219

A BEGINNER'S CONSTRUCTIONAL COURSE

PRACTICAL WIRELESS

13

APRIL
1958

EDITOR: F.J.CAMM

A NEW SERIES

COMMENCING IN THIS ISSUE IS A SERIES OF CONSTRUCTIONAL ARTICLES PREPARED ESPECIALLY FOR THE BEGINNER. THE ILLUSTRATIONS ABOVE SHOW THE FIVE STAGES IN THE CONSTRUCTION OF A MULTI-VALVE MAINS RECEIVER, EACH STAGE COMPLETE IN ITSELF, AND IN THIS ISSUE THE FIRST STAGE — A COMPLETE ONE-VALVER, SHOWN ON THE RIGHT — IS DESCRIBED.

AND NOW THERE ARE TWO

Stern's "fidelity" TAPE RECORDERS

PRICE . . . Including **CRYSTAL MIKE** and 1,200ft. reel of **PLASTIC TAPE.**

£49.10.0 OR £3 EXTRA WITH REV. COUNTER

CREDIT SALE: Deposit £12 8/- and 9 monthly payments of **£4 10/8.**

HIRE PURCHASE: Deposit £24 15/- and 12 monthly payments of **£2 5 11.**

(Plus £1 10 - carriage and insurance of which £1 is refunded on return of Packing Case.)

IT INCORPORATES: The **NEW TRUVOX MK. IV TAPE DECK** together with the "fidelity" **MODEL HF TR2 TAPE AMPLIFIER** (both fully described on this page), and a Rola 10in. x 6in. P.M. Speaker.

PRICE . . . Including **CRYSTAL MIKE** and 1,200ft. reel of **PLASTIC TAPE.**

39 GNS.

CREDIT SALE: Deposit £10 5 - and 9 monthly payments of £3.15.2.

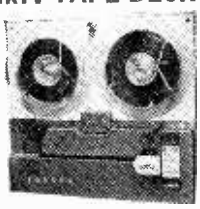
HIRE PURCHASE: Deposit £20/10 - and 12 monthly payments of £1 18 -.

IT INCORPORATES: THE TRUVOX Mk. III TAPE DECK together with correctly matched **HF TR1A TAPE AMPLIFIER** and a 7in. x 4in. Speaker.

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

The NEW TRUVOX MkIV TAPE DECK

ONE OF THE BEST DECKS ON THE MARKET.



PRICE (Plus 10/- carr. and ins.)

£27.6.0.

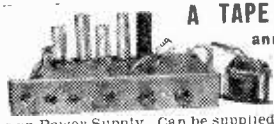
CREDIT TERMS: Deposit £6 17/- and 9 monthly payments of £2 10/-.

H.P. TERMS: Deposit £13 13/- and 12 monthly payments of £1 5 4.

WE ALSO HAVE A FEW DECKS WITH REV. COUNTERS. Price £30 9/-

Send S.A.E. for details.

A TAPE PRE-AMPLIFIER and ERASE UNIT



STERN'S MODEL HF TR1.—A completely assembled Pre-amplifier with own Power Supply. Can be supplied correctly matched for use with Truvox or Collaro Decks and incorporates Recording Level Indicator and Monitoring facilities. Please send S.A.E. with any enquiry.

PRICE **£11.10.0.** (Plus 5 - carr. and ins.)

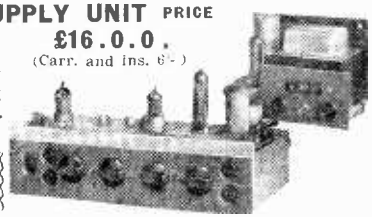
SPECIAL PRICE REDUCTION WHEN PURCHASED WITH TAPE DECK.

The "fidelity" TAPE AMPLIFIER MODEL HF/TR2 With POWER SUPPLY UNIT

PRICE

£16.0.0.

(Carr. and ins. 6/-)



H.P. TERMS: Deposit £8 and 9 months of £1.

CREDIT TERMS: Deposit £4 and 9 monthly payments of £1 9 4. When ordering, please advise make of deck in use. Send S.A.E. for full details.

Can be supplied to correctly operate with Collaro and Truvox Decks.

HOME CONSTRUCTORS

We can supply a COMPLETE KIT OF PARTS to build this TAPE AMPLIFIER for £12 (plus 5 - carr. and ins.). The Assembly Manual, Practical Diagrams, etc., are available for 2 6.

WE MAKE SPECIAL PRICES TO PURCHASERS OF TAPE EQUIPMENT (i.e., buyers of Deck and Amplifier together, etc., etc.). **SEND YOUR ENQUIRY TO US . . . H.P. and CREDIT SALE TERMS ARE AVAILABLE.**

"FRUSTRATED EXPORT ORDER"

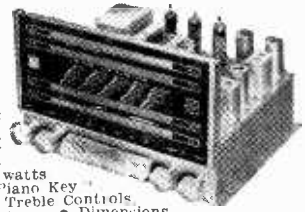
The Cossor Model 527/X 4-Valve "All dry" Battery Portable.

Offered for **£6.15.0.** (Plus 5/- carr. & ins.)

Consists of a 4 - valve Superhet Receiver covering Medium Waveband 197-575 metres, and two Short Wavebands 13.6 to 136 metres. The new low consumption valves are incorporated and the whole is accommodated in an attractive robustly made case. Battery required is 90 volts and 1.4 volts (price 19 6) and is external to case.

MODERNISE YOUR OLD RADIOGRAM

The NEW ARMSTRONG PB. 409 A.M./F.M. Radiogram Chassis



"A chassis for those who want the highest quality." ● A 9-valve line up employing the latest MULLARD preferred-type valves ● Provides complete coverage of the V.H.F. F.M. Transmissions plus the Short, Medium and Long Wavebands. ● Has Push-Pull Output with Negative Feedback for 6 watts peak Output. ● Quick Action "Piano Key" Selectors and separate Bass and Treble Controls ● Has "Magic Eye" Tuning Indicator. ● Dimensions 13in. x 9¼in. x 8in. high. Dial size 11¼in. x 5¼in.

PRICE **£29.8.0.** TERMS: Credit **£7.7.0** and 9 monthly payments of **£2.14.0.** (Plus 6 - carr. & ins.) H.P. **£14.14.0** and 12 monthly payments of **£1.7.3.**

SEND S.A.E. FOR ILLUSTRATED LEAFLET.

STERN'S "F.M." TUNING UNIT

A 5-valve Tuner incorporating the latest Mullard Permeability Tuning Heart and a "Magic Eye" Tuning Indicator.

PRICE ASSEMBLED £14.10.0.

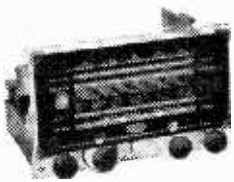
READY FOR USE

(Plus 7 6 carriage and insurance.)

TERMS: (a) Hire Purchase: Deposit **£7.5.0** and 9 monthly payments of **18/4.** (b) Credit: Deposit **£3.12.6** and 9 monthly payments of **£1.6.7.**

HOME CONSTRUCTORS—You can build this unit for Full Assembly Instructions are available for 1/6. **£10.0.0.**

WE HAVE THE FULL RANGE OF DULCI CHASSIS IN STOCK



THE MODEL H.4, is illustrated but all Chassis and Tuners are similar—send S.A.E. for leaflets, H.P. and CREDIT SALE TERMS are available. Send S.A.E. for details.

RADIOGRAM CHASSIS

These two Chassis are really well designed and reproduce most excellent quality on both Radio and gram.

MODEL H.3. A 3 Waveband AM/FM CHASSIS **£20.17.0.**

MODEL H.4. A 4 Waveband AM FM CHASSIS **£24.6.6.**

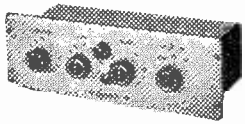
MODEL H4 T. A 4 Waveband AM FM TUNER with self-contained POWER SUPPLY **£20.17.0.**

STERN RADIO LIMITED (Dept. P.W.)

PLEASE SEND S.A.E. WITH ALL

COMPLETE KITS of PARTS for the "Hi-Fi" ENTHUSIAST

STERN'S REMOTE CONTROL UNIT



Designed in particular for use with the MULLARD 5-10 Main Amplifier

Ideally suited for simple domestic installation as an alternative to the more elaborate Pre-amplifier (shown and described opposite). Tone Control facilities are really excellent and in conjunction with the "5-10" Main Amplifier reproduction is of very high quality. Perfectly suitable for use with all the popular Record Players (B.S.R., Collaro, Garrard) and the modern Radio Tuner Units. Front Panel contains: (a) Coloured Indicator, (b) Separate BASS and TREBLE CONTROLS, (c) 3 position Selector Switch, (d) Volume control. Inputs on back for Radio and Gram. and Gram. equalising is incorporated.

FULL DATA is contained in the 5-10 MAIN AMPLIFIER MANUAL at 1/6.

RECORD PLAYERS

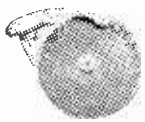
THE VERY LATEST MODELS ARE IN STOCK

MANY AT REDUCED PRICES!!!

TRANSCRIPTION UNITS — AUTO-CHANGERS, SINGLE RECORD PLAYERS

Send S.A.E. for ILLUSTRATED STOCK LIST

SPECIAL CASH OFFERS!!



The Latest Collaro 4 Speed Single Record Player.

Incorporating the very popular STUDIO "O" CRYSTAL PICK-UP. For only, **£6.19.6**

(Plus 5/- carr. and ins.)

Incorporates Auto-Stop and Plays 78 r.p.m. and all types of L.P. Records.

The Collaro "Junior" Rim Drive 4 Speed Record Player

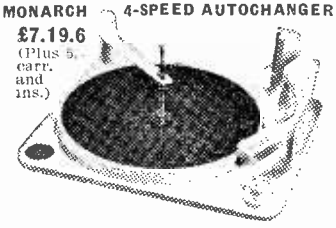
Offered complete with Collaro Crystal Pick-up. For **£4.10.0**

(Plus 4/- carr. and ins.)

We also offer . . . Gram Motor and Turntable at **£3.2.6.** Crystal Pick-up only, **£1.12.6.** (carr. and ins. 2/6 extra.)

THIS LATEST BRAND NEW B.S.R. MONARCH 4-SPEED AUTOCHANGER

£7.19.6 (Plus 5/- carr. and ins.)



● Minimum base-board size required 14in x 12¼in. with height above 5¼in., & height below baseboard 2¼in.

WE ALSO HAVE A FEW ONLY

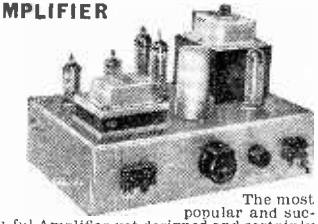
COLLARO 4-Speed "Mixer" Auto-changers. The Units are BRAND NEW and incorporate the STUDIO "O" Pick-up. PRICE, **£8.15.0** (Plus 5/- carr. and ins.)

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

Telephone: FLEet 5812 3/4.

CORRESPONDENCE

The MULLARD "5-10" MAIN AMPLIFIER



The most popular and successful Amplifier yet designed and certainly needs no recommendation from us. Our kit is complete to MULLARDS specification including the latest PARMEKO ULTRA LINEAR OUTPUT TRANSFORMER and the recommended Mullard Valve line-up.

PRICE OF COMPLETE KIT OF PARTS (Plus 5/- carr. & ins.) **£9.10.0**

or alternatively we supply — FULLY ASSEMBLED and TESTED for **£11.10.0** (Plus 5/- carr. & ins.)

The ASSEMBLY MANUAL containing FULL SPECIFICATION is available for 1/6.

We also offer the "5-10" incorporating the latest PARTRIDGE ULTRA LINEAR OUTPUT TRANSFORMER for an extra ... £1.6.0

STERN'S "fidelity" PRE-AMPLIFIER TONE CONTROL UNIT

"A design for the Music Lover"

This unit can be used with any Main Amplifier. Briefly it has inputs for all types of MICROPHONES, HIGH and LOW GAIN PICK-UPS and a RADIO TUNING UNIT. It incorporates (a) GRAM EQUALISING CONTROL. (b) STEEPCUT FILTER. (c) Continuously variable BASS and TREBLE CONTROLS, a variable OUTPUT CONTROL which enables its use with any type of Amplifier, and Jack Sockets on Front Panel for TAPE RECORD and TAPE PLAYBACK.

Used with the "5-10" the reproduction is comparable to that normally associated only with the very expensive commercially made High Fidelity Amplifiers. PRICE OF COMPLETE KIT OF PARTS **£6.16.0**

WE ALSO OFFER IT ASSEMBLED READY FOR USE. **£8.10.0** (plus 5/- carr. & ins.)

The ASSEMBLY MANUAL contains full specification and is available for 1/6.

SPECIAL PRICE REDUCTIONS . . . WE OFFER YOU . . .

PRICES ARE SUBJECT TO £1.6.0. EXTRA IF PARTRIDGE TRANSFORMER IS PREFERRED.

(a) **The COMPLETE KIT of PARTS** to build both the **MULLARD 5-10** and the **REMOTE CONTROL UNIT** for..... **£11.11.0**

(b) **The COMPLETE KIT of PARTS** to build both the **MULLARD 5-10** and the "Fidelity" **PRE-AMPLIFIER TONE CONTROL UNIT** for **£15.15.0**

ALTERNATIVELY WE WILL SUPPLY ASSEMBLED and FULLY TESTED, as follows—

(a) **The MULLARD 5-10** and the **REMOTE CONTROL UNIT** for..... **£14.0.0**

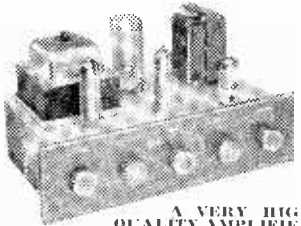
CREDIT SALE TERMS. £3.10.0 Deposit and 9 monthly payments of £1.5.8. H.P. TERMS. £7 Deposit and 9 monthly payments of 17/9.

(b) **The MULLARD 5-10** and the "Fidelity" **PRE-AMPLIFIER-TONE CONTROL UNIT FOR**..... **£18.18.0**

CREDIT SALE TERMS. £4.15.0 Deposit and 9 monthly payments of £1.14.7. H.P. TERMS. £9.9.0 Deposit and 12 monthly payments of 17/6.

WHEN ORDERING PLEASE INCLUDE 7/6 to cover cost of carriage and insurance.

THE NEW MULLARD "3-3"



A VERY HIGH QUALITY AMPLIFIER PROVIDING EXCELLENT REPRODUCTION AND HAVING AN ATTRACTIVE PERSPEX FRONT PANEL

Price - For complete kit of parts: £7.10.0

(plus 6/6 coverage and insurance).

Alternatively supplied **ASSEMBLED and FULLY TESTED: £8.19.6**

(plus 6/6 coverage and insurance).

The complete specification is available for 1/6. Developed from the very popular 3-valve 3-watt Amplifier designed in the Mullard Laboratories. Our kit is complete to the Mullard specification, including supply of specified components, valves and a **PARMEKO OUTPUT TRANSFORMER.** We also include switched inputs for 78 and L.P. records, plus a radio position. Extra power to drive a Radio Tuning Unit is also available.

THE IDEAL AMPLIFIER FOR A SMALL HIGH QUALITY INSTALLATION

WE ALSO SUPPLY SEPARATELY—

(a) The 2-Stage (plus Rectifier) **AMPLIFIER** **£4.2.6**

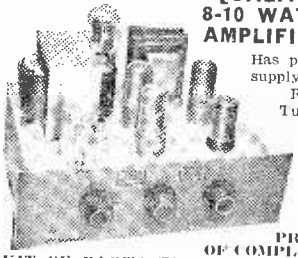
(b) The **PORTABLE CARRYING CASE** **£3.17.6**

(c) **P.M. SPEAKER** **18/9**

Carriage and insurance, 4/- extra.

We also have a smaller **PORTABLE CASE ideal for Record Players.** PRICE ONLY **£3.3.0** (plus 3/- carr. & ins.).

STERN'S "HIGH QUALITY" 8-10 WATT AMPLIFIER



Has power supply for Radio Tuning Unit

PRICE OF COMPLETE KIT OF PARTS (Plus 5/- carr. & ins.) **£7.10.0**

SUPPLIED ASSEMBLED and READY FOR USE **£9.10.0**

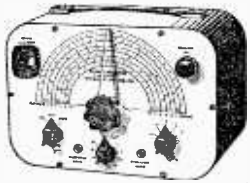
Proved one of the most popular models yet offered to the HOME CONSTRUCTOR. Provides excellent reproduction up to 8 watts, employing 6V6's in push-pull, incorporating negative feedback. Provides for use of both 3 and 15 ohm speakers.

SPECIAL CASH ONLY OFFER !!

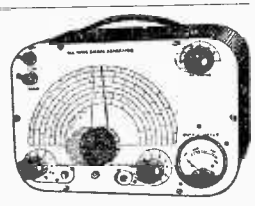
This very attractive **PORTABLE AMPLIFIER CASE** together with a good quality **GRAM AMPLIFIER** and a matched **P.M. SPEAKER.** ALL for ONLY **£8.7.6** (plus 7/6 carr. & ins.)

The Amplifier consists of a 2 Stage design incorporating 3 modern B.V.A. valves and has separate BASS and TREBLE CONTROLS. The Portable Case will also accommodate almost any make of Autochanger, and is attractively finished in Maroon and Grey colour Rexine.

SIGNAL GENERATORS

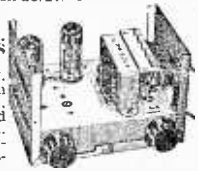


25/- deposit and 6 monthly payments of 21/6. Cash £6.19.6. Post and Packing 5/- extra.
Coverage 100 Kc/s-100 Mc/s on fundamentals and 100 Mc/s to 200 Mc/s on harmonics. Metal case 10in. x 6¼in. x 5¼in., grey hammer finish. Incorporating three miniature valves and Metal Rectifier. A.C. Mains 200/250 v. Internal Modulation of 400 c.p.s. to a depth of 30%; Modulated or unmodulated R.F., output continuously variable 100 millivolts. C.W. and mod. switch, variable A.F. output. Incorporating magic eye as output indicator. Accuracy plus or minus 2%.



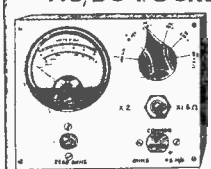
25/- deposit plus P. & P. 5/- and 4 monthly payments of 21/6. Cash £4/19/6 plus P. & P. 5/-.
Coverage 120 Kc/s, 84 Mc/s. Metal case 10in. x 6¼in. x 4¼in. Size of scale, 6¼in. x 3¼in. 2 valves and rectifier. A.C. mains 230-250 v. Internal modulation of 400 c.p.s. to a depth of 30%, modulated or unmodulated R.F., output continuous variable 100 millivolts. C.W. and mod. switch, variable A.F. output and moving coil output meter. Grey hammer finished case and white panel. Accuracy plus or minus 2%.

CONVERT TO I.T.A. FOR ONLY 25/- deposit plus P. & P. 5/- and 4 monthly payments of £1/5/6. Cash £5/17/- plus P. & P. 5/-.
ANY T.V. (except Philips or Valley Area, Wales)
WITHIN 35 MILES OF I.T.A. TRANSMITTER. ALL CHANNELS NO ALTERATIONS TO SET.
Complete with built-in power supply, 230-250 v. A.C. mains. Crackle finish case 5¼in. long, 3¼in. wide, 4¼in. high, incorporating gain control and band switch. Illus. with cover removed. Complete installation comprises "Converter," Wolsey 3-element I.T.A. outside or loft aerial. 36ft. I.T.A. lead, two plugs. (Wolsey 5-element 10/- extra.)



"CONVERTER" only £3/19/6 plus P. & P. 2/6.

AC/DC POCKET MULTI-METER KIT



Comprising 2in. moving coil meter, scale calibrated in AC/DC volts, ohms and milliamps. Voltage range AC/DC 0-50, 0-100, 0-250, 0-500. Milliamps 0-10, 0-100. Ohms range 0-10,000. Front panel, range switch, wire-wound pot. (for ohms zero setting), toggle switch, resistors and rectifier. In grey hammer finish case.
19/6 Plus P. & P. 1/6. Built and tested 7/6 extra.
Point to point wiring diagram 1/- free with kit.

4-VALVE ALL-DRY SUPERHET PORTABLE KIT

incorporating Ferrite rod aerial.
Medium and long waves. In grey leatherette. Size 9in. x 7in. x 6in. Valve line-up: 1T4, 1R5, 1S5, 3V4. Complete kit of parts (less batteries).
£5.19.6 Plus Post & Packing 3/6.

COMPLETELY BUILT PORTABLE AMPLIFIER

approx. size 6¼in. x 2¼in., incorporating 2 valves, contact-cooled metal rectifier, bass and treble lift controls **39/6** & P. 3/6. Plus P. and double wound mains transformer 230-250 v. **5" P.M. SPEAKER & O.P. TRANSFORMER**, if purchased with the above, 18/6. Plus P. & P. 1/6.

COLLARO 4-SPEED AUTOMATIC CHANGER

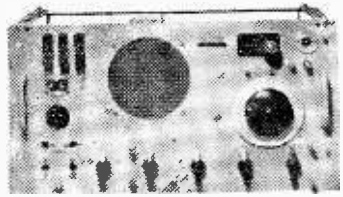
Model 457 (suitable for use with above amplifier). A.C. mains, 200-250 v., turnover crystal head. Brand new, fully guaranteed.
£8.19.6 Plus P. & P. 5/-, or 25/- deposit, plus P. & P. 5/-, and 7 monthly payments of £1/5/0.

RADIO & T.V. COMPONENTS (Acton) LTD.

23 HIGH STREET, ACTON, LONDON, W.3
All enquiries S.A.E. GOODS NOT DISPATCHED OUTSIDE U.K.

SPUTNIK SPECIAL

SHORT-WAVE RECEIVER 10-60 Mc/s (5-30 Metres) RECEPTION SET TYPE 208



Complete with 6 valves, 2-6K8G, 2-EF39, 6Q7G and 6V6G. Internal mains power pack and 6 v. vibrator pack. Built-in 6½" speaker. Muirhead slow-motion drive. B.F.O. and R.F. stage. Provision for 'Phones and Muting and 600 ohm. Dual Input 100/250 v. A.C. and 6 v. D.C. Size 24 x 18 x 12. Weight 70 lbs. In metal transit case. All sets in new condition and air tested. I.F. Frequency 2 Mc s.
£6. 19. 6. Carr. 15/6.
BE PREPARED TO LISTEN TO THE SATELLITES

"TRANSISTOR—8"

Push-Pull Portable Superhet **Can be built for £11/10/-**

This Portable 8 Transistor Superhet is tunable for both Medium and Long Waves and is comparable in performance to any equivalent Commercial Transistor Set. Simplified construction enables this set to be built easily, and quickly into an attractive lightweight cabinet supplied.

Send for circuit diagrams, assembly data, illustrations and instructions, and full shopping list, 3d. in stamps.

We can supply all these items including Cabinet for £11/10/-. All parts sold separately.

"EAVESDROPPER"

THREE TRANSISTOR POCKET RADIO
(No Aerial or Earth required)
Variable Tuning. Total cost, as specified including Transistors, Transformers, Coils, Condensers and Battery, etc., with circuit and plastic case. **77/6** POST FREE.
All items sold separately.
With Balanced Armature, 81/-. With Acos Mike, 90/-. With Min. Hearing Aid, 90/-.

MINI-TWO

TWO-TRANSISTOR MINIATURE POCKET RADIO
The smallest Transistor set offered on the market. Variable Tuning. Drilled Chassis. Plastic Case size 3in. x 2in. x 1in., Miniature Hearing Aid, 2 Transistors and all components including 1½ volt Battery. Circuits and full practical layout diagrams. All items sold separately.
Total Cost **49/6** Complete

"HOMELIGHT" 2-TRANSISTOR PERSONAL PORTABLE

Variable Tuning
We can supply all components including 2 Transistors, Diode, Resistors, Condensers and Miniature Hearing Aid and Plastic Case size 4½ x 2½ x 1¼in. and 1½ v. Battery. FOR **52/6**
All items sold separately.

TRIPLETT A.C./D.C. POCKET TEST-METER TYPE 666H

15 Ranges 1,000 ohm p.volt.
A.C./D.C. 10/50 250/1,000/5,000 volts.
Milliamps. 0-10 100 500 m/a.
Ohms. 0-300 250,000 ohms.
£5/10/-
In new condition with Prods and Internal Battery.

U.S.A. TESTMETER TYPE "834-S"

A.C./D.C. 15-RANGES F.S.D. 1,000 o.p.v.
A.C./D.C. Volts. 12/60/300/600 v./1,200/6,000 v.
Milliamps. 1.2/12/60/600 m/a.
Ohms. 0-5,000,5 meg.
£6/19/6
Complete in wooden carrying case with leads and internal batteries.

SEND STAMPS FOR NEW 1958 28-PAGE CATALOGUE
OPEN MONDAY to SAT. 9-6. THURS. 1 o'clock.

HENRY'S RADIO LTD.

6 HARROW ROAD, EDGWARE ROAD, LONDON, W.2
TEL.: PADDINGTON 1008-9

BENDIX RECEIVER RA 10.

A 4 waveband superhet covering 150 kc/s-10 mc/s. Valves 6SK7 1st R.F. 6K8 Mixer. 6SK7 1st and 2nd I.F. 6R7 2nd Det. 6C5 B.F.O. 6K6 output. Size 6½ x 15½in. Easily converted to mains operation as described on page 453 of the September "Practical Wireless." **£5/10/-**, carr. 7/6.

HIGH RESISTANCE HEADPHONES. 4,000 ohms. Brand new **11/6** each, P. & P. 2/-.

INDICATOR UNIT SLC No. 5. Ideal for conversion into an Oscilloscope using a 139A or ACR 10 tube. Unit consists of 2-VR65, 1-VR66, various resistors. condensers and pots. Size 11 x 6 x 3in. Brand new, complete with modification circuit. **20/-**. P. & P. 3/- each.

COLVERN WIRE WOUND POTENTIOMETERS. 25 watts 50k and 100k. Price **6/-** each.

LEAD ACID ACCUMULATORS. 2 volts 16 A.H. Ideal for 6 volts and 12 volts supply. Brand new original cartons. Size 4in. x 7in. x 2in. **5/6** each. P. & P. 2/6. 3 for **15/-**. P. & P. 3/6. 6 for **27/6**. P. & P. 5/-.

AMERICAN THROAT MICROPHONES. Type T.S. 30. 3/- each. Post paid.

VIBRATOR PACKS

12 VOLT input, 300 volts output at 150 mA. As a bridge rectifier will handle 450 volts RMS at 120 mA. Pack consists of 12 volt vibrator, 4 metal rectifiers, chokes and smoothing condensers. ONLY **30/-**. Carriage 5/-.

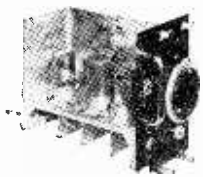
6 VOLT input, 230 v. output at 100 mA., complete 4-pin vibrator. OZ4 rectifier. Fully smoothed, **25/6** each. P. & P. 2/6.

PYE 45 mc/s I.F. STRIPS. Complete with seven valves, 6-EF50. 1-VR92, 6 tunable I.F. transformers. **30/-**. Post paid.

DYNAMIC SOUND POWERED HEADPHONES. Type D.L.R. 5. 60 ohms. Individual earpieces can be used for room-to-room communication. No Batteries required—just connect up. Can also be used as miniature speakers. ONLY **7/6** pair. P. & P. 2/6.

CONVERTERS

Easily the most useful units released by the Ministry. Within minutes you can extend the frequency of any receiver to cover the following :—



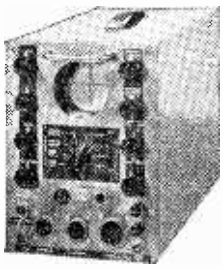
R.F.26, 50-65 Mc/s., **20/-** each.
R.F.25, 40-50 Mc/s., **8/6** each.
R.F.24, 20-30 Mc/s., **12/6** each.
R.F.24. Shop soiled, **7/6** each.
Complete with valves and circuit.
3/6 Postage on each.

COMMUNICATION RECEIVER R.1155

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 N type drive circuit and instruction booklet. **£8.10.0.** Carr. 10/-.

OSCILLOSCOPE!!

Latest Ministry release of Test Set type 43. Employs 3½in. CRT type VCR138A, 4-617. 4-VR54. 1-5Z4, 1-VU120. Panel controls : X shift, Y shift, Focus. Brilliance, External or internal sync., Four speed time base. Internal H.T. & E.H.T. Mains power pack. Size 12in. x 9in. x 18in. Complete with leads. Brand New and Unused.



£8.10.0

Carr. 15/-.

SIGNAL GENERATOR AND WAVEMETER

Type W.1649. Frequency of Signal generator : 140 to 240 Mc/s. Accuracy ±0.5 Mc/s. Frequency of Heterodyne Wavemeter : 155-255 Mc/s. Accuracy ±0.2 Mc/s. Containing VR.135 and 4-VR915 meg. crystal. Retractable aerial. Power requirements : 6.3 volts and 120 volts. Unit housed in copper lined wooden case. Size 15½in. x 13in. x 14½in. **45/-**. Plus 10/-.

TRANSMITTER RECEIVER No. 19.

Two transmitter-receivers and an intercom amplifier in one case. "A" set covers 2—8 mc/s, RT and CW. and "B" set 240 mc/s, RT only. Complete with 15 valves and 500 Micro amp. check and Tuning Meter. Complete with circuit and instruction booklet. Only **60/-**, plus 10/- carr.

SPECIAL VALVE LIST

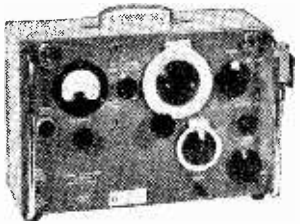
New Original Cartoned American Valves

2C26	3/6	6AG7	9/6	6X5GT	8/6	9006	3/6
2X2	2/6	6H6	2/6	807	6/-	12J5GT	6/-
3B24	7/6	6SH7	6/-	830-B	40/-	1625	5/-
5U4G	7/6	6SL7GT	7/-	955	1/9	446B	25/-
6AC7	5/-	6SN7GT	6/6	956	1/9	464A	25/-
6AG5	5/6	6V6GT	7/6	9004	1/9		

All brand new and fully tested. Please add postage.

SIGNAL GENERATOR TYPE 52A

Frequency 6-52 Mc/s. in four ranges. Internal mains pack. extensively filtered. 50μ amp. R.F. Meter. Internal or external modulation. Calibrated coarse and fine (in μ V.) attenuator, output impedance 70 or 100 ohms. minimum output 0.5 μ Volts, maximum output 100 mV. Complete with all leads, calibration charts and circuit. Brand new in original manufacturers' cases. **£8.10.0.** Carr. 10/-.



Relda Radio Ltd.

(Dept. "P") 32A, Coptic Street, London, W.C.1. *Phone : MUSeum 9607.*

Tottenham Court Road Underground. Fourth turning on the left down New Oxford Street.

WHEATSTONE BRIDGE.

Consisting of four stud switches : 0-10 ohms, 0-100 ohms O-INF. Galvanometer centre zero F.S.D. 2.5 mA. Ranges easily extended. Housed in oak cabinet 16 x 7½ x 6in. Complete with instructions, **40/-** P. & P. 4/-.

MUIRHEAD VERNIER SLOW MOTION DRIVES. Scaled 0-180 deg. Ratio 25 to 1. 3in. dia. **10/6**. P. & P. 1/6.

R.C.A. MAINS TRANSFORMERS. Input 110-240 v., output 345-0-345 at 150 mA. 6.4 v. at 4.5 amps. 5 v. at 2 amps. Brand new, fully shrouded. Limited quantity. Write now. Only **35/-**. P. & P. 3/-.

WESTON 1 Amp. H.F. METERS. 2in. circular. Brand new, **5/6**. P. & P. 1/-.

AMERICAN ROTARY CONVERTERS. With cooling Fan. Input 12 v. D.C. Output 250 v. at 90 mA. Completely suppressed. Brand new. **19/-** each. Plus P. & P. 3/-.

COMMAND RECEIVERS. 1.5-3 mc/s, fully valved, with circuit, **65/-**. P. & P. 3/6.

LUMINOUS MAGNETIC MARCHING COMPASS. Pocket size. Brand new with instructions. ONLY **12/6**. P. & P. 1/-.

POCKET VOLT METERS. Read 0-25 volts and 0-250 volts D.C. Brand new. Only **12/6**. P. & P. 2/6.

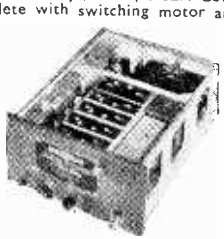
PUSH BUTTON COIL PACKS. 465 Kc/s. I.F. Gram., long, medium and 6 short waveband spread. **8/6**. Post 1/6.

