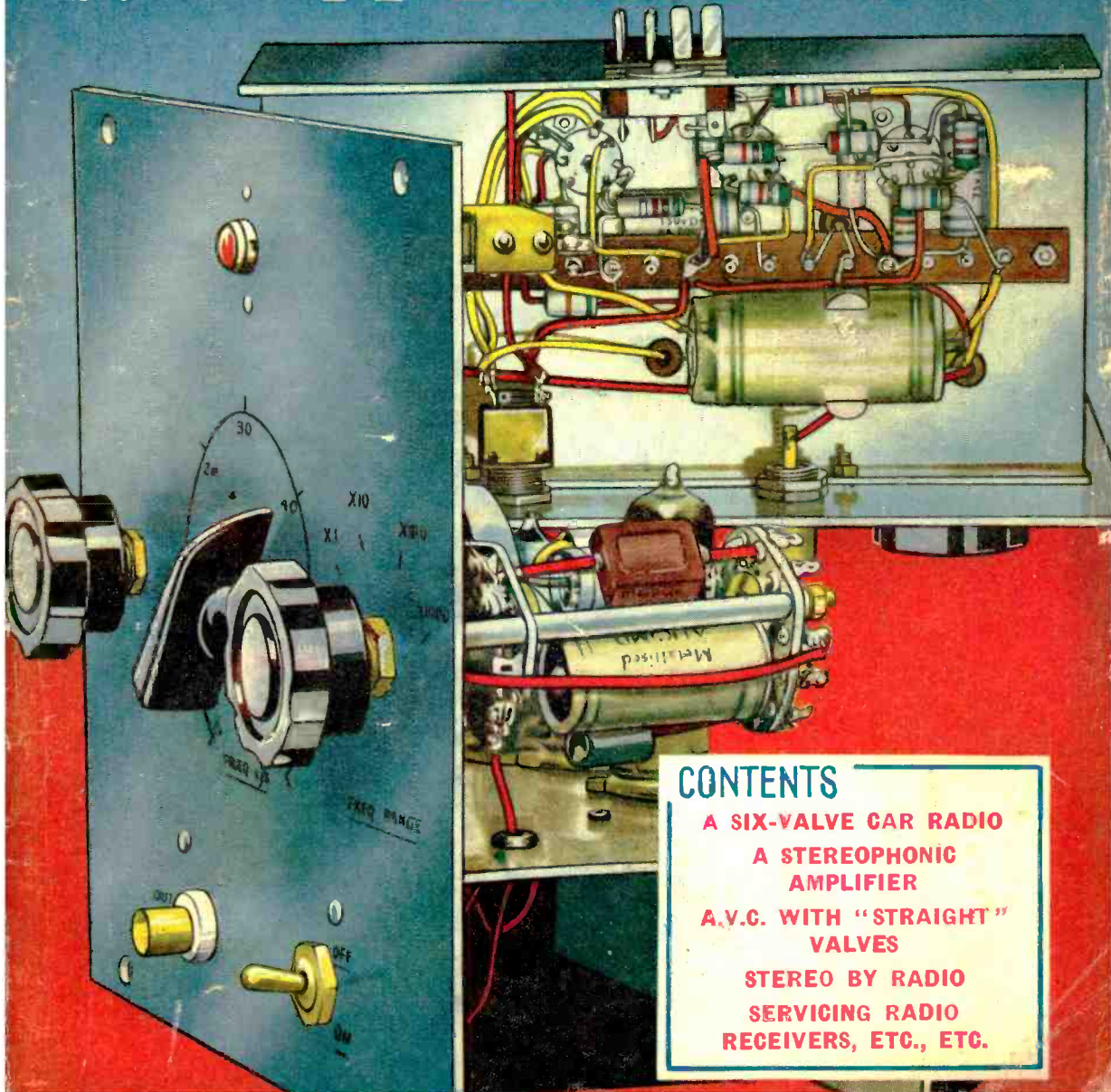


AN AUDIO SIGNAL GENERATOR

PRACTICAL 13

WIRELESS

MARCH
1959
EDITOR: F.J. CAMM



CONTENTS

A SIX-VALVE CAR RADIO

A STEREOPHONIC
AMPLIFIER

A.V.C. WITH "STRAIGHT"
VALVES

STEREO BY RADIO

SERVICING RADIO
RECEIVERS, ETC., ETC.



COSSOR OSCILLOSCOPE

A truly magnificent first grade L.F. oscilloscope incorporating a hard valve time base, speeds 1.5-40 milliseconds, easily extended for a few shillings to 3 c.p.s. to 30 kc/s. speeds. Has high-class amplifier with fine and coarse gain controls. Brightness and focus controls, X & Y shifts. 115 v. & 230 v. Mains power pack fully fuse protected. Employs 2½ in. tube ACR 10 size 19 in. x 7 in. x 12 in. Only 20 in stock so first come first served. Genuinely cost £59 each, our price **£14.0.0** Carr. 15/-.

HEADPHONES. BRAND NEW.

American, chamois padded (as illus.), moving-coil 100 ohms, 25/- U.S.A. light weight, Type H.S.30, 15/-. Low resistance 120 ohms, 6/6. High resistance, 12/6. P. & P. 1/6 on each.

RECEIVER R1155. This magnificent receiver covers 5 ranges: 75-200 kc/s, 200-500 kc/s, 600-1,500 kc/s, 3-7.5 Mc/s, 7.5-18.5 Mc/s. Fully tested before despatch. Complete with circuit and instruction booklet, £8.10.0. Carriage 10/-.

BUILD AN F.M. TUNER with this **MINIATURE 373 I.F. STRIP 9.72 MC/S.** Complete with 6 valves, 3 EF91, 2 EP92, 1 EB91, F.T.s, etc., supplied with circuit and complete conversion to F.M. Tuner details. The best buy of the year at 40/- with valves. 12/6 less valves. P. & P. 2/6.

PORTABLE AMPLIFIER. PRINTED CIRCUIT. Size 6½ in. wide, 2½ in. deep, 3 in. high. Will suit all crystal pick-ups. Output 3 watts. Uses UCL82 output, UY85 rectifier. Volume and tone controls. With circuit diagram. **ONLY 45/-.** 7 in. x 4 in. elliptical speaker for above, 14/6.

WHEATSTONE BRIDGE. Consisting of four stud switches: 0-210 ohms. Galvanometer centre zero F.S.D. 2.5 mA. Ranges easily extended. Housed in oak cabinet 16 x 7½ x 6 in. Complete with instructions, 22/6. P. & P. 2/6.

H.R.O. SENIOR RECEIVERS. 50 kc/s.-30 Mc/s Complete with all valves, 4 Frequency coil sets, "5" meter, crystal gate, matching mains power pack. Fully tested and supplied ready for immediate operation. We are proud to offer these magnificent receivers at only **£16.19.6.** Carr. 20/6.

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



POLICE-AIRCRAFT-HAM U.S.A. RECEIVER BC624

This is a must for all intelligent radio enthusiasts. Complete receiver covering 100-156 Mc/s, has no less than 10 valves, is a superhet with R.F., 31.F.s second det., and O/P stages, perfect for 2 metres. Power requirements 300 volts 60 mA. and 12 v. at 1.7 amps. Supplied with full operating details and circuit, etc., all for only 30/- P.P. 5/-. Mains power pack kit, 42/6.

TRANSMITTER BC625 used with above receiver, covers 100-156 Mc/s, will deliver 15 watts, consists of seven valves (2-832), 3 for modulation, 4 for R.F. Complete with operating details and circuits, only 45/- P.P. 5/-. Complete Trans./Receiver Assembly, 70/- Carr. 10/-.

WALKIE/TALKIE SET



ONLY 60/- EACH P. & P. 4/-

Consisting of transceiver covering 7.4-9 Mc/s, range up to 10 miles, complete with 5 valves, headphones, microphone, junction box & 6ft. telescopic aerial. Only requires 120 v. & 3 v. dry battery. These magnificent Walkie/Talkie sets (as used by H.M. Forces) are ideal for any application and can be operated with ease by young and old alike.

TWO FOR £6 POST FREE.

SOLDERING IRONS

230-250 volts instrument type, 25 watts, complete with neon indicator. Brand new 16/6. P.P. 2/6.

INTERCOM

The perfect system for 2-way conversation offering 101 uses. This amazing offer consists of 2 Dynamic Sound Powered Microphone Receivers and 15 yards of twin wire.

ONLY 8/6 PER PAIR P. & P. 1/6.

• No Batteries
• No Soldering
• Just connect and use.

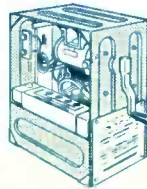
RECTIFIER BARGAINS

Mains (doubler) 300 volts per section at 120 mA., 5/- each. P. P. 1/6. Two (full wave) for 8/- P.P. 2/-.

SUPPLY UNIT No. 5

Contains Hand Generator giving 6 v. output with overload cut-out, ideal to boost a flat car battery; 6 volt Vibrator Pack giving 3 volts and 150 volts with output leads, plugs, etc., for Army 38 and 18 sets; Battery box for three 2 v. accumulators. This is a fully portable and multi-purpose power supply unit. **BRAND NEW.**

ONLY 30/- Carr. Paid.



AERIAL VARIOMETERS.

These magnificent instruments will enable you to re-ceive maximum signal strength on all S.W. receivers. Precision calibrated control. Complete with connection details, 12/6. P. & P. 2/6.



T.C.S. TRANSMITTER. Covering 1.5-12 Mc/s (160-80-40 metres) consists of V.F.O. Buffer, Doubler, P.A. with internal push/pull modulator, and provision for V.F.O. or crystal control on 4 channels. Output 40 w. phone. 100 w. C.W. Complete with aerial current and plate current meters. £9.10.0. Carr. 15/-.

R.B.Z. PORTABLE RECEIVER. Covering 5 to 13 Mc/s. Only 9 in. long, 2½ in. wide, 1½ in. deep, weight 30oz. 5 valve permeability tuned superhet receiver. Incorporates on/off gain and frequency controls. Complete with headphones, aerial, matching battery container, canvas case and 55 page instruction book. Operates from standard dry batt. Brand new. Fully guar. Ready for immediate operation. **Only £5.** P. & P. 5/- (Batteries 12/8 extra.)

WESTINGHOUSE J.50 PEN-CIL RECTIFIERS. 500 v. 5 mA., 5/- P. & P. 1/-.

SEE AT NIGHT! Yes, it's true! With this complete Infra-Red night driving installation you can see at night and in fog yet the operator cannot be seen. Comprises adjustable long vision binoculars, 12 v. power pack, control unit, connecting cables. Can be assembled within minutes. Govt. acquisition, £200. Brand new, boxed, £6.10.0. Carr. 10/-.

MICROPHONES. BRAND NEW. Throat, magnetic, 4/6; No. 8 carbon with switch, 6/6; No. 7 moving coil, 8/6.

INFRA RED MONOCULAR. Ideal for night viewing, etc. Complete with push-button zamboni pile power unit and focus lens. Brand new in beautiful leather carrying case. Originally cost Govt. £40. **OUR PRICE 17/6.** P. & P. 2/6.



Fully illustrated catalogue, 1/3.
32a, COPTIC STREET, LONDON, W.C.1.
87, TOTTENHAM CT. RD., LONDON, W.C.1.
Telephone: MUSeum 9607.

All post orders and correspondence to:
(Dept. 'P') 32a, Coptic Street, London, W.C.1.

ADVANCE YOUR CAREER through a SHORT SERVICE COMMISSION*

Have you recently qualified—or hope to do so soon? Then a R.A.F. Short Service Commission can bring you greater all-round technical and executive experience than almost any civilian appointment.

With ever-growing aircraft, missile, electronic and nuclear developments, a Technical Officer in the Royal Air Force today has almost unlimited scope. The work is interesting, responsible and, above all, varied.

2 SCHEMES OF ENTRY

**For men with
engineering qualifications
(especially electrical)**

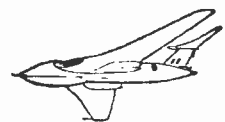
Commissions are for 3 to 6 years. Minimum requirements are a Higher National Certificate in Electrical or Mechanical Engineering and G.C.E., or equivalent, in English Language at 'O' level. By joining at 21, you could be earning over £1,250 (including full allowances) by 27, if married. The upper age limit for entry is under 37.

**For men under 21
without
technical qualifications**

Commissions are for 5 to 8 years. Minimum requirements: G.C.E., or equivalent, with passes in English Language and four other subjects, which must include Pure and Applied Mathematics and Physics at 'A' level. Join at 20 and, by 26, you could be earning, if married, over £1,100 a year (including full allowances).

With both schemes you must, of course, be physically fit. They also offer the possibility of extending a Short Service Commission or converting to a Permanent Commission, leading to higher ranks; and if you return to industry, there are special facilities to help you obtain a post in line with your age and added experience.

This is a fine way to help your future career, gain executive experience, see something of the world—and be well-paid while you are doing it! Write *now* for full details to Air Ministry (P.W.213), Adastral House, London W.C.1.

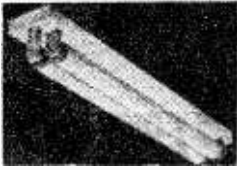


THE ROYAL AIR FORCE

*IF YOU ARE A GRADUATE with a Science or Engineering degree, and under 30, you can apply for a R.A.F. Permanent Commission straight away. Write for details of the fine career prospects and pay offered.



Fluorescent Lighting



Complete lighting fittings. Built-in ballast and starters—stove enamelled white and ready to work. Ideal kitchen, workshop—anywhere.
 14 in. 20 approximately 27in. long complete with two 20W tubes. 49/6.
 Single 40 approximately 4ft. long complete with one 40W tube. 39/6.
 Inductor 80 approximately 5ft. long complete with one 80W tube. 59/6.
 Carriage and insurance up to 150 miles 5/8. up to 250 miles 7/6.
 21in. Miniature complete with 13 watt tube. Ideal for showcase or position where miniature fitting is required. Complete with latest 1in. diameter tube. 49/6 each.

Why Mend Fuses ?

To prevent this bothersome time loser we can offer a 230 v. A.C. Circuit Breaker which will stand loads up to 10 Amps. but will trip on short circuit. It is an ideal unit for controlling a work bench, as it is also an on/off switch. New U.S. surplus, reference No. M418082, probably cost at least £4 each, limited quantity only—27/6 each, plus 2/- post and packing.

**Hi-Fi Snip
Infinite Wall Baffle**



Nicely veneered and polished. Corner fitting (attaches to picture rail). Takes up no floor space. Gives a really fantastic result with only low-priced 8in. speaker. Fitting for tweeter. Only 45/- each, carriage and insurance 3/6.

Unused and Boxed Valves

OZ4	9/-	6D6	6/6	7B5	12/6
1A4	9/-	6P5	9/6	7C7	12/6
1A6	9/-	6P6	7/6	7D5	9/6
1F7	12/6	6P7	12/6	7D3	9/6
1L18	8/6	6P8	9/6	7H7	8/-
1L16	8/6	6P32	10/6	7K8	12/6
1N50	3/6	6C6	7/6	7R7	10/-
1LD5	3/6	6H6	2/6	7S7	10/-
1T4	7/6	6J5	5/6	12H6	8/6
1R5	7/6	6J7	6/-	12SH7	8/6
1S5	7/6	6K6	7/-	12SJ7	8/6
1T5	8/-	6K7	5/-	12SK7	8/6
2A5	12/6	6L5	9/-	25B5	12/6
2A6	12/6	6L6	9/-	25	10/-
2A7	12/6	6L7	10/7	27	10/-
2D13C	5/-	6N7	8/6	28D7	3/6
2X2	4/6	6B7	9/-	31	7/6
3A4	7/-	6R7	8/-	32E	7/6
3D6	5/-	6SA7	8/-	34	12/6
3C4	7/6	6SC7	8/-	39/44	10/-
4D1	2/6	6SH7	6/-	41E	9/6
5U4	8/-	6SJ7	8/6	42	8/-
5Z3	12/-	6SK7	6/-	43	10/-
5Z4	9/6	6SL7	5/-	57	10/-
6A6	12/6	6SN7	7/6	58	10/-
6AG5	6/6	6SQ7	9/-	71	9/6
6AC7	6/6	6SS7	9/-	75	12/6
6A8	10/-	6T7	12/6	77	8/6
6B4	5/-	6U5	8/6	83	12/6
6B7	10/6	6V6	8/6	94	8/6
6B9	4/6	6V5	6/6	807	8/6
6BQ6	12/6	6V6	9/-	954	3/6
6C4	6/6	6Z5	15/-	1625	10/6
6C8	6/6	7A2	12/6	805	80/-
6C8	5/-	7A7	9/6	913	90/-

Good range of British Valves kept at all addresses.

**TWO OUTSTANDING METERS
The Taylor Meter Model 100A**

All the advantages of a valve voltmeter but none of its disadvantages, it is, in fact, the only meter in the world with a sensitivity of 100,000 ohms per Volt and all these other features :

- D.C. Current—2 microamp to 10 Amps. D.C. in 8 ranges.
- D.C. Volts—10 microvolt to 25 KV. in 8 ranges (25 KV. with external adaptor Optional extra).
- A.C. Volts—0.2.5 KV. A.C. in 6 ranges.
- Ohms—0-200 Megs. in 4 ranges (self-contained).
- 5 ranges of decibels.
- 5 ranges of output.
- 5in. mirror scale movement.
- Automatic cut-out for meter protection.
- Reverse polarity switch.
- Truly a fine instrument moderately priced at £31.10.0.
- Non-callers add 10/- carriage and insurance.



The Taylor Meter Model 127A

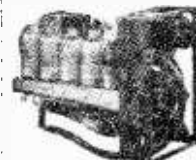
A pocket size meter but with a big scale and a sensitivity of 20,000 Ohms per volt D.C., therefore an ideal unit for television servicing—robustly made and complete with leads and prods—20 ranges as follows :

- D.C. current 50 micro-amps. to 1 Amp.
- D.C. voltage—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 Ohm in three ranges (self-controlled).
- Self-contained, 3in. movement. Price £10 or 10/- deposit and 21 fortnightly payments of 10/-.
- Non-callers add 5/- carriage and insurance.



THIS MONTH'S SNIP
 High output car battery charger. Gives quick (ear start charge) or trickle charge. Input standard A.C. mains, output 6 or 12 volt at 1.2i or 4 amps. With meter and variable charge selector. Complete in hammer finish louvered case. Only 75/- plus 4/6 carriage, or 10/- deposit and 8 fortnightly payments of 9/-. New and unused, guaranteed for 2 years.

Complete Walkie-Talkie 25/-



This is the 46 Walkie-Talkie. It has a range of approx. 5 miles—just right for search parties, fire brigades, etc. Operates from dry batteries. Complete with six valves and in metal case. Size approx. 12in. x 6in. x 3in. Complete but less crystal, not tested nor guaranteed, 25/-, plus 2/6 carriage.

Break-up Bargain

- The unit 35/5 less valves and I.F. strip. This contains components valued at at least £10 as follows :-
- 20 Paper tubular condensers up to 1 mfd.
 - 40 Carbon Resistors many high stability.
 - 40 Silver Mica Condensers.
 - 30 R.F. Chokes.
 - 13 Octal Valve Holders.
 - 1 Yaxley Switch.
 - 1 A.F. Choke.
 - 2 Miniature Variable Condensers.
 - 1 Transformer.
 - 2 Mansbridge Condensers.
 - 1 Useful chassis size 18in. x 11in. x 7in. with plus hundreds of miscellaneous items, nuts, bolts, washers, tag strips, I.F. sockets, etc. All for 6/6.
 - 8/5 carriage up to 250 miles.

**FOR ADDRESSES SEE
OPPOSITE PAGE**

Band III Converters

Suitable Wales, London, Midlands, North, Scotland, etc. All the parts including 2 EF80 valves, coils, fine tuner, contrast control, condensers and resistors. (Metal case available as an extra). Price only 19/6. plus 2/6 post and insurance. Data free with parts or available separately. 1/6.

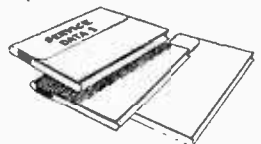


W.D. Circuit Details

Diagrams and other information extracted from official manuals. All 1/6 per copy, 12 for 15/-.

- A.1134 R.109
- BC.348 HRO Receiver
- BC.312 R29/ARC5
- R.103A H1116A
- RA.342 RA-1B
- RA-1B AR88D
- R-208 AN/APA-1
- R-1155 78
- R-1124A 78
- R-1132A, R-1491 R.T.18
- R-1147 CAY-46-AAM-
- R-1234A RADAR
- R-1082 A.S.B.-3
- R-1355 Indicator 62A
- B.C.1208-A.B Indicator A.S.B.3
- B-455-A (or-B) Indicator 52
- B-454-A (or-B) Indicator 6K.
- B-463-M-A (or-B) R.F. unit 24
- Transmitter T1154 R.F. unit 25
- Fifty-eight walkie R.F. unit 26
- talkie R.F. unit 27
- Frequency meter Wireless set No. 19
- B.C. 221 Demobbed valves

T.V. Service Sheets



150 sheets covering the most popular post-war Televisors by leading makers—Cossor, Ekco, Ferguson, Pye, etc. £1.10.0 post free.

A.C./D.C. Multimeter Kit

Ranges : D.C. volts 0.5- 0.50- 0.100- 0.500- 0.1000- A.C. volts 0.5- 0.500- 0.100- 0.500- 0.1000- D.C. milliamps 0.5- 0.100- 0.500- Ohms 0.50-0.000 with internal batteries. 0.500-0.000 with external batteries. Measures A.C./D.C. volts, D.C. current and ohms. All the essential parts including metal case, 2in. moving coil meter, selected resistors, wire for shunts, range selector, switches, calibrated scale and full instructions, price 19/6. plus 2/6 post and insurance.



Metal Rectifier

80 mA. 300 volt, 3/6 each, plus 5. post 1/-.

Novelty Radio

Completely wired tunable medium and long wave, originally intended for BTG valves and external batteries but could easily be converted for transistors with internal batteries. Less valves and speaker, otherwise complete, 15/-, plus 1/8 postage.



Multi-Purpose Mains Transformer

Heavy duty construction, must have cost at least £3 to make. Offered at a snip price of 14/6.

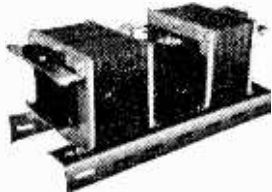
- Specification :-
 Primary Standard 230 v.
 Secondary 1. 660 v.-200 mA. centre tapped.
 Secondary 2. 80 v.-100 mA.
 Secondary 3. 23 v.-750 mA.
 Secondary 4. 7 v.-5 amp. centre tapped.
 Secondary 5. 5 v.-3 amp.

In addition there is a window space for extra L.T. windings, winding ratio is 2:1 turns per volt. Weight of transformer is 12 lb., size approximately 6in. x 4in. x 4in. Connections all brought out to terminals on bakelite panel. We have only 500 of these, so order at once to avoid disappointment. Non-callers add 3/6 postage please.

"Dim and Full" Switch

Particularly useful for controlling photo-flood lamps which have only a short life at full brilliance. This toggle 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 operational shots. Also useful for controlling night lights, heaters, etc., etc. Price 2/6 each. S. post 9d. Circuit diagram included.

Mains Isolation Transformer



Makes servicing safe. Input tapped 200-250 v., output tapped 200-250 v. Rated at 500 watts, intermittent rating 2,000 watts. Screens for suppressing mains interference. Size approximately 4in. x 6in. x 6in., weight approximately 40lbs. Price £5.12.6. Carriage and insurance 7/6 (up to 250 miles).

Avo Prodclips



The advantage of these test prods is that by pressing the trigger at the side they become crocodile clips and can be left in circuit. This is a great time saver when servicing. Price 15/- pair.

Miniature Microphone

American made. Dynamic type, real bargain at 1/6. Plus 6d. postage.

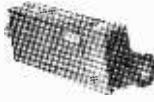


Headphones

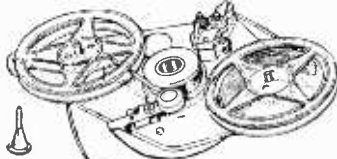
Ex-Government low resistance, perfect, 7/6 pair. Plus 1/6 postage.

Cine Cameras

16 min. motorised (24VAC) for 16 frames per second, contains fine F.8.5 triple anastigmatic lens and spool to carry 25ft. of film - probable cost around £150, brand new and in sealed carton £6.10.0 or 20/- deposit and 13 fortnightly payments of 10/- post and insurance 3/6.

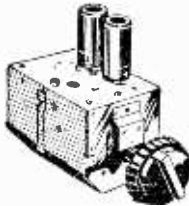


Gram into Tape Recorder

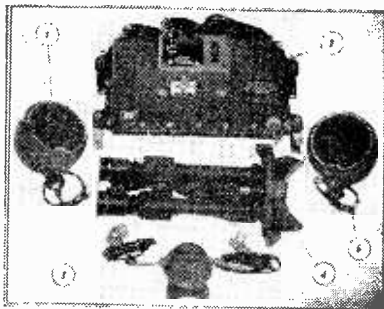


Convert your Record Player or Radiogram into a Tape Recorder. Can be fitted in a few seconds and then you have immediately all the facilities afforded by a normal Tape Recorder, i.e., record playback, erase, rewind, etc. As illustrated. But less pre-amp (circuit diagram of suitable pre-amps included) only 7.10.0, or 10/- down and 16 weekly payments of 10/-. Non-callers please add 5/- carriage and insurance. With pre-amp £13/2/6 or £1 down and 26 weekly payments of 10/-.

LATEST TYPE Turret Tuner



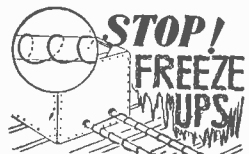
Brand new stock, not surplus, with coils for Band I and III complete with valves. Model 1 I.F. output 33.33 Mc/s. Series heaters Model 2 I.F. output 16.19 Mc/s. Parallel heaters. With instructions and circuit diagram. 79/6. With knobs 3/6 extra, post and insurance 2/6.



TABBY EQUIPMENT COMPLETE

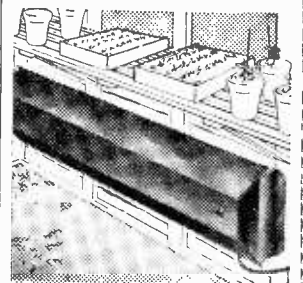
Complete equipment for seeing in the dark, as fitted to Army vehicles for night driving, etc. Complete working equipment comprises: 2 Infra Red Radiators, adjustable binoculars, powerpack for 6 or 12 volts, control units and inter-connection cables. Original cost probably around £100. Unused and in perfect order - £6.19.6 or 10/- deposit and 15 fortnightly payments of 10/-.

Definitely your last chance! We still have a few of the R208 Communication Receivers (Spintak Specials) and if you hurry your order to us you may be in time - but please act promptly. Price for tested receiver is £6.19.6, or 10/- deposit and 16 weekly payments of 10/-, plus 15/- carriage.



Wrap your heater cable around the pipes in your loft to prevent a freeze-up. With full instructions. 16 yds. 9/6.

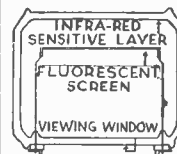
Convector Heater



Convector heater. Made from heavy gauge sheet steel (galvanised). For greenhouse, workshop, aviary, etc. 500 watts, £1 12/6; 1,000 watt, £2 10/-; 1,000 watt with wired, but separate thermostat, £3 17/6. 2K watt free standing or wall mounting, £3 19/6; 2K watt with built-in thermostat, £4 19/6. Carriage and insurance 5/- per heater. ALL ARE GUARANTEED FOR 5 YEARS.

Yaxley Switches

3 Pole 2 way	1/6
12 Pole 2 way	2/-
3 Pole 3 way	1/6
9 Pole 3 way	2/-
2 Pole 4 way	2/-
6 Pole 4 way	2/6
4 Pole 5 way	2/6
2 Pole 6 way	2/6
1 Pole 7 way	2/6
1 Pole 11 way	2/6
2 Pole 11 way	3/6
1 Pole 12 way	3/6
2 Pole 12 way	4/6
6 Position Shorting	2/-



"Sniper-scope" 5/- only.

"Cats eye" used for seeing in the dark. Will work burglar alarms, counting circuits, smoke detectors and the hundred and one other devices as will the simpler type of photo cell. Price 5/- each. Post and ins., 1/- Data will be supplied with cells if required.

Long, Medium and Short Wave Coil Pack. An exceptionally well made coil pack which covers the standard long, medium and short wavebands for 465 kc. I.F., complete with diagram of connections. 14/6, plus 1/6 postage and insurance - limited quantity only. Neon Lamp, midget wire ended. Ideal for making mains tester or for any of the dozen-and-one applications to which a neon can be put. 2/-.

All items advertised can be obtained from the following Companies.

- If ordering by post, address your order to the Company nearest to you and please include postage.
- Electronics (Eastbourne), Ltd., 66, Grove Rd., Eastbourne. Phone: Eastbourne 6565. Half day Wednesday.
 - Electronics (Ruislip) Ltd., 42-46, Windmill Hill, Ruislip, Middx. Phone: RUISLIP 5780. Half day, Wednesday.
 - Electronics (Croydon) Ltd., 266, London Road, Croydon, CRO 6558. Half day, Wednesday.
 - Electronics (Finsbury Park), Ltd., 29, Stroud Green Rd., Finsbury Park, N.4. Phone: ARCHWAY 1049. Half day, Thursday.

BENTLEY ACOUSTIC CORPORATION LTD.

THE VALVE SPECIALISTS. 38 CHALCOT ROAD, LONDON, N.W.1. Telephone: PRIMROSE 9090.

EXPRESS SERVICE! C.O.D. ORDERS RECEIVED BY 3.30 P.M., EITHER BY LETTER, PHONE OR WIRE, DESPATCHED THE SAME AFTERNOON, ALL ORDERS RECEIVED BY FIRST POST DESPATCHED SAME DAY.

ANY ORDER UP TO £10 INSURED AGAINST DAMAGE IN TRANSIT FOR ONLY 6d. EXTRA. ORDERS OVER £10 INSURED FREE.

Table listing various electronic components and parts such as valves, capacitors, and tubes, organized in columns with alphanumeric codes.

NEW METAL RECTIFIERS—FULLY GUARANTEED

Table listing metal rectifier specifications, including models like DRM-1B, DRM-2B, and various voltage/wattage ratings.

VOLUME CONTROLS

All with long spindle and double-pole switch. 4/6 each. 10K. 25K. 50K. 100K. 1 meg. 2 meg. 1 meg. 2 meg.

ELECTROLYTIC CONDENSERS

Standard Can 100 x 400 mfd., 275 v. 12/6 Wire-ended Tubular 8 x 8 mfd., 450 v. 3/-. 32 x 32 mfd., 450 v. 5/9 100 mfd., 275 v. 2/6 8 mfd., 450 v. 1/9

TERMS OF BUSINESS: CASH WITH ORDER OR C.O.D. ONLY. POST-PACKING CHARGES 6d. PER ITEM + ORDERS VALUE £3 OR MORE POST FREE. C.O.D. 28 EXTRA. WE ARE OPEN FOR PERSONAL SHOPPERS MONDAY TO FRIDAY 8.30-5.30. SATURDAYS 8.30-1 P.M. ALL VALVES, NEW, BOXED, TAX PAID, AND SUBJECT TO MAKERS' GUARANTEE. FIRST GRADE GOODS ONLY. NO SECONDS OR REJECTS. CATALOGUE OF OVER 1,000 DIFFERENT VALVES, WITH FULL TERMS OF BUSINESS, PRICE 6d. PLEASE ENQUIRE FOR ANY VALVE NOT LISTED. 3d. STAMP. RELEASE.

The "NEW" 1959

Stern's "fidelity" TAPE RECORDER

for truly "Hi-Fi" Recordings

IT INCORPORATES

- The latest COLLARO TRANSCRIBTOR TAPE DECK.
- The model HF/TR3 "fidelity" AMPLIFIER. (Described below.)
- ROLA/CELESTION 10in. x 6 P.M. Speaker.
- 1,200 reel EMI tape.
- ACOS Crystal Microphone.

BEFORE CHOOSING YOUR TAPE RECORDER YOU SHOULD HEAR THIS MODEL—TRULY "HI-FI" RECORDINGS ARE OBTAINABLE and it is comparable to much higher-priced Recorders.
Alternatively send S.A.E. for ILLUSTRATED LEAFLET.

(Plus £1/10/0 Carriage and Insurance, of which £1 is refunded on return of Packing Case.)

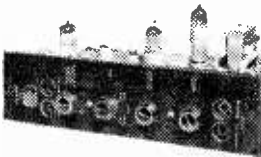
THE MODEL HF/TR3 TAPE AMPLIFIER

INCORPORATING

3-SPEED TREBLE EQUALISATION by means of the latest FERROXUCUBE POT CORE INDUCTOR.

PRICE FOR COMPLETE KIT OF PARTS **£12.15.0**

PRICE FULLY ASSEMBLED & TESTED **£16.10.0**



HIRE PURCHASE. Deposit £3.6.6 and 12 monthly payments of £1.4.2. A very high-quality Amplifier based on the very successful TYPE "A" design completed in the MULLARD LABORATORIES. ONLY NEW HIGH-GRADE COMPONENTS are incorporated including MULLARD VALVES and a GILSON OUTPUT TRANSFORMER. Other features are—Magic Eye Recording hand indicator—Effective Tone Control—Monitoring and Extension Speaker Sockets—Has own Power Supply and can be used as independent Amplifier for direct reproduction of Gram Records or from Radio Tuner. Overall size 11in. x 6in. x 6in. Can be supplied for use with Truvox—Collaro—Lanc—Brenell or Motek Decks. Please specify which.

Send S.A.E. for leaflet or 2/6 for the complete Assembly Manual.



HOME CONSTRUCTORS YOU CAN BUILD THIS PORTABLE TAPE RECORDER from £41.10.0

WE OFFER YOU THIS SELECTION

- (a) The PORTABLE CASE illustrated here (£5.0.0), 1,200ft. E.M.I. TAPE (£1.15.0), ACOS CRYSTAL MIKE (£1.15.0), ROLA 10in. x 6in. LOUD-SPEAKER (£1.10.0). ALL FOR **£9.0.0**

AVAILABLE ON HIRE PURCHASE WITH (b) or (d) below:

(b) The COLLARO MK. IV TAPE DECK (£25.0.0) and the HF/TR3 AMPLIFIER Assembled and Tested. FOR **£36.0.0**

H.P. Deposit £7.4.0 and 12 months of £2.12.6.

(c) As in (b) above, but HF/TR3 supplied as **£32.10.0**

COMPLETE KIT OF PARTS.....

(d) The TRUVOX MK. IV TAPE DECK incorporating Precision Rev. Counter (£30.9.0) and the HF/TR3 AMPLIFIER **£41.10.0**

Assembled and Tested.....

H.P. Deposit £8.6.0 and 12 months of £3.0.10.

(e) As in (d) above, but the HF/TR3 supplied as **£38.0.0**

COMPLETE KIT OF PARTS.....

(Carriage and Insurance on above quotes 10/- extra.)

NOTE: Messrs. Collaro when supplying the MK. IV Deck do not wire up the Deck Switches. We will do this at charge of £1.0.0, or supply a Wiring Diagram to the Home Constructor.

Please send S.A.E. with all correspondence.



PRICE
£49.10.0

Terms: Dep. £9.15.0 and 12 monthly payments of £3.12.7 or Dep. £16.10.0 and 12 monthly payments of £3.0.6.

THE LEGS SHOWN IN THE ILLUSTRATION ARE READILY DETACHABLE, AND ARE AN OPTIONAL EXTRA AT £1.2.6.

THE NEW MULLARD TYPE "C" TAPE PRE-AMPLIFIER-ERASE UNIT

INCORPORATING THE NEW FERROXUCUBE POT CORE PUSH-PULL OSCILLATOR and 3-SPEED TREBLE EQUALISATION by means of the latest FERROXUCUBE POT CORE INDUCTOR.

PRICES... INCLUDING SEPARATE SMALL POWER SUPPLY

COMPLETE KIT OF PARTS **£14.0.0**

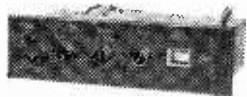
ASSEMBLED AND TESTED **£17.0.0**

Deposit £3.8.0 and 12 months of £1.4.11.

ALSO AVAILABLE EXCLUDING POWER SUPPLY UNIT FOR **£11.15.0** and **£14.10.0** respectively.

(Carriage and Insurance is 5/- extra.)

WHEN ORDERING PLEASE STATE MAKE OF TAPE DECK TO BE USED. We present this "Hi-Fi" Pre-amplifier strictly to Mullard's specification incorporating ONLY NEW HIGH-GRADE COMPONENTS and the SPECIFIED NEW MULLARD VALVES. It comprises a COMPLETELY SELF-CONTAINED UNIT, all components and valves being contained in a well-ventilated Box-Chassis neatly finished in Hammered Gold with a very attractively engraved PERSEFX FRONT PANEL.



TO ADD FULL TAPE RECORDING FACILITIES To any modern "Hi-Fi" AUDIO AMPLIFIER (such as our Mullard "5-10" and 2 valve Pre-amplifier) ... ALL YOU NEED IS ... THE TYPE "C" PRE-AMPLIFIER and a TAPE DECK ... WE OFFER—

(a) The COLLARO MK. IV TAPE DECK and the MULLARD TYPE "C" PRE-AMPLIFIER with Power Unit Assembled and Tested **£37.0.0**

H.P. Deposit £7.8.0 and 12 months of £2.14.3.

