dinsdale, 69 Spen Lane, Leeds 16, Yorkshire.

This society will soon begin a new programme of activities, starting on September 20th with an informal exhibition of members' equipment.

Future Events:
September 27th—Demonstration of 4m equipment.
October 4th—Spares Sale.

MITCHAM AND DISTRICT RADIO SOCIETY
Hon. Sec.: M. Pharaoh, G3LCH 1 Madeira Road, Mitcham.

G3NFA/P was at Hindhead during the 2-metre field day and made quite a good score. The number of contacts made by G3NFA (assisted by G3LSP and G3LCH) was 195 with several contacts with stations other than English. G3LAR, who was operating from the Norfold area during the contest, made about 72 contacts.

NEWBURY AND DISTRICT AMATEUR RADIO SOCIETY
Hon. Sec.: G. T. Allen, G3JTK, 83 Huntsmoor Road, Tadley, Hampshire.

At the August meeting, members brought items of test equipment etc., to the headquarters and explained their various uses.

Future Events:
September 29th—"On understanding radio"; a short talk by G3LLK.
October 1st—The Southern Regional Meeting.
October 27th—Constructional Competition.

NORTHERN HEIGHTS AMATEUR RADIO SOCIETY
Hon. Sec.: A. Robinson, G3MDW, Candy Cabin, Ogden, Halifax, Yorkshire.

Recent activities have included a talk by G2SU on his "50 Years of Radio," and a visit to a local television factory. The subject of the meeting on September 6th was Radio Astronomy.

Future Event:
September 20th—An informal meeting.

PETERBOROUGH RADIO SOCIETY
Hon. Sec.: D. Byrne, G3KPO, Jersey House, Eye, Peterborough.

A barbecue has been planned for September 10th at the Society's riverside site at Alwalton. Autumn and winter meetings will be held at the Peterborough Technical College at 7.15 p.m. on the first Friday in each month.

Future Events:
October 6th—"Aerials".
November 3rd—The Annual General Meeting.

READING AMATEUR RADIO CLUB
Hon. Sec.: R. G. Nash, G3EJA, 9 Holybrook Road, Reading, Berkshire.

From August 25th, Friday evenings have been taken up by slow morse classes given by G5XB or G6WO, starting at 7 o'clock. On August 25th D. Keable discussed the method of aligning superhet receivers.

Future Event:
September 30th—G5TP will demonstrate and discuss the G2DAF SSB transmitter.

SLADE RADIO SOCIETY
Hon. Sec.: C. N. Smart, 110 Woolmore Road, Erdington, Birmingham 23.

On August 25th members visited an electrical control manufacturer's factory for a demonstration of automatic control equipment.

Thursday evening meetings include informal discussions, operation of the club transmitter, and instruction in morse. Slow morse transmissions are radiated each Monday evening from G3AYJ on 1·9Mc/s from 8 p.m. to 8.30 p.m.

Future Events:
September 8th—Exhibition of members' equipment.
September 16th—Annual dinner.
September 22nd—A lecture called "How far can radio waves be heard?"

WANSTEAD, WOODFORD AND DISTRICT RADIO CLUB
Hon. Sec.: J. R. Seaman, 67 Beattyville Gardens, Ilford, Essex.

During August the club held its field-day. Members operated on 1·8, 14 and 144Mc/s for most of the time.

Members for the junior section is continuing to grow.

COURSES OF INSTRUCTION

BATTERSEA MEN'S INSTITUTE
Latchmere Road, Lavender Hill, Battersea, London S.W.11.

The radio course, in preparation for the City and Guilds Examination in May 1962, has been extended, and now takes place on Monday and Thursday evenings, from 7.30 to 9.30 p.m., at the Spencer Park School, Trinity Road, London S.W.11. The course covers the entire syllabus of the examination and no prior knowledge of radio is required.

There are also two classes—beginners and advanced—in general radio and television at the Battersea Institute.