RELAYS. 6,500 ohms and 3,500 ohms. **8/-** pair. Post paid.

WAVEMETER TYPE W1433. Frequency 154-260 mc/s., with crystal check and calibration chart. Mains 50 cycle. **50/-**. Carriage 10/-.

BENDIX RECEIVER MN26.C.

Covering 150-1,500 kc/s in 3 bands. Valves used 5-6K7, 2-6N7, 2-6J5, 1-6F6, 1-6L7. Complete with switching motor and



dynamotor. This superb unit has been modified for 12 v. operation. With circuit. Only **80/-**. Carr. 8/6.

R.S.C. BATTERY CHARGING EQUIPMENT

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	33/9
6 v. or 12 v. 4 amps	59/9

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

SELENIUM RECTIFIERS F.W. BRIDGE TYPES

6/12 v.	1 a.	4/11	
6/12 v.	2 a.	9/3	
6/12 v.	3 a.	11/9	
6/12 v.	4 a.	14/9	
6/12 v.	6 a.	19/9	
6/12 v.	10 a.	25/9	
6/12 v.	15 a.	35/9	

L.T. Types H.W.
2-3 v. ½ a., 1/11
6-12 v. ½ a, H.W., 2/9

H.T. Types H.W.

150 v.	40 mA,	3/9
250 v.	50 mA,	5/9
250 v.	80 mA,	7/8
250 v.	250 mA.	11/9

BATTERY CHARGER KITS

Consisting of Mains Transformer. F.W. Bridge, Metal Rectifier, well ventilated steel case. Fuses, Fuse-holders. Grommets, panels and circuit. Carr. 2/9 extra.

3 v. or 12 v. 1 amp	22/9
6 v. 2 amps	25/9
6 v. or 12 v. 2 amps	31/6
6 v. or 12 v. 4 amps	53/9

BATTERY CHARGER KIT

Consisting of F.W. Bridge Rectifier, 6/12 v. 5 a. Mains Trans., 0-9-15 v. 6 a. output and Ammeter, 49/9. Post 3/9.

ASSEMBLED CHARGER

6 v. or 12 v. 2 amps. Fitted Ammeter and selector plug for 6 v. or 12 v. Louvred metal case, finished attractive hammer blue. Ready for use. With mains and output leads. Double Fused. Only **49/9**. Carr. 3/9.

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

Assembled 6 v. or 12 v. 4 amps.

Fitted Ammeter and variable charge rate selector. Also selector plug for 6 v. or 12 v. charging. Louvred steel case with stoved blue hammer finish. Fused and ready for use with mains and output leads. Carr. 4/6. Credit Terms: Deposit 30/- and 4 monthly payments, 13/-. **75/-**

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. 2a.	16/9
350-0-350 v. 80 mA, 6.3 v. 2 a, 5 v. 2 a....	18/9
250-0-250 v. 100 mA. 6.3 v. 4 a, 5 v. 3 a.	23/9
300-0-300 v. 100 mA. 6.3 v. 4 a. 5 v. 3 a.	23/3
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 v. 4 a, C.T. 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. Midget type 2½-3in.	17/6
250-0-250 v. 100 mA, 6.3 v. 4 a. 5 v. 3 a.	28/9
250-0-250 v. 100 mA, 6.3 v. 6 a, 5 v. 3 a. for R1355 conversion	31/-
300-0-300 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, 5 v. 3 a.	23/9
300-0-300 v. 130 mA. 6.3 v. 4 a, 6.3 v. 1 a. for Mullard 510 Amplifier	35/9
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. 2 a, 5 v. 3 a.	35/9
425-0-425 v. 200 mA, 6.3 v. 4 a, C.T. 6.3 v. 4 a, C.T., 5 v. 3 a. Suitable Williamson Amplifier, etc.... ...	49/9

FILAMENT TRANSFORMERS

All with 200-230 v. 50 c/s. primaries 6.3 v. 1.5 a, 5/9; 6.3 v. 2 a, 7/6; 0-4-6.3 v. 2 a, 7/9 12 v. 1 a, 7/11; 6.3 v. 3 a, 8/11; 6.3 v. 6 a, 17/6; 12 v. 3 a, or 24 v. 1.5 a, 17/6.

JUNCTION TRANSISTORS. Brand new R.F. Type 17/6.

VOLUME CONTROLS with long (1in. diam.) spindle all values less switch, 2/9; with S.P. switch, 3/9; with D.P. switch, 4/6.

H.T. ELIMINATOR AND TRICKLE CHARGER KIT. Input 200-250 v. A.C. Output 120 v. 40 mA. Fully smoothed and rectified supply to charge 2v. accumulator. Price with louvred metal case and circuit, 29/6, or ready for use, 8/3 extra.

ELIMINATOR TRANSFORMERS

Primaries 200-250 v. 50 c.s.

120 v. 40 mA, 5-0-5 v. 1 a.	15/9
90 v. 15 mA, 4-0-4 v. 500 mA.	9/9

CHARGER TRANSFORMERS

All with 200-230-250 v. 50 c.s. Primaries:
0-9-15 v. 1½ a. 11/9; 0-9-15 v. 3 a. 16/9;
0-3-15 v. 5 a. 19/9; 0-9-15 v. 6 a. 21/9.

SMOOTHING CHOKES

250 mA, 5 H 100 ohms	12/9
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

Midget Battery Pentode 60:1 for 3S1, etc....	3/9
Small Pentode, 5,000Ω to 3Ω... ...	3/9
Small Pentode 7/8,000Ω to 3Ω ...	3/9
Standard Pentode, 5,000Ω to 3Ω ...	4/9
Standard Pentode, 7/8,000Ω to 3Ω...	4/9
10,000 Ω to 3Ω	4/9
Push-Pull 10-12 watts 6V6 to 3Ω or 15Ω	15/9
Push-Pull 10-12 watts to match 6V6 to 3-5-8 or 15Ω	16/9
Push-Pull EL84 to 3 or 15Ω	16/9
Push-Pull 15-18 watts, 6L6, KT66 ...	22/9
Push-Pull 20 watts, sectionally wound 6L6, KT66, etc., to 3 or 15Ω	47/9

MAINS TRANSFORMERS

Manufacturers' surplus. Primaries 200-250 v. 50 c/s. 250-0-250 v. 70 mA. 6.3 v. 2.5 a. Drop through type, 11/9. 375-0-375 v. 150 mA, 6.3 v. 4 a, C.T. 6.3 v. 1 a. Fully shrouded, 22/9. Postage 2/9 on either type.

SPECIAL OFFERS: Electrolytics. 32-32-32 mfd. 250 v. Dubilier small can, 2/9 ea. 150 mfd. 450 v., 3/9. Small .0005 mfd. 2-gang, 4/9 ea. Westinghouse Rectifiers 250 v. 250 mA, 7/9. **CO-AXIAL CABLE.** 75 ohm. 1in. 8d. yd. Twin-Screened Feeder 11d. yd.

R.S.C. BATTERY TO MAINS CONVERSION UNITS

Type BM1. An all-dry battery eliminator. Size 5½ x 4½ x 2in. approx. Completely replaces batteries 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 5½ x 2½in. Supplies 120 v. 90 v. and 60 v., 40 mA, and 2 v. 0.4 a to 1 amp, fully smoothed. **Thereby completely replacing both H.T. batteries and L.T. 2 v. accumulators.** When connected to A.C. mains supply 200-250 v. 50 c.s. **SUITABLE FOR ALL BATTERY RECEIVERS** normally using 2 v. accumulator. Complete kit of parts with diagrams and instructions, 49/9, or ready for use, 59/6.

MINIATURE MOTORS. 24/28 v. D.C. or A.C. made by Hoover Ltd., Canada. Size only 2½ x 1¾in. Spindle 1¼in. long, ¼in. diam. Brand New, 9/9.

HEADPHONES. Brand new. Low resistance. Only 6/9 pr.

EX-GOVT. 50 WATT SPEECH AMPLIFIERS. For normal 200-250 v. A.C. mains. Complete with hand 'mike' with good length of lead and all valves. Ready for use, in wood transit cases. Only 9 Gns., carr. 15/-.

TANNOY RE-ENTRANT 8 WATT SPEAKERS. For use with above, 27/6 ea.

EXTENSION SPEAKERS

Ready for use in walnut veneered cabinet.

8in. 2-3 ohms, 35/9.

Very limited number.

EX-GOVT. METAL BLOCK (PAPER) CONDENSERS.

4 mfd. 350 v., 2/9;	4 mfd. 1,000 v., 4/9;
8 mfd. 500 v., 4/9;	10 mfd. 500 v., 3/9;

EX-GOVT. SMOOTHING CHOKES

300 mA, 20 H 200 ohms	19/9
250 mA, 5 H 50 ohms	12/9
150 mA, 10 H 100 ohms	11/9
150 mA, 6-10 H 150 ohms Trop. ...	6/9
120 mA, 12 H 100 ohms	9/9
100 mA, 5 H 100 ohms	3/11

EX-GOVT. E.H.T. SMOOTHING CONDENSERS. .02 mfd. 5,000 v. Cans. 2/9.

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. It consists of a high gain H.F. stage and low distortion anode bend detector. Power pentode output is used. Valve line-up 6K7, SP61, 6V3G. 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, 1/9. Maximum building costs £4/19/6, including attractive Brown or Cream Bakelite or Walnut veneered wood cabinet 12 x 6½ x 5½in.

EX-GOVT. DOUBLE WOUND STEP UP/STEP DOWN TRANSFORMERS. 10-0-100-200-220-240 v. to 5-0-75-115-135 v. or REVERSE. 80-100 watts. Only 11/9, plus 2/9 post. 10-0-100-200-220-240 v. to 9-0-110-122-136-148 v. or REVERSE. 200 watts, 35/9, plus 7/6 carr. Both 50 c.p.s.

EX-GOVT. MAINS TRANSFORMER. Primary 0-110-120-200-210-220-230-240-250 v. 50 c.p.s. Secs. 275-0-275 v. 100 mA, 6.3 v., 7 a, 5 v. 3 a, Govt. rating, 22/9. Following with 230-250 v. primaries, 400-0-400 v. 200 mA, 5 v. 3 a, 5 v. 2 a, 19/9; 230-0-230 v. 100 mA, 12.6 v. 1.5 a, 5 v. 2 a, 11/9; 12.6 v. 3 a, 5 v. 3 a, 9/9. Postage 2/9 on any type.

Primary 200-250 v. Sec. 0-16-18-20 v. 60 amps Suitable Welding or Soil Heating, 79/6, carr. 7/6.

EX-GOVT. CASES. Size 14-10-8½in. high. Well ventilated, black crackle finished, undrilled cover. IDEAL FOR BATTERY CHARGER OR INSTRUMENT CASE, OR COVER COULD BE USED FOR AMPLIFIER. Only 9/9, plus 2/9 postage. Size 8½ x 13½ x 8½ ins. with undrilled well ventilated cover, finished in stoved grey enamel. Suitable for charger or instrument case, 7/8, plus 2/9 post.

EX-GOVT. VALVES (NEW)

1T4	7/9	6J6	4/9	ECC91	4/9
1S5	7/9	6V6G	7/9	EF80	7/9
3S4	8/9	6X4	6/9	EB91	4/9
5Y3G	8/9	6X5GT	8/9	EF91	8/9
5U4G	8/9	6L6G	11/9	EF36	4/9
5Z4G	9/9	807	7/9	EL32	3/9
6K7G	5/9	12A6	7/9	KT44	8/9
6SJ7GT	6/9	15D2	4/9	EZ90	6/9
6SLGT	8/9	35Z4GT	8/9	EL84	10/6
6SN7GT	8/9	MH4	4/9	FW4/500	9/9
6AT6	7/9	ECC83	9/9	SP61	2/9

ELECTROLYTICS (current production) NOT EX-GOVT.

Tubular Types	Can Types
8µF 450 v. ... 1/9	16 mfd. 350 v. 1/11
8 mfd. 500 v. 2/6	16 mfd. 500 v. 2/9
16µF 350 v. ... 2/3	16µF 450 v. ... 2/9
16µF 450 v. ... 2/9	32µF 350 v. ... 2/11
16µF 500 v. ... 3/9	32 mfd. 450 v. 4/9
32µF 350 v. ... 3/9	100 mfd. 450 v. 4/9
25µF 25 v. ... 1/3	8-8µF 450 v.... 2/9
50µF 12 v. ... 1/3	8-16µF 450 v. 3/11
50 mfd. 25 v. ... 1/6	16-16µF 450 v. 4/11
50µF 50 v. ... 1/9	32-32µF 350 v. 4/9
100 mfd. 12 v. 1/9	32-32µF 450 v. 5/9
100 mfd. 25 v. 2/3	100-100 mfd. 350 v. 4/9
1,500 mfd. 6 v. 1/6	64-120 mfd. 350 v. 7/9
3,000 mfd. 6 v. 3/9	100-200 mfd.
6,000 mfd. 6 v. 3/9	275 v. ... 6/9

Many others in stock.

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 ± 3db., 30-30,000 c/cs. 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 **STRING BASS, GUITARS,** etc. **OUTPUT SOCKET** with plug provides 300 v. 20 mA. and 6.3 v. 1.5 a. For supply of a **RADIO FEEDER UNIT.** Size approx. 12-9-7in. For A.C. mains 200-230-250 v. 50 c/cs. 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/-.

£7-15-0

If required louvred metal cover with 2 carrying handles can be supplied for 18/9. Additional input socket 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** 25/6 and nine monthly payments 25/6.

HIGH-FIDELITY MICROPHONES and **SPEAKERS** in stock. Keen cash prices or Credit terms if supplied with amplifier.

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/cs. A specially designed sectionally wound ultra linear output transformer is used with 807 output valves. All components are chosen for reliability. Six valves are used, EF86, EF86, ECC83, 807, 807, GZ33. Separate Bass and Treble Controls are provided. Minimum input required for full output is only 12 millivolts so that **ANY KIND OF MICROPHONE OR PICK-UP IS SUITABLE.** The unit is designed for **CLUBS, SCHOOLS, THEATRES, DANCE HALLS or OUTDOOR FUNCTIONS,** etc. For use with Electronic **ORGAN, GUITAR, STRING BASS,** etc. For standard or long-playing records. **OUTPUT SOCKET PROVIDES** L.T. and H.T. for a **RADIO FEEDER UNIT.** An extra input with associated vol. control is provided so that two separate inputs such as Gram and 'Mike' can be mixed. Amplifier operates on 200-250 v. 50 c/cs. A.C. Mains and has outputs for 3 and 15 ohm speakers. Complete kit of parts with fully punched chassis and point-to-point wiring diagrams and instructions. If required cover as for A8 can be supplied for 18/9. The amplifier can be supplied, factory built with 12 months' guarantee, for **£13.13.0. TERMS: DEPOSIT 36/-** and 9 monthly payments of 31/-.

ONLY £10-19-6 Carr. 10/-

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 200-250 v. Auto Trans. only **7 Gns.** Carr. 5/6.

COLLARO CONQUEST 4-SPEED AUTO-CHANGERS with high fidelity Studio Pick-up. Latest model. Brand new. Cartoned. For 200-250 v. 50 c.p.s. A.C. mains. Our price **£8 19/6.** Carr. 5/6. Credit Terms. Deposit **3 gns.** and 6 monthly payments of **21/6.**

COLLARO 4 SPEED SINGLE PLAYER with separate pick-up, as fitted RC457. For 200-250 v. A.C. mains. **£4.12.6.** Post 3/9.

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 6¾ x 4¼ x 2¼in. Controls: Vol. and Tone with switch. Guaranteed 12 months. Only **55/9.**

SUPERHETFEEDER 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.Ch. Sw. incorporates Gram position. Controls are Tuning, W.Ch. and Vol. Only 250 v. 15 mA. H.T. and L.T. of 6.3 v. 1 amp. required from amplifier. Size of unit approx. 9-6-7in. high. Simple alignment procedure. Point-to-point wiring diagrams, instruction 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 feed-back 12 db. Separate Bass and Treble Controls. For A.C. mains input of 200-250 v. 50 c/cs. Output for 2-3 ohm speaker. Three miniature Mullard valves used. Size of unit only 6-5-5¼in. 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 200-230-250 v. 50 c/cs. A.C. mains. Valve line-up ECC83, ECC83, EL84, EL84, EZ81 miniature Mullard. The unit has self-contained Pre-amplifier Tone Control stages and separate Bass and Treble Controls. Independent 'Mike' and Gram input sockets are provided. Size is only 9-7-6in. Output Matchings for 3 and 15 ohm speakers. Only **12 GNS.** or Deposit 26/9 plus 10/- carr. and 9 monthly payments of 26/9. Send S.A.E. for leaflet.

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

A highly-sensitive 4-valve quality amplifier for the home, small club, etc. Only 50 millivolts input is required for full output so that it is suitable for use with the latest high-fidelity pick-up heads, in addition to all other types of pick-ups and practically all 'mikes'. Separate Bass and Treble Controls are provided. These give full long-playing record equalisation. Hum level is negligible being 71 db. down. 15 db. of negative feedback is used. H.T. of 300 v. 25 mA. and L.T. of 6.3 v. 1.5 a. is available for the supply of a Radio Feeder Unit, or Tape Deck pre-amplifier. For A.C. mains input of 200-230-250 v. 50 c/cs. Output for 2-3 ohms 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 LT45 HIGH QUALITY TAPE DECK AMPLIFIER. With "built in" power pack and output stage. For Tape Decks with High or Low Impedance, Playback and Erase Heads, such as Lane, Truvox, Aspden, Collaro, Brennell, etc. For A.C. Mains 230-250 v. 50 c/cs. **Linear frequency response of ± 3 db., 50-11,000 c/cs.** Negative feedback equalisation. Illustrated leaflet 6d.

Ready for Use. ONLY 12 GNS. Carr. 7/6

STAAR GALAXY 4 SPEED MIXER AUTO-CHANGER. Attractive two tone finish. A precision manufactured unit with a motor which virtually eliminates "wow" and rumble. The only changer with exclusive finger tip control. Playing Desk size 11½ x 10in. Depth below baseboard 2in. Above 5in. Fitted pick-up with dual sapphire tipped stylus. For 200-250 v. 50 c.p.s. A.C. mains. A limited number of these luxury units available at only **9 GNS.** Carr. 4/6. Brand New.

R.C.A. 20 WATT RE-ENTRANT SPEAKERS, 15 ohms or 600 ohms matching. For Outdoor work. Only **8 GNS. P.M. 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.** 6½in. Goodmans, **17/9.** 8 in. Rola, **19/9.** 10in. Goodmans, **27/9.** 10 x 6in. Elliptical Goodmans, **27/9.** 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 ohm HIGH FIDELITY SPEAKER 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 complete, only **£5/17/6.**

M.E. SPEAKERS 2-3 ohms, 8in. R.A. Field, 600 ohms **11/9.**

R.S.C. 3-4 WATT A7 HIGH-GAIN AMPLIFIER

For 230-250 v. 50 c/cs. 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.

AM/FM RADIOGRAM CHASSIS HIGH QUALITY 6-8 WATT PUSH-PULL OUTPUT

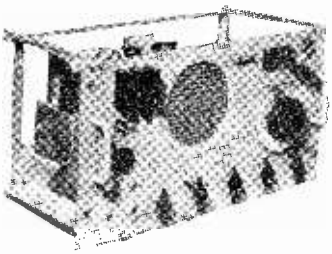
For 200-250 v. Mains. Long wave, Medium, F.M. and Gram. Complete with 8 B.V.A. valves. Guaranteed 12 months. Only **22 GNS.** Or Deposit £2/12/- and 9 monthly payments of £2 12/-.

Terms: C.W.O. or C.O.D. NO C.O.D. under £1. Post 1/9 extra under £2; 2/9 extra under £5.
All goods supplied subject to terms and guarantee as detailed in current catalogue.
Open 9 to 5.30; Sats. until 1 p.m. Catalogue 6d. Trade list 5d. S.A.E. with all enquiries.

RADIO SUPPLY CO. (LEEDS) LTD.

32, THE CALLS, LEEDS, 2

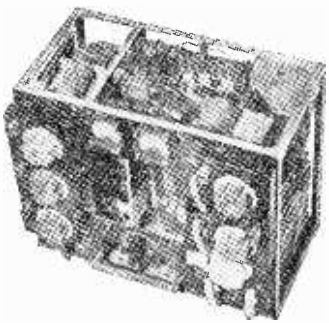
SHORT WAVE COMMUNICATIONS RECEIVER
R.208. ONLY £6 - 19 - 6



This is a super short-wave receiver covering 5-9) metres (10-6) Mc's). Uses 6 valves. Has R.F. stage, 2 I.F. stages, B.F.O. etc. Muirhead instrument drive, two internal power packs, mains and battery vibrator pack. Complete with own P.M. speaker. Provision for phones and speaker muting. Complete in metal transit case; size approx. 24 x 18 x 12in.; weight 70lb. Suitable A.C. mains 100-250 and 6 volt battery. In perfect condition, practically unused. Tested before despatch and guaranteed. Handbook free with each. Price **£6.19.6**, carriage and insurance 15/-.

Famous Transmitter virtually given away

The famous R1154N—unused but slightly soiled and not tested. Covers 200-500 Kc's, 3-5.5 Mc's and 5.5-10 Mc's. Has unique "click stop" mechanism (7 stops) and permits selected frequency to be held, returned to, etc. Hartley Oscillator, Power Amplifier, Keying and Speech. Wonderful breakdown value, meters, relays, switches. Complete with valves—real bargain at 29/6 plus 10/- carriage.



STOP PRESS ITEMS

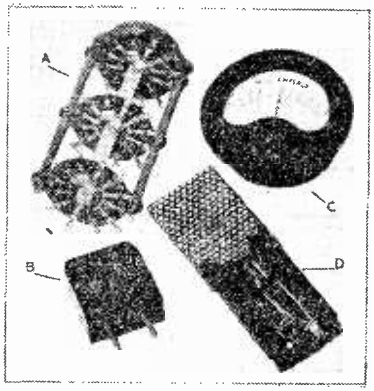
R. & C. SUBSTITUTION BOX

As described in last month's issue—author describes this as second most used instrument on his bench. Kit of components with full instructions. **£2.10.0**, plus 2/6 post and insurance.

SIMPLETONE

electronic organ described in February issue. Kit of components as specified complete with valves but not chassis or case. **£4.10.0**, plus 3/6 post and ins.

FOUR EXCEPTIONAL BARGAINS



A **Yaxley Switch.** 4-position, 6 pole, 1in. spindle of reasonable length. Price 2/6 or 24/- per doz.

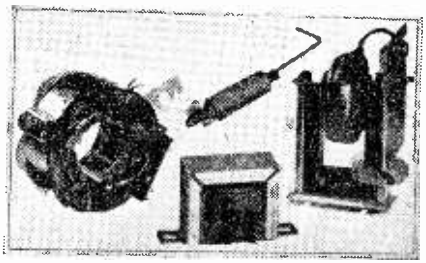
B **500KC Crystal,** plug-in type, 6/6.

C **5-0-5 Centre Zero Milliamp Meter.** 2½in. moving coil. **17/6**, plus 1/6 post and insurance.

D **Thermal Delay Unit.** 6.3 operated. Switches on or off, **3/6**.

FOR THOSE EXTRA PLUG POINTS

Three-core cable 7.029 (15 amps) 500 v. grade—a big purchase enables us to sell this at **37/6** per coil (50 yards). Carriage 3/6.



FOUR ITEMS FOR THE PRICE OF ONE

This set of modern T.V. parts is equally suitable for modernising an old televisor or for building into a new one. Suitable for wide angle 14in. or 17in. tubes using EHT or 12-14 kV. The four items comprise: (1) Line output EHT transformer (2) 70° scanning coils on ferrite yokes. (3) Width control with ferrite core. (4) Frame output transformer. With these parts we also give free, complete circuit diagram of a modern televisor which uses them. We offer the whole lot at the price of the Line output transformer only, namely **57/6**, plus 2/6 post and insurance.

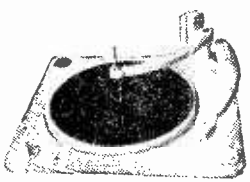
TABLE RECEIVER CABINET

Fine walnut veneered table receiver cabinet complete with metal chassis, three colour glass scale back plate and scale mounts, as illustrated but less knobs. Offered at less than the price of the cabinet, namely **39/6** plus 5/- carriage and insurance.

HI-FI SNIP
Infinite Wall Baffle

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

Yours for 10/- down and 17 weekly payments of 10/- or cash price £8.10.0

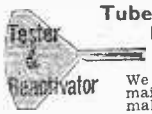


The latest most up-to-date Record Player made by the famous B.S.R. company. Using Hi-Fi Crystal Pick Up and fitted with every modern device. Definitely a record changer which will give years of trouble-free music. Not surplus but the current model. Price **£8/10.-** or 10/- deposit and 17 weekly payments of 10/-, carriage and insurance 5/-.

ELECTRONIC PRECISION EQUIPMENT LTD.
66 GROVE ROAD, EASTBOURNE

For Shop Address see Double Page Advertisement

Tube Tester and Re-Activator



We can supply all the main components for making this unit which will not only test Cathode Ray Tubes but also will re-activate them, supplied complete with full instructions. Price £3, plus 2/6 post and ins.

Transistor Timer

All the parts for making transistorised Enlarging or Process Timer with constructional details. £2/10/-. plus 2/6 post and pks.

Beginner's Superhet

All the components including metal chassis, valves, metal rectifier, coils, tuning condenser, etc., etc. required to build the "Beginner's Superhet" as described in the January issue, are available as a parcel. Price £3, plus 3/- post and ins.

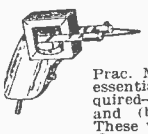
Condenser Tester and Re-Activator

This unit tests condensers under correct working conditions at proper voltages, it can also be used for "reforming" electrolytics. All basic parts and full instructions, 50/-, plus 2/6 post and ins.

Band III Converter

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.

Making a Solder Gun



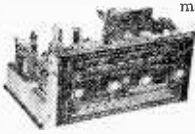
A 7-second solder gun of the type costing £3-£4 was described in Prac. Mech. Only two essential parts are required—(a) transformer and (b) push switch. These we can supply at 13/6, plus 2- post. The rest of the parts you will have in your own "junk" box. Copy of the article concerned given free with the kit.

A.C./D.C. Multimeter Kit

15 Basic Ranges

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.

AM/FM Chassis



made by the famous McCarthy Radio. This employs a printed circuit in the F.M. Tuner section, it uses 8 valves and has a very attractive three colour dial, size approximately 12 x 5¼in., covers four wavebands: 1000-2000 m., 200-550 m., 15-50 m., and 88-100 mc/s. This is a precision made chassis with four controls, tuner, volume, wavecharge and tone. Fully guar. Price £22/10/-, post and ins. 5/-.

19 RANGE TESTMETER

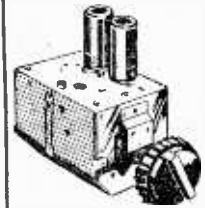
Can be yours for only 10/- deposit and 19 payments of 10/- weekly. Like all AVO meters it is a very fine instrument: it has a sensitivity of 10,000 ohms per volt and 19 most useful ranges as follows:—D.C. volts 0-1,000 (seven ranges), A.C. volts 0-1,000 (five ranges), D.C. Current 0-1 amp. (5 ranges), resistance 0-2 megs. (2 ranges) (complete with test leads). Immediate delivery. **Cash price £9.10.0—non-callers please add 3/6 post & ins.**

FREE GIFT.—All purchasers of the above item this month will receive the M.M. Range Extender which adds: capacity 0.1 m.r. in two ranges—inductance 0-100 henrys and decible —20 to + 36.

TAPE DECK SNIP—LAST CHANCE

TAPE DECK.—Made by the famous Truvox Company. This contains exactly the same essentials as the current model. Only the styling is different. It also takes the sterophonic head.

SPECIFICATION.—3 B.T.H. shaded pole motors with silent friction drive eliminating wow and flutter. Push button controls, elecrically and mechanically interlocked. Patented electric type push button controlled brake. Tape loading on the drop in principle, accommodation for reels of 7in. diameter. Tracking sense to British and American standards. Playing times: up to 3 hours with L.P. Tape or 2 hours with Standard Tapes. Two tracks side by side with safety gap. Positive Azimuth adjustment of Record/Player head. High Impedance Heads. Overall size 14½ - 12½ - 5in. approx. 120 only of these fine decks offered at non-repeatable price of **£17/10/-.** Non-callers add 10/- carriage and ins.



NOW 2 MODELS
Turret Tuner

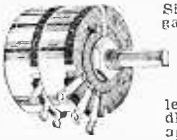
Brand new stock, not surplus, with coils for Band I and III complete with valves. Model 1 I.F. output 33·38 Mc/s. Series heaters. Model 2 I.F. output 16-19 Mc/s. Parallel heaters. With instructions and circuit diagram. 79/6. With knobs 3/6 extra, post and insurance 2/6.

THIS MONTH'S SNIP
Complete Walkie-Talkie for £1

Complete Walkie-Talkie Radio Transmitter has a range of approx. 5 miles. Just right for search parties, fire brigades, etc. Operates on dry batteries. Complete with five valves and in metal case. Size approx. 9" x 6" x 3½". Unused but not tested or guaranteed. £1 only, plus 2/6 post and insurance.

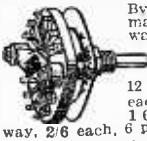
Big stocks of all types of components are kept at all depots. Some special component bargains are also listed below.

Morganite Potentiometers



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

Ceramic Switches

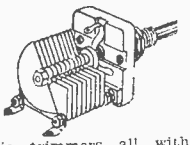


By one of our best makers, 3 pole, 3 way, 2/6 each, also standard type switches 12 pole, 2 way, 1/6 each, 6 pole, 3 way, 1/6 each, 3 pole, 6 way, 2/6 each, 6 pole, 4 way, 2/6.

50 assorted resistors. Well mixed and useful values, ½ and ½ watts. **Price 5/- per 50.**

50 assorted resistors. Well mixed

Fine Tuners



Ceramic trimmers all with ¼in. spindle of fair length, 5, 10, 15, 30-P.F. at 2/3 each or 24/- per dozen.

Transistors

A good range of transistor parts, miniature transformers, electrolytics, etc., available at all branches.

Red Spot and audio ... 10/-
Blue Spot 1.6 Mc/s. ... 15/-
White Spot 2.5 Mc/s.... 20/-

Filament Transformer

Suitable 200-250 input, output 6.3 volts 1½ amps. Price 6/6.

Connecting Wire

P.V.C. covered in 100ft. coils—2 or 3 a coil or four coils different colours. 10/- post free.

Mains Transformer. 250-0-250, 60-80 mA. 6.3 v. standard mains input. Half shrouded, 15/-, post and insurance 2/6.

.1 mfd. 350 v. Small Tubular Metal cased Condensers. Made by Dubilier. 2/6 per dozen.

Germanium Diodes. B.T.H., with wire ends. **10d.** each or **9/-** dozen.

Midget I.F. Coils. Dust cored, size 1¼ x 1in., 465 Kc/s. **6/6** pair.

Standard Size I.F. Coil. Dust cored. 465 Mc/s. **6.6** pair.

.0005 twin gang tuning condensers. 4/9, post 9d.

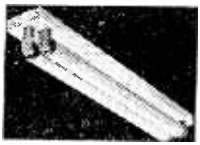
Bakelite 5 Amp. Electric Wall Switch. "Hicraft." **9d.** each, or 8/- per dozen.

Series, parallel and off-electric wall switch made by Crabtree. Price 1/3 each, or 13/6 per dozen.

BAND III PRE-AMP

In difficult areas it will be necessary to increase the signal level and this is the ideal unit for this purpose. It is A.C. mains operated and is fitted with input and output coax. plugs. Price **£4**, post and packing 3/6.

FLUORESCENT LIGHTS



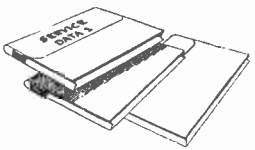
These are complete fluorescent lighting fittings. Built-in ballast and starters—stove enamelled white and ready to work. Ideal for the kitchen, over the work-bench and in similar locations.

Single 40. 4ft. 3in. long, uses a 40-watt tube.

Twin 20. Uses 2 20-watt standard tubes.

Price for either type **39/6**, with tubes. Carriage and ins. up to 150 miles 5/6, up to 250 miles 7/6.

T.V. SERVICE SHEETS



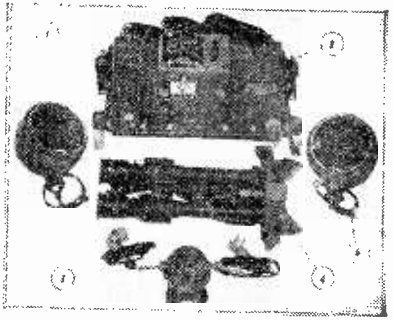
100 sheets covering the most popular post-war Televisors by leading makers—Cossor, Ekco, Ferguson, Pye, etc., etc. Give circuit diagram component values, I.F. frequencies, etc., £1 post free.