(b) As in (a) above but the Type "C" supplied as COMPLETE KIT OF PARTS..... **£34.0.0**

(c) The TRUVOX MK. IV TAPE DECK incorporating Precision Rev. Counter, and the MULLARD TYPE "C" PRE-AMPLIFIER with Power Unit Assembled and Tested **£42.10.0**

H.P. Deposit £8.10.0 and 12 months of £3.2.4.

(d) As in (c) above but the TYPE "C" supplied as COMPLETE KIT OF PARTS..... **£39.10.0**

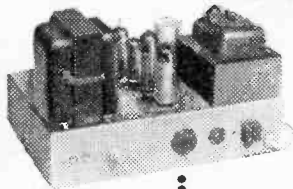
(Carriage and Insurance on above quotes 10/- extra.)

STERN RADIO LTD.
109 & 115 FLEET ST., LONDON, E.C.4
Telephone: FLEET STREET 5612/3/4

AMPLIFIERS PRE-AMPLIFIERS FOR THE "HI-FI" ENTHUSIAST

MULLARD DESIGNS FOR THE HOME CONSTRUCTOR

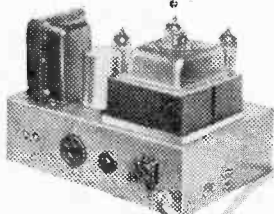
**THE VERY
POPULAR
MULLARD
"5-10" MAIN
AMPLIFIER**



**MULLARD'S
NEW, 2-STAGE
PRE-AMPLIFIER
TONE CONTROL**



**THE NEW
MULLARD 3-3
MAIN
AMPLIFIER**



Undoubtedly the most successful amplifier yet designed, and used in conjunction with the new Mullard Pre-amplifier, an undistorted power output of up to 10 watts is obtained. Thoroughly recommended to the "Hi-Fi" enthusiast who contemplates a very high quality home installation. In addition the versatility of the equipment makes it quite suitable for use in small halls, etc. We supply complete to MULLARD'S Specification with specified valves and components and including the latest PARMEKO Ultra-linear Output Transformer and the PARMEKO Mains Transformer which has power available to drive Radio Tuning Unit.

COMPLETE KIT £10.0.0 Alternatively we supply **£11.10.0**
OF PARTS ASSEMBLED & TESTED
(Carriage & Insurance 5/- extra.)

THIS "5-10" with the latest PARTRIDGE for £1.6.0 extra
ULTRA-LINEAR OUTPUT TRANSFORMER

A completely new design employing two EF86 valves, and in particular designed to operate with the Mullard range of Power Amplifiers, but also perfectly suitable for other makes, etc.

- Equalisation for the latest R.I.A.A. characteristics.
- Input for variable reluctance. ● Magnetic Pick-Ups.
- Input for Crystal Pick-Ups. ● Input for Tape replay.
- (a) Direct from High Impedance Tape Head.
- (b) From a Tape Amplifier or Pre-amplifier.

- Sensitive Microphone Channel.
- Wide range Bass and TREBLE Controls.
- Attractive Perspex front control panel.
- Our Kit is strictly to MULLARD'S SPECIFICATION.

COMPLETE KIT OF £6.6.0 Alternatively we supply **£8.0.0**
PARTS ASSEMBLED & TESTED
(Carriage & Insurance 5/- extra.)

Based entirely on the present very popular "3-3" model and designed to operate in conjunction with the new 2-stage PRE-AMPLIFIER (shown left) thus providing all the facilities associated with the more expensive "Hi-Fi" Equipment. We recommend it as the IDEAL HOME INSTALLATION where very high quality is desired at the lower volume level (up to 3 watts). We supply completely to MULLARD'S SPECIFICATION including the latest PARMEKO Output Transformer, specified Valves and Components. Has power available to drive a Radio Tuning Unit.

COMPLETE KIT OF £7.0.0 Alternatively we supply **£8.0.0**
PARTS ASSEMBLED & TESTED
(Carriage & Insurance 5/- extra.)

Please enclose S.A.E. if ILLUSTRATED and DESCRIPTIVE LEAFLETS are required; the ASSEMBLY MANUALS, containing Practical Drawings, etc., are available at 1/6 each.

Only NEW HIGH GRADE Components and MULLARD VALVES are supplied with these Kits—

SPECIAL PRICE REDUCTIONS . . .

(a) The COMPLETE KIT OF PARTS to build both the "3-3" MAIN AMPLIFIER and the 2-STAGE PRE-AMPLIFIER-CONTROL UNIT **£12.10.0**
(b) The COMPLETE KIT OF PARTS to build the "5-10" MAIN AMPLIFIER and the 2-STAGE PRE-AMPLIFIER-CONTROL UNIT **£15.15.0**
PRICES FOR THE "5-10" ARE SUBJECT TO £1.6.0 EXTRA IF THE PARTRIDGE TRANSFORMER IS REQUIRED.

(a) The "3-3" and the 2-STAGE PRE-AMPLIFIER **£15.0.0**
both ASSEMBLED and TESTED

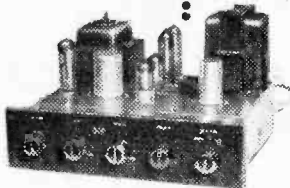
H.P.: DEPOSIT £3.0.0 and 12 Monthly Payments of £1.2.0.

(b) The "5-10" and the 2-STAGE PRE-AMPLIFIER both ASSEMBLED and TESTED **£18.18.0**

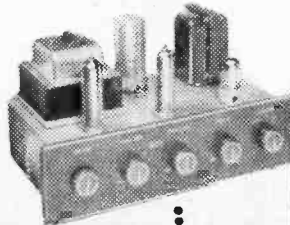
H.P.: DEPOSIT £3.16.0 and 12 Monthly Payments of £1.7.8.
When ordering include an extra 7/6 to cover Carriage and Insurance.

MODEL 510/RC

**THE NEW
COMPLETE
MULLARD 5-10
AMPLIFIER**



**THE NEW
COMPLETE
MULLARD 3-3**



Designed for a simple domestic installation with Genuine High Quality reproduction up to a maximum of 10 watts. Separate BASS and TREBLE Controls are incorporated with switched inputs for 78 and L.P. Records plus Radio Tuning Unit. We incorporate SPECIFIED COMPONENTS and NEW MULLARD VALVES. We also give the purchaser the choice of two of the best ULTRA-LINEAR OUTPUT TRANSFORMERS made—first the latest by PARMEKO LTD. and also the latest by PARTRIDGE (£1.6.0 extra). We also supply the PARMEKO MAINS TRANSFORMER and this has extra power available to supply a Radio Tuning Unit. The Control Unit can easily be detached from the Amplifier Chassis for use in a remote position.

COMPLETE KIT OF PARTS £11.10.0 Alternatively we supply **£13.10.0**
(PARMEKO Transformer) ASSEMBLED and TESTED

H.P. Terms: Dep. £2.14.0 and 12 Monthly Payments of 19.10.
Send S.A.E. for ILLUSTRATED LEAFLET or 1/6 for the ASSEMBLY MANUAL.

THE IDEAL AMPLIFIER FOR A SMALL HIGH QUALITY INSTALLATION

COMPLETE KIT £7.10.0 Alternatively supplied ASSEMBLED OF PARTS and FULLY TESTED **£8.19.6**
(plus 6/6 coverage and insurance)

H.P. Terms: Dep. £2.0.0 and 8 Months of £1.0.0.

Developed from the very popular 3-valve 2-watt Amplifier designed in the Mullard Laboratories. Our kit is complete to MULLARD'S SPECIFICATION including supply of specified components, Mullard valves and a PARMEKO OUTPUT TRANSFORMER. Send S.A.E. for leaflet or 1/6 for ASSEMBLY MANUAL.

STERN RADIO LTD.

STERN'S FOR STEREO

OUR POPULAR MULLARD MAIN AMPLIFIERS ARE RECOMMENDED FOR USE WITH THE DULCI STEREO PRE-AMPLIFIERS

THE "STEREO EIGHT" PRE-AMPLIFIER
£23.2.0
(Carr. & Ins. 5/- extra.)



THE "STEREO TWO" PRE-AMPLIFIER
£9.9.0
(Carr. & Ins. 5/- extra.)

Both Pre-amplifiers can be supplied to correctly operate with our very popular MULLARD "3-3" and "5-10" MAIN AMPLIFIERS (described opposite). For Stereo reproduction TWO Main Amplifiers are necessary, but for normal "Hi-Fi" reproduction the "Stereo Eight" and the "Stereo Two" are perfectly suitable to operate with ONE Main Amplifier and the second Main Amplifier can then be added at any time, thus transforming a standard "Hi-Fi" installation over to Stereo.

WE OFFER PRE-AMPLIFIER AND AMPLIFIER AT SPECIALLY REDUCED PRICES

Send S.A.E. for full details.
OTHER STEREO EQUIPMENT AVAILABLE:
GRAM UNITS fitted with Stereo cartridge by . . . GARRARD-COLLARO LENC0-B.S.R.
HIRE PURCHASE TERMS ARE AVAILABLE.

TO MODERNISE YOUR OLD RADIOGRAM

THE NEW ARMSTRONG "JUBILEE"

A.M./F.M. RADIOGRAM CHASSIS

PRICE **£30.9.0**

(Plus 7/6 Carr. and Ins.)

HIRE PURCHASE: Deposit £6.2.0. 12 Months at £2.4.8.

Messrs. Armstrong have always been associated with very high-class equipment, and this chassis is undoubtedly one of the best they have ever produced.

MAIN FEATURES

- 6 watts push-pull output with negative feedback.
- 9 valves and 2 diodes.
- Full F.M. band (87-108 Mc/s) plus medium and long waves.
- Automatic frequency control on F.M.
- Adjustable Ferrite rod aerial on A.M. bands.
- Tape playback and record facilities.
- Two compensated pick-up inputs.
- Frequency response 30-22,000 cps. ± 2 dB.
- Separate wide-range bass and treble controls.
- Output impedance for 3, 7-1, and 15-ohm SPEAKERS.
- Tuning Indicator.
- Size of chassis 12in. x 8in. x 7in. high.

THE DULCI MODEL H.4/PP AM/FM RADIOGRAM CHASSIS

A 4 Waveband Receiver Designed for first-rate reproduction of Radio and Gram. (Plus 7/6 Carr. & Ins.)
£29.3.10

H.P. TERMS: Deposit £5/18/10 and 12 months at £2/2/10.

BRIEF SPECIFICATIONS

- Covers Short, Medium, Long and F.M. Wavebands.
- Employs Full A.V.C.
- The latest 8-valve line-up.
- Excellent Tone range up to 4 watts output.
- Internal Aerial for local stations.
- Overall size 12in. x 8in. x 7in. high.
- For 3 or 15 ohm P.M. Speakers.
- "Magic Eye" Tuning Indicator.
- PUSH-PULL Ultra Linear Output up to 8 Watts.

THE DULCI MODEL H.4/2 INCORPORATING OWN POWER SUPPLY

is in Stock. Specifically designed for operation with High Fidelity Amplifiers and capable of very high performance on Long, Medium and Short Wavebands plus the complete VHF FM Transmissions. Thoroughly recommended where a complete self-powered "All Wave" Tuner is wanted.

PRICE **£24.19.0** (Plus 7/6 Carr. & Ins.)

HIRE PURCHASE: Deposit £5 and 12 months at £1 16 7. A fully illustrated leaflet is available, please enclose S.A.E.

A SPECIAL CASH ONLY OFFER !!

This very attractive PORTABLE AMPLIFIER (ASK 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 Maroon and 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) P.M. SPEAKER **18/9**



Offer a COMPLETE KIT OF PARTS FOR ONLY **£2.19.6**

EASY-TO-FOLLOW ASSEMBLY INSTRUCTIONS ARE INCLUDED. Will charge 6 or 12 volt Batteries at max. 2 1/2 amps. The design incorporates Ballast Resistor and Fuse, and we supply complete with Metal Box container.

109 & 115 FLEET ST., LONDON, E.C.4

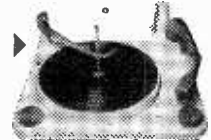
Telephone: FLEET STREET 5812/3/4

!!! RECORD PLAYERS !!!

THE LATEST MODELS ARE IN STOCK MANY AT REDUCED PRICES!!!

SEND S.A.E. FOR ILLUSTRATED LEAFLET A FEW CASH BARGAINS

- B.S.R. MONARCH
- UA8 4-speed mixer
- Autochanger with
- Crystal Pick-up



£6.19.6

The COLLARO "CONQUEST" 4-speed Autochanger, Studio Pick-up **£7.19.6**

The latest COLLARO "CONTINENTAL" 4-speed MIXER Autochanger, Studio "O" Pick-up **£8.19.6**

The COLLARO 4-speed Single Record Player, Studio Pick-up **£6.19.6**

THE NEW B.S.R. Model UA12 is in Stock. A 4 "SPEED" MIXER AUTOCHANGER. **£8.19.6**

UA12 also available incorporating the B.S.R. STEREO Pick-up, plays L.P. and 78 Records **£11.17.6**

B.S.R. MODEL TU9 4-speed Single Record Player, complete with separate Crystal Pick-up **£4.10.0**

(This high output Pick-up is available separately for £1/12/6.)
Carriage and Insurance on each above 5/- extra.

HIGH FIDELITY UNITS IN STOCK

The latest GARRARD TRANSCRIPTION MOTOR "301" with Stroboscopically marked turntable **£28.0.11**

The new GARRARD Model 4HF High-quality Single Record Player fitted with the latest T.P.A.12 Pick-up Arm and G.C.8. Crystal Cartridge **£19.7.10**

As above but fitted with the G.M.C.5 Moving Coil Pick-up and T.P.1 Transformer **£27.14.7**

GARRARD Model T.A.M.K. II Single Record Player fitted with high output Crystal Pick-up detachable Head **£9.15.8**

The GARRARD T.P.A.12 TRANSCRIPTION PICK-UP ARM is available separately or with Crystal or Moving Coil Pick-up Heads.

GARRARD AUTOCHANGERS AVAILABLE FROM STOCK. Send S.A.E. For Leaflet.

NEW HIRE PURCHASE TERMS ARE AVAILABLE ON ALL EQUIPMENT VALUE £9.0.0 AND OVER.

STERN'S MK. II fidelity P.M. TUNING UNIT

PRICE **£15.0.0**
(Plus 5/- Carr. & Ins.)

HIRE PURCHASE: Deposit £3.0.0 and 12 Monthly Payments of £1.2.0.

Incorporates the latest MULLARD PERMEABILITY TUNING HEART and the corresponding MULLARD VALVE LINE-UP comprising ECC85, 2 type EF85s (or EF85s) EM84 Tuning Indicator, plus 2 type O.A.79s Germanium Diodes. A really first-class Tuner, very attractively presented and comparable to many offered at much higher prices. Power consumption is only 1.5 amps at 6.3 volts and 25 ma at 250 volts.

HOME CONSTRUCTORS! YOU CAN BUILD THIS TUNING UNIT FOR ONLY £11.0.0 (Plus 5/- Carr. & Ins.) Please send S.A.E. for fully descriptive leaflet, or the Assembly Manual is available for 1/6. This contains easily followed PRACTICAL DIAGRAMS together with relative instructions.



HOME CONSTRUCTORS

A RANGE OF "EASY TO ASSEMBLE" PREFABRICATED CABINETS Designed by the W.B. "STENTORIAN" COMPANY for "Hi-Fi" Loudspeaker systems or to accommodate high-quality equipment. The acoustically designed Bass Reflex Cabinets containing the very successful "Stentorian" Speakers give really first-class reproduction and are well recommended. Models are also available to accommodate high-quality Amplifiers, Pre-amplifiers, Tuning Units, Record Players, etc. All models are very easily assembled, in fact, only a screwdriver is required. Fully illustrated leaflets are available, including complete specifications of the various STENTORIAN LOUDSPEAKERS. PLEASE, ENCLOSE S.A.E. WITH ALL CORRESPONDENCE.



A SMALL DEPOSIT will bring you enough parts to make a complete TRANSISTOR POCKET RADIO

(Size $5\frac{3}{4} \times 3\frac{1}{4} \times 1\frac{1}{4}$) using a printed circuit

★ Send for FREE PRICE LIST (all parts sold separately) and/or 3/- for new simplified instruction booklet with suggested circuits and assembly details.

OUR CIRCUITS OFFER
HIGH SENSITIVITY
HIGH SELECTIVITY

using

R.F. Transistors 1 GN. each
L.F. Transistors, 10/- each
all specially selected to give
HIGH OVERALL GAIN with A.V.C.

FULL MEDIUM & LONG WAVE COVERAGE

for as little as **£9.19.6**

- Miniature loudspeakers, only $\frac{1}{8}$ in. deep x $2\frac{1}{2}$ in. diam. **27/6**
- Miniature oscillator and i.f. coils, $\frac{1}{8}$ in. high, $\frac{3}{8}$ in. diam. **8/-**
- Jackson 00 twin gang tuning condenser with intersection screen **10/6**
- Attractive high impact polystyrene cabinet with fittings for tuner, trimmers, speaker and circuit board **12/6**

MANY OTHER SUB-MINIATURE COMPONENTS AVAILABLE

SPECIALISED ELECTRONIC COMPONENTS LTD 8 Eccleston Square · London · SW1

MAIL ORDERS ONLY

YOURS FOR 10% DEPOSIT

Detailed below is a selection of equipment available on easy repayment terms.

Whatever your requirement—we stock it.

	Cash	Deposit	12 M'thly payments of	18 M'thly payments of
AMPLIFIERS & CONTROL UNITS				
Acoustical Quad.				
Mk. II	£42 0 0	£4 4 0	£3 12 6	£2 10 6
Leak TL12 and Point One C/U				
	£31 10 0	£3 3 0	£2 14 4	£1 17 10
Rogers Junior MK. II	£28 0 0	£2 16 0	£2 8 4	£1 13 7
LOUDSPEAKER ENCLOSURES COMPLETE & SPEAKER UNITS				
Wharfedale SFB3	£39 10 0	£4 0 0	£3 8 1	£2 7 4
Goodmans Sherwood I	£32 11 0	£3 6 0	£2 16 1	£1 19 0
Acoustical Electrostatic				
	£52 0 0	£5 4 0	£4 7 5	£2 19 10
Goodmans Axiom 300	£11 5 9	£1 4 0	19 4	13 6
Wharfedale Super 12FS/AL	£17 10 0	£1 15 3	£1 10 2	£1 1 0
Goodmans Stereophonic Bowt Unit	£8 8 0			
TAPE RECORDERS				
Grundig TK35	£86 2 0	£8 13 6	£7 8 5	£5 3 3
Ferragraph 3AN	£82 19 0	£8 9 0	£6 19 0	£4 15 3
Sound 555	£68 5 0	£6 17 3	£5 17 3	£4 1 10
Elizabethan Essex	£68 5 0	£6 17 3	£5 17 8	£4 1 10
Brennell 3 Star	£69 18 0	£6 8 0	£5 1 9	£3 7 5
Grundig TK20	£51 12 0	£5 12 0	£4 11 6	£3 2 8
Feletunken KL75K	£52 10 0	£5 5 0	£4 8 3	£3 0 5
Sound 444	£47 5 0	£4 14 6	£4 1 6	£2 16 9
Elizabethan Escort	£47 5 0	£4 14 6	£4 1 6	£2 16 9
Sound Belle	£27 6 0	£2 16 0	£2 5 9	£1 11 4
*Complete with Microphone.				
TURNTABLE UNITS AND P/U				
Garrard 301 Stroboscopic	£28 0 11	£2 17 6	£2 8 3	£1 13 7
Connoisseur Type B	£29 5 3	£2 0 0	£2 10 4	£1 15 0
Lenco GL58/1RD (with Stereo P/U)	£29 3 10	£2 19 6	£2 10 1	£1 14 11
Decca Stereo P/U	£22 0 0	£2 4 0	£1 18 0	£1 6 5

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Brand new. Latest design with printed circuit. Dimensions 7in. x 2½in. x 5in. A.C. only. Mains isolated. 2-3 watts output. Incorporating EL84 as high gain output valve. Volume and tone controls. Knobs 2/6 extra. P. & P. 3/6.

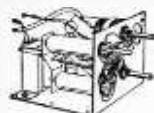
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79/6



(R.P.4)

Stylish cabinet by famous manufacturer. Cloth covered in contrasting colours (red and grey). Grilled front controls panel. Size 15 x 19 x 8½in. deep. Beautifully made. A cabinet of which you can really be proud. Takes 4-speed B.S.R. Autochanger. 6½in. round or elliptical speaker. Room for any amplifier of your own choice. Carr. & Ins. 4/6.

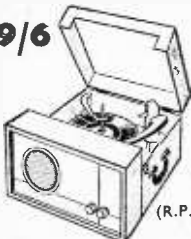
69/6



(R.P.2)

A beautifully styled cabinet. Made by a famous manufacturer. In polka dot grey cloth with clipped lid and carrying handle. Size 16 x 14½ x 8½in. deep. Will take B.S.R. Monarch 4-speed Autochanger and 4 x 7in. elliptical speaker and most of the modern portable amplifiers. Carr. & Ins. 4/6.

79/6



(R.P.3)

A practical cabinet, nicely designed, cloth covered two-tone (brown and coffee). Size 15 x 17 x 8in. deep. Takes B.S.R. 4-speed Autochanger and 6½in. round or elliptical speaker. Carr. & Ins. 4/6.

49/6



(R.P.1)

A delightful-looking cabinet, 14½ x 17½ x 8½in., in two-tone leatherette. Will take a B.S.R. Monarch 4-speed Autochanger and 6½in. round speaker. Carr. & Ins. 4/6.



B.S.R.

4-SPEED
AUTOCHANGER,
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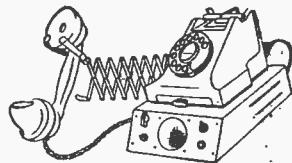
COLLARO 4-SPEED AUTOCHANGER,

£7.19.6

Incorporating auto and manual control complete with studio crystal p.u. and sapphire stylus. P.P. & Ins. 5/6.

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89/6



Invaluable in a noisy office or workshop. 3 valves: UY41; UF41; UL41. 3in. speaker and a suction type vibration microphone. A.C./D.C. Size of amplifier 7 x 11 x 3in. Fits any type of G.P.O. telephone. P. P. & Ins. 4/6.

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49/6



(R.P.6)

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STEREOPHONIC AMPLIFIERS, £7.19.6

12 months' guarantee

Beautifully made for portable stereophonic record players. Latest design with printed circuit. Dimensions 3 x 5½ x 9½in. A.C. only. Mains isolated. Twin amplifiers each side giving 3-4 watts output. Incorporating ECL82 triode pentode valve. Full tone, volume and balance controls. Complete and ready to fit. Knobs 3/6 per set extra. P.P. & Ins. 4/6.

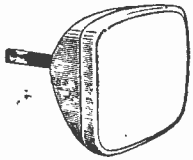
B.S.R. FUL-FI crystal turnover cartridges, 19/6. Brand new. Including sapphire needles for L.P. and Standard giving fullest range and finest tone obtainable for any player. Can be fitted to all standard pick-up arms. P. & P. 9d.

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EXPRESS DESPATCH SERVICE. Please phone to confirm Tube in stock. Send Telegraph Money Order. Tube despatched Passenger Train same day.

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SOUND AND VISION STRIP, 5/9 Salvaged. Complete sound and vision strip. 8 valveholders. Less valves. I.F.s 16-19.5 Mc/s. Size 8½ x 4½ x 4½in. Drawings free with order. P. & P. 2/6.

SOUND AND VISION STRIP, 5/9. Salvaged. Superhet. 8 valveholders. Less valves. I.F.s 7.25 Mc/s sound, 10.75 Mc/s vision. Vision complete from input up to video output. Sound complete from input to A.F. Amplifier. P. & P. 2/6.

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D.3
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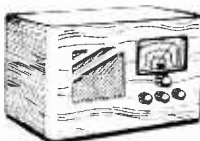
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600/13

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A.C./D.C. Universal mains 5-valve octal superhet; 3 waveband receiver can be adapted to gram. p.u. In attractive wooden cabinet 9½ x 18½ x 11½in. Ins. Carr. 7/6.



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R.F. E.H.T. Not tested. Amplifier stage 6V6 with O.P. trans. 3 ohms matching. Smoothed H.T. 350 volt at 250 m.a., 6.3 v. at 5 amp., 22 v. at 3 amp., 6.3 v. at 4 amp. and 4 v. centre tapped. Less valves. Drawings free. Size 14½ x 9 x 7in. Ins. Carr. 5/6.

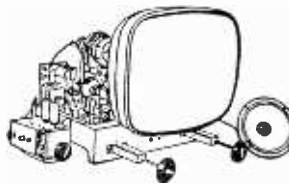
POWER PACK AND AMPLIFIER 9/9

Output stage PEN45. O.P. trans. choke. Smoothed H.T. 325 volt at 250 m.a. 4 v. at 5 amp., 6.3 v. at 5 amp., 4 v. at 5 amp. centre tapped. Valve base for rectifier, Octal or 4 pin. Output is taken from standard plugs. Less valves. Ins. Carr. 5/6.

POWER PACK AND AMPLIFIER 19/6

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17in. T.V. Chassis, Tube and Speaker, 16 Gns.



17in. Rectangular Tube on modified chassis. Supplied as single chassis covering B.B.C. channels 1-5, or, incorporating Turret Tuner which can be added as an extra at our special price to chassis purchasers of 50/-, giving choice of any 2 channels (B.B.C. and I.T.A.). Extra channels can be supplied at 7/6 each. Chassis size 12 x 14½ x 11in., less valves. Similar chassis are

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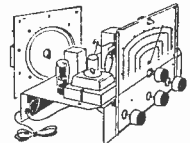
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Popular 12in. Plessey T.V. Chassis, 39/6

This is a real bargain for anyone wanting to make up their own T.V. at a very low cost. I.F.s 10.5-14 Mc/s. Simply adapted for a 12 channel Turret Tuner and can be modified to take a larger tube. A chassis in one unit. Untested. Less valves, tube, speaker and scanning coils. (All can be supplied as extras.) Circuit diagram available at 3/6 or free with order. Carr. & Ins. 10/6.

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5 valve superhet chassis including 8in. P.M. speaker and valves. Four control knobs (tone, volume, tuning, w/change switch). Four wavebands with position for gram. p.u. and extension speaker. A.C. Ins. Carr. 5/6.



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110 v., 6 v. or 12 v. (special adaptor for 200/240 v. 10/- extra). Automatic solder feed including a 20 ft. reel of Ersin 60/40 solder and spare parts. It is a tool for electronic soldering or car wiring. Revolutionary in design. Instantly ready for use and cannot burn. In light metal case with full instructions for use. Post 2/9.

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Heater Transformer, 3/9. 2-1 Ratio or 1-2 Ratio auto transformer. 2 volt at 1.4 amp. primary, 4 volt secondary. P. & P. 1/9.

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Drop Through Type, 12/9. 350-0-350 volts at 250 m.a., 6.3 volt at 4 amp., 6.3. volt at 4 amp., 4 volt at 3 amp., 22 volt at 3 amp., 4 volt centre tapped at 1.5 amp. Primary 200-250 volt. 50 cycles. P. & P. 3/9.

Drop Through Type, 12/9. 350-0-350 volts at 250 m.a. 6.3 volts at 5 amp., 4 volt at 4 amp., 4 volt at 7 amp., 4 volt centre tapped at 1 amp. Primary 200-250 volt. 50 cycles. P. & P. 3/9.

Upright Type, 3/9. 350-0-350 volt at 80 m.a. 12 volt at 1.5 amp., 4 volt at 2 amp. Primary 100-120-200-250 volt. Fully shrouded. Ideal for mains auto transformers. P. & P. 2/9.

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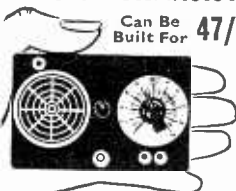
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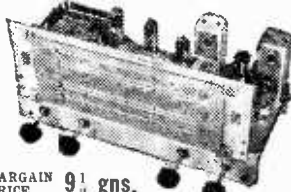
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6N7	8 6ECS4	12 6EY86 14/6
6V6	7 6EP80	12 6E246 8/6
6X4	7 6ECP2	12 6E280 8/6
6X6	7 6ECH2	10 6E281 8/6
7Y5	9-6ECH1	10 6M174 9/6
7Y4	8 6ECL80	12 6PCN4 10/6
6AP96	9-6ECL82	12 6PCF80 10/6

SPECIAL PRICE PER SET
 1RS, 1T4, 185, 184 or 384, or 3V4 ... 27.6
 1DK96, DP96, 1AP96, 1L456 ... 35
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 ... 35

RE-GUNNED TV TUBES GENUINE OFFER

New Heater, Cathode and Gun Assembly can now be fitted to your old Tube—Reconditioned virtually as new. Fully guaranteed to highest standards—as used by our own Service Dept.
 12in. £8. 14in. £10.0. 17in. £10.
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25.25 v. 50/12 v. 1/8	Can Types, Clips 3d. ea.	3
25.50 v. T.C.C.	2- 8.500 v. Dub.	3
50.50 v. 4,500 v.	2- 8+8.450 v. T.C.C.	4/6
100/25 v. 2,450 v.	2- 8+16.450 v. Hunts	5/6
8/450 v. T.C.C.	2- 16+16.450 v. T.C.C.	4/6
8+8/450 v. B.E.C.	4/6	32/275 v. B.E.C.
8+16/450 v. T.C.C.	5/-	32+32/275 v. Hunts
16/450 v. B.E.C.	3/6	32+32/450 v. T.C.C.
16/500 v. Dub.	4/-	250/350 v. B.E.C.
16+16.450 v. T.C.C.	6/-	60/350 v. T.C.C.
32/50 v. B.E.C.	4/-	60+100/350 v. B.E.C.
32/500 v. Dub.	5/-	60+250/275 v. B.E.C.
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MULLARD 3-3 QUALITY AMPLIFIER—A first-class Hi-Fi Companion Unit to the Jason Tuner. H-Duty Mains Trans. allows for H.T. and L.T. Power supply. Mullard's latest circuit, 3 valve, 3 watt. Freq. response 40 c/s-20 Kc/s + or -1db with special sectionalised O/P/T. Trans., Punched Chassis, all components, valves, etc. Only £6.19.6. Ready wired and tested, 8 gns. Carr. and ins. 4/6.

SENERCEL RECTIFIERS. E.H.T. Type Fly-back Voltages. K3/25 2 kv., 5/-; K3/40 3.2 kv., 6/9; K3/45 3.6 kv., 7/3; K3/50 4 kv., 7/9; K3.100 8 kv., 13/6. MAINS TYPES—RM1, 125 v. 60 mA., 4/9; RM2 125 v. 100 mA., 5/6; RM3 125 v. 120 mA., 4/6; RM4 250 v. 250 mA., 16/-; RM4B type 270 mA., 17/6; RM5, 250 v. 200 mA., 21/-.

SPEAKER FRET—Expanded Bronze anodised metal 8 x 8 in., 2/3; 12 x 8 in., 3/-; 12 x 12 in., 4/6; 12 x 15 in., 6/-; 24 x 12 in., 9/6, etc.

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SPEAKERS P.M. 3 ohm 2 1/2 in. Elac. 16.6. 3 1/2 in. Goodman, 18.8. 5 in. R. & A., 17.6. 6 in. Celestion, 18.6. 7 x 4 in. Goodman, 18.6. 8 in. Rola, 20/- 8 in. Special Cine 6 mms, 21.6. 10 in. R. & A., 25/-

EMITAPE Recording Tape ALL NEW & BOXED. Type 88 (Stand). Type 99 (Long Play). 3 in. ... 175ft., 7/-; 250ft., 9/-; 5 in. ... 850ft., 19/-; 7 1/2 in. ... 250ft., 24/6; 1,200ft., 21/6; 7 in. ... 1,200ft., 30/-; 1,800ft., 45/-

Spore Reels (Unboxed) 7 in. metal, 1/6; 7 in. plastic (EMD), 3/6.

RECORDING TAPE—1,200 ft. on 7 in. Plastic reel, 88 type. Hi Quality Product. Each boxed, 22.6.

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Semi-air-spaced, low-loss, high quality 80 ohm coaxial. Stranded conductor, standard 1/4 in. Famous make. ONLY 8d. per yard. See what you save by ordering:
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Listed above are only a few items from our very large stock. Send 3d. stamp today for Complete Bargain List.

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RADIO COMPONENT SPECIALISTS (Est. 1946)

70 BRIGSTOCK ROAD, THORNTON HEATH, SURREY (THO 2188)
 50 yards Thornton Heath Station.
 Buses: 130A, 133, 159. 166 and 190

R.S.C. BATTERY CHARGING EQUIPMENT

All for A.C. Mains 200-250 v., 50 c/s. Guaranteed 12 months.

ASSEMBLED CHARGERS

6 v. 1 amp.	19/9
6 v. or 12 v. 1 amp.	27/9
6 v. 2 amps.	29/9
6 v. or 12 v. 2 amps.	36/9
6 v. or 12 v. 4 amps.	56/9

Above ready for use. With mains and output leads. Carr. 3/6.

SELENIUM RECTIFIERS

F.W. BRIDGE TYPES	
6/12 v. 1 a.	3/11 L.T. Types H.W.
6/12 v. 2 a.	7/3-2-6 v. i. a. 1/11
6/12 v. 3 a.	9/9/6/12 v. i. a. H.W. 2/9
13/11 H.T. TYPES H.W.	
6/12 v. 6 a.	17/11 150 v. 40 mA. 3/9
6/12 v. 10 a.	25/9 250 v. 50 mA. 5/9
6/12 v. 15 a.	35/9 250 v. 80 mA. 7/9
24 v. 2 a.	14/9 250 v. 80 mA. 7/9
24 v. 6 a.	26/9 250 v. 250 mA. 11/9



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. Louvered steel case with stoved blue hammer finished. Fused 75/- and ready for use with Carr. 4/6 mains and output leads. Credit Terms: Deposit 14/11 and 5 monthly payments 14/11.

ASSEMBLED CHARGER

6 v. or 12 v. 2 amps.
Fitted Ammeter and selector plug for 6 v. or 12 v. Louvered metal case, finished attractive hammer blue. Ready for use. With mains and output leads. Double Fused.
Only 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.
6 v. or 12 v. 1 amp. 22/9
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 41/6
6 v. or 12 v. 4 amps. 53/9
BATTERY CHARGER KIT 6/12 v. 6 amp. consisting of F.W. Bridge Rectifier, Mains Trans. and Ammeter. 49/9. Post and packing 4/6.

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.	16/9
350-0-350 v. 100 mA.	6.3 v. 2 a. 5 v. 2 a.	18/9
250-0-250 v. 100 mA.	6.3 v. 4 a. 5 v. 3 a.	23/9
300-0-300 v. 100 mA.	6.3 v. 4 a. 5 v. 3 a.	25/9
350-0-350 v. 100 mA.	6.3 v. 4 a. 5 v. 3 a.	23/9
350-0-350 v. 100 mA.	6.3 v. 4 a. 4 a. C.T.	23/9
0-4-5 v. 3 a.		23/9
350-0-350 v. 150 mA.	6.3 v. 4 a. 5 v. 3 a.	29/9

FULLY SHROUDED UPRIGHT

250-0-250 v. 60 mA.	6.3 v. 2 a. 5 v. 2 a.	
Midiget type 21-3-31n.		
250-0-250 v. 100 mA.	6.3 v. 4 a. 5 v. 3 a.	26/9
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
300-0-300 v. 130 mA.	6.3 v. 4 a. 6.3 v. 1 a.	
for Mullard 510 Amplifier		
350-0-350 v. 150 mA.	6.3 v. 4 a. 5 v. 3 a.	33/9
350-0-350 v. 150 mA.	6.3 v. 2 a. 6.3 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. Suitable Williamson Amplifier. etc. 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. 17/8; 12 v. 3 a. or 24 v. 1.5 a. 17/6.

CHARGER TRANSFORMERS

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SMOOTHING CHOKES

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

OUTPUT TRANSFORMERS

Midiget Battery Pentode 6B61 for 3S4, etc.	3/9
Small Pentode. 5,000 Ω to 3 Ω	3/9
Small Pentode 7,000 Ω to 3 Ω	3/9
Standard Pentode 5,000 Ω to 3 Ω	4/9
Standard Pentode 7,000 Ω to 3 Ω	4/9
10,000 Ω to 3 Ω	4/9
Push-Pull 10-12 watts 6V6 to 3 Ω or 15 Ω	15/9
Push-Pull 10-12 watts to match 6V6	16/9
Push-Pull EL84 to 3 or 15 Ω	16/9
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 15 Ω	47/9

ELIMINATOR TRANSFORMERS

Primaries 200-250 v. 50 c/s.	
12 v. 40 mA. 5-0-5 v. 1 a.	15/9
90 v. 15 mA. 4-0-4 v. 500 mA.	9/9

R.S.C. BATTERY TO MAINS CONVERSION UNITS

Type BM1. An all-dry battery eliminator. Size 5 1/2 x 4 1/2 x 2 1/2 in. approx. Completely replaces battery supplying 1.4 v. and 90 v. where A.C. mains 200-250 v. 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 5 1/2 x 2 1/2 in. Supplies 120 v. 80 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.P. 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.