Classes commence on the 25th September and the schools will be open for enrolment during the week 18th to 22nd September. Fees: one class £1 0s. 0d., two classes £1 2s. 6d.

ILFORD LITERARY INSTITUTE
High School for Girls, Cranbrook Road, Ilford.

Classes for the eight month RAE course will be held on Wednesdays at 7.15 to 9.15 p.m. Classes of the six month morse course will be held on Mondays from 7.30 to 9.30 p.m.

Fees for those living in the Essex County Council area are; 30s. for the RAE course and 20s. for the morse course.

Classes commence September 18th.

Those interested should apply to, Mr. C. H. L. Edwards, 28 Morgan Crescent, Theydon Bois, Epping, Essex.

STREATHAM AND TOOTING L.C.C. INSTITUTE
J. Caley, 6 Farnan Road, Streatham, London S.W.16.

Radio and television classes at Dunraven, Penwortham and Hillcroft schools will be held on Mondays, Wednesdays and Fridays at 7.30 p.m.

For the benefit of new students instruction will be given on basic principles assisted by practical demonstration and test equipment.

Classes commence on September 25th.

WEMBLEY EVENING INSTITUTE
99 Watford Road, Wembley, Middlesex.

Radio Amateur's Examination classes will be held on Mondays at the Wembley Evening Institute, Copland School, High Road, Wembley. Morse practice will be held from 7 to 8 p.m., and radio theory from 8 to 10 p.m. Persons wishing to enrol may do so from 11th September to 14th September, and classes start the following week.

Letters to the Editor

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

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.

YOUNG ENTHUSIASTS

SIR,—I made my first radio (a crystal set) when I was 12½. Since then I have made a transistor set and a few one-valve receivers (some of the designs were taken from issues of P.W. dated 1930 to 1940). I also made a morse oscillator.

I would be pleased if anyone could supply information about a station received on Sunday, 23rd July, at 10.15 p.m. The transmissions were repeated alternately in English and Italian and as far as I could make out were as follows: "This is Rome Radio, Maritime Radio Telephone Service. This is a test transmission for receiver . . ." I could not ascertain the wavelength but it was on the lower part of the S.W. band. — D. HILL (Edinburgh).

LIGHT PROGRAMME AMPLIFIER

SIR,—I read with interest Mr. Joyce's letter in the August issue, concerning reception of the Light Programme on his amplifier without a tuner. This occurrence is common among audio amplifiers and is caused by rectification taking place in one of the circuits. Most probably the input wires to the amplifier form a tuned circuit which resonates at one of the Light Programme frequencies. Rectification in the amplifier is often caused by a grid bias resistor "going high", making the valve operate nearly at cut off, thereby producing anode bend rectification.

Mr. Joyce could, with advantage, connect a tuning capacitor across the input terminals to his amplifier, thus enabling another station to be tuned in.—S. H. NANKIVELL (New Mills, Derbyshire).

PHONETIC ALPHABET

SIR,—I thoroughly agree with Mr. P. A. Ellis's plea (August) for an official phonetic alphabet. The situation is made worse by those gentlemen who use geographical names in their transmissions, so that one is likely to hear something like: "Glasgow, Fife, Cardiff".

The I.C.A.O. alphabet is not ideal, but if everyone used this there would at least be some uniformity.—F. DORMAN BYERS (London, S.E.19).

LIGHT PROGRAMME VOLUME

SIR,—I have noticed, while listening to the Light Programme on medium waves, that a marked increase in volume occurred immediately the television receiver was switched on in the next room.

The two aerial systems are quite independent and the mains supply for one is from a power point, while the other is connected to the lighting circuit.

The receiver is a conventional four-valve TRF. I wonder if any reader can explain this occurrence? —T. F. WALL (Preston).

CORRESPONDENTS WANTED

SIR,—I would very much like to correspond with anyone interested in Short-wave reception, transmitting and radio construction in general. I will answer all letters received.—R. CHIPPERFIELD (4 Bayston Road, Stoke Newington, London N.16).