CRYSTAL MICROPHONE

Miniature crystal type has high gain and is suitable for all purposes—tape recorders—amplifiers. Price **4/9**, post and ins. 9d.

MAINS-MINI

Uses high-efficiency coils, covers long and medium wave-bands and fits into the neat white or brown bakelite cabinet—limited quantity only. All the parts, including cabinet, valves, in fact, everything, **£4/10/0**, plus 3/6 post. Constructional data, free with the parts, or available separately **1/6**.



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—**£10**, plus 10/- carriage and insurance. Mains power pack £4 extra.

PUBLICATIONS FOR CONSTRUCTORS

Title	Short Description	Price of data
Car Starter Charger	A 6-12 volt 5 amp battery with overcharge position.	1/6
Chimelite ...	Door chimes and hall light combined.	2/-
I.T.A. Converter	A two valve unit suitable for converting any type of television.	1/6
Crispian	Four valve all dry battery portable.	1/6
Economy Amplifier	Cheapest possible 3 valve mains amplifier	1/6
Skysearcher ...	Cheapest possible 3 valve mains receiver for medium wave.	1/6
Economy Three...	Three valve battery version of the Skysearcher.	1/6
F.M. Tuner ...	Good unit quality tuner based on the original Radio Constructor circuit.	1/6
Mini Radio ...	Four valve mains T.R.F. medium and long wave.	1/6
A.C./D.C. Multimeter	15 range test meter for A.C. and D.C. volts, ohms and milliamps.	1/6
Simplex	The simple transistor receiver for headphones.	9d.
Transistor Timer	For photographic and process timing.	9d.
Easy to Build T.V.	A modern set suitable for wide angle 14" or 17" tubes which can be assembled in an evening, only 24 solder joints to make!	3/6
Condenser Tester	Tester for all types of condensers, can also be used for reforming electrolytics.	9d.
C.R.T. Tester ...	A device for testing and re-activating television picture tubes.	9d.
Beginners' Superhet	A 4 valve mains operated receiver, simple to make and align.	9d.
Two Way Switch	Describes how to control a light from two points.	9d.
Moisture Operated Switch	Describes a switch which is operated by moisture.	9d.
Electric Blanket	Describes how to make a foolproof, waterproof electric blanket.	9d.
Anti-burst ...	Describes how pipes in lofts can be prevented from freezing.	9d.
Thermal Delay Switch	Gives circuits of process timer, sequence switch, overload relay, smoke control, etc.	9d.
Solder Gun ...	Shows how to make a 7 second solder gun.	9d.

Special Offer : All the above booklets and pamphlets, 12/6 or any ten at half price.

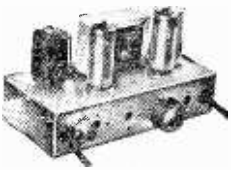
Guitar Amplifier operates directly from A.C. mains—high-fidelity.

3-valve 4/5 watt with frequency response better than 40-15,000 c.p.s. Control panel size 8in. x 2½in. comes fixed to chassis but is intended for independent mounting. Separate bass and treble controls giving fullest variation of cut and lift. Separate switch, absolutely no mains hum. Remarkable value at **£4/19/6**.

500 WATT STEP DOWN TRANSFORMER

With output tapped from 110 v.-155 v. in 3 volt steps, massive transformer which will withstand considerable overloading. Price **45/-** plus 5/- carriage (up to 250 miles).

The "ESTRONIC" Band III Converter



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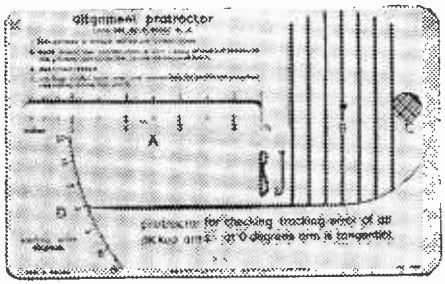

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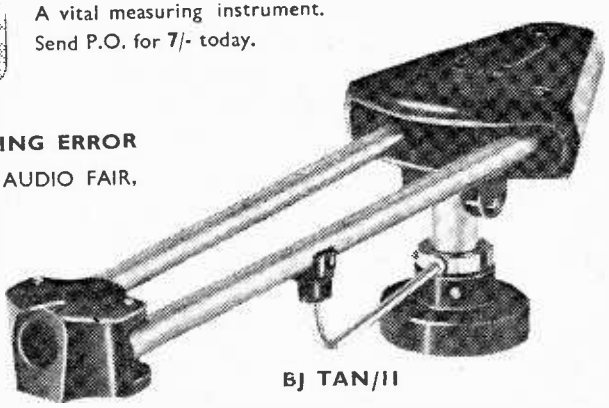

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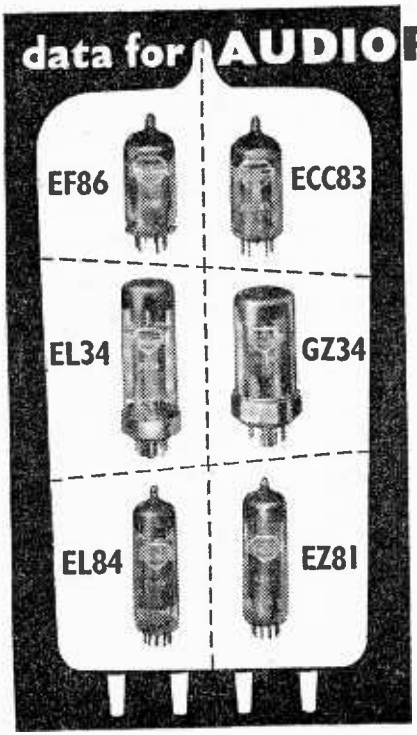

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EVERY MONTH EDITOR : F. J. CAMM 26th YEAR OF ISSUE

VOL. XXXIV, No. 616, APRIL 1953

COMMENTS OF THE MONTH BY THE EDITOR

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CONTENTS :

The Editor will be pleased to consider articles of a practical nature. Such articles should be written on one side of the paper only, and should contain the name and address of the sender. Whilst the Editor does not hold himself responsible for manuscripts, every effort will be made to return them if a stamped and addressed envelope is enclosed. All correspondence intended for the Editor should be addressed : The Editor PRACTICAL WIRELESS, *George Newnes, Ltd., Tower House, Southampton Street, 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.*

ADVICE TO CONTRIBUTORS

DURING the course of the year large numbers of manuscripts are submitted to us, but a proportion of them have to be rejected for various reasons. It will be helpful to contributors if they bear in mind the following points. Preference is given to constructional articles, not necessarily of complete receivers, but also of components and test gear. The articles must actually have been made and tested, and they must be original. Articles which should be from 1,500 to 2,000 words in length, typewritten on one side of the paper only, using double spacing, and 1 in. margins, should contain the name and address of the contributor on the top left-hand corner of the first folio. They should be accompanied by a list of components, with values, and sources of supply. All of the components must be readily available. Articles describing a piece of apparatus designed round some old components "found in the junk box" are not required, since all readers' junk boxes may not contain such components. A circuit diagram, should accompany the list of the components, and be marked to coincide —V1, V2, etc. ; R1, R2, etc. ; C1, C2, etc. A wiring diagram should also be included as well as photographs. Negatives should also be supplied. We pay on a generous scale for all such articles. In the first place you should write a letter to us, outlining the proposed article so that we can ascertain whether the subject appeals.

—AND ADVICE TO QUERISTS

MAY we once again remind readers that our Query Service is only available to those who provide evidence of their readership by enclosing the query coupon cut from the current issue. It appears at the foot of page iii of the cover each month. A stamped and addressed envelope must also be enclosed. We are receiving so many letters from those who are obviously not readers of the paper that we are compelled to insist upon rigid adherence to our rules. We cannot undertake to answer questions aroused by articles in contemporaries, nor can we undertake to modify circuits to suit individual requirements. Purchasers of ex-Government apparatus should address queries relating to such to the suppliers.

HOME CONSTRUCTION ON THE INCREASE !

IT is pleasant to be able to record in this 26th year of our existence that the sales of this journal continue to increase and that more sets are being built than has been the case since 1939. Each year sees a new generation come along anxious to learn the fundamentals by the practical instruction which set building provides.

THE 1958 RADIO SHOW

THE 25th National Radio and Television Exhibition will be held at Earls Court, London, from Wednesday, August 27th to Saturday, September 6th, with a preview on Tuesday, August 26th.—F.J.C.

Our next issue, dated May, will be published on April 2nd.

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 December, 1957, 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	1,083,676
Home Counties	1,087,938
Midland	809,336
North Eastern	1,056,632
North Western	789,236
South Western	678,336
Wales and Border Counties ...	424,468
Total England and Wales ...	5,929,622
Scotland	779,274
Northern Ireland	184,087
Grand Total	6,892,983

Receiver Sales Top Million

THE monthly retail survey for November, published recently by the British Radio Equipment Manufacturers' Association, shows that retail sales of radio receivers (excluding car radios) for the first eleven months of the year was over one million, compared with 982,000 for the whole of 1956.

A comparison of sales during the eleven-month periods January-November, 1957 and 1956, shows that television receiver sales have declined by 3 per cent.; sales of radio receivers have increased by 20 per cent.; and sales of radiograms by 24 per cent. (It should be noted that the statistics cover retail sales only and do not include rental or relay transactions.)

Orkney V.H.F.

AS already announced, the BBC proposes to build a combined Television and V.H.F. Sound broadcasting station in Orkney to serve the Orkney Islands and the north coast of Caithness. Consideration of the method of conveying the sound and vision signals from the main network to the area to be served has shown that the signals can best be relayed from a point near Wick and thence to Orkney. It has been decided, with the approval of the Postmaster General, that the installation at Wick will be designed in such a way as to provide the radio link to Orkney and at the same time to provide V.H.F. Sound and Television services in Caithness.

V.H.F. Multichannel Radio Link

THE capacity of the Salisbury-Umtali V.H.F. multichannel radio link in Southern Rhodesia operated by the Ministry of Posts is to be extended by a purchase of additional Marconi radio equipment and a rearrangement of the existing units. The route, covering a distance of some 135 miles, will be completed in four hops, with terminals located at Salisbury and Umtali, and repeater stations at Marandellas, Castle Beacon and Rusape.

A single path system will be employed using the well-tried Marconi Type HM100 V.H.F. multichannel terminal units at all the sites except Rusape, where a Marconi Type HM150 V.H.F. multichannel repeater will be installed. The repeater stations at Marandellas and Castle Beacon will have back-to-back HM100 terminals, so that provision is made for a number of channels to be taken off at these sites when required at a future date.

Music by Wire

THE Postmaster General announces that he is prepared to consider applications from private persons and companies for licence to distribute music by wire. The Postmaster General's consent is required for such music services, for they would otherwise infringe his telegraphic monopoly.

The licence will allow persons and companies to operate music distribution centres and wire networks for sending their own programmes of recorded music to business premises such as shops, restaurants, offices and factories but not to private homes. Live or recorded radio broadcast programmes, advertise-

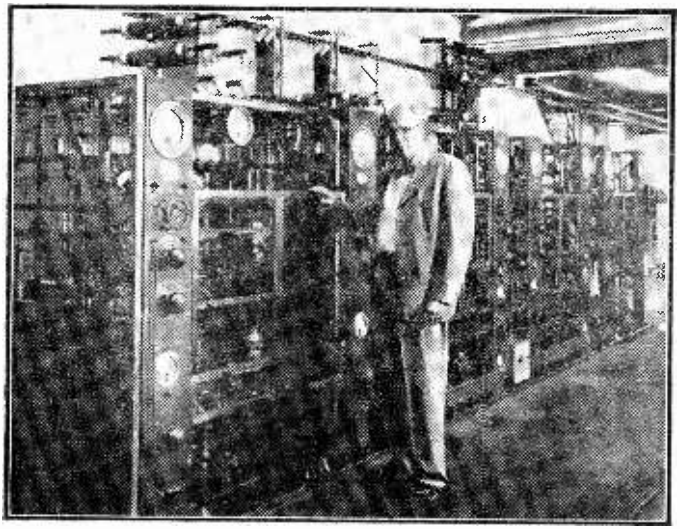
Tuning forks are used by the Police to check the new radar speed traps. Five forks are used to check at 20, 30, 40, 50 *and* 60 *m.p.h.*

ments and propaganda will not be permitted. The area over which music may be distributed will be defined in the licence.

Licensees will themselves have to provide the wires from the music distribution centres to their customers' premises but where the Post Office has spare wires these may be rented for linking music distribution centres one with another.

Ekco Search Radio

THE Vickers "Viscount" airliners now operated by the Iraqui Airways are being fitted with Ekco Airborne Search Radar.



The 30-year-old transmitter in South Africa.

This Ekco radar equipment, which is already installed in the B.O.A.C. Bristol "Britannia" fleet and is specified for many other modern airliners, detects turbulent cloud formations ahead of the aircraft, thus enabling the pilot to take avoiding action. Ekco Search Radar also gives an accurate indication of high ground in the path of the aircraft and provides facilities for "map painting" the land below.

B.I.R.E.

THE following meetings will take place during March, 1958:

London: London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, London, W.C.1, Tuesday, March 18th, at 6.30 p.m. A Discussion on the Technical Committee's Report "Recommended Method of Expressing Electronic Measuring Instrument Characteristics. 1:—A.M. or F.M. Signal Generators." Wednesday, March 26th, at 6.30 p.m. "Electronics in Medicine."—R. F. Farr, B.Cs.

North Eastern: Wednesday, March 12th, at 6 p.m. Institution of Mining and Mechanical Engineers, Neville Hall, Westgate Road, Newcastle-upon-Tyne. "Industrial Television."—S. G. Gobbi.

West Midlands: Wednesday, March 12th, at 7.15 p.m. Wolverhampton and Staffordshire Technical College, Wulfruna Street, Wolverhampton. "Analogue Computers"—K. C. Garner.

Frequency Allocation Committee

THE Postmaster General announces that the members of the Frequency Allocation Committee have been appointed following the recent announcement that Sir Lawrence Bragg would be its Chairman. The Committee will be representative of the radio industry, users' organisations and Government departments and it is expected that its meetings will provide opportunity for industry and users to be associated more closely with frequency planning.

The terms of reference are "to advise the Postmaster General on the broad aspects of radio frequency planning with a view to the efficient use of the radio frequency spectrum and the economic development of equipment for that purpose by the radio industry."

International Microwave Convention

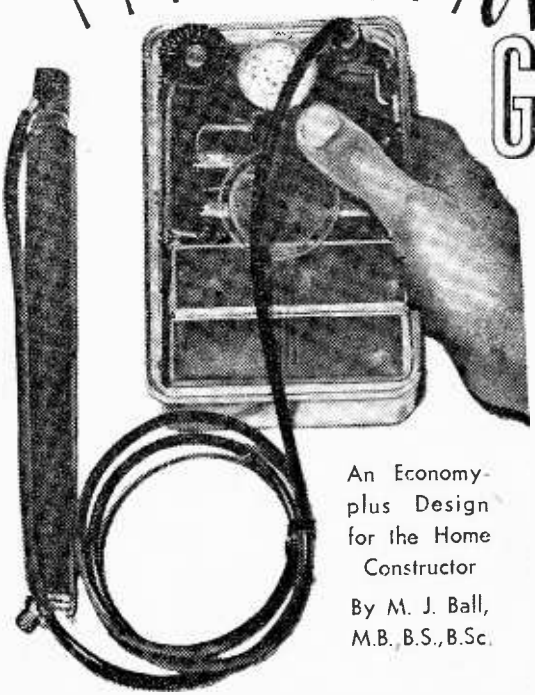
AMONGST the many post-war developments in the field of engineering science, those in radar, communications and navigational aids have been outstanding. They have all been made possible by the evolution of valves working at microwave frequencies, a field which is expanding so rapidly, and with so many new departures in concept and technique, that regular international conferences must be held to enable scientists in every part of the world to get together and exchange ideas. The latest of these conferences has been arranged by The Institution of Electrical Engineers, which is organising an International Convention on Microwave Valves to be held at The Institution in London from the 19th to 23rd May, 1958. The Convention will survey present knowledge and discuss future trends, with particular attention to work in progress or recently completed.

30-year-old Transmitter

A SHORT-WAVE transmitter supplied by Marconi's in 1926 for the Klipheuvel radio station of the South African Post Office Administration is still used to provide a radio link between Klipheuvel and Somerton in England. The transmitter, a Type SWB 1, 20 kW equipment, was installed to initiate the beam service between the United Kingdom and South Africa which began in 1927. Originally designed to operate in the 11 and 5 Mc/s bands, the transmitter and aerial system were subsequently altered to operate in the 18 and 9 Mc/s bands.

This is the oldest working short-wave transmitter in southern Africa and it is intended to preserve it as a reminder of the first stages in the development of point-to-point radio communication.

Making a Simple Geiger Counter



An Economy-plus Design for the Home Constructor

By M. J. Ball, M.B., B.S., B.Sc.

IN this country, unlike the United States, the general public has not yet become "atom conscious," which is a surprising fact considering that we are well to the fore in the field of industrial and scientific nuclear development, and in research utilising radio-isotopes.

In this country, practically all that are available in the way of geiger counters are large mains-driven items of bench equipment, or rather bulky portable instruments containing a field-strength meter and involving the wearing of headphones in areas of low radiation intensity.

At the other end of the scale are the attractive sounding "pencil size" geiger counter units—attractive, that is, until one learns that one must carry a boxful of high tension batteries and wear headphones which only give a faint clicking. It was with this in mind that the author designed this geiger counter which, although not incorporating any radically new principles, supplies a long felt need in the amateur constructor's equipment.

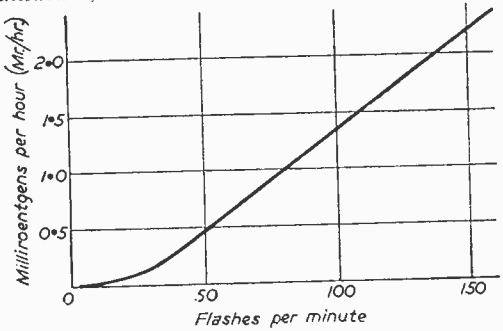


Fig. 6.—Typical calibration curve of the instrument with a value of .01 μF for C6.

It is a very easily constructed and inexpensive four-valve circuit, made of components that are readily obtainable new or on the surplus market, and the whole unit is contained complete with batteries in a transparent plastic sandwich box such as can be seen in any chain store. No cumbersome headphones are necessary since two methods of registration are employed. Every charged particle or ionising radiation hitting the Geiger-Mueller (G.-M.) tube gives rise to a loud click in the crystal insert which is easily heard across a room. There is also a visual indicator in the form of a miniature neon lamp which flashes at a scaled down logarithmic rate proportional to the radiation intensity.

When the G.-M. tube is plugged in and the set is turned on, it provides a highly sensitive detector of radioactivity, on account of the large size G.-M. tube that is used. Whether the radiation arises from natural deposits of uranium or thorium ore, the luminous dial of your watch or even the increase in the background radiation following the fall-out in this country of a hydrogen bomb test somewhere in the world, the set is able to record it both qualitatively and, with the aid of a stop watch, quantitatively (Fig. 6).

As well as its use for amateur prospectors (the Stationery Office publishes several pamphlets and detailed memoranda on the deposits of uranium in the British Isles, including the price the

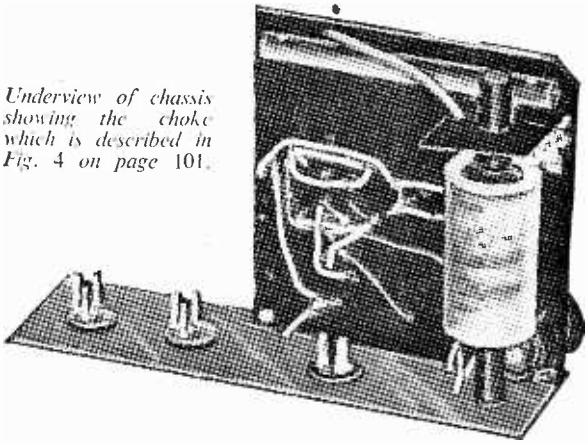
LIST OF PARTS

R1—22k Ω
R2—1 Meg Ω
R3—4.7k Ω
R4—470k Ω
R5—2.7 Meg Ω
R6—1 Meg Ω
R7—120k Ω
R8—see text
C1—2, 5, 6—.01 μF tubular ceramic
C3—.01 μF mica
C4—.001 μF mica
Xtal—1⅜in. diam. Acos or Cosmocord deaf aid Microphone
V 1, 2, 3, 4—Type CK 505 AX Wire-ended deaf aid pentode.
M.R.—Metal rectifier type K.8.40.
Ne—neon, midget wire-ended.
Coax. socket moulded polythene Belling Lee type.
Geiger-Mueller tube '20th Century Electronics' Type G24.
Choke—(See text) Teletron Type EH10.
Batteries—H.T. two type OL230 or equivalent.
Batteries—L.T. type OL 250 or equivalent.
Box 'Hygienic Food Pack' or equivalent.

Government pays per ton of ore !) this counter could be used in Civil Defence training and around laboratories and hospitals where radio-isotopes are in use for industrial, diagnostic and therapeutic purposes, both for tracing lost sources and for checking personal radiation hazards.

The Circuit

For convenience in interpretation, the circuit is best considered in two parts : the high voltage oscillator (which produces up to 1,400 volts) and the amplifier.



Underview of chassis showing the choke which is described in Fig. 4 on page 101.

The circuit uses four wire-ended deaf aid valves of a type which has become abundant and cheap since deaf aids are being transistorised, and which have extremely low filament and H.T. consumption ratings. Three of the valves are used in the oscillator and one in the amplifier.

The oscillator is a conventional multivibrator with the first valve V1 coupled as a triode by strapping the screen-grid and anode, and with two pentodes, V2 and V3 in parallel as the output stage. This is necessary to obtain sufficient power for the high voltage pulse and permits a standardisation of the type of valve in the circuit, and is in the long run cheaper than buying a single valve rated as an output valve in place of these two which are listed as voltage amplifiers. The arrangement also permits the fractional voltage filaments to be connected in series-parallel, as is explained later.

The output stage screen-grids are used as the multivibrator "anode" whilst their anodes proper are fed with 90 volts H.T. through the "ringing choke." A high voltage is developed across the choke by the sudden collapse of magnetic flux with each cycle of oscillation, and these pulses of voltage are rectified by the metal rectifier M.R., smoothed by the reservoir condenser C3, and the steady high voltage is applied across the G.-M. tube via the neon circuit and R5.

As each ionising particle enters the tube, the resultant cascade of electrons causes a voltage drop across R5 which is fed as a pulse to the grid of the amplifier valve V4 via C4 and is registered as a click in the crystal insert in the anode circuit of this valve. Now each cascade of electrons also serves to charge the condenser C6 and, when the striking potential of the neon is reached, a flash occurs and the charging cycle starts again.

The minimum rate of flashing is around four per minute, and is dependent on the background count of cosmic rays and local radioactivity, and on the leakage resistance across the G.-M. tube.

The flashing rate increases as the radiation intensity rises till at the maximum (to which one

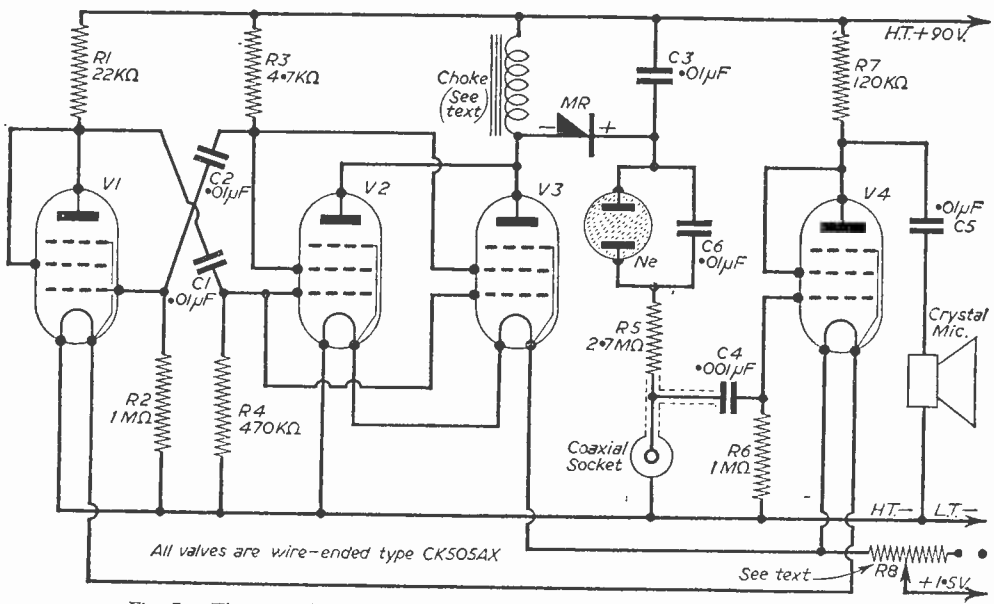


Fig. 7.—Theoretical circuit of the geiger counter. Parts are listed on page 98.

should never expose oneself !) the rate is uncountable and is a function of the time constant of R5C6.

Several finer points about the circuit are worth noting. The component values have been chosen to give a frequency of oscillation high enough to allow a small value of C3, yet low enough not to give a troublesome whistle from the crystal unit whose size makes it relatively inefficient in radiating low frequencies.

The residual buzz is due to stray capacities and can be reduced if desired by shielding the coax socket and its associated wire from the generator anode circuit by means of earthed copper foil or tinplate bent to shape and soldered into place. Some buzz should remain, however, to indicate when the set is switched on, and to develop grid bias for V4 across R6. In some crystal units the buzz can be minimised by covering the central holes with Sellotape, leaving the peripheral holes open. This does not affect the loudness of the click.

The H.T. supply is 90 volts. In the model illustrated, two 45 volt layer type deaf-aid batteries were used. The H.T. current drain is about 2 milliamps.

The L.T. supply is 1½ volts and the valves are wired in series-parallel, their individual filament voltages being listed as 0.625. The current is adjusted to a figure somewhere between 50 and 60 milliamps by means of R8.

This component is a midget wirewound potentiometer of about 25 ohms or less, from which part of the wire should be unwound so that an "OFF" position is provided, and so that sufficient current flows to allow an immediate start of oscillation when switching on (see Fig. 1). This avoids unbiassed valves receiving the full 90

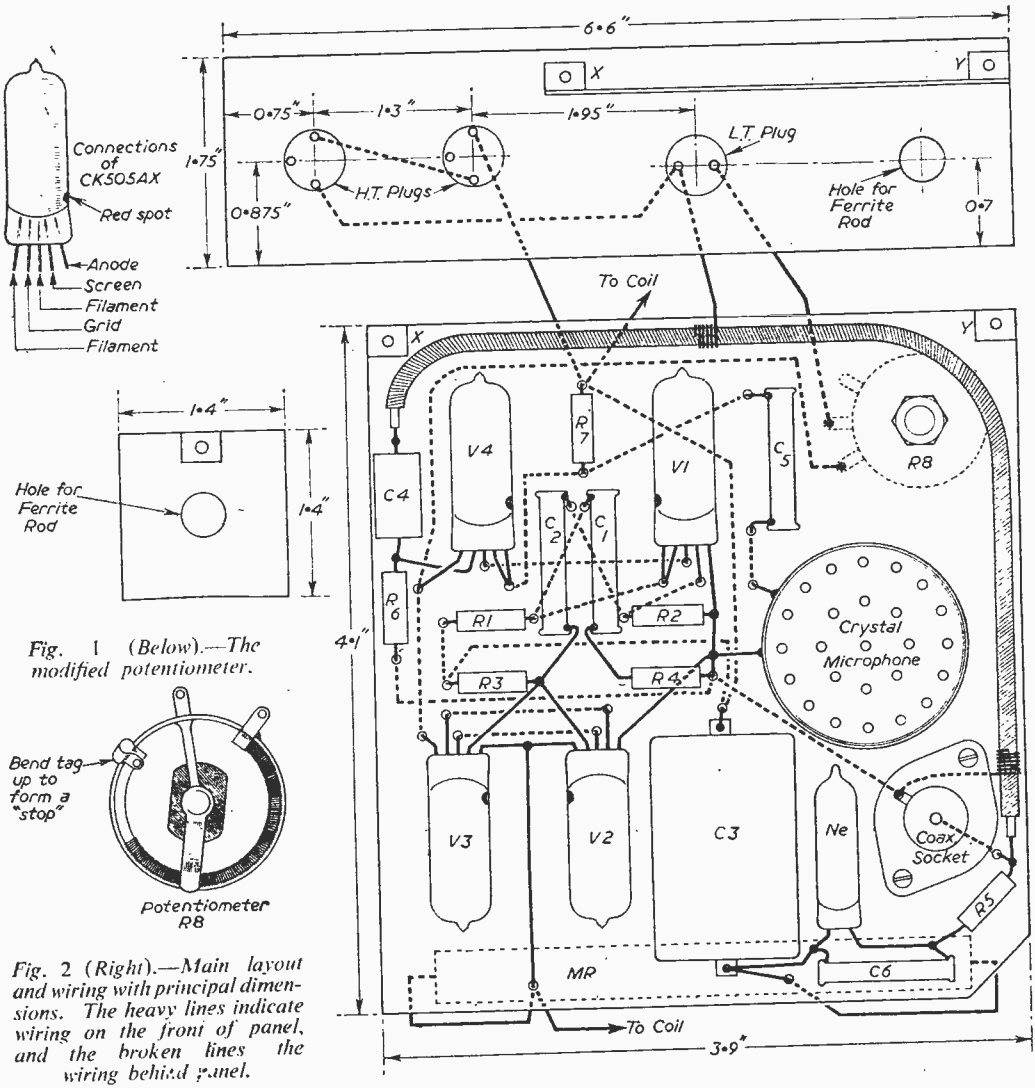


Fig. 1 (Below).—The modified potentiometer.

Fig. 2 (Right).—Main layout and wiring with principal dimensions. The heavy lines indicate wiring on the front of panel, and the broken lines the wiring behind panel.

volts H.T. which might damage them. The method of adjusting to the tube operating voltage is described in a later paragraph.

Construction

It is to the simplicity of construction that the unit owes its cheapness—furthermore, it can easily be built in an evening.

The "chassis" consists of three pieces of paxolin joined by small metal brackets (Fig.2). On one piece are mounted the battery plugs and one end of the ferrite rod, on the second is the

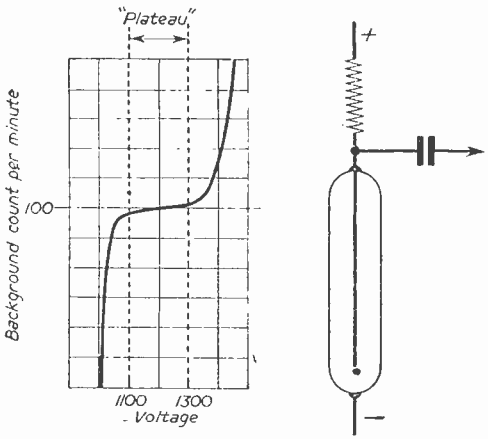
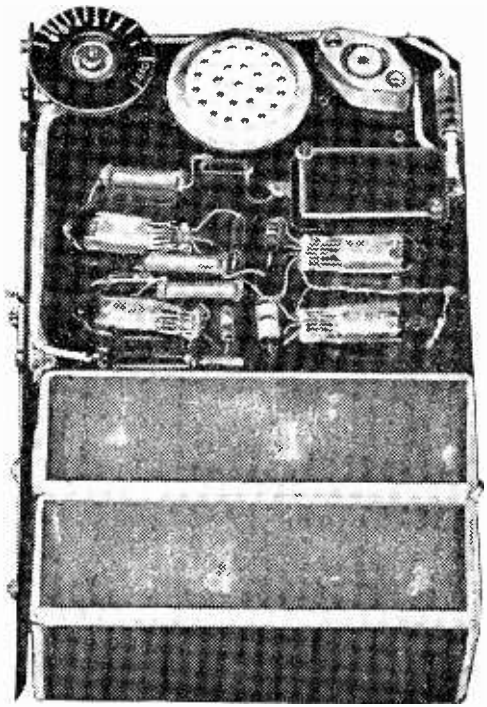


Fig. 5.—Characteristics and connections of a typical tube.

valve circuitry, and the third piece supports the other end of the ferrite rod.

The method of wiring is exceedingly simple and merely entails pricking fine holes where required with an awl, bending the wire ends of the components at right angles (caution! care needed) and pushing the wires through holes. Very little connecting wire is necessary if these component wires are sleeved and bent into position. At the high potential side of the circuit, polythene-covered wire should be used when piercing the panel. The core of good quality coaxial cable is quite suitable. The condensers are of the midget ceramic variety but mica types individually selected for absence of internal leaks are used at the high voltage end. Part of the circuit can be used to this end (see Fig. 3). After the initial charging current has passed, the neon will stop flashing if the condenser is satisfactory.