STEREOPHONIC EQUIPMENT AT SPECIAL PRICES

(a) Linear L33 Stereo Amplifier. 7 GNS.; (b) Star Galaxy Auto-Changer fitted Turn-over head for Stereo. Long Playing and Standard Records. £8.19.6. Carr. 4/6; (c) Matched 12in. P.M. Speakers in polished Walnut finished wood cabinets. £6.15.0 per pair; (d) Cabinet Speakers, illustrated below. £9.19.0 pair; (e) Matched High Flux 8in. P.M. Speakers in polished Walnut veneered Cabinets. £3.19.9 pair; (f) Matched 6in. K.A. P.M. Speakers in polished veneered Walnut cabinet. £3.10.0 pair; (g) (a), (b) and (c) 19 gns., carr. 15/-; (d), (e) and (f) 22 gns., carr. 15/-; (a), (b) and (c) 15 gns., carr. 15/-; (d), (e) and (f) 17 gns., carr. 15/-.

12in. 10 WATT HIGH QUALITY LOUD-SPEAKERS 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/- and 9 monthly payments of 11/-.



D.C. SUPPLY KIT. 12 v. 1 a. consisting of partially drilled metal case, mains trans., F.W. Bridge Rectifier, 2 fuse-holders and fuses. Change Direction switch, variable Speed regulator and circuit. For 200-250 v. A.C. mains. Suitable Electric Trains, etc. Limited number available at 29/9.

ACOS CRYSTAL 'MIKE' INSERTS. Approx. 1in. square. Fly lead connections. Only 5/11 each. Brand New. Round type approx. 1 1/2in. diam. Ex-equipment, tested. 4/11 each.



LUCAS 6 v. 22 A. H.V. MOTOR-CAR BATTERY. Brand New. Sealed List price £31.11. Limited number available at only 29/9. Carr. 4/6.

PORTABLE CABINETS. High Quality Finish. Rains covered. Attractive design. Inside measurements: 17in. x 12 1/2in. x 8 1/2in. High. Clearance above base-board 5 1/2in. Below 2 1/2in. 69/9 each. Or size 14 1/2in. x 13 1/2in. x 6 1/2in. 47/9 each.

SPECIAL OFFER. Above cabinet. LG3 Amplifier, B.S.R. Changer and 6in. P.M. Speaker. 13 GNS. Carr. 19/-.

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 anode bend detector. Power pentode output. Valve line-up 6K7, 5P6L, 6V6G. Selectivity and quality are well up to standard, and simplicity of construction is a special feature. Point-to-Point wiring diagrams, instructions and parts lists. 1/8. Maximum building costs £4.19.6. inc. attractive Brown or Cream Bakelite or Walnut veneered wood cabinet 12 x 6 1/2 x 5 1/2 in.

14 WATT AMPLIFIERS. Unused and in good order but store soiled. For 200-250 v. A.C. mains input. Outputs for 3 and 15 ohm speaker. Inputs for "mike" and Gram. Limited number complete with valves. Only 6 GNS., carr. 5/-.

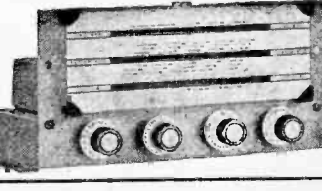
EXTENSION SPEAKERS

Ready for use in walnut veneered cabinet. 6in. 2-3 ohms, 29/11
8in. 2-3 ohms 35/9.
Very limited number



AMFM RADIOGRAM CHASSIS HIGH QUALITY 6-8 WATT PUSH-PULL OUTPUT

For 200-250 v. Mains. Long wave. Medium, P.M. and Gram. Complete with 8 B.V.A. valves. Guaranteed 12 months. Only 22 GNS. Or Deposit £2.12.0 and 9 monthly payments of £2.12.0.



R.S.C. A8 ULTRA LINEAR 12 WATT AMPLIFIER

High fidelity Push-Pull Amplifier with "Built-in" Tone Control. Pre-amp stages, high sensitivity, includes 5 valves (807 outputs). High Quality sectionally wound output transformer, specially designed for Ultra Linear operation, and reliable small condensers of current manufacture. **INDIVIDUAL CONTROLS FOR BASS AND TREBLE** "Lift" and "Cut." Frequency response +3 db. 30-30,000 c/c.s. Six negative feedback loops. Hum level 71 db. down. ONLY 70 millivolts INPUT required for FULL OUTPUT. Suitable for use with all makes and types of pick-ups and practically all microphones. Comparable with the very best designs.

For STANDARD or LONG - PLAYING RECORDS. For MUSICAL INSTRUMENTS such as GUITARS, etc. OUTPUT SOCKET with plug provides 300 v. 20 mA. and 6.3 v. 1.5a. For supply of a RADIO FEEDER UNIT. Size approx. 12-9 7/16". For A.C. mains 200-250 v. 50 c/c.s. Outputs for 3 and 15 ohm speakers. Kit is complete to last nut. Chassis is fully punched. Full instructions and point-to-point wiring diagrams supplied. Unapproachable value. at £7/15/- or factory built 45.- extra. Carriage 10/-.

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If required lowered metal cover with 2

COLLARO RC54 3-SPEED AUTO-CHANGERS with Studio pick-up. Brand new. For 110 v. 50 c.p.s. A.C. mains. Price with 110 v. to 220-250 v. Auto Trans. only £5/19/6. Carr. 5/6.

COLLARO CONQUEST 4-SPEED AUTO-CHANGER with high fidelity Studio pick-up. Latest model. Brand new. Cartoned. For 200-250 v. 50 c.p.s. A.C. mains. Our price £7/19/6. Carr. 5/6.

COLLARO 4-SPEED SINGLE PLAYER with separate pick-up, as fitted RC57. For 200-250 v. A.C. mains. £4/10/0. Post 3/9.

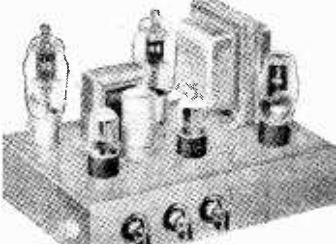
PICK-UP ARMS complete with Hi-Fi turnover crystal head. Acos GP54. Limited number brand new, perfect, at approx. half price. Only 55/9.

LG3 MINIATURE 2-3 WATT GRAM AMPLIFIER. For use with above or any other single or auto-change units. Output for 2-3 ohm speaker. For 200-250 v. 50 c.p.s. A.C. mains. Overall size 6 1/4 x 4 1/2". Controls: Vol. and Tone with switch. Guaranteed 12 months. Only 55/9.

SUPERHIT FEEDER UNIT. Design of a high quality Radio Tuner Unit (specially suitable for use with any of our Amplifiers). Delayed A.V.C. employed. The W.C.H. Sw. incorporates Gram position. Controls are Tuning, W.C.H. 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. 9-5 7/16" high. Simple alignment procedure. Point-to-Point wiring diagrams, instructions and priced parts list with illustration. 2/6. Total building cost £4 15/- For descriptive leaflet send S.A.E.

LINEAR L45 MINIATURE 4.5 WATT QUALITY AMPLIFIER. Suitable for use with Collaro, B.S.R. or any other record playing unit, and most microphones. Negative feedback 12 db. Separate Bass and Treble Controls. A.C. mains input of 200-250 v. 50 c/c.s. Output for 2-3 ohm speaker. Three miniature Mullard valves used. Size of unit only 6-5 5/16" high. Output for 2-3 ohm speaker. Guaranteed for 12 months. Only £5 19/6. Send S.A.E. for illustrated leaflet. Credit Terms. Deposit 22/6 and 5 monthly payments of 22/6.

LINEAR 'DIATONIC' 10-14 WATT HIGH FIDELITY PUSH-PULL ULTRA LINEAR AMPLIFIER. For 200-250 v. A.C. mains. Valves ECC83, ECC83, EL94, EL84, E281 miniature Mullard. Self-contained Pre-amp. Tone Control stage, and separate Bass and Treble Controls. Independent 'Mike' and Gram input sockets are provided. Output Matchings for 3 and 15 ohm speakers. Only 12 4/8" h. or Deposit 22/6 plus 10/- and 12 monthly payments of 22/6. Send S.A.E. for leaflet.



carrying handles can be supplied for 18/9. Additional input sockets, with associate Vol. control so that two different inputs such as Gram and 'Mike' or Tape and Radio can be mixed, can be provided for 13/- extra. Guaranteed 12 months. TERMS on assembled two input model: DEPOSIT 18/9 and 12 monthly payments. 18/9. **HIGH FIDELITY MICROPHONES and SPEAKERS** in stock. Keep cash prices or credit terms if supplied with amplifier.

R.S.C. 4.5 WATT A5 HIGH-GAIN AMPLIFIER

A highly-sensitive 4-valve quality amplifier for the home, small club, etc. Only 50 millivolts input is required for full output so that it is suitable for use with the latest high fidelity pick-up heads, in addition to all other types of pick-ups and practically all 'mikes'. Separate Bass and Treble Controls are provided. These give full long-playing record equalisation. Hum level is negligible being 71 db. down. 15 db. of negative feedback is used. H.T. of 300 v. 25 mA. and L.T. of 6.3 v. 1.5 a. is available for the supply of a Radio Feeder Unit, or Tape-Deck pre-amplifier. For A.C. mains input of 200-250 v. 50 c/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/-, 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.



LINEAR STEREOPHONIC L/3 3+3 WATT QUALITY AMPLIFIER

Output 6 watts when not used with stereo head. For 200-250 v. 50 c.p.s. A.C. mains. Ganged controls. Volume and Tone. Outputs matched by preset balance control. For use with 2 matched 3 ohm speakers. Only requires connecting to Pick-up speakers and mains point. Sensitivity 159 m.v. Supplied with guarantee and instructions. Send S.A.E. for leaflet. Terms available.

7 GNS.

Terms: C.W.O. or C.O.D. No C.O.D. under 21. All goods supplied subject to terms and guarantee as detailed in current catalogue. Open 9 to 6; Weds. until 1 p.m. Catalogue 6d. Trade supplied. S.A.E. with all enquiries.

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/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, C233. 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/c.s. A.C. Mains and has output for 3 and 15 ohm speakers. Complete kit of chassis and point-to-point wiring diagrams and instructions. If required cover as for A8 can be supplied. The amplifier can be supplied, factory built with 12 months' guarantee, for £13.19.6. TERMS: DEPOSIT 24/9 and 12 monthly payments of 24/9.

11 GNS.

Carr. 10/- cover as for A8 can be supplied. The amplifier can be supplied, factory built with 12 months' guarantee, for £13.19.6. TERMS: DEPOSIT 24/9 and 12 monthly payments of 24/9.

LINEAR 50 WATT HIGH FIDELITY AMPLIFIER. Sensitivity 25 millivolts for full output. Suitable for any kind of microphone or pick-up. Output Matchings for 3 and 15 ohm speakers. Brand New. Guaranteed 12 months. For 200-250 v. A.C. mains. Only 19 gns. Carr. 15/-. Terms available. Twin handled cover available at 25/- Send S.A.E. for leaflet.

LINEAR L745 HIGH QUALITY TAPE DECK AMPLIFIER. With "built in" power pack and output Ready for stage. For Tape Decks Use ONLY with High or Low Imp. Playback and Erase Heads, such as Lane. 12 GNS.

SPEAKERS. All 2-3 ohms, suitable for use with LG3, L45, A5 or A7 amplifiers. 5in. Goodmans, 17/9. 7 x 4in. Elliptical Elac, 19/9. 6in. Goodmans, 17/9. 6in. Rola, 19/9. 10in. R.A., 27/9. 10 x 6in. Elliptical Goodmans, 29/6. 12in. Plessey, 29/11. 10in. W.B. 'Stentorian' 3 or 15 ohms type HF1012 10 watts, hi-fidelity type. Recommended for use with our A8 Amplifier, £4/10/9. 12in. Plessey 3 ohms 10 watts (12,000 lines), 59/6.

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 A8 or similar amplifier. Rated 10 watts. Price only £5 17/6.

ACOS HGPS9 Hi-Fi Crystal Cartridges. (Turnover type with sapphire stylus.) Standard replacement for Garrard and B.S.R. only 19/9.

R.S.C. 3-4 WATT A7 HIGH-GAIN AMPLIFIER For 230/250 v. 50 c/c.s. Mains input. Appearance and Specification, with exception of output wattage, as A5. Complete Kit with diagrams, £3/15/-. Assembled 22/6 extra. Carr. 3/6.

Mail Orders to 29/31 Moorfield Rd., Leeds 12. Callers to 5 and 7 County (Mecca) Arcade, Briggate, Leeds 1.



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EF86

Low hum, low noise voltage amplifying pentode.

**ECC83**

High μ double triode with separate cathodes.

**EZ81**

Full wave indirectly heated rectifier with maximum output of 150 mA.

**GZ34**

Full wave indirectly heated rectifier with maximum output of 250 mA at V_a (r.m.s.) = 2 x 450V.



Mullard Audio Valves have been acclaimed for their superiority all over the world, and are fitted by leading equipment manufacturers both in this country and overseas.

Whether you buy or build your audio equipment, make sure it is fitted with Mullard Audio Valves.

EL34

Output pentode with 25W maximum anode dissipation.

**EL84**

Output pentode with 12W maximum anode dissipation.



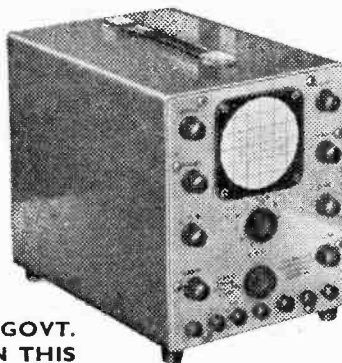
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The **TRESCOPE**, designed around a most modern 3" cathode ray tube and new type valves, meets all the requirements for a high performance and versatile general purpose oscilloscope. Its overall size is 7" x 8½" x 11" and the specification, too comprehensive to be fully given here, is contained in our illustrated brochure, a copy of which will gladly be sent on receipt of S.A.E.

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PRACTICAL WIRELESS

EVERY MONTH

VOL. XXXV, No. 627, MARCH 1959

COMMENTS OF THE MONTH

EDITOR : F. J. CAMM

27th YEAR
OF ISSUE

BY THE EDITOR

THE GROWTH OF THE CLUBS

THERE was a noticeable increase in club activity during the past year. Old clubs which have waxed and waned have again sprung into life and new clubs are being formed every month. Readers will have noticed the increased amount of space we are now devoting to club reports, and it is in this connection that we ask club secretaries to co-operate with us by sending in reports not later than the 10th of the month for publication in the following month's issue. Time, tide and printers wait for no man and reports which arrive after the deadline are scrapped. It is unfortunately true that some club secretaries are lax and presume that there is some elasticity about press dates. There is none. We mention this point because occasionally we receive a complaint from a club secretary that his report has been omitted, but the fault lies with him. We are anxious to encourage the club movement and we make no charge for the insertion of club reports. It is not too much to ask that club secretaries co-operate with us. Another point: it would be a convenience if club reports were prepared in the style in which we print them. Remember when writing reports that they should contain matter of general interest to other readers. A report that a lecture was given on such and such a date by Mr. So-and-so is already well known to local members. Try to extract from the speaker's remarks some fact or facts of general interest to other readers. If the club issues a club magazine, we are always glad to have copies for reference. There are many clubs in existence which do not circulate a monthly report to the press; we hope that they will now do so. There are many readers who wish to join a club and write asking for details of one in their area. We are engaged upon compiling a directory of radio clubs so that we will be able to put readers on to the nearest club secretary. We hope that every club secretary will forward us details giving the name of the club, meeting place, time and frequency of meeting, membership qualifications, annual subscription, etc. A book of rules for filing purposes would be welcome. We are also glad to receive and to publish photographs of any interesting club events, such as a field day, practical demonstrations, etc.

START OF VOL. 35

WITH this issue, we commence the 27th year of publication with a larger circulation than ever before, and it is still rising. We have the largest circulation of any technical radio journal, and it is pleasant to receive letters from time to time from readers who have been with us from the start. Home construction is as virile as ever. Needless to say, the index to the past volume is in course of preparation and an announcement will be made as soon as this is ready.

"THE PRACTICAL HOUSEHOLDER" EXHIBITION

A FINAL reminder that the exhibition organised by our companion journal, *The Practical Householder*, opens at Earls Court, on Wednesday, February 18th, and extends to Saturday, February 28th. A free ticket is printed in every copy of the March issue which is now on sale.—F. J. C.

Our next issue, dated April, will be published on March 6th

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PRACTICAL WIRELESS

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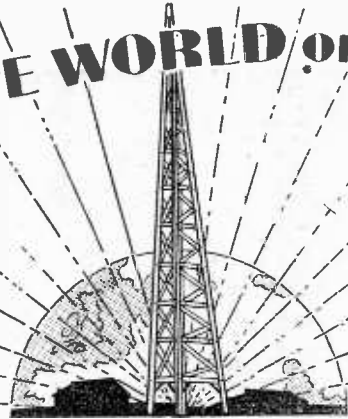
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The Editor will be pleased to consider articles of a practical nature. Such articles should be written on one side of the paper only, and should contain the name and address of the sender. Whilst the Editor does not hold himself responsible for manuscripts, 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, Strand, W.C.2. Owing to the rapid progress in the design of wireless apparatus and to our efforts to keep our readers in touch with the latest developments, we give no warranty that apparatus described in our columns is not the subject of letters patent.

Copyright in all drawings, photographs and articles published in PRACTICAL WIRELESS is specifically reserved throughout the countries signatory to the Berne Convention and the U.S.A. Reproductions or imitations of any of these are therefore expressly forbidden. PRACTICAL WIRELESS incorporates "Amateur Wireless."

ROUND THE WORLD OF WIRELESS



By "QUESTOR"

Broadcast Receiving Licences

THE following statement shows the approximate number of Broadcast Receiving Licences in force at the end of November, 1958, 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 Postal	979,166
Home Counties	974,824
Midland... ..	717,162
North Eastern... ..	879,125
North Western... ..	678,995
South Western... ..	592,046
Wales and Border Counties...	367,669
<hr/>	
Total England and Wales ...	5,188,987
Scotland	632,892
Northern Ireland	171,377
Grand Total	5,993,256

Tape Recorder Amalgamation

RECORD HOUSING LIMITED, the London firm of hi-fi cabinet manufacturers, have taken over the whole of the distribution and sales organisation of Magnafon Tape Recorders.

Four models are marketed—the lightweight Courier, with the Motek deck; the Courier Stereo; the Diplomat high fidelity recorder with the latest Collaro Mark IV deck and the new Magnafon "Adadek," which can be plugged into any radio, radiogram or amplifier. Special screw-in legs are available for all these models in order to turn them into console sets.

The instruments first appeared in a new range of cabinets specially designed for the 1958 Radio Show.

New Isle of Wight Ship-shore Service

A NEW ship-shore service, operating from the Isle of Wight, has now come into use. It is the third in the chain of ship-shore V.H.F. stations operated by the Post Office and provides similar facilities to those already in use in the Firth of Clyde and at North Foreland.

V.H.F. radiotelephone communication between telephone subscribers in the United Kingdom and suitably equipped ships of all nationalities are now available in the approaches to Southampton and the English Channel within about 50 miles of St. Catherines Point.

Shore equipment is on St. Boniface Down, near Ventnor, and the calls are handled by the existing Post Office coast radio station at Niton. The equipment complies with inter-

nationally recommended engineering standards, and uses frequency modulation. The frequencies employed give a single-frequency calling channel on 156.8 Mc/s, and a two-frequency traffic channel using 161.85 Mc/s for transmission and 157.25 Mc/s for reception. The use of these frequencies has been agreed internationally for radio services of this kind.

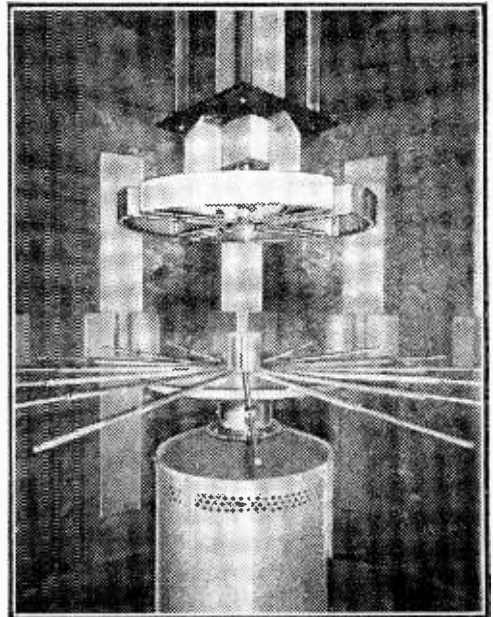
Charges for a 3-minute call is 6s. 6d. for the combined coast station and ship charges, plus a landline charge of 6d. or 2s. 6d., depending on the distance between

Niton and the telephone subscriber. Further services are planned from the existing coast radio stations at Lands End and Humber (Mablethorpe).

Marconi VOR for U.K. Network

FOLLOWING an exhaustive evaluation of V.H.F. Omnidirectional Radio Range (VOR) equipment, the Ministry of Supply has ordered eleven complete VOR installations from Marconi's Wireless Telegraph Company, on behalf of the Ministry of Transport and Civil Aviation. These installations will be distributed at selected points on the U.K.'s airways to provide a nation-wide navigational system for suitably equipped aircraft.

The Marconi VOR complies fully with the specification of the International Civil Aviation Organisation. It operates on the



The aerial system of the Marconi VOR installed in the aerial tower.

internationally agreed frequency range of 112-118 Mc/s. with a power output of 200 watts.

A specially designed flat-roofed building is normally employed for installation. This enables the aerial and associated counterpoise aerial to be mounted on the flat roof surface, the aerial changeover unit and the phase unit to be mounted on a wall of the building, and the remaining units in standard cabinets on the floor space. Each of the two transmitters is assembled in a cabinet 6ft. high. The remaining units are assembled in 3ft. 6in. cabinets which are normally placed between the transmitter cabinets.

Valve Design Technique

THE English Electric Valve Co., Ltd., are holding a private exhibition at the Kensington Palace Hotel from March 17th to 21st, both dates inclusive.

The display will consist of all that is modern in valve design technique in the world of radar, communication, transmitting, broadcasting—both sound and vision—and instrumentation, together with new types of storage tubes. They will be pleased to welcome any readers who may wish to come.

BBC Engineering Division Appointment

THE BBC announces the appointment of Mr. M. Taylor, A.M.I.E.E., as Engineer-in-Charge of the Lisnagarvey Transmitting Station near Belfast, Northern Ireland, in succession to Mr. J. P. McCurdy who is retiring after thirty-four years' service.

Mr. McCurdy started his career with the BBC at Belfast in 1924. He joined the staff of the Lisnagarvey Transmitting Station in 1935 and became Engineer-in-Charge in 1942.

Mr. R. A. Rennie

MR. R. A. RENNIE has also been appointed to the BBC Engineering Division as Engineer-in-Charge (Sound), Glasgow, in succession to Mr. J. G. W. Thompson, who has retired after thirty-four years' service. Mr. Thompson started his career with the Corporation in 1924 at Edinburgh. He became Assistant Engineer-in-Charge at the Glasgow Studios in 1942 and Engineer-in-Charge in 1955.



Listening to tape recordings are John Borwick who presents the programme "Sound", and Marguerite Cutforth, the producer.

Mr. Rennie joined the Corporation at the Aberdeen Studios in 1941. Since 1952 he has been in the Sound Section of the Planning and Installation Department in London, from where he takes up his present appointment.

B.I.R.E.

THE following Institution meetings will be held during February:

London. At London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, W.C.1. Medical Electronics Group, Friday, February 13th, 6.30 p.m. "Some Instrumentation Problems in Medical Electronics with particular reference to Electromyography," by Peter Styles. Institution Meeting, Wednesday, February 25th, 6.30 p.m. "Patents and the Radio Engineer," by E. D. Swann.

Audio Again at Radio Show

PLANS for the National Radio and Television Exhibition to be held at Earls Court, London, from August 26th to

September 5th, 1959, include an audio hall on a larger scale than 1958.

The audio hall, which was an innovation at the last radio show, was regarded as one of its most successful features, and according to attendance survey, was visited by more than one quarter of a million people.

The Programme "Sound"

IN January last a new fortnightly series began in the BBC Network Three. The series contains practical help and examples of first-class recording and news of the latest and most novel developments of interest to amateur tape recording enthusiasts and hi-fi fans.

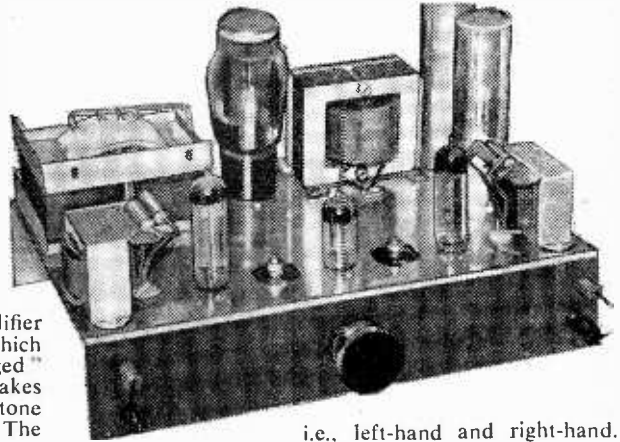
Educational Filmstrips

MULLARD EDUCATIONAL SERVICE announces a new series of filmstrips dealing with the history and basic principles of scientific developments. Details are obtainable from Unicorn Head Visual Aids Ltd., 42, Westminster Place Gardens, S.W.1.

A STEREOPHONIC AMPLIFIER

AN ECONOMICAL CIRCUIT DESIGN
INCORPORATING TWO OUTPUT
VALVES WITH ONE DOUBLE-TRIODE
VALVE FOR THE TWO DRIVER
STAGES

By D. J. Hussey



THE only critical parts in this amplifier are the two output transformers which need to be identical. A "rugged" power pack is required as the amplifier takes about 100 mA H.T. current. An Elstone SR250 mains transformer is used. The

i.e., left-hand and right-hand.

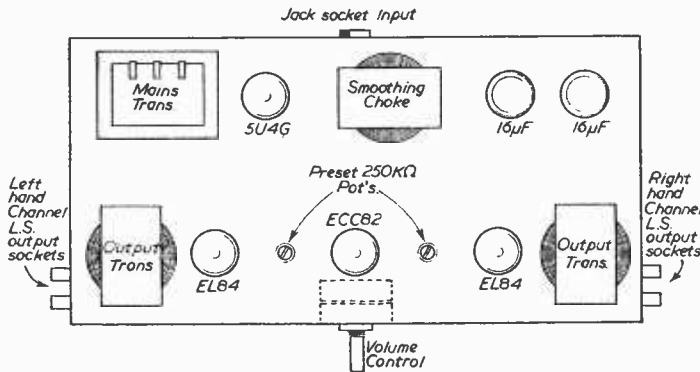


Fig. 1.—The chassis layout.

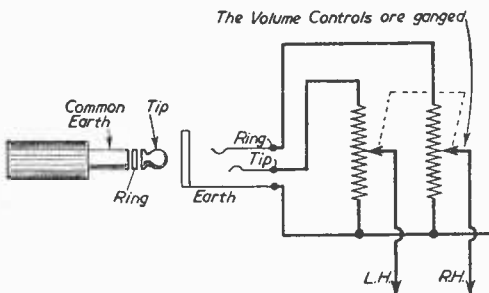
rectifier valve is a 5V4G. The D.C. resistance of the smoothing choke should not exceed 100 ohms. Reservoir and smoothing capacitors of 16 µF each were found to be adequate. The amplifier was arranged in the manner shown (Fig. 1) to discriminate between the two channels,

The Circuit

As the two channels are identical it will suffice to describe only one. The signal from the pick-up is applied to the grid of the A.F. amplifier (half of an ECC82 valve) and from the anode of this valve it passes via a capacitor to a 250 kilohm potentiometer. The signal passes then to a pentode output stage using an EL84 valve in a conventional circuit.

The H.T. decoupling between the A.F. and output stages was introduced to minimise hum. With no input, and the volume control at maximum, the hum level is practically inaudible. In the input circuit a three-way jack plug and socket were used for the pick-up connections (Fig. 2). The chassis layout is not critical but some effort should be made to separate the power supplies from the amplifier.

Care should be taken with the screening of the



An aid to the P.U. connections:—
R for ring and Right Hand channel
T for tip and "The other" (L.H. channel)

Fig. 2.—Wiring of the jack plug and socket.

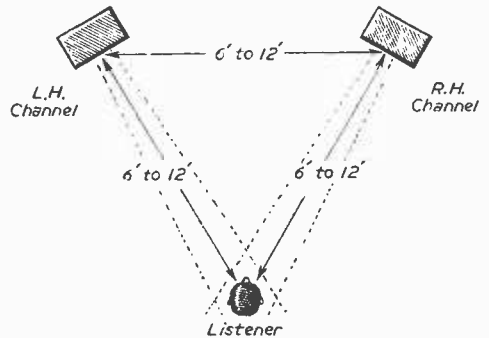


Fig. 3.—The positioning of the loudspeakers.

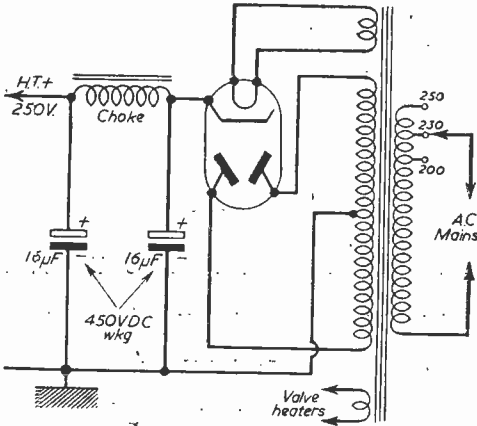


Fig. 4.—Circuit of the power supply.

Note: The cathode of the 5V4G is joined internally to the side of the heater connected to pin 8.

input leads, and the phasing of the loudspeakers. The circuit is otherwise extremely simple to set up. The fixed tone correction capacitors across the O.P. transformers can be adjusted according to personal preference.

Operation

Connect up the pick-up as shown: make sure that the loudspeakers are connected and switch on the amplifier. Play a stereo record—preferably a "demonstration" type—and turn up the two preset 250 kilohm pots (clockwise). The loudspeakers should be six to 12 feet apart and the listener should be six to 12 feet from them, as shown in Fig. 3.

The demonstration record enables the amplifier channels to be balanced using one of the two preset controls. If the test frequency or speech should be coming from between the two loudspeakers but appears to be coming from the left (or right), turn down the left (or right) preset control until the sound appears to come from the correct location. The ganged volume control is used in the same way as a normal volume control. If balance is unobtainable, reverse the

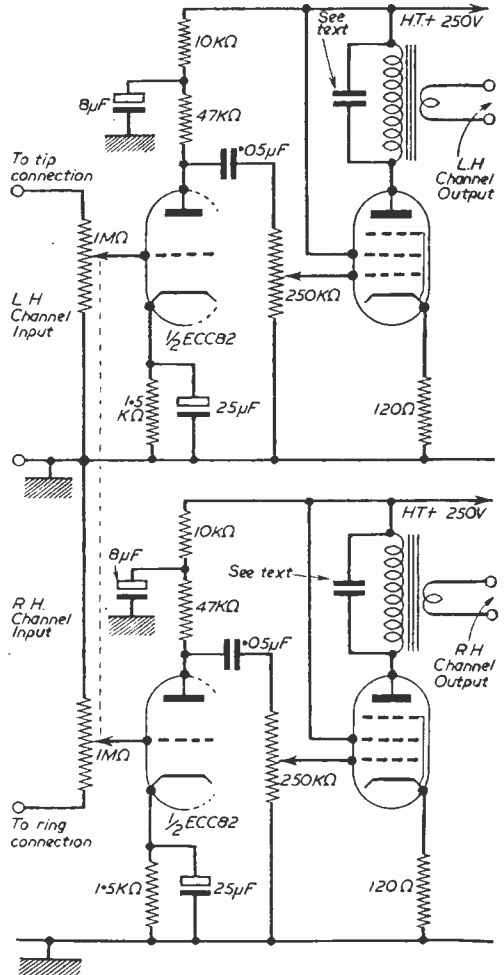


Fig. 5.—Circuit of the two-channel amplifier.

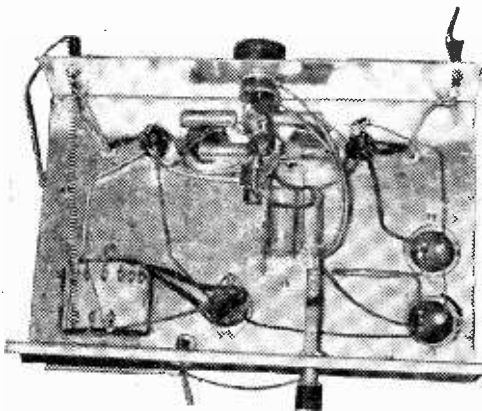
connections to one of the loudspeakers. This reverses the phase of the current through that loudspeaker and the two will then be operating in phase, enabling balance to be obtained.

Loudspeakers

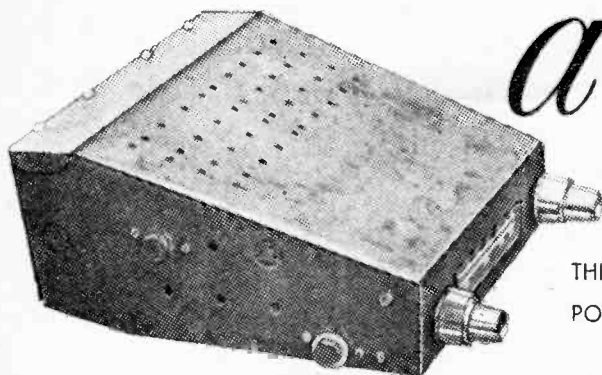
The two loudspeakers should, if possible, be identical, otherwise it may be difficult to secure balanced conditions. If you do not possess, or cannot afford to buy identical loudspeakers, use the one which has the better treble response for the left-hand channel, since in, for example, orchestral recordings, the higher pitched stringed instruments are positioned towards the left-hand side and the cellos and double-basses towards the right-hand side.

Results

Although this amplifier is inexpensive when compared with some of the elaborate high-fidelity apparatus which is now displayed in the windows of radio dealers' shops, it will be found to give results which are quite satisfactory, even to those with critical ears.



View of the underchassis.



A Six Valve Car Radio

THIS SET IS BUILT IN TWO UNITS: THE POWER PACK AND THE RECEIVER PROPER

By T. Murphy

THE car radio about to be described was designed around a circuit that I constructed about four years ago, giving excellent results as a domestic receiver.

There have been some slight modifications to the R.F. amp and frequency changer stages to accommodate the Osborn coils.

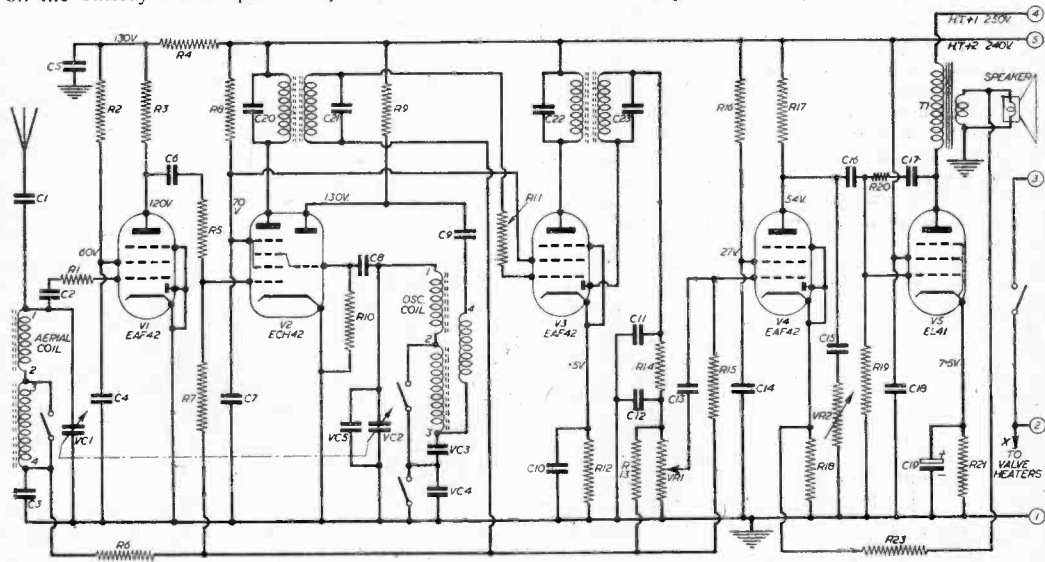
It was decided to use the single diode-pentode var- μ type valve EAF42. This has been used in three stages and if one of them goes low, the positions can be changed. The frequency changer is conventional, using an ECH42. An EL41 was chosen for its greater output, in preference to the EL42, although the latter nearly gained preference owing to its low heater current. Throughout in the design, and in the choice of valves, the drain on the battery was of prime importance.

where cruising speeds were more than 60 m.p.h. and although this car is prone to wind noise at high speeds, the output was always available for comfortable listening.

If space is available, an 8in. or 9in. \times 5in. speaker could be used to advantage.