TRANSISTOR RESULTS

SIR,—I have built a number of transistor receivers over the past year or so and have been very intrigued with the ferrite type of aerials. So far I have not seen a single article, either in your magazine or in any other, which gives characteristics or calculations for such an aerial. In examining some commercial sets I find that there are single rods, flat slabs and, in some cases, two or three rods bound together. I have experimented with these types of aerial and cannot find any basis upon which I could draw up my own data. Using the same winding, placed upon slabs and doubled-up rods, the performance is distinctly different, and I was unable to find the optimum arrangement; single wires, Litz, silk and cotton covered, of all gauges seeming to give quite unrelated results. I do not own any reliable test apparatus, so I could not make quantitative measurements, but I should like to see some definite data, preferably issued by one of the better firms, on this important aspect of the modern portable receiver.—G. HUTCHEON (Derby).

TRANSMITTER LICENCES

SIR,— Recent correspondence in your magazine about the possibility of a novice licence, brings to mind my own wish of a couple of years ago, when I was all for such a scheme. Now, however, after passing the RAE and the GPO morse test, I realise that such a licence would do more harm than good, particularly as it is evidently those people who do not have the necessary knowledge to pass the examinations who want low-power transmitter licences.

I do not consider it so difficult to learn what is required for the RAE and to learn the C.W. code. —C. R. MORLEY (Reigate).

CORRECTION

Will readers please note that the advertisement for Messrs. Stern Radio Ltd., in both issues dated August and September, for the "special offer of tape" should have read 1,200ft on 7in. Spool 21/-, 1,800ft on 7in. Spool 32/6, and not vice-versa as printed.

RECEIVERS & COMPONENTS

"HEATHKITS" can now be seen in London and purchased on easy terms. Free brochure. DIRECT TV REPLACEMENTS LTD., Dept. PW/7/9, 138 Lewisham Way, S.E.14. Tideway 6666.

COMPONENTS, VALVES, Tubes. etc. Write or phone for free list. ARION TELEVISION, 4 Maxted Road, Peckham, S.E.15 (New X 7152).

SPEAKER REPAIRS. Cones/Fields fitted. Clock Coils Wound. L. S. REPAIRS, Pluckley, Ashford, Kent.

"WEYRAD" TRANSISTOR RECEIVER

LONG & MEDIUM WAVE, P.P. O/P. ALL COMPONENTS AVAILABLE TOTAL COST £8.5.6.
CONSTRUCTOR'S BOOKLET 2/-. CABINET TO SUIT 17/6.
TRANSISTOR AM FEEDER UNIT. Size 4½ x 3 x 1½in. TOTAL COST OF COMPONENTS £4.10.0.
CONSTRUCTOR'S BOOKLET, 1/9. Send S.A.E. for Shopping Lists.
35 OHM ALLAN SPEAKERS, 27/1. JACKSON "00" GANG (with Trimmers), 10/6.

WESTHAM RADIO SUPPLIES
Rear of 176 Abbotsbury Road
WEYMOUTH, DORSET

KITS BUILT, tested, supplied. S.A.E. details: — J.A.K., 6 Hooker Road, Heartsease, Norwich. NFK NOR 25.

SPEAKERS BRAND NEW 2in. 75 ohms **18/6,** 3in. 25 ohms **20/6,** 5in. 35 ohms 22/-, OC81D, OC81 mat pr **30/-,** Diodes **1/-** min cap. **2/3** each. RM5 **10/6,** SM5 **11/6.** TAPE: Stand: 5½in. 850ft **16/6,** 7in. 1,200ft **20/-,** 7in L.P. 1,800ft **25/6.** Postage paid by CHAPPLE RADIO, 107 Neasden Lane, N.W.10.

RATES: 6/6 per line or part thereof, average five words to line, minimum 2 lines. Box No. 1/- extra. Advertisements must be prepaid and addressed to Advertisement Manager, "Practical Wireless" Tower House, Southampton St., London, W.C.2.