The box is a polystyrene sandwich box cut down to the depth of the H.T. batteries to economise in space. The box was chosen not only for its availability, but also for the excellent insulating properties of this plastic. Insulation



The completed instrument.

is so important at the high voltages and small currents involved that merely breathing on the "hot" end of the G.M. tube will set the neon flashing at an alarming rate.

Should any constructor care to diverge from the details of this design to the extent of fitting miniature deaf aid batteries, the actual size of the set could be reduced to less than a half of that illustrated, but the battery life would be proportionately shortened and one would have to search for another polystyrene box of a suitable shape.

Holes in the box for the voltage control, crystal insert and Belling-Lee plug are best cut with a soldering iron or hot poker and trimmed up with a file, since polystyrene is rather too brittle for drilling large holes.

(*Concluded on page 150*)

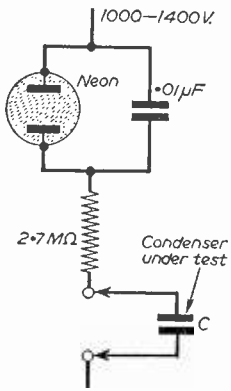


Fig. 3.—Checking condensers for leakage.

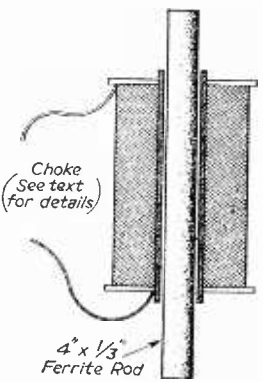
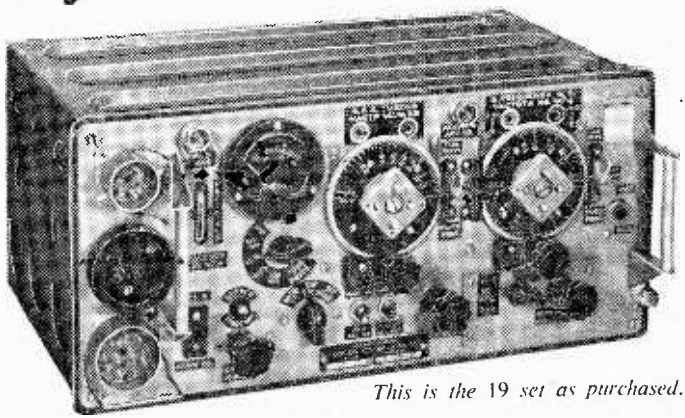


Fig. 4.—Details of the special choke.

Converting the 19 Set

HOW TO MODIFY THIS POPULAR EX-ARMY RECEIVER FOR AMATEUR USE

By K. E. Marcus



This is the 19 set as purchased.

THERE is now available on the surplus market an ex-army receiver-transmitter, the W.S.19 MK II, which can be modified at practically no cost to a highly efficient communication receiver.

It should, however, be borne in mind that this modification is a major engineering effort which should only be undertaken by readers who are patient enough to carry it through.

The sets on the market are either of British, Canadian or American manufacture. During the war contracts were placed in Canada with two or three firms and then sub-contracted in U.S.A.

These Canadian and American sets are by far the better engineering efforts. For this description a Canadian Marconi has been used as basis. As sets of American manufacture are not easily obtainable it is suggested to use either a Canadian Marconi or a R.C.A. for this conversion.

General

The 19 Mk II contains a transmitter-receiver for two ranges (8-4½ Mc/s plus 4½-2 Mc/s), a transmitter-receiver for 240 Mc/s, and an intercom-amplifier. This and the 240 Mc/s affair as well as the transmitter portion of the main set ("A" set), are not required, though good use will be made of part of the components in the course of this conversion.

After conversion the new set will cover 3.3-15.5 Mc/s in two ranges, be equipped with a B.F.O. and will be highly sensitive.

As will be seen 66 modifications which are well within the capacity of an amateur will produce the new set.

The following description refers throughout to the official diagram, which should be obtained, if possible, before an attempt at conversion is made.

First Phase (Front Panel "B" Section, "I/C" Section)

For a start the front panel is to be removed, cutting off all the leads to the components fitted to it.

Then remove all components in the screened partition to the left, only leaving the valve base V7A (horned triode).

After that remove both sender-receiver relays under the chassis.

These operations leave one with the main ("A") set proper.

Second Phase (R.F. Portion Modifications)

To the right of the four-gang condenser are three valves: starting from the rear of the chassis they are the mixer valve 6K8, the R.F. amplifier 6K7, and a sender-mixer 6K8.

The sender-mixer valve (V2B) is now removed.

To the left of the four-gang condenser are two valves; near the I.F. transformer a 6H6 (V6A), which is to be removed including the valve base. Further to the front is the EF50 (V5A) which will be used as a first R.F. amplifier in front of the 6K7 (V1A). To achieve this the following operations have to be carried out.

(A) Unsolder the connection to the anode of V2B (sender-mixer); this wire goes to the range switch S11A, segment 1. Disconnect this wire from the switch, likewise the capacitor C2C (100 pF) fixed to the same spot. Mark this spot: the EF50 anode will be connected here later.

(B) On coils L7 and L21 remove the connecting wire between the tags 5 (bottom of the coil) and solder off C4T (0.1 μF to earth) and R5E (2,200 Ω to H.T.).

(C) Cut off from segment 2 on S11A the old connection to tags and disconnect the trimmer C10E.

(D) Transfer the two wires from S11A, segment 2, from their present position, namely the common-to-both windings tags 3 (top of the coil) to tags 5 (bottom of the coil).

(E) Interconnect both tags 3 and solder back to this spot C4T and R5E, further, connect to it the wafer point where the old connection to tags has been taken off in operation C.

(F) Remove C5C (.01 mF) from S11A, segment 2, and transfer the line to the main gang from the far end of C5C to this wafer point. Mark it: this is where the grid lead to V1A (R.F. amplifier) will be connected to later.

(G) Unsolder the connection to anode of V5A (EF50); this wire goes to range switch S11A, segment 3. Disconnect this wire from the switch, likewise the capacitor C2E (100 pF) fixed to the same spot. Mark this spot: the aerial lead will later be connected here.

(H) On coils L4 and L6 remove the connecting wire between the tags 5 (bottom of the coil) and remove C4R (.1 μF to earth) and R5D (2200 Ω to H.T.).

(I) Cut off from segment 4 on S11A the old connection to tag and disconnect the trimmer C10F.

(K) Transfer the two wires from S11A. segment 4. from their present position. namely the common-to-both windings tags 3 (top of the coil) to tags 5 (bottom of the coil).

(L) Connect both tags 3 together to the wafer point where the old connection to tag 5 has been taken off in operation I. and earth it.

(M) Remove C5B (.01 μF) from S11A. segment 4. and transfer the line to the main gang from the far end of C5B to this wafer point.

(N) Bring to this wafer point capacitor C2C (100 pF) which was left afloat in operation A. To do this this condenser has to be taken off the grid pin of the EF50. where it will go back to at the end of the next operation.

(O) Now take out the valve base of the EF50 and refit it with a 180 deg. turn-about and reconnect the screen grid—and cathode components. The grid leak R1E (470 KΩ) will be connected between EF50 grid and earth and the coupling condenser from the aerial-circuit (C2C) can now be brought back to the grid of EF50.

(P) On top of the chassis there is a wire coming out of the gang which is soldered to a tag on the tank coil. This wire is now taken through a hole through the chassis and connected via a capacitor. 100 pF. to the wafer point mentioned in operation F.

(Q) Finally. connect the anode of EF50 (V5A) to the wafer point S11A segment 1 marked in operation A.

These 16 operations complete the R.F. modifications. apart from the changes to the coils and the gang.

The sender-mixer base. the B.F.O. can near it.

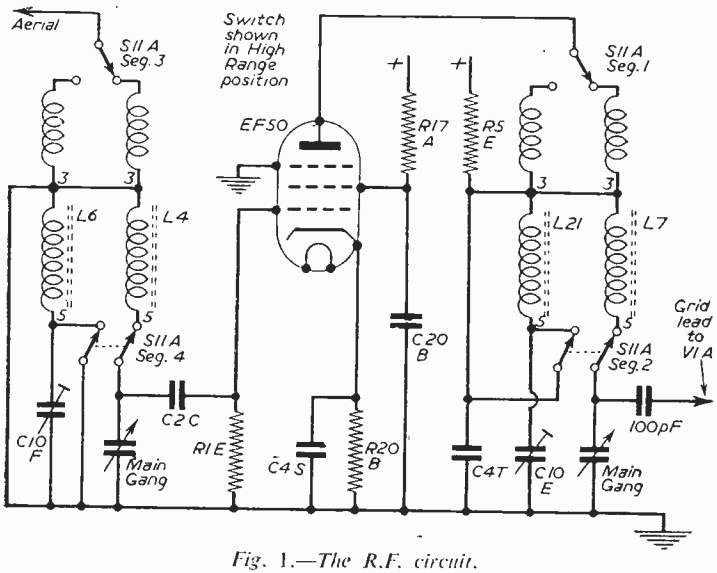


Fig. 1.—The R.F. circuit.

the P.A. valve 807 and its base. and the tank coil. can now be removed. So can be a great deal of wiring afloat.

Thereafter it is advisable to check over the work done with Fig. 1. and to remove all components not required any more round the sender portion of the set.

Finally make sure that in the high range

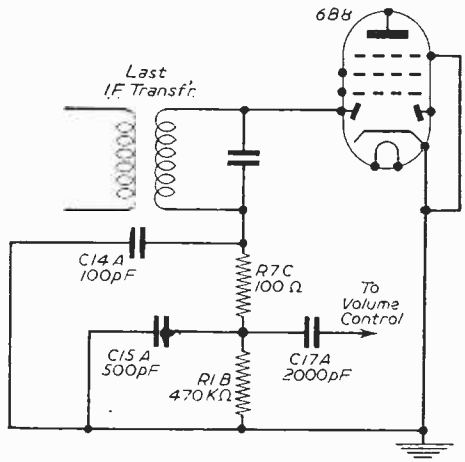


Fig. 2.—The detector stage.

position the low range tuning coil is now shorted (ref. to operations E and L.).

Third Phase (Detector)

There are no modifications at present on either the R.F. amplifier, the mixer or on the 2 I.F. amplifiers.

The next stage of the conversion concerns the detector-stage.

(A) Cut off all connections to valve base V3A (6B8) except. (1) the direct lead from the I.F. transformer to one of the diodes. (2) the two heater lines.

(B) Earth. provisionally. the cathode (pin 8) of V3A.

(C) Fit. provisionally. the B.F.O can which has been removed in phase 2. to where the tank coil used to be. Do not connect up yet. it needs modification to be described in phase 9.

(D) Earth the cold end of diode load resistor R1B (470 kΩ) and remove all components and wiring of this stage except. (1) capacitor C17A (2.000 pF). and (2) the old grid lead of the 6B8. which will be used for a new Audio Amplifier valve 6K7 in Phase 5.

It is advisable again to check the work done by Fig. 2. and to remove all surplus wiring and components thereafter.

Fourth Phase (Engineering)

This is mainly an engineering stage.

(A) Into the rear left corner goes the mains transformer (350-0-350v 100 mA).

(B) The smoothing choke goes under the chassis beneath the mains transformer.

(C) The valve base V7A is used for the new rectifier 5U4.

(D) The reservoir and smoothing condensers go where the valve V1D used to be.

In fitting these components it should be kept in mind that the 3in. loudspeaker has to go on

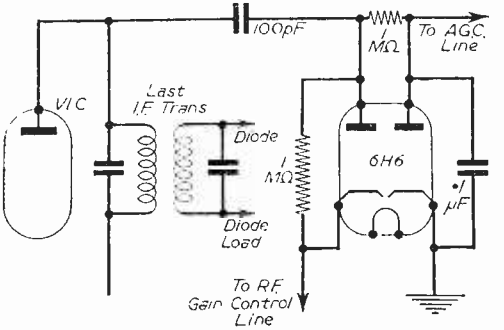


Fig. 3. The A.G.C. stage.

to the new front plate and clearance for it has to be allowed.

(E) Two new valve base holes have to be drilled : one to the left of the third I.F. transformer and close to it, where the double-output transformer T5A/T6A used to be ; the other one just behind the 807 base hole. These holes are to be fitted with salvaged octal bases.

(F) A third octal base is to be fitted over the 807 hole.

(G) Finally, the transformer T2A (which was fitted sideways to the screen surrounding the B-1/C section) goes underneath the chassis near, but to the front of, the newly drilled hole, about where the tank condenser used to be above chassis.

Fifth Phase (Wiring of Power and Output Stages)

Throughout the following four operations reference should be made to the relevant diagram.

(A) Plug into the new base next to the last I.F. transformer the salvaged 6H6 and connect up according to Fig. 3.

(B) Plug into the new base behind the old 807 a salvaged 6K7, and into the new base replacing the 807 a salvaged 6V6 and connect up according to Fig. 4.

(C) Plug into the old E1148 (V7A) base a 5U4 and connect up according to Fig. 5. The choke should be able to dissipate 10W without undue heating ; it should be rated at least 10H for 100mA. and if its ohmic resistance is less than 950Ω the difference from the recommended 1,000Ω should be made up by putting a resistor in series with it. The 1KΩ5W resistor should be of the wirewound vitreous variety.

(D) The valves in the WS19 Mk II were all in series—parallel. The last operation of this phase is to rewire them for 6v A.C. parallel heating. Pin 2 on the octal bases and pin 1 on the EF50 should always be earthed : pin 7 on octals and pin 9 on EF50 goes to the 6v A.C. busbar.

Sixth Phase (Front Plate)

This phase concerns itself with the fitting of the new front plate.

(A) The spindle of the 4-gang condenser determines the position of the tuning mechanism which is a Muirhead drive.

(B) The spindle of the range-switch determines the location of the range handle.

(C) The R.F. gain control (5kΩ) goes to the right in line with the range switch. As soon as the front-plate is in position it is connected up according to Fig. 6.

R4A is the screening grid bleeder resistance of the mixer, the cold end of which has to be taken off chassis. R2A (220 Ω) is the cathode resistor of the 6K7 and R9A (1 KΩ) that of the first I.F. amplifier; both have to be taken off chassis. These three resistors are connected to the R.F. gain control line

(D) One of the salvaged toggle switches goes to the left in line with the range switch. It will be labelled "A.G.C. on/off" and earths the A.G.C. line when operated. As soon as the front plate is in position it is connected up according to Fig. 7. L10A is the "grid leak" of 6K7 R.F. amplifier, which is already connected to L8A, the first I.F. transformer grid coil (A.G.C.-line). On the corresponding point on L8B the old wire is taken off, a resistor 100 KΩ and a capacitor .01 μF soldered on, and the other side of this condenser earthed. On the base of V5A (EF50) the earth connection of pin 4 (suppressor grid) is broken and this pin earthed through a parallel combination of 47 KΩ and .01 μF. A resistor, 100 KΩ, is then taken to the A.G.C. line.

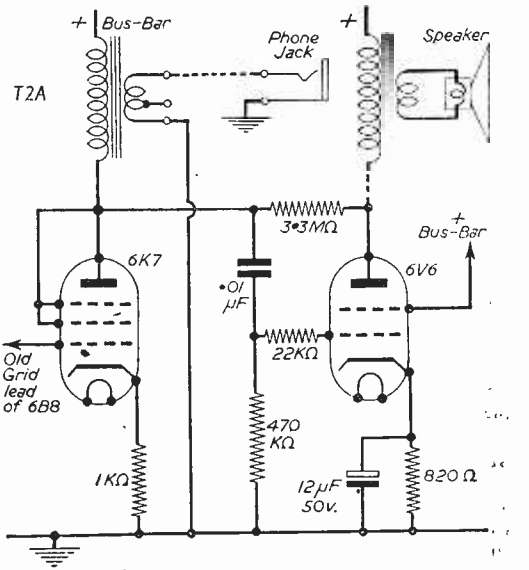


Fig. 4.—The output stage.

(E) About where the old system switch used to be the audio gain control R13A will be fitted. After fitting the front plate a screened lead will be taken from the hot end of the control to C17A (2000 Ω) in Fig. 2: on to the slider goes the screened lead to the new audio amplifier 6K7, and the cold end is earthed.

(F) Again, further to the left in line with the

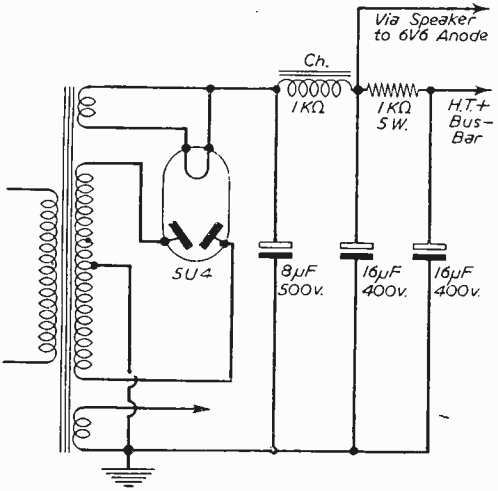


Fig. 5.—The power supply section.

controls fitted, goes the salvaged key-jack, which is connected up according to Fig. 4 as a telephone line (600 Ω) jack.

(G) Finally in this line goes the mains on/off switch, and above it a 6v. pilot of the P.O. telephone type.

(H) A salvaged Pye-plug will be fitted to the top right-hand corner of the front plate and connected up via a capacitor, 300 pF, and a short length of coax through the hole through the chassis to range-switch S11A, segment 3, i.e., the spot marked in operation G of the second phase for aerial.

(I) To the left of the Muirhead-drive and near the top edge of the front plate the salvaged set-meter will be fitted. It will be connected up in the ninth phase, operation G.

(K) To the left of the Muirhead-drive near the deck, about half way up the front plate, the salvaged tuning condenser of the B-set will be fitted. Its modification and connection will be described in the ninth phase, operation F.

(L) Again further to the left the hole for the 3in. loudspeaker will be drilled. The loudspeaker and its transformer should be fitted and connected up according to Figs. 4 and 5 when the front plate is in position.

Seventh Phase (Final Connections and Test)

(A) Complete now the H.T. line. The set had originally two H.T. lines, one the receiver H.T. and the sender H.T. They can now be combined and taken to the H.T. end of the smoothing chain (refer to Fig. 5).

(B) The mains lead can now be connected up.

(C) The following components, which originally transferred part of the oscillator voltage to the sender-mixer, should now be removed: C21A + R42G + R7L and the lead to sender-mixer grid.

(D) capacitor C39A which injected the B.F.O. voltage into the second I.F. transformer can likewise be removed.

(E) The set is now ready for test. It should be receiving on its old ranges, 8 to 4½ Mc/s and 4½ to 2 Mc/s. If it works, no attempt should be made to realign it. If not, the usual trouble shooting should be carried out.

It is strongly recommended not to skip operation E.

Eighth Phase (Modification of Range Coverage)

This again is a major operation and great care should be exercised.

(A) Remove each of the three R.F. coils, L6, L21, L23 on the lower range in turn. Each has 23 turns as tuner; take off four turns, but leave the coupler windings unmodified except on L23 (mixer grid coil) where seven turns should be taken off the coupler winding.

(B) Remove each of the three R.F. coils, L4, L7, L22, on the higher range in turn. Each has 14 turns as tuner; take off five turns. Leave coupler windings on L4 unmodified. On L7 take four turns off the coupler winding. On L22 take six turns off the coupler winding.

(C) Remove the two oscillator coils L24 and L25 at the same time. L24 goes back unmodified into position L25 (low range). The old L25 has 25¼ turns as tuner and 15⅜ turns as tickler. Rewind to 8¼ turns as tuner and 5¾ turns as tickler.

(D) Solder a trimmer 50 pF across the tuner windings of each of L24 and L25 (the two bottom lugs opposite each other)

(E) Remove padders C8A (3100 pF), C12A (1780 pF), trimmer C11A (140 pF max.) and fit new padders (2000 pF from the low frequency oscillator coil to earth, 4000 pF from the high frequency oscillator coil to earth), instead to the same lugs where the old ones have been taken off, i.e., as the common tuner-tickler lug No. 4 of the coils. C12A can be re-used with 250 pF ± 5 per cent. in parallel for the 2000 pF padder. C8A can be re-used with 800 to 1000 pF ± 5 per cent. in parallel for the 4000 pF padder if required.

(To be continued)

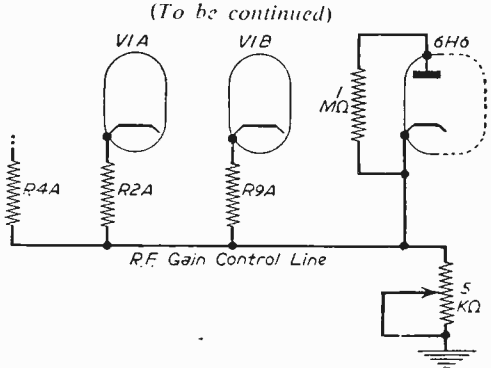
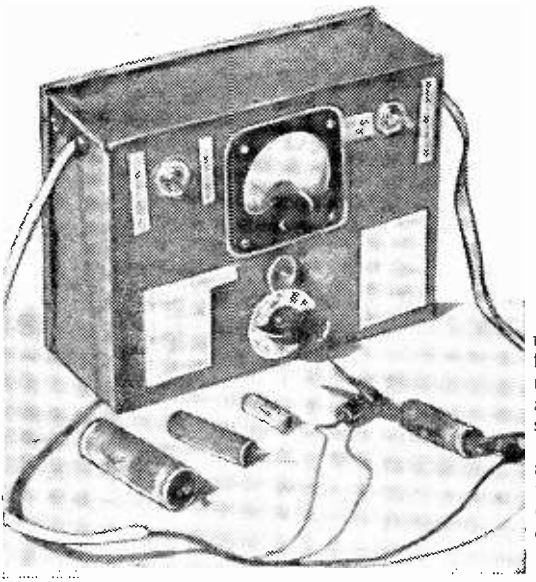


Fig. 6.—How the R.F. gain control is connected.



A Condenser Condition Tester

A MODIFIED FORM OF THE INSTRUMENT DESCRIBED IN THE FEBRUARY ISSUE

By J. BROWN

THE article "Condenser Condition Tester" that appeared in the February issue of PRACTICAL WIRELESS has caused quite a controversy, judging by the letters from readers. These were of all different natures, so the whole unit has been modified with hopes that most readers will possibly be now pleased to see some more protection of the meter. Also S3A has been modified and a different idea for the method of procuring the required voltage for tests. We should like to clear up some points first re the original article.

(1) The voltages given on page 866 were measured at the junctions of the chain by a valve voltmeter. This possibly explains the difference in other figures when measured with other meters.

(2) Meter protection. Originally one section of S3 was allocated for a meter protection device which still has to be proved to be efficient.

Having had experience with test gear, British, American, Continental, even Japanese, the writer has yet to see an infallible protection circuit. Either they work and are very hard to reset, or they do not work at all.

When the idea of the tester materialised, it was automatically thought that each individual had his own pet ideas re the test of condensers.

The writer prefers to test with a multirange meter on the highest ohms range first. As the test meter is so arranged that the battery power supply is adjusted to read full scale, very little damage may be done, so the suggestion is to test with an ohmmeter first before any other tests are carried out.

However, in this modified design it is so arranged that on each position of S2 the meter reads just on full scale even with a S/C condenser. The only damage to meter that can be now done is when a capacitor is connected with the wrong polarity, so at all times *observe correct polarity*.

Going back for a brief moment, the statement re meter protection devices is said with all good faith regards manufacturers. We realise that a meter in the wrong hands is subject to abuse at all times, so the golden rule is "If in doubt, switch off, think and look."

Capacitors or condensers can be reformed by applying to them, in correct polarity, the working voltage via a limiting resistor. This limits the current to a safe value. In the modified circuit our working voltage is obtained via the resistor chain R3 to R12.

The 600 volt range current is obtained from its own resistor R2. After being selected by S2, it is passed to the meter via the limiting resistor used on all settings, R13, then to the positive terminal. S3 has been modified to any two position single-pole switch. The power supply is the same, as is the neon leakage side. R1 is the smoothing and dropper resistor to ensure we have 600 volts at the junction of R1, R14, R2 and 3. Carry out the reforming by selecting the correct voltage or a little under would be better, connect the condenser, *correct polarity*, and reform till the lowest figure is obtained on the meter. This was quoted at one-tenth of a milliamp per μF. There seems to be some query at this.

In another reference work we see quoted "The maximum leakage for a 8 μF condenser should be between .4 and .5 mA." Other readers have

LIST OF COMPONENTS
for original model (see also P.107)

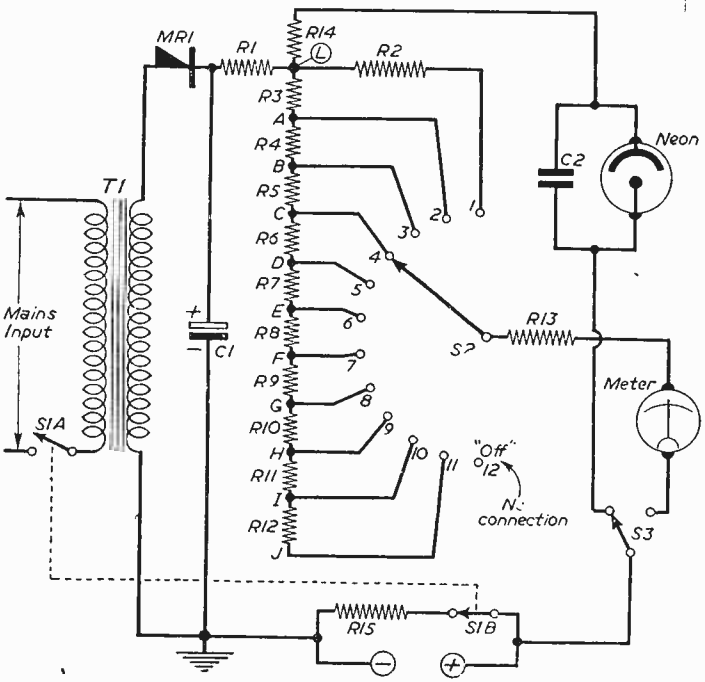
T1—One 2½ : 1 ratio L.F. transformer.
One metal rectifier 10C/13186 (surplus).
MR1 or 4-RM2 in series.
C1—One 4μF 600 volt condenser.
R1—18 K.
R2-R12—1 megohm
R16—2.2 meg.
R15—4.7 meg.
R13—1 meg.
R14—1 K 3 watt
All 1 watt except where otherwise stated.
C2—.25μF 500 volts working.
One 5 mA meter Govt. surplus. Meter.
S2—One 12-way single-pole Yaxley switch.
S1A and S1B—Double-throw changeover.
S3A and S3B—Double-throw changeover.
Two terminals.
1 Neon Lamp. The original was a surplus type CV988 or GE991, although any type can be used if the resistor which is incorporated in some neons is removed. If a commercial neon is going to be used, inquire if it is fitted with a resistor to limit the current.

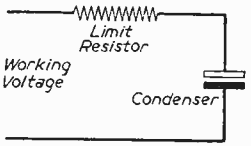
had various figures. The basis of the tester was as aforementioned. "the voltage equal to the working voltage is applied to the condenser via the limit current resistor." This is illustrated as below, Fig. 2, the only difference being that we have an indicator of the amount of leakage.

The values of the divider resistors are changed. we now have a series chain. the voltage required is taken from the preceding resistor. Hence the values are given below.

There was a suggestion that the position 12 be connected to the negative side of meter. but the safest way is to leave this with no connection. Hence the capacitor under test cannot discharge through the meter. All these above resistors are different from the original circuit and are all normal values except R12. this may be easily made up by putting in series a 2.5 K plus a 1 K. The wattage of these should be 2-3 watts, but 1 watt resistors have been used.

Resistor Number	Value	Position Voltage from Chassis	S2 position for operation
R2	120 K	L 600	Position 1
R3	20 K	A 500	,, 2
R4	20 K	B 400	,, 3
R5	20 K	C 300	,, 4
R6	10 K	D 250	,, 5
R7	10 K	E 200	,, 6
R8	10 K	F 150	,, 7
R9	10 K	G 100n	,, 8
R10	10 K	H 50	,, 9
R11	25 K	I 25	,, 10
R12	2.6 K	J 12	,, 11
Nil	Nil	Nil	No connection





Figs. 1 (left) & 2 (above). The modified circuit and basic arrangement.

Value of R13

The value of R13 was chosen as a compromise between the required values. However, during the operation of reforming, the meter will momentarily exceed the full scale. This does not seem to damage the meter in any way, but should any reader think it will be injurious. a 100K resistor (variable wirewound) may be inserted between the meter connection of R13 and the meter. We now have a Maximum to Minimum control to safeguard the meter during the initial stages of reforming. The operation would then be: Connect the condenser, polarity correct, set the 100K to Minimum. the maximum amount of resistor in circuit, switch S2 to correct position. and then switch on. After a short period. the 100K pot may be increased.

COMPONENTS
for the modified version described in this issue.

T1 as original.
R15 as original.
S1A and S1B as original.
R13 is limiting resistor for ranges 2-11-10 K.
R2 is limiting resistor for range 1.
Neon and C2 as original.
Meter as original.
C1 as original.
S2 as original.
R1-3 K 3 watt.
MR1 as original.
R14 is 1 meg.
S3 changed to single pole.
2 position or change-over S/P.

Constructing a Direct-coupled A.C./D.C. Amplifier

IN the March issue an article appeared under the above title in which the two circuits. Fig. 1 and Fig. 2 were shown with the usual theoretical symbol for an earth connection. As the apparatus described in that article is of the so-called "Universal" type it should be remembered that a direct earth should not be connected to any equipment constructed according to those details.

On Your Wavelength

BY THERMION

Improved Recording Technique

I HAVE, on very good authority, learned that a well-known gramophone record company has made a revolutionary advance in recording on records. The idea is to put on the disc a composite recording made by both lateral and hill and dale methods in the same groove. For reproducing, a player amplifier is required that has a single stylus. The two recordings are passed through two crystals and then go to two separate amplifiers. The output from these is combined in a final output stage. I have been given to understand that the results are fantastic.

The development of the photoelectric cell and the sound track on film led to the belief some years ago that the gramophone disc, which developed from the old Edison type cylindrical record, would eventually vanish, and instead we should have a machine consisting of a photo-electric cell and amplifiers which would run for several hours from a recording on celluloid tape. It was estimated that the complete recording of an opera could be accommodated on a coil of celluloid no larger than the present discs. As I have mentioned before, such a machine was actually marketed and indeed exhibited at one of the early radio shows, but it was bought up and "killed" by a rival concern. I still think that that is the inevitable development of recorded music.

The plain fact must be faced, however, that gramophone discs are selling in far larger numbers than ever before and the gloomy forebodings of the gramophone industry who in the early days thought that radio would kill the demand for discs have not been fulfilled. As with L.P.R., the transition from gramophone discs to celluloid tape must be gradual, and it would take place over a long period of years. All of the recorded music could not be re-recorded in less than, say, 10 years.

Dens

I HAVE had a small response to my request to readers for photographs of their dens. Those which have come to hand so far are, however, extremely interesting and I shall shortly hope to publish the first group. Remember I shall pay one guinea for every photograph published and there is no time limit.

A Spring Clean

THE annual urge to go through one's documents, papers and periodicals and throw away those which are of no further interest possessed me the other day. Like most other amateurs I found it a slow process, for you start reading old catalogues and find that a large amount of time has passed and the waste paper basket is still empty. Finally, you find that you can't throw this away or that away and you end up with a pile as before. There is a fascination about browsing through old catalogues. My collection goes back to the beginning of radio. I carefully file all of the catalogues collected at exhibitions and sent to me by manufacturers, and even to-day I find it necessary to refer to them. I know that the proper procedure is to keep a carefully indexed register, extract what you want from the literature, and then throw it away. I, however, prefer to keep the lot. And there have been many occasions when I have been glad that I did so.

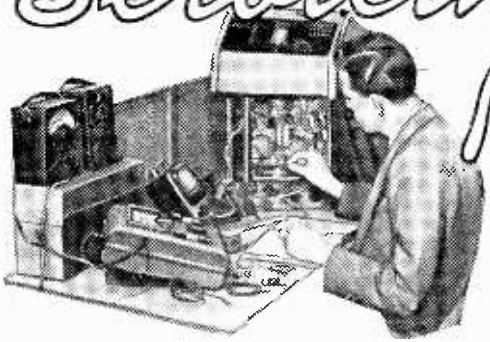
The Late F. H. Robinson

I DEPLORE the passing in February of my old friend, F. H. Robinson (Robbie to his friends). His death came suddenly. He had a long connection with radio journalism and was editor of the "Broadcaster" (now "Electrical and Radio Trading"). That was in the early '20s, the days of fierce competitive radio journalism, and although Robbie remained on the trade side of journalism he took a keen interest in all branches of it, and particularly in the social side. He was honorary social secretary of Radio Industry Club, president of the Radio Industry's Golfing Society, and just before his death had finished an historical souvenir which was issued at this year's annual R.I.G.S. ball. He was known to everybody in the radio trade, and he will be missed by that wide circle of friends.