Noise

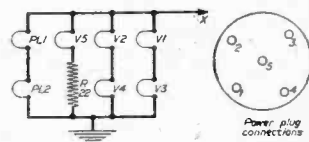
Vibrator noise is practically non-existent and ignition suppression is excellent. The output is extremely good (A.V.C. action) under all but the very worst conditions. Selectivity is also excellent, and tuning quite sharp, a necessity on a small dial. The receiver will, in fact, give results in many cases which are superior to those obtained with more expensive ready-built sets.



This is approximately 2.7 amps. when on full load, delivering 270 v. at 50 mA, and supplying heaters.

The set has been in continuous use in a Morris Minor for about nine months; prior to that it was on bench test for about two-three months. It has been used in the car on 350 mile journeys

Fig. 1.—Theoretical circuit of the receiver section.



RESISTORS	
All $\frac{1}{2}$ watt except where stated.	
R1	3.3 k Ω V1 grid
R2	100 k Ω V1 screen
R3	3.9 k Ω V1 anode
R4	33 k Ω (1 watt) V1 H.T. dropper
R5	3.3 k Ω V2 grid
R6	330 k Ω A.V.C.
R7	1 M Ω A.V.C.
R8	68 k Ω V2 & V3 screen dropper
R9	18 k Ω V2 osc. anode
R10	47 k Ω V2 osc. grid
R11	3.3 k Ω V3 grid
R12	330 Ω V3 cathode
R13	1 M Ω A.V.C.
R14	47 k Ω R.F. filter
R15	1 M Ω V4 grid to A.V.C.
R16	680 k Ω V4 screen dropper
R17	180 k Ω V4 anode
R18	10 Ω V4 cathode
R19	1 M Ω V5 grid
R20	3.3 M Ω V5 anode to grid (anti-parasitic)
R21	170 Ω (1 watt) V5 cathode
R22	8.2 Ω (4 watt) V5 series heater
R23	180 k Ω Feedback from output trans. to V4 cathode

VR1, VR2.—500 k, 100 k, c/w On, Off. Code V105 (Code V100 see text). All resistors $\frac{1}{2}$ watt except where indicated. Low-resistance high wattage types available from H. E. Smith, Edgware Rd., London. Chrome knobs, 2 inner, 2 outer, c/w telescopic spindles. Small dial. 4 small brass pulleys. 4 and 6 B.A. countersunk screws. 4 panel bushes. Valve-holders, valves, loudspeaker, etc. (see text).

CONDENSERS, ETC.		
I.F.T.'s	R.S. Midget	Matched Pair
C1	100 pF	Ceramic Tubular
C2	100 pF	" "
C3	.05 μ F	Paper (Hunts)
C4	.01 μ F	Ceramic Tubular
C5	.01 μ F	" "
C6	100 pF	" "
C7	.01 μ F	" "
C8	100 pF	" "
C9	100 pF	" "
C10	.1 μ F	Paper 250 V/W
C11	200 pF	Ceramic Tubular
C12	200 pF	" "
C13	.01 μ F	Paper 250 V/W
C14	.01 μ F	" "
C15	.001 μ F	" "
C16	.01 μ F	" "
C17	470 pF	Ceramic Disc
C18	.01 μ F	Ceramic Tubular
C19	25 μ F 25 V/W Electro.	" "

All Radio Spares Midget. Clyne-Radio, London. Plugs and sockets. C/W covers, 2 of each, type M.5, 1 of M.3A.

VC1 } .0005 μ F Miniature Tuning Condenser.
 VC2 }
 VC3—250 pF Medium Wave Oscillator Padder.
 VC4—500 pF Long Wave Oscillator Padder.
 VC5—3-30 pF Oscillator Trimmer.

Coils—Osmor Q.A.170 and QOS.170.
 Switch—3-pole, 2-way Miniature.
 (4-pole shown, but one is idle.)
 Osmor Limited.

Construction

The set is constructed in two separate units—the power unit, which is fixed under the bonnet, and the R.F. and audio amplifier unit in a case fitted under the dashboard.

If it is so desired the power supply could also be fitted under the dashboard behind the radio unit. The speaker is fitted external with a three-pin miniature plug and socket. This offers a choice of speakers and mounting positions.

If desired V1 and V4 may be EF41 Pentodes. It has also been found that the set is quite stable using 6F13s for V1 and V4, but since the circuit was designed around the variable μ EAF42s it is

VALVES	
V1	EAF42 (may be EF41).
V2	ECH42.
V3	EAF42.
V4	EAF42 (may be EF41).
V5	EL41.
Valve Bases, 5, type B8A.	
Speaker—6 in. x 4in. Elliptical, 3 Ω .	
Relda Radio Ltd., London.	
Output Transformer—Miniature EL41 to 3 Ω .	
Osmor Limited.	

suggested that they be used. Although the ECH42 has a slightly higher current rating than V4, the series heating chain is direct, no damage being sustained by V4.

Layout

The only thing to guard against in the component layout is that the position of V4 is not confused with V3, owing to the latter's position relative to V5.

The Radio Unit

The chassis, switch, coil pack group and front panel are made from 18 s.w.g. aluminium. The case bottom, top, sides and back are made from 22 s.w.g. tinned steel. All bolts from the outside case are 4 or 6 B.A. countersunk types, with the exception of 10 PK self-tapping 6 B.A. $\times \frac{1}{4}$ in. screws holding the front cover and

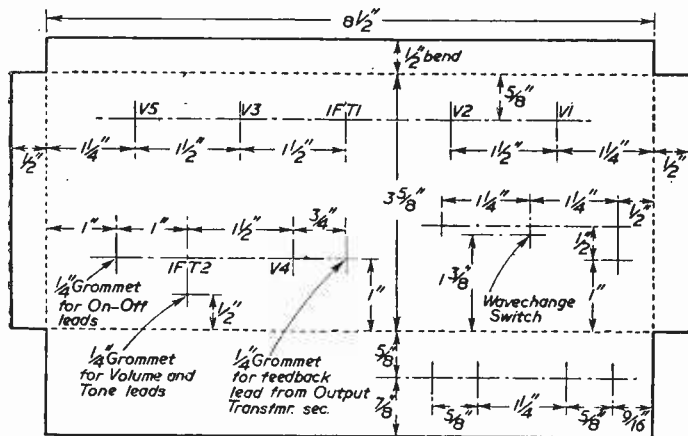


Fig. 2.—Details of the chassis carrying the valves, etc.

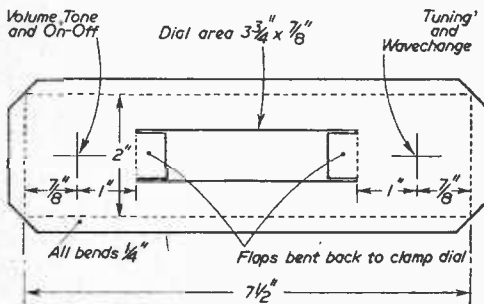


Fig. 3.—Details of the front

dial assembly *in situ*. The case is bent and drilled as shown, the sides being soldered to the base. Here a high wattage iron is necessary.

Applying soldering fluid to both edges to be soldered, just tack the inner edge down, check for squareness at the back then tack down, if all is well apply a few spots of solder at odd places along the intended joint. Having secured the side to the base, press the edges close together to get as tight a joint as possible. Having completed the inside, attention can be turned to the outside. Gently tap the base edge to the side to get as tight a joint as possible, then solder up the outside. If perfection

is aimed at, plumbers lead can then be liberally applied to the joint and filed down to hide from the outside all traces of a joint as was done in my case. It goes without saying, of course, that all holes are drilled prior to soldering, except the smaller ones. Even then, if a block of wood is cut to size and fitted inside the case, the possibility of cracking the joints is removed. The sides can be welded on or riveted. My case bending was done with the aid of a vice, a pair of angle iron pieces, a hammer and a small wrench. It will be found that this case will fit most modern cars. Having completed the case it can be painted inside with "blackboard black" and the outside finished crackle black or any colour scheme to match up the car. The top cover is secured to the case by 6 B.A. $\frac{1}{4}$ in. PK screws approx. $1\frac{1}{2}$ in. intervals. The back is also secured by 6 B.A. $\frac{1}{4}$ in. PK screws. Approximately 36 of these are required.

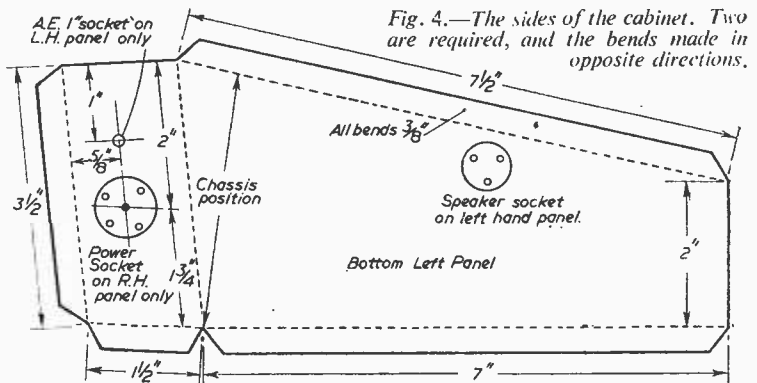


Fig. 4.—The sides of the cabinet. Two are required, and the bends made in opposite directions.

The volume and tone control spindles must be carefully shortened. They are mounted on a bracket approximately $1\frac{1}{2}$ in. long, $\frac{3}{4}$ in. wide and $\frac{1}{4}$ in. thick. This bracket is mounted on the base close to the front panel so that about three threads are protruding through the front panel, later to be locked to front panel by an additional nut. This shaft may come through the front panel via a rubber grommet if so desired. The base of this bracket had a 4 B.A. oval hole to assist in any slight misalignment, and final tightening was carried out with the dial plate *in situ*. The inner shaft is cut to length after fitting the controls to the bracket.

Fitting the Tuning Device

Now comes the most tricky bit of the whole assembly, fitting the tuning drive gear and wave-change controls. The gang condenser is controlled by the inner knob for finer tuning. Fitted to the gang shaft is a 6:1 reduction drive; this drive is secured to the base by a small bracket. Fitted to the other end of the reduction drive is a constructional toy gear, $\frac{1}{4}$ in. face, $\frac{1}{2}$ in. tooth length (Part No. 26A). This gear is bored out $\frac{1}{4}$ in. for about two-thirds its depth, the other end of this gear is drilled out a little less than one-third its depth to $\frac{3}{16}$ in. to act as a bush for the tuner control rod.

(To be continued)

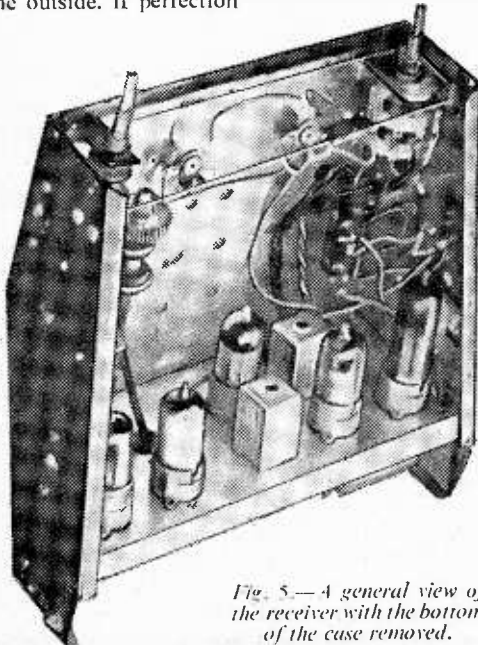
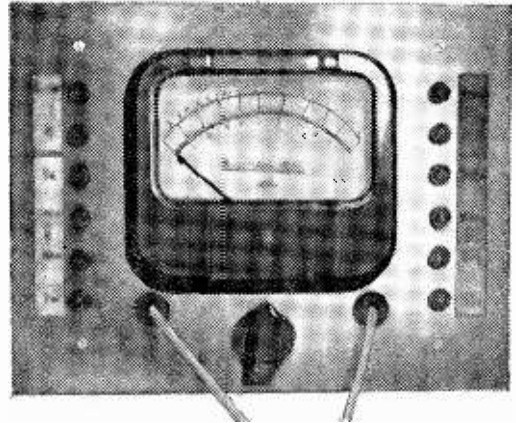


Fig. 5.—A general view of the receiver with the bottom of the case removed.

A Push-button Multi-range Testmeter

IN THIS SECOND ARTICLE THE SWITCHING IS EXPLAINED

By Hugh Guy



THE table mentioned last month is given below and shows the calibration of a 100Ω, 1 mA meter, for resistance measurement.

The details given so far should equip each reader with enough information to enable him to construct a multi-range instrument around any moving coil milliammeter provided its sensitivity and resistance are known.

The multipliers and shunts thus deduced will suit an instrument which uses either rotary or push-button switching.

Rx. ohms	0	100Ω	250Ω	500Ω	1k	1.5	2k
D.mA.	1	.938	.857	.75	.6	.5	.43
Rx. ohms	3k	4k	5k	10k	20k	50k	100k
D.mA.	.33	.27	.23	.13	.07	.03	.015

For the reader who intends to proceed with the push-button design, all the resistance values have been calculated for a meter with a 1 mA movement of 100Ω resistance, giving a ready-made design to construct.

Switch Details

There appears to be a large variety of push-button switch banks available on the surplus market, several different versions of which would be suitable for the instrument described here. Two switch banks are required, and for the sake of simplicity they are identical.

The switch specification is as follows. Six switches on each bank; and the contact arrangement is 4 double pole double throw; 2 pole double throw; and double pole single throw.

A close examination of the contact arrangement of the switch bank illustrated in circuit form in Fig. 6 shows that there are differences in the two switches which make

other push-button combinations suitable and a detailed switch specification for each bank of six may be compiled from the circuit.

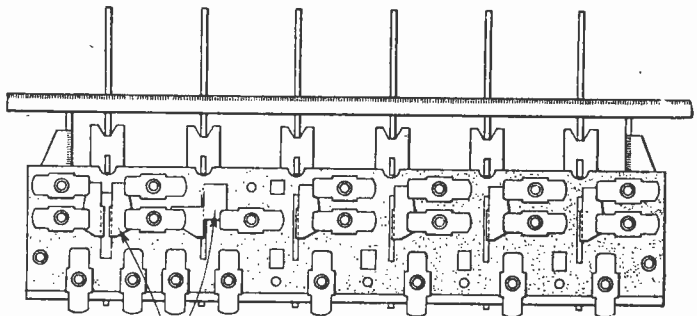
One side of the six-bank push-button combination is shown in the view in Fig. 7. The top contact of each set (with the exception of the second set from the left in the view shown) is normally "made" to the contact immediately below it. This middle contact is like the wiper, or armature, of the rotary type of switch. When the switch is operated, the wiper contact moves down to link the middle and corresponding bottom contact. Hence the latter is the "normally open" contact of the equivalent rotary switch.

The second set from the left shown in the figure is rather different in that the wiper contact links the appropriate bottom two contacts when it is operated.

The position of this switch and that of the first one are interchanged on the other side of the bank to give a three-pole action to each of the first two switches.

This is made clearer in the wiring diagram of Fig. 8 which shows the tag panels of each of the two switches as they would appear if hinged outwards from the back of the respective switch banks. The moving contacts are not shown for the sake of clarity.

The components list gives the values of the shunts and multipliers required for all ranges of the instrument designed around the commonly



Contact arrangement for these sets reversed on other side of switch

Fig. 7.—View of one side of the six-bank push-button combination.

available 0.1 mA meter of 100 ohms resistance. However, a great variety of meters is available on the surplus and other markets and to suit the current and resistance requirements of these the formulæ given earlier must be used to calculate the values of the appropriate multipliers and shunts.

One additional resistance not accounted for in these formulæ is the one labelled R1 in Fig. 6. Its value is determined by the ratio of the two resistance scales. If one assumes that the ratio of the larger-to-smaller resistance ranges is N —in the case of the particular design described here N is 100—then if the total meter circuit resistance is R (R is 1.5k in Fig. 5) R1 is given by

$$R1 = \frac{R}{N-1}$$

Used with the circuit of Fig. 5 therefore R1 would be 15.15 Ω . In practice a 15 ohm resistor is used, the extra 0.15 Ω being contributed by unavoidable switch contact resistance.

Tolerance

This resistor should be of 1 per cent. or 2 per cent. tolerance and a high stability component, as should all the multiplier resistors R5 to R10 inclusive. The components list gives their wattage rating and also suitable alternative pairs of preferred values of resistance which in general will be more readily available at component retailers than their single equivalent resistors. These pairs of resistors will, when the two are connected in parallel, give the required value of multiplier to within very close limits. These close tolerance high stability resistors are not expensive.

It will be seen that the value of the shunts is very low and consequently they are most conveniently provided by hand-made resistors wound either with Eureka resistance wire, or, if it is preferred, with insulated copper wire. Copper wire is less preferable owing to the variation of its resistance with temperature, but provided the current flowing through it does not heat the shunt made with it, it should prove quite satisfactory.

The required lengths of wire for the three shunts R2, R3, R4, wound in either Eureka resistance wire or copper wire will be given in the next article.

With the wiring shown in Fig. 6 last month, on the 0 to 1 k range the meter current is in the reverse direction. This can be corrected by a rearrangement of the wiring associated with S2a and S2b. (The wiring in Fig. 8 above is correct.) (To be continued)

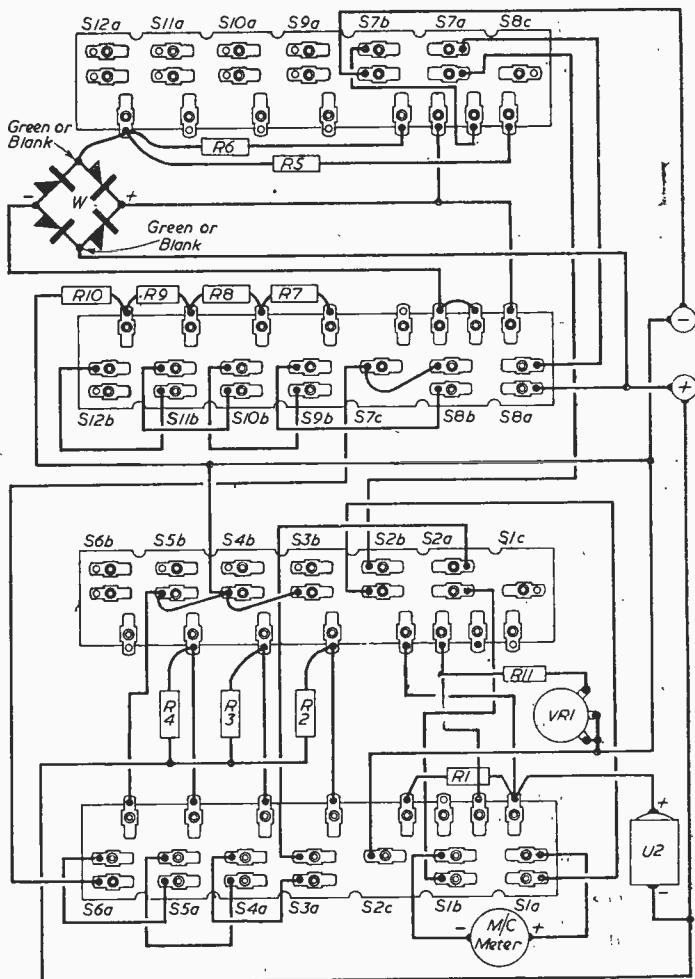


Fig. 8.—Complete wiring diagram.

COMPONENTS LIST

- R1—15 Ω
 - R2—0.1001 Ω WW
 - R3—1.01 Ω WW } See text.
 - R4—11.11 Ω WW }
 - R5—270k.
 - R6—8.2k.
 - R7—200k or 270k and 820k in parallel.
 - R8—91k or 220k and 150k in parallel.
 - R9—6.8k.
 - R10—22k/3.3k in parallel.
 - R11—1.2k 5% $\frac{1}{2}$ watt carbon.
 - VR1—250 Ω WW, Pot.
- All resistors 1 w. 1% High Stability unless otherwise stated.
- Two six-bank push-button switches (see text).
- 0.1 mA. M.C. meter 100 Ω or other (see text).
- 0.1 mA. Meter bridge rectifier, or other to suit meter.
- One red, one black terminal.
- Toggle DPCO switch (optional—see text).
- 1.5v. cell—U2, and fixing clip.
- Tag strips, single strand inter-connecting wire, fixing nuts and screws, solder, etc.

PRINTED CIRCUITS

No. 2.—DESIGNING A TRANSISTORISED AUDIO AMPLIFIER

By W. G. F. Roberts

BEFORE proceeding to design a printed circuit it must be remembered that a printed circuit is not easily or cheaply capable of modification, and thus the circuit diagram itself must be right before an attempt is made to convert to printed circuit. Thus, the circuit must be made to work on the bench first. A very important point often neglected by the amateur is the necessity to make the circuit work with mains variations of, say, ± 20 per cent., or.

This enables the circuit to be tried in its final form. Later on, we shall see how this is done. To assist in design work on, say, computers, a special printed circuit, called a "panic plate" is sometimes used. Fig. 5 shows one of these circuits. A number of copper patches with holes are provided, across which small components, such as resistors, capacitors, diodes, and transistors, are connected. The example shown plugs into a standard assembly alongside conventional printed circuit panels.

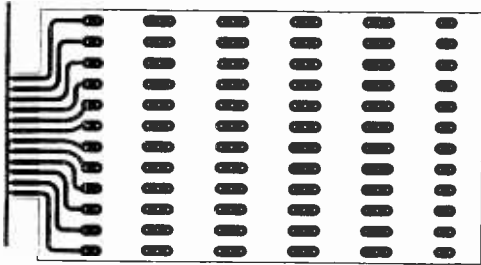


Fig. 5.—A "panic plate."

One further consideration remains before design is started: that of size. Clearly, the selected size must be large enough to hold the components, but there may be considerations imposed by the equipment in which the circuit has to be fitted. For example, the designer of the printed circuit for a miniature radio may be told to keep his circuit within a size of, say, 6in. \times 3in. and with a maximum depth of 1½in., find space for a battery, loudspeaker and aerial.

if working from a battery, with a reduction of 50 per cent. during the life of the battery.

Component Positioning

Component Selection

The first step is to examine the theoretical circuit. As an example, a transistor audio amplifier, with 100 mW output has been chosen. Examination of Fig. 6 shows that at four points A, B, C and D, wires cross over. Points A and B are linked by a resistor, and, clearly, this resistor could bridge across the wires leading to the 100 Ω and 5.6 Ω resistors. A similar argument might, at first, be thought to apply to the cross-overs C and D, but this assumption is not

Having evolved the circuit, it is then necessary to choose the components to be used, for their size and terminal disposition is a fundamental consideration in the design of the printed circuit. The manufacturer of radio or other electronic equipment in quantity has a decided advantage here over the amateur. He has available the latest catalogues of a wide range of component manufacturers, and, if he cannot select the component he requires from them, he can have it designed and manufactured. The amateur, however, must obtain his parts from his usual supplier, or adapt those from his own junk-box.

Having obtained both the circuit and the components, some designers wish to try the circuit in its final form before preparing the master drawing. One method is to obtain a piece of 1/16in. bakelite board, drill holes, and mount the components. Wiring is done on the reverse side of the board with tinned copper wire.

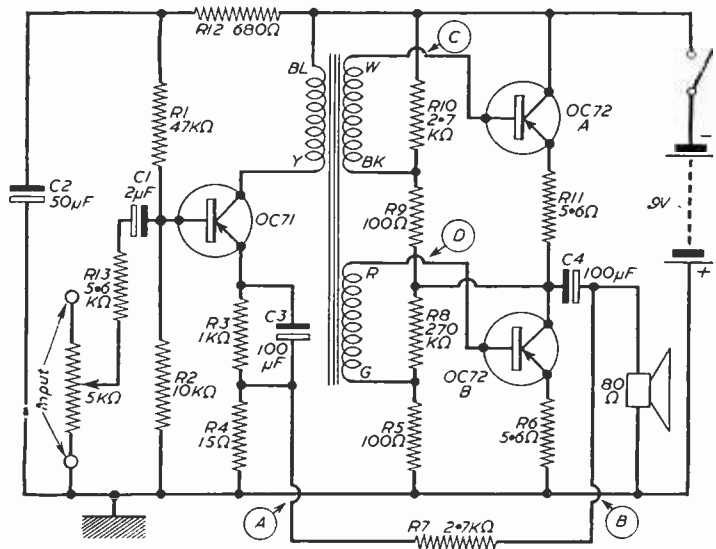


Fig. 6.—Circuit of amplifier.

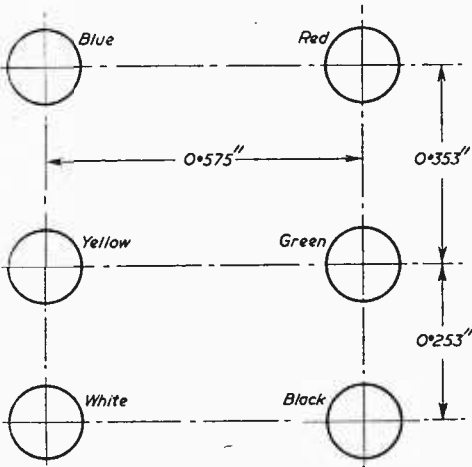


Fig. 7.—Transformer piercing.

justified as the transformer terminals are not in the same position as on the theoretical circuit. The transformer chosen is a Fortiphone Type L442.

The connections are as shown in Fig. 7, which also shows the panel drilling for the component, viewed from the printed circuit side. The relevant part of the circuit diagram is then sketched around these, as in Fig. 8, and it is obvious that crossovers can be avoided by returning a 9-volt lead between the two rows of the terminals. We can note that, if it is wished to have both OC72's below the transformer, the connection from the red terminal can pass as shown by the dotted line. This conversion of a theoretical symbol to a practical form is a valuable aid in printed circuit design. Suppose, for example, we wish to design a printed circuit using an ECC81 or 12AT7. On the left of Fig. 9 is shown the normal valve symbol, and, on the right, how it should be drawn to show the base

connections for printed circuitry. There is, of course, no need to attempt to draw the valve electrodes.

Drawing Out the Circuit

What we have done, then, is to analyse the circuit preparatory to making a printed circuit of it. It would be possible to redraw the circuit diagram from the conclusions drawn, but this is hardly necessary, as we have our notes available to make the printed circuit master. The next step is to list the components to be used, and obtain them to examine their size and determine the mounting centres. The resistors in our example all mount on 0.8in. centres; the 2 μ F capacitor is the same, and the 50 μ F and 100 μ F mount on 1in. The transformer is as shown in Fig. 7, and the transistors have flying leads. The volume control (which also carries the battery switch), R13, the loudspeaker, and the battery, are not on the circuit. A piece of squared paper (1/10in. squares) is used for drawing out the design. With the aid of the data previously obtained, and the theoretical circuit, the printed circuit pattern can be roughed out. Do not, of course, forget that

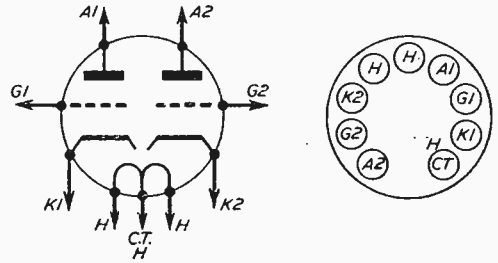


Fig. 9.—Valve connections.

the components are on the other side of the board to the printed circuit. The rough sketch of the chosen circuit is shown on Fig. 10.

At this stage a "bread-board" version of the circuit can be made. A suitable piece of 1/16in. bakelite or perspex is obtained, and squared paper, suitably cut, attached to it by tabs of transparent tape. The drilling centres are then punched through the paper with a centre punch, the paper removed, and the panel drilled. The components are then inserted, and held by bending over the wires or any other convenient method. Using the paper circuit as a guide, wiring is then completed in bare tinned copper wire of about 24 s.w.g. The circuit can then be tried out. This is important for the amateur, as it would cost him about £3 to have a printed circuit made. In fact, he may be satisfied with having produced a simulated printed circuit in this manner.

The Master Drawing

Next a master drawing is prepared (Fig. 11). This is done on white cardboard of a special type known as Bristol Board, obtainable from any artists' supplier. In industry, boards are sometimes used with a blue grid overprinted with lines spaced 0.3in. apart. This is to allow the drawing to be three times full size; to improve

(Continued on page 33)

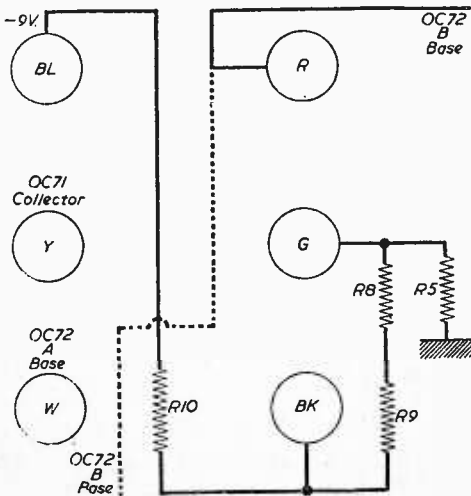


Fig. 8.—Transformer circuit.

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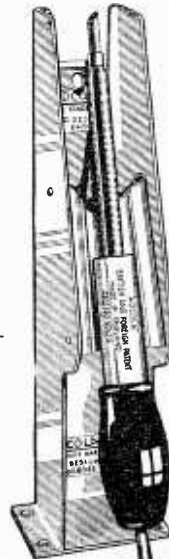
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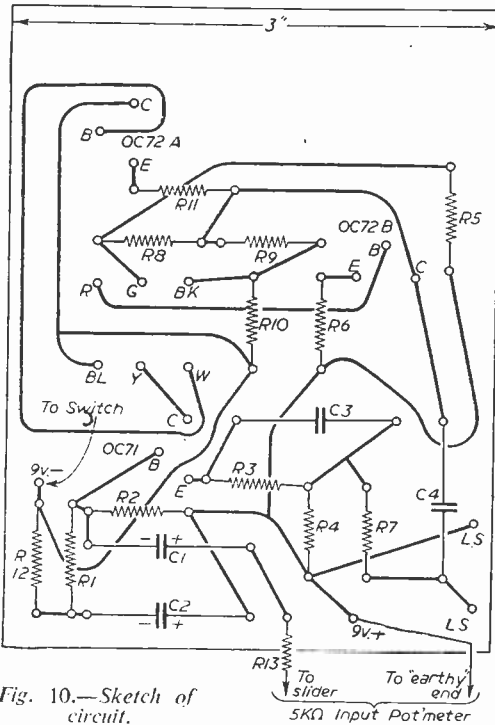


Fig. 10.—Sketch of circuit.

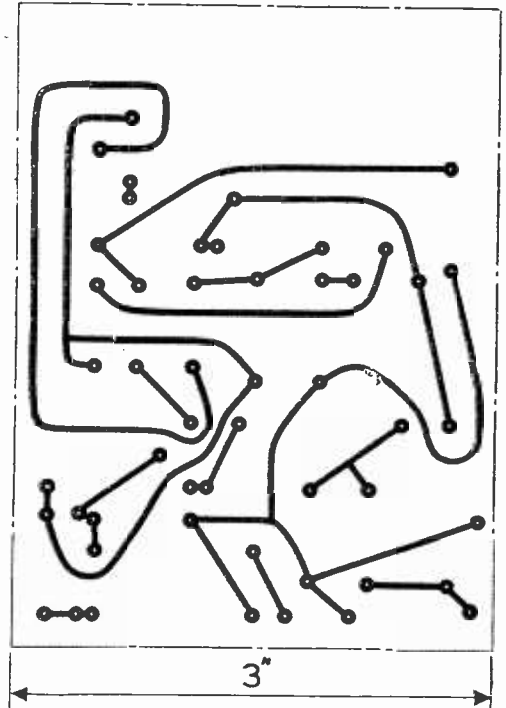


Fig. 11.—Master drawing.

definition and accuracy. The blue grid disappears during subsequent photographic processing. The pencil sketch is then transferred to the new scale, and the printed circuit drawn, bearing in mind all the rules laid down in the first article of this series.

Various aids are available for the draughtsman at this stage, as well as the graticuled board. Self-adhesive black circles are provided for component centres, and similar tape for the connecting lines can be obtained in any width required from a small machine at his side. A basic outline of any standard connections, etc., may be pre-printed on his board. Remaining parts of the drawing are done by painting in process black which is obtainable from most artists' colourmen. Indian ink is not used, as its shiny surface interferes with later camera work. Naturally, if the special aids mentioned are not available, the whole drawing is done in process black. Corrections are made by painting over with a special white preparation or with the more easily obtained Chinese White oil colour. The master drawing of the circuit is shown in Fig. 11.

Layout

It will be seen that whilst the printed circuit wires run in any direction, the components are all parallel to the edges of the circuit board. This has no technical advantage, but, wherever possible, an orderly layout of components is better to look at, and a neat and workmanlike appearance is part of good engineering design.

Before leaving the subject of masters, mention must be made of a material known as

"Astracscribe" used in industry for very large circuits. This is a plastic foil sheet, sometimes used on its own for printed circuit masters, as it is more stable dimensionally than Bristol Board. It is coated on one side with a non-actinic orange lacquer. The printed circuit is then "drawn" full size in negative form by scraping away the lacquer. A retouching fluid is available to cope with errors.

Having obtained the master drawing, the next step is to consider how the circuits are made. This will form the subject of the next article in the series.

PRACTICAL TELEVISION

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A.V.C. WITH "STRAIGHT" VALVES

VARYING SCREEN GRID VOLTAGES TO ALTER GAIN

By James Kaye

THE normal variable slope or variable-mu valve can have its gain altered by a change in the D.C. potential of the grid of the valve. Where the screen of the valve is fed via a feed resistor the valve compensates to quite an extent for the change in grid bias because the screen voltage rises. A rise in screen voltage increases the gain of the valve.

Obtaining the Control Voltage

During the last war the EF50 valve was introduced, and with it a circuit for the application of A.V.C. to the screen of the valve. Although the valve was a high slope "straight" type, varying the screen potential altered the gain. Thus A.V.C. can be obtained with straight valves, but the difficulty lies in obtaining the varying potential for the screened grid. The normal rectifier circuit gives the correct polarity, but if this is applied to a valve control grid to amplify it.

resistance such as 10 M Ω and should preferably be fed by way of a Pi network with a large time constant. R1 is the value of screen resistor that would normally be used for the screen supply of the combination of valves used. R2 should be of such a value that it passes about 5 to 10 mA. (the more current the better). R3 should be such that the valve will be nearly cut off, R4—a 500 or 1,000 ohms wire-wound pot. is for setting the A.V.C. delay characteristic. With the valve not cut off, there will be no A.V.C. delay, but if it is cut off the voltage in excess of cut-off will be the A.V.C. delay voltage.

Action of Circuit

A positive signal is rectified and applied to the grid of the valve. This has the effect of overcoming the cut-off and allowing the valve to pass current and so increase the voltage drop across R1. The larger the positive voltage applied to the grid then the larger the drop across R1 and the lower the gain of the controlled valves. The capacitor from the anode of the valve to chassis should be about 0.1 μ F of ample working voltage. Separate decoupling between the screens of the valves fed can also be used to good effect.

A simple and inexpensive circuit is shown in Fig. 2 and two similar valves can be used for it. It can be fed off the normal negative A.V.C. line to increase A.V.C. efficiency in the receiver with the normal types of variable-mu valve—or used with straight valves. The circuit has only two resistors: R1 must allow for the triode to take some current, as well as feed the screens of the controlled valves. R2 must act both to couple the cathodes and over bias both valves considerably—the values of both these resistors will have to be found by experiment. When the negative control voltage is applied the current through V1 falls, reducing the voltage across R2 and in consequence the bias on V2. This latter then takes more current and reduces the screen voltages of the controlled valves. As stated the circuit values will depend on the valves used and will have to be found by trial and error.

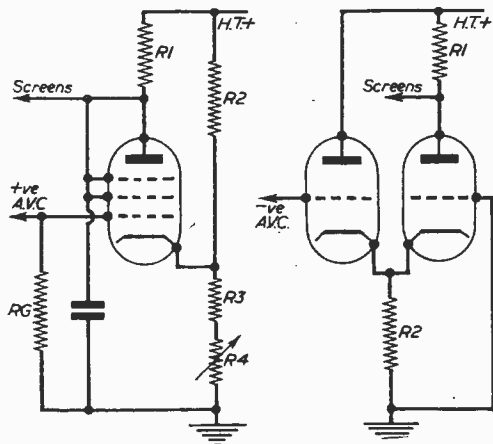


Fig. 1 (left) and Fig. 2 (right) give circuits for screen controlled A.V.C.

the polarity is reversed. Thus, a positive voltage is required to feed to a valve—or a polarity reversing device is necessary. The first is simple: the normal type of A.V.C. detector circuit is used from the I.F. valve anode, but the diode is reversed. This cannot be done with the normal double-diode-triode, but it can be achieved by the use of either a separate double-diode or one of the modern triple-diode-triodes such as the Mullard EABC80.

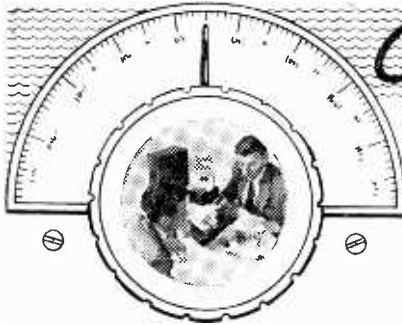
Circuit

In Fig. 1 is shown a simple circuit for screen control. The component values will depend to a very large extent on the valves available. The control valve can be almost any type strapped as a triode, a high slope triode, R.F. pentode, or even (and best of all) a high slope output valve. The grid is returned to earth by a suitable high

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Edited by F. J. CAMM

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On Your Wavelength

BY THERMION

ing voice and a background of din created by strumming on a draining board is not singing, nor music.