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COMPLETELY REPROCESSED TUBE
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12.6v and 6.3v, 0.3 amp., 17 and 15in. Types	**£6.10.0**
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12v, 15in. Types	**£7. 0.0**
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Electrostatic 90 degree and 110 degree tubes 10/- extra. Carr. paid.

17in. BBC and STV Receivers ... **£19.0.0**
COMPLETELY OVERHAULED AND FITTED WITH PROCESSED TUBE
STV and BBC 14in. Receivers ... **£2.10.0**
COMPLETE WITH VALVES AND TUBE.
CALLERS ONLY. CARRIAGE EXTRA.
OPEN SATURDAY AFTERNOONS

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Renfrew : Scotland
Tel.: Renfrew 2642

RECEIVERS & COMPONENTS
(continued)

NEW AND Surplus Valves, fully guaranteed. S.A.E. for List. Also Reclaimed Valves, perfect 5/- maximum. Genuine bargains, valves bought.—LEWIS, 46 Woodford Avenue, Ilford, Essex.

TUBES! NEW 12in. **75/-.** Most rebuilds 75/-, new guns, guaranteed. Seconds **30/-.** Finest value.—3 Pank Avenue, New Barnet. BAR 1934.

LEADER RADIO

THE NEW REPANCO JOURNEYMAN—6
A highly sensitive medium and long wave six transistor superhet receiver. Design incorporates printed circuit with prealigned coils and transformers. 5in. high flux speaker and car aerial socket. Complete kit less battery..... **£10.10.0**

REPANCO MIN-7
The amazing new Transistor set for the home constructor. Seven Transistors, superhet circuit, fully tunable over long and medium waves. Equal to any manufactured set. Kit complete with instruction data (excluding battery) **£10.0.0**

REPANCO MINI-4
The popular pocket four transistor superhet. Size 5½ x 3½ x 1 11/16in. with prealigned coils and transformers. 2½in. high flux speaker, ferrite slab aerial. Easy to build. Kit complete with instruction data, less battery..... **£6.19.6**
REPANCO, OSMOR, TELETRON. T.S.L. coils, transformers, etc., for transistor radios. S.A.E. for lists.
TELETRON transistorised tapejack, medium and long wave £5.9.0. Carr. 2/6.
COLLARO STUDIO TAPE DECK. 3 motors, 3 speed, only **£11.10.0.** S.A.E. with enquiries.
73 VISTA WAY, KENTON, HARROW, MIDDX. Phone: WOR 4512.

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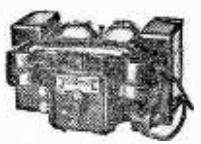

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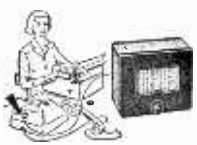

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The index letters which precede the Blueprint Number indicate the periodical in which the description appeared. Thus PW refers to PRACTICAL WIRELESS; AW to *Amateur Wireless* and WM to *Wireless Magazine*.

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 PW 3-speed Autogram	—	8/-
The PW Monophonic Electronic Organ	—	8/-
(No constructional details are available with this blueprint)		
The PW Roadfarer	—	5/-
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TELEVISION		
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Title	*Number*	*Price*
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Experimenter's Short Wave	PW30a	2/6
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PRACTICAL WIRELESS, OCTOBER, 1961

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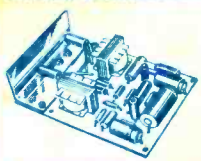

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Built and Tested
69/6 P. & P. 1/6

A printed circuit high gain amplifier, size 4 x 2¾ x ¾in., using Mullard OC71/OC81D and 2-OC81 Transistors. Ideal for Intercomm., Record Player, Tuner Amplifier or any application requiring a quality and reliable amplifier.

● **FULL DETAILS AND USES ON REQUEST** ●

"TRANSFIVE" PORTABLE

MEDIUM AND LONG WAVE PORTABLE RADIO

Size 8¼ x 6½ x 3½in.