M.P.R.

I HAVE received a large number of letters from readers who are interested in making or purchasing one of those really midget printed circuit transistorised pocket receivers which do not require a battery four times the size of the receiver. I wonder if any of the manufacturers will take the hint and put such receivers on the market? I suggest that they might usefully experiment with some of the long-life pellet batteries now being used in place of mainsprings in American wrist watches. Although no larger than sixpence in diameter and thickness they operate the watch for a year, develop a full voltage of 1.5v., although their discharge rate is comparatively low, being in the order of a milliamp or so. They would, however, solve battery space problems, and used in conjunction with special low consumption peanut valves they should provide the answer to the problem. Unfortunately, such batteries are not at present available to the general public, although they are available to manufacturers. I understand that at least one Swiss manufacturer is also producing them.

Servicing Radio Receivers



ALBA RADIO—MODELS 3211, 6224, 6231, 6241 AND 6251

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

AT the finish of the last series under this title, it was promised that a new series would be commenced dealing with radio receivers of more modern styling, and in particular with sets featuring V.H.F-F.M. and transistorised circuits. With co-operation from leading manufacturers this series can now be launched, and since new models will be under the spot-light readers will be kept up to date with regard to the latest developments and circuit techniques.

The seven-valve Alba chassis, the complete circuit of which is given in Fig. 1, forms the basis of five models; a table model (Model 3211) and four radiograms. The chassis can be switched over four bands—L.W., M.W., S.W. and V.H.F.-F.M.—and the band-selector switch has provision for switching in a pick-up (the latest crystal type eminently suitable), the switch thus has five positions. The remaining three controls are ganged A.M./V.H.F.-F.M. tuning, volume and tone. There is also a "magic eye" tuning indicator which functions on both A.M. and V.H.F.-F.M.

The Circuit

Looking first at the A.M. sections of the circuit V2 is a fairly conventional heptode frequency changer stage, whose aerial and oscillator tuned circuits are selected by ganged switch sections in the usual manner. At this point it should be noted that only when the main ganged band-selector switches are themselves switched to the "F.M." position are the A.M/F.M. changeover switches in the "F.M." position. On all other positions of the "band-selector" the A.M./F.M. changeover switches are in the "A.M." position. This is common practice, and the changeover switches themselves are ganged to the "band-selector" switches, thereby facilitating the use of a common control knob.

Dual I.F. Transformers

In the anode circuit of the heptode section of the frequency changer valve are placed the A.M. and F.M. I.F. transformers in series, L9/L10 being the A.M. section and L11/L12 the F.M. section. It will be seen that a changeover switch serves to short out the primary of the transformer not in use. In the secondary circuit the F.M. winding is shorted out when the chassis is switched to "A.M." but when switched to "F.M." both windings remain in series and the A.G.2 line is shorted to chassis. Switching of the I.F.s is not essential owing to the considerable difference between the A.M. and F.M. intermediate frequencies, and is not always adopted in combined receivers. The "standard" I.F.s being 470 Kc/s on A.M. and 10.7 Mc/s on F.M., as in the Alba chassis.

The selected I.F. is thus conveyed to the common I.F. amplifier valve (V3), and the signal is developed in amplified form across the appropriate second I.F. transformer. Again it will be seen that the I.F. transformers are connected in series, but that the secondary windings convey the selected I.F. signals to the appropriate detectors for demodulation.

On A.M. the signals across L17 of T2 are applied direct to the A.M. diode in V4B. At this stage it should be noted that V4 is one of the new multi-electrode valves (Mullard EABC80), in which are incorporated three diodes and a triode—two of the diodes having separate cathodes and the cathode of the other one being common to the triode. It is usual practice to employ as A.M. detector the diode whose cathode is common to the triode, as shown in Fig. 1 (V4B).

The A.M. detector load is formed by R20, R26 and C40 being the detector filter components. The

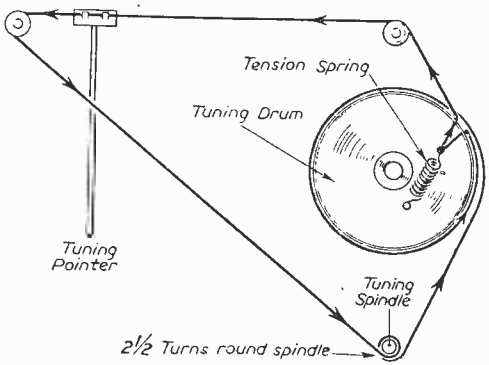


Fig. 2.—Details of the tuning drive.

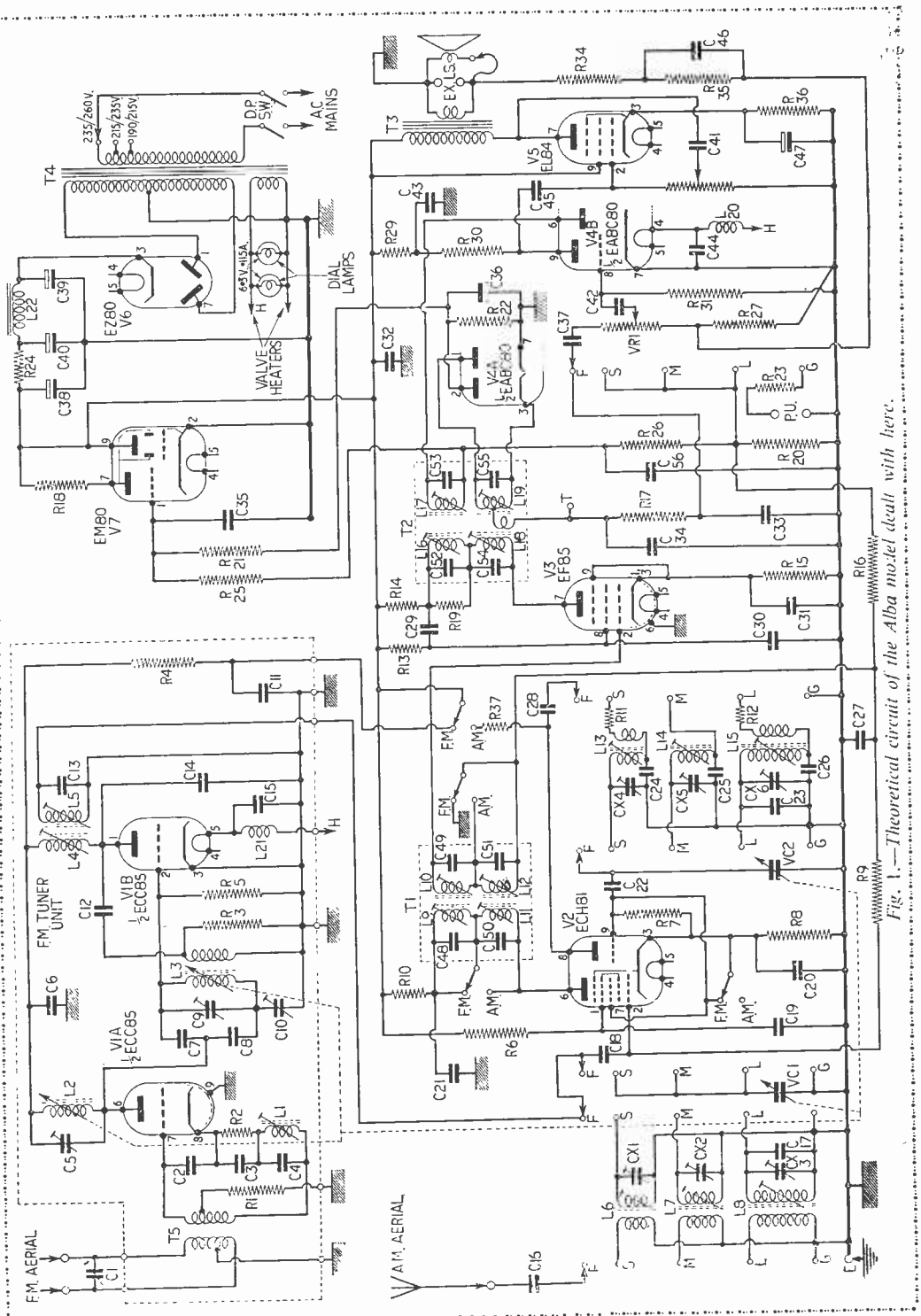


Fig. 1.—Theoretical circuit of the Alba model dealt with here.

A.F. content of the signal across the load is fed to the grid of the triode section of V4B by way of the band-selector switch. C37. the volume control (VR1) and C42. From hereon the circuit follows conventional practice. The amplified A.F. signal appearing across the load resistor (R30) of the A.F. amplifier triode is capacitively coupled through C45 to the control grid of the output valve (V5). the anode circuit of which is loaded by the loudspeaker. A degree of negative feedback is applied over the two A.F. stages from the secondary of the output transformer to the grid of V4B. A selective feedback tone control circuit is given by C41 and the tone control (VR2).

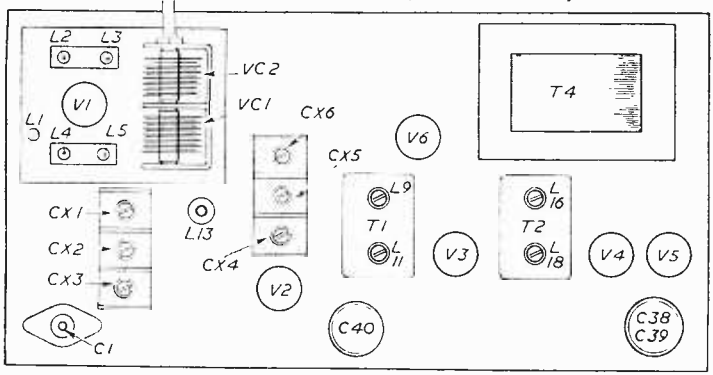


Fig. 3.—Top view of chassis, showing trimmer adjustments and major components.

A.G.C. and Tuning Indicator

The D.C. content of the signal at the A.M. detector is used as an A.G.C. bias. being fed to stages V2 and V3 by way of R16 and R9. C27 acting as decoupler. and also as a bias for operating the magic eye tuning indicator (V7). In this latter function the bias. whose magnitude is dependant upon the I.F. carrier signal at the A.M. diode. is applied to the grid of V7 through R25. C35 filtering any residual I.F. component. The tuning indicator is connected in the normal manner across the H.T. line.

F.M. Operation

Apart from the operations already mentioned. when the receiver is switched to F.M. the A.M. oscillator is muted by the band-selector switches disconnecting the oscillator coils and removing the oscillator anode from the H.T. line. At the same time H.T. is applied to the F.M. tuner unit. the triode/heptode coupling link is shorted to V2 cathode and the 10.7 Mc/s I.F. output from the tuner is connected to the control grid of the heptode by way of C18. Under this condition the heptode operates as an additional F.M. I.F. amplifier.

The F.M. Tuner Unit

The F.M. tuner is an independent unit whose permeability tuning is ganged by means of a cam to the main A.M. tuning mechanism. A single double-triode valve (V1) is featured. section V1A arranged as an R.F. amplifier and section V1B as a self-oscillating frequency changer. Although it may not appear so from first glance. the R.F. stage is connected in the earthed-grid mode. the grid being connected to chassis by way of a section of the grid winding of T5 and R1. In this way the internal electrode capacitances of V1A are neutralised and any tendency for positive feedback is avoided. A 300 ohms balanced aerial input circuit is adopted and impedance matching and coupling of the signal to the tuned cathode circuit (L1) are accomplished by the flatly tuned aerial transformer T5. The cathode coil L1 is also flatly tuned to embrace the whole of Band II. but the R.F. stage generally is tuned over the band by the anode coil L2 and its associated slug.

The amplified R.F. signal is applied to the grid of the frequency changer at the point of zero oscillator voltage which exists at the junction of C7 and C8. In this way oscillator radiation by way of the aerial. due to feedback through the R.F. stage. is kept to a minimum. since the voltage at the R.F. coupling point is maintained at zero as long as the bridge circuit comprising C7. C8. C10 and the valve capacitances is balanced. The trimmer T10 is provided to adjust for optimum balance which is indicated by the smallest oscillator signal at the aerial terminals.

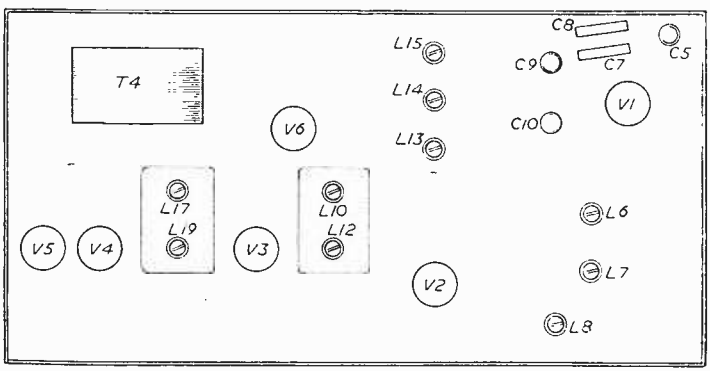


Fig. 4.—Under-chassis view, showing trimmer adjustments and major components.

The F.M. I.F. signal appears in V1B anode circuit. and is coupled to the heptode by way of L5. as already described. Tuning of the oscillator circuit is also performed by a slug in the oscillator coil L3. which is also ganged to the slug in L2 and the A.M. tuning system.

On F.M. the F.M. I.F. signal travels through

the circuits and appears in amplified form across the secondary of the ratio detector transformer L19. The ratio detector is completed by the two diodes in V4A, by the stabilising capacitor C36 and associated load resistor R22. The A.F. F.M. signal appears across C34 from whence it is conveyed to the volume control by way of the de-emphasis network R17 and C33, the band-selector switch and C37. The signal from here follows the same course as already described. A source of bias for operating the tuning indicator is available across the load resistor R22, and is fed from here to the grid of V7 through R21.

VOLTAGES

Valve	Set on F.M. Anode	Screen	Cath.	Set on M.W. A.M. Anode	Screen	Cath.
ECC85	a' 165	—	—	—	—	—
ECC85	a' 170	—	2.4	—	—	—
ECH81	230	90	1.9	250	75	2
	Oscillator			Oscillator		
	—	—		at 150	—	
EF85	120	85	1.85	130	95	2
EABC80	at 50	—	—	at 50	—	—
EL84	215	240	7.1	230	255	7.7
EM80	—	—	—	—	—	—
EZ80	295 volts each anode		300	295 volts RMS each anode		305

Readings taken on a AVO 7 with gang at Max.

The Power Circuit

The receiver uses a mains transformer which isolates the mains from the chassis, a full-wave rectifier and a two-stage choke/resistive filter, comprising L22 and R24, capacitors C38, C39 and C40 being the associated smoothing elements. A single L.T. winding on the mains transformer energises the valve heaters, including the rectifier, and the 6.3 volt 0.115 amp MES spherical dial lamps.

Servicing Notes

A sudden cutting off of F.M. signals after the set has been working for a while is usually caused by failing emission of the frequency changer section of V1. When this is the case, the F.M. section can usually be brought back to life by tuning to the high-frequency end of Band II and then retuning the set to the local Band II station.

A modulation hum occurring on F.M. when the tuning is adjusted slightly either side of the optimum tuning point is invariably the result of a defect in V4. Substituting the valve with one in good condition quickly proves this possibility.

Distortion on F.M. but not on A.M. is sometimes caused by unbalance of emission of V4A diodes. If valve replacement does not cure the trouble, however, misalignment of the ratio detector transformer, L18/L19, should be suspected. This trouble is also revealed on the tuning indicator by the tuning point for minimum distortion not coinciding with maximum deflection of the "eye."

Distortion on both services should lead to a check of C45 (for insulation resistance), R30 and R31 (for open-circuit or high value).

As an aid to fault finding, the voltages to be expected on the electrodes of the various valves, when the receiver is switched both on A.M. and F.M., are given in the table on the left.

Details for restringing the tuning drive are given in Fig. 2. A fine nylon cord is suitable for this purpose.

A.M. Alignment

The receiver should first be aligned on A.M., and the following procedure adopted. Short-circuit the oscillator tuning gang (VC2), inject a 470 Kc/s modulated signal across VC1, switch the receiver to M.W. and close the tuning gang. After allowing about five minutes for the receiver and signal generator to become frequency stable, adjust the cores in L9, L10, L16 and L17, in that order, for maximum indication on an output meter connected to the extension loudspeaker sockets. Repeat until no further increase in output can be obtained.

Remove the short-circuit from VC2, inject a 600 Kc/s modulated signal by way of a dummy aerial across the A.M. aerial and earth sockets, tune the receiver to 500 metres and adjust L14 and L7 for maximum indication on output meter. Repeat for best results. Retune the generator to 1,500 Kc/s and the receiver to 200 metres and adjust CX5 and CX2 for maximum output.

(To be continued)

LIST OF VALUES FOR FIGURE 1

C1—30 pF.
C2—8.2 pF.
C3—1,000 pF.
C4—47 pF.
C5—30 pF.
C6—570 pF.
C7—39 pF.
C8—39 pF.
C9—30 pF.
C10—30 pF.
C11—2,200 pF.
C12—18 pF.
C13—15 pF.
C14—12 pF.
C15—2,200 pF.
C16—200 pF.
C17—100 pF.
C18—100 pF.
C19—2,000 pF.
C20—.05 μF.
C21—.005 μF.
C22—100 pF.
C23—190 pF.
C24—5,343 pF.
C25—600 pF.
C26—270 pF.
C27—.1 μF.
C28—100 pF.
C29—.05 μF.
C30—3,900 pF.
C31—.1 μF.
C32—.25 μF.
C33—2,500 pF.
C34—330 pF.
C35—.005 μF.
C36—5 μF.
C37—.02 μF.
C38—32 μF.
C39—32 μF.
C40—8 μF.
C41—200 pF.
C42—.02 μF.
C43—.1 μF.
C44—1,000 pF.
C45—.01 μF.
C46—.1 μF.
C47—25 μF.
C48—100 pF.
C49—100 pF.
C50—27 pF.
C51—27 pF.
C52—100 pF.
C53—100 pF.
C54—10 pF.
C55—50 pF.
C56—100 pF.
R1—120 Ω.
R2—220 Ω.
R3—2.2 KΩ.
R4—4.7 KΩ.
R5—1 MΩ.
R6—47 KΩ.
R7—47 KΩ.
R8—220 Ω.
R9—1 MΩ.
R10—1.5 KΩ.
R11—220 Ω.
R12—10 KΩ.
R13—56 KΩ.
R14—10 KΩ.
R15—150 Ω.
R16—1 MΩ.
R17—12 KΩ.
R18—470 KΩ.
R19—68 KΩ.
R20—220 KΩ.
R21—2.2 MΩ.
R22—56 KΩ.
R23—100 KΩ.
R24—600 WW.
R25—2.2 MΩ.
R26—220 KΩ.
R27—100 Ω.
R28—
R29—220 KΩ.
R30—220 KΩ.
R31—10MΩ.
R32—
R33—
R34—1.5 KΩ.
R35—10 KΩ.
R36—150 Ω.
R37—27 KΩ.
VR1—500 KΩ. with D.P., S.W.
VR2—500 KΩ.

A Two-Valve Portable Radiogram

UTILISING ONLY TWO VALVES, THIS PORTABLE RADIO WILL ALSO FORM A USEFUL RECORD REPRODUCER

By M. L. Michaelis

(*Continued from Page 43. March issue*)

IT should be remembered that the chassis of this receiver is liable to be live, thus all earthed points projecting externally must be insulated. Pay particular care to grub screws of control knobs, and isolation of any metal masses of the record player.

Adjustments of Radio-amplifier

After completing the construction, check all wiring carefully. Then disconnect R2 from the grid cap of V1.

Advance the reaction control, after allowing sufficient time to warm up, on medium-wave radio setting. If it is not possible to obtain oscillation, reverse connections 5 and 6 on the tuning coil (Fig. 6). Oscillation should then be possible by sufficient advance of the reaction control at all positions over the tuning range of both wave-bands.

Now reconnect R2 to grid cap of V1 and switch to gramophone. Set VR2 to about the middle of its range with a small screwdriver. If a medium-frequency loud howl is now heard with the radio-amplifier volume control at maximum, remove lead 1 from contact A of VR2 and connect it to contact B (Fig. 7). But if nothing, or only a very high-pitched whistle, was heard with the volume control VR1 at maximum, then leave the lead 1 as it is.

Now, leaving VR1 at full volume, turn VR2 fully anticlockwise (or fully clockwise if lead 1 had to be altered). Then slowly advance VR2 until a high-pitched whistle just starts. Then turn it back about 30 degrees past the point where the whistle stops. The negative feedback is now correctly set up.

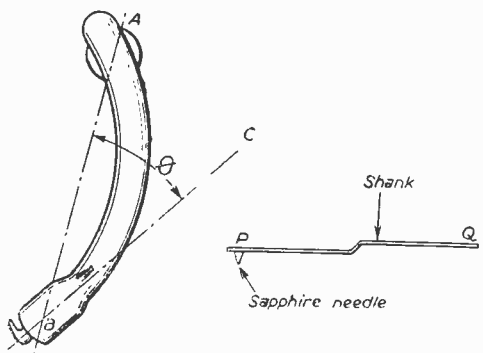


Fig. 7.—The pickup mounting is critical, see details on the right.

The Record Player

The exact design and layout of the record player, on the mechanical side, is largely a question of carpentry and, apart from the points discussed below, can be executed according to individual taste. A suggested overall appearance is shown in Fig. 9, this being that adopted in the author's equipment.

The position of the pickup foot in relation to the centre spindle of the turntable is a critical matter, and some care paid to it will be amply rewarded. If the pickup foot is incorrectly positioned, we get what is called "tracking distortion," which has the following characteristics. Reproduction tends to be more or less normal on the outer grooves at the start of a record, and then progressively deteriorates towards the centre of the record. High notes especially are affected, becoming woolly and muffled, giving a rasping noise getting worse and worse as the end of the side is approached.

In the absence of specific instructions from the makers, the following procedure should be used for positioning a loose pickup in relation to the turntable (see Fig. 7). It will be noticed that the only critical distance is that from the exact centre of the turntable spindle to the exact centre of the swivel-pivot about which the pickup turns in the horizontal plane. This swivel-pivot usually coincides with the centre of the foot, but should it not be found to do so, appropriate correction must be made.

Measure the distance from the swivel-pivot to

the needle-tip, to the nearest twentieth of an inch. Call this L inches. The best way to do this is to hold the pickup horizontally over a piece of drawing paper and make small dots exactly below the swivel-pivot (A) and the needle-tip (B).

Next, without moving the pickup after the previous stage, draw a line BC through B parallel to the shank, PQ, of the needle.

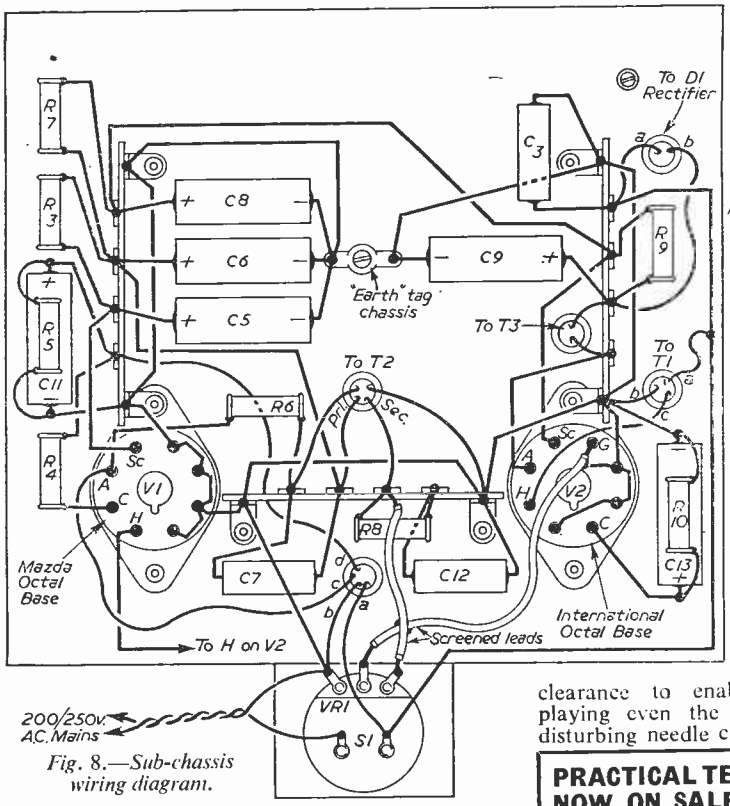


Fig. 8.—Sub-chassis wiring diagram.

Measure the angle ABC (θ) in degrees as accurately as possible by means of a protractor on the drawing paper.

Then: Required distance from turntable spindle centre = (L − 0.021θ) inches
to swivel-pivot = R inches

Assuming that the swivel-pivot coincides with the centre of the foot, the latter may now be placed anywhere on the circumference of a circle of radius R inches centred on the turntable spindle axis.

The second point to take care of is the height of the pickup in relation to the turntable. If a pickup and motor unit are purchased as a matched kit this point will most likely have been catered for during manufacture, so that the correct level is obtained simply by fixing the motor unit and pickup foot on a level board by means of the existing screw-holes or other attachment devices. However, if a pickup and motor unit are purchased separately, one or the other must be raised on its fixing device until the pickup arm runs true horizontal *whilst playing a record.*

Finally, it is necessary to adjust the counterbalance device in order to obtain correct stylus pressure on the record. The adjustment is usually some form of spring tensioning device underneath the pickup near the foot. Or it may be a sliding weight. If no device at all is found, yet the stylus pressure does not check correct, suitable pieces of lead foil will have to be attached.

Obtain a calibrated depression-type letter balance, as sensitive as possible. Prop up the record player and the balance on suitable books until, upon swinging out the pickup arm, the needle just touches the pan when the arm is horizontal. Adjust the counterbalance step by step until the balance registers between 6 and 8 grammes when the needle is gently rested on the pan. If the pressure is too small (below 6 grammes), the needle is liable to jump grooves on loud recordings; whilst if the pressure is too high (over 8 grammes) unnecessary record and needle wear result.

To avoid introducing motor rumble, the motor unit and the pickup should be attached to the board by resilient rubber or spring mountings.

When making the record player case, allow sufficient clearance to enable the lid to close whilst playing even the largest records. This avoids disturbing needle chatter noises.

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Ditto with mains primaries, 12/6 each.
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NOTE.—It is essential to use mains primary types with T.V. receivers having series-connected heaters.

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5 watt } **WIRE-WOUND RESISTORS** { 1/3
10 watt } 25 ohms—10,000 ohms......... { 1/6
15 watt } { 2/-
15,000 ohms—50,000 ohms, 5 w., 1/9; 10 w., 2/3.

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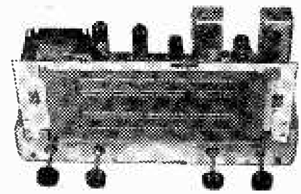
1S5	8/6	6Q7	10/6	EBF80	8/6	HVR2A	7/6
1T4	8/6	6SA7	7/6	ECC84	12/6	ML14	10/6
2X2	3/6	6SN7	8/6	ECF80	10/6	P61	6/6
3V4	8/6	6V6G	7/6	ECF82	10/6	PCC84	12/6
5U4	8/6	6V6GT	8/6	ECH42	10/6	PCC84	12/6
5Y3	8/6	6X4	7/6	ECL80	12/6	PCF80	10/6
5Z4	10/6	6X5	7/6	ECL82	12/6	PCF82	10/6
6AM6	8/6	12A6	7/6	EF39	7/6	PCL82	10/6
6B8	5/6	12AH8	10/6	EF41	10/6	PEN25	6/6
6BE6	7/6	12AT7	10/6	EF50	5/6	PL82	10/6
6BH6	10/6	12AU7	10/6	Equip.		PY80	10/6
6BW6	8/6	12AX7	10/6	EF50	5/6	PY81	10/6
6BW7	8/6	12BE6	10/6	Sylv.	8/6	PY82	10/6
6CH6	10/6	12BH7	10/6	EF80	10/6	SP61	5/6
6D6	7/6	12K7	8/6	EF92	5/6	UBC41	10/6
6F6	7/6	12Q7	8/6	EL32	5/6	UCH42	10/6
6H6	3/6	35Z4	10/6	EL84	10/6	UF41	10/6
6J5	6/6	80	8/6	EY51	12/6	UL41	10/6
6J6	7/6	954	1/6	EZ40	19/6	UY41	10/6
6J7	8/6	EA50	1/6	EZ81	11/6	U22	10/6
6K6	6/6	EABC80	8/6	E1148	1/6	X79	10/6
6K7	5/6	EB91	6/6				



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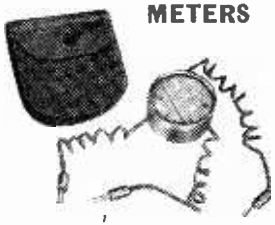

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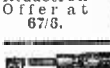

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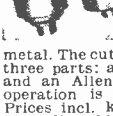

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		WX6	3 11

TRANSISTORS in Practice

5.—R.F. AMPLIFICATION

By R. Hindle

(*Continued from page* 48, *March issue*)

IT was pointed out in a previous series dealing with valve amplifiers that there is no difference between the amplification of audio and radio frequencies if all the factors are taken into consideration. In practice, however, reactive effects, i.e., stray capacitance and inductance, are ignored when considering simple audio design, but most certainly have to be taken into consideration when working with radio frequencies because their effect is no longer negligible. This is equally true of transistors. These have been considered, quite conveniently but sufficiently accurately up to now, as being purely reactive at both input and output, giving exactly 180° phase shift or zero shift depending on whether the common base or common emitter circuit is used. At R.F., this is no longer a fair assumption. Transit time effects are present because of the sluggish passage of carriers across the base from emitter to collector. As with valves, this effect sets an upper limit to the frequency that can be effectively handled, and in the case of transistors commonly available at present that limiting frequency is lower than in the case of valves.

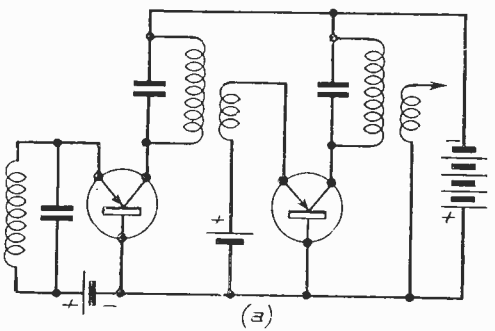


Fig. 30 (a—above, and b—below).—Basic circuit of the common-base R.F. amplifier.

Cut-off Frequency

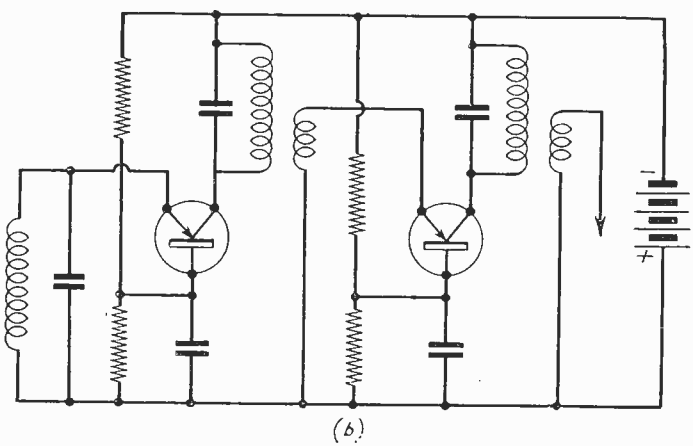
Transistors vary, of course, and their effectiveness at higher frequencies is indicated by the parameter called the "alpha cut-off" and designated by the symbol $f\alpha$. This is the frequency at which the current amplification factor falls by 3db. compared with the low frequency amplification factor α, not the frequency at which it stops amplifying in spite of its name. The word "cut-off" should not be taken too literally. This particular way of specifying the upper frequency is adopted to make the life of the mathematician as easy as possible—we ordinary folk use it as a basis for comparing one transistor with another and it serves that purpose quite well.

The symbol $f\alpha$ refers to the common base circuit; as usual a dash indicates a symbol referring to the common emitter circuit, so $f^1\alpha$ is the alpha cut-off frequency using the common emitter circuit. Sometimes $f\beta$ is used—it means the same. $f^1\alpha$ is lower than $f\alpha$, and the relationship is approximately $f^1\alpha \simeq \frac{f\alpha}{\alpha^1}$

in words, the cut-off frequency using a common emitter circuit is equal, or more or less, to the cut-off frequency base working (the figure usually quoted in transistor literature) divided by the current gain with common emitter circuit.