"Educating Archie"

I PRESUME that the Research Department of the BBC has taken a measure of the popularity of *Educating Archie* sometime, and have facts to support the continuation of this inane programme with its plethora of feeble jokes and thin humour. I took a consensus of opinion the other day among a circle of my friends and found that not one liked this programme and I am wondering whether you agree with me. I see no purpose in having a ventriloquial act on sound radio. The part of the dummy could be better performed by a human being. Indeed, Archie sounds as if he is a real person. If the programme is wanted, it should be confined to television.

Programmes for Tape and Hi-fi Enthusiasts

ALL readers interested in tape recording and high fidelity will welcome the new series of programmes on sound which started on January 5th on Network 3. The BBC, in its announcement stated that the large and ever-growing body of enthusiasts for hi-fi sound reproduction and tape recording are to have their own programme entitled "Sound." It will consist of practical help and examples of first-class recordings and news of the latest developments. It will be a half-hour programme once a fortnight on Mondays at 6.45 p.m. on Network 3. On the Mondays in the weeks between, recorded repeats of the previous Monday's live programme will be broadcast at the same time.

Specialist dealers in tape and hi-fi will especially welcome this programme for it will be a great sales aid.

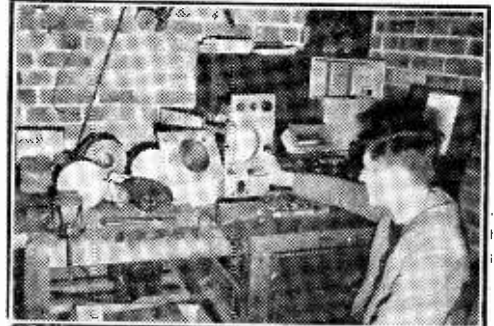
How Many Valves in Push-pull?

ONE of my older readers, Mr. A. Brook, of Hastings, says that it is rather more than 33 years ago since he first read my writings in this journal. He remains a reader and marvels at the fact that I am still able to keep my beard from getting tangled in the wheels of my bath-chair! I am delighted to say, however, that I have not yet reached that stage of decrepitude where I need a wheeled aid. I am pleased also to be able to say that I have never grown one of those revolting hirsute appendages known as a beard—an affectation now adopted by large numbers of young men to give, in conjunction with horn-rimmed spectacles, an owl-like and professorial veneer to an otherwise vapid and vacuous countenance. The radio trade is full of bearded youths, anxious to impress. Of course, they all smoke pipes as well to increase the illusion of "the thinker." Nor have I ever grown a moustache, being too fond of soup for either.

Mr. Brook asks me how many valves in all can be operated in parallel push-pull, ignoring problems of capacity which this might cause, in either audio or R.F. amplifiers. Whilst my own experience is limited to four valves, there is really no practical limit, although I cannot for the life of me understand why anyone should want to use more than four. This is a problem, however, which readers might like to debate.

Slanguage

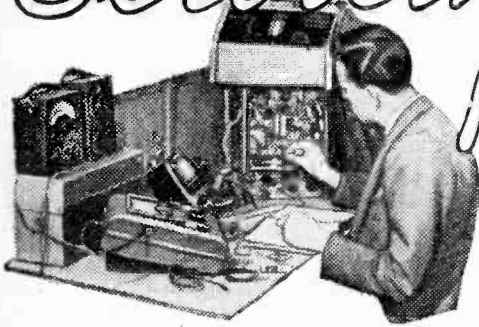
I HAD no idea so many people were taking note of the slipshod and would-be superior pronunciation used by announcers and artists. Some gems have reached me: Storbins (St. Albans); Mawbra (Marlborough); and Soresbery (Salisbury). It is impossible to distinguish between a BBC Malden and Morden, since they are both pronounced similarly. Evidently, this mispronunciation confuses other members of the BBC staff, for it is said that one producer required a fanfare as incidental music for a play. The record library supplied a record of a mechanical organ and shouts of "roll up"—a fanfare, which shows the danger of messing about with vowel sounds. The general tendency of artists to imitate negro pronunciation is adding to the confusion. No one could be more of a Cockney than Master T. Steele. He, however, must refer to "Mar Bebbey," uttered in a staccato fashion when he is really referring to some lady friend. These pop singers should remember that a bawl-



Mr. P. R. Thompson of Taunton, Somerset in his den.

It is known that there are at least 250,000 home tape recorders in use in this country and the number is increasing daily. The potential audience is therefore large.

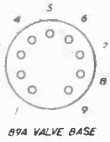
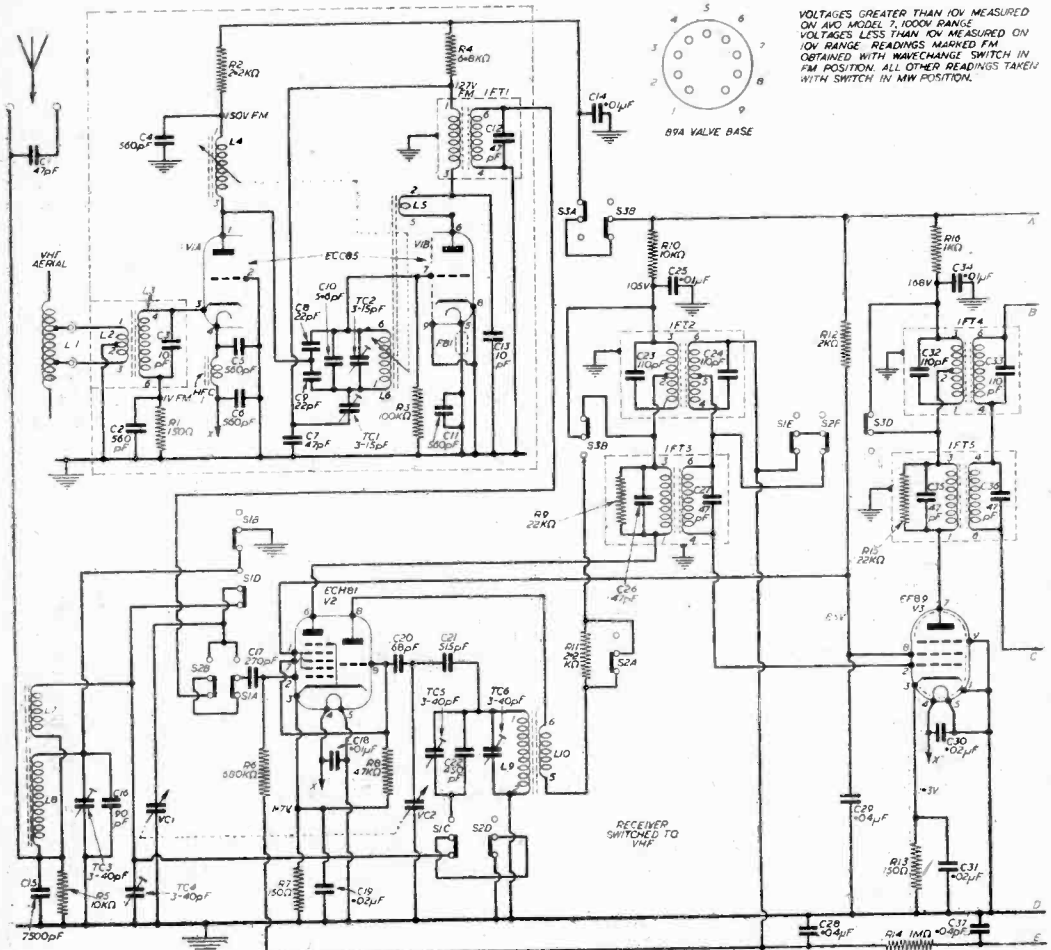
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By Gordon J. King, A.M.I.P.R.E.

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Fig. 1 (a)—Circuit of F.M. R.F. and frequency-changer stages; A.M. frequency-changer stage and common I.F. amplifier. Note: The F.M. tuner unit (V1A and V1B) is used in several other models and, if heaters are wired in series, C11 is used as a heater by-pass capacitor.

while two concentric controls provide for the adjustment of volume and tone. The V.H.F. tuning drive is coupled to the tuning capacitor spindle and the tuning control knob is thus common to both the A.M. and F.M. services.

With the application of negative feedback over the audio stages, a low distortion audio output of approximately 2.5 watts is given by the EL84 output valve. Facilities are provided for the connection of a high impedance (crystal) pick-up and for an extension permanent magnet loud-speaker having a speech coil impedance in the region of 2.5 ohms. An internal ferrite rod aerial for A.M. reception is permanently connected in circuit, but a socket is provided for the connection of an external aerial. For F.M. a loaded dipole is fitted to the back of the cabinet which, if required, can be connected to the V.H.F. aerial sockets by way of the 80-ohm feeder provided. In areas of weak V.H.F. signal, reception is much improved by abandoning the internal dipole and using a good indoor or outside aerial.

The receiver is suitable for use on A.C. supplies only (40-100 c/s), but can be adjusted over the ranges of 100-120 volts and 200-250 volts. Mains consumption is approximately 65 watts.

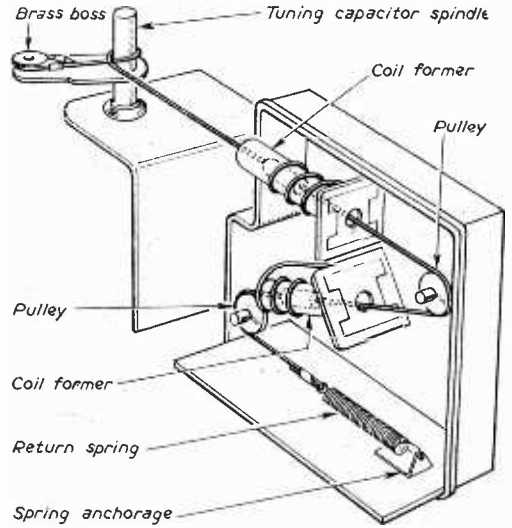


Fig. 2.—V.H.F. tuning cord drive.

Valve Line-up

The circuit operates in two modes, one when switched to the long and medium bands and the other when switched to V.H.F. When switched to L.W. or M.W. the valve line-up is as follows: ECH81 (V2) frequency changer; EF89 (V3) first I.F. amplifier; EF89 (V4) second I.F. amplifier; EABC80 (V5) A.M. detector, A.G.C. diode and audio amplifier; EM81 (V6) tuning indicator;

EL84 (V7) output; EZ80 (V8) full-wave H.T. rectifier.

When switched to V.H.F. the circuit is slightly modified, the V.H.F. tuner is brought into circuit and the valve line-up is as follows: ECC85 (V1 in the tuner) V.H.F. amplifier and frequency changer; ECH81 (V2) heptode section as first I.F. amplifier; EF89 (V3) second I.F. amplifier; EF89 (V4) third I.F. amplifier; EABC80 (V5) ratio detector and audio amplifier; EM81 (V6) tuning

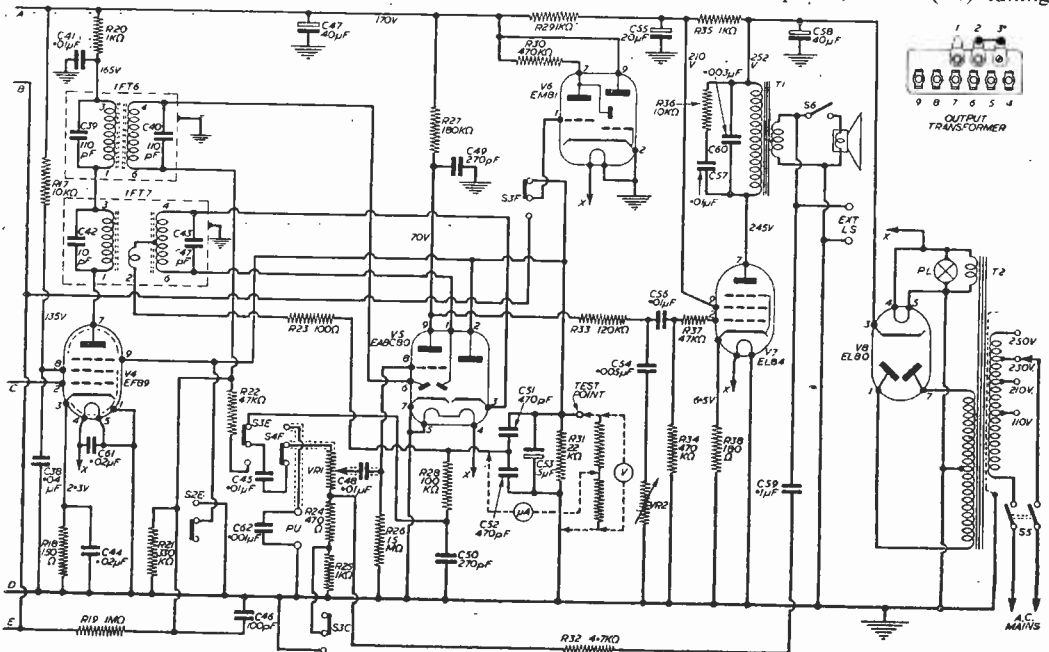


Fig. 1 (b).—Circuit of detector and output stages, power-pack and tuning indicator.

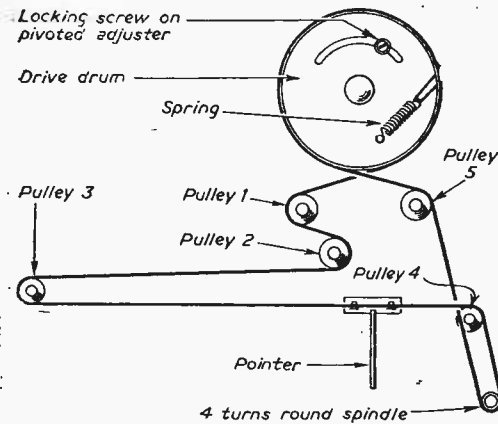


Fig. 3.—A.M. tuning cord drive.

indicator; EL84 (V7) output; EZ80 (V8) full-wave H.T. rectifier.

The Circuit

The valves as detailed above are numbered in accord with the circuit in Fig. 1. A fairly conventional arrangement is utilised, though the additional I.F. stage is worthy of note since it goes far in increasing the overall sensitivity, and renders the receiver useful in areas of weak V.H.F. signal.

When the receiver is switched to V.H.F., as shown in the circuit, the V.H.F. tuner is energised from the H.T. line via switches S3A and S4B and the I.F. output (10.7 Mc/s) is connected to the control grid of the heptode section of V2 via S2B and S1A. The triode A.M. oscillator is also muted by the opening of S3B, while the secondary of the A.M. I.F. transformer IFT2 and the primary of the A.M. I.F. transformer IFT4 are short circuited by switches S1E, S2F and S3D.

The A.F. signal from the ratio detector is developed across C50 and fed through S3E, C45 and S4F to the volume control VR1. From here the required level of signal is selected and fed through C48 to the grid of V5 triode. From the anode of this valve section, the amplified A.F. signal is applied to the output valve in the usual manner.

The rectified carrier voltage appearing across R31 is applied to the tuning indicator V6 via S3F. The voltage at this point is also applied to the suppressor grid of the third I.F. amplifier valve V4 to provide a form of A.G.C. De-emphasis is provided by R28 and C50, and further tone correction is given by the tone control VR2 and C54.

The V.H.F. tuner is contained within a separate box and the tuning is achieved by means of spring-loaded dust-iron cores which traverse the oscillator and R.F. anode coils. The movement of the cores is controlled by means of a drive cord coupled to the spindle of the A.M. tuning capacitor. The arrangement is clearly illustrated in Fig. 2. In the event of a breakage of the drive cord or tuning cores, the manufacturer recommends the replacement of the complete drive cord and core assembly (part No. AP24888).

When the receiver is switched to the L.W. or M.W. bands, the V.H.F. tuner is disconnected and the A.M. oscillator is energised. The shorts from across the A.M./I.F. transformers are removed and the receiver functions as a conventional A.M. model, but with two I.F. stages.

The A.M. detector load is R21, and the A.F. signal here is conveyed to the grid of V5 triode section as before by S3E changing over. The suppressor grid of V4 is earthed by S2E and the control voltage for the tuning indicator V6 is taken from the A.G.C. line, which itself is fed from the detector load. A.G.C. bias is applied to both I.F. stages and to the frequency changer.

Current feedback is applied to the output valve by the omission of a cathode bypass capacitor and voltage feedback is taken from the secondary of the output transformer, through C59 and R32, to the control grid circuit of V5 triode. The voltage feedback is somewhat frequency selective, being greater at the higher frequencies owing to the reducing reactance of C59 as the frequency is increased. The A.F. response is smoothed and controlled by the components across the primary of the output transformer.

Servicing Notes

In the event of failure of the A.M. drive cord, a good quality nylon drive cord should be used as a replacement, or the complete clip and drive cord assembly (part No. P1940) should be obtained from the makers, and should be installed in accord with the diagram in Fig. 3.

The scale lamp is rated at 6.5 volts 0.3 amp. and this can also be obtained from the makers under part No. AP18628.

Complete Failure

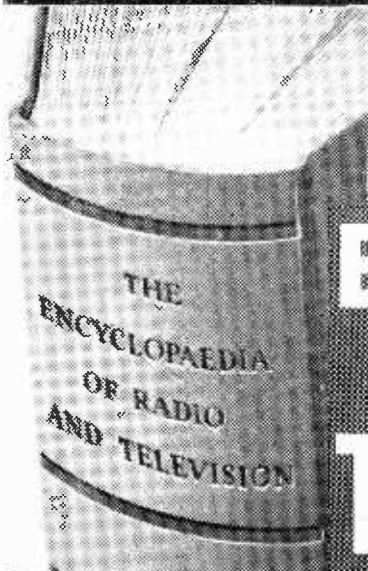
Lack of signals on all bands should lead first to a check of the H.T. line voltage across C47. If there is no voltage here, but there is voltage across C55, the trouble is caused by open-circuit of R29 and a possible short in C47. If voltage is present at the cathode (pin 3) of the rectifier V8, but is missing from across C55, R35 should be suspected for open-circuit: these filter resistors often go open-circuit, but are easy to test.

If H.T. is available all the way through the receiver, the A.F. stages can be quickly checked by putting a finger on the centre tag of the volume control when the control is turned full on. If this does not result in a loud hum from the loudspeaker, then the trouble lies in V5 or V7 or in the associated circuits. Open-circuits of R27 or of the primary of the output transformer gives this symptom. There is also the possibility, of course, that the loudspeaker speech coil is open-circuit or that the speaker is disconnected from the secondary circuit; a check should be made of the speaker switch.

If the A.F. stages are working correctly, a fault is present in stages V2, V3 or V4. Valve trouble is the most likely cause, and this will destroy the operation of the tuning indicator, though this may work normally on tuning a station even if the A.F. section is defective, provided the diodes in V5 are in good working order.

(Continued on page 52) -

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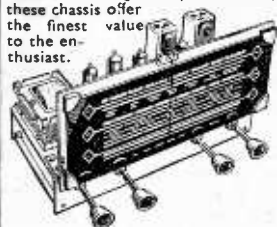
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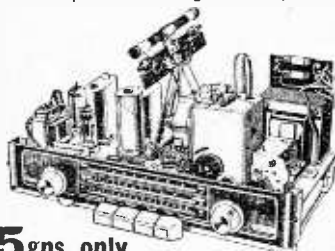
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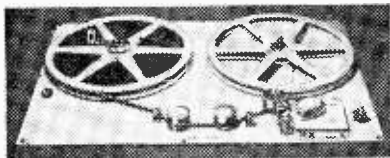


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STEREO BY RADIO

PRESENT-DAY METHODS USING TWO TRANSMITTERS

By J. Booth

IT is now general knowledge that when two or more separate and quite independent audio channels are used to record and reproduce, say an orchestra, so that the original spaciousness and perspective of the complex sound are re-created by the loudspeaker system in the listening room, the result is said to be stereophonic sound.

Present stereo practice, from the domestic angle, makes use of just two channels. At the transmitting end two microphones are placed in such a way that one is more responsive to sounds originating from the right-hand side of the source of sound, while the other is more responsive to sounds originating from the left-hand side. Eventually the signals are fed to two separate loudspeakers, these being arranged in the listening room to give the best stereo illusion (see Fig. 1).

Two Radio Channels

There are no great problems involved in the broadcasting of stereo sound, and a method which has been adopted experimentally both in this country and in the U.S.A. calls for the use of two independent radio channels and transmitters at the sending end and two receivers at the listening end. This is very expensive as it calls for duplicated equipment throughout the chain, as can be seen from Fig. 2. Nevertheless, the method does serve to illustrate the feasibility of stereo broadcasting.

Over the past several months, the BBC has been actively engaged in stereo broadcasting experiments. Television and V.H.F. channels and medium wavelengths have been utilised in various combinations to carry the right-hand and left-hand stereo signals so that the greatest number of listeners could participate in the experiment.

A further series of tests at fortnightly intervals between 10.15 and 11.15 a.m. on Saturdays are being carried out by the BBC at the time of writing. Both medium-wave and V.H.F. Network Three transmitters are used for the left-hand channel, while the BBC television sound transmitters are used for the right-hand channel.

Readers can participate in these experimental stereo transmissions by using a TV receiver and either an ordinary broadcast receiver, tuned to M.W., or a V.H.F. receiver. The loudspeakers of the two receivers should be spaced by about 6ft. to 8ft. and the listener should be approximately equidistant from each. For the best stereo illusion, the quality and level of the sound from each loudspeaker should be matched as far as possible.

Because the phase difference between the signals in each channel has a governing effect on the stereo illusion, the use of two transmitters far removed from each other may disturb this phase relationship and detract from the quality

of the stereo. This is, at least, one shortcoming of stereo broadcasting from separate transmitters which are not co-sited.

In America, two separately owned F.M. stations sometimes get together so that one station broadcasts the sound of one channel, while the sound of the other channel is being broadcast by the other station. The idea is the same as the experiments of the BBC, of course, but in America the difficulties must be greater as the stations are not under a common control.

A regular service adopting a method using two transmitters is hardly good economics, and is very unlikely to be employed. There is also the question of compatibility, for if stereo was not required by a listener, tuning in to just one of the stereo channels would give him only one half of the available audio signal, which would not be the same as a balanced single-channel broadcast.

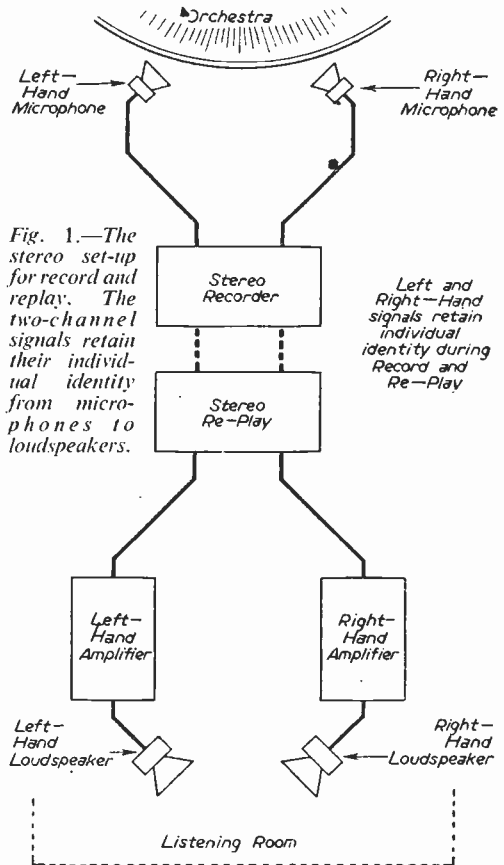
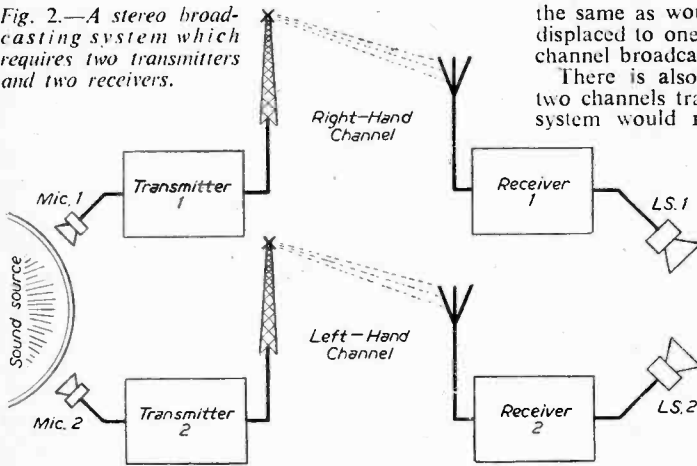


Fig. 2.—A stereo broadcasting system which requires two transmitters and two receivers.



Two Audio Channels on a Common Carrier

There is no undue difficulty in carrying two (or more) audio channels by way of a single transmitter using only one carrier. This technique is not new by any means, and represents the basis of multi-channel radio links. It obviously has potentialities with regard to stereo broadcasting, and has been the subject of many experiments in America. The system is usually referred to as "multiplex" broadcasting. One channel is transmitted by the F.M. or A.M. station in the ordinary manner, while the other channel modulates a sub-carrier which is not at a very high frequency, but is outside the audio spectrum. A sub-carrier in the region of 50 kc/s is quite common. This modulated sub-carrier is itself then caused to modulate the main carrier along with the modulation of the normally transmitted channel.

At the receiving end, an ordinary receiver, tuned to the station carrier, would reproduce the audio which was normally modulated. The sub-carrier would also be demodulated by the receiver, but since this is well above the audio spectrum it would not be heard and would, in any case, be highly attenuated by the receiver's detector and A.F. section filters.

In order to extract the intelligence of the channel carried by the sub-carrier, the demodulated sub-carrier present at the receiver's detector would have to be directed into a further detector circuit. The audio output of this circuit would be fed into a second A.F. amplifier and loud-speaker system to match those of the receiver proper. The arrangement is illustrated in Fig. 3.

While the general idea is admirably suitable for stereo broadcasting, it again suffers from the drawback of incompatibility: an ordinary receiver tuned to the station would reproduce only the signal in one channel—this being the right-hand channel in Fig. 3. The reproduction would not be unduly mutilated, of course, but it would lack balance, exactly

the same as would occur if the microphone were displaced to one side of an orchestra on a single-channel broadcasting system.

There is also the question of bandwidth, for two channels transmitted by the simple multiplex system would require at least twice the bandwidth of a single-channel system. From the aspect of the power radiated from the transmitter, this may well introduce a power reduction of some four times (6 db power).

Sum and Difference Method

In order to render this stereo broadcasting system compatible, experiments are being carried out in the U.S.A. at the present time on what is known as the sum and difference method. A sub-carrier is used as before, but

the transmitter is modulated in the normal way with the *sum* of the signals in the two channels. This sum signal is equivalent to that from a correctly balanced single-channel system.

The signals in the two channels are also subtracted from each other to produce a *difference* signal, and it is this signal which is used to modulate the sub-carrier. In order to take advantage of the stereo feature of the transmission, it is necessary to employ a decoding arrangement and an additional audio channel at the receiver, as before. The decoder serves to recover the difference signals and combine them in correct proportion to the audio in the two receiver channels so as to secure the correct stereo illusion.

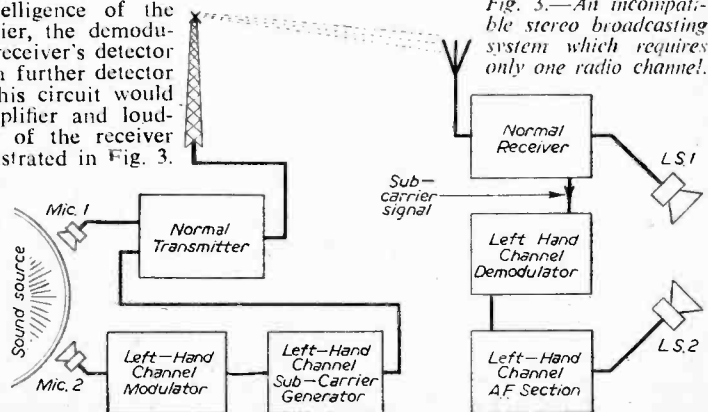
Percival Method

Experiments along these lines are also going on in this country in the research laboratories of E.M.I. under the direction of Dr. W. S. Percival, who has devised a compatible stereo broadcasting system which differs somewhat from that developed in America.

In order to secure compatibility, the signals in

(Continued on page 56)

Fig. 3.—An incompatible stereo broadcasting system which requires only one radio channel.



THE THERMISTOR IN PRACTICE

THESE HEAT-SENSITIVE DEVICES ARE WIDELY USED TO-DAY

By James Seaforth

A THERMISTOR of the form adopted in radio and television receivers looks rather like a carbon resistor which has dissipated power far in excess of its wattage rating. Indeed, it may well be taken for such an ill-used component by the novice enthusiast when it is first discovered in a set which is being investigated for total failure.

The fact that it gets very hot may also heighten the impression that overloading as the result of a circuit fault is to blame—it being assumed that the high temperature was responsible for the removal of the paint colour markings.

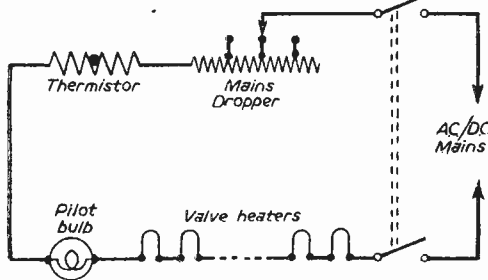


Fig. 1.—A series-connected thermistor avoids current surges in a heater chain.

It should be known that thermistors are designed to get very hot and this is the reason why they are devoid of paint and identification marks, which would not survive when the component is put into service.

Temperature Sensitive

A thermistor is in essence a resistor, but it differs from the normal run of resistors inasmuch as its value decreases greatly as its temperature increases. It is thus highly heat sensitive and is endowed with a negative temperature coefficient of resistance.

It may be utilised in one of two ways. In one way the component's sensitivity to temperature change may be exploited for the controlling of a current which is actually present in the thermistor and causing it to heat. And in the other way the component's change in resistance owing to variation in ambient temperature may be used to stabilise a secondary circuit of which the resistance has a tendency to drift in the opposite direction.

A thermistor is invariably introduced into a series-connected heater chain (see Fig. 1). Heaters used in valves have a positive temperature coefficient of resistance. This means that when the heater is cold its resistive value is considerably below its normal operating value when hot. With series-connected heaters the chain current is governed by the value of the ballast or mains dropping resistor, and this is calculated in accord with the heater current of the valves.

Thus, when the set is first switched on, the heater resistance is well below normal and the chain current starts off at an abnormally high value and falls off gradually to normal as the heaters increase in resistance. This is not too bad if the heaters increase in resistance together and in step as they warm up. Unfortunately, this does not usually happen, and one or two heaters may reach normal operating temperature and resistance some time before the others when the chain current is high. Since less voltage is dropped by the valves still warming up, an excessive voltage is developed across the valves which have gained their normal temperature and resistance, which means that their heaters are somewhat overloaded which is likely to result in premature failure.

This can be avoided by the use of a series-connected thermistor. The relatively high resistance of the component when cold serves to limit the heater chain current initially flowing through it, but it inevitably warms up and gradually decreases in resistance as the valve heaters increase in resistance. The positive temperature coefficient of the resistance of the heater chain is thus neutralised by the negative temperature coefficient of resistance of the thermistor and harmful current surges are in this way eliminated.

To cater for the variation in valve heating time within a large chain of valves such as is present in television receivers, it is sometimes necessary to shunt the thermistor with a wire-wound resistor of a certain value so as to delay the drop in thermistor resistance until the heaters have had an opportunity to become temperature stable. The value of the shunt resistor is not sufficiently low to permit the passage of a substantial current before the thermistor's resistance drops to its hot value, but it is low enough when cold to bypass some of the chain current away

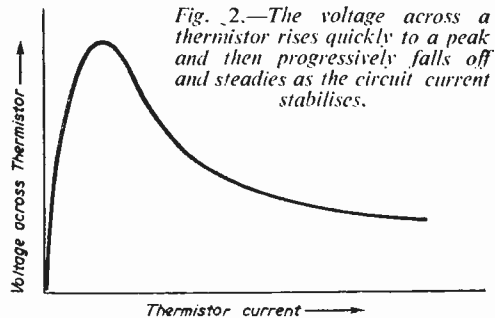


Fig. 2.—The voltage across a thermistor rises quickly to a peak and then progressively falls off and steadies as the circuit current stabilises.

from the thermistor and thus delay its warming up time.

The cold resistance of a thermistor may be several thousand ohms—the Brimistor CZ1 is 3,000 ohms at 20 deg. C.—but only tens of ohms when hot and passing maximum current.

The hotter that a thermistor becomes the lower falls its resistance, and if the current were not

limited by some means it would get red hot and collapse. In a limited current circuit, however, the voltage across the thermistor rises quickly to a peak and then progressively falls off and steadies as the circuit current stabilises. This is shown in Fig. 2.

Pilot Bulb Shunt

If a pilot bulb which is connected in a heater chain fails the chain is broken and the heaters go out. This is less liable to happen if a series thermistor is adopted as current surges are then almost eliminated. To prevent a pilot bulb from being over-run a wire-wound resistor is invariably connected in shunt so that the bulb is protected from the full chain current—a portion of it then being bypassed by the shunt resistor.

Should the bulb fail under such a condition, though, the heaters will continue to be energised since the shunt resistor will maintain chain continuity, but they will then be under-run owing to the extra resistance which will be wholly effective in the chain. By utilising a thermistor as a bulb shunt the trouble is avoided, for in the event of bulb failure the thermistor will quickly heat up and its very low hot resistance will have little or no effect on the chain current. A type CZ3 Brimistor is suitable for this application, provided the heater current does not exceed 0.2 ampere.

Rectifier Valve and Reservoir Capacitor Protection

A thermistor is highly suitable as a surge-limiting device in H.T. rectifier circuits. Normally, when high value electrolytics are employed, especially for reservoir capacitors, the switch-on current may be excessive and lead to flashing in the rectifier and excessive loading on the electrolytics. The inclusion of a thermistor, as shown in Fig. 3, gives the components a longer life. A

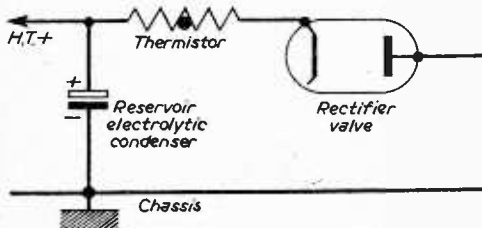


Fig. 3.—A thermistor serves as an efficient surge-limiter.

type CZ1/A is suitable for D.C. up to 100 mA, a type CZ6 for 100 to 200 mA and a type C4 for D.C. exceeding 200 mA.

H.T. Voltage Delay

If a directly-heated H.T. rectifier valve is employed, the voltage across the electrolytic capacitors may rise to a dangerously high level during the period before the indirectly heated valves pass current. When the valves conduct, of course, the H.T. circuit is loaded and the voltage falls below the open-circuit voltage level.

Usually, this is taken care of by the use of an indirectly heated rectifier, but there may be a time when the correct valve is not available and a directly heated substitute is contemplated.

A voltage delay comparable with an indirectly heated valve can be accomplished with a directly heated valve by the inclusion of a thermistor in the rectifier circuit as shown in Fig. 4.

When selecting a thermistor for this application, due consideration must be given to the fact that the R.M.S. current in the H.T. secondary tap will be approximately 1.6 times the D.C. output current at the rectifier heater.

Compensation for Increase in Resistance of Coils

With the older-style television receiver in which a focus coil is used, readjustment of the focus control is invariably necessary to combat focus drift which occurs progressively as the temperature

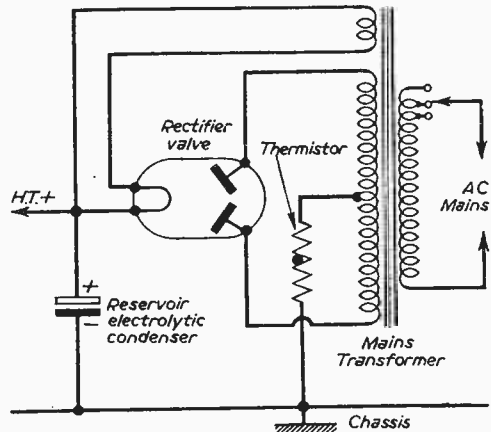


Fig. 4.—A voltage delay is given to a directly-heated H.T. rectifier by the introduction of a thermistor in the circuit, as shown.

of the coil increases. The coil, being wound with copper wire, increases in resistance as it warms up and the coil current falls as a consequence, thereby altering the focusing field.

Focus stability can be accomplished by the insertion of a thermistor in the circuit of the focus coil, as shown in Fig. 5. In this case, however, it is necessary to place the thermistor snugly against the focus coil so that its change in temperature is efficiently transferred to the thermistor.

Thus, as the coil and thermistor warm up, the coil resistance increase is neutralised by the decrease in resistance of the thermistor, and in this way the current and the focusing field are stabilised.