- 325 mW Push-Pull Output on 5-inch Speaker.
- Fully Illustrated Plans.
- Easy to Build Printed Circuit.
- Carded Components.
- 5 "Top Grade" Transistors.

AFTER SALES SERVICE and FULLY GUARANTEED

● Full coverage on Medium and Long wavebands. Excellent quality with full station separation.

TOTAL COST OF ALL PARTS
£6.19.6 P.P. 2/6
NO EXTRAS TO BUY

● **BUILDING PLANS & PRICES FREE ON REQUEST** ●

● **ALL PARTS IN STOCK FOR "P.W. POCKET 6"** As previously advertised, at £8.19.6. LEAFLET ON REQUEST

COMBINED PORTABLE AND CAR RADIO "CONTESSA"

6 TRANSISTOR MEDIUM & LONG WAVE SUPERHET

TERRIFIC SENSITIVITY UNBEATABLE IN PERFORMANCE AND APPEARANCE

Specification:

- 425mW Push-Pull Output.
- 6 "Top-Grade" Ediswan Transistors.
- New Type Printed Circuit with all Components marked.
- Full Medium & Long Wave Tuning.
- High "Q" Internal Ferrite Aerial.
- Car Radio Adaptation and AVC.
- "Hi-Fi" Quality Speaker
- Slow Motion Finger-tip Tuning with Station names clearly marked.
- Attractive Rexine Covered Cabinet. Red/white or Blue/white.

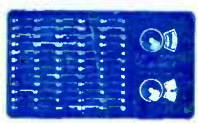
Fully illustrated building plans and packaged components enable the "Contessa" to be built without any technical knowledge.

- All parts sold separately.
- Descriptive leaflet on request.

TOTAL COST OF ALL PARTS
£10.19.6 P.P. 3/6
● **NO EXTRAS TO BUY** ●

6-TRANSISTOR FIDELITY "CORONET"

MEDIUM AND LONG WAVE POCKET RADIO



- Size 2¾ x 4¾ x 1¼in.
- Quality Push-Pull Speaker Output.
- Guaranteed for 12 months.
- Phone and Tape Sockets.

9½ gns Reg. Post 2/6
(INCL. BATTERY)

ALL BRITISH DESIGN AND CONSTRUCTION

"QUINTET"

MEDIUM AND LONG WAVE POCKET LOUDSPEAKER RADIO

Size 5¼ x 3 x 1¾in.

- 250mW Push-Pull Output.
- Plainly marked Printed Circuit Board.
- 5 "Top Grade" Transistors.
- Carded Components.

A new design. Fully tunable on both wavebands. Guaranteed reception of Continental and local stations, including Luxembourg, anywhere with full station separation. Fitted Car Aerial and Earpiece Sockets.

TOTAL COST OF ALL PARTS
£5.10.0 P.P. 2/-
NO EXTRAS TO BUY

VERY EASY TO BUILD AND USE.
After Sales Service—
All Parts Sold Separately

● **Illustrated Instructions FREE ON REQUEST** ●

AVO MULTI-METERS

● **AVO MODEL 7** ●
COMPLETE WITH INSTRUCTIONS LEADS AND BATTERIES
(List £19.10.0)
OUR PRICE **£12.10.0** Reg. Post 5/-

● **AVO MODEL 8** ●
COMPLETE WITH LEADS BATTERIES AND INSTRUCTIONS
(List £24.10.0)
OUR PRICE **£17.10.0** Reg. Post 5/-

BOTH TYPES ARE FULLY GUARANTEED

PLEASE ← TURN PAGE

Henry's Radio Ltd 5 HARROW RD., LONDON, W2

Opposite Edgware Road Tube Station. PADdington 1008/9. Open Monday to Sat. 9-6, Thurs. 1 o'clock
★ **Let us have your Enquiries for Components, Miniature and Standard** ★
NOT ALL OUR UNITS ARE ADVERTISED ABOVE, SEND FOR DETAILS OF OUR RANGE