The transistors available until recently had a comparatively low $f\alpha$ and attempts at R.F. amplification generally used the common base circuit. Though, under these circumstances, the current gain of the transistor itself is less than one, power gain was obtained by virtue of the higher output impedance, and transformer coupling gave, from emitter to emitter of two transistors, the current gain looked for. The higher gain claimed previously in audio cases for the common emitter circuit was lost at R.F. due to the low cut-off frequency of the earlier transistors and the lower input/output resistance ratio of the common emitter circuit made this circuit less effective.

The basic circuit of a transistor amplifier with two stage working with common base is given in Fig. 30(a). A step-down inter-transistor transformer is used to match the higher resistance output to the lower resistance input of the follow-



ing transistor. The transistor output reactance is absorbed in the tuned circuit.

Separate emitter batteries would not be used in practice, and can be avoided by using base bias from a potentiometer as indicated in Fig. 30 (b).

The common emitter circuit is preferred at R.F. as at A.F. if the $f\alpha$ of the transistor is suitable for the frequency to be worked. The cut-off frequency for common base operation, that is usually quoted in transistor data, should be ten times the frequency that it is intended to work in the common emitter circuit to get optimum gain and so, a R.F. amplifier intended to work on the medium waves with a common emitter circuit should preferably use a transistor with a cut-off at 10 Mc/s. Quite significant gain can be obtained with transistors of somewhat inferior frequency performance.

Feedback

It will be remembered that one of the characteristics of a transistor that is responsible for a complication in circuit technique is that the output circuit is directly coupled to the input circuit internal to the transistor and not isolated as in the case of a valve used in an audio circuit. But of course, the old hands will remember that input and output is far from being isolated when a triode valve is used for R.F. amplification. The transistor, or at least those now available, are triodes and the problem presented is much like the one involved in designing a triode valve R.F. amplifier. Subsequently valves with more electrodes were developed to avoid the coupling between anode and grid and similar developments are now taking place in the field of transistors. Sooner or later the tetrode transistors with means of accelerating the passage of current carriers and reduced coupling from output to input will be made available and these will operate at much higher frequencies than those now offered.

Meanwhile the triode-type of transistor has to be used, and so we are just where we were when only triode valves were made. Experiences of those earlier days can be drawn upon for the solution to the transistor problem now being contemplated.

The way out, for the benefit of those who have not experienced the earlier valve problems, is to neutralise the effect of unwanted feedback by providing a second feedback loop exactly like the unwanted one, but feeding it from a point where there is a signal 180° out of phase with that from which the spurious feedback arises.

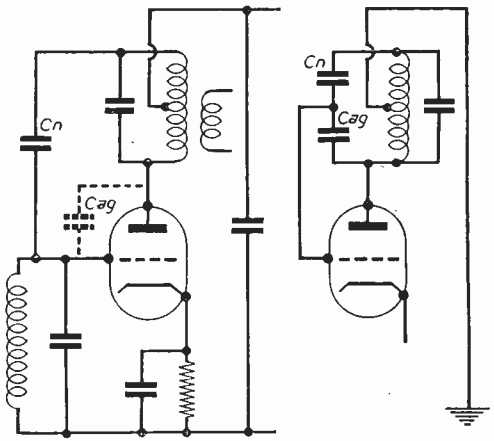


Fig. 32.—Triode valve neutralised R.F. amplifier. *Fig. 33.—Neutralised Circuit redrawn as bridge.*

There is no D.C. path from anode to grid of a triode valve and the feedback that takes place is via the anode to grid stray capacitance. This stray capacitance is represented in Fig. 32 by Cag. shown dotted. Normally the top of the anode tuned circuit goes to H.T. positive, but if, instead, the coil is centre-tapped and the centre-tap is connected to H.T. positive (which so far as signals are considered is equivalent to earth) as shown in this illustration, the valve is just as effectively fed with current but only a half of the signal across the tuned circuit is now fed on to the following circuit. A signal also exists between the centre-tap and the upper end of the tuned circuit and this is 180° out of phase with the anode signal. It is necessary, now, only to add to the circuit Cn in Fig. 32, which is made equal to Cag (in practice a variable is provided) to provide satisfactory neutralisation, the signal is fed back through Cn being equal and opposite to that via Cag, which is thereby cancelled out.

Maybe some readers will find it easier to think in terms of a bridge circuit, and so the circuit of Fig. 32 is redrawn in Fig. 33 to show the bridge effect more clearly.

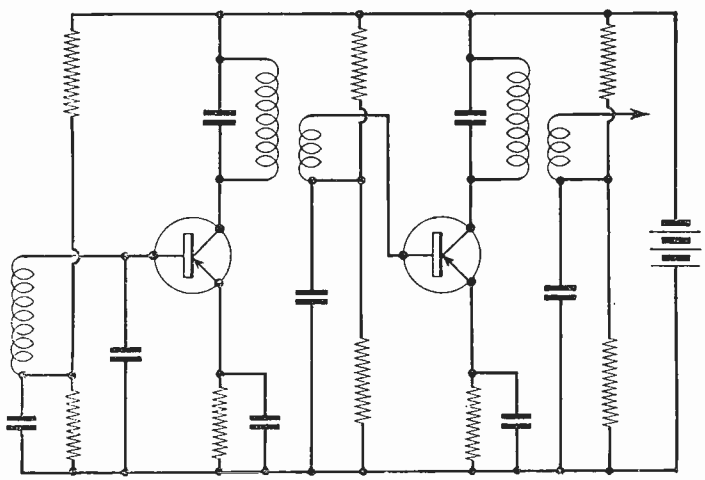


Fig. 31.—Basic circuit of common-emitter R.F. amplifier.

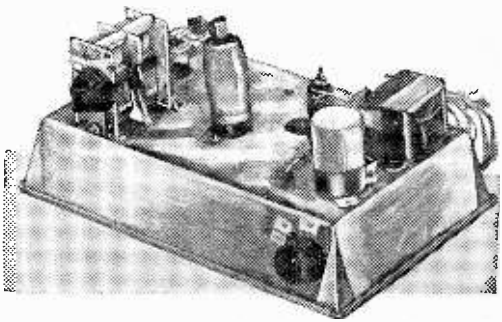
(To be continued)

A Beginner's CONSTRUCTIONAL COURSE—III

A NEW SERIES WRITTEN ESPECIALLY FOR THE AMATEUR

By E. V. King

1.—A 1-VALVE A.C. SET



THERE have been numerous requests for a course for beginners, and with this in mind the author set out to design a receiver in such a way that each stage could be built and got working before the next was attempted. The beginner often has limited finances and it was decided to build the receiver round three SP61 or SP41 valves, both of which are obtainable very cheaply. The total cost of the receiver when it is completed comes to a maximum of £2 10s. without the speaker, and many who go in for careful selective buying from advertisements in this magazine will cut down on that quite a lot.

The circuit used is a well tried 3-valve T.R.F. arrangement, but the practical wiring is arranged to give the beginner confidence in sorting out the various wires and parts. In some cases the experienced man may wonder why a certain thing has been done, i.e., it will be seen that H.T. is taken to pin 7 of each valve, this is not the easiest arrangement for one with experience, but it is for the beginner.

The prototype of the receiver, when completed received scores of continental stations on a short aerial at loudspeaker strength and the output, though not large, is ample for the ordinary living-room. A larger output stage will be detailed at the end of the course for those who wish to have a louder output.

Theoretical and Practical

The beginner is advised to use the theoretical circuits in conjunction with the practical layouts given. The author has made a complete circuit (for each section) with which the beginner should check his modifications for the month. This circuit has been purposely set out in a slightly different way from subsidiary circuits given earlier.

It is proposed firstly to make up an L.T. power unit, an H.T. power unit, and a one valve receiver for use with phones.

The Chassis

It is possible to build this receiver on quite a small chassis but the beginner must not do this as many mechanical and electrical difficulties are introduced. Soldering in small places can only be done after much practice and electrical feed-back due to interaction of close components causes oscillations which it is difficult for the beginner to get rid of. The chassis thus measures approximately 10in. × 5½in. × 2in. high, the measurements are not important and can vary by about 10 per cent. either way without harm.

Making a chassis is not easy unless you have a well equipped workshop and so the author used baking tins from a popular store for the demonstration prototypes photographed with the series. Oil drum metal straightened, cleaned and aluminium painted makes a good chassis, aluminium, copper or tinplate can also be used. The baking tins used by the author were old ones so they were made to look better with aluminium paint, this is scraped away where tags connect to the chassis.

If you wish to make your own chassis the shape required is given in Fig. 1.

Cutting the Holes

The valve and condenser holes must be cut

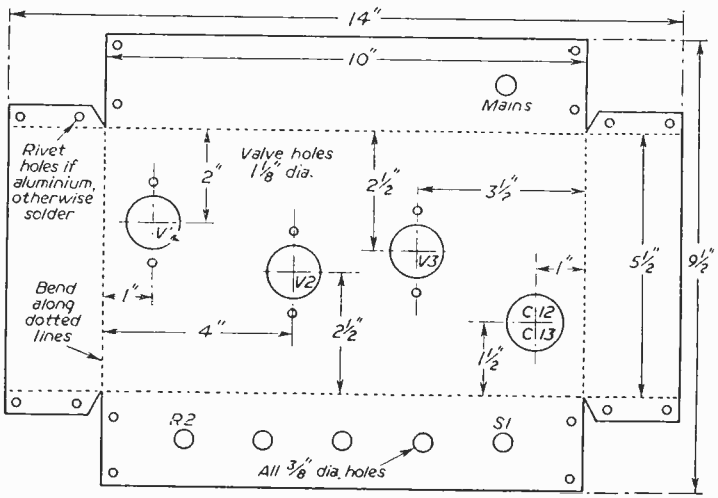
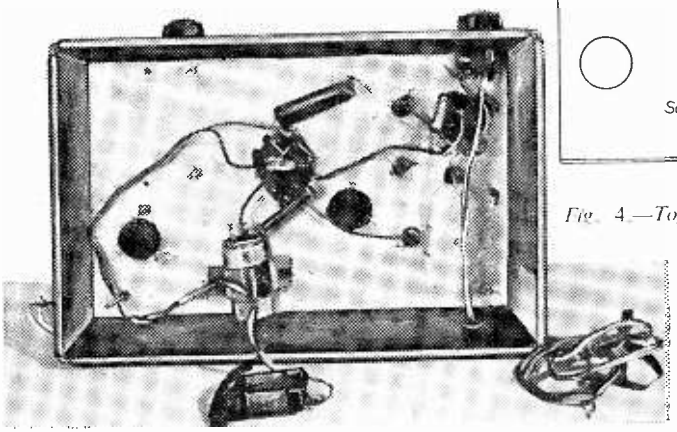


Fig. 1.—Details of the chassis. This may be made from tinplate, copper or aluminium. You can also make use of an ordinary baking tin.

out. There are various ways of doing this. Special valve hole cutters may be bought at radio dealers, or variable tank cutters may be purchased much more cheaply at an ironmongers or borrowed from a plumber. They need, however, to be used with great care or they will tear the tin and spoil the chassis. A quite satisfactory, though rather longer method, is to drill a series of ⅛in. holes round the edge of the one to be cut out, and the centre is then loosened either with small tinsnips or a chisel. The burred edges are then carefully filed with a fine mesh half round file. The holes are all to be exactly 1⅛in. in dia., do not make the holes smaller in any event, and not larger by more than 1/16in. It is best, if making a chassis, to cut the holes out before bending the metal to shape.

When the holes have been cut out hammer the metal chassis flat on a smooth surface.

A top view of the chassis with approximate dimensions to centres is given in Fig. 1 and Fig. 2a, a front view in Fig. 2b.



Under side view of Stage 1.

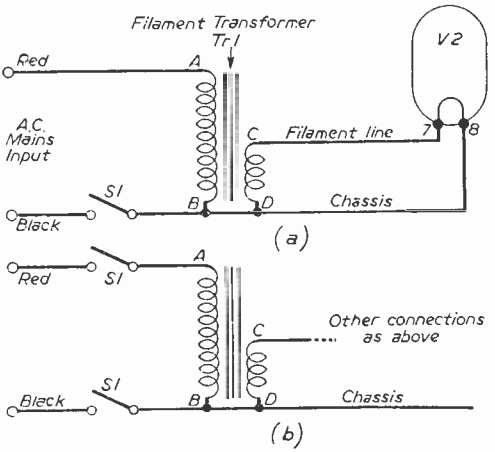


Fig. 3.—Details of the heater circuit.

The L.T. Power Unit (Filament Supply)

Since the receiver requires 4 or 6.3 volts to light the valve filaments, the available mains voltage has to be reduced by a suitable transformer and an on/off switch incorporated.

The L.T. supply shown in Figs. 3 and 4 uses a transformer TR1 for filament supplies. The beginner may use either SP41 or SP61 valves. The following points may

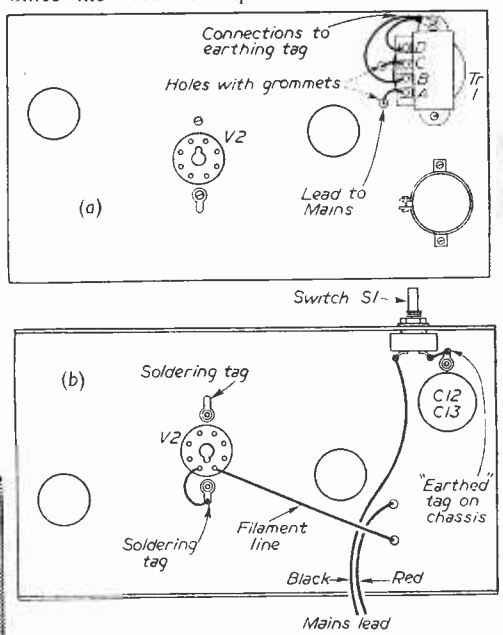


Fig. 4.—Top and underside views of the heater circuit.

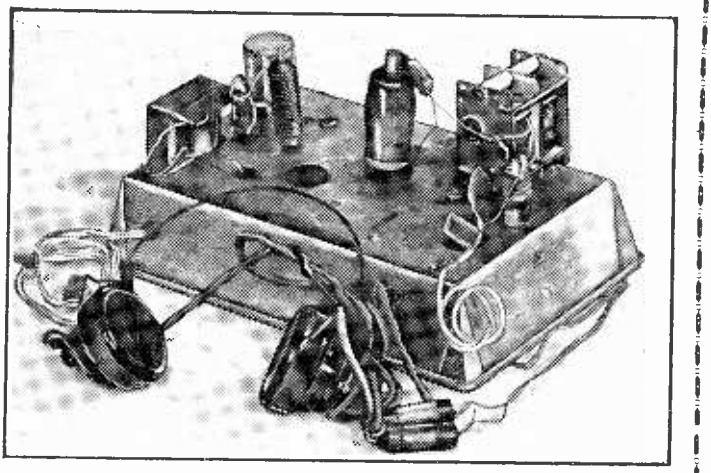
LIST OF CO

Components used for first stage (their function will be explained in the next issue.)
Baking tin or chassis.
Grommets.
Nuts, bolts, soldering tags, push back insulated wire, solder, flux, etc.
V2—SP41 (VR65A) or SP61 (VR65).
Mazda Octal valve base and top cap connector.
MR1—Metal Rectifier, any type rated at 240 v. and 30 mA or more.
C1—500 pF ceramic or mica, 500 v. working.
C7—100 pF ceramic or mica 300 v. working.
C10—.1 μF paper 350 v. working.
C15—100 μF mica or ceramic 500 v. working.
C9—One half of a double electrolytic condenser, 8-8 μF, 350 v. working.
C12 and 13—Another double electrolytic, 16-16 or 32-32 μF 350 v. working.
R4—1 Megohm ½ watt. (Brown, Black, Green.)
R7— ditto. ditto.

enable him to decide which to buy. SP41 valves require 4 volts and SP61 require 6.3 volts for the heaters. A six volt filament transformer is more likely to be useful to the experimenter if he ever strips this receiver to make another. SP41 valves are just as good as SP61's but are somewhat cheaper. It is quite possible to use a standard speaker transformer for lighting the 4 volt filaments if you have 240v. A.C. mains. Suitable transformers are obtainable from an advertiser at 1s. 9d. These were used on the prototypes shown.

Fix your transformer, valveholder and rotary (not toggle) on/off swich as shown in Figs. 2a and 2b and Fig. 4.

If you are not sure about the connections to the tags on the transformer use a torch battery and flash lamp bulb as shown in Fig. 5, noting that when two tags are found which will light the lamp, then those tags are the filament connections. It does not matter which way round each pair are connected.



A general view of the finished Stage 1.

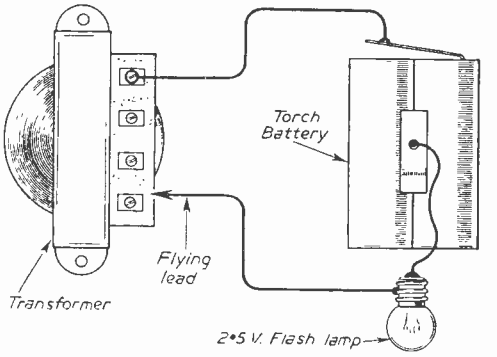


Fig. 5.—How to check an unmarked transformer.

Fix the valve base *under* the chassis with the locating lug to the rear when viewed from underneath (Fig. 4 (a and b)). If your holders are paxolin make sure that they are mounted so that the valve pins, when inserted, do not short to chassis. Fix soldering tags (home-made ones of cocoa tin metal will do) with the nuts and bolts fixing each valveholder. Only one holder need be purchased and fitted this month. Note that the base is known as a Mazda Octal and is quite different in size from the International Octal. Do not try and force the valve in if you have the wrong base. If the holders are old surplus stock scrape them clean in the sockets and on the soldering tags.

Wiring the L.T. Supply

Here is a suggested plan for the beginner to

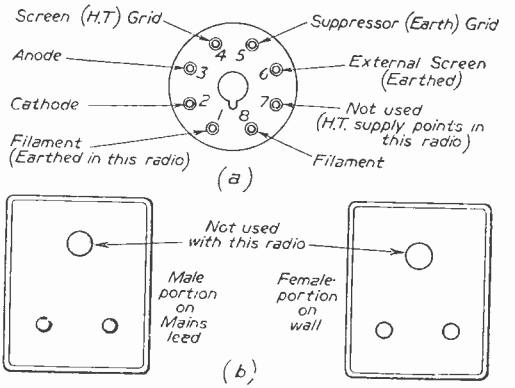


Fig. 6.—The top illustration shows the valve base identification, and the lower illustration gives the standard mains 3-pin plug details.

PONENTS

R8—470k ½ watt. (Yellow, Violet, Yellow.)
R6—10k ½ watt. (Brown, Black, Orange.)
R11—3k 3 watt. (Orange Black, Red or printed letters.)
TR1—Filament transformer or output transformer used as such. See Text. 240-200 v. to 4 or 6.3 volts.
L1—Wearite PA2 coil.
S1—Single-pole single-way rotary switch with insulated knob.
C5 and C6—Double variable 500 pF condenser fitted with trimmers and a tuning knob (large one or slow motion drive).
Phones fitted with two .05 μF 500 v. condensers as stated in text.

(Note.—The beginner may always use condensers of higher rated voltage than stated and resistors of higher wattage provided there is room for them in the receiver.)

follow. Take the twin mains lead through a hole in the back using a grommet to avoid the wire insulation cutting and shorting to chassis and connect the black wire to one tag of the on/off switch S1, Figs. 3 and 4. Take the red lead through another grommet to the top of the chassis and solder it to one mains tag of the filament transformer. Join the other mains tag of the transformer to earth i.e., to chassis, using a soldering tag where the bolt holds the transformer in position (Fig. 4a). Earth also one of the filament tags or wires. Join the other tag of the switch to chassis again using a tag. Now take a coloured wire to take the filament current and connect it to the other filament wire or tag on the transformer, feed it through a grommet to pin 8 on V2 (Fig. 4b). Join pin 1 V2 to earth by a tag mounted with the holder. The L.T. circuit is now complete for our one-valver.

The following points may be helpful for the beginner:

1. The bases are numbered as shown in Fig. 6 when viewed from underneath in a clockwise direction starting at the lug. In his early days the author built a similar receiver and made the common learner's error and viewed them from on top.

2. The mains switch must be a type which uses an insulated knob or there is a danger of shock if the unit is incorrectly connected to the mains. A two-pole type could be used, the other two contacts being inserted in the lead going to TR1 (see Fig. 3b). If the cheaper single pole type is fitted always disconnect from mains plug when working on the receiver.

3. Do not work on a mains receiver when standing on a garage, shed, concrete, or other damp floor. If you do your work in such a place use a good rubber mat in perfect condition. Do not work near water taps or other earthed objects. Provided the user is not himself wet he is not likely to do himself harm, but he certainly will drop a chassis or valve when 240v is applied to his body! Never touch a mains radio with wet hands or feet.

4. On this receiver if you connect the mains the wrong way round the chassis becomes live, so be sure to connect the lead going via S1 to chassis to the neutral or black wire and connect correctly to the 3-pin socket (Figs. 6a and 6b).

5. If in doubt connect a small mains lamp or neon lamp between chassis and any earth (i.e., water pipe). if the lamp does not light all is well. if it does then the chassis is connected to the live side of the mains and the plug connections must be reversed.

Testing the Filament Circuit

Plug in the valve. locating the lug correctly and holding it by the bakelite portion. Connect the mains as detailed above. Switch on at the mains and set by means of S1. A slight hum will be heard coming from the transformer. If it is excessive it is probably not screwed down tightly but if it is getting very warm then you have caused a short by incorrect wiring and you will have to recheck. In 30 seconds V2 filament, viewed around the top cap, should be alight. Do not leave it on for longer than necessary.

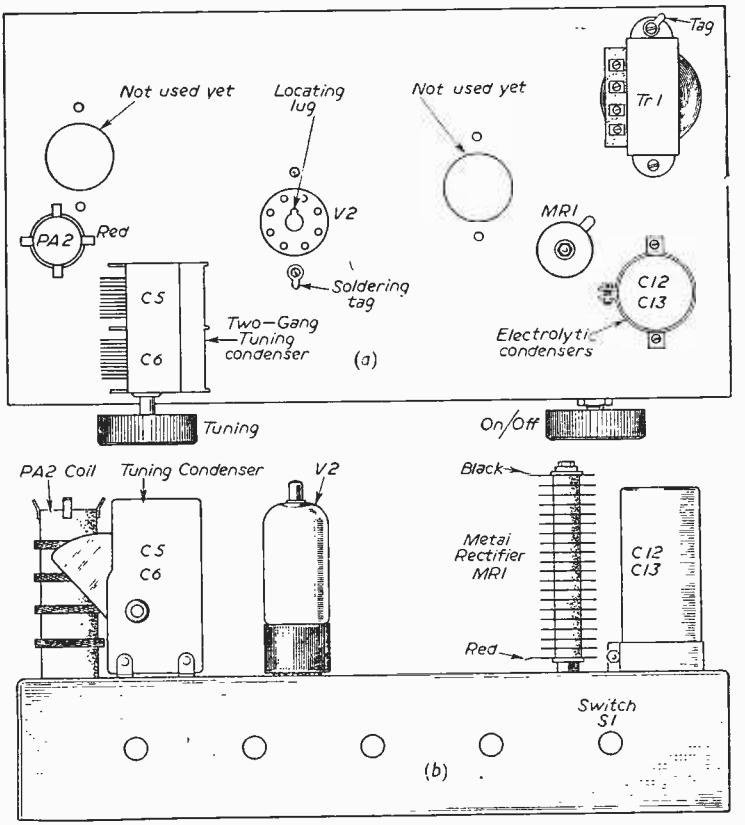


Fig. 2.—(a) above and (b) below. Top and front views of the receiver showing component positions.

Transformer Temperature Rise

The transformer should never get hotter than can be tolerated by the fingers, if it does and no short is present, then the transformer is not capable of supplying the current required, which this month is just under 1 amp. Do not proceed until you have this part of the circuit functioning perfectly.

The H.T. Power Unit

Here the mains is taken as an A.C. source at 200v to 250v and is rectified and smoothed to D.C. and then fed to each valve in turn. The theoretical circuit in Fig. 7 should be compared with the practical layout in Figs. 8a and 8b. The rectifier may be any metal type capable of having 240v across it and supplying 30 mA or over: it is mounted on one end and above the

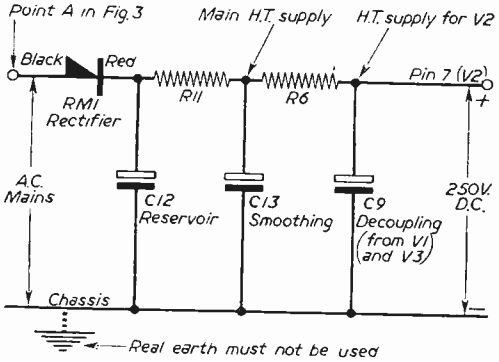


Fig. 7.—Circuit of the mains unit.

chassis to allow adequate cooling of its fins. Do not alter the tightness of the nuts which hold the rectifier together or it will be ruined. It is mounted with the black tag uppermost and the red tag adjacent to the chassis. C12 and C13 are the smoothing condensers made in one largish can. they are rated at 16 or 32μF and 350v working (or 450v for added safety). If you examine this can, you will notice three tags, one tag is common to both condensers and is usually coloured black. This has to be earthed to chassis. Sometimes there are only two tags in which case the can itself is the other connection and it must be so attached to the chassis that it makes a perfect connection. Often too, one of the condensers is able to take more A.C. (ripple) than the other, this is noted on the case. is usually coloured red, and should be used for C12. The smoothing resistor R11 is of large wattage and is rated at 300 ohms (sometimes written 3k) and 3 watts or over. It gets quite hot in operation and is mounted directly on to the tags of C12 and C13 with leads at least one inch long at each end. It is suspended "in air" and care should be exercised so that no wires go near to it or they may have their insulation burnt off.

In this stage we are only concerned with V2 so the output from R11 is fed through a decoupling resistor R6 (this is very necessary when more stages are added) to one tag of another double electrolytic condenser C9 (the other half, C8 is not used yet). The remarks given about the other double electrolytic apply here too: no ripple is present however.

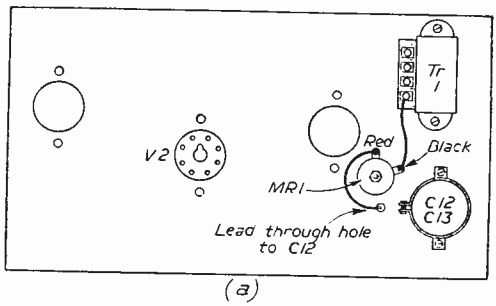
Electrolytic condensers must be new. they will not keep on the shelf indefinitely but keep better when in use. If they are connected the wrong way round (or the rectifier is the wrong way round) they are ruind beyond repair.

Wiring the H.T. Supply

Here is a suggested plan for the beginner to follow. Study Tr1 and you will notice that one mains tag is earthed. the other goes to the mains (red) lead. take a short wire from this tag and solder it on to the black tag of the metal rectifier MR1. Do not overheat the rectifier in so doing. Now take a lead from the red tag of MR1 through a grommet to the positive tag of C12. Prepare R11 and solder in position between C12 and C13. Now take a lead from C13 to pin 7 on V2 base. fixing to this tag one end of R6. The other end of R6 is then connected to tag of C9. Remember to earth the black tag of the two electrolytics if necessary as already detailed. The junction of R6 and C9 is the feed point for the valve we are using at this stage.

Testing the H.T. Supply

Plug in. switch on at mains and by S1. Observe that no resistors get hot (there is no load on them yet). If they do then there is a short circuit, a condenser is faulty or the rectifier is not doing its job. After one minute switch off. Unplug from mains. Hold an insulated screwdriver in such a way that it shorts junction of R6 and C9 to chassis. A big fat blue spark should jump across. Always discharge electrolytics in this way when servicing the receiver. If you wish to play safe you may wire a 1k $\frac{1}{4}$ watt resistor in one of the leads to RM1. this resistor



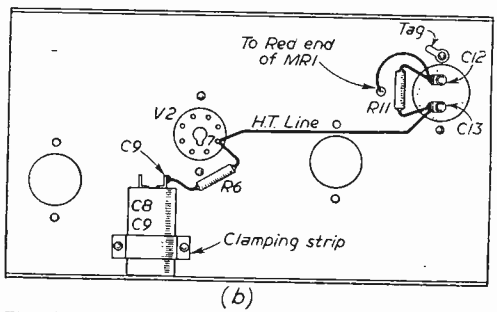


Fig. 8.—Additional wiring to complete the H.T. circuit of Fig. 7.

will act as a fuse and burn out if you have made an error in the wiring. This resistor is much cheaper than another RM1. If you are lucky enough to have a meter check between chassis (negative) and junction R6 and C9. it should be about 300 volts since no load is being applied. Do not proceed with the radio until this circuit is in order.

(To be continued)

The Application of Rectifiers

METAL RECTIFIERS MAY BE USED FOR A VARIETY OF PURPOSES AS EXPLAINED HERE

By "Serviceman"

ANY device which enables an electrical current to pass more readily in one direction than in another can act as a rectifier, and modern metal rectifiers are among the most robust and convenient units of this kind. They have a very wide field of application, and suitable circuits can usually be connected up without any undue difficulty. They may be used with models, or in plating, charging and spark-suppression circuits, as will become apparent when their application is considered in detail, and usually have very long and useful lives.

The ratings of such rectifiers should first be considered, and are expressed in terms of the maximum voltage and current they can safely handle. For example, a 12v. 2 amp rectifier would have a maximum current rating of 2 amps, and could be used in a circuit where the voltage does not exceed 12. It would also be suitable for use on any lower voltage or current, and this fact considerably increases the usefulness of any rectifier obtained. When a rectifier is operated at or near its maximum ratings, reasonable ventilation should be allowed and the fins should preferably be situated vertically. With lower ratings, heating may be extremely slight and ventilation is less important. A number of holes should, however, be drilled in any type of case containing a rectifier and its associated components, unless operation will be for short periods only.

Such rectifiers consist of specially prepared metal plates or discs usually secured together by a long bolt or threaded rod, and in no circumstance should they be dismantled. They are available in half-wave, full-wave and bridge types, and this should always be kept in mind when a rectifier is to be purchased for any particular circuit.

A half-wave rectifier has two tags only and is shown at "A" in Fig. 1. It allows current to flow in one direction, but not in the reverse direction. When alternating current is applied to it, as with the transformer secondary illustrated, a pulsating direct current flows in the external circuit. This form of rectification is suitable for many purposes, but full-wave rectification has the advantage that both positive and negative pulsations of the A.C. supply are used. The type of rectifier shown at "B" uses a centre-tapped transformer, and has three tags. For a given output voltage, the transformer secondary will have to be of twice the voltage rating of the secondaries in "A" or "C." The last type of rectifier shown at "C," is often most convenient, for full-wave use, for this reason. For given outputs "A" or "C" could use a secondary of, say, 12v. rating. "B" would require a 12-O-12v. secondary, the "O" being, in effect, a centre-tap on a winding delivering 24v. in all.

Before considering actual working circuits, the output voltage desired from any piece of equipment using a rectifier should be considered. Some voltage drop arises in a rectifier, according to its type and loading. If charging is in view, it should also be remembered that a normal 2v cell rises to 2.8v on charge. Because of these factors, allowance must be made for possible voltage drop. To avoid insufficient output, the transformer secondary should provide up to 50 per cent. more voltage than will be required, or 100 per cent. when low voltage charging is in view. Should the voltage eventually prove a trifle high, a wire-wound resistor will drop it to the required level. On the other hand, if insufficient output is encountered, no simple way of increasing it exists. For example, a 6v transformer and 6v rectifier would be quite inadequate for charging a 6v. accumulator. When

(Continued on page 129)

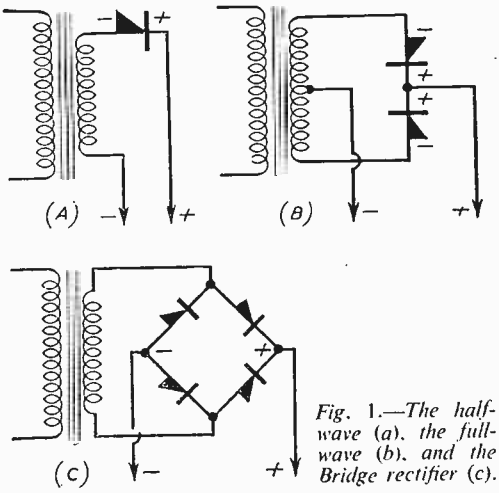


Fig. 1.—The half-wave (a), the full-wave (b), and the Bridge rectifier (c).