It will, of course, be appreciated that exact compensation demands that the fall in thermistor resistance will be precisely the same as the increase in coil resistance over the range of temperature variation encountered. To provide such a balance it may be necessary to shunt the thermistor with a compensating resistor (shown in broken line in Fig. 5). Another balancing artifice which has been satisfactorily adopted by the author resolves to the adjustment of the characteristic of the thermistor by filing away small portions of the composition until the coefficient characteristics of the thermistor and coil match in opposition.

The thermistor should be dressed in a thin insulating material and strapped tightly to the outside of the focus coil by empire tape.

The thermistor is capable of providing similar compensation to other sections of the receiver where temperature change alters the circuit parameters. For example, temperature increase of the frame scanning coils and frame output transformer often results in a reduction in frame scan amplitude, necessitating frequent adjustment of the height control. A thermistor thermally coupled to the offending winding or windings and introduced into the frame circuit where its resistance variation will combat the rise in coil resistance solves the problem. In this respect, it is often possible to insert the thermistor in the cathode circuit of the frame amplifier valve provided it is suitably "padded" with a resistor to make up the correct nominal value of cathode resistance. Brimistor type CZ2 or CZ3 units are suitable for the above applications.

Transistor Applications

Transistors themselves are heat sensitive, and as a result large and disturbing variations in their operating currents may well occur when operating under differing temperature conditions. The thermistor is an ideal agent for eliminating this trouble. In Fig. 6 is shown a transistor-amplifier stage, in which a thermistor is employed in the base bias stabilising network. As the transistor

temperature increases the collector current would normally increase, but this is offset by the thermistor which serves to reduce the base bias current.

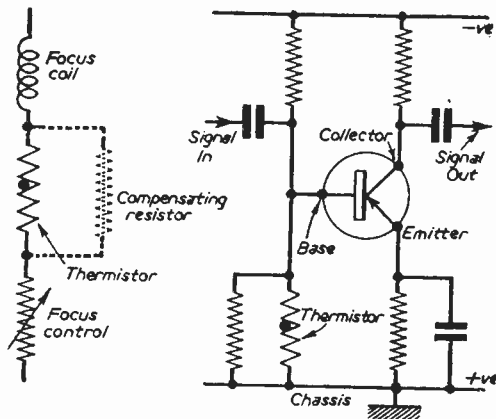


Fig. 5 (Left).—A thermistor is highly suitable for stabilising the current in a focus coil.
 Fig. 6 (Right).—A suitable thermistor in the base potential divider of a transistor serves to offset the increase in collector current with temperature increase.

BICC Polypole Coupler Systems

BRITISH INSULATED CABLES LIMITED have introduced polypole coupler systems to provide the equipment designer with everything necessary for the reliable interconnection of electronic and similar types of equipment. Typical applications are studio, outside broadcast and industrial television camera chains (including colour), ground radar, radio relay links and specialised signalling, remote control, observation and measuring equipment.

Main Components

The main components of BICC polypole coupler systems are multicore cables terminated with moulded-on couplers, and appropriate panel-mounting units to which terminated cables may be connected. Cable couplers normally consist of a robust moulding which both holds the individual plug and socket contacts in position, and also provides a firm anchor for the cable. This moulding is, in turn, encased in a strong metallic housing. The cable couplers include straight and right-angled types, and in some flanges are incorporated for permanent mounting. At the

point of entry into coupler the cable is also protected against severe bending either by a substantial rubber muff or, in some cases, by a tough epoxy moulding. Panel-mounting couplers are provided with mounting flanges and are fitted with short flexible insulated tails of appropriate types.

Couplers are normally of the plug and socket type, although alternative dual-purpose designs which are identical and interconnectable are available for some systems. For both types lengths of cable may be connected one to another to increase the distance between units of equipment.

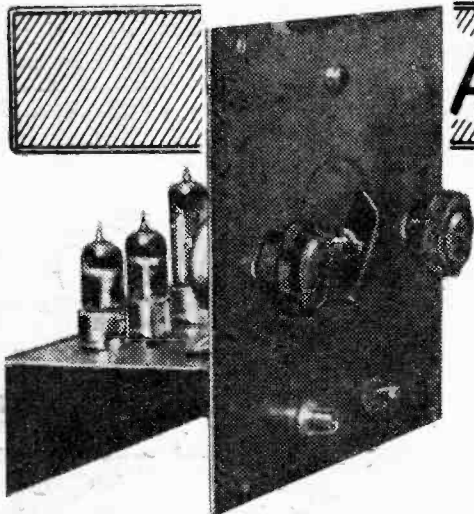
For some types of coupler, equivalent demountable versions are available, thus facilitating rapid repairs especially in countries overseas, when the return of couplers to Great Britain may be difficult or expensive. Nevertheless, BICC moulded couplers in general are more robust, better able to withstand vibrations when used with mobile equipment, have superior electrical properties and are less susceptible to moisture ingress, than are the demountable types.

Joined by Lock Rings

The couplers are joined together by lock rings on the socket-type couplers which engage screw threads on the metal housings of the plug type and thus provide the force necessary to engage or disengage the coupler contacts. Where necessary, special tools are available and should be used to ensure that the couplers are properly engaged. In order to ensure correct connections, couplers of a given system are made with specific and selective keyway arrangements. If required, protective caps of either metal or moulded polythene can be supplied.



A BICC 37-wav, moulded-on polypole coupler.



A WIDE-RANGE AUD.

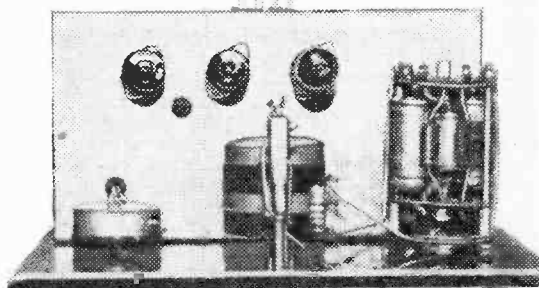
THIS UNIT COVERS 6 TO 70,000 C/S IN FOUR

two sets of switched condensers; the variable ganged resistors and their associated series limiters; the cathode load of the first valve and the thermistor.

More accurate setting of the frequency is possible if continuously variable capacitors are used in conjunction with switched, fixed resistors; this method was, however, discarded on the grounds that a 4-gang variable condenser would

THE usual signal generator coverage of 20-20,000 c/s is no longer sufficient with the introduction of hi-fi amplifiers, magnetic tape recorders and the like. The circuit to be described has a coverage of 6-70,000 c/s and it is found that in particular the extended high frequency range is very useful for covering the bias and erase frequencies of magnetic tape recorders.

The circuit also has the advantage of simplicity and can be built into a small compact unit.



View from above.

Circuit Description

The chosen circuit is basically a relatively low impedance Wien Bridge network, formed by the

be needed which would be clumsy and prone to pick-up.

It was therefore decided to use ganged potenti-

Notes
All resistors are 1/4 watt unless otherwise stated
Coupling condensers are 250volts working

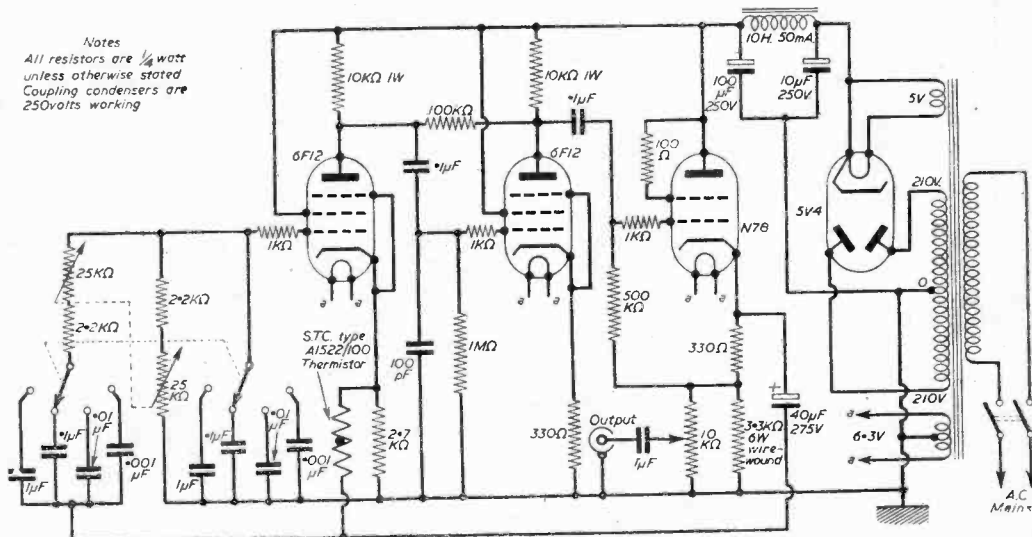


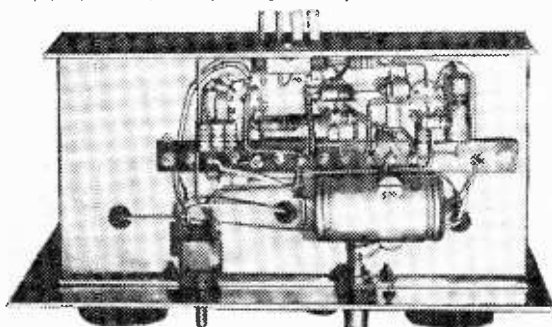
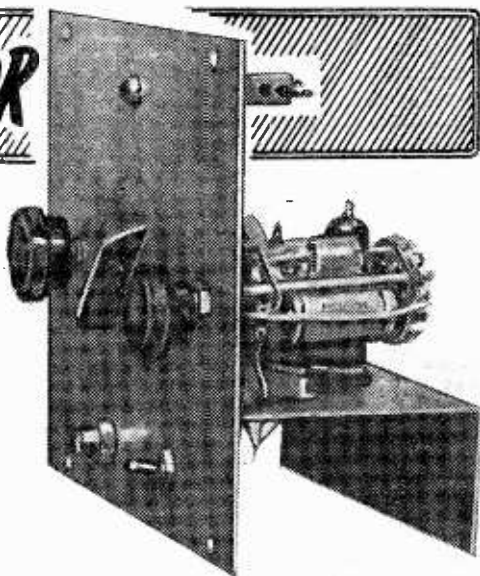
Fig. 1.—The complete circuit diagram of the signal generator.

SIGNAL GENERATOR

RANGES By K. J. Clark, B.Sc., A.M.Inst.E.

eters of value chosen so that the smallest value of capacity required for the high frequency range is still large enough to avoid instability owing to stray capacity occurring.

The values finally chosen are as shown: 25 k Ω ganged potentiometers, with a fixed series limiting resistor of 2.2 k Ω , together with condenser values of 1.0 μ F, .1 μ F, .01 μ F, .001 μ F. These provide frequency ranges of 6-70 c/s, 60-700 c/s, 600-7,000 c/s, 6,000-70,000 c/s respectively. The switched



Underchassis view.

condensers are a coarse range control and the ganged potentiometers a fine control.

Special precautions are taken to ensure constant amplitude over the entire frequency range; namely the insertion of a cathode follower and a thermistor. The output is fed via the cathode follower V3 ensuring a low output impedance. Thus any variation of the output load has only a small effect on the oscillator and amplifier circuits. A

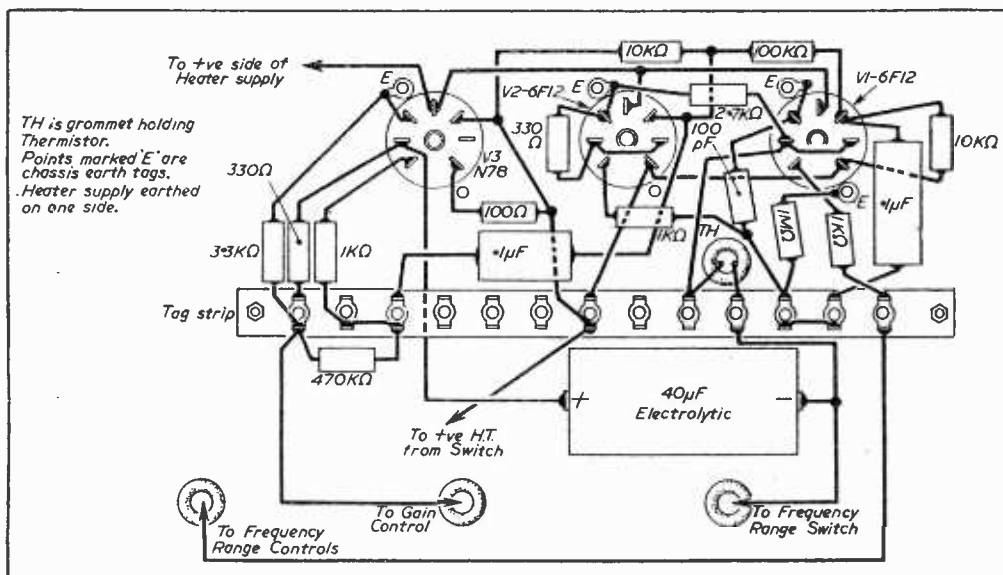


Fig. 2.—Underchassis wiring of the unit.

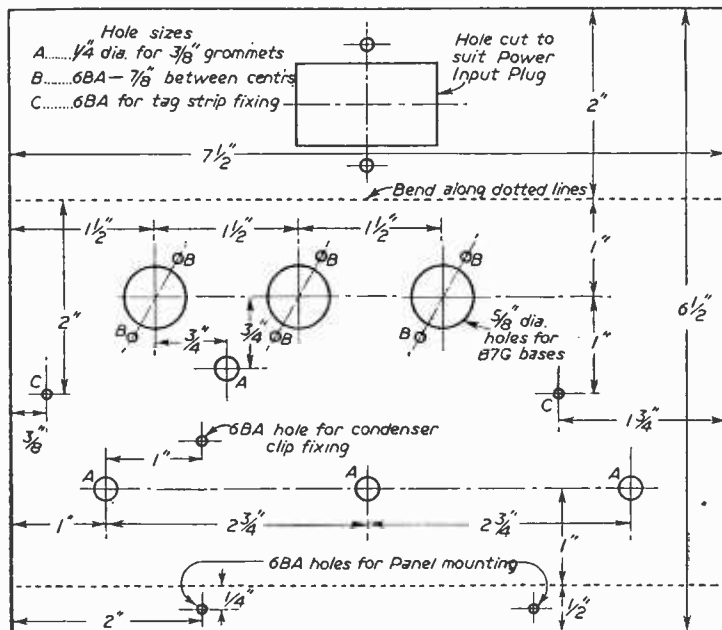


Fig. 3.—Details for the drilling of the chassis.

further small degree of control is provided by the thermistor, resulting in constant amplitude and also very good waveform shape, this being a pure sine wave.

The choice of valves is by no means critical, since any high-slope pentode may be used for the amplifiers V1 and V2 and similarly any high-slope output valve may be used as the cathode follower. Both are simple circuits having, in addition to the normal arrangement, feed-back loops in the anode of the amplifier valve and in the cathode of the output cathode-follower.

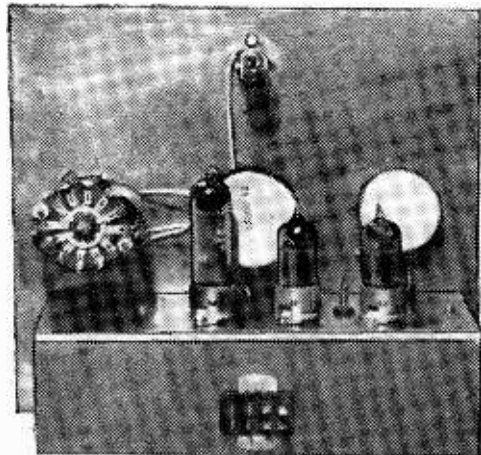
It should, however, be noted that a fairly high-power output valve should be used since a large

voltage swing is needed so that, on switching on, the thermistor is forced past the peak of its characteristic curve when it will operate correctly.

The 40 μ F feed-back capacitor is of such a high value because of the need to maintain good waveform shape at very low frequencies. It was decided to use an electrolytic to reduce the physical size of this component. Provided that a high voltage type is used as specified there will be no deterioration in waveform, which could be brought about through leakage in the condenser. The case of this electrolytic should, of course, be insulated from the chassis.

Output

The output from this circuit may be summarised as follows: a pure sine wave, continuously variable over a frequency range of



View from the rear.

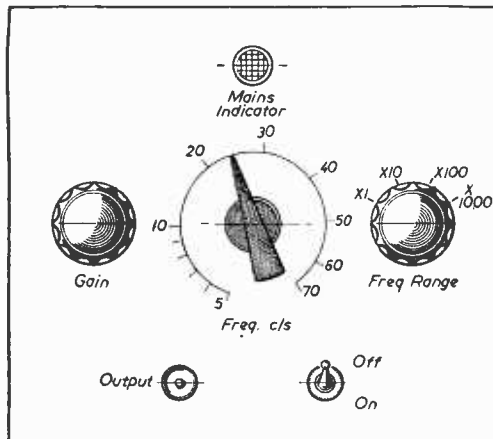


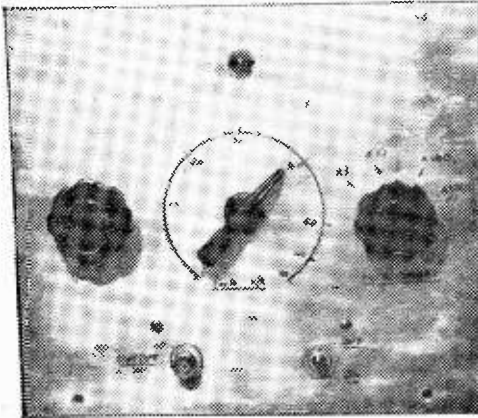
Fig. 4.—The front panel.

6-70,000 c/s. An amplitude of up to approximately 45 volts, peak-to-peak, is provided at the relatively low output impedance of approximately 200 ohms. Harmonic distortion and amplitude variation is negligible over the entire range: two very desirable factors in testing high-fidelity equipment.

Amplitude control is effected by the addition of a 10 k Ω potentiometer in the output cathode of the cathode-follower.

Calibration

The unit is capable of operating to a very high degree of accuracy and stability. The accuracy



The front panel.

actually obtained depends only on the degree of calibration accuracy. Probably the simplest way is to measure the frequency of the output waveform by displaying the output on an oscilloscope, proceeding as follows:

1. Fit the two .01 μF condensers, which should be 1 per cent. and preferably matched.

2. Read off frequencies for various positions of the ganged potentiometer, marking the positions and noting the values.

3. Mark the scale calibrations from 6-70 c/s according to the positions found above.

Note that the frequencies actually measured were in the range 600-7,000 c/s, since 1 per cent. condensers value .01 μF are readily available, but the actual scale markings are made one hundredth of

these values so that the coarse range switch may then be simply marked x1, x10, x100, x1,000.

4. Fit condensers into the other ranges of very slightly lower values than those stated so that padding with parallel condensers will bring them into line.

5. Switch to the first range, select a frequency near the centre of the dial and add padding condensers until the correct frequency value to match the marked scale is obtained. The calibration may then be assumed to be correct over the rest of the range.

6. Repeat this for the remaining two ranges, remembering the multiplication factor of 10 between each range. Only one spot frequency check is necessary on each range.

7. Mark the coarse range switch with the multiplication factors as above.

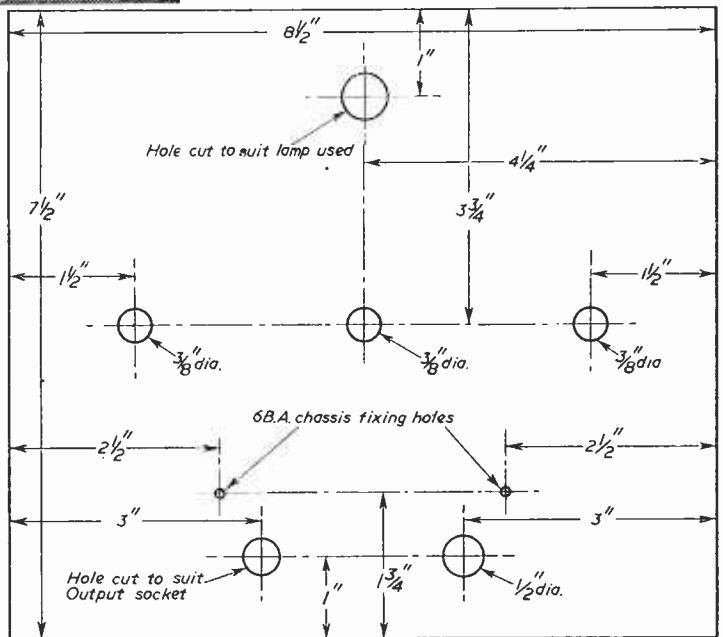
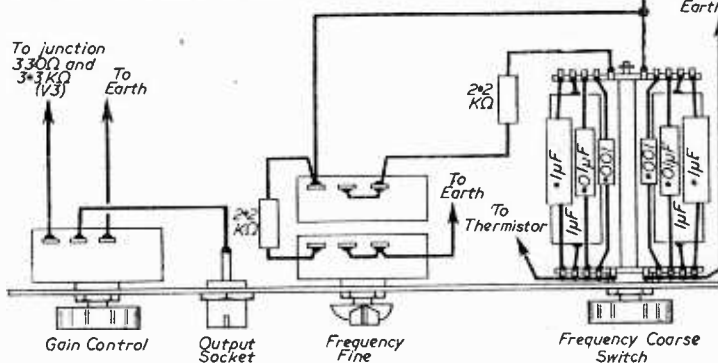


Fig. 6 (Below).—Wiring above the chassis.

Fig. 5.—Drilling of front panel.

Wiring to On-Off Switch and Mains Indicator Lamp not shown



Construction

The lay-out is in no way critical and no special precautions need be taken (except that the 1 k Ω grid stoppers should be as near to the valve bases as possible). Power supplies are entirely conventional as shown in the circuit. The output of the mains transformer may be anywhere in the range 200-0-200 to 250-0-250 volts without affecting the performance to any degree. The smoothing capacitor is large to bypass low frequencies.

An Economy Mains Transportable

No. 3.—FINAL DETAILS OF THE RECEIVER

By R. Hindle

(Concluded from page 984 of the February issue)

IT will be found that to make the spindle coincide with the hole the tuning capacitor has to be mounted a little way clear of the chassis. The mounting is by three tapped holes on the capacitor frame and the method adopted is to cut three $\frac{3}{8}$ in. lengths of screwed rod (the capacitor used is tapped for 4 B.A.). These are screwed into the mounting holes taking care that they do not project through the frame and foul the vanes, and a lock nut run on and screwed up to the frame on the underneath so as to hold the rod firmly in place. Another nut placed loosely on each bolt can be adjusted until the component is level and at the right height when fitted in the mounting holes on the chassis. The whole is locked into position by means of a further nut on each bolt underneath the chassis so that the final appearance is as in Fig. 4.

Leaving the tuning capacitor mounted in position, the backplate of the dial should be removed temporarily and the drive drum slipped on to the shaft, locking it centrally over the drive cord holes with the break in the rim at the bottom nearest the chassis. The driving spindle is mounted so that the part that takes the cord is in line with the cord holes and the drum and the cord can then be placed into position, passing the cord round the drive spindle twice, up through the holes, round the drum until the two ends meet at the bottom of the drum; then both ends come up through the break in the rim and are fixed to the cord spring so that this will keep the cord taut. The drum should be locked to the capacitor spindle by means of the lock screws so that the vanes are at the middle of their run when the drum is in the position specified.

The only components mounted on top of the chassis are the I.F. transformers, tuning capacitor, heater transformer, output transformer, speaker and twin electrolytic capacitor C12, C13. The smoothing choke goes inside the chassis and is

mounted on the rear wall, and the mains rectifier is bolted to the underneath of the chassis so that its base is in good thermal contact with the metal of the chassis. An aluminium bracket is made to hold the strip of trimmers facing the open end of the chassis alongside the wavechange switch. Two tag strips, each with two tags and earth are fitted in the positions indicated in the wiring diagram. One fixes on one of the tuning capacitor bolts and the other is fixed by means of one of the bolts for the holder of V4. A soldering tag is used for earthing components associated with V1, V2 and V3, this being in each case fixed by means of one of the valve-holder bolts in the position shown on the wiring diagram.

Wiring

Before commencing wiring it is as well to try the chassis in the cabinet in order to ensure that no mechanical snags are going to arise. It is easier to deal with these at this early stage than when the chassis has been completely wired.

Fig. 3 gave the wiring of the chassis. As usual, it is recommended that the heater and mains wiring be done first, using well insulated wire for the latter and keeping these leads in close proximity to the chassis. Signal leads, on the other hand, take the most direct route from place to place, and do not necessarily follow the route indicated on the diagram because inevitably when an attempt is made to draw the connections the run has to be changed somewhat for the purposes of clarity. The diagram gives the positions of tag strips and earthing tags.

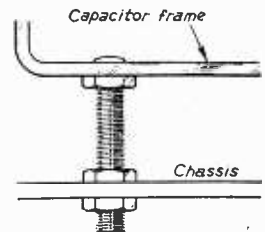
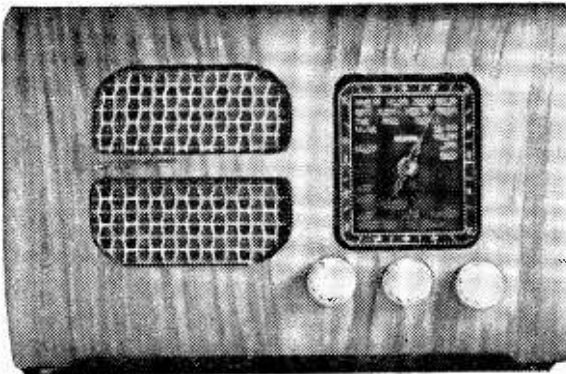


Fig. 4.—Fixing the tuning capacitor.



A view of the finished receiver.

Precautions with A.C./D.C. Technique

There are some precautions that must be taken in the case of a receiver in which the chassis is connected to the mains as in the present design, but if these are taken there is no undue risk. Some of these have to be taken in the course of construction. A back is provided for the cabinet and, of course, this must be fitted when the receiver is in use. The spindles of the controls are in metallic connection with the chassis. If the knobs fit snugly to the chassis it is a good idea to cut a felt washer to fit behind each; a very slight pressure on the knob against the washer whilst tightening the grub screw will then seal the gap between knob and cabinet. Where the knob cannot be fitted snugly in this way the method

used is to wrap a piece of transparent sticky tape around the spindle. Unless the tops of the grub screws sink well into the knob so that they cannot be touched, the holes over these screws should be filled with wax. The constructor will have to carry out some adjustments with the chassis out of its cabinet, so he must remember not to touch it with his hands without disconnecting the mains. Trimming tools used for adjustment are insulated; if proper tools are not available they can be improvised by using a piece of plastic knitting needle or similar material filed to the shape of a screwdriver blade at one end.

Operating the Receiver

Wiring should be carefully checked before attempting to apply power to the receiver. When satisfied on this score, testing and alignment can proceed. Remember all the time that mains is connected to the chassis. As the dial is not fixed to the chassis it is necessary to mark on the backplate the positions to be used in alignment. Only two points are needed, one at the upper end of the dial and one at the lower end. If a signal generator is to be used it is convenient to make one point the harmonic of the other so that it is then unnecessary to adjust the generator during the course of the alignment. Conveniently, 450 metres and 225 metres are used for this purpose, because both these points are marked on the dial, and by tuning the generator to 450 metres the other position is the second harmonic. Of course, if alignment is to be done without a signal generator it will be necessary to take the wavelengths of two stations that are generally received at good strength and as near as possible to the two wavelengths specified above. It would be as well to purchase the I.F. transformers pre-aligned so that very little adjustment will be needed. Having determined the wavelengths on which alignment is to take place, the chassis is fitted into place in the cabinet and the tuner adjusted to the correct place on the dial. Now withdraw the chassis and place a small pencil mark to indicate the position of the pointer on the dial backplate. Repeat this operation for the other frequency to be used for alignment. This step is not necessary, of course, if the dial is fixed to the chassis.

Alignment

The first step in alignment is to adjust the I.F. transformers. If a signal generator is available set up these for 465 kc/s; otherwise it will be necessary to obtain a signal before adjusting. (If the I.F. transformers are pre-aligned, this should be possible.)

If it is impossible to obtain a signal on the ferrite rod aerial at this stage, an aerial can be connected to the end of the medium-wave aerial coil remote from earth, and, of course, the wave-change switch must be set to medium waves. Now tune in any signal and adjust the I.F. transformers for maximum signal. There are no A.V.C. complications in this receiver and the optimum point should be clearly defined. Of course, if a signal generator was used these circuits will have been set up previously and will

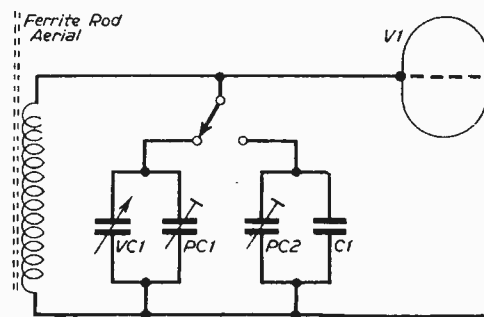


Fig. 5.—Modification to give M.W. pre-tuned station.

not now need to be re-adjusted. Now tune in the signal to be used for alignment at the upper wavelength end and adjust the core of the oscillator coil for maximum. Turning to the signal at the lower wavelength end, the oscillator trimmer is adjusted for maximum, and these two adjustments are made alternately until no further improvement can be achieved. Now remove the aerial if one has been used and align the aerial circuit in a similar way, sliding the medium-wave coil on the ferrite rod aerial for maximum at the upper wavelength position and adjusting the aerial trimmer at the lower wavelength position. Take great care in adjusting the ferrite rod coil in view of the connection of the mains to the chassis, and use an insulated tool for this and other adjustments.

Long Waves

When satisfied with the medium-wave setting turn to the long waves. From now on no further adjustment of the medium-wave circuits must be made; the two long-wave trimmers only must be adjusted. In order to ensure that only these are moved it is as well to mark clearly the four trimmers. An aerial can again be brought into use if the long-wave station cannot be heard—there will be no purpose in turning the tuning capacitor control as it will have no effect and the signal is searched for by adjusting the long-wave oscillator trimmer. When the station is heard both oscillator and aerial trimmer are adjusted for maximum signal. If the station comes in with either trimmer at maximum or minimum it will be necessary to alter the value of the fixed capacitors already fitted across that trimmer—if the trimmer is screwed right in for maximum results the equivalent fixed capacitor should be changed for one about 50 pF larger, or if it is screwed out the fixed capacitor needs to be 50 pF smaller.

M.W. Light Programme

The constructor may have no need for long wave for the Light programme, in which case he could get the same facilities by providing preset tuning for the medium-wave Light programme. The fixed capacitor C4 will now be less in value than that quoted, the actual size depending on the particular conditions, but will probably be no more than 30 pF and so only small sizes need be tried; it might be found that the trimmer by itself suffices. Only a medium-wave winding

will be needed on the ferrite rod aerial and the switch SW1 (a). will have to be wired to the circuit given in Fig. 5. Once more, C1 will be only small.

A refinement that the constructor may wish to have is a dial light; the position of this is indicated on the circuit diagram but not on the wiring diagram. If this is needed a wire should be run from the side of the 6.3 v. winding of the mains transformer remote from earth and taken through one of the holes through the chassis. A holder of the clip-on variety was used for the prototype. A small bracket of aluminium was made and bolted in one of the holes on the dial backplate. This was of such a size that the holder would fit on it and when so fixed hold the dial light just over the backplate. When the chassis was then placed in the cabinet the glass dial was adequately lit.

Adjustment of Receiver

During the adjustment of the receiver it is necessary to have the ferrite rod accessible so that the coils can be adjusted. It will be noticed that the beginning of each winding is connected to earth. This lead is placed on the component itself so that there are only three leads from the receiver to the rod. These should be left long enough for the aerial to be mounted inside, but at the top of the cabinet. Having done this, during tests, the aerial can be left lying on the

bench but this must be done carefully so that the windings are not damaged and it should not be dragged about by the leads when moving the chassis. Also, it must not be allowed to come into contact with any earthed object because one end is connected to one side of the mains. The two clips are screwed to the top of the cabinet so that the aerial can clip into them.

It should be remembered that the proximity of metal will affect the inductance of the coils and will upset the adjustment, so keep it clear of the chassis. If this precaution is taken it is unlikely that the change resulting from moving the aerial into its place inside the cabinet will cause the need for further adjustment. The ferrite rod aerial is directional, of course, and so it should be turned until the best signal is obtained and when making the preliminary search for stations this factor should be in mind. In practice it is found that the ferrite rod tends to be almost unidirectional and so if one maximum is not good enough, results may be improved by turning the aerial through 180 degrees. Incidentally this directional effect can be put to good use to reduce interference, and also in the comparatively rare cases where the signal picked up is large enough to overload the receiver, the input may be reduced by turning the aerial away from the direction of maximum signal.

Note that an earth connection must not be fitted to this receiver.

SERVICING RADIO RECEIVERS

(Continued from page 38)

If the F.M. section operates, but the A.M. section is dead, the fault possibly lies in the A.M. oscillator, and if the triode anode voltage is normal, V2 should be checked by substitution. There is also the possibility that C20 or C21 is open-circuit.

If the A.M. section operates, but the F.M. section is dead, the V.H.F. tuner or the switching is at fault. V1 should first be checked by substitution, and if the fault is still present, a continuity test should be made across the associated switches.

Distortion

A frequent cause is low emission of V7 or low H.T. voltage due to a faulty rectifier, but a leak in C56 will considerably upset the valve's bias and result in the same symptom and almost certainly ruin the output valve at the same time. R27 increasing in value is another cause of the trouble, as also is emission failure of V5 triode.

Modulation hum on a V.H.F. signal is sometimes promoted by trouble in the diodes of V5. A substitution check of the valve soon proves this, however. A constant mains hum (100 c/s) should lead immediately to a check of the smoothing capacitors.

A test point is available for the connecting of instruments during the alignment operation. This is shown on the circuit. Two matched 47 k resistors are connected in series between the test point and chassis and the voltage across them

is metered, a maximum indication being obtained when the signal and I.F. circuits are brought into correct tune. The discriminator is adjusted for zero indication on a current meter connected between the junction of the resistors and point B on the circuit.

Publication Received

BRANS RADIO TUBE VADE MECUM. Many of our readers are now familiar with this publication. This is the 14th edition and has 464 pages, including 47 pages of wiring diagrams for valve bases. The valves are tabulated in both numerical and alphabetical order, and to avoid thousands of repetitions of types which are really identical, but which have been given special initials by their makers preceding the actual type number, these initials have been omitted. Symbols and abbreviations have been restricted to a very small number. These are given on a bookmark, which can be laid out next to the tables, thereby simplifying consultation. Written and published by P. H. Brans, at 32s., it is available from Messrs. Bailey Bros. & Swinfen Ltd., London, W.C.1.

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NEW SERIES

Basic Theory For Constructors

No. 2.—POTENTIAL DIVIDERS AND BRIDGE CIRCUITS

By G. Palmer

WE have now graduated to the stage where we are able to compute the resultant value of resistors connected in series and parallel, and we are able to discover the current flowing in the various branches of a resistive network, the voltage developed across the circuit resistors and the power dissipated in them individually. We have, in fact, sufficient knowledge to solve quite a number of simple problems which are likely to be encountered in resistive networks associated with radio circuits.

Before we attempt to investigate definite examples of this nature, there are first a few more basic laws that we should consider. There is, for instance, the potential divider.

The Potential Divider

In its simplest form, the resistive potential divider is shown in Fig. 1. As will be seen, it consists of two resistors connected in series across a source of voltage (in this case a battery). The

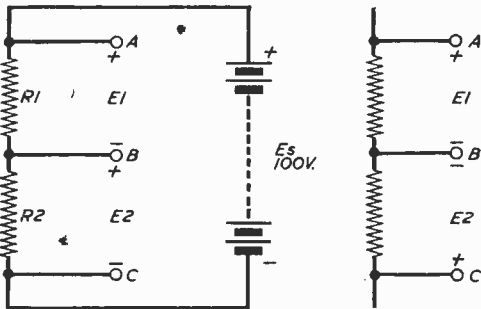


Fig. 1 (Left).—Simple potential-divider circuit. Here the voltages E_1 and E_2 are series-aiding, i.e., $E_s = E_1 + E_2$.

Fig. 2 (Right).—The voltages E_1 and E_2 are added in opposition in this circuit. That is, the smaller voltage is taken from the greater voltage.

potential across the network is thus divided, in terms of E_1 and E_2 , in proportion to the values selected for resistors R_1 and R_2 .

It becomes easy to calculate E_1 and E_2 when it is realised that these potentials are simply those developed across the associated resistors. For example, E_1 is the voltage developed across R_1 and E_2 is the voltage developed across R_2 . We have given the supply as 100 v. Now if we make R_1 and R_2 both 500 ohms, we have a total resistance of 1,000 ohms (1 k) across the battery. This means that a current of 100 mA (0.1 A) is flowing through the circuit, thereby causing 50 v. to be developed across both R_1 and R_2 . This is as would be expected, of course, since the sum of E_1 and E_2 must equal the supply voltage, which is 100 v.

At this stage it is desirable to consider the

polarity of the potentials across the resistors. It will be seen that if E_1 is equal to E_2 , then the combined voltage across terminals A-C would be zero. If E_1 were greater than E_2 , then the total voltage would be equal to $(E_1 - E_2)$. The production of voltages in opposition across series-connected resistors need not concern us at the present time, the idea being at this stage to understand how the polarity can affect the magnitude of the total voltage.

In the potential divider in Fig. 1 we discover that resistors of like value give at their junction in relation to either terminal equal voltages, both being exactly half of the supply voltage, with a series-aiding (positive to negative) polarity. In order to save all the trouble of working out the circuit current and then finding the voltage developed across the potential-divider resistors, a simple formula can be used.

Let us suppose that we require to find the voltage E_2 . Since the voltage is proportional to the resistive value R_2 , we can say that $E_2 = \frac{(R_2 \times E_s)}{(R_1 + R_2)}$ where E_s is the supply voltage.

Let us suppose that we require to find the voltage E_1 . Since the voltage is proportional to the resistive value R_1 , we can say that $E_1 = \frac{(R_1 \times E_s)}{(R_1 + R_2)}$

The resistor at the top of the fraction should represent that across which it is required to find the voltage. If R_1 and R_2 in Fig. 1 are each 500 ohms, we have $E_1 = (500 \times 100)/(500 + 500)$, which gives 50 v.; similarly, $E_2 = (500 \times 100)/(500 + 500)$, again giving 50 v.

If R_1 is 20 ohms and R_2 80 ohms, then $E_1 = (20 \times 100)/(20 + 80)$, which works out to 20 v., while $E_2 = (80 \times 100)/(20 + 80)$, which gives 80 v. Thus $(E_1 + E_2)$ gives the applied 100 v.

If we like we can look at it as a fraction in relation to the applied voltage: for example, the

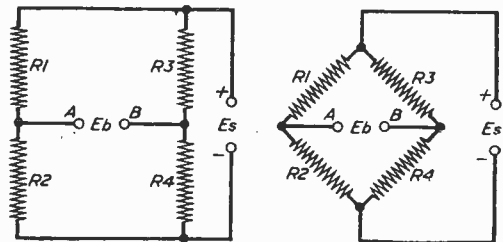


Fig. 3(a) (Left).—A bridge network can be considered as two potential-dividers connected across a common supply voltage.

Fig. 3(b) (Right).—The circuit is redrawn in the accepted manner.

voltage across R2 is $R2/(R1 + R2)$ of the applied voltage, or the voltage across R1 is $R1/(R1 + R2)$ of the applied voltage.

Bridge Network

In Fig. 3(a) we find two potential dividers connected across a common supply voltage E_s . From our knowledge to date, we will realise that, provided the ratio of R3 to R4 is exactly the same as the ratio of R1 to R2, the voltage across R1

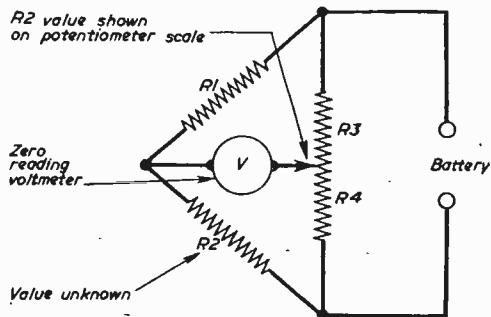


Fig. 4.—An adjustable bridge circuit which can be used for the measurement of a resistor of unknown value.

will be the same as the voltage across R3, and the voltage across R2 will be the same as the voltage across R4.

This means that the potential at terminal A with respect to either side of E_s will be exactly the same as the potential at terminal B. The potential between the terminals will therefore be zero, so if a voltmeter or current meter were connected across them it would indicate zero voltage or current.

This is known as the condition of *balance*, which exists when $R1/R2 = R3/R4$ and is the expression invariably adopted when bridge circuits are discussed. The circuit is redrawn in Fig. 3(b) in conformity with the generally accepted presentation of the network, although it will be noticed that it is exactly the same as the circuit in Fig. 3(a).

When a bridge circuit is off balance a potential will exist across the output terminals' (this being represented by E_b in the diagrams), while the polarity of the potential will depend on the relative balance of the two ratios $R1/R2$ and $R3/R4$ in relation to the supply polarity.

Let us assume that initially the circuit is in perfect balance and that a centre-zero voltmeter connected across terminals A-B is steady at the zero point. Now, if the value of R4 is reduced, the voltage across R4 will also reduce, the bridge will go out of balance and the potential at terminal B with respect to terminal A will be negative, as indicated by the swing of the voltmeter from zero.

If, on the other hand, the value of R4 is increased, then the voltmeter will swing the other side of the zero mark, meaning that terminal B is positive with respect to terminal A. The degree of deflection (that is, potential across the

terminals) will depend on the extent of the unbalance and the voltage E_s .

The bridge circuit is often used for the accurate determination of the value of a resistor (capacitor or inductor) by using a common resistor for positions R3 and R4 and a slider on the resistor to select the point of balance. The idea is shown in Fig. 4, in which R3/R4 is really a potentiometer (an adjustable potential divider), and either R1 or R2 is a resistor of accurately known value. The resistor not used then represents the resistor of unknown value.

Let it be supposed that R2 is the unknown value, then the slider is used to alter R3/R4 for zero reading on the voltmeter. At this point the ratio of R3/R4 can be read from a scale associated with the potentiometer pointer. As stated earlier, R is a resistor of accurately known value. Then from the ratio $R3/R4 = R1/R2$, the unknown resistor (R1) may be found.

(To be continued)

Stereo by Radio

(Continued from page 42)

the two channels together are used to modulate the transmitter in the usual manner, so that a stereo broadcast picked-up by an ordinary receiver would provide a correctly balanced single-channel output.

The signals in the two channels are also subtracted one from the other to provide the directional intelligence, and it is this signal which, in essence, represents the difference between a stereo and a single-channel broadcast. This signal is caused to modulate a sub-carrier, as we have already considered, and the modulated sub-carrier is added at the transmitter to the signals representative of the two channels. The transmitter is thus modulated by the two-channel signals and the sub-carrier, which itself is modulated by the directional signal.

Experiments have proved that the bandwidth of the directional signal can be much curtailed without detracting severely from the quality of the stereo reproduction. The reduced bandwidth also avoids undue reduction in transmitter power, with a consequent avoidance of loss of range of an existing transmitter when it is modified to cater for stereo broadcasts.

A receiver suitable for taking advantage of the stereo feature of the broadcasts would, of course, require a decoder for extracting the directional signal as well as two A.F. channels and loudspeakers.

Book Received

THE RIGHT WAY TO TAPE RECORD. By Laurence Mallory. 128 pp. 24 illustrations. Published by Eliot Right Way Books. Price 7/6.

Amongst the contents of this interesting book are: How the Tape Recorder Works, Microphones, Recording in a Room, Music at Home, Sound Effects, Location Recording, Editing, etc., Points to Consider When Buying, Glossary.

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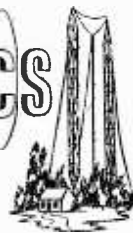
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TRANSMITTING TOPICS

FUNDAMENTALS OF OPERATING

By O. J. Russell, B.Sc.(Hons.), G3BHJ



THE beginner is often overwhelmed by advice on operating methods, only to hear some of the advisers blithely ignoring their own good advice when on the air. A small sprinkling of common sense is advisable, as many statements have been made and repeated without any examination of the feasibility or otherwise of the recommendations. One such recommendation concerns the CQ call. We all know the fatuity of the long drawn out CQ. Operators on all bands can hear "lids" churning out endless strings of CQ's before signing their call-signs. Thirty, forty and even fifty CQ's may be heard before the operator signs. Often QSB takes the signal below audibility when the call-sign is sent, while some get so hypnotised by sending a long string of CQ's that they forget to give a call-sign at all, and send the "K" signal without a clue as to who or what they are. Thus determined to end this menace at the source, many writers have advised the "snappy" CQ, or the celebrated "three times three" CQ.

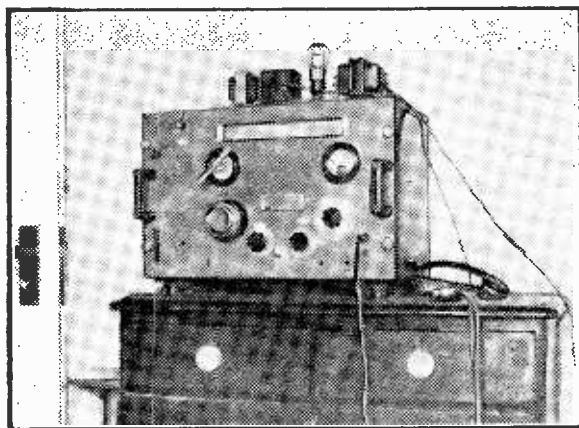
Calling "CQ"

The "three times three" CQ method is to call "CQ" three times and give the call-sign three times. Thus on CW: "CQ CQ CQ de G3BHJ G3BHJ G3BHJ K." Purists, of course, sign "AR K," but this adds little information, and a straight "K" (meaning "invitation to transmit") is perfectly adequate. Anyone trying the "three times three" procedure will be very lucky if they receive a reply to such a CQ call. On the DX bands a reply would generally be a miracle—at any rate for a G operator. For G operators on the DX bands, more contacts will result by calling DX stations who are calling CQ than vice versa. The writer calls CQ about once for thirty QSO's, and has log pages devoid of any CQ calls at all. However, a CQ call, particularly on the L.F. bands is often in order. The "three times three" procedure is not very efficient. Generally the newcomer, having read up extensively on "operating procedure for the beginner," and anxious to do the right thing and avoid overlong CQ calls may persist with this procedure. Having tried one "three times three" call, he tries another and another and another and so on until he gets a contact. By this time he has sent "CQ" some twenty times and his own call twenty times.

"Nine Plus Three" CQ Call

This is *not* surprising. The object of communication of any kind is to transmit information. The amateur calling "CQ" is trying to inform fellow amateurs that he

wants a contact. Thus, the information is divided into "CQ"—the information that a contact is wanted—and secondly his call-sign so that his identity is indicated to any amateur who might wish to contact him. On the basis of Information Theory, the "three times three" CQ call is ridiculously proportioned. Thus "CQ" sent three times represents six morse symbols. However, "de G3BHJ G3BHJ G3BHJ K" represents eighteen morse symbols. Thus, roughly speaking the "three times three" call devotes 24 per cent. of the transmission time to the important information that G3BHJ wants a contact, and 76 per cent. of the time to letting an amateur know that G3BHJ is on the air. If we devote an equal time to the "CQ" and to the call-sign, we need roughly eight or nine "CQ" signals to the triple call-sign ending. Such a CQ call balances the time between the two pieces of information. Thus the "Nine plus three" CQ call is recommended as a logical and time saving method of getting a contact *if* one has to call CQ. Anyone persisting with the "three plus three" method will discover that he has to make several of such calls before getting a contact, and a "nine plus three" call of nine CQ's and three call-signs will win hands down. Under average conditions, an operator tunes around until he hears a station calling CQ, and listens for the call-sign. With the "three times three" call, he has exactly five seconds out of some twenty seconds to hear that C.W. is being called, that is at a code speed of twelve words per minute. If we are dealing with a brisk 24 w.p.m. sender, some 2½ seconds of CQ are available to an amateur tuning the band to hear that a CQ is being called.



A Short-wave set owned by L. Hayward, of Swanage.

This points up the absurdity of the "three times three" call as a communication measure under average conditions. Moreover the suggested "Nine times three" call of nine CQ's to a three sent call-sign only occupies some thirty seconds in all even at a very moderate C.W. sending speed. Thus the "Nine times three" call occupies little time, but *does* inform a tuning amateur that a CQ call is in progress some 15 seconds rather than the 5 seconds allocated to the "CQ" by the same code speed "three times three" call.

"Tail-ending"

Some contacts start with a CQ call, but this is not invariably so. Thus, stations keeping a regular schedule call each other. Also, a station may "tail end" on a contact just ending. This is common with many operators, though this may very easily become a pernicious habit. Thus every time an operator in QSO signs over to the station he is working, "tail enders" may jump in with a frantic call to the station being worked. This most often occurs when some choice piece of rare DX is being worked. Under such conditions "tail enders" may become a nuisance particularly if they make long drawn out tail-end transmissions. The only possible type of

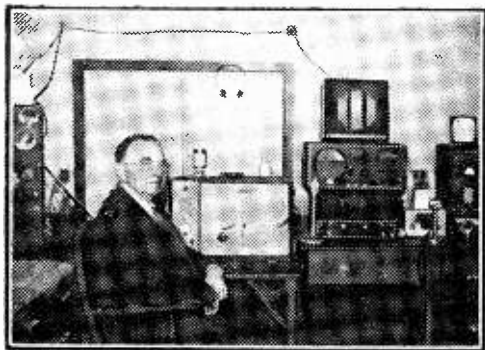
rate a rapid "single switch" change-over, is necessary. By making a quick "is that Roger break" one can get a quick "Roger" and be away to the next contest contact without laborious "over to you" procedures. In any case in a phone contact there is no need to say "well back to you then" or "over to you G7XX from G3BHJ. Key please," when "G7XX from G3BHJ over" is sufficient, with four words doing the work of eight. However repetition is not to be despised, as under heavy QRM conditions repetition may be needed to exchange reports. Repetitions should be used only when needed, as when copy is solid it is extremely irritating.

When calling a station, a "three times three" call is almost always sufficient. With good conditions a DX station may be raised by giving its call *once* followed by your own call three times. Some quiet amusement may be obtained by calling a station with a "once times three" call and enter into QSO while other stations are still calling. Moreover a short call to a DX station may be repeated if it does not reply immediately, so that by quick calls and listening between calls one can avoid QRM should the station reply to another station. It should be noted that when calling a specific station, the "three times three" call . . . thus "ZX7ZX ZX7ZX ZX7ZX de G3BHJ G3BHJ G3BHJ K" balances evenly the information content between who is calling and who is being called and is thus an efficient means of calling.

Different Operating Conditions

However, the operator will find contest operating conditions very different from "normal" or semi-normal DX operating. Thus the contest contact is strictly functional, and must be restricted to the minimum necessary for passing the signal report and serial number requisite for the contact. In the CW contest, operating skill is developed to a fine art in order to obtain as many points as possible as accurately and cleanly as possible in the shortest time. For obvious reasons poor CW operators do not participate in CW contests. Many operators are so scared of the machine gun fire exchanges of fast bug key operators that they do not enter such contests. But, participation in such contests is one sure way of developing speed and accuracy in CW operating. One does not have to be a .30 w.p.m. bug key addict to participate. Many such CW contests have plenty of room for the average CW operator to participate without necessarily being a high speed merchant. This applies particularly to DX contests where a G contact might give valuable bonus points to a DX station. Having to slow down (QRS) for a slow CW operator would be preferable to the DX operator rather than losing a bonus multiplier. One should call the station at the speed at which you want a reply. A fumbled call sent faster than your comfortable operating maximum, will cause more confusion than a confident solid call sent at your comfortable working speed. If the C.W. operator is a good operator he will reply to you at the speed you call him—that is he will recognise that the slow call is from a slow operator and will

(Continued on page 63)



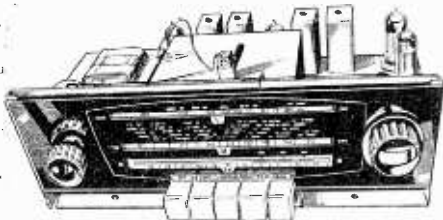
The radio shack of C. H. Jervis, in the village of Rio Seco, just outside Punta Arenas, Chile.

"tail end" is a quick and snappy one. Thus on C.W. a single "de G3BHJ" or on phone "G3BHJ on the frequency" is enough.

Contest Work

The operator will learn, of course, to suit his operating to the conditions of the moment. Thus engaging in a ragchew or "standard type" QSO is perfectly in order for a normal QSO. When a piece of choice DX is eagerly handing out "rubber stamp" contacts to an anxious horde of DXers, the correct answer is a similar rubber stamp reply. Moreover, phone and C.W. operating have different procedures for different times. Contest operating is a case in point. No operator is going to make any sort of score with sloppy long drawn out operating. It is noteworthy, too, that under normal QSO conditions, names, reports and QTH's are repeated several times. Under contest conditions even if these are sent once the operator gets them, However for contest and for snappy operating generally a fast break-in procedure or at any

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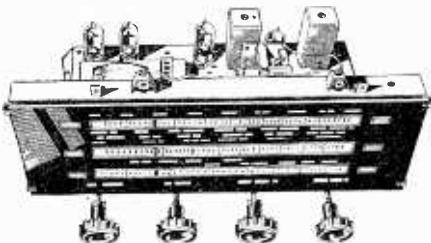
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not confuse you with a fast reply. It should be noted that fast C.W. sending is not necessarily an indication of a good C.W. operator. Much fast C.W. if taken down *as sent* is gibberish. Whilst there are some extremely good operators who send an effortless stream of fast C.W. that is readable with little strain, there are many others who send a fast, jerky stream of alleged morse that is very tiring to copy. The hallmark of good, fast C.W. is that it is readable without undue strain.

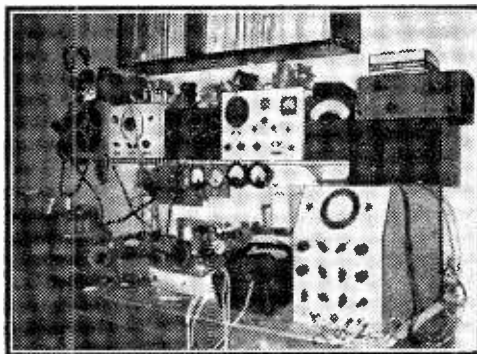
Slower Operators

One can easily discover the good and bad C.W. operators by a little listening. The object of operating is to do so well whatever your speed. Thus while listening round in a contest one will find several operators occupying spots in the band. After working one station they will send a single "QRZ?" and work another and another station in a stream. Obviously if such an operator is heard working without trouble a stream of stations, a slow operator would be well advised not to add to the QRM by putting in a call. If you do put in a call a "one by one" or a "one by two" exchange of call-signs is all that is needed. More repetition of call-signs is unnecessary QRM, as the DX contestant is probably through with one station and starting with another while you are still calling him! Thus if you really are a slow C.W. man, wait till the heat of the contest has died down a little, and search for some contestant who is having to call "QRZ" several times to get replies, or who has to call "CQ TEST" a few times for each reply. He is obviously scoring slowly, and would be very glad for a contest QSO. Thus when you hear "CQCQCQ TEST de VZ1A VZ1A" drop on the frequency with a snappy "VZ1A de G3BHJ G3BHJ K." This should produce the reply "G3BHJ de VZ1A UR RST 579 312 579 312 579 312 BK." This, of course, is your signal report plus the contest serial number. That is, this contact is the three hundred and twelfth that the DX station has had in the contest. All you need to send now is "R" to indicate you have received all OK, pass on your report and serial number, and confirm the report and serial the DX station has sent to you. Thus: "R. UR RST 579001 579001 579001. QSL UR RST 579312 579312. VZ1A de G3BHJ K." This should receive a "G3BHJ de VZ1A QSL UR 579001 579001 BK." Drop in with an "R" to indicate the DX operator has reported your "number to him" correctly, and leave the frequency to him. Thus a maximum of "R CUL GL CTST ES 73 VZ1A de G3BHJ SK" should be sent, indicating report and check received correctly, "see you later" (after the contest), "good luck in the contest" and "best wishes." This example will be regarded as extremely long winded by some operators, who, by utilising the "break" symbol, would reduce call-sign and other exchanges to the barest minimum, but it will be appreciated that under contest conditions where QRM may be prevalent, a fast "break" procedure may minimise QRM and time.

"Dxpeditions"

We come now to the present day phenomenon

of DX operating, the "Dxpedition." One or more amateurs may make a special trip to some island or other locality and "put it on the air" for a limited period. Generally the spot chosen represents a "new country" for DXCC and other certificate purposes, so that the object of these tactics is to give as many contacts as possible in the time available. Also, if the expedition has been at all publicised, hordes of amateurs are, of course, waiting to call it. This immediately creates the well known "pile-up." Hearing a "pile-up" in progress is often the first indication to many that a rare area is on the air via a Dxpedition. In fact a casual listener may tune



The electronics lab. of S. Villa of Malta.

across such a pile-up without learning which station is operating. To save time, the DX station may reply to a calling station and go on to work another without indicating its own call-sign; or the stations working the DX station may omit the DX station's call and merely give their own. This procedure is very often encountered, although it is against licence regulations. Thus the DX station may give a single "QRZ" and the band in the immediate neighbourhood at once erupts with stations calling the DX. The DX station logs the call-sign of one station calling and may reply as follows: "G3BHJ RST 579 579 579 BK." The station "worked" replies "R RST 589 589 589 73 BK." This may be followed "R 73 QRZ." and a further station is then immediately worked and so on. In this fashion some hundred "contacts" per hour are handed out. Diligent listening over a period may be necessary to identify the "DX," as a call-sign may be sent only occasionally.

Procedure

In such DX pile-ups, the laborious over repetition of call-signs is very definitely not recommended. It will be appreciated that generally there may be hundreds of stations calling the DX station, so that snappy procedure is necessary. Moreover, any given operator wishing to contact the DX station may have to standby on the frequency waiting for the "QRX" signal before calling the DX station. With contacts being made at a high rate, with average luck one does not have to wait too long for a brief contact with the Dxpedition station.



BRADFORD AMATEUR RADIO SOCIETY

Hon. Sec.: David M. Pratt (G3KEP), "Glenluce," Lyndale Road, Eldwick, Bingley, Yorkshire.

IN December we had a very successful Social Evening. Many prizes were presented for the games played, in the form of chocolates for the ladies, and radio components supplied from a radio and television manufacturing firm for the men.

This was followed by a very interesting lecture by Arthur Bailey (G3IBN) on Resistor/Capacitor Bridges with demonstrations. On December 30th, R.S.G.B. and Mullard films were shown at the Annual Film Meeting.

Forthcoming meetings:

February 10th.—Colour Television. Dr. G. N. Patchett (at the Bradford Institute of Technology).

February 24th.—Transmitter Design and Construction. D. M. Pratt (G3KEP).

March 10th.—Junk Sale.

March 24th.—Annual General Meeting.

Unless otherwise stated, meetings are held at 7.30 p.m. at Cambridge House, 66, Little Horton Lane, Bradford. 5. We welcome to our meetings anyone interested in radio or television.

BURY RADIO SOCIETY

Hon. Sec.: Mrs. Jean Hodgkins (G3JZP), 24, Beryl Avenue, Tottington, Nr. Bury, Lancs.

THE above Society meets at 8 p.m. at the George Hotel, Kay Gardens, Bury, on the second Tuesday of every month.

Forthcoming meetings:

February 10th.—Construction Practice, a talk by Mr. A. Moss (G8VF).

March 10th.—Jodrell Bank, a talk by a member of the staff. Since the Society was re-formed three years ago, the membership has almost doubled and covers a large area of East Lancashire. Newcomers are always welcome and copies of the Society's 1959 programme may be obtained from the Hon. Sec.

CRAY VALLEY RADIO CLUB

Hon. Sec.: W. E. Sutton, G3FW1, 30, Sherwood Park Avenue, Sidcup, Kent.

THE February meeting of the above Radio Club will be held at the Station Hotel, Sidcup, at 8.0 p.m. on Tuesday. February 24th, when Rowley G. Shears, G8KW, will talk about "K.W. Products."

The Annual General Meeting of the club will be held on Tuesday, March 24th, at 8 p.m., also at the Station Hotel, Sidcup.

Readers are always welcome visitors to our meetings which are held on the fourth Tuesday of each month at 8 p.m. at the Station Hotel, Sidcup.

OVERSTONE AMATEUR RADIO SOCIETY (O.A.R.S.)

Hon. Sec.: G. C. George, 75, Broadway, Northampton.

THIS club has been meeting weekly for the last six months. Subjects which have been discussed include General Radio Theory, Antennae, etc.

The club also took part in the recent 160 metre CW contest, using the call sign G3KQH (J. R. Hunt—president). It caters mainly for the younger radio-minded enthusiasts in the districts around Northampton.

THE SLADE RADIO SOCIETY

Hon. Sec.: C. N. Smart, 110, Woolmore Road, Erdington, Birmingham.

THE following meetings will be held during the first quarter:—
February 13th.—"The Human Ear," by Mr. C. Naylor Strong.

February 27th.—"Round the Local Hams," a talk by Mr. C. H. Young (G2AK, member), with colour slides of many Midland amateur radio stations.

March 6th.—Special Mullard Film Show at the Y.M.C.A., Snow Hill, Birmingham, at which will be screened "The Manufacture of Junction Transistors" and other films.

March 13th.—"V.H.F. Business Radio," by Mr. J. F. Moseley, of Messrs. Pye Telecommunications, Ltd., with a sound film.

March 27th.—"The Construction and Use of Test Equipment" by Mr. T. J. Hayward (G3HHD) and Mr. G. Nicholson (G3HKC) (members).

Club Station Activities.—The Club Station (G3JBN), at The Church House, is available for the use of members for constructional purposes. Instructional morse classes are held on every Wednesday at 7.45 p.m. Slow morse transmissions are radiated on the air each Tuesday evening from Station G3AVJ on 1.9 Mc/s, at 8 p.m.

The headquarters are: The Church House, High Street, Erdington, Birmingham, 23, although the activities of the Society may be obtained from the Hon. Sec. Visitors to the meetings, which commence at 7.45 p.m. prompt, and to the Club Station are cordially welcome.

TEES SIDE AMATEUR RADIO CLUB

Hon. Sec.: Allan Layton (G3JMO), 12, Endsleigh Drive, Acklam, Middlesbrough, Yorks.

THE notice given about the Club Dinner in no small way led to our having a record attendance of 46 local "hams."

The dinner was very well supported and was a success. Our new catering arrangements proved satisfactory, and it was voted a "good night." Messrs. Viners (Middlesbrough) Ltd., who advertise in the PRACTICAL WIRELESS from time to time, provided the top raffle prize, a "ball and biscuit" type Aco crystal microphone, and this, together with the draw prize of a £1 Premium Bond, were both won by guests, not club members!

G3LCZ, Tom, brought down his new shiny Vanguard transmitter (how heavy they are!), a very fine rig indeed, and was the centre of much attention all the evening. He wired the kit himself; it worked fine and was not difficult to do.

One or two pieces of gear and some valves (including two 829B's) changed hands on the swap table. The 829B's vanished before the dinner was served, G3HAE, Les, knew about that; he was looking for them all the evening, but they had gone for good!

G3INP, Bill, who has been very ill, was back with us again, fit and well, but G2CKN, Reg, is still in hospital but much improved.

We have a meeting on February 20th. We hope to arrange a stereo demonstration if we can. All these at our club H.Q., Settlement House, Newport Road, Middlesbrough.

TORBAY AMATEUR RADIO SOCIETY

Hon. Sec.: L. H. Webber (G3GDW), 43, Lime Tree Walk, Newton Abbot.

AT the December meeting members warmly applauded the generous gift of a new Model 40 Avometer from the company to help the society in its hospital work. The sum of £5 4s. was raised by a junk sale and members were told of the Ham Hop Club activities. A brief demonstration of tape recording was given by Mr. R. D. Knappe, who lectured on technical aspects of this activity at the January meeting.

WEST LANCS RADIO SOCIETY

Hon. Sec.: A. Crighton, 77, Myers Road West, Great Crosby, Lancs.

CLUB now well-established in new headquarters at "Colony," Crosby Road South, Waterloo, Liverpool, 22.

Weekly meetings: Tuesday, 8.30 p.m. Theory and Morse classes. Alternate weeks. Programme: February 10th, Discussion T.V.I. February 17th: "Practical Alignment" G3F2G. February 24th Morse Procedure, G3GST. New members and visitors always welcome.

HALIFAX AND DISTRICT AMATEUR RADIO SOCIETY

Hon. Sec.: A. Robinson, G3MDW.

AT the monthly meeting of the Halifax and District Amateur Radio Society on January 6th, held at the Sportsman Inn, Ogden, a very useful lecture was given to a good attendance of members by Mr. Duncan Enoch, G3KLZ, whose subject was Fault Finding Made Easy. The meeting was presided over by Mr. A. Robinson, G3MDW.

The future programme of the club is February, DX Expeditions by Mr. M. Whittaker, G3IGW.

March Hi-Fi Reproduction by Mr. Falkus of Fane Acoustics Ltd.

April. Quiz on Licence Conditions.

May. Junk Sale.

June. Recorded Lecture on Aerials.

THE BRITISH AMATEUR TELEVISION CLUB

Change of Address

The new address of the Hon. Sec.: D. S. Reid, M.A., is:—149, Ongar Road, Brentwood, Essex.

BRIGHTON & DISTRICT RADIO CLUB

Hon. Sec.: E. Roberts, 9, Clifton Hill, Brighton, 1.

CLUB meetings are now held on Wednesdays, at 8 p.m. at the "Eagle Inn," Gloucester Road, Brighton, 1, and future events include:

February 11th.—"Automatic Telephone Exchange Systems," by E. Roberts.

February 18th.—National Field Day Discussion.

February 25th.—"DX Operating," by C. T. Fairchild (G3YY).

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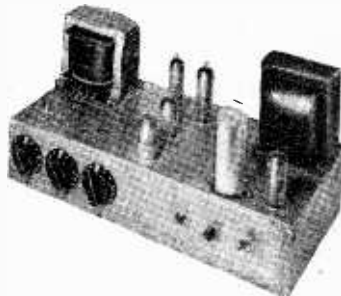
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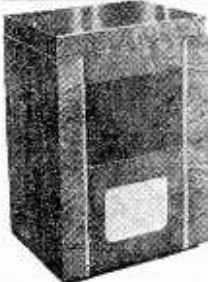
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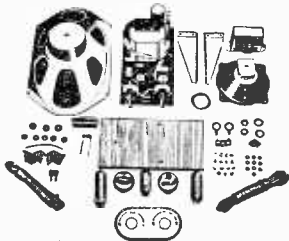
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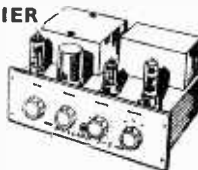


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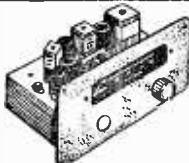
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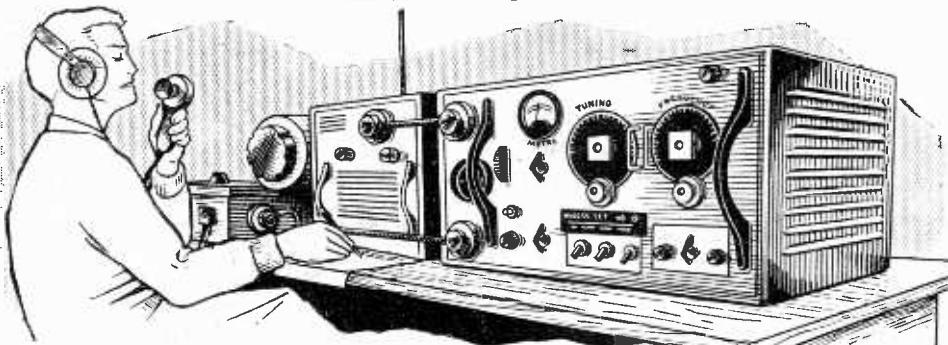
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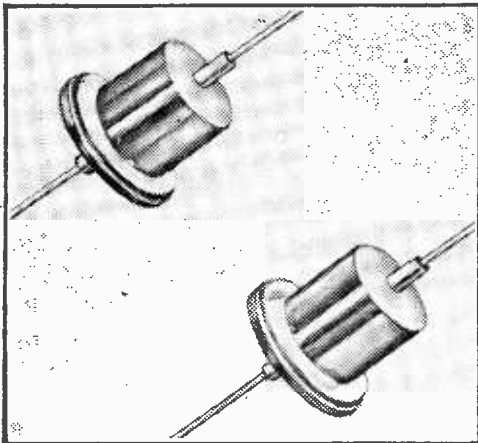
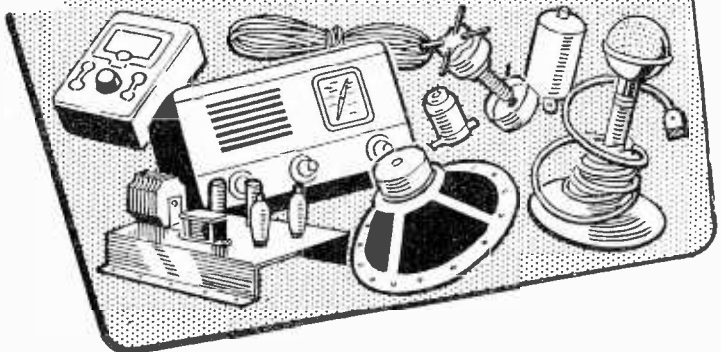
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NEWS FROM THE TRADE

LATEST DEVELOPMENTS
IN RECEIVERS AND
COMPONENTS

SIMET SILICON RECTIFIERS

FOLLOWING the licensing agreement between The Plessey Company Limited and General Instruments Corporation, Plessey of Vicarage Lane, Ilford, Essex, announce the first series of a new range of Simet silicon rectifiers. To be known as the "G" series, they are hermetically sealed, medium power rectifiers, designed to operate in ambient temperatures between -55°C and $+150^{\circ}\text{C}$, and are suitable



Simet silicon rectifiers "G" series.

for a wide range of applications including magnetic amplifiers and D.C. blocking. The series covers the range 100-1,000 peak inverse volts, 400-750 mA (25°C rating) and up to 250 mA at 150°C . Long life and stable operation at temperatures up to 150°C is claimed.

TRANSISTOR RANGE FOR THE HOME CONSTRUCTOR

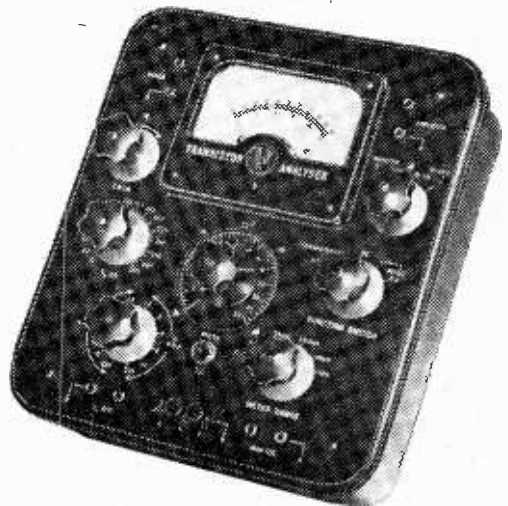
INCREASED demand from home constructors and experimenters for economically priced quality transistors is met by the Ediswan-Mazda XA103 (list price 15s.) and XA104 (list price 18s.) transistors, now made available through dealers.

To complete the range the Ediswan-Mazda XB102 and XB104 are now available at the much reduced list price of 10s. XA103 is an I.F. amplifier with minimum common base cut-off frequency of 2 Mc/s. Maximum peak or mean collector-to-emitter voltage is 12 v., and minimum small signal current gain is 15. XA104 is a general

purpose R.F. transistor, frequency changer and/or oscillator for long and medium wavebands with minimum common base cut-off frequency of 4 Mc/s. Maximum peak or mean collector-to-emitter voltage is 12 v., and minimum small signal current gain is 18. XB102 and XB104 are general purpose audio transistors with a maximum peak or mean collector-to-emitter voltage of 16 v. The range of small signal current gain is 18.47. The maximum collector dissipation of XB102 at 25°C is 150 mW, at 45°C is 90 mW; of XB104 at 25°C is 120 mW, at 45°C is 60 mW.

TRANSISTOR ANALYSER

A PORTABLE, compact, battery operated transistor tester suitable for testing small and medium n-p-n or p-n-p transistors either *in situ* or removed from associated apparatus is made by Avo Ltd., 92/96, Vauxhall Bridge Road, S.W.1. The instrument is suitable for taking I_b/I_c characteristics with a choice of V_c with the transistor in the grounded emitter configuration. β can be measured at any predetermined



The Avo transistor analyser.

point on the I_b/I_c characteristic and I_{c0} is directly indicated in μA .

Provision has been made for the measurement of transistor noise by comparing peak noise over the approximate range 100 c/s-10 kc/s. with an equivalent input signal calibrated in $m\mu A$ from the internal 1,000 c/s oscillator. The instrument can also be used as a multi-range test meter for servicing transistorised apparatus.

FERRITE ISOLATORS

MARCONI'S WIRELESS TELEGRAPH COMPANY are manufacturing a range of ferrite isolators as components for use in the main microwave communication frequency bands. As British made components for these frequency bands are not readily obtainable through the normal trade channels in this country it has been decided to make them available to the electronics industry. At present orders can be accepted for the following range:

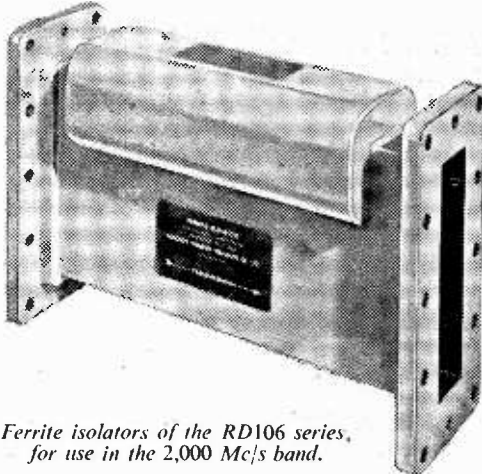
Series RD 103 for the 4,000 Mc/s band.