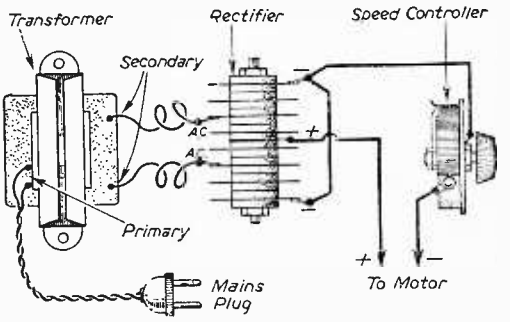


Fig. 2.—Operating a D.C. type motor.

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NEW MULLARD 2 VALVE PRE-AMP
Constructional details for this appear in the March issue of Radio Constructor. We can supply all items, write for list.

MULLARD TAPE AMPLIFIER TYPE "C"

THE MULLARD TAPE AMPLIFIER TYPE C is a new version of the Type B Amplifier. It comprises a recording amplifier and a play-back Pre-amplifier, and is intended to use an existing amplifier for play-back. It uses a Ferroxcube Inductor in the treble boost circuit and has a switch for the speed equalising circuits in place of the plug-in unit on the Type B Amplifier. The circuit gives details for use with Brenell, Collaro, Truvox and Lane Tape Decks.
INSTRUCTION MANUAL is available from us free of charge. Please send 4d. in stamps to cover cost of postage.
COMPLETE KIT containing all components, valves and sundries kit.
KIT A.—With alternative valves. £14.0.0.
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the exact output required is not known, it is helpful to have a transformer with a number of tappings, so that various voltages may be chosen.

For Permanent-magnet Motors

Motors of this type are used in quite a number of models, especially trains, so that reversing is possible by changing the polarity of the supply. Motors with wound fields and armatures may be run from A.C., but this is not so with permanent-magnet motors, and a rectifier is required. One suitable circuit is shown in Fig. 2, though the other forms of rectification indicated in Fig. 1 may be used, if components for these are to hand.

With the type of rectifier shown, positive and negative tags are marked with red and black, or with the usual positive and negative signs. These must be observed in any circuit where the polarity of the output is important. The rectifier input tags are marked "A.C." in Fig. 2, and may be thus indicated on the rectifier; in other cases, green may be used, or a sign similar to the letter "S." The centre bolt is usually insulated from all the plates.

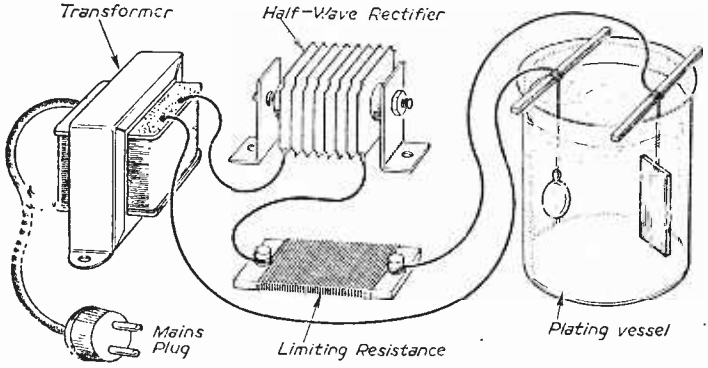

Fig. 3.—A simple circuit for electroplating.

To avoid troublesome experiment in obtaining the exact output voltage required, a wire-bound resistor or speed controller can be added in one lead with advantage. For most purposes a value of about 0 to 5 ohms will be satisfactory. Or a controller may be constructed from spirals of resistance or iron wire fixed between studs or bolts contacted by a rotating arm.

If the transformer is sound, all secondary connections will be safe to handle. The primary connections, being at mains voltage, should be of good flex, with no bare joints, and a proper mains plug. If joints are necessary at the transformer, they should be adequately covered, or the components enclosed in a wooden box. As a further safeguard it is recommended that a fuse of low rating (about 1 amp) be included in each mains lead, and that the frame, core and secondary of the transformer be wired to earth on the mains plug. If this is done, any breakdown in the transformer insulation will cause the fuses to blow and the secondary circuit will not became alive at mains voltage. The usual 5, 13 or 15 amp house fuses are not adequate protection against this.

Plating and Charging

When electroplating objects where a fairly heavy current is required for a long period, batteries are not very satisfactory, and may be replaced by a transformer and rectifier, when A.C. mains are available. A simple circuit of this type is shown in Fig. 3, but full-wave rectification could be used. The rating of the transformer and rectifier will, of course, depend upon the type of plating and the current which must flow. A meter may be included in one lead to show the current flowing, just as with battery circuits.

A simple charging circuit is shown in Fig. 4. Here, again, a full-wave rectifier circuit can be used. A transformer with a tapped secondary is indicated, so that batteries of different voltages can be handled. The variable resistor also enables the output to be adjusted, and permits control of the charging rate. When first using this circuit, the lowest voltage tapping should be used and the resistor set at maximum value. If the charging current is too low, the resistor may be turned towards zero, or a tapping chosen which gives more voltage.

No current can flow unless an accumulator is actually connected. To guard against possible damage due to shorting of leads or connecting the battery in the wrong polarity, a fuse may be wired in series with the meter, or a fixed resistor of about 2 ohms may be included, to limit the current. The correct charging current is usually indicated on the accumulator. Lower currents may be used, if necessary, though the accumulator will then require to be left on charge for a longer period. After charging has been in progress some time, the current will tend to fall, due to an increase in battery voltage. This is normal, and does not indicate any fault or deterioration in the rectifier or other parts.

Other Applications

In addition to making available a ready source of D.C. from A.C. mains, rectifiers have several applications of a rather different nature. One of these is shown in Fig. 5, and is very useful for relays or other inductive loads controlled by

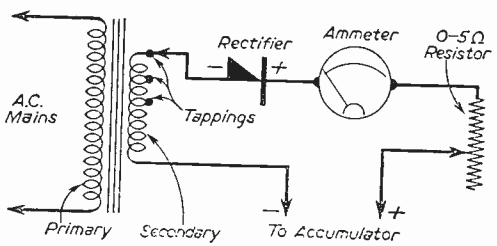

Fig. 4.—A circuit for accumulator charging.

contacts of low current-carrying capacity. With such inductive loads, a high voltage surge arises when the contacts are opened, causing a spark to pass. This voltage is usually many times that of the voltage of the operating source, and of reversed polarity. Such sparking may be suppressed by wiring a rectifier in parallel with the coil winding or other inductive load, as shown. The rectifier presents an infinite resistance to the normal applied voltage, but acts as an effective short circuit to back E.M.F. generated when the contacts are opened. As the load is only momentary, the rectifier need usually have a voltage rating only equal to that of the applied operating voltage. This kind of circuit is recommended by some relay manufacturers, especially when a relay with very light contacts is used to control a larger relay. Sparking at the contacts of the first relay can thus be avoided.

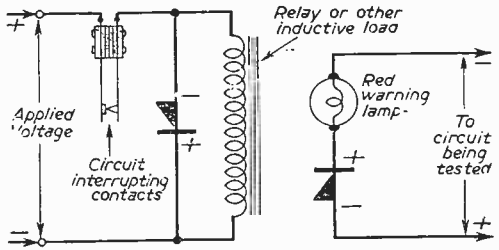

Fig. 5 (Left).—A spark-quenching circuit.
Fig. 6 (Right).—Polarity reversal warning circuit.

A second application of interest is shown in Fig. 6, and useful in any instance when it is desired to know that an applied polarity is correct or when equipment may be connected to a D.C. source in the wrong polarity (e.g., with D.C. mains). When polarity is correctly applied, the lamp does not light because no current flows. If, however, the polarity is reversed, current flows and the warning lamp is illuminated. This is particularly useful with any equipment which would be damaged if switched on when connected in the wrong polarity (e.g., D.C. mains operated amplifiers), or when any indication is at once required if the polarity is wrong (as, for example, when connecting up a number of accumulators). For mains voltages a 250v rectifier and low-consumption mains-voltage lamp or neon is required; for low voltages a low-voltage rectifier and bulb will be suitable.

Dry-cell Activator

A directly-operated circuit for dealing with batteries up to 150v, is shown in Fig. 7, and may be made up at extremely low cost. Here the fuses are to safeguard the equipment in the event of any short circuit. The double-pole switch isolates the cells, etc., when in the "Off" position, and is essential when operation directly from the mains is undertaken. It can in no circumstance be replaced by a single-pole switch unless the mains plug is always withdrawn before touching any bare connection.

The 100 ohm resistor limits the peak rectifier current, and the 16μF condenser provides a measure of smoothing and acts as a reservoir for the pulses received from the rectifier. The current adjusting potentiometer requires to be of the wire-wound type, and can be of 10,000 ohms. A further resistor, of about 1,000 ohms, limits the battery current.

If torch batteries and other low voltage batteries only are to be dealt with, a charging circuit such as that in Fig. 4 may be used. The current is, however, very small, compared with that required for an accumulator. The circuit in Fig. 7 can deal with radio H.T. batteries, but is not very suitable for batteries of very low voltage. The actual charging current will depend upon the size of the cells, and will usually be about 10 to 30 mA (.01 to .03 amp). Batteries which have been discharged in a reasonably short period are particularly suitable for re-charging.

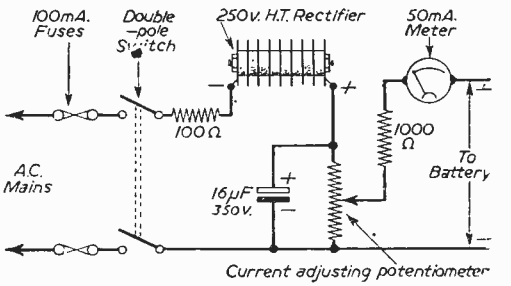

Fig. 7.—Circuit of a dry-battery reactivator.

and can give a new period of long service. Corroded cells are not satisfactory, and it is usually necessary to abandon the battery after it has been charged a few times.

Finally, it will have been noticed that transformers are used for isolating the low-voltage side of the circuits given, and to reduce the voltage. Users not familiar with circuits of this type should not overlook that transformers cannot be used with D.C. mains, and this should be kept in mind when making up equipment for the first time.

TRANSMITTING TOPICS

THE SIMPLEST TRANSMITTER

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

FROM time to time, the simplest set has been recommended in this feature as a standby or training arrangement for the newcomer. No apology is given therefore for repeating the circuit of Fig. 1, showing a simple tetrode crystal oscillator. Incidentally, "almost any" valve may be used in such a circuit. "Almost any" is, indeed, correct, for practically any small triode, tetrode or pentode valve may be used. Thus the triodes 6J5, 6C5, 6C4, 7193, etc., may be used, and some of these valves may be picked up for a few shillings on the surplus market. Moreover, in the pentodes and tetrodes, types such as the QV-04-7, EF91, EF50, 6AM5, 6AM6, 6F6, 5763, 6Y6, 6K6, 6V6, 6L6, 6AG7, 6AK7, 807, 6146, KT66 and a host of other such valves as the 6BW6 and so on may be used.

There is little difficulty, therefore, in selecting a valve for such a circuit. Indeed, even a battery pentode or triode will give a watt or so up to a few watts according to type in such a circuit. Small dry battery valves such as the 3V4 and 3Q4 indeed will give a respectable output in such a circuit, and enable DX contacts to be made. Reference to QRP exploits with transistors will convince any sceptic that a watt or so of R.F. will enable DX contacts to be achieved. This is necessary, as after recent experiences it is clear that many imagine that large amounts of power are necessary. This extends up to all levels. As a W contact worked regularly on a ten metre schedule, when the W was using 300 watts as "low power" input to his Viking KW set he was most apprehensive that he would not make the schedule when a fault entailed his using a low power exciter "with only 65 watts." I was able to reassure the W that he was still audible, and refrained from pointing out that I had always employed a power of 75 watts throughout the schedule of transmissions. In fact as an analysis of W stations worked shows that the average input is around the 100 watt mark, a fact confirmed by other sources such as QST, a kilowatt is not an essential to DX working. However, a simple crystal oscillator is capable of ten watts or so of R.F. and under good conditions will cover the world. Despite the fact that VFOs are used to a very great extent, there are still many DX stations using crystal control. We can quote, of course, the "rarest" of rare DX JT1AA as a prime example, but many "non-DX" stations are working DX with crystal controlled sets. Thus W9QHR can be heard on a remote controlled crystal set, and this is a consistent signal over here worked by the author many times, even under poor or crowded band conditions, while "ERV" has consistent QSOs with DX stations such as ZS9G, helping G3BHJ to contact a "new one" incidentally! Further, the much sought after UR2BU is crystal controlled, and in fact requests DX stations to QSY off his frequency after the QSO for that reason.

Some Pitfalls

However, while it has been stated that a newcomer will gain useful experience with a simple crystal controlled outfit, it is necessary to point out some of the pitfalls that can arise even from such a simple arrangement as a plain crystal oscillator. This is borne out by observing a number of "new hams" struggling with crystal oscillator sets. Despite their simplicity, it is necessary to use skill in extracting satisfactory results. This despite the sophisticates who consider a crystal oscillator beneath them, and plunge straight into a multi-stage set-up. Usually it appears that to get these sophisticates operational requires a large amount of effort on the part of some experienced amateur, which does not give the neophyte experience in operating and adjusting his station. Once some Good Samaritan has tuned up the set, adjusted aerial arrangements and loading taps so that the set can be put on the air, the neophyte is then happy just to operate, oblivious of the fact that a new aerial or some other alteration may leave him with no idea whatsoever on how to get good results. Attention to basic principles that could have been acquired by a simple set would save such embarrassments. Indeed, a number of promising operators have given up amateur radio because the simple "know-how" necessary for taming a transmitter has been lacking. Rather than "humble" themselves by calling in a

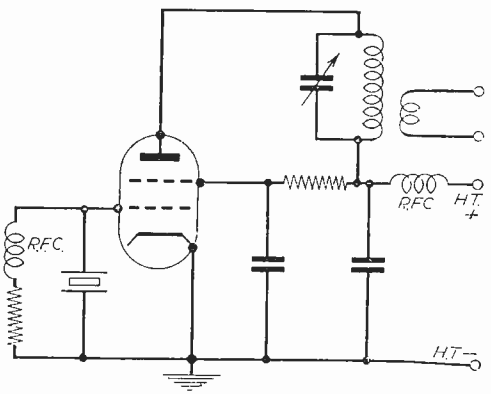

Fig. 1.—A basic crystal oscillator circuit that makes a useful simple transmitter.

handy and experienced ham time after time they have tried a series of random fiddlings, to no avail, and finally given up. The fact is that the basic necessity for sorting things out for oneself is not necessarily inborn, but may be developed by the right training. However, in some cases the would-be ham never acquires this training, and is lost when faced with a chirpy topband VFO feeding a buffer stage that has parasitics feeding a P.A. stage of apparently zero efficiency. It is too much all at once, despite the fact that many such "quitters" when in the Services were able to adjust complicated sets by following "the book." However, proper ham radio experience provides a higher training than this . . . it teaches—or should teach—by experience to go "beyond the book." In other words the true amateur is able to deal

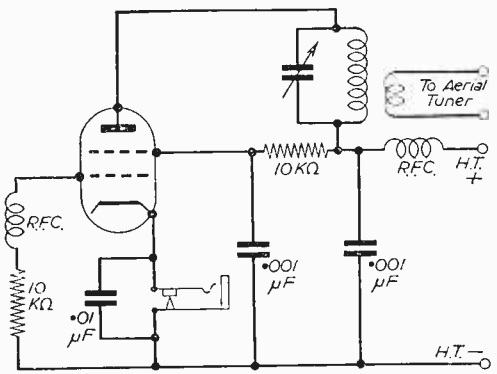

Fig. 2.—Simple crystal oscillator circuit with component values used originally.

with all sorts of circuit and adjustment, and if necessary to improvise workable gear. Moreover, his own rig will depart "from the book" in many particulars in order to achieve greater efficiency, and will in fact be altered from time to time for better results. This mental flexibility is to be prized today, despite the factory made sets that are available. A spoon-fed amateur is unlikely to arise to emergency as did the Dutch amateur who wound a tank coil on a beer bottle and used the output valve of a broadcast set to improvise an emergency set-up during the catastrophic floods a year or so ago. That is being an amateur as opposed to operating on the amateur bands. Not, of course, that we object to using factory built sets; what we object to is not acquiring the amateur "know-how" that enables the true amateur to keep on the air despite all difficulties, and to improvise his own gear if necessary rather than buy a ready made item. In an emergency one may not be able to run out to a shop. The British amateur who was instrumental in saving a ship during severe gales was only able to do this by swinging his VFO out of the amateur band—a feat more difficult with a packaged commercial set. Also, of course, running repairs can be cheerfully made upon a set one has built oneself, whereas a commerical unit may require some close study to find one's way around the wiring. However, despite this, commercial sets are here to stay. One solution that preserves the personal participation of the amateur is the "kit" set, and is a good solution where time is limited, as metal drilling operations are all done at the factory leaving the amateur assembly and wiring up operations to complete the transmitter.

Using the Set

Nevertheless, for an amateur faced with using a set, home built or commercial, there is the necessity of acquiring "know-how" in adjustment and use of the gear. The simplest crystal oscillator set offers quite a few opportunities in this direction. Let us consider the mythical case of a new and inexperienced and wholly imaginary new amateur who is using such a set. The complete circuit is given in Fig. 2, together with the associated aerial tuning unit in Fig. 3. It would seem that first-class results should be expected. However, our hypothetical neophyte, flushed with the success of passing the R.A.E. exam, is soon face to face with problems that the R.A.E. syllabus is no help at all in solving. The first problem was a fabulous chirp. This had to be heard to be believed, and at times "dots" were "lost" due to the violence of the chirp. Moreover, local amateurs on the watch to have a QSO with the new hand could sometimes hear him at a modest RST 539 to RST 559 when QRM from distant stations permitted. In some cases he was not heard at all, despite the fact that he was known to be transmitting, as more distant stations could be heard working him with very unflattering signal reports. Despite this, no amount of searching could pull the local signal through the Sunday QRM on 3.5 Mc/s! It was clear, particularly as the new hand could hear local amateurs at S9 plus, that all was not in order. A new aerial some hundred feet long was installed, in the hope that the acrial was at fault. This boosted signals to a RST 559 locally to RST 569 "under favourable conditions"—the favourable conditions being a more charitable frame of mind of the reporting amateurs, or possibly a growing skill in sorting out a weak and chirpy signal from the more distant QRM.

Inspection of the outfit revealed that some 80 mA of anode current were being drawn at some 400 volts input by the 6L6G oscillator. Moreover, hardly any aerial loading was in evidence, despite the fact a bulb in series with the aerial was glowing (Fig. 4). Despite this the operator had had a few QSOs outside England, and was apparently resigned to his fate, or at a loss as to how to proceed. Refraining from the obvious reference to transistor DX on a few milliwatts, it was clear that radiation efficiency was tragically low.

The way in which such faults can be overcome is simple—if one has the necessary technical training for a reasoned approach. However, no doubt the modern educational tendency to concentrate on non-essentials has unduly discouraged an enquiring and adventurous frame of mind. Technically speaking the use of over 30 watts

(Continued on page 137)

of input to produce very unflattering signal reports from far and near is obviously a point to query. Furthermore, operating at such high power levels in a crystal oscillator is a potent source of chirp. However, the set was running virtually unloaded at 30 watts, so that the most elementary step would seem to alter the circuit parameters to reduce this unduly high "unloaded" level of power. The simplest and most efficacious step is to increase drastically the grid-leak value to at least 47,000 ohms and preferably 100,000 ohms. This immediately stabilises operation and ameliorates chirp to vanishing point. A further change is to alter the screen

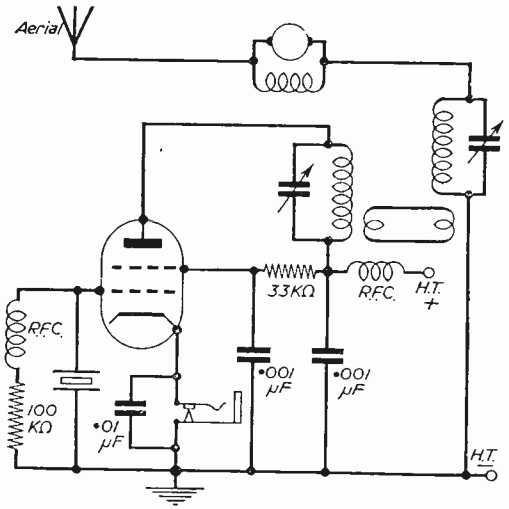

Fig. 4.—The crystal oscillator with revised component values.

resistor to a higher value also, say, 22,000 or 33,000 ohms, with a similar beneficient effect upon oscillator performance. Furthermore, use of such "realistic" values of resistance for screen and grid resistor operation will provide a healthy oscillation dip in plate current and reveal the efficacy or otherwise of aerial loading. In its original form, there was scarcely any change between oscillating and non-oscillating current due to the low value of grid resistor, and the rather low screen resistor.

The Aerial System

Having thus ameliorated the operating parameters of the "simple" set, attention was turned to the aerial system. The writer recoiled with a shrill scream of pure horror as he observed that the "series bulb" used as a current indicator was a special low current 0.04 amp bulb. As the hot resistance of such a bulb is something like 100 ohms, it is scarcely the thing to place in an aerial circuit. No one interested in an efficient aerial inserts a 100 ohm resistor, or for that matter constructs an aerial of resistance wire totalling 100 ohms of resistance. Yet here was a resistance of approximately that value deliberately inserted! It was quickly demonstrated that with a small coil of three turns shorting the bulb it still lit. Moreover, an original bulb of higher current rating and hence lower resistance had been replaced by this bulb because "it lights better." In fact the high resistance bulb was lighting to only a fraction of its 0.15 watt rating, indicating a radiated power probably way down in the milliwatts originally. However, the parallel coil of a few turns effectively shorts out the resistance of the bulb, while allowing enough light to indicate well. In fact the probable aerial current had increased many times, so that the bulb light now represented only a fraction of the actual aerial current, instead of all of it as previously. In fact the proud owner now started to face a new peril, as on pressing the key T.V.I. reared its ugly head through a faint grille on the TV receiver, a further proof that much more power was percolating skywards.

However, even with this improvement, it was clear that coupling was still infinitesimal. A quick survey of the aerial tuning and output system revealed why. Links had been wound and positioned as shown in Fig. 5. No attempt had been made to alter or adjust the links, and it can probably be assumed that because they "looked like" a circuit drawing of a linked assembly, they could be expected to work. Indeed, one factor may have been a "fear" that the chirp would be increased. However, the chirp that originally existed was quite independent of the microscopic degree of loading that existed, and was in fact due to the incorrect circuit parameters that were originally used.

Of course the degree of coupling with the arrangement as shown is infinitesimal, a fact that the writer has stressed before. The coupling of an end link rises sharply if it is actually over the winding it is coupled to, so that it was not surprising that pulling the link at the transmitter end a little way toward the tank coil "cold" end produced a dramatic increase in bulb brilliancy, and the T.V.I. grille became much stronger, while key thumps became audible on the TV sound channel! However, it was not possible to move the link very much, as it was firmly tied down at the earthy end, the reason being given as "so I can't overcouple." No mathematical evidence of elaborate calculations of coupling factors and power transfer coefficients was forthcoming to support what was presumably a superstitious belief in overcoupling beginning

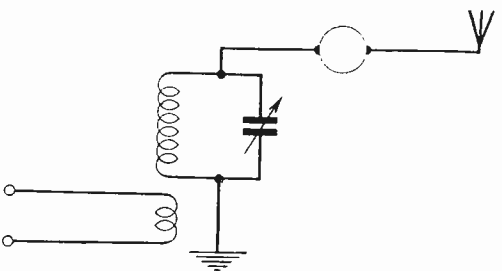

Fig. 3.—Aerial tuner for link coupling to a transmitter.

very early on in the approach of one coil to another. In fact, of course, the actual coupling was indeed infinitesimal, and a rearrangement of the links so as to be "overwound" with the lower ends of the aerial and oscillator tank coils provided a suitable amount of coupling (Fig. 6). It again does not seem to be appreciated that with a link coupled tuner of this kind, unless a marked reaction of the aerial tuner with the transmitter loading can be obtained, the coupling available is inadequate. Putting up longer aerials will have little effect.

Afraid to Touch It

The trouble in such cases is that the proud owner is afraid to touch his set "in case I stop it working." In such cases the solution is to do something. Try various values of grid leak. Alter link coil spacings and number of turns, and consider what next to adjust. Naturally don't adjust at random. If coupling seems inadequate, or if local reports are very low, try a tighter coupling, search for high resistance bulbs used as "series aerial bulbs," and if the link coils do not seem to help loading, try various numbers of turns. However, only too often one finds operators running with negligible efficiency, afraid to alter anything because the "set is working," and seem to imagine that even if a grid leak is changed disaster will result. The fact that the original grid leak or component may again be replaced never seems to enter their heads. The cure is for such faint hearts to rapidly wire in a series of components of varying value and check how this affects operation. Also, of course, they might reflect that loading down a crystal oscillator with, say, a 10 K grid leak is after all

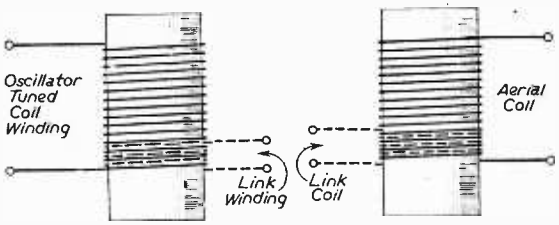

Fig. 6.—Interwound link coils for the aerial coupling and tuner circuit, which give a much higher degree of coupling.

rather foolish, due to the heavy damping caused by the grid drawing high grid current, so that it is no wonder a chirp results, whereas with a value like 100 K the damping is ten times less and hence it is no surprise that chirp disappears almost completely. Moreover, although with the new grid leak and one or two other changes the rig may only run, say, 10 watts input, this, if efficiently coupled, gets out with fine signal reports, whereas the 30 watts input with inefficient coupling never did get a good report.

While this sort of experience is not the inevitable experience of amateurs, many of whom have a good experimental sense, it is one that the writer encounters quite often. While our quoted experience is mythical in that it does not apply to any specific amateur it represents the sort of thing that the writer actually encounters and has encountered many times in the past few years. It is, of course, true that some newly licensed hams

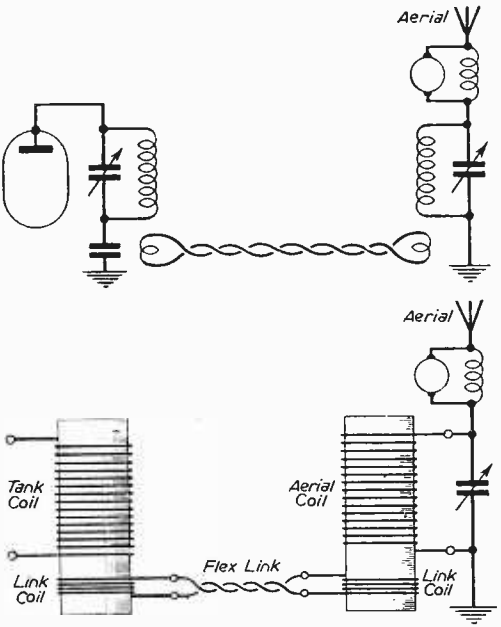

Fig. 5.—The theoretical circuit, and the too literal practical disposition of the actual output coupling and aerial tuner.

have never had to find their own way in situations of this type. Hams with some school training in science can automatically apply experimental principles, but the products of certain educational systems seem incapable of such rational behaviour, and are content to sit waiting for a miracle to happen, or even to blame local conditions for poor results. With a little reconsideration, they may realise that the R.A.E. does not cover all aspects of amateur radio, and that practical experimentation is a different matter to memorising the simple tricks demanded by the R.A.E. exam. With a little adventuring and a little reconsideration of all the factors involved a solution may be found. Even their struggling with a "simple" set will then provide a useful lesson in technique, which will serve in good stead when experimenting with new circuit arrangements, aerials and so on. Experienced hams will know what is meant.

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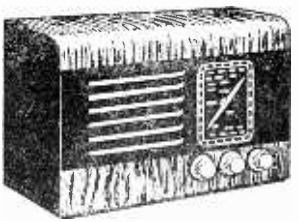

107/6

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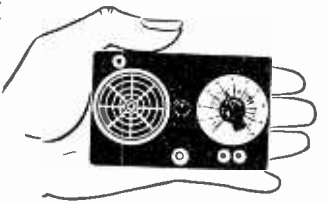

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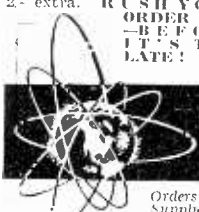

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Hum Troubles

THE CAUSES AND CURES FOR ONE OF THE MOST COMMON OF SET FAULTS

By Gordon J. King, Assoc.Brit.I.R.E.

BY far the most frequent of symptoms encountered by the experimenter and service technician in all ranges of electronic equipment is that of mains hum. It has been estimated that some three-quarters of all hum complaints can be traced to defective reservoir and smoothing capacitors associated with the equipment's power supplies, and that the remaining quarter of complaints demand real investigation in order to bring to light the faulty component or circuit section.

The section of search can be narrowed down by making a few simple tests with the receiver switched on. For example, if the hum is still present with the volume control backed off, the front part of the circuit up to and including the detector stage is free from defect. Why this is so can be realised by studying the circuit diagram on page 142 (McMichael Model 153).

Here the demodulated signal appearing across the detector load resistor R22 is coupled, via C57 and switch S2—front, to the top of the volume control R23. The A.F. signal is thus developed across this control, and the required level is tapped off by the slider and applied to the grid of V3 by way of C51, the triode section of V3 serving as A.F. amplifier and the diodes as detector and A.G.C. rectifier. With the volume control at minimum, the slider is at the earthy side of the control and is thus at the point of zero signal. Should the hum level increase as the volume control is advanced, then the hum signal is accompanying the required A.F. signal across the resistive track of the volume control.

Let us suppose that the hum level remains constant irrespective of volume control setting. In order to discover whether or not it is being introduced by V3 itself, the next best move would be to short-circuit the control grid of V4 (output valve) to chassis.

Faulty Power Circuits

If this action results in little difference in hum level, then there is small doubt that the disturbance is the result of trouble in the power supply circuits. If the hum level is high and the reproduction of low volume is distinctly modulated by the ripple, the reservoir capacitor (C60A Fig. 1) being open-circuit or of low value is the most likely cause. The reservoir capacitor is that electrolytic whose positive side is connected direct to the cathode of the rectifier (or to the positive—red—terminal in the case of a metal rectifier). Such a fault may well reduce the H.T. line voltage by as much as 40 per cent., thereby promoting reduced volume as well as excessive hum.

A disturbing heavy hum, though less prone to modulate the reproduction with ripple and cause low volume, results from low value or open-circuit of a filter electrolytic, such as C60B (Fig. 1). The quickest and most effective method of checking for suspect electrolytics is by shunting with a capacitor known to be in good condition. The value and voltage working should be approximately the same as those of the suspect. It is a good idea to keep in the tool kit a capacitor of some 8 μF or 16 μF (500 volts working) solely for test purposes. The capacitor can be connected to fly-leads, and the negative lead terminated by a crocodile clip for connection to the receiver chassis or negative point, while the positive lead is best terminated by an insulated test-prod. It is then a simple and convenient matter to make the negative connection and run round the positive tags of suspect capacitors with the test-prod. It is important, however, to discharge the capacitor after each test—this should be done through a 5,000-ohm resistor to avoid an instantaneous discharge which would be liable to damage the test component.

In the remote event of the electrolytics being in good condition, and hum still present with the control grid of the output valve shorted to chassis, attention should be given to the output valve itself. In A.C./D.C. receivers a heater-to-cathode leak or short in this valve reflects a strong ripple voltage into the control grid circuit and thus promotes the symptom. To be on the safe side it is most desirable to check the valve by substitution.

Unbalanced Rectifier

Unbalanced emission or failure of one side of a full-wave rectifier circuit is sometimes the cause of a slight ripple effect on the reproduction, possibly accompanied by reduced volume as the result of low H.T. voltage. In the circuit at Fig. 1, for example, open-circuit of either R43 or R44 would disconnect one anode of the H.T. rectifier (V5)—the possibility is well worth bearing in mind. Unbalanced emission resulting either in the valve itself or in the associated circuit can usually be discovered quite easily by comparing the voltage at each anode with respect to chassis (with the test meter switched to A.C., of course). If the voltage is greater at one anode than at the other, the anode on which the greater voltage exists is passing less current than the other anode, this being indicated by the smaller volts drop across the resistance of the appropriate half winding of the transformer secondary and surge limiting resistor (if used). Such a test would, of course, reveal mismatch of surge limiting resistors and transformer secondary resistance, relative to the centre-tap, as well as unbalanced valve emission.

Shorting turns in the H.T. secondary windings may well promote unbalanced voltages at the two anodes, and also result in hum, but the trouble would not be long in revealing itself more drastically in the form of serious overheating of

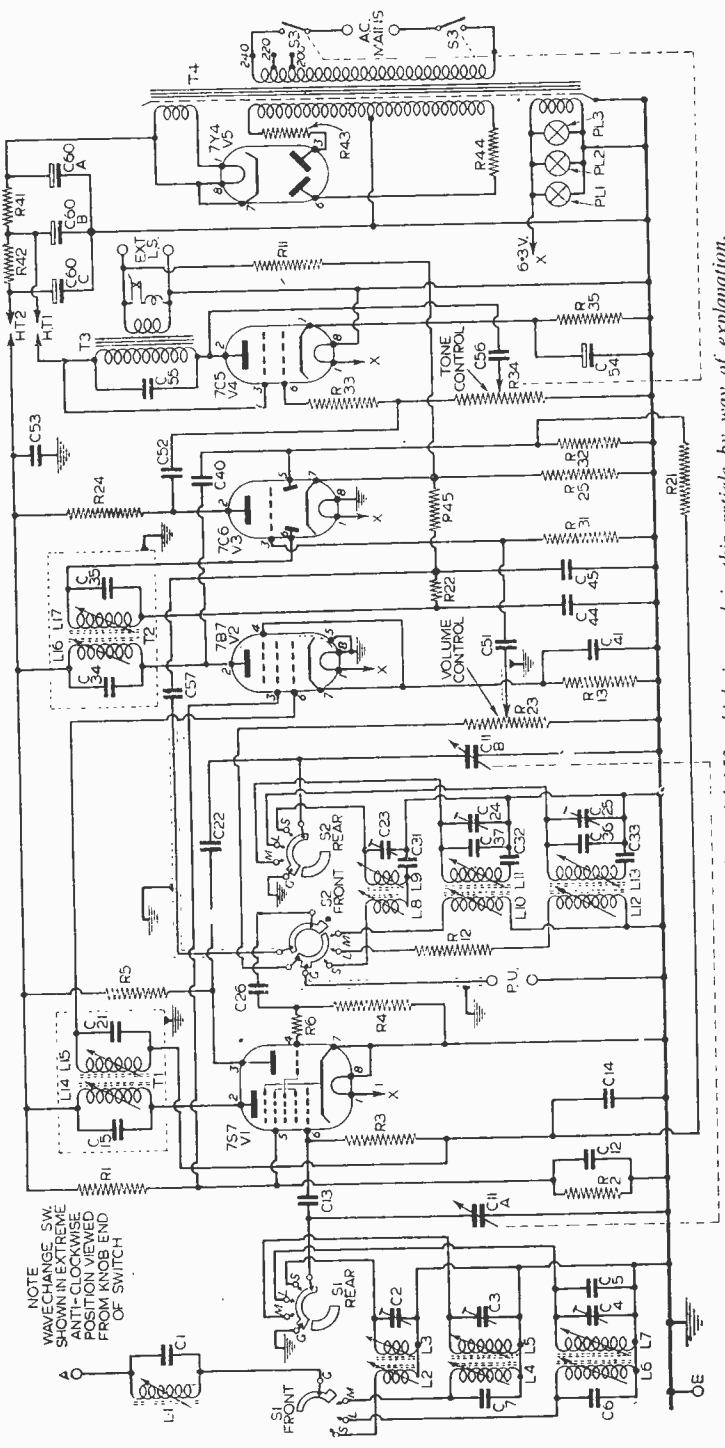


Fig. 1.—Circuit of the McMichael Model 153 which is used in this article by way of explanation.

the mains transformer. If transformer trouble of this nature is suspected, the rectifier valve should be removed and the voltages at the anode tags of the valve holder compared. If the voltages differ by more than 5 to 10 per cent., the transformer is almost certainly in need of replacement.

Check the A.F. Amplifier Stage

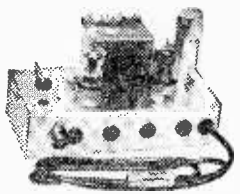
If the hum disappears on shorting the control grid of the output valve to chassis, and is unaffected by operation of the volume control, the trouble lies somewhere in stage V3 of the circuit in Fig. 1. A high ripple content on H.T.2 line is a possible cause, and this would result from open-circuit or low value of the filter electrolytic C60C. A heater-to-cathode leak in V3 may introduce a ripple voltage across the cathode resistor R25 and thus cause it to be reflected into the grid circuit through R31. This trouble happens more often, however, in A.C./D.C. equipment in which the valve heaters are series-connected.

Pre-detector Troubles

In cases where the hum increases when the volume control is advanced, it will nearly always be found that the hum is present only when the aerial is connected and the receiver is tuned to a station. This manifestation of the symptom is usually referred to as modulation hum, since the hum actually modulates the signal on its way through the receiver to the detector.

Frequent causes in this connection are poor H.T. filtering in the R.F., frequency changer and I.F. stages (check decoupling capacitors), impaired heater-to-cathode insulation in the pre-detector valves (the best test is by

(*Continued on page 145*)



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20% Type, ¼ w..	3d.	5 w. 25 ohms	1/3
½ w., 5d.; 1 w.,	6d.;	10 w. 10,000	1/6
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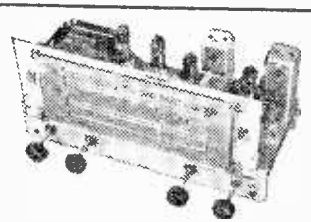

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6AT6	8/6	EABC80	9/6	EL41	10/6
6K7	6/6	EB91	6/6	EL84	11/6
6K8	8/6	EBC41	10/6	EM85	11/6
6Q7	8/6	ECC83	9/6	EY51	12/6
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2-day alignment service now available. **7/6** plus P.A.P.

substitution) and feedback of harmonics of the mains frequency to the aerial input circuit of the set. In the latter case the effect may be aggravated by a considerably distorted mains waveform applied to the set. Sharp charging pulses at the input of the mains filter circuits are also responsible for the production of interfering harmonics which result in modulation hum.

The cure is sometimes difficult to find, particularly if the disturbance is present only on a heavily loaded mains circuit. However, the following dodges are well worth trying: connect an 0.1 μF 300-volt A.C. capacitor across the mains supply to the receiver; connect an 0.01 μF A.C. capacitor (of suitable voltage) between the anode of the rectifier valve and chassis—both anodes should be so decoupled where a full-wave rectifier is used; reverse the mains plug in its socket; check on the efficiency of the aerial and—most important—the earth system; check the H.T. rectifier by substitution; connect an R.F. choke across the aerial and earth terminals of the set.

It often happens that modulation hum, or a very similar symptom, is caused by interference from some other equipment connected to the mains supply near by. Television receivers are frequent offenders in this respect. Mains filters connected to both the affected and offending receivers are often called for, while a good aerial and earth system at the affected end invariably pays dividends.

Points to Watch

When making a substitution test with an electrolytic, as described earlier, it sometimes happens that the sudden surge due to the connection of the test part temporarily "heals" the faulty capacitor. This can be avoided, however, if the substitution capacitor is charged before being connected to the circuit.

Watch out for poor chassis connections during the course of investigating for hum troubles. A high resistance connection sometimes develops between the tags riveted to the chassis and used as common earthing points. If the tag happens to be associated with the power circuits as well as decoupling points for the A.F. and I.F. stages a high hum level invariably results, possibly accompanied by instability at high volume settings.

LIST OF COMPONENTS

C1—500 pF.
C2—4.40 pF.
C3—4.40 pF.
C4—4.40 pF.
C5—20 pF.
C6—1,000 pF.
C7—250 pF.
C11a and b—13.5—528 pF.
C12—0.1 μF.
C13—100 pF.
C14—0.1 μF.
C15—100 pF.
C21—100 pF.
C22—100 pF.
C23—4.40 pF.
C24—4.40 pF.
C25—4.40 pF.
C26—100 pF.
C31—6,770 pF.
C32—503 pF.
C33—150 pF.
C34—100 pF.
C35—180 pF.
C36—60 pF.
C37—10 pF.
C40—50 pF.
C41—0.1 μF.
C44—100 pF.
C45—100 pF.
C51—.01 μF.
C52—0.1 μF.
C53—0.1 μF.
C54—25 μF.
C55—.001 μF.
C56—500 pF.
C57—.01 μF.
R1—18 KΩ.
R2—47 KΩ.
R3—1 MΩ
R4—47 KΩ.
R5—18 KΩ.
R6—100 KΩ.
R11—680Ω.
R12—680Ω.
R13—270Ω.
R21—1 MΩ.
R22—47 KΩ.
R23—2 MΩ.
(Volume control)
R24—390 KΩ.
R25—33Ω.
R31—10 MΩ.
R32—1 MΩ.
R33—100 KΩ.
R34—0.5 MΩ.
R35—390 Ω.
R41—750 Ω.
R42—1 KΩ.
R43—100 Ω.
R44—100 Ω.
R45—470 KΩ.

News from the Clubs

THE AMATEUR RADIO CLUB OF NOTTINGHAM (G3FKW)
Hon. Sec.: F. V. Farnsworth, 32, Harrow Road, West Bridgford, Nottingham.

NOTTINGHAM Amateur Radio Club continues to meet every Tuesday and Thursday at Woodthorpe House, Mansfield Road, Nottingham and welcomes new members. Top-band is being worked regularly from the club room, which has good facilities for construction work. Morse practice and discussions on all aspects of amateur radio. Details from hon. sec.

WELLINGBOROUGH AND DISTRICT RADIO AND T.V. SOCIETY (G3KSX)
Hon. Sec.: P. E. B. Butler, 84, Wellingborough Rd., Rushden, Northants.

AT the A.G.M. held on January 9th the chairman, Mr. G. Wilford, said that a full winter programme, now half way through, had provided interesting and instructive lectures.

The equipment officer, Mr. R. Tilley (G3KSC), reported that a modulator had been constructed for the club T.X., which would be going on the air, on phone, in the near future.

The following officers were elected for the coming year.

Mr. G. A. Wilford, chairman; Mr. P. E. B. Butler, secretary; Mr. N. Seabrooke, treasurer; Mr. R. Tilley (G3KSC), equipment officer.

On Saturday, March 8th the society visits Northampton Power Station, and on March 12th Mullard Ltd. presents a film and lecture on the "History and Development of the C.R.T." April 3rd, Mr. R. Marriott will answer TV queries and on April 17th a junk sale will be held.

Meetings are held every Thursday evening, 7.30 p.m., at the club room above the C.W.S. fruit shop, Silver St., Wellingborough.

Visitors and new members welcome. Details from hon. sec.

THE BOURNEMOUTH AMATEUR RADIO SOCIETY
Hon. Sec.: C. R. Davies (G3JAU), 107, Talbot Road, Winton, Bournemouth.

AT the A.G.M. held on January 3rd the following were elected for 1958:

Chairman: D. A. Pilley (G3HLW).

Secretary: C. R. Davies (G3JAU).

Treasurer: J. Glass.

Membership is now 45 of which 24 are licensed amateurs. Meetings are held regularly on the first Friday of every month at our headquarters, The Cricketers Arms, Windham Road, Bournemouth, and a warm welcome is extended to new members and visitors.

Programme Pointers

Our Critic, Maurice Reeve, Reviews Some Recent Programmes

THE hundred and fiftieth programme in the "Music to Remember" series affords the opportunity for choosing it to open this month's notes. They are given on Monday evenings at 7 p.m., before an invited audience, in all parts of the country, and last for one hour. Mostly they are provided by the regional orchestras—though by no means always—and frequently they contain a soloist. Though occasionally the programmes contain a number which would best be forgotten, most items are well worth remembering. Furthermore, the choices can seldom offend the general body of unsophisticated music lovers for whom they are presumably meant to cater—the "others" won't be listening, anyway. The performances are always average to good.

But perhaps their chief feature is that each item is "introduced" by a well-known music critic or pedagogue, which is, perhaps, the point where the highbrow listener dons his hat and mutters to himself, "I've heard those dashed remarks so many times before that I'll throw a flowerpot at somebody if I'm forced to endure, them again."

Hasn't everybody, for that matter?

For thirty years now the BBC has given us every single work in the repertoire dozens and hundreds of times and nearly always with historical and biographical details. As these are very circumscribed even for the largest and most complicated work, the public has long since wearied of them past the point of satiety. Whilst the gentlemen performing this task do so with delightful and sauve erudition, it is high time that the listener was relieved of the boredom of their endless repetition, especially by announcers from legitimate symphony concerts. I respectfully suggest a twelve months truce, during which time the public can express their wish for their return if they want them.

Topical Affairs

The monthly programme "Radio Link" is one of the most vital and forceful of all the periods devoted to topical affairs. This, doubtless, is because it is either unscripted, or less inhibited, than any of the others; one cannot hear the speakers "turning the pages." It is very breezy, forthright and refreshing. The last issue I heard featured Mr. Aneurin Bevan being interviewed from London, Paris, Washington and Moscow respectively and simultaneously, Robert McKenzie was the admirable chairman. "At Home and Abroad," as well as some of the others, have become very stilted, stuffed-shirted and announcer-ridden. "Radio Link," so far, is like standing on Hastings promenade in the teeth of a good sou'-wester coming up the Channel.

The late Richard Tauber had a magnificent tenor voice which was heard far too often in light, and not nearly often enough in serious, classical opera. An hour's programme honoured the tenth anniversary of his death. Though the script of Roy Plomley made him out as never putting a foot wrong—they never do!—the many excerpts from his various successes showed just the wrong turnings his—artistic—career took. It was a well-balanced if conventional feature, contributed to by many well-known personalities and including some of Tauber's own recordings.

"Don't Do It Yourself"

The name of the editor of this and his numerous other "Practical" journals is known to tens of thousands up and down the land. But his voice is naturally known to fewer, among whom his present correspondent is happy to number himself. It came over in its familiar tones in a telling talk, on Network Three, which he styled "Don't Do It Yourself." To do or not to do, electrocute yourself or play safe, let the baby suck the lead paint off his pram or his fingers; all this, and much more besides, was in this tightly packed *quart d'heure*.

Adapted Novel

Richard Hurndall, Marjorie Westbury, Norman Shelley and Deryck Guyler headed a very long cast in an adaptation for radio of the novel by Gilbert and Margret Hackforth-Jones, "Fish Out of Water." An exciting war-time story of the chase, successful, of course!, after some deliberately-made sub-standard mines.

Some of these stories would do more good in a staff college or cadet school than many of the instructors one meets with at such places; no one ever puts a foot wrong or says anything but the right thing on the instant. The power of command is overwhelming, heroism is instructive and the villains are doomed from before the curtain rises. With beautiful women thrown in for good measure and love equally triumphant with duty, what a syllabus they would furnish. The recruiting queues might reach Cup Final proportions. It made a good radio play.

A repeat hearing of Dame Peggy Ashcroft in "Hedda Gabler" was worth most of the Monday night pieces rolled up into one.

FUN TO BUILD AND A THRILL TO OWN!

It's fun to build this **"POCKETPAL" shoulder or pocket radio.** So easy to build—it covers all the medium waveband with exceptional sensitivity and selectivity. Features a high efficiency pentode valve in well tested, powerful circuit. Personal phone **ALLDRY** battery operation (Batteries fit inside) slings over the shoulder—**AERIAL IS INSIDE THE SLING LEAD!**—or slips into pocket. Minisize 3" x 2" x 5½". Build in about 90 minutes **WITHOUT ANY EXPERIENCE**, using our **"STEP-AND-CHECK" INSTRUCTION MANUAL WHERE EVERYTHING YOU DO IS SPELLED OUT FOR YOU IN PICTURES SO YOU CAN'T GO WRONG!** This **"POCKETPAL"** radio can be built for only **38/-**, including Case, Valve, Manual, Nuts, etc. Post & Packing is 2/- (C.O.D. 2/-). **PARTS SOLD SEPARATELY**—shopping list, etc., 1d. **HEAVY DEMAND CERTAIN—DON'T PUT IT OFF—SEND NOW!**

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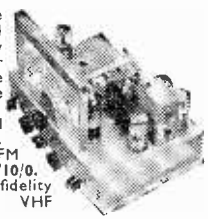

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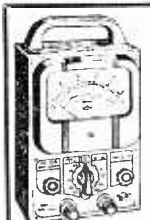

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Open to Discussion

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

Converting the Command Receiver

SIR,—Mr. Coulson's interesting articles on the the above-mentioned subject appeared in issues of PRACTICAL WIRELESS for November/December 1957, and he closed his helpful directions with the comment that he is unable to suggest any further modifications in the case of this particular receiver.

I have taken matters a stage further in the modification of the B.C.455 and in the thought that your readers may find the conversion of interest, I give a circuit diagram using the same part numbers as Mr. Coulson.

Very briefly, what I have done is to take out the last two valves in the B.C.455—that is, the 12SR7 and the 12A6. After removing the wiring from the 12A6 base except the heater leads, I replaced the 12A6 with a 12K8 using the B.F.O. oscillator coil to convert the I.F. frequency of the 455 to 200 Kc/s. The output from the 200 Kc I.F. transformer is taken to the aerial lead of a B.C.453 and the latter receiver is tuned to 200 Kc/s. I have three R.F. 24s working on 10, 15 and 20 metres respectively, coupled to the B.C.455 and thence to the B.C.453.

This conversion has been working for more than a year and the result is greatly improved selectivity and remarkably quiet reception when one thinks that there are four frequency conversions involved.

Good luck to your interesting magazine which I have enjoyed regularly for years.—A. D. Forsyth (Pretoria).

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

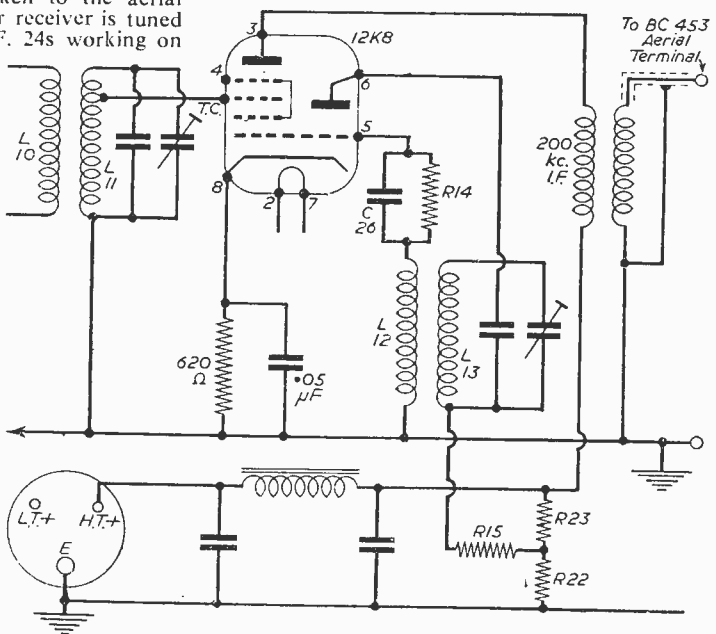
A Reader's Satisfaction

SIR,—Perhaps there are many in my circumstances who cannot afford to keep paying out for the meters used in these handy little gadgets described in PRACTICAL WIRELESS, for instance the "Simple One Meter Transistor Tester" and the "Condenser Condition Tester" in the February 1958 issue, which would have cost me over a pound (£1), just for these two items. However, being the owner of an Avo F, I made up the components as described, but where the leads to the meter ran, I led to two holes through tin, finished them off with two spade plugs and coupled them to Avo meter set to appropriate range.

Now I merely couple Avo up to whichever unit I require to use.—R. J. PIERRE (Southend-on-Sea).

Amateur Transmitting

SIR,—I should like to say how much I agree with "Old Timer's" encouragement to budding amateurs; I am a classified C.C.F. operator, and am seventeen and a half years old. Yet, despite the fact that I have access to a large amount of equipment, I cannot take the R.A.E./morse exams, for apart from the fact that I have very little time to study, I calculate that the all-in expenses, taking a cheap R.A.E. course,



The Command receiver modification referred to in Mr. Forsyth's letter above.

would be around £12, which is quite a considerable sum for a student in his busiest year or two; and when I am settled in a job, I may have little time for radio work (or play).

I am in full support of a high-frequency band, licence free, for amateurs, and would suggest that possibly one might only be allowed to use it for, say, nine months, before taking one's exam.—J. ANDERSON (Bramhall).

Midget Sets

DEAR THERMION.—Your remarks about midget transistor-operated sets interested me. I, for one, would be most interested in seeing one for home-making. I have had pocket sets in the past—the earliest used two Weco peanuts—(the One Volt Wonder!) They fairly galloped up the L.T. at ¼ amp each. The biggest bugbear with miniature sets is batteries. Either they are small, and easily exhaustible, or the set becomes bulky. I have been toying with the idea fo making a little set to take away on holiday, using hearing-aid valves in the early stages and a normal B7G 1.4-volt output pentrode. I haven't started to dabble with transitors yet. And printed circuits are not easily available.—P. C. JONES (N.10).

Restrictive Practices

SIR.—Valves with no manufacturers' names and the type number printed on in light green or grey are manufactured on the continent, mostly Germany and Holland. They carry purchase and import tax, which has been duly paid. The writer's experience over the last four years, or so, is that they are just as reliable as B.V.A. valves, and, if bought from a reputable supplier, carry the usual guarantee. B.V.A. valves offered at cheap prices are often "rejects" and should be treated with suspicion unless the purchaser knows, personally, that the dealer concerned will change faulty ones. (Note: "reject" does not infer of itself that the valve is faulty, as it may have been rejected from a "special purpose" circuit).—S. F. H. (N.W.3).

MAKING A SIMPLE GEIGER COUNTER

(*Continued from page 101*)

The Choke

For those who prefer to wind their own coils, these dimensions give a good result (see Fig. 4).

The former is a rolled paper tube with paxolin end cheeks well smoothed with sandpaper, spaced at 1.8in. and held in place with Durofix. 40 s.w.g. double silk-covered wire is wound on, to an outside diameter of 1⅛in. Wavewinding is essential to reduce the internal capacitance. End connections may be made either by small copper strips cemented in place or by lengths of multi-strand wire. The completed coil may be immersed in good quality wax and the windings protected with a layer of Cellotape if desired. The coil is mounted by pushing the ferrite rod through holes in the paxolin "chassis." Teletron Products have recently made the author a prototype production model of the ringing choke, which works very well; its type number is EH.10.

Operation

The set is designed for use with a 10in. long gamma counter tube with an operating voltage of around 1200. These are considerably cheaper than the latest halogen quenched tubes. 3ft. to 5ft. of coaxial cable with a Belling-Lee plug connect the tube to the set. No excuse is tendered for the following explanation of the principle of the G.-M. tube.

There is basically a tube of metal or graphite-coated glass forming the cathode, and a centrally positioned fine wire which is the anode. (N.B.—Though similar in appearance, this has the opposite polarity to a thermionic diode.) The tube is filled with an ionisable gas such as argon under low pressure, and a smaller quantity of an inert gas such as alcohol vapour or a halogen. The tube operates as follows: a particle such as a beta particle or a meson, or an ionising radiation such as X-rays, gamma rays or cosmic rays cause an atom of argon to ionise and the released electron is accelerated towards the central wire by the applied voltage, causing a shower of electrons by secondary emission on the way. This causes a single pulse of current in the wire. Any tendency for a chain reaction to spread through the tube, or for an ionising glow to persist is "quenched" by the presence of the large clumsy alcohol molecules, and by the fact that the pulse current through the series resistor causes the applied voltage to drop below the critical point.

The characteristics of a typical tube are shown in the graph (Fig. 5). The "plateau" or operating range in a good tube is fairly flat over about 200 volts and the figures are often marked on the tube.

If the operating voltage is exceeded for any length of time, or if the polarity is reversed accidentally, the tube may be permanently damaged by decomposition of the alcohol vapour, so care must be exercised in switching on the set.

If an electrostatic voltmeter is not available, the routine is as follows: the knob of R8 is rotated until the sporadic clicking is first heard (about 80 to 100 per minute normally, but this has risen by 15 per cent. since nuclear tests were started), then the knob is slowly advanced until the background count starts to rise a little. The position half-way between these two points is then marked. In the model illustrated a flat calibrated disc was used instead of a pointer knob and dial, since it could not be easily turned on by accident in the pocket.

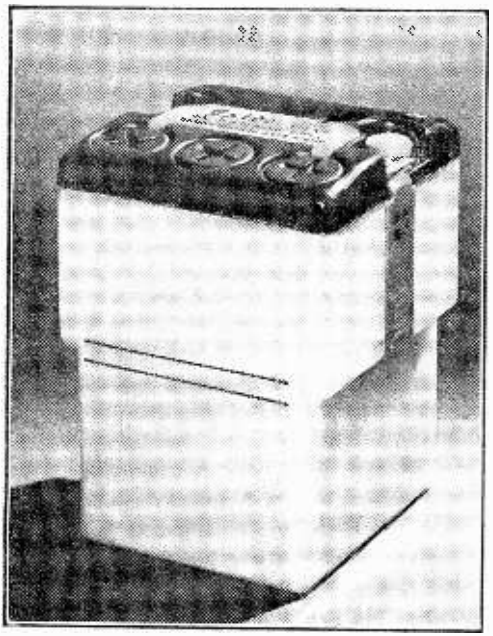
Most home constructors will find many of the components and materials used in this geiger counter lying around their workshops, but if one starts from scratch and purchases all the components, and winds the choke oneself, the total cost of construction will be found to lie between £3 and £4—and this includes the cost of the G.-M. tube.

News from the Trade

SILVER EXIDE BATTERY

A NEWCOMER to the extensive range of Exide batteries is a portable 6 volt unit, the 3EN5, which has a wide potential use in radio and communications equipment, portable tape recorders, instrumentation equipment and similar applications.

This portable unit weighing only 3½lbs., filled, is completely unspillable in any position. It is assembled in a multi-compartment container moulded in translucent high impact polystyrene



The Silver Exide battery.

which is capable of withstanding mechanical abuse either in handling or in transit. The level of electrolyte can been seen through the material of the container—the maximum and minimum acid levels being marked by two red lines. Unspillability is obtained by a special built-in device through which gas is allowed freely to escape from the cell, while the electrolyte is completely retained in whatever position the battery may be placed.

Filling holes are of sufficient diameter to permit easy topping up which can be carried out without removing the cover and the screwed ebonite plugs have coin slots for easy removal.

Inter-cell connections are made internally through the cell partitions, reducing the weight of the battery and providing the shortest possible path for current and therefore, the lowest internal voltage drop.

The terminals are screwed steel studs which have been cadmium plated and situated as far as possible from the gas vent so as to reduce the possibility of corrosion. That part of the terminal assembly not forming the contact area is protected by a cover against accidental short circuits. The terminal studs are themselves anchored in the lid moulding so that the strain of connecting leads is not transferred to the internal cell assembly.

Double separation consisting of sheets of microporous Porvic and glass wool is used. These separators provide complete immunity from short circuiting and help to retain the active material in the plates.

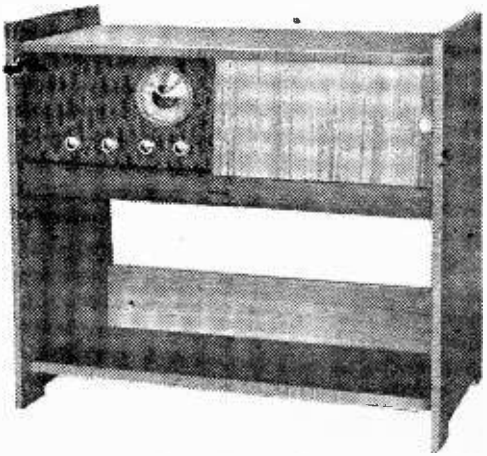
The dimensions are 3 11/16in. long (3 5/23in. at base) × 3 9/16in. wide × 5in. tall and this 6 volt battery type 3EN5 has a capacity of 5 ampere hours at the 20 hour rate of discharge.—Chloride Batteries Limited, Exide Works, Clifton Junction, Manchester.

NEW COSSOR BOOKCASE RADIOGRAM

COSSOR RADIO AND TELEVISION LTD., announce a completey new radiogram, Model 570, with a novel approach in design. Known as the "Melodygram." Model 570 has unique attributes, being a combination of radio, record reproducer and bookcase with sideboard top. The bookcase shelf can hold a considerable library of record albums, books or magazines. The cabinet is finished in light oak veneer.

A two wave-band printed circuit radio receiver is incorporated and a 4-speed automatic record changer with alternative manual control, and turn-over high-fidelity pick-up. Three Cossor "multiple" valves plus rectifier and an internal Ferrodyne rod aerial are used. There is continuously variable tone-control and the output is fed to a 7in. × 4in. eliptical speaker. Model 570 is for A.C. mains operation. 200/250v., 50c/s.

Dimensions: Height, 27½in., width, 29¾in., depth, 13⅜in., at top broadening to 15⅜in. at base. Price 39 gns. tax paid.—Cossor Radio and Television Ltd., Highbury Grove, London, N.5.

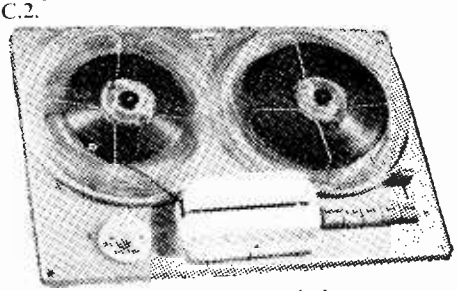


The Cossor Bookcase radiogram.

PHILIPS TAPE RECORDERS

A PROGRAMME indicator (three-digital revolution counter), designed to clip on to the edge of the carrying case of the AG8109 tape recorder is a new accessory now being marketed by Philips Electrical Limited. It can also be used, by clipping to the carrying handle of the case, with models AG8105 and AG8107. A programme indicator is already available for model AG8106.

Known as Type EL 3979/17, the new indicator is finished in grey plastic to match the AG8109 and the digits are in white. There is a plastic cap at the end of the drive cable, and this is pushed over the top of the spool spindle. The accessory can therefore be very quickly and easily fitted and removed as required. It sells at £3 7s. 6d. (free of tax).—Philips Electrical Limited, Century House, Shaftesbury Avenue, London, W.C.2.



The new motor tape deck.

LOUDSPEAKER FOR PORTABLE RECEIVERS

THE latest addition to the range of loudspeakers produced by The Plessey Company Limited is a 3in. shallow unit which has been specially developed for use in the smaller types of portable receivers.

The overall depth and volume of the speaker have been reduced to the minimum proportions that are consistent with obtaining high sensitivity and maximum value from a very small input. It can be supplied, either with a circular chassis for mounting with a clamp around the magnet yoke, or with a square chassis which has four fixing holes.

Features of the unit are the flat chassis and the window cut-outs, which are shaped to facilitate maximum use being made of the space behind the speaker for mounting other components.

Overall depth of the standard model is 1in. and the flux density is 8,500 gauss; it also employs a magnet with a ¼in. diameter pole. In instances where a greater depth can be accommodated, a magnet with the value of 10,000 gauss can be supplied.

The standard voice coil is 3 or 5 ohms impedance, but high impedance coils up to 80 ohms may be fitted if required.—The Plessey Co., Ltd., Ilford, Essex.

THE MOTEK TAPE DECK

THE Motek K9, a new and entirely British tape deck, is manufactured and introduced by Modern Techniques who have a wide experience in this field. Designed to enable easy fitment by the manufacturers of tape recorders, this particular deck offers simplicity of control and operation. Patents are pending on the many outstanding features of this fine deck and include: Choice of three speeds. 7½. 3¾. 1⅞ inches per second at the turn of a knob. Built-in revolution counter for precise tape location. Continuous playing time range from 1½ to six hours. Pause control switch. Fully automatic press-button controls. Eight two-way change-over switches available on record and play wafers on push-button unit, allowing for possible amplifier wiring. Foolproof interlocking system. Price 21 gns.—Modern Techniques, Wedmore Street, London, N.19.

TAPE RECORDING BOOKLET

TWENTY-FIVE ideas for widening the use of tape recorders are contained in a new 12-page give-away booklet published by the 3M Company, makers of Scotch Boy magnetic tapes.

The ideas range from the suggestion of a "snapshots in sound" album for a growing family to a tip that businessmen can use tape recorders to improve their own speech and that clergymen can enlist their aid to rehearse sermons.

The booklet goes on to explain what one should do to obtain best quality recordings and then gives advice on splicing tapes and other aspects of the use of a tape recorder.—Minnesota Mining and Manufacturing Company, Ltd., of 3M House, Wigmore Street, London, W.1.

HIGH-FREQUENCY TRANSISTORS

THE R.C.A. 2N370, 2N371 and 2N372 are drift transistors of the germanium p-n-p type designed for use in all-wave battery portable receivers. The 2N370 is intended for R.F. amplifier service, the 2N371 oscillator service, and the 2N372 for mixer service. These three transistors provide the designer of such receivers with a complete transistor complement for high-gain R.F. tuners.

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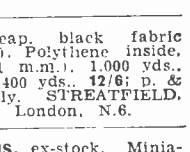

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