Series RD 105 for the X-band.

Series RD 106 for the 2,000 Mc/s band.

Research is continuing to develop other specialised components difficult to obtain.

Ferrite isolators are "one way streets" in microwave transmission lines, permitting propagation of energy in one direction, and absorbing energy reflected at any mismatch travelling in the opposite direction. The isolators in the Marconi series employ resonance absorption of spinning



Ferrite isolators of the RD106 series, for use in the 2,000 Mc/s band.

electrons which precess in a static magnetic field. Two notable features of the isolators are the very good wide-band match effected with adjoining transmission lines and their ability to operate in a wide temperature range without significant deterioration in performance.

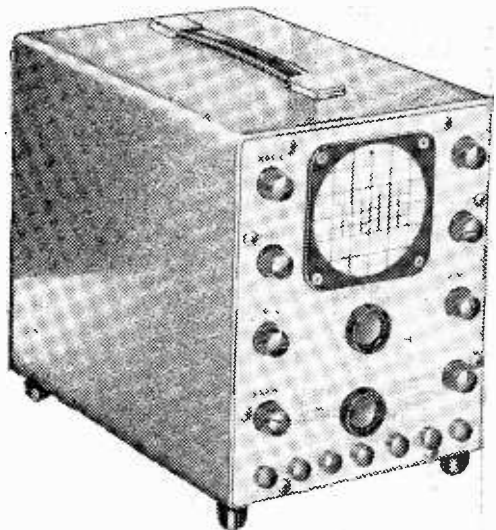
The field of application of these components extends from microwave test benches to microwave multichannel and colour television links. They are particularly valuable in test equipment to isolate reflecting loads from sensitive oscillators, the frequency of which would be affected by such reflections. By using these new isolators the

performance of microwave links can be greatly improved to carry a substantially increased number of channels or colour television channels.

The components are manufactured to fine limits. For example, the tolerance of the standing wave ratio is 1.05 to 1.02 or better. This ensures that the equipment in which the components will be used will conform to C.C.A.R. recommendations.

THE TRESCOSCOPE

THIS is a general purpose, high performance oscilloscope designed around a first-grade 3in. cathode ray tube type 3AFP1. It is suitable for use by radio and television service engineers, amateur experimenters, and has many applications in industry.



The Trescoscope.

It is housed in a well-proportioned cabinet which is fitted with a carrying handle and feet, and is attractively finished in a scratch resisting grey hammer cellulose. The tube face is protected by a transparent perspex graticule ruled horizontally and vertically to provide a convenient reference for the measurement of trace amplitude. All input terminals are keyed into the front panel to prevent over-turning and subsequent loosening. They are fitted with captive insulated heads which cannot be removed and lost. The cabinet and all metalwork is of steel, the main chassis and C.R.T. bulkhead being suitably treated to prevent corrosion and rust.

The instrument utilises BVA valves, and it is manufactured by The Range Electronics Co., Cormorant Works, Lett Road, E.15.

A 12v. VALVE-TRANSISTOR CAR RADIO

REGARDING the above article which appeared in the January issue, will readers please note that the continuation line was inadvertently inserted. The article was concluded in that issue.

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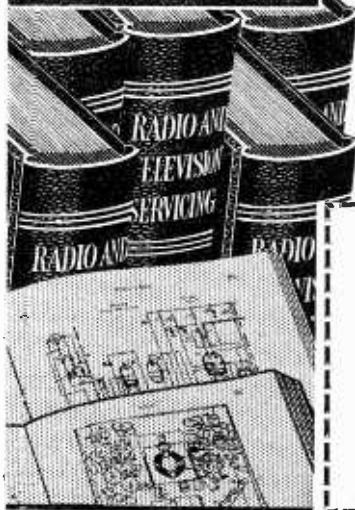
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On the other hand, one reading does not extract all the information contained in it. I find that I refer to your books again and again; they often contain a clearer treatment on acoustical problems than can be found in the standard reference texts.

17th November, 1958 R.F.F.

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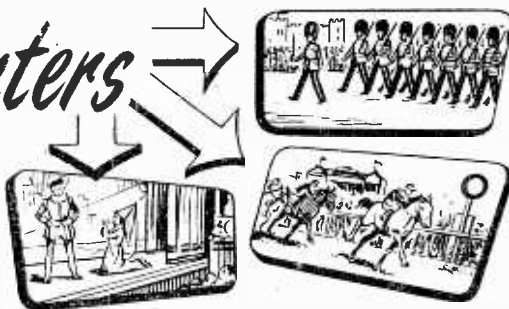
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Programme Pointers

OUR CRITIC, MAURICE REEVE, REVIEWS SOME RECENT PROGRAMMES



THOMAS DEKKER'S *The Shoemaker's Holiday*—the first in a series of British Drama 1600-1642—gave a delightful picture of bygone days when smells and plagues were rife and street criers part of the daily scene. The denizens of Holborn and Fleet Street could well nigh shake hands across the road from their top windows whilst those who chafed under such restrictions might quit on the *Mayflower*, shortly to set sail. Sir Donald Wolfit headed a long cast of citizens and scallywags and the play moved with speed and gusto.

If not wholly changed, another scene which has at least been radically altered is that which forms the setting for Dame Ethel Smyth's charming and nostalgic opera, *The Boatswain's Mate*. Set to a story by W. W. Jacobs, it was given a repeat broadcast. The piece is set outside and in *The Beehive*, a country inn, at the opening of this century. Stanford Robinson and the Northern Orchestra and singers, with Alexander Young, Dennis Bowen, Margaret Ritchie, Mildred Watson and Scott Joynt, gave a spirited and sparkling performance—adjectival similes appropriate to *The Beehive*!

The BBC have often been very kind to a composer, a work or a performer, without which patronage a thin time might have ensued. For some time now the lucky one has been the Scandinavian composer, Carl Nielsen, and very lucky he is. His symphonies bear the not unsuitable titles of the "indistinguishable," etc. I prefer to know them as "the indigestible," "the incomprehensible" or "the incredible." May Mr. Nielsen's period of favour soon be over!

Now we come to the main work in the programme! This is a favourite remark of concert programme announcers. How embarrassing it must be for modern composers with a work of some magnitude that happens to lie beside one of the hoary old classics!

Plays

The Importance of Being Earnest is one of a small band of works which age cannot wither nor custom stale its infinite variety. Rising above either "whodunit" sensation or sticky, cloying passion, it enables us to lean back and relish its pearls of wit and its masterly craftsmanship. "World Theatre" did it very well indeed, with Robert Eddison as John Worthing, Peter Cook as Algernon, Joan Matheson as Lady Bracknell, Beryl Calder as Cecily, Monica Grey as Gwendoline and James Thomason as Canon Chasuble in the principal parts. Produced by Martyn C. Webster, it rolled along to everyone's delight and joy.

Good Entertainment

A newspaper story is always good entertainment. The rushing hither and thither, the great machines at work and the frantic grabs for scoops, have a fascination all their own. It only wants a beautiful secretary—blonde, maybe, but not dumb—and the picture is complete. *The Fielding Story* was a very good one. Edward Chapman as the paper owner, showed, with terrifying realism, how far some papers will go to get a sensational front page. Whilst James McKechnie, as his editor, fought for a greater degree of decency and respect for a woman's rights.

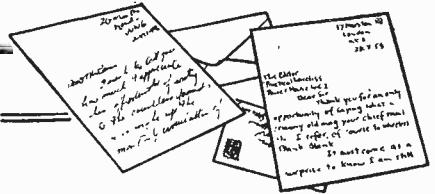
Mendelssohn

Little is known of Mendelssohn's *Midsummer Night's Dream* music—that marvellous outpouring of a lad of seventeen, resumed and completed fifteen years later as though no break had occurred—than what is heard in the concert hall namely the overture and the scherzo. Not even the peerless Wedding March is heard outside a church. So the BBC Northern Orchestra, in the *Music to Remember* series, under Stanford Robinson, and with the Northern singers, did a service in giving the whole of this wonderful music. Robert Irwin linked the numbers with a helpful and well composed narrative. *The Dream* without Mendelssohn is surely like Dickens without Phiz or lamb without mint sauce: not quite complete!

Speaking personally, I would like to see a second series of *The Verdict of the Court* started. I thought that those now concluded were both excellent entertainment and important instruction in the mind and working of the course of justice. They gave us the "whodunit" of real life, which must always be superior to the manufactured article. Congratulations to scriptwriter Jenifer Wayne, narrator James McKechnie, producer Joe Burroughs and the cast.

Noah, by the French playwright André Obey, featured Sir Ralph Richardson. Needless to say, it was the story of the flood in modern language. I was surprised to read in the *Radio Times* that Sir Ralph wanted particularly to play the part. Not that the piece was without interest or not worth doing, far from it. But to me Sir Ralph was lost in it: wasted. The sounds of hammering at the commencement, when the ark is under construction, sounded more like a child knocking up a toy with some odd pieces of wood. Percy Edwards must have had a grand time imitating all the birds and animals in creation.

Open to Discussion



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

Live Chassis Circuits

SIR.—Very frequently on looking through articles on live-chassis circuits one sees the warning to connect the chassis itself to the neutral side of the mains to minimise the risk of shock to the operator or experimenter. However, it seems to me that one very important point is never mentioned in these same articles—namely, that the pin on a mains socket labelled N is only too often carrying 240 volts! Having had this brought to my notice the hard way, I checked several installations and found a very high percentage wrongly wired. And this applied even to a large scientific department installed, at least in theory, by competent electricians.

Could I take this chance, therefore, to warn especially the younger experimenter that it is not safe to assume that the neutral pin on his house circuit is not carrying high voltages. Obviously, the experienced Ham has checked all his wiring, but he is also the very man who has the knowledge not to take chances with the mains. The beginner can easily check his wall socket by using a neon screwdriver, a tool that is a good investment for the few shillings it costs.—W. SINCLAIR (Edinburgh).

Electronic Organ

SIR.—I feel sure that the last item in Mr. R. H. Cowtan's letter in PRACTICAL WIRELESS, December issue, must have made many organ fans think. No doubt all of us at some time have had microphones in our American organs or harmoniums. Many, too, will have meddled with the electronic organ keyboard, advanced in design or otherwise, but the words "So later I made every reed one plate of a condenser microphone, etc., etc." must be of especial interest to many of us. Mr. Cowtan has wet our lips. I wonder if he or your organ enthusiasts would give us an article on this application.—O. PENNOCK (Hartlepool).

Long-wave Reception

SIR.—I have been following the correspondence on long-wave reception in PRACTICAL WIRELESS with great interest. May I, a mere woman reader, add a word too?

Much of the enjoyment I obtain from listening-

in, is derived from long-wave programmes and particularly from France 1 (Inter.) with its excellent fare.

Long may our radio manufacturers continue to supply us with sets incorporating long waves.—MISS M. MARSHALL (London, N.W.3).

"Beginner's Constructional Course"

SIR.—In answer to Mr. M. J. Redman's letter (December, 1958), I also made the three-valve receiver described in the "Beginner's Constructional Course." I am 14½ years old and had success with each stage built.

I am looking forward to the multi-range meter to be described, as mentioned in October PRACTICAL WIRELESS.

I have been having PRACTICAL WIRELESS for a year now and find it most informa-

tive.—J. STEVENSON (Birmingham).

Stereo Reproduction

SIR.—I have recently written two letters for the Open to Discussion columns and am told there are three of all good things, so may I crave space to reply to G. R. (S.W.3), January issue.

First, let me advise him to read, or re-read, the article by A. M. St. Clair in the July number of PRACTICAL WIRELESS and also your editorial in that number. I, too, fancy this subject is somewhat exaggerated. In modern jargon, there is the matter of "creating markets" as, for instance, persuading girls to daub their mouths with a mass of fat and colour. Stereophonic sound will depend a very great deal on the size, shape and acoustics of your room while the listener must sit at the apex of an equilateral triangle.

I had a long experience in the research department of one of the largest radio manufacturers and between the two wars we investigated many things, including stereophonic sound, for the subject is by no means new. It takes all sorts to make a world and this is how I see it after a life experience in the reproduction of sound.

Let us suppose we have an orchestra on a platform twenty feet wide, the listener sits at the apex of his triangle, twenty feet in front. His right ear will hear first the instruments on the extreme right and gradually on, across to the left-hand side, the volume becoming very slightly less as he proceeds to the left, but the journey

(Continued on page 75)

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 the coupon from page iii of cover.

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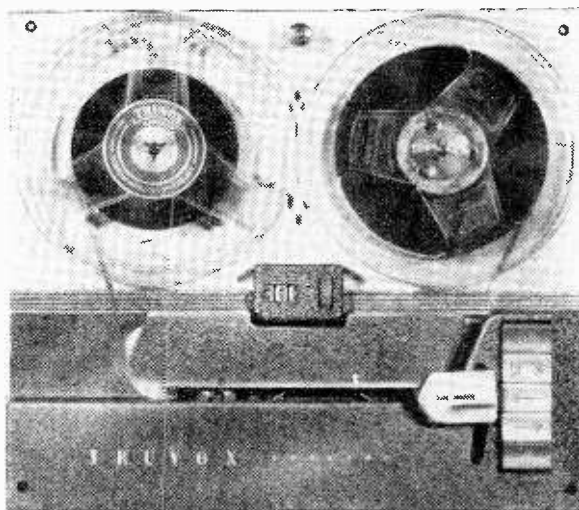
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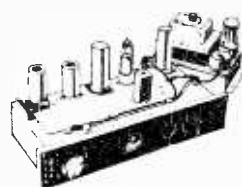
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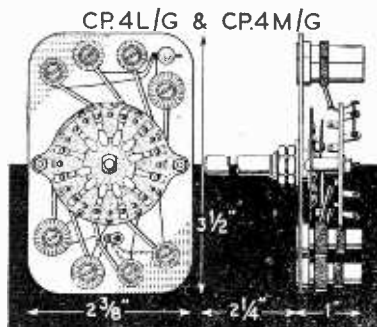
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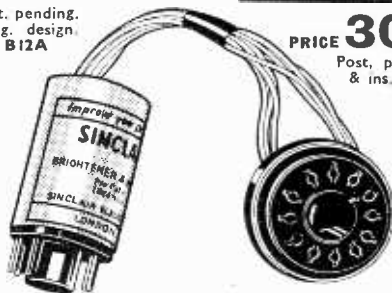
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across is very quick indeed and the difference in volume very slight, so, vice versa, with the left ear. Now, we have both ears working and the music coming right, left and centre to both ears at great velocity and I will defy the average person to say what he is hearing, particularly, in the right or left ear, except the whole music. That is, of course, in practice not theory.

Instead of the listener, let us have a microphone at the right-hand side of the platform and another at the left, each feeding a separate circuit to the two halves of a 45-45 recorder stylus and it is my case that the recorder is in the same position entirely as was the listener's ears. There may be the slightest emphasis on the right and left but at any rate the speed of the vibrating reproducing needle, sapphire or diamond, is so great that it becomes negligible, except only when a single moving object is taken first from right to left, or reverse, when it will be heard slightly sooner on one side, a technique in some films.

And now to return to G.R. (S.W.3), there are several ways of simulating stereophonic sound. One way is to have a centre-tapped coil in an electro-magnetic pick-up, the centre is earthed and the ends go to the two channels of the amplifier, or to correct phase, two coils, the ends to earth and beginnings to the amplifier. There are other ways of dealing with crystal and m/c pick-ups. Then, you may split up your push-pull output by using a centre-tapped output transformer and feeding two speakers, and a very simple way is to feed radio or gram into a high-slope pentode which in turn feeds the two grids of two output valves each having its own output transformer. But let me repeat, this is simulated, not true stereophonic sound, but in the average room the average listener will never know the difference.

Finally, let us forget all the foregoing, and for the average room let us have the best equipment we can manage, sit where we like and enjoy our single source of sound, and never let us confuse stereophonic with stereoscopic.—R. H. COWTAN (Thetford).

Ex-Service Equipment

SIR,—I agree wholeheartedly with H. T. R.'s suggestion in the January issue that data on ex-government apparatus should be compiled. You have, of course, given lists of specific items, e.g., valves and resistors, but a composite list would be very welcome.—W. H. R. (Watford).

Correspondents Wanted

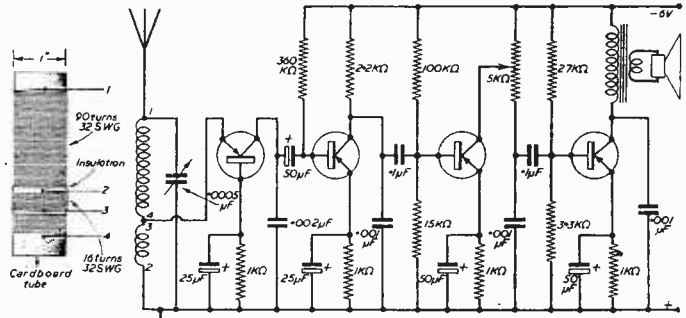
SIR,—I am interested in radio and electronics in general and I would be very pleased if I could obtain a pen-friend in England aged about 15 to 18. I would prefer someone living in London itself or to the south of London.—D. K. HUMPTON, 494, Avonside Drive, Avonside, Christchurch, N.E.2, New Zealand.

Auto-changer Cut-out

SIR,—With reference to Mr. R. Shatwell's design for the "Staar" Auto-changer cut-out, Mr. Shatwell is quite correct in his assumption that a switch is fitted to some models. In fact a micro-switch for the changer can be obtained for the modest sum of 4s. 6d. from the Technical Trading Co., Portsmouth, who advertise in this journal.—J. MITCHELL (Heathfield).

Transistor Receiver

SIR,—I have built quite a few transistor sets. One of my most successful ones is shown in the diagram below. It gives very good results, even though reception in this area is pretty poor. The transistors I used were a Brimar TS3 for a detector, two "red spot" transistors for the A.F. stages and a Mullard OC71 for the output stage. The volume is amazing.—J. BOWYER-LOWE (Southwich, Essex).



Circuit diagram of the transistor receiver.

BBC Stereo Sound

SIR,—I have had good results from the BBC's stereophonic sound tests, but on the most recent one I used headphones (right hand phone receiving TV sound, left-hand phone receiving Network Three) and the results were even better!

I think this was because: (1) the acoustics of the room can have no effect on the headphones and (2) the sound is brought direct to each ear.—G. DAVIES (Felixstowe).

Interference from TV Receivers

SIR,—Now that every "Idiot's Delight" television set which is installed completely spoils radio reception in its vicinity, and with the G.P.O. receiving £4 licence fee for a television as against £1 a year for a radio, it is my personal opinion that everything is being done to force radio listeners to turn to television.

It is the duty of the G.P.O. to check interference with reception, but what happens when a television set next door blots out a neighbour's radio? One unfriendly call from an engineer and then silence in the majority of cases. The G.P.O. doesn't care; the offending neighbour (who may or may not have a licence at the time) doesn't care. I have just had my radio reception

completely destroyed by a piercing TV whistle from a set placed to back up to mine through the wall, but I seem to be the offender by daring to complain! It is the old story of the strongest getting their own way, with the makers of TV sets having bludgeoned the authorities into allowing low standards of construction, with widespread radio interference.—F. J. LORD (Stamford).

"Arrangements"

SIR.—As a consistent reader of "On Your Wavelength" for many years, I find Thermion's pages again and again re-echo my own sentiments.

In some previous issues of PRACTICAL WIRELESS he has dealt with the question of "arrangements," and at first I agreed with him 100 per cent. Composers' tunes are distorted, almost out of all recognition. Most of the music so tampered with has been with us some time, and we look forward to hearing it from time to time like an old and trusted friend, and usually when it has been arranged or tampered with, our old friend turns out to have gone berserk.—R. MANCHESTER (Bucks).

"Servicing Without Instruments"

SIR.—Although Gordon Cole's article (Servicing Without Instruments) was in factual detail substantially correct, I cannot but help feeling uneasy that beginners should be taught such methods prior to using the more orthodox servicing techniques.

A suitable test-meter can be bought for about thirty shillings, or the would-be experimenter can make one of those which are periodically described in your pages for much less. With such a meter a much more comprehensive check can be made upon a receiver, and I feel sure that the genuinely interested novice would be far better off by finding his way about his set with the aid of a meter, than by relying on the oft-doubtful indications of odd sparks, hums, clicks, etc. After all, if the experimenter is genuine, then he will get himself a test-meter sooner or later, and the sooner the better. If he is merely one of those "I know how to do this, its kids stuff" people, then I strongly recommend that his talents will be better employed in repainting the kitchen.

I must correct Mr. Cole on one point though, experienced constructor or novice, professional or amateur, one must check for overheating before switching on a faulty receiver.—P. R. WILLIAMS (East Molesey).

Comments on Letter "Servicing Without Instruments"

THE author states:—"I have read with interest the comments of P. R. Williams, and I should like to emphasise that my article "Servicing Without Instruments" was in no way meant to disparage the use of conventional servicing techniques.

Indeed, I agree fully with Mr. Williams that the serious experimenter should make all effort to acquire a suitable testmeter as early as possible in his career, but I would qualify this by

saying that considered attention should be given to this purchase, as the employment of an instrument of low sensitivity may bewilder rather than assist the beginner, and a meter in the price range intimated by Mr. Williams may well be of that kind.

However, as revealed by the correspondence which is directed to our query department, there are legions of beginners and experimenters not possessing an instrument of this kind and yet whose interest in radio is far in advance of that required to incite "repainting the kitchen."

It was towards these interests that the article was primarily directed. Having gleaned a fair understanding of circuits from being a reader of PRACTICAL WIRELESS, a normally non-practising enthusiast may well be successful in the repair of his own receiver by following the lines given in the article. The enthusiast may then decide to construct or purchase an instrument to aid him in more detailed work as his practical interest heightens.

Nevertheless, it is truly surprising just how much information on a faulty set can be obtained without the help of instruments if the "clicks" and "sparks" are interpreted with care.

In conclusion, I would say that it is perfectly safe to check for slight overheating of components with a receiver actually switched on. This can save time without being dangerous. A receiver possessing a serious short, giving rise to an excessive and rapid rise in component temperature, would, in any case, hardly lend itself to this test, as either the component would burn out almost immediately, thereby revealing the approximate location of the trouble, or the fuse, if fitted, would blow, indicating the definite need for checking for a short."

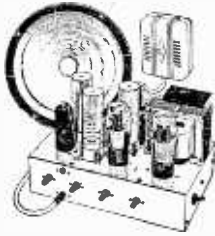
Novice Licence

SIR.—I am baffled by the repeated demands in "Open to Discussion" for the institution of a Novice Licence. Have the would-be "novices" never heard of the Amateur Sound Licence issued by the P.M.G. which costs £2 annually, and is granted after satisfying the authorities that one possesses elementary radio knowledge and can send and receive morse at 12 words per minute?

I am left with one conclusion: the aspirants to a Novice Licence are looking for an easier road to their objective than that which exists at present. They simply cannot be bothered to acquire the elementary principles necessary for the issue of an orthodox licence.

If some of the writers in "Open to Discussion" who have pleaded for a Novice Licence during the last six or seven years had spent as much time reading basic theory as they have obviously spent in thinking up some of the far-fetched, naïve and impracticable ideas as grounds for such a licence, then they would by now be experienced transmitting operators.

I shall be pleased to assist, in any way I can, anyone who genuinely would like to obtain an Amateur Sound Licence. There are only two requirements: enthusiasm and average intelligence.—J. D. PEARSON, G3KOC (Barrow-on-Humber).

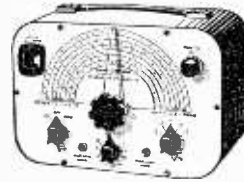


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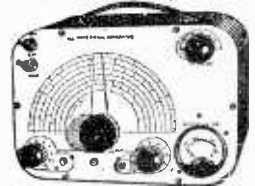


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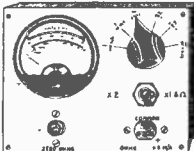
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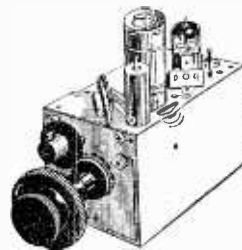
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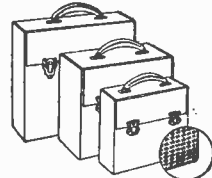
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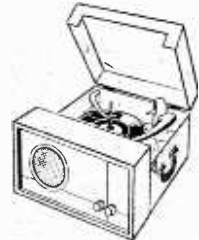
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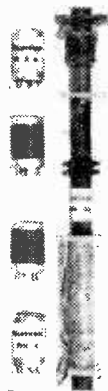
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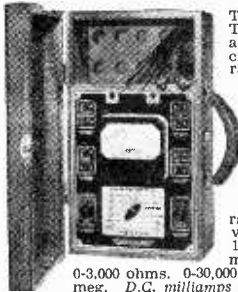
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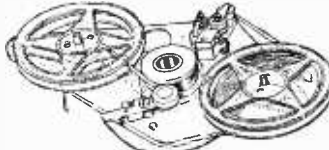
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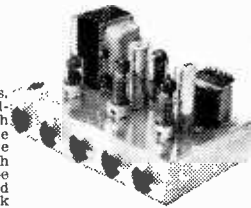
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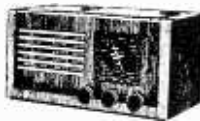


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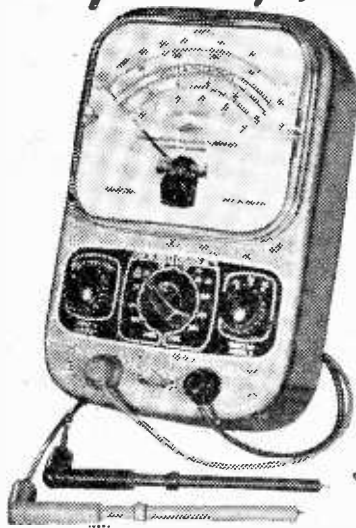
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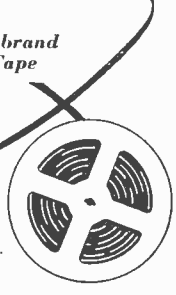
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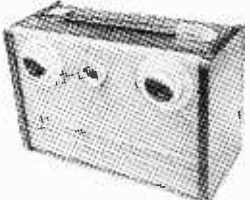
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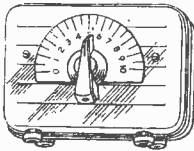
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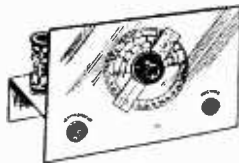


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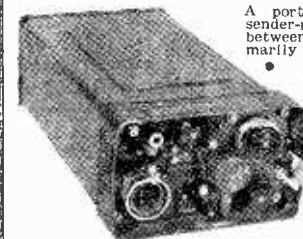
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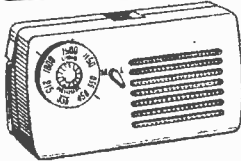
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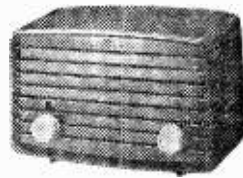
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- ★ SLOW MOTION TUNING
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The product of a well-known radio manufacturer: Gives world-wide coverage on all wavebands.

The ideal unit for a radio-gram or portable radio

Models available:

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Containing two Mullard valves type UL84 and UY85, Elac 7" x 4"
elliptical speaker, volume control, tone control. Nothing else to
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Brand new. desk type with lead.

ONLY **65/-** P.P. 1/-.

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Complete with: 6—EF50; 5—EA50; SP61.
Relays etc.

35/- P.P. 2/6.

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Tuning 30 to 40 Mc/s. Includes 3 SP61's.
Circuit 9d.

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Includes: 4—EF50; 2—SP61; EB34; multibank switches;
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ONLY **30/-** P.P. 3/-.

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½ in. Square ... 3/6 1½ in. Round (Acos) ... 7/6

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Moulded plastic hand mic case suitable for any of above, only 2/6
P.P. 6d. per item.

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VALVES AND TRANSISTORS. SEND FOR FREE LISTS.

THE NEW MULLARD 3-3 HI-FI AMPLIFIER

- ★ 3 watts output.
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- ★ Overall size 10½ x 8½ x 3½ in.

This is the new super all enclosed model; a hi-fi amplifier at a reasonable price. **£8/8/-**, p.p. 3/-.

VIBRATOR PACKS. Input 6V d.c. Output approx. 100V. d.c. at 30 mA, fully smoothed and r.f. filtered. Size 6½" x 5" x 2". Fitted with Mallory 629C vibrator. BRAND NEW. Boxed. **12/6**.

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Complete in screened case with 6SL7GT; 28D7; relay; leads; jack plug. etc. Handbook.

BRAND NEW. ONLY **12/6** P.P. 2/-.

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Ready wired on board, complete with key.

ONLY **4/6** P.P. 11/6.

Headphones 7/6 pair. Requires 4½ volt battery.

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The ideal F.M. conversion unit as described in "P.W." April/May, 1957. Complete with 6 valves, three EF91's, two EF92's and one EB91.I.F.T's, etc., in absolutely new condition. With circuit and conversion data.

12/6 (less valves) **37/6** (with valves)

Postage and packing 2/6 (either type) FM AT ITS CHEAPEST!

PYE 45 Mc/s. STRIP TYPE 3583

Complete with 12 valves. 10-EF50; EB34; EA50, with modification data; For TV Sound Strip.

ABSOLUTE BARGAIN **39/6** Carriage 4/6.

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12 volts D.C. input. 220 volts, 165 mA. output. **32/6**, Post FREE.

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24 v. D.C. to 230 v. A.C. 50 cycles. 100 watts. Brand new and unused. **£5.10.0** Carr. 7/6.

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Chassis board filled with high-stability resistors; condensers; unistors (S.T.C.); V/H, etc. **5/-** P.P. 1/-.

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2/- each	
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Fury Four Super (SG, SG, D, Pen) ...	PW34C*

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*No. of
Blueprint*

SHORT-WAVE SETS

Battery Operated	
One-valve : 2/6 each	
Simple S.W. One-valver ...	PW88*
Two-valve : 2/6 each	
Midget Short-wave Two (D, Pen) ...	PW38A*
Three-valve : 2/6 each	
Experimenter's Short-wave Three (SG, D, Pow) ...	PW30A*
The Perfect 3 (D, 2 LF (RC and Trans)) ...	PW63*
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MISCELLANEOUS

2/6 each	
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AMATEUR WIRELESS AND WIRELESS MAGAZINE

STRAIGHT SETS

Battery Operated	
One-valve : 2/6	
B.B.C. Special One-valver ...	AW387*
Mains Operated	
Two-valve : 2/6 each	
Consoelectric Two (D, Pen), A.C. ...	AW403

SPECIAL NOTE

THESE blueprints are drawn full size. The issues containing descriptions of these sets are now out of print, but an asterisk denotes that constructional details are available, free with the blueprint.

The index letters which precede the Blueprint Number indicate the periodical in which the description appears. Thus P.W. refers to PRACTICAL WIRELESS, A.W. to *Amateur Wireless*, W.M. 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, Strand, W.C.2.

*No. of
Blueprints*

SHORT-WAVE SETS

Battery Operated	
One-valve : 2/6 each	
S.W. One-valver for American ...	AW429*
Two-valve : 2/6 each	
Ultra-short Battery Two (SG, det Pen) ...	WM402*
Four-valve : 3/6 each	
A.W. Short Wave World-beater (HF, Pen, D, RC, Trans) ...	AW436*
Standard Four-valver Short-waver (SG, D, LF, P) ...	WM383*
Mains Operated	
Four-valve : 3/6	
Standard Four-valve A.C. Short-waver (SG, D, RC, Trans) ...	WM391*

MISCELLANEOUS

Enthusiast's Power Amplifier (10 Watts) (3/6)	WM387*
Listener's 5-watt A.C. Amplifier (3/6) ...	WM392*
De Luxe Concert A.C. Electrogram (2/6) ...	WM403*

QUERY COUPON

This coupon is available until Mar. 6th 1959, and must accompany all Queries sent in accord with the notice on our "Open to Discussion" page. PRACTICAL WIRELESS, MAR. 1959.

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A FIVE TRANSISTOR POCKET SUPERHET ON PERDIO PRINTED CIRCUIT, USING EDISWAN TRANSISTORS.

Size $5\frac{1}{2} \times 3\frac{1}{2} \times 1\frac{1}{4}$ in.
Weight: 12 ozs.

Total cost, including EDISWAN transistors, cabinet, etc., **£8.10.0**, P.P. 2/6.
ALL ITEMS SOLD SEPARATELY

★ Easy to follow printed circuit.

★ 5 EDISWAN transistors.

★ Full medium wave coverage.

★ Full speaker output.

★ Attractive Plastic Case (Red, Blue or Cream).

★ Long life battery.

★ Built-in ferrite aerial.

★ Complete building instruction.

"THE TRANSISTOR-8"

Push-Pull Portable Superhet.

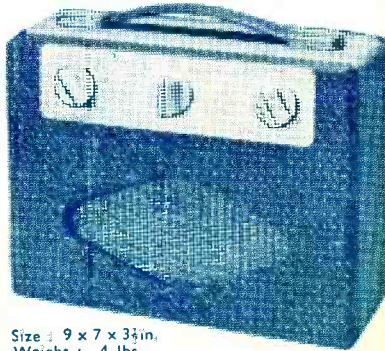
This Portable 8 Transistor Superhet is tunable for both Medium and Long Waves and is comparable in performance to any equivalent Commercial Transistor Set. Call and Hear Demonstration Model.

- ★ 8 EDISWAN Transistors.
- ★ 250 Milliwatts Output Push-Pull.
- ★ All components identified.
- ★ Medium and Long Waves.
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- ★ 7 x 4 in. Elliptical Speaker.
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- ★ Point-to-Point Wiring and Practical Layout.
- ★ Economical. Powered by $7\frac{1}{2}$ v. battery.
- ★ Highly sensitive.
- ★ Attractive lightweight contemporary case. In various colours.

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Two sets for the price of one.

We can supply all these items including Cabinet for £11.10.0, P.P. 2/6. All parts sold separately. Circuit diagrams and shopping list free.



Size $9 \times 7 \times 3\frac{1}{4}$ in.
Weight: 4 lbs.

Car Radio Conversion Components, 8/- extra.
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JUNCTION TYPE P.N.P.

EDISWAN XA104 6 Mc/s. osc./mixer: R.F. amplifier ...	18/-
" XA103 4 Mc/s. I.F. and R.F. amplifier ...	15/-
" XB104 1 Mc/s. Audio output and driver ...	10/-
(A pair in push-pull will give up to 250 mW. audio output.)	
Continental OC44 12 Mc/s. osc./mixer: R.F. amp. ...	30/-
" OC45 6 Mc/s. I.F. and R.F. amp. ...	25/-
" OC72 325 mW in push-pull ...	20/-
Red Spot 800 Kc/s. Audio Amplifier ...	7/6
White Spot 2 to 5 Mc/s. R.F. and I.F. amp. ...	12/6
Green/Yellow 600 Kc/s. Audio Amplifier ...	7/6
Red/Yellow 1.5 to 8 Mc/s. R.F. and I.F. amp. ...	15/-

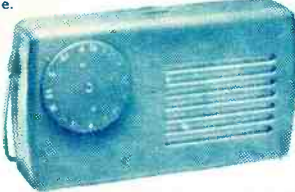
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SIX TRANSISTOR POCKET-SUPERHET

- ★ Medium and Long Wave.
- ★ 6 Selected Transistors.
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- ★ 30 ohms Speaker.
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- ★ Low consumption.
- ★ Attractive Plastic Cabinet (Red, Blue and White colours).
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- ★ Easy to Build.



All items supplied special inclusive price of £9/19/6. P.P. 2/6.

This set is an ideal Portable. Highly sensitive, selective, combining latest features with simplicity in construction giving amazing results.
ALL COMPONENTS SOLD SEPARATELY. SEND FOR LISTS.

MAJOR-2



All items can be supplied, including EDISWAN transistors, battery, case and personal 'phone, etc., for 72/6, post free. All components sold separately. Circuit and shopping list FREE. Call and Hear Demonstration Model.

- ★ 4-stage reflex circuit.
- ★ Variable tuning over medium waves.
- ★ Highly sensitive.
- ★ No aerial or earth.
- ★ Home, Light and Third.
- ★ Economical.
- ★ Drilled and mounted chassis.
- ★ Size $4\frac{1}{2} \times 3 \times 1\frac{1}{4}$ in.
- ★ Internal ferrite aerial.
- ★ Weight less than 4 ozs.
- ★ Complete layout diagram.
- ★ May be built in 1 hour.

MINOR-1



Total cost, including transistor, personal miniature 'phone, case, battery and complete circuit and layout diagrams, 52/6 post free. All components sold separately. Circuit and shopping list FREE.

- ★ Variable tuning over medium waves.
- ★ 3-stage reflex circuit.
- ★ Highly sensitive.
- ★ Internal ferrite aerial.
- ★ Drilled chassis.
- ★ Long-life battery.
- ★ Complete constructional details.
- ★ Size only $3 \times 2 \times \frac{3}{4}$ in.

SEE OTHER ADVT. INSIDE

TRANSISTOR SQUARE WAVE GENERATOR

2.5 Kc/s. Complete Kit with 2 Transistors, Components. Circuit and plastic case.

20/-

TRANSISTOR SIGNAL TRACER

Complete Kit with 2 Transistors, Components, Phones and Circuit and plastic case.

37/6